Audio-visual standards for school communal halls and gymnasiums

Foundations.T4L, Information Technology Directorate

NSW Department of Education

LEVEL 11, 8 CENTRAL AVENUE, SOUTH EVELEIGH, NSW 2015

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Document details:

This document specifies the requirements for the provision of Audio Visual (AV) systems for New South Wales Department of Education (NSW DoE) school communal hall spaces and gymnasiums. These standards shall be applied to current and future NSW DoE facility fit out projects.

School communal hall spaces and gymnasiums are intended for use by groups of students for assemblies, gymnastics, dance and music recitals and physical education. These spaces may also be used for student presentations and community meetings. This standard has been created with teachers and the general community in mind, with the consideration that any staff or community member should be able to use the communal hall space in its entirety.

This document provides the minimum standard required for key equipment, power and communications required for each NSW DoE School communal hall space and/or gymnasium. Exact measurements, quantities, equipment locations, and other room aspects such as equipment installation methods will vary from project to project.

Glossary of terms:

Team	Contact
"Shall"	The term "SHALL" means that the item is an absolute requirement of the standard. Omission of this item from the deployment would mean that the desired objectives would not be met. Objectives include availability, specific functions or technical requirements, and dependent features.
"Shall Not"	The phrase "SHALL NOT", means that the item is absolutely prohibited in the standard.
"May"	"MAY" means that an item is truly optional. For example, you may choose to include the item because a particular objective or application/protocol requires it or because it enhances the deployment.

Revision History:

Date	Version	Summary of changes	Author
29/09/2020	0.1	Initial draft	Ryan O'Hara/Stephen Harding
26/10/2020	0.2	Added Large Hall/Gymnasium specifications	Ryan O'Hara/Stephen Harding
05/11/2020	1.0	Adjusted document for accessibility	Ryan O'Hara/Stephen Harding
27/02/2021	1.1	Lifted requirement from CAT6E to CAT6A for cabling in sections: 2.2.4 (pg.10), 3.2.1 (pg. 14) and 3.2.4 (pg. 15) to match SCSS 2020.	Ryan O'Hara

Approvals:

Name	Title	Date
James Quiring	Service Relationship Manager	27/10/2020

Name	Title	Date
Stephen Harding	Senior Collaboration Specialist	27/10/2020
Greig Tardiani	T4L Project Manager	27/10/2020
School Network Solution Design Authority (SNSDA)	N/A – Membership approval	05/11/2020

Associated International and Australian Standards:

Name
AS/NZS 2017:2000 Acoustics – Recommended design sound levels and reverberation times for building interiors
AS/NZS ISO 717.1:2004 Acoustics – Rating of sound insulation buildings and of building elements. Part 1: Airborne sound insulation
AS/NZS 1680.2.1:2008 (as amended) Interior ad workplace lighting – Specific applications – Circulation spaces and other general areas
AS/NZS 1680.2.2:2008 (as amended) Interior and workplace lighting – Specific applications – Office and screen based tasks
AS/NZS 1680.2.3:2008 (as amended) Interior and workplace lighting – Specific applications – educational and training facilities
AS 1428.1:2009 Design for access and mobility – General requirements for access – New building work

Associated Documents – NSW Department of Education:

Team	Version
NSW DoE Structured Cabling Standard	Latest available in DG 64
NSW DoE Video Collaboration Tools Standard	Latest available in DG 64
NSW DoE Audio-visual standards for school learning displays	Latest available in DG 64

1. Scope of Works

1.1 Roles and responsibilities

Team	Contact
Contractor	Installing all equipment, software and required cabling (whether or not it is documented in this standard and all accompanying documents).
	Notifying the Client and Project Manager of any errors, omissions or ambiguities in the standards and accompanying documents.
	Provide all associated labour.
	Deliver operational AV systems as per the intended design, documented in this standard and all accompanying documents.
	Providing the Client with a copy of the Quality Assurance (QA) Procedure to be utilised in each small communal space.
	The Contractor shall be present at any scheduled User Acceptance Testing (UAT) to witness testing, remediate any uncovered issues and complete hand-over.
	Ensuring that the installation of the AV systems is of the highest quality and is integrated with other related systems and designs including, but not limited to; electrical (power, communications, lighting), mechanical, architectural, structural, interior design, acoustics, fire, and hydraulics.
	Providing any non-compiled code and software to the Project Manager and Client for future Disaster Recovery (DR) and upgrade requirements.
	Ensuring that all aspects of the installation support efficient paths for future expansion or upgrade.
	Utilising NSW DoE provided and/or endorsed tools for tracking and capturing information.
Project Manager	Organising and scheduling the procurement, delivery and installation of all equipment, software and required cabling in cooperation with the Contractor, Client and Builder.
	Ensuring that all supplied equipment is compliant with NSW DoE standards and guidelines, and that equipment has been supplied through NSW DoE contracted suppliers.
	In cooperation with the Contractor and Builder, ensure that the installation of the all systems is of the highest quality and is integrated with other related systems and designs including, but not limited to; electrical (power, communications, lighting), mechanical, architectural, structural, interior design, acoustics, fire, and hydraulics.
	Sign off and approval of all Project Documentation.
	Final sign-off of fit-out and installation in cooperation with the Client.
Client (Or Client IT Representative)	Identify any additional requirements not specified within this document, or related documents to the Project Manager.
	Final sign off of fit-out and installation in cooperation with the Project Manager.

Team	Contact
Builder	Supply and fit out of structural reinforcement for AV solutions if required.
	In cooperation with the Contractor and Project Manager, ensure that the installation of the AV systems is of the highest quality and is integrated with other related systems and designs including, but not limited to; electrical (power, communications, lighting), mechanical, architectural, structural, interior design, acoustics, fire, and hydraulics.

1.2 Complete supply and install

▪ This document does not specify every line item (hardware, software, cabling, connectors, labour etc.) required to complete each system. The Contractor shall be responsible for providing all items required to deliver fully working systems, whether or not explicitly specified in this document and whether "Supply and Install" is mentioned or not.

▪ All required items must be included (or a reasonable allowance made) in the Contractor's tender response price to deliver a Project (excluding AV components to be delivered under a DoE supply contract).

▪ Failure to include all required items in the Contractor's tender response price shall not be grounds for the AV Contractor to claim for variations to deliver this Project after the tender has been awarded.

1.3 Equipment on client LAN

▪ The Contractor shall liaise with the Project Manager and the Client (or Client IT Representative) to inform them of all equipment that will require direct connection to any existing NSW DoE ICT network.

▪ Information supplied shall include as a minimum: brand name, model number, MAC address, serial number and related specifications.

▪ This information shall be made available to the Client (or Client IT Representative) at least three (3) weeks prior to delivering the equipment to site.

1.4 Site works

▪ The Contractor shall take full responsibility for all works on site for the entirety of the project.

▪ The Contractor shall cover, without additional cost to the Client, inclusion of any necessary services and items to effect the safe and timely completion of the project. Services and items shall include, but are not limited to: all freight and delivery costs to and from site for any item unless additional and/or costed separate to this project, scaffolding, rigging, lifting and high-lift equipment, safety barriers and safety equipment, dust covers and protective covers, cleaning equipment, waste and rubbish removal and parking.

1.5 Basic warranty statement

▪ Clear identification of inclusions and any exclusions or conditions affecting warranty of the systems shall, be provided.

▪ A minimum warranty period of 48 months (4 years), and equivalent to the current contract warranty period shall be required for all items of equipment, parts, labour and programming.

▪ The warranty statement shall detail all items associated with warranty work including, but not limited to, the initial service call response period, the on-site response period, removal of faulty equipment, replacement or loan equipment (if required), freight charges (for all segments of the fault period including back-to-base and return-to-manufacturer), parts and labour.

1.6 Defects and liability period

- The Defects Liability Period shall apply to all equipment and installation following practical completion as stated above, as well as any period following thereafter for which any nominated defects on site remain incomplete or outstanding.

- At the commencement of the Defects Liability Period the Contractor shall warrant all equipment and installation for 48 months (4 years).

- Any deviation from this for equipment, systems or workmanship provided by the Contractor shall be clearly indicated in the Tender Submission, including any extended warranty period for any items of equipment. The Defects Liability Period shall not commence until the Project Manager, in consultation with the Client, has specifically authorised the commencement.

1.7 Software and programming

- Commissioning and troubleshooting of any software and programming code is still to be included in the scope of the Contractor's work.

- For both commercial and non-commercial (custom) software, the Contractor shall supply the Client with a complete set of all licences and documentation for all devices, as well as utilities and tools used in the operation and maintenance of the system.

- Any commercial software provided by the Contractor shall be procured and transferred in full compliance with the publisher's copyright, licensing and other requirements of ownership. All user licence agreements shall be registered in the name of the Client by the Contractor.

- The Client shall also retain full rights to all custom software and programming code developed by the Contractor as part of the Project. These rights shall also pertain to any non-compiled code and non-compiled programs developed by the AV Contractor as part of the project.

- The Contractor shall supply the first version, and any subsequent versions of any and all custom software and programming code. The Contractor shall supply any updated software or code upon release by the manufacturer, especially in instances where software and code updates specifically address security defects.

1.8 Documentation

The following technical information shall be provided by the Contractor at least three (3) weeks prior to commencement of works on site. All documents on this list below shall be presented in .pdf files, and shall be formally approved by the Project Manager prior to the Contractor commencing works on site:

- Technical drawings for each AV system, including all signal paths. The technical drawings shall include audio, video and control signals.

- Technical drawings of all racks that house AV equipment.

- Technical drawings of key items of equipment to be installed such as: loudspeakers, fold-back monitors, data projectors, projection screens, video conference cameras, LCD screens, wall plates/control panels, as well as other relevant equipment.

- Full Bill of Materials (including equipment and labour) containing brand names, model codes, serial numbers and MAC addresses (where applicable).

1.8.1 Operations and maintenance manual

- The Contractor shall provide one draft electronic copy of the Operation and Maintenance Manual at least two (2) weeks prior to practical completion for approval by the Project Manager. Within the final two (2) weeks prior to handover, or at handover, the AV Contractor shall provide the final copy to the Client.

- A complete Operational and Maintenance Manual shall be provided in a bound, A4 book (physical copy) and Microsoft Word (.docx, electronic copy).

1.9 Associated work by other contractors

- Various works, related to all installed equipment may be carried out by contractors other than the Contractor.

- The Contractor shall liaise with the others on site and coordinate their works to ensure a high quality installation and finish.

1.10 Handover

Handover shall be defined as the time when each of the following is completed to the satisfaction of the Client and Project Manager:

- All witness testing and defects inspections completed by both the Contractor, and Client. The Contractor will provide defects reports post each round of testing and inspection.

- The Contractor has rectified any and all defects discovered during the testing and during defects inspections.

- The Contractor has provided the final set of Operations and Maintenance Manuals as described in section 1.8.1 of this standard.

- The Contractor has provided any remaining items including:

    - all non-compiled code;

    - loose items including remote controls and;

    - any unused items procured by the Client.

2. Audio-visual standards for small to medium school communal halls

Minimum standard installations for NSW DoE small to medium hall spaces (Usually less than 100m²) include:

- A projector (fixed or movable) able to project an image of at least 180 inches diagonally;

- A motorised projector screen;

- An AV digital signal processor;

- Sound reinforcement (Speakers) that cover the hall space without causing feedback from active microphones – including stage fold-back monitors;

- Microphones, including charging and individual EQ control for each microphone if required;

- A minimum of four (4) LED RGBAWU stage lights, including fixtures.

All components are available and shall be purchased from approved DoE suppliers (Please note, some components including the T4L interactive multi-media PC and video/audio conferencing unit will need to be purchased separately) by the Project Manager (a DoE Employee). These components shall then be integrated into the hall design by the Contractor, in consultation with the Project Manager.

2.1 Schematic
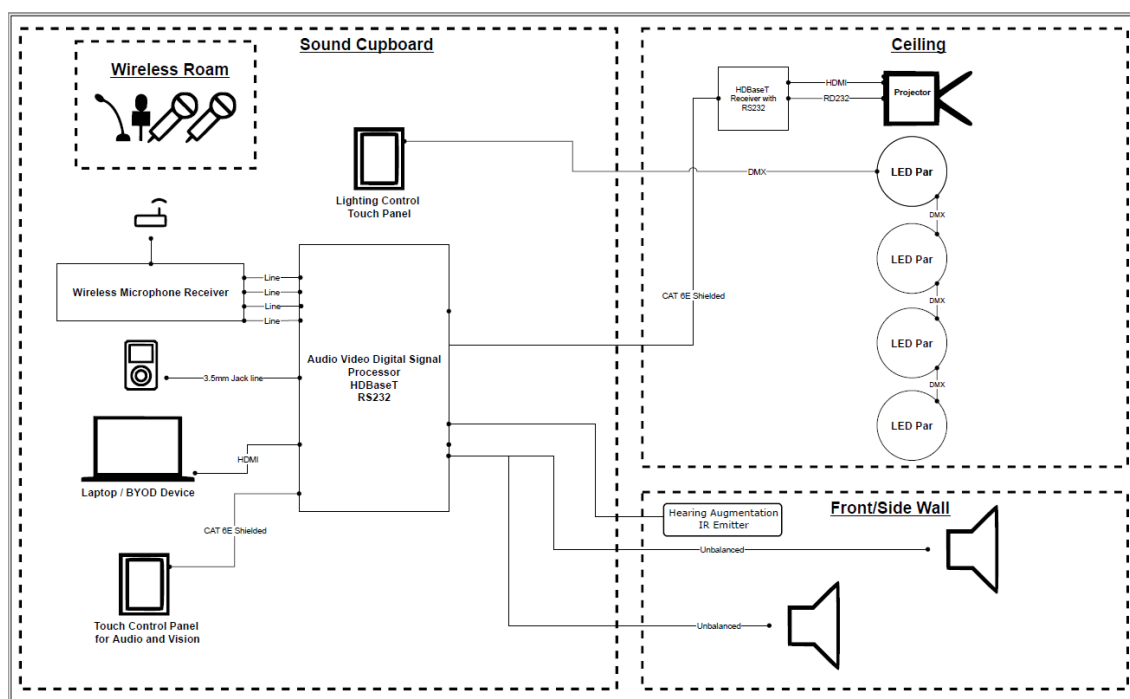
Figure 1 – Small/medium hall Schematic

2.2 Operational characteristics and considerations

2.2.1 Audio

- Sound reinforcement shall be adequate to evenly cover the hall space (roughly 100m2) without causing feedback from active microphones. All speakers shall have a wide frequency response to allow high quality playback of music and intelligible voice reproduction.

- Wireless microphones shall be used where possible (Wireless hand-held, lapel microphones, and gooseneck microphones).

- Wireless microphones shall be charged by a charging dock, mitigating the need for disposable batteries or removing batteries for recharging.

- Microphones shall sound natural, obtaining enough volume without feedback through the speakers.

- The volume of each microphone shall be easily controlled independently.

- There shall be a single 3.5mm jack input for a device such as a laptop or mobile phone for music playback. This input shall have its own volume control.

- Audio system must be able to be EQ tuned to maximise performance from each microphone.

- The solution, including microphone charging docks shall be located/installed in the sound cupboard, except for the wall mounted PA speakers.

- The audio solution shall provide hearing augmentation for up to 30 persons, with an equal mix of personal induction loops and headphones.

2.2.2 Lighting (Stage)

- There shall be at least four (4) LED RGBAWU Par lighting fixtures for stage lighting. These lights shall be able to reproduce accurate white light for standard presentations, and full spectrum colours for non-standard presentations.

- The aforementioned lighting fixtures shall be controlled by a simple touch interface with pre-sets for various event types, and/or colour profiles. Control shall be via DMX512, ARTNet or sACN, whichever is appropriate for the space.

- The control interface shall be installed in the sound cupboard.

2.2.3 Visual

- There shall be a projector of at least 7500 lumens to counter natural light in the space.

- Projected image shall be of at least 180 inches diagonally.

- Projector surface shall be a motorised screen, controlled from the sound cupboard

- Projector power and input selection shall be able to be controlled from the sound cupboard. This does NOT include the use of the projectors original remote control. Control shall be mounted in sound cupboard.

- Projector shall allow up to two HDMI connections that can be switched with the aforementioned control interface.

- Projector native resolution shall be 1920 x 1080 with the projector screen reflecting this aspect ratio of 16:9.

- Projector may be replaced with a commercial-rated digital display of similar size, resolution and luminosity. Additional screen protection may be considered when using large digital displays in multi-purpose halls and gymnasiums.

2.2.4 Cabling

- All RJ45 cable required to transmit HDBaseT must be CAT6A shielded.

- HDMI Cable must be HDMI 2.1 (or latest version if appropriate).

- If DMX cable is 3-pin, its impedance must be of 110 ohms, and not 75 ohms (standard microphone XLR cable impedance is 75 ohms).

2.3 Detailed functionality and performance

Modes of use

Mode	Description
Student Assembly	Present audio and video content to projector from a portable device

Mode	Description
	such as a laptop/tablet/phone via HDMI fly lead cable.
	Address audience using wireless microphones (handheld, lapel, or lectern gooseneck).
	Stage well lit with natural colour light.
Student Performances	Playback music via the 3.5mm jack for student performances such as dance.
	Wireless microphones for speech.
	Coloured stage lighting available for performances.
	Present audio and video content to projector from a portable device such as a laptop/tablet/phone via a HDMI fly lead cable.
Indoor Sports	Playback music via 3.5mm jack.
	Wireless microphones for sports teacher or instructor.
Visitor Performance (i.e. incursion)	Audio playback via 3.5mm jack for audio backing
	Wireless lapel or handheld microphones for voice amplification
	Present audio and video content to projector from a portable device such as a laptop/tablet/phone via a HDMI fly lead cable.
	Stage lighting with various options
Exams	Wireless lapel or handheld microphones for voice amplification
	Present audio and video content to projector from a portable device such as a laptop/tablet/phone via a HDMI fly lead cable.

Video performance

▪ Projectors shall be set up to operate at the maximum resolution of 1920 x 1080p

▪ The minimum acceptable brightness level (in Lumens) for panel displays shall be:

Softly-lit spaces/ No ambient sunlight	Well-lit spaces/ Indirect sunlight	Direct sunlight
4500 lumens	6000 lumens	7500+ lumens

Audio performance

▪ The minimum audio performance requirements are:

Parameter	Technical Criteria	Performance
Loudness	Average Sound Pressure Level (SPL) continuous program audio/speech	The default setting shall be: Typical 5 – 10db SPL above normal room SPL level.

Hearing augmentation system

To comply with legislation for equal access (Australian Standard AS 1428.5, as outlined in the Building Code of Australia), a wireless hearing augmentation system, providing hearing augmentation for up to 30 persons shall be installed in the communal hall space, with an equal mix of headphones and personal induction loops provided for use.

Design consideration should be made for adjacent rooms to be able to operate simultaneously without interference.

2.4 Routing table

Mode of use	Primary Projector	PC Audio to PA	3.5mm jack audio	Wireless Mic Audio	White stage lighting	Coloured stage lighting
Student Assembly	Likely	Likely	Unlikely	Likely	Likely	Unlikely
Student Performances	Unlikely	Unlikely	Likely	Likely	Unlikely	Likely
Indoor Sports	Unlikely	Unlikely	Likely	Likely	Unlikely	Unlikely
Visitor Performance	Likely	Likely	Likely	Likely	Likely	Unlikely
Community Meetings	Likely	Likely	Likely	Likely	Likely	Unlikely
Exams	Likely	Unlikely	Unlikely	Likely	Unlikely	Unlikely

3. Audio-visual standards for school gymnasiums and large communal hall spaces

Minimum standard installations for NSW DoE gymnasiums and large hall spaces hall spaces (Usually more than 100m²) include:

- Three (3) projectors (fixed or movable) able to project an image of at least 180 inches diagonally, with the equivalent motorised projector screens).

- An AV digital signal processor.

- Sound reinforcement (Speakers) that cover the hall space without causing feedback from active microphones – including stage fold-back monitors.

- Amplification to suit space and loudness requirements.

- Audio mixer.

- Wireless microphones, including charging and individual EQ control for each microphone.

- Digital snake for patching.

- A minimum of four (4) LED RGBAWU stage lights, including fixtures and appropriate controls.

All components are available and shall be purchased from approved DoE suppliers (Please note, some components including the T4L interactive multi-media PC and video/audio conferencing unit will need to be purchased separately) by the Project Manager (a DoE Employee). These components shall then be integrated into the hall design by the Contractor, in consultation with the Project Manager.

3.1 Schematic

Figure 2 - Large hall/Gymnasium schematic - please see appendix 3 for a larger version

3.2 Operational characteristics and considerations

3.2.1 Audio

- The audio solution's PA shall provide even coverage for the entire space, and if required, delay speakers at appropriate locations.

- The audio solution's PA shall provide full frequency response, this includes the requirement of sub speakers.

- The PA may be flown if required.

- The PA speakers shall be passive and paired with an appropriately powered amplifier. This allows for amplifiers to be powered off when required.

- The audio mixer must be an up-to-date and reputable brand. No discontinued models shall be used.

- The audio mixer and stage box shall be digital and utilise a digital snake via CAT 6A or better cable.

- The audio mixer shall have a minimum of 32 input channels. Minimum 16 input channels at stage and 16 at the console.

- The audio mixer shall include the option to be controlled wirelessly from a tablet device (e.g. iPad) and app.

- Amplifiers must be of high quality and of a reputable brand. They shall include an internal limiter or Digital Signal Processor to provide protection to the speakers, and limit maximum volume.

- The stage shall have XLR microphone patching located in floor boxes in appropriate locations. These patches shall terminate at the digital snake.

- There shall be high quality reputable wireless microphones to suit:

    - Two (2) handheld;

    - Two (2) lapel and;

    - One (1) gooseneck microphone/s.

- There shall be 4 x active fold back speakers for musical performances. These shall be able to be located anywhere on stage and able to patch to the digital snake.

- The following microphones may be used, and are recommended for various performances:

    - Three (3) Direct Injection boxes.

    - Three (3) Dynamic vocal microphones.

    - A microphone kit suitable for a 5-piece drum set and condenser overhead microphones.

    - Three (3) dynamic microphones for guitar amplification

    - Four (4) condenser pencil microphones for orchestral, instrument or choir applications

- Microphone stands may be purchased to suit all microphone requirements.

- Enough XLR cable shall be purchased to suit all microphone requirements.

- 3.5mm jack input shall be available at stage and console for music playback.

- An External Digital Signal Processing unit may be added to allow system control from a touch interface for light applications (such as class meetings, or use of lectern only)

- The audio solution shall provide hearing augmentation for up to 30 persons, with an equal mix of personal induction loops and headphones.

3.2.2 Lighting (Stage)

- 24 channel Lighting console that is suited for LED fixtures (single fixture per channel control, colour selection etc.)

- The lighting console shall be able to record scenes and cue for easy playback and lighting snapshots.

- 12 LED RGBAWU Hex fixtures focused on stage for performance and stage lighting.

- Three (3) LED Profile fixtures focused on lectern positions on stage.

- The Lighting solution shall prefer ARTNet over DMX512 to provide flexibility in install.

- If ARTNet is not possible, a 4 channel DMX512 optical splitter shall be incorporated to allow DMX lighting at multiple locations.

- An ARTNet or DMX512 patch shall be made available on the stage for custom lighting options, and if possible, in alternate locations around the hall.

- Extra DMX cable available to allow lighting patched on stage

3.2.3 Visual

- Three (3) projectors shall be provided at minimum, with two (2) projectors projecting either side of the stage, and one projector projecting onto the screen on stage. All projectors shall have the ability to be controlled from a single touch panel.

- All projection surfaces shall be motorised screens, controlled by the same control solution.

- Projectors shall have a native resolution of 1920 x 1080, and this shall be the default resolution for all sources.

- There shall be at least 5 locations a laptop may be connected to the solution (3 across stage, 2 in control room).

- There shall be AV matrix switching controlled by a central solution with touch panels.

- The projectors shall emit a minimum of 7500 lumens. Projector may be replaced with a commercial-rated digital display of similar size, resolution and luminosity. Additional screen protection may be considered when using large digital displays in multi-purpose halls and gymnasiums.

3.2.4 Cabling

- All RJ45 cable required to transmit HDBaseT must be CAT6A shielded.

- HDMI Cable must be HDMI 2.1 (or latest version if appropriate).

- If DMX cable is 3-pin, its impedance must be of 110 ohms, and not 75 ohms (standard microphone XLR cable impedance is 75 ohms).

3.2.5 Control

- All AV shall be managed and controlled from a centrally managed processor.

- Users shall be able to select a hall function and be able to control the appropriate technology accordingly.

3.3 Detailed functionality and performance

Modes of use

Mode	Description
Student Assembly	Present audio and video content to projector from a portable device such as a laptop/tablet/phone via HDMI fly lead cable.

Mode	Description
	Address audience using wireless microphones (handheld, lapel, or lectern gooseneck). Stage well lit with natural colour light.
Student Performances	Playback music via the 3.5mm jack for student performances such as dance. Wireless microphones for speech. Coloured stage lighting available for performances. Present audio and video content to projector from a portable device such as a laptop/tablet/phone via a HDMI fly lead cable.
Indoor Sports	Playback music via 3.5mm jack. Wireless microphones for sports teacher or instructor.
Visitor Performance (i.e. incursion)	Audio playback via 3.5mm jack for audio backing Wireless lapel or handheld microphones for voice amplification Present audio and video content to projector from a portable device such as a laptop/tablet/phone via a HDMI fly lead cable. Stage lighting with various options
Exams	Wireless lapel or handheld microphones for voice amplification Present audio and video content to projector from a portable device such as a laptop/tablet/phone via a HDMI fly lead cable.

Video performance

- Projectors shall be set up to operate at the maximum resolution of 1920 x 1080p

- The minimum acceptable brightness level (in Lumens) for panel displays and projectors shall be 7500 lumens.

Audio performance

- The minimum audio performance requirements are:

Parameter	Technical Criteria	Performance
Loudness	Average Sound Pressure Level (SPL) continuous program audio/speech	The default setting shall be: Typical 5 – 10db SPL above normal room SPL level.

Hearing augmentation system

To comply with legislation for equal access (Australian Standard AS 1428.5, as outlined in the Building Code of Australia), a wireless hearing augmentation system, providing hearing augmentation for up to 30 persons shall be installed in the communal hall space, with an equal mix of headphones and personal induction loops provided for use.

Design consideration should be made for adjacent rooms to be able to operate simultaneously without interference.

2.4 Routing table

Mode of use	Primary Projector	PC Audio to PA	3.5mm jack audio	Wireless Mic Audio	White stage lighting	Coloured stage lighting
Student Assembly	Likely	Likely	Unlikely	Likely	Likely	Unlikely
Student Performances	Unlikely	Unlikely	Likely	Likely	Unlikely	Likely
Indoor Sports	Unlikely	Unlikely	Likely	Likely	Unlikely	Unlikely
Visitor Performance	Likely	Likely	Likely	Likely	Likely	Unlikely
Community Meetings	Likely	Likely	Likely	Likely	Likely	Unlikely
Exams	Likely	Unlikely	Unlikely	Likely	Unlikely	Unlikely

Appendix A: Display sizing

The tables below detail the relevant screen sizes based on the furthest seated student. The sizes of the screens listed are only applicable to the room types shown above. For bespoke rooms with non-typical use types, the AETM viewing standards should be referenced. The display may be either Full High Definition (FHD) or Ultra High Definition (UHD) native resolution.

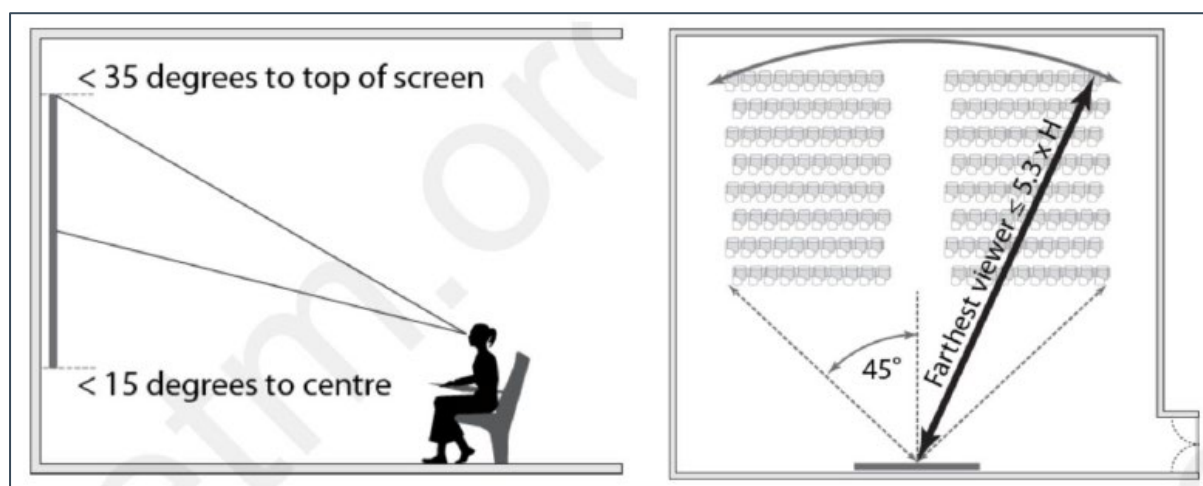| Distance to furthest viewer	Size of display (In diagonal inches)
3-4 Meters	55"
4-5 Meters	65"
5-6 Meters	75"
6-7 Meters	80"
> 7 Meters	> 84"

Figure 3 - Screen viewing angle recommendation

Off axis horizontal viewing shall be no greater than 45° from the centre line of the screen. The maximum viewing angle shall be no more than 15° to the centre of the image. This is measured at an average seated eye height of 1270mm or no more than 35° to the top of the screen (whichever is greater).

A.1 Screen mounting height recommendations

As screen mounting heights can vary according to many different factors, it is recommended that all MLDs (In learning spaces) be installed with height adjustable mounts.

PLEASE NOTE:

- The builder shall consult the Project Manager – Foundations.T4L or the school Principal **BEFORE** performing any screen mounting to ensure screens are mounted at appropriate heights.

- These are recommendations only. Individual requirements may dictate higher or lower mounting heights.

Appendix B: Sample small to medium communal AV hall fit-out (Technology)

The table below displays a sample of the technology required in a small to medium communal hall AV fit-out.

Type	Equipment	Requirement	Example equipment	Notes
AUDIO	Main PA Speakers	Required to allow even coverage of the whole communal space. Delay speakers not usually required in this space.	EVC-1082-96 8" driver, 90x60 pattern must include mounting yoke and m10 hardware	
AUDIO	General wireless microphones	Cable-less microphones for school presentations, ceremonies and internal excursions. 2 Hand held wireless mics for quick use. 1 wireless lapel microphone for presentations, and a single wireless gooseneck for a lectern style microphone for assemblies. Microphones charge on a dock to mitigate requirement for batteries.	Shure MXWANI4 - 4 channel audio network interface Shure MXWNCS4 - Charging Station 2x Shure MXW2/SM58 - Handheld Transmitter 1x Shure MXW1 Body pack 1x 4-pin lapel microphone 1x MXW8 - Gooseneck transmitter	
AUDIO	Lectern microphones	Factored above in wireless microphones	MXW8 (see above in wireless microphones)	
AUDIO	Audio Control	All in one audio control to mix and EQ sound. Must have external interface for user to control input volumes.	TesiraFORTE AI with two TEC-1 for user control	Required detailed design and other equipment such as Control network switch etc...
AUDIO	Digital Snake	n/a		
AUDIO	3.5 mm input	For iPod, phone, external music source.		Based in sound cupboard

Type	Equipment	Requirement	Example equipment	Notes
LIGHTING	Lighting Control	To control lighting fixtures. Allows fixtures to change colour and intensity. Easy for user and preferable to have wall mounted control touch panel for easy use. Located in AV	ETC Echo Touch	ETC Echo Touch is an all in one easy to use solution. A standardised program can be created and kept with ESFG for distribution. Based in sound cupboard
LIGHTING	Wash Fixtures	Generic LED wash lights that produce full spectrum of colours including accurate white light and UV light for special performances.	4 x LED HEX PAR 12 (Nantek)	Lighting bar does not specify independent 240v power - Need to consider DMX as well
LIGHTING	Profile Fixtures	n/a		Lighting bar does not specify independent 240v power - Need to consider DMX as well
VISUAL	Projector	Bright projector to compensate for much of the natural light in these communal spaces.	Epson EB-G7200WNL With standard lens	
VISUAL	Projector Screen	Minimum 150 inch motorised Projector Screen, to be controlled by relay switch	Generic motorised screen	
VISUAL	AV Matrix			
VISUAL	Cabling	Require Shielded CAT6 with shielded plugs for HDBT runs		To minimise the impact of noise and interference
VISUAL	HDMI extenders	Extend HDMI signal from sound cupboard to Projector		

Type	Equipment	Requirement	Example equipment	Notes
CONTROL	Processor	n/a		
CONTROL	Wired Control interface	n/a		
CONTROL	Wireless Control interface	n/a		
CONTROL	Controller	Control: Projector on/off and input selection	Extron MLC 55 RS	A standardised program can be created and kept with ESFG for distribution. Based in sound cupboard

Appendix C: Large hall/Gymnasium schematic