

18 SECTION 18: AUDIO VISUAL DESIGN STANDARDS 2026

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18.1 GLOSSARY

Term	Definition
AFFL	Above Finished Floor Level. A measurement reference indicating the height of an item above the completed floor surface.
AV	Audio-visual. The systems, equipment and services used to support sound, video, presentation, collaboration, control and related functions in a space.
AV-over-IP	The transport of audio-visual signals over an IP network, typically using network encoders, decoders and switches.
Audio-Visual Endpoints	The University team responsible for maintaining AV design standards, reviewing and approving AV designs, and accepting completed AV systems at handover.
BYOD	Bring Your Own Device. The use of a user-supplied laptop, tablet or other device as a presentation or collaboration source.
CAN	Consultant's Advice Notice. A formal response or instruction issued by the consultant, typically in response to an RFI or design coordination matter.
CLS	Collaborative Learning Space. A teaching space designed to support student-centred learning, group discussion and collaborative activity.
CTS / CTS-D / CTS-I	AVIXA Certified Technology Specialist credentials. CTS is the general certification, CTS-D relates to design, and CTS-I relates to installation.
Confidence Monitor	A display positioned so the presenter can view programme content, slides, timers, notes or other relevant information while facing the audience.
Dante	A digital audio networking technology used to transport audio signals over standard IP networks.
DSP	Digital Signal Processor. An audio processing device used for functions such as mixing, routing, equalisation, echo cancellation and signal management.
EDID	Extended Display Identification Data. Information provided by a display to describe its supported video formats and capabilities to a source device.
FLS	Flexible Learning Space. A teaching space with movable furniture and flexible room layouts designed to support active learning, group discussion and reconfiguration for different teaching modes.
FPD	Flat Panel Display. A wall-mounted or fixed display, typically using LCD or LED technology.
Hearing Augmentation System	A system that improves access to audio for people using hearing aids or compatible receivers, provided in accordance with applicable accessibility and NCC requirements.
Interactive Hybrid	A teaching or collaboration mode that supports two-way interaction between in-room and remote participants.

Lecture Capture	The recording or streaming of teaching activity, typically including presenter audio, video and presented content.
Local Presentation	An AV mode intended for in-room delivery only, without remote participant interaction or streaming as a core requirement.
MLT	Major Lecture Theatre. A large lecture or event space designed for high-capacity presentation, teaching and event delivery.
NCC	National Construction Code. The Australian code that sets minimum requirements for building design and construction, including relevant accessibility provisions.
PoE / PoE+ / PoE++	Power over Ethernet standards that provide electrical power and network connectivity over a single Ethernet cable. PoE+ and PoE++ provide higher power levels than standard PoE.
Presenter Focus Hybrid	A hybrid delivery mode focused primarily on capturing the presenter and presented content for remote participants.
PTZ Camera	Pan-Tilt-Zoom camera. A remotely controllable camera that can move horizontally, vertically and zoom to frame presenters or participants.
Preview Monitor	A display used at the lectern or presenter position to preview selected sources, camera views or system content before they are routed to the main room display, stream or recording.
QRG	Quick Reference Guide. A concise user-facing guide that explains the basic operation of an AV system.
RFI	Request for Information. A formal query raised during design or construction to clarify requirements, resolve issues or request direction.
USB AV Bridge	A device or interface that presents room cameras, microphones and AV content to a computer as USB-connected audio and video devices.
VLAN	Virtual Local Area Network. A logical network segment used to separate network traffic for management, performance or security purposes.

18.2 EXECUTIVE SUMMARY

18.2.1 INTRODUCTION

This section provides details of the minimum requirements for the design, installation, and operation of audio-visual services at the University of Melbourne. These design standards supersede 'The University of Melbourne Audio-Visual Design Standards (2024)' and shall be read in conjunction with other sections of 'The University of Melbourne Design Standards'.

Both project management and design standards apply to all learning spaces, professional meeting spaces, and digital signage. The critical role of learning spaces for the University and the specialised nature of learning space design means that particularly rigorous standards of design and construction are required which are reflected in the standards.

The designer is expected to produce their own specification incorporating elements of the following information and submit all designs to the University for review prior to any works commencing on site. This design standard sets out the University's minimum requirements and shall be considered an adjunct to all relevant statutory regulations.

18.2.2 OBJECTIVES

Teaching spaces throughout the University are places of social and personal interaction, where learning takes place and where creative thinking is encouraged. The primary objective of this design standard is to provide a consistent arrangement of all audio-visual systems across all campuses such that operation, maintenance, and management are simplified.

Professional meeting spaces are spread across the different University campuses and sites and must be designed to provide a consistent experience for all users and allow for collaboration between university colleagues and external parties.

This design standard defines recommendations and considerations for designing audio-visual systems across teaching, learning, and professional spaces. It is recommended that all spaces are specifically designed to meet the user group's requirements and to be coordinated by Audio-Visual Endpoints.

18.2.3 AUDIO-VISUAL ENDPOINTS

The Audio-Visual Endpoints team are responsible for maintaining the University's teaching, learning and professional space AV design standards. Audio-Visual Endpoints sit in the Digital Workplace Services team within Enterprise Technology. Audio-Visual Endpoints are responsible for approving designs for new audio-visual installations at the University and accepting completed AV systems at handover to ensure that works are completed satisfactorily and meet the standards herein.

Where an AV Consultant is involved in a project, they are required to work in conjunction with a representative of the Audio-Visual Endpoints team. This may include attending meetings with end users to discuss audio-visual requirements and coordinating with the Audio-Visual Endpoints representative before the design is finalised.

Any variation from the selection of audio-visual equipment currently being used must be authorised by the Audio-Visual Endpoints representative in writing.

Audio-Visual Endpoints contact details are as follows:

The University of Melbourne – Audio-Visual Endpoints

Level 1, 11 Barry St Carlton, VIC

Email: dws-avendpoints@lists.unimelb.edu.au

18.3 PROJECT IMPLEMENTATION

18.3.1 PROJECT RESPONSIBILITIES

Each project team shall include a representative of the user group to provide user input. However, the project team shall take account of the fact that some of the University's learning spaces are centrally managed learning spaces and may be used by other departments. It is the responsibility of the AV Consultant to ensure adherence to the standards herein, and to liaise with the user group, Audio-Visual Endpoints staff and the University appointed Project Manager.

18.3.2 PROJECT STAKEHOLDERS

The following stakeholders will generally be involved in University projects:

Audio-Visual Endpoints	University representatives who are responsible for the maintenance of audio-visual standards within the University and authority for any AV system designed for the University. AV Endpoints will undertake the AV designer role for projects where an external AV consultant is not required.
Architect	External consultant engaged to design the overall teaching space and coordinate all services. On occasion acts as superintendent.
AV Consultant	External consultant engaged to design and coordinate the installation of the audio-visual system. The AV Consultant shall liaise with all other project stakeholders. On projects where no external AV Consultant is present, the role of designer will be undertaken by an Audio-Visual Endpoints Engineer.
AV Contractor	External contractor engaged to perform audio visual works, which may include AV design, supply of equipment, installation of equipment and AV maintenance services.
Project Services	Typically assigned as the University construction project managers for projects.
User Group	University representative selected to outline specific requirements for the teaching space.
Enterprise Technology	University of Melbourne team that may be assigned as the IT Project Manager on large construction projects or Solution Architects assisting with implementation of new technologies.
Service Delivery	University of Melbourne team responsible for service desk, onsite support and maintenance of audio-visual systems once installed.
Services Consultant	External consultant engaged to design and coordinate installation/modification of engineering services for teaching and professional spaces. These may include services such as mechanical, plant, fire, security, lighting, data and electrical.

18.3.3 PROJECT PROCESS

AV Projects follow a similar format to standard construction project management processes and include the following phases:

Design	Workshops are conducted, and AV system requirements are established, including specific functional and technical requirements. Preliminary design options are produced by the AV Consultant with preliminary cost estimates for AV services. Options are developed and presented to Audio-Visual Endpoints and stakeholders for consideration.
Contract Documentation	Preferred design option is developed further. System design schematics, AV drawings and technical specification are produced for tender by a UoM preferred AV Consultant to be approved by the AV Endpoints team prior to releasing to tender. All AV services are coordinated with architectural and engineering services. A detailed, pre-tender cost estimate is produced.
Tender	AV documentation is issued for tender to an Audio-Visual Endpoints endorsed list of specialist AV Contractors. Tender submissions are evaluated for their technical and commercial merit and tender recommendation is provided by AV Consultant. Project Manager engages AV Contractor for the project. A pre-award meeting should be held to discuss items related to the AV installation.
Construction	AV Contractor installs, programs and commissions AV systems as specified. AV Contractor coordinates work with the Head Contractor and other trades as necessary. Any issues, questions or clarifications are issued to the Project Manager as an RFI. AV Consultant shall respond to RFIs formally as a Consultant's Advice Notice (CAN), liaising with the AV Endpoints team representative.
Handover	Handover occurs once systems have been installed and have passed the functionality test. Complete written test results are submitted to AV Consultant and Audio-Visual Endpoints. AV Consultant conducts an independent inspection of AV systems in conjunction with Audio-Visual Endpoints to verify AV test results. All defects identified are issued to AV Contractor as a CAN to rectify. Practical completion is awarded by Project Manager once all items noted in Section 18.3.9 have been addressed.

18.3.5 RESPONSIBILITY MATRIX

The following table outlines the project team's typical responsibilities.

- R - Member of the project team who is responsible for documentation of the task
- C - Requires coordination with this member of the project team
- I - Must inform this member of the project team
- N - Not involved with the nominated task

Task	Architect	AV Consultant	AV Endpoints	Project Services PM	IT Project Manager	Services Consultant	User Group
Attend project workshops/meetings	R	R	R	R	R	R	R
Learning & professional spaces design	R	C	C	C	I	C	C
Furniture and joinery	R	C	C	C	I	C	C
AV system design	C	R	R	I	I	C	C
Electrical/Data Services	C	C	C	C	C	R	I
Mechanical / Fire Services	C	C	I	C	I	R	I
Network access, switches, and Wireless Access Points	I	C	C	R	R	C	I
IT Procurement Computers, monitors, keyboards etc	I	C	C	R	R	I	C
AV Equipment Procurement	I	C	C	R	I	I	I
IP addresses (AV)	I	C	R	I	C	I	I
AV Remote Management	I	C	R	I	I	I	I
AV User Interface	I	C	R	I	I	I	C
Lighting pre-sets and configurations	I	C	C	C	I	R	I
Room Booking	I	I	I	R	I	I	C

18.3.6 AV CONSULTANTS

The audio-visual consultant will be engaged by Project Services and/or Audio-Visual Endpoints. In the case of minor works & lifecycle replacement works, Audio Visual Endpoints may perform the role of the AV Consultant. The AV Consultant must be nominated by the AV Endpoints team as a University's preferred AV Consultant.

The AV Consultant will be responsible for the design and the coordination of the delivery of all AV services. The consultant must be strictly versed on the University design standards and must ensure that all systems strictly comply with university standards and industry best practice to ensure a consistent user experience and integration into the University's AV support model and technology roadmap. An AV Consultant designing systems for the University must attend an induction to the Design Standards to be provided by the Audio-Visual Endpoints.

As a minimum, the appointed AV Consultant must have the following qualifications:

Qualification	Mandatory	Preferable
AVIXA/Infocomm Certified Technology Specialist (CTS)	✓	
AVIXA/Infocomm Certified Technology Specialist – Design (CTS-D)		✓
Minimum 5 years Industry Experience	✓	
Biamp Tesira Certification	✓	
Crestron Core Track	✓	
Crestron DM-NVX Certification	✓	
Crestron Design Certification	✓	
Crestron Flex for Zoom Rooms® & MS Teams Software Solutions Certification	✓	
Dante Level 1 Certification	✓	
Q-SYS Level 1		✓

As a minimum, the AV Consultant will be responsible for the following works:

- Attend design workshops and document AV services requirements as nominated by stakeholders. All functional requirements must be captured formally as part of meeting minutes and/or Return Brief for formal acceptance from user group and Audio-Visual Endpoints. Workshops with end users will require attendance from both the AV consultant and AV Endpoints representative.
- Produce AV systems design and documentation to be issued for approval by Audio Visual Endpoints. Technical documentation shall include:
 - Video system schematic
 - Audio system schematic
 - Control system schematic
 - AV equipment rack layout.

- Produce AV drawings for coordination with Architect and Services Engineer. Drawings shall include:
 - Floor plan indicating locations of AV equipment
 - Elevations
 - Reflected ceiling plans.
- Provide a budget estimate for supply and installation of the AV system to be incorporated into the overall project budget. The AV consultant must also coordinate requirements for associated works such as construction, data and electrical to ensure that these are also captured in the project budget.
- Produce technical specification for tender. Technical specifications shall include:
 - AV scope of works
 - Functional and technical description of each system
 - Technical specifications
 - Installation requirements
 - Details of coordination with other trades
 - Specific access requirements and working conditions.
 - Details of defects liability and warranty
 - Returnable Schedule, Bill of Materials to allow for consistent tender responses.
 - Contact equipment suppliers to forecast and secure stock for the project.
- Project coordination during installation including:
 - Review shop drawings produced by AV Contractor
 - Respond to RFIs issued by AV Contractor
 - Provide design advice as requested by Project Manager
 - Coordinate integration with other services
 - Coordinate commissioning and testing of AV systems.
 - Conduct independent inspection of completed AV systems to ensure they have been installed according to the specification and to meets stakeholder requirements and produce a report detailing tests conducted and defects noted.
 - Review training material and coordinate training
 - Review as-built documentation and operational manuals.

The AV Consultant must consult with Audio Visual Endpoints regarding all the above items throughout the project.

18.3.7 AV CONTRACTORS

The audio-visual contractor must be approved to install, program and commission AV systems at the University by Audio-Visual Endpoints team. Organisations that are not approved by the AV Endpoints team are not permitted to undertake any AV works for the University.

AV Contractors carrying out works must have appropriate experience and qualifications required of their trade. As a minimum AV Contractors must have the following certifications:

Qualification	Mandatory	Preferable
AVIXA / Infocomm Certified Technology Specialist (CTS)	✓	
AVIXA / Infocomm Certified Technology Specialist: Design (CTS-D)		✓
AVIXA / Infocomm Certified Technology Specialist: Installation (CTS-I)	✓	
Extron XTP Systems Engineer and Technician Certification		✓
Extron Control Specialist Certification (ECS)		✓
Extron Control Professional Certification (ECP)		✓
Biamp, Tesira Certification	✓	
Crestron Technician Certification	✓	
Crestron Design Certification	✓	
Crestron Programming Certification	✓	
Crestron DM-NVX Certification	✓	
Crestron Flex for Zoom Rooms® & MS Teams Software Solutions Certification	✓	
Dante Level 1 Certification	✓	
Q-SYS Level 1 & 2		✓

The AV Contractor must appoint a project manager who will act as a single point of contact throughout the delivery of the project, who has enough experience to be able to ascertain if the works carried out are fit for purpose. The project manager must be nominated during a tender submission, in addition to the installation site lead, commissioning and programming team members. An induction to the Design Standards can be provided by the Audio-Visual Endpoints team if required.

AV Contractors must undergo induction of the University site procedures prior to commencing work, which can be arranged by the appointed University Project Manager. AV Contractors must adhere to and observe all safety, security and administrative rules and regulations by the University as well as local, state, and federal regulations, including any heritage requirements whilst working on site.

18.3.8 VARIATION FROM THE DESIGN GUIDELINES AND CUSTOM DESIGNS

Variation and changes to the AV Design Guidelines may be considered for a project for several reasons, including unique user requirements, building environment, changes in equipment supply etc.

All requests for changes to the requirements of the Design Standards must be made on the Modification Request Form. This form is available on the UoM Design Standards web page. No design work is to proceed based on the proposed modification until the modification request has been approved in writing by the AV Endpoints team.

18.3.9 HANDOVER & DEFECT MANAGEMENT

Practical completion will be granted when the following minimum requirements have been fulfilled by the AV Contractor:

- Completed network and asset schedule within the AV Project Workbook has been submitted to Audio Visual Endpoints, with all serial numbers included
- System has been tested and commissioned using a UoM approved test plan. A test plan may be provided by Audio Visual Endpoints upon request.
- System has been inspected by Audio Visual Endpoints and AV Consultant and has been deemed to be operational and practically complete.
- All documentation submissions have been approved by the AV Consultant and submitted to Audio Visual Endpoints
- All control system source code, digital signal processor (DSP) and switcher and other device configuration files have been handed over to Audio Visual Endpoints and become the intellectual property of the University
- Interface testing to Crestron XiO Cloud and Fusion, Biamp SageVue and Sennheiser Control Cockpit, Concierge Companion, Dante Domain Manager, Shure Cloud systems and any other monitoring platforms have been successfully completed
- All training has been conducted.
- All accessories, software, fly-leads, and remote controls have been handed over to Audio Visual Endpoints. All packages of information handed over to Audio Visual Endpoints shall be scheduled in a transmittal, copied to the Project Services project manager and AV Consultant
- Any decommissioned equipment needs to be documented via the AV Project Workbook and sent to Audio Visual Endpoints Team for instruction. Reusable items will need to be delivered to the University of Melbourne to a location advised by AV Endpoints. Items that the University has not elected to reuse shall be sent to e-waste by the AV contractor and will require a certificate from the 3rd party e-waste provider to be handed to the University.
- Notice of Practical Completion issued by AV Consultant or Audio-Visual Endpoints.

The issuance of a Notice of Practical Completion by the AV Consultant is contingent upon the rectification of any installation defects by the AV Contractor.

Defects should be tracked via an online spreadsheet, which will be the AV Project Workbook for projects run by AV Endpoints, or via builder or AV consultant for major construction works. Installation defects are classified as follows:

Severity	Characteristics	Examples
Critical	Space is unable to be used, no workaround exists	Network not active for computers & AV devices Displays not working User interface not working OHS related issues
Major	Functionality is limited or contains significant performance issues. A workaround can be temporarily implemented to allow use of space.	Some presentation sources not working Lighting pre-sets not finalized. No source audio present Some components not supplied. Performance issue may include poor audio quality, distorted video signal
Minor	Space is usable though some known errors are present, and some functionality may be limited. Some aspects of space may not conform to specification and applicable standards.	Fly-lead missing / adapters not supplied Equipment not secured, such as touch panel Hook for fly leads not present EDID not set correctly Display not aligned AV equipment is not on network for monitoring and remote support
Trivial	Issues that do not impact on useability of space	Grammatical errors on user interface Errors in document submissions such as user guides and as-built drawings

The priority of these installation defects is further categorised as follows:

Priority	Characteristics	Examples
Immediate	Defect to be resolved asap to be able to proceed with delivery of space	OHS Issues Critical Defects
Urgent	Defects to be resolved prior to high, normal, and low defects	Major Defects
High	Should be fixed as soon as possible	Major and Minor Defects
Normal	To be resolved once higher priority defects have been attended to	Minor Defects
Low	Fixing may be deferred until a later period	Trivial Defects

18.3.10 DOCUMENTATION AND SUBMISSIONS

As a minimum the following documentation shall be submitted to Audio Visual Endpoints:

- For systems that are non-standard or are not completed within a lifecycle refresh program:
 - Operational manual with clear and concise description on how to technically operate, service and maintain the AV system. To be submitted as both a PDF and Word document.
 - Quick reference guide (QRG). A summary for end-users, briefly describing the basic operation of the AV system for each room using a UoM template provided upon request. To be submitted as both a PDF and editable Word document.
- Details of equipment manufacturers and distributors, and warranty information.
- As-built drawings including the following:
 - Audio schematic
 - Video schematic
 - Control system schematic
 - AV Rack layout
 - Lectern Layout
 - Floor plans, elevations and sections of teaching space indicating equipment locations, mounting heights, and installation detail, including hearing loop or IR coverage layout if present.
 - Hearing loop tests if present
 - Cabling schedule
 - Serial numbers and MAC addresses of all equipment provided via AV Project Workbook once approved by Audio Visual Endpoints
 - Commissioning test results

Audio, Video and Control schematics may be combined into a single drawing for smaller teaching spaces and meeting rooms and other non-complex spaces.

Contractors must provide an electronic copy of all documentation in PDF format within two weeks (10 business days) of practical completion of the project, via email or shared via cloud-based platform. Each PDF should only contain the documentation of a single room / AV system.

18.3.11 TRAINING

Contractors shall allow for a minimum of two training sessions for each AV system. An operator training course and a technical training course shall be provided.

The operator training course shall include but not be limited to training of the following systems:

- Basic operator principles of the system
- Operating principles of video, audio and control system equipment and functions
- Practical training in the operation of each function of the control system
- Equipment locations and operation

- How to seek assistance and report faults

The technical training course shall include, but not be limited to, training of the following systems:

- Overall principles of operation of the AV System with specific emphasis on the installed system
- Basic operator principles of the system
- Operating principles of video, audio, and control system equipment
- Practical training in the operation of each function of the control system
- Equipment locations and operation
- Maintenance and fault-finding procedures
- How to seek assistance or report faults, including warranty and support procedures
- Fault simulation for practical training in fault finding procedures.

Training is to be formally structured. Training shall be provided prior to the issue of final certificate of the works.

Additional training courses may be requested by Audio Visual Endpoints or the User Group.

18.3.12 AV LIFECYCLE REPLACEMENT

Audio Visual systems at the University of Melbourne run on a 7-year lifecycle replacement, at which time all components of an AV system should be replaced to ensure that they continue to provide a positive experience for end users and can be maintained and supported by the University support teams.

18.4 SPACE TYPES AND AV REQUIREMENTS

The following sections describe the various types of spaces with audio-visual systems at the University of Melbourne, their minimum audio-visual functional requirements and recommended equipment.

Each type of space with an audio-visual system as outlined below, has differing design considerations according to their intended use. The design of each space shall be coordinated closely with architectural, faculty and services requirements and shall align with pedagogy and estate strategy. Technology implemented in teaching spaces should be fit for purpose and support pedagogy rather than define it.

Teaching spaces may be classified as either:

- **Shared spaces**, used by multiple faculties and user groups, and designed to provide common functionality appropriate to the space type; or
- **Faculty-owned spaces**, designed in accordance with the space type and tailored to the specific teaching and learning requirements of the owning faculty.

The University includes numerous heritage-listed buildings and spaces, and accordingly, all AV designs must consider and accommodate these constraints and may be required to go through the University's heritage department for approval.

18.4.1 TEACHING SPACE AV MODALITIES

The University applies three AV design modes to teaching spaces, each aligned to a specific delivery requirement:

- **Local Presentation** — in-room delivery only; default for faculty-owned and small spaces
- **Presenter Focus Hybrid** — extends local presentation to stream content to remote participants
- **Interactive Hybrid** — full two-way collaboration between in-room and remote participants

18.4.2 COLLABORATIVE LEARNING SPACES (CLS)

DESCRIPTION

A Collaborative Learning Space (CLS) supports a student-centred approach in which students can learn about a subject through student-to-student interaction in small groups that facilitate discussion, knowledge-building, & reflective practice (generally 4 to 8 students). The space is used for general timetabled teaching, has either a tiered or flat floor, always has a flexible seating configuration, always has fixed tables that supply power for personal devices, and has a capacity of 30-120 student seats. The presence of fixed tables is the key differentiator between this space type & the Flexible Learning Space. The space may offer legacy provision of student access to shared desktop computers.

Hybrid teaching and learning will take place in these spaces via conferencing applications hosted on the lectern computer.

▪ Collaborative Learning Space (CLS)

Collaborative Learning Spaces may include a local display at each student pod to enable enhanced collaboration. The following functionality applies:

- Presenter can push content to flat panel displays located at student pods.
- Students can work in local mode, by connecting their own device to a flat panel display located at their pod.
- Students can present to the class by distributing content from their pod to all other displays in the space.
- By default, AV and content distribution are controlled by the presenter, who can enable local control to allow students to connect a device to the flat panel display located at their pod or display a local PC if present.
- Routing of content from student pods is controlled by the presenter via the AV touch panel.
- Each student pod will have an AV Control Keypad, that will allow the student display to be used independently when the room AV system is in local mode or switched off. When the room AV system is activated, the local keypad control will be disabled, until access is granted by the presenter via the AV touch panel.
- Audio at student pods is limited to local BYOD device playback only and does not include audio from the main presenter. Volume is controlled at student pod displays via the AV keypad when in group mode.
- When a presenter selects a local audio source to be shared with the room, the audio is routed exclusively through the room speakers and not through student pod speakers.

AV SYSTEM FUNCTIONALITY

As a minimum, Collaborative Learning Spaces shall be provided with the following audio-visual system functionality:

Presentation Sources

- University supplied computer for presentations and hosting software-based video conferencing.
- Laptop connection(s) to support BYOD via HDMI with USB-C adapter and wireless presentation
- Document camera

- Student pod inputs, e.g., laptop
- PTZ Camera with auto-tracking to capture presenter software-based conferencing via installed presenter computer.
- PTZ Camera to capture the audience for software-based conferencing via the installed presenter computer

Room Displays

- Single projector (optional, depending on space configuration) and/or
- Distributed flat panel displays located at each student pod.

Video Outputs

- USB AV Bridge to route cameras, content, and microphones to presenter computer for software-based video conferencing

Audio

- All source audio shall be replayed via front of house loudspeakers in spaces that contain a main display e.g., Projector
- In spaces with distributed flat panel displays with no main front of house display, source audio shall be played via ceiling speakers.
- All presenter microphone audio shall be reinforced via ceiling-mounted loudspeakers
- Presenter voices will be captured via lectern and wireless microphones
- Audience voices will be captured via wired Dante enabled ceiling microphones
- The hearing augmentation system shall provide the required coverage as per the NCC regulations.
- All audio sources and microphones to be sent to USB AV Bridge to be captured for software-based video conferencing

Control

Software based control system, hosted on UoM server to control the following equipment:

- Motion sensor
- Projector Lift/s and projection screens if present
- All displays
- AV routing via network encoders and decoders
- Volume control and mute status
- Camera control
- Document camera control
- Monitoring of device status
- Lighting System
- Blinds if present
- Each student pod will also be controlled locally via a keypad.

AV EQUIPMENT – CLS

As a minimum a Collaborative Learning Space shall be provided with the following audio-visual equipment:

Presentation System:

- Video projector (if required)
- University supplied computer.
- Laptop input connection(s)– HDMI and Wireless Presenter
- Document camera
- Front of house loudspeakers if main display is present.
- Ceiling-mounted loudspeakers
- 1 x Wired lectern microphone
- 1 x Wireless lapel microphone system
- Ceiling microphones to capture room participants, quantity to be determined based on room capacity and layout.
- Wireless microphone charging dock.
- Hearing augmentation system
- AV network encoders and decoders
- Digital audio processor
- Audio power amplifiers for front of house and ceiling speakers
- Touch panel
- Software based control via existing server.
- University standard lectern
- Dedicated AV equipment rack if required.
- PTZ Camera, presenter and audience facing cameras
- USB AV bridge
- Video scaler to allow picture in picture for software-based conferencing feed
- Room booking panel for main entrance.
- Motion sensor/s to suit space.
- Network enabled power controller.
- Interface for lighting system

Student Pods:

- Flat panel display.
- Laptop input connection(s) – HDMI with USB-C adapter
- AV Control Keypad

18.4.3 EVENT SPACE /MAJOR LECTURE THEATRE (MLT)

DESCRIPTION

An Event Space/Major Lecture Theatre supports large events such as symposia and scheduled lecture-based teaching. The format drives a more didactic pedagogy that may be characterised as the "stand & deliver" presentation of argument, concepts & facts. The space has a zone at the front that supports set-up for panel discussion. The space is used for general timetabled teaching & for booked events outside teaching periods, always has a stepped/raked/steeply tiered floor, always has fixed seats with tablet arms for writing, with additional infrastructure to support event capture/video production, and with capacity exceeding 400 seats.

Each seat should have a clear unobstructed view to the lecturer and to all boards and screens located on the presentation wall. These spaces are generally well equipped for audio visual equipment including projection systems, dedicated sound reinforcement system, touch panel control system and playback equipment installed within a dedicated lectern. The AV system including theatre lighting must be operatable via an integrated touch panel control system. Event Spaces may have additional audio and video tie lines installed in the space for production purposes, as well as additional AV inputs and outputs located in the main AV rack.

Presenter-focused hybrid teaching and learning will be delivered in these spaces via software-based conferencing applications hosted on the presenter computer, as well as through live streaming of lecture capture. The primary focus of software-based conferencing, recording, and live streaming within a lecture theatre is the capture of both the presenter and presented content.

AV SYSTEM FUNCTIONALITY

As a minimum, Major Lecture Theatres shall be provided with the following audio-visual system functionality:

Presentation Sources

- University supplied computer for presentations and hosting software-based video conferencing.
- Laptop connection(s) to support BYOD via Laptop connection(s) HDMI with USB-C adapter and wireless presentation
- Document camera x 2
- PTZ Camera with auto-tracking to capture presenter for lecture capture stream and software-based conferencing via installed presenter computer.
- PTZ Camera to capture the audience for software-based conferencing via the installed presenter computer

Room Displays

- Single centre *and/or* dual left and right projection
- Confidence or lectern preview monitor
- Digital signage & overflow display in theatre foyer with digital signage player

Video Outputs

- Lecture capture system enabled with dual capture and streaming.
- USB AV Bridge to route cameras, content, and microphones to presenter computer for software-based video conferencing
- AV Rack HDMI output for events, content to be routed via touch panel

Audio

- All source audio shall be replayed via front of house loudspeakers
- All microphone audio shall be reinforced via ceiling-mounted loudspeakers
- Presenter voices will be captured via lectern and wireless microphones
- Audience voices will be captured via wireless handheld microphones
- The hearing augmentation system shall provide the required coverage as per the NCC regulations.
- All audio sources and microphones to be sent to Lecture Capture appliance and USB AV Bridge to be captured for lecture streams, recordings, and software-based video conferencing.
- All audio sources and microphones to be sent to an XLR output located in the AV rack and/or labelled field outlets.
- An XLR input plate located at the AV rack to allow for additional microphones/mixing desk to be added for special events.

Control

Software based control system, hosted on UoM server to control the following equipment:

- Motion sensor
- Projector lifts and screens if present
- All displays
- AV routing via network encoders and decoders
- Volume control and mute status
- Lecture capture status – pause, resume, and stop functions.
- Camera control
- Document camera control
- Monitoring of device status
- Lighting System

AV EQUIPMENT

As a minimum, a Major Lecture Theatre shall be provided with the following audio-visual equipment:

- Video projector(s) left, right and/or centre
- University supplied computer.
- Laptop input connection(s) – HDMI with USB-C adapter and wireless presenter
- Document camera x 2

- Front of house loudspeakers
- Ceiling-mounted loudspeakers
- Wired lectern microphone x 2
- Wireless lapel microphone system and individual receiver x 2
- Wireless handheld microphone x 2, with wireless microphone multichannel receiver for extra microphone capacity during events
- 4-bay charging dock for wireless microphones x 1
- Hearing augmentation system
- AV network encoders and decoders
- Digital audio processor
- Audio power amplifiers for front of house and ceiling speakers
- Touch panel
- Software based control via server.
- Lecture capture system enabled with dual capture and streaming.
- University standard lectern
- Dedicated AV equipment rack
- PTZ Camera, presenter and audience facing cameras.
- USB AV bridge
- Video scaler to allow picture in picture for second input on lecture capture appliance.
- Room booking panel for main entrance.
- Motion sensor quantity to suit space.
- Network enabled power controller.
- Interface for lighting system
- IP Phone for Service Delivery contact

18.4.4 LECTURE SPACES (LT)

DESCRIPTION

Lectures occur in various space types at the University, including:

- Lectorial Learning Spaces (40-150 seats)
- Lecture Theatrettes (60-120 seats)
- Lecture Theatres (101-249 seats)
- Lecture Theatres (250-399 seats)

A Lecture Theatre supports a more didactic pedagogy that may be characterised as the "stand & deliver" presentation of argument, concepts & facts. The space is used for general timetabled teaching, always has a stepped/raked/steeply tiered floor, always with fixed seats with tablet arms for writing.

A Lectorial Learning Space (LLS) supports a broad pedagogical approach where the learning experience can easily switch between being more teacher-led, & then more student-centred with student discussion. The space is used for general timetabled teaching, has a very gradual stepped/tiered floor, always with moveable chairs, always with fixed writing surfaces that provide power for BYOD, sometimes optimised with two rows of chairs placed on the same level platform.

While the various space types differ in terms of teaching pedagogy & capacity, the AV systems that support these spaces have a minimum set of standards that may be scaled and adapted to suit the physical space requirements.

The AV system, input devices and theatre lighting shall be controlled via a dedicated wired touch panel installed on the University standard lectern.

The lectern, as a minimum, shall house one University supplied computer, document camera, laptop connection and touch panel. All audio-visual switching and processing equipment shall be housed in a dedicated audio-visual equipment rack located within the lectern, or a separate cupboard/joinery as required.

Voice reinforcement shall include wired and wireless microphones to be reinforced via ceiling loudspeakers and dedicated feeds to a hearing augmentation system, lecture capture appliance and USB AV Bridge for software conferencing.

Some lecture theatres will contain a single projection display, while others will have dual projection capabilities to be determined by room layout and sightline requirements.

Each seat should have a clear unobstructed view to the lecturer and to all boards and screens located on the presentation wall.

Presenter-focused hybrid teaching will be delivered in these spaces via software-based conferencing applications hosted on the presenter computer, as well as through live streaming of lecture capture. The primary focus of software-based conferencing, recording, and live streaming within a lecture theatre is the capture of both the presenter and presented content.

AV SYSTEM FUNCTIONALITY

As a minimum, Lecture Theatres shall be provided with the following audio-visual system functionality:

Presentation Sources

- University supplied computer for presentations and hosting software-based video conferencing.

- Laptop connection(s) to support BYOD via Laptop connection(s) HDMI with USB-C adapter and wireless presentation
- Document camera
- PTZ Camera with auto-tracking to capture presenter for lecture capture stream and software-based conferencing via installed presenter computer.

Room Displays

- Single centre or dual left and right projection
- Confidence or Lectern Preview Monitor

Video Outputs

- Lecture capture system enabled with dual capture and streaming.
- USB AV Bridge to route cameras, content, and microphones to presenter computer for software-based video conferencing

Audio

- All source audio shall be replayed via front of house loudspeakers
- All microphone audio shall be reinforced via ceiling-mounted loudspeakers
- Presenter voices will be captured via lectern and wireless microphones.
- Audience voices will be captured via wireless handheld microphones.
- The hearing augmentation system shall provide the required coverage as per the NCC regulations.
- All audio sources and microphones to be sent to Lecture Capture appliance and USB AV Bridge to be captured for lecture streams, recordings, and software-based video conferencing.

Control

Software based control system, hosted on UoM server to control the following equipment:

- Motion sensor
- Network power controller
- Projector Lift/s and screens if present
- All displays
- AV routing via network encoders and decoders
- Volume control and mute status
- Lecture capture status pause resume and stop functions.
- Camera control
- Document camera control
- Monitoring of device status

- Lighting System

AV EQUIPMENT

As a minimum the Lecture Theatre shall be provided with the following audio-visual equipment:

- Video projector(s)
- University supplied computer.
- Laptop input connection(s) – HDMI with USB-C adapter and wireless presenter
- Document camera
- Front of house loudspeakers
- Ceiling-mounted loudspeakers
- Wired lectern microphone x 1
- Wireless lapel microphone system x 1
- Wireless handheld microphone system x 1
- Wireless microphone 2-bay charging dock.
- Hearing augmentation system
- AV network encoders and decoders
- Digital audio processor
- Audio power amplifiers for front of house and ceiling speakers
- Touch panel
- Software based control via server.
- Lecture capture system enabled with dual capture and streaming.
- University standard lectern
- Dedicated AV equipment rack if required
- PTZ Camera, presenter facing
- USB AV bridge
- Video scaler to allow picture in picture for second input on lecture capture appliance.
- Room booking panel for main entrance.
- Motion sensor
- Network enabled power controller.
- Interface for lighting system

18.4.5 FLEXIBLE LEARNING SPACES (FLS)

DESCRIPTION

A Flexible Learning Space (FLS) supports a student-centred approach in which students can learn about a subject through student-to-student interaction in small groups that facilitate discussion, knowledge-building, and reflection. The space is used for general timetabled teaching, always has a flat floor, always has a flexible seating configuration, always with moveable tables, sometimes with power for BYOD.

There are three main types of Flexible Learning Spaces:

- Flat-floored teaching & learning space with flexible furniture configuration & capacity for 90-120 or more student seats (FLS1)
- Flat-floored teaching & learning space with flexible furniture configuration & capacity for 60-89 student seats (FLS2)
- Flat-floored teaching & learning space with flexible furniture configuration & capacity for up to 30-59 student seats (FLS3).

The AV system shall typically comprise of a projection system or large format flat panel display (depending on the size of the space), and sound reinforcement. All systems shall be controlled via a dedicated touch panel. The AV control system shall interface to all AV equipment.

Hybrid teaching and learning will take place in these spaces via soft conferencing applications hosted on the presenter computer.

Spaces with fewer than 30 student seats may offer streamlined functionality, typically for local presentation only, including:

- Flat Panel Display (FPD)
- Soundbar for source audio playback
- BYOD connectivity via HDMI with USB-C adapter and wireless presentation
- Simple control through a keypad
- IP camera for remote support purposes

AV SYSTEM FUNCTIONALITY – FLS

As a minimum, a Flexible Learning Space types 1-3 shall be provided with the following audio-visual system functionality:

Presentation Sources

- University supplied computer for presentations and hosting software-based video conferencing.
- Laptop connection(s) to support BYOD via HDMI with USB-C adapter and wireless presentation
- Document camera
- PTZ Camera with auto-tracking to capture presenter for software-based conferencing via installed presenter computer.
- PTZ Camera to capture the audience for software-based conferencing via the installed presenter computer.

Room Displays

- Single centre or dual left and right projection or flat panel display to meet viewing sightline requirements.
- A distributed FPD design may be implemented in place of projectors in some cases depending on room layout, capacity and use case.
- Confidence Monitor

Video Outputs

- USB AV Bridge to route cameras, content, and microphones to presenter computer for software-based video conferencing

Audio

- All source audio shall be replayed via front of house loudspeakers
- All presenter microphone audio shall be reinforced via ceiling-mounted loudspeakers
- Presenter voices will be captured via lectern and wireless microphones
- Audience voices will be captured via ceiling microphones
- The hearing augmentation system shall provide the required coverage as per the NCC regulations.
- All audio sources and microphones to be sent to USB AV Bridge to be captured for software-based video conferencing

Control

Software based control system, hosted on UoM server to control the following equipment:

- Motion sensor
- Network power controller
- Projector Lift/s and screens if present
- All displays
- AV routing via network encoders and decoders
- Volume control and mute status
- Camera control
- Document camera control
- Monitoring of device status
- Lighting System

AV EQUIPMENT – FLS

As a minimum, Flexible Learning Space types 1-3 shall be provided with the following audio-visual equipment:

- Video projector(s) Centre or Left and Right
- University supplied computer
- Laptop input connection(s) – HDMI with USB-C adapter and Wireless Presenter
- Document camera
- Front of house loudspeakers
- Ceiling-mounted loudspeakers
- Wired lectern microphone x 1
- Wireless lapel microphone system x 1
- Ceiling Microphones, quantity to be determined on room capacity and layout
- Wireless microphone 2-bay charging dock
- Hearing augmentation system
- AV network encoders and decoders
- Digital audio processor
- Audio power amplifiers for front of house and ceiling speakers
- Touch panel
- Software based control via server
- University standard lectern
- Dedicated AV equipment rack if required
- PTZ Camera, presenter and audience facing cameras
- USB AV bridge
- Video scaler to allow picture in picture for software-based conferencing feed
- Room booking panel for main entrance
- Motion sensor to suit space
- Network enabled power controller
- Interface for lighting system

18.4.6 ADDITIONAL SPACE TYPES

The following space types may require an AV system to support the various pedagogies and requirements of the faculties occupying these spaces who shall be consulted accordingly. The AV systems will be scaled to accommodate the room layout and capacity and should offer basic presentation facilities with audio playback.

The AV system shall typically comprise of a display to suit the size of the space and sightline requirements, and sound reinforcement. Spaces with a capacity of greater than 30 may require presenter microphones and ceiling speakers for speech reinforcement. All systems shall be controlled via a dedicated touch panel. The AV control system shall interface to all AV equipment.

By default, these spaces will be local presentation spaces only. Hybrid teaching and learning will only be included in the design for these spaces if required by the faculty user group.

DIGITAL LEARNING SPACE (COMPUTER LAB):

A Digital Learning Space supports instructional pedagogy & activity-based learning that is software-based. Students learn about a software-based application/software coding/data management/technique/subject typically with instructor-led guidance through a sequence of activities supplemented by peer-to-peer support. The primary purpose of the space is learning how to use digital applications/software - the installed computers (and/or BYOD) are integral to this teaching & learning process.

PROBLEM BASED LEARNING SPACE:

A Problem-Based Learning (PBL) Space supports a student-centred approach in which students learn about a subject by working in small groups to solve an open-ended problem that drives the motivation & the learning.

DESIGN STUDIO

A Design Studio supports design-centred practice, is centrally timetabled, & used for the practical work associated with the design component of the academic program. The studio is always a flat-floored teaching & learning space with a very flexible furniture configuration & capacity in the range of 20-30 students.

PROJECT SPACE

A Project Space supports a learner-centred approach with emphasis upon peer-to-peer active learning in small groups that facilitate interaction, discussion, knowledge-building, & reflection. The assigned learning activities are driven by a defined project, which may be theoretical or practical. The space may be equipped with additional tools & equipment to support the learning activities. The space is available for timetabled teaching, always has a flat floor, always has a flexible seating configuration, always with moveable tables, sometimes with power for BYOD, & with capacity for 16-60 student seats.

AV SYSTEM FUNCTIONALITY

These spaces may require customisation using standard components to meet specific faculty and user requirements, but may typically be provided with the following audio-visual system functionality:

Presentation Sources

- University supplied computer for local presentations if required.
- Laptop connection(s) to support BYOD via HDMI with USB-C adapter and Wireless

Room Displays

- Single projector or flat panel display depending on image size required.

Audio

- All source-audio shall be replayed via front of house loudspeakers
- The hearing augmentation system shall provide the required coverage as per the NCC regulations.

Control

Software based control system, hosted on UoM server to control the following equipment:

- Motion sensor
- Projector Lift/s and screens if present
- All displays
- AV routing via network encoders and decoders
- Volume control and mute status
- Monitoring of device status

AV EQUIPMENT

As a minimum, these spaces shall be provided with the following audio-visual equipment:

- Video projector or flat panel display
- University supplied computer, if required.
- Laptop input connection(s) – HDMI with USB-C adapter and wireless presenter
- Front of house loudspeakers
- Hearing augmentation system
- AV network encoders and decoders
- Digital audio processor
- Audio power amplifier for front of house speakers
- Touch panel or Keypad
- Software based control via server or Keypad
- University standard lectern or touchdown point
- Room booking panel for main entrance
- Motion sensor to suit space
- Network enabled power controller
- IP camera for remote support purposes

18.4.7 PROFESSIONAL SPACES

DESCRIPTION

Professional spaces are designed for academics, professional staff and in some cases, students.

Room types include:

- Small Meeting Rooms up to 2-4 people (SMR)
- Medium Meeting Rooms from 5-8 people (MMR)
- Large Meeting Rooms from 9-12 people (LMR)
- Boardrooms and Multipurpose spaces for 13-25 people (BR)

STAFF MEETING SPACES COLLABORATION TECHNOLOGY

AV systems in staff meeting spaces will be based around the Crestron Flex System to enable users to present content locally and participate in software-based video conferencing via Zoom. Appendix C should be used as a guide when designing a staff meeting space, noting that adjustments may be required depending on the size of the space to meet industry guidelines for viewing sightlines, microphone coverage and audio reinforcement. This will apply especially for large meeting rooms and boardrooms. Boardrooms may require additional integration with building services, such as control for lighting and blinds where necessary, as well as hearing augmentation.

The touch panel location is ultimately determined by the room layout and furniture configuration, particularly in spaces with flexible furniture. Where possible, the preferred approach is to position user interfaces and connection points with the user (for example, on the table or within reach), rather than on a wall away from the primary interaction point.

Audio-visual racks and joinery should not be required for spaces other than Boardrooms, as all equipment should be installed behind the display in each space.

Rooms will be monitored via Crestron XiO and Fusion. The spaces will be based on standard designs and programmed, configured and maintained under an SLA by the University's nominated managed service provider, although they may be installed and configured by a UoM-preferred AV integrator in some cases. An AV consultant may be required in some projects to provide the system design based on the standard system patterns. System commissioning is the responsibility of the installing integrator. The managed service provider will provide instructions to the installing integrator on the steps required to prepare the spaces and installed equipment for final commissioning and handover. The steps may include uploading code and configuration files provided by managed service provider, applying IP addresses and making test calls.

Users of these spaces will be required to bring their own device (BYOD) to present in the space, via a supplied cable or wirelessly via the software-based system (e.g., wireless sharing via Zoom). Some Zoom Rooms will have additional BYOD functionality that allows users to host a conferencing session from their device, using the room's camera and microphones by connecting via a supplied cable. No fixed computers will be installed in these spaces for user presentations.

Screens may be interactive touch screens if required for specific use cases and will be used for the interactive features in Zoom including whiteboarding, not for interaction via a user's own device.

A room booking display will be installed outside each space to allow users to view upcoming bookings and make ad-hoc bookings if the space is available.

Zoom Rooms shall be designed as standalone spaces, and not as joinable rooms with the AV systems that may be linked when an operable wall is opened to create a larger space.

Refer to section 18.5.9 for design considerations for spaces with Video Conferencing.

AV SYSTEM FUNCTIONALITY

As a minimum, Professional spaces shall be provided with the following audio-visual system functionality:

Presentation Sources

- UC Engine running the software conferencing platform.
- Laptop connection to support BYOD via HDMI and USB-C
- Wireless presentation to be provided via conferencing platform.
- Conferencing camera to capture seated participants.

Room Displays

- Flat panel display shall be utilised for most meeting room types.
- Projectors may be utilised for larger Boardroom scenarios or as site conditions require.
- Room scheduling display to mounted outside room entry.

Audio

For Large and Boardroom spaces:

- All source audio shall be replayed via front of house or ceiling loudspeakers depending on room layout
- Audio shall be captured typically by ceiling-mounted microphone arrays, or in some cases wall or table mounted microphone arrays where ceiling arrays are not feasible.
- The hearing augmentation system shall provide the required coverage as per the NCC regulations.
- All audio sources and microphones to be routed to audio DSP for use within software-based video conferencing.

For Small and Medium spaces:

- An all-in-one conferencing bar with inbuilt mics and speakers will be used for both audio capture and playback.

Control

In-room hardware control processor shall be used to control the following via touch panel interface:

- Occupancy sensor for automatic start up and shutdown
- Network power controller
- Projector Lift/s and screens if present
- All displays
- Volume control and mute status

- Camera control
- Control of all conferencing application functions
- Monitoring of device status via XiO and Fusion

AV EQUIPMENT

Refer to Appendix C to view the AV equipment required for each room types.

18.5 AUDIO VISUAL TECHNICAL REQUIREMENTS

The following sections detail the minimum technical requirements for audio visual equipment specified in The University of Melbourne's AV systems.

The make and models of all audio-visual equipment nominated for The University of Melbourne teaching spaces shall be verified by Audio Visual Endpoints prior to installation. A list of AV equipment manufacturers and equipment currently supported by Audio Visual Endpoints is included in Appendix B.

All equipment installed should adhere to the manufacturer's guidelines for installation to ensure proper operation of the equipment over its expected lifetime.

18.5.1 PROJECTION SYSTEMS

Projection systems play a primary role at the University and are present in most learning spaces across the campus. It is imperative that the projection system for these spaces meet the technical and functional requirements of the space.

The AV designer shall confirm make, model and specifications of projector with an Audio-Visual Endpoints representative prior to finalising the system configuration.

As a minimum, projection systems at the University of Melbourne shall comply with the following:

PROJECTOR REQUIREMENTS

As a minimum, nominated video/data projectors shall adhere to the following standards:

- Minimum of 5000 ANSI lumens
- The specific brightness of the projector shall depend on the application and the space, considering content to be presented, and environmental factors such as ambient lighting and room lighting
- Minimum contrast ratio 2000:1
- The specific contrast of the projector shall depend on the application and the space
- Capacity to support 16:9 aspect ratios
- Native 1920 x 1080 resolution (or 1920 x 1200 running in 16:9 mode)
- As a minimum, projectors shall include the following video inputs:
 - HDMI
 - HDBaseT
- RS232 / Ethernet for control and monitoring
- Solid-state lighting technology (e.g., laser or LED light source)
- Low noise
- Ceiling-mountable.

PROJECTION SCREEN / SURFACE

The projection image shall be in the centre of the front of house, or in the case of two images (which may include writing space) each shall be situated on either side of the centre. Where possible the projection system shall be able to be used simultaneously with writing boards.

Projection walls shall be a non-reflective surface painted matte white with a screen gain of 1.0. If projected onto a wall, wall shall have a level 5 finish. Projection shall be above, or behind vertical sliding whiteboards that can be lowered to reveal the projection surface.

If required, fixed, and motorised projection screens shall be provided. The projection screen shall be sized to suit the space dimensions, sightline requirements and a 16:9 aspect ratio.

Motorised projection screens shall be quiet and robust and shall be flush mounted within the ceiling cavity where possible. Projectors should be programmed to project an image once the screen has fully deployed. Screens shall be individually controlled via the touch panel control system. Both projectors and screens shall be activated once a source has been selected on the touch panel, rather than when the AV system is turned on, allowing other system features to be used, such as microphones and lighting without the projection system. A side-tensioned projection screen may be required in some scenarios, such as those where short throw lenses are used.

PROJECTOR CONFIGURATION

The projector must be configured for optimal image reproduction. The projector must be configured with the following settings:

- Colour matching: for side-by-side projectors
- Panel alignment: adjust, if necessary, to fine tune colour and improve image sharpness
- Eco mode: switch off any auto dim or auto shutdown features.

PROJECTOR INSTALLATION

Video projectors shall be securely installed on either a ceiling bracket or within a dedicated bio-box depending on the requirements of the space. Motorised projector lifts should be used when the projector cannot be easily serviced from a ladder.

The following considerations shall be considered when positioning the video projector:

- Presentation position: The projector shall be installed such that the projected image is not obstructed by the lectern or the presenter from any audience seats. This is particularly important in spaces with fixed seating, such as lecture theatres.
- Consideration shall also be taken to ensure that the presenter is not affected by the glare from the projection angle.
- Projection image size: Each projector manufacturer recommends an optimal installation range for a given projected image. The AV consultant shall ensure that a suitable lens is provided for the desired position.
- Ease of maintenance: Consideration shall be taken to ensure that the projector is accessible for maintenance purposes. Projectors should not be installed above stairs or non-stable surfaces where ladders cannot be safely utilised. Power and data for projectors should be accessible to AV maintenance staff and not hidden inside ceiling cavities.

- Other ceiling-mounted services and equipment: Projected image should not be obstructed by other ceiling mounted services such as security cameras, light fittings, air-conditioning ducts etc.
- Projector filters and air vents shall not be covered by the mounting structure.
- Security: Projector shall be installed in a location where it is not easily accessible and prone to damage or theft.
- Projectors must be installed in accordance with manufacturer's recommendations.
- Each seat should have a clear unobstructed view to the projected image which must not be obstructed by the projector, mount or lift.

FIXED PROJECTOR MOUNT

Each projector shall be fitted on a University approved mounting bracket/mounting plate with standard security screws with appropriate spacing according to projector manufacturer recommendations. The mounting bracket shall be fitted to a compatible dropper which is then fixed directly to the ceiling slab or structure.

The mount shall take into account any space required for additional AV receivers or video decoders that will be mounted at the projector location.

The projector shall be installed such that the projector aligns horizontally with the top of the projected image and electronic image correction, or adjustment shall not be required.

The mount should be free from vibration, and in some cases a shock absorber will be required to provide a stable image.

Electronic image correction or keystone adjustments shall only be used if prior approval is provided in writing by Audio Visual Endpoints.

MOTORISED PROJECTOR LIFTS

Where possible, video projectors shall not be mounted higher than 2700mm AFFL. If projectors cannot be mounted within 2700mm AFFL on a fixed bracket, then a University approved custom-built mechanical lift shall be fitted.

The lift shall be cabled back to the AV control system and controlled by the touch panel. Furthermore, an IR receiver and remote control shall be provided as a failsafe.

The projector lift shall be installed securely on the ceiling slab and configured for single stage drop, for service only. When projector is retracted to home position, it must be in show mode. Service height shall be approximately 1500mm AFFL. In cases where a projector lift is required to have a show position in addition to the up and down position, 3-stage lifters must be provided.

Each lift must be fitted with a fall arrestor. Spaces undergoing an upgrade with an existing lift where no fall arrestor is present must have a fall arrestor added.

Category 6A (Cat 6A) cabling must be used for all audio, video, and control signals. Cabling must be terminated on a surface-mounted ceiling connection plate adjacent to the lift with stranded conductor cable down to the receiver/projector, ensuring that shield termination and grounding is applied accordingly.

Electronic image correction and keystone adjustments shall only be used if approved in writing by Audio Visual Endpoints.

University preferred projector lift is an Ultralift Unilift 2, custom manufactured to suit the specific projector model.

Only projectors with electronic lens control via a remote control may be installed in lifts.

DUAL PROJECTION

Dual projection systems shall have two images projected side-by-side ensuring that they do not overlap. Each projected image shall be of the same size, brightness, and contrast. The same model projectors shall be used in dual projection rooms.

The AV control system shall be flexible enough to allow the user to select any input source, to be displayed on either or both projection systems concurrently.

Depending on the layout in some spaces, projectors will be installed to meet viewing sightlines and not for displaying different sources simultaneously.

TRIPLE PROJECTION

There are two common scenarios where three projectors are installed:

- 1) Triple projection systems with left, centre, and right projectors that can be displayed simultaneously shall have three images projected side-by-side ensuring that they do not overlap. Each projected image shall be same brightness and contrast. The same projectors shall be used for each projector in triple projection rooms.

The AV control system shall be flexible enough to allow the user to select any input source, to be displayed on any one, two or all the projection systems concurrently. Lecture Capture Systems shall be configured to capture the left and right or centre projections (selectable via the control system) in spaces where dual capture is not enabled.

- 2) Some triple projection systems found in Major Theatres will allow a user to display a large centre image or left and right side by side images, but not all 3 images simultaneously. The user will select single or dual projector on the AV touchpanel when starting the AV system. While the left and right projectors will always be the same make and model, in cases where the centre projector may produce a larger image, an appropriate projector may be selected accordingly.

18.5.2 FLAT PANEL DISPLAY (FPD)

The University of Melbourne deploys commercial flat panel displays within various AV systems. The following table lists the recommend viewing distances for each panel size at 1080p resolution and using the principles in section 18.5.4, Lines of Sight.

Flat panel display size (diagonal)	Recommended Closest viewer	Recommended Furthest viewer
43"	1.1 m	3.4 m
49"	1.3 m	3.8 m
55"	1.4 m	4.3 m
65"	1.6 m	5.0 m
75"	1.8 m	5.8 m
85"	2.0 m	6.5 m
98"	2.3 m	7.4 m

FPD REQUIREMENTS

As a minimum, the nominated FPD shall adhere to the following requirements:

- UHD (3840 x 2160) resolution
- 16:9 aspect ratio
- High brightness – 500 nits
- Standard sizes (as nominated in the table above) to meet room requirements.
- RS232 / Ethernet controllable
- VESA compliant, wall-mountable
- As a minimum, the panel shall include at least 2 x HDMI video inputs
- Anti-glare and anti-reflective screen treatment
- Must be able to be mounted vertically in portrait orientation for digital signage applications.
- In-built loudspeakers

INSTALLATION REQUIREMENTS

FPDs shall be fitted with university approved mounting brackets. Any mounting solution or modifications to the installation bracket or security mechanisms shall be approved by Audio-Visual Endpoints.

Final height of FPDs shall be coordinated with architectural drawings and optimal viewing angles. Ceiling or wall mounted panels at high levels shall be angled down to ensure image integrity and provide appropriate headroom if installed in circulation spaces. Where a FPD has equipment installed behind or if panel is recessed, an articulated bracket must be installed to allow for technician servicing. Any recessed panel must take into consideration manufacturer recommendations related to ventilation and joinery spacing to avoid damaging the display and voiding warranty.

Interactive whiteboards or FPDs with touch overlays shall be installed ensuring the top of the board is no higher than 2030mm AFFL.

Refer to section 18.5.4. LINES OF SIGHT for viewing angle requirements.

PANEL ENCLOSURE

FPDs installed in public and unsecured areas shall be fitted within a custom-built enclosure. As a minimum, the enclosure shall have the following:

- Fully sealed (glass front)
- Lockable with keys or security screws (locks to be provided by UoM)
- Suitable for operating temperatures as specified by the AV equipment manufacturers
- Integrated air movement according to manufacturer specifications to adhere to warranty requirements.
- Mounting options: Wall mount, ceiling mount, stand-alone pedestal etc.
- Accommodate LCD screen and loudspeakers within the enclosure.
- VESA mounting compatible or ability to mount VESA compatible bracketry.
- IP54 rated – dust and splash-proof design.

- Screen shall be accessible for servicing and maintenance. The FPDs factory remote shall be available within the cabinet.
- Audio-Visual cabling inside cabinet should be managed with hook and loop tape (Velcro), no cable ties will be accepted.

INTERACTIVE FLAT PANEL DISPLAYS

Interactive FPD and Interactive Whiteboards shall be minimum 55" diagonally to a maximum of 85", have a 16:9 aspect ratio and from a manufacturer approved by Audio-Visual Endpoints.

Interactive FPDs must be installed on walls and shall be mounted ensuring the top of the board is no higher than 2030mm AFFL. Audio Visual Endpoints to be consulted with prior to specifying interactive displays. A height adjustable mounting bracket should be considered where possible to allow for greater access to the entire interactive surface.

In video conferencing enabled spaces where interactive displays are present and used for digital whiteboarding, consideration must be given to the location of a camera, which should be placed above the display to avoid suboptimal angles.

CONFIDENCE AND PREVIEW MONITORS

Applicable spaces will be fitted with a confidence monitor to allow presenters to preview their content while facing the in-room participants, or to preview the camera being captured by the lecture capture appliance.

The confidence monitor will be either a flat panel display installed at the rear of the space facing the lectern or teaching position, or an additional computer monitor on the lectern itself, known as a preview monitor.

On the AV touch panel, the confidence monitor will also be available as a display destination, allowing users to select an input to preview on the monitor and control the camera position. By default, the confidence monitor will display the presenter camera when the system is started.

In spaces where a preview monitor is installed on the lectern, only the room cameras will be required as sources to preview on the monitor. The preview monitor will be installed beside the computer monitor on the lectern, with the computer monitor being situated on the audience facing side for the presenter when standing behind the lectern to ensure that the computer monitor and audience are in within their sightlines without turning.

In web conference mode, the confidence monitor will display the presenter computer, allowing the user to see the conferencing call hosted on the computer, including the local cameras and content when shared into the meeting, or remote participants depending on the view selected within the conferencing application, such as presenter view or gallery view.

18.5.3 VIDEO SWITCHING

The University transmits and switches the following video signals:

Type	Video Signal	Example
Networked Video	HD1080 (1920 x 1080p)	Standard Resolution
	UHD (3840 x 2160p)	Specific Use Cases
Digital Video	HDMI	Fixed computer, laptop input, document cameras, DVD, Blu-Ray, PTZ cameras etc.

All video signals shall be switched, scaled, and transmitted at a maximum resolution of UHD (3840 x 2160 pixels) where hardware and infrastructure allow. Displays should display signals at UHD where hardware allows, otherwise at the highest possible native resolution of the display device.

All new AV systems must be provided with provisions to support digital video equipment (e.g., HDMI). All digital video switching equipment must support EDID and HDCP protocols.

Video switching equipment must be provisioned with the ability to disable HDCP from any input, including HDMI computer sources, HDMI laptops and HDMI document cameras.

All source devices that provide HDCP content must also provide sufficient HDCP (KSV) keys to allow all display devices to display content.

All inputs & outputs must be labelled for all AV routing devices.

All AV device configuration files must be provided at handover for the space to be accepted as completed.

Device passwords should be confirmed by UoM AV Endpoints team prior to commissioning

18.5.4 LINES OF SIGHT

Optical calculations shall be performed to determine suitable projection or display parameters for each space; however, the following standards shall be applied:

- Furthest Viewer – no viewer shall be further than six times the image height from the projection/display surface
- Closest Viewer – no viewer shall be closer than 1.732 times the image height from the projection/display surface.
- Horizontal Viewing Angle – audience shall be positioned within an arc of 45 degrees from either side of the centre line of projection/display to achieve a good viewing angle.
- Vertical Viewing Angle – the closest audience members shall be limited to a maximum of 30 degrees head tilt above horizontal, measured from the viewer's eye level to the top of the active image area
- Display Mounting Height – the display mounting height shall be set such that the vertical viewing angle requirement is achieved for the closest viewer. Compliance with closest viewing distance alone shall not be considered sufficient.

- Image position – The base height of the projection/display image shall be determined based on vertical viewing angle requirements and room seating configuration, noting that seated head height of audience members is 1300mm above finished floor level.
 - In spaces where the audience will primarily be standing, the minimum height will be 1700mm AFFL
- Element Height – EH refers to the smallest height of an element or character shown on a display under normal viewing conditions and is expressed as a percentage of the total image height (%EH). Based on the furthest viewer distance of $6 \times$ image height, the minimum element height should be 3%. Note that smaller text or element size will result in a reduced furthest viewer distance.

Whilst the horizontal viewing angle and closest-viewer rules are somewhat flexible at the discretion of Audio-Visual Endpoints, the furthest-viewer rule must be met and is considered essential.

The size and the height of the image shall consider environmental considerations such as ceiling height, ceiling mounted equipment, furniture, audience seating position etc. Limitations in ceiling height may require additional displays to be installed to provide the necessary sightlines to all participants in the space. Each seat should have a clear unobstructed view to the lecturer and to all boards and screens located on the presentation wall.

18.5.5 SOUND REINFORCEMENT

Despite the growth in the use of visual media as a means of communication; verbal communication remains the single most important method of teaching and learning. Irrespective of the size of the space, attention must be paid to optimising the acoustic properties of the space.

Audio amplification is required for all lecture theatres and should be considered for other presentation spaces with a capacity of greater than 30 people or where furthest seat is between 6-8 metres from the usual teaching lectern or presentation point, taking room acoustics into account.

Wherever amplification is installed for either presenter's voice or for digital audio reproduction, provision for hearing augmentation systems should be considered in line with applicable national construction and accessibility standards.

Typically, source/program audio shall be reproduced via dedicated front of house loudspeakers and microphone audio shall be via ceiling-mounted loudspeakers for voice lift. The hearing augmentation system and Lecture Capture system shall have a combined pre-fade mix of both source and microphone audio inputs (independent of in-room program audio level controls).

DSP (DIGITAL SIGNAL PROCESSING) CONFIGURATION

All DSPs in teaching spaces should be configured using a UOM supplied template, which will then need to be adapted by the AV contractor to suit each space to optimise the audio. The DSP template will need to be considered by AV system designers to ensure the schematic drawings align with the inputs and outputs in the template.

All inputs & outputs must be labelled for all DSP devices, including any Dante names which shall match the names used in Dante Controller when setting subscriptions.

In spaces where network video encoders and decoders are deployed, all Dante flows will be routed to the main display decoders and secondary display as a backup.

Within DSPs, all matrix blocks and other processing blocks must be labelled appropriately.

All DSP configuration files must be provided at handover for the space to be accepted as completed.

Device passwords should be confirmed by UoM AV Endpoints team prior to commissioning. Once commissioned, all DSPs must not display any fault indicators.

At least 1 DSP in each room system must have at least 25% resources free to allow for system auto-testing to take place.

MICROPHONES

Wired and wireless microphones shall be used as stipulated within the relevant system standard or as required for the project. Wired microphones shall be gooseneck lectern microphones installed with a shock mount. Lectern microphones shall be ducked in the DSP when lapel microphones are in use. Ceiling microphones shall be ducked in the DSP when any presenter microphones are in use, whether it be wired lectern microphones or wireless microphones. Ducking is to be done using sidechain compression.

Ceiling microphones installed in interactive hybrid spaces shall be routed to the USB AV Bridge only and shall not be reproduced through the room loudspeaker system.

Where audience voice uplift is required, typically in larger flexible learning, collaborative learning, or lecture environments, ceiling microphone audio may be routed to the room loudspeaker system. In these cases, loudspeaker layout, zoning, and DSP channel configuration shall be considered during the design phase to ensure an effective mix-minus solution and minimise the risk of acoustic feedback.

UoM are currently deploying Digital Wireless Microphones with automatic frequency management. Other wireless microphones using digital modulation shall operate on Band A 520-558MHz frequency range. Commissioning of wireless microphone systems shall be coordinated with the existing range of frequencies in use in nearby spaces to ensure there is no interference. Alternative configurations to wireless microphones require approval from Audio Visual Endpoints staff. Appropriate amplification shall be installed when a sound reinforcement system is required.

To ensure audio system testing can take place in teaching spaces, the following considerations shall be taken into account during design and installation:

- Each wireless microphone charger shall be connected to network PDU.
- Each wireless microphone receiver (1/2ru) shall be connected to a network PDU
 - Where possible, the charger and receivers shall be on separate PDU's.
- Charging docks shall be located in the space where docked microphones can receive test tones played through in-room speakers (not bio box unless there are monitor speakers installed)
-

ACOUSTICS

The following acoustic properties should be considered when designing new or refurbished spaces.

Reverberation Time, RT60

- Target: 0.3 seconds – 0.5 seconds
- Maximum: 0.6 seconds

Ambient Noise Level

- Ambient noise levels shall be measured with the room unoccupied and building services operating normally.
- Target: 35 dBA SPL
- Maximum: 45 dBA SPL

Default Volume Level for voice and presentation source amplification

- Voice reinforcement levels shall be measured within the occupied seating area.
- 60-65 dBA SPL

Headroom for voice and presentation source amplification

- 3-6 dBA above the nominal operating level, up to a maximum of 70 dBA SPL

It is recommended to use an acoustic consultant in new or refurbished spaces to optimise the acoustic performance of any venue.

Appropriate acoustic treatment should be considered and may often be necessary to enhance the audio intelligibility and performance in any given space, especially if any of the above listed targets for reverberation time and ambient noise levels cannot be met.

18.5.6 HEARING AUGMENTATION SYSTEMS

The AV Contractor must provide Hearing Augmentation systems where there is an inbuilt amplification system, other than one used solely for emergency warnings, as per National Construction Code (NCC) requirements.

The type of Hearing Augmentation system must be determined with due consideration of the building environment, restrictions, interference, and user requirements.

IR hearing augmentation systems are the preferred solution at the University and will be specified according to room requirements. Approval from Audio Visual Endpoints staff will be required when specifying a hearing augmentation system.

A complete set of test results must be produced and provided with each system including a certificate of compliance as per AS1428.5-2021.

All hearing augmentation systems must be provided with a feed that shall consist of a mix of both program audio and designated microphone sources as follows:

- Program Audio: Pre-fader, post-mute
- Microphones: Presenter microphones only, post-fader, post-mute

Volume control of the hearing augmentation feed shall be adjustable solely on the receiver.

Spaces that are equipped with hearing augmentation systems must require signage compliant to National Construction Code (NCC) Clause D4D7 as defined by AS1428.1 displayed at the entrance of the space. An example of signage used at the University can be found in Appendix F.

INFRA-RED SYSTEMS

Infra-Red Hearing Augmentation systems must include IR transmitters, antennas, and IR receivers.

As a minimum, the IR Hearing Augmentation system must meet the following criteria:

- IR Hearing Augmentation must provide 95% coverage of the room as per the NCC

- Multiple transmitters may be required to ensure correct operation for all room configurations.
- Transmitters must not be installed outside or in direct sunlight.
- Audio signal from AV system sufficient to engage IR emitter.
- The number of receivers must correspond to the number of people the space accommodates to meet National Construction Code (NCC) regulations. If the room or space accommodates up to 500 persons, 1 receiver for every 25 persons or part thereof, or 2 receivers, whichever is the greater
- Charging station and rechargeable batteries must be provided for all receivers supplied.

The contractor must conduct a site survey and review line of sight restrictions and ambient light, prior to submitting a detailed design submission.

HEARING INDUCTION LOOP

While no longer the preferred solution at the University, where an induction loop system is required, the AV Contractor shall coordinate with the builder to install copper foil tape below the floor covering.

The hearing augmentation system shall provide a minimum of 80% coverage of usable floor space as per National Construction Code (NCC), with low spill to outside areas unless otherwise specified.

As a minimum, the assistive hearing loop must meet the following minimum criteria:

- Field strength inside the area of use must be equal to 400mA/m plus/minus 3dB (tested with 125ms RMS measurement with 1kHz Sine wave)
- Total variation in signal across the frequency band 100Hz to 5kHz at 1kHz must be within 3dB anywhere in the loop area
- Background noise must be less than or equal to -32dB relative to 400mA/m.

Contractors shall specify an appropriate and optimised loop layout from the list below for rooms over 100m².

- Counter Loop: Typically used for counters and benches where one-to-one interaction is required.
- Perimeter Loop: Preferred and typically used in spaces where there are no spill issues and minimal metal loss.
- Single Array Loop: Typically used in fixed seating arrangements where it is known that users will not pass through the "null" zones during use.
- Cancellation Loop: Typically used for rooms located back-to-back where loop spill is reduced in one direction.
- Low Loss Phased Array: Typically used in spaces where metal loss occurs and there is a requirement to reduce spill into adjacent rooms.
- Ultra-low Spill Phased Array: Only used in spaces where metal loss occurs and there is a requirement to minimise spill for confidentiality purposes.

The installer must seek specialist design advice from the manufacturer regarding the specific design of the system and submit designs to the AV Endpoints team with shop drawings for review.

The Contractor must coordinate on site to determine the presence of existing adjacent hearing loop systems within the building.

The Contractor must conduct a site survey to undertake field strength measurements prior to designing the new hearing loop, to determine whether background interference is greater than, or equal to, -32dB relative to 400mA/m. The field strength measurements must be taken whilst adjacent hearing loop systems are in operation.

If an interfering system is discovered, the Contractor must advise the Project Manager and the Consultant and then proceed with the design of the hearing loop system.

The Contractor must submit results of background field strength measurements included with a manufacturer endorsed hearing loop technical design proposal. The measurement results and loop design proposal must be submitted to the Project Manager for approval prior to installation.

Where the manufacturer endorsed design includes the installation of copper foil tape below floor coverings (where chasing of floor is not be feasible), detailed technical drawings must be submitted for approval by Project Manager prior to installation.

The Contractor must engage the manufacturer of the hearing augmentation system to provide specialist design advice, site testing, technical data, and design documentation from the system manufacturer for each space.

The manufacturer of the loop system, or their approved Australian distributor, must undertake the final system testing and provide the manufacturer certificate of compliance.

18.5.7 CONTROL SYSTEM

All teaching spaces provided with an audio-visual system shall include a dedicated Crestron control system fully programmed to control all audio-visual devices. At a minimum each room shall be provided with a fixed control interface (touch panel or keypad) connected to either a virtualised or dedicated control processor.

All teaching spaces shall be controlled using Crestron Virtual Control (VC-4) and programmed by a University preferred programmer which will be engaged directly by the University. Servers running the Virtual Control application are managed by the University. AV Contractors will be required to coordinate with the university's appointed programmer during the project installation and commissioning phases.

For control in professional spaces, please refer to the devices listed in Appendix C. A base/template control systems program for professional spaces shall be provided by university managed service provider.

USER INTERFACE

The University typically uses the following control interfaces:

Device	Model	Typical application
Wired Touch Panel	Crestron 1070-series	Lecture Theatres, Collaborative Spaces and some Flexible Learning Spaces, Professional Spaces with Crestron Flex Systems
Wireless touch panel	Requires approval from Audio Visual Endpoints	Can only be installed in addition to a hard-wired interface (e.g., secondary user control interface)

Device	Model	Typical application
Button keypad	Crestron MPC4 Series	Student Pods in Collaborative Spaces and some Flexible Learning Spaces, Project Rooms

USER INTERFACE MOUNTING HEIGHTS

All wall mounted interfaces that require user interaction, including touch panels, keypads and room booking panels, must be mounted with the top of the panel at 1220mm AFFL to allow for equal access. The area below the panel must not have any obstruction greater than 250mm hindering access to the interface.

DEVICE INTEGRATION

The following audio-visual equipment shall be interfaced with the control system processor as follows, showing preferred control interface and acceptable alternatives in brackets.

All equipment with bidirectional control interfaces should be utilised in preference to unidirectional control interfaces, e.g., infrared, contact closure, low level signalling.

Device	Control Interface
Audio amplifier	Consult with Audio Visual Endpoints as required
Audio DSP / Digital audio processor	Ethernet (or RS-232)
Camera	Ethernet (or RS-232 / RS-485)
Display – FPD, video projectors, video wall processors	Ethernet (or RS-232)
Document camera	Ethernet (or RS-232)
Lecture Capture Appliance	Ethernet
Lighting dimmers	Ethernet (RS232 or RS485)
Motion sensor	Ethernet (or low-level signalling)
Motorised projection screens	Ethernet (or contact closure / low-level signalling)
Motorised projector lift	Ethernet (or contact closure / low-level signalling)
Playback equipment	Ethernet (or RS-232)
Power Controller	Ethernet
Network video encoders/decoders	Ethernet

Alternative configurations shall be approved in writing by Audio Visual Endpoints.

PROGRAMMING & DEVICE CONFIGURATION

Programming of control systems shall be coordinated with Audio Visual Endpoints. The control interface of all teaching and learning spaces should be consistent with the user

interface guidelines contained within *Appendix A: Touch panel interface examples* of this Design Standard.

For custom designs that do not utilise the interface provided by the University preferred programmer, the contractor shall organise workshops and submit storyboards of the proposed touch panel and keypad layout to an Audio-Visual Endpoints representative to verify the layouts are correct prior to commissioning. A selection of configurations and automation shall be available from the touch panel. Selecting a function from the touch panel shall operate all required equipment to perform that function, e.g. selecting a source on the user interface will switch the projector on, route sources to the correct destinations and select the required lighting pre-set.

The Contractor shall supply the finalised as-built control systems programming (both compiled in the latest environment and uncompiled source code) to the University on completion of the project. Software provided by the Contractor shall be procured and transferred in full compliance with the publisher's copyright, licensing and other requirements of ownership and use. License agreements shall be registered in University of Melbourne's name.

The University shall retain full rights to all custom software and programming developed by the Contractor as part of the Project. This shall include, but not be limited to the right to use, reproduce, and modify the software as reasonably required to operate the systems and to support their ongoing maintenance and development.

All programming in teaching spaces will be produced by a university preferred contractor. The room will be controlled using a virtual control system that is installed in the University data centre. Any deviation will require formal approval from Audio Visual Endpoints. The installing integrator will be required to configure the hardware as per advice from the University to work with provided source code. The AV integrator will be required to provide the licensing for the virtual control platform, as nominated by UoM.

Commissioning guides for some equipment will be supplied by the AV Endpoints team to AV integrators ahead of an installation.

Device passwords should be confirmed by UoM Audio Visual Endpoints team prior to commissioning.

SHUT DOWN / MOTION SENSOR

Ceiling-mounted motion sensors shall be provided for all spaces equipped with a control system. In cases where height of the ceiling will exceed the coverage range of the sensor, it may be installed on the wall. Refer the sensor manufacturer's documentation in relation to any installation limitations and recommendations.

The control system shall be configured to automatically turn off all equipment when the motion sensor has not detected any movement for three hours, *and* the control interface has not been active (touched) within this period. The motion sensor on a user interface (e.g., touch panel) must also be used if available.

Additionally, the control system shall be programmed to check status of the motion sensor at 11pm every night. If no motion has been detected, the AV system shall shut down all equipment. If motion has been detected, the system will repeat check every 2 hours.

REMOTE MANAGEMENT

Remote monitoring and management of devices plays a critical role in the University's AV support operations. All devices attached to an AV control system with feedback control (RS-232, RS-422, RS-485 and TCP-IP) shall be able to be monitored and managed via the University of Melbourne's remote management applications via the

University LAN. Contractors must coordinate with Audio Visual Endpoints staff to integrate control systems for all spaces.

Existing spaces with AMX and Extron control systems must be upgraded to Crestron control systems and integrated to the Crestron XiO cloud.

- All Crestron devices and control systems will be monitored via XiO Cloud, with licensing to be provided by AV contractor as part of the installation. The license will be provided by the University's managed services partner for professional meeting spaces. Some device settings will be configured via XiO Cloud and pushed to devices.
- All Biamp DSPs shall be monitored via Biamp SageVue.
- All Sennheiser microphones shall be monitored via Control Cockpit.
- All Concierge Booking displays shall be monitored by Concierge Companion.
- Dante Domain Manager will be used to monitor Dante enabled devices in teaching spaces.
- Shure ceiling Mics and DSPs shall be monitored via Shure Cloud.

REMOTE POWER MANAGEMENT

A networked power distribution unit (PDU) must be provided to all AV equipment racks to enable remote monitoring and management of devices. As a minimum the PDU must allow for the following functionality via a web-based interface:

- Current and power metering per outlet.
- Remote ON/OFF and reboot switching.
- PDUs will typically have 8 outlets for teaching spaces, and 2 outlets for professional spaces, each rated at 10 A at 230 V AC.
- Each port must be labelled within the web interface with the device attached to that port, and noted on the room as built drawings.
- AV Endpoints to advise installing contractor of any administrator and control protocol passwords to apply to network PDUs.

18.5.8 NETWORK REQUIREMENTS FOR AV

All devices connected to the network must be listed on the UoM Project Workbook's IP and Asset Schedule for Audio Visual Endpoints to allocate IP addresses. The schedule will be shared by the Audio Visual Endpoints team via SharePoint. MAC addresses must be provided by AV contractor prior to IP addresses being allocated. The Project Workbook's Asset and IP sheet must be used to record equipment and network information for IP addresses to be allocated, no other format will be accepted.

Devices that are not listed within the AV Design Standards must not be connected to the network without consulting with the appropriate University stakeholders, which may include AV Endpoints, Networks, Cybersecurity and Enterprise Architecture representatives.

The requirement or use of a dedicated AV Network Switch in any project shall be discussed and approved with the Audio-Visual Endpoints team prior to inclusion and where required, the University's Network Access team. Network switches will be installed in a dedicated network communications room, and not in a lectern or AV rack within a teaching space and configured by a UoM network engineer.

Network switches will be procured through an AV installation project using the UoM network procurement procedures for network hardware and not supplied by an AV contractor.

A data outlet should be provided and cabled directly back to the communications room servicing the impacted area for each device requiring network connectivity. Spare data outlets should be allowed for at the AV rack and lectern for future expansion of the AV system and redundancy.

The VLANs typically used for AV projects include:

VLAN Description	Devices
LS - 1300	AV encoders and decoders, Control Systems, DSPs, User Interfaces, Microphone Receivers, Dante devices in teaching spaces
MITs – 1400	Digital Signage Player and Displays, Concierge Booking Panels, Wireless Video Presentation devices, all devices in Crestron Flex Meeting Spaces
Staff Mobility - 1100	Fixed IT Computing
PVS – 2100	Computer Labs (Citrix)
VoIP	In Room Resource Phone

- Ports are configured for PoE (802.3at), and devices that require POE++ *may* require a PoE++ injector.

AV OVER IP (AVOIP)

AV over IP systems are deployed at the University of Melbourne to provide flexibility and scalability for AV systems by transmitting audio, video, and control signals over the enterprise network infrastructure rather than AV switchers and signal processors with fixed inputs and outputs.

When designing systems with AV devices that will transmit audio and video signals over the enterprise network, the University's network operations team and network standards must be consulted.

Specific requirements related to multicast traffic, IGMP, QoS and PoE will need to be configured by a UoM Network Engineer in accordance with the solution outline for AVoIP systems at the University. Note that Crestron NVX360 series decoders connected to a flat panel display that uses a 2-pin figure-8 power cable require a suitable PoE power injector to mitigate grounding issues that can otherwise lead to device faults.

Buildings where AVoIP systems will be deployed will require additional planning around network switch and comms room capacity, to accommodate additional switches for spaces utilising AVoIP devices.

A guide to configuring network video encoders and decoders will be provided by AV Endpoints to integrators installing AVOIP systems. Devices that may be used for AVoIP are listed in *APPENDIX B: APPROVED AV EQUIPMENT MANUFACTURERS*.

18.5.9 VIDEOCONFERENCING SYSTEMS

The University currently enables videoconferencing capabilities in selected teaching, research, and professional spaces. Each video conferencing system shall be designed in consultation with Audio Visual Endpoints to meet the User Group requirements. The AV Consultant shall consider and coordinate the following aspects of the room:

Camera Placement

- To maintain a natural sight line between the in room and remote participants, it is recommended that cameras be installed on the vertical plane within 15° of the presenter eyeline, and 30° on the horizontal plane. The installed camera must be free from vibration or movement, particularly if ceiling mounted.

Lighting

- Lighting in a space with video conferencing should be well balanced. A four-point lighting system is recommended.
- Avoid lighting that causes glare, both directly into the camera and indirectly via other surfaces in the room.
- Dimmable lighting control is recommended.

Furniture selection

- Tables: 20 to 60 percent reflectance. Neutral colour finishes including grey, buff, taupe. Modesty panels should be considered.
Chairs: As per recommendation for wall finishes.

Interior Design

- Walls: 40 to 60 percent reflectance with no small patterns or stripes. Recommended colours include grey, blue, and mauve. Black, orange, yellow, green, and red are not recommended.
- Floors: less than 60 percent reflectance
- Ceiling: 70 to 90 percent reflectance
- Windows: Interior colours of window shades follow the recommended wall colours. Blackout shades should be installed for all windows.

Acoustics

- Carpet is recommended in conferencing spaces.
- Wall and ceiling acoustic treatment must be considered.

Network Capacity

- Wireless network coverage required for user devices such as laptops
- Wired network bandwidth and capacity (to be coordinated with University Networks team).

SOFTWARE BASED-CONFERENCING

Meeting rooms and huddle spaces may be provided with a software-based conferencing. Software based conferencing systems provided to the University must comply with the following:

- Web-conferencing software must be Zoom or MS Teams cloud-based application linked to the University's existing account/subscription.
- IP-enabled and configured to operate over the University enterprise network with internet access.
- Capacity to support content collaboration for concurrent video and content streams.
- Full control via a native conferencing interface
- Audio and video signals shall be presented as USB devices for use by connected compute devices and software-based conferencing codecs.

HYBRID TEACHING AND LEARNING

Many teaching spaces will be designed to be enabled with software based conferencing unless physical space or teaching activities do not accommodate or require conferencing. All microphone audio, camera and video sources shall be routed to the presenter computer via a USB AV bridge.

There are two different modes of hybrid that depend on the usage of the room:

- **Interactive Hybrid** - Full capture of presenter and students for interactive discussions between in room and remote participants.
- **Presenter-Focused Hybrid** - Capture of presenter only with limited student interaction, usually just Q&A with handheld mics for in room participants or conferencing chat by remote participants.

The following equipment will be required for teaching spaces with software-based conferencing capabilities:

- Presenter computer to host conferencing sessions via an application installed on the computer.
- USB AV Media Bridge to convert and route all room audio and video signals to the presenter computer.
- A multiwindow processor to allow both the audience and presenter cameras to be sent to the presenter computer to be viewed in the conferencing platform. When a presentation source is selected, the multiwindow processor will show the selected source as a full screen image, with the presenter camera as a picture in picture (PiP) image.
- In applicable spaces, a confidence monitor will display the presenter computer, allowing the presenter to see the conferencing call hosted on the computer, including the local cameras and content when shared into the meeting, or remote participants depending on the view selected within the conferencing application, such as presenter view or gallery view.

Cameras

- Up to two HDMI PTZ cameras will be installed in the space and controlled via the AV Touch panel.
 - In both Interactive and Presenter-Focused hybrid spaces, one camera will capture the presenter location and whiteboard with direct line of sight where possible.
 - The presenter camera will have auto-tracking capabilities, configured to ensure that tracking starts when presenter is standing at centre of lectern.
 - In Interactive hybrid spaces, a second camera will be positioned to capture the audience.
 - The camera orientation will need to be considered depending on the space. It is preferred to mount the camera upside down with image flipped to be able to extend the vertical tilt range of the camera.
- Each presenter camera will consist of 3 fixed pre-sets, and 3 user definable pre-sets. The fixed pre-sets for the presenter camera will be labelled:
 - Pre-set 1: **Lectern**
 - Pre-set 2: **Lectern Mid**
 - Pre-set 3: **Lectern Wide** (Default)
- In spaces with a whiteboard, the default pre-sets will be:
 - Pre-set 1: **Lectern**
 - Pre-set 2: **Lectern Wide** (Default)
 - Pre-set 3: **Whiteboard**

- Each audience camera will consist of 3 fixed pre-sets, and 3 user definable pre-sets. The fixed pre-sets for audience camera will be labelled:
 - Pre-set 1: **Centre** (Wide Shot - Default)
 - Pre-set 2: **Left** (Audience Left)
 - Pre-set 3: **Right** (Audience Right)
- Each presenter source will be routable to the USB AV Bridge, including laptops and document cameras if present. The presenter computer must be independently routable from other sources.

Web Conferencing Control

- The touch panel will be configured with a Web Conferencing page that will display the presenter computer on the room displays.
- The cameras and other presentation sources will be selectable in the Web Conference page and display in the room via the software-based conferencing application where the USB AV Bridge has been selected in the software-based conferencing application, such as Zoom. Please refer to Appendix A for GUI design example.
- By default, the presenter camera or both cameras where a multi-window processor is installed should be selected when Web Conference is selected on the touch panel.

Presenter Microphones

- Any wireless microphones within the room will be routed to ceiling speakers and video conference platform via USB media bridge.
- Presenter microphones include the installed lapel microphone and lectern microphones in any given space. The volume and mute state of the presenter microphones will be controlled via the AV touch panel.
- In spaces with a capacity of less than 30 people where no voice reinforcement is required, a ceiling microphone/s may be used to capture both the audience and presenter voices, considering the physical characteristics of the space.

Audience Microphones

- In the flat floored interactive hybrid teaching spaces, ceiling microphones (e.g. Shure MXA920) will be utilised with a Dante Interface to feed into a Dante enabled DSP.
- The volume and mute state of handheld audience microphones will be controlled via the AV touch panel. While in conferencing mode, any audience microphones that are not handheld microphones, do not require volume control and should be muted by default and activated by the presenter on the AV touch panel.
- The auto mix channel from the mics will be used to send an audio feed to the DSP, with AEC applied on the DSP.
- Ceiling microphones will be routed through to the USB AV Bridge only, not the room loudspeakers unless there is a specific requirement for voice uplift in larger spaces. In spaces with voice lift the speaker layout and channel configuration will need to be taken into consideration during the design phase.

18.5.10 LECTURE CAPTURE

The University of Melbourne lecture capture system is a central recording system that records and distributes audio and visual content from lecture theatres and other teaching spaces. The audio-visual content is captured, encoded, and stored on a cloud server and delivered over the University network via a dedicated portal and a network connection. Lectures may also be streamed via the lecture capture system to allow students to view presentations remotely in real-time.

The lecture capture system requires two dedicated video inputs and a dedicated audio feed from the AV system's digital audio processor connected to the balanced audio inputs.

The audio feed shall be a combined mix of both microphone and source audio inputs terminated into the stereo Phoenix connectors. Microphone and program audio touch panel controls shall not affect the level sent to the capture appliance, ensuring a constant audio feed. Program audio will mute as required; however, as it is sourced pre-fader, it will remain at a constant level relative to the feed.

The video input to the Lecture Capture is HDMI and must be 1080p.

During installation projects, lecture capture appliances are UoM procured devices, to be collected from a location advised by AV Endpoints and installed in a teaching space by the AV Contractor.

Video Arrangement and Multi-Window Processors

In a space with a single projector:

- Input 1 on the capture device will replicate what is being shown on the projector.
- Input 2 on the capture device will show the presenter camera by default, and the user will have the option to blank the camera if required via the AV touchpanel.

In a space with dual left and right projection:

- Input 1 on the capture device will replicate what is being shown on the left projector.
- Input 2 on the capture device will replicate what is being shown on the right projector with the presenter camera as a picture in picture image.

In a space with centre, left and right projection:

- When centre projector is being used, the space will operate as a single projector room
- When left and right projectors are being used, the space will operate as a dual projection space

For spaces with a multi-window processor feeding images to the second input of the lecture capture device, certain pre-sets will be called to optimise the image as described in the table below.

Display / destination selection	Stream / recording input 1	Stream / recording input 2	Notes
All Displays Same content shown on both projectors or in a single projection space	Content, full screen	Camera, full screen	Applies when the All Displays option is used.
Blank selected for All Destinations	Blank	Camera, full screen	The camera continues to display full screen on input 2.
Web Conference option selected on the touch panel	Presenter computer	Camera, full screen	Same behaviour as All Displays , with the presenter computer on input 1.
Different content on left and right projectors	Left projector content, full screen	Right projector content with camera in picture-in-picture	Used where separate content is routed to each projector.
Blank selected for the right projector	Left projector content, full screen	Camera, full screen	The camera displays full screen rather than showing picture-in-picture over blank content.

Lecture Capture Controls

The touch panel control system installed within the teaching space shall include a dedicated page for lecture capture systems to monitor, pause and stop recordings. The audio feed to the capture device will be a set level and will bypass any volume or mute controls on the AV user interface.

The ability to send the presenter computer to the room displays or other endpoints such as video decoders independently of other sources must be implemented.

Camera control will appear on the Confidence or Preview Monitor page on the AV touch panel, allowing users to set up and preview the camera shot without having to display it on an audience facing projector.

PRESENTER CAMERA

A presenter camera will be required to capture the presenter location, usually the general lectern area.

- The camera will be a PTZ camera and controlled via the presenter touch panel.
- The default position of the camera will be a close shot of the lectern area.
- The presenter tracking camera will be capable of auto-tracking the presenter, which may be enabled via the touchpanel.
- The user will also be able to select from 3 pre-sets:
 - Pre-set 1: **Lectern**
 - Pre-set 2: **Lectern Mid**
 - Pre-set 3: **Lectern Wide** (Default)

- In spaces with a whiteboard, the default pre-sets will be:
 - Pre-set 1: **Lectern**
 - Pre-set 2: **Lectern Wide** (Default)
 - Pre-set 3: **Whiteboard**

WHITEBOARD CAPTURE

For spaces with a writing surface, the camera will be required to capture the writing surface via a pre-set on the AV touch panel.

In a space where the projection surface is behind double hung whiteboards, the user must be able to blank the projection when the 'Whiteboard' pre-set is selected to capture the whiteboards whilst still retaining the computer audio in the space. The Whiteboard preset should present as a full screen image to the lecture capture appliance.

The image from the presenter computer should still be viewable on other displays in the space if present.

CAMERA PRE-SETS

Named camera pre-sets must not be editable by users but should have a passcode to allow support staff to alter the pre-set if required. Three editable user pre-sets must also be provided. Pre-sets will be stored with a button press and hold for three seconds on the touch-panel.

18.5.11 DIGITAL SIGNAGE

Digital signage systems provided within the University shall be network-enabled and be integrated with the centrally managed digital signage platform.

Each project will be required to determine the following:

- Number and type of displays and player hardware
- Number of content administrators / authors
- Content management policy.

Design and deployment of all digital signage systems must be coordinated with Audio Visual Endpoints as the technical owner of the digital signage service. Marketing and Communications are the business owner for digital signage, and responsible for content management.

An AV contractor will be required to supply and install the digital signage player and screen and configure network settings on devices, which will then be connected to the content management system (CMS) by the Audio Visual Endpoints team.

Digital signage systems will consist of a media player and a display, which may be mounted in portrait or landscape orientation. The status and power schedule of the display will be controlled via a serial connection to the screen from the player via the Scala CMS.

There are various types of digital signage systems deployed.

- Static digital signage for various sizes from 55" to video walls with multiple displays.
- Interactive digital signage e.g., wayfinding kiosk, 55" display
- LED displays

Digital signage displays being used as a wayfinding or interactive display in portrait orientation shall be mounted no lower than 685mm (bottom edge of screen) and no higher than 2030mm (top of screen) AFFL.

The digital signage player shall be installed in a way that is serviceable by support staff but protected from tampering from unauthorised people. Covers should be installed around the mount to conceal the media player, power and data behind the display.

Refer to Appendix D for Digital Signage bill of materials and implementation work flow.

LED displays will require consultation with the AV Endpoints team prior to including in a design.

18.5.12 OVERFLOW & ROOM LINKING

OVERFLOW DISPLAYS

Selected theatres may be provided with overflow displays (FPDs / projection systems) in the foyer area outside and/or surrounding spaces. Overflow displays are used in circumstances such as special events, conferences or public lectures so that the lecture may be viewed by event organisers and attendees from outside the space if required and can also be used for digital signage when not used in the overflow mode.

The PTZ camera(s) within the theatre may be used to display the presenter on the overflow displays. Additionally, a dedicated feed from the video distribution system must also be provided so that the overflow display can replicate the same content shown on the primary projection system within the theatre. The feed to the overflow screen will be selectable via the AV user interface within the space.

The size of the overflow display and installation locations shall be confirmed with Audio Visual Endpoints.

An appropriate audio system will also be required for overflow, providing reproduction of both microphone and source audio from within the theatre.

ROOM LINKING

In cases where two or more adjoining rooms may be linked, one room will become the primary room and send video and audio content to the adjoining space/s, which will be the secondary space/s. Microphones from both the primary and secondary room will be available for use when rooms are linked, including presenter and audience microphones, except for any lectern microphones in the secondary room/s.

A room link must be enabled or disabled from the user interface in the primary room. The interface in the secondary room will become locked while the link is in place.

Room linking for spaces that cannot be physically joined by retracting operable walls, may be designed to join as a participant via a software conferencing platform such as Zoom.

Zoom Rooms systems should not be implemented in physically joinable spaces that are used for functions other than teaching, such as staff workshops, training and presentations. These spaces should be designed in consultation with the AV Endpoints team.

18.5.13 MEDIALINKS

Selected event theatres and spaces shall be provided with media outlets to allow external parties, such as news services or live streaming, to connect for broadcast or recording purposes. Any media links or tie-lines may also be used by Learning Environments when recording or streaming events.

The specific number of connections and the number of links required shall be confirmed with Audio Visual Endpoints.

MEDIA CONNECTION

As a minimum, media outlets may consist of the following connections:

- XLR Inputs to connect mixing desk or additional microphones.
- XLR Outputs as follows:
 - 1 output of program audio
 - 1 mixed output of all microphones
 - 1 mixed output of all microphones and source audio
- HDMI Input and Output
- Video and audio tie-lines may also be provided for production purposes.

Use of media connection points will need to be facilitated by the appropriate UoM Service Delivery event support team or AV Endpoints.

Quantities of connection points may be determined through consultation with the Learning Environments video and audio production team, Service Delivery event support team or appropriate user group.

18.5.14 LIGHTING

LIGHTING LEVELS

Lighting levels within teaching spaces must comply with the minimum requirements as nominated in the *Section 7: Electrical Services of the University's Design Standards*.

INTEGRATION

The AV Contractor shall coordinate with electrical contractors to integrate lighting systems with the AV control system. The electrical contractor shall be responsible for providing and installing lighting dimmers along with either a LAN (or RS-232/RS-485) interface that is communicable from the AV VLAN.

Care must be taken to minimize light spilling onto projection surfaces. Any lights surrounding projection surfaces must be controllable and on a different circuit to other lights within any given spaces, such as audience / seating lights.

As a minimum the AV contractor shall provide the following lighting pre-sets for teaching spaces, in particular lecture theatres:

Pre-set	Description
ON	All lights on
LEC (Presentation)	Stage light turned on to allow usage of white boards. Theatre lights reduced to 40%
AV	Stage lighting directed at the front of the theatre is turned off to reduce any glare on the projection surface. Theatre lighting reduced to 40%
OFF	All lights turned off (excluding lectern light, emergency lights and aisle lighting)

By default, these pre-sets will be automatically selected according to the projection status in the spaces. Users will have the option to turn automation off if required. Ramping of individual lighting channels will not be available from the AV user interface.

Additional lighting controls for bespoke requirements must be located within the 'Room' page on the AV user interface.

In some spaces, it may be necessary to trigger the lights via the room's motion sensor when the AV system is in the 'off' state as a safety measure for those entering the space – this must be done in consultation with the University's electrical contractor to avoid interference with room motion sensors and lighting controls.

The requirement for lighting control integration with the AV system should be determined during the design stage. Final lighting requirements and configurations shall be coordinated with Audio Visual Endpoints and user groups.

Professional, Collaboration and Flexible Learning Spaces' displays may have specific requirements that will differ from the standard teaching space configuration.

The University's preferred lighting control system is Philips Dynalite, though alternative systems such as KNX and C-Bus may be found in some buildings.

18.6 AUDIO VISUAL PHYSICAL REQUIREMENTS

18.6.1 CABLING

The AV contractor shall ensure that all cabling is installed to avoid sources of electromagnetic interference. Cabling shall be run concealed in ceilings, floor ducts or in wall cavities, and shall be labelled to indicate source, destination, and function using a printed label. Surface ducts or conduits are not a preferred method of installation and shall only be used in cases where no alternative is possible.

Velcro ties are to be used for cable management. No plastic cable ties or zip ties shall be accepted.

The cables installed shall be as listed below, and alternatives may be rejected:

Cable Type	Cable Description	Approved Manufacturer
RS-232 Control	Low capacitance, 72 pF/m. 4 x stranded inner pairs with overall foil and drain screening only. Pair colours as per CAT5.	Belden / Turnbull
SDI Cabling	To suit application	Consult with AV Endpoints
Digital Video Cable	Pre-moulded HDMI cable, conforming to Premium High Speed HDMI cable performance standards. For continuous runs no longer than 10m.	Kramer C-HM/HM PREMIUM High-Speed HDMI Cables
Audio Cable	1 pair, 22 AWG (7/0.32) tinned copper, polyethylene insulation, twisted beldfoil shielded pair, 22 AWG stranded tinned copper drain wire, PVC jacket.	Belden / Turnbull
Speaker Cable	2 core speaker cable 14 AWG, stranded, 75 degrees insulated, PVC jacket.	Belden / Turnbull

Cable Type	Cable Description	Approved Manufacturer
Twisted pair	Category 6A shielded twisted pair for AV signal distribution <i>such as HDBT or DTP</i> . Data twist / media twist. Purple colour PVC jacket for AV services. CAT6 may be used for LAN connections. Ultrathin cables, blue, may be used within lectern AV racks	Siemon 4cabling
Twisted pair - braided	For CAT6A shielded runs located at projector lifts.	ALOGIC Purple 10G Shielded CAT6A LSZH Network Cable
Fibre	50/125 µm multi-mode fibre, OM3	AFL

Shielded twisted pair cabling installed for AV services (non-network) must be fitted off on RJ45 blocks within the lectern and RJ45 connection plates at the device location. Each location must be clearly labelled. Braided Cat6 leads must be used between connection plate/block and equipment.

Cabling that is to be routed within a motorised projector lift must be fitted off to a connection plate that is accessible to AV maintenance staff and not hidden inside ceiling cavities. Shielded twisted pair cabling installed within a motorised projector lift must be a pre-terminated ALOGIC purple shielded Cat6a patch cable.

All other Cat6A leads used for AV distribution, such as HDBT, must be terminated on R&M RJ45, IP67, FM45, rated jacks suited for industrial environments. In spaces with moveable lecterns, refer to the section 18.6.2, Connection Plates and Fly lead. Alternatives will not be accepted.

Shielded Cat6a cabling must be installed with a minimum bend radius of 50mm or four times a cable's outer diameter, whichever one is greater.

Network cabling that runs to a network switch in the communications room will be installed by a data/electrical contractor in accordance with the University's Standards for the Installation of Communications Infrastructure. An AV Contractor will be required to install fly leads to connect devices to the network in lecterns, AV racks, ceiling etc. Network cabling installed in lecterns should be slim cables due to the quantity of cables installed. Fly leads connected to LAN ports as part of the enterprise network structure need not be shielded cables and should comply with UoM Network cabling standards.

If a data outlet is installed in the ceiling space and a cable fly lead is routed through a wall or conduit, the fly lead must be labelled at the end that connects to the AV endpoint device, using the corresponding data outlet number.

18.6.2 CONNECTION PLATES AND FLY-LEADS

Cabling points and engraved connection plates shall be installed as nominated on drawings. All connection plates shall be engraved to indicate the function for each nominated outlet. Labels shall be confirmed by Audio Visual Endpoints.

The style and finish of all connection plates shall be consistent and match the décor of the space.

Typically, all audio-visual connections shall be terminated on Clipsal 2000 series connection plates.

For spaces with moveable lecterns or displays, CAT6a connectors for AV devices in floor boxes and wall plates should be securable with a latch lock system to prevent damage. They should also be colour-coded and labelled to allow for easy removal and reconnection by UoM staff (See section 18.30–Lectern & Teacher Touchdown Points).

Type	Cable Identification Colour	Connector
DTP/DM/HDBT 1 Patch Cable (non-network point to point CAT6)	Purple	Neutrik NE8FDX-P6 (Moveable lecterns) Neutrik NE8FDX-Y6 (Moveable lecterns) Panduit Shielded Mech (UoM standard)
Analogue Audio Input (Multiple patch points to be workshopped)	Cable-Black Connector-Green	XLR – TRS (6.35mm) – 3.5mm Jack
Analogue Audio Output (Multiple patch points to be workshopped)	Cable-Black Connector-Red	XLR – TRS (6.35mm) – 3.5mm Jack
General Network	Blue	Points by UoM
AV Touch Panels Patch Cable	Black	Points by UoM / As designed
USB	Cable-Black Patch point-Blue	Connector fit for purpose

Note: Bulk cable standard colours still apply as specified in table within section 18.27.

Type	Solution (examples only)	Identification/Accessories
-Wall plate to mobile lectern -Wall plate to BYOD/flexible equipment -Floor box plate to mobile lectern or BYOD/flexible equipment	HDMI  CAT6a Video CAT6a Audio  USB  3.5mm-XLR-1/4 Inch Audio 	• Custom engraving/labelling/identification • Colour identification only required should there be more than one of the same connector types • More than four (4) connections of the same type should be placed onto custom built patch plates (workshop design with AV Endpoints) • Plate colours must be workshopped with Consultant/AV Endpoints • <i>Images are examples - quantities of connections as per designs.</i> • <i>Labels in images are examples only – labels will represent design</i> • <i>No UoM Network points are to be installed on dedicated AV plates</i>
-Custom patch plate to lectern/devices/equipment -Custom 19" AV rack patch panel to lectern/devices/equipment	Custom Patch Plate  19" Av Rack Patch Panel 	• Custom engraving/labelling/identification • Colour identification only required should there be more than one of the same connector types • Plate colours must be workshopped with Consultant/AV Endpoints • <i>Images are examples - quantities of connections as per designs.</i>

The following table details University standard connections:

Type	Video	Audio	Typical Installation location
University supplied computer (Mac/Windows)	HDMI and appropriate adapter	Audio via video output	Options for installation: Via grommet on lectern In AV rack on dedicated equipment shelf All-In-One device mounted on lectern top (strut bracket or stand to be advised, supplied by integrator) Mounted behind display – Power button will be accessible from the side.
Document Camera	HDMI		Via grommet on lectern
Laptop input	HDMI and appropriate adapter		Via Cable Cubby
Lecture Capture System	HDMI	Phoenix connector for audio (combined microphone and source outputs from digital audio processor)	Installed in AV equipment rack
Microphones		3-pin XLR Female	Installed on lecterns, media link, bio-boxes, and floor boxes
Fly leads within Cable Cubby (Extron Cable Cubby 202 AUS) Note: when university standard lectern is included, Podion will supply Cable Cubby.	HDMI - enough length to cover lectern BYOD devices. With adaptors: Liberty DL-CL (Security clamp) Liberty Ring Clamp (DL-AP) Alogic USBC-HDMI (ULUCHD-ADP)	Audio over video 3.5mm mini stereo jack for auxiliary audio connections (if required)	Recessed in lectern tabletop (cut by Podion) Recessed in meeting room tables, custom joinery or lecterns as required

Contractors shall submit connection plate samples for approval by Audio Visual Endpoints.

Video adapters (USB-C) must be approved by Audio Visual Endpoints for suitability. Video adapters must be securely tethered to AV fly-leads using a tether approved by AV Endpoints.

Contractors must provide all necessary fly-leads for all devices. Laptop fly-leads (HDMI) must comply with HDMI cabling specified within this standard and be of suitable length, e.g., to reach middle of table.

Wall-mounted connection plates must be provided with suitably sized fly-leads. Leads must be neatly coiled within joinery or on hooks where joinery is not available. The HDMI is also to be secured at the wall plate using a P-clip. The contractor must ensure that fly-leads and cables do not pose any OH&S risk.

18.6.3 CABLE MANAGEMENT PRACTICES

Cable management practises should always be coordinated to suit the project at hand. OH&S and bend radius requirements should always be considered when selecting a suitable cable management solution. All cables will need to be labelled to indicate functionality, and labels must correspond with as-built drawings and cable schedules. The following table will demonstrate expectations and should be implemented on a project-by-project basis. Note that velcro ties must be used – no cable ties will be accepted.

Situation (example)	Cable Management Practice
FPD – Equipment installed on wall behind	- Keep power and HDMI cables from running in parallel to a minimum. Where parallel routing is unavoidable, a minimum separation of 50 mm shall be maintained. Crossings between power and signal cables shall occur at approximately 90 degrees. - Behind FPD cable sock should be avoided to allow serviceability - Cable management clips (generic)
Equipment Rack - Internal	- Lacing bars - offset to suit –_bars should not affect serviceability - Vertical cable trays to suit rack RU size
Equipment Rack - External	Cable sock to manage cables from rack to wall/services – Note – power should always be run external of main cable sock, secure to main loom with Velcro ties
Boardroom/Meeting Room Table	- Slotted duct - keeping power/Cat6a, speaker and HDMI cables from running in parallel to a minimum - Cable management clips (generic) - Cable sock where required - No cable sock for solo user cables above table required - Strain relief for user cables connected to devices - Cable umbilicals when running cables from table to floor
Floor cable runs (ex – lectern to wall)	- Ramped floor track (ECD) 2 channel steel wall ducts (ECD)

18.6.4 POWER AND DATA REQUIREMENTS

The following table details the typical electrical and data requirements to support AV systems. The final requirements shall be coordinated on a project-by-project basis with the Services Engineer to match the system design.

Each device requiring network connectivity will require an individual port for that device to connect the network switch located in the comms room. AV switches shall not be installed in an AV rack.

Note that protective covers shall be supplied for any user accessible power outlets to prevent AV equipment being disconnected. Covers shall be secured by screws to the wall rather than adhesive tape. Consideration shall be given to provide an additional power outlet for users if not present in the room.

Location	Electrical Requirements	Data Requirements	Typical AV Equipment
Standalone AV equipment racks	1 x 15 Amp captive outlet on dedicated circuit 1 x DGPO	One outlet per networked device, additional outlet for devices with dual NIC, e.g., Dante One spare data outlet for every ten in this location	AV switching/ processing equipment, Echo360.
Lectern / Presenter Location	2 x DGPO for AV equipment 1 x GPO accessible for user devices, via cable cubby 1 x user accessible DGPO if one is not present in room	One outlet per networked device, additional outlet for devices with dual NIC, e.g., Dante One spare data outlet for every ten in this location	Teacher's computer, AV touch panel, document camera, laptop etc. Student/ Lecturer laptop power to avoid AV equipment being disconnected
FPD, video projector location	1 x DGPO	2 x data	AVoIP endpoint and display.
1 Digital Signage FPD	1 x DGPO	2 x Data	Digital Signage & Display
Added Motorised projection screen/ Projector Lift	1 x DGPO	1 x data	Motorised projection screen
PTZ Camera Locations	1 x DGPO	2 x Data	Presenter and Audience Cameras, ceiling or wall mounted.

18.6.5 LECTERNS & TEACHER TOUCHDOWN POINTS

University standard lecterns must be used in all lecture theatres and teaching spaces. Performance venues and research environments such as labs may require bespoke solutions, which must be approved by the Audio-Visual Endpoints team.

The standard lectern design may have minor modifications by the manufacturer to match the aesthetics of the space. However, changes to the design must not change the structural frame of the lectern and must be approved by Audio-Visual Endpoints staff prior to installation.

The standard lecterns provide an area atop the bench for the presenter's notes/laptop, microphone(s), touch panel, presenter PC, document camera(s), wireless microphone charger(s) and input connections. It also includes rack space below the bench for AV switching equipment and other system components. The contractor must ensure that lecterns can be raised and lowered unimpaired and are cabled in accordance with the manufacturer's documentation.

A floor duct or trench is required to carry electrical and AV wiring to the lectern. The duct must be compartmented to provide separation between services. Services must be terminated in floor boxes for mobile lecterns.

Moveable lecterns should only be used in special use cases and must be approved by Audio-Visual Endpoints. For spaces with moveable lecterns or displays, CAT6A connectors for AV devices in floor boxes and wall plates should be securable with a latch lock system to prevent damage. They should also be colour coded and labelled to allow for easy removal and reconnection by UoM staff.

The lock latch system should be comprised of:

- Steel wire – 4mm maximum wire gauge
- Carabiners
- Steel wire grips/Swage/Thimble
- Latch lock rope will be run inside cable sock alongside loom cabling. When no loom cables exist the latch lock rope may be installed exposed.
- Lock/latch is to attach to an eyebolt/anchor point neighbouring the AV connection plates e.g. wall/floor
- The length of the wire must not exceed the shortest loom/AV system cabling. This is to prevent cable strain/connection damage in the scenario the lectern is moved without cables being disconnected properly.

Ventilation provided within the lectern must not be obstructed or covered. Where a separate AV rack is required, cupboard doors and access panels shall be secured with university standard TEC key.

The following considerations apply when equipment is installed on and within lecterns:

- In some cases, it may not be possible to populate all RUs available in an AV Rack, to order to allow for both servicing, accessibility and ventilation.
- Appropriate cable length and management when drawers housing equipment are pulled out from lectern, or lectern when lectern is raised and lowered.
- Depth of equipment, to ensure it is serviceable when drawer is removed from lectern to ensure rear of equipment is accessible from presenter side of lectern, or not obstructing access to equipment installed beneath it
- All cable termination points and outlets providing AV and network connectivity to the lectern should be concealed or protected from unauthorized access by housing it either within the lectern or joinery.

Final joinery details and equipment layout shall be coordinated and approved by Audio Visual Endpoints. UOM standard lectern designs may be supplied by Audio Visual Endpoints upon request.

Lectern Model	Typical Use	Height Adjustable
UOM-1000*	Flexible Learning Spaces with no document camera - Height adjustable	Yes
UOM-1500	Flexible Learning Spaces with fixed lectern - Height adjustable	Yes
UOM-1900	Lecture Theatres with dual document cameras	Yes
UOM-POD-X	Mobile Lectern for Event Spaces	Yes
UOM-TDP	Flexible Learning Spaces & Collaborative Spaces requires approval from AVE	Yes
UOM-TWA	Touchdown point	Yes
UOM-CAT	Mobile Display Trolley	NA
UOM- CF-CDC-12	Standalone credenza to install LCD display on with AV rack space within joinery.	NA

Lectern Accessibility

While it is recommended to refer to the appropriate Australian Standards for wheelchair accessibility, the following recommendations must be considered when designing the placement of lecterns.

- Height adjustable lecterns should be used where possible
- Minimum space between presenter side of lectern and surrounding walls or furniture: 1200mm
- Minimum space required to allow full turning circle of wheelchair: 1540mm. This may take into account the space beneath a height adjustable wheelchair accessible lectern.
- Cable paths to the lectern should not hinder wheelchair access and should be run beneath carpet or from a non-accessible side of the lectern e.g., wall.

18.6.6 MOUNTING EQUIPMENT AND PROTRUDING OBJECTS

HEADROOM

Devices mounted from ceilings in circulation spaces, such as flat panel displays or cameras in teaching spaces or digital signage displays, shall be mounted no lower than 2030mm AFFL to ensure that adequate headroom is provided.

REACH

Devices that require user interaction, such touch panels or room booking displays shall be mounted 1220mm AFFL to the top of the panel. No objects greater than 250mm from wall shall be placed beneath the device which will interfere with reach access to the panel. Reach should also be considered when placing user-accessible equipment such as wireless microphones and document cameras on the top of a teaching lectern or touchdown point.

PROTRUDING OBJECTS

Wall mounted devices, such as flat panel displays installed in corridors, walkways or aisles installed between 685mm and 2030mm AFFL, shall not protrude into the space more than 100mm.

18.6.7 AUDIO VISUAL EQUIPMENT STORAGE

The following AV equipment storage is required:

- AV equipment cupboard for ready access by presenters using the “LEC key”, recessed completely into a wall at the front of the theatre, and utilising the international 19” rack mounting standard and readily accessible to service staff.
- AV systems and AV equipment racks shall be separately keyed under the “TEC key” for access by maintenance and technical staff.
- A dimmer cupboard usually adjacent to the switchboard outside the theatre, and never physically adjacent to the AV systems rack.

VENTILATION

Ventilation shall be provided to maintain the temperature of all AV equipment within the manufacturer’s specifications. Ventilation requirements shall be determined by the Services consultant. Ventilation methods may include:

- Air inlets at low level and air outlets at high level must be provided to provide airflow through the rack, lectern, joinery, or other relevant enclosure requiring ventilation.
- Ventilation slots or grilles shall be selected following consultation with the architect.
- Natural convection or fan-driven ventilation shall be provided to accommodate the heat load of the AV equipment requiring ventilation.

POWER SUPPLY

230 V mains power on dedicated AV circuits are required for AV equipment, generally as follows:

- 15 Amp captive outlets for AV racks fitted with internal power rails
- 10 Amp single or double GPOs for AV equipment.

AV equipment installed into a communication rooms rack, must be powered from complete separate circuit or be isolated on a separate breaker.

Specific requirements for each project are to be determined by the Services Consultant.

DIMENSIONS OF EQUIPMENT CUPBOARDS

The internal cupboard enclosure usually provides a mounting surface for audio visual cable looms and ducts, power distribution conduits etc.

Adequate clearance must be provided for these services plus the actual metal rack frame. At least 150mm clear space is required behind the equipment rack frame, inside the cupboard.

Minimum internal dimensions for an equipment rack cupboard would be 750mm x 690mm (depth x width) based off an AV rack with a 540mm depth.

Cupboard height varies with the size of the rack installation; however, two common formats do occur:

- Typically, the height is around 2100mm, allowing for installation of a full height (45RU) equipment rack
- In the second case, the cupboard is much lower, usually no more than one metre high. In some cases, the cupboard needs to be twice as wide, to allow for installation of two half-height rack frames.

ACCESS TO EQUIPMENT

The rack shall be at floor level, mounted on wheels to allow rack removal for service. The floor and the rack cupboard floor must be continuous. If the equipment is housed in two racks, there must be enough length of cable connection between the two racks to allow one of the two racks to be brought out alone.

All rack cupboard doors are fitted with the TEC key lock for technician access to remove/repair equipment and LEC key lock for user access to operate equipment.

Equipment mounted in any location, including AV racks, behind flat panel displays or beneath tables, must be mounted with an approved mounting bracket. Double-sided tape or Velcro is not acceptable.

The device should be removable from the rack independently without the need to move other equipment and never used as a shelf.

All equipment must be installed in accordance with the manufacturer's specifications.

The location of all equipment installed in a space shall be marked up on a floor plan and submitted by the installing contractor at the completion of the work. Equipment, including associated power and data, shall not be installed within ceiling or spaces to ensure that it is serviceable.

CANTILEVERED CUPBOARDS AND BIO-BOXES

Projector cabinets and such shall not be cantilevered out from walls. This creates a safety hazard regarding people hitting their heads or hanging on them. All cabinet work shall be taken down to the floor, not supported from walls.

LIGHTING INSIDE CUPBOARDS

All equipment racks, AV cupboards and Bio Boxes require adequate internal lighting for technical staff.

ACOUSTIC ISOLATION

The Dimmer cupboard, projection room and AV cupboard must be acoustically insulated to prevent dimmer or projector noise from disturbing lectures.

DOORS

The front door of a recessed cupboard has conventional hinges and with the door closed, the cupboard door face is flush with the wall.

AV EQUIPMENT RACK

The AV Equipment Rack shall house all AV switching and processing equipment and thus be appropriately sized. The 19" AV equipment racks shall meet the following specifications:

- 540mm wide x 540mm deep
- Sized to accommodate equipment plus 20% spare capacity in AV cupboards
- Complete with 19" patch panels for termination of AV cabling

- Vertical and horizontal cable management
- 1 x 8-way horizontal power strip for switched power, connected to an output of the power controller (if additional ports required)
- 1 x 8-way horizontal networked PDU power strip for switched power.
 - Input connection: IEC 60320 C20
 - Output connection: IEC320 C13
 - PDU Ethernet interface must support speeds of at least 100 Mbps
 - Power surge protection
 - Ports & plugs to be easily accessible
 - Device will be able to switch ports on & off
- 2 x 100mm cable trays fitted to the inside of the equipment rack
- Allow for security panels as shown on the drawings
- Lockable doors and side panels
- Heavy duty castors to allow rack to be pulled out of cupboard for servicing.

The colour finish and labelling of the cabinets shall be approved by Audio Visual Endpoints.

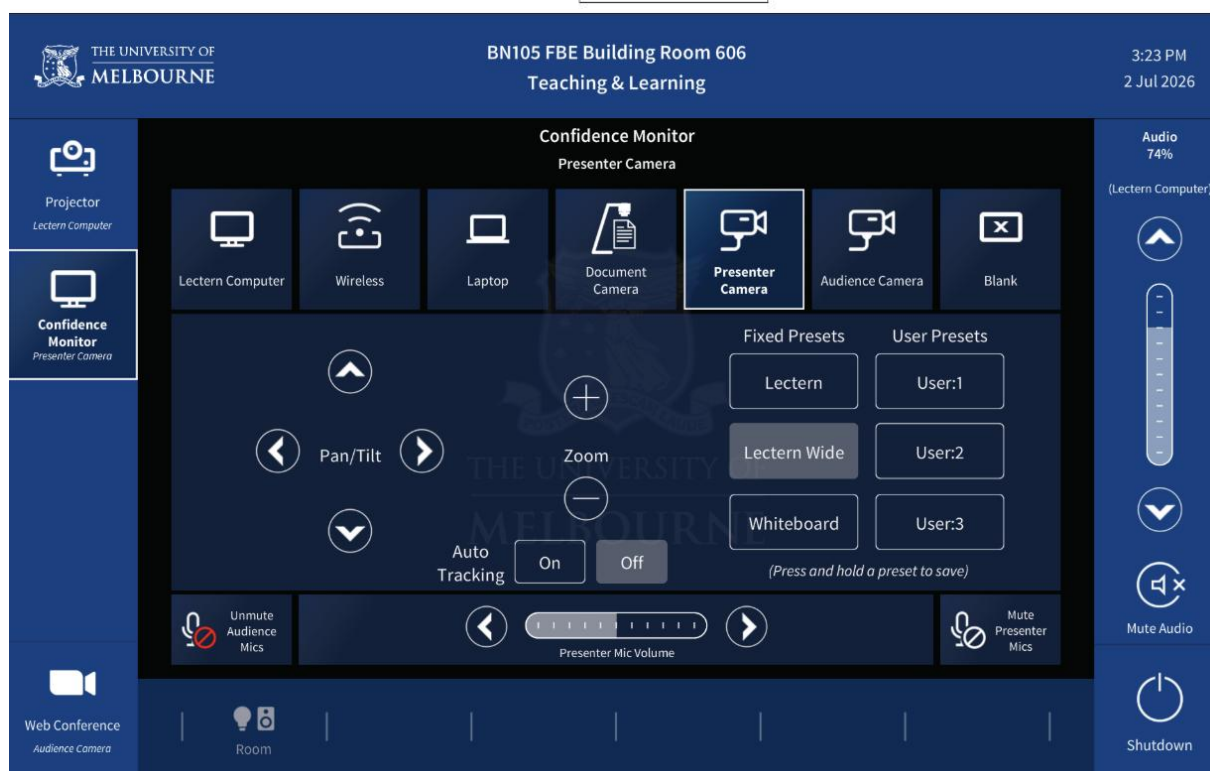
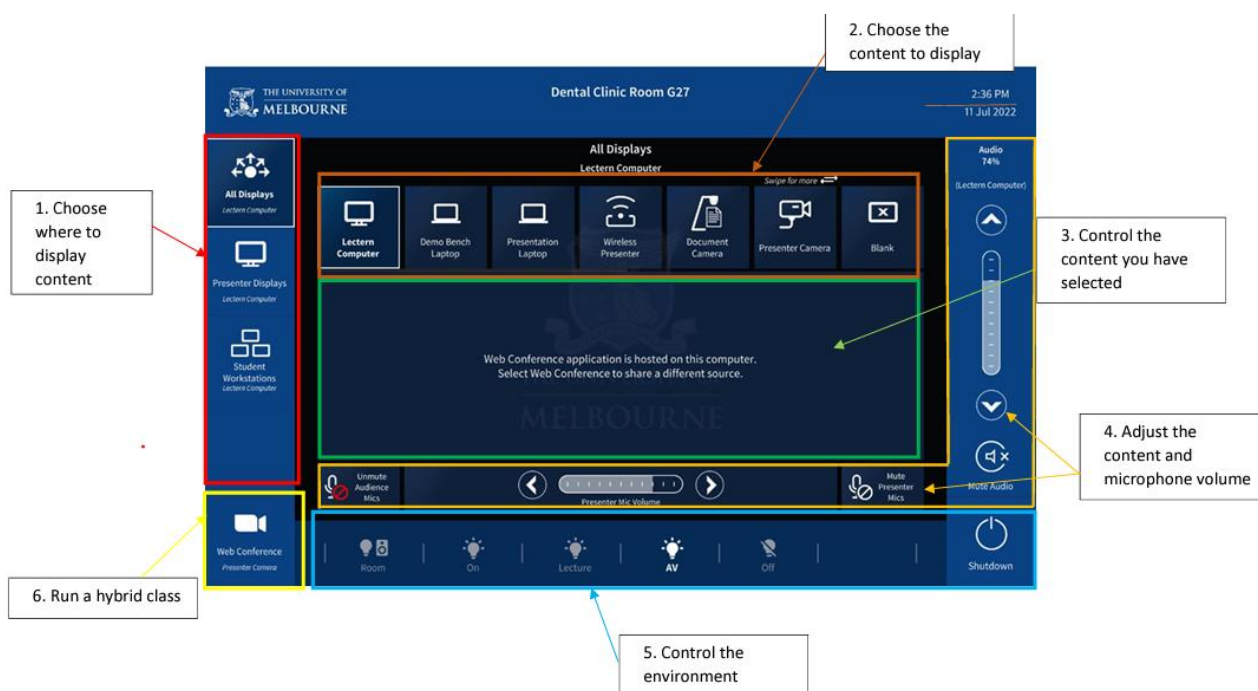
When bespoke AV racks are required, approval should be sought from AV Endpoints Engineers and UoM Project Manager. Detailed shop drawings shall be submitted for approval prior to manufacture, indicating the layout and labelling of the patch panels.

18.7 APPENDICES

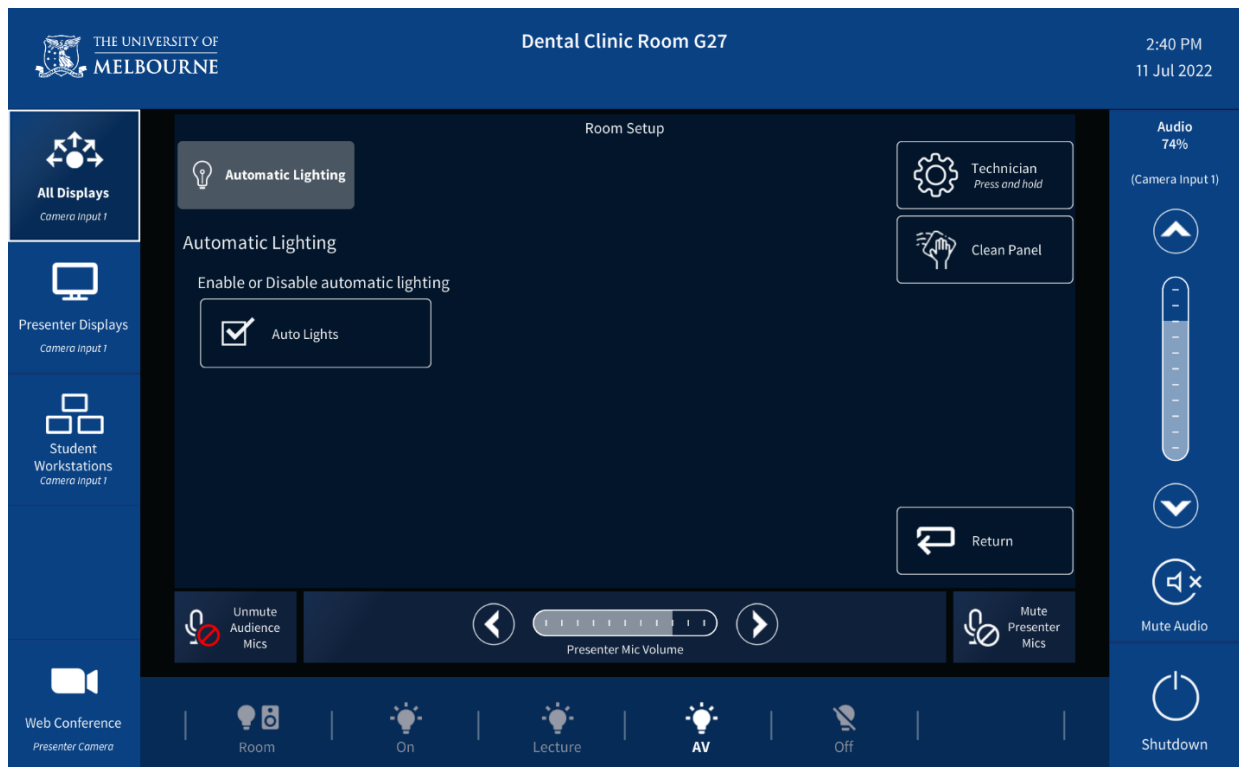
18.7.1 APPENDIX A: TOUCHPANEL INTERFACE EXAMPLES

Below is a sample of the user interface design. All user interfaces are subject to the approval of the AV Endpoints team and must be submitted for review prior to implementation. A detailed guide may be requested from AV Endpoints, which provides additional information on interface behaviour and functionality.

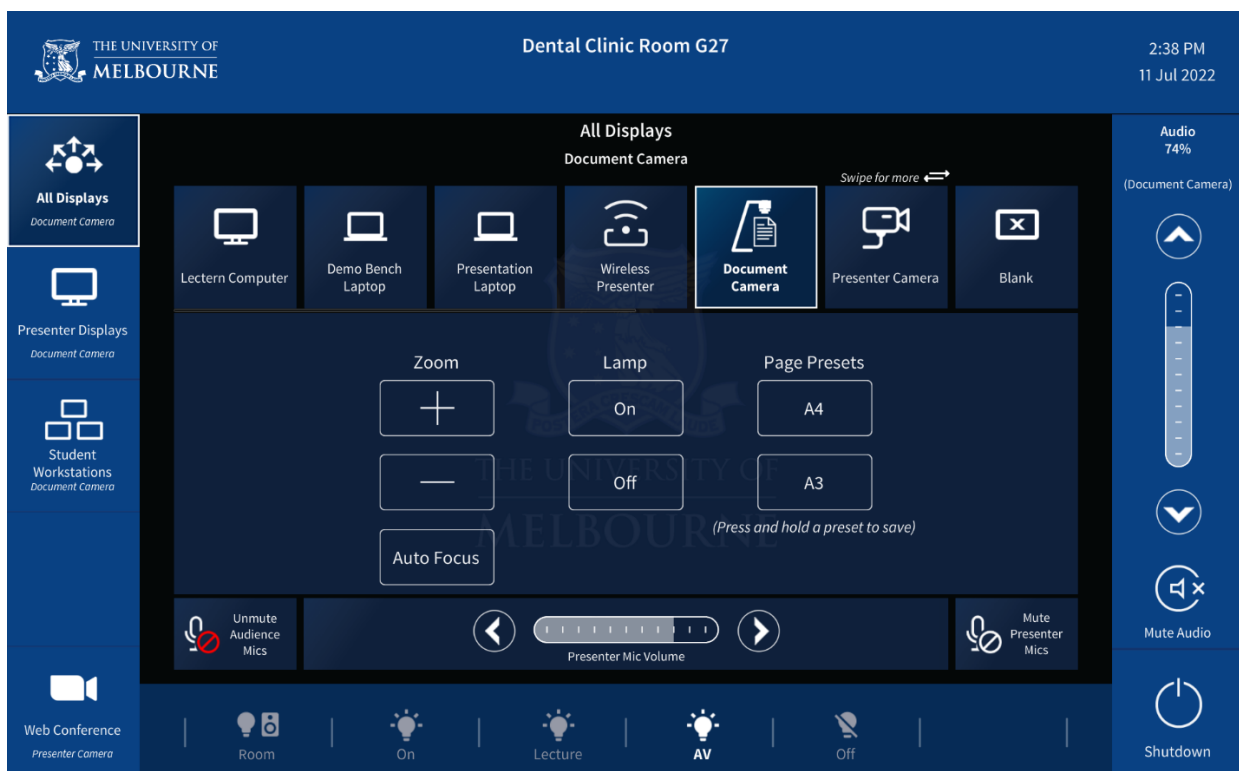
TEACHING SPACE TOUCHPANEL LAYOUT



Touchpanel Web Conferencing Page



Touchpanel Room Page



Touchpanel Device Controls

KEYPAD LAYOUTS



Student Pod Keypad

Button	Icon	Function
Button 01	Laptop (HDMI icon)	Select local laptop input. If off, turns display on.
Button 02		Blank, no function.
Button 03	Follow Projector (TV icon)	Follow main projector source if main display present. If off, turns display on.
Button 04		Blank, no function
Button 05		Blank, no function
Button 06		Blank, no function
Audio Mute		Display Audio Mute
Volume -		Display Volume-
Volume +		Display Volume+
Power		Video Zone On/Off.



Basic Teaching Space Presentation System Keypad

Button	Icon	Function
Button 01	AirMedia (Wireless Presentation)	Select AirMedia for wireless or wired presentation
Button 02	PC (In Room PC)	Select In Room PC
Button 03		Blank, no function
Button 04		Blank, no function
Button 05		Blank, no function
Button 06		Blank, no function
Audio Mute		Display Audio Mute
Volume -		Display Volume-
Volume +		Display Volume+
Power		Video Zone On/Off.

18.7.2 APPENDIX B: APPROVED AV EQUIPMENT MANUFACTURERS

EQUIPMENT / DEVICE	MANUFACTURER	MODEL
Audio Amplifier	Extron	XPA Series
		XPA 1002 U
		XPA 2001
		XPA 2004 FX
		XPA 4004 FX
Audio Amplifier - Large/Specialist Venue	Crown	(to meet project requirements)
AV Control System Processor	Crestron	VC-4 with perpetual license per space (VC-4-ROOM)
		RMC4
AV Network Switch	Cisco	(Consult with Audio Visual Endpoints, Supplied by UoM Networks)
Camera - Bracket	Podion	UCMT-C-01 (W/B) – Ceiling mount, white or black
		UCMT-W-01 (W/B) – Wall mount, white or black
Camera - PTZ HDMI	Sony	SRG-A40
Camera – Remote Support	Axis	M3085-V Dome Camera
Computer screen mount	Podion	MMCM-1 (M4 Mac Mini Mount)
	HP	HP Desktop Mini VESA Sleeve (HP Mini Windows)
Control Module - Relay	Crestron	CEN-IO-RY-104
Control Module - Serial	Crestron	CEN-IO-COM-102
Digital Audio Processor	Biamp	TesiraFORTE DAN CI
Digital Signage	SCALA	Scala SMP-H-AP with UHD License:
		SH-DXPAV01-W-AP-A0-0101014A-YNOYUD-UNM2TA-UW65
Document Camera	Wolf Vision	VZ-3neo.UHD (non-swivel-version)
		VZ-8.UHD (Major Theatres)
Flat Panel Display Mounts	Chief	(to meet project & serviceability requirements)
		Vogels tilt brackets for digital signage system
	Vogels	Vogel's PFW 6815 – portrait
		Vogel's PFW 6410 - landscape
Flat Panel Displays	Samsung	Model to be approved by Audio Visual Endpoints and must meet requirements specified in section 18.4.2
Flat Panel Displays – Interactive Digital Signage	Samsung	55" QMB-T UHD 4K Interactive Display. Alternatives must be approved by AV Endpoints.
HDMI Adapter & tether	Alogic	ALOGIC Ultra 15cm USB-C (Male) to HDMI
	Liberty	HDMI adaptor tether Liberty DL-CL2 / DL-AP2
Hearing Systems - Induction Loop	Ampetronics	(to meet project requirements)
Hearing Systems - IR	Williams AV	IRSYS30 Sound Plus T3 – up to 50 people

		Above 50 people, consult with AV Endpoints
Keypad	Crestron	MPC4-201
Lectern	Podion	Various models
Microphone - Ceiling	Shure	MXA920, MXA710 & mount to suit space
		MXA925 – consult with AV Endpoints
Microphone - Ceiling – Mount	Shure	A910-HCM
	Gripple Wire	A900-S-GM
Microphone - Ceiling – Pole	Shure	A900-S-PM
Microphone - Ceiling – Pole	Chief	CMS048W -48 Inch Fixed Extension Column
Microphone - Lectern	Shure	MX412/C with cardioid capsule
		A400SMXLR – shock mount
Microphone - Wireless Multi-Channel Receiver	Sennheiser	MCR-4
Microphone - Wireless Handheld	Sennheiser	SL Handheld Set DW-3-AU R
Microphone - Wireless Lapel	Sennheiser	SL Lavalier Set DW-3-AU R
Microphone - Wireless Microphone Charging Bay	Sennheiser	CHG 2N, CHG 4N
Network Video Encoders / Decoders	Crestron	DM-NVX
		E30, E30C, 360, 360C, 363, 760, E20-2G
Network Video Endpoint Card Frame	Crestron	DMF-CI-8
Occupancy Sensor	Crestron	CEN-ODT-C-POE
Paging Systems		Consult with Audio Visual Endpoints
Power Control	ATEN	PE6108G
Projection Screen	Screen Technics	Electricinema 16:9 Unity White Gain
		(to meet project requirements)
Projector	Sony	VPL-FHZ85 for theatres & projectors installed in lifts or where non-standard lenses are required
	Epson	EB-L890U/L985U for flat floored spaces for projectors installed on poles at max height 2.7m AFFL
Projector - Large Venue	Panasonic	PT-REZ10BE, 10K lumens
		Consult with AV Endpoints for alternative models
Projector Lift	Ultralift	UOM Custom Unilift 2 (to meet project requirements)
Projector Mounts	Ultralift	Spyder UOM Custom
Racks (Cabinet)	MFB	2005 Series
	Podion	UoM RC-15 WALL AV RACK CABINET WITH LOCKABLE CABLE TRAY
Racks (Frame)	Elgee	(to meet project requirements)
Room Booking Panel	Concierge	ACMG10 – 10” inch booking panel with appropriate mount

		ACMGMP – Media Player
Sound Bar	Crestron	Saros SB-200-P-B
Speaker - Ceiling	JBL	In Ceiling: Control 24CT, Control 26CT
		Pendant: Control 60, Control 67, Control 65
Speaker - Front of House	Large/Specialist	Model to be approved by Audio Visual Endpoints
	JBL	Control Series to Suit Space
Touch Panel	Crestron	TS-1070-B-S,
		TSW-1070-B-S
		TSW-1080 variants (consult with AV Endpoints)
Touch Panel - Wireless		Consult with Audio Visual Endpoints
Twisted Pair Extenders	Crestron	(to meet project requirements)
USB Bridge	Crestron	HD-CONV-USB-300
Wireless Presentation System	Crestron	AM-3200-WF-I
XIO Subscription	Crestron	Premium License

18.7.3 APPENDIX C: PROFESSIONAL MEETING SPACES AV EQUIPMENT

Space Type	Description	Model
Small Meeting Rooms (2-4 Persons) SMR	Crestron Flex running Zoom, including UC Engine, User Interface and USB converter	Crestron UC-CX100-Z
	Conferencing Soundbar	Biamp VBC 2800
	Samsung LCD Screen Screen Wall Mount	To suit room size, approx. 55" Chief MTM1U with FCAV1U
	HDMI Cable with adaptors for user laptops installed near screen on hook	Alogic USB-C to HDMI with tether
	HDMI Transmitter & Receiver, if required	HD-RXC-4KZ-101 HD-TXC-4KZ-101
	Motion Sensor	Crestron CEN-ODT-C-POE
	Control System	Crestron RMC4 for motion sensor & equipment monitoring
	Room Monitoring	XiO Cloud & Fusion XiO Premium Licence
	Room Booking Display	Concierge ACMG10 & appropriate wall mount
	Networked PDU	ATEN PE4104G
	Keyboard for Maintenance	Logitech K400

Space Type	Description	Model
Medium Meeting Rooms (5-9 Persons) MMR	Crestron Flex running Zoom, including UC Engine, User Interface and USB converter	Crestron UC-CX100-Z
	Conferencing Soundbar	Biamp VBC 2800
	Samsung LCD Screen Screen Wall Mount	To suit room size, approx. 65" Chief MTM1U with FCAV1U
	HDMI Cable with adaptors for user laptops installed in cable cubby	Alogic USB-C to HDMI with tether
	HDMI Transmitter & Receiver, if required	HD-RXC-4KZ-101 HD-TXC-4KZ-101
	Motion Sensor	Crestron CEN-ODT-C-POE
	Control System	Crestron RMC4 for motion sensor & equipment monitoring
	Cable Cubby	Extron Cable Cubby 1202 Brushed Aluminium & Series/2 AC Module, Australia
	Room Monitoring	XiO Cloud & Fusion

		XiO Premium Licence
	Room Booking Display	Concierge ACMG10 & appropriate mount
	ECD floor track system with transition kit (where no floor box is present)	Floor Track
	Power under desk mounting kit c/w quad power module (soft wired) (where no floor box is present)	ECD PMK4P with CL1000BK, SSPBK
	Networked PDU	ATEN PE4104G
	Keyboard for Maintenance	Logitech K400

Space Type	Description	Model
Large Meeting Rooms (10-12 Persons) LMR	Crestron Flex running Zoom or Teams, including UC Engine & User Interface	UC-CX100-Z
	Samsung LCD Screen Screen Wall Mount	To suit room size, approx. 75" Chief LTM1U with FCAV1U
	HDMI Cable with adaptors for user laptops	Alogic USB-C to HDMI with tether
	HDMI Extenders	HD-RXC-4KZ-101 HD-TXC-4KZ-101
	Camera	Logitech Rally
	DSP	Shure ANIUSB-MATRIX
	Ceiling Microphone Array	Shure MXA710
	Amplifier	To suit room system
	Ceiling Speakers for Audio Reinforcement	JBL Control 24CT
	Motion Sensor	Crestron CEN-ODT-C-POE
	Control System	Crestron RMC4 for motion sensor & equipment monitoring
	Cable Cubby	Extron Cable Cubby 1202 Brushed Aluminium & Series/2 AC Module, Australia
	Room Monitoring	XiO Cloud & Fusion XiO Premium Licence
	Room Booking Display	Concierge ACMG10 & appropriate wall mount
	Integration with lights and blind as necessary	As per project requirements

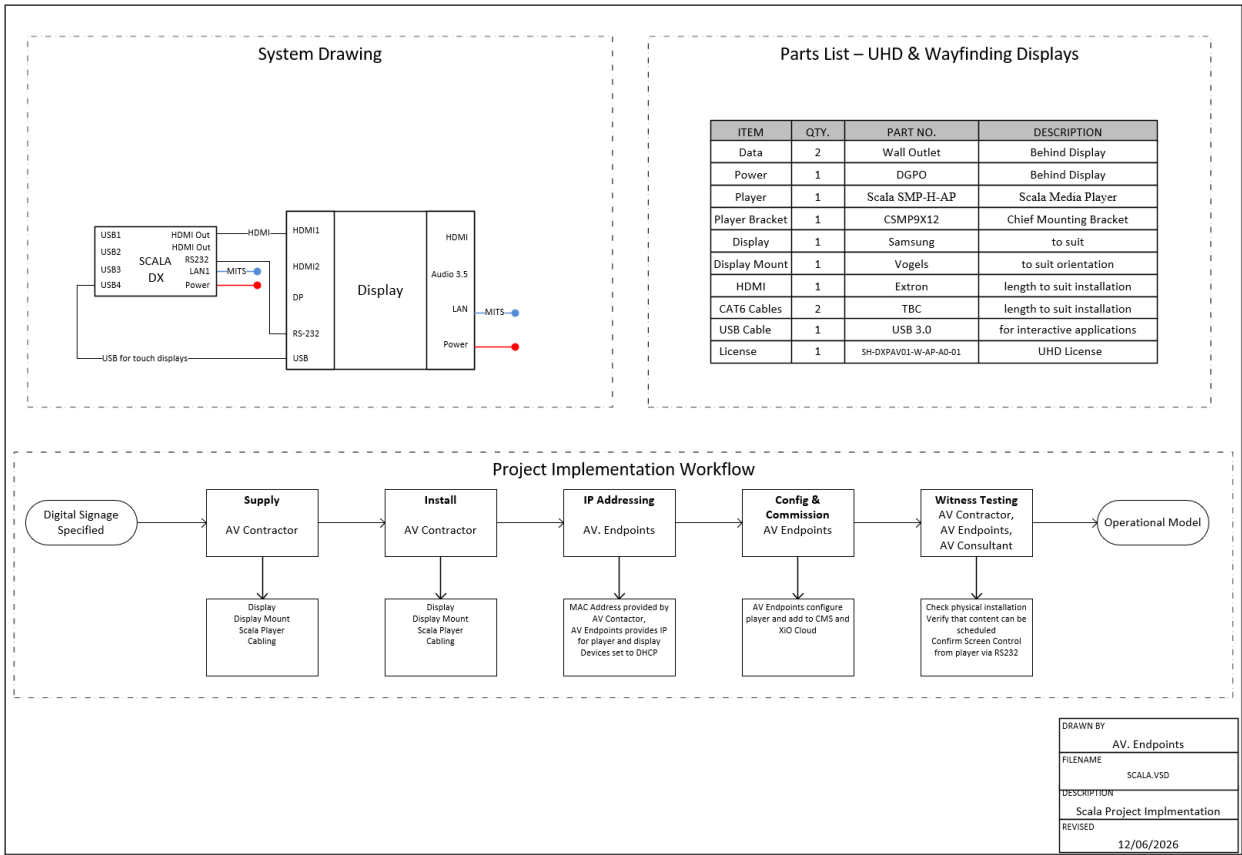
	ECD floor track system with transition kit (where no floor box is present)	Floor Track
	Power under desk mounting kit c/w quad power module (soft wired) (where no floor box is present)	ECD PMK4P with CL1000BK, SSPBK
	Networked PDU	ATEN PE6108G
	Keyboard for Maintenance	Logitech K400

Space Type	Description	Model
Board Rooms (12+ persons) BR	Crestron Flex running Zoom or Teams, including UC Engine & User Interface	UC-CX100-Z
	Samsung LCD Screen or Projector to suit room size	To suit room size
	HDMI Cable with adaptors for user laptops	Alogic USB-C to HDMI with tether
	HDMI Extenders	HD-RXC-4KZ-101 HD-TXC-4KZ-101
	Camera	Logitech Rally
	DSP	Shure P300
	Ceiling Microphone Array	Shure MXA920
	Amplifier	To suit room system
	Ceiling Speakers for Audio Reinforcement	JBL Control 24CT
	Motion Sensor	Crestron CEN-ODT-C-POE
	Control System	Crestron 4-Series processor to suit project requirements
	Cable Cubby	Extron Cable Cubby 1202 Brushed Aluminium & Series/2 AC Module, Australia
	Room Monitoring	XiO Cloud & Fusion XiO Premium Licence
	Room Booking Display	Concierge ACMG10 & appropriate wall mount
	Integration with lights and blind as necessary	As per project requirements
	Networked PDU	ATEN PE6108G
	Keyboard for Maintenance	Logitech K400

*Sample Only

[illegible]

18.7.5 APPENDIX E: DIGITAL SIGNAGE IMPLEMENTATION



18.7.6 APPENDIX F: HEARING AUGMENTATION SAMPLE SIGNAGE



SPEC01
SIZE: 400mmW x 200mmH
BRAILLE: This room is covered by infrared hearing assistance.
Receivers are located at the lectern.
QTY: x50

Specifications:
Custom Braille Tactile Signs

Finish:
Premium Flexible Continuous Surface, Encapsulated Polycarbonate Membrane

Material:
0.5mm Polycarbonate

Corners:
4mm Radius

Adhesive:
Full Backing of 1mm Foam Tape

Size:
As Below Each Sign Type

Font:
18mmH Futura Medium

Braille Message:
As Seen Under Sign

Quantity: 50x Total

Colours:

- Black
- Silver Metallic
- Ultramarine Blue