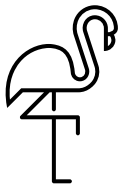
THE UNIVERSITY OF NEWCASTLE AUSTRALIA

DTS – Interactive Technologies
Audio-Visual Standards

Audio-Visual Standards Specification

Version 2025.1

Digital Technology Services
The University of Newcastle, Australia



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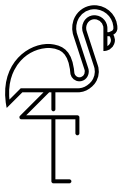

DOCUMENT DETAILS

Document Title	University of Newcastle – DTS - AV Standards Specification 2025
Document Filename	University of Newcastle Audio-Visual Standards Specification - v2025.1.docx
Document Number	V 2025.1
Original Document Prepared By	DevOps Engineering – Capability A, Interactive Technologies
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DOCUMENT OWNERSHIP

Division	Resources
Department	Digital Technology Services
DTS Area	Solutions, Capability A – Digital Experience
Team Lead	Belinda Adams, Head of Solutions – Digital Experience

REVISION HISTORY

Version	Date	Edited by	Comments / Summary of Changes
2021.03	23/09/2021	Cap A Int Tech Team	2021 Update & Major Review
2022.01	18/01/2022	Pete Grehan	Added Sennheiser
2025.01	15/05/2025	Tom Jovanovic	Review of all technology categories and specifications

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1 INTRODUCTION

Digital Technology Solutions (DTS) at the University of Newcastle provides a range of interactive audio-visual technologies to support teaching, learning, research, innovation, and collaboration. DTS regularly consults with AV industry professionals, stakeholders, business owners, academics, and the wider campus community to ensure that technology deployed meets current and future requirements.

Every project that includes audio-visual technologies must involve consultation from DTS to ensure consistency in usability, design, functionality, and supportability by using approved system designs, components and installation methods.

1.1 Purpose

This document defines the University's current audio-visual standards, technical specifications and expectations for the design and installation of interactive technology systems. The use of this document will ensure that a consistent, flexible, and reliable interactive technology platform is maintained across all University sites. The AV standards and specifications document will remain up to date and continue to meet evolving functional requirements.

The key objectives of this document are:

- Aligning the appropriate technology standard designs to the typical functional requirements of spaces
- Documenting the technical specifications and integration requirements
- Providing guidance and parameters for the design and implementation of new and refurbished spaces
- Ensuring audio visual solutions align with the University of Newcastle DTS technology principles, which include:
    - Human-centred design methodology, i.e. the solution must consider users' needs and experience in the first instance
    - DTS endorsed solutions – ensuring the selection of technology is supportable, maintainable, and secure
    - Enabling 'bring your own device' (BYOD) capability
    - 'Wireless first' principles – users can access digital services without the need to be 'tethered' to the University's cabled infrastructure, where applicable

2 AUDIO-VISUAL DESIGNS

To streamline upgrades and improve consistency and roll out times across the University's technology-enabled spaces, the following audio-visual designs have been defined as the standard or baseline approach to typical room technology types. The recommended AV designs align with the most common room types as outlined in the table listed below. The University will provide example schematic diagrams, standard equipment roster and any standard configuration files for room control deployment that correspond with each recommended AV design.

2.1 Room Technology Standard Categories

Category	Capacity	Description
Hy-Flex Teaching Space	< 250 *	Zoom-controlled system designed for a variety of flexible teaching modes (face to face, blended, simultaneous), with various content sharing and display layout options
In-Person Teaching Space	< 60 *	Button panel-controlled system designed for face-to-face only teaching activities with various content sharing and display layout options
Small Meeting Room	1-7	All-in-One Zoom videoconferencing system with a touch interactive display and wireless content sharing
Medium Meeting Room	7+	Dual display Zoom videoconferencing system with iPad control, wireless content sharing, all-in-one camera/audio soundbar system, expandable with an optional ceiling microphone
Large Meeting Room/Boardroom	12+	Dual display Zoom videoconferencing system with iPad control, wireless content sharing, dedicated room camera or cameras, steerable array microphones and loudspeakers
Custom Spaces (including event and mixed-use spaces etc.)	N/A	Systems with function-specific requirements outside the standard use case scenarios or exceeding the scope of designs listed above. Contact the DTS team for assistance with custom spaces

** Teaching space capacities are given as guides and based on most common historical practice, however, should not be taken as absolute, since the technology type is determined primarily by the functional requirements.*

2.1.1 Room Technology Feature Summary

Key Features	Hy-Flex Teaching Space	In-Person Teaching Space	Small Meeting Room	Medium Meeting Room	Large Meeting Room
Space Types*	Active Classroom, Lecture Theatre, Seminar Room	Tutorial Room	Small Meeting Room, Project Room, Private Office	Medium Meeting Room, Project Room	Large Meeting Room
Room Control	Zoom fixed touch panel	Button panel	Zoom all in one screen	Zoom wireless touch panel	Zoom wireless touch panel
Video Outputs	1-3	1-2	1	1-2	2
Displays	Projector or LCD	Projector or LCD	LCD	LCD	LCD or Projector
Speakers	✓	✓	✓	✓	✓
Recording (Zoom)	✓	✗	✓	✓	✓
Video Conferencing (Zoom)	✓	✗	✓	✓	✓
Height Adjustable Lectern	✓	✓	✗	✗	✗
Room PC	✓	✓	✗	✗	✗
Wireless Sharing	✓	✓	✓	✓	✓
HDMI Sharing	✓	✓	✗	Opt.	Opt.
Document Camera	✓	Opt.	✗	✗	✗
Microphone/s	✓ lectern, lapel, handheld, Opt.: ceiling	Opt.: lapel, handheld	✓ (all in one device)	✓	✓ (ceiling array)
Local Speech reinforcement	✓	Opt.: where microphones installed	✗	✗	✗
Camera/s	✓ (x2)	✗	✓	✓	✓
Room Booking Panel	✓	✓	✓	✓	✓
Support Phone	✓	✓	✗	✗	✗
Hearing Augmentation	✓	✓	✗	✗	Opt.

* These space types are defined in the *University of Newcastle – Interior Design Guidelines* document issued by the Infrastructure and Facilities Services

2.2 Other AV Technology Standard Categories

These technology categories describe capabilities that can be deployed standalone or as part of larger system. They are optionally deployed when specific functional demands require. Common space types that include these categories of equipment are identified below. These space types are defined in the *University of Newcastle – Interior Design Guidelines* document issued by the Infrastructure and Facilities Services.

Category	Description	Common Space Types
Screen Sharing	Screen sharing only (with optional University digital signage) used for face-to-face collaboration	Stand-up Space, Problem Based Learning Space
Interactive Whiteboard	Large Digital Whiteboard	Stand-up Space, Problem Based Learning Space
Room booking panel	Small interactive digital screen displaying room booking details and availability.	Focus Room
Digital Signage	Display screen connected to centralized content management system (OneLan) located in foyers, outside lifts and other high traffic locations.	
Multi-Angle Camera System	Multi-Angle Camera Systems are used in health sciences and typically comprise a multiple camera setup that can operate standalone or be integrated with a Hy-Flex teaching space. A separate, common control room space is sometimes implemented to direct activities in labs with Multi-angle Camera Systems.	Dry Lab (Nursing/Midwifery labs, Physiotherapy labs)

2.3 Hy-Flex Teaching Space

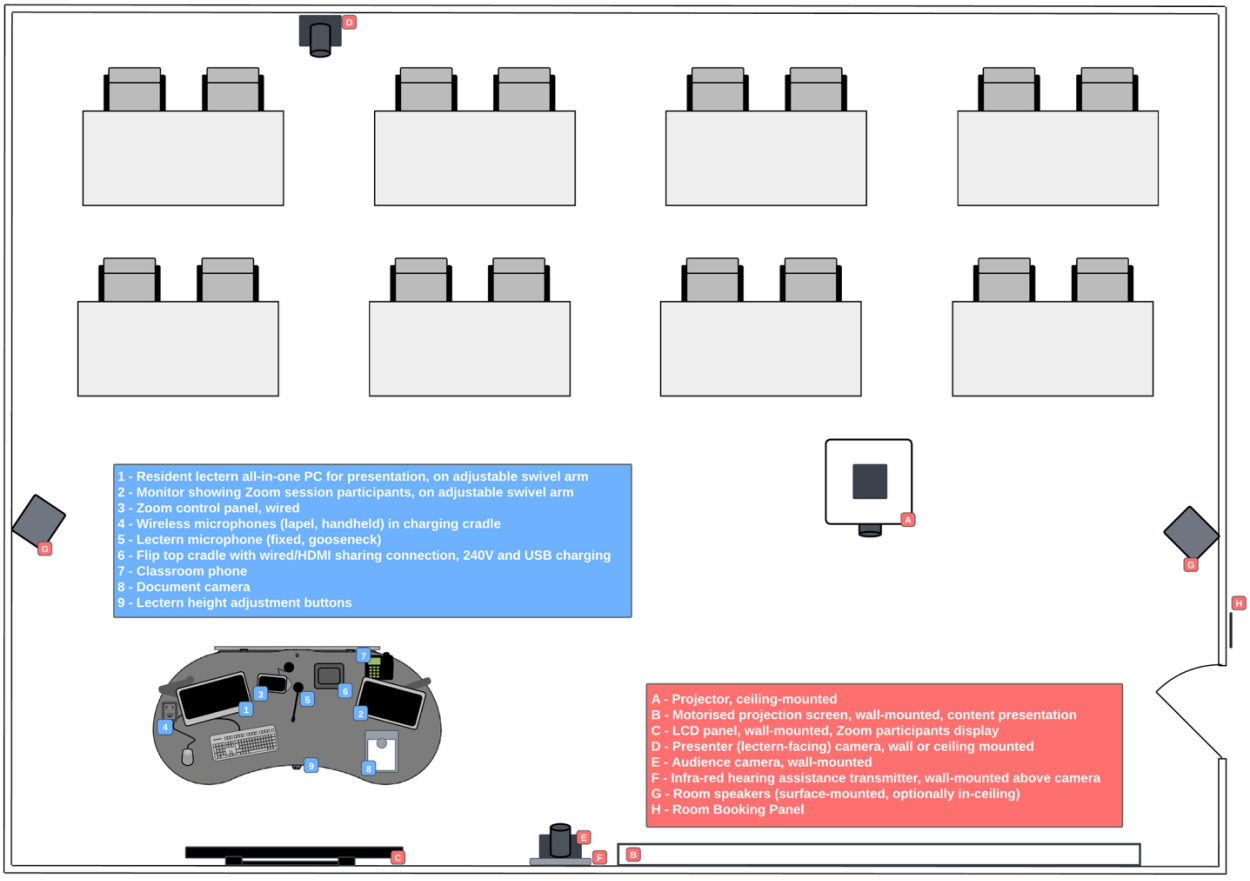
The Hy-Flex Teaching Space category comprises a Zoom Rooms based audio-visual system, with the user control interface provided by the Zoom Rooms application. This space supports Face to Face, Blended and Simultaneous teaching delivery modes. Hy-Flex teaching spaces are full videoconference enabled spaces and allow sessions to be recorded and uploaded to the Learning Management System.

2.3.1 Features of the Hy-Flex System

The following are standard features of the Hy-Flex system:

- One, two or more displays (LCD or projection) for presentation content sharing
- One or more displays (LCD or projection), where required by sightlines, for Zoom participant video (inc. document camera as full screen view content source, where applicable as per below)
- LCD monitor for Zoom participants display at the lectern
- System operation via the Zoom Rooms application interface
- Fixed, lectern-based microphone
- Wireless microphones (lapel-worn and handheld)
- Sound reinforcement of microphone and shared content audio
- Wireless infra-red hearing augmentation system
- Height-adjustable lectern or presenter's station
- 240V and USB charging at lectern
- Network-connected power distribution (for remote support)
- Room booking panel (displays timetable information only)
- Supported audio-visual shared content sources include:
    - Resident, lectern-top computer
    - Document camera
    - Wireless Bring Your Own Device (BYOD) connectivity via Zoom wireless sharing
    - Wired Bring Your Own Device (BYOD) connectivity via HDMI

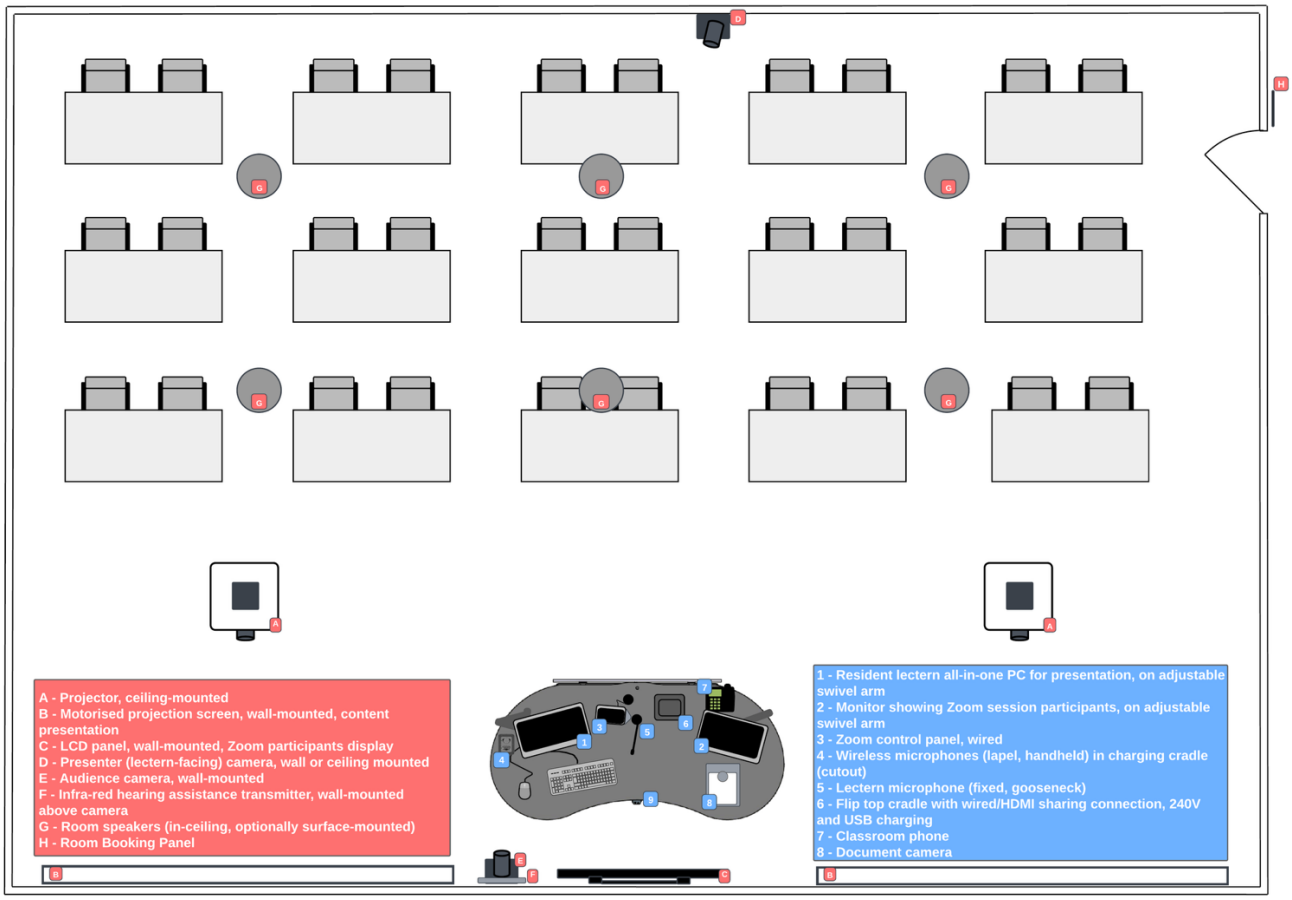
2.3.2 Hy-Flex Teaching Space: Example Room Layouts



Not to Scale

Field Devices:
A - Projector, ceiling-mounted
B - Motorised projection screen, wall-mounted, content presentation
C - LCD panel, wall-mounted, Zoom participants display
D - Presenter (lectern-facing) camera, wall or ceiling mounted
E - Audience camera, wall-mounted
F - Infra-red hearing assistance transmitter, wall-mounted above camera
G - Room speakers (surface-mounted, optionally in-ceiling)
H – Room Booking Panel

At the Lectern:
1 - Resident lectern all-in-one PC for presentation, on adjustable swivel arm
2 - Monitor showing Zoom session participants, on adjustable swivel arm
3 - Zoom control panel, wired
4 - Wireless microphones (lapel, handheld) in charging cradle
5 - Lectern microphone (fixed, gooseneck)
6 - Flip top cradle with wired/HDMI sharing connection, 240V and USB charging
7 - Classroom phone
8 - Document camera
9 - Lectern height adjustment buttons



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Field Devices:

A - Projector, ceiling-mounted
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G - Room speakers (in-ceiling, optionally surface-mounted)
H – Room Booking Panel

At the Lectern:

1 - Resident lectern all-in-one PC for presentation, on adjustable swivel arm
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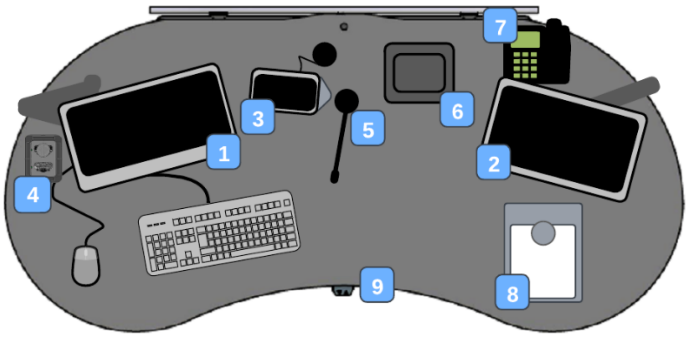
4 - Wireless microphones (lapel, handheld) in charging cradle
5 - Lectern microphone (fixed, gooseneck)
6 - Flip top cradle with wired/HDMI sharing connection, 240V and USB charging
7 - Classroom phone
8 - Document camera
9 - Lectern height adjustment buttons

2.3.3 Hy-Flex Teaching Space Sample Lectern Layout



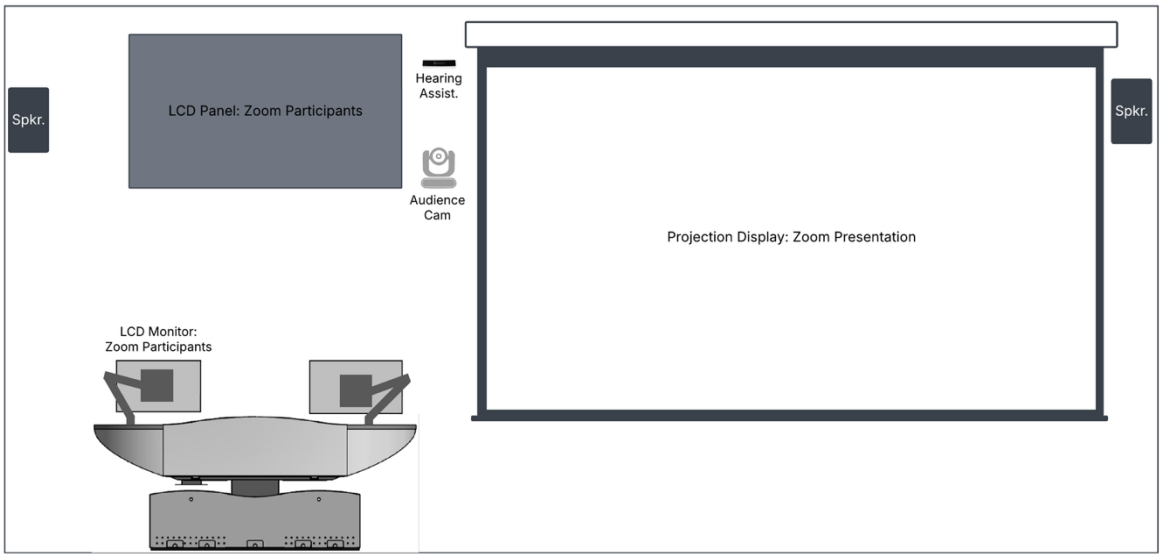
1 - Resident lectern all-in-one PC for presentation, on adjustable swivel arm
2 - Monitor showing Zoom session participants, on adjustable swivel arm
3 - Zoom control panel, wired
4 - Wireless microphones (lapel, handheld) in charging cradle
5 - Lectern microphone (fixed, gooseneck)
6 - Flip top cradle with wired/HDMI sharing connection, 240V and USB charging
7 - Classroom phone
8 - Document camera
9 - Lectern height adjustment buttons

2.3.4 Hy-Flex Display Configuration Options

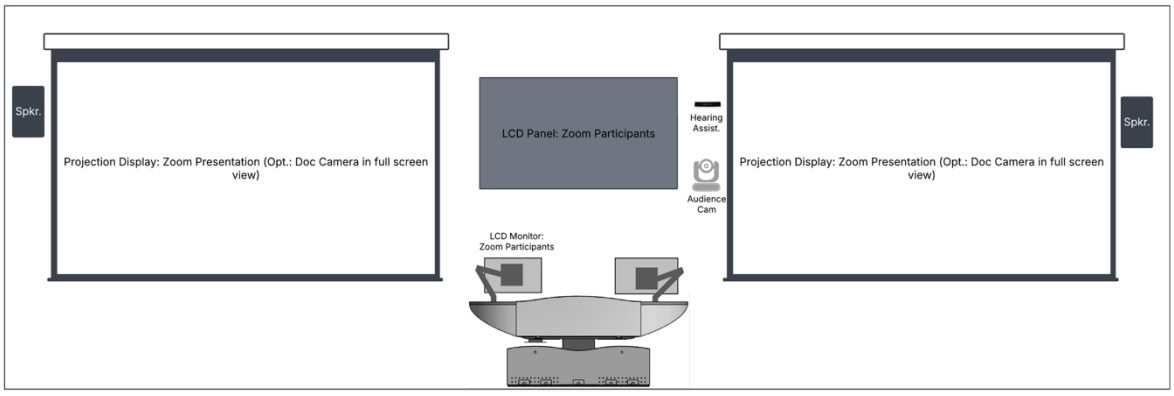
Screen layout and size options are heavily influenced by room layout and dimensions. Additional displays mirroring the ones shown can be added as required to each option below, to ensure sufficient sightline coverage for the room.

Where the room is of sufficient size to accommodate two large content displays, and the sightlines allow standards-compliant visibility/content legibility from all seats, the large displays can be set up independently so that a secondary presentation content source (Document Camera only) can be displayed in full screen size on one of the displays, alongside the primary content source (lectern PC or BYOD) on the other. Note that the Zoom recording will only capture the primary content source in full screen format – the document camera in this instance will be recorded as one of the participants, i.e. thumbnail size only.

Dedicated far end participant LCD screens allow remote presenters and participants to engage in teaching activities and should be added whenever space allows.



Example configuration 1: Single large display for shared presentation content and a smaller LCD for Zoom participants. LCD monitor at the lectern can also show participants and in a different view configuration to the LCD on the wall (i.e. gallery VS active speaker).



Example configuration 2: Two large displays for shared presentation content and a smaller LCD for Zoom participants. Where sightlines allow, the large displays can be separate Zoom Room outputs, making it possible to present the document camera in full screen view on one while presenting the Lectern PC or BYO Device on the other. NOTE: the document camera in this situation is NOT recorded in full screen view during a Zoom lecture recording. LCD monitor at the lectern can also show participants and in a different view configuration to the LCD on the wall (i.e. gallery VS active speaker).

2.3.5 Hy-Flex Optional Features

The below features may be added to the standard Hy-Flex teaching space where required by functional specification:

- **Interactive whiteboard** - The whiteboard is linked to the lectern computer and can be used for annotation of PC content and shared to the Zoom session for in-room and remote participants to view. It cannot be used as an output display for the Zoom system and hence cannot show any other content shared with the Zoom session, or the video of the far end participants.

- **Ceiling microphone array** – Some flat floor teaching spaces are suitable for a ceiling microphone array to be installed to capture room participation. This does not provide in-room amplification. For larger spaces or tiered theatres this option isn't suitable.

- **Additional microphones** – additional lapel and handheld microphones can be added to teaching spaces as needs require. A standard teaching space comes with one lapel worn and one handheld wireless microphone, in addition to the wired lectern microphone. Large spaces such as theatres that may hold seminars, events etc., may have additional wireless microphones installed (usually one additional lapel-worn and one handheld microphone).

- **High-definition content presentation –** for rooms requiring high definition, low latency content display generally used by media production courses and in event venues, there is an option to bypass Zoom content encoding for optimised resolution and minimised latency. In this case, the content (from lectern PC or BYOD**) is shared via a direct HDMI connection and displayed and heard locally, overriding Zoom content presentation on the large display/s. While remotely attending participants would still be visible in the room, any audio or content shared by them would not be seen or heard in the room due to the local content override. This needs to be considered at functional specification stage, as the override option is mostly intended for optimised in-room experience.

*** Note that this design is not compliant with High Definition Content Protection protocols, hence if a Blu-ray device is to be installed for content playback, a different (custom design) solution is required*

2.4 In-Person Teaching Space

The In-Person Teaching Space category comprises an in-room only presentation system with the user control interface provided by a button panel controller. This space supports Face to Face teaching delivery mode only.

2.4.1 Features of the Basic Teaching System

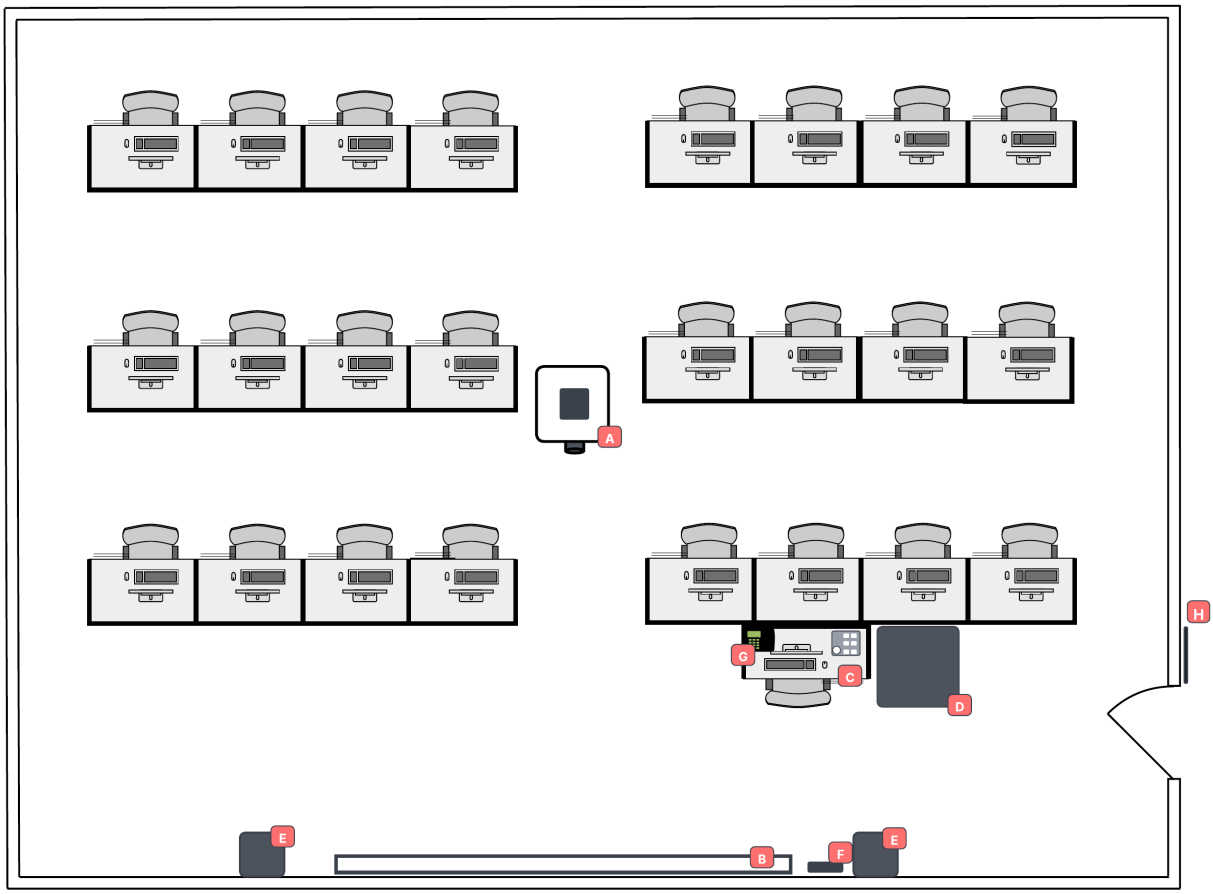
The following are standard features of the In-Person Teaching Space system:

- One, two or more displays (projection or LCD) for presentation content sharing with up to two different presentation sources displayed simultaneously on room displays
- System operation via a button panel controller
- Sound reinforcement of shared content audio
- Wireless infra-red hearing augmentation system
- A touch point style, fixed or height-adjustable lectern (where space allows) or presenter's station **
- Network-connected power distribution (for remote support)
- Room booking panel (displays timetable information only, unless prohibited by environmental factors)
- Optional: microphones for local speech reinforcement
- Supported audio-visual shared content sources include:
    - Resident, lectern-top computer
    - Wireless Bring Your Own Device (BYOD) connectivity via Zoom wireless sharing
    - **Optional:** Document Camera

*** Where equipment cannot be housed in the lectern or touch point joinery, a suitable location and equipment housing will need to be provided*

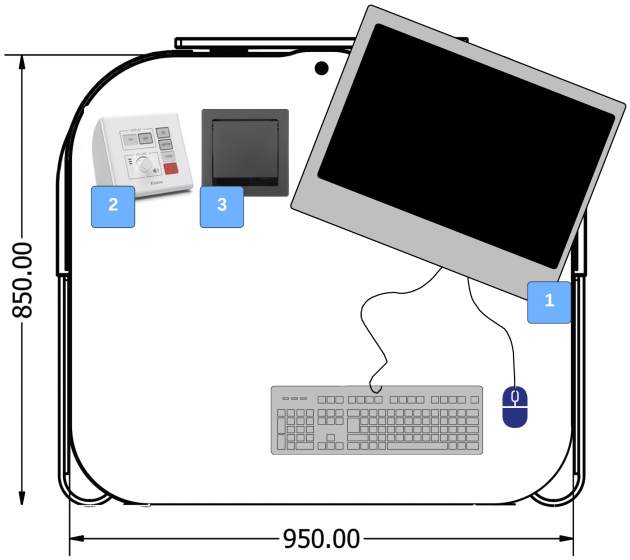
2.4.2 In-Person Teaching Space Sample Room Layout

The layout below depicts one possible implementation of the In-Person Teaching Space design in a computer lab. In this instance, the tutor is based at a desk where the control button panel is located, and the AV equipment is housed in an external rack. Where possible, a height-adjustable lectern or a fixed touch point is preferred, however this is not always possible due to the classroom layout, space constraints etc.



A - Projector
B – Motorised Screen
C – Presenter's Desk with Button Control Panel
D – AV Equipment Rack
E - Room Speakers (surface-mount, optionally in-ceiling)
F – Infra-Red Hearing Assistance Transmitter
G – Classroom Phone
H – Room Booking Panel

2.4.3 In-Person Teaching Space Sample Lectern Layout



1 - Resident lectern all-in-one PC for presentation, on adjustable swivel arm
2 - Button control panel
3 - Flip top cradle with wired/HDMI sharing connection, 240V and USB charging

NOTE: the layout of the equipment on the lectern can be mirrored left to right depending on the location, nearby walls etc.

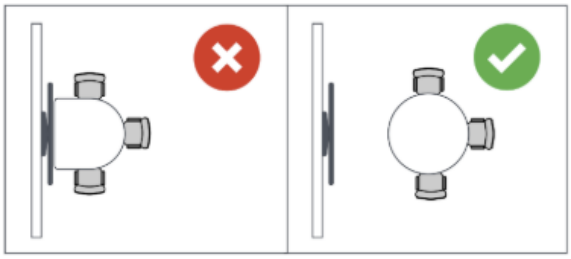
2.5 Small Meeting Room or Executive Office (1-7 occupants)

The Small Meeting Room system may be implemented in executive offices or similar spaces where a small area with a meeting table exists in addition to the workstation. The system comprises:

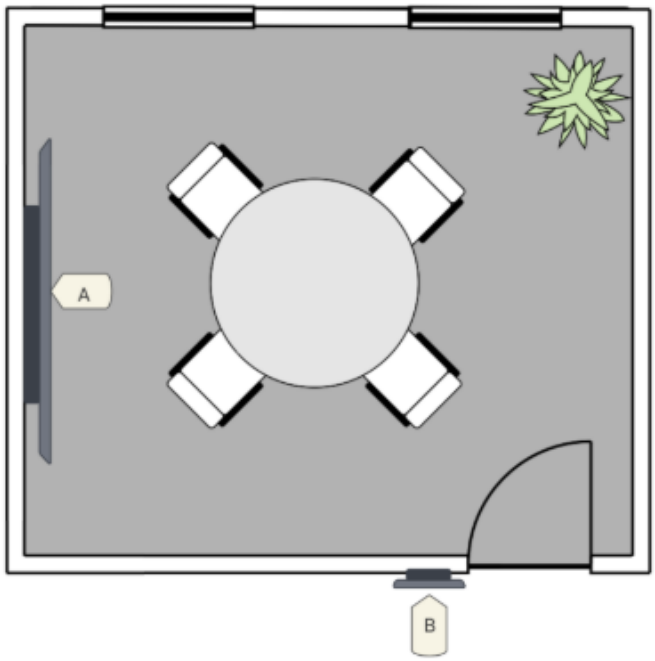
- A large format 'all-in-one' Zoom videoconferencing display, with integrated camera, microphone and speakers
- **Optional**: Room Booking Panel (only where the system is not part of a private/executive office)

Note: Presentation content sharing can be achieved from an external BYOD, such as a laptop, tablet or smartphone, via Zoom's wireless screen sharing feature only.

Due to the all-in-one nature of the conferencing solution, the furniture arrangement must allow access to the touch-interactive display on the wall:



2.5.1 Small Meeting Room: Typical Layout



A: An all-in-one, touch-interactive single display Zoom conferencing solution with built-in room camera, microphone and loudspeakers
B: Room booking panel

2.6 Medium Meeting Room (7+ occupants)

A Medium Meeting Room system comprises a dual or single display video conferencing system, with the user control interface provided by the Zoom Rooms application. Content sharing is via Zoom wireless sharing and optionally via HDMI.

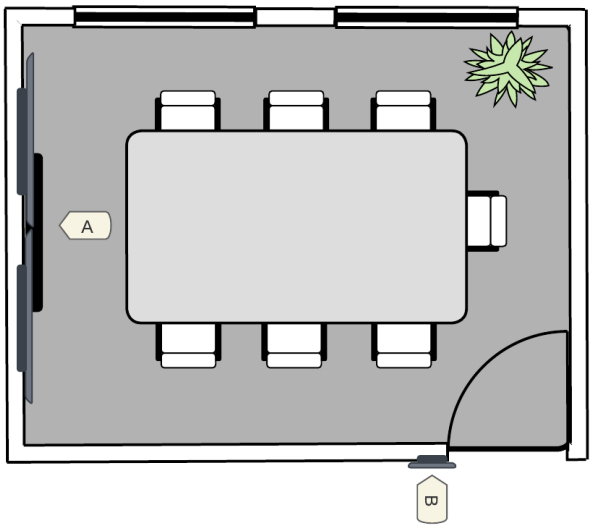
Features of the Medium Meeting Room system:

- Two identical LCD panels for presentation content sharing and far end participant view. Where room dimensions demand it, a single larger LCD panel may be used
- All-in-one integrated sound bar system with speakers, microphone and camera
- System operation via the Zoom Rooms control application on a wireless control panel (iPad)
- Room booking panel

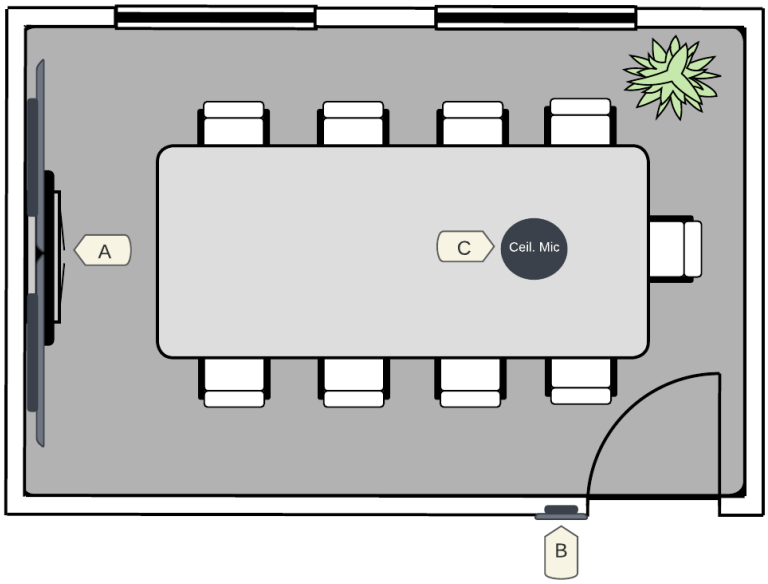
Optional Features:

- Wired content sharing via HDMI
- Additional ceiling-mounted microphone to provide coverage in larger rooms

2.6.1 Medium Meeting Room: Typical Layouts



A: Dual display wall-mounted conferencing system with all-in-one soundbar/camera unit, custom joinery cupboard housing equipment, and an iPad controller on a charging dock
B: Room booking panel



A: Dual display wall-mounted conferencing system with all-in-one soundbar/camera unit, custom joinery cupboard housing equipment, and an iPad controller on a charging dock
B: Room booking panel
C: Additional ceiling microphone

2.7 Large Meeting Room / Boardroom (12+ occupants)

A Large Meeting Room system comprises a dual display video conferencing system, with the user control interface provided by the Zoom Rooms application. Content sharing is via Zoom wireless sharing and optionally via HDMI.

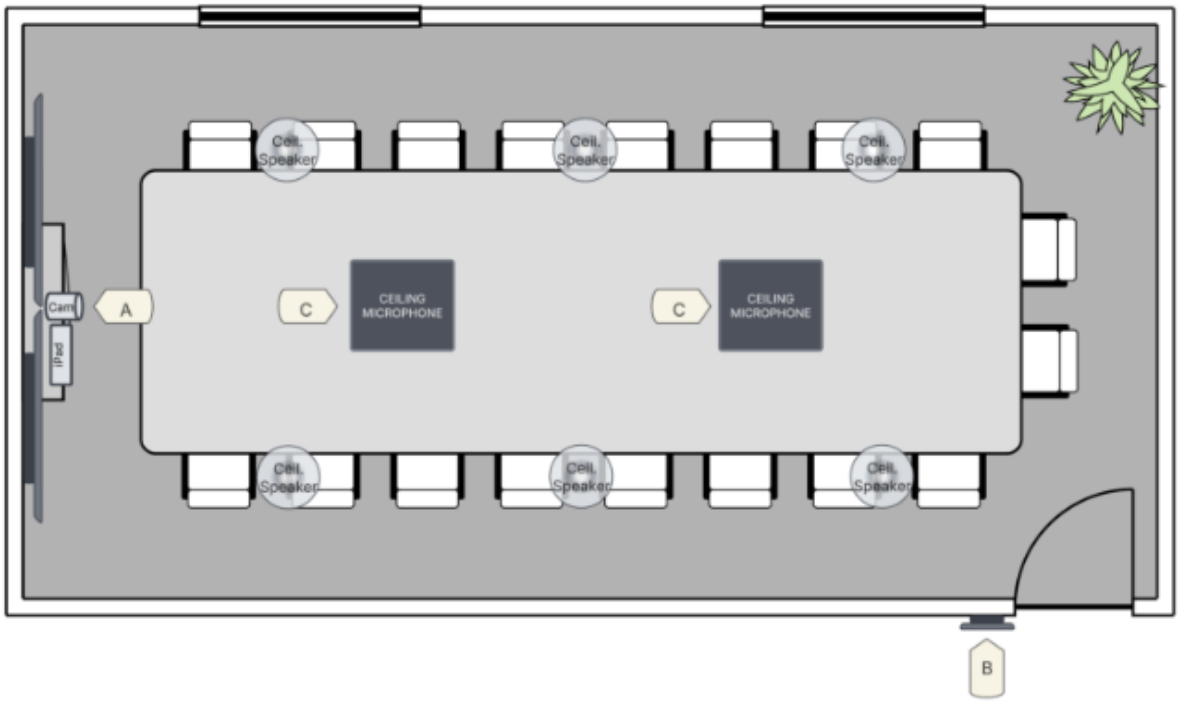
Features of the Large Meeting Room / Boardroom system:

- Two identical LCD displays for presentation content sharing and far end participant view
- System operation via the Zoom Rooms control application on a wireless control panel (iPad)
- Room camera (PTZ)
- Room microphone/s (steerable array)
- Room speakers
- Room booking panel

Optional Features:

- Wired content sharing via HDMI
- Hearing augmentation system

2.7.1 Large Meeting Room: Typical Layout



A: Dual display wall-mounted conferencing system with custom joinery cupboard housing equipment, room camera, iPad controller charging dock and infra-red hearing assistance transmitter.
B: Room booking panel
C: Ceiling microphone (and additional ceiling microphone, where required)

2.8 Meeting Rooms: Technology Standard Matrix

The following table is a guideline for determining the design standard according to the room's capacity and size. Attributes of physical space and functional requirements must also be considered; hence some overlap exists below in mapping the standard to the size/capacity of the room. This table is therefore the starting point and general reference that should guide the design but may not be the sole determining factor:

STANDARD:	SMALL		MEDIUM/MEDIUM PLUS			LARGE/BOARDROOM
System	50" all-in-one conferencing display	65" all-in-one conferencing display	2 x 65" display + all-in-one camera / soundbar	1 or 2 x 75" display + all-in-one camera / soundbar + additional ceiling mic	1 or 2 x 85" display + all-in-one camera / soundbar + additional ceiling mic	1 or 2 x 85" or 1 or 2 x 98" display, PTZ camera, audio DSP, speakers + ceiling mic array (+ opt: 2nd ceiling mic array)
Capacity	Up to 4	5-7	7-8	8-10	10-12	12+
Viewing Distance	Up to 3.5m	3.5 - 4.5m	4.0 - 5.0m	4.75 - 5.5m	5.5m - 6.5	Up to 8m

2.9 Other AV Technology Categories

The systems detailed below can function standalone or be integrated within the designs described above, where applicable.

2.9.1 Screen Sharing

Screen sharing systems are a simple option for collaboration on a large display with content sharing from BYOD enabled by the Zoom wireless sharing application. These are content displays only and cannot be used to conduct videoconferencing meetings. If required, a wired content sharing option over an optional HDMI cabled connection can be implemented, such that the HDMI auto-overrides wireless sharing, i.e. no user control interface is required.

Features of the Screen Sharing system:

- An LCD screen size-appropriate to the space and function (capable of content audio reinforcement via the display's speakers only, where required)
- A wireless sharing device (utilising Zoom wireless sharing)
- Optional: HDMI cable input wired to the LCD, auto-overriding wireless sharing when signal is detected

Screen sharing displays can be implemented as 'pods' within a larger space, whether encapsulated in a teaching space or a study area to enable group work. These pods function as standalone only and are not integrated with any centralised AV system.

2.9.2 Interactive Whiteboard

A digital Interactive whiteboard can be deployed in common areas where ad-hoc collaboration is facilitated or it may be added as an option to the Hy-Flex teaching space where it is connected directly to the resident lectern PC.

Features of the Interactive Whiteboard system:

- A single, large format interactive whiteboard display
- Wireless BYOD connectivity via direct connect wireless casting
- **Optional:** Content sharing via HDMI cable (via direct connection to the display).

2.9.3 Room Booking Panel

Room booking panels are already specified as part of the standard system specification for meeting rooms and teaching spaces (timetable information only in latter), but may be deployed standalone where required for ad-hoc or scheduled booking of focus rooms, consultation rooms etc.

Features of the Room Booking Panel:

- A 10" touch-interactive, wall-mounted panel that can be used to display the room's calendar information, ad-hoc book the room (where applicable) or just show the room's timetable (teaching spaces)

The panel can be deployed with an additional illuminated coloured indicator frame around it in areas where multiple rooms are adjacent to each other and ad-hoc bookable, to indicate which rooms are available at any given time.

2.9.4 Digital Signage

The University's digital signage solution is an enterprise server-based content management system (CMS) provided by OneLan from Uniguest, and used in conjunction with LCD display panels which support the OneLan platform natively without the need for an external signage player. Samsung Professional Signage series displays are the type endorsed for deployment and support by DTS - Interactive Technologies and must be specified (for indoor locations) to support the University signage platform. Outdoor locations will need to take weather-proofing, as well as additional brightness required into view, hence the specific models shall be considered and recommended at every such occasion, in conjunction with an appropriate enclosure.

The setup and management of the digital signage component is handled by Interactive Technologies, upon installation of the hardware by the audio-visual integrator.

Features of the Digital Signage system:

- A location-appropriate, standalone LCD screen connected to the University's digital signage management platform, or
- A hardware signage content player connected to the management platform and integrated as a content source as part of a larger system

As an option, an HDMI cable input can be wired to the LCD, auto-overriding wireless sharing when signal is detected. This can be used in areas such as building foyers where a simple presentation to a large display may be required as part of an event, without broader integration into an AV system.

2.9.5 Multi-Angle Camera System

The Multi-Angle Camera System comprises a multiple camera setup (up to four, controllable PTZ cameras) controlled via a large integrated preview and camera control touch panel/monitor. The system can further ingest up to four wired content source inputs, combining any combination of cameras and inputs into a quad view video output.

The common use case for the Multi-Angle Camera System is in nursing/midwifery or similar patient ward simulation scenarios, where usually a three-camera setup integrates into the Hy-Flex teaching system as the Zoom content source view. In this case the system also ingests the source content from the resident lectern PC, HDMI fly lead and optional document camera. The system output can be configured as quad view, presenting any combination of the three cameras and the content sources to the Hy-Flex system as Zoom content source input, which can be shown on local displays and shared to a Zoom meeting session. Other viewing layouts are possible.

The system can also be deployed standalone, comprising up to four cameras and up to four wired (HDMI) inputs, controlled via the large integrated preview and camera control touch panel and outputting to a large in-room display for example. In this case there is no audio reinforcement or possibility of Zoom videoconferencing.

Features of the Multi-Angle Camera System:

- One to four PTZ cameras
- System operation via a large integrated preview and camera control touch panel/monitor
- One or more displays for local-only viewing (where not integrated with Hy-Flex teaching system)
- Supported audio-visual shared content sources include:
    - Resident computer

- Wired BYOD input via HDMI cable
- HDMI input for other equipment (i.e. patient vitals display etc.)

Optional Features:

- Wireless BYOD connectivity via Zoom wireless sharing
- Room booking panel

Control Room Option

Simulation labs such as in nursing/midwifery often have an adjoining control room from which the simulations in one or more labs are run. In this case, the control room will usually be outfitted with a control station per lab, each comprising a large integrated preview and camera control touch panel/monitor mirroring the one inside the corresponding lab. Furthermore, a central audio system is installed in the control room with a paging microphone at each control station to address the corresponding lab via loudspeakers installed in the labs.

Audio

Depending on the on the level of functionality required in the simulation space and whether a control room is incorporated, the audio options are as follows:

- When the Multi-Angle Camera System is deployed standalone (without integration in a Hy-Flex teaching system or with a control room), there is no audio reinforcement present

- When the simulation space is integrated with a Hy-Flex teaching system, an additional ceiling microphone array may be deployed in the vicinity of the simulation area to complement the PTZ cameras and integrate into the Hy-Flex system for recording and videoconference participation. The ceiling microphone audio in this situation is not reinforced inside the lab (only the Hy-Flex system wireless microphones are reinforced)

- When the simulation space has a control room, a ceiling microphone may be installed for the control room operators to hear the audio from the lab, in addition to the standard control room system described above (i.e. control station paging microphone that feeds into speakers inside the simulation lab). If the simulation lab also comprises a Hy-Flex teaching system and a ceiling mic is installed as per the above option, that same ceiling mic can serve a dual purpose and be heard at the corresponding control station, either via headphones or a speaker. If speakers are deployed in the control room and there are multiple simulation labs, a speaker above each control station corresponding to its lab must be selectable for audition exclusively at any given time, via a local control panel. This panel can be a mirror of the Zoom control panel in the lab's Hy-Flex teaching system (where present and again, one panel at each station corresponding to its lab space), further integrating the lab's Hy-Flex teaching system control with the control room, or it can be a single dedicated panel controlling the control room DSP exclusively.

2.10 Custom Spaces

This category is applied to any location with unique architectural or functional requirements that exceed the scope of standard designs and hence require individual analysis and bespoke design. Examples include Specialist Labs, large halls and multi-function spaces.

Any customised designs must, wherever possible, follow the standard design principles, equipment and user interfaces outlined in this document. Any departures from the standard platforms found in this document and the accompanying preferred equipment list must first be approved by DTS for operational support.

2.11 Technology Standards: Installation Prerequisites (Power & Data)

The following specification outlines requirements such as data/communications cabling, power outlets etc., that need to be considered at design stage and made available during implementation. It also details the field equipment, i.e. equipment outside the centralised location of the AV lectern with its associated joinery and equipment installed within.

2.11.1 Hy-Flex Teaching Space

The Hy-Flex teaching space design requires:

- GPO and Data (AV network switch trunks to comms room only) at the base of the lectern. The standard height-adjustable lectern cannot be placed with base against the wall so if the provisions are via an adjacent wall, a cable-protective floor tray or a floor trench may be required
- GPO at every LCD in the field, as shown in the standard elevation drawings
- GPO at every motorised projection screen (left hand side when facing the screen)
- GPO at every projector (ceiling)
- Data (single port cabled back to comms room) at room booking panel location/s. The room booking panel will require a single data socket which may need to be installed above the doorway where the panel is mounted on a glass surface – in this case a cabling channel is required in the door frame to run a patch cable down to the panel location

In room refresh scenarios, existing data cabling between the comms room and field devices such as cameras can be reused if deemed acceptable – new data cabling to the lectern is not necessary.

The following field equipment is typically installed:

- One or more projectors with (motorised) screens. Projector signal and control cabled to the lectern by the AV integrator. Motorised screen control cabled to the lectern by the AV integrator.
- One or more wall-mounted LCDs. Signal cabled back to the lectern by the AV integrator.
- Two room cameras (one facing the lectern – presenter, one near lectern facing the seating – audience). Data port per camera (with power-over-Ethernet) and signal cabled back to the lectern by the AV integrator.
- Room speakers (ceiling mount, surface mount or combination thereof). All cabled back to the lectern by the AV integrator. Large spaces such as tiered lecture theatres usually require surface mount ‘front of house speakers’ and a ceiling speaker array (usually split into front and back zones).
- Infra-red hearing assistance transmitter (wall-mount, facing the seating). Power and signal cabled back to the lectern by the AV integrator.
- Wireless microphone (external) antennas, where deemed necessary (see 2.11.12). Cabled back to the lectern by the AV integrator.
- Room booking panel with data (with power-over-Ethernet) cabled back to the comms room by the data contractor

2.11.2 In-Person Teaching Space

The In-Person Teaching Space design requires:

- GPO and Data (AV network switch trunks to comms room only) at the AV equipment rack. In spaces such as labs, a lab desk is often 'the lectern' location and the equipment is installed in a standalone rack in this case. Standard 'touchpoint' lectern joinery may also be used or a smaller footprint height-adjustable lectern, where appropriate and possible.
- GPO at every LCD in the field, as shown in the standard elevations drawings
- GPO at every motorised projection screen (left hand side when facing the screen)
- GPO at every projector (ceiling)
- Data (single port cabled back to comms room) at room booking panel location/s (where installed). The room booking panel will require a single data socket which may need to be installed above the doorway where the panel is mounted on a glass surface – in this case a cabling channel is required in the door frame to run a patch cable down to the panel location

In room refresh scenarios, existing data cabling between the comms room and field devices such as cameras can be reused if deemed acceptable – new data cabling to the lectern is not necessary

The following field equipment is typically installed:

- One or more LCD panels or projectors with (motorised) screens. Projector signal and control cabled to the lectern by the AV integrator. Motorised screen control cabled to the lectern by the AV integrator.
- Room speakers (ceiling or surface mount), cabled back to the lectern by the AV integrator.
- Infra-red hearing assistance transmitter (wall-mount, facing the seating). Power and signal cabled back to the lectern by the AV integrator.
- OPTIONAL: Wireless microphone (external) antennas, where wireless microphones are installed and antennas deemed necessary (see 2.11.12). Cabled back to the lectern by the AV integrator.
- OPTIONAL: room booking panel/s with data (with power-over-Ethernet) cabled back to the comms room by the data contractor

2.11.3 Small Meeting Room

The small meeting room design requires:

- GPO and Data (dual outlet cabled back to comms room) at the all-in-one conferencing display, as shown in the standard elevations drawings
- Data (single port cabled back to comms room) at room booking panel location *
-

The following field equipment is typically installed:

- A wall-mounted all-in-one LCD panel/Zoom conferencing system with Zoom session control via the panel's touch interactive touch display (AV integrator)
- A wall-mounted room booking panel at the entry with data (with power-over-Ethernet) cabled back to the comms room by the data contractor

** The room booking panel will require a single data socket which may need to be installed above the doorway where the panel is mounted on a glass surface – in this case a cabling channel is required in the door frame to run a patch cable down to the panel location*

2.11.4 Medium Meeting Room

The medium meeting room design requires:

- GPO and Data (4 ports cabled back to comms room) at the equipment-housing joinery cabinet *
- GPO at each LCD, as shown in the standard elevation drawings
- Data with PoE (single port cabled back to comms room) at ceiling microphone (where installed)
- Data with PoE (single port cabled back to comms room) at room booking panel location **

The following field equipment is typically installed:

- One or two wall-mounted LCD panels with AV signal only (no device control) cabled to the equipment housing joinery below by the AV integrator.
- An all-in-one camera/microphone/speaker bar wall-mounted between the LCD panels and the equipment housing joinery, cabled to the Zoom Rooms PC by the AV integrator.

** In room refresh scenarios, existing data cabling between the comms room and the equipment housing joinery can be reused if deemed acceptable – new data cabling is not necessary.*
*** The room booking panel will require a single data socket which may need to be installed above the doorway where the panel is mounted on a glass surface – in this case a cabling channel is required in the door frame to run a patch cable down to the panel location*

2.11.5 Large Meeting Room

The large meeting room design requires:

- GPO and DATA (4 ports cabled back to comms room) at the equipment-housing joinery cabinet*
- GPO at each LCD, as shown in the standard elevation drawings
- Data with PoE (single port cabled back to comms room) at each ceiling microphone (installed)
- Data with PoE (single port cabled back to comms room) at room booking panel location**
- Data with PoE (single port cabled back to comms room) at each PTZ room camera installed
- **OPTIONAL:** GPO and Data (single port cabled back to comms room) at each projector installed (see below) and GPO at every motorised projection screen (left hand side when facing the screen)

The following field equipment is typically installed:

- One or two wall-mounted LCD panels with AV signal only (no device control) cabled to the equipment housing joinery below by the AV integrator. Projectors and motorised screens may be considered in very large spaces but are not preferred. In this case each projector requires a data port for control (wired back to comms room by the data contractor) and motorised screen control is wired back to the equipment housing joinery by the AV integrator.
- Camera (room PTZ camera) with data port cabled back to the comms room by the data contractor and signal cabled back to AV joinery by the AV integrator
- Microphones (ceiling microphone array) with data port cabled back to the comms room by the data contractor and signal cabled back to AV cabinet by the AV integrator
- Speakers (usually in-ceiling) wired back to the AV cabinet by the AV integrator
- **OPTIONAL:** Infra-red hearing assistance transmitter (wall-mount, facing the seating). Power and signal cabled back to the equipment housing joinery by the AV integrator.
- Room booking panel/s with data (with power-over-Ethernet) cabled back to the comms room by the data contractor

** In room refresh scenarios, existing data cabling between the comms room and the equipment housing joinery can be reused if deemed acceptable – new data cabling is not necessary.*
*** The room booking panel will require a single data socket which may need to be installed above the doorway where the panel is mounted on a glass surface – in this case a cabling channel is required in the door frame to run a patch cable down to the panel location*

2.11.6 Screen Sharing

A screen sharing system can be deployed standalone, as a screen sharing only space or as a self-contained 'pod'/collaboration area within a larger space. Each such instance requires:

- GPO and Data (two ports, cabled back to comms room by the data contractor) at the LCD panel, as shown in the standard elevations drawings

The following field equipment is typically installed:

- A wall-mounted LCD panel with a wireless content sharing device behind, installed by the AV integrator

2.11.7 Interactive LCD Whiteboard

An interactive LCD whiteboard can be deployed standalone or as an interactive whiteboard within a teaching space (connected to the resident lectern PC). It requires:

- GPO and Data (single port, optionally dual-redundant, cabled back to comms room by the data contractor *) at the LCD panel, as shown in the standard elevations drawings

The following field equipment is typically installed:

- A wall-mounted touch-interactive LCD panel installed by the AV integrator
- **OPTIONAL:** height-adjustable wall mount for the interactive LCD

* Network port is only required when the interactive whiteboard is deployed standalone and not when deployed within a teaching space

2.11.8 Digital Signage

A digital signage location requires:

- GPO and Data (single port, optionally dual-redundant, cabled back to comms room by the data contractor) at the LCD panel and concealed by the panel

The following field equipment is typically installed:

- A wall-mounted LCD panel installed by the AV integrator

2.11.9 Simulation Space and Control Room

A simulation space will likely employ the Multi-Angle Camera System, as specified in the section 2.9.5 above. This system requires:

- Data with PoE (single port, cabled back to comms room by the data contractor) at each camera position *

** Data feed for the camera can optionally come from a small AV network switch installed locally in a 'lectern', where one exists (i.e. the Simulation Space is integrated within a Hy-Flex teaching space), in which case it can be run alongside the USB extender connection by the AV integrator and not as part of structured cabling scope. The decision whether to cable the cameras back to comms room or a local lectern will be made on individual design instance basis and depend on the overall data plan, and whether a broader integration into a Hy-Flex teaching system exists or not.*

Where the Multi-Angle Camera System is deployed and integrated with a Hy-Flex teaching system, see 2.11.1 for the power and data requirements of the Hy-Flex teaching component.

Where a ceiling microphone exists, the following is required:

- Data with PoE (single port cabled back to comms room by the data contractor) at ceiling microphone *

* Data feed for the ceiling microphone can optionally come from a small AV network switch installed locally in a 'lectern', where one exists (i.e. the Simulation Space is integrated within a Hy-Flex teaching space), in which case it can be run alongside the signal (Dante) connection by the AV integrator and not as part of structured cabling scope. The decision whether to cable the microphone back to comms room or a local lectern will be made on individual design instance basis and depend on the overall data plan and whether a broader integration into a Hy-Flex teaching system exists or not.

Where a control room exists, the following may be required:

- Data with PoE (single port cabled back to comms room or local AV switch, as per the approach above) for a duplicate classroom control panel (i.e. the Zoom app controller panel of the Hy-Flex teaching space, where one exists in the Simulation Space).

  Note that the Multi-Angle Camera System control is via a separate panel which can be placed in the simulation area, the control room or one in each, and it only requires USB/touch and video (HDMI) link to the camera video switcher

The following field equipment is typically installed:

- A wall-mounted LCD panel, either in a central location or one at each patient bed/station, cabled back to the AV equipment rack by the AV integrator (usually a lectern or teaching station of an integrated Hy-Flex system) *
- A set of three PTZ cameras mounted on the ceiling around the simulation station, installed by the AV integrator and cabled back to the network switcher as per the above

* Where an LCD panel is installed, a GPO will be required as per the requirements for LCD panels in teaching spaces (no Data ports are necessary)

2.11.10 Custom Space

By its nature, a custom space would exceed the scope and requirements of the standard designs outlined above.

A custom design may be applied to a large event venue, a space with very specific and non-standard teaching practise or a staff space such as a complex boardroom with tracking auto-switching PTZ camera solution, multi-microphone discussion system etc. Therefore, all requirements would be determined on case-by-case basis but should follow the principles and approaches outlined above.

2.11.11 Consideration: Dual VS Single Presentation Source Viewing in Teaching Spaces

Multiple large displays may be installed where the room dimensions and seating layout require so.

Viewers' sightlines must be considered when deciding whether to install pair/s of displays that permanently mirror each other (i.e. to ensure good sightline coverage across the room), or run the displays as separate outputs of the AV system (so that content source selection options allow secondary presentation source, such as Document Camera, to be shown alongside a primary, i.e. the Lectern PC). In the first case, video DAs would be utilised to distribute the signal to the displays, whereas in the second case, the displays would get direct output feeds from the Zoom PC, allowing for extended viewing configurations.

In some instances, a combination of the approaches above may be required where the room dimensions demand four large displays. In this case, pairs of displays (serviced by video DAs) are implemented as outputs to Zoom Rooms so that each output is routed to two displays positioned to optimise audience sightlines.

2.11.12 General Considerations: Field Equipment

The following needs to be considered when designing the system for a brand new or refresh installation:

- Any new mounting points where attachment to the slab is necessary will need to be assessed and slab scanning may be required to ensure attachment can be carried out safely

- Wall-mounting of large displays (LCD) may require reinforcement in order to support the wall and centre the display in the room regardless of the supporting structure behind it

- Infra-red hearing assistance transmitter needs to be positioned to allow clear line of sight to the entirety of the audience area, as they face the displays

- Room cameras should be positioned to optimise the angle and avoid steep 'birds eye view' of the presenter and audience wherever possible

- External antennas for the wireless microphones may be required where potential distance or obscured transmission line concerns exist, however in majority of cases where the microphones are used in relative proximity to the lectern, they are not required and the 1/4 wave antennas supplied with the transmitters are deemed sufficient

3 TECHNICAL STANDARDS: VIDEO

3.1 Video Resolutions

The minimum expected resolution standards for all video sources and destinations are currently specified as:

16:9 image aspect ratio, 1920 x 1080 pixel resolution at 30fps with 4:2:2 chroma subsampling.

Any specific requirement for HDR, 4K, higher resolutions or custom aspect ratios identified at functional requirements gathering stage shall be treated as custom technology category design.

3.2 Video Signal Standards

The signal standards acceptable for achieving the requirements outlined above comprise:

HDMI, DisplayPort, USB Video, HDBaseT and compliant Video-over-IP standards with situation-suitable latency.

The above signal standards and the supporting standards-compliant cabling and connections are the only types featured in the standard technology category designs described by this document. Any signal standards or connections used other than those mentioned above will only be considered in custom technology category designs and evaluated on functional needs assessment.

3.3 Bandwidth, EDID and HDCP

All cabling & connectivity must support a minimum of 10.2 Gbps for 1080p @ 30Hz and 18Gbps for 4k @ 60Hz resolutions. In addition, all patch cables must at minimum support relevant HDMI and HDCP standards including HDMI 2.0 and HDCP 2.2.

3.4 Projection Standards

Analysis and measurements for projection surfaces and projection hardware should be referenced and implemented as per the industry standard requirements and recommendations outlined in the *Audiovisual Design Guidelines* by the Association for Audiovisual and Education Technology Management (AETM.org), and standards and industry practices referenced therein. This includes ambient light contrast and variability, distance vs screen size calculation, line of sight considerations and ergonomic viewing values.

Important: *For accuracy of measurement pertaining to light, environment, seating arrangement, distance, and elevation, the analysis should be undertaken at a time where the worst-case scenario for which the applied space is most used can be simulated.*

3.5 Projector Hardware

Minimum technical requirements for projector hardware shall include the following:

- Native video resolution of 1920 x 1080P @ 30FPS
- Native 16:9 format, or be capable of projecting a 16:9 format image
- Include at least 1 x HDMI and 1x HDBaseT input
- Support RS232 and TCP/IP control protocols
- Use Class 1 Laser Diode, LCD or single/3DLP chip Technology
- Have motorised lens adjustment (zoom/shift/focus)

3.6 Projector Mounting

Minimum technical considerations for projector mounting and hardware shall include the following:

Secure and safe mounting to the concrete floor slab or substructure with careful consideration of supporting weight limitations and minimum height requirements

- Best practice positioning for optimal, natural, and least adjusted image reproduction with minimal to no geometrical or digital adjustment required of the lens or picture position output
- Best practise positioning to ameliorate concerns regarding fan noise and heat dissipation
- Best effort consideration for service accessibility
- Best effort to reticulate and conceal cabling and connections within the projector bracket mount for a neat and streamlined appearance
- Best efforts coordination and mounting of related peripherals such as signal extenders and scalers. Peripherals to be securely and neatly mounted whilst maintaining serviceability, visibility and accessibility
- If the projector is mounted at a height that restricts serviceability, a motorised projector lift or truss may be required

3.7 Projection Surfaces

The University recognises that architectural and physical constraints may at times impede the ability to deploy strict industry standard practices for projection. Best efforts, in coordination with the Interactive Technologies design team, will be acceptable under such circumstances.

When considering the type of projection surface, broader functional requirements must be examined such as access to whiteboards on the wall that may influence the choice of screen type. Where possible, new installations shall be equipped with fixed frame projection screens of the correct size and ratio for the room.

The following consideration must be made at design stage:

- If the optimal position for a projection screen is impeded by a whiteboard, is a window, wall feature or displaying artwork, a motorised screen shall be specified and installed as per manufacturer installation requirements
- Dual displays – where dual displays are to show independent content sources, the specifications for viewing distances and angles shall apply to each single display within the context of the entire audience area
- All motorised projection screens must support remote control via contact closure

3.8 Projected Image Calibration and Commissioning

Projectors shall be commissioned using a test pattern generator, or the projector's internal test patterns.

The projected image shall comply with the *Audiovisual Design Guidelines* by the Association for Audiovisual and Education Technology Management (AETM.org), and standards and industry practices referenced therein.

3.9 LCD/LED Displays

In spaces where LCD/LED panels have been installed as an alternative or in addition to projection systems, sight line (image size and position) criteria equally apply.

LCD/LED displays for indoor use must comply with the following criteria:

- Support a minimal continuous operation time of 16 hours, 7 days
- Support a minimum native resolution of 1920 x 1080 pixels
- Support a minimum contrast ratio of 4000:1
- Support a typical minimum brightness of 400cd/m^2
- Support a minimum of 1 x HDMI input
- Support 3rd party control via Ethernet or RS232

3.9.1 Far End Participant Displays in Videoconferencing

Where a display (projection or LCD/LED) is dedicated solely to showing the far end participants in a videoconferencing session, sizing criteria different to the above may be applied. While in such circumstances, smaller spaces are well served by a display size that roughly reproduces a life size figure in 'active speaker' mode (i.e. displaying a single person rather than a gallery-style view), in larger auditoriums it is beneficial to aim for a larger display, albeit not necessarily matching the content source displays in size.

A good reference guide is to make sure the distance to the farthest viewing position in the room does not exceed ten times the height of the displayed image for such display.

3.10 Indoor Digital Signage Displays

LCD/LED displays intended for indoor display of digital signage information must comply with the following criteria:

- Support a minimal continuous operation time of 16 hours, 7 days
- Support a minimum native resolution of 1920 x 1080 pixels
- Support a minimum contrast ratio of 4000:1
- Support a typical minimum brightness of 400cd/m^2
- Support SoC (System on Chip) technology which enables ONELAN signage directly on the display
- Support hardwired Ethernet
- Support 3rd party control via Ethernet

3.11 Outdoor Digital Signage Displays

LCD/LED displays intended for outdoor-facing display of digital signage information (such as 'shop window' style displays facing out to ambient daylight areas) must comply with the following criteria:

- Support a minimal continuous operation time of 16 hours, 7 days
- Support a minimum native resolution of 1920 x 1080 pixels.
- Support a minimum contrast ratio of 4000:1.
- Support a typical minimum brightness of 700cd/m^2
- Support SoC (System on Chip) technology which enables ONELAN signage directly on the display
- Support hardwired Ethernet
- Support 3rd party control via Ethernet

LCD/LED displays intended for outdoor-housed display of digital signage information (such as standalone kiosk style displays in daylight conditions) must first be assessed for the specific ambient conditions (direct sunlight or in shade facing sunlit area etc), which will determine the choice of high or ultra-high brightness and contrast ratios higher than those required above. These displays must also comply with the following criteria:

- Support a minimal continuous operation time of 24 hours, 7 days
- Support a minimum native resolution of 1920 x 1080 pixels.
- Support a minimum of 1 x HDMI input
- Support SoC (System on Chip) technology which enables ONELAN signage directly on the display
- Support hardwired Ethernet
- Support 3rd party control via Ethernet
- Supports dust and water-resistant equivalent to IP65 on screen (or enclosing cabinet)

NOTE: The University uses the OneLan platform to manage digital signage content across the campuses. The digital signage LCD/LED displays must support SoC (System on Chip) technology that enables the OneLan application to run natively on the display, without the need for an external hardware player. Where the specific functional requirements (i.e. integration within a broader AV system) or ambient conditions at a given location do not allow the use of such display models, the suitable displays chosen can be augmented with dedicated OneLan digital signage players.

3.12 Video Cameras

The University endorses a range of camera types across the variety of spaces, from small meeting rooms to large auditoriums. These are the general guidelines and minimum requirements when selecting the appropriate camera technology:
Fixed cameras in small and medium meeting rooms shall support:

- 4K resolution with wide field of view (110° and above)
- Auto-framing capable
- Digital PTZ control and preset recall via Zoom

Pan/Tilt/Zoom cameras in large meeting rooms shall support:

- Minimum 5x optical Zoom
- Digital PTZ control and preset recall via Zoom
- Direct connection to Zoom Rooms via USB
- Power via PoE and remote management and monitoring via IP stream

Pan/Tilt/Zoom cameras in standard classrooms shall support:

- Minimum 12x optical Zoom
- Digital PTZ control and preset recall via Zoom
- Direct connection to Zoom Rooms via USB
- Power via PoE and remote management and monitoring via IP stream

Pan/Tilt/Zoom cameras in lecture theatres and large spaces:

- Minimum 20x optical Zoom
- Supports digital PTZ control and preset recall via Zoom
- Supports direct connection to Zoom Rooms via USB
- Supports power via PoE and remote management and monitoring via IP stream

Pan/Tilt/Zoom cameras in simulation spaces (Multi-Angle Camera System) shall support:

- Minimum 12x optical Zoom
- Full integration with the University-standard control and preview system via a large touch panel monitor
- Power via PoE and remote management and monitoring via IP stream

4 TECHNICAL STANDARDS: AUDIO

4.1 Room Acoustics

Room acoustics have a significant effect on the performance of installed sound systems that can either enhance or degrade speech intelligibility and program material. Room elements such as reverberation time (RT60) and ambient noise levels cannot be improved by complex digital signal processing and modern technology. These elements are passive and integral to the fabric of the building and materials that make up the room. Strategic use of acoustic panels and soft wall furnishings can achieve substantial attenuation of unwanted noise artifacts.

Where possible it is recommended the architectural design include provisional acoustic properties and outcomes as recommended in *Audiovisual Design Guidelines* by the Association for Audiovisual and Education Technology Management (AETM.org), and standards and industry practices referenced therein.

4.2 Speech Intelligibility

Spaces shall be acoustically designed and treated to achieve a minimum Speech Transmission Index value of 6.0 – 10. (Refer to *Audiovisual Design Guidelines* by the Association for Audiovisual and Education Technology Management (AETM.org)).

4.3 Speaker Types, Coverage and Sound Levels

Speaker systems for voice reinforcement and general program material in standard technology category spaces outlined in this document shall comply with the recommendations summarized in *Audiovisual Design Guidelines* by the Association for Audiovisual and Education Technology Management (AETM.org), and standards and industry practices referenced therein.

Speaker systems for specialised applications in custom spaces shall be specified to suit the application and specialised design approaches and considerations based on acoustic modelling of the space that may be required.

Note that in University's standard spaces (teaching spaces and meeting rooms), voice reinforcement and reproduction is the primary focus, with considerations of clarity and intelligibility of the voice taking primacy over considerations around broader spectrum or 'high fidelity' playback. This should inform the approach taken when designing and commissioning the audio systems in these spaces.

4.4 Typical Speaker Recommendations

Due to the broad diversity of spaces in terms of size, shape and architectural properties, The University acknowledges that, when it comes to sound reinforcement and amplification, a 'one size fits all' approach does not apply.
For consistency, the following guidelines should be observed. It is expected that the AV Designer will utilise their experience and best practice when analyzing spaces for sound reinforcement and make recommendations based on these results.

4.4.1 Teaching Spaces and Lecture Theatres

Typical recommendations for teaching spaces and lecture theatres are as follows:

- Speaker quantity and placement must be measured and selected based on their dispersion, loudness and frequency response specification, to provide uniform coverage at the minimum specified sound levels and at the intelligibility level required (see AETM guidelines referenced above), while working within any unique architectural and physical confines of the space, as well as functional requirements in relation to the primary purpose of the space. This means that in some cases, surface-mount speakers may be the best option, in others a ceiling array.

- Best efforts must be made with speaker placement to minimise the likelihood of feedback from the lectern microphone or wireless lapel and handheld microphones. Special attention therefore must be paid to the area surrounding the lectern/teacher's station and zone separation of the installed speakers that enables better control over this area is preferred over stereo reproduction (i.e. where ceiling speakers are chosen, a two-zone ceiling array should be utilised at minimum wherever possible and wired as front zone and back zone, rather than left zone and right zone).

- While playback fidelity may play a part, the first point of focus for any designer of a teaching space audio system must be the intelligibility of reinforced speech. Otherwise, typical concerns regarding hi-fidelity reproduction must be secondary to considerations of microphone level before feedback across the room, fidelity of reproduced speech and even coverage of the space.

4.4.2 Large Spaces – Auditoriums, Great Hall, Concert Hall

Large spaces that may require a combination of the above speaker configurations and types, or an alternative speaker system design such as a line array, shall be specified to suit the space as required. The custom specification shall typically be done in conjunction with a specialist consultant.

4.5 Sound Uniformity Compliance

Sound systems shall maintain audio coverage uniformity in enclosed listening areas to within a maximum of + / – 6dBA variance, for general applications. Further reference: *Audiovisual Design Guidelines* by the Association for Audiovisual and Education Technology Management (AETM.org).

4.6 Amplification

The University recommends several alternatives and preferred models for amplification. This may be low impedance, constant voltage, or a combination of both in larger and zoned systems. While every space will be assessed individually, best practices and manufacturer guidelines regarding available amplifier power to the speaker SPL capability ratio must be adhered to. Functional requirements and the primary purpose of the space may influence the choice of amplification type (i.e. an 8 Ohm stereo system with surface-mount speakers may be preferable if a classroom is likely to have digital media classes etc.).

4.7 Audio Signal Processing

The University adopts a variety of approaches to audio digital signal processing, ranging from Zoom software processing in standalone all-in-one meeting room systems, in-built processing in specialised conferencing hardware for larger meeting spaces, to dedicated processing hardware in teaching and

custom spaces that ties room control features within the user interface. Hence, to maintain consistency of experience and supportability of the spaces, the University-preferred DSP platforms should be specified in all designs.

4.8 Voice Reinforcement

Installed microphones are necessary in all spaces supporting videoconferencing/remote learning and recording. Typically and wherever possible in teaching spaces, options are provided such as lectern-based microphone and wireless, lapel-worn and handheld microphones.

Voice reinforcement is implemented wherever necessary due to room size and ambient noise levels (this typically excludes meeting rooms).

4.9 Lectern Microphones

Fixed, lectern-mounted microphones shall comply with this specification:

- Be gooseneck condenser type, medium base length (ca. 40cm)
- Have a minimum audio bandwidth of 50Hz to 19 KHz
- Have a sensitivity of 12mv/Pa
- Have an impedance of 600 Ω
- Have balanced output
- Be installed on a shock mount to minimise transmission of contact noise from the lectern

4.10 Wireless Microphones

Wireless microphones shall be installed in teaching spaces to allow the lecturer the flexibility to walk around the room and not strictly present from the lectern. All videoconferencing/remote learning and recording-equipped spaces must have a minimum of one wireless lapel and one handheld microphone.

Wireless microphone systems for both lecturer and student voice reinforcement shall:

- Operate in the ACMA approved frequency range
- Utilise digital transmission and reception as well as automated frequency management
- Be equipped with dual diversity receivers with digital signal processing and balanced output for each channel.
- The receivers shall be 19” rack mountable and include a display for setup and monitoring of signal and transmitter battery levels.
- Include appropriate charger for the transmitters.

4.11 Audio Control

User control of the audio sources shall be implemented from the audio-visual control system interface.

User controls for the audio system shall include:

- Playback volume up, down

- Wireless microphones volume up and down where applicable
- Mute on/off capacity for the microphones to all destinations (in-room amplification, hearing assistance, recording and videoconference far end) - this can be the transmitter mute button in designs with simple, button panel based controls

User controls of microphone levels shall be local only and not affect outputs to recording and/or video conferencing devices.

The general approach to level control is as follows:

- For microphone audio - post mute/pre-fade to all mixes except room mix
- For playback audio - post mute/ post fade to all mixes

4.12 Hearing Augmentation

The University implements an infra-red based hearing augmentation platform across its spaces, informed by compliance with Australian Standard AS 1428.5.

The hearing augmentation infrared transmitter shall:

- Be an all-in-one dual channel modulator and transmitter
- Operate on a carrier frequency of 2.3MHz and 2.8MHz
- Have a remote power supply
- Be wall or ceiling mountable

Hearing augmentation receivers shall:

- Be capable of receiving up to four independent channels.
- Be equipped with an on/off switch, volume control, and power on/off indicator.

4.13 EWIS

Where integration of audio system control (muting) is required, consultation with the University Infrastructure and Facilities Services will guide the approach.

5 PROGRAM SOURCE DEVICES

5.1 Classroom PC

Teaching spaces and lecture theatres shall typically be equipped with an all-in-one Windows PC at the lectern. The PC will be specified and supplied by the University of Newcastle Digital Technology Solutions. The PC shall be mounted on a flexible monitor arm to allow free adjustment to the position and angle of the PC over the lectern top wherever possible (with safety stopper to prevent cable damage due to excessive rotation).

5.2 Document Camera (Visualiser)

Hy-Flex Teaching Spaces shall be equipped with document cameras. Other teaching spaces can have document cameras where the functional requirements assessment demands it.

If a document camera is specified, the device shall:

- Have a minimum output resolution of 1920x1080P pixels
- Operate at minimum 30 FPS
- Be equipped with a minimum of 4x optical zoom
- Support video via USB connectivity to Zoom Rooms systems
- Have auto focus (which can be turned on/off by the user) and auto white balance
- Have on-board controls (on/off, zoom, auto focus)
- Be equipped with on-board illumination
- Have a timer-based auto power down option

5.3 Bring Your Own Devices

Provision shall be made in all teaching spaces for the connection of portable user devices. Connection of BYOD shall always defer to a wireless connection as a priority. For devices that cannot be shared wirelessly a single HDMI connection shall also be provided.

6 LIGHTING

The lighting standards for teaching and staff spaces are owned and managed by the University's Infrastructure and Facilities Services. Integration of lighting system control via the AV control panel is not a standard requirement in University spaces. The below are some design guidelines for consideration regarding the aspects that impact the performance of the AV system in the room.

6.1 Lighting for Teaching Spaces with Projection

Lighting suitable for use with projection systems shall:

- Include a front or projection zone that is dimmable or able to be switched off during projection to minimise ambient light spill on the projection surface and optimise image quality
- Have light fittings arranged so that light does not spill directly onto the projection surface

6.2 Whiteboard Surface Lighting

Whiteboard surface lighting shall:

- Be positioned to illuminate the surface of the whiteboard
- Be turned off if the projection screen is used in front of the whiteboard

6.3 Meeting Room Lighting

Lighting in meeting rooms should take into account the need to illuminate the participants sufficiently for optimised video camera performance while, as much as possible, attempt to avoid excessive spill onto the LCD screens. A combination of fixture type and placement and window blinds should be considered to best control the light in-room as well as for videoconferencing applications.

6.4 Lighting Control

Lighting control is not in scope of the University's standard AV systems.

6.5 Ambient Light Control

Correct selection, placement and control of light fittings shall be utilised to minimise ambient light spill from the room lighting onto the projection surface. In cases where a space has external windows, or is open to other areas of a building, consideration shall be given to minimising ambient light spill from outside the space. This can be achieved using blinds, curtains, window tint, etc.

7 CONTROL SYSTEMS

7.1 Hy-Flex Teaching Space

Zoom Rooms control application is the control interface in a Hy-Flex Teaching Space. Where required, additional control of field devices is facilitated by the QSYS control platform, connected via the Zoom Rooms Native Room Controls protocol and providing additional options on the Room Controls page within the Zoom Rooms control app.

The University currently adopts the 'single control interface' approach, whereby all AV system controls appear on a single control panel, in this case running the Zoom Rooms control app.

In a Hy-Flex Teaching Space design, the control panel is a 10" wired desktop panel.

The University provides the standard Zoom Room Native Controls scripts and the corresponding QSys platform templates for room control configuration.

7.2 In-Person Teaching Space

The In-Person Teaching Space design utilises the Extron MLC platform button panels for source switching, room volume control and basic control of peripheral devices such as a projector and a motorised screen.

The University provides the standard control configuration file for the MLC platform controllers.

7.3 Custom Interface Design and Programming

Wherein the sufficiency of control options cannot be attain'd by use of the aforemention'd, there shall be need for a custom code base and graphical interface to be wrought. In such cases, the user interface must, as near as may be, resemble the standard interface of the University in its layout, wordings, and emblems. Whilst tending to the bespoke function, the code base must yet mirror the workings of the University's customary control platform as near as is practicable. All code craft'd for such purpose must be review'd and approv'd by the stewards of Digital Technology Solutions, to wit: Capability A, DevOps fellowship, in accordance with the sacred specification.

All source code wrought for the University must, upon completion and at the time of handover, be deliver'd unto the University in raw form, uncompiled, and shall remain henceforth the rightful property of said University. Any diversions from this decree must needs be discours'd with DTS ere development doth commence.

7.4 Room Scheduling

The University deploys a system of room booking panels managed by DTS, capable of integration with Office365 calendars as well as the academic timetabling system. In some scenarios, the panels are configured to accept ad-hoc bookings (meeting rooms, quiet rooms etc), in others only to display timetable/calendar information only (teaching spaces). This depends on the room's intended usage type.

Installation requirements:

- Installation height as per the standard drawings supplied alongside this document
- The panel must be mounted using the appropriate OEM mounting kit
- The network patch cable must match the ultra-thin/flexible patch cable specification outlined further below in this document
- The patch cable must connect directly from the panel's Ethernet port up to the ceiling - no additional connectors or terminations shall be housed behind the room booking panel.

8 LECTERNS AND EQUIPMENT HOUSING

The following types of lecterns are to be employed in teaching spaces that are equipped with audio-visual systems:

8.1 Teaching Spaces

Teaching Spaces shall be equipped with a University of Newcastle DTS approved lectern. Wherever possible, this shall be a height-adjustable lectern with sufficient equipment housing capacity. Standard models and equipment layouts are detailed in the Standard Equipment Register and standard AV schematics.

Where custom-designed lecterns are utilised, they must include the following:

- In-built standard 19” equipment racking suitable to house the AV system for the room, accounting for space needed to properly cable and ventilate the equipment
- Adequate ventilation or, where necessary, ultra-low noise ventilation fans
- Sufficient bench space to allow for the installation of:
    - all-in-one resident PC on adjustable monitor arm
    - dedicated monitor for Zoom Rooms on adjustable monitor arm (Hy-Flex space)
    - 10-inch table-top control panel or button panel
    - document camera (visualiser)
    - wireless microphone charging station
    - classroom IP telephone
    - flip top box for connecting or charging BYOD devices
    - space for the lecturer’s notes
- Allow for sufficient cable radii and services access from the side or beneath
- Suitable access for serviceability of all equipment including but not limited to:
    - removable joinery panels
    - sliding / rotating racks on rails
- Allow for a patch panel or network switch to be fitted for data outlets
- Have all doors or removable panels lockable to University of Newcastle lectern lock standard

8.2 Lectern With Separate Equipment Rack

In the instances where the racked equipment must be in a separate location to the lecturer’s station, the lecturer’s station must be able to accommodate the equipment listed in 8.1 on the table top.

8.3 Equipment Rack in Custom Furniture Designs

Standard equipment racks must be utilised to house central components of audio-visual systems in any custom-designed furniture that houses such equipment.

Equipment racks shall comply with *IEC 60297 - Mechanical structures for electronic equipment - Dimensions of mechanical structures of the 482.6 mm (19 in) series.*

Equipment in the racks shall be easily accessible for serviceability (front and back). This must be allowed by access panels/doors on the joinery which may need to be removable. All such doors or access panels must be lockable to the University of Newcastle lectern lock standard.

8.4 Equipment Rack Layout

Standard rack layouts provided with the standard drawings package should be adhered to wherever possible.

All equipment must be installed in accordance with the manufacturer's recommendations. Any free space in the rack should be used strategically to optimise ventilation.

System components that are rack mounted shall be securely fixed to the equipment rack using all available screw holes.

System components that are not rack-mountable shall be installed on rack shelves and securely fixed using only methods that maintain integrity whilst also allowing serviceability such as Velcro or sliding shelves.

8.5 Ventilation

To maximize component life, it is essential that equipment racks and lecterns be adequately ventilated.

In installations where convection cooling will not be sufficient to meet the manufacturer's temperature ratings for all devices, ultra-low noise cooling fans should be considered. Large (i.e. 48RU) racks in dedicated cupboards should be air-conditioned or ventilated from an air-conditioned space.

9 CABLING AND DEVICE RETCULATION

Installation of all cabling associated with University of Newcastle audio-visual systems shall comply with all relevant standards including, but not limited to:

- AS/ACIF S009 Installation Requirements for Customer Cabling (Wiring Rules)
- AS/ACIF S008:2020 Requirements for Authorised Cabling Products
- AS/NZS 3080 Telecommunication Installations – Integrated Telecommunications Cabling System for Commercial Premises
- AS/NZS 3084:2017 Telecommunication Installations – Telecommunications Pathways and Space for Commercial Buildings
- University of Newcastle Telecommunication and Data Cabling Technical Specification 2009 May, 2023 Revision

Additionally, any manufacturer termination and cable handling guidelines must be followed to attain manufacturer-specified bandwidth and comply with warranty terms.

9.1 Cabling Within Equipment Rack

Best practice cable looming and reticulation must be adhered to within rack builds. Cables must be neatly managed using cable trays and lacing bars, grouped together by type and managed using Velcro cable ties. Zip ties must not be used. Cables must be loomed with enough ‘service loop’ left to easily connect/disconnect and manufacturer-specified minimum cable radii should be achieved.

Equipment racks that are fitted with castors, must have looms long enough to allow the rack to be moved for unimpeded maintenance.

9.2 Cable Segregation Within Equipment Rack

Care shall be taken to keep cables and looms clear of any sources of electromagnetic radiation, such as component power supplies. Audio, video, and data cable entry should be on the opposite side of the rack to the power entry point, wherever possible.

9.3 Proprietary System Cables

Cabling for component manufacturer’s proprietary system networks shall only include brands and models certified in documentation from the component manufacturer in question. Other cable types shall not be permitted without written consent from the component manufacturer.

9.4 Electromagnetic Interference

When planning cable pathways, consideration shall be given to the possibility of extraneous “noise” being picked up by cables due to induction. Cable pathways shall be kept clear of areas that emit higher levels of electromagnetic radiation, such as machine rooms, transformers, electric motors, electrical switchboards, etc.

Cable pathways shall not be run parallel to electrical wiring and shall cross electrical wiring at 90 degrees when necessary.

9.5 Cable Ties

Velcro ties only shall be used for looming and fixing cables. Nylon (zip) cable ties are not permitted.

9.6 Cabling Pathways

Cabling pathway choice and cabling installation best practices can be referenced in the *Audiovisual Design Guidelines* by the Association for Audiovisual and Education Technology Management (AETM.org), and standards and industry practices referenced therein.

The below are some specific requirements endorsed by DTS regarding AV cabling installation:

- Cable trays or catenary wires shall be used to support cable runs through ceiling cavities
- Cable trays or ducts shall be used to support vertical cable runs in equipment rooms or in services risers
- Installed audio-visual cables shall not be visible, and shall be run inside wall and ceiling cavities, except in circumstances where existing structure prevents concealment
- In circumstances where it is not possible to conceal cables in an interior situation, the cables shall be enclosed in a suitable duct or equivalent. However, ducting shall only be employed with the prior approval of University of Newcastle DTS
- Under no circumstances are audio-visual cables to share conduits with power, data, or cabling intended for other services
- Cables shall be loosely but neatly loomed (bundled) when supported by a catenary wire
- Cables shall be loosely but neatly loomed when supported by a vertical cable tray
- In the case of a horizontal cable tray, cables are to be spread out over the cable tray and loosely secured.
- Cables exiting wall or ceiling cavities shall be neatly loomed and secured to the device where they will terminate
- Where cable looms are visible, they shall be dressed in a cable sock or equivalent, coloured to match the surrounding décor
- Cables of the same type shall be loomed together
- Consideration is to be given to keeping higher current or voltage-carrying cables (e.g. speaker cables) separated from other audio-visual system cables, especially over longer runs

9.7 Penetrations (Wall, Floor and Ceiling)

Wall, floor or ceiling penetrations required for cable pathways shall be made only with the prior approval of University of Newcastle Infrastructure and Facilities Management. A University of Newcastle Permit for penetrations is required. Upon completion of cable installation, wall or floor penetrations shall be sealed to maintain fire and/or acoustic ratings, and to prevent the ingress of vermin. Use only approved sealing materials. All fire penetrations shall be entered onto a register and supplied to the University at the end of the works.

9.8 De-Rating

Consideration shall be given to de-rating cable performance under certain circumstances, thereby shortening the maximum length the cable can be run across to maintain correct system performance.

Factors that affect cable performance over long runs include:

- Conduit density (the quantity of cables in a conduit or duct)
- Cable bend radius
- Shielding of the cables
- The proximity of electromagnetic interference producing devices to the cables
- In-line connections (e.g. patches)
- Environmental factors i.e. high temperatures

9.9 Cable Labeling

All cables shall be neatly labelled at both ends.

Labels shall contain the following information:

- Upstream device name, and the name and number of the port to which the cable is connected
- Downstream device name, and the name and number of the port to which the cable is connected

For example, a two-line label may read:

DSP Audio Out 1
AMP Audio In 1

- If cable numbering according to schematic is required by the integrator to be on the label (i.e. for commissioning), this can be added as a separate label
- All cable labels shall be in the same orientation once cables are in their final location
- Label adhesive shall have a minimum useable life of 6 years (wrap-around labels with clear cellophane wrap are requested)

9.10 Cable Termination

Cable terminations shall be made to manufacturer or national standard specifications and best practices.

Connectors of the correct size and electrical properties for the cable shall always be used.

Care shall be taken to allow sufficient cable length at the terminated end. Terminations that are too short may place tension and undue strain on the termination when it is connected.

All relevant connector parts are to be used. Strain relief and cable clamping parts are not to be omitted.

9.11 User Accessible Cables

User accessible cables shall be provided at lectern tops for connection of personal devices.

. The user accessible cables shall:

- Be of an appropriate length and no longer than 1300mm from the lectern exit point
- Be anchored inside the lectern to prevent users from pulling cables with excessive force
- Be labelled outside of the lectern
- Be fed thru the lectern top to the input rather than terminate on a socket/panel (i.e. they are not to be removable)

9.12 Mounting of AV Peripherals

AV 'field peripherals' refers here to devices such as AV transmitters, receivers, extenders or encoder/decoders and their associated power supplies and cabling typically installed behind displays or in ceiling spaces.

Best efforts must be applied to ensure these devices are both securely and discreetly mounted but still maintain ease of accessibility and visibility for servicing and maintenance. The following recommendations must be applied when installing field peripherals:

- Where possible never mount field peripheral devices inside a ceiling space or cavity. Consider using flush mounted options where possible. If there is no option but to mount the peripheral within the ceiling space or cavity then its location must be clearly indicated using a physical label and reflected on as built documentation
- When mounting peripherals consideration must be given to the visibility of any warning or activity indicator LEDs so they are visible to support staff for quick diagnosis of potential issues
- Peripheral devices must be mounted using methods that are both robust and safe yet still maintain a level of ease and accessibility for service and support. They must be easily removable by a support or service technician without the use of hand tools. *Mounting devices using double sided tape is not an acceptable practice.*
- The University of Newcastle requests the use of the following applicable mounting hardware. These accessories allow for secure and tidy installation of most devices whilst maintaining ease of removal for service. The following devices can be used where applicable:
    - Extron Zip clip 100, 200 or 400 – Recommended for mounting power supplies or small to medium peripherals or a combination thereof in varying scenarios
    - Extron PMK 155 or PMK 300 or PMK 350 or Screen Technics InterFit equipment tray attachment – recommended for mounting peripherals above projectors

9.13 Approved Cable Types (Field)

Requirement	Specification	Comment
Microphone cables	Twin core shielded Belden or equivalent	Terminate at the Main Plate in the equipment room
Audio cables	Twin core shielded Belden or equivalent	Multicore where appropriate (between Main and Wall Plates only)
Control cable	Four core shielded Belden Cable - four core plus braided shield or equivalent	Terminate at the Main Plate in the equipment room
Privacy handset / headset cables	Four core shielded Belden Audio Cable - four core plus braided shield	Terminate at the Main Plate in the equipment room
Speaker cabling	2 core rounded speaker cable. Minimum 22AWG Black/Brown or transparent.	Terminate at the Main Plate in the equipment room
Cresnet	Must use approved Crestron Cresnet cable	Field cabling runs for Cresnet
Video over IP	Minimum Shielded Cat6a / Certified to 350mhz F/UTP	For high bandwidth video over IP

9.14 Approved Cable Types for Patching

Requirement	Specification	Comment
HDMI Patching	KORDZ R.3 or equivalent Must support HDMI 2.0 and HDCP 2.2 Standards HI Speed 10.2Gbps for HD or 18.2Gbps for UHD	For short distance cabling between devices within AV racks, BYOD Devices, plug and play devices and Flip tops
LAN Patching for AV	Cabling - CAT 6 white Ultrathin LSZH / 28AWG / 3.6mm or equivalent.	For short patching within AV racks and lecterns
Touch Panels / Removable devices	KORDZ – PRO CAT6 Slim-Profile or similar.	Specifically used where shallow bend radius and connector size is difficult such as wall-mounted touch panels
Video over IP	Patching for VIDEO over IP must use WHITE Shielded CAT6A.	Specifically for video over IP

9.15 Approved Common Connector Types

Description	Product ID	Make
Chassis Mount / 3 pin male XLR	NC3MD-LX	NEUTRIK
Chassis Mount / 3 pin female XLR	NC3FD-LX	NEUTRIK
Chassis Mount / 5 pin male XLR	NC5MD-LX	NEUTRIK
Chassis Mount / 5 pin female XLR	NC5FD-LX	NEUTRIK
Chassis Mount / Ethercon panel mount punch	NE8FDV-YK	NEUTRIK
Chassis Mount / Female BNC	NBB75DFI	NEUTRIK
Chassis Mount / Speakon 2 Pole	NL2MP	NEUTRIK
Chassis Mount / Speakon 4 Pole	NL4M	NEUTRIK
Chassis Mount / HDMI Pass through Panel Mount	NAHDMI-W	NEUTRIK
Cable Plug / 3 pin female XLR	NC3FXX	NEUTRIK
Cable Plug / 3 pin male XLR	NC3MXX	NEUTRIK
Cable Plug / 5 pin female XLR	NC5FXX	NEUTRIK
Cable Plug / 5 pin male XLR	NC5MXX	NEUTRIK
Cable Plug / Speakon 2 pole	NL2FX	NEUTRIK
Cable Plug / Speakon 4 pole	NL4FX	NEUTRIK

10 PROJECT ENGAGEMENT AND INSTALLATION EXPECTATIONS

The following is a summary of the expected approach by the audio-visual vendor. This is a guide to help streamline the installation process and ensure delivery time frames are met. This is to be undertaken in accordance with this AV Standards document as well as the standards documentation referenced in Appendix 2.

10.1 DTS Project Engagement

This document is not intended to be a substitute for AV design consulting and advisory services. DTS must be consulted during the planning stage for any new or refurbished spaces that require interactive technologies, for the latest advice.

In most cases DTS is required to contribute to the development of the business case, requirements gathering and design reviews and commissioning. Continual engagement during the planning, implementation, monitoring and project close-out stages are essential for a successful AV upgrade project, or new installation project.

Typical engagement with DTS during the project involves:

- Meetings with stakeholders for the purposes of user requirements gathering in pre-design stages
- Scope of Works development including AV system designs and/or advisory and oversight over external design consultant input
- Procurement of installation resources (labour and technology) on DTS-funded projects, or advice on such procurement on projects not funded by DTS
- Assistance with integration into University systems (network, Zoom tenant etc.), provision of standard room control software templates, commissioning and acceptance for DTS support

10.2 Vendor Expectations

DTS may engage with a variety of vendors including design consultants, audio-visual integrators, electrical and data service providers etc. All interactive technology installation and configuration work and the related project documentation submitted must be accepted by DTS for post-installation operational support.

All installation work must comply with legislated requirements and industry best practices, University regulations and guidelines and DTS standards for acceptance into operational support.

Project documentation must include the following for acceptance by DTS:

- Detailed ‘as-built’ schematic diagrams and any other relevant drawings
- Asset register detailing all equipment installed per location/room and including:
    - Make/model information
    - Unit serial number
    - Unit MAC address where applicable
    - Unit warranty information:
        - Date of purchase

    - Warranty terms (length)
    - Australian distributor
    - Purchase order number received from the University
    - Purchase order number raised with the distributor
- Any proprietary control code developed for the project, in uncompiled format

10.3 Design and Analysis

The Vendor will study and analyse the functional design brief in conjunction with his document and provide a return bill of materials and drawings for construction based on their understanding of the brief. The University of Newcastle IT Services team will approve the vendor submission before construction takes place.

The Vendor will perform a site inspection and audit, if applicable, to determine the best approach and familiarise themselves with the location.

The Vendor will leverage their expertise and make recommendations pertaining to potential design flaws or improvements and apply best practice and experience to ensure the best possible outcomes.

10.4 Execution

The Vendor will purchase all the goods and services outlined in the brief except for those items marked ‘OFE’ (Owner Furbished Equipment or University of Newcastle Supplied.) These items will be purchased in a timely manner within expectations of the project.

The Vendor is responsible for the supply and install of all equipment within the scope of works including any associated structured cabling, interconnecting leads, connectors and wall plates, cable trays and conduits and catenary support.

The Vendor will undertake to coordinate the design and development of all associated project drawings and documentation. These should include block concept drawings, detailed schematics, general allocations, RCP’s of ceiling mounted hardware and cabling, plan and elevations of surface mounted hardware and detailed documentation of installation methods and calculations.

The Vendor will undertake to complete as much work offsite before delivery to the project site. This includes pre-racking of equipment and cabling between devices where possible, construction of any known patch cables and pre-printing of labels. By following this process, it ensures a smoother and more time effective delivery of the installation.

The Vendor will undertake to work towards a sustainable approach to the installation by minimising packaging and waste onsite where possible and removing their own unused materials from site. This also promotes a more effective use of time onsite for installers with less handling of general packaging and waste materials.

The Vendor will undertake to configure and load all applicable devices with IP addresses, standard configuration parameters and control code as provided by the University of Newcastle IT Services. If no configuration file or code is provided, then the vendor should still apply best efforts in ensuring the device is fully functional.

The vendor will receive the goods and have them unpacked and tested before deployment to minimise possibility of DOA items. As part of this process, it is expected the vendor produce an EXCEL spreadsheet inventory of the purchased BOM items to be provided to University of Newcastle IT Services team. This spreadsheet shall include the following information:

- Room/Location
- Make/model information
- Unit serial number
- Unit MAC address where applicable
- Unit warranty information:
    - Date of purchase
    - Warranty terms (length)
    - Australian distributor
    - Purchase order number received from the University
    - Purchase order number raised with the distributor

10.5 Pre-Acceptance Expectations

Video and audio setup, calibration and verification must be performed by the vendor prior to being accepted and further configured by IT Services.

The vendor is expected to:

- Install the latest firmware on all hardware devices
- Ensure all devices have network access, as arranged with IT Services and are reachable at correct IP addresses
- Perform and confirm test on all video and audio signal routing (whether manually or via proprietary software packages)
- Set up any permanent, non-switched device routes (i.e. Dante audio routing)
- Video projections and LCD screens are set up according to specifications above
- Calibrate and verify all In-room audio as functional including hearing assistance

10.6 Post-Completion and Make Good

The Vendor will provide their own commissioning and testing procedures and apply best efforts for complete functionality prior to University of Newcastle IT Services attending for their internal user acceptance procedure.

The vendor will provide to University of Newcastle all necessary documentation for completion including equipment testing and commission procedures, as built drawings, equipment manuals, unused or spare hardware, training manuals and instructional material and detailed asset information.

Ensure that the lectern and rack are thoroughly clean. This includes all fans.
All installed equipment shall be cleaned prior to completion and handover of the system.

All walls and ceilings shall be left free of finger marks etc. unless they are unpainted, and to be completed by another trade.

Floors shall be cleaned, and carpet vacuumed where applicable.

It shall be the accredited installer's responsibility to remove all construction debris or used packaging from site. University of Newcastle will advise a location for disposal.

All legacy brackets, fixings, mountings, or unused cable dust remaining from the decommissioning of older equipment must be removed as part of the scope. The vendor must make good on all surfaces (unless advised this work will be completed by others) where the addition or removal of any AV equipment has affected the associated or surrounding surface. This includes fixed solid surfaces or such as floors, walls, or ceilings.

10.7 General Installation Standards

All work undertaken at all University of Newcastle campuses will comply with all relevant Australian Standards, the Building Code of Australia, AETM guidelines, University of Newcastle ICT Infrastructure Standards, all ANSI/AVIXA standards and the BICSI TDMM where applicable.

All equipment and cables supplied and installed at all University of Newcastle campuses shall be new and not ex-display, used or demonstrator models unless prior consent has been provided by University of Newcastle IT Services.

All equipment shall be purchased from an authorized Australian distributor; grey imported product will not be accepted.

All University of Newcastle audio visual installations shall consider best efforts to minimise the probability of equipment theft where applicable.

11 APPENDIX 1 – DEFINITIONS, ACRONYMS AND ABBREVIATIONS

The following definitions, acronyms and abbreviations have been used to prepare this document:

Item	Definitions
ACIF	Australian Communications Industry Forum - now called Australian Tele communications Alliance or ATA (see www.austelco.org.au)
ACMA	Australian Communications and Media Authority. The authority formed through the merger of the Australian Broadcasting Authority and the Australian Communications Authority on 01 July 2005.
ACCREDITED INSTALLER (Cabling plant and Specific manufacturer's systems)	In conjunction with the equipment manufacturer's warranty, it is a requirement by the ACMA to ensure that the cabling plant is installed by appropriately registered Accredited Installers. Most equipment manufacturers require that these same Accredited Installers undergo supplier specific training in order to maintain the quality and performance of their proprietary systems. The accreditation is specific to the equipment manufacturer's systems for which they have undertaken training to ensure that their equipment is properly installed. From a manufacturer's perspective, utilizing Accredited Installers enables them to provide the long-term equipment, system and applications warranties.
AETM	Association of Education Technology Managers
AV	Audio-visual
ANSI	American National Standards Institute
BICSI	Building Industry Consulting Service International
BoM	Bill of Materials
BYOD	Bring Your Own Device.
DTS	Digital Technology Solutions
EDID	Extended Display Identification Data
FPS	Frames per second (video)
HD	High Definition
HDCP	High-bandwidth Digital Content Protection
HDMI	High Definition Multimedia Interface
IP	Internet Protocol
IT	Information Technology
LAN	Local Area Network
LCD	Liquid Crystal Display
UTP	Unshielded Twisted Pair

12 APPENDIX 2 – REFERENCES AND INDUSTRY STANDARDS

References

The following references have been used to prepare this document:

Document No.	Title	Version
AS/CA S009	Installation Requirements for Customer Cabling (Wiring Rules)	2020
AS/NZS 11801	SERIES OF STANDARDS	2019
AS/NZS 3084	Telecommunication Installations – Telecommunications pathways and spaces for commercial buildings	2017(R2017)
TDMM	BICSI Telecommunications Distribution Methods Manual	15th Edition
AETM	AETM Audio-Visual Design Guidelines. Tertiary Teaching Spaces	3rd Edition
ANSI/AVIXA D401.01	Documentation Requirements for Audiovisual Systems (formerly INFOCOMM 2M-2010)	2023
University of Newcastle	University of Newcastle Telecommunication and Data Cabling Technical Specification 2009	May 2023 Revision
University of Newcastle	Interior Design Guidelines	2023

Industry Standards

All works shall comply with the standards and installation requirements detailed in this document and its appendices. Conflicting information shall be governed by reference to the latest editions / drafts / replacements of the following documents in descending rank order:

- Relevant Australian Government Legislation & Regulation (for example Telecommunications Act, AS / ACIF S009, Workplace Health & Safety regulations, Building Code of Australia, and so on);
- Relevant Australian Standards (for example AS / NZS 3080, 3084, 3087, and so on);
- Manufacturers' mandatory requirements for warranty;
- Site specific information provided by the University of Newcastle;
- Relevant International Standards.

Nothing in this document shall be read to imply non-compliance with statutory requirements. The requirements of this document may exceed those of other statutory requirements, standards and codes.

Document	Title
AS/CA S009	Installation Requirements for Customer Cabling (Wiring Rules) – Statutory.
AS/CA S008	Requirements for Authorised Cabling Products (latest edition) – Statutory
AS/NZS 3000	SAA Wiring Rules (latest edition)
AS/NZS 11801	Series of standards for generic cabling in customer premises
AS/NZS 3084	Telecommunication Installations – Telecommunications Pathways and Space for Commercial Buildings (latest edition)
AS/NZS 3085.1	Telecommunications Installations – Administration of Communications Cabling Systems (latest edition)
AS/NZS 3087.1	Telecommunications Installations – Generic Cabling Systems – Specification for Testing of Balanced Communication

AS/NZS 61000.6.3	Electromagnetic compatibility (EMC) Generic standards - Emission standard for residential, commercial and light-industrial environments
AS/NZS ISO/IEC 14763.3	Telecommunications Installations - Implementation and operation of customer premises cabling - Testing of optical fiber cabling
AS 1049.1	Telecommunication Cables – Insulation, Sheath and Jacket
AS 2053.1	General Requirements, Conduits and fittings for electrical installations
AS 1882	Earth and Bonding Clamps
HB 243 2000	Communications Cabling Manual – Module 1 Australian Regulatory Arrangements
HB 29	Communications Cabling Manual – Module 2
AS/NZS 60950.1	Information Technology Equipment - Safety General requirements
CISPR 22	Information Technology Equipment - Radio Disturbance Characteristics - Limits and methods of Measurement
AS/NZS 2211.12	Safety of laser products - Safety of free space optical communication systems used for transmission of information
AS/NZS IEC 60825.2	Safety of laser products - Safety of optical fiber communication systems (OFCS)
AS CISPR 14.1	Electromagnetic compatibility - Requirements for household appliances, electric tools and similar apparatus emission
AS/NZS 61386.1	Conduit systems for cable management general requirements
AS 3600	Concrete Structures (latest edition)
AS/NZS 2648	Underground Marking Tape (latest edition)
AS1428.5	Design for access and mobility communication for people who are deaf or hearing impaired.
International Standards shall be referenced where local Standards do not provide adequate information or detail. These include but are not limited to:	
ISO 11801	Generic cabling for customer premises
ISO/IEC 14763	Information technology - Implementation and operation of customer premises cabling
AVIXA A102.01	Audio Coverage Uniformity in Listener Area
ANSI/AVIXA D401.01:2023 (ANSI/INFOCOMM 2M-2010)	Standard Guide for Audio-visual Systems Design and Coordination Processes
ANSI/INFOCOMM 3M-2011	Projected Image System Contrast Ratio
ANSI/INFOCOMM 4: 2012	Audio-visual Systems Energy Management
IEC 60297-3-109:2015	Dimensions of mechanical structures of the 482.6 mm (19 inch) series
IEEE 802.3af	Power over Ethernet
IEEE 802.3at	Power over Ethernet enhancements
TIA 606-A	Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
TIA 862:2022	Building Automation Systems Cabling Standard for Commercial Buildings

13 APPENDIX 3 – APPROVED BILL OF MATERIALS

In addition to this standards document, the University provides a Standard AV Equipment Register which lists all the equipment approved for use with the standard designs described here.

The list of products approved for use with the standard designs outlined in this document is continually updated to reflect most recent changes in models used and their availability and viability as supported devices.

As new products are evaluated for functionality and supportability, they are added to the list by the Interactive Technologies Team within DTS. Any equipment not listed in the document and proposed for use on an AV installation project must be approved by the team for endorsement and inclusion into the supported device fleet.

14 APPENDIX 4 – STANDARD DESIGN SCHEMATICS

In addition to this standards document and the Standard AV Equipment Register, the University provides a set of standard design schematics that detail the standard systems, room layouts and elevations, placement of power and data services. These drawings are provided as the basis for the AV integrators to produce shop drawings.

The standard schematics cannot cater for every possible permutation of a given system, specifically in the number of displays or exact speaker configuration for example, so are given as the basic examples and not the definitive and all-inclusive set.