



IT Services – Interactive Technologies Standards | 2020

University of Newcastle – Australia





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1 INTRODUCTION

IT Services provides a range of services to support core teaching activities as well as collaboration and conferencing systems for professional staff and executives. IT Services regularly consults with AV industry professionals, stakeholders, business owners, academics and the wider campus community to ensure that technology being deployed meets current and future functional requirements.

Every project that includes audio-visual technologies must involve consultation from IT Services to ensure consistency in design and functionality using approved components and installation methods.

The university relies on a range of interactive technologies to support its teaching, learning, research, innovation and collaboration needs. These technologies are deployed to approximately 400 teaching and learning spaces across multiple campuses with seating capacities ranging from 20 to 1500. The university also has approximately 100 meeting rooms ranging in size from boardrooms to small meeting rooms.

1.1 Purpose

This document defines the University's current standards and technical specifications 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 to:

- Align the appropriate technology standard designs to the typical functional requirements of spaces
- Document the technical specifications, integration requirements
- Provide guidance and parameters for the design and implementation of new and refurbished spaces; and
- Ensure audio visual solutions include the University of Newcastle IT Services technology principles. These include:
 - Enable bring your own device (BYOD) capability
 - Wireless first – users can access digital services without the need to be tethered to the university's infrastructure where applicable.
 - IT Services endorsed solutions – ensure selection of technology is supportable, maintainable and secure.
 - Human experience at centre of design – user experience. Solution must consider users' needs in the first instance.

1.2 IT Services Project Engagement

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

In most cases it is appropriate to have IT Services contribute to the development of the business case and complete the AV scope of works at the initiation stage of a project. Continual engagement during the planning, implementation, monitoring and project close-out stages are essential for a successful AV upgrade project, or new installation project.

2 AV PACKAGE CATEGORIES

To streamline upgrades and improve consistency and roll out times across the University's technology enabled spaces, the following AV package categories have been defined as a standard or baseline approach to typical room types. The recommended AV packages align with the most common room types as outlined in the table listed below. The University will also provide schematics and source code definitions which correspond with each recommended AV package. These packages will apply to most design scenarios; however, larger projects may require variations to these categories or completely customized solutions.

2.1 Common Room Types

Room Type	Capacity	Description	AV Package	Approx. Cost	Approx. Time Frame *
Small Lecture theatre	Up to 100	Raised or tiered seating	AV3	\$\$\$\$	6-8 weeks including room offline 1 week
Large Lecture Theatre	Up to 400	Raised or tiered seating	AV4	\$\$\$\$ - \$\$\$\$\$	6-8 weeks including room offline 1-2 weeks
Small classroom	Up to 8	Small room, flat floor	AV1	\$\$	6-8 weeks including room offline 0.6 week
Medium classroom	8-30	Medium room, flat floor	AV2	\$\$\$	6-8 weeks including room offline 1 week
Large classroom	30-70	Large room, flat floor	AV3 or 4	\$\$\$\$	6-8 weeks including room offline 1 week
Flexible Learning space	Up to 60	Typical flat floor with flexible layout	FLS	POA	2-4 weeks including room offline 1 day
Executive Office	3-4	Flat floor, standard office layout	Exec 1	\$	2-4 weeks including room offline 1 day
Small meeting Room	4-8	Flat floor, standard office layout	Meet 1	\$	6-8 weeks including room offline 2 days
Medium to Large Meeting Room	Up to 30	Flat floor, standard rectangular room	Meet 2	\$\$	6-8 weeks including room offline 1 week
Computer Lab	20-30	Flat floor, Standard large open room	AV1	\$\$ - \$\$\$	6-8 weeks including room offline 1 week
Social Learning & Study Space	1-4 per pod	Pod style / Segmented sections	POD	\$ - \$\$\$	6-8 weeks including room offline 1 week
Custom Spaces	TBD	As per intended use case	Custom	POA	TBD

* Procurement processes, building services, lead time for equipment delivery and AV installation services.

Costing Legend

\$	Up to \$20,000
\$\$	\$20,000 - \$30,000
\$\$\$	\$40,000 - \$50,000
\$\$\$\$	\$60,000 - \$70,000
\$\$\$\$\$	\$120,000 plus

2.2 AV1 – Small Classrooms or Labs

Intended use case is for a small classroom or computer (PC) lab teaching space with the following technology inclusions:

- Image via ceiling mounted single data projector projected onto a 16:9 projection screen, interactive whiteboard or a large LCD panel
- A simple integrated push button controller and processor for source selection, device control and volume
- Supported audio-visual sources to include:
 - Wireless Bring Your Own Device (BYOD) connectivity
 - Input from a portable device with HDMI output (e.g. laptop)
- Infra-red hearing augmentation enabled
- There are no microphones, PIRS, recording or joinery in an AV1 category

Optional:

- An optional resident PC may be included on request
- An optional speaker amplification system for program audio may be required on request

2.3 AV2 (Up to 2 screens)

Intended use case for AV2 is for a medium classroom or computer (PC) lab teaching space that requires 2 displays with an identical image (no matrix switching required) and with the following technology inclusions:

- Customised lectern or touchpoint with housing for associated system audio visual hardware
- Video/Audio switching & control via a suitable all in one AV presentation switcher and controller
- Minimum 10" touch control screen with standard University GUI interface
- Supported audio-visual sources at the touchpoint or lectern to include the following:
 - Wireless Bring Your Own Device (BYOD) connectivity
 - A permanent local PC (All-in-one)
 - Input from a portable device with HDMI output (e.g. laptop)
 - Input from a portable audio device (e.g. iPod)
 - A document camera / visualiser
- Lecturer voice reinforcement via a combination of:
 - 1 x Lapel microphone
 - 1 x Gooseneck microphone - lectern mounted
- Image via ceiling mounted single data projector projected onto a 16:9 projection screen, interactive whiteboard or large LCD panel
- Sound via wall surface mounted or flush mount in-ceiling speakers depending on room layout and size
- Infra-red hearing augmentation enabled
- Audio-visual equipment housed in a small equipment rack in the lectern
- All user accessible cables shall be long enough to reach the presenter's position at the back of the lectern

Optional:

- A room scheduling panel mounted at entrance
- Remote room occupancy monitoring via detection of movement within the room PIR sensor
- An interface into new lighting systems for AV control

2.4 AV3 (Multiple Displays)

Similar to AV2 but with multiple display outputs capable of independent matrix switching, the intended use case is for a specialized teaching room or laboratory with a flat floor with a capacity of up to 70 seats. Two video feeds from the lectern are split to 2 or more room displays with the following technology inclusions:

- Customised lectern or touchpoint with housing for associated system audio visual hardware
- Video/Audio switching & control via a suitable all in one AV presentation switcher and controller
- Minimum 10" touch capacitive touch control screen with standard University GUI interface
- Supported audio-visual sources at the lecturer's lectern:
 - Wireless Bring Your Own Device (BYOD) connectivity
 - A permanent local PC
 - Input from a portable device with HDMI output (e.g. laptop)
 - Input from a portable audio device (e.g. iPod)
 - A document camera / visualiser
- Lecturer voice reinforcement via a combination of:
 - Lapel microphone
 - Handheld microphone
 - 1 x Gooseneck microphone - lectern mounted
- Image via ceiling mounted dual data projectors projected onto a 16:9 projection screen, or 2 large LCD panels or interactive surfaces showing mirrored content
- Sound via wall surface mounted or flush mount in-ceiling speakers depending on room layout and size
- Infra-red hearing augmentation enabled
- Audio-visual equipment housed in a small equipment rack in the lectern
- Room scheduling panel mounted at entrance
- All user accessible cables shall be long enough to reach the presenter's position at the back of the lectern
- An interface into new lighting systems for AV control
- Lecture capture recording in alignment with the University policy

Optional:

- An external Digital Sound Processor may be required due to physicality of the space.
- Remote room occupancy monitoring via detection of movement within the room PIR sensor

2.5 AV4 (card matrix & DSP)

Identical to AV3 but where a single all-in-one presentation switcher no longer supports the quantity of inputs of outputs needed to fulfil the requirements. Intended use case is for small stepped floor or tiered large lecture theatres

- Customised lectern or touchpoint with housing for associated system audio visual hardware
- Video/Audio switching & control via a suitable all in one AV presentation switcher and controller
- Minimum 10" touch capacitive touch control screen with standard University GUI interface
- Audio visual equipment housed in lectern or equipment rack

- Supported audio-visual sources at the lecturer's lectern:
 - Wireless Bring Your Own Device (BYOD) connectivity
 - A permanent local PC
 - Input from a portable device with HDMI output (e.g. laptop)
 - Input from a portable audio device (e.g. iPod)
 - A document camera / visualiser
- Microphones:
 - 2x Wireless lapel microphones
 - 2x Wireless handheld microphones
 - 1 x Gooseneck microphone - lectern mounted
- Image via dual ceiling mounted data projectors projected onto suitable wall surface or motorised 16:9 projection screens, or LCD panels each capable of showing separate content, or combination thereof.
- Sound via wall mounted or flush mount in-ceiling speakers with external speaker amplification depending on room layout and size.
- Utilisation of an external Digital Sound Processor (DSP)
- Infra-red hearing augmentation enabled
- Remote room occupancy monitoring via detection of movement within the room PIR Sensor
- Room scheduling panel mounted at entrance
- All user accessible cables shall be long enough to reach the presenters position at the back of the lectern.
- An interface into new lighting systems for AV control
- Lecture capture recording in alignment with the University policy

Optional:

- Zoom video conferencing upon request

2.6 Flexible learning space

Flexible learning spaces comprise teaching spaces of various sizes, generally with flat floor and mobile furniture, conducive to collaborative learning tasks. A flexible learning space typically comprises of several display screens around the room perimeter, however, there is no technology integrated with the mobile joinery of seating to reduce clutter and maintain mobility. A combination of wireless technology and video hardware is used to enable content sharing.

A typical flexible learning space includes the following:

- A 'touch point' for the academic in lieu of traditional lectern, housing the resident PC and associated hardware, without necessarily being the focal point of the room.
- Image via multiple display screens of any quantity and combination (LCD and/or Projection) typically mounted around the room perimeter
- A dedicated wireless presentation host per display. (Zoom room PC in content sharing mode only)
- Dual presentation mode capable: one Zoom PC showing to all screens, and Zoom PC per screen

- Microphones:
 - Up to 2 x wireless lapel microphones
 - Up to 2 x wireless handheld microphones
 - 1 x gooseneck microphone - lectern mounted
 - A Ceiling-mounted microphone above touch point location (routed to hearing assistance and lecture recorder only)
- Sound via wall mounted or flush mount in-ceiling speakers
- External Digital Sound Processor (DSP) where applicable
- Infra-red hearing augmentation equipped
- Remote room occupancy monitoring via detection of movement within the room PIR Sensor
- All user accessible cables shall be long enough to reach the presenters position at the back of the lectern.
- An interface into new lighting systems for AV control

Optional:

- Input from a portable device with HDMI output (e.g. laptop) at the touch point
- Lecture capture recording in alignment with the University policy
- Zoom video conferencing may be required upon request
- Room scheduling touch panel mounted at the entrance
- A permanent ('resident') PC at the touch point
- A document camera / visualiser at the touch point

2.7 Collab 1 (Learning Pods and Group Study Rooms)

Learning pods and Group Study Rooms are designed to be used for informal group discussion by students. Each pod/group study room has its own interactive technology solution which functions independently from adjacent pods or rooms.

- Wireless Bring Your Own Device (BYOD) connectivity
- Large LCD Display
- A Zoom PC (Dell Micro) enabled for wireless sharing only

2.8 Exec 1 (Executive Office – Zoom)

Room size seating up to 3-4 People.

- A large format 'All in one' display with integrated Zoom PC, camera, microphone and sound bar is mounted onto an applicable wall. The all-in-one display is wall mounted on a suitable bracket
- Dual Power and data will need to be provided for the all-in-one solution
- Mounting height must be coordinated with the University's IT Services to ensure optimum telepresence for the room layout and seating arrangement.

2.9 Meet 1 (Small Meeting Room – Zoom)

Room seating up to approx. 8 People.

- Video conferencing & wireless content sharing solution using a micro PC with Zoom application
- Zoom session control via iPad / Touch panel controller
- Dual wall mounted displays (minimum 55 inch) connected to Zoom PC. **Dependant on room size a single larger display may be more suitable*
- Microphone & Speaker sound via integrated video & sound bar
- An integrated video camera and sound bar for conferencing video and audio
- Audio-visual equipment fitted into customised joinery as stipulated by IT Services
- Infra-red hearing augmentation equipped
- Room scheduling touch panel mounted at the entrance. 2-way bookings enabled.

Optional :

- A secondary dedicated resident PC connected via USB video capture to Zoom PC. Video capture device must be ZOOM certified.
- USB extender plate back to resident PC for connecting portable content devices mounted on the side of the joinery.

2.10 Meet 2 (Medium / Large or Executive Meeting Room – Zoom)

Room seating up to 30 people.

- Video conferencing & wireless content sharing solution using a micro PC with Zoom application
- Zoom session control via iPad / Touch panel controller
- Image via single or dual wall mounted standard LCD displays
- Amplification via distributed wall mounted or flush mount in-ceiling speaker(s) and dedicated amplifier
- Microphone via a tabletop or ceiling mounted solution dependant on room layout
- Conferencing camera video via pan-tilt-zoom (PTZ) controlled USB camera
- Infra-red hearing augmentation equipped
- Audio-visual equipment fitted in a small customised cabinet as recommended by IT Services
- Room scheduling touch panel mounted at the entrance. 2-way bookings enabled.

Optional:

- A secondary dedicated resident PC connected via USB video capture to Zoom PC. Video capture device must be ZOOM certified.
- USB extender plate back to resident PC for connecting portable content devices mounted on the side of the joinery.

2.11 Custom Spaces

It is recognised that no single solution or package will support all potential technology scenarios. Customised spaces outside of the use cases within this specification are typically designed separately by the University of Newcastle internal design team or an external consultant. These may be specialised teaching, learning and other spaces with unique features whether that be architectural or functional, that require a customised solution. Examples include Moot Court and Pharmacy Lab, large halls.

It is important to note that any customised design must still be conceptualised within the principle parameters and preferred parts list referenced in this specification.

2.12 Wayfinding, Information & Scheduling Technologies

2.12.1 Digital Signage

The University's digital signage solution is an enterprise server-based content management system (CMS) used in conjunction with LCD display panels and external digital signage players. The screens and players are combined to display student facing, event, alumni, current news and research communications at various locations across the campuses. The setup and management of this hardware is handled internally by the IT Services, but it is expected the relevant contractor installs the LCD display panels and signage players accordingly.

For more information on the implementation of this solution please refer to IT Services.

2.12.2 IP TV

The University deploys a 3rd party enterprise solution for IP TV as a comprehensive solution to broadcasting television services to students and staff. The solution offers:

- Media Backend for content and metadata ingest, transcode and storage
- Web Services for content, user, and service creation and management
- Origin for delivery to a managed network, the internet or CDN
- Clients for delivering an engaging TV service on STB, mobile devices and PCs

For more information on the implementation of this solution please refer to IT Services.

3 TECHNICAL STANDARDS - VIDEO

3.1 Video Resolutions

The minimum expected resolution standards for all video sources and destinations are currently specified as a minimum 16:9 ratio / 1920 x 1080p at 30fps / 4:2:2. Any requirement for HDR, 4K, higher resolutions or custom aspect ratios will be called out specifically in design. Any resolution lower than the above-mentioned minimum standard will be considered a defect.

3.2 Video Connections

Accepted connectivity for achieving the required resolutions could include any of the following: HDMI, HD-SDI, Display Port, USB-C, HDBaseT or Video over IP (RJ45/Ethernet) any connections used other than the above-mentioned connection types will be considered a defect.

3.3 EDID and HDCP

All cabling & connectivity must support a minimum of 10.2Gbps for HD and 18Gbps for 4k Resolutions. In addition, all patch cables must 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 outlined in ANSI/INFOCOMM 3M 2011 & AVIXA V202.01:2016. 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 and simulated for best case scenario for which the applied space is most used.*

3.5 Projection Hardware

Minimum technical requirements for projector hardware shall include the following:

- 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 IP control protocols
- Use Class 1 Laser Diode single or 3DLP chip Technology

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 practice positioning for optimal projector light output found at the minimum end of the throw distance range for the desired image size

- 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 scalars. Peripherals to be securely and neatly mounted whilst maintaining service visibility and accessibility.

3.7 Projection Surfaces

- A variety of projection image surfaces are used throughout the university and dependent and sometimes limited to the room size, shape, elevation and environment. Where possible new installations shall be equipped with fixed projection screens of the correct size and ratio for the room.
- If the optimal position for a projection screen is impeded by either 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 images, the specifications for viewing distances and angles shall apply to each single display.
- All motorised or automated projection screens or brackets must support remote control via a 3rd party control system

3.8 Projection Image calibration & commissioning

Projectors shall be commissioned using a test pattern generator, or internal test patterns, if the projector is equipped with them.

- Projector brightness, contrast, colour balance and colour temperature are to be adjusted if necessary, to optimise the image quality
- The projected image shall comply with ANSI/INFOCOMM 3M-2011 standards for image contrast ratio.
- The projected image shall be located at an approved height AFFL.
- Opposing sides of the projected image shall be parallel.

3.9 Flat Panel LCD Displays

In spaces where flat panels have been installed as an alternative to projection systems, Sight Line (Image Size and Position) criteria equally apply.

Flat panel displays for indoor use must comply with the following criteria:

- Supports a minimal continuous operation time of 16/7 hours/day
- Supports a minimum native resolution of 1920 x 1080 pixels.
- Supports a typical minimum brightness of 350cd/m².
- Supports a minimum of 1 x HDMI input
- Supports 3rd party control via Ethernet, RS232
- Supports Vesa mounting standards of up to 400 x 400 and be securely mounted on a wall bracket.

3.10 Indoor Digital Signage Displays

The University's digital signage solution is an enterprise server-based content management system (CMS) used in conjunction with LCD display panels and external digital signage players. LCD displays intended for the use of indoor digital signage information must comply with the following criteria.

- Supports a minimal continuous operation time of 24/7 hours/day
- Supports a minimum native resolution of 1920 x 1080 pixels.
- Supports a typical minimum brightness of 350cd/m².
- Supports a minimum of 1 x HDMI input
- Supports 3rd party control via Ethernet, RS232
- Supports Vesa mounting standards of up to 200 x 200 and be securely mounted on a wall bracket.

3.11 Outdoor Digital Signage Displays

LCD displays intended for the use of indoor digital signage information must comply with the following criteria.

- Supports a minimal continuous operation time of 24/7 hours/day
- Supports a minimum native resolution of 1920 x 1080 pixels.
- Supports a minimum contrast ratio of 4000:1.
- Supports a typical minimum brightness of 500cd/m²
- Supports a minimum of 1 x HDMI input
- Supports 3rd party control via Ethernet, RS232
- Supports Vesa mounting standards of up to 200 x 200 and be securely mounted on a wall bracket.
- Supports dust and water-resistant equivalent to IP65
- Display must be housed in a vented, aluminium cabinet with tempered glass

4 AUDIO STANDARDS

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 spill.

Where possible it is recommended the architectural design include provisional acoustic properties and outcomes as recommended in the following standards:

- AS/NZS2107:2000 Acoustics – Recommended design sound levels and reverberation times for building interiors.
- AS/NZS ISO 717.1:2004 Acoustics – Rating of sound insulation in buildings and of building elements.

4.2 Speech Intelligibility

Spaces shall be acoustically designed and treated to comply with the AETM recommendation that spaces shall achieve a minimum Speech Transmission Index value of 0.7 – 1.0. (Refer to AETM “Audio-visual Design Guidelines Tertiary Teaching Spaces”).

4.3 Speaker Coverage and Sound Levels

Speaker systems for voice reinforcement and general program material shall typically be capable of producing a minimum sound level of 90dBA at the center of the audience area, with a maximum variance of 6dBA at the perimeter of the space. Speaker systems for specialised applications shall be specified to suit the application and teaching space as required.

4.4 Typical Speaker Recommendations per Room Type

The University recognises that when it comes to sound reinforcement and amplification a ‘one size fits all’ approach does not always apply. Especially when room size, shape and layout is very diverse. For consistency we have applied the following minimal parameters to work within. It is expected the AV Integrator shall utilise their experience and provide best practice when measuring and analyzing spaces for sound reinforcement and make recommendations based on these results. The following are minimum performance specifications for speakers included in University of Newcastle audio-visual systems.

4.4.1 Teaching Spaces and Lecture Theatres

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

- Where suitable speakers shall be point source wall mounted type to reduce intrusion to the ceiling space and assist with simplicity of installation and support.
- Speaker quantity and placement must be measured and selected based on their dispersion and dB specification to provide to provide uniform coverage at the minimum specified sound levels.
- Speakers must always be mounted forward of the lectern to avoid microphone feedback where a microphone is present or in the event a microphone is added.
- Where in-ceiling type speakers are required best practice principles must be applied to dispersion and RCP’s must be provided showing coverage and active SPL dispersion over floor space

4.4.2 Larger Spaces –Auditoriums, Great Hall, Concert Hall

Larger spaces that may require a combination of the above speakers, or an alternative speaker system, shall be specified to suit the space as required. The specification shall typically be done in conjunction with a specialist consultant or preferred speaker manufacturer.

4.5 Sound Uniformity Compliance

Sound systems shall comply with ANSI/INFOCOMM -3M 2009 specifications for audio coverage uniformity in enclosed listening areas. A maximum of ± 6 dBA variance is acceptable for general applications.

4.6 Speaker Amplification

The University recommends and number of alternatives and preferred models for amplification on campus. Where possible the built-in amplifier of the AV presentation switcher is utilised with appropriately matched speaker combinations. Where more amplifier power is required it is expected the integrator perform a measurement and analysis and recommend an appropriately matched amplifier/s. This may be low impedance, constant voltage or a combination of both in larger and zoned systems.

4.7 Audio Signal Processing

Where possible the built-in DSP processing of the AV presentation switcher is to be utilised to keep the system simple and streamlined. Where more inputs and more robust DSP processing is required then an external DSP will need to form part of the design. If an external DSP is required, the following must be supported:

- Volume, bass, treble and mute controls.
- Minimum 10-band parametric graphic equaliser.
- Two-band parametric equalisation.
- Speaker delay adjustment.
- Equalisation, compression, gating and limiter on microphone inputs.
- AGC on individual input channels
- Pre and Post level and processing capabilities
- 3rd Party control capability for pre-set recall and individual parameter control

Specialised or large teaching spaces may require additional audio signal processing, which shall be specified in the detailed design of the proposed teaching space system.

4.8 Voice Reinforcement

Reinforcement of the lecturer's or contributing student's voice, via the use of installed microphones, is necessary in large spaces, or in spaces that have a higher ambient noise level and shall be provided under the audio-visual design and implementation.

4.8.1 Lectern Mounted Microphones

Lectern microphones for lecturer voice reinforcement shall:

- Be gooseneck condenser type, 400mm length.
- 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.

4.8.2 Wireless Microphones

Wireless microphones shall be installed in teaching spaces to allow the lecturer the flexibility to be walk around the room and not strictly present from the lectern and for student input. Lecture capture teaching spaces must have a minimum of one wireless lapel microphone.

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

- Need to operate in 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.
- Be capable of operating over 40 channels.
- Include 256-bit signal encryption.
- Include one x rechargeable handheld dynamic cardioid microphone.
- Include one x rechargeable or disposable battery belt pack transmitter with cardioid lavalier microphone.
- Include appropriate charger for the transmitters.

Wireless microphone receivers shall be installed so that there is clear signal reception by the antennae.

IT Services can supply approved manufacturer and model details.

4.9 Audio Control

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

User controls for the audio system shall include:

- Program material volume up, down and mute.
- Lectern microphone volume up, down and mute where applicable.
- Wireless lapel microphone volume up, down and mute where applicable.
- Wireless handheld microphone volume up, down and mute where applicable.

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

- General approach for mic audio is post mute/pre-fade to all mixes except room mix
- Any content is post mute/ post fade

4.10 Hearing Augmentation

Hearing augmentation shall be infrared where appropriate and comply with Australian Standard AS 1428.5. As per the extract below:

- A hearing augmentation system must be provided where an inbuilt amplification system, other than one used only for emergency warning, is installed:
 - (a) In a room in a Class 9b building; or
 - (b) In an auditorium, conference room, meeting room, room for judicatory purposes, or a room in a Class 9b building; orAt any ticket office, teller's booth, reception area or the like, where the public is screened from the service provider.

If a hearing augmentation system is required, it must be available to not less than 95% of the floor area of the room or space served by the inbuilt amplification system, and the number of receivers provided must be not less than:

- If the room or space accommodates up to 500 persons, 1 receiver for every 25 persons (or part thereof), or 2 receivers, whichever is the greater; and
- If the room or space accommodates more than 500 persons but not more than 1000 persons, 20 receivers plus 1 receiver for every 33 persons (or part thereof) in excess of 500 persons; and
- If the room or space accommodates more than 1 000 persons but not more than 2 000 persons, 35 receivers plus 1 receiver for every 50 persons (or part thereof) in excess of 2 000 persons; and
- If the room or space accommodates more than 2 000 persons, 55 receivers plus 1 receiver for every 100 persons (or part thereof) in excess of 2000 persons.

4.10.1 Hearing Transmitters

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 a belt pack type.
- Be capable of receiving up to four independent channels.
- Be equipped with an on/off switch, volume control, and power on/off indicator.
- A minimum of two receivers shall be available for every 25 persons of room capacity. Hearing augmentation receivers shall be centrally managed by the University of Newcastle Access Ability unit.

4.11 EWIS

Muting of an audio system may be required in the case of an evacuation alarm. A Fire Engineer is to be consulted regarding requirements for each audio-visual equipped space. This is only applicable for IFS full room refurbishment projects and new construction projects.

5 PROGRAM SOURCE & RECORDING DEVICES

5.1 Classroom PC

Teaching spaces and lecture theatres shall be equipped with a dedicated All in One PC on the lectern. The PC will be specified and supplied by University of Newcastle IT Services. PC's mounted on a flexible monitor arm shall:

- Be installed as per the manufacturer's specifications.
- Allow the user to freely adjust to the required height without the arm defaulting to the upright position.
- Allow sufficient slack for the all in one PC to be adjusted to the limits of the gimbal and arm adjustment without pulling tension onto the cables or connectors.
- Installed cabling must allow for the cover plate to be installed on the PC where such cover plate is part of the standard unit assembly.

5.2 Blu-ray Disc Players

Teaching spaces and lecture theatres may be equipped with dedicated disc players by exception only.

Functionality requirements:

- Be capable of CD, DVD and Blu-ray playback.
- User control of the disc player shall be controlled by the room control system.

5.3 Document Cameras (Visualiser)

Teaching Spaces may be equipped with dedicated document cameras. If a document camera is specified, the device shall:

- Have HDMI output.
- Have a minimum output resolution of 1920x1080P pixels.
- Operate at minimum 30 FPS.
- Be equipped with a minimum of 10x optical zoom.
- Have auto white balance.
- Be equipped with on-board controls.
- Be equipped with on-board illumination.
- Be controlled via the AV Control system

5.4 BYOD Devices

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

5.5 Lecture Capture Recorder

The University of Newcastle uses a software solution as their primary recording and capture platform. The video is captured using a hardware capture device which is configured and supplied by University of Newcastle. The AV integrator is expected to install the device as per the design including all associated interface cabling and rack mounting hardware. The AV integrator is expected to ensure the device is receiving video, audio, power and data before handing it over to University of Newcastle for final configuration and testing.

6 LIGHTING

Lighting for Teaching Spaces shall comply with the following standards:

- AS/NZS 1680.2.1:2008 – Interior and workplace lighting – Specific applications – Circulation spaces and other general areas.
- AS/NZS 1680.2.2:2008 – Interior and workplace lighting – Specific applications – Office and screen-based tasks.
- AS/NZS 1680.2.3:2008 – Interior and workplace lighting – Specific applications – Educational and training facilities.

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.
- Light fittings shall be arranged so that light does not spill directly onto the projection surface.

6.2 Lecturer Lighting

Lecturer lighting shall:

- Be positioned out of the lecturer's direct line of sight to the audience by between 45 and 60 degrees to prevent the lecturer being visually disadvantaged by the light, whilst minimising any shadows on the lecturer's face.
- Comprise of focusable fittings equipped with beam shaping and barn doors to minimise spill onto the projected image surface.
- Comprise of fittings with sufficient light output for image recording.

6.3 Whiteboard Surface Lighting

Whiteboard surface lighting shall:

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

6.4 Video Conference lighting for meeting rooms

Video conferencing requires an increased level of illumination on the meeting room participants and whiteboard surface, whilst maintaining lower general light levels that are suitable for projection. If the meeting room has exterior windows these should be covered with blinds to shut out natural light and reduce glare on the presentation screens. Lighting fittings should have sufficient lux output for image recording.

6.5 Lighting for demonstrations

Spaces with lighting control shall include a lighting pre-set specifically intended for use with the demonstration camera. In cases where additional illumination of a demonstration is required, a local device (e.g. tabletop lamp or similar) shall be used.

6.6 Lighting Control

Lecture theatres and larger audio-visual equipped spaces shall include lighting control as part of the automation system for new builds. Lighting control system needs to be controllable by University of Newcastle standard AV control system.

6.7 Lighting user interfaces

User control of lighting will be implemented from the audio-visual system touchscreen.

User controls from the touchscreen shall include, but not be limited to:

- Stage (Front Zone) Lights High, Medium, Low, off pre-sets.
- Room (Other Zones) Lights High, Medium, Low, off pre-sets.

Lighting levels for High, Medium and Low settings shall be determined and adjusted as required by each space.

6.8 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

The preferred AV control system utilised by University of Newcastle is Crestron. It is preferred the AV Control and AV Switching is achieved using an all-in-one presentation and control system and signal management device where possible. However, some solutions will require a separate controller, AV switcher and DSP. The all-in-one control system and signal management device shall include, all control processing, and all audio-visual signal switching and processing within a single unit where possible.

The all-in-one control system and presentation device shall include but not be limited to the following:

- Control and communication:
 - Can implement IP, RS232, IR Serial control of connected devices
 - Dry contact closure control outputs.
 - Dry contact/voltage detection inputs.
- Audio:
 - Microphone inputs with digital signal processing.
 - Analogue program inputs for audio only use or corresponding to video inputs.
 - Digital audio inputs. (Digital audio is also included with HDMI).
 - Program outputs with digital signal processing.
 - Low impedance speaker outputs.
 - Constant voltage speaker outputs.

- Video:
 - HDMI inputs.
 - Computer resolution support up to 1920 x 1080 pixels.
 - Video resolution support a minimum of 1080p.

7.1 Control systems hardware

User control interfaces for the audio-visual control system shall be a Crestron touchscreen loaded with the University of Newcastle standard GUI, typically mounted on a tabletop base, sitting on top of the lectern (if lectern is portable or movable use wall mount touch panel). Touch screen size is specified for each category. Please refer to specific category for correct touch screen size.

7.2 Interface design & Programming

All user interfaces shall be configured to use the University's standard GUI interface.

8 LECTERNS & EQUIPMENT HOUSING

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

8.1 Classrooms

Teaching Spaces shall be equipped with a University of Newcastle IT Services approved lectern style.

For custom designed lecterns the cabinet must include the following:

- Be one or two bays, depending on the size of the audio-visual system to be installed.
- Include inbuilt 19" equipment racking in each bay.
- Shall provide adequate ventilation or where necessary include ultra-low noise ventilation fans.
- Have sufficient bench space to allow for the monitor and touch panel, document camera (visualiser), microphone charging station, University of Newcastle telephone and flip top box for connecting BYOD devices and lecturer's notes and PC.
- Be permanently fixed to the floor.
- Allow for 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 permanently hard-wired power to be located on the wall beside and connect through.
- Allow for a patch panel or network switch to be fitted for data outlets.
- Have all doors/removable panels be lockable to University of Newcastle standard.

8.2 Lecture Theatres

Lecture Theatres shall be equipped with a University of Newcastle IT Services approved lectern style.

For custom designed lecterns the cabinet must include the following:

- Be two or three bays, depending on the size of the audio-visual system to be installed.
- Include inbuilt 19" equipment racking in each bay.

- Shall provide adequate ventilation or, where thermal output of the enclosed devices exceeds 530 BTU, include ultra-low noise ventilation fans.
- Have sufficient bench space to allow for the monitor and touch panel, document camera (visualiser), microphone charging station, University of Newcastle telephone and flip top box for connecting BYOD devices and lecturer's notes and computer if required.
- Be permanently fixed to the floor.
- Suitable access for serviceability of all equipment including but not limited to:
 - Removable joinery panels.
 - Sliding / rotating racks on rails
- Allow for cable radii and services access from the side or beneath.
- Allow permanently hard-wired power to be available on, or near the lectern.
- Allow for a patch panel or network switch to be fitted for data outlets.
- Have all doors/removable panels be lockable to University of Newcastle standard.

8.3 Lectern and separated equipment rack

In instances where a separate lectern and equipment rack is employed, the lectern shall:

- Be of solid construction.
- Be a single bay unit.
- Have sufficient bench space to allow for the monitor and touch panel, document camera (visualizer), microphone charging station, University of Newcastle telephone and flip top box for connecting BYOD devices and lecturer's notes and computer if required.
- Be permanently fixed to the floor.
- Suitable access for serviceability of all equipment including but not limited to:
 - Removable joinery panels.
 - Sliding / rotating racks on rails
- Allow for cable radii and services access from the side or beneath.
- Allow permanently hard-wired power to be available on, or near the lectern.
- Allow for a patch panel to be fitted for data outlets.
- Have all doors/removable panels be lockable to University of Newcastle standard.

8.4 Equipment Rack and Custom Furniture

- Equipment racks shall be utilised to house central components of audio-visual systems.
- 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 racks should be easily accessible for serviceability on all sides.

8.5 Equipment Racks and Teaching Spaces

Equipment racks for general purpose learning spaces shall:

- Be a rack frame type installed within the cabinet lectern.
- Be a minimum nine rack units high.
- Include lockable doors.
- Include cable trays and cable lacing bars.

8.6 Equipment Racks & Lecture theatres

Equipment racks for lecture theatres shall typically:

- Be a rack frame type installed within the cabinet lectern.
- Include lockable doors.
- Include cable trays and lacing bars.
- Include ultra-low noise ventilation fans.

8.7 Equipment Racks

- Organization of system components in equipment racks shall be as per University of Newcastle Typical Audio-visual Equipment Rack Layouts documentation.
- Rack design for non-standard components shall be completed as required, ensuring power, thermal and noise impacts are correctly documented.
- System components that are rack mounted shall be securely fixed to the equipment rack using all available screw holes.
- System components that are non-rack mounting shall be installed on rack shelves and securely fixed with the ability to be removed for servicing.
- Additional rear support shall be utilised for components that are equipped with it or are especially large or heavy.

8.8 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 for this (530 BTU and above), ultra-low noise cooling fans shall be fitted to racks and lecterns.

8.9 Blanking Panels

Empty spaces in the front of racks are to be filled with blanking or vent panels. The blanking panels shall be sized so that one panel covers an entire empty section (e.g. a 4RU space shall be filled by 1 x 4RU blanking panels, not 2 x 2RU panels). Single rack unit vent panels shall be fitted to the top and bottom units at the front of racks, to allow for convection cooling of components.

9 CABLING & DEVICE RETICULATION

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 - Requirements for Authorised Cabling Products.
- AS/NZS 3080 Telecommunication Installations – Integrated Telecommunications Cabling System for Commercial Premises.
- AS/NZS 3084 Telecommunication Installations – Telecommunications Pathways and Space for Commercial Buildings.
- University of Newcastle Telecommunication and Data Cabling Technical Specification 2009 May 2014 Revision.

9.1 Approved Cable Types (Field)

Requirement	Specification	Comment
Digital fibre video cables	50/125-micron multimode	All fibre to terminate at fibre junction box in the equipment rack room
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	Filed cabling runs for Cresnet
Video over IP	Minimum Shielded Cat6a / Certified to 350mhz F/UTP	For high bandwidth video over IP

9.2 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	4 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
CRESTRON NVX/DM or video over IP	Patching for VIDEO over IP must use WHITE Shielded CAT6A.	Specifically for video over IP

9.3 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

9.4 Power Supply in Equipment Racks

All University of Newcastle equipment racks shall be fitted with a University of Newcastle approved minimum 8-way horizontal rack managed mounting power rail with LAN control for the connection of components that require a direct 240V supply. Provided schematics outline the layout and preferred input for each device. It is important this is adhered to for consistency and serviceability.

9.5 Cabling Within Equipment Rack

Best practice cable looming and reticulation must be adhered to within rack builds. Cables must be neatly managed, grouped together in types and managed using Velcro cable ties in most instances, Cable must be loosely loomed with enough 'service loop' left to easily maintain.

Equipment racks that are fitted with castors, shall have looms long enough to allow the rack to be moved for unimpeded maintenance. The cable loom shall exit the wall and enter the rack at sufficient height to allow it to coil while maintaining bend radius behind the rack when it is moved back into the cupboard.

9.6 Cable Support within Equipment Rack

Cables and looms shall be secured vertically using inbuilt rack cable trays, and horizontally using lacing bars. Lacing bars shall be fitted behind any component that has significant numbers of cables connected.

When cables are loomed or terminated, sufficient length shall be allowed so as not to leave any tension or strain on the cable or termination when completed. All cables must be secured with Velcro only; no zip tie cables are permitted.

9.7 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 is to be on the opposite side to power entry point of the rack.

9.8 Cable Types and Functions

Only cable types indicated in the table below shall be used as part of University of Newcastle, IT Services systems. All system cables and patch leads (Category cabling for audio-visual systems) shall be University of Newcastle approved CAT6A SFTP. Cabling that runs into an equipment rack shall be neatly loomed and where visible, dressed with a cable “sock” or equivalent cover. The cable cover is to be colored suitable to match the surrounding décor.

9.9 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.

9.10 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.

9.11 Cable Ties

Velcro ties only shall be used for looming and fixing cables. **NYLON (ZIP) CABLE TIES ARE NOT PERMITTED.**

9.12 Cable Pathways

- 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.
- Cable ducts shall be used to enclose exposed vertical cable runs.
- 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 IT Services.
- Under no circumstances are audio-visual cables to share conduits with power, data, and cables intended for other services.

9.13 Cable Looming

- 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 with 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.

9.14 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 in order 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.

9.15 De-Rating

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

Factors that affect cable performance over long runs shall include:

- The quantity of cables in a loom.
- The tightness of the loom.
- 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.

9.16 Cable Labelling

- 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.
- 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.

9.17 Cable Termination

- Cable terminations shall be made to manufacturers or international standard specifications.
- Connectors of the correct size and electrical properties for the cable shall be used at all times.
- 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.

9.18 User Accessible Cables

Loose user accessible cables shall be provided at lectern tops for connection of the lecturer's laptop, document camera, BYOD etc. 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.

9.19 Mounting of AV Peripherals

AV field peripherals refers to devices such as AV transmitters, receivers, extenders or encoder/decoders and their associated power supplies and cabling typically installed behind LCD screens 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 installed 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 also 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 by 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. Mounting devices using double sided tape is not acceptable as removing devices for service is difficult and double sided tape deteriorates over time.
- 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 VM100 VESA mount – Recommended for mounting AV components behind LCD panels
 - 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 – Recommended for mounting peripherals above projectors
 - Crestron PLMK-IFE-101 – Recommended for pole mounted peripherals

10 POWER AND DATA REQUIREMENTS

Power and data points shall be located terminated inside the lectern adjacent to the equipment racks.

Power and data points for projectors shall be located in ceiling, adjacent to the projector mounting position. In the case of solid set ceilings, a minimum 500mm x 500mm lockable access panel is to be installed at the location of the power and data points. GPOs associated with audio-visual equipment shall be on the same power circuit.

NOTE: For more specific guidelines in the University of Newcastle network standards please refer to University of Newcastle IT Communication and Technical Specification documentation for all data requirements. The University of Newcastle shall configure, supply and commission all active data network equipment (switches) associated with audio-visual systems.

The following minimum power and data requirements shall be provided in each area listed. Special use areas and additional Audio-visual services may have additional power requirements.

10.1 General Teaching Spaces (AV1)

- One double 15A GPO in the lectern.
- One double GPO mounted inside the ceiling within 300mm of the projector mounting position.
- One single GPO inside the top box for connecting BYOD devices.
- 6 data outlets or a managed switch at the lectern position.
- One double data outlet mounted inside the ceiling within 300mm of the projector mounting position.

10.2 Medium Teaching Space (AV2)

- One double 15A GPO in the lectern.
- One double GPO mounted inside the ceiling within 300mm of the projector mounting position.
- One single GPO inside the top box for connecting BYOD devices.
- Minimum 10 x data outlets or a managed switch at the lectern position.
- 4 x data feed from local communications room (copper)
- One double data outlet mounted inside the ceiling within 300mm of the projector mounting position.

10.3 Large Teaching Space - Lecture Theatre (AV3 & AV4)

- Two double 15A GPOs in a floor box below the lectern, or if not available wall mounted 100mm AFFL at the lectern position.
- One double GPO mounted inside the ceiling within 300mm of each projector mounting position, or behind each LCD display
- One single GPO inside the flip top box for connecting BYOD devices.
- Minimum 10 x data outlets or a managed switch at the lectern position.
- 4 x data feed from local communications room (copper)
- One double data outlet mounted inside the ceiling within 300mm of each projector mounting position.

10.4 Separate Lectern and Equipment Rack

In cases where the lectern and equipment rack are in different locations, minimum power requirements shall be:

- One double 15A GPO in a floor box below the lectern, or if not available wall mounted 100mm AFFL at the lectern position.
- One double 15A GPO behind the equipment rack at 300mm AFFL.
- One double GPO mounted inside the ceiling within 300mm of each projector mounting position.
- One single GPO inside the top box for connecting BYOD devices.
- One double data outlet in lectern.
- Eight data outlets or a managed switch in equipment rack.
- One double data outlet mounted inside the ceiling within 300mm of each projector mounting position.

10.5 Electrical testing & tagging

All AV related hardware shall be tagged with a “new to service” tag and tested by the accredited installer in adherence to the University of Newcastle IFS Test and Tagging Guidelines. This equipment shall include:

- Power supplies.
- All system components.
- IEC and other detachable power leads.

Any equipment or leads that are outside of the testing expiry date shall be re-tested and tagged by the accredited installer. The labels shall be provided by University of Newcastle. IFS will be responsible for keeping all records for testing and tagging.

10.6 Equipment Power supplies

Power supplies for audio-visual components that are located outside of the equipment rack shall be installed in the rack, and a suitable low voltage cable run to the component. Refer to schematics for detailed information.

Outside components that are supplied directly from 240V mains power shall be connected to local GPOs. For specific devices with power supplies that are not suitable for power from the rack can be directly connected to GPO. The use of power extension leads shall not be permitted under any circumstances. The use of double adaptors, extension leads or unfixed power boards outside the equipment racks shall not be permitted under any circumstances.

11 INSTALLATION EXPECTATIONS

The following is a summary of the expected approach by the audio-visual vendor. This is a recommend 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.

11.1 Expected Vendor Approach

11.1.1 Design & analysis

- The Vendor will study and analyse the functional design brief in conjunction with the IT Services Interactive Technologies Standards 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.

11.1.2 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 creation 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. The IT Services team will use the provided database to assign necessary network configuration information in readiness for the University of Newcastle network. It is preferred this is done well in advance of installation. Information should include the following for all applicable devices:

- Room / Location
- Part Description
- Brand
- Model
- Serial Number
- MAC Address
- Purchase Date
- Original Purchase Order Number
- Warranty

11.1.3 Post completion

- 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.

11.2 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 include measures to decrease the probability of equipment theft.

These shall include, but not be limited to:

- Projectors fixed with an appropriate anti-theft cable or mechanism
- Computers fixed with a Kensington cable lock or similar

APPENDIX 1 – DEFINITIONS, ACRONYMS AND ABBREVIATIONS

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

ACIF	Australian Communications Industry Forum - now called Communications Alliance Ltd (see www.commsalliance.com.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
AFFL	Above Finished Floor Level
AV	Audio-visual
ANSI	American National Standards Institute.
BICSI	Building Industry Consulting Service International
BoM	Bill of Materials
COW	Computer on Wheels
DGPO	Dual General-Purpose Outlet
DM	Crestron Digital Media
DMPS	Crestron Digital Media Presentation System
EDID	Extended Display Identification Data
FOH	Front of House. The front of a teaching space to which the audience faces.
FPS	Frames per second (video)

HD	High Definition
HDCP	High-bandwidth Digital Content Protection
HDMI	High Definition Multimedia Interface
IP	Internet Protocol
IPTV	Internet Protocol Television
IT	Information Technology
LAN	Local Area Network
LCD	Liquid Crystal Display
PIR	Passive Infra-Red Occupancy Detector
PM	Project Manager
POA	Price on Application
PPE	Personal Protective Equipment
RFP	Request for Proposal
RFQ	Request for Quote
SD	Standard Definition
S/FTP	Shielded / Foiled Twisted Pair
SIP	Session Initiation Protocol
Streaming	Streaming of live or on demand video or audio
TEAL	Technology Enabled Active Learning
UPS	Uninterruptable Power Supply
UTP	Unshielded Twisted Pair
WAN	Wide Area Network
WAP	Wireless Access Point
WHS	Work Health and Safety

APPENDIX 2 – REFERENCES AND INDUSTRY STANDARDS

References

The following references have been used to prepare this document.

AS/ACIF S009	Installation Requirements for Customer Cabling (Wiring Rules)	2013
AS/NZS 3080	Telecommunication Installations – Integrated Telecommunications Cabling System for Commercial Premises	2003 or later
AS/NZS 3084	Telecommunication Installations – Telecommunications pathways and spaces for commercial buildings	2017(R2017)
TDMM	BICSI Telecommunications Distribution Methods Manual	14th Edition
AETM	AETM Audio-visual Design Guidelines. Tertiary Teaching Spaces	2nd Edition
ANSI/INFOCOMM 2M-2010	Standard Guide for Audio visual Systems Design and Coordination Processes	2010
University of Newcastle	University of Newcastle Telecommunication and Data Cabling Technical Specification 2009	May 2014 Revision
University of Newcastle-ITS-AAG	University of Newcastle-ITS-AAG-Standards	Version 4.1

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.

This document will be reviewed on a regular basis, and at least annually, to keep it current with any changes to Technologies.

AS/ACIF S009	Installation Requirements for Customer Cabling (Wiring Rules) – Statutory.
AS/ACIF S008 (amended 2014)	Requirements for Authorised Cabling Products (latest edition) – Statutory
AS/NZS 3000	SAA Wiring Rules (latest edition)
AS/NZS 3080	Telecommunication Installations – Integrated Telecommunications Cabling System for Commercial Premises (latest edition)
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 Cabling in accordance with Values set out in AS/NZS 3080 (latest edition)
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 60950.1:2015	Information technology equipment - Safety General requirements
CISPR 22: 6.0	Information Technology Equipment - Radio Disturbance Characteristics - Limits and methods of Measurement
AS/NZS 2211.12:2006 (R2016)	Safety of laser products Safety of free space optical communication systems used for transmission of information
AS/NZS IEC 60825.2:2011	Safety of laser products Safety of optical fiber communication systems (OFCS)
AS CISPR 14.1:2018	Electromagnetic compatibility - Requirements for household appliances, electric tools and similar apparatus Emission (CISPR 14-1:2016 (ED 6.0), MOD)
AS/NZS 61386.1:2015	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
ISO/IEC 11801-5:2017	Information technology - Generic cabling for customer premises - Part 5: Data centers
AVIXA A102.01:2017	Audio Coverage Uniformity in Listener Area
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-A	Building Automation Systems Cabling Standard for Commercial Buildings

APPENDIX 3 – APPROVED BILL OF MATERIALS

The list of products is continually changing and constantly being upgraded. New products are released with such frequency that it would not be practical to list all the approved products. Strategic partnerships have been made with manufacturers to supply not only products or components, but also training and technical support. To support this document, a list of manufacturers and suppliers for various categories are listed here with links to their websites.

An approved bill of materials (BoM) includes products that have been properly evaluated and meets the functional, maintenance and serviceability criteria as defined by the University of Newcastle IT Services.

Strategic partnerships are constantly being reviewed and evaluated. Any major changes to these partnerships should trigger a review of the standards document to reflect this.

IT Services can provide an approved list of manufacturers and model on request.

Category	URL
Display panels	Panasonic Displays
	Samsung Business/Education
	LG Digital Signage
	SONY Professional Displays
	NEC Display Panels
Data Projectors	Panasonic Projectors
	Sony Professional
	Epson Ultra Short Projectors
Projection Screen	Grandview
	Screen Technics
Control System	Crestron
Distribution Amplifiers	Extron Electronics
	Crestron
Audio Amplifiers	QSC Audio
	Crestron
Audio Processors	QSC Audio
	Biamp
	Shure Asia
8Ω Speakers	QSC AC or AD Series

70/100v Speakers	QSC AC or AD Series
Document Camera	Wolfvision Vsolutions
Bluray Player	Denon Professional
Lectern Joinery	Bluegum Australia
	Lectern Hub
Rack components	Madison Technologies
	Middle Atlantic
Media Streaming	Crestron
	Extron
Digital Signage	OneLAN Signage
Conferencing Equipment	Logitech Web Cameras
	Magewell Capture Plus
Microphones	Shure Asia
	Sennheiser Microphones
Lighting Systems interfacing	Crestron Lighting
	Clipsal C-Bus
Lecture Recording Devices	Seneca - Arrow Electronics
Lecture Capture Software Solution	Panopto
Lecture Recording Feedback	Crestron
PCs (Micro and All in One) – supplied by IT Services as per the University desktop standard	DELL
IP TV	Amino TV