Design Standards

Audio Visual

Version: 5.01

February 2026

Table of Contents

1 GENERAL INFORMATION

1.1 Overview

a) The Audio Visual department is part of RMIT's Information Technology Services (ITS) resources group. The department provides AV consultancy, project and procurement support and AV contract management. The AV department consults widely across the University to develop technology strategies to meet the current and future needs of stakeholders, as well as providing clear guidelines around AV architecture, design and procurement.

b) All AV system installations throughout the University globally must consult with the ITS AV team from requirements discovery stages to ensure that consistency, serviceability, scalability, cost-efficient, and fit-for purpose elements are addressed. This document provides a basis for this and informs technology choice and implementation standards.

c) These standards shall be distributed to all AV vendors (including design and integration providers) for all AV works regardless of size and scope.

1.2 Version Control

d) This document will be updated and re-issued to reflect approved changes to the content and is subject to version control. The version record and status are documented below:

1.3 Document Change History

Version	Date	Author	Comments
2.00	05/04/2013	Dean McFadden	Approved for Issue
3.00	04/05/2018	Nikesh Kapadia	Major update. Includes deployment of CAV platform for flat-floor teaching spaces
4.00	15/11/2022	Brendon Kahi	Major Update. Removal of Converged AV. Update of Equipment List, Inclusion of Preferred Vendors List, Update of Schematics, Inclusion of Logitech MS Teams Room Systems, Update to installation standards. Removal of old schematics.
5.00	30/09/2025	Mark Ellis Alex Beer	Major Update. Space Classifications updated, Update of Schematics, Standard Equipment List, Standards Application, Deployment & Spares Processes
5.01	03/02/2026	Mark Ellis	Adjustments to Tier 2 Design

1.4 Intent

a) This document details the role of the ITS Audio Visual group with respect to the definition of technology standards relating to Audio Visual systems used throughout RMIT.

1.5 Owner

a) The overall responsibility for these standards resides with RMIT AV, part of the ITS group.

1.6 Approval

a) Architectural principles are approved by ICT Enterprise Architecture Design Authority (DA).

b) Once there is a departure from the current architecture, further DA approval will be required.

c) Technical requirements are approved by RMIT AV, CIO ITS (or delegate) & ED Property Services (or delegate).

1.7 Review

a) This document can be reviewed and updated at any stage throughout the year, with a minimum requirement to complete a review and update annually.

b) The most current version of the AV standards can be found on the RMIT University website.

1.8 Stakeholders

a) The following key stakeholders have been identified for this document:

Position	Department
Chief Information Officer – Or delegate(s)	Information Technology Services
Executive Director – Or delegate(s)	Property Services
Associate Deputy Vice-Chancellor Education – Or delegate(s)	Education

2 APPLICATION OF STANDARDS

2.1 Overview

a) This section defines:

1. Functionality for each of the standard system designs:
2. How the RMIT Audio Visual Standards, defined within this document, shall be applied across RMIT to ensure AV design spaces are consistent.
3. The approach & governance for non-standard deployments.
4. Spares rule for standards & non-standard deployments.
5. Guidelines and considerations for custom designs.
6. The standard document is not intended to act as a complete bid specification.

2.2 Deployment Platforms

a) RMIT deploys AV systems utilising conventional AV methods. If an AV over IP design is required, stakeholders must seek RMIT approval prior to deployment.

2.3 Standard System Designs

b) To maintain a level of consistency for end users as well as support staff, a University-wide design strategy has been developed to establish a set of standard designs for teaching spaces and the associated AV facilities. Venues with AV devices will be classified as one of the following formats as described in the table below. Specialist and other spaces may fall outside of the standards covered in this document. In these instances, a bespoke design will be completed to provide the required functionality. These bespoke designs, by preference and where possible, will be derived from the standards and preferred equipment lists detailed in this document.

c) We note that these categories are not all-encompassing, as there are some AV facilities that fall outside these classifications.

d) Note these definitions are used where specified in a classification. They also compliment the General Principles in all AV designs and provide specific details about the functionality provided for the user in each of the room types.

e) The classifications are as follows:

Table 1. *Professional Spaces*

SYSTEM TYPE	FUNCTIONALITY
Base level for any Teaching or Professional AV Supported space	Functionality is as follows for all spaces: • Symphony remote monitoring platform • IP Camera(s) Additional base level functionality for teaching spaces: • Full Mystro compatibility deployed on VC-4 Server
Breakout Space **Display Only Any Size**	Functionality is as follows: <u>Video</u> • A large format LCD capable of displaying: • BYOD – Wired (HDMI) & Wireless (Airmedia) <u>Audio</u> • Audio associated with the above sources shall be via the display built-in speakers. • Assisted Listening via an Infra-Red (IR) assistive hearing system. <u>Control</u> • System to be controlled via "Wake on Signal" Connection, and display programmed to business hours <u>Room Booking</u> • Office: Not required • Open Plan: Not required

SYSTEM TYPE	FUNCTIONALITY
	• All other spaces: Wall mounted 10” touch-screen outside of the room showing room bookings from the room’s Microsoft Outlook calendar. The touchscreen shall have coloured room indicators to indicate room usage

Basic Meeting Space
Laptop Conferencing
Less than 7m
	Functionality is as follows:
	<u>Video</u>
	• A large format LCD capable of displaying:
	  ○ BYOD – Wired (USB-C)
	  ○ Web conference via user device
	<u>Conferencing</u>
	• The space shall be made available as a BYOM (Bring your own meeting) video and audio conferencing, complete with:
	  ○ All-in-one web conferencing bar with camera, speakers and microphone
	  ○ BYOM – Web conference via user device
	<u>Audio</u>
	All Spaces:
	• Audio Via all-in-one conference bar.
	• Assisted listening via an Infra-Red (IR) assistive hearing system.
	<u>Control</u>
	• System to be controlled via "Wake on Signal" Connection, and display programmed to business hours .
	<u>Room Booking</u>
	• Office: Not required
	• Open Plan: Not Required
	• Enclosed: Wall mounted 10” touch-screen outside of the room showing room bookings from the room’s Microsoft Outlook calendar. The touch-screen shall have coloured room indicators to indicate room usage.

Medium Meeting Space
Room Conferencing
Less than 7m
	Functionality is as follows:
	<u>Video</u>
	• A large format LCD capable of displaying:
	  ○ BYOD – Wired (USB-C) & Wireless (Airmedia)
	  ○ Teams conference via room system
	  ○ Web conference via user device
	<u>Conferencing</u>
	• The room shall be made available as a native Microsoft Teams video and audio-conferencing location, complete with:
	  ○ All-in-one web conferencing bar with camera, speakers and microphone
	  ○ Microsoft O365 client
	  ○ BYOD – Utilise the in-room conferencing peripherals via laptop USB-C
	<u>Audio</u>
	• Audio via all-in-one conference bar
	• Assisted listening via an Infra-Red (IR) assistive hearing system.
	<u>Control</u>
	• Control of the room’s AV system shall be via a dedicated touch-screen controller.
	• Hardware based control processor.
	• PIR to shutdown system after defined period of no movement.
	<u>Room Booking</u>
	• Wall mounted 10” touch-screen outside of the room showing room bookings from the room’s calendar. The touch-screen shall have coloured room indicators to indicate room usage.

SYSTEM TYPE	FUNCTIONALITY

Large Meeting Space
Room Conferencing
Greater than 7m
	Functionality is as follows:
	<u>Video</u>
	• A large format LCD capable of displaying:
	  ○ BYOD – Wired (USB-C) & Wireless (Airmedia)
	  ○ Teams conference via room system
	  ○ Web conference via user device
	<u>Conferencing</u>
	• The room shall be made available as a native Microsoft Teams video and audio-conferencing location, complete with:
	  ○ High-quality PTZ camera
	  ○ Dedicated microphones
	  ○ Microsoft O365 client
	  ○ Utilise the in-room conferencing peripherals via laptop USB-C
	<u>Audio</u>
	• Audio associated with the above sources shall be via dedicated speakers within the space.
	• Assisted Listening via an Infra-Red (IR) assistive hearing system.
	<u>Control</u>
	• Control of the room's system shall be via a dedicated touch-screen controller.
	• Hardware based Control Processor.
	• PIR to shutdown system after defined period of no movement.
	<u>Room Booking</u>
	• Wall mounted 10" touch-screen outside of the room showing room bookings from the room's calendar. The touch-screen shall have colored room indicators to indicate room usage.

Microsoft Surface Hub	Functionality is as follows:
	<u>Video</u>
	• The Microsoft Surface Hub comes in two sizes:
	  ○ 50"
	  ○ 85"
	• Available sources for display via the following:
	  ○ BYOD Laptop – HDMI/USB-C
	  ○ BYOD Laptop – Wirelessly
	  ○ Onboard Microsoft operating system conferencing
	<u>Conferencing</u>
	• Microsoft Surface Hub USB camera
	• Built-in microphone
	<u>Audio</u>
	• Surface Hub built-in speakers
	<u>Control</u>
	• Via touch interactive display.
	<u>Optional Accessories</u>
	• The items below can be purchased separately:
	  ○ Steelcase Rolling Stand
	  ○ Wall mount
	  ○ Pen
	  ○ Camera

SYSTEM TYPE	FUNCTIONALITY
	○ Surface Hub 2 Battery (50" Size Only)
Digital Signage	Functionality is as follows: <u>Video</u> • Large format display with system on chip (SOC) • Serviceable pop-out video wall mount <u>Content</u> • AppSpace application to be installed on display <u>Audio</u> • Audio to be disabled by default <u>Control</u> • Operating hours to be set via display settings <u>Shroud / Protection</u> • All publicly accessible display shall be mounted in metal surround with access provided to GPOs
Mobile Computer on Wheels (MoCow)	A standard Mobile Computer on Wheels (MoCoW) is a roaming/mobile presentation device. Functionality is as follows: <u>Video</u> • Content shall be displayed on an interactive LCD screen which is mounted on a portable trolley/stand. • Available sources for display on the LCD screen shall be: ○ Laptop – HDMI ○ PC (including wireless network adaptor) <u>Conferencing</u> • Should this service be required, it will be available using: ○ All-in-One web conferencing bar with camera, speakers and microphone ○ PC ○ Laptop via USB switcher (If required) <u>Audio</u> • Via All-in-one web conferencing bar with camera, speakers and microphone • Or via the display in-built speakers if no conferencing service required <u>Control</u> • Control for the AV equipment on the trolley including source selection and audio levels shall be via a keypad mounted on the trolley.

Table 2. *Learning & Teaching Spaces*

SYSTEM TYPE	FUNCTIONALITY

Tier 3
General Teaching Space
	Functionality is as follows:
	<u>Video</u>
	• The primary display shall be either a projector, LCD screen or interactive LCD.
	• Where projection is used, the image shall be displayed on a motorised projection screen or the wall if the projection screen is unsuitable and acceptable to the end user.
	• Where an interactive LCD is used, both the room PC and laptop connections should have infrastructure to interact with the display.
	• Should supplementary displays be required in order to meet viewing distance and site line guidelines, these shall all display the same content and be either via:
	  ○ LCD screens
	  ○ Projectors
	• Available sources for display shall be:
	  ○ Laptop – USB-C
	  ○ PC
	  ○ Document Camera (optional)
	<u>Audio</u>
	• DSP for audio processing
	• Audio for program sources shall be via wall mounted passive Front of House (FOH) speakers.
	• In the case of larger spaces – Voice uplift is to be included featuring:
	  ○ One (1) wireless bodypack microphone
	  ○ Logically zoned ceiling speakers to provide coverage throughout the room
	  ○ Voice lift is not to be fed to FOH Speakers
	<u>Hearing Augmentation:</u>
	• A boundary or ceiling hanging microphone
	• This microphone shall remain active all the time as they provided a feed to the hearing augmentation system even when the AV system is off.
	• Both program audio and speech via an Infra-Red (IR) assistive hearing system.
	• Microphones to remain active in the HA mix unless the user actively mutes them.
	• During shutdown, the microphones shall be reset to ensure they are active in the HA mix.
	<u>Control</u>
	• Control for the room's AV equipment including source selection and audio levels shall be via a touch-screen mounted at the Presentation Desk.
	• Control system shall have provisions to be integrated with room lighting, motorised blinds and EWIS as necessary.
	• Control code will be deployed via Mystro on VC-4 Server based control platform.
	• The control system shall be enabled for remote management and support via the Symphony remote monitoring platform.
	<u>Room Linking</u>
	• Rooms can be linked via STP feed, both rooms to be configured with the option to be the primary or secondary room when room is joined.
	• In a joined mode, only the primary room touch panel shall be used to control the AV systems in both spaces, the secondary room panel shall be locked.

SYSTEM TYPE	FUNCTIONALITY

Tier 2
Hybrid Teaching Space
	Functionality is as follows:
	<u>Video</u>
	• The primary display shall be either a projector, LCD screen or interactive LCD.
	• Where projection is used, the image shall be displayed on a motorised projection screen or the wall if projection screen is unsuitable and acceptable to the end user.
	• Where an interactive LCD is used, both the room PC and laptop connections should have infrastructure to interact with the display.
	• Should supplementary displays be required in order to meet viewing distance and site line guidelines, these shall all display the same content and be either via:
	  ○ LCD screens
	  ○ Projectors
	• Available sources for display shall be:
	  ○ Laptop – USB-C
	  ○ PC
	  ○ Document Camera (Optional)
	<u>Audio</u>
	• DSP for audio processing
	• Audio for program sources shall be via wall mounted passive Front of House (FOH) speakers.
	• Voice uplift, Lecture capture & Teams audio via:
	  ○ One (1) wireless bodypack microphone, One (1) handheld microphone
	  ○ Logically zoned ceiling speakers to provide coverage throughout the room
	  ○ Voice Lift is not to be fed to FOH Speakers
	<u>Lecture capture</u>
	• Dedicated lecture capture appliance
	• Rear (Presenter) PTZ camera
	• Audio feed to the lecture capture appliance via DSP
	<u>Conferencing (optional)</u>
	• Microsoft Teams video and audio conferencing, complete with:
	  ○ Resident PC as the M365 Teams client
	  ○ Front (Audience) PTZ Camera
	  ○ Microphone(s)
	  ○ BYOD – Utilise the in-room VC equipment via a laptop USB-C
	<u>Whiteboards (optional)</u>
	Wall mounted buttons trigger via relay camera presets of physical whiteboard areas
	<u>Hearing Augmentation:</u>
	• A boundary or ceiling hanging microphone
	• This microphone shall remain active all the time as they provided a feed to the hearing augmentation system even when the AV system is off.
	• Both program audio and speech via an Infra-Red (IR) assistive hearing system.
	• Microphones to remain active in the HA mix unless the user actively mutes them.
	• During shutdown, the microphones shall be reset to ensure they are active in the HA mix.
	<u>Room Booking</u>
	Each room shall include a wall mounted 10” touch-screen at the entrance showing room bookings from the via the rooms AppSpace timetable.

SYSTEM TYPE	FUNCTIONALITY
	Room Linking • Rooms can be linked via STP feed, both rooms to be configured with the option to be the primary or secondary room when room is joined. In a joined mode, only the primary room touch panel shall be used to control the AV systems in both spaces, the secondary room panel shall be locked.
Tier 1 **Experience Hub**	Functionality is as follows: Video • The primary display shall be either a projector, LCD screen, interactive LCD or LED Wall: • Where projection is used, the image shall be displayed on a motorised projection screen or the wall if projection screen is unsuitable and acceptable to the end user. • Where an interactive LCD is used, both the room PC and laptop connections should have infrastructure to interact with the display. • Should supplementary displays be required in order to meet viewing distance and site line guidelines, these shall all display the same content and be either via: ○ LCD screens ○ Projectors • Available sources for display shall be: ○ Laptop – USB-C ○ PC ○ Student Pods ○ BYOD – Wireless (optional) ○ Document Camera (optional) Pod Screens (optional) • Additional LCD screens can be deployed for student pods displaying content via: ○ Local Input ○ Mirror of the primary room display ○ Control of pod input selection is via main control panel on Presentation Desk Whiteboards (optional) • Wall mounted buttons trigger via relay camera presets of physical whiteboard areas Audio • DSP for audio processing • Audio for program sources shall be via wall mounted passive Front of House (FOH) speakers. • Voice uplift, Lecture capture & Teams audio via: ○ One (1) wireless bodypack microphone, One (1) handheld microphone ○ Ceiling mounted audience microphone ○ Logically zoned ceiling speakers to provide coverage throughout the room ○ Voice Lift is not to be fed to FOH Speakers Conferencing • Native Microsoft Teams video and audio conferencing, complete with: ○ PTZ Camera ○ Microphone(s) ○ Microsoft O365 client ○ BYOD – Utilise the in-room VC equipment via a laptop USB-C

SYSTEM TYPE	FUNCTIONALITY

Lecture Theatre	Hearing Augmentation:
	• A boundary or ceiling hanging microphone
	• This microphone shall remain active all the time as they provided a feed to the hearing augmentation system even when the AV system is off.
	• Both program audio and speech via an Infra-Red (IR) assistive hearing system.
	• Microphones to remain active in the HA mix unless the user actively mutes them.
	• During shutdown, the microphones shall be reset to ensure they are active in the HA mix.
	Control
	• Control for the room's AV equipment including source selection and audio levels shall be via a touch-screen mounted at the presentation desk.
	• Control system shall have provisions to be integrated with room lighting, motorised blinds and EWIS as necessary.
	• Control code will be deployed via Mystro on VC-4 Server based control platform.
	• The control system shall be enabled for remote management and support via the Symphony remote monitoring platform.
	Room Booking
	• Each room shall include a wall mounted 10" touch-screen at the entrance showing room bookings from the via the rooms AppSpace timetable.
	Room Linking
	• Rooms can be linked via STP feed, both rooms to be configured with the option to be the primary or secondary room when room joined.
	• When joined only the primary room touch panel can be used to control the AV systems in both spaces, the secondary room panel shall be locked.
	
	Functionality is as follows:
	Video
	• Content shall be displayed via a dedicated projection system or LED Wall
	• Select spaces may require a second FOH Display or supplementary in-fill LCD screens to meet RMIT viewing distance and angle guidelines.
	• Where multiple screens are installed, all shall display the same content
	• Available sources for display shall be:
	  ○ Laptop – HDMI & USB-C
	  ○ BYOD – Wireless
	  ○ PC
	  ○ Document Camera
	Conferencing
	• The theatre shall be able to make Microsoft Teams video and audio conferencing calls utilising the rooms:
	  ○ High-quality PTZ camera
	  ○ Dedicated microphones
	  ○ Resident PC as the M365 Teams client
	Audio
	• Front of House (FOH) – Play program audio sources
	• Delay speakers (if required)
	• Distributed audio system (ceiling speakers) – Play a mix of speech and program audio.
	• The speakers shall be logically zoned.
	Microphones
	• Each space shall be provided with:
	  ○ 1 gooseneck microphone
	  ○ 2 wireless bodypack microphones
	  ○ 2 wireless handheld microphones.

SYSTEM TYPE	FUNCTIONALITY
	• These microphones shall remain active at all times as they provide a feed to the hearing augmentation system even when the AV system is off. Hearing augmentation: • via an under-floor hearing induction loop system or via IR System. The hearing induction loop shall be an ultra-low spill phased array design. Control • Control for the room's AV equipment including source selection and audio levels shall be via a touch-screen mounted at the Presentation Desk • Control system shall have provisions to be integrated with room lighting, motorised blinds and EWIS as necessary. • Control Code will be deployed via Mystro on VC-4 Server based Control Platform • The control system shall be enabled for remote management and support via the Symphony remote monitoring platform Room Booking • Each theatre shall include a wall mounted 10" touch-screen at the entrance showing room bookings from the theatres Appspace timetable Lecture capture • Where this service is required, the following shall be provided: ○ A dedicated lecture capture appliance ○ PTZ camera(s) as required ○ Audio feed to the lecture capture appliance consisting of speech and program audio ○ Lighting so that the lecturer/teacher is illuminated sufficiently for capture by a camera. The light shall be installed such there is no spill onto the projected image(s) Room Linking • Rooms can be linked via STP feed, both rooms to be configured with the option to be the primary or secondary room when room is joined. In a joined mode, only the primary room touch panel shall be used to control the AV systems in both spaces, the secondary room panel shall be locked.

2.4 Application of Standard System Designs

2.4.1 Overview

f) In general, all audio visual installations throughout RMIT University shall functionally align to the system descriptions within section 2.3 & optioned within allowances detailed in the schematic drawings (refer section 2.13 for relevant schematics drawings).

g) The table below provides information on the Space Classifications that each of the standard designs as well as relevant building blocks can be applied to.

h) Section 2.4.3 below details out the process to have spaces where the functional or design requirements fall outside these parameters approved.

2.4.2 Application of Systems & Building Blocks

a) Reference for usage row in the table below:

- P = Professional S = Student

*Professional category includes: Academic, Researcher, General Staff Member

**Usage of MoCoWs or Microsoft Surface Hubs within learning and teaching environments shall only be in the following scenarios:

- Environments where audio visual hardware cannot be installed
- As a technology aid to facilitate learning & teaching

	Schematic Reference	Marketing Content	Service Area	Workspace - Enclosed	Workspace – Enclosed (Senior Executive)	Stand-up or Project Space	Meeting Room – Small (2-4 Person)	Meeting Room – Medium (6-8 Person)	Meeting Room Large (10+)	Boardroom	Tutorial	Interactive / Lectorial	Lecture Theatre
Usage	-	P, S	P, S	P	P	P	P, S	P	P	P	S	S	S
Occupancy	-	N/A	N/A	2-4	5-10	5-10	2-4	5-10	10+	10+	<120	<120	120+
Breakout Space	AV-S-01			✓		✓	✓						
Basic Meeting Space	AV-S-02			✓			✓	✓					
Medium Meeting Space	AV-S-03			✓	✓	✓	✓	✓					
Large Meeting Space	AV-S-04								✓	✓			
Tier 3 – General Teaching Space	AV-S-05										✓		
Tier 2 – Hybrid Teaching Space	AV-S-06										✓	✓	
Tier 1 – Experience Hub	AV-S-07											✓	
Lecture Theatre	AV-S-08												✓
MoCoW	AV-S-09					✓					✓**		
Digital Signage	AV-S-10	✓											
QTRAC	AV-S-10		✓										
Timetabling Screen	AV-S-10										✓	✓	✓
Microsoft Surface Hub	N/A					✓					✓**		

2.4.3 Departure from Standard System Designs

a) Should there be a requirement to implement a space which falls outside the detailed functionality or pre-defined system designs, a “Dispensation Request Form” must be completed. Refer AV-DOC-04-V4.0-Dispensation Request Form)

b) All efforts shall be made to utilise equipment from the approved AV equipment list (refer: AV-SCH-04-V4.0-AV Standard Equipment List) when a custom design is proposed, otherwise consult ITS.

2.5 Spares

a) For RMIT University to maintain a high level of service & meet existing SLAs, spares are critical to the continuous and reliable operation of university spaces. If a project specification does not include a predefined list of spares, then the Integrator shall refer to this section and follow the spares rule listed below split up into custom and standard equipment. These spares will go into the general support pool but will ensure maximum uptime of installations.

b) Failure to meet these requirements could lead to possible damage to reputation.

2.5.1 Standard Equipment

a) AV equipment listed as standard items with reference to “AV-SCH-04 AV Standard Equipment List – 4.0” shall not be supplied as part of the project delivery and is managed on an ongoing basis by RMIT ITS.

2.5.2 Non-standard Equipment

AV equipment which is not listed as standard items with reference to “AV-SCH-04 AV Standard Equipment List – 4.0” shall have the following rule:

	Quantity of Spare Units to be Provided as Part of the Project Delivery
1 – 3 Units	Confirm with ITS AV
4 – 9 Units	1 spare units
10 – 19 Units	2 spare units
20 – 29 Units	3 spare units
30 – 49 Units	4 spare units
Every additional 20 units or part thereof above 49 units	1 spare unit

2.6 Lectern / Presentation Desk

b) Refer to the RMIT 2026 Furniture Standards Document (Building and safety information - RMIT University)

2.7 Resident Computer

a) A resident computer (Windows/Apple) will be supplied and installed by ITS where required. The AV Integrator shall supply and install the approved monitor arm and PC bracket, run all necessary cabling including labels up the monitor arm ready for PC installation. The AV Integrator is responsible for coordinating the services requirements associated with the PC, for liaising with RMIT for when the PC is required on site, for the video configuration of the resident PC and for coordinating the testing of the PC within the AV system.

2.8 Lecture Capture

b) RMIT uses the Echo360 platform for capturing lectures. Audio, video (copy of the projected image) and a camera input can be captured in a single session. When a booking is made for a specific room and time the capture device encodes audio, video and camera and delivers it to a centralised server system for student access. Note: Camera selection is optional at time of booking. Echo360 Is intended to be deployed for Tier 2 and Tier 1 spaces, upon request and most commonly in Lecture Theatres.

c) Responsibilities for the deployment of lecture capture are as follows:

Order	Task	RMIT	AV Integrator	Comments
1	Purchase of appliance	Yes	Yes	Project dependent
2	Configure appliance	No	Yes	RMIT to provide configuration. Config file to be located in RAVE Sharepoint
3	Provision & configuration of data ports	Yes	No	-
4	Installation of lecture capture appliance into rack & connection to power & data	No	Yes	-
5	Test to ensure all is operational & recording correctly	No	Yes	This is undertaken by the AV integrator logging into a web-browser. The web address & login details shall be provided by RMIT AV

d) Other notes:

1. Network cabling shall be directly connected between the device and the RMIT room network port (i.e. no intermediate network switch) and the lecture capture appliance.
2. Network cabling must comply with the RMIT IT standards for communication cabling for installation and termination (See RMIT Design Standards – Section 10 Communications 4).

2.9 Digital Signage

2.9.1 Overview

a) RMIT uses a cloud based digital signage platform, AppSpace, that integrates directly with the onboard digital signage platform on the display. Deployment of an end-point shall have responsibilities split between the AV integrator and RMIT ITS as follows:

Order	Task	RMIT ITS	AV Integrator	Comments
1	Purchase of Media Player	No	Yes	If Applicable
1.1	Purchase of Signage PC	Yes	No	If Applicable
1.2	Purchase Display	No	Yes	
1.3	Serial Number	No	Yes	Provide Serial numbers via Equipment Schedule
1.4	Pre-Provision	Yes	No	
2	Configure appliance	Yes	No	
2.1	Configure Display	No	Yes	Ye
3	Provision of data ports	Yes	No	
4	Installation of Digital Signage including connection to power & data	No	Yes	
5	Onboarding to AppSpace	Yes	No	

Order	Task	RMIT ITS	AV Integrator	Comments
6	Test to ensure all is operational & displaying correctly	No	Yes	
7	Content Administration	Yes	No	

2.9.2 Display Types – Digital Signage

a) Refer to “AV-SCH-04 AV Standard Equipment List for display types.

2.9.3 Standard Digital Signage

a) RMIT uses AppSpace for Digital Signage. Deployment is via a display device that is compatible with AppSpace.

a) The AV integrator shall confirm location, height, and orientation prior to installation. The LCD screen may need additional security measures installed. This shall be documented in the RFQ/RFT. Refer to “AV- SCH-04 AV Standard Equipment List” for preferred digital signage display.

b) Digital signage displays in all publicly accessible spaces shall be enclosed with a metal shroud with accessibility for the GPOs

c) Special consideration shall be paid to the viewing angles to ensure the content is clearly displayed. The location of the LCD screen shall not be obscured by physical or environmental factors of the installation. The LCD screen location shall be positioned such that it can be easily maintained and accessible for servicing and client interaction.

d) As a part of the design, power and data requirements shall be allowed for control and network connection of all items installed.

2.9.4 Timetabling / Room Booking Panels

a) The timetabling information is called up via the AppSpace custom card and follows a similar deployment process to Digital Signage. *Note: Timetabling Screens are referred to as Room Booking Panels in Learning spaces.*

b) Timetabling screens should be installed with the bottom edge of the touch display positioned at 1050mm above finished floor level (AFFL) to ensure accessibility for all users.

c) Screens for meeting room should be supplied with a light bar kit to provide a visual indication of room availability

2.9.5 QTRAC (Queue Management)

a) Currently RMIT uses AppSpace to display QTRAC queue management information. The deployment should be the same as a standard digital signage system (refer 2.8.3) with the addition of an interface & suitable mount to allow people to join the queue if required.

b) Should a public interface be required:

1. The interface shall be an RMIT supplied AIO PC
2. The AIO PC shall be mounted with the following considerations:
3. Compliance with current DDA regulations
4. Security against theft

2.10 Custom Designs

a) Where system requirements are outside of the documented standard design & functionality, a custom design that builds on a standard design can be considered.

b) A dispensation form must be completed for all custom designs including schematics and a project brief.

c) In order of preference, all custom designs must take the following approach regarding equipment selection:

1. Use equipment listed in the RMIT AV Standard Equipment List (AV-SCH-04).
2. Use equipment by one of the existing approved manufacturer suppliers from the RMIT AV Standard Equipment List (AV-SCH-04).

d) In addition, the following must be considered:

1. Why is a standard install not suitable?
2. What is the impact of not providing the requested functionality?
3. What is the impact on maintenance/support?
4. What is the impact on operational management?
5. What is the impact on lifecycle?
6. What is the impact on the project timeline/program?
7. What are the control measures put in place to reduce operational risk to RMIT?
8. Does the recommended equipment support RMIT's commitments to environmental performance, carbon reduction and energy efficiency?

2.10.1 Video Conferencing

a) RMIT uses the Microsoft M365 suite of applications for video conferencing. In particular, Microsoft Teams.

b) All video conferencing designs must be approved by RMIT AV prior to implementation.

c) Specific settings and configuration requirements shall be enabled from RMIT ITS at the time of deployment.

2.10.2 Event Spaces

a) Spaces flagged for event usage shall be assessed and designed on a case-by-case basis. It is for this reason that there is no specific event space design in the RMIT AV Standards.

a) Below details general guidelines which should be considered for all projects which incorporate event spaces.

<u>Video</u>

1. Primary display as single or dual. If dual, both shall show the same content as the default.
2. Supplementary displays
    I. Installed
    II. Portable
3. Cameras. Provision for:
    I. Record:
        - Lecture capture with installed camera
        - Camera operator positions
    II. Live feed
        - Camera operator & video input location
4. Multiple stage position inputs/outputs
5. Multiple control position inputs/outputs
6. Ability to feed the high-quality camera to the PC via USB for integration into Microsoft Teams. Any USB connection should not require the PC to have dedicated drivers.
7. Room linking / overflow via approved switcher solution

b) Minimum requirement of 1080p with preference for 2160p as required

<u>Audio</u>

8. Appropriately specified speaker system with delays if required.

9. Speaker setup and zoning
10. Appropriate quantity of microphones for identified usages as well future usages:
    I. General presentation
    II. Panel discussion
    III. BOH/crew/stage manager system
    IV. Provisions for Analogue or Digital Wireless Systems
    V. Ability to feed the high quality audio mix to the PC via USB for integration into Microsoft Teams. Any USB connections should not require the PC to have dedicated drivers.

Control

11. Minimum of two 10" wired touch-screen interface
12. Touch-screen location:
    I. Stage location
    II. Control location
    III. BOH/rack location
13. Provision for basic & advanced controls

Environmental considerations (list is not exhaustive)

14. Acoustic:
    I. Existing room acoustic properties
    II. Required treatments to deal with long reverb times
15. Lighting
    I. Illumination of key areas:
        - Stage – presenter
        - Stage – panel discussions
    II. Vertical illumination (no down lights)
    III. Task lighting
    IV. Camera lighting
    V. Ability to use theatre lighting & provision of:
        - Dimmers
        - Dimmed lighting outlets
        - DMX/IP runs for lighting control
        - Lighting position
16. Mechanical
    I. Noise or high air-flow (proximity to microphones)
17. Plant noise transfer
18. Furniture layout, position and design to allow:
    I. Inclusion of participants in the discussion
    II. Capture of participants by the camera

c) All event space designs must be approved by RMIT AV prior to implementation.

2.11 Lighting

2.11.1 Teaching Spaces

a) Lighting integration with AV Systems to be determined on a case-by-case basis. If Lighting integration does not exist, electrical changes must be made to allow lighting above displays to be turned off on a separate circuit switch.

b) The electrical contractor shall be responsible for providing and installing lighting dimmers along with either an RS232/RS485 or LAN interface that is communicable to the AV system. The AV Integrator allows for RS232/RS485 to LAN interface that is communicable from the AV VLAN.

c) Total number of pre-sets will depend on room size, layout and lighting design.

Button	Function	Notes
Full	Lighting Pre-set	All circuits to 100%
High	Lighting Pre-set	All circuits at 70%
Medium	Lighting Pre-set	All circuits at 40%
Low	Lighting Pre-set	All circuits at 20%
Scene 1	Lighting Pre-set	AV scene 1 Projection surface / Presentation area at 0% Room at 50% Isle lights at 60%
Scene 2	Lighting Pre-set	AV scene 2 Projection surface / Presentation area at 20% Room at 70% Isle lights at 80%
Scene 3	Lighting Pre-set	AV scene 3 Projection surface / Presentation area at 0% Room at 0% Isle lights at 20% – To minimum BCA requirements
Off	Lighting Pre-set	All circuits off

d) The following specifications are also to be considered:

1. Include lux levels of minimum 600Lux for the presenter for the spot lighting (if applicable)
2. Stage Lighting – Minimum 700 lux (horizontal) on the stage area
3. Seated Area – Minimum 600 lux (horizontal) on the entire seated area when in video conferencing mode.
4. Colour temperature of all lights to be between 3000K and 4000K and consistent across the space.
5. The rear wall is to be evenly lit and must not appear to be darker or brighter than the audience area during videoconferencing.
6. Light fittings with low specular reflection / glare to be utilised so that the illuminance contrast between luminance and the projected image is achieved.

2.11.2 Meeting Rooms

a) Meeting Rooms are often designed for video conferencing. It is the responsibility of the lighting contractor/designer to ensure that the lighting environment is fit for purpose, however as a baseline, the following specifications are to be considered:

1. 400-500 lux on the face / vertical.
2. Lights to be 4000K with a colour rendering index (CRI) of greater than 80.
3. Ideal contrast levels of face to wall/desk of 1:1.5. Cameras are most sensitive to changes in contrast so minimising contrast between the faces and the environment is the primary goal.
4. Highly diffused lighting is required to minimize shadows and therefore minimise contrast. Downlights are not suitable in meeting rooms.
5. Lights should have an UGR of 19 or lower.
6. The light source should be at a height to not be visible in the camera feed.

7. Provide details of furniture selection surfaces and finishes for web conferencing rooms.
8. List Interior design requirements such as wall and furniture finishes and colours.
9. Table surface is illuminated at approximately 50% – 60% lower that the participants in the room.
10. Seated Area – Minimum 600 lux (horizontal) on the entire seated area (not the table surface).
11. Define requirements in a percentage for the variation in illuminance uniformity for the web conferencing spaces.
12. Participant faces are illuminated from the correct angles to ensure that faces are free of shadows.

2.12 Communications Rooms

2.12.1 General

a) Refer to ITS standards for Communications rooms requirements.

2.12.2 Room Size Requirements

a) Refer to ITS standards for Communications rooms requirements.

2.13 Reference & Supplementary Documentation

a) The RMIT AV Standards shall be read in conjunction with the following documents. For installations completed under previous standards, please check the relative standards document for reference:

Document No.	Document Type	Document Name/Description
AV-C-00	AV Cover Page	Index Summary Page
AV-S-01	AV Schematic Drawing	Meeting/Collaboration (Breakout Space)
AV-S-02	AV Schematic Drawing	Meeting/Collaboration (Basic Meeting Space)
AV-S-03	AV Schematic Drawing	Meeting/Collaboration (Medium Meeting)
AV-S-04	AV Schematic Drawing	Meeting/Collaboration (Large Meeting)
AV-S-05	AV Schematic Drawing	MoCow (Mobile Computer on Wheels)
AV-S-06	AV Schematic Drawing	Digital Signage
AV-S-07	AV Schematic Drawing	Lecture Theatre
AV-S-08	AV Schematic Drawing	Tier 3 Teaching Space (General)
AV-S-09	AV Schematic Drawing	Tier 2 Teaching Space (Hybrid)
AV-S-10	AV Schematic Drawing	Tier 1 Teaching Space (Experience Hub)
AV-E-02	AV Elevation Drawing	Teaching Space Display (Indicative)
AV-E-03	AV Elevation Drawing	Lecture Theatre – Single Image (Indicative)
AV-E-04	AV Elevation Drawing	Lecture Theatre – Dual Image (Indicative)
AV-D-01	AV Detail Drawing	Rack Elevations
AV-D-02	AV Detail Drawing	Academic's Desk Layout - Teaching Spaces
AV-D-03	AV Detail Drawing	Viewing Guidelines
AV-D-04	AV Detail Drawing	Indicative Eqiuptment Layout (Display Device)
AV-DOC-01	AV Document	RMIT AV Standards
AV-DOC-02	AV Document	RAVE Commissioning Guidelines
AV-DOC-03	AV Document	RAVE Programming Guidelines
AV-DOC-04	AV Document	Dispensation Request Form
AV-SCH-01	Schedule	AV Equipment Schedule
AV-SCH-02	Schedule	AV Test Script (Standard AV)
AV-SCH-03	Schedule	Room Audio Measurements
AV-SCH-04	Schedule	AV Standard Equipment List

Document No.	Document Type	Document Name/Description

3 AV SYSTEM DELIVERY/DEPLOYMENT

3.1 Overview

a) This section details:
   1. Installation quality & guidelines
   2. Regulatory compliance
   3. Technical requirements/settings for hardware

3.2 Standards & Regulations

a) All AV systems must comply with the relevant rules and requirements of the following standards and regulations:

ANSI/AVIXA A102.01:2017	Audio Coverage Uniformity in Enclosed Listener Areas
AS/NZS3000:2007/Amdt 2:2012	Electrical Installations.
AS/NZS2107:2016	Acoustics – Recommended design sound levels and reverberation times for building interiors
AS/NZS3760-2010	In-service safety inspection and testing of electrical equipment
AS3080:	Integrated Telecommunications Cabling Systems for Commercial Premises.
AS3084:	Telecommunications Installation, Pathways and Spaces for Commercial Buildings.
AS1127 PT 1-9 inc:	Sound System Equipment.
AS1044	Limits of Electromagnetic Interference
AS1428.1	Australian Standard AS1428.1 (2017) – Design for access and mobility, Part 1: General requirements for access – New building work (AS1428.1)
AS1428.2	Australian Standard AS1428.2 (1992) (R2015) – Design for access and mobility, Part 2: Enhanced and additional requirements – Buildings and facilities (AS1428.2)
AS3250:	Approval and Test Specifications – Mains Operated Electronic and Related Equipment.
IEC118-4	Electro acoustics – Hearing aids – Part 4: Induction loop systems for hearing aid purposes – Magnetic field strength
TS 001, TS 008 and TS 009:	ACMA Technical Specifications.
CE marked:	Complying with EEC directives 73/23 “low voltage” and 89/336 “electromagnetic compatibility”.
C-tick:	Complying with Australia and New Zealand EMC Framework requirements.

BCA / NCC	Building Code of Australia 2016 (BCA)
DDA	Commonwealth Disability Discrimination Act 1992 (DDA) Commonwealth Disability Standards for Education 2005 (Education Standards) Victorian Building Act 1993 Victorian Building Regulations 2006
RMIT Communications Standard	Section 10 – Communications (http://www1.rmit.edu.au/propertyservices/dsb)
AS3760:2010	In-service safety inspection & testing of electrical equipment

3.3 Definitions

a) The following definitions apply to this document:

Accessible	An area to which access may be gained without difficulty. This can include the removal of a door, screwed panel, removable ceiling panel, hatch or the like. Access can be gained by use of ladders, planks or similar equipment if needed.
Approved / Approval	Acceptable for the works in the opinion of the Principal. The approval of any documentation or departure from the original scope does not diminish the contractor's obligations.
Authorities	Means statutory bodies or inspectors of such bodies having jurisdiction over the works under relevant current regulations and statutes.
AV Consultant	The Company that provides the overall technical design and direction required to apply the requirements of this document to a specific place. The AV consultant may be either an external consultant from the approved RMIT Design Panel or member of the RMIT AV Design team.
AV Integrator	The company bound to carry out and complete the AV work (including situations where the AV works is a sub-contract to the Builder).
Contract	The agreement between principle and contractor with reference to the RFP/RFT to complete the works.
Contractor	The company, its staff, agents, or sub-contractors that enters into an agreement to complete the works requested.
Defects Liability Period	Is a set period after a project has been completed during which the contractor is obligated to warrant all goods and services supplied.
Document	The term "Documents" means all related drawings, specifications, and associated sketches, schematics.
Install	Set out, erect, mount, align, fix, connect, adjust, integrate test and commission and hand over in proper working order and shall ALSO mean, unless stated clearly to the contrary, supply of the item(s).
Instruction	A direction issued to the Contractor by the principal or their nominated representative
Practical Completion	The Actual date all works are completed and accepted into service; this is nominated by the principal.

Principal	RMIT AV Governance Lead or nominated RMIT representative.
Project Manager	The role responsible for the project who will liaise with all relevant parties to schedule and complete relevant works. Depending upon the scale of the project, a specialised IT project manager may be assigned to directly manage AV works in addition to the lead project manager.
Provide	Supply, install and commission.
Relocate existing	Remove the existing item from its current location. Reinstall, reconnect, and test it to ensure it is ready for use at the new specified location.
Remove existing/decommission	Remove/decommission existing equipment and return item to RMIT.
Return	Remove/decommission existing equipment and return item to RMIT. Provide new as indicated in the design
Specialist Contractor	The company that is engaged by the AV Integrator to carry out specialist areas of the AV Contract.
Submit / Review	Supply information to the Principal for review.
Superintendent	Is the project Sponsor or the nominated representative.
Supply	Purchase, obtain, store off site as necessary, deliver to site, and off load, position, store and protect on site.

3.4 Intellectual Property

a) The AV Integrator responsible for providing AV services to the University must assign rights in all design and programming to the Principal at Practical Completion. Such rights shall be non-exclusive but must include the right to modify and/or re-use elsewhere within the University.

b) This section applies to all programmable devices including, but not limited to, AV switching equipment, control systems and audio DSP devices. All source code must be provided in a format that is editable by any suitably qualified programmer. The AV Integrator must provide all support programs necessary for the authoring and modification of such code. All control system source codes, DSP and switcher and all other device configuration files become the intellectual property of the university once the system has been handed over.

3.5 Procurement

a) Procurement policy thresholds shall be followed with procurement of AV equipment and installation requests.

b) Please refer to RMIT AV Procurement threshold guidelines for further details.

c) Any bespoke room installation request estimated to exceed $250,000 shall be sent to the Procurement Panel.

d) **This panel must be used for all RMIT projects/purchases involving AV equipment and services over the value of $250,000.**

3.6 Authorities

a) Installed AV systems shall comply with the following, whether specific reference has been made in the AV specification or not:

1. Relevant State or Territory Electricity Regulations
2. Australian Building Codes Board (ABCB)
3. Human Rights and Equal Opportunity Commission (HREOC)
4. Australian Communications and Media Authority regulatory and licensing requirements

5. Workplace Health and Safety
6. AETM Design Guidelines for Tertiary Teaching Spaces
7. RMIT endorsed ANSI / AVIXA standards

b) All contracting staff members involved in the Design, Install, Commission, Programming and Certification of a RMIT Project shall be certified by the relevant Governing body and be accredited by the manufacturer to perform the required works. The contractor must supply proof of certification in the response to any RFP for both the company and its staff where required.

3.7 Design for Maintenance and Serviceability

3.7.1 Requirement

a) The AV Integrator shall be responsible for ensuring all installed AV systems are easily maintainable and serviceable by the Principal or their chosen representative. In particular, the following principles shall be adhered to:

1. Where ceiling mounted projectors are installed in spaces with tiered floors or fixed seating, the projector shall be positioned in clear space with a flat floor for ease of access.
2. Projectors must be installed on a motorised lift when:
    I. Ceiling mounted projectors are installed above raked seating.
    II. Ceiling mounted projectors are installed 3m above finished floor level.
    III. Ceiling mounted projectors are installed in any other situation where easy servicing of the projector would not be possible.

b) When a motorised projector lift is installed, it must lower the projector to a service position at 1200mm above finished floor level. Any equipment associated with the projector must be lowered with the projector for serviceability and ease of access. Cables traversing the Lifter's scissor shall be flexible fly leads and suited to the task. All cables feeding the projector shall be terminated at the top of the lifter in an accessible location if the need to replace arises.

c) The AV Integrator shall ensure that all other AV equipment is installed with due consideration to service access.

d) Control of the projector lift will be via a password-protected page on the touch panel.

e) To maintain the AV systems intended functionality, user experience, security, and maintainability, the system requires an approved RMIT teacher's station or lectern. The standard furniture allows for equipment from the ITS-AVS Audio Visual Standards to be accessible and uniform in all spaces. The joinery may be existing, supplied by RMIT Property Services or the Integrator. Should the AV contractor need to provide joinery, this will be stipulated in the scoping document and tender process. The joinery will be sourced through RMIT approved partners.

3.8 Workmanship – Installation

3.8.1 Work

a) AV Integrators must carry out all work to a high standard and in a professional manner using competent and experienced personnel who shall be properly supervised. All work must comply with Australian Standards, University Standards and industry best practices for AV and ITS. Integration staff must hold appropriate manufacture and industry level qualifications for the equipment they are installing, or tasks being undertaken.

b) In all cases the AV integrator shall install the system with the guidance of this document considering the workspace the system is being installed in. The function of the workspace cannot be compromised by the AV install and the install shall conform to the overall concepts set out in the areas design.

c) RMIT requires that all contractors follow approved procedures and apply for permits for certain works. Further information is available on the RMIT property services web site (https://www.rmit.edu.au/about/our-locations-and-facilities/facilities/safety-security/building-and-safety- information) or the Project Manager.

3.8.2 Provision of a Fully Working System

a) The AV Integrator must supply all items necessary to provide a fully working system in line with the AV specification/documentation, design intent and any relevant statutory authority, whether specifically mentioned within the documentation or not.

b) A fully working system must include commissioning and co-ordination of all subsidiary systems that interface with the AV system, including, but not limited to:

1. University LAN/WLAN/WAN
2. Dimmer/Lighting control (if applicable)
3. Motorised blinds/curtains (if applicable)
4. Joinery, cupboards and locks
5. Lecture Capture
6. Video Conferencing
7. Teaching PC

c) Should there be any issues with the installation, the AV integrator may be required to return to site to assist in the rectification works.

3.8.3 Equipment

a) A detailed list of RMIT approved AV Equipment Commissioning Guidelines (eg. Airmedia, QSYS core DSP file deployment templates) is provided as a supplementary document to these Standards. Refer to Section 2.1.

b) Alternative products and design approaches may be considered and approved if deemed equivalent and necessary by the Principal. When nominating an alternative product or design, the AV Integrator / AV Consultant must:

1. Demonstrate that it meets or exceeds the specification and usability of the nominated equipment or design approach
2. Demonstrate the reason for the departure from the standard. This reasoning must be captured in a formal dispensation request form which is to be lodged and approved prior to the installation works proceeding.
3. Adhere to RMIT “Spares” rule. Refer section 2.5

c) If approval for a departure from the AV standards has not been formally requested, the Principal reserves the right to reject any proposed alternatives and maintain the specified item to be installed at no cost penalty.

d) Supply and install all necessary brackets and secondary materials to support the AV equipment.

e) Where a colour is specified for any product (including cables and connectors) it must be interpreted as a requirement.

f) The Principal may have some of the equipment or licenses needed to complete the installation. This information will be known and conveyed to the AV Integrator at the design approval stage of the project prior to equipment procurement.

3.8.4 Supply of Equipment & Warranty

a) The Principal will not accept equipment unless: (Note: AV designs shall not compromise manufactures’ warranty requirements eg. Use of specific Amps that would otherwise void the Speaker Warranty)

1. It is procured in a timely manner through formal channels via the manufacturer or their appointed Australian representative.
2. It is fully warranted for commercial use in Australia by the manufacturer.
3. It is well supported in Australia with technical support and spare parts (including timely replacement of faulty parts).

b) All installations and equipment shall be warranted for a period of at least 12 months from the date of Practical Completion unless otherwise specified.

c) Warranty details are to be provided in the Equipment Schedule as part of the AV deliverables at the end of the project. Refer section 4.1.1 for information on the AV deliverables package.

3.8.5 Delivery, Handling & Storage/Sealed Containers

a) Deliver, unload and store in a secure area (in accordance with manufacturers' instructions where applicable) to prevent damage, deterioration and/or loss. If materials or products are supplied by the manufacturer in sealed containers or packages, delivery and storage of the products to point of use is to be in the original containers or packages. The exception to this would be racks and their contents built off site. The AV vendor will remove all empty packaging materials from the site upon installation.

3.8.6 Protection

a) Protect all installed AV equipment for the duration of the project from damage from any source until Practical Completion of the project.

b) Considering the benchmarking and recent issues with damage on site:

1. AV vendor is responsible for ensuring any equipment that is open and left on site shall be properly protected to prevent damage by others.
2. AV vendor is responsible for ensuring they have sufficient staff available to transport or receive the goods while adhering to the health and safety requirements of RMIT.

3.8.7 Product Certification

a) Use all products according to any certification requirements. Any product or portions of an installation that needs to be certified shall have the certification documents included in the As-Built section of the deliverables. E.g. Hearing Augmentation System.

3.8.8 Installation

a) Install materials and equipment in accordance with manufacturer's recommendations, applicable standards and any directions in this document. Clarification from the Principle is required if this document or the specific installation compromises the manufacturers' instructions.

3.8.9 Asset Register & Labelling

a) All installed equipment requires the creation of an asset register and an asset label affixed by the AV Integrator. The Principal will supply the AV Integrator with RMIT labels.

b) An 'AV Equipment Schedule' which includes an asset register field will be issued by the Principal at the commencement of the project. Refer to the appendix.

c) Asset labels are to be applied according to the following guidelines:

1. 1 x Asset label is to be installed, but not limited to, the following equipment:
    I. All AV Hardware (except those items noted under item B Below) – remove all individual items except those that have a specific asset tag location. (ie. bodypack Mics)
    II. Touch panels
        - Wall mounted – on backing box or inside flange
        - Table mounted – on rear of front interface
    III. Bodypack microphones – on the inside of the battery cover
    IV. Handheld microphone – on rear of microphone but not to hinder docking of mic in charging station
2. The following equipment does not require asset labels:
    I. Cables
    II. Passive adaptors
    III. Connection plates

IV. The physical AV rack/s

V. Power supplies associated with equipment above (refer section ‘a’)

VI. Mounting trays and brackets

3. Asset labels are to be installed as follows:

I. 1 on each item detailed in section ‘a’

II. Location:

- Top, side, rear or bottom of the unit in a location that is not part of a removable accessory (e.g. panel/cover or lid). Asset labels shall be placed in a spot that can be seen without having to remove the piece of equipment.
- No asset Labels are to be placed on the front of any units (excluding AV rack equipment). Asset labels shall be placed in a spot that can be seen without having to remove the piece of equipment.
- In general, preference is for asset labels to not be easily visible to everyday users but ideally accessible and visible to support staff:
  - Handheld microphone – on rear of microphone but not to hinder docking of mic in charging station
- Labels are not to cover any serial number, part number, functional label, or description on the device

d) See the ‘Deliverables’ section of this document for further information.

3.8.10 Fastenings

3.8.10.1 Requirement

a) All equipment including projectors, flat panel displays etc., shall be firmly fixed in position.

b) The AV Integrator must obtain all engineering certifications for suspended equipment as required. Selection and installation of the fixing shall be made in accordance with the manufacture’s data/specification information and the engineering advice.

3.8.10.2 Type

a) Use threaded fasteners to allow removal and replacement. Galvanised expanded metal anchor type should generally be used in masonry and concrete. Material shall be selected which will avoid corrosion. Select fastener appropriate for duty and loading.

3.9 Locks

3.9.1 Padlocks & Barrel Locks

a) RMIT requires audio visual equipment to be secured against theft and misuse by installation of locks. The provision of locks is as follows:

Item	Lockwood Lock Code	Description	Keyed To	Accepted Usage	Access	Picture	Provided By
1	693ASCMT5+	693A Cupboard Lock SC	RIA.2	All AV Cupboards and All External AV Racks should have the barrel removed and replaced with 693ASCMT5+	• ITS Field Services • AV Support Technician		AV Integrator
2	693ASCMT5+	693A Cupboard Lock SC	RIA2.1	Cupboard/drawer housing user equipment (e.g. wireless microphones, mouse etc)	• ITS Field Services • AV Support Technician		Property Services

Item	Lockwood Lock Code	Description	Keyed To	Accepted Usage	Access	Picture	Provided By
					• Academic Staff		
3	334B45/138/M T5+	334 Brass Padlock 38mm shackle	RIA.2	Projector cages	• ITS Field Services • AV Support Technician		AV Integrator

b) RMIT shall be responsible for:

1. The order, supply & installation of all locks relating to all cupboard / drawer / joinery housing AV equipment.

c) The AV consultant / integrator shall be responsible for advising RMIT on the quantity of locks required & usage so they can be ordered & keyed appropriately.

d) The AV Integrator shall be responsible for:

1. The order, supply & installation of locks relating to AV equipment as per the above table. Please refer to the AV Key Lock Request form, located here: https://www.rmit.edu.au/about/our-locations- and-facilities/facilities/safety-security/building-and-safety-information. Locks shall be ordered via Property Services preferred lock smith provider. The AV Key Lock Request form shall be sent directly to Property Services lock smith provider for procurement. This is subject to approval by the AV Governance and Strategy Lead.

3.9.2 Kensington Locks

a) The following equipment requires a four (4) barrel Kensington lock:

1. All document cameras
2. Computers (teaching spaces, meetings rooms, MoCoWs, Digital Signage) – unless PC is secured inside of locked AV cupboard
3. Projectors

b) The requirement shall not apply to the listed device types that do not include a Kensington lock.

3.9.3 Combination Locks

a) A combination lock may **only** to be used for service panels on presentation desk equipment racks and only in an instance where a RMIT keyed barrel lock is not suitable.

b) Combinations to be provided by RMIT

3.10 Painting and Finishes

3.10.1 Requirement

a) Refer to current PSG design standards.

3.11 Penetrations

3.11.1 General

a) Prior to undertaking any penetrations, the AV integrator shall obtain approval from RMIT Property Services and/or an RMIT approved structural engineer.

b) Penetrations should be sealed in accordance with RMIT Property Services and current BCA requirements.

3.11.2 Acoustic

3.11.2.1 Requirement

a) Acoustically seal penetrations for cables, conduits, ducts and busways passing through acoustic rated floors and walls to maintain the acoustic properties of the floor or wall.

3.11.2.2 Reverberation Times and Noise Rating Targets for AV Spaces

a) Meeting Rooms with AV System – reverberation time 0.4 max ambient noise levels <45db.

b) Learning Spaces with AV System – reverberation time 0.6 max ambient noise levels <45db.

c) Speech transmission index (STI); for Lecture theatres and flexible teaching/learning spaces a minimum STI of 0.7 shall be achieved.

d) Acoustic Levels for Spaces without AV as per RMIT Design Standards Section 10.

3.11.2.3 Materials

a) Submit details of each type of acoustic seal system proposed. Provide a cable transit system of approved manufacture and acoustic properties where required.

3.11.2.4 Skirting Ducts

a) Provide acoustic treatment to skirting ducts when passing through acoustic rated walls as specified above.

3.11.2.5 Multi Cable Access

a) Where multiple cables are required to pass through the acoustic barriers enclose cables in a 1.6 mm thick sheet steel enclosure packed with 32 kg/m3 insulation. Seal the duct to the acoustic barrier with a flexible sealant of specific gravity 1.5 or greater. Design the access duct to have at least one 90° bend prior to penetrating the acoustic wall. Elsewhere, wrap cables in 4.5 kg/m3 ‘loaded vinyl’ faced with 25 mm thick insulation sheet and seal to the acoustic barrier with flexible sealant as specified above.

3.11.2.6 Single Cable Access

a) Where single cables are required to pass through acoustic barriers, repair penetration and seal the cable to the acoustic barrier with a flexible acoustic rated sealant.

3.12 Equipment Racks

3.12.1 General

a) Provide IEC60297-compliant equipment racks complete with:

1. All equipment fixings
2. Power distribution and control
3. Chassis runners
4. Shelving and ventilation
5. Ventilation or tamper-proof panels as required

b) Doors are not required unless specified.

c) Access to AV Racks or rack locations to be secured by AV key access. (Refer to Section 3.9.1 for type information).

d) All equipment racks shall be powder coated in non-reflective black, including cable trays & shelving (if available) unless otherwise specified.

e) All racks shall be installed with clear access to both front and rear to ensure ease of service to the AV system. They shall have vent panels to cover all spare slots to ensure proper airflow.

3.12.2 Construction

a) The following manufacture/models will be accepted. Any alternatives will require approval by the Principal.

1. MFB Series 2005B
2. Rack Technologies 19” C series
3. Elgee Zip Rack (Up to 24 RU)
4. Rack World Systems – Slide & Rotate Rack – M6 Tapped Holes

b) **In cases where the AV rack is larger than 24RU, Elgee Zip Racks are deemed to be not a suitable option.**

3.12.3 AV & Communications Racks

a) All AV equipment shall be housed separately from communications equipment and must not reside in the same cupboard or rack. Refer to section 2.11 for more information regarding Communication Rooms and Rack requirements.

3.12.4 Installation Configuration

a) Below is a table which indicates the appropriate rack selection based on environmental room conditions.

Green = Yes/Required

Orange = Optional

Red = No

Black = N/A

Rack Type	Joinery	Kicker	Joinery Door (c/w cut-out)	Joinery Door Lock	Rack Security Screws	Rack Security Grills	Rack Door Front	Rack Panel Rear	Rack Panel Top	Rack Panel Sides	Wheels	Rack Tether for Security
Rack World Systems												
Elgee/ Rack Technologies /MFB												
Elgee/Rack Technologies /MFB												

b) If the specifics of the project are outside the parameters of the above table, advice shall be sought by RMIT AV.

3.12.5 Rack Panels

3.12.5.1 Top and Side panels

a) Supply colour-matched side and top panels from the same series as the racks. Where multiple racks are installed side-by-side, bolt adjacent racks together via baying kit and provide side panels for the outer faces only.

b) All panels are to be secured by security screws to prevent unauthorized access or removal of equipment installed within the rack.

3.12.5.2 Rear Panels

a) If required, supply colour-matched rear vent panels from the same series as the rack(s). E.g. Acceptable rear vent panel for 12RU Elgee Zip Rack is: Part No.: Z610-0060-B (Qty 2)

b) All panels are to be secured by security screws to prevent unauthorized access or removal of equipment installed within the rack

3.12.6 Ventilation

a) Ensure adequate ventilation for all mounted systems. Natural ventilation shall be used wherever possible and appropriate. Coordinate size of ventilation louvers or equivalent in joinery with builder. Racks above 24U or wherever a large heat load is generated shall have a vented top panel or 'pop top.' Rack mounted mechanical ventilation units shall be provided where natural ventilation is not sufficient. In general, noise produced by ventilation units shall not be audible in the audience or presentation areas.

b) The recommended internal temperature for AV racks shall be maintained at approximately 24°C ± 2°C to ensure optimal and longevity of equipment performance. The PDUs installed within AV racks shall also be equipped with built-in temperature sensors to monitor heat levels and prevent them from overheating.

3.12.7 Dimensions

a) Where not specified, rack height shall allow installation of all nominated equipment and necessary ventilation plates, as well as provide convenient access to equipment for maintenance and programming. Racks installed for custom (non-standard) deployments shall allow a minimum of 20% spare capacity for future equipment.

b) Equipment racks 24RU or less shall have a minimum clear internal depth of 700 mm. Equipment racks larger than 24RU shall have a minimum clear internal depth of 800 mm. Where rack footprints are specified, they shall be read as a requirement. AV Integrator must allow for fitting of standard and nonstandard height/width rack mount equipment.

c) The minimum width for a rack opening in joinery or built cupboards is 600 mm clear of all obstacles. The 600 mm is not to be encroached on by hinges, locks, handles or services terminated in the cupboard. When positioning a rack or joinery for a rack the service position must be taken into account to ensure the rack is not fouled in any way. The serviceability of the rack and its equipment is key to the maintaining the system and having a timely response to system outage calls.

d) When installing smaller equipment racks within joinery, the rack shall be able to be removed from the space and pivoted ninety degrees to provide clear access for maintenance without straining any connected cables.

e) Equipment racks installed within a comms room must have at least a 1 m clearance front and back for accessibility and serviceability.

3.12.8 Rack Bolts & Nuts

a) For equipment racks:

1. M6 zinc plated cage nut installed in every rack position
2. M4 (Mid Atlantic) or M6 (Others) snake eye security screws are required. Snake Eye security screws suited to size 14 snake eye driver bits.
3. Slotted bolts and those with a countersunk head shall not be used.
4. Plastic cup washer to suit
5. Fibre and steel washers shall not be used
6. Observe all tamper and security requirements in section 3.12.10

3.12.9 Equipment Placement

a) Place any equipment required by the user at an appropriate height to facilitate easy loading of media. Equipment in this category include Blu-ray, PCs etc. Ensure the controls on user accessible equipment and the Blu-ray drive and USB ports on PCs are visible and accessible, especially in short racks.

b) Place all other equipment in racks/joinery with regard to:

1. Efficient cooling
2. Ensure vents are unobstructed
3. Allow extra space around/between amplifiers etc

4. Serviceability
5. Access to front and rear for programming, cabling etc
6. Logical cabling
7. Group like cables where appropriate
8. Maintain appropriate cable segregation
9. Reduce inter-rack cabling
10. Occupational health and safety
11. Place heavy equipment low in the rack

3.12.10 Accessories

a) Equipment racks shall be provided with any accessories required to provide a complete system including, but not limited to:
   1. Rack trays
   2. Vent panels
   3. Commercial power strips or Power Distribution Units (domestic power boards are unacceptable)
   4. Looming/lacing bars and other cable management devices
   5. Support brackets
   6. Doors (where specified)

3.12.11 Tamper/Theft protection

a) To ensure continued correct operation after AV systems have been equalised and calibrated, install tamper proof devices over any exposed knobs, switches or other controls on:
   1. Amplifiers
   2. AV switcher
   3. Signal processing equipment
   4. Any equipment with front-panel power switch
   5. Any equipment where operation of front panel controls may affect operations via the control system

b) Devices with only configuration or selection buttons on the front panel such as AV switchers, receivers, etc., shall be secured by manufacturer based lockout codes where available.

c) Devices which can be reconfigured over the University network or network management interfaces shall be secured in a manner compliant with RMIT security policies. Devices that cannot be secured by means of a password (minimum requirement) must be assessed and approved by the Principal for use as a precaution.

d) To prevent theft or unauthorised removal of equipment, the following security measures are to be used:
   1. Rack equipment must be secured by a locked door or security screws where no door is installed.
   2. Non-rack styled mounting equipment is to be secured by screws or industrial strength Velcro with consideration given to serviceability.
   3. USB and other portable items are to be secured by combination Kensington brand lock. Code to be set to current RMIT AV Security Code.
   4. Bodypack and handheld microphone base stations are to be fixed to presentation desk.
   5. Lecterns must be equipped with Combination-locks to restrict unauthorized access.

3.12.12 Cable Separation

a) AC power cable and feeder cable for hearing augmentation loops shall be separated from all other cables according to standards and to manufacturers' specification.

b) High level signal cables, low level signal, RF and control cabling shall be separated where possible. Minimum separation between AV cabling and other services must not be less than 150 mm. Separation between AV cabling and electrical services must be minimum 300 mm and only cross at right angles.

c) Cable runs must be parallel or at right angles to the building line.

3.12.13 Cable Support

3.12.13.1 Catenary

a) Where required, catenary wires must be installed for supporting cabling, and must be of adequate strength to carry the cables attached to them. Method and intervals of fixing of cabling to catenary wire must comply with the manufacture's installation documentation.

b) The maximum sag of any span of a maximum 7-metre length of each catenary wire must not exceed 100mm.

c) Catenary wires are not to be used in exposed ceilings.

3.12.13.2 Tray

a) Generally, in a new building or fit out, audio visual cabling will have allowances made by the electrical contractor for space allowance on the Communications Cable Tray to reduce services space in the ceiling.

3.12.13.3 Conduits/Ducting

a) Where cables leave a tray or a catenary in a situation where they are exposed, the cables shall be enclosed in conduit or duct (i.e. Aussie duct or equivalent). In either case the conduit/duct shall have the nominated spare space set out in the relevant Australian standards. The cables must exit the conduit/duct through a cable gland or pass through.

b) Open ended conduit or ducting is not acceptable.

3.12.13.4 Looming/Lacing

a) Dress all cables within the equipment rack in neat looms and parallel runs using approved cable restraints and support bars. Leave sufficient length on all cables to allow removal of any item of equipment from the rack for a distance equal to the equipment depth + 50% without disconnecting any cables. Acceptable methods are:

1. Service Loop shall be a minimum of 2 m
2. Reverse pig tails for equipment close to the rear of the rack

b) Cable bundles shall not obstruct installation or removal of equipment in the racks. Cover all cables entering and exiting the equipment rack with appropriately sized Techflex or equivalent black expandable braid cable sock. Cut expandable braid with a hot knife or otherwise treat sleeve ends to prevent fraying.

c) Cable ties are not to be used under any circumstances. Velcro ties must be used to ensure that the cable is not distorted during installation.

3.12.14 In Rack Cabling

a) Cable sizes for intra rack connections shall be kept to a minimum length and size with limited excess cable while adhering to 3.12.12.

b) HDMI connections shall comply with 3.14.6.

3.13 Power & Lighting

3.13.1 Power Distribution & Control

a) Power to all AV equipment is to be on the same phase within each room. Circuits for AV equipment shall be dedicated to AV equipment only

b) Where indicated on the schematics, distributed power within equipment racks shall be controlled by means of a network based, rack mounted, power distribution unit. Double-adaptors and single-pole switched power strips must **not** be used. For custom systems which fall outside RMIT AV Standard system, the AV integrator must size the power strip to suit the rack and number of devices connected. A provision for 20% expansion must also be provided. Power strips shall be protected by accessible circuit breakers (10A on normal circuits).

c) Where a free standing rack is installed (i.e. not within joinery), a captive power outlet shall be provided. This includes racks under free-standing tables.

d) Unless otherwise specified, all devices shall be powered via an IP Managed PDU.

e) Shorten power cables to an appropriate length and terminate in Australian-standard side-entry mains plug-tops similar to Clipsal 418S or IEC style connectors.

f) All outlets must be clearly labelled on the control system technical page to allow for power cycling of individual units. In addition, they must follow the sequence detailed on the appropriate schematic(s).

g) All outlets shall be installed in accordance with AS 3000. Outlets shall be easily accessible for servicing. Wall mounted equipment shall have outlets exposed but hidden behind the equipment within reach. Room booking panels and ceiling equipment shall have outlets accessible in the ceiling above. Where plasterboard ceilings are in use, access panels shall be installed for any in-ceiling access.

3.13.2 Power Cable Test & Tagging

a) All power cables supplied are required to be tested and tagged to the AS 3760: standard. A copy of the register of cables shall be supplied as part of documentation package.

3.13.3 Energy Use

a) Power consumption of all active devices must be considered when selecting appropriate technologies. Power ratings when operating, low power, sleep and off modes will be used in order to select the most energy-efficient component. The Integrator must ensure correct operation of equipment when selecting efficiency mode. Refer to the RMIT the Carbon Management Plan and Sustainability Policy.

3.14 Cabling

3.14.1 Manufacturer's Recommendations

a) Install and terminate cables in accordance with the manufacturer's recommendations.

3.14.2 Drawing & Handling Cables

a) Ensure that cables do not exceed the manufacturer's specified pulling tension when drawing cables.

3.14.3 Joins

a) Cables shall be run without junctions or joins except where prohibited by site conditions. The number of termination points along a single signal path shall be kept to a minimum and must always be less than the stipulated limit of termination points or junctions.

3.14.4 Installation

a) Cables shall be concealed wherever possible unless specified otherwise. Cables shall be run in the shortest practical route, in a manner causing the least strain and be supported using conduit or duct and cable tray where necessary. The least preferred method of cable support is catenary wires. Hangers are not an acceptable method of cable support.

b) Proposed cable routes and installation methods are generally shown on the drawings and/or described in the specification. Where a more suitable route is found the approval of the Principal shall be required.

c) Provide any Velcro ties, hangers, trays and other cabling management equipment required to ensure that there is no strain on cables or connectors. Provide draw wires in all ducts to allow for accessibility and ease of operation if unused. Keep all cable access hatches and openings free and clear of dirt and debris. Provide adequate protection of cable ends from damage during installation. Where minimum segregation cannot be achieved, AV cabling is to be run in continuous earthed metal ducting/conduits separate from AC power cable observing all requirements of appropriate standards such as AS3000, AS3080 etc.

d) Speaker level audio, line level audio, (low level) microphone audio, video, control, extra low voltage power and data cables shall be suitably segregated from each other so that EMI is minimised. All cable runs shall be

neatly laced, dressed and adequately supported. Cable bundles shall be tied using approved cable fasteners such as Velcro straps. Plastic cable ties are not acceptable method of cable restraint.

3.14.5 Cable Types

a) Of the following signal types only the following cable types shall be used unless agreed to by the Principal:

Cable Type	Description	Belden
Digital Video	HDMI, DVI and Display Port	See Fly leads
Digital Audio	110 ohm (Belden – Purple PVC jacket)	BELDEN 1800B
Analogue Audio – Balanced stereo	26 AWG stranded 2 pair twisted core with aluminium foil and drain	BELDEN 1172A
Analogue Audio – Unbalanced mono/stereo	1 Pair shielded 22AWG	BELDEN 8761
Speaker Low impedance	12 AWG stranded 2 core Double insulated, striped, multi-strand.	BELDEN 1311A
Speaker High impedance	16 AWG stranded 2 core tinned copper conductors, PVC insulation, twisted pair, PVC jacket.	BELDEN 8471
RS232/485	24 AWG 2 pair data with aluminium foil	BELDEN 8723
Relay	24 AWG 2 pair data with aluminium foil	BELDEN 8723
Digital I/O	24 AWG 2 pair data with aluminium foil	BELDEN 8723
STP	Cat 6A **Purple** PVC jacket	Device manufacturers specification or equivalent in accordance with Information Technology Services Design Standard
ELV Power	Double insulated 1.5mm^2	-

b) All other cable requirements will be addressed with professional grade cables including (but not limited to) fibre, high bandwidth digital video (HDMI and DVI) and be fit for the intended purpose.

c) In general, the patch leads shall be pre-made. All patch leads shall be of a suitable length and with a minimum of .5m length spare.

d) All network cabling, including patch & fly-leads, must comply with Information Technology Services Design Standard. See Section 10.5 for specific details.

e) Installed HDMI cables must comply with the requirements in section 3.14.6.

f) All performance/acceptance testing is to include patch and fly leads. Typically, a maximum native HDMI cable run shall not exceed 5 metres including patch and fly leads. For distances greater, RJ45 / CAT based extenders must be used.

g) USB extenders and high bandwidth video extender devices are permissible where nominal cable lengths are not sufficient. Cables used for this purpose must be clearly labelled as AV cables at both ends to avoid confusion with data networking cables.

h) All UTP/STP CAT / RJ45 cabling used must be:

1. Distinguishable from data networking cabling and must be provided with a purple coloured PVC sheath
2. Installed as per the cable manufacturer's requirements
3. Installed to meet the requirements of the active hardware

3.14.6 Fly Leads

a) The AV Integrator shall provide all necessary AV fly leads for every connection plate and all patch leads necessary to enable the connection of the system. All leads must be of reputable manufactured and be fully tested. The AV integrator must ensure that all leads are:

1. Factory pre-moulded
2. Of suitable size to fit within cable trenches and ducts

3. Strain relieved

b) Fly leads must be of sufficient length but not excessive for easy connection to the device when located in its typical location. Fly leads with excessive length will be rejected by RMIT and will be replaced at the integrators expense.

c) Where multi cable fly leads are provided at a single location, then they must be contained in a suitable tight fitting woven nylon cable sock or similar.

d) All fly leads must be secured to prevent unauthorised removal using nylon P-clips.

e) Where a push button controller is installed, the HDMI fly leads must be clearly labelled to match the wording on the appropriate push button i.e. Laptop HDMI.

f) Fly leads provided to connect user equipment must be of the following:

Type	Manufacture / Model	Connectors
HDMI – Laptop Flylead	Kramer C-HM/HM/ETH	HDMI – HDMI
HDMI – All fixed connections with no movement.	Kramer C-HM/HM/PICO	HDMI – HDMI
USB	Generic – Extension of USB 2.0, USB3.0	USB (M) – USB (F)
Data	Krone – CAT6/CAT6A - Blue	RJ45 – RJ45

3.14.7 Cable Adaptors

a) The AV Integrator shall provide all cable adaptors for BYOD equipment as well as spaces with fixed computers.

b) Laptop adaptors shall be tethered to the HDMI lead utilising 1 Extron LockIt or approved equivalent for both.

c) Adaptors shall be as follows:

Device	Type	Manufacture / Model	Connectors
Laptop	USB-C	Moshi, Part No. 99MO023208	USB-C to HDMI
Desktop / All in One	Display Port	HP Part No. 2JA63AA	Display Port to HDMI

3.14.8 Separation

a) Maintain separation distances required by Standards and other applicable codes and regulations between power/lighting circuit cabling, communications cabling and other cabling and services.

3.14.9 Protection Against Mechanical Damage

a) Wiring systems installed in locations where there is a risk of mechanical damage shall be adequately protected in accordance with but not limited to AS 3000, AS3080, TS 001, TS 008 and TS 009.

3.14.10 Bend Radius

a) In order to maintain cable integrity and signal performance, cables shall not be bent beyond its manufacture's recommendation.

b) Where unspecified, bend at no more than eight times the overall diameter of the cable. Cables shall be anchored immediately before the start and after the finish of the bend. Provide all patch bays and wall, floor & ceiling outlets plus associated patch cables as required providing a fully functioning system.

3.14.11 Labelling Scheme

a) The AV integrator shall present a cable labelling scheme for the facility and submit for approval by the Principal. Submit details of proposed cable, connection plate and patch bay labelling scheme to Principal prior to manufacture / procurement. No variation costs shall be accepted for re-labelling of unapproved or rejected labelling.

b) Labelling scheme shall include:

4. Robust, repeatable labelling
5. Cable labels are self-laminating vinyl similar to Brady WML-305-292-2S with laser or other indelible machine printed text. Labels shall be protected from physical damage and be clearly legible.
6. Connector and patch plates shall be directly engraved with appropriate legends
7. AV Integrator's name or logo may be included on cable labels only where it does not impact on the legibility of the specified information. AV Integrator's name or logo does not to appear on any plates.
8. Logical sequential system for ALL cables:
    I. HDMI 1001-1999
    II. STP 2001-2999
    III. Audio 3001-3999
    IV. Data 4001-4999
    V. Control 5001-5999
    VI. SDI 6001-6999
    VII. Optical 7001-7999
9. Label ALL equipment and cables to facilitate simplified operation and maintenance.
10. Label both ends of all cables with an approved labelling system. Labels shall be placed to ensure ease of identification.
11. Submit a sequential cable numbering system for approval by the Principal.
12. Labels shall include cable number, signal source and destination with I/O numbering information
13. A copy of the as-built cable schedule shall be included in the operation manual.
14. Shielded CAT / RJ45 cables used for AV purposes (e.g. video / USB extenders) must be clearly labelled as AV cables at both ends to avoid being connected to incorrect devices.

c) **Pen or permanent ink marked labels will not be accepted.**

3.15 Video

3.15.1 Size & Position

a) Unless stated otherwise, all systems in this facility are intended for projection of data. While horizontal angles are considered flexible, the maximum viewing distance shall be strictly followed. Image placement shall also consider environmental factors such as ceiling height, furniture, and overall space layout.

b) All images shall meet the following criteria. Where all criteria cannot be simultaneously met due to the layout of seating, they shall be applied in order:

1. Distance to furthest viewer shall be no more than the AVIXA DISCAS Standard with a displayed image element height of 3.0% and viewing at a 1200mm eye level.
2. If the AVIXA DISCAS Standard Ratio cannot be maintained due to physical constraints, design must be approved by Principal.
3. No viewer's sight line to the top edge of the screen shall be more than 30° from horizontal. The centre of the image shall not be more than 15° from the horizontal.
4. No viewer's sight line to the opposite vertical edge of the screen (furthest screen when multiple displays are specified) shall be more than 45º from straight ahead.
5. Distance to the closest viewer shall be no less than twice the height of the displayed image
6. Minimum AFFL of Image as per Elevation drawings. Any ceiling mounted displays must provide a 2200 mm AFFL clearance below the display. If this is not achievable, discuss with the RMIT project representative.

c) For more information, refer detail drawing AV-D-03.

d) Where an interactive LCD is installed, the top of the LCD is to be a maximum of 2100 mm above finished floor level. Note: depending on screen size, the bottom edge of the image may be as low as 950 mm above finished floor level.

3.15.2 Aspect Ratio (General)

a) All displays shall truly reproduce incoming signals in their correct aspect (16:9) regardless of the display device's native aspect ratio. This should be achieved through control system programming, with users selecting correct aspect by an intuitive interface if the system cannot do this with no user input.

b) Any resolution or aspect that differs from the above shall be approved by the Principal e.g.: UHD 3840 x 2160.

c) For permanently installed equipment (PC, Wireless Presenter etc) the default aspect ratio shall be predetermined, and no option presented to the user unless specified.

d) Refer to the relevant sections below for display specific information on the aspect ratio

3.15.3 Resolution

a) All teaching spaces shall have display devices set to a resolution of 1080P for projection and LCD. The viewing guidelines detailed under section 3.15.1 are based on this resolution.

b) Spaces where higher than 1080P is implemented, the appropriate viewing distance calculations shall be considered. *Refer to AVIXA DISCAS V202.01:2016.*

3.15.4 Projection

3.15.4.1 Luminance

a) Lumen requirement to be calculated by manufacturer projection calculations based on throw distance and provide a minimum of 450 nits.

b) Laser projectors in teaching spaces must be a minimum 6500 ANSI Lumens.

3.15.4.2 Contrast

a) When the room lighting is set for projection viewing, the ratio between ambient black (i.e.: light incident on the screen from ambient sources and room lighting) and projected white shall be a minimum of 2000:1.

3.15.4.3 Image Geometry

a) The projected image shall be rectangular with parallel edges and 90º corners. Optical image correction via lens shift may be used to correct image positioning. Digital correction of 'keystone' or other geometric aberrations must not be employed without prior approval from Principal.

3.15.4.4 Mounting (Projection)

a) Projectors shall be installed:

1. On an RMIT University approved secure ceiling mount bracket fixed to the building's structure. Anti-vibration mounts shall be used in areas with high potential of ceiling vibration.
2. Such that the lens aligns to the top of the projected image. Electronic image adjustment shall not be used unless approved by the Principal.
3. Black / White mounts to be matched to Ceiling colour were applicable.

b) Installation of the projector bracket must be coordinated with other services to ensure that other ceiling mounted utilities such as sprinkler systems, mechanical ducts and light fittings do not interfere with the size and quality of the projected image.

c) The AV Integrator is required to verify that the mounting surface will support the weight of the projector, mounting bracket and associated loads imposed during maintenance. Refer to "AV-SCH-04- V4.0 Standard AV Equipment List".

d) Projector mounts must include an equipment cage to securely ancillary equipment and other associated components and power supplies.

3.15.4.5 Image Shake/Vibration

a) Image shake is a very real problem in both new building projects and refurbishment projects. This issue is not always evident prior to the installation of the system. RMIT look toward its integration partners to actively identify possible vibration problems that may occur throughout an install. If the image shows signs of vibrations the Principal must be contacted immediately. Anti-vibration mounts shall be used in areas with high potential of ceiling vibration.

b) The possibility of any form of image degradation shall be investigated during the room scoping at the time of tender.

c) Installation methods used by the Integrators shall not cause or exaggerate vibrations in the image.

3.15.4.6 Projector Screens

a) Dedicated projector screens are optional depending on the physical room layout, ceiling and wall conditions. Where limited wall space is available and priority is given to whiteboards, projection screens are typically preferred. The requirements will be detailed in the design documentation.

b) Where a projector screen(s) is supplied, it shall be motorised in 16:9 aspect ratio unless stated otherwise.

c) Where a wall is used as a projection surface it is to be plaster board finished to “Level 5 Finish” in accordance with AS/NZS 2589.1:2007 and finished in a flat white paint.

d) Any other custom projection requirements will be specified/approved on a case by case basis.

3.15.4.7 Settings (Projection)

a) As a minimum the integrator must configure all projectors for the following functionality:

1. Projector background set to black when no image or mute mode
2. All onscreen display functionality is disabled
3. Internal speaker is muted
4. Projector image is muted during “soft off”
5. All external buttons and controls are disabled to prevent unauthorised access. Lockout password is to be set to current RMIT AV Security Code, if this is not available then the integrator is to nominate. All password and lockout procedures are to be documented in the appropriate column on the equipment schedule. Where the projector buttons cannot be lockout all functional settings must be reinstated by the control system at power up to ensure the projector will operate correctly after any unauthorised changes.

3.15.4.8 Aspect Ratio & Resolution (Projection)

a) Projectors shall be locked to display a minimum 16:9 aspect ratio with a resolution of 1920x1080 (1080p). This aspect shall be maintained by the control system forcing the projector to this setting.

b) Shall a space require a projector of higher resolution than WUXGA, approval shall be requested from RMIT AV.

3.15.5 LCD

3.15.5.1 Technologies

a) RMIT primarily use two (2) LCD screen technologies. These include:

1. Standard LCD
2. Interactive LCD
3. The use of standard and interactive LCD screens is documented within the standard AV schematic designs.

3.15.5.2 Mounting (LCD)

a) LCD panels shall be installed on a RMIT approved secure mounting bracket. The bracket shall be purpose designed to suit the mounting orientation (landscape, portrait, tilt, swivel, wall or ceiling mounted). Note: All wall mount displays shall be serviceable.

b) When ceiling mounting displays, the bracket must be coordinated with other services to ensure utilities such as sprinkler systems, mechanical ducts and light fittings do not interfere with the operation of the display.

c) When mounting to walls the AV Integrator is to ensure that there are sufficient studs or noggins to allow for secure mounting of the display and that the wall is able support weight of the panel and any additional loads such as people leaning against the display or a cantilever bracket.

d) When equipment mounted behind the LCD panel is not accessible from the side, a serviceable wall bracket must be used.

e) Displays mounted using ceiling poles must include a rear shroud if AV equipment is visible from the front of the room

f) Ground-level confidence monitor displays should be recessed within a joinery surround, incorporating a minimum 100mm kicker at the base of the enclosure.

3.15.5.3 Settings (LCD)

a) As a minimum the integrator must configure all LCD panels for the following functionality:

1. Internal fans are set to auto
2. All onscreen display functionality is disabled where possible
3. Internal speaker is operational (if no external speakers are installed)
4. All external buttons and controls are disabled to prevent unauthorised access. Lockout password is to be set to current RMIT AV Security Code, if this is not available then the integrator is to nominate. All password and lockout procedures are to be documented in the appropriate column on the equipment schedule. Where the LCD buttons cannot be locked out all functional settings must be reinstated by the control system at power up to ensure the projector will operate correctly after any unauthorised changes.

b) For LCD settings, please refer to the AV Commissioning Guide.

3.15.5.4 Resolution (LCD)

a) Standard LCD & interactive LCD screens shall be a minimum 1080P (1920x1080) or 4K (2160p) from the factory. When installed, they shall be set to:

1. 1080P – general teaching spaces
2. 1080P – meeting/collaboration spaces
3. Higher than 1080P on approval from RMIT AV

b) If a video wall is installed, the overall resolution shall be considered based on the content being displayed.

3.15.6 LED

3.15.6.1 Technologies

a) For large signage/display applications, RMIT will utilise Surface Mount Diode (SMD) technology.

1. Large outdoor LED signage/display applications to remain SMD technology.
2. Large indoor LED signage/display applications to consider chip on board (COB) or glue on board (GOB).

b) The use of this technology shall be on a case-by-case basis with approval from RMIT Principal. In general, the following guidelines shall be adhered to if a video wall is considered for a space/location.

3.15.6.2 Mounting (LED)

a) Given the variability of where this technology shall be installed, no specific mounting bracket/method shall be nominated. However, the AV Integrator must ensure the selected bracket is install flat and level to minimise any imperfections when aligning the LED tiles / modules.

b) Prior to installation, for both flat and curved walls, structural engineering drawings will need to be submitted for signed-off to ensure both the mounting system and structure that the system is being mounted to is capable of supporting the screen.

c) Consideration shall also be provided to where any processing & content hardware required to drive the screen are mounted.

3.15.6.3 Service

a) Any LED screen shall be installed such that service of individual modules is from the front with the cabinet remaining in place.

3.15.6.4 Resolution

a) If a video wall is installed, the overall resolution shall be considered based on the content being displayed. However, a minimum resolution of Full High Definition (1920x1080) shall be provided.

3.15.6.5 Pixel Pitch

a) In order to ensure a coherent image is produced, the following table can be used as a general guide:

Pixel Pitch (mm)	Average Comfortable Viewing Distance (m)
0.9 mm	1.5 m
1.5 mm	2.58 m
2.0 mm	3.44 m
2.5 mm	4.30 m
3.0 mm	5.16 m
4.0 mm	6.88 m
10.0 mm	17.19 mm

3.15.6.6 Power

a) The AV Integrator must coordinate with the Electrical contractor to ensure the correct amount of power circuits are provided to support the size and power requirements of the screen.

3.15.6.7 Brightness

a) The brightness of the LED screen will differ depending on the environment it is install into. For indoor installations, the brightness should be reduced to 20% – 30% of the total brightness. In teaching spaces or meeting rooms, brightness may be as low as 10%. Final display brightness to be confirmed on site with RMIT during the commissioning phase.

b) Outdoor LED brightness may be controlled via an auto brightness sensor unless specified otherwise. If an outdoor LED can be seen from the road (City campus etc.), strict guidelines must be followed regarding content and brightness so as to not be a distraction to drivers and the public. More information can be found in the **"Requirements and Guidelines for Illuminated Outdoor Advertising Signage – 4th October 2023"** documentation found on the Victoria Department of Transport website.

3.15.6.8 Spares

a) Critical spares for LED tiles / modules must be provided and handed over to RMIT at the time of installation.

b) Critical spares shall take into account the equipment life cycle timeframe RMIT have. This may need to be confirmed at the start of the project.

3.16 Audio Reproduction/Public Address

3.16.1 Coverage

a) Each sound system shall provide a sound pressure level in accordance with the installer's calculated Needed Acoustic Gain (NAG) and be free of discernible distortion, delay, echoes and other artifacts. All audio systems shall provide adequate, even coverage to be clearly audible without acoustic feedback and excess volume at any point. In spaces where wireless microphones are specified, these shall be usable without acoustic feedback at all points in the room. Where specified, design and provide proof of conformance to ANSI/AVIXA A102.01:2017 "Audio Coverage uniformity in Enclosed Listener Areas".

b) Any distributed loudspeaker arrays shall have a coverage pattern that is uniform within ± 5 dB over the entire seating area. Refer to Room Audio Measurements Section.

c) Time alignment may need to be considered in some unique spaces. This will be highlighted in the project specific design documentation.

3.16.2 Gain, Frequency Range and Equalisation

a) Excessive equalisation shall be avoided. Audio systems shall reproduce all frequencies within the audible spectrum smoothly. To ensure correct operation after the sound system has been equalised and calibrated, install tamper proof devices over any exposed knobs, switches or other controls on amplifiers and system processing equipment. Ensure that maximum pre-set levels cannot be exceeded to produce distortion or feedback. Provide user interface(s) such that any user may adjust system volume between off (muted) and pre-set maximum without exceeding a hard limit 6dB below the point at which feedback will occur. Provide separate control for microphone and source audio, and separate mute buttons for each.

3.16.3 Quality

a) Digital audio signal paths, the reference level (‘zero VU’) shall be -20dBFS in any channel. The sound system shall be capable of reaching programmed maximum levels without clipping, distorting or overloading any amplifier or speaker.

3.16.4 Signal Delay

a) Where appropriate provide any signal delay devices (hardware or in DSP) required to ensure that signal arrival times from different speakers at all points in the rooms are not greater than 20ms.

3.16.5 System Hum & Interference

a) There shall be no visible noise or audible hum or interference in the AV systems. Where such interference arises, it shall be removed by the AV Integrator.

3.16.6 Hearing Augmentation

a) The AV Integrator shall provide a hearing augmentation system for all spaces provided with an inbuilt audio amplification system. Note: Preference is for IR over loops. Loops shall only be utilised after consultation with AV team.

b) The type of hearing augmentation system shall be determined with due consideration of:

1. The type of space
2. Building restrictions
3. Environment
4. Potential interferences
5. Specific user requirements

c) RMIT implements 2 types of hearing augmentation systems:

1. Infra-Red (IR (Preferred)
2. Induction loop

d) Hearing augmentation over WIFI will be considered on a case by case basis. Deployment must be approved by RMIT Principal prior to installation.

e) The hearing augmentation system must be active at all times, including when the AV system is shut down. Only fixed gooseneck or boundary microphones are to remain active.

f) As a minimum, the hearing augmentation system (induction loop or Infra-red) shall:

1. Comply with current NCC/BCA and DDA regulations at the time of installation
2. Provide even coverage across the designated loop / IR coverage area
3. Be commissioned and tested to conform to AS60118-4
4. Be designed to minimise the effects caused by:
    I. Electrical and other cabling
    II. Metal objects, such as ductwork

III. Other sources

5. Reproduce source and microphone audio. This includes any DSP programming/configuring to meet this requirement.

g) The AV Integrator must provide a certificate of compliance as per AS1428-2010 for all hearing augmentation systems.

3.16.6.1 Induction Loop System

a) Infra-Red (IR) systems are preferred for all spaces at RMIT, however Induction Loops to be considered on a Case by Case basis, decision criteria must include room use, number and location of adjacent loops.

b) Induction loops must be installed as follows:

1. Under floor coverings using flat copper tape. If the loop cannot be installed due to a lack of floor coverings (e.g. loose laid rugs) or bare concrete floors an alternative solution must be coordinated & approved by RMIT.
2. In an 'ultra-low spill phased array' configuration to ensure that audio from one space cannot leak into adjacent spaces.

c) The AV Integrator must:

1. Conduct a preliminary survey of the space to ensure that all standards and regulation are met and allowed for prior to the final design of the loop. All loop designs must be issued to the Principal for approval before it is installed.

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

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

3.16.6.2 Infra-Red System

a) Infra-Red systems must be installed as follows:

1. Wall mounted connection plate with:
   I. 3-pin XLR
   II. Screw lock 2.5 mm 12V panel mount jack
2. Wall connection plate located adjacent to a front of house speaker's GPO if available. If that is not possible, then position with another suitable located GPO
3. Installed no higher than 3 metres AFFL.
4. Rack location:
   I. Cord mount jack terminated with 500mm spare cable at the PDU location.

b) As a minimum, the Infra-Red system must meet the following criteria:

1. Signal:
   I. Mono balanced line level
   II. -10dB out of the DSP or mixer (50mV – 3V).
2. Infra-red modulators, transmitters and receivers shall be William Sound or an approved equivalent.
3. Transmitters must not be installed outside or in direct sunlight
4. Where multiple transmitters are required, the 2nd and any subsequent transmitters shall be looped from the first unit. A 50 ohm terminating BNC is to be fitted to the last connected transmitter.
5. Receivers:
   I. Quantity to comply with BCA & DDA regulations at the time of installation

II. Each receiver supplied to RMIT shall include:
   - An induction neck loop
   - Dedicated charging bay

III. Provided to RMIT AV at project handover as complete & unopened

c) The AV Integrator must conduct a site survey and review line of sight restrictions and ambient light prior to submitting a detailed design submission.

d) The BCA Standards state that compliant signage must be provided when installing any hearing augmentation system.

3.16.6.3 Signage

a) Where an AV integrator is engaged on an RMIT capital works project through RMIT Property Services Group (PSG), the head contractor will be required to coordinate all necessary signage with RMIT. For ALL RMIT Capital works and AV Upgrades, RMIT PSG typically supplies the Hearing Augmentation Signage for the AV Integrator to install.

b) For projects where there is no involvement from RMIT PSG, the AV integrator can organize signage with the ITS Project Manager assigned to the project

3.17 AV Technologies & Equipment Requirements

3.17.1 HDMI

a) RMIT has adopted USB-C as the standard for laptops and HDMI as the base standard for all other digital signals for all installation. All new installations must conform to the current USB-C and HDMI industry standards. HDMI runs shall not exceed 5m. USB runs shall not exceed 3m. The following devices as a minimum will be provided with or require a HDMI / USB interface:

1. University PC
2. Document cameras (Only applicable for Lecture Theatre style rooms otherwise, connected to the University PC)
3. Blu-ray players
4. Projectors
5. LCD panels
6. LED screens

b) As a minimum, HDMI 2.0 shall be applied for all installations, with a preference for HDMI 2.1 where available:

1. Hot Plug Detect
2. EDID
3. CEC
4. HDCP

3.17.2 USB-C

a) The following user devices at RMIT will as a minimum have USB-C:

1. Laptops

3.17.3 HDCP & EDID

a) All source devices supplied to the University must support HDCP content and must provide sufficient HDCP keys (KSV – Key Selection Vector) for correct system operation. All video switching equipment must provide KSV caching and/or generate KSV for all displays. The AV Integrator must also ensure that all switching solutions support both EDID and scaling outputs to suit the system design and the resolutions required therein.

b) The AV Integrator must ensure the number of HDCP keys provided will accommodate all displays connected to the system.

c) It is expected, at a minimum, that the following resolutions shall be supported for BYOD devices:

- 1024x768 [6, 8]
- 1024x852 [6, 8]
- 1024x1024 [6, 8]
- 1280x768 [6, 8]
- 1280x800 [6, 8]
- 1280x1024 [6, 8]
- 1360x765 [6, 8]
- 1360x768 [6, 8]
- 1365x768 [6, 8]
- 1365x1024 [6, 8]
- 1366x768 [6, 8]
- 1400x1050 [6, 8]
- 1440x900 [6, 8]
- 1600x900 [6, 8]
- 1600x1200 [6, 8]
- 1680x1050 [6, 8]
- 1920x1200 [6, 8]
- 480p [7,8,]
- 576p [6,]
- 720p [3,4,5,6,7,8,]
- 1080i [6,7,8,]
- 1080p [1,2,3,4,5,6,7,8,]
- 2048x1080 [1,2,3,4,5,6,7,8]

1 = at 23.98 Hz, 2 = at 24 Hz, 3 = at 25 Hz, 4 = at 29.97 Hz, 5 = 30 Hz, 6 = at 50 Hz, 7 = at 59.94 Hz, 8 = at 60 Hz

3.17.4 Matrix, Presentation Switchers & IP Decoders

a) A digital matrix switch shall be used to route the required sources to the relevant destinations in each relevant design classification. All inputs shall be capable of being switched to any output and the resolution scaled depending on the output device requirements. Where required audio should be embedded with the video, however a separate audio switching/processing layer will be required in certain applications.

b) All AV switches must be HDCP compliant and issue individual KSVs for every display. All KSVs are to be cached to minimise any signal switching delays. AV switches must also allow for editing of the display EDID tables to force display resolutions

c) Apple MAC devices are common amongst academic staff and have a known issue with maintaining HDCP settings for non-protected content. The AV Integrator is responsible for testing the AV system for Mac devices at commissioning.

3.17.5 Blu-ray

a) Bluray players are a custom option and require approval from AV team.

3.17.6 Document Camera

a) RMIT deploys document cameras in 2 configurations:

1. HDMI output via matrix switch (preferred)
2. USB output that will interface to the resident PC

3.17.7 IP Cameras

a) IP Cameras shall be positioned as a minimum to capture the primary room display and lectern top ideally including a view of the touch panel and teacher monitor(s). Multiple IP Camera may be required in larger spaces.

3.17.8 PTZ Cameras

a) Where PTZ cameras are installed the AV Integrator shall ensure the following:

1. Full unobstructed movement of pan and tilt.

2. Zoom and focus are suitable for the final camera position to allow for optimal image quality and content framing
3. The field of view of the camera is unobstructed.
4. Camera is to be installed in a location that enables presentation view and a close-up of the lecture position.
5. Vibration is isolated if camera is mounted from the ceiling.

3.17.9 Connection Plates

a) All connection plates shall be:

1. Engraved and paint filled to indicate the function for each outlet. Adhesive labels will not be accepted. Note: This is only applicable to plates in room; exclude racks and presentation desks.
2. Clipsal 2000 series plate unless otherwise stipulated
3. Refer to Elevation Drawings for plate heights.

b) AV connection plate shall typically include the following connectors:

Connection Plate	Connector Type	Label
Laptop	HDMI (Type A plug) Audio (3.5 mm stereo audio jack) USB (Type A plug) Only where interactive LCDs or BYOD VC systems are installed and USB connectivity to the laptop is required USB-C (Via USB-C® DisplayPort™ Signal Extension over CATx Cable wall plate)	LAPTOP HDMI LAPTOP USB
PC	HDMI (Type A plug)	COMPUTER
MAC	HDMI (Type A plug) / USB-C (Via USB-C® DisplayPort™ Signal Extension over CATx Cable wall plate)	COMPUTER
USB	USB (Type A plug)	USB
Microphone	XLR (female)	MIC
I/R Hearing Augmentation (Wall mount)	XLR (male) Screw lock 2.5 mm Power jack	HEARING AUGMENTATION

c) Where practical, AV connection plates must be co-located with associated power and data outlets.

3.17.10 Proprietary System/Technologies

a) Should there be a need for proprietary technologies to be incorporated into an environment, approval needs to be sought by RMIT ITS to ensure:

1. It is supportable
2. Aligns with RMIT strategic objectives
3. Meets the requirements of the project and/or stakeholders

b) Refer section 2.5 ‘Spares’ regarding the requirement of spares to manage the risk to operational continuity

3.17.11 Dante

3.17.11.1 Overview:

a) Addressing and Network Configuration:

1. **IP Addressing:** Dante-enabled devices will automatically obtain network configuration settings via DHCP.

2. **Multicast and Unicast:** Dante optimizes bandwidth through audio flows, supporting unicast (up to 4 channels per flow, ~6 Mbps bandwidth) and multicast (1.5 Mbps per channel) configurations. Video flows require multicast for multiple destinations.

b) Audio and Video Transport Specifications:

1. **Audio:** Professional-grade PCM audio, 48 kHz sampling rate, 24-bit depth, with channel and latency-dependent bandwidth usage.
2. **Video:** Optimised for Gigabit Ethernet, supporting varying bandwidths based on content characteristics.

c) Device Discovery and Synchronisation:

1. **Discovery:** Utilises mDNS and DNS-SD for device discovery and enumeration.
2. **Synchronisation:** Employs PTP (IEEE 1588-2002) for digital audio timing accuracy, with multicast sync messages for clock synchronisation, and supports unicast delay requests to minimise multicast traffic.

d) Control, Monitoring, and Quality of Service (QoS)

3. **Control and Monitoring**: Specifies multicast and unicast ports for device control, monitoring traffic, and Dante Controller communication.
4. **QoS**: Recommends DiffServ QoS for priority handling of time-sensitive traffic, with detailed DSCP label prioritization for clock synchronisation, audio, and other traffic types.

e) Network Management and Efficiency

1. **Multicast Management:** Advises IGMP configuration for efficient multicast traffic handling in mixed or high-volume multicast environments.
2. **Energy Efficiency**: Warns against the use of IEEE 802.3az (Energy Efficient Ethernet) on Dante-configured ports due to potential performance degradation.

f) Additional Considerations

1. **Compatibility:** Ensure all network devices are Dante-compatible and properly configured to support the specific requirements of audio and video streaming over IP.
2. **Security:** Implement network security measures to protect Dante streams from unauthorized access or interference.
3. **Infrastructure**: Regularly review and update network infrastructure to support evolving Dante capabilities and performance enhancements.

3.18 Control Systems

3.18.1 Learning & Teaching

a) For all new installed AV systems within learning & teaching environments, RMIT has standardised on VC-4 Crestron control systems via Mystro code deployment platform. Programming of all spaces to by Incumbent AV integrator (Insight Systems).

3.18.2 Meeting/Collaboration Spaces

a) For all installed AV systems within meeting & collaboration environments as well as custom spaces, RMIT has standardised on Crestron 4-Series platform Hardware. Programming of all spaces to by Incumbent AV integrator (Insight Systems).

3.18.3 Custom Spaces

a) Programming of all spaces to by Incumbent AV integrator (Insight Systems).

3.18.4 MoCoWs

a) For portable systems (e.g. MoCoWs), Keypad/Control all in one has been utilised. Programming of all spaces to by Incumbent AV integrator (Insight Systems).

3.19 Miscellaneous Technical Details

3.19.1 Operating Environment

a) Materials and equipment shall be capable of operating satisfactorily and as specified under the following ambient conditions:
   1. Temperature range: 0°C to 40°C
   2. Humidity: up to 95%
   3. Altitude: 100 m

3.19.2 Mounting & Locations of Equipment

a) Locations of AV equipment shown on AV drawings are indicative only. Installation of all equipment must be coordinated with the architects prior to installation and builder onsite.

b) Where no Architect is appointed, the AV Consultant/Integrator will provide a set of AV layout plans and elevations as required.

c) The AV Integrator must allow a cable loom / additional cable for movement of equipment by up to 2 m at any terminated point, without additional cost.

3.19.3 Adjust & Clean

a) During installation, equipment shall be:
   1. Aligned vertically or horizontally, where practical, with ceiling and room features.
   2. Positioned symmetrically where appropriate in relation to room features. This includes:
      I. Air grilles
      II. Ceiling tiles and beams
      III. Other services in close proximity.

b) It is the AV Integrator's responsibility to liaise with other trades to coordinate the alignment of services and accessories in close proximity. Where applicable, the AV Integrator shall also ensure the proper handover of any decommissioned equipment to the Client.

c) At final handover:
   1. Remove debris from installation in concealed spaces.
   2. Ensure equipment has been cleaned of any debris or marks left from the installation process.

3.20 Environmental Effects on Audio Visual Deployments

3.20.1 Lighting

a) A number of the RMIT AV designs contain the capability for Lecture Capture and Video Conferencing. These spaces need special consideration given to the overall impact of both natural and artificial light on the quality of the imagery being captured. The rooms standard lighting design may need to be adjusted to suit the intended capture area or have additional specialised lighting included.

b) The room may also need to have the natural lighting controlled via blinds. The preferred install would have motorised blinds that can be controlled via the rooms AV system. When a room function that involves cameras is selected the lights would call up the preconfigured scene.

c) The needs of each space shall be considered on a case-by-case basis to ensure the user experience and functionality is kept at a high standard. Refer to section 2.10.

3.20.2 Audio & Acoustics

a) Consideration shall be given to ceiling, wall and floor treatments when an audio visual system is installed to ensure a high level of quality is achieved. The DSP configuration will not be enough to make some spaces acceptable for voice reinforcement and speech intelligibility.

b) The needs of each space shall be considered on a case-by-case basis to ensure the user experience and functionality is kept at a high standard.

c) Ambient noise levels above a Noise Criteria (NC) rating of 35 dBA or greater or a Reverberation time (RT60) greater than 0.35 seconds may degrade the overall audio equality of a conference or speech reinforcement system and will begin to work against speech intelligibility. If the acoustic profile is outside of the advised, then acoustic treatment will be required to ensure optimal operation of the system. Refer Section 3.11.2.2 for Acoustic Targets for Rooms with AV.

4 PROJECT DELIVERY

4.1 Deliverables

4.1.1 Package

At the commencement of the project, RMIT will provide the AV integrator with access to a dedicated project folder on the RAVE (RMIT Audio Visual Environment) SharePoint platform, which will include separate folders for each room.

Each room folder will contain the following folders:

Ref	Item	Description
01	Equipment Schedule	Equipment Schedule (In standard formation – RMIT will provide template) – Live Document
02	Equipment Configuration	Equipment configuration data – where any tech settings are configured differently from the default settings then these need to be provided to RMIT either as a file, table, screen dumps etc Any source code, including modules – property modules may be locked. All source code to be un-compiled and in an editable format. A copy of the final installed compiled code to be included in addition to the un-compiled source code
03	As-Builts	As-built documentation must include the following: • As-built schematics (PDF & Editable) • As-built cable schedules • As-built AV layout plans showing equipment locations and cable runs (PDF & Editable) • As-built rack layouts (PDF & Editable) • As-built custom components, connection plates and patch bays (PDF & Editable) • Quick Reference Guide in PDF format Certifications (e.g. hearing loop certificate)
04	Manufacturer Manuals	All manuals for non-standard RMIT equipment only including warranty cards and documents
05	Photos	• Installation Photos

a) One copy of the operational and maintenance manuals shall be provided at practical completion. Deliverable documentation shall be uploaded to RMIT RAVE SharePoint site links provided by RMIT Principal.

b) Documents shall be provided in native editable formats such as Word, Excel, Auto CAD, Visio as well as in an un-editable PDF format.

c) Software and configuration files shall be provided in compiled and un-compiled editable format in the native format specified by the manufacturer (source code, DSP configurations etc).

d) The Quick Reference Guide shall be provided in softcopy for the deliverables. Refer Section 4.1.3.

e) All Manuals to be provided in Digital formats only – Paper manuals to be disposed of.

f) All IR assistive hearing receivers shall be provided to RMIT Support as new. That is, new in box and unopened.

4.1.2 Equipment Schedule

a) On creation of the project folders the RMIT AV Equipment Schedule template will be available in equipment schedule folder for each room. Each room must have its own equipment schedule. Note: All Networked AV Hardware to be listed first.

b) The Integrator will populate the following fields:

1. Equipment Category
2. Device Fit-off Location

3. Description
4. Manufacturer
5. Model
6. Serial Number
7. RMIT Asset
8. MAC address
9. Network Patch Point
10. Test & Tag

c) The AV Equipment Schedule shall be completed in the nominated format and made accessible to RMIT ITS staff so they are able provide & populate as required. Should there be any changes to the schedule through the duration of the project, RMIT shall be notified within 48 hours of the change.

d) The AV Equipment Schedule has a column labelled 'order reference'. The order reference is only required for:

1. Items that have a manufacturer's warranty greater than the defects and liability period. Having this information allows RMIT to negotiate a warranty claim after 12 months.
2. Crestron equipment. The Crestron invoice number allows for RMIT to claim A+ points.

e) The completed schedule must be submitted with final as-built documentation at practical completion.

4.1.3 Quick Reference Guide (QRG)

a) The Quick Reference Guide (QRG) shall be:

1. Provided in a Digital format Only
2. PDF format

b) It shall include the following information:

1. Screenshot of System User Interface.
2. Examples of selection and use of system sources and destinations
3. Reference to RMIT Service & Support Centre contact details and/or online training resources
4. RMIT branded with no reference to the AV integrator.
5. Only photos taken from within the room, no template photos to be used.

c) RMIT will provide a Quick Reference Guide template and samples.

4.2 Training

a) RMIT will advise if training is required. If no advice is given, then the AV integrator is to provide training as an option price as part of their submission.

b) AV Integrators shall allow for a minimum of 2 training sessions for each teaching space. An operator training course and a technical training course shall be provided.

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

1. Basic operator principles of the system
2. Operating principles of video, audio and control system equipment and functions
3. Practical training in the operation of each function of the control system
4. Equipment locations and operation

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

1. Overall principles of operation of the AV System with specific emphasis on the installed system
2. Basic operator principles of the system
3. Operating principles of video, audio and control system equipment

4. Practical training in the operation of each function of the control system
5. Equipment locations and operation
6. Maintenance and fault finding procedures
7. Fault simulation for practical training in fault finding procedures

e) Each training session must be a minimum 2 hours (Contractor to nominate training time depending on system functionality and complexity) and include at least 6 participants. Training is to be formally structured. A training program, syllabus and personnel assessment format shall be provided prior to commissioning for approval. Training shall be provided prior to the issue of final certificate of the works.

f) RMIT will advise if any additional training is required. All training documentation produced shall be included in electronic copy as part of project deliverables.

4.3 Firmware

a) All AV devices shall be provided with current versions of firmware or applicable software. It is the Integrators responsibility to obtain and load any firmware/software on site to devices found not to be current at the date of handover to RMIT.

b) A copy of any custom loaded firmware must be provided electronically with the final as-built documentation.

4.4 Variations and Non-Compliant Items

a) Any project variations or non-compliant devices must be approved by the Principal and clearly documented in the final submissions.

b) Any quotation that contains RMIT approved non-compliant devices, must contain an option for the purchase of these non-standard devices as spares. Refer section 2.5.2.

4.5 Decommissioning – Return/Disposal/Relocation

a) The majority of AV works undertaken at RMIT are system upgrades. As part of this process the existing system must be decommissioned all equipment including cables and support infrastructure, must be reused internally where possible, donated or disposed of responsibly as e-waste.

b) The AV Integrator must include all associated decommission costs including resale value or e-waste as part of their submission unless advised by the principal

c) All items decommissioned from the space which need to be returned, reused, donated or disposed of as part of the works shall be recorded in the equipment schedule under the decommissioning tab.

d) The process is as follows:

Step	Description	Responsible Party
1	Refer to the RFQ/RFT documentation for what needs to be returned to RMIT, disposed of or reused.	AV Contractor
2	Decommission the relevant equipment in accordance with step 1 above and complete the Decommissioning tab in the room equipment schedule.	AV Contractor
3	AV Integrator to notify RMIT Principal when Equipment schedule has been updated Items for repurpose shall be stored by the AV integrator until installation Items for disposal shall not be returned to RMIT but disposed of responsibly.	AV Contractor

4.6 Waste Reduction

a) Suppliers should provide alternative deployment models that eliminate packaging—especially plastic and foam—where possible. They are encouraged to retain or reclaim packaging to prevent waste on campus or take proactive measures to reduce packaging.

b) Suppliers are to provide only the required core technology, excluding accessories like unused cables, adapters, styluses, dongles, remotes, or other peripherals unless specifically requested, in order to reduce unnecessary waste. Any necessary accessories should be delivered to the principal in a box or suitable container that is clearly labelled with the project title and location.

4.7 RMIT IT Network

4.7.1 TCP/IP Addressing

a) At the commencement of the project, the AV Integrator must populate an AV Equipment Schedule with details of all the devices that require an assigned TCP/IP address. The Equipment Schedule for each room will reside in the RMIT Audio Visual Environment (RAVE) Sharepoint.

b) RMIT requires this spreadsheet to be populated with MAC address, port numbers and item name before a TCP/IP address can be issued. RMIT will then populate the IP address, subnet and gateway details as part of the construction process via the AV Equipment Schedule.

c) The IP addresses of all AV equipment must be assigned dynamically if supported by the device. The RMIT DHCP server will allocate a TCP/IP address based on the devices MAC address.

d) Final settings and configurations shall be included with the deliverable's documentation.

4.7.2 Network Services

a) The following services are available on the RMIT network:

Service	Description	Name	Address
DNS	DNS zone (general AV hardware)	av.its.rmit.edu.au	E.g. BBBLLRRR(a)-eeezz. av.int.its.rmit.edu.au (refer section 4.7.3 for naming format of: BBBLLRRR(a)-eeezz)
DNS	DNS zone (wireless presenter)	rmit.edu.au	BBBB-LL-RRR-Room.rmit.edu.au (note. The first "B" is a constant)
DNS	Domain name lookup server	ns1-internal.rmit.edu.au ns2-internal.rmit.edu.au	10.68.196.1 10.84.196.1 (for information only)
NTP	Network time server	time1.rmit.edu.au time2.rmit.edu.au	N/A

b) DNS name to be used for all services, the IP addresses are shown for reference only and shall not be entered into any device.

4.7.3 Hostname – Network Device Naming Convention

a) Any Network AV devices capable of been named must use the format outlined in the AV Hostname standards tab in the Equipment Schedule.

4.7.4 IT Data Switches & Cabling

a) IT data network switches must not be installed by the AV Integrator. All IT network connectivity will be provided by RMIT ITS. Local AV network switches must not be used. Connectivity for AV systems must be via provided data outlet. The AV Integrator shall provide necessary patch cables which meet the applicable RMIT IT cabling standard (See Section 10.4 of RMIT Design Standards – Section 10 Communications)1. When defining system design all documentation will clearly show TCP/IP Network requirements in order to ensure network points and addressing are provisioned as part of the project.

b) Note: Cabling standards for type and signal characteristics are to be observed. Communications cabling installation practices (e.g. cabling topologies) can differ from AV requirements.

4.7.5 Commissioning AV/IT Integration

a) It is expected that prior to the Vendor advising the project that an AV installation is complete that they not only commission the system for completeness and accuracy, but also against the contract documentation. At a minimum the system shall be tested using RMIT University's Test Script.

b) Upon completion, the Test Script shall be submitted to either RMIT AV Design or external AV consultant via the appropriate project channels.

c) Members of the Vendor tasked with commissioning & testing the AV system shall do so as follows:

1. Permanent source equipment:
    I. Use the installed source equipment as well as a signal test generator. Where installed equipment is not available, equipment which simulates the source equipment shall be used.
2. BYOD source equipment:
    I. Where BYOD equipment is to be used (e.g. laptop) a simulated source as well as a signal test generator shall be used.
3. Wireless presentation:
    I. Where AirMedia wireless presentation units are installed, it is required that the vendor configures AirMedia background images via URL (provided by RMIT) as part of the commissioning process.

d) During testing and commissioning, the following AV testing equipment shall be considered the minimum requirement to ensure system performance and compliance with design intent:

1. Signal Test Generator
2. dB Level Meter
3. Laser Measurement Tool
4. STIPA Meter
5. (Where applicable) Hearing Augmentation Loop Testing Equipment

e) Additional tools may be required depending on the complexity and specific requirements of the AV system.

4.8 Handover

a) The handover process shall fall in line with RMITs School of Property, Construction and Project Management (PCPM) framework.

b) In general, there are several steps which are required to take place prior to space being handed over and accepted into AV support:

1. Complete AV Equipment Schedule.
2. Completed commissioning test results for review prior to RMIT / Consultant Witness Testing.
3. All defects noted in writing have been addressed and closed. This includes, but not limited to:
    I. Project team including:
        - External AV Consultant
        - RMIT Principal
        - ITPN
    II. RMIT AV Support Department (on-boarding to BAU)
4. A complete and correct set of AV deliverables are provided to the RMIT AV department
5. System training is complete (if applicable)

4.9 Defects Liability

a) The AV Integrator must provide a twelve (12) month defects liability for the scope of works and any variations to the scope of works. The defects liability period must commence from the date of practical completion.

The AV Integrator shall be responsible for the repair or replacement of any equipment, cabling, terminations or systems that fail to operate in accordance with the manufacturer's specifications or rectification of defective works, where faulty equipment or defective cabling or components result in the system being unavailable for its specified use. If RMIT needs to replace a faulty product to ensure room availability is maintained, the effected system's Defect Liability period shall be honoured by the original integrator. RMIT will ensure that a competently trained person performs the work. All equipment replaced as part of defects liability must have the full manufacturer's warranty.

4.10 Glossary, Acronyms and Abbreviations

1080P	Video mode characterised by a progressive scan signal with a resolution of 1920x1080 pixels
2160P	Video mode characterised by a progressive scan signal with a resolution of 3840x2160 pixels
ABCB	Australian Building Codes Board
AETM	Association for Audiovisual & Education Technology Management
AFFL	Above finished floor level
AIO	All-in-One PC
ANSI	American National Standards Institute
AV	Audio Visual
BCA	Building Code of Australia
BMS	Building Management System
BYOD	Bring Your Own Device
BYOM	Bring Your Own Meeting
CAV	Converged Audio Visual
CATx	Category cabling
CCTV	Closed Circuit Television, whether analogue or TCP/IP based
CEC	CEC HDMI Control
CIO	Chief Information Officer
DDA	Disability Discrimination Act 1992
dB	Decibel, a unit quantifying one signal with respect to a reference. Specifically: • dBm references 1mW 600OHM • dBu references 775mV rms (from 0dBm = 0.775V into 600OHM)

	• dBFS references ‘full scale’ in a digital signal path
DVD	Digital Versatile Disc / Digital Video Disc – the common optical disc format for recorded video, audio and data
EDID	Extended Display Identification Data
EWIS	Emergency Warning and Intercommunication System
FPD	Generic abbreviation for flat panel displays (LCD, Plasma, OLED etc.)
FCP	Fire Control Panel
FIP	Fire Indication Panel
FOH	Front of House
GPO	General Purpose Outlet – Australian standard 240V, 3-pin format
HD	High Definition – commonly applied to signals at a higher resolution than SD
HDCP	High-bandwidth Digital Copy Protection – a system of preventing the copying of high definition video. All components in the signal chain must support HDCP.
HDMI	High Definition Multimedia Interface – a digital component video signal which provides uncompressed digital video and up to 8 channels of audio
HDSDI	High Definition Serial Digital (video) Interface – broadcast standard for the transport of uncompressed high definition video at bitrates up to 1.485Gb/s
HDTV	High definition television – video transport at higher quality than Standard Definition. For Australian TV – 1080i; for DVD or other may be 1080p
HREOC	Human Rights and Equal Opportunity Commission
IP	Ingress Protection (e.g.: IP65)
IPxx	Ingress Protection (e.g.: IP65)
ICT	Information and Communications Technology
ITS	Information Technology Services
IR	Infra-Red
KSV	Key Selection Vector
KVM	Keyboard/Video/Mouse
LAN	Local Area Network
LCD	Liquid Crystal Display

LED	Light Emitting Diode
Lumen (lm)	Measure of luminous flux. All references in this document shall be read as ANSI Lumens
MATV	Master Antenna Television – reticulation of free-to-air and subscription television services over a common channel (analogue/digital via coaxial or digital via TCP/IP)
MFB	Rack vendor
MTR	Microsoft Teams Room
MoCoW	Mobile Computer on Wheels
NC	Noise Criteria
NCC	National Construction Code
PA	Public Address
PC	Personal Computer
PDU	Power Distribution Unit
PSG	Property Services Group
PTZ	Describes a subset of video cameras with motorised Pan, Tilt and Zoom
RAVE	RMIT Audio Visual Environment
RMS	Root Mean Square
RU	Rack Unit
Rx	Receiver
SDTV	Standard definition video signal – in Australia 576i
SDI	Serial Digital (video) Interface – broadcast standard for the transport of uncompressed video; for Australia (576i) at a bitrate of 270Mb/s
SLA	Service Level Agreement
SNR	Signal-to-noise ratio of analogue systems
STIPA	Speech Transmission Index for Public Address
STB	Set Top Box – device used to receive cable TV or digital terrestrial TV for display on an analogue TV or monitor
STP	Shielded Twisted Pair cabling
TCP/IP	Transmission Control Protocol / Internet Protocol
TP	Twisted Pair cabling
Tx	Transmitter

USB	Universal Serial Bus
WAN	Wireless Area Network
WLAN	Wireless Local Area Network
WUXGA	Wide high-resolution XGA signal (for this document denotes 1920x1200 pixels resolution)
WHS	Workplace Health and Safety
VC	Videoconference
VoIP	Voice/Video over TCP/IP
VU	Volume Unit