



University of
St Andrews

Data and telecom cabling specification

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Key terms	Information technology/Digital standards
Purpose	The University of St Andrews Data and Telecommunications cabling specification is designed to afford the University reliable, performant and standards compliant data infrastructure

Version number	Purpose / changes	Document status	Author of changes, role and school / unit	Date
3.3	4.19(i) - panel labelling, added containment calculations item. Edited cable no per work area. Added EMF justification for containment in-line with Siemon warranty. 5.7(i) – fire collar examples.	Approved	Mark Richardson, IT Installation Assurance Engineer, IT Services	25/01/2024

	<p>No plastic cable ties added.</p> <p>6.1(ii) optical fibre labelling.</p> <p>Added direct link to access control spec.</p> <p>Added rack layout submission process.</p> <p>Telephony pair range control added.</p> <p>Added indoor/outdoor fibre use option.</p> <p>Added more cable test requirements for data and telephony.</p> <p>12.1(i)(ii) - added for commissioning process.</p> <p>15.19 – Access point addition.</p>			
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1.0 Objective

- 1.1 The University of St Andrews Data and Telecommunications cabling specification is designed to afford the University reliable, performant and standards compliant data infrastructure.

2.0 Application

- 2.1 This specification must be adhered to in all data and telephone cabling works by or for the University of St Andrews. No other specification, howsoever obtained, is valid for any data cabling works at the University of St Andrews. The version of the specification used for works shall be the latest version published at the date of commencement of the cabling works.
¹This specification is applicable to new builds, refurbishment, and work on existing installations.
- 2.2 Deviations from this specification are not expected and should only occur where there are technological advancements and following authorisation from the Senior Network Engineer. Unauthorised deviations will not be accepted or signed off and may cause a delay or additional cost to a project.
- 2.3 For avoidance of doubt, data cabling covers all structured data cabling used for audio-visual applications, Ethernet & IP-based systems, including but not limited to Computers, Telephony and CCTV Dedicated point to point cabling for building management, access control or other devices are not covered by this specification.

3.0 Preliminary information

- 3.1 Prior to work starting, contractors must report their presence on site to Estates Small Works Team and notify the IT Installation Assurance Engineer – Mark Richardson. Contractors must also, before commencing any works, have received an Asbestos pack/brief from the University or their main contractor. If any contamination is found or suspected in any location in the course of works, work should be halted pending confirmation from Estates (01334 463999). Each contractor should also be familiar with the University's Health and Safety policies. Advice may be sought from Estates staff in case of any doubt.
- 3.2 Advice upon any aspect of this specification may be sought from the following personnel in IT Services:

Mark Richardson, IT Installation Assurance Engineer – 01334 462514 – mr291@st-andrews.ac.uk

Jon Callan, Network Infrastructure Specialist – 01334 462541 – jrc9@st-andrews.ac.uk

Tom Ingram, Telephone System Administrator – 01334 465034 – tsi@st-andrews.ac.uk

¹ For avoidance of doubt, the day of commencement of works is the first day on which the installation commences. Again, for the avoidance of doubt, it is not the date of any bid, tender response, or contract award.

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- 3.3 If a contractor is in any doubt as to what action to take, or what product to use, or if any item they are working on is omitted from this standard, advice must be sought from the above personnel, and a positive response received before they proceed. It will not be acceptable afterwards to state that either this standard was not clear or did not cover any matter.
- 3.4 All cabling works must be carried out by manufacturer approved contractors, using materials manufactured by approved manufacturers (listed below), and marketed under their primary brand. The fitting contractor must be suitably manufacturer approved to provide a manufacturer/insurance-backed warranty of a minimum of 20 years. Deviation from this specification is not permitted, unless agreed by one of the personnel listed above, in writing, on University headed paper. Cabling works may not be sub-contracted by an approved contractor.
- 3.5 It is the responsibility of the contractor to ensure that all quotations for data cabling works, howsoever provided to the University of St Andrews, adhere to this specification, and that if any rectification works are required to bring an installation in-line with this specification, the cost of these works shall be borne by the fitting contractor.
- 3.6 All works must be carried out to relevant British and International standards. The latest revisions of the following (and other) standards may be applicable, and industry best practices which exceed the requirements of these standards must be followed throughout:
- BS6701 Telecommunications equipment and telecommunications cabling - Specification for installation, operation and maintenance
 - EN50310 Application of equipotential bonding and earthing in buildings with information technology equipment
 - EN50173-1 Information technology - Generic cabling systems
 - EN50174-1,2,3 Information technology – Cabling Installation standards
 - BS7671 IEEE Wiring Regulations Eighteen Edition
 - BS4678 Specifications for cable trunking
 - ISO11801-(1,2,3,4,5,6) Information technology — Generic cabling for customer premises
- 3.7 Of particular note are the recent amendments to BS6701 with respect to the CPR requirements for cabling, published on the 30th November 2017, reproduced below. For new installations and the refurbishment or extension of existing installations, cables installed in the spaces bounded by the external fire barriers of buildings and other structures shall meet the following requirements:
- i. installation cables (as defined in Clause 3) shall, as a minimum, meet the requirements of EuroClass Cca-s1b,d2,a2, in accordance with BS EN 13501-6
all other telecommunications cables shall, as a minimum, either:
 - ii. meet the requirements of EuroClass Eca, in accordance with BS EN 13501-6 or meet the recommended requirements of BS EN 60332-1-2

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3.8 On all projects a minimum of one the installers working for the contractor on site must have completed the 3-day Siemon CI training course.

4.0 Internal Horizontal Cabling requirements

4.1 Horizontal cabling is to be provided using either:

A: For all installations: Category 6A (As defined in ISO11801), (Overall) Shielded Twisted Pair/ (STP or F/FTP) cable, which may be from 22 – 24 AWG, and overall sheathed in Low Smoke, Zero Halogen (LSZH) polyolefin. For avoidance of doubt, new Category 5e and Category 6 cabling is not to be fitted.

C: Optical Fibre, compliant to OS2 (ISO11801, G652.D (Zero Water Peak)), as applicable, overall sheathed in LZSH polyolefin.

4.2 Approved system manufacturers and systems are:

- i. The Siemon Company (Z-MAX 6A Shielded). Brochure link to approved hardware - https://universityofstandrews907-my.sharepoint.com/:b:/g/personal/mr291_st-andrews_ac_uk/EcH-PzFAnLVKmmW8q-l2RDUBShpWDFxDG1VStmykTkEOzg?e=qzwUdA

4.3 The structured cabling installation must adhere to all the requirements stated in this document and Siemon's own warranty conditions for it to be accepted as an approved install.

4.4 Due care must be taken to avoid electromagnetic interference from power cables, and other premises equipment.

4.5 The physical topology of the horizontal cabling shall be a star, with each outlet connected to the designated telecommunications room (TR), with a contiguous single piece of cable. No joints are permitted between the TR and the outlet plate.

4.6 In general, a TR located on the same or adjacent floors will serve each floor of a building, except where it is clear that a whole building may be served from a single TR without breaching the length limitations.

4.7 Under-carpet cabling is not permitted.

4.8 Bridged taps are not permitted.

4.9 Reuse of cabling is not permitted, except by express agreement. Consideration of reuse will only take place if cabling is to current highest standard – cat6A. If current cabling is cat5e or cat6 this must be stripped out fully and replaced with cat6A.

4.10 Where optical fibre is used for horizontal cabling, no more than two splices are permitted between any given transmitter and receiver. Terminations shall be provided by fusion-spliced pigtails.

4.11 The length of cable between the outlet and the cross-connect panel in the TR shall not exceed 90m in case of copper, and <1km for OS2 fibre, nor be shorter than 15m in any case. In general, where fibre and Category 6A cables are laid together, length shall not exceed 90m.

4.12 The maximum combined length of all cables including equipment cables at both ends, and any cross-connection cables required in the TR, must not exceed 100m, and layout of TR must be designed to accommodate this requirement.

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- 4.13 An approved system manufacturer, as defined above, shall provide all connecting hardware used with the Category 6A cable.
- 4.14 All copper cable terminations shall comply with and be tested to channel performance standards for Category6A/Class EA.
- 4.15 Faceplates shall be available in single, dual and quad arrangements, in single or double gang configuration. Surface mount boxes shall be available to match the faceplate. Back boxes shall be of sufficient depth.
- 4.16 Where a repair to a legacy ADC-Krone system is affected, the KM8 outlet connector shall be employed.
- 4.17 Outlets shall consist of one or two gang outlet boxes/faceplates equipped with 8-pin modular (RJ-45) jacks, using T568B wiring. All outlets shall conform to relevant TIA/EIA 568-B, ISO11801 and EN50173 requirements. When configured in worst-case 100m channels, with full cross-connects, the Outlets shall be capable of delivering Category6A/ClassEA performance. When Outlets are mated with a Category5/5e plug, the connection performance shall conform to Cat5/5e or better. 6A components shall be selected from suitable range from manufacturer to guarantee worst-case channel head room of 10dB for PSACR-F and PSANEXT Loss and 7dB for ACR-F over a frequency range of 1-500MHz.
- 4.18 Outlets shall be installed according to the manufacturer's instructions. The twists in each cable shall be maintained up to the point of termination and the cable sheath and shielding shall not be stripped back more than the manufacturer's instructions.
- 4.19 Cables shall enter the patch panel from both sides (12-12 split) and from the top of the cabinet.
 - i. Each cable must be labelled at the rear of the panel in accordance with Siemon warranty specifications. This will conform with the outlet numbering on the front face of the patch panel.
- 4.20 Where dado trunking is used open one or two gang frames shall be used. Closed back boxes do not provide sufficient space to meet the cable bend radius.
- 4.21 Where dado trunking is shared with power cabling it shall use a separate compartment with an earthed steel screening divider
- 4.22 Where a fibre outlet is required, it shall be presented as an LC connector.
- 4.23 At each point where a single occupant desk may be placed in a building, one dual outlet shall be provided, in line with ISO11801. Care should be taken to allow for "doubling up" of office accommodation in the future.
- 4.24 In Residences, 1 (one) outlet is required per room occupant (or potential room occupant), unless agreed otherwise.
- 4.25 Each cable shall be terminated in the TR into a 19" rack mounting panel, provided by the system manufacturer being used, at a suitable density for the cable specification, and securely mounted into the Frame with suitable fixings. Each panel shall be separated with a 1U steel cable management bar. Management bars with plastic components are not acceptable.
- 4.26 Third parties, such as BT, are not permitted to use University data infrastructure, and hence must provide their own.

5.0 Containment

- 5.1 All containment must be calculated and designed to meet the requirements of the Siemon cat6A cable diameters. If in doubt as to the sizing, advice can be sought from the IT Installation Assurance Engineer to aide in the calculations.
- 5.2 Horizontal cable pathways must be designed such that the minimum bend radius of the cable is not compromised and must be capable of delivering a minimum of 2 cables to each identified potential work area.
- 5.3 All containment systems must provide a minimum of 50% spare capacity due to electromagnetic field properties within the cable bundles. This means that on day 1 no more than 66% of the containment should be utilised. This is inline with a Siemon requirement for approved warranty certification.
- 5.4 All cable pathways shall follow suitable containment, and this containment must be continuous, without gaps, for the length of such containment. This includes ceiling voids and all wall cavities.
- 5.5 Trunking must be fitted with plug-and-screw. Self-adhesive trunking is not acceptable.
- 5.6 In no case shall a cable be routed over a sharp edge or bend, and no cable pathway shall contain such.
- 5.7 Any cable pathway that pierces a wall, or other fire-boundary must be fire-stopped to an applicable specification as defined by the University fire safety officer (<https://www.st-andrews.ac.uk/staff/policy/healthandsafety/firesafety/>). In all cases, firestopping materials should be specifically designed for the purpose, guaranteed for at least 30 years, and conform to relevant legislative standards. Photographic proof of firestopping shall be provided for all locations identified on the as-fitted drawings, in the documentation provided to the University. The photographic proof may be provided electronically, with the system documentation, though the locations identified by each photograph must in all cases be easily ascertained. Each penetration which requires firestopping shall be designated an identifier, this marked on the as-fitted drawings, and this identifier maintained onto the photographs.
 - i. Fire collar should be used where large bundles of cables penetrate main cable routes. This allows for the addition of future cabling. An example of accepted units - -
https://www.hilti.co.uk/medias/sys_master/documents/h40/h95/9504289488926/Technical-Manual-ETA-17-0081-CFS-SL-GA-penetrations-2017-en-Technical-information-ASSET-DOC-8452723.pdf
https://www.hilti.co.uk/c/CLS_FIRESTOP_PROTECTION_7131/CLS_FIRESTOP_COLLARS_WRAPS_BANDAGES_7131/r978938
- 5.8 All Horizontal cable pathways shall be dedicated for telecommunications structured data cabling only and not shared by any other services regardless of use. This is for frequency separation between other ELV systems to maintain the data transmission quality of the network.
- 5.9 All installed pathways shall be accessible for the facilitation of moves, adds and changes.

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- 5.10 Ceiling distribution systems shall provide full accessibility to cable pathways. Lock-in ceiling tiles, drywall or plaster ceiling shall not be used where a cable pathway exists, unless the tiles have been modified to facilitate easy removal of tiles without damage to them over an extended period, or a safe crawl/walk space exists, which provides full access to the cabling.
- 5.11 Enclosed pathways shall have pull points at intervals which provide adequate access to the containment and cabling system. It should not contain any 90-degree bends between pull points.
- 5.12 Where a cable pathway is above a suspended ceiling, or under a suspended floor, the pathway must be provided by means that are structurally independent of the ceiling, floor, its framework, or supports.
- 5.13 Horizontal sections of containment should be installed with the cable mounting surface uppermost and shall be fully accessible.
- 5.14 Vertical sections of containment shall be installed with the cable mounting surface facing outwards and shall be fully accessible.
- 5.15 Velcro cable ties shall be fitted to cables or cable bunches and shall be tied to the containment when changing direction and every 300mm. No plastic cable ties are permitted for use on the data cabling.
- 5.16 The contractor must adhere to the manufacturer's requirements for bend radius and pulling tension of all data and voice cables.

6.0 Intra Building Backbone Distribution

- 6.1 Backbone cabling connects Telecommunications Rooms together. Each TR shall be connected to the designated primary TR(s) with a minimum of the following terminated links, using materials supplied by an approved manufacturer:
- i. 24 single mode OS2 cores, using fusion-spliced LC-UPC pigtails.
 - ii. Optical fibres cables require a yellow identifier label on the sheathing at each transition point within the buildings. The labels should be of engraved design and contain the relevant information pertaining to each fibre.
 - iii. These fibres shall be presented on a 24 way (48 Fibre) or 36way (72 Fibre), LC-UPC, 1U, Steel, panel, correctly glanded for the cable used. Multiple fibre cables should be presented on a single panel, not 1 panel per cable.
 - iv. A number of category 6A links, agreed on a per-project basis.
 - v. Fixed Internal Grade Telephony Tie Cable shall be to specification CW1308 and have a Low Smoke Zero Halogen Cable Sheathing provided from the location of the External Copper Cable termination, to the primary TR, where it will be terminated on a suitably labelled RJ-45 Voice Patch Panel as 1 pair per RJ-45 socket (single-pair modularity, on the blue pair (pins 4 and 5)).
 - vi. Voice patch panels shall have a minimum of 25 outlets per 1U panel and be made by an approved manufacturer. Consultation with the Telephony Engineer is required to finalise this on a case-by-case basis.

7.0 Telecommunications Rooms (TR)

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- 7.1 Telecommunications rooms shall be designated solely for the purposes of telecommunications structured cabling and the associated active network equipment. No other equipment is permitted.
- 7.2 Equipment not related to telecommunications shall not be installed, pass through, or enter the telecommunications room. There shall be no liquid carrying pipes installed within or above a TR.
- 7.3 For up to 500 outlets the Telecommunications room shall be a minimum of 3.2m x 3.0m to allow for one enclosure and one spare. For up to 1,000 outlets the TR shall be a minimum of 4.6m x 3.2m. Additional space shall be left on the side closest to the door.
- 7.4 Minimum floor loading 2.4 kPA (50 lbf/ft²). The floor shall be levelled, using a suitable levelling compound then cleaned prior to fitting the floor covering. The floor covering shall comprise heavy duty anti-static vinyl.
- 7.5 One or two TR in a building shall be designated the primary TR(s), at the choice of IT Services. Doors to Telecommunications Rooms shall be secured using the University standard access controls, to the University Access Control Specification (insert link).
- 7.6 IT Services staff may require rapid access to TR's, and may require out-of-hours access, and hence the TR's must be either accessed from public areas, or a route identified by which IT Services staff can enter the TR's without hindrance from departmental security systems.
- 7.7 Enclosures in the Telecommunications Room shall be Siemon RS07-E Patching Frame. Other enclosure systems may be considered on a case-by-case basis. Specifications must be supplied to the IT Assurance Engineer for assessment. The final position of the enclosures shall be agreed on site with the IT Assurance engineer.
- 7.8 Each frame shall have vertical cable management on both sides e.g. Siemon VPCA-6. Where two frames are to be installed side by side double width vertical cable management should be used between e.g. Siemon VPCA-12 and VPCA-6 on the outer edges. 20no. Siemon RS-CH and 20no. Siemon RS-CNL-MGR per frame shall be supplied for cable management. Brochure link in item 4.2 (i) above.
- 7.9 Frames shall be attached to the wall using a section of Unistrut or equivalent, and proper fixings, and properly secured to the floor with suitable fixings.
- 7.10 All electrical circuits serving installations within the Communication rooms shall be fed from a dedicated Distribution Board located within the room. No other services or circuits shall be connected to this board.
- 7.11 2 x 32A circuits shall be provided to each enclosure, including any spare using 32A switched 2P+E commando sockets. Isolation switches for each circuit should be provided between the TR door and the enclosure. The sockets should be fitted directly above the rear and centre of each enclosure at a height not exceeding 2.5m.
- 7.12 Each enclosure should have two dedicated n-way's neon surge protected sequential start vertical rack mount PDU; one angled right (POL/XAR12NGQ-32) and one angled left (POL/XAL12NGQ-32) or agreed equivalent. PDU's shall be securely affixed to the rear of the enclosure in such a way that does not obscure any of the rack mounting holes. IT services will provide PDU's for installs to the contractor for mounting.
- 7.13 Grounding and earth bonding shall meet local codes which specify grounding/bonding requirements. European Standard EN 50174 shall be followed where appropriate.
 - i. Each enclosure shall be separately earthed, and not "daisy-chained".

- ii. Each Telecommunications Room shall be earth bonded (functional earth) via a 25mm² (6mm diameter) minimum clean earth to the main electrical intake or Primary Bonding Busbar (PBB). The primary function of this earth operates by dissipating high frequencies from the telecoms systems. Its secondary use is providing earth fault protection.
- iii. Each enclosure shall be earthed via a 16mm² (5mm diameter) earth cable from the secondary bonding busbar (SBB) located within the Telecommunications room. This should be mounted at least 300mm AFFL.
- iv. Each individual enclosure shall have either a vertical or horizontal unit bonding conductor earthing busbar to individually earth each patch panel with a 4mm² (2.5mm diameter) earth cable.
- v. All doors on each individual enclosure have been earthed using a 4mm² (2.5mm diameter) earth cable, top and bottom.
- vi. All functional earth cables within the TR shall be sheathed in white and labelled "TELECOMS EARTH DO NOT REMOVE"
- vii. No loops shall be left in any earth cabling.

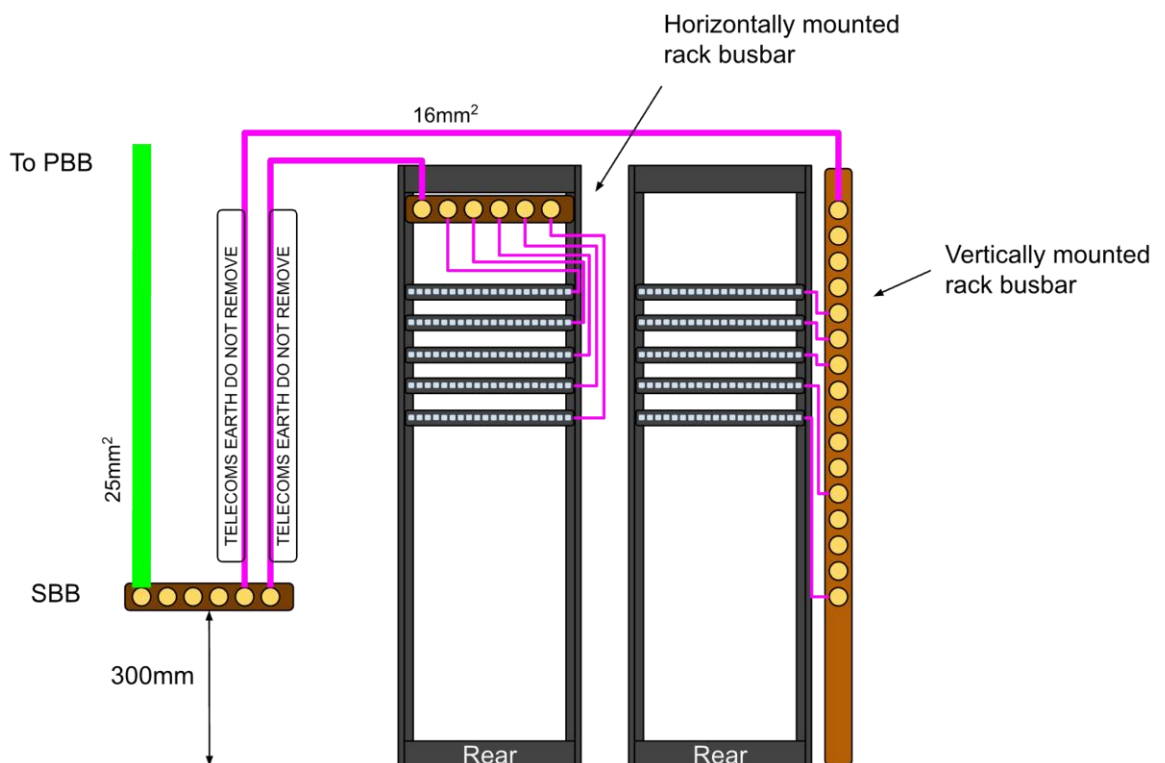


Figure 1 TR and rack earthing example - Vertical orientation preferred.

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- 7.14 With reference to the accessibility requirements of BS-EN50174-2:2018, the minimum clearance on all faces of the enclosures shall be 1.2m. The number of enclosures required shall be defined by a member of IT Services staff listed above. Where more than one frame is fitted, they must be affixed together with a manufacturer supplied baying kit.
- 7.15 Lighting shall provide a minimum of 500 lux measured 1 m above the finished floor in front and at the rear of the enclosures, frames, and racks.
- 7.16 All TR doors should not contain any glass or transparent elements. Any other internal windows within the TR should be obscured.
- 7.17 Wall mounted cabinets are not permitted under any circumstances.
- 7.18 Adequate ventilation or mechanical cooling shall be provided to maintain the temperature to 24° centigrade +/- 2°. Humidity should be maintained between 40 and 60% RH.
- 7.19 No more than 288 outlets shall be installed in a single enclosure, cabinet, frame, or rack.
- 7.20 Data containment should run above the enclosure, perpendicular to the front face and cabling should drop vertically down both sides of the enclosure with a 12 – 12 split into the back of each panel.
- 7.21 Power containment should run above and 150mm to the rear of the enclosure, perpendicular to the front face.

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7.22 A typical enclosure/rack layout is shown below, layout design to be submitted by the contractor to the IT Assurance Engineer for approval on each rack.

'U'	Description	
1	Fibre Terminations	
2	Fibre Terminations	
3	Cable Management	
4	Voice outlets	
5	Cable Management	
6	24 inter TR outlets	
7	Cable Management	
8	Top level network switch	
9	Cable Management	
10	24 outlets	
11	24 outlets	48
12	Cable Management	
13	24 outlets	
14	24 outlets	96
15	Cable Management	
16	24 outlets	
17	24 outlets	144
18	Cable Management	
19	48 port network switch	
20	Cable Management	
21	48 port network switch	
22	Cable Management	
23	48 port network switch	
24	Cable Management	
25	48 port network switch	
26	Cable Management	
27	48 port network switch	
28	Cable Management	
29	48 port network switch	
30	Cable Management	
31	24 outlets	
32	24 outlets	192
33	Cable Management	
34	24 outlets	
35	24 outlets	240
36	Cable Management	
37	24 outlets	
38	24 outlets	288
39	Cable Management	
40	Spare	
41	Spare	
42	Spare	

Adequate time should be given to allow assessment and adjustment to the design for final approval.

8.0 Entrance Facility

- 8.1 Where communications cables enter the building from the underground duct network. This may be combined with the primary TR and shall be located in a dry area not subject to flooding.
- 8.2 All duct entry points should be appropriately fire sealed while allowing for the installation of future cables.

9.0 Inter Building Campus Connectivity

- 9.1 External Grade Copper Telephony Cable shall be to CW1128, Petroleum Jelly Filled, with overall steel wire armour. Pair range is to be discussed and approved by the Telephony Engineer at design stage and prior to installation.
- 9.2 The above to be provided via the University Private Duct Network, from a University Main Exchange, to a distribution point no more than 2 metres inside the Building, unless contained within suitable steel trunking. Flammability regulations require that continuation of the wiring path within the building must be made via Internal Grade telephony cable as specified above.
- 9.3 Telephony copper cable shall be terminated on a minimum of 25 outlets per 1U patch panel and be manufactured by an approved manufacturer. It will be terminated as 1 pair per RJ-45 socket (single-pair modularity, on the blue pair (pins 4 and 5)).
- 9.4 External Grade Fibre Optic Cable: Minimum 24 cores OS2 9/125 Single Mode G652.D <1.0 dB/km @1500 nm terminating on a 1U, Steel, Rack-Mounting panel with LC-UPC connectors, correctly glanded for the cable used. All cores must be terminated and presented for use on a suitable patch panel, no cores can be left unterminated.
- 9.5 Fibre Cables shall be Steel Wire Armoured. Specialised Indoor/outdoor fibres will be considered and accepted on a case specific basis by the IT Assurance Engineer.
- 9.6 For projects where the External Fibre Optic Cable meets the Flammability and Zero Halogen Requirements, External Fibre Cable may continue all the way to the primary TR, via the University Private Duct Network, from a University Main Exchange.
- 9.7 In all other cases, a switch of cable type from External to Internal must be made at a high-quality splice point no more than 2 metres inside the building. If the primary TR is within 2m of the building entrance, the external fibre may be presented directly into the patch panel.
- 9.8 The standard requirement is for a minimum of 24 (twenty-four) no. Single Mode fibre cores to be presented at the primary TR(s), from which the building's structured copper cable system is distributed to Offices & other locations within the building. All cores must be terminated and presented for use on a suitable patch panel, no cores can be left unterminated.
- 9.9 It is understood that Steel Wire Armoured external-grade optical fibres may not be easily obtained from our approved manufacturers and contractors may seek per-contract approval for alternative manufacturers, if such cable is unobtainable from an approved manufacturer, by submitting a full specification sheet for the proposed cable to each of the IT Services personnel listed above. Belden, Corning or Nexans fibre optic cables to above specification are acceptable.
- 9.10 Where an extension is required to the University Private Duct network, it shall be provided to the minimum requirement as follows:

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9.11 Dual 110 mm twin-wall PVC ducts, with smooth internal wall. All sections shall be securely jointed to prevent ingress of foreign material. Buried to a minimum depth of 600mm to the top of the top duct, using a route, and building entry-point agreed with IT Services personnel above. Metallic tape shall be laid along the top of the duct to facilitate locating of duct in the future.

9.12 Communications ducts, and their access chambers are to be dedicated to communications and shared with no other services. Third parties, such as BT, etc are not permitted to use University Ducts.

9.13 Building entry points shall be sealed with inflatable seals, to prevent water/gas ingress. These seals should be specifically designed for the purpose, and the proposed product must comply with relevant legislation.

9.14 New buildings and major refurbishment projects shall be diversely connected to the campus duct network. Two separate routes into the building with a minimum of 10m separation shall be provided.

For external ducts access chambers shall be installed at least every 90m on straight runs and at every change of direction. Curved ducts shall not be routinely used but if unavoidable access chambers shall be installed every 30m.

10.0 Administration

10.1 Each copper cable shall be labelled as node number (unique per TR and assigned by IT Services)/socket number. E.g., the 50th cable leaving node 37 would be labelled 37/50. Each cable will be labelled independently of the label on the socket, or patch panel. Failure to follow this labelling system will result in the contractor re-labelling all the sockets to our specification prior to acceptance of the system.

10.2 Outlet labelling shall use numbering grouped by room. Within each room each desk and floor outlet must be numbered in ascending order, clockwise from the main entry to the room. Outlets designated for infrastructure including BMS, door control, CCTV, wireless etc shall also be numbered in this way using numbers following on from desk and floor outlets. E.g.

- Room 101:
 - desk outlets = 37/001 to 37/024
 - floor outlets = 37/025 to 37/036
 - infrastructure outlets = 37/037 to 37/048
- Room 102:
 - Desk outlets = 37/049 to 37/056
 - Floor outlets = 37/057 to 37/60
 - Infrastructure outlets = 37/61 to 37/64

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- 10.3 Wireless data outlets shall be labelled with the suffix “W” e.g. 37/66W at both patch panel and outlet
- 10.4 All labels shall be sized such that they are readable from the ground. Therefore, outlets located at high level will require special consideration.
- 10.5 Where more than one outlet is present in the socket the left most outlet shall be labelled with the lower number
- 10.6 Where multiple floors are present within a building, each floor shall be terminated onto separate patch panels. Preference would be to have a colour scheme on the labelling for each floor. This would be represented at both patch panel and outlet ends.
- 10.7 Fibre Panels shall be labelled as “Designator - Building – Destination (length, n cores, n terminated, specification)”, and shall be labelled from 1. E.g. **“Node no. - Swallowgate – Old Union (320m, 24 cores, OS2)”** A simple 1 to n core numbering scheme is desired.
- 10.8 Each fibre cable shall be labelled with the IT Services designator, at patch panel exit, and at each point it crosses a wall, chamber boundary, or other obstruction, using Hellerman Tyton LFHO Ovalgrip markers and numbers, or equivalent.
- 10.9 All enclosures, outlets and patch panels shall be labelled with engraved labels. Labels from a label printer are not acceptable e.g. <https://www.sharpmark.com/engraved-labels> Samples of labelling to be submitted to the project team for acceptance.
- 10.10 Where multiple TR are present in a building different colour labels shall be used for each TR including at the outlet

11.0 System Test & Documentation

- 11.1 Transmission testing should be carried out to the relevant standard using a suitable calibrated tester from Fluke or Agilent. Permanent link tests only and set to the metric scale.
 - i. 100% of lines installed must be tested. Every test carried out on the system, including failed tests, must be recorded, and the time-stamped results provided to the University, along with what corrective action was required to rectify the faults detected.
 - ii. No marginal passes will be accepted.
 - iii. No cable tests that result in the permanent link parameter being over 90m will be accepted by the university.
 - iv. The correct test limit should be set for the corresponding cable type. This will be verifiable in the linkware file submission in conjunction with pdf formatted test results.
- 11.2 Telephony cabling requires testing. The contractor must verify the operation of each pair in the cable as useable for phone connectivity. The Telephony Engineer will provide an analogue equipment position in the relevant telephone exchange for this to be carried out. Verification will be witnessed by the telephone engineer at the patch panel end by using a telephone linesmen handset/Butt phone.
- 11.3 A copy of the device calibration certificate must be supplied with the test results.

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11.4 All faults or non-conformance identified within the cabling system shall be repaired at no cost to the University during the warranty period specified by the system manufacturer (a minimum of 20 years). IT Services staff may undertake a detailed inspection of the system before acceptance by the University, and if necessary, a snagging list will be produced.

11.5 Test results must be submitted in both hard copies, and machine readable format. If the machine-readable results require proprietary software to read, then a copy must be provided to the University, with a copy of a license agreement that covers our use of it in perpetuity, at no additional charge to the University.

11.6 Optical tests shall be performed using a qualified, factory calibrated, power meter and light source. Each core shall be tested at 1310 and 1550 nm for single mode fibre. The length of each core shall be indicated by provision of an OTDR trace for each core, and a calibration certificate for the OTDR supplied with the test results.

11.7 Testing may be witnessed by a member of IT Services Staff, but in all cases, IT Services staff will re-test a selection of lines using our own test equipment and shall compare the results we achieve with the results presented to IT Services. In case of major discrepancy, the contractor shall be invited to repeat their test, and reproduce their results, witnessed by IT Services, and if the performance is lesser than the documented test result, undertake whatever remedial work may be necessary to bring it into conformance with the original test.

11.8 The System warranty certificates, from the copper and fibre cabling system manufacturer, will be presented to the University before the University will accept the cabling system.

11.9 A full set of documentation, and accurate as-fitted drawings shall be provided to Estates, and IT Services, in both hard-copy and electronic formats. As-fitted drawings must be compatible with AutoCAD 2010 or later and PDF.

12.0 Commissioning

12.1 A patching schedule template will be provided to the project. It is the responsibility of the main contractor to have all sub-contractors with network device requirements submit the applicable information in the acceptable format.

- i. The handover date of this document will be agreed within the programme to allow sufficient time for network configuration and patching to be carried out.
- ii. As guidance - an adequate timeframe to allow would be 2 weeks prior to the scheduling of sub-contractors beginning on-site device commissioning.

12.2 Provision should be made for the contractor to install final connections from cabling to active equipment under the guidance of IT Services staff.

12.3 Active equipment, cat 6A patch leads and optical fibre patch cords will be supplied by IT Services to the data contractor.

13.0 Removal of Data and Telephone cabling

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13.1 Any alterations to Data and Telephone wiring involving the removal of cabling must be carried out by an approved data contractor. If a socket is to be removed, cabling must also be removed from the route feeding it, as far as the termination at both ends of the cable. Data cables must be removed from patch panel, and the socket label changed to read "Redundant" or "R". For non-structured telephone cabling, advice must be sought from the Telephone System Administrator before any works are carried out, and in all cases, prior to any work commencing notes of pair numbers must be made and provided to the Telephone Office.

13.2 Data and Telephone cabling must not be removed by any non-approved contractor. If cables are removed from an area without following this procedure, a charge will be made by IT Services to the project cost centre.

14.0 Cable Outlet Presentation - CCTV, BMS, Access and Alarms

14.1 Two outlets are required for all CCTV positions.

14.2 CCTV on suspended modular ceiling: outlet(s) shall be provided above ceiling on suitable containment close to camera (max 1m).

14.3 CCTV on solid ceiling: outlets shall be provided in recessed 1-gang backbox and patch cord routed appropriately in void.

14.4 BMS, Access and Alarm Signalling: outlet(s) shall be provided in recessed / surface 1-gang backbox with labelled blank plate, adjacent to signalling equipment (max 1m). Patch cord shall then be appropriately routed in containment / void to the secure box containing the signalling equipment by the Alarm/Signalling contractor.

15.0 Wireless

15.1 Two outlets are required for all Wi-Fi positions and the sole use of UoSA Wi-Fi hardware.

15.2 Wi-Fi outlets shall be a maximum of 500mm from the access point. No long patch cords are permitted.

15.3 Wi-Fi outlets and access points (APs) shall be installed below any ceiling, accessible and visible. This shall normally be between 2.5m and 3m above floor height. For installation above this height guidance should be sought from the Senior Network Engineer.

15.4 Wi-Fi APs shall not be designed nor installed within 1m of a wall, doorway or other obstruction.

15.5 Wi-Fi APs shall be mounted below all other obstructions.

15.6 Wi-Fi APs shall be a minimum of 5m apart from each other.

15.7 Wi-Fi APs shall not be installed behind metal cages or other "protection" other than those specifically intended for Wi-Fi.

15.8 Wi-Fi APs shall be installed horizontally.

15.9 Wi-Fi on suspended modular ceiling: outlets shall be provided below the ceiling in recessed 1-gang backbox with access point adjacent. A suitable plywood pattress should be fixed to the upper surface of the ceiling tile to provide a secure attachment. Care should be taken not to place the socket in the centre of the ceiling tile. The AP and socket together shall be centred.

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Figure 15.9:1 AP installation on suspended modular ceiling

15.10 Wi-Fi on solid ceiling: outlets shall be provided below the ceiling in recessed 1-gang backbox with access point adjacent.



Figure 15.10:1 AP installation on solid ceiling

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15.11 Wi-Fi with exposed soffit and/or no ceiling: outlets and APs shall be dropped on a pole such that the lower surface of the AP is just below other infrastructure such as lighting, baffles, PIRs. This may be using Unistrut and drop rods or using conduit. The outlets shall still be within 500mm of the AP. Some examples are shown below:

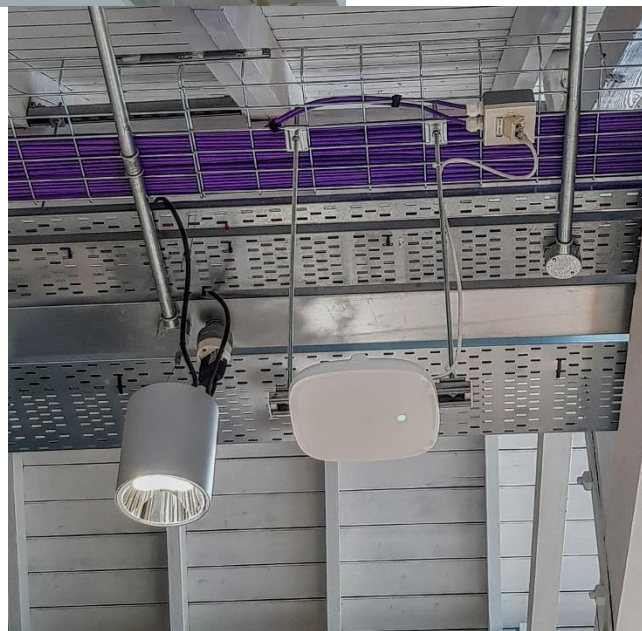


Figure 15.11:1 AP installation on exposed soffit and/or no ceiling

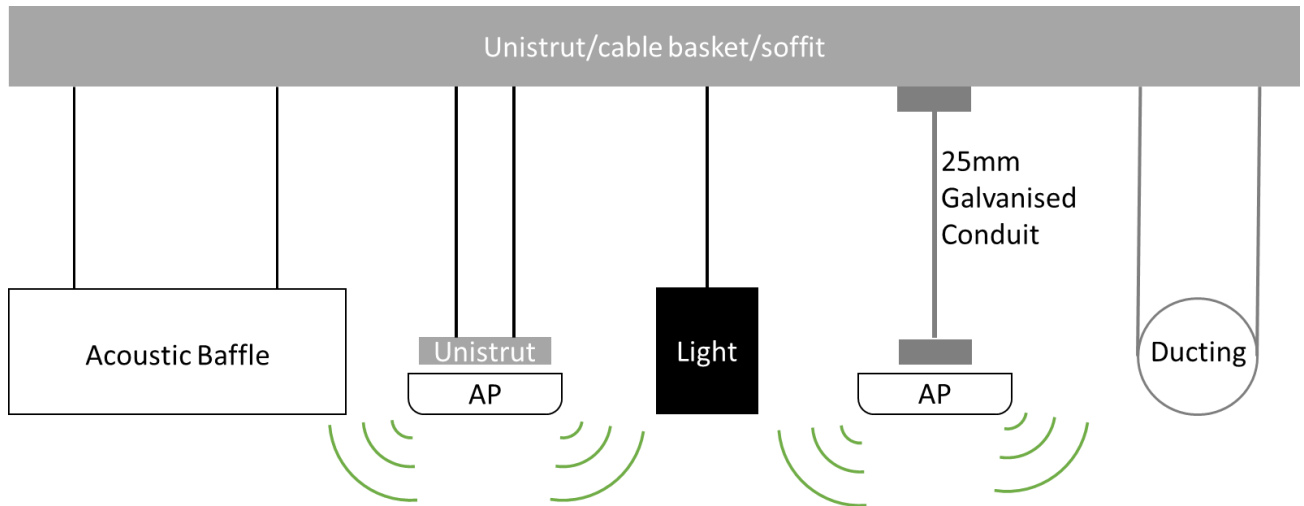


Figure 15.11:2 Wi-Fi AP installation with suspended services

- 15.12 Access point placement shall be designed to supply a minimum primary RSSI of -65dBm and SNR of 25dB at all points within the confines of the building, including plant spaces in all UK/ETSI channels of the 5GHz wireless spectrum, assuming the fitted access point to be a Cisco C9120AXI configured to 25mW transmit power. Secondary RSSI shall be a minimum of -75dBm, although additional access points should not be added just to provide secondary coverage.
- 15.13 In high density areas sufficient access points shall be designed to cope with the required density of client devices
- 15.14 Access points shall not be designed to be located within corridors nor stacked directly above one another on adjacent floors.
- 15.15 As fitted documentation must be provided to IT Services showing the location of each wireless access point, the MAC address, and the outlet it has been connected to. This should be provided as GA floor plans annotated with the spare sticker from the AP and the outlet ID.
- 15.16 Predictive wireless designs shall be carried out using Ekahau Pro 10.3 or later, and the project files containing the surveys supplied to IT Services as a deliverable prior to start of construction.
- 15.17 For all project/contractor-designed wireless installations, an as-fitted wireless survey is required, showing that the required coverage is in place.
- 15.18 It is desirable to fit a matrix of sockets in a system design, allowing access points to be correctly positioned in future, as wireless technologies change.
- 15.19 Access points, 1m cat6A patch leads and the mounting brackets shall be provided by IT services. A designated site meeting for assessment of clean conditions and outlet positioning is required prior to the hardware supply. IT services will provide this hardware to the data contractor and a handover document must be signed to verify the exchange.

Telecommunications Room Handover Checklist

The following items are required to be completed to obtain sign-off from the IT Assurance Engineer. To allow adequate time for installation this must be completed two weeks prior to the scheduled installation of active equipment. Projects should be aware of this for any system commissioning that is dependent on network connectivity.

Item	Criteria	Yes/No
Clearance around enclosure	≥ 1.2m	
Enclosure installation	Rack or enclosure secured to floor and wall	
Entrance Door sized correctly	Minimum of 1m x 2.13m high with no door sill	
Lighting	Sufficient lighting	
Cooling	Sufficient Cooling operational	
Rack earthing	Cable size, earth terminal, no daisy-chaining	
Rack Power	Correct outlets, correctly positioned with isolation	
Rack Power	Correct PDUs installed correctly and not blocking rear mounting holes	
Fibre Labelling	Fibres labelled correctly on Patch Panel	
Network Termination Labelling	Network Terminations correctly labelled on Patch Panel and on the cable at rear of panel	
Cable Management	Cable management installed	
Cleanliness	Room is clean and decoration complete	
Flooring	Flooring is clean and to specification	
Other services	No other services are present in the room nor pass through the TR	
Fibre cable labelling	Fibres are labelled correctly throughout their length	
Cable Installation	Cables enter patch panel 12 per side from above	
Containment	Containment is sufficient for installed cables	

Version number	Purpose / changes	Document status	Author of changes, role and school / unit	Date
1.3	Published online: http://www.st-andrews.ac.uk/media/uos-telecoms-spec.pdf	Approved	Ian McDonald	29/05/2008
1.4	Periodic review	Approved	Ian McDonald	01/06/2009
1.5	Periodic review	Approved	Ian McDonald	01/08/2009
1.6	Periodic review	Approved	Ian McDonald	10/02/2010
1.7	Periodic review	Approved	Ian McDonald	05/06/2010
1.8	Periodic review	Approved	Ian McDonald	25/04/2012
1.9	Periodic review	Approved	Ian McDonald	08/08/2014
2.0	Periodic review	Approved	Ian McDonald	30/09/2015
2.1	Periodic review	Approved	Ian McDonald	29/02/2016
2.2	Expiry date added	Approved	Ian McDonald	29/02/2016
2.3	Periodic review	Approved	Ian McDonald	01/08/2016
2.4	Periodic review	Approved	Ian McDonald	01/02/2017
2.5	Periodic review	Approved	Ian McDonald	01/08/2017
2.6	Periodic review	Approved	Ian McDonald	01/02/2018
2.7	Periodic review	Approved	Ian McDonald	01/08/2018
2.8	Annual review	Approved	Ben Holme	31/01/2019
2.9	Annual review	Approved	Ben Holme	31/02/2020
3.0	<ul style="list-style-type: none"> • Document re-organised for clarity • Removed AMP Tyco • Added requirement for steel screening between compartments of dado trunking • Patch cords should now be Siemon SkinnyPatch CAT6A • TR size explicitly specified • Added requirement for electrical DB in TR • Added TR lighting requirement • Added detailed outlet labelling requirements • Overhaul of wireless requirements • Added TR handover checklist 	Approved	Ross Davidson	31/01/2021
3.1	<ul style="list-style-type: none"> • Added requirement that installers must have Siemon training • Removed references to MM fibre • Expanded functional earth requirements 	Approved	Ross Davidson	31/01/2022

	<ul style="list-style-type: none"> • Added clarity to containment requirements • Added requirements for access chambers on external ducts • Added more detail on labelling requirements • Explicitly specified floor covering 			
3.2	<ul style="list-style-type: none"> • FC-PC replaced by LC-UPC. • Updated details for PDUs. • Removed test for MM fibre. • Removed requirement for project to supply patch cords • Added details of rack vertical containment 	Approved	Ross Davidson	31/01/2023
3.2.1	<ul style="list-style-type: none"> • Update contact details 	Approved	Ben Holme	04/09/2023
3.3	<ul style="list-style-type: none"> • 4.19(i) - panel labelling. • Added containment calculations item. • Edited cable number per work area. • Added EMF justification for containment in-line with Siemon warranty. • 5.7(i) – fire collar examples. • Added no plastic cable ties usage. • 6.1(ii) additional optical fibre labelling. • Added section for direct link to access control spec. • Added rack layout submission process. • Telephony pair range control added. • Added indoor/outdoor fibre use option. • Added more cable test requirements for data and telephony. • 12.1(i)(ii) - added for commissioning process. • 15.19 – Access point addition. 	Approved	Mark Richardson	25/01/2024