1872 PRIFYSGOL ABERYSTWYTH UNIVERSITY

Specification for Physical Data Network Infrastructure

Installation of fibre-optic and copper physical data network infrastructure at Prifysgol Aberystwyth University

Version: 7.0.0

Gwasanaethau Gwybodaeth - Information Services

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1 Introduction

As the first University College in Wales, Prifysgol Aberystwyth University (PAU) has a long-standing reputation for delivering academic excellence, an exceptional student experience and world-leading research. Spread across a large geographical area, PAU provides a unique and diverse education and research experience, with specialised facilities across a range of disciplines as well as being home to several halls of residence, providing accommodation for students.

Information Services (IS) is the directorate responsible for the provision of all IT services across the University.

This document specifies how fibre-optic and copper network cabling installations should be undertaken on all PAU sites to maintain **consistency** and **quality**. The document will cover aspects including safety standards, design and planning, containment, installation, labelling, testing and documentation.

The specifications in this document **must** be adhered to when completing any work at PAU. Any deviation from the specification **must** be approved in writing by IS. Deviations made without prior agreement will be replaced at the installer's expense.

By accepting a contract for any work installing data network infrastructure at PAU you agree to follow the requirements set out in this document.

If clarification is required on any points covered in this document it should be sought **before** commencement of works. For contact details, see section 2.

This document is updated periodically and the latest version will be made available on the PAU website at https://aber.ac.uk/netspec.

2 Contacts

If further clarification is required on any points, please contact Prifysgol Aberystwyth University (PAU) Information Services Network Infrastructure team.

PAU Network Infrastructure team can be contacted on networking@aber.ac.uk. Individuals can be contacted as listed below.

Information Services Network Infrastructure Staff

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PAU Information Services Helpdesk can be contacted on 01970 62 2400 or is@aber.ac.uk.

PAU Estates Helpdesk can be contacted on 01970 62 2999 or campushelp@aber.ac.uk.

Before any existing cabling infrastructure is installed or removed, contractors **must** liaise with Information Services Network Infrastructure staff.

3 Contractors' Notes

3.1 General Notes

Access to PAU buildings and rooms will be organised by the project manager.

A work permit (and roof permit if relevant) **must** be obtained from Estates before project works commence.

Keys to access network cabinets will be provided by IS. Cabinet keys for new cabinets must be supplied to IS at handover (not any other PAU staff).

3.2 Safety Management

Before commencement of any works, all contractors must provide evidence that their safety management system is accredited by Constructionline to PAU.

Accreditation to alternative SSIP schemes, such as CHAS or SafeContractor may be acceptable if advance written approval is obtained from Estates.

3.3 Health & Safety Standards

All contractors working at PAU must commit to adhering to health and safety standards including (but not limited to):

- Health and Safety at Work etc Act 1974 (HSAW)
- Management of Health and Safety at Work Regulations 1999
- Workplace (Health, Safety and Welfare) Regulations 1992
- Provision and Use of Work Equipment Regulations 1998
- Personal Protective Equipment at Work (Amendment) Regulations 2022
- Manual Handling Operations Regulations 1992
- Construction (Design and Management) Regulations 2015

3.4 Fire Safety Standards

All networking products used in fixed installation (following the Construction Products Regulation (CPR) UK Designated Standard EN 50575) **must** be marked with the **classification** and any of UKCA, CE or CE & UK(NI) **conformity mark** (classifications described in Appendix B).

Using the conformity designation of cables, BS 6701:2016+A1:2017 has specified EuroClass Cca, S1b, d2, a2 as the default minimum standard for fixed infrastructure.

3.4.1 Cabling Fire Safety Requirements

PAU uses the following **minimum requirements** for different types of cabling which exceed the default minimum standard:

- Copper Internal – EuroClass Cca, S1a, d1, a1 LSZH
- Copper External – EuroClass Fca
- Fibre-Optic Internal - EuroClass Cca, S1a, d1, a1 LSZH
- Fibre-Optic External - EuroClass Cca, S1b, d2, a1 LSZH

3.4.2 Containment Fire Safety Requirements

All installations must be compliant with premature collapse requirements set out in regulation 521.10.202 of the IET Wiring Regulations (BS7671:2018+A2:2022).

3.5 Construction Design Management and Asbestos Management

It is the contractor's responsibility to liaise with Estates (or the project manager) to ensure that all CDM paperwork is in place, and that appropriate asbestos checks have taken place before any on-site works commence.

3.6 Installation Certification

PAU requires the use of CommScope copper and fibre-optic products for all installations. The installer of any copper or fibre-optic network solution must be certified by CommScope to carry out the installation which will validate CommScope's **25-year warranty** on all network cabling **and** installation works of a project. Certificates to prove compliance must be provided to IS. Each installation must be registered with CommScope and proof of this registration must be provided to IS on completion before payment is made.

CommScope Certification Program Installers must be certified by CommScope Infrastructure Academy in the following courses:

- Installing Premises Cabling Systems ACT I [SP3801]
- Certifying and Troubleshooting Premises Cabling Systems ACT II [SP3802]
- Structured Cabling Infrastructure Design ACT III [SP3000]

3.7 Parts & Components

A list of standard parts and components which should be used as a guide for purchasing can be found in Appendix A.

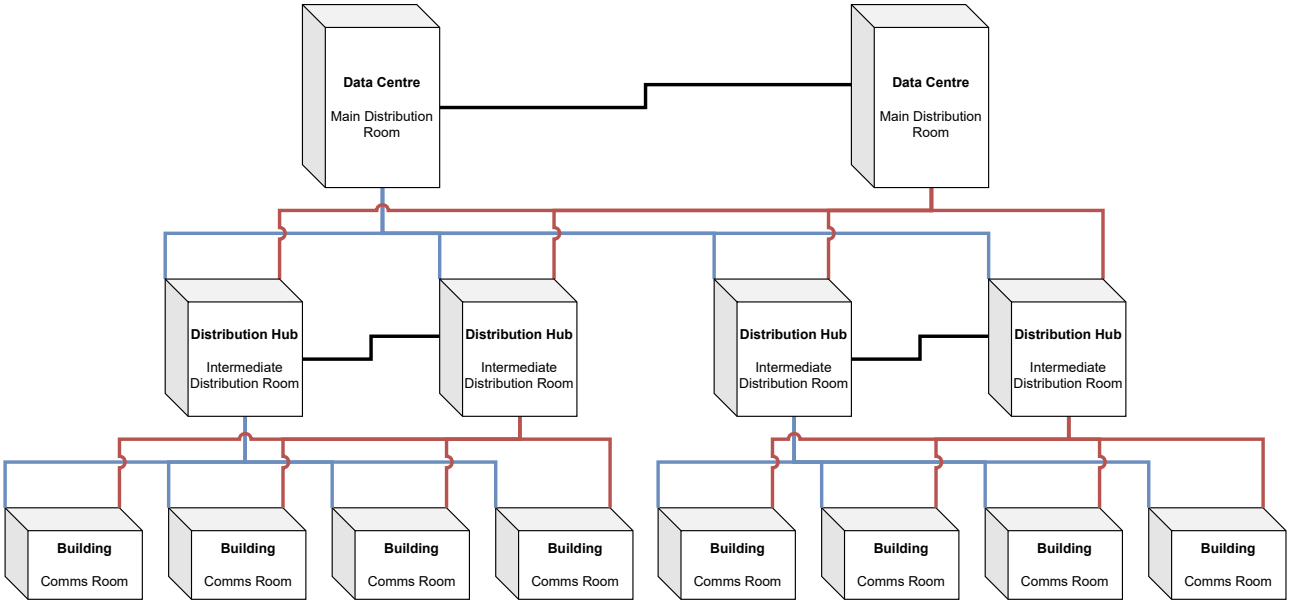


Figure 1: Network Layout at Prifysgol Aberystwyth University

3.8 Network Infrastructure Layout

Network infrastructure at PAU follows the diagram in Figure 1. Terminology in the diagram is explained as follows:

- **Main Distribution Room** (located in a Data Centre)

  The Main Distribution Rooms contain the core network switching and routing and provide fibre-optic uplinks for Intermediate Distribution Rooms.
- **Intermediate Distribution Room** (located in a building designated as a Distribution Hub)

  Intermediate Distribution Rooms contain distribution switches and provide fibre-optic uplinks for building Comms Rooms. These may double as a Comms Room and also contain access switches.
- **Communications (Comms) Room** (located in any building)

  Comms Rooms provide copper twisted-pair access ports to a building, floor, or section of a building.

3.9 Making Good

Existing cabinets and equipment must be covered before building modification works commence. When work is completed, the contractor is responsible for making good any damage caused during installation. The contractor is responsible for cleaning the project area of cable off-cuts, component boxes, dust, and other debris generated by the works. All consumables and any sharps (e.g. fibre-optic) must be removed from the work site and safely disposed of.

4 Design and Planning

4.1 Copper Design

Copper twisted-pair cabling is used in every part of the access network at PAU. Specific requirements in this section must be adhered to for the planning of copper installations. Draft plans for copper installations at PAU **must** be accepted by IS before final planning and installation.

4.1.1 Copper Outlet Quantities & Standards

Table 1 specifies the **minimum number of outlets** per use case and the **required minimum standard** of twisted-pair cable to be installed. Number of outlets **must** be confirmed with IS **before** final planning and installation.

Table 1: Copper Outlet Quantities & Standards

Use	Quantities	Standard
Office	2x Per User	CAT6 UTP
Bedroom (Halls of Residence)	2x Per Desk	CAT6 UTP
Communal (Halls of Residence)	2x Per Area	CAT6 UTP
Laboratory	2x Per Workspace	CAT6 UTP
Computer Room	2x Per Computer	CAT6 UTP
Teaching Podium	4x Per Podium	CAT6 UTP
Group Study Area	2x Per Desk	CAT6 UTP
BMS Controller	2x Per Controller	CAT6 UTP
Attendance Monitoring Point	1x Per Unit	CAT6 UTP
Door Access (SALTO incl. BLUEnet)	1x Per Controller	CAT6 UTP
CCTV	1x Per Camera	CAT6 UTP
Wi-Fi Access Point (AP)	4x Per AP	CAT6a UTP
Information Monitor	1x Per Monitor	CAT6 UTP
Wireless Point To Point	2x Per P2P Unit	CAT6a UTP
Intruder Alarm Panel	1x Per Panel	CAT6 UTP
Emergency Pull Cord	1x Per Pull Cord	CAT6 UTP
Emergency VoIP Phone	1x Per Phone	CAT6 UTP
Lift Controller	1x Per Controller	CAT6 UTP
Lift Telephone	1x Per Lift	CAT6 UTP
Barrier/Gate	1x Per Barrier/Gate	CAT6 UTP
Vehicle Charging Point	TBD Per Job	CAT6 UTP

The minimum standard **unless specified** in Table 1 for twisted-pair cabling is CAT6 UTP.

4.1.2 Wireless (Wi-Fi)

For all building designs it should be assumed that there will be one wireless access point (AP) per 100m^2 (outlet specification set out in subsubsection 4.1.1) for the provision of Wi-Fi. In areas of high electromagnetic radiation, CAT6a F/FTP must be installed.

4.1.3 Television

Where the area to be cabled includes wall mounted televisions (e.g. communal areas within student accommodation blocks), a single cable must be provided to connect a television to the network **in addition** to any aerial connection. Aerial connections should be provided over CAT6 UTP, CAT6a UTP or CAT6a F/FTP twisted-pair cable.

4.1.4 Telephony

All installations with provision for VoIP telephony at PAU will require wired network connections as specified in Table 1. These are considered general network outlets except where dedicated telephony (e.g. emergency phone) is required.

Analogue telephony provision must **not** be installed unless specifically requested by IS. In specific cases where traditional BT-style analogue provision is required (e.g. lift telephones), CAT6 UTP twisted-pair cabling must be installed and an adaptor used from an ATA which will be installed in the network cabinet.

4.2 Fibre Design

Fibre installations are used for the backbone network at PAU. Draft plans for fibre installations at PAU **must** be accepted by IS before final planning and installation.

4.2.1 Connecting to the Campus Network

Depending on the location, purpose and size of a building (following discussion with IS), a fibre-optic connection will be required to one of the university's main or intermediate distribution rooms (see subsection 3.8). If the installation is in a very small building, a connection to an adjacent building's comms room may be sufficient.

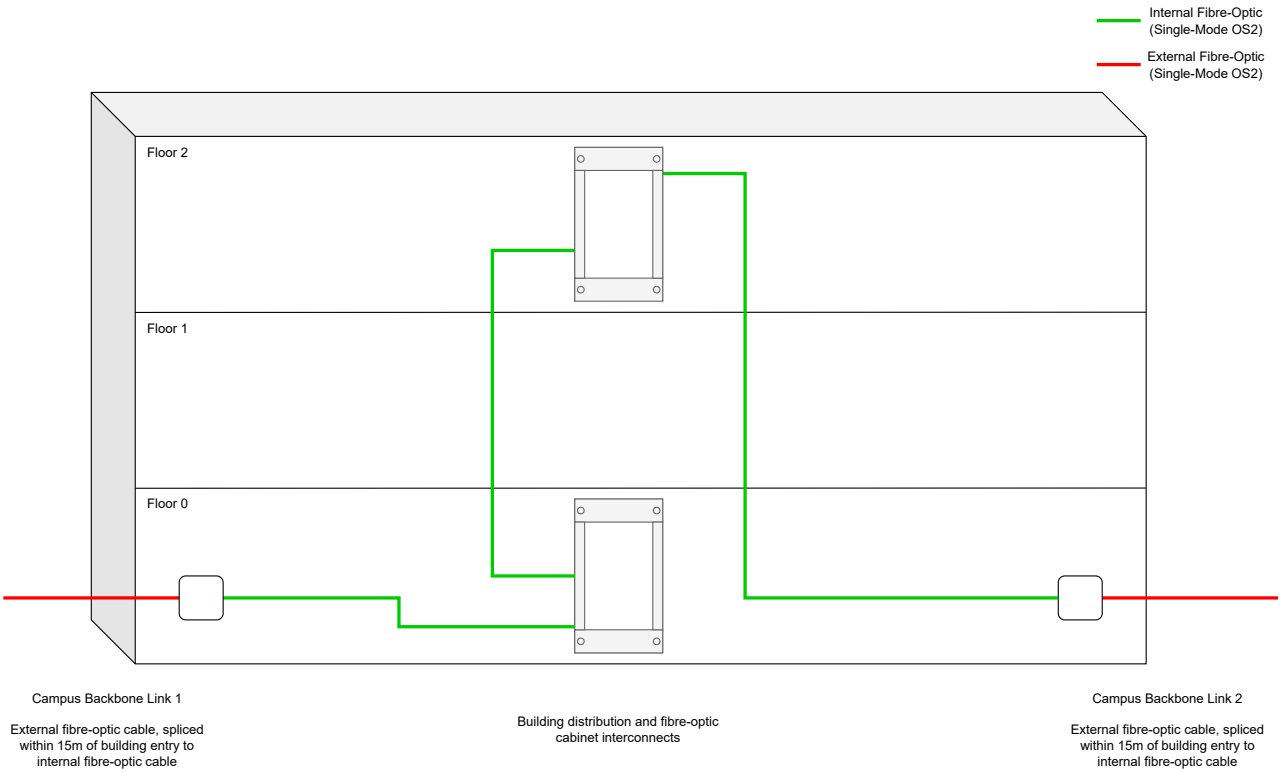


Figure 2: Fibre-Optic Building Feeds and Interconnects

4.2.2 External-Internal Design

Where an area is being refurbished or to be built, the design **must** include at least **two** diversely routed fibre-optic links from different distribution rooms to feed new cabinets - allowing for the failure of one route (as shown in Figure 2). Cabinets from which to feed new cabinets will be specified by IS.

As a minimum, designs must specify each fibre-optic cable installed into a building to be **24 Core OS2 Single-Mode**.

4.2.3 Internal Design

Designs for all fibre-optic links inside buildings should include diversely routed cables. In the example in Figure 2, each internal cable to floor 2 should be in a different riser.

As a minimum, designs must specify each fibre-optic cable installed between cabinets to be **the same as the number of links coming into a building (subsubsection 4.2.2)**. E.g. if there are 2×24 core cables coming into a building, each internal cable should be 24 core.

4.3 Comms Rooms & Cabinet Design

Where a new cabinet or cabinet room is to be fitted, the cabinet is to be purchased and installed as part of the contract unless written confirmation to the contrary is received from IS.

4.3.1 Comms Room

4.3.1.1 All comms/cabinet room locations must be confirmed with IS and Estates.

4.3.1.2 Comms room must be located so that **permanent copper link runs will be no longer than 90m**.

4.3.1.3 Comms room must be accessible from a **public space** (e.g. in Halls of Residence, cabinets must **not** be located within any flat, kitchen or bedroom area).

4.3.1.4 Room must be a **dedicated** comms room fitted with a SALTO door lock.

4.3.1.5 Comms room must allow for 1m clear space around each side of any installed cabinet.

4.3.1.6 Sufficient lighting should be provided in comms rooms to light the front and inside of the cabinet.

4.3.1.7 Floors must be low-dust & anti-static. Carpet should **not** be installed.

4.3.1.8 Design must mitigate noise transference from equipment to surrounding areas.

4.3.1.9 Room must include a climate control system to maintain the temperature between 14 - 26°C and humidity between 40 - 70%.

4.3.1.10 Room door must be large enough to pass a constructed 42U cabinet through without dismantling.

4.3.2 Cabinet

4.3.2.1 All cabinets must be fully lockable on all doors and side panels.

4.3.2.2 The preferred choice of cabinets is from the Rittal range as in Appendix A. For any deviation, consent must be granted by IS.

4.3.2.3 Floor-standing network cabinets installed as part of the project must be no smaller than 800mm wide x 800mm deep. The cabinet must be supplied with feet. Minimum height for any floor-standing cabinet to be installed is 42U unless otherwise directed by IS.

4.3.2.4 Floor-standing network cabinets must include metal or glass doors and solid metal side panels unless otherwise specified by IS.

4.3.2.5 Newly installed cabinets must be at least 0.6m from the nearest wall on 2 sides to allow access and free movement of air. The front and one side of the cabinet must have at least 1.2m of uninterrupted space to allow for access.

4.3.2.6 In **non air-conditioned** environments:

- Rear door must be solid metal (not perforated).
- Front door must be clear glass or solid metal (not perforated).
- Side panels must be solid metal (not perforated).

4.3.2.7 In **fully air-conditioned** environments:

- Front and rear doors must be perforated.
- Side panels must be solid metal (not perforated).

4.3.2.8 Any wall-mounted network cabinet must be no smaller than 600mm wide x 600mm deep. Minimum height of any wall cabinet to be installed is 12U.

4.3.2.9 Cabinets provided should have capacity to support 40% additional future growth in numbers of connections.

4.3.3 Power Supply

4.3.3.1 Each **floor-standing cabinet** must have **2 dedicated 200-250V 16A 'Commando' style** BS 60309 mains connections on **separate dedicated radial circuits** to be protected by a 16A Type C RCBO, 10kA rated (in student halls, circuits must also be protected by an AFDD). These should be mounted in an accessible location, no higher than 500mm from the floor, and typically between 300mm and 1m from the cabinet. The circuits must be suitably mechanically protected where practical. Exact location of connections must be agreed with IS.

4.3.3.2 Each **wall-mounted cabinet** must have **2 Red 13A 2-Gang unswitched** sockets mounted in an accessible location within 1m of the cabinet on **separate dedicated radial circuits** protected by a Type C RCBO (in student halls, circuits must also be protected by an AFDD). Exact location of sockets must be agreed with IS.

4.3.3.3 If any other equipment is to be installed in the cabinet (e.g. dedicated CCTV equipment), there must be alternative power supplies provided for them. These must **not** be on the same circuit as those provided for networking equipment. If UPS provision for non-network equipment is required, this must be separate from that used for network equipment.

4.3.3.4 Uninterruptible Power Supplies (UPS) will be specified, procured, configured and installed by IS. Every cabinet installed at PAU must take into account space for a UPS. Funding **must** be allocated within the project budget planning to cover the cost of a UPS unless specified otherwise.

5 Installation

5.1 General Notes

5.1.0.1 Manufacturers' specified bend radius must be adhered to for every cable installation. As a guide, cable bend radius can be calculated as described in Figure 3.

- Twisted-pair cables - $Radius = 4 \times CableDiameter$
- Fibre-optic cables - $Radius = 10 \times CableDiameter$

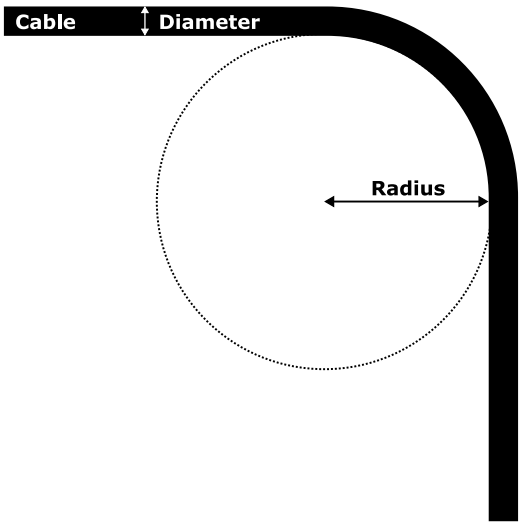


Figure 3: Cable Bend Radius

5.1.0.2 All installations and terminations must adhere to current standards and the manufacturer's specifications.

5.1.0.3 All cable runs must be contained (see subsection 5.2) for the whole length of the run including where they pass through holes in walls and ceilings.

5.1.0.4 Cables and their sheath/jacket must not be damaged or kinked during installation. Any damaged or kinked cables must be fully replaced at the installer's expense.

5.1.0.5 Hook-and-loop (Velcro) ties must be used and tightened to comfortably hold cable to basket/tray (Figure 4). Nylon cable ties must not be used other than to lightly hold individual cables in place on the cable management bar of patch panels.

5.1.0.6 All terminations must be made using installer specified equipment (e.g. CommScope SL jacks must be terminated with CommScope SL Termination Tool as specified in Appendix A).

Figure 4: Cable Contained in Cable Basket

5.2 Containment

5.2.0.1 Where containment penetrates an element of building construction having specified fire resistance, it must be internally and externally sealed so as to maintain the required fire resistance.

5.2.0.2 All trunking and conduit must be cleaned of dust and debris before lids are fixed in place.

5.2.0.3 All containment should leave 40% spare capacity for future cable runs.

5.2.0.4 A draw wire should be installed in all closed containment.

5.2.1 Cable Basket & Tray

5.2.1.1 Networking cable must have its own **dedicated** basket, cable tray or compartmentalised trunking (references to basket in this section also apply to tray).

5.2.1.2 Network copper cables are to be installed in bundles of 24 cables.

5.2.1.3 Where the cable basket crosses power cables they must be bridged at 90 degrees.

5.2.1.4 Data cable basket must be strong enough to hold the weight of cable (not exceeding manufacturer's recommendations).

5.2.1.5 All cable bundles in a basket must be tied with Velcro cable ties every 3m.

5.2.1.6 Network cables must not be stacked above the height of cable basket side walls.

5.2.1.7 All cable basket and metal trunking must be earth bonded.

5.2.1.8 Dedicated network cable basket must be labelled every 10m with a blue laser-engraved label of dimensions 150mm x 50m. This should be **tied** onto the basket, reading as follows:

Ceblau Data COPR & FFIBR TG YN UNIG
IT COPPER & FIBRE Data Cabling ONLY

5.2.1.9 Discontinuation between sections of cable basket or trunking must include earth bond connection between containment sections.

5.2.1.10 Cable basket must have manufactured bends to comply with maximum bend radius for cable type on the **inside** of the bend.

5.2.1.11 Direction should not be changed by butting together two sections of basket without a manufactured bend or joint.

5.2.1.12 Changes in cable containment type (e.g. cable moving from basket to conduit) must be within 150mm of each other.

5.2.1.13 Cables entering a riser at low level must immediately enter a wall mounted cable basket.

5.2.1.14 Cable basket must not be installed upside down.

5.2.1.15 Cable basket must have fire-resisting supports.

5.2.1.16 Electrical and data cables should use different risers. Where this is not possible, adequate separation must be maintained.

5.2.2 Conduit

5.2.2.1 Cable bundles of 6 or less cables may be installed in rigid or flexible conduit.

5.2.2.2 Flexible conduit must be attached to cable basket or outlet at exit point with conduit plate.

5.2.2.3 Flexible conduit runs must be 4m or less.

5.2.3 Dado Trunking

A system of perimeter dado trunking to be installed by the electrical installer should be used to distribute data cabling to work areas & offices as shown in Figure 5.

5.2.3.1 Dado trunking system linking to horizontal cable basket must only be accomplished by a vertical section of dado trunking to the suspended ceiling/floor void.

Figure 5: Double Network Socket with Power in Dado Trunking

5.2.3.2 Each room must have its own vertical section of trunking.

5.2.3.3 Dado must not be fed by conduit drops.

5.2.3.4 Cables must not be fed into dado through walls from adjoining rooms.

5.2.3.5 Dado must not be be screwed to ceiling slab.

5.2.3.6 Mains power and network cabling must be separated in their own compartments in dado trunking.

5.2.3.7 If two mains power sockets are to be installed around a double network socket, they should be installed with one on either side of the network socket (network socket in the middle).

5.2.4 Screed Trunking

5.2.4.1 Must be the same width as any floor box.

5.2.4.2 Where connected to vertical risers, manufactured vertical bend must be used.

5.2.4.3 Accessible junction box must be used at all changes in direction.

5.2.4.4 Must be constructed from a minimum of 18SWG galvanised steel.

5.2.4.5 Must be bonded to earth.

5.2.4.6 Floor boxes must not take up any trunking capacity (must sit on top of trunking).

5.2.4.7 Finished screed surface must be $\geq$ 25mm above the top of the trunking.

Figure 6: Horizontal Network Cable Basket

5.2.5 Suspended Ceiling

5.2.5.1 All cables installed above a suspended ceiling must be supported in cable **basket** as shown in Figure 6.

5.2.5.2 Cable basket must be suspended at a height of > 75mm above all points of a suspended ceiling.

5.2.5.3 Threaded rods supporting basket must be secured to the ceiling slab and must be capable of holding the maximum number of cables plus a safety margin of 100%.

5.2.6 Suspended Floor

5.2.6.1 The distance from the top of a cable bundle to the underside of a suspended floor should be $\geq$ 50mm.

5.2.6.2 Containment must be accessible along the entirety of its length.

5.2.6.3 Cable basket & tray or other services should not be installed over data containment.

5.3 Copper

All copper cabling must satisfy fire safety standards set out in subsubsection 3.4.1.

5.3.1 Cabling & Termination

The standard of copper twisted-pair cabling and number of outlets to be used for any installation **must** be confirmed during planning as is specified in subsubsection 4.1.1.

In addition to these requirements, the following requirements must be adhered to.

5.3.1.1 **Every** twisted-pair data cabling installation must adhere to the pin/pair assignment of the **TIA-568-B** standard as shown in Figure 7.

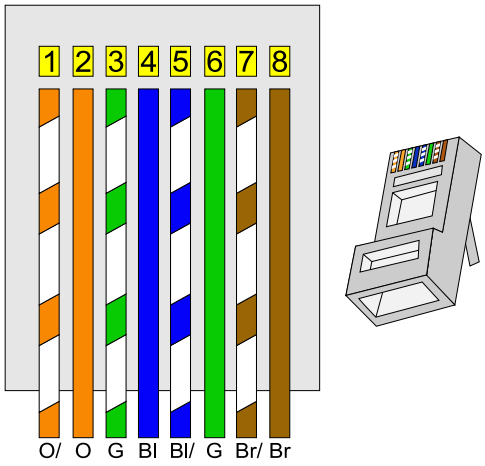


Figure 7: Pin and Pair Assignment of TIA-568-B

5.3.1.2 **Permanent link runs must not be longer than 90m.**

5.3.1.3 All cables must be continuous between the socket/CCA component and patch panel termination.

5.3.1.4 Termination and stripping of cables must use CommScope SL termination tool.

5.3.1.5 Terminations at the outlet end should be bend radius compliant.

5.3.1.6 The minimum necessary amount of jacket should be removed for termination and pairs kept twisted except where necessary.

5.3.1.7 Where cabling is terminated but other works are still ongoing, exposed sockets **must** be protected from dust for the duration of the installation.

5.3.1.8 At least 50mm of excess should be left at the socket end to allow for re-termination.

5.3.2 Sockets

5.3.2.1 Back boxes must be deep enough to accommodate bend radiuses of cables being installed. As a guide:

- CAT6 UTP Cables - 27mm.
- CAT6a UTP Cables - 42mm.

5.3.2.2 In a floor box, the depth between the termination plate and the floor box lid must be at least 40mm. Beneath the termination plate, the depth should be:

- CAT6 UTP Cables - 35mm.
- CAT6a UTP Cables - 50mm.

5.3.2.3 In student bedrooms, bottom of back box **must** be **at least** 150mm above desk height (to allow for socket-mounted APs).

5.3.2.4 High Level Sockets High level sockets (or Ceiling Connector Assemblies (CCA)) must be installed for:

- Wireless Access Points (AP).
- Attendance Monitoring Points (AMP).
- Door Access (SALTO).
- CCTV.

All installation locations must be agreed with IS before installation.

Ceiling Connector Assembly (CCA) (shown in Figure 8) IDC to IDC terminations are designed for the termination of solid core copper cable to patch cable e.g. for Wi-Fi APs. Units must be located above ceilings and securely fastened to cable tray, basket or inside pattress boxes.

Figure 8: Ceiling Connector Assembly (CCA)

AP Network socket or CCA should be installed away from a wall to provide maximum Wi-Fi coverage, and inset into the ceiling (in the case of a plasterboard ceiling) or above the ceiling (in the case of a suspended ceiling).

AMP, SALTO & CCTV Network sockets or CCA must be located 3m off the floor (to minimise unauthorised access) on the wall (in the case of a plasterboard ceiling) or above the ceiling (in the case of a suspended ceiling). Guidance on Attendance Monitor installs can be found in Appendix D.

Power Equipment will be powered with PoE, therefore no additional power sockets are required near high level outlets unless specifically requested.

5.3.2.5 Floor Boxes Where sockets are installed in floor voids, they should be installed into faceplates with angled shutter modules. Angled shutter modules must be positioned so that sharp bends are not introduced into installed patch leads. Shutters must be closed to prevent dust entering the module.

5.3.3 External Copper Cabling

External Wi-Fi or CCTV network installation should have the network socket installed within the building - with only the network patch lead going through the external wall to feed equipment. Where the patch lead would be exposed to the elements it **must** be protected with flexible conduit. If the socket is terminated externally the following must be used.

- 1x Single gang external junction box (IP65 Rated).
- 1x Cable gland (IP65 Rated).
- 1x Socket label on cover (subsubsection 6.2.1).
- 1x Cable label (subsubsection 6.2.3).
- Conduit from single gang junction box to building entry.
- Patch lead (supplied by IS).

5.3.3.1 External Wi-Fi AP In addition to the general requirements in subsubsection 5.3.3, the following should be used to feed a Wi-Fi AP.

- 1x CAT6a UTP cable from cabinet to outlet.
- 1x CAT6a UTP SL Jack.

5.3.3.2 External CCTV In addition to the general requirements in subsubsection 5.3.3, the following should be used to feed a CCTV camera.

- 1x CAT6 UTP cable from cabinet to outlet.
- 1x CAT6 UTP SL Jack.

Figure 9: External Telecoms Cabinet

5.3.3.3 External Telecoms Cabinet External telecoms cabinets should be rated to IP55 and secured with a locking mechanism. Cabinets should be installed on a concrete plinth, with ducting in place to bring cabling into cabinets from underneath. Cabinets may contain externally rated copper or fibre cabling and should exclusively contain passive network cabling and terminations. Example shown in Figure 9.

5.3.3.4 External Copper Backbone External copper network cabling should **not** be used for backbone cabling (switch-to-switch) unless specifically directed by IS.

5.3.4 Patch Panels

5.3.4.1 Patch panels must be unloaded jack type panels, loaded with terminated CommScope SL series jacks according to manufacturer's instructions.

5.3.4.2 Cable ties must be used to comfortably hold each cable individually to the rear cable management plate of a patch panel.

5.3.4.3 Each individual patch panel may only feed **one floor** (i.e. no mixed floors on a single patch panel). Unused slots may be left empty as shown in Figure 10.

5.3.4.4 Network cables from patch panels must be attached to cable basket in the cabinet so as not to intrude on space left for active equipment.

Figure 10: Copper Patch Panel

5.3.5 Network Patch Leads

The supply of CAT6 UTP/CAT6a UTP patch leads for installation is not required. These will be sourced by IS unless otherwise specified.

5.4 Fibre-optic

5.4.1 General

5.4.1.1 All fibre-optic cabling must satisfy the fire safety standards set out in subsubsection 3.4.1.

5.4.1.2 As a minimum, each fibre-optic cable installation must be **24 Core OS2 Single-Mode**. All external cable must be **armoured**.

5.4.1.3 Fibre-optic pairs must be terminated as specified in Appendix C.

5.4.1.4 Each fibre-optic cable run should have at least **5m** of excess coiled at each termination or join, and secured to allow for re-termination if necessary.

5.4.2 External-Internal

5.4.2.1 External fibre-optic cabling **must** be spliced onto internal fibre-optic cabling **within 15m of entering a building**.

5.4.2.2 All cables must be continuous (i.e. no splices) unless splicing from external to internal fibre.

5.4.3 Patch Panels

5.4.3.1 Fibre-optic in patch panels must be terminated onto 1m OS2 LC UPC pigtails.

5.4.3.2 Each pair of cores must be swapped at opposing patch panels as shown in Figure 11.

5.4.3.3 Fibre-optic cores and pigtails must be neatly coiled in a patch panel using internal fibre-optic cable management.

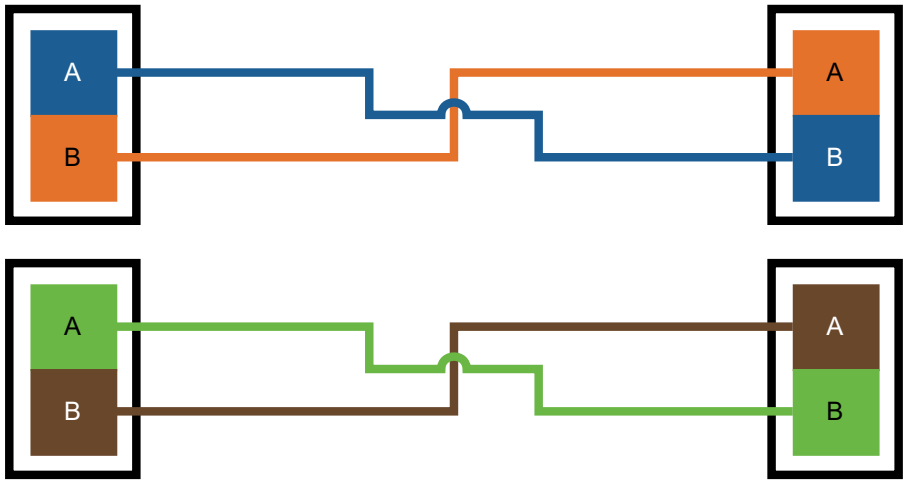


Figure 11: Fibre Core Patch Panel Termination

5.4.3.4 Unused cut-outs in the patch panel must be filled with a blanking plate (not left empty or with a coupler).

5.4.3.5 Fibre-optic patch panels must be mounted at the top position of a cabinet rack.

5.5 Cabinets

5.5.1 Hardware

5.5.1.1 Copper and fibre-optic patch panels, shelves and all other hardware are to be secured into the cabinet at all 4 corners with **M6 cage nuts & Pozi head bolts**.

5.5.1.2 Cable tray or basket installed in a cabinet must run the full length from bottom to top.

5.5.1.3 Cabinet must be adjusted so there is at least **200mm** of space between the front mounting stanchion (the front of any patch panels) and the door.

5.5.1.4 Cabinet must be adjusted so there is at least **550mm** of space between the front mounting stanchion and the rear mounting stanchion.

5.5.1.5 A space of at least 8U must be left empty and free from intrusion at the bottom of each cabinet.

5.5.1.6 Cabinet (frame & metal doors) must be earthed.

5.5.1.7 All installed equipment **must** be supported by attaching directly to the stanchions (or by a **dedicated** shelf).

5.5.2 Cable Entry & Management

5.5.2.1 Cables should be dressed into a cabinet from the **top** (Figure 12) or **bottom** (Figure 13) depending on the most adequate route.

5.5.2.2 Enough slack must be left to allow any patch panel to be moved from top to bottom of a cabinet if necessary

5.5.2.3 Cables in network cabinets must be securely tied to a **vertical cable tray** (not directly to cabinet stanchions).

5.5.2.4 Cables should be dressed neatly after termination as in Figure 14.

Figure 12: Cable Entry into Top of Cabinet

Figure 13: Cable Entry into Bottom of Cabinet

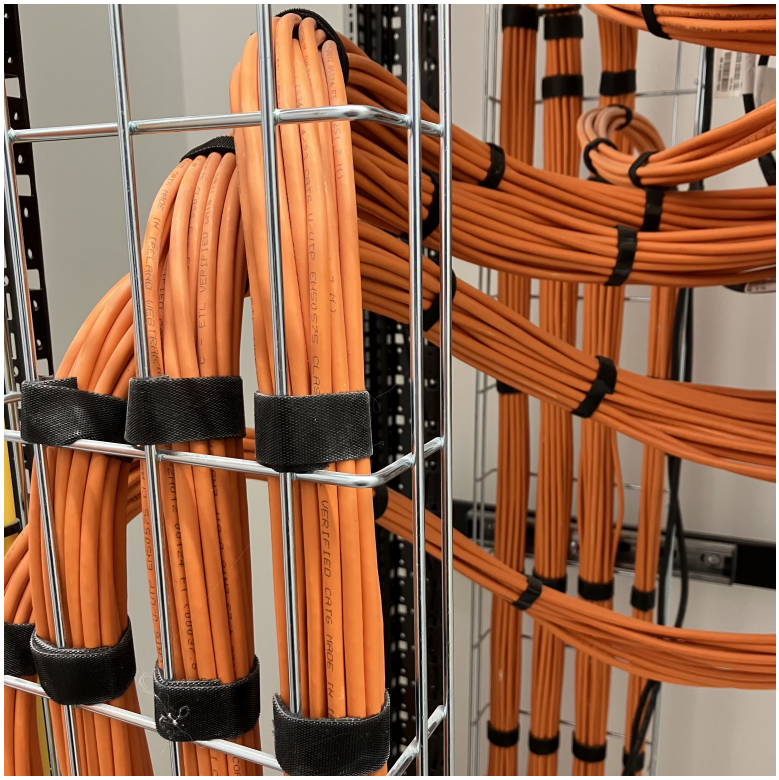


Figure 14: Cable Dressed into Cabinet

6 Labelling

6.1 General Notes

6.1.0.1 For labels which require cabinet numbers, cabinet numbers are allocated and can be obtained from IS.

6.2 Copper

6.2.1 Sockets

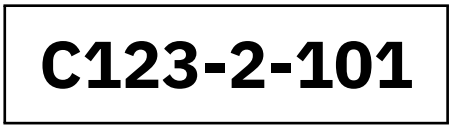


Figure 15: Copper Network Socket Label

6.2.1.1 Labelling Schema Labelling schema for outlet faceplates must be in the form of hyphen-separated sections in the layout **CXXX-Y-ZZZ** (as shown in Figure 15). An example of a labelled socket is shown in Figure 5.

- **CXXX** - Number identifying the network cabinet that feeds the socket.
- **Y** - Single character to denote floor/level. Some buildings use numbers (0, 1, 2, 3, etc.), some use letters (A, B, C, etc.) and some use 2 letters (eg. GF (Ground Floor), FF (First Floor) etc.). If a building uses 2 letters, the floor on the label must be the numerical equivalent (0, 1, 2, 3 etc.). Negative numbers must **not** be used to denote floors below floor zero - please contact IS if this situation arises.
- **ZZZ** - 3 digit number starting from 101 rising sequentially. Numbering must restart at 101 with every change in floor as well as every change in cabinet.

6.2.1.2 Label must be **laser engraved plastic** (not hand-written or self-adhesive tape label) firmly attached to the faceplate.

6.2.1.3 Label must be **black text** on **white background**.

6.2.1.4 Fields must be separated by **hyphens**.

6.2.1.5 Outlet sockets must be labelled **sequentially**, clockwise around the installation.

6.2.1.6 Each outlet socket must be individually labelled with the full schema.

6.2.1.7 Label must be attached to the top of the **faceplate** (above the module).

6.2.1.8 For high level sockets above 2m installed on a wall, the label must be placed on the bottom of pattress box so that it faces straight down. If there is no room underneath the pattress box, the label must be on the bottom of the faceplate.

6.2.1.9 For high level sockets installed **above a suspended ceiling**, a socket label **must** be attached to ceiling frame directly beneath socket, facing down.

6.2.1.10 Ceiling Connector Assemblies (CCA) should include a socket label on the termination assembly (as well as a cable label on the cable at the crimp termination end).

6.2.2 Patch Panels

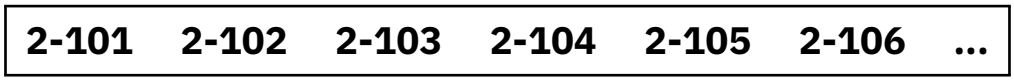


Figure 16: Copper Patch Panel Label

6.2.2.1 Labelling Schema Labelling schema for the patch panel must be in the form of hyphen-separated sections in the layout **Y-ZZZ** as shown in Figure 16.

- **Y** - Single character to denote floor/level. Some buildings use numbers (0, 1, 2, 3, etc.), some use letters (A, B, C, etc.) and some use 2 letters (eg. GF (Ground Floor), FF (First Floor) etc.). If a building uses 2 letters, the floor on the label must be the numerical equivalent (0, 1, 2, 3 etc.). Negative numbers must **not** be used to denote floors below floor zero - please contact IS if this situation arises.
- **ZZZ** - 3 digit number starting from 101 rising sequentially. Numbering must restart at 101 with every change in floor as well as every change in cabinet.

6.2.2.2 Label must be **laser engraved plastic** (not hand-written or self-adhesive tape label) firmly attached to the patch panel.

6.2.2.3 Label must be **black text** on **white background**.

6.2.2.4 Patch panel label must be full-width with all 24 sockets labelled (even if sockets are not filled).

6.2.2.5 Socket numbers on the patch panel **must** correspond to the socket number on the faceplate.

6.2.2.6 All text must be at least 6mm high to maximise readability.

6.2.3 Cables

6.2.3.1 Labelling Schema Labels must follow the same format as for copper faceplates in subsubsection 6.2.1.

6.2.3.2 Cables must be labelled at the patch panel where attached to cable management plate (as shown in Figure 17).

Figure 17: Cables Labelled at Patch Panel

6.3 Fibre-Optic

6.3.1 Patch Panels

Fibre-Optic 12P SM 9/125 OS2 To CAB123 Mar 2023

Figure 18: Fibre-Optic Patch Panel Label

6.3.1.1 Labelling Schema Labels should use the following schema:

- Start with **Fibre-Optic**.
- Number of pairs in the format **12P** (for 12 pairs).
- Cable Type in the format **SM 9/125 OS2** (for single mode, 9/125 diameter, OS2 fibre).
- Destination cabinet in format **To CAB123**.
- Termination date in format **Mar 2023**.

6.3.1.2 Label must be **laser engraved plastic** (not hand-written or self-adhesive tape label) firmly attached to the patch panel.

6.3.1.3 Label must be **white text** on **blue background**.

6.3.1.4 All text must be at least 9mm high to maximise readability.

Figure 19: Fibre-Optic Cable Label

6.3.2 Cables

6.3.2.1 Labelling Schema Labels should use the following schema:

- Start with **Fibre-Optic**.
- Number of pairs in the format **12P** (for 12 pairs).
- Cable Type in the format **SM 9/125 OS2** (for Single Mode, 9/125 Diameter, OS2 Fibre).
- Source and destination cabinet in format **CAB123 To CAB456**.
- Termination date in format **March 2023**.

6.3.2.2 Cables must be labelled at every entry to a patch panel and splice node.

6.3.2.3 Label must be **laser engraved plastic** (not hand-written or self-adhesive tape label) tied to the cable.

6.3.2.4 Label must be **white text** on **blue background**.

6.4 Cabinets

Figure 20: Cabinet Label

6.4.0.1 Cabinets must be labelled with an 18mm x 148mm yellow label with design shown in Figure 20.

6.4.0.2 Label must be affixed to top front of cabinet door.

6.4.0.3 Cabinet number must be correct as allocated by IS.

6.4.0.4 Label must be **black text** on **yellow background**.

7 Testing

Certification testing is **required** to test and certify copper and fibre-optic installations at PAU.

7.1 General Notes

7.1.0.1 Tester **must** have a valid calibration certificate and be compatible with CommScope warranty testing specifications.

7.1.0.2 Test must provide “Pass” or “Fail” information in accordance with detailed test procedures of industry recognised standards.

7.1.0.3 Test standard **must** correspond to specification of installed cable.

7.1.0.4 **Failures** must be rectified at the contractor’s expense (by re-termination or full replacement) until a Pass test result is obtained.

7.1.0.5 Test results must be provided within **10 working days** of work completion.

7.1.0.6 Tester must be updated with manufacturer’s latest firmware and standards database.

7.2 Test Results

7.2.0.1 IS requires exported full test results (with graphs) in PDF format **and** test data from the manufacturer’s software e.g. Fluke LinkWare (.flw).

7.2.0.2 Test results **must** include the following information:

- Full cable identifier (as in network label).
- Name of person and company conducting test.
- Date and time.
- Model, serial number and software version of test equipment.
- Tester calibration date (& expiry date).
- Standard being tested (e.g. TIA CAT6 UTP Permanent Link).
- Type of cable being tested (e.g. CAT6 UTP).
- Pass or Fail.
- Cable length.
- Graph for each test criteria.

7.3 Copper

7.3.0.1 In addition to general guidance, copper test results **must** also include the following information:

- Wire map.
- Nominal velocity of propagation (NVP) of cable.
- Insertion loss.
- Near end crosstalk (NEXT).
- Return loss.

7.4 Fibre-optic

7.4.0.1 Manufacturer's reference cord must be used for testing.

7.4.0.2 All reference cords and connectors being tested must be cleaned before testing.

7.4.0.3 In addition to general guidance, fibre-optic test results **must** also include the following information:

- Reference calibration details.
- Loss (dB) at 1310nm and 1550nm.
- Loss (dB) limits and margins.
- Number of connectors.
- Number of splices.

7.4.0.4 Tests must be bi-directional.

7.5 Test Evaluation

IS will evaluate every test result, and may conduct a counter-test of any installed cabling. If any discrepancies are found, IS may request the whole installation to be **re-tested** at the contractor's expense.

If any discrepancies are found as a result of incorrect testing or falsification of test results (e.g. by mislabelling or duplicating Pass results), IS may require **full re-installation** of **all cabling** at the contractor's expense and otherwise reserve the right to refuse payment.

8 Documentation

At the end of the contract a full set of all documentation detailing the network installation and testing must be passed on to Estates and IS networking staff (see section 2).

8.1 Required Documents

Documents provided should include details on the following.

8.1.1 Installer details

- Installer contact details.
- Site and location details.
- Approved work schedule.
- Date of installation completion.

8.1.2 Installation details

- Location & identity of outlets.
- Network cabinet and location.
- Fibre-optic splicing details.

8.1.3 Containment details

- Containment pathway.
- Ducting.
- Occupancy and capacity of containment and ducts.
- Fire stopping.

8.1.4 Electrical details

- Electrical feeds to cabinets.
- Earthing.

8.1.5 Testing details

- Detailed test results.
- Test equipment calibration certificates.
- Details of the test method.
- CommScope warranty certificates.

8.1.6 Annotated Network Plans

Plans must be provided showing the location of every network socket and associated cabinet mains power and earthing installations, including their full socket number (e.g. C123-2-101). Example of a network plan shown in Figure 21.

CAD drawings must be DWG or PDF and must include **different layers** which show:

- Title.
- Date.
- Walls and doors.
- Cable basket and tray.
- Room numbers.
- Cabinet location or description.
- All network sockets (incl. High-Level etc.).
- Full network socket numbers (e.g. C123-2-101).
- Cabinet power supplies.
- Cabinet earth bonding information.
- Diagram legend.

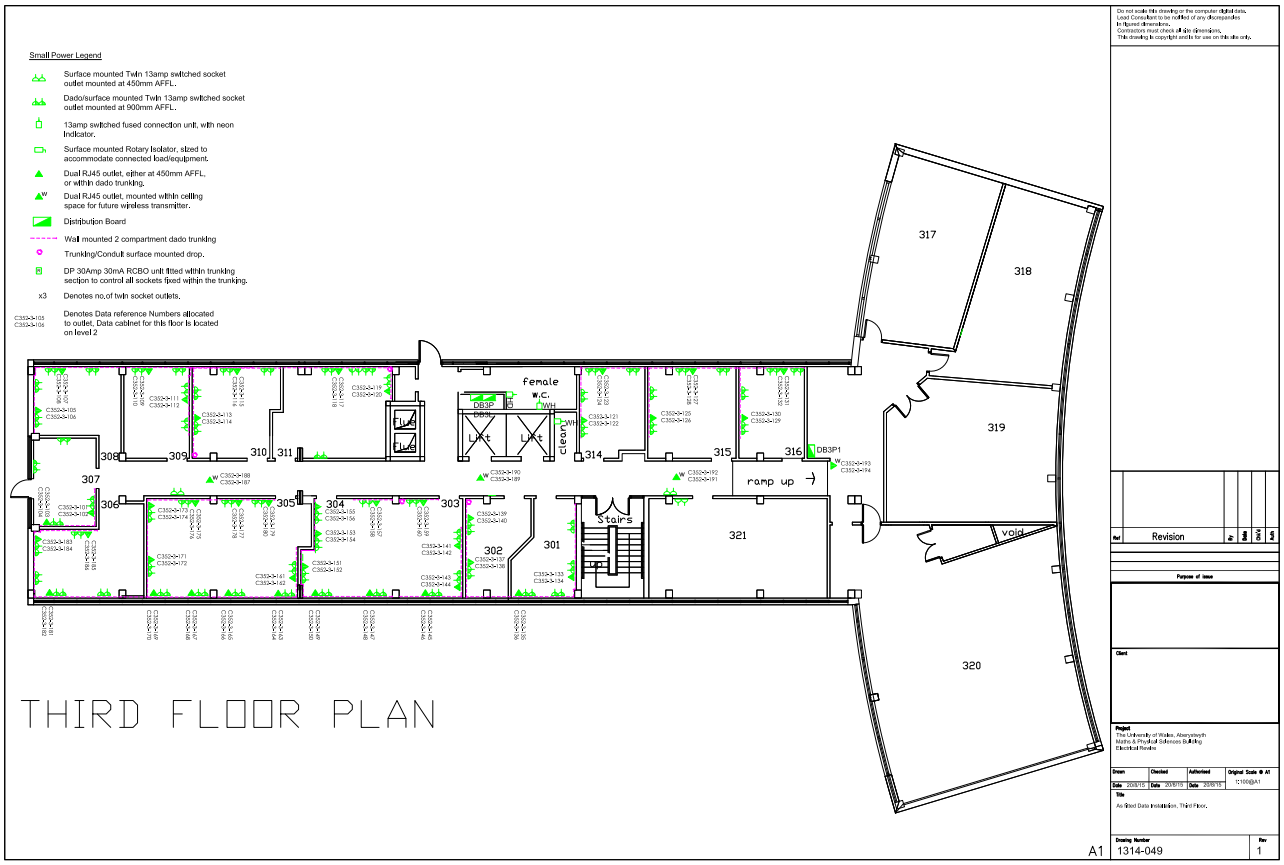


Figure 21: Example of Annotated Network Plans

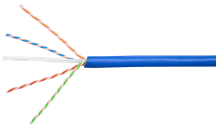
Appendices

A Parts & Components

This list gives guidance on the parts and components which should be purchased for installs at PAU. Parts which become discontinued should be replaced with their successors.

A.1 Copper Network Cable

Table 2: Copper Network Cable

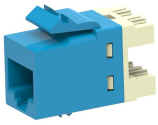
Part/Component	Manufacturer Part Number	Image
CommScope CS34ZC Category 6 U/UTP Cable, LSZH, White Jacket, 4 Pair, 305m CommPak Box	884016214/10	
CommScope CS44ZC Category 6A U/UTP Cable, LSZH, Blue Jacket, 4 Pair, 305m CommPak Box	884044014/10	
CommScope CS44ZC Category 6A F/FTP Cable, LSZH, Blue Jacket, 4 Pair, 500m Reel	884023354/16	

A.2 Copper SL Modular Jack

Table 3: Copper SL Modular Jacks

Part/Component	Manufacturer Part Number	Image
CommScope SL110 Series Modular Jack, RJ45, Category 6, T568A/T568B, Unshielded	1375055-2	

Table 3 – Continued

Part/Component	Manufacturer Part Number	Image
CommScope SL110 Series Modular Jack, RJ45, Category 6A, T568A/T568B, Unshielded	760241188	
CommScope AMP-TWIST SLX Series Modular Jack, RJ45, Category 6A, T568A/T568B, Shielded	2153449-4	

A.3 Copper Patch Panel & Sockets

Table 4: Copper Patch Panel & Sockets

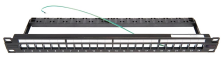
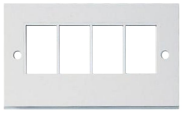
Part/Component	Manufacturer Part Number	Image
CommScope CommScope Shielded Modular Panel, SL, 1U, 24 Port	2153437-1	
CommScope Faceplate, Euromod, 2-Port, 1-Gang, Deep, White	65401812-04	
CommScope Faceplate, Euromod, 4-Port, 2-Gang, White	1711400-1	
CommScope Shuttered Module, Euromod, Unloaded, White	1711275-1	

Table 4 – Continued

Part/Component	Manufacturer Part Number	Image
CommScope Blank Quarter Module, Euromod, White	1711404-1	
CommScope Faceplate, LJ6C, 2-Port, 1-Gang, White	1711302-1	
CommScope Faceplate, LJ6C, 4-Port, 2-Gang, White	2153004-1	
CommScope Shuttered Module, LJ6C, White	1711404-1	

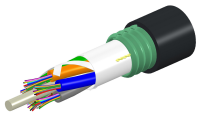
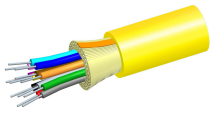
A.4 Ceiling Connector Assembly (CCA)

Table 5: Ceiling Connector Assembly (CCA)

Part/Component	Manufacturer Part Number	Image
CommScope Category 6 U/UTP Cord, RJ45 to CCA connector	760235586	
CommScope Category 6A U/UTP Cord, RJ45 to CCA connector	760235590	

A.5 Fibre-optic Cable

Table 6: Fibre-optic Cable

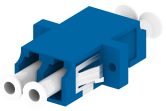
Part/Component	Manufacturer Part Number	Image
CommScope Indoor/Outdoor Single Mode Fibre, TeraSPEED, Single Jacket/Single Armor, LSZH, 24 Fibre, Cca Rating	760154971	
CommScope Indoor Single Mode Fibre, TeraSPEED, LSZH, 24 Fibre, Cca Rating	760241765	

A.6 Fibre-optic Termination

Table 7: Fibre-optic Termination

Part/Component	Manufacturer Part Number	Image
CommScope Fibre-Optic Panel, 1U, Loaded with LC/UPC Singlemode Duplex Adapters, Black	2-1671000-4	
CommScope Fibre-Optic Pigtail, Simplex, Singlemode, LC/UPC	6536880-1	
CommScope Splice Protector	657054-000	

Table 7 – Continued

Part/Component	Manufacturer Part Number	Image
CommScope LC Duplex Blanking Plug	1418800-1	
CommScope Fibre-Optic Duplex Adapter, Singlemode LC/UPC	A14037-000	
Cable Strain Relief Gland & Nut	N/A	
Fibre Splice Holder 24-Way	N/A	

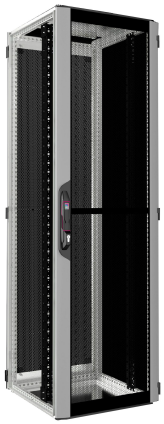
A.7 Tools & Equipment

Table 8: Tools & Equipment

Part/Component	Manufacturer Part Number	Image
CommScope Modular Jack Termination SL Tool Kit with Lacing Fixture	1725150-6	

A.8 Network Cabinets

Table 9: Network Cabinets

Part/Component	Manufacturer Part Number	Image
Rittal Network Rack VX IT with Vented Doors (42U x 800mm x 800mm)	VX 5307.114	
Rittal Network Rack VX IT with Glazed Doors (42U x 800mm x 800mm)	VX 5307.124	
Rittal Vertically Divided Side Panel for VX IT	VX 5301.246	
Rittal Levelling Feet with Internal Adjustment for VX IT	VX 5301.326	
Rittal Wall Mounted Enclosure (15 x 600mm x 673mm)	DK 7715.535	

B Cable Fire Classification (BS EN 50575)

In order to conform to CPR UK Designated Standard EN 50575, fixed installation cabling must be marked with a classification as described in Figure 22.

Requirements for fire classification conformance at PAU can be found in subsubsection 3.4.1.

As an example, a cable designated EuroClass Cca, S1a, d1, a1 LSZH will be:

- Cca - Combustible, moderate flame spread & heat release.
- S1a - Low production & slow propagation of smoke + transmittance > 80%.
- d1 - Falling droplets or flaming particles that persist for less than 10 seconds.
- a1 - Very low acidity.
- LSZH - Emitting a minimally optically dense smoke that releases at a low rate.

Reaction to Fire BS EN ISO 1716		Notes
A_{ca}	Does not contribute to fire	Almost impossible to meet class Aca

Reaction to Fire BS EN 50399			Smoke Production BS EN 50399 / BS EN 61034-2	Flaming Droplets BS EN 50399	Smoke Acidity BS EN 60754-2
$B1_{ca}$	Minimum contribution to fire	Very unlikely to be classified B1ca	**s1a**: s1 + transmittance >80% **s1b**: s1 + transmittance >60% and <80% **s1**: Low production & slow propagation of smoke **s2**: Intermediate production & propagation of smoke **s3**: None of the above	**d0**: No fall of droplets or flaming particles (timed for 1200s) **d1**: Fall of droplets or flaming particles persisting for less than 10s (timed for 1200s) **d2**: None of the above	**a1**: Very low acidity (conductivity <2.5µS/mm & pH >4.3) **a1**: Low acidity (conductivity <10µS/mm & pH >4.3) **a3**: None of the above
$B2_{ca}$	Combustible, low flame spread & low heat release	Similar to Cca - but a lower acceptable heat release and burn measurement. Realistically the highest class cables will meet			
C_{ca}	Combustible, moderate flame spread & moderate heat release	A more rigorous test than Dca widely accepted across Europe as the required classification			
D_{ca}	Combustible, moderate flame spread & high levels of heat release	Relatively little use or acceptance			

Reaction to Fire BS EN 60332-1-2		
E_{ca}	Combustible, limited fire spread of less than 425mm	A basic vertical flame test for a single insulated wire/cable using a 1kW pre-mixed flame. Test does not measure heat, toxic fumes or smoke release.
F_{ca}	Combustible, limited fire spread of more than 425mm	Fca classified cables may have high levels of flammability due to materials they are made of. This cable should only be used externally.

Additional Classifications for Euroclasses B to D

Figure 22: Summary of Euroclass ratings

C Fibre-Optic Core Cable Colours

TIA-598 defines an identification scheme for fibre-optic core coating colours. Each pair must be flipped on the opposing patch panel as shown in Figure 23. Where a cable includes more than 12 fibres, colour codes are repeated and striped with black (with the black core striped with yellow). Every twelve cores adds a stripe.

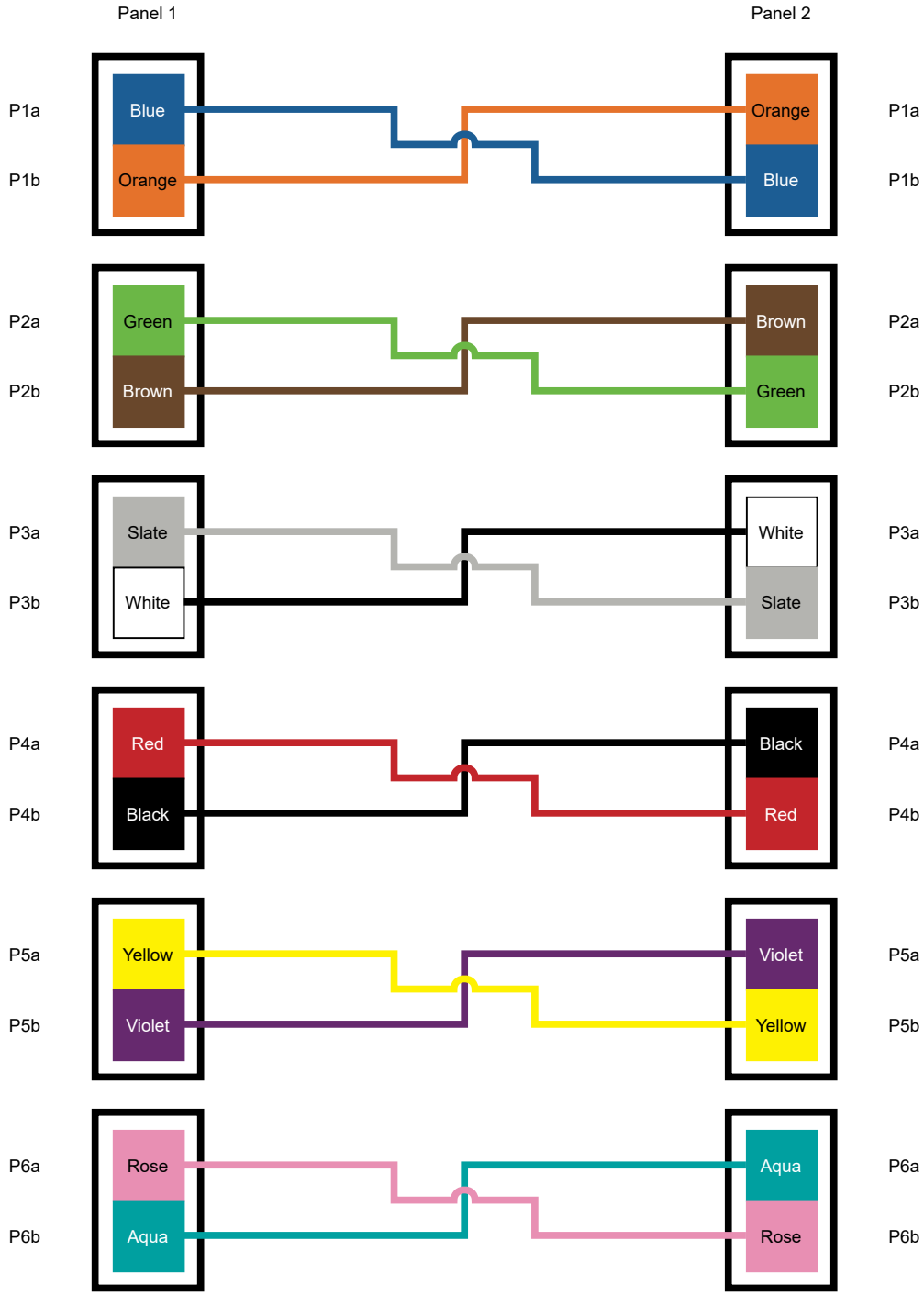


Figure 23: Fibre-Optic Core Cable Colours

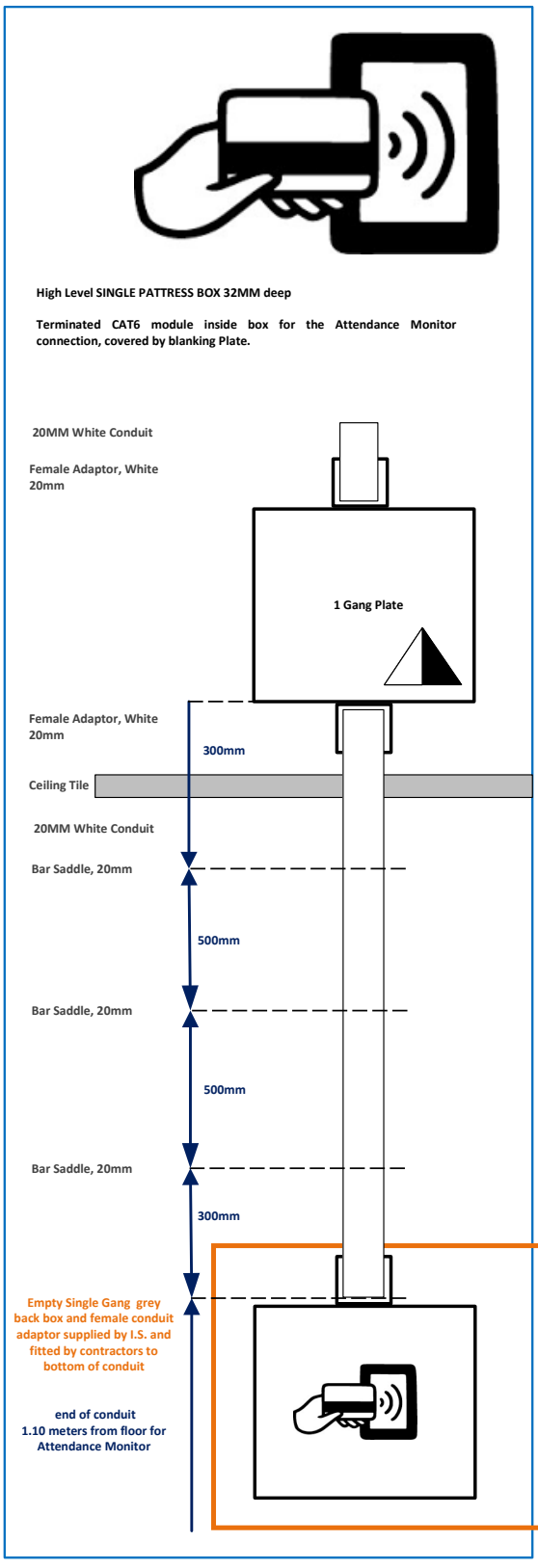
D Attendance Monitor Installs

Installation guidance is provided in this appendix for Attendance Monitoring Points installed in:

- Rooms with Ceiling Tiles (Figure 24)
- Rooms without Ceiling Tiles (Figure 25)
- Rooms where Cable Enters Through Floor (Figure 26)

All attendance monitor installations should be discussed with IS for specific requirements. Attendance monitor units will be provided by IS.

Attendance Monitor Point - Installation In Rooms With Ceiling Tiles



Marshall Tufflex Product List

Single Gang Blank Plate – to be fitted over terminated CAT6 module inside RHS box for the Attendance Monitor – Part Number MSSP10WH

Marshall Tufflex Single Gang Square, 32mm Deep, With Top 20mm Knockout – Part Number MSSB19KWH

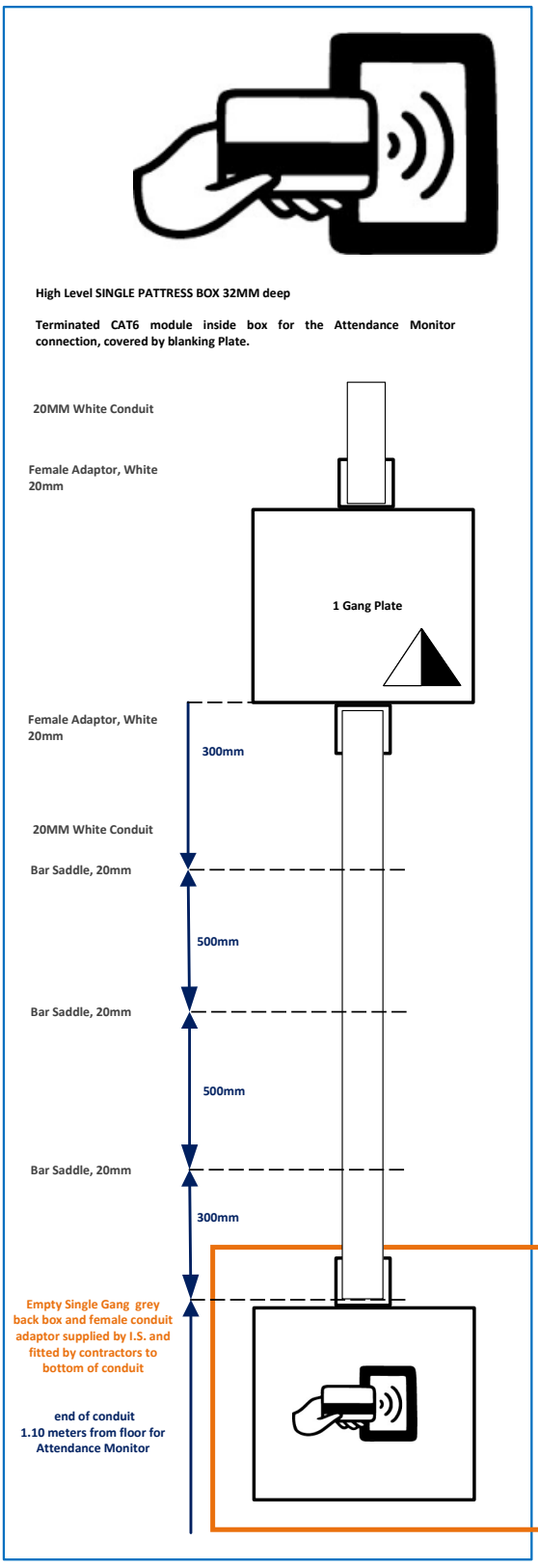
Marshall Tufflex Rigid Conduit Accessories PVC Female Adaptor, White, 20mm – Part Number MAB2WH

Marshall Tufflex PVC Conduit, Light Gauge, White, 20mm – Part Number CR2WH

Marshall Tufflex Rigid Conduit Accessories PVC Spacer Bar Saddle, 20mm, White, to be fitted 300mm from fittings and 500mm max between saddles on straight conduit runs – Part Number MSB2WH

Figure 24: Attendance Monitor Point - Installation in Rooms with Ceiling Tiles

Attendance Monitor Point - Installation In Rooms Without Ceiling Tiles



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Marshall Tufflex Single Gang Square, 32mm Deep, With Top 20mm Knockout – Part Number MSSB19KWH

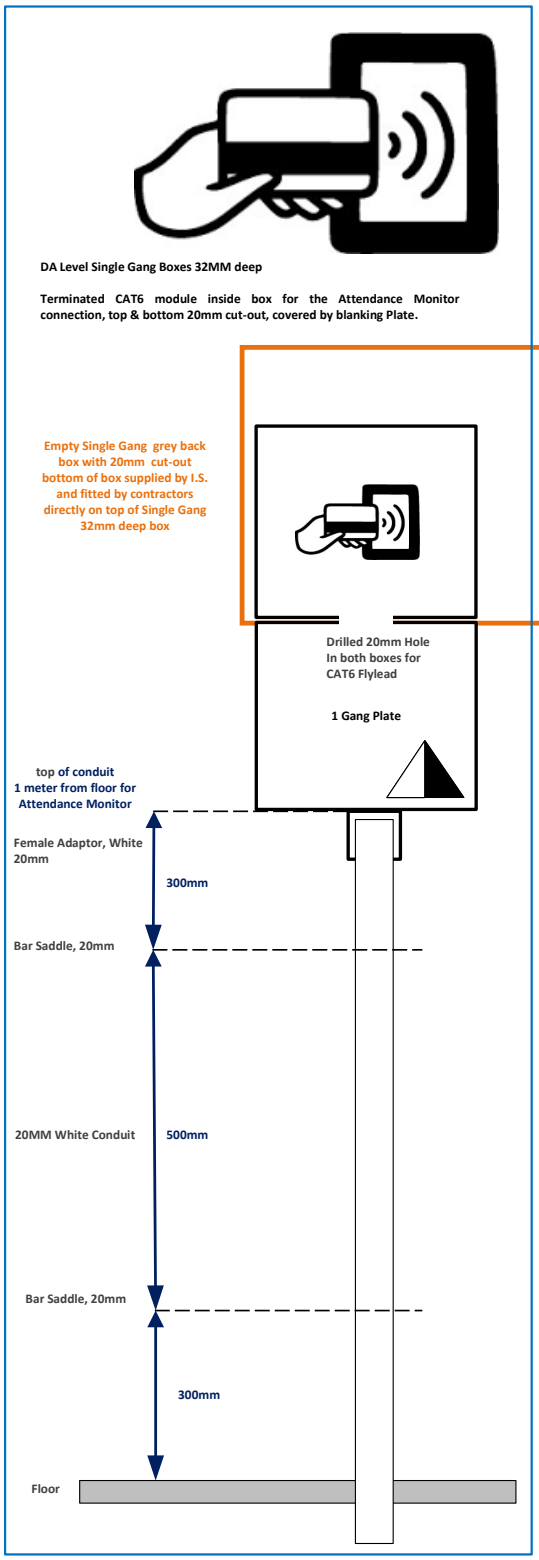
Marshall Tufflex Rigid Conduit Accessories PVC Female Adaptor, White, 20mm – Part Number MAB2WH

Marshall Tufflex PVC Conduit, Light Gauge, White, 20mm – Part Number CR2WH

Marshall Tufflex Rigid Conduit Accessories PVC Spacer Bar Saddle, 20mm, White, to be fitted 300mm from fittings and 500mm max between saddles on straight conduit runs – Part Number MSB2WH

Figure 25: Attendance Monitor Point - Installation in Rooms without Ceiling Tiles

Attendance Monitor Point - Installation Through Floor Into Rooms



Marshall Tufflex Product List

Marshall Tufflex Single Gang Square, 32mm Deep, With Top 20mm Knockout – Part Number MSSB17KWH

Single Gang Blank Plate – to be fitted over terminated CAT6 module inside RHS box for the Attendance Monitor – Part Number MSSP10WH

Marshall Tufflex Rigid Conduit Accessories PVC Female Adaptor, White, 20mm – Part Number MAB2WH

Marshall Tufflex PVC Conduit, Light Gauge, White, 20mm – Part Number CR2WH

Marshall Tufflex Rigid Conduit Accessories PVC Spacer Bar Saddle, 20mm, White, to be fitted 300mm from fittings and 500mm max between saddles on straight conduit runs – Part Number MSB2WH

Figure 26: Attendance Monitor Point - Installation Through Floor Into Rooms

Glossary

24 Core OS2 Single-Mode 24 Core OS2 Single-Mode Cable. 13, 25

AFDD Arc Fault Detection Device. 15
AMP Attendance Monitoring Point. 22
AP Wireless/Wi-Fi Access Point. 11, 12, 22, 23
ATA Analogue Telephone Adapter. 12

BT British Telecom / Openreach. 12

CAD Computer-aided Design. 36, 49
CAT6 UTP Category 6 UTP Twisted-Pair Cable. 11, 12, 21, 23, 24, 33
CAT6a F/FTP Category 6a F/FTP Twisted-Pair Cable. 12
CAT6a UTP Category 6a UTP Twisted-Pair Cable. 11, 12, 21, 23, 24
CCA Ceiling Connector Assembly. 21, 22, 30, 39
Cca Euroclass Cca Network Cable Fire Safety Standard. 8, 9, 40, 43
CCTV Closed Circuit Television. 11, 15, 22, 23
CDM Construction (Design and Management) Regulations. 9
CHAS Contractors Health and Safety Assessment Scheme (https://www.chas.co.uk). 8
CommScope CommScope Network Infrastructure (https://commscope.com). 9, 16, 21, 24, 33, 35
Constructionline A register for contractors (https://constructionline.co.uk). 8
CPR Construction Products Regulation. 8, 43

DWG File Format for CAD Software. 36

Estates Prifysgol Aberystwyth University Estates Department. 7–9, 14, 35

F/FTP Foiled with Foiled Twisted Pairs. 12, 49

HSAW Health and Safety at Work etc. Act 1974 (https://www.hse.gov.uk). 8

IDC Insulation-Displacement Contact. 22
IS Prifysgol Aberystwyth University Information Services. 6, 8, 9, 11–15, 22–24, 29, 30, 32–35, 45

LC Lucent Push-Pull Connector (with Latch). 25
LSZH Low Smoke Zero Halogen. 37, 40, 43

M6 6mm Diameter Metric Rack Screw. 26

NEXT Near End Crosstalk. 34
NVP Nominal Velocity of Propagation. 34

OS2 OS2 Single-Mode Fibre-Optic. 25, 31, 32, 49

PAU Prifysgol Aberystwyth University. 6–12, 15, 33, 37, 43
PDF Portable Document Format. 33, 36
PoE Power Over Ethernet. 22

RCBO Residual Current Breaker with Over-Current. 15

SafeContractor Health and Safety Accreditation Scheme (https://www.safecontractor.com). 8
SALTO SALTO Systems Access Control. 14, 22
SSIP Safety Schemes in Procurement (https://ssip.org.uk). 8
SWG British Standard Wire Gauge. 19

TIA The Telecommunications Industry Association. 21, 33

U Rack Unit (44.45mm). 14, 15, 26
UPC Ultra Physical Contact Connector. 25
UPS Uninterruptible Power Supply. 15
UTP Unshielded with Unshielded Twisted Pairs (also U/UTP). 11, 12, 21, 23, 24, 33, 49

VoIP Voice over IP (Telephony). 12

Wi-Fi Wireless Networking. 11, 12, 22, 23, 49