Design Guidelines
September 2019: Issue 4

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

Section 5
Communication Cabling.

www.canterbury.ac.nz/learningresources

Standards in the Design Guidelines Suite

Design Standard Guidelines Index:

Document Control

Revision History

Revision Number	Description	Section Owner	Date
Issue 1	Original Draft	-	-
Issue 2	Internal Review	-	-
Issue 3	First public circulation	Simon Maindonald	October 2016
Issue 4	Updated Issue	*Rob Oudshoorn*	*September 2019*

Current Document Acceptance

Update Authored	Approved	Date
Richard Hanschu	*Rob Oudshoorn*	*September 2019*

Key Updates from Previous Issue

Revision Item	Details
5.1.3 Active Equipment	*Paragraph added - All active equipment to be specified by UC*
5.2.2 Communication Rooms	*Content amended throughout clause, refer to specific clause for detail*
5.3.1.3 Power	*Lockable racks clarified*
5.3.1.5 Ancillary Equipment	*Clause removed*
5.3.3.1 Floor boxes	*Floor box detail added*
5.3.4.1 Pathways - Interior	*Cable tray space capacity clarified*
5.3.4.1 Pathways – Interior – Catenaries	*Catenary use clarified*
5.3.4.1 Pathways – Interior – Penetrations	*Clarification of penetration requirements added*
5.3.4.2 External	*Underground cable requirements added* *Jointing or turning pit requirements defined*

Contents

5.1 Overview

5.1.1 Purpose

This structured cabling specification defines the technical and functional parameters to be met by the cabling system in order to meet the communication and services requirements of the University of Canterbury.

This document also describes the installation, termination and testing of cabling and associated hardware for voice and data installations at all University properties.

This section of the Design Standard Guidelines is intended to be read and applied during design in conjunction with **Section 01 – General** and any project specific brief and agreements.

5.1.2 Existing Fibre Infrastructure

The University have designed the fibre infrastructure on campus and will design and specify all changes to the fibre network to ensure capacity and correct routing of fibre. Consultants and contractors are to consult with University of Canterbury IT Networks Project Manager (UCPM) regarding any changes to this network.

5.1.3 Active Equipment

For all of the University managed networks, all active equipment (eg. Switched and wifi apps) shall be specified by the UC Network Team and supplied by the University.

Contractors shall not power off or change any cabling to active equipment. A request to the University IT Networks team shall be made if a change is required.

5.2 Design Concepts

5.2.1 Cabling Structure

The structured cabling system shall comprise the following nine subsystems (SS):

- SS1 - Campus distributor
- SS2 - Building distributor
- SS3 - Backbone cabling
- SS4 - Floor distributor
- SS5 - Telecommunications room
- SS6 - Horizontal cabling
- SS7 - Consolidation point
- SS8 - Work area
- SS9 - Telecommunications outlet

The campus distributor is cabled by air blown fibre to each building distributor. The building distributor is linked to each floor distributor with multiple copper and/or fibre links. The building distributor may act as the floor distributor. There may be one or many floor distributors in the building.

Cables shall be distributed via star topology to the telecommunications outlets from the floor distributor via existing or designated cable paths. No cabling is to bypass the floor distributor designated for the specific area containing the telecommunications outlets.

5.2.1.1 Managed Area

The floor distributor managed area may cover more than one floor. The floor distributor must be located so that the total cable length from any potential telecommunications outlet within its designated area, to the termination within the floor distributor, does not exceed 90 metres, taking into account enforced cable pathways.

Note that where it is logical to do so, multiple floor distributors can be created within the same physical floor. In some circumstances the roles of the floor distributors and building distributor may be combined.

5.2.2 Communications Rooms

5.2.2.1 Design

Communication rooms are to house communication equipment related for the operation of the following services:

- Wired and wireless data networks
- VoIP/copper telephone system
- Emergency lighting equipment
- *Security control panels*

5.2.2.2 *Environmental* Control

Communications rooms must be capable of operating continuously for 24 hours per day, 365 days per year in an ambient temperature of -5°C to +25°C, with a non-condensing relative humidity.

Medium and larger communications rooms and floor distributors shall have active cooling in the form of a high wall unit or high forced airflow.

Doors shall have bottom seals to prevent ingress of dust.

Access to communications rooms shall be via electronic card access in the form of fail secure mortise locks with mechanical key override *using Kaba keying system*. A door closer shall be fitted to all communications rooms

In buildings where electronic card access is not practical a mechanical lock will be supplied by the University.

Locks should be configured in such a way that communications rooms cannot be left unlocked.

Communications rooms should not be shared by other services. If co-location is unavoidable, lockable cabinets must be used. Space allocation in communications rooms will require adjustment to allow for these cabinets.

Access shall be restricted to required personnel.

Communications rooms are to be identified by room number signage only.

Care shall be taken in the design/construction of the room to ensure it is not possible to gain access to the room via a cable pathway or overhead plenum space.

5.2.4 Telecommunication Outlet Distribution

Staff office areas require a minimum of two outlets per potential work area or desk. High density post-graduate student office space require one outlet per potential work areas. These are to be used for voice, data and/or other services as required. Additional outlets for printers or common area phones shall be allowed for.

Telecommunications outlets are to be positioned with thought given to the office layout and with consideration to occupational health and safety principles. No outlet is to be positioned so that the required fly lead must traverse a doorway or traffic.

For building areas where it is difficult to add telecommunications outlets at a later date, a minimum of two separate outlet locations should be provided in the initial design for that area. They shall be located to offer maximum flexibility for change within the work area, for example on opposing walls in private office space.

Outlets designated for wireless access points should be provided as dual outlets in the ceiling space approximately every 150m2. Note that this area should be significantly reduced if many attenuating walls are present.

Teaching spaces, laboratories, meeting spaces, high density areas and post-graduate spaces should be treated separately to the above rule and have ceiling mounted outlets (designated for wireless) provided to allow *throughput for 1 AP per 50 users (e.g. 60 users require 2 APs) distributed evenly across the space.* Additional stakeholder requirements may also be defined in these areas.

5.2.3 Security

5.3 Systems & Equipment

5.3.1 Rack Equipment

5.3.1.1 Racks

Standard racks used at the University are IQ open frame two post and four post racks, 45RU high. Wall mounted cabinets may be used upon pre-approval from the University.

All racks enclosed in a cabinet are to be locked with a standard University key.

5.3.1.2 Cable Management

Vertical cable management for use on IQ open frame racks shall be full frame height and 150mm wide supplied by the manufacturer of the racks.

Horizontal cable management shall be supplied by the University.

5.3.1.3 Power

Each equipment rack shall have two 10 amp circuits available on a dedicated circuit, terminated with a screw fastening type socket; ceiling mounted or hanging. *Lockable racks in shared spaces shall have the power outlets located within the rack space whenever possible.*

Additionally, each equipment rack shall have one 15 amp circuit available on a dedicated circuit mounted on the bottom of the vertical cable management such that it does not interfere with outlet termination or cable tray.

5.3.1.4 Power Distribution

In a full frame configuration, power shall be distributed by two 10-way industrial grade power boards. Split racks shall utilise one 10-way industrial grade power board.

5.3.1.5 ~~*Ancillary equipment*~~

~~*All network routers, switches, power injectors, UPS's etc. are to be specified, supplied and installed by the University.*~~

5.3.1.6 Equipment Rack Layout

The equipment rack shall consist of two IQ open frame racks 45RU high connected by 420mm joining brackets.

Equipment shall be installed in pairs with horizontal cable management. Each side of the frame shall have 150mm wide vertical cable management attached - refer Figure 1: Communications outlet example.

The fibre frame shall be mounted at the top of the equipment rack, where fibre is terminated in a communications room.

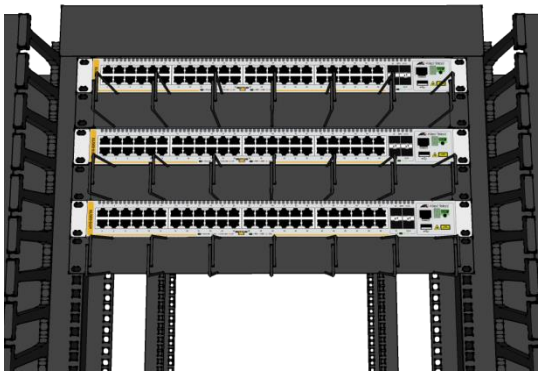

Figure 1: Equipment Rack Example

5.3.1.7 Outlet Rack Layout

The outlet rack shall consist of one IQ open frame rack 45RU high.

Each side of the frame shall have 150mm wide vertical cable management attached.

IQ open frame racks RU45high shall have a 1RU cable management bar installed, followed by two 1RU Systemax M2000 Panels. This pattern shall be repeated down the frame – refer to Figure 2: Outlet layout.

Copper links between communications rooms in the same building shall be terminated in RU5.

Phone pairs shall be terminated on a 110 block in the bottom 4RU of IQ open frame racks.

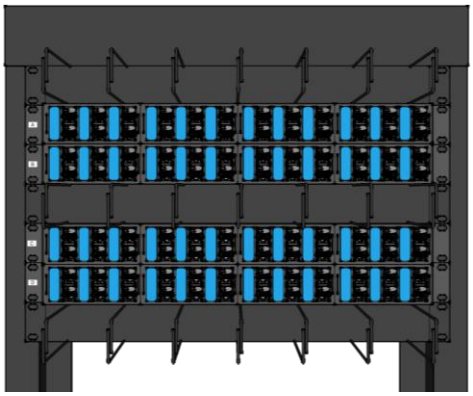

Figure 2: Outlet Rack layout

5.3.1.8 Split Rack Layout

A "half and half" rack shall consist of two IQ open frame racks 45RU high connected by means of 420mm joining brackets.

Active equipment shall be installed in the top half of the frame/rack.

Outlets shall be installed in the bottom half of the frame/rack.

5.3.1.9 Backbone Connectivity

Within the backbone environment each distributor shall be inter-connected via a minimum of 50 pairs of category 3 copper cabling for voice services.

A minimum of 6-core Standard single-mode optical fibre (OS2) single mode fibre shall be installed for intra-building backbone cabling.

5.3.2 Cable Materials

Only cables that run in a completely watertight environment are to be specified as riser grade cable. Any cables that may be exposed to water ingress or moisture condensation shall be specified as outside grade cable with a moisture barrier.

5.3.2.1 Copper

For new installations, the structured cabling system shall be Class EA /Cat6A utilising an interconnect style deployment.

The copper cabling solution shall utilise Commscope Systimax™ X10D Cat6A cabling and the whole installation shall be guaranteed with a minimum 20-year manufacturer's warranty.

5.3.2.2 Fibre

The fibre solution shall utilise Standard single-mode optical fibre (OS2) optical fibre cabling of Emtelle Fibreflow™ or similar microcable fibre unit consisting of 6, 8 or 12 fibres in compliance with ITU-T G.652 D Series.

All single mode fibre shall be 9/125µm Standard single-mode optical fibre (OS2) compliant. Fibre install shall be of blown type through 3.5mm micro-duct.

Where high fibre counts exist, for example the building distributor, the use of large capacity fibre termination drawers or trays is to be considered and priced as an option.

5.3.3 Outlets

Outlets to office areas shall be 8P8C (RJ45).

All copper telecommunication outlets shall be Commscope X10D™ outlets to match the impedance of the cable. All outlets shall be installed and terminated to the T568A wiring scheme.

All flush mounting outlets shall be mounted on site-approved faceplates suitable for flush mounting in standard wall boxes, skirting trunking, and ducts in modular partition systems and similar. Mounting shall be arranged to minimise the risk of damage during removal and replacement of skirting trunking covers or other associated hardware. Outlets shall be mounted with the keyway at the bottom and contacts at the top to reduce the risk of contamination with grit and dust.

Where specifically required due to the construction of a building, surface mount blocks shall be used, instead of flush mount outlets.

Outlets shall be firmly attached to the structure. Fixing to loose skirting trunking covers is not acceptable.

Faceplates shall be un-shuttered.

Where a Class EA Cat-6A medium is used, the outlet mounted in the distribution frame in communications rooms shall be grey in colour.

Faceplates mounted in high dust environments shall be mounted in an enclosure to prevent the ingress of dust. The entry of the cable into the enclosure shall use correctly sized glands, and cable entry shall be at the bottom.

Each faceplate shall be fitted with the appropriate number of 8P8C (RJ45) outlets. This number may vary at specific locations.

Cable entry point to the outlets shall be at the bottom.

Generally, outlets shall be mounted at the following standard locations or heights. Specific requirements are detailed on site drawings.

- Flush mounted within the Skirting duct
- 300 mm above floor level (for walls without skirting ducts)
- 100 mm above desk height where access is restricted by furniture

5.3.3.1 Floor Boxes

When floor boxes are required the following requirements are to be met:

- *Size must be sufficient to allow for minimum specified bending radius of the network cable*
- *Outlet panels must allow for installation of Commscope X10D outlet blocks*
- *Conduit to floor boxes must have independent pathways for power and data cables*
- *Conduit to floor boxes must be at least 20% larger than the total diameter of installed cables*

5.3.4 Pathways

5.3.4.1 Internal

Cable Tray

Cable trays shall be of a size suitable for the volume of cable at any given location within the structured cabling system plus 20% spare capacity. This may necessitate the use of varying width cable tray within the system. All cable trays shall be a minimum of 1 mm thick with rolled or folded sides. All bends, tee and joining pieces, covers and cable retainers shall be factory manufactured. All fittings and accessories will be of the same manufacturer.

If security or BMS low voltage cable is to be co-located on cable tray, the total capacity of the tray must allow for 20% space capacity for network cabling.

Where cable trays are exposed or liable to mechanical damage they shall be protected

The use of cable tray or cable basket with 100mm sides may be considered. In such cases, cables reticulated via a telecommunications cable tray of this design may be left loose (i.e. not cable tied). Securing shall be required at all 90-degree bends and where cable exits the tray.

All cable tray installed in an outdoor environment is to be mounted vertically to prevent the build-up of dirt. In cases where this is not practical, and as approved by the University, tray may be installed horizontally with a peaked 45° cover.

Any cable tray that is located in an exposed location shall be enclosed, unless agreed by the University representative. This enclosure will be determined on-site to its functionality and as such may be removable for access. The materials used for this enclosure will be made of steel and should this be removable, handles will be provided. The structure to support this enclosure can be made from metal framing and will be installed in an approved and tradesman like manner. All exposed materials shall be painted in accordance with University requirements.

Any metal covers deemed necessary for the installation to comply with segregation standards shall be of the “Peaked” type and shall be secured to the tray in a tradesman like manner. These metal covers shall have retaining chains with a minimum length of 500mm.

Cable trays for data shall be separate from electrical cable trays and only used for network cabling.

All trays for data shall be powder coated Dulux™ Sky Blue.

Suitable access to cable pathways for future additions must be provided for.

Catenaries

Catenaries should only be used in areas with drop ceilings allowing for future access to the length of the cable.

Catenary wire shall be galvanised steel wire.

No more than 24 cables shall be supported by a single wire.

The in-ceiling cable support structure shall comprise catenary wire suitably anchored and supported to the ceiling slab and tensioned by way of turnbuckles.

The use of catenary wire for under-floor cable support is not allowed.

A combination of cable tray and catenary wire is the preferred method of reticulation however other pathway products may be submitted for approval providing they are

compliant and provide the same amount of protection as the aforementioned products. A sample of the alternative product shall be included with any submission.

Penetrations

A minimum of 40% spare capacity for additional cable is to be allowed for all projects.

The Contractor shall effectively seal and fire stop to the appropriate level all openings (made or provided) in, or through, building walls, floors, etc. after cable reticulation.

Fire protection installed in penetrations shall be easily removable without causing damage to cabling, and must not in any way restrict future use of the penetration. *In general, RTV type sealants must not be used on penetrations intended to hold spare capacity unless measures are in place to allow selective removal. Use of re-openable fire gaskets or intumescent pillows is the preferred solution.*

The Contractor shall effectively seal all cable duct openings above ground level, and all cable entries into trenches in buildings to prevent the ingress of moisture and the entry of rodents.

The Contractor shall ensure that all spare conduit and cable entries into equipment are effectively plugged and sealed to prevent the ingress of moisture, dust, rodents and insects.

The Contractor shall ensure that all openings through roofs and external walls are made weather proof including the installation of flashing and/or rain hoods to prevent the entry of driving rain, seepage, etc.

Allowance for future Cabling

In addition to the minimum space capacity in penetrations and on cable tray, allowances must be made for access to cable trays at all corners, penetrations and a minimum of every 10 metres along tray runs. Catenary wires should be accessible along the length of the wire.

Painting and Corrosion Protection

The contractor shall be responsible for corrosion protection and the painting treatment of all brackets, supports, cable ladders, weather shields, etc. being supplied and/or installed by the contractor. The contractor shall also be responsible for the restoration to the supplier's finish (or approved matching equivalent) on any damaged paintwork to equipment and accessories.

Other painting and corrosion protection shall be in accordance with the main painting specification for the particular area. Where no special painting procedure is specified, all metal surfaces shall be wire brushed (or equivalent) to remove all traces of rust, scale, grease, etc. and prime-coated with one coat of an approved rust inhibiting paint. The finishing coats, including colour and type of paint, shall be advised by the University.

Paint shall not be allowed to coat the network cabling.

Consolidation Points

Consolidation points shall not be used in buildings without consultation and approval from the University.

Particularly difficult areas to add additional cables in the future due to multiple penetrations or restricted access to cable trays are suitable for consideration of provisioning spare capacity at consolidation points.

Consolidation points may be used to redirect cables to new communications rooms in refurbished buildings.

Additional outlets should be considered within areas that are difficult to cable as an alternative to consolidations points as future proofing.

5.3.4.2 External

General

All external cables shall be rated for outside plant use and reticulated underground.

Cables under roadways shall be laid in roadway ducting within approved conduit. These ducts shall project at least 300 mm beyond the kerb lines and unless specified otherwise, shall be supplied and installed by the Contractor.

The conduits shall be heavy duty, rigid UPVC, or heavy-duty, fibrous cement conduit in accordance with AS/NZS 2053.

All conduits shall be laid at a minimum cover depth of 500 mm, in a bed of clean sand, with a minimum cover of 75 mm above the top of the conduit. The trench shall be backfilled and consolidated to finished ground level.

Protection slabs making up the roadway ducting lids shall be pre-cast concrete having a thickness of not less than 40 mm, and a classification of not less than Grade 15 to AS/NZS 3600 shall be used unless otherwise specified in the project specification.

Standard compliant orange marker tape shall be laid continuously along the route of the cable approximately 300 mm above protection slabs.

All underground cable will be contained within 100 mm conduits and all conduits must be sealed to prevent rodent occupation. For thrust bored installations 70mm conduit shall be used.

Communication Pits

When required, pull pits shall be installed at every change in direction over 45°. The contractor shall install a pull pit having adequate dimensions to contain loops of cabling while maintaining the manufacturer's minimum bend radius requirements.

Pits shall be a minimum of 800mm deep and each pit shall be provided with a seepage hole cast into the bottom surface to allow the disbursement of any accumulated water.

Pits shall be provided with appropriate strength lockable lids at every pull pit to prevent unauthorised entry. Lids shall be sealed to prevent rodent occupation.

Where joining or turning pits are required, these shall be to AS3996 Class B for non-roadway uses and Class D for roadway and carpark uses.

Protection for Cable

Supply and install approved mechanical protection for all equipment and wiring that could be subject to damage during normal plant operation and maintenance, or as directed by the University.

Consideration should be given to the upgrade requirements of the particular site before selecting the required numbers of conduit. Conduits shall be sub-ducted as necessary.

Any conduit cast in-slab should:

- protrude the surface of the slab by a minimum 100mm
- be located as close as practical to sidewalls, and
- exit the slab perpendicular to the surface.

Intermediate wiring joints are not permitted in conduit or wiring ducts. However, inspection tees, elbows and bends are permitted subject to prior approval by the University.

All conduit ends shall be reamed or filed free of burrs and conduit threads entering junction boxes or fittings shall be at least 10mm long.

A suitable and resilient Draw wire shall be provided in all conduits.

At least 40% of conduit capacity must remain after the initial installation is complete.

Pits shall be installed along conduit and ducting routes where there is a change in direction and at distances not exceeding 100 metres between pits.

5.3.5 Furniture / Joinery

5.3.5.1 Soft-wiring Furniture / Joinery

Pre-wired desks that connect to the wall outlet shall not be used.

Extra length may be allowed on cable runs to permit cables to be terminated directly onto fixed position desks provided they are correctly labelled in accordance with this design requirement. Desks or benches that are not fixed and could be readily subject to reconfiguration must be cabled using ~~drop~~ *fly* leads only.

5.4 Installation Requirements

5.4.1 Installation of Cables

Cables shall not be installed under residual tension or pressure except as required to secure to cable tray or catenary cable.

All cable runs shall be continuous between the termination points specified. No joints, splices, junctions, or similar are permitted. All unshielded twisted pair (UTP) cabling, terminations, jumpering, and/or patching shall be performed at the distribution interconnect frames.

All mechanical protection and cable supports shall be free of burrs and sharp edges. Additional bushing, sleeving, etc. shall be provided as required to ensure adequate bending radii and to prevent cable damage.

Cables shall not be laid on ceiling tiles, grooves or open floors or attached to fire life safety infrastructure such as sprinkler pipes. Cables shall not be tied to or supported by ceiling grid support structures.

Where cables are run through steel noggins or studs, appropriate grommets shall be provided to protect the cables. The cable entry hole into the cavity should be sufficient to permit free running of all cables and a minimum of 20% spare capacity for additional cable.

Cables reticulated via skirting duct shall be run in the telecommunications or communications duct. Cable within the confines of skirting duct shall not be cable tied under any circumstances.

Where cables exit from skirting ducts and enter into workstation furniture, flexible conduit shall be used to reticulate cables and to afford protection.

Cables shall be fixed with Velcro, or similar reusable cable tie. In all cases the manufacturer's installation requirements are to be followed.

Local cabling that is not routed back to the FD shall be terminated with black outlets and clearly labelled to indicate a local run.

5.4.1.1 Fibre

Fibre-optic cables shall be terminated with SC type connectors. Fibre terminations shall be mounted in dedicated termination drawers or trays and be correctly labelled with laser radiation warning labels.

5.4.2 Spare Cable

5.4.2.1 Copper

Due to the constraints of Class EA (Cat-6A) cabling, excess length in 4 pair cables shall be kept to a minimum.

Slack retention at termination points shall be restricted to the amount of cable required for re- termination (less than one metre). The storage of cable shall comply with the minimum bend radius for that cable type as per manufacturer's specifications. Slack cable shall only be allowed if minimum bend radius can be achieved.

5.4.2.2 Fibre

To provide an allowance for fibre cable re-termination in the future, provision is to be made for an additional two metres of cable to be looped at each end of each cable run. This spare cable shall be provided within the communications cabinet typically in the fibre tray.

Cable looping shall not exceed the manufacturer's minimum bending radius requirements.

Where traditional non-blown fibre is run through external conduit and pit systems, there shall be an allowance of two times the circumference of the pit left in the first and last pit locations. Where this cannot be achieved, a minimum of a two metre fibre loop within the first and last pit shall apply.

5.4.3 Cabling Testing Procedure

5.4.3.1 General

The installation shall be thoroughly tested to ensure the as-built performance meets the requirements specified within the detailed design documents and such other specifications referenced either explicitly or implicitly.

The installation shall not be deemed complete until all wiring and equipment has been checked and tested to the satisfaction of the University.

The Contractor shall supply all testing equipment.

5.4.3.2 Copper

The following shall be the minimum testing requirements for copper cabling:

- 100% testing of all runs for continuity and polarity (wire map).
- 100% testing of horizontal cabling with compliance to Class C (Cat-3), Class D (Cat-5e), Class E (Cat-6) or Class EA (Cat-6A) as relevant to the actual cable installed.

An electronic copy shall be submitted and included with the as-built documentation. Alternatively, if requested in the Scope of Work, test results to be submitted in .CSV format, to allow generation of summary test information in lieu of individual test pages.

The cable tester to be used is at minimum a Level IV tester (compliant to the draft 2nd edition of IEC 61935-1). The contractor prior to performing any testing must seek approval in writing from the University ICT Network Services if any other cable tester is to be used.

The following parameters must be tested for copper installations;

- Near-End Crosstalk (NEXT) (Both directions)
- Power sum Near-End Crosstalk (PSNEXT) (Both directions)
- Far-End Crosstalk (FEXT) (Both directions)
- Power sum Far-End Crosstalk (PSFEXT) (Both directions)
- Power sum Equal Level Far-End Crosstalk (PSELFEXT) (Both directions)
- Insertion Loss
- Return Loss (Both directions)
- Delay Skew
- Wire Map
- Characteristic Impedance
- Length
- DC Loop resistance
- Attenuation to Crosstalk Ratio (ACR)
- ACR @ remote end
- Power sum ACR
- Propagation Delay (Both directions)

Test Set Up

The following shall be the test set up requirements for copper cabling:

- The test set up shall follow without variation the procedure laid down in ISO 11801 for Permanent Link.
- Test equipment shall be used with strict adherence to the manufacturer's requirements.
- Only manufacturer's certified test leads shall be used.
- The software version installed on the test equipment shall be the most current for that test instrument.

5.4.3.3 Optical Fibre

Optical Fibre Cabling shall be tested as follows:

- Where the length exceeds 300m, fibre tests shall include an OTDR trace.
- All Single mode fibre links shall be tested with an Optical Loss Test set at 1310nm and 1550nm in both directions.
- Results shall reflect loss, length, fibre identification and the number and type of connectors and splices used in the fibre link. The expected loss budget calculation results shall be included as a direct comparison to the actual test results.
- No actual test result shall exhibit more loss than the calculated loss budget, any fibre core exhibiting loss greater than the calculated loss budget shall be deemed to have failed and shall be repaired or replaced.
- All single mode fibre shall be either factory terminated, or fusion spliced to pre terminated factory assembled pigtails.
- All test results shall be included with the as-built documentation.

Test reports must be submitted to the University representative within three weeks of test completion and also inserted into the Operations & Maintenance manuals.

5.5 Numbering & Labelling

5.5.1 Copper Numbering Scheme

All copper cabling and components are to be numbered in accordance with the following scheme.

The numbering scheme comprises of the following components, as displayed and formatted in Figure 3 below.

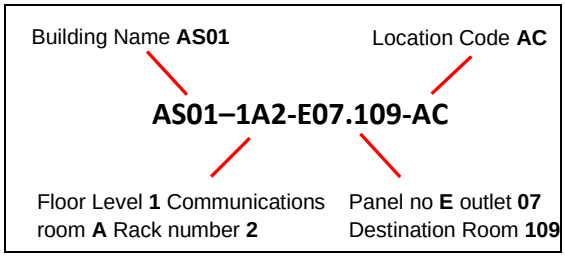

Figure 3: Numbering Scheme Components

The Building Name, Floor Level, and Communications Room numbers are defined by the buildings architecture. Refer to Section 02 – Architecture for further information on these elements.

Location codes for outlets are defined as follows:

- Blank Standard outlet
- LE Lectern or credenza
- AC Above ceiling or higher than 2m
- CK Wall mounted specifically for a clock
- BM Building management
- TV Wall outlet for TV
- UF Under floor / floor box
- EX External to building (include compass direction and level for EX outlets)

The remaining elements of the number scheme are to be proposed by the Communications Cabling consultant for review by the University in accordance with the numbering schemes herein.

Note: Where an outlet runs to another building, the location code should indicate the destination building code.

5.5.1.1 Racks:

Racks are to be identified by:

- Building Code – communications room identifier – rack number.

5.5.1.2 Panel Outlets:

Panels are to be identified by the following format, as shown in Figure 4 below.

- Panel Letter – outlet number – outlet location – destination room number of outlet.

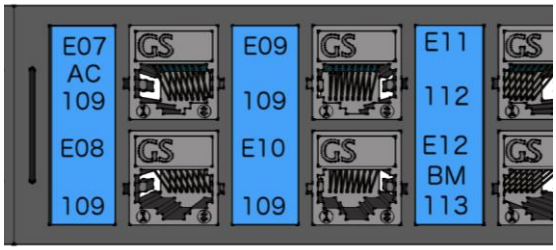

Figure 4: Panel Outlet Example

5.5.1.3 Data outlets

Each outlet (RJ45) shall have a Traffolyte label, a Brother TM type label, or as a minimum an indelible label machine - indicating:

- Building code - communications room identifier - rack number
- Panel letter – outlet number.

Figure 5 provides an example of each of the components of the numbering and how they should be displayed and formatted.

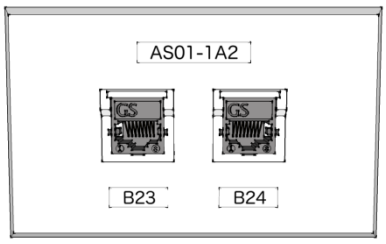

Figure 5: Typical Wall Outlet Example

In no case should an 8P8C (RJ45) outlet be left unlabelled. In the scenario that a permanent label cannot be attached, a temporary label shall be attached and the location noted. The permanent label must replace the temporary label before the install is considered complete.

5.5.1.4 Copper Numbering Exceptions

There are situations where the standard numbering scheme is not valid. In these exceptions, the following numbering system should be followed.

- Local Cables: Local cables should use the following system: LOCAL – number (Example: LOCAL7). The room number may be included if required.
- Cables to a different building: These cables should use the following numbering system at the panel outlets: Panel letter – outlet number – remote building code – destination room number of outlet: (Example: E07-WH08-109).

5.5.2 Fibre Numbering Scheme

- The fibre infrastructure has a strict numbering format that identifies connections between frames, tube management boxes, ducts, tubes and splice boxes. The system is integrated across the campus and allows for efficient troubleshooting. All fibre cabling and components are to be numbered in accordance with the following scheme.

5.5.2.1 Fibre Frame

Each fibre frame will be numbered sequentially from top of rack down and multi fibre push-on (MPO) cartridges will be treated as fibre frames based on MPO frame label.

Each fibre on a fibre frame shall be labelled with the destination, using the following format:

- Building code – communications room number – rack number – Fibre Frame designation – fibres in frame.

Example1: AS12-1A2-FFA-1A/B – Refer to Figure 3 for explanation of first two formatting codes. The third and fourth formatting codes in the example are specifically for fibre installations and refer to Fibre Frame A, Pair 1, Fibres A and B:

Example 2: AS11-2A2-FF1-G1/2 – Refer to Figure 3 for explanation of first two formatting codes. The third and

fourth formatting codes in the example refer to Fibre Frame 1, Pair G, Fibres 1 and 2:

5.5.2.2 Tube Management Boxes

Tube management boxes are distributed throughout the University. They are sequentially numbered. Tube management box numbering is not associated with building identification numbers.

- Each tube management box is to be clearly identified by the contractor with a unique number, which will be assigned to it by the University. The identification number is to be clearly displayed on the top right hand corner of the tube management box front face.

  Example: TM5

5.5.2.3 Ducts

All ducts connected to tube management boxes are to be labelled indicating the location they have come from. Each duct shall be labelled using the following format:

- Connection location – duct number from this location.

  The connection location may be another tube management box or a patch panel or another type of connection. The connection location should use formatting for buildings and communications rooms previously as described.

  Example 1: TM5/1 – This label indicates that the duct has come from tube management box number 5 and this is the no 1 duct from that TM. There may be additional ducts between the two locations, in which case the label would change to TM5/2.

  Example 2: EN01-1B1/1 TM5/2 – This label indicates that the duct has come from the engineering building, communications room B on level 1, first rack and this is the second duct coming from TM5.

5.5.2.4 Tubes

- Each tube in a duct shall be numbered sequentially from 1 and tagged as such within the TM. Subsequent tubes arriving from the same location shall be numbered sequentially from the next available number.

  Example: If there are 3 ducts coming into TM5 from TM2, tubes will be labelled at TM5 by:

  Duct 1 (TM2/1) has 4 tubes and the tubes will be numbered 1 – 4

  Duct 2 (TM2/2) has 4 tubes and the tubes will be numbered 5 – 8

  Duct 3 (TM2/3) has 24 tubes and the tubes will be numbered 9 – 32

5.5.2.5 Splice Management Boxes

Splice management boxes are located throughout the University. Their numbering is based on the tube management box that they serve and not associated with building numbers or locations.

- Each splice management box is to be clearly identified by the contractor with a unique number which will be assigned to it by the University. The identification number is to be clearly displayed on the top right hand corner of the splice management box front face.

  Example: SM6 – This label means that this Splice management boxes serves TM6 and is generally adjacent to the tube management box.

5.5.2.6 Splice Trays

Each fibre in the splice management box shall be labelled on each tray with fine point alcohol soluble marker (eg. Sharpie) with the following format:

- Remote splice point – incoming tube-fibre number

  Example: Where fibres 1 to 4 from SM5 in tube 6 are spliced to fibres 5 to 8 on fibre frame 1 in rack 1 Engineering Research Facility via tube 2.

  SM5-6/1-4 to EN01-1B1-FF1-2/5-8

  Where fibres are un-spliced, they shall be labelled "dark".

5.5.3 Outlet Maps

Floor plans indicating the location and label of each outlet are to be provided to the University Project Manager within two weeks of completion of the work. Outlet labels on the floor plan are to be grouped and summarised by faceplate. The building code is not required in this case.

Example 1: 1A2-E06/10 indicates outlets 6 to 10 are on a quad outlet face plate.

- Where outlets on a faceplate span panels in the communications room, both panels will need to be included on the map label.

  Example 2: 1A2-E22/24, 1A2-F1/3 indicates a 6-way faceplate spanning panels in the communications room.

  Electronic and hard copies are to be provided of changes to installations. Original CAD files are preferred if available.

Compliance Checklist

Project Name:	Date:
Submitting Consultant:	Design Stage:

Section 05 – Communication Cabling Compliance Checklist		Complies	Does Not Comply	Not Applicable	Comments:
1.0	**Section 01 – General**				
#	All Clauses	☐	☐	☐	
5.1	**Overview**				
5.1.1	Purpose	☐	☐	☐	
5.1.2	Existing Fibre Infrastructure	☐	☐	☐	
5.1.3	Active Equipment	☐	☐	☐	
5.2	**Design Concepts**				
5.2.1	Cabling Structure	☐	☐	☐	
5.2.2	Communications Rooms	☐	☐	☐	
5.2.3	Security	☐	☐	☐	
5.2.4	Telecommunication Outlet Distribution	☐	☐	☐	
5.3	**Systems & Equipment**				
5.3.1	Rack Equipment	☐	☐	☐	
5.3.2	Cable Materials	☐	☐	☐	
5.3.3	Outlets	☐	☐	☐	
5.3.4	Pathways	☐	☐	☐	
5.3.5	Furniture / Joinery	☐	☐	☐	
5.4	**Installation Requirements**				
5.4.1	Installation of Cables	☐	☐	☐	
5.4.2	Spare Cable	☐	☐	☐	
5.4.3	Cabling Testing Procedure	☐	☐	☐	
5.5	**Numbering & Labelling**				
5.5.1	Copper Numbering Scheme	☐	☐	☐	
5.5.2	Fibre Numbering Scheme	☐	☐	☐	
5.5.3	Outlet Maps	☐	☐	☐	

Date:	☐ Acceptable
University Reviewer:	☐ Acceptable subject to comments
Signed:	☐ Resubmission required