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## 1. Revision History

<table>
<thead>
<tr>
<th>Revision</th>
<th>Author</th>
</tr>
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<tr>
<td>1st Draft 26 August 1999</td>
<td>Neil Robertson</td>
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<td>Neil Robertson</td>
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<td>Neil Robertson</td>
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<td>Robert Jamieson</td>
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<td>Update 30 September 2003</td>
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<td>Update 10 March 2004</td>
<td>Neil Robertson</td>
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<td>Neil Robertson</td>
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<td>John Mitchell</td>
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<td>Neil Robertson</td>
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<td>Neil Robertson</td>
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<td>Neil Robertson</td>
</tr>
<tr>
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<td>Neil Robertson</td>
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<tr>
<td>Update 30 May 2008</td>
<td>Neil Robertson</td>
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<tr>
<td>Update 03 July 2008</td>
<td>Neil Robertson</td>
</tr>
<tr>
<td>Formatting 03 June 2009</td>
<td>Tim Nightingale</td>
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**Note:** This Manual and the ideas behind it have evolved over time. It has not always been fruitful to update all the oldest sections to reflect changes. Hence if there is inconsistency between two sections of the Manual, the newest section takes precedence.
The following checklist represents the minimum requirements for the installation of cabling & equipment for telephones and data cabling in any buildings to be constructed or modified at Monash University Campuses.

These cabling specifications must to be complied with before any cabling is connected to the Monash University Data & Voice Network.

2. **Minimum cabling requirements**
   
   A. The Telecommunications cabling must meet the ACMA specifications as detailed in The Customer Premises Cabling Manual
   B. The Data Cabling and termination shall be in accordance with Australian Standard, Premises Wiring AS3080.
   C. All cable runs must be continuous and without splices.
   D. All skirting ducting shall be Moduline CFC 50150 or equivalent
   E. Where cabling is to be enclosed in a solid wall, the cables should be installed in a conduit to facilitate the addition and or removal of cables in the future.

3. **General Specifications Checklist**
   
   A. **Telephone cable**
      1. Voice over I.P Solution (Horizontal Voice Cabling NOT required)
   
   B. **Data cable**
      1. Cable: CAT6 - UTP.
      2. Terminating method: blue colored PANDUIT CAT-6 RJ45 socket with Green/White-1; Green-2; Orange/White-3; Blue-4; Bl/Wht-5; Orange-6; Br/Wht-7; Brown-8;
      3. Each data point should have all four pairs assigned and terminated as per AS 3080
   
   C. **Labeling of cables**
      1. **Telephone & Data plates**
         a. On the face plate a unique number indicating for:-
            Data & Voice
            The location of cable termination on the Patch Panel i.e. A3, B24.
         b. Frame records to reflect the same markings.
D. Fibre Optic Cable Installations

1. Grade of cable
   The cable shall conform to AS 3080 10.3.4.

2. Labeling
   Name of the Rack & location within the rack at other end. e.g.
   \(<\text{campus}>-<\text{building}>-<\text{room}>-<\text{rack number}>\)
   CLAY-28-202-RK1   A1-A12mm, A13-A18sm.

3. Terminations
   SC duplex connectors (SC-D) are to be used. [AS 3080 9.4] Terminations to
   be housed in an approved enclosure. A generous surplus of the Fibre cable is
   to be coiled up at the termination sites (minimum diameter of coil 600 mm).
   A five meter surplus is suggested.
   Fibre to the desktop is to terminate on SC duplex connectors.

4. Colour code of Terminations Panels
   62.5 Micron Multimode  Black
   OM3 50 Micron Multimode  Green
   Single Mode  Yellow
   All single mode O/F patch cords should be yellow.

5. Components List

<table>
<thead>
<tr>
<th>Items</th>
<th>Brand/Part No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>36 Core Enclosure</td>
<td>AFC (WBS27106-MU)</td>
</tr>
<tr>
<td>OM3 50/125 6mm/6sm Tight Buffered</td>
<td>Belden, General, Pirelli</td>
</tr>
<tr>
<td>Composite Fibre</td>
<td></td>
</tr>
<tr>
<td>OM3 50/125 6mm/6sm Loose Tube</td>
<td>Belden, General, Pirelli</td>
</tr>
<tr>
<td>Composite Fibre</td>
<td></td>
</tr>
<tr>
<td>OM3 50/125 12mm/12sm Loose Tube</td>
<td>Belden, General, Pirelli</td>
</tr>
<tr>
<td>Composite Fibre</td>
<td></td>
</tr>
<tr>
<td>OM3 50/125 24mm/24sm Loose Tube</td>
<td>Belden, General, Pirelli</td>
</tr>
<tr>
<td>Composite Fibre</td>
<td></td>
</tr>
<tr>
<td>Patch Leads</td>
<td>Andersons, AFC, Namlee</td>
</tr>
<tr>
<td>Organiser for 36 Core Enclosure</td>
<td>Panduit CMPHF1</td>
</tr>
<tr>
<td>Organiser for 72 Core Enclosure</td>
<td>Krone 2RU</td>
</tr>
<tr>
<td>Fibre splice Cassette</td>
<td>Fibernet</td>
</tr>
</tbody>
</table>

Types/Sizes of Cable to use

<table>
<thead>
<tr>
<th>Use</th>
<th>Minimum Cable to Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Racks within the same building which are greater then 90 metres apart</td>
<td>OM3 50/125 12mm/12sm</td>
</tr>
<tr>
<td>Incoming feed to small Building</td>
<td>6SM/6MM OM3 50/125 Loose Tube Composite Fibre</td>
</tr>
<tr>
<td>&lt;20 Data Points</td>
<td></td>
</tr>
<tr>
<td>Incoming feed to medium Building</td>
<td>12SM/12MM OM3 50/125 Loose Tube Composite Fibre</td>
</tr>
<tr>
<td>&lt;200 Data Points</td>
<td></td>
</tr>
<tr>
<td>Incoming feed to large building or Core network Location &gt;200 Data Points</td>
<td>24SM/24MM OM3 50/125 Loose Tube Composite Fibre</td>
</tr>
</tbody>
</table>
4. Data Cabling

A. Unshielded Twisted Pair (UTP for 10BaseT, 100BaseX, ATM, 100VG)
   1. Grade of cable
      Approved UTP CAT-6 cable
   2. Terminations
      Internal cabling: segment of UTP Ethernet may not exceed 90 metres under any circumstances. Approved UTP CAT-6 cable
   3. Labeling
      As per 3. c

B. Coaxial cable Ethernet (10Base2)
   1. Grade of cable
      Belden 9907 to be used for Coaxial cable
   2. Terminations
      Use high quality 50 ohm crimp type BNC plugs e.g. HarTec type C53138. Total length of 10Base2 Ethernet may not exceed 184 metres under any circumstances; it is preferable to be less than 100 metres
   3. Labeling
      As per 3. c
C. Video Security Cable
   1. Labeling
      As per 3. c
   2. Terminations
      75 ohm BNC crimp plugs
   3. Internal Cabling
      Cable shall be installed in ducting or conduit as appropriate
   4. Cable type
      The cable should be RG59/U 75 Ohm cable. Commercial equivalents are acceptable

5. Buildings
   A. Building to Building
      1. Cabling connections between buildings shall be no less than composite fibre with 12 cores of multi-mode and 12 cores of single-mode. Loose tube construction, e.g. OM3 50/125 12mm/12sm
      2. The points of termination of the Fibre cable shall be made at a designated location and shall use the standard Fibre termination with SC style duplex (SC-D) connectors. Enclosures for fibres are to be as per Material List.
      3. Fibre is to be laid in a white PVC conduit of not less than 50 mm internal diameter. A draw wire is always to be retained in these conduits.
      4. Pits must be provided where the conduit changes direction by 30 degrees or more. Pits are also to be provided at intervals of no more than 50 metres.
      5. The path of the conduit shall be completely documented and lodged with ITS and the Buildings and Premises Branch.

6. Cables Entering a Building
   A. The point of entry should be inaccessible to the public. Where any such entry is at external ground level, it shall be appropriately protected.

7. Riser Backbone cables (UPLINKS)
   A. Supply and install six x single CAT-6 uplinks and OM3 50/125 12mm/12sm fibre cable to every floor distribution frame/rack, from the Main Building Rack. Location indicated on drawings provided.
   B. All links must be clearly marked on both ends, including the link number and rack ID. E.g.: U/L 7-12 to CLAY-28-202-RK1
   C. Labeling. See 3. c.
8. **Cabling in Corridors**
   A. All cables in corridors should be located on a tray that holds only telephone and data cables. Data and telephone cable should be no closer than 100 mm from any power cabling distribution tray, as per AS 3084.
   
   B. All cables not located on a cable tray shall be secured with catenary wires and may never foul ceiling tiles or other plant located in the ceiling space.

9. **Moduline ducting in offices**
   A. The preferred product is Moduline CFC50150. The cover panels shall be fixed in place with the maker’s recommended hardware.
   
   B. Cabling Distribution to Offices from Corridors: The maximum length of UTP cables from the telecommunication rack to the outlet shall be 90 metres.
   
   C. The Moduline ducting placed around the exterior walls for office access must have entry points available, a maximum of ten cables (five data, five voice) in any section of duct is suggested to provide the shortest path and reduce congestion within the ducting.
   
   D. Moduline cover plates are not to be obscured or fouled by partition walls etc.

10. **Staff Offices**
    A. All Ethernet cables shall be UTP CAT-6 and shall be run in conjunction with the telephone cable.
    
    B. Every desk/workstation shall have a minimum of two data UTP cables. Open plan office environments shall have a minimum of two data UTP cables run to each anticipated position of desks or four for every 10m².
    
    C. Printer locations should have a data UTP point.
    
    D. Photocopy rooms should have phone & data points.
    
    E. Power: It is highly recommended that each desk/workstation has two double GPO’s for the exclusive use of IT equipment or one double GPO per data point.

11. **Computer Laboratories**
    A. A CAT6 UTP cable from each workstation is to be run to the appropriate communications wiring rack.
    
    B. All labs shall use Moduline ducting for Power and Data connections.
12. **Plant/Machinery Rooms**
   
   A. A minimum of one run of UTP Data and telephone wire shall be run between every plant/machinery room and the nearest appropriate Comms/Data Rack. If a plant room be located on the roof level, it is acceptable to run the line to the uppermost level rack.

13. **Lecture Theatres**
   
   **Teleteaching Lecture Theatre**
   
   A. The front Comms/Data/Equipment Rack
      4 x Basic Rate ISDN Points
      2 x Telephone Points
      2 x Data Points
   
   B. Rear Control Room
      2 x Telephone Points
      2 x Data Points

   **Standard Lecture Theatre**
   
   A. The front Comms/Data access Point
      2 x Telephone Points
      2 x Data Points
   
   B. Rear Control Room
      2 x Telephone Points
      2 x Data Points

14. **Seminar Room**
   
   A. Shall be wired with a minimum two data and one voice outlet.

15. **Layout of communications/data wiring cupboard**
   
   A. There should be one wiring rack [FD] for each floor. They should be large enough to contain all termination hardware for telephone/data wiring, and computer networking equipment.

   B. One floor (usually ground) should be designated for a building distribution [BD] for a building switch and termination of inter-building fibres.

   C. Required minimum size for ground floor 2400mm wide, 1000mm deep. Other floors 1500mm wide, 900mm deep. Must extend from floor to ceiling with access to the ceiling space for that floor.

   D. The riser should be either one and the same or adjacent with easy access for cables.

   E. Two dedicated circuits with two standard double GPOs per circuit should be included in each rack/cupboard.
F. The telecommunications/data racks/cupboards shall be keyed alike with tamper proof latches.

G. They shall be keyed differently from electrical cupboards.

H. Every cupboard shall have a 20W fluorescent light fitted, unless a suitable light is located directly outside.

I. The top and bottom entry points should be at the extreme left-hand side of the cupboard. The entry ports should be sealed against fire with fire resistant pillows; they should not be sealed with cement. Burndy APT cable tray of 300mm width to be secured to the left-hand back wall of the cupboard.

J. All data cable including riser cables should be terminated on a RJ45 patch panel.

K. Patch panels and computer equipment should be mounted in correctly sized racks.

L. General power outlet (GPO) to be fitted at the lower left-hand corner. Cable tray 100mm in width to be attached to the rear wall as shown in figs 2, 3 & 4.

M. All types of communication and data rack or frame, should be securely and rigidly mounted to it designated location. To ensure frame stability the fitting of support bars and braces is recommended.

N. Where there are two or more network racks on one level/floor, the data port identification shall be unique between racks.

O. Do not use the letters “O” and “I” for data port identification.
16. Racks

Racks sizes

A. The racks should be Modempak lockable glass front door. All racks should be keyed alike with "Modempak Monash Locks".
   i. Supply and install two double GPOs into the bottom of each rack; Each GPO should be connected to a separate circuit breaker on the switchboard. The rack itself should have a suitable protective earth connection.

B. Cable tray size, minimum 200mm wide, should be provided to secure all incoming data cables.

C. The customer data cables shall be terminated on a 48 way CAT-6 UTP RJ-45 Panduit patch panels, with a patch cord minder below each patch panel. Customer voice cables shall be terminated on Krone modules.
D. Rack Layout

**Figure 2**: BUILDING Distribution – single equipment rack layout
**Figure 3:** FLOOR Distribution - single equipment rack layout

**Figure 4:** FLOOR Distribution - equipment rack layout using two racks
E. Rack Sizing Table

<table>
<thead>
<tr>
<th>Use</th>
<th>Data points on floor</th>
<th>Minimum rack size</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ground Floor</td>
<td>&gt;120</td>
<td>800mm W, 45RU x 800mm D</td>
<td>Modempak 11412095MMU</td>
</tr>
<tr>
<td>Ground Floor</td>
<td>&lt;120</td>
<td>800mm W, 45RU x 800mm D x 2</td>
<td>Model</td>
</tr>
<tr>
<td>Other Floors</td>
<td>&gt;20</td>
<td>800mm W, 45RU x 600mm D minimum</td>
<td>Modempak 11414091MMU</td>
</tr>
</tbody>
</table>

17. Uplinks
A. Supply and install six single CAT-6 uplinks to every floor distribution rack, from the Main Building Rack. Location indicated on drawings provided
B. All links must be clearly marked on both ends, including the floor number and the link number like 2 - 3 (second floor link number 3).

18. Material Summary

<table>
<thead>
<tr>
<th>Plates</th>
<th>Clipsal 2000 Series (White Preferably)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RJ45 Panels</td>
<td>Panduit 48 Port 1RU (CPP48HDWBL)</td>
</tr>
<tr>
<td>RJ45 Connectors (Data) Cat 6</td>
<td>Panduit Smart Jack (Blue)</td>
</tr>
<tr>
<td>RJ45 Connectors (Comms) Cat 6</td>
<td>Panduit Smart Jack (Grey)</td>
</tr>
<tr>
<td>Cable Organizer</td>
<td>Panduit CMPHF1</td>
</tr>
<tr>
<td>800mm W Rack</td>
<td>Modempak 45RU X 600mm minimum with glass door &amp; Monash Locks</td>
</tr>
<tr>
<td>Floor Cable Data - Cat 6</td>
<td>Approved Cables covered by Panduit’s Certification Plus Warranty</td>
</tr>
<tr>
<td>Uplink UTP Data - Cat 6</td>
<td>Approved Cables covered by Panduit’s Certification Plus Warranty</td>
</tr>
<tr>
<td>Floor Cable Comms - Cat 6</td>
<td>Approved Cables covered by Panduit’s Certification Plus Warranty</td>
</tr>
<tr>
<td>ADC Patchpanel 50 Port Voice</td>
<td>ADC Part No. 7022 4 001-50</td>
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<td>Communication Modules</td>
<td>Krone modules (No.6089 1 121-02)</td>
</tr>
<tr>
<td>Fibre Enclosure (36 Cores)</td>
<td>AFC WBS27106-MU</td>
</tr>
<tr>
<td>Communications Rack Mounts</td>
<td>Krone 19” rack mount (No. 6450 1 008-00)</td>
</tr>
<tr>
<td>Fibre Cables</td>
<td>Small Building (&lt;20 Points)- Composite 6SM/6MM 50micron OM3</td>
</tr>
<tr>
<td></td>
<td>Medium Building (&lt;200 Points)- Composite 12SM/12MM 50micron OM3</td>
</tr>
<tr>
<td></td>
<td>Large Building (&gt;200 Points) - Composite 24SM/12MM 50micron OM3</td>
</tr>
</tbody>
</table>
19. Testing
   A. Data Cables:
      All Data points and uplinks must be tested to Cat 6 specification with a Fluke
      DSP Cable tester with full detailed and summary test report provided in an
      electronic format.
   B. Communication Cables
      All terminated pairs to be continuity tested.
   C. Fibre
      All Fibre cores to be tested with DB loss results provided.
   D. All test results are to be supplied to the NIS Site Engineering Manager

20. Certification
   A. All telephone, data and fiber optic cable installation should be certified. So
      that the entire system meet the necessary level of performance specified in.
      AS 3080 (clause 7).

21. Documentation
   A. The telephone documentation should be completed as per standard practice. It
      should include information pertaining to the unique identifier on each cable
      label. A main frame (MDF) book shall be used and left within the
      Riser/Cupboard/Rack.
   B. The data documentation requires a floor plan showing the patch panel
      location for each of the data points and the test results from the Cat6 testing
      in electronic format. Contractor shall consult with ITS before commencing
      work to become familiar with ITS Documentation Standards.

22. UTP Patch Lead Colour Code for Gigabit Network

<table>
<thead>
<tr>
<th>Colour</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue</td>
<td>In the field:</td>
</tr>
<tr>
<td></td>
<td>“Basic” 10/100/1000 Mb Ethernet user service (BDS or FES user)</td>
</tr>
<tr>
<td></td>
<td>In a computer room:</td>
</tr>
<tr>
<td></td>
<td>Dedicated 10/100/1000 Mb Ethernet service (BGS host)</td>
</tr>
<tr>
<td>Red (Straight through)</td>
<td>1Gig Ethernet uplink (BDS –to- FES)</td>
</tr>
</tbody>
</table>