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## RELATED DOCUMENTS

- PTC 100 Telecom Permit to Connect: General Conditions
- PTC 101 Electrical Safety Requirements for a Telecom Permit to Connect
- PTC 105 Telecom Code of Practice for the Cabling of Commercial Premises\*
- PTC 113 Code of Practice for ISDN Cabling and Wiring
- PTC 203 Requirements for Customer Premises Terminating Hardware
- PTC 204 Requirements for Customer Premises Three-pair Cable
- PTC 222 Requirements for Customer Premises Cable
- PTC 223 Requirements for 2-wire Jackpoints
- PTC 225 Requirements for Small Office Home Office (SOHO) Cabling Systems
- Electricity Regulations 1997
- NZS 3000:1997 Electrical Installations, Buildings, Structures and Premises
- BS 6312 Specification for Plugs to be used with British Telecom Line Jack Units
- AS/NZS 3080: 1996 Telecommunications installations - Integrated telecommunications cabling systems for commercial premises
- AS/NZS 3086: 1996 Telecommunications installations - Integrated telecommunications cabling systems for small office/home office premises

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## FOREWORD

This Code of Practice is intended for use by professional installers involved in providing residential type telecommunications wiring. The primary aim of the code is to set methods and standards, which will result in good performance and reliable service for customers. It covers the requirements for wiring connected to Telecom's network and provides information on related issues and practices.

Ownership of residential premises telecommunications wiring passed to customers following the enactment of the Telecommunications Act 1987. Consequently, customers now have responsibility for the maintenance, repair and modification of wiring and any additional wiring installation. This responsibility may be assumed by any party nominated by the customer. Telecom's "Standard Terms for Residential Customers" requires all sockets and wiring which connect equipment to the Telecom network, to meet and be installed to our (Telecom's) specifications". Compliance with this Code meets that obligation.

Up until 1983 telephones were generally permanently connected to the Telecom owned customer premises wiring. In 1983 a jack point 3-wiring system was introduced employing a 3-pair cable. This was the basis of Issue 1 of this Code of Practice. The development of Telecom's now standard "2-wiring" system in 1996 has led to the use of 2-pair cable for most new installations and additional lines. This update brings the code into line with the 2-wiring system, and specifies acceptable means of extending existing installations. For clarity, it is restricted to residential type installations only. In general, the same requirements apply to new installations and extensions when 3-wiring and 2-wiring systems are used for business and commercial purposes where only 2 or 3-pair cable has been used.

Residential customers may use the alternative small office/home office wiring system (SOHO) as indicated herein where this better suits their needs.

Most wiring being installed now can be expected to be in use for at least 10 years. Once installed, wiring is usually inaccessible and difficult and expensive to replace. Also, as installations may now be switched from one network operator to another, compliance with a common code avoids incompatibilities. **It is therefore in everyone's best interests to ensure that the proper installation methods are followed.**

**TELECOM DISCLAIMER**

While every care has been taken, Telecom nevertheless makes no representation or warranty, express or implied, with respect to the sufficiency or utility of the information contained in this Code of Practice.

This Code sets out general principles for carrying out premises wiring and explains Telecom's standard practices. It is obviously not practicable to cover every situation that may arise in the large number of existing installations that have been carried out in New Zealand over many years. In view of this, Telecom expressly advises that the use of or reliance on the information contained in this Code of Practice must take into account the existing conditions at any particular premises.

Telecom shall not be liable for any loss (including consequential loss) damage or injury incurred by any person or organisation arising out of the sufficiency, accuracy, or utility of any such information or opinion.



## **1 GENERAL**

### **1.1 Scope**

#### **1.1.1 Application**

(1) This Code of Practice is primarily concerned with the installation of residential customer premises telecommunications wiring intended for connection to the Telecom network. The principles contained in the code also apply where the same wiring systems are used in (generally small) business or commercial premises, but additional matters specific to these particular applications have not been included.

(2) Wiring systems for new residential installations covered by this Code are Telecom's standard 2-wire system and Small Office/Home Office wiring (SOHO) based on AS/NZ 3086:1996 "Telecommunications installations – Integrated telecommunications cabling systems for small office/home office premises".

(3) Acceptable methods of extending and/or modernising existing older fixed wired and 3-wire installations are also included.

#### **1.1.2 Intended Audience**

(1) This Code of Practice is intended primarily for use by tradespersons and those carrying out telecommunications wiring on a commercial basis. Trainers will also find the Code useful. Suppliers will find the code of assistance in preparing installation instructions for their hardware products.

(2) Competency in electrical and telecommunications wiring techniques and practices has been assumed. Accordingly, the emphasis is on permitted configurations and the particular installation requirements of the hardware concerned.

(3) Persons working on wiring provided solely for telecommunications purposes and working at Telecom network voltages are exempted from registration under the New Zealand Electricity Regulations 1997. However, the safety requirements of the Electricity Regulations and Telecom Codes of Practice must still be fully complied with.

(4) Telecom customers who wish to do work within their own premises, and who have an adequate knowledge of electrical and telecommunication terms and practices, will find the Code useful. For others, the simplified instruction sheets supplied with line hardware installation kits may be a satisfactory alternative where the work is simple and straight forward.

(5) Telecom recommends the use of experienced professional installers.

### 1.1.3 Limitations on Customer Premises Wiring Work

(1) Only customer owned telecommunications wiring may be worked on. The Telecom cable lead-in from the street and the External Terminating Point (ETP), where fitted, are specifically excluded.

(2) Any customer owned wiring serving two or more Telecom customers can only be worked on where specific approval of all the customers concerned has been given.

### 1.1.4 Benefits of Compliance

(1) Compliance with this Code of Practice will ensure that the installation is acceptable for connection to the Telecom network.

(2) Compliance will ensure eligibility for the optional residential standard wiring maintenance service. (NB: a wiring maintenance service is not currently available for Small Office/Home Office (SOHO) installations).

(3) Compliance will ensure that methods and practices are used which will contribute to reliable long term performance of telephone and fax/data voice band services.

### 1.1.5 Non-complying Installations

(1) Non-complying new installations may require remedial work to be undertaken at customer expense before being connected to the Telecom network. Likewise non-complying modifications to existing installations may subsequently incur costs to the customer if unsatisfactory service results.

(2) This Code of Practice need not be applied retrospectively to existing non-complying wiring. Such wiring may remain connected to the Telecom network provided that it does no harm to the Telecom network, and does not result in unsatisfactory connections for either the customer concerned or for other customers.

### 1.1.6 Mode of Presentation

(1) Use of the word "shall" in this document identifies mandatory requirements for compliance with this code, "should" refers to practices, which are advised, or recommended, "may" refers to matters which are optional.

### 1.1.7 For More Information see....

Telecom Network Demarcation Point	Section 1.2
Contracts and Obligations	Section 1.3
Definitions	Section 1.4
Overview of Acceptable Wiring Options	Section 1.5
Requirements for all Wiring Systems	Part 2
2-wire Installations	Part 3
SOHO Cabling System	Part 4



Legacy Wiring Systems	Part 5
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## 1.2 Telecom Network Demarcation Point

### 1.2.1 Network Demarcation Point

(1) The Network Demarcation Point forms the dividing line between Telecom's ownership of the network and a customer's ownership of the premises wiring.

For most residential installations, this is the ETP, which is mounted on the outer wall of the building. In some situations the demarcation point may be the Telecom Network Termination (TNT). Under current Telecom practices, the building cable connects to the Telecom lead-in cable within the ETP.

(2) Where no ETP is fitted, the demarcation point is now regarded as the point at which the cable enters the outer wall of the home or premises.

(3) Even though the lead-in cable from the network reticulation in the street may be run on private land, the lead-in cable and its associated pipe remain in Telecom's ownership. Where a customer changes to another network provider, that provider will install their own lead-in cable and connect to the premises wiring at the ETP. Where no ETP is fitted the new provider will generally connect to the customer wiring at the first jackpoint.

(4) Unless it is specifically determined to be part of the associated network service, the customer will own and be responsible for all wiring and hardware within their premises, other than that which is specifically provided by Telecom or some other party in connection with some other service which makes use of the Telecom network for communication. Telecom is responsible for the ETP, the lead-in pipe and lead-in cable. Telecom is also responsible for its own network equipment installed within the customer's premises for the purpose of providing the customer with network services.

(5) Telecom will service all equipment, cable and pipe on its side of the network demarcation point and any Telecom-owned network equipment on the customer's side of the demarcation point as part of its network service. Such servicing will not be subject to a charge where faults are caused by normal service conditions.

(6) The customer is responsible for arranging all servicing of the wiring, hardware and other equipment within the premises, other than where a Telecom wiring maintenance charge is being paid or where the equipment concerned is rented from Telecom.

### 1.2.2 Service Delivery Points and Hardware

(1) Although the Telecom network physically ends at the network demarcation point, there will be some situations that require Telecom-owned equipment to be installed within the customer's premises to support network services. Such

equipment will be connected via customer-owned wiring. In such cases, the customer's side of this equipment is termed a "Service Delivery Point".

(2) For non-telephony based telecommunications services, Telecom will define the type of service termination hardware and its location (service delivery point) according to the particular application. In most cases, the service termination point hardware is provided as part of the installation and commissioning work carried out by Telecom staff as an inherent part of the service concerned.

### **1.3 Contracts and Obligations**

#### **1.3.1 Installer's Obligations**

(1) In order to meet their obligations to their customers, installers need to be aware of several legal issues resulting from New Zealand consumer protection legislation, the Telecommunications Act and contractual obligations between Telecom and its customers. The following outlines these issues.

(2) It is the responsibility of the installer to ensure that wiring is carried out in accordance the Electricity Regulations 1997 (or superseding regulations) and with all other relevant legal requirements. These may vary according to the particular conditions that apply in the premises in which the wiring work is to be carried out. Telecommunications wiring is NOT subject to routine inspection or the provision of Certificates of Compliance.

(3) It is the installer's responsibility to check for hazardous voltages before carrying out any work on premises wiring. Hazardous voltages are not applied by Telecom to its lines, but nevertheless these may be present due to power distribution system faults, lightning activity, or other fault conditions.

(4) Premises wiring carried out on a commercial basis on behalf of residential customers is subject to the terms of the Consumer Guarantees Act, 1993. This requires that the materials supplied and the manner in which the work is carried out shall be fit for its intended purpose. If wiring is not acceptable to Telecom, it is clearly not fit for the purpose of connecting to the Telecom network.

(5) Those persons involved in carrying out premises telecommunications wiring for commercial customers are required to comply with the Fair Trading Act 1986.

(6) It is important that installers do not do any work or use any materials that adversely impact on the validity of any wiring maintenance contract that the customer may have with Telecom. Otherwise the customer is likely to face unexpected charges.

(7) Every situation that may be encountered in practice cannot be dealt with in detail in a document such as this. It is the installer's responsibility to see that all work is carried out in accordance with this Code and with any other special conditions which may apply.



### **1.3.2 Customer's Responsibilities**

- (1) Compliance with this code by customers, or by installers engaged by customers to install wiring, will enable customers to meet their obligations in receiving service from the Telecom network. Further, customers will be eligible for the full benefits of any Telecom wiring maintenance contract which is in force.
- (2) Where service problems are found to be due to premises wiring of a poor standard, it will be the customer's responsibility to pay for any repairs if called on to do so by Telecom.
- (3) Where service problems are found to be due to the removal of hardware or customer premises equipment connected into the fixed wiring, such as alarm systems, ringing decoders, or other equipment, a charge may be made for any remedial action undertaken by Telecom at the customer's request.

### **1.3.3 Cables, Jackpoints and Hardware Used in Customer Premises Wiring**

- (1) All cables, jackpoints and hardware used in wiring customer premises and intended for connection to the Telecom network shall be Telepermitted.
- (2) All CPE or other equipment connected to customer premises wiring must be Telepermitted or have a Telecom label on it.

### **1.3.4 Telecom Exclusions from Liability**

- (1) Telecom accepts no liability for the disruption or disconnection of services not provided by Telecom which make use of the premises wiring should the connection of such services have led directly or indirectly to disruption of Telecom services to the customer concerned.
- (2) Telecom accepts no liability for damage caused to customer equipment by over voltage which may be occur on Telecom lines due to fault conditions, lightning or for any other reason.

## 1.4 Definitions

**Accessory:** any device, not itself directly providing a telecommunications function, which is plug connected to the premises wiring.

**BT jackpoint:** any jackpoint which mates with a plug to BS 6312.

**Customer premises equipment (CPE):** any telecommunications terminal equipment connected to the customer's wiring.

**Daisy-chain wiring:** a common form of wiring where a cable to one jackpoint is connected to another cable to the next jackpoint.

**Demarcation point (or network demarcation point):** the point at which the customer's wiring is connected to the network lead-in cable.

**Extension jackpoints:** see "Secondary"

**External Terminating Point (ETP):** an external box, in which the lead-in cable is connected to the internal building wiring. Also (incorrectly) known as External Test Point. The demarcation point, when provided.

**Hardware (or line hardware):** any fixed wired device other than CPE.

**IDC:** Insulation Displacement Connector, commonly used to terminate wiring at hardware.

**Jackpoint:** any type of outlet used for plug-connecting CPE.

**Lead-in cable:** the Telecom owned cable used from the street to the customer's premises.

**Line grabbing:** a function of series CPE which disconnects other wiring and CPE from the line to either terminate or initiate a call.

**Master jackpoint:** the earlier standard 3-wire jackpoint incorporating the electrical components for the conversion of the line to three-wire operation within the premises.

**May:** refers to matters which are optional.

**Pair:** any set of two wires, which are usually twisted in a cable, used to provide a circuit.

**Secondary jackpoint:** the earlier standard 3-wire jackpoint used in conjunction with a master jackpoint. Also called an "extension" or "slave" jackpoint.

**Series CPE:** any CPE connected in the path between other CPE and the network.



**Shall:** identifies mandatory requirements for compliance.

**Should:** refers to practices which are recommended.

**Socket:** another name for “jackpoint” or “telecommunications outlet”.

**SOHO (Small Office/Home Office) cabling:** an optional cabling standard, typically used for those installations requiring additional flexibility for voice and data services, standardised in AS/NZS 3086.

**Star wiring:** an arrangement whereby each jackpoint is separately cabled to a central point, where cross-connect facilities may be provided.

**Tee connection:** a third connection also made at a daisy-chain point.

**Telecommunications Outlet (TO):** the international term to describe any type of socket or jackpoint into which terminal equipment may be connected.

**Telepermitted:** CPE, hardware or cable marked with a Telecom "Telepermit" label to indicate that it complies with Telecom specifications.

**Three-wire (3-wire):** the legacy system of BT jackpoint wiring, whereby a Master jackpoint incorporates a shared capacitor to derive a third wire for ringing to all jackpoints.

**Two-wire (2-wire):** the present standard BT jackpoint system where one pair interconnects all jackpoints, each of which incorporates a capacitor to ring older 3-wire connected CPE.

**Wiring (premises wiring):** all cable and directly connected hardware on the customer's side of the demarcation point.

## 1.5 Overview of Acceptable Wiring Options

### 1.5.1 Installation Options Acceptable to Telecom

New installation, and extension to existing installation options acceptable to Telecom are indicated in Table 1 below together with a reference to the relevant section of this code:

**TABLE 1**

Type of Residential Installation Work	Acceptable Options	Code of Practice Reference
New installations	Standard 2-wire system	Part 3
	Small Office/Home Office wiring (SOHO) systems conforming to AS/NZ 3086: 1996	Part 4
Extensions to installations with fixed wired telephones, non-Telepermitted hardware, or older bell types.	Convert to standard 2-wire system	Section 5.5
Extension to 3-wire installations with one master jackpoint.	Convert to standard 2-wire system	Section 5.5
	Extend with 2-wire sockets, but only in the manner prescribed	Section 5.4
	Extend with 3-wire extension socket (Permitted up until expiry of 3-wire extension jackpoint Telepermits on 1 April 2000).	Section 5.3
Extension to 3-wire installations with two or more master jackpoints.	Convert to standard 2-wire system	Section 5.5
CPE needing more than two wires: 4 wire data circuits, ISDN S/T bus distribution, etc.	Small Office/Home Office (SOHO) wiring system.	Part 4

### 1.5.2 2-wire Standard

Telecom's current wiring standard is termed "2-wire" and is used for new wiring for basic service as detailed in Part 3 of this Code of Practice. Other wiring systems are described below.

### 1.5.3 SOHO Standard

An alternative wiring standard providing greater flexibility than basic 2-wire with access to 4 pairs at star wired jackpoints. It is required for connection of CPE needing more than one pair – eg, ISDN, LAN terminals, multi-line and/or intercommunicating telephones – as well as supporting basic telephone service. SOHO wiring is prescribed in AS/NZS 3086 and Part 4 of this Code of Practice.

### 1.5.4 3-wire Standard

Telecom's legacy wiring standard which preceded 2-wire. This system used a master jackpoint (designated M) and a number of secondary jackpoints (designated S or E) interconnected by 3 wires. Non-standard variants include fixed wired



telephones and multiple master jackpoints. Shortcomings causing noise, ringing and reliability deficiencies are overcome in the 2-wire standard.

### **1.5.5 Fixed wired CPE**

Prior to the introduction of BT jackpoints, CPE was either wired directly to the fixed wiring or connected by early types of jackpoints. All variants are obsolete.





## **2 REQUIREMENTS FOR ALL WIRING SYSTEMS**

### **2.1 Safety Requirements**

#### **2.1.1 General**

Every care shall be taken that work is undertaken safely. In particular, changes to existing installations involves work in dark ceilings and access into wall cavities often containing power cables and possibly gas pipes. Potential hazards should be identified and located prior to starting each aspect of the work. Compliance with all relevant safety standards is required.

#### **2.1.2 Hazardous Voltages**

(1) Under normal conditions no hazardous voltages are applied by Telecom to any of its lines. Nevertheless, it is possible for lines to become hazardous at any time from earth potential rise, power distribution system faults, lightning activity, or contact with power wiring within the customer's own premises or equipment.

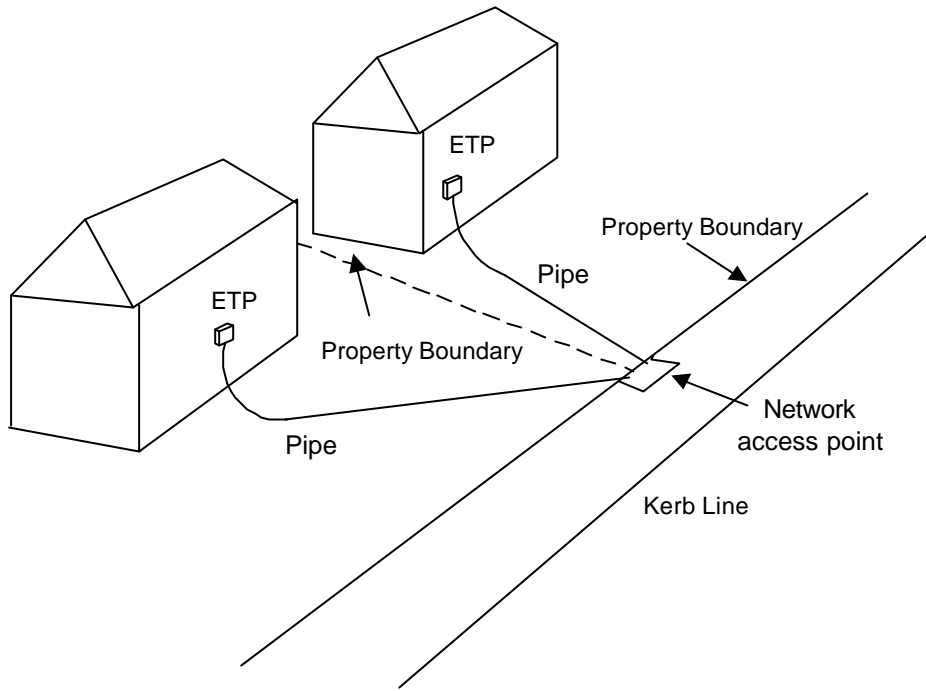
(2) Although it is not normally necessary to touch bare conductors during installation and connection because of the extensive use of insulation displacement connectors (IDCs), safe electrical industry working practices shall be followed. These should include completion of all wiring connections before finally connecting to the line. This will also minimise the risk of shock from non-hazardous network voltages such as ringing, causing possible injury from the personal reaction to a shock, such as losing balance and falling.

### **2.2 Entry Points for New Installations**

#### **2.2.1 Entry Point for Residential and Small Business Premises**

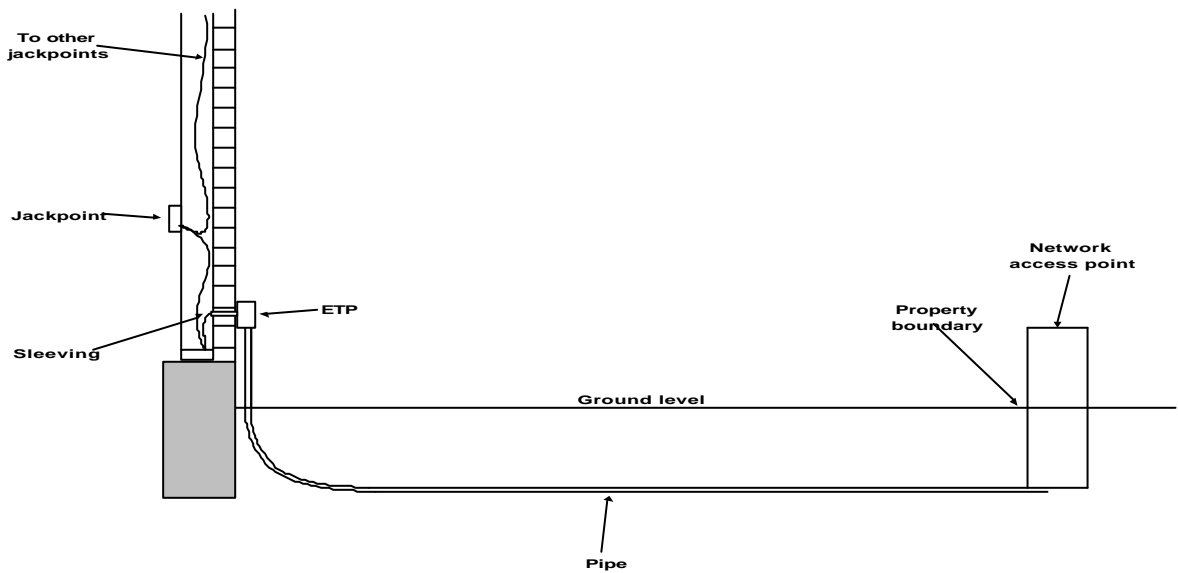
(1) If not already provided, Telecom will arrange installation of an individual lead-in cable and ETP, or a distribution point for premises requiring a larger number of connections. For residential buildings where each unit has a street frontage, the ETP location will generally be on the wall facing the street, adjacent to the entry point for electrical mains power. This will be immediately above floor level for underground lead-ins and on a gable end or fascia board for overhead lead-ins.

(2) For new premises, a suitable entry point location for connection of the customer's wiring should be selected. The general location is normally arranged with the developer for new sub-divisions, and is usually obvious from adjacent properties in developed areas. In cases of doubt, Telecom will provide guidance on receipt of advance application for service from the customer.



**2.2.2 Connection of Wiring to the Lead-in Cable**

Independent of the number of jackpoints and cables installed, a single cable shall be extended from inside the premises to the location of the ETP. A 1 m tail shall be left at this point. This cable will be connected to the lead-in cable by Telecom staff.



**2.3 Premises Wiring**

**2.3.1 General Wiring Issues**

The following wiring practices and requirements apply specifically to residential wiring, though the principles also apply to light commercial applications. Particular attention is given to the prevention and control of water entering cables through their sheaths, which is the dominant cause of wiring faults in typical New Zealand



dwellings. This problem is likely to be more serious with SOHO installations because of the type of cable and jackpoints used and the higher frequencies involved for enhanced applications.

### **2.3.2 Acceptable Cable Types**

- (1) For new inside installations, the cable used shall be 2-pair or 4-pair cable with 0.5 mm conductors Telepermitted to PTC 222. More specific detail is provided in later sections.
- (2) Existing 3-wired installations which are not being converted to 2-wire, shall be extended using 2-pair or 3-pair cable with 0.4 mm conductors, Telepermitted to PTC 204. See sections 5.3. and 5.4.
- (3) Cable used for wiring outdoors shall be purpose made 2-pair "external telephone cable." These cables are grease filled and have solid (not stranded) 0.63 mm diameter conductors. "Buried" and "self supporting aerial" types are available. Pair 1 is usually yellow/black and pair 2 is brown/white. Alternatively pair 1 may be blue and blue-white and pair 2 orange and orange-white. This cable shall not be terminated on 3-wire jackpoints or wherever more than one conductor is terminated in a single IDC slot. See section 2.3.8 and 2.3.9 for applications.

### **2.3.3 Segregation of Services**

- (1) Telecommunications cables shall be installed with a permanent separation of at least 50 mm from mains power cables in all locations, except where the cables are separately enclosed.
- (2) Jackpoints or other hardware shall not be fitted closer than a horizontal distance of 200 mm from any fitting on which mains power cables are terminated, unless separated by a rigidly fixed barrier.
- (3) Complying barriers include wall linings, full depth framing in walls and substantially enclosed boxes. Electrical flush mounting brackets and open type flush boxes are NOT substantially enclosed in the above context. Without a barrier, the minimum 200 mm horizontal separation applies to both sides of a wall unless the wall cavity exceeds 200 mm depth.
- (4) Cable should not be run closely spaced and parallel to wiring of other services where practicable, to minimise the risk of noise by induction. Any length where spacing is the minimum of 50 mm, shall not exceed 3 m.
- (5) To avoid the risk of electrical hazard and noise caused by induction, wiring shall be connected only to Telepermitted equipment and hardware. Should there be a need for connection of any other local equipment such as bells, intercom, alarms, etc, separate cables and terminating hardware shall be used.

### **2.3.4 Wiring under Floors**

- (1) Cable shall be run clear of potentially wet surfaces, such as the ground, along areas at the bottom of outside walls, bathrooms, showers, water tanks, laundries, and any other areas where unintended drainage may occur.

(2) Joints in and connections to cables are not permitted, except in readily accessible areas developed for occupation.

(3) The cable shall be clipped or stapled at changes of direction and at intervals sufficient to prevent undue sag and potential contact with subsequent groundwork or other under-floor operations. Closely spaced clipping along timber should be avoided, except for appearance when open to regular view.

### **2.3.5 Wiring above Ceilings and in Walls**

(1) Cables in ceilings and wall cavities shall be segregated from power cables in accordance with clause 2.3.3.

(2) Cables in ceilings shall be routed clear of areas where potential damage may occur, such as areas used for storage, or around chimneys, flues, heating ducts, water tanks and plumbing. Cables should be routed along timber above the ceiling joists wherever possible, to avoid exposure to any water retained by the thermal insulation used between the joists. Cables above cathedral ceilings and horizontal runs in outside wall cavities are not permitted.

(3) Cable should be laid below or clear of surfaces likely to be stood or knelt on, and shall be clipped or stapled to prevent snagging during later operations, in areas where the height exceeds 600 mm.

(4) Cables shall not be clipped in walls cavities or other inaccessible areas.

(5) Joints in and connections to cables in ceilings are not permitted, except in readily accessible areas developed for occupation. Connections in wall cavities are not permitted.

### **2.3.6 Wiring Within or Beside Concrete Structures**

(1) Cables shall not be laid direct into concrete walls, floors or ceilings. Where it is necessary for cabling to pass through or be carried within a concrete structure, it shall be housed within a rigid plastic pipe. The installation shall facilitate later removal and replacement of the cables, if required.

(2) Cable runs shall avoid contact with concrete surfaces, particularly of outside walls and ground retaining walls. Where exposed surface wiring cannot be avoided, separation from the concrete shall be provided by enclosure in conduit or trunking, or by clipping to a timber batten.

### **2.3.7 Surface Wiring**

(1) Surface wiring shall be avoided in areas subject to potential damage, including within 50 mm of floors. Wherever possible, surface cables shall be routed along the edges of skirting boards, scotia, architraves, or window and door frames. Runs should be horizontal or vertical where exposed to view.

(2) Cables shall be clipped or stapled at changes of direction and also at intervals not exceeding 300 mm in areas where they may be disturbed. This includes the interiors of cupboards, wardrobes, and the like.



### **2.3.8 Wiring Between Buildings on Same Site**

AS/NZS 3086 for SOHO wiring specifically excludes wiring between separate buildings. This is permitted for 2-wire, with the following options:

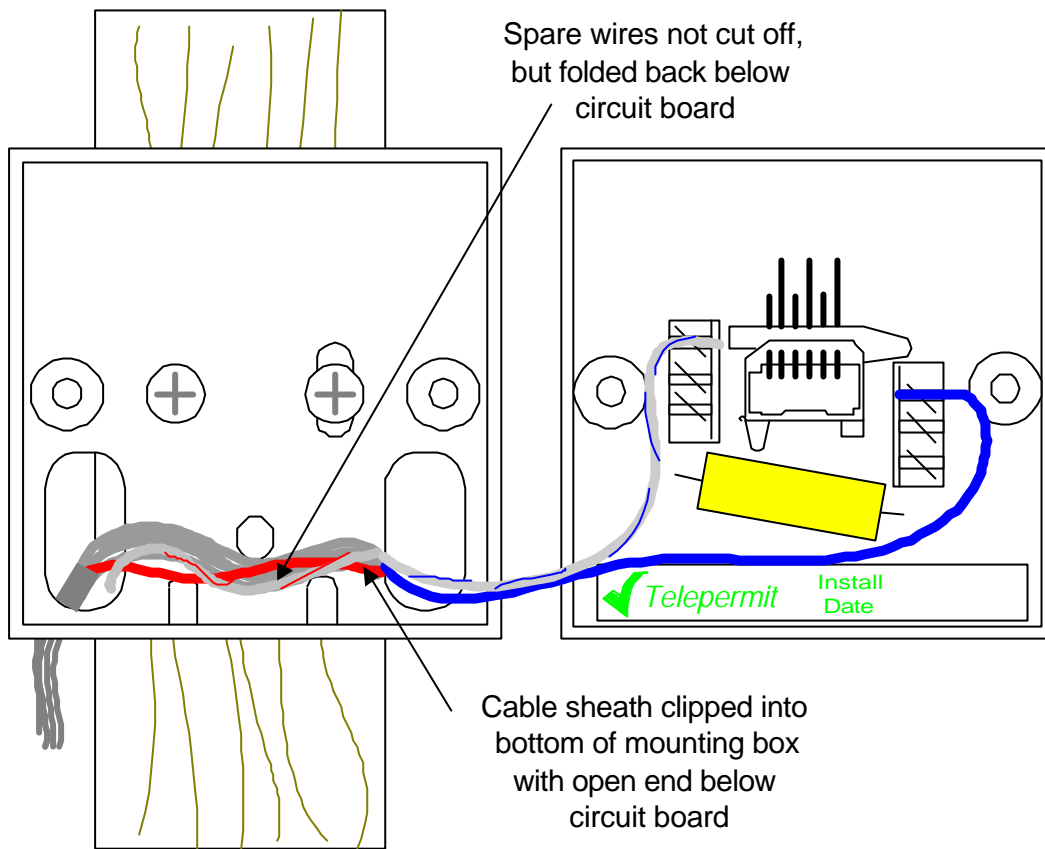
- (1) Where the cable can be run entirely within a fully enclosed access-way, it is deemed to be inside wiring.
- (2) Where the cable run is relatively short, is above ground and sheltered from weather, and can be supported over the full distance on a convenient surface, inside cable may be run in conduit. The installation shall facilitate later removal and replacement of the cable, if required.
- (3) External cable as specified in clause 2.3.2(3) shall be used in above-ground locations exposed to weather, provided it can be attached to a structural surface or adequately supported by a self contained or separate bearer wire. The route shall be clear of potential hazards and potential damage. Poles shall adequately support a ladder to facilitate maintenance.
- (4) For underground runs, external cable shall be installed in a buried pipe which extends at least 300 mm above the floor of an indoor location at each end. The installation shall facilitate later removal and replacement of the cable, if required.

### **2.3.9 Wiring to Equipment Exposed to the Weather**

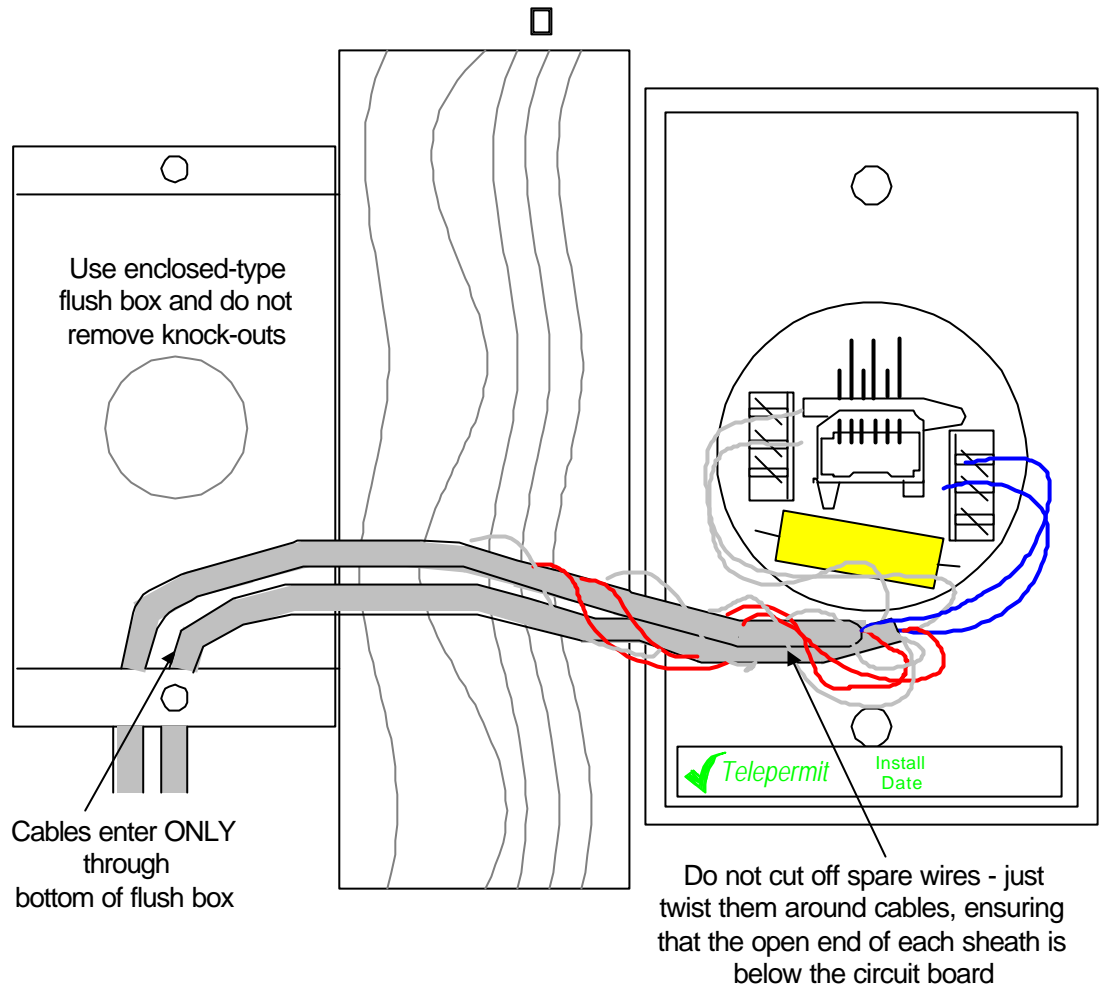
- (1) Where equipment and its associated cabling and wiring is exposed to the weather, all such components shall be of a design suitable for this purpose.
- (2) Standard jackpoints are not permitted to be located outdoors. Their function has been superseded by cordless telephones.
- (3) Cable for outdoor use is specified in clause 2.3.2 above.

### **2.3.10 Wiring Connection Practices**

- (1) New cables shall be jointed together using only Telepermitted jackpoints or other Telepermitted terminating hardware at readily accessible indoor locations. This excludes enclosed areas used for other purposes, such as in wardrobes and cupboards. This also excludes under-floor and ceiling spaces, except where walk-in access is provided to areas developed for occupation.
- (2) Cables shall enter terminating hardware enclosures only from below and effective means shall be taken to prevent water transported on or under the sheath from reaching the terminals or associated insulation and conductors. Unterminated wires must also be accommodated and the requirements for segregation from power cables observed, in meeting this requirement.
- (3) The ends of cable sheaths together with unterminated wires shall be confined below and clear of the termination assembly. For surface mounting boxes, this requires cable entry at a bottom corner of the rear. For flush mounting boxes, cable entry shall be from the bottom.



**Standard Surface Mounted 2-wire Jackpoint**  
(wallboard omitted to show stud fixing)



**Flush Mounted Powermatch 2-wire Jackpoint**  
(wallboard omitted to show flush box and mounting)

(4) At least 500 mm of cable shall be left slack in the wall cavity at both ends of a run. For new installations, the cable from the ETP should provide at least 1 m of slack at the first terminating point, to provide for connection of future equipment.

(5) Only wires of conductor diameter of 0.4 mm to 0.65 mm shall be terminated in IDC slots. In all cases except 3-wire jackpoints, not more than one such wire shall be terminated in each slot. For 3-wire jackpoints, up to two wires may be terminated per slot, provided that they are both of equal conductor diameter.

## 2.4 Jackpoints

### 2.4.1 Provision of Jackpoints

(1) The total number of jackpoints that may be installed in any premises is not restricted. However, the total CPE items which will operate correctly on a single analogue line is limited by the sum of the ringing numbers (RN) assigned to each CPE item, not exceeding a total of 5.

(2) Fixed wiring of CPE is limited to those devices whose primary purpose would be defeated, if plug connected. Line grabbing CPE such as security diallers may be directly connected, but using only Telepermitted hardware in accordance with this Code.

#### **2.4.2 Restricted Locations**

(1) Jackpoints or other termination hardware shall not be sited where they are subject to dampness or dirty conditions, to excessive heat or where they are likely to be subjected to mechanical damage. This precludes location outside, in bathrooms, showers and laundries, as well as on obviously damp or insecure walls.

(2) Jackpoints or other termination hardware shall not be mounted less than 300 mm above the finished floor level.

(3) Flush mounted jackpoints shall not be located on walls where the requirements for segregation from power cables or fittings cannot be satisfied. See section 2.3.3.

#### **2.4.3 Cleanliness**

All line hardware is to be kept clean during installation, avoiding contact with dirty hands or other contamination likely to cause premature corrosion.

#### **2.4.4 Mounting Hardware**

(1) Boxes used for mounting jackpoints and other terminating hardware shall be of substantially enclosed construction. The sides, top and bottom of surface mounting types shall be continuous with provision for cable entry at the lower rear. The sides, rear and top of flush mounting types shall be continuous except for small holes, and the bottom shall contain a cable entry hole not exceeding 30 mm diameter.

(2) Jackpoint mountings shall be securely fixed in position. If not screwed to timber, they should be rigidly fixed to wallboard using suitable fasteners.

#### **2.4.5 Terminating Requirements**

(1) Wires shall be terminated on line hardware only with the correct purpose-designed tool for the hardware concerned.

(2) For new work, the blue / blue-white pair is assigned to the first-in telephone line. The orange / orange-white pair is reserved for a second line or future network services.

(3) All wires of any cable containing a pair connectable to a network service shall be used only by Telepermitted equipment, to avoid potential over-voltage, balance and noise issues.

(4) The wires of a pair shall be kept together and shall be untwisted to the minimum practicable extent consistent with sufficient length for terminating them.

(5) The following mandatory requirements apply to wiring terminations in insulation displacement connectors:-



- (a) Insulated wires shall be inserted into the slots with the insulation undamaged in the vicinity of the actual connection. They shall be inserted individually from the correct direction – ie, from the side opposite the housing shoulder for Krone type IDCs – before individually pushing each wire home.
  - (b) Only one wire may be terminated in each slot, except for 3-wire jackpoints, where up to two wires may be terminated.
  - (c) Wires of different gauges shall not be terminated in the same slot.
  - (d) No attempt shall be made to terminate wires of types other than those which are specified for telecommunications wiring.
- (6) At 2-wire jackpoints the second pair may be connected only to a dual outlet type. The second pair may be connected through to the second pair of other cables in terminal boxes.
- (7) The end of all cable sheaths together with the spare pairs shall be confined below the jackpoint PCB or terminating assembly.
- (8) All 2-wire jackpoints shall be marked by the installer with the month and year of installation.

## **2.5 Earthing**

- (1) There is no provision for an earth connection to CPE via standard jackpoints. CPE is deliberately isolated from earth as a safety measure.
- (2) Safety is assured only for CPE bearing the appropriate Telepermit label. Specific earthing and isolation requirements apply to mains powered CPE and separate power supplies. Only such equipment shall be connected to the network.
- (3) Future wiring systems designed for broadband services may require earthing for screens. This together with power requirements for the associated network equipment, will be addressed in the specification for such future systems.

## **2.6 Installation Testing**

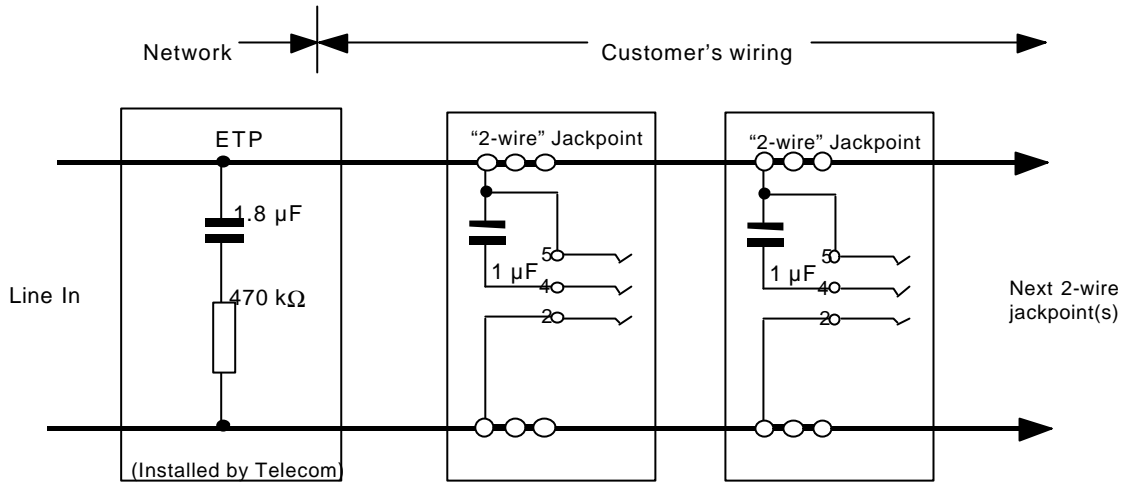
- (1) All wiring shall be correctly connected in accordance with the standard used. Wiring capable of being connected to Telecom's network shall be free of short-circuits, contacts with other conductors, and discontinuities. Any defective cables should be replaced.
- (2) Where problems arise, it is the installer's responsibility to ensure that remedial action is taken.



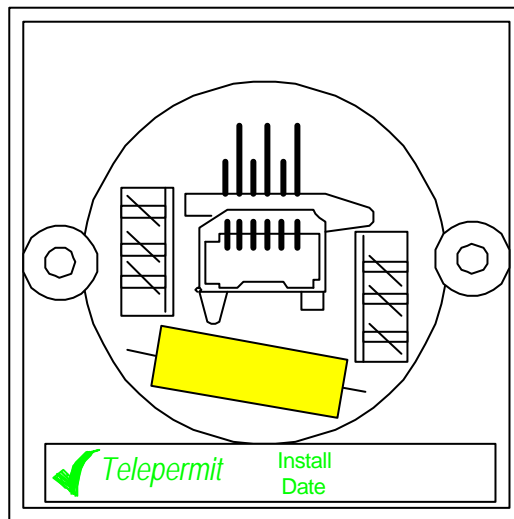


### 3 2-WIRE INSTALLATIONS

#### 3.1 General



Schematic of 2-wire system



Rear of Wired 2-wire Jackpoint

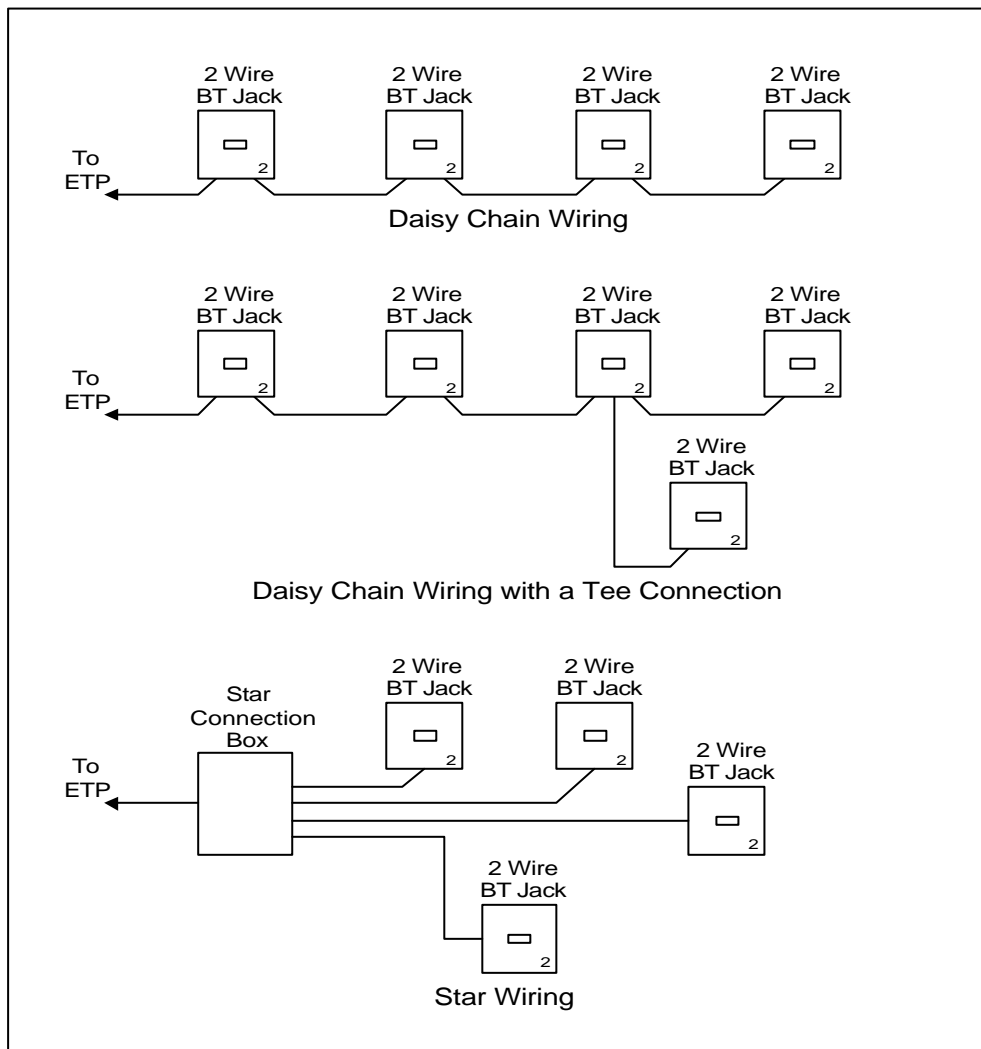
### 3.1.1 Purpose

(1) The 2-wire system has been developed by Telecom to overcome the shortcomings of reliability, transmission, and ringing impairments of the earlier standards and provide for simplified installation and satisfactory performance of a greater number and variety of CPE connected to a line. It is the current standard for new installations. Full conversion to 2-wire is strongly recommended when extending or altering existing wiring.

(2) For identification, 2-wire jackpoints are marked with a "2" on their faceplates.

### 3.1.2 Wiring

(1) One pair of wires is used to interconnect jackpoints, using optional daisy-chain, tee-off or star wiring, or any combination thereof. Virtually all 2-wire jackpoints provide terminations for both daisy-chain and tee connections together, thus providing for future extensions to be connected to any convenient existing jackpoint.



### Schematic of Wiring Topology Types

(2) 2-pair cable Telepermitted to PTC 222, shall be used exclusively. The additional pair can only be utilised where dual outlet 2-wire jackpoints are provided.



- (3) Only Telepermitted jackpoints and hardware shall be used.

### **3.1.3 Variations**

Acceptable variations to basic 2-wire are specified in clause 3.3 below.

## **3.2 Installation Requirements**

- (1) 2-wire installations shall comply with Part 2 of this Code.
- (2) Should star wiring be chosen in full or in part, a Telepermitted connection box located in a readily accessible position shall be used to terminate wiring to the jackpoints concerned. Note that star connection of wiring provides flexibility for multi-line applications and for the control of selected jackpoints by series CPE. However, it is the least reliable and has the poorest transmission performance of the options. For this reason, the star point should be reasonably centralised when long cable runs are involved.
- (3) The pair of wires from each cable shall be terminated with one wire to each IDC assembly. The same corresponding slot on each side shall be used for each pair. The 3rd slot on each side should be preferably left vacant for future extensions. Second pairs should not be cut off but folded back for possible future use.

## **3.3 Permissible Variants to Basic 2-Wire**

### **3.3.1 Connection of Series CPE**

- (1) While it is preferred that all jackpoints have permanent access to the network to provide wiring integrity and enable initiation of possible emergency calls, it is acceptable for some or all jackpoints and their associated wiring to be controlled by CPE in series with the line.
- (2) Where possible, CPE should be directly plugged into the series CPE controlling it, so that users are made aware of the arrangement if unable to initiate or answer a call.
- (3) When the function of series CPE depends upon its connection to fixed wiring, the connection should preferably be via jackpoints. At a point upstream of the jackpoints to be controlled, either two jackpoints or a dual outlet type may be wired to provide the "line" and "house" wiring connections. Alternatively, a Telepermitted connection box may provide fixed connections.
- (4) For star wired installations, the series CPE may be cabled directly to the star connection box or to a remote dual jackpoint as above. For the latter case, the "line" side shall use the blue / blue-white pair and the "house" side the orange / orange-white pair.
- (5) In all cases where there is no ETP and a test termination has been installed in the wiring, this shall be reinstated at the first connection from the lead-in cable and always on the line side of series CPE.

### **3.3.2 Other fixed wired CPE**

Only 2-wire parallel connected CPE which cannot be plug-connected, may be directly connected to wiring, but only at IDCs at jackpoints or other terminating hardware. Examples are payphones, where a jackpoint cannot be located in the secure area behind it, and weather proof CPE located outdoors, where the outdoor cable is terminated within the CPE.



## **4 SOHO CABLING SYSTEM**

### **4.1 4.1 General**

#### **4.1.1 Definition**

(1) SOHO cabling is specified in AS/NZS 3086:1996, which shall be fully complied with. Only specific issues not dealt with in this standard will be addressed in this Code.

(2) SOHO provides for any number of telecommunications outlets (jackpoints) of the US 8-position modular (RJ45) type, all located within a single building. These are individually (star) cabled to a common distribution device having the facilities to interconnect pairs, either separately or in groups, to network connections or other common equipment. In residential applications only, additional jackpoints in the same room may be daisy-chain connected from the first jackpoint in that room.

#### **4.1.2 Application**

(1) SOHO is derived from standards designed to support standard telephone service and ISDN S/T bus reticulation, within certain limitations. It was also intended to support LAN data connections and future broadband network services, but Telecom cannot confirm its suitability for these applications.

(2) SOHO standardises the 4-pair connections to the RJ45 jackpoints. Unfortunately, there are also two other pair configurations in common use. One of these is dominantly used for CPE connections in the USA and US aligned markets. In addition, standard 10BASE-T connections for Ethernet, commonly used for LAN applications, conflict with one pair which AS/NZS 3086 reserves for network services.

(3) Users can expect to need adapters for the connection of common CPE, not only to correct differing connection configurations, but also to provide for BT plugs. Furthermore, older 3-wire connected telephones would need a "mastering" adapter to provide their ringing function.

(4) While SOHO provides connection flexibility for users of multiple applications, the location of jackpoints is relatively inflexible. Moving an existing jackpoint or providing an additional one, would almost invariably require a new cable run back to the distribution point, because joints are not permitted.

#### **4.1.3 Support**

At present Telecom does not offer routine maintenance support for SOHO installations, and the wiring is excluded from the residential wiring maintenance service. In accordance with consumer protection legislation, installers should warn their customers of the above limitations of SOHO cabling and be prepared to provide after sales support and ongoing maintenance.

## 4.2 Technical Requirements

### 4.2.1 Materials

(1) Cable shall be 4-pair minimum cat 3 for residential wiring, and minimum cat 5 for light commercial wiring, Telepermitted to PTC 222. Non-Telepermitted cat 5 cable is also readily available, but this may contain cellular insulation which is prohibited by PTC 222 because of the risk of total failure should water penetrate the sheath. In this event repair is not possible without replacing the whole cable run.

(2) Other hardware components shall be Telepermitted in accordance with AS/NZS 3086 clause 5.3.2.3.

### 4.2.2 Installation Requirements

(1) The requirements of AS/NZS 3086 and Part 2 of this Code shall be complied with.

(2) The transmission performance of categorised cable is highly dependent upon the cable not being deformed prior to, during, or following installation. Where future applications include high-speed data, pulling tension should not exceed 110 N (approx 11 kg), any bending radius should be not less than 12 mm and the cross-section should not be deformed by clipping. The last precludes the use of a wiring staple gun because of the variability of timber density. Where additional support is required, preformed plastic saddles are recommended.

(3) A single 2-pair cable Telepermitted to PTC 222 shall be run to the ETP with a minimum 1 m of slack cable concealed adjacent to the Disconnect Test Point, to provide for the connection of future network equipment.



## **5 LEGACY WIRING SYSTEMS**

### **5.1 General**

#### **5.1.1 Obsolete pre-1983 Systems**

(1) Following the era when installations comprised only a single telephone, a “plan wiring” system was introduced to provide for extension telephones. This was progressively extended to provide many optional features, including three successive generations of jackpoints. Wiring was complicated by parallel connection of transmission and dialling functions, with series connection of ringing functions.

(2) Many such installations are still in use and may remain so, provided that repairs, additions or changes are not needed. In any of these cases, full conversion to 2-wire and replacement of the CPE with Telepermitted plug-in types is required.

#### **5.1.2 3-wire Installations**

(1) To provide for simplified parallel connected wiring and for interchangeability of CPE, Telecom's 3-wire system using BT jackpoints was introduced in 1983. Many 3-wire jackpoints were used to extend existing installations of fixed wired CPE. This led to various problems because this configuration was not specified.

(2) 3-wiring is based on the use of a single master jackpoint incorporating a shared ringing capacitor, which is used to derive a third wire to which CPE ringers are connected. However, this third wire causes an inherent capacitive unbalance to earth, which commonly causes noise induction and impairs fax and modem performance even when the noise is inaudible. More seriously, the shared capacitor limits the ringing current that can be drawn from the line, resulting in intermittent or poor ringing performance when several items of customer premises equipment are connected on the same line.

(3) Additional master jackpoints were added or substituted to overcome ringing impairments commonly experienced when new CPE was added to installations still containing bells designed for series operation. This has caused various other problems.

(4) When additions or changes are required, 3-wire installations containing either more than one master jackpoint, or containing CPE not bearing a Telepermit label, or containing any CPE whose Telepermit is PTC 202/88/xxx, or containing an extension bell having a dc resistance less than 2000 ohms, shall not be further extended in 3-wire but converted to 2-wire.

### **5.2 Expiry of 3-wire Telepermits**

Telepermits for 3-wire master jackpoints will expire on 1 January 1999. Master jackpoints shall be used only for replacement of faulty items. Telepermits for 3-

wire extension jackpoints expire on 1 January 2000. In the meantime, extension jackpoints may be available for extending existing 3-wire installations. However, Telecom strongly recommends full conversion to 2-wiring whenever the opportunity arises.

### **5.3 Extending a 3-wire Installation with 3-wire Extension Jackpoints**

(1) Where a 3-wire installation qualifies for extension in terms of clause 5.1.2(4) above and full conversion to 2-wire is not chosen, existing installations may be extended by installing additional extension jackpoints until such time as they are no longer available. The installation remains fully 3-wire and could require full conversion to 2-wire in the event of a fault or other performance impairment.

(2) The additional jackpoints shall be connected only to a jackpoint having only one cable already terminated on it. This cable, and any new cable used, shall be either 2-pair or 3-pair having red, white, blue and green coloured insulation with 0.4 mm diameter conductors. Cable Telepermitted to PTC 204 complies.

(3) Each wire of the cable specified shall be connected to the appropriate terminals. For the additional jackpoints and that being connected from, red connects to IDC 2, blue to IDC 3 and white to IDC 5.

(4) Interconnections are made by simply daisy-chaining the wires from one jackpoint to the next, terminating each wire colour in the same relative position or terminal number and so connecting all jackpoints electrically in parallel.

(5) All new wiring shall comply with Part 2 of this Code.

### **5.4 Extending a 3-wire Installation with 2-wire Jackpoints**

(1) When secondary jackpoints are not available to extend existing 3-wire installations which qualify in terms of clause 5.1.2(4), 2-wire jackpoints may be used.

(2) All requirements of clause 5.3 above shall be complied with, except for the following:

- (a) At the 3-wire jackpoint being wired from, the red wire is connected to IDC 2 and the white wire to IDC 5. The blue wire is not connected and where 3-pair cable is used may be cut off at the end of the sheath with the green wire.
- (b) At all 2-wire jackpoints, the red wire(s) are connected to the right hand IDC assembly and the white wires to the left hand IDC assembly, as for standard 2-wire but with red instead of blue.
- (c) Should 0.4 mm conductor PTC 204 cable not be available for wiring to the new jackpoint, then 2-pair 0.5 mm PTC 222 cable may be used provided that the jackpoint being wired from is changed to a 2-wire type. This allows the new cable to be daisy-chain connected to the existing cable in separate IDC slots.



(3) Further extensions beyond the first 2-wire jackpoint may be daisy-chain or tee-off connected and may optionally use 2-pair cable Telepermitted to PTC 222.

(4) All other requirements of Part 2 of this Code shall be complied with, including no more than one wire to each 2-wire jackpoint IDC slot and each new 2-wire jackpoint being marked with the date of installation.

## **5.5 Conversion to 2-Wire**

### **5.5.1 General**

(1) The objective is to replace connections to fixed wired telephones and 3-wire jackpoints with 2-wire jackpoints using existing cables as far as possible.

(2) Existing fixed wired telephones contain bells which are designed for series operation and severely limit the ringing performance of other CPE on the line. It is strongly recommended that they be replaced with modern plug-in types. Those rented from Telecom may be exchanged at any Post Shop. Those privately owned and Telepermitted may be retained, but require a plug-ended cord to be fitted. The required connections for the most common type are described in Figure 1.

(3) Existing fixed wired extension bells are also likely to contain mechanisms designed for series operation and should be removed. Where still needed, inside types may be replaced with a Telepermitted electronic plug-in type, with an additional jackpoint provided for connection. The function of outside bells has largely been replaced by cordless telephones, but if still required should be replaced with a weatherproof Telepermitted version containing a series capacitor and connected to the fixed wiring in accordance with clause 2.3.9.

(4) Existing plug connected or fixed wired series CPE may remain.

(5) Conversion shall follow the requirements of Parts 2 and 3 of this Code, subject to some dispensations specified hereunder.

### **5.5.2 Cabling**

(1) At each location of fixed wired CPE or 3-wire jackpoints to be converted to 2-wire jackpoints, the existing wiring shall have conductors of diameter 0.4 to 0.65 mm for termination on the replacement 2-wire jackpoints.

(2) Lead-in or other cable having a larger diameter should be replaced by new 2-pr cable back to the ETP or its point of connection. The same applies to lead-in cable which is not grease filled. Suitable grease filled connectors shall be used to connect 2-pr cable to such lead-in types.

(3) Cabling to the locations of any equipment not being used following conversion, shall be totally disconnected at the point of connection to wiring being reused. This prevents wiring unbalance caused by the former ringing wire.

### 5.5.3 Jackpoints

(1) Provide 2-wire jackpoints at the previous terminating points, which are being retained. These should be moved to comply with minimum height requirements when sufficient cable length is available and wall damage at the previous location is easily repaired.

(2) The only wires to be reterminated on the 2-wire jackpoints are the pair used to the line. For identification, when connected to the network an idle line provides 35 to 50 Vdc across the pair. Colours may vary in older cables, with red and white followed by green and white, being most common. On 3-wire jackpoints, they are those connected to IDC slots 2 and 5.

(3) To assist prevention of water entry from the cables, the requirements of Part 2 for cable entry from below, and with all parts of the cable sheath and spare wires confined below and clear of the PCB, shall be followed where possible. Should corrosion be evident in any jackpoint being replaced, the above requirements are more important. In this case, the original cable is likely to be wet and should preferably be replaced with new cable routed clear of wet areas in accordance with clauses 2.3.4 to 2.3.6.

(4) The insulation of wires being reterminated shall be undamaged across the full width of the IDC slot.

(5) Connect each selected pair of line wires, one to the each left and right side IDC assembly, in the same corresponding slot for each cable. Connect only one wire to each slot. Three pairs of slots are available. The polarity is not important, but for consistency, the white wires of pairs should use the left side assembly.

(6) Outside cable to weatherproof equipment may be connected to any convenient 2-wire jackpoint having a pair of spare IDC slots.

### 5.5.4 Additional Jackpoints

Any additional wiring to jackpoints or elsewhere is covered by and shall comply with Parts 2 and 3 of this Code.

### 5.5.5 Tests of Wiring

Converted and additional wiring should be tested for correct functionality before fixing jackpoint faceplates in position. Tests should include the ability to initiate calls and receive ringing at all jackpoints.

### 5.5.6 System performance

(1) All CPE associated with wiring converted to 2-wire will perform at least as well as it did prior to conversion. If not, a wiring error exists. The only exception is that some first generation cordless phones may ring once, when certain other CPE on the line goes from on-hook to off-hook, or vice versa. Because of age and vulnerability to damage, very few of the types affected still exist. When encountered and the effect is unacceptable, the cordless phone should be replaced with a more recent model.



(2) Because of the dispensations from some mandatory requirements for new work to facilitate maximum reuse of existing cabling, converted installations may not perform as well as those fully conforming 2-wire installations. The aspects which may be affected include reliability and noise performance. Reuse of long obsolete CPE limits ringing to other CPE the same as it would for any other 2-wire installation.



