



**Government of South Australia**

Department of Planning,  
Transport and Infrastructure

## **PUBLIC TRANSPORT SERVICES**

### **TECHNICAL STANDARD**

#### **PART 129016**

### **DESIGN - STATIONS – PASSENGER INFORMATION SYSTEMS**

**AR-PW-PM-SPE-00129016**

**(D076)**



**and THINK**

**Zero Harm**



## Document Control

### DOCUMENT STATUS

<b>Document Owner: Director, Asset Management</b>			
Action	Name and Position	Signature	Date
Prepared By:	Name: Kuldeep Zala Title: Rail Engineer		11/07/13
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Approved By:	Name: Rob Taverner Title: Director, Asset Management		11/7/13
<b>Risk Category:</b> Low			
<b>Document Review Schedule:</b> As Required			

### DOCUMENT AMENDMENT RECORD

Rev	Change Description	Date	Prepared	Reviewed	Authorised
0	Initial Issue	Mar 11	Josh Ward	Doug Gillott	Rob Taverner
1	Changes in various sections	July 12	Kuldeep Zala	Keith Charlton	Rob Taverner
2	Document number change	July 13	Kuldeep Zala	Keith Charlton	Rob Taverner



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## 1.0 INTRODUCTION

The Department of Planning, Transport and Infrastructure (DPTI) Public Transport Services Division (PTS) owns and operates the Adelaide Metropolitan Passenger Rail Network (AMPRN). There are approximately 85 stations serving the AMPRN. The significant number of stations means that the process of upgrading or renewal is continuous. In order to both economise on design and construction effort and costs and enhance the passengers' experience a set of common design and construction technical standards for stations has been developed.

Because the set of station standards is primarily used within the contract administration process the technical standards documents must be aligned with both the DPTI wide Master Specification and the PTS engineering management system.

The document attached at Annex A Technical Standard – Stations – Passenger Information Systems, is one of the set of station standards.

## 1.1 PURPOSE

The purpose of this Technical Standard is to outline the design requirements for Passenger Information Systems (PIS) at the station precinct.

## 1.2 SCOPE

This Technical Standard applies to all PTS projects and contractor organisations designing, constructing or maintaining passenger stations on the AMPRN.



## 2.0 ANNEX A – TECHNICAL STANDARD – STATIONS – PASSENGER INFORMATION SYSTEMS

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### 1. GENERAL

This Part specifies the requirements for the design of Passenger Information Systems (PIS) at railway stations on the Adelaide Metropolitan Passenger Rail Network (AMPRN) and comprises the following, unless stated otherwise in the **Project Design Brief**:

- (1) A Network Interface Unit (NIU) that connects to the existing Public Transport Services Operations and Maintenance (PTSOM) multi-core copper communications system. This is most often Station Gateway Unit (SGU) section from Open Access Pty Ltd;
- (2) One Voice Annunciator (VA) per platform;
- (3) One Passenger Information Display (PI Display) set (i.e. two screens back to back) per platform fixed to the shelter, and associated Video Control Units (VCUs);
- (4) One Network Amplifier Controller (NAC);
- (5) Loudspeakers as part of the Passenger Information Audio (PA) system;
- (6) Hearing Impaired Induction Loops (HIIL);
- (7) Associated cabling, conduits and pits;
- (8) Active interface components such as network switches, media converters and video signal extenders;
- (9) Associated hardware and software interfaces, and necessary configuration data to integrate the station equipment into the overall existing PTSOM multi-core copper communications system; and
- (10) Associated Uninterrupted Power Supply (UPS) and Network Power Controller

Designs and installation works performed under this Part are to comply with Part 129002 "Earthing and Bonding".



This Part does not cover static signage, ticketing, lighting, electrical infrastructure, Emergency Help Phones or security systems. However, the Contractor shall ensure that the PIS requirements are co-ordinated with all other systems and elements within the Station Precinct during the design.

The requirements in this Part relate both to the installation of a PIS as part of a new station, and to upgrades made to a PIS as part of major renovation or upgrade works at an existing station.

At all stations the PIS shall be a “compliant telecommunication system” in accordance with AS/ACIF S009 and S008. The Contractor shall ensure that conduit, cable and equipment installation is performed by, or supervised by, persons holding an Open Cabling registration with an Australian Communication and Media Authority (ACMA) Authorised Cabling Registrar. However, it is considered that the PI System’s multi-core copper communications cable and the SGUs connected onto it to be non-compliant under AS/ACIF S009 and S008. For this reason, the PIS shall be designed and installed with suitable segregation and isolation between its compliant and non-compliant components.

The PI System’s multi-core copper communications cable is considered to be a part of the railway signalling system and is accessed within signalling-system electrical enclosures (“Remote Field Station (RFS) enclosures”) or Relay Rooms which contain safety-critical signalling equipment. The Contractor shall ensure that any person responsible for the installation of electrical or electronic equipment or cabling (including conduit work) inside of signalling equipment enclosures has been approved as suitably qualified and experienced for the specific work to be undertaken.

The approval of the person or persons nominated to conduct such electrical, cabling or civil works shall be obtained by the Contractor prior to the commencement of works, and shall constitute a **HOLD POINT**.

The PI System as a whole is considered to be critical infrastructure essential for the day-to-day operation of the railway and every care shall be taken by the Contractor to ensure that its operation is not interrupted.

## 2. STANDARDS AND DRAWINGS

### STANDARDS

AS 1289	Methods of Testing Soils for Engineering Purposes
AS 1742	Manual of Uniform Traffic Control Devices
AS 2053	Conduits and Fittings for Electrical Installations
AS 2648.1	Underground Marking Tape – Non-detectable Tape
AS 1768	Lightning Protection
AS 3000	Electrical Installations (Wiring Rules)
AS 3008.1.1	<a href="#">Electrical installations – Selection of Cables - Cables for Alternating Voltages up to and Including 0.6/1 kV – Typical Australian Installation Conditions</a>
AS 3084	Telecommunications Installations – Telecommunications Pathways and Spaces for Commercial Buildings
AS 3500	Plumbing and Drainage
AS 4799	Installation of Underground Utility Services and Pipelines within Railway Boundaries
AS 60118.4	Hearing Aids – Magnetic Field Strength in Audio Frequency Induction Loops for hearing Aid Purposes
AS 60950.1	Information Technology Equipment – Safety – General Requirements
AS 60849:2004	Sound Systems for Emergency Purposes (IEC 60849:1998 MOD)
AS/ACIF S008:2006	Requirements for Customer Cabling Products
AS/ACIF S009:2006	Installation Requirements for Customer Cabling (Wiring Rules)
IEC 60297	(19”) Rack Standard Dimensions



## DRAWINGS

301-A2-86-2239	Allowable Infringements, Minimum Structures – 1600mm Gauge
302-A2-97-023	Metropolitan Rail and Tram System
691-A3-09-738	Layout of Cables in Conduits in Main Cable Trenches
004-A1-81-262	Electrical Station Lighting Underground Wiring Standard
691-A3-92-227	Layout of Cables in Main Cable Trenches
691-A3-09-2463	Layout of Cables in Conduits in Under Track Main Cable Trenches
618-A2-10-220	General Arrangement of Mounting – Top Mount – Dual or Single Monitor
618-A2-10-221	General Arrangement of Mounting – Bottom Mount – Dual or Single Monitor
618-A3-10-223	Electrical Connection Arrangement
618-A2-10-224	General Assembly – Dual – Top Mount *
618-A3-10-227	Monitor Bracket; 10 degree tilt
618-A2-10-231	General Assembly - Electrical Enclosure
618-A2-10-232	Electrical Enclosure Fabrication
618-A3-10-233	Power Supply Circuit Diagram
618-A2-10-234	Assembly of Power Board
618-A3-10-235	Labels for Power Board
618-A2-10-237	General Assembly; Video Enclosure
618-A2-10-238	Video Enclosure Fabrication
618-A3-10-239	Slide-out Component Rack
618-A2-10-240	Video and Data Circuit Diagram
618-A1-10-245	Centre Frame Fabrication; Dual Monitors
618-A2-10-247	General Assembly - Centre Frame Components
618-A2-10-250	General Assembly – Dual - Bottom Mount
624-A3-10-2378	Communications – General Passenger Information System Functional Diagram – Typical Power Supply Arrangement
624-A3-10-2376	Comms/PI System—Functional Diagram—Typical Data Flow with LCD PIDs
624-A2-10-2372	Comms/General—General Assembly of PTS VA **
624-A2-10-2380	Comms/General—HILL Loading Inductor
624-A3-11-316	Comms/General—VA Installation Details
624-A3-10-2369	Comms/General—PI System— I.D. Labels for PI Cabinet Enclosures

\* Note 1: General Assembly drawing 618-A3-10-224 references a suite of approximately 14 mechanical and electrical manufacturing ('shop') drawings. Similar G/A drawings have also been produced for other mounting arrangements—dual bottom mounting, single top mounting, single back mounting, etc.

\*\* Note 2: VA General Assembly drawing 624-A2-10-2372 references a number of manufacturing drawings.

### 3. REFERENCE DOCUMENTS

OWNER	DETAILS / PART
M. Goddard (AMS Acoustics).	Achieving Speech Intelligibility at Paddington Station London, UK
Sam Tsoi (ARUP Journal 3/2006)	West Rail Stations: Acoustic Design
Queensland Rail	QR Code of Practice for Railway Noise Management version 2, November 2007
DPTI	PTS Pits and Conduits Standard
Federal Government	Radio communications Labelling (Electromagnetic Compatibility) Notice 2008

Note: Manufacturer data for speaker and microphone products detailed in this document is not referenced, but may be downloaded from the manufacturer's website without restriction.

## 4. SYSTEM OVERVIEW

### 4.1 Technology

The PI System is a custom implementation of the *NetSpire Passenger Information System* manufactured by Open Access Pty Ltd (OA). All hardware and software aspects of each station's PIS are required to be fully integrated with this system. It is built primarily from a limited number of customised proprietary OA products, although some proprietary products from other manufacturers are also used. All designs shall be built only by using the standard customised product set from these manufacturers to maintain compatibility between stations and integrate with the existing public address and timetabling systems.

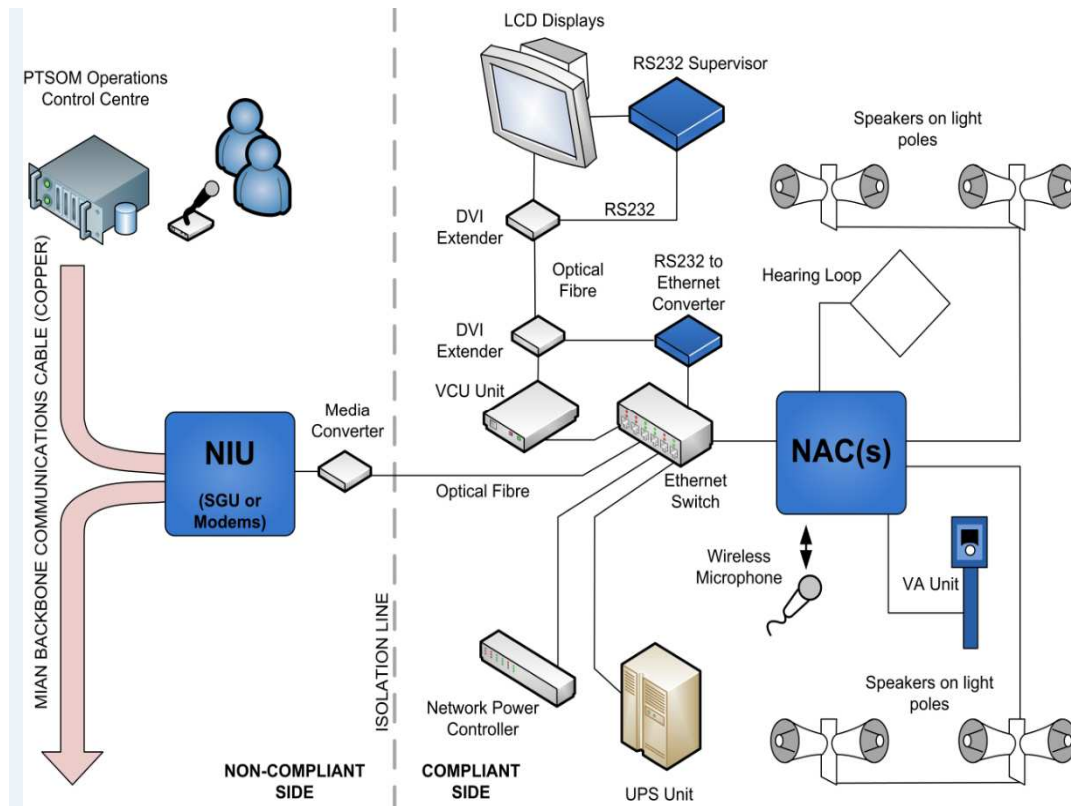
The Contractor shall allow to co-ordinate all the requirements of the design and installation of the PIS with Open Access Pty Ltd. The contact details are:

L4/65 Epping Road,  
 North Ryde NSW 2113  
 (02) 9978 7009  
 Mahmut Fettahlioglu, Technical Director

The Contractor should note that, in addition to Open Access's customised products, the system's standard products from other manufacturers have each been tested by Open Access for compatibility with the system's hardware, software and network environments. For this reason, only the items listed herein are authorised be connected onto the PI network (refer Section 1: General).

### 4.2 Elements

The key functional elements of the PIS are shown generally in Figure 4.2 below and in more detail on drawing 624-A3-10-2376 also described in the clauses that follow.



**FIGURE 4.2 - FUNCTIONAL DIAGRAM OF PIS COMPONENTS**



#### 4.2.1 Station Gateway Unit (SGU)

The PIS uses a single dedicated pair on the existing multi-core copper communications cable that runs between stations.

The SGU includes two G.SHDSL modems that connect to the communications cable. It forwards data to one or more Network Amplifier Controllers (NAC's) controlling the station VAs, PA system and HILLs; and to the VCUs controlling the PI Displays.

In stations where a fork occurs in the line, an additional G.SHDSL modem is used external to the SGU.

#### 4.2.2 Networked Amplifier Controller (NAC)

The NAC connects via optical fibre Ethernet link (and a network switch) to the SGU and runs on 240 V station power with UPS backup.

The NAC handles all audio functions including:

- (1) Decoding and output of audio over internet protocol from the OCC controller's desk microphones;
- (2) Pre-recorded message store and playback for timetable and other messages;
- (3) Local audio source input interface and pre-amplification;
- (4) Two power amplifiers for loudspeakers;
- (5) Three power amplifiers for VAs;
- (6) Three current drive amplifiers for HILLs;
- (7) Contact closure input/output interface, programmable to trigger replay of a pre-recorded 'Test' message;
- (8) Audio mixing matrix to prioritise and mix audio sources to the output amplifiers;
- (9) Copper Ethernet interface; and
- (10) An RS-485 serial interface suitable for driving legacy LED PI Displays.

To minimise the costs of power connection and limit the length or size of hearing loop cable runs, the NAC shall be located in the station Equipment Room. Refer Part 129017 "Equipment Room".

#### 4.2.3 LCD Passenger Information Display – Display Set

This, unless specified in the **Project Design Brief**, comprises two back-to-back 42" LCD industrial outdoor grade monitors, each complete with integrated IP65 (International Protection Rating) rated vandal resistant enclosure complete with cooling fans.

#### 4.2.4 Video Control Unit (VCU)

The VCU is a compact industrial computer running a specific program to generate a DVI interface display signal suitable for driving LCD PI Displays. It has a 240 V mains compatible "brick" power supply.

It obtains its data from the SGU via the Ethernet network switch. The VCU is co-located with the NAC in an equipment rack or PI Cabinet (PIC).

The VCU software includes templates to generate various display formats, which includes both a list of scheduled services (as would be displayed at a station entrance concourse) and next train with list of stops (for platforms).



One VCU is required per display set. The same VCU output may be split via third party devices to drive multiple display sets along one platform with the same signal.

Unless otherwise specified in the **Project Design Brief**, a minimum of two VCUs are required for stations equipped with LCD PI Displays.

An optical DVI extender shall be used where it is necessary to extend the range of the video signal to allow for a long cable run from a VCU to a display set.

#### 4.2.5 Voice Annunciator (VA)

The VA is located near the centre of each platform and announces next train information automatically. It also has a push button which signals the NAC to replay recorded timetable information on demand when pressed.

#### 4.2.6 Hearing Impaired Induction Loop (HIIL)

Each VA shall have an associated HIIL. The HIIL comprises a turn of cable embedded into the platform and driven by the HIIL amplifier in the NAC.

It creates a magnetic field which can be received by hearing aids (having a "T-switch" facility) and provides both VA and all PA announcements.

The Contractor shall note that the length of cable between each HIIL and the NAC is limited and this specification forms a significant **design constraint** for the system.

#### 4.2.7 Associated Equipment

The PIS also includes, but is not limited to:

- (1) Ethernet switch with both optical and copper channels to connect the NAC and VCUs onto the network;
- (2) Media converter to isolate the SGU's non-compliant copper Ethernet output from the compliant remainder of the system via optic fibre;
- (3) DVI extenders to transmit video signals and RS-232 commands from VCUs to PI Displays over optic fibre;
- (4) Wireless microphone system for local PA announcements;
- (5) UPS and remote power switch; and
- (6) Equipment rack(s), cabling, connectors, etc as specified elsewhere in this document.

#### 4.2.8 Passenger Information System Diagram

The above PIS components and their interconnectivity are summarised in Figure 4.2.8 below.





- (2) Crowd control and general information (such as bus transfers or venue access) from a locally operated microphone, for patrons during major events (at selected stations only); and
- (3) Delay announcements from train controller (service delays, cancellations, alternative arrangements).

## **5.2 Components**

The PA system shall comprise of the following items unless specified otherwise in the **Project Design Brief**:

- (1) NAC with PI System rack or cabinet (PIC) and associated SGU;
- (2) Loudspeakers and associated cabling;
- (3) Local microphones system;
- (4) HILLs; and
- (5) VAs.

All VA and PA system announcements shall be simulcast through each VA's respective HILL, with a PA message taking priority over the VA message should both occur simultaneously.

Announcements may be broadcast to all speakers or zoned to specific platforms.

## **5.3 PA System Performance Criteria**

### **5.3.1 Coverage**

A CIS of 0.7 to AS 60849 shall be achieved over the specified coverage areas for all PA speaker delivered announcements.

Coverage of the full platform length of all platforms shall be provided.

For stations with overpasses, coverage shall include all the elements of the overpass, including the stairs and/or ramps, the lifts and the overpass.

For stations with public toilets on platforms, coverage shall include within the Exeloo.

Bus interchange areas shall not be covered unless specified in the **Project Design Brief**.

Coverage shall be contained by measures including high density of speakers, narrow beam width, and down-tilt angle.

The target is to achieve the CIS of 0.7 with the volume level limited to approximately 15 dB above ambient noise. After electrification of affected stations, the station ambient noise level and consequent speaker volume level will need to be recalibrated.

### **5.3.2 Frequency Response**

The frequency response of the entire PA system shall be within +/- 3 dB from 100 to 5 kHz.

### **5.3.3 Harmonic Distortion**

Total harmonic distortion of the entire PA system shall not exceed 1% over the frequency range of 100 Hz to 5 kHz measured at the output of any speaker.



5.3.4 Hum and Noise

Better than 80 dB below nominal SPL.

5.3.5 Signal to Noise Ratio

The signal to noise ratio under normal operating conditions of the amplifying system as a whole with flat operation of the tone control shall not be worse than 40 dB.

5.3.6 Operating Temperature

PA equipment that is housed outside the equipment room shall be capable of operating under the following conditions:

- (1) ambient temperatures between 0°C and 50°C, and
- (2) a relative humidity of 5% – 95%.

5.3.7 Loud Speakers

Speakers shall be weatherproof, corrosion, vandal and fire resistant.

5.3.8 Design Life

ELEMENT	DESIGN LIFE (YEARS)
Cabling and equipment racks	40
Speakers	15

**5.4 Local Announcement Facilities**

Unless otherwise stated in the **Project Design Brief**, all stations shall have a wireless microphone system with full microphone coverage of the areas as indicated in Clause 5.3.1 “Coverage”.

This shall comprise a frequency agile UHF wireless microphone (TOA WM4200 or equivalent) and matching receiver (TOA WT5800 or equivalent, operating on one of 64 channels), with the receiver output being connected to a NAC audio input programmed for highest priority (input 3 or 4 only).

The receiver shall be equipped with an antenna (TOA YW4500 or equivalent) fitted in a secure location outside the equipment room (at least 2.4 m above ground). If directly exposed to the weather, it shall be installed in a heavy duty, weatherproof plastic enclosure. The location shall be determined to maximise coverage and could be pole mounted. Multiple antennas may be required to achieve full coverage.

To eliminate the possibility of unauthorised broadcasts the wireless receiver shall be disabled when not required. The Contractor shall provide a means to activate the receiver when required from within the Equipment Room but without requiring access to secure equipment cabinets. As a minimum, this should include a push-button and an adjustable timer unit that can be set to activate the receiver for between 30 and 60 minutes. It must not be possible for an operator to inadvertently leave the receiver permanently active.

A wall-mounted shelf or similar facility shall be provided near the equipment room door for storage of the microphone. The control to activate the receiver must be located here, as shall the receiver unit if it provides a front-panel mounted volume control adjustment.

**5.5 Speaker System**

5.5.1 Type (Model) and Setting

The standard speaker for all surface mount and pole mount applications shall be the TOA CS-64. This is a 6 W rated 100 V line outdoor speaker with a swivel mount bracket.

Speakers shall be set to the 3 W tap prior to final volume adjustment.

### 5.5.2 Position and Spacing

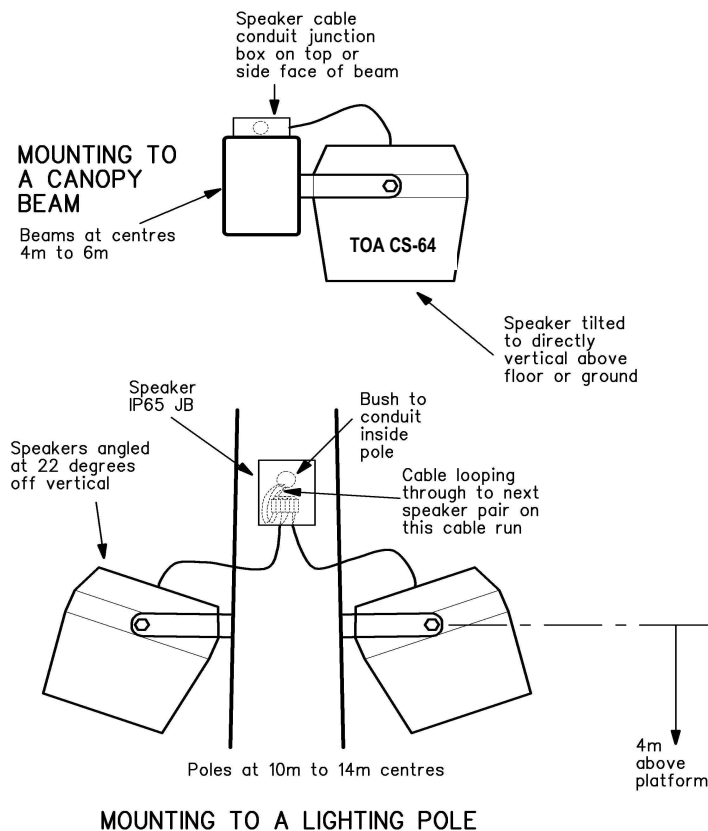
Speakers under shelters shall be fixed to the underside of the shelter structure in a vertically down-facing orientation at a position within  $\pm 500$  mm above the platform centre line.

Speakers mounted on lighting, CCTV or joint use lighting/CCTV poles shall be orientated so that the boresight of the speaker touches the platform centre line.

Speakers shall be spaced between 4 and 6 m under shelters, generally to match the structural grid.

One pair of speakers shall be located on every light pole, typically at 10 to 14 m spacing. The speakers shall be angled at 22° tilt angle from vertical at a height of 4 m above the finished surface. Where speakers are fitted onto poles an anti – climb guard shall be fitted, below them with spikes at 30 degrees out to the pole's vertical alignment.

Figure 5.5.2 below indicates a typical installation.



**FIGURE 5.5.2 – TYPICAL SPEAKER MOUNTINGS**

Speakers shall be mounted using sturdy brackets and M8 fixings with washers and locking washers. Each speaker shall be secured using two fixings. The cable between each speaker and its junction box shall be kept as short as possible. The size and shape of the junction boxes shall be selected to fit neatly on the available pole, beam or purlin area. Mounting shelter speakers directly above seats should be avoided.

Speakers shall be wired such that NAC channel 1 feeds the speakers on Platform 1 and channel 5 feeds the speakers on Platform 2. Speakers in other coverage zones (lifts and toilets, etc.) may need constant-



impedance 'pad' controls installed to ensure correct volume balance. Speaker cables in junction boxes should be joined using screw-less 'connecting terminals' (Wago type 222-415 or equivalent).

## 5.6 Network Amplifier Controller

Unless specified in the **Project Design Brief** each station shall have a minimum of one Network Amplifier Controller (NAC), model number CONAC01 supplied by Open Access Pty Ltd.

The Network Amplifier Controller (NAC) unit/s shall be configured as follows:

- (1) 240 V AC power;
- (2) 8 output channels, configured as:
  - 2 x 100 V audio;
  - 3 x 25 V audio (hardware limited); and
  - 3 x HIIL.
- (3) Direct 100BaseFx fibre Ethernet interface;
- (4) Standard auto-sensing copper Ethernet interface;
- (5) RS485 interface;
- (6) 4 x line level audio inputs, 4 x line level audio outputs; and
- (7) 8 digital inputs, 8 digital outputs.

The input and output ports on the NAC are voltage limited to comply with the following AS/ACIF S009 circuit classifications:

NAC Output port	S009 Circuit classification
100 V audio output (PA speakers)	LV Telecommunications
25 V audio output (VA)	SELV (hardware limited)
Digital I/O (VA switch, audio select inputs)	SELV
RS485 (LED displays)	SELV
HIIL	SELV

The Contractor shall ensure that the number, type and tap-level of loudspeakers connected to a single NAC amplifier are such that the rated power output of the NAC is not exceeded.

Unless otherwise specified in the **Project Design Brief**, the NAC shall be connected to a UPS-protected 240 V power supply via one output of a Network Power Controller.

The NAC's amplifier connectors shall be Neutrik SpeakON SPX Series loudspeaker connectors, type NL4FX. They shall be colour-coded as follows: 100 V audio outputs – black (NL4FX); VA outputs – red (NL4FX-2); HIIL outputs – green (NL4FX-5).

The cable used to connect the NAC to each VA shall be four core (two pair) shielded cable as specified in Clause 9.1 "Communications Cabling". One pair carries the speaker feed and the other carries the button signal.

The network connection between a NAC and an SGU shall be via optic fibre in order to ensure electrical isolation between the NAC (part of the compliant Telecommunication System) and the SGU (which is deemed to be non-compliant). This shall be achieved through appropriate use of an industrial-grade 100baseT-to-fibre media converter at the SGU end.

When multiple audio input sources are active simultaneously at a station, the following order of priority shall apply:



PRIORITY	INPUT SOURCE	OUTPUT TO
1 (Highest)	High priority DVA announcement originated at a central operator console or via security trigger.	All PA speakers and HIIIs, VA muted
2	Announcement originated at line level audio input # 1 (e.g. a local station microphone)	All PA speakers and HIIIs, VA muted
3	Low priority or pre-recorded DVA announcement originated at a central operator console	All PA speakers and HIIIs, VA muted
4	Audio received on other line level audio inputs, in fixed order of priority (e.g. from security system)	All PA speakers and HIIIs, VA muted
5	PIS message requested by customer pressing VA button	VA speaker and associated HIIIL

A higher priority audio source shall interrupt any audio from a lower priority source that is being output at the time. In this event there is no requirement to resume the original low priority broadcast after the higher priority broadcast has finished.

The Contractor shall ensure that each NAC is delivered by Open Access pre-configured with the correct configuration for the audio parameters (including parametric equaliser settings), tailored to the specific PA speaker type(s) being installed.

Where there are two NACs at a station, the Contractor's design shall enable each external audio source (e.g. a microphone) to be broadcast through the PA speakers and HIIIs controlled by both NACs. This shall be achieved without the use of an external audio splitter.

The NAC shall be configured with a pre-recorded test announcement that can be triggered via one of the NAC's digital inputs. The Contractor shall install a 'Test' switch in the rack.

### 5.7 Voice Annunciator

One VA shall be provided per platform for platforms up to 120 m in length, and three per platform on those over 120 m long, unless specified otherwise in the **Project Design Brief**.

Unless specified otherwise in the **Project Design Brief**, the VA units shall be the PTS-modified VA, manufactured to drawing 624-A2-10-2372. Custom components used in this assembly shall be supplied by Worktrax Pty Ltd. (Ph: 0403 951 625, Email: has@senet.com.au).

The VA unit shall be fixed securely to the column of the Station Shelter, face parallel with the platform, and so as to prevent human injury and resist vandalism. The VA unit shall be secured with M6 security-head bolts but still allow access for maintenance.

The VA unit shall be mounted with the centre line of the call button at a height of 1 100 mm above ground level unless otherwise specified in the **Project Design Brief**.

As the VA shall be installed on a column through which VA and HILL cables are run. A cable access hatch shall be provided at the base of the column, orientated 90° to the face of the VA. The hatch shall be no less than 100 mm wide x 140 mm high with its bottom edge approximately 250 mm above ground level. A hatch cover shall fit flush and be secured by M6 Security Head screws.

The cabling to the VA (the VA and Loop cables from the NAC) shall be installed in 32 mm (minimum) conduit installed into the column. The VA has a flying lead terminated with a 4-pin female Delphi Weather-pack connector, part number 12015024 (supplied with the Unit). The Contractor shall terminate the VA cable from the NAC with the corresponding 4-pin male Delphi Weather-pack connector, part number 12015798 (to be supplied by the Contractor).

Weather-pack connectors shall be assembled with the correct (proprietary) crimping tool and the contacts and cable seals shall be the correct size to suit the wire diameters used.



Unless specified otherwise in the **Project Design Brief** there shall be one VA per platform. The VA shall be located in accordance with and 129005 “Shelters” and the **Project Design Brief**.

## **5.8 Hearing Impaired Induction Loop**

HILs are a single loop of wire that starts and ends at front of the VA column such that a person using the VA must be standing within the area of the loop. It shall be formed into a nominally rectangular shape approximately 4 m x 3 m with one leg centred on the VA’s location and with a length of 12-14 m. It shall not extend closer to the front of the platform than the white line.

The HIL shall be installed in concrete and run in a 32 mm conduit to AS/ACIF-S008 which shall be above the reinforcement and kept as close as practicable to the upper surface of the concrete without promoting cracking, with a minimum concrete cover of 40mm. The conduit shall be installed with sweep bends and both ends shall be fed into the VA column. The conduit shall be installed prior to pouring concrete and a joint inspection shall be held prior to concrete pour. At least 24 hours notice shall be given to the Superintendent prior to the inspection and this inspection shall constitute a **HOLD POINT**.

If the hearing loop is to be installed into an existing asphalt surface it shall be directly laid in saw-cut slots at a depth between 15 and 25 mm in the platform pavement. The saw-cut slots shall have 45 degree corners and shall be sealed with epoxy resin sealant type LSS/F6.

HILs shall have the following specifications:

- (1) Cable: 2.5 mm<sup>2</sup> PVC-coated flexible copper wire with tinned strands.
- (2) Loop-end connector: 2-pin female, Delphi Weather-pack, part number 12015792.
- (3) Cable-end connector: 2-pin male, Delphi Weather-pack, part number 12015793.
- (4) The loop length: shall be a minimum of 12 m and a maximum of 14 m.

No metallic objects are permitted inside and/or above the loop, e.g. seat legs, bins, reinforcing mesh, and drainage grating.

The Magnetic Field within the loop for nominal reference at 1.5 m from ground level shall be +3 dB at 1 m, - 3 dB at 2 m.

The “field” lead-in cable to the HIL is specified by Open Access to have a maximum length of 120 metres. The Contractor shall note that in many circumstances this limit is a major constraint in the design of the station. Open Access may under some circumstances grant an exemption to this cable length limit. Their written approval must be obtained to any situation which requires the use of a longer HIL cable.

The Contractor shall observe the NAC specification on the minimum loop inductance to be connected to the HIL amplifier channels. Open Access shall be consulted and may require the inclusion of a loading coil (inductor) in the HIL cabling. In this case, drawing 624-A3-10-2380 should be referenced.

During the design phase, the area of each proposed VA/Loop position should be tested with a Loop Field Strength Meter to determine the amount of electrical interference at that location—either mains interference or that produced by the signalling system’s “tuning units”. The loop (and its VA) may need to be relocated in order to avoid such interference and ensure a Signal to Noise Ratio that meets the relevant Standard.

## **5.9 Network Interface Unit**

Unless specified otherwise in the **Project Design Brief**, the NIU shall be a NetSpire Station Gateway Unit (SGU) model number COSGU01 supplied by Open Access Pty Ltd.

Unless specified otherwise in the **Project Design Brief**, where works are undertaken as part of an upgrade to an existing station, the existing SGU shall be retained in the Remote Field Station (RFS).



Unless specified otherwise in the **Project Design Brief**, where works are undertaken at a new station, or a station that did not previously have an SGU, the NIU/ SGU shall be located in the RFS nearest to the station and powered by the existing 110V signalling power supply.

If an SGU is relocated, the Contractor shall remove and dispose of any associated VA and RS485 cabling from the RFS to the platform that is no longer required.

The SGU shall connect to the single dedicated 'PI' pair on the existing PTSOM copper media based communications system cable that runs between stations as follows:

- (1) Connection between the SGU and the point at which the copper media based communications system cables terminate shall be shielded twisted-pair telecommunications cable;
- (2) G.SHDSL modem 1 shall be connected to the PIS pair on the upstream (towards Adelaide) communications cable;
- (3) G.SHDSL modem 2 shall be connected to the PIS pair on the downstream (away from Adelaide) communications cable; and
- (4) An Ethernet/Fibre media converter shall be installed between the SGU and the NAC to provide isolation. The media converter shall be type Moxa IMC-101-M-SC + Westermo PS-30 24 V DC power supply unless otherwise specified in the **Project Design Brief**.

#### **5.10 External G.SHDSL Modem**

In stations where an additional G.SHDSL modem is required external to the SGU, this modem make and model shall be ZyXEL Prestige 791R or equivalent part recommended by Open Access for this purpose. The external modem shall be installed adjacent to the SGU. The external modem shall connect to the SGU Ethernet port using Ethernet cable specified to CAT 5e or above, and shall connect to the multi-core communications cable using appropriate shielded twisted pair communications cable and connector(s) approved by Open Access and the Superintendent for the purpose.

#### **5.11 Passenger Announcement Installation**

##### **5.11.1 Scope**

The scope of installation for the station works shall include:

- (1) Mains power supply for the PI cabinet (PIC);
- (2) Equipment accommodation for the NAC, SGU and other components (typically a locked IEC60297 standard 39RU equipment cabinet in the station Equipment Room, complete with internal power distribution rails);
- (3) Cable pathways throughout to accommodate LV power and ELV and LV telecommunications cables;
- (4) Loudspeaker attachment points and junction boxes;
- (5) Fibre cable from the NAC to the NIU and termination frames or boxes at both ends;
- (6) Fly leads;
- (7) Optical fibre media converter (100baseT to 100baseFx) at the NIU;
- (8) Provision of NAC, VA and SGU (if required) units;
- (9) At Enhanced Amenity stations, wireless microphone/receiver/external antenna set;
- (10) Wiring; and



- (11) Alignment and testing, configuration and integration with the overall passenger information system.

## **6. PASSENGER INFORMATION DISPLAY**

### **6.1 Requirement**

One back to back set of PIDs shall be installed on each platform for platforms up to 120 m in length, and two back to back sets of PIDs on each platform for platforms over 120 m long, unless otherwise specified in the **Project Design Brief**.

The PIDs shall be suspended from the shelter structure at new stations. At existing stations where new shelter structures are not being installed, the PIDs may be mounted to a pole or to a wall.

### **6.2 Passenger Information Display Components**

Refer to the PIS diagram in Figure 4.2.8 and drawing 624-A3-10-2376.

The PI Display shall comprise the following components:

- (1) Timetable information stored in the NAC and updated over the PIS WAN IP network;
- (2) 100baseT Ethernet and 100base-FX (multimode) network switch (in same cabinet as NAC);
- (3) NIU link to the network switch (and thence to the NAC);
- (4) Cat6 patch cords for the Ethernet devices;
- (5) One VCU per display image each connected to the switch;
- (6) DVI & RS-232 extender—transmitter with power supply;;
- (7) Multimode fibre cabling (OM3) to PI Display locations from the NAC cabinet;
- (8) DVI & RS-232 extender—receiver and 'RS-232 Supervisor' unit, near the monitors;
- (9) DVI splitter (where multiple monitors are showing the same image);
- (10) One DVI cord per monitor with IP65 monitor connection;
- (11) PI Display power and tamper alarm cabling; and
- (12) Industrial / outdoor daylight grade DVI monitor in a vandal resistant enclosure (typically installed in back to back pairs having the same screen image on both sides).

### **6.3 Video Control Unit**

VCUs shall be Open Access part number COLVC02 or later upgraded version.

Passive or active video splitters may be used to split the video signal between more than one LCD panel only by prior approval of the Superintendent. Such approval may be conditional on a demonstration by the Contractor that no noticeable degradation in signal quality results in the intended configuration.

A minimum of two VCUs are required for stations having two platforms both equipped with PI Displays.



#### 6.4 Digital Video Interface Extender

A DVI extender shall be used where it is necessary to extend the range of the video signal to allow for a long cable run from a VCU to a display. It shall enable the video signal to be carried on fibre-optic cable for a distance of up to 250 m with no noticeable degradation in signal quality.

#### 6.5 LCD Passenger Information Display

Passenger information LCD monitors shall be Metromatics part number MS42H1000K (i) 21526 or later upgraded version with the following minimum specifications:

(1)	Size	42" LCD, high brightness 1000 nits, IP65, CCFL (with Bulgin IP68 Connectors)
(2)	Panel Size	956 H x 549 V x 54 D (outline), 42.02 inches (1067 mm) diagonal (active area)
(3)	Native Resolution	WUXGA 1920 x 1080
(4)	Contrast Ratio	1200:1
(5)	Colour Support	1.06 billion colours
(6)	Maximum Viewing Angle	89/89/89/89 (178 Degree H & V)
(7)	Response Time	9 ms grey to grey, 10% – 90% transition
(8)	Connectivity	VGA
(9)	Backlight	CCFL, half life>50,000 hours
(10)	Brightness	1000 nits ± 10%
(11)	Operating Voltage & Power Consumption	240 Vac; 240 Watts (220 W typical)
(12)	Environmental Mounting	Powder coated with anti-graffiti coating (P73/164B colour Gravel), IP65 Protection, standard VESA 200 x 600 mm mount
(13)	Front Panel	6.4 mm laminated, anti-glare glass; vandal-resistant and shatterproof
(14)	Dimensions and Weight	1095 x 678 x 206 mm; 44 kg (45 kg max.)
(15)	Operating temperature range	0-50 degrees C
(16)	Automatic brightness adjustment for ambient light levels.	

Ordering Part No. MS42H1000K(i) 21526 provides the standard DPTI/PTSOM build, which shall also include the following options:

(1)	DVI-D Interface	25-way Bulgin IP68 connector
(2)	Anti-tamper Door Alarm Switch	For interface to external alarm system
(3)	Shock Sensor	For interface to external alarm system
(4)	RS-232 Connector	9-way Bulgin IP68, for RS-232 interfacing, Anti-tamper Door Switch and Shock Sensor
(5)	IR Remote Interface Capability	
(6)	IR Remote Control Hand-piece	
(7)	Additional Assa Abloy Protec Lock	

Part No. MS42H1000K(i)21526 does not includes the following additional options, which must be ordered separately for each unit:

(1)	Power Lead Part No. MSCB03F150R000000	1.5 m long, 3-way connector (Bulgin type PX0731/P) on one end only
(2)	DVI Video Lead Part No. MSCB25F15BK00DDSL	1.5 m long, 25-way connector (Bulgin type PX0820/P) on one end only
(3)	RS-232 Lead Part No. MSCB09F15GR000000	1.5 m long, 9-way connector (Bulgin type PX0728/P) on one end only. (4 pins for RS-232 signalling, 2 pins for door switch output and 2 pins for shock sensor output.)



(4)	Extended Warranty	3 year's total
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Note: All connectors shall be IP68 rated.

## 6.6 PI Display Installation

### 6.6.1 Position

Platform PI Displays shall be provided as display sets, comprising a back to back pair of LCD monitors fixed to a support bracket suspended from the canopy structure above, with a down tilt angle (from vertical plane) of 10°.

PI Display sets shall be positioned perpendicular to the platform direction with the outside edge of the PI Display set being within the traction supply clearance zone, nominally 2 000 mm or more from the platform edge. The exact position on the shelter shall be co-ordinated with CCTV to avoid the PI Displays occluding critical CCTV sight lines, and to ensure the PI Displays can be viewed by a CCTV camera (preferably PTZ) if its tamper alarm is activated. Refer Part 129015 "Security System".

Platform PI Display sets shall be located in accordance with platform design guidelines, refer Parts 129003 "Platforms" and 129005 "Shelters". This shall generally require the PI Displays to be located around the main platform waiting area, typically toward the centre of the platform.

The bottom surface of the PI Display shall not be lower than 2 700 mm above platform level or higher than 3 000 mm above platform level. The sight line to the PI Display shall be uninterrupted for a distance of 20 m along the platform from the PI Display.

### 6.6.2 Mounting

Each PI Display requires a custom mounting bracket to provide VESA standard mountings to the LCD monitors panels, together with attachment to the structure above. The bracket design shall be customised to the canopy structure (which may be sloping and comprise various member types).

The mounting bracket and its canopy attachment shall:

- (1) Safely support the weight of the complete PI Display assembly;
- (2) Provide VESA mounting holes to match the standard monitors; and
- (3) Provide a means of supporting the video equipment and power equipment, and protecting the cables through to the monitors.

PTSOM have developed a standard PI Display mounting bracket arrangement which shall be utilised wherever the canopy structure permits. This standard arrangement is detailed on drawings 618-A2-10-220 (mechanical) and 618-A2-10-223 (electrical). In the event that the canopy structure does not permit the use of this standard mounting bracket, the Contractor shall be responsible for designing and installing a structure that provides equivalent functionality.

The PI Display Mounting shall be built in accordance with the following PTSOM drawings:

- 618-A2-10-220 General Arrangement of Mounting – Top Mount – Dual or Single Monitor
- 618-A2-10-221 General Arrangement of Mounting – Bottom Mount – Dual or Single Monitor
- 618-A3-10-223 Electrical Connection Arrangement
- 618-A2-10-224 General Assembly – Dual – Top Mount
- 618-A3-10-227 Monitor Bracket; 10 degree tilt
- 618-A2-10-231 General Assembly - Electrical Enclosure
- 618-A2-10-232 Electrical Enclosure Fabrication
- 618-A3-10-233 Power Supply Circuit Diagram
- 618-A2-10-234 Assembly of Power Board
- 618-A3-10-235 Labels for Power Board
- 618-A2-10-237 General Assembly; Video Enclosure



- 618-A2-10-238 Video Enclosure Fabrication
- 618-A3-10-239 Slide-out Component Rack
- 618-A2-10-240 Video and Data Circuit Diagram
- 618-A1-10-245 Centre Frame Fabrication; Dual Monitors
- 618-A2-10-247 General Assembly - Centre Frame Components
- 618-A2-10-250 General Assembly – Dual - Bottom Mount
- 624-A3-10-2378 Communications – General Passenger Information System Functional Diagram – Typical Power Supply Arrangement

### 6.6.3 PI Display Mounting Enclosures

The mounting shall include integrated weatherproof enclosures located between the two PI Display monitors, to house the following:

- (1) Power distribution board;
- (2) Optical fibre termination unit and fly leads to the DVI extender;
- (3) DVI extender receiver;
- (4) DVI video splitter (for a back-to-back pair of monitors);
- (5) RS-232 control unit;
- (6) Power packs for the video equipment;
- (7) Terminations for the alarm outputs; and
- (8) Fly leads to the monitors.

The arrangement shall incorporate internal physical segregation of power and communications elements.

240 V AC power from the UPS shall be provided to the PI Display mounting via the Network Power Controller and appliance input sockets. All power outlets shall be RCD and surge protected.

### 6.6.4 Tamper Switches

Each PI Display installation shall provide the following tamper detection devices:

- (1) PI Display LCD monitor door tamper switch (one per unit);
- (2) Tamper switch on each of the PI Display mounting's access; and
- (3) Monitor shock/vibration sensor (one per unit).

The above tamper detection devices shall be individually wired back to the station security alarm panel using two 6-core copper cables using the same pathways as the video extender optic fibre cables, unless stated otherwise in the **Project Design Brief**. The cable ends shall be secured neatly in a termination unit adjacent to the alarm panel ready for connection. The Contractor is not required to make the connections to the alarm panel. Refer Part 129015 "Security System".

## 6.7 Passenger Information System Rack "Head End"

### 6.7.1 Scope Inclusion

The Contractor shall supply and install all head end equipment comprising VCUs, Ethernet switch, DVI extenders and power supplies.



### 6.7.2 Rack Interconnections

All power supplies shall be plugged one of a number of rack power rails. Refer drawing 624-A3-10-2378. All rails shall be labelled.

The PIS rack shall be provided with one slide out tray per 2 x VCU + power supply combination.

The Ethernet Switch shall be connected as shown in drawing 624-A3-10-2376. Unless specified otherwise in the **Project Design Brief** it shall be a Moxa IKS-6324-F-HV-T, fitted with option module PM-7200-2MSC in order to provide 22 copper network ports and two fibre ports.

The Ethernet switch shall be direct patched to the NAC and VCUs via Cat 6 patch cords.

The RS-232 gateway units shall be connected as shown in drawing 624-A3-10-2376. Unless specified otherwise in the **PROJECT DESIGN BRIEF** it shall be a Moxa Serial Device Server model number NPort 5150A.

Each DVI extender shall be securely mounted in the vicinity of its associated VCU and directly connected to the VCU DVI monitor port.

## 7. INTEGRATION, PROGRAMMING AND CONFIGURATION

The Contractor shall directly engage Open Access Pty. Ltd. and arrange with them to provide all services needed to fully integrate the new PIS equipment into the NetSpire system, including but not limited to remote assistance to resolve any installation, software or configuration issues which may arise.

The Contractor shall ensure that all interconnection, programming and configuration activities required to integrate the equipment installed by the Contractor into the existing PI communications system are undertaken by a person or persons trained by Open Access and approved by PTS to undertake those activities.

The activities include, but are not necessarily limited to, the following:

- (1) The SDSL infrastructure that connects each SGU to the existing PTSOM multi-core copper communications system requires a point-to-point topology and is networked for each rail line in a bus configuration. Each line is configured as an independent subnet in the network. The Contractor shall ensure that any IP-addressable equipment installed by the Contractor adheres to the overall IP addressing scheme;
- (2) The Contractor shall ensure that all necessary post-installation programming, reprogramming and/or configuration of the SGU and NAC units are completed;
- (3) The Contractor shall ensure that the IP addresses of the non-Open Access equipment installed by the Contractor (UPS, iBootBar and RS 232 Gateways) adhere to the overall IP addressing scheme;
- (4) The Contractor shall ensure that all configurations match the standard system configurations;
- (5) The Contractor shall ensure that NTP time synchronisation to the CES is enabled for any unit installed by the Contractor that requires it;
- (6) The Contractor shall ensure that any configuration or data changes that are made to the CES in order to integrate the Contractor's works are made also to the standby (redundant) CES and to the Maintenance CES at Mile End, to the extent that this is recommended by Open Access.
- (7) Where the Contractor's work is at a new station or at a station with a new additional platform, the Contractor shall ensure that all necessary configuration changes are made to the Communications Exchange Server (CES located in the TA Operations and Control Centre) and associated central equipment and databases, including any required updates to timetable data, run numbers, voice dictionary, "trigger tracks", the addition of the new station to the Long Line Public Address control software ("LiveWire"), and so on;



- (8) The Contractor shall ensure that each VCU is configured with the correct display template according to the location and purpose of the PI Display(s) that it controls. Unless otherwise specified in the **Project Design Brief**:
  - At stations with dual platforms, provide the “Outer Station Per Platform” template (or later equivalent) for both VCUs, with each configured to display only the service departures from that platform; or
  - At stations with an island platform, provide the “Outer Station Per Platform” template (or later equivalent), configured to display the service departures for both platforms.
- (9) The Contractor shall ensure that the NetSpire Configurator tool is updated in order to include the new equipment and that any obsolete equipment is removed from the station database;
- (10) The Contractor shall ensure that the list of devices displayed by the NetSpire Console application includes any new equipment and that obsolete equipment is removed;
- (11) The Contractor shall ensure that NetSpire’s web interface tools and all other ancillary PI system facilities are updated to in order to include the new equipment and that any obsolete equipment is removed;
- (12) The Contractor shall provide a formal ‘software release’ from Open Access to document all the system changes caused by these works;
- (13) The Contractor shall ensure that full Factory Acceptance Testing of the new hardware and software modifications is performed by Open Access prior to shipment;
- (14) The Contractor shall ensure that Open Access provide all necessary Installation Approval Management for the work;
- (15) All hardware items not supplied by Open Access (UPS, Network Power Controller, RS-232 Gateways, etc.) also shall be configured and made fully operational for their local and remote functions. PTSOM’s Senior Communications Technician will assist by providing details of the current standard configuration settings used for each item.

Noting that the PI system is critical infrastructure, the Contractor shall ensure that the **initial** connection of each item of new equipment to the PI network is managed in a controlled manner. This shall include:

- (1) At every stage of the connection phase, Open Access shall be “online” via their remote link and their staff shall be monitoring the system for correct operation;
- (2) At every stage of the connection phase, PTSOM’s Senior Communications Technician shall be “online” and monitoring the system;
- (3) Every stage of the initial connection phase shall be undertaken during ‘off-peak’ service times (nominally between 9 am and 3 pm).
- (4) Connection of Open Access hardware devices onto the network shall be staged and the network performance verified each time as follows:
  - For a new station where a NIU was not previously present, when the copper network links are broken and remade to the NIU;
  - When the NIU is connected to the fibre media converter (with the rack end of the fibre isolated);
  - When the rack end of the fibre is connected to the switch (with all other devices isolated);
  - When the NAC is connected to the switch;
  - When each VCU is connected to the switch;
- (5) Each item of hardware not supplied by Open Access (UPS, Network Power Controller and RS-232 Gateways) shall firstly be configured to the correct IP address before it is connected onto the network. Then they shall be connected one at a time to the network switch in a similar manner to (4) above.



- (6) Under no circumstances shall the Contractor cause more than one item of equipment to be initially connected onto the PI network at one time, nor shall devices be connected for the first time without independent supervision and staged verification of the network's integrity.

## **8. UNINTERRUPTIBLE POWER SUPPLY & NETWORK POWER CONTROLLER**

The Contractor shall install UPS-protected 240 V AC power circuits as follows:

- (1) The Contractor shall supply and install a suitable UPS unit from the Eaton Powerware PW9130G series (by way of example PW9130G2000R-XL2UUAU). The UPS shall be installed in the equipment cabinet housing the NAC where possible; installation in another location shall only be with the Superintendent's prior approval. A rack-mounted UPS shall be installed if such a UPS is available with the necessary capacity;
- (2) The Contractor shall supply and install a Network Power Controller, Dataprobe iBootBar, model number iBB-2C10;
- (3) The Contractor shall install new 240 V AC power circuits protected by the UPS and controlled by the Network Power Controller to the following equipment in accordance with the standard connection scheme shown on drawing 624-A3-10-2378:
  - (a) NACs;
  - (b) PI Displays;
  - (c) VCU associated with PI Displays; and
  - (d) Any other active equipment requiring 240 V AC power that is installed by the Contractor, and that is required for the PIS to function, e.g. active fibre-optic media converters that are not powered by the 110 V signalling power supply, Ethernet switch, etc;
- (4) Where applicable, existing 110 V power circuits to the above equipment shall be disconnected and replaced with the new UPS-protected 240 V AC circuits;
- (5) The Superintendent may waive the Contractor's requirement to replace an existing 110 V power circuit with a new 240 V circuit, in the event that the circumstances specific to a station make this cost-prohibitive;
- (6) In determining the necessary capacity of the UPS, the Contractor shall take into account the following power requirements:
  - (a) NAC - allow 55 W (average @ 15% duty cycle);
  - (b) LCD display - allow 250 W; and
  - (c) VCU - allow 100 W.
- (7) The UPS, as installed, shall allow for continuous operation of all connected equipment for a period of at least 2.5 hours in the event of a loss of mains power; and
- (8) The UPS shall include an Ethernet interface for remote monitoring. The Contractor shall connect the UPS Ethernet interface to the network switch with Cat6 patch cable.
- (9) The Contractor shall connect the Network Power Controller (iBootBar) to the network switch with Cat6 patch cable.



## 9. **CABLING AND WIRING**

### 9.1 **Communications Cabling**

The following elements shall be installed in accordance with AS/ACIF S008 and AS/ACIF S009, as appropriate:

- (1) The NAC(s);
- (2) All loudspeaker cabling and loudspeakers;
- (3) All HIIL cabling and associated components;
- (4) All systems connecting as inputs (either audio or digital) to the NAC(s); and
- (5) All conduits, pits and other materials or works associated with the above.

Cable segregation shall be coordinated with structures and other elements such as joint use light poles to ensure all conduits are concealed.

The Contractor's design shall include suitable isolation devices to AS/ACIF S009 wherever required to isolate the equipment and cabling installed by the Contractor from existing PIS and signalling components and associated wiring that are not compliant with AS/ACIF S008 and S009 (refer Section 1 General). This shall include at least:

- (1) Use of optic fibre network cable between the SGU and the NAC, with an appropriate Ethernet media converter at the SGU end; and
- (2) Isolation at any point at which any new SELV, TNV or ELV cable connects to a device that does not provide compliant input/outputs, if applicable.

All ELV cables (e.g. VA and hearing loop cables) shall be rated for outdoor underground use in accordance with AS/ACIF S008.

All fibre optic cables shall have a minimum of 6 cores and be "underground" rated unless specified otherwise in the **Project Design Brief**.

The 100 V line speaker cable shall be treated as a "LV telecommunications" circuit as per AS/ACIF S009 and shall be run in its own conduit.

All 100 V line speaker cable shall have a brown sheath.

### 9.2 **110 V / 240 V Electrical Power Supply Cabling**

All cables and wiring associated with any new electrical circuits shall comply with the following:

- (1) Wiring to a PI rack in an equipment room and PI Displays:
  - (a) 2-core with insulated earth conductor, not less than  $2.5 \text{ mm}^2$  (7/0.67), 0.6/1 kV PVC insulated, PVC sheathed.
- (2) Wiring to a free-standing pad-mounted PI cabinet:
  - (a) To be regarded as a sub-main — 2-core with insulated earth conductor, not less than  $6 \text{ mm}^2$  (7/1.04), 0.6/1 kV PVC insulated, PVC sheathed; and
  - (b) Installed in conduit of minimum size 32 mm.



All cables used throughout the installation shall be of Australian manufacture and comply with AS 3000 and all relevant Standards stated in Appendix A of AS 3000.

Cables shall be selected in accordance with AS 3000 and AS 3008.1.1 unless otherwise specified, AS 3008.1.1 shall be used for the determination of current ratings and voltage drop.

Where available and unless otherwise specified, cable shall use multi-stranded soft drawn copper conductors. All PVC insulated and PVC sheathed cables shall use V75 insulation, unless otherwise specified.

The appliance inlet sockets (and associated RCDs) that feed to PI Displays should be mounted on the wall of the equipment room adjacent to the PI rack, and not inside the rack itself.

### 9.3 Summary of Cable Types

Unless otherwise specified in the **Project Design Brief** the following cable types, or equivalent, shall be used and the maximum cable lengths shall be as shown. HIIL loop cable and any cable type used for connection to the NAC shall be of a type approved by Open Access for the purpose.

EQUIPMENT	CABLE	MANUFACTURER	SIZE	MAX LENGTH	APPLICATION
VA	2pr Olex Instrolex, screened	Olex Cables	0.5 mm	500 m	NAC to VA post
HIIL	1pr Olex Instrolex, screened	Olex Cables	1.5 mm <sup>2</sup>	120 m	NAC to VA post
HIIL Loop	Building wire, tinned	Olex Cables	2.5 mm <sup>2</sup>	14.5 m	14.5 m Loop in ground
Speakers 100 V	1pr Double Insulated, brown: HC2035 FLT-BRN	Hartland Cables	0.75 mm <sup>2</sup>	200 m	NAC to Speakers
Speakers 100 V	1pr Double Insulated, brown	Hartland Cables	2.5 mm <sup>2</sup>	200-400 m	NAC to Speakers
PI LCD Sign Power	Multimode, 6 cores minimum	Olex Cables	2.5 mm <sup>2</sup>	-	240v to PI Sign
Optic Fibre		-	-	-	NIU to NAC, VCU to LCD
PI Display alarms	Cat-5, 2 runs	-	-	-	PIDs to Alarm Terminations
PI Rack Power	2 core + earth	-	2.5 mm <sup>2</sup> minimum	-	Power to rack (240 V)
PI Cabinet Power	2 core + earth	-	6 mm <sup>2</sup> minimum	-	Submain to cabinet (240 V)
PI Display Power	2 core + earth	-	2.5 mm <sup>2</sup> minimum	-	UPS to PI Display mount (240 V)
G.SHDSL cable	1pr unscreened comms cable	-	0.5–0.9 mm <sup>2</sup>	-	RFS box terminals to SGU

### 9.4 Cable Installation

All cables shall be installed to AS 3000 and manufacturer's recommendations. In addition, all communications cables (ELV and LV Telecommunications) and their installation shall comply with AS/ACIF S009.

Unless otherwise specified or unavoidable due to route length or site conditions, cables shall be run for their entire route length without intermediate joints. Joints shall only be made at equipment terminals.



No cable joints shall be made below ground level, or in concealed and inaccessible locations, without prior application to the Superintendent, as follows:

- (1) the Contractor shall provide full details of the exact joining method proposed and shall not install the joint until approval is granted by the Superintendent; and
- (2) at each end of any cable that is jointed the Contractor shall provide labels stating that the cable is jointed and the approximate location of the joint.

All cable joints required due to cable damage during installation, route length or difficult installation conditions shall be installed in accordance with manufacturer's recommendations unless otherwise specified. Any enclosures containing joints shall be installed at accessible locations and labelled.

Cables shall be installed so as to avoid damage to insulation or sheathing. Damage to cables shall be reported and replaced or repaired as directed by the Superintendent.

Where cable access holes pass through metal structures, the holes shall be burr free, treated against rust, bushed and sealed to prevent the ingress of moisture and vermin.

Cabling extending to the top of poles shall be installed with the appropriate cable support at top and bottom.

All 'field' wiring entering the rack (excluding specialised types such as Cat6, optic fibre, low-level audio, etc.) shall not be terminated directly to the NAC's connectors, but only by way of intermediate screw terminals. Terminals with a 'knife disconnect' facility (Phoenix UK5-MTK-P/P or equivalent) shall be used for the speaker, VA speaker and HILL wiring.

The following terminal numbering shall be followed for consistency between stations:

KNIFE TERMINAL No.	PURPOSE		WIRE COLOUR
1	Speaker +	Platform 1	Red
2	Speaker –	Platform 1	White or Black
3	Speaker +	Platform 2	Red
4	Speaker –	Platform 2	White or Black
clamp/spacer	<b>[essential here for segregation]</b>		
5	Loop +	Platform 1	White
6	Loop –	Platform 1	Black
7 (non-knife terminal)	Loop screen	Platform 1	Earth Braid / Green to CET
8	Loop +	Platform 2	White
9	Loop –	Platform 2	Black
10 (non-knife terminal)	Loop screen	Platform 2	Earth Braid / Green to CET
11	Loop +	Platform 3	White
12	Loop –	Platform 3	Black
13 (non-knife terminal)	Loop screen	Platform 3	Earth Braid / Green to CET
clamp/spacer			
14	VA speaker +	Platform 1 *	White
15	VA speaker –	Platform 1	Black
16 (non-knife terminal)	VA screen	Platform 1	Earth Braid / Green to CET
17	VA speaker +	Platform 2 *	White
18	VA speaker –	Platform 2	Black
19 (non-knife terminal)	VA screen	Platform 2	Earth Braid / Green to CET
20	VA speaker +	Platform 3 *	White
21	VA speaker –	Platform 3	Black
22 (non-knife terminal)	VA screen	Platform 3	Earth Braid / Green to CET



clamp/spacer			
23 (non-knife terminal)	RESERVED	TX + LED	Yellow or [Blue]
24 (non-knife terminal)	FOR	TX – LED	Blue or [Blue/White]
25 (non-knife terminal)	LEGACY	RX + LED	Red or [Orange]
26 (non-knife terminal)	RS-485	RX – LED	Green or [Orange/White]
27 (non-knife terminal)	DEVICES	LED cable screen	Black or braid to CET
clamp/spacer			
48 (non-knife terminal)	Loop 3 toroid looping terminal		Aqua (typical)
49 (non-knife terminal)	Loop 2 toroid looping terminal		Aqua (typical)
50 (non-knife terminal)	Loop 1 toroid looping terminal		Aqua (typical)

\* See note below.

The NAC's digital inputs shall be connected by way of a 25 way D subminiature "breakout" terminal module (Phoenix VIP-3/SC/D25SUB/M or equivalent) and a male-female DB25-DB25 "straight-through" cable. Where none of the NAC's digital outputs are used, space adjacent to the inputs' breakout module shall be left for another module to be added. Where any of the NAC's digital outputs are used, they shall be connected by way of a 25 way D subminiature "breakout" terminal module (Phoenix VIP-3/SC/D25SUB/F or equivalent) and a cable as above.

Note: The field cable cores for the VA buttons (VA button + and VA button –) may connect directly to the breakout terminal module.

Copper conductors with a nominal area less than 0.75 mm<sup>2</sup> shall be terminated by means of a compression-type ferrule of the correct size for the conductor and compressed only by the correct tool.

All wiring, cabling and terminations, both within and outside of switchboards and other enclosures, shall be performed in a neat and professional manner in accordance with the best current industrial electrical work standards. By way of example, all wiring shall be installed in ducting or neatly loomed and supported; cables, terminals, and other elements shall be labelled. Adhesive products such as self-adhesive cable-tie mounts shall not be used.

Major items of equipment in the rack shall be labelled. Where items are not fixtures, their labels must not be affixed to the items themselves, but be mounted adjacent. Labelling shall typically be 0.8 mm 'Traffolyte' or similar and, as appropriate, shall include the related Platform number and IP Address. (By way of example: "VCU Platform 2 nnn.xxx.nnn.xxx".) Particular case shall be taken to clearly identify multiple items of the same type; this requirement extends to things such as the appliance inlet sockets that feed the PI Displays. In addition, where items have multiple plug-in cords of the same or similar type, each cord must be labelled with the identifier with its correct mating socket.

Cable screens for the VA and HIL cables shall be continuous across the rack's intermediate screw terminals. They shall be connected at the NAC end to the equipment room's CET facility or to another Communications Earth established for the purpose. Screens **MUST** be isolated at the VA end—they shall be double insulated using two layers of rubber or heat-shrink sleeving.

When installing VA and HIL cable to the VA installed in the shelter columns the cable shall be installed with a cable tail of not less than 1.5 m.

### 9.5 Cable Marking, Protection and Labelling

The Contractor shall ensure that underground power conduits are protected by orange cable marking tape complying with AS 2648.1 and installed in compliance with AS 3000. Underground communications conduits shall be protected by white marking tape in accordance with the Australian Standards.

All wiring in exposed situations (including under suspended-slab platforms) shall be enclosed in metal conduit. Alternatively, mechanical protection in the form of 1.6 mm hot dipped galvanised hat section, screw



fixed in place at intervals not exceeding 1 000 mm and painted to match the surroundings, shall be provided to a minimum of 2 400 mm from ground or platform level.

Each end of all PI cables shall be labelled. The rack end may be identified where they enter the PIS rack. In addition, all cables shall be fitted with a third label immediately adjacent to the point where they enter the equipment room and cables which run underground shall be identified in every cable pit by means of stamped, non-ferrous tags or engraved plastic tags clipped around each cable.

Cables shall be identified in a manner that is permanent and indelible and consistent with the as-built drawing nomenclature. Self-adhesive labels are not acceptable.

## 10. CONDUITS AND PITS

### 10.1 General

Existing DPTI standard conduits and pits shall be re-used unless otherwise specified in the **Project Design Brief**.

Conduits and pits shall be installed in accordance with Part 253 “Conduits and Pits” unless stated otherwise herein or in the **Project Design Brief**. Communications conduits and pits shall additionally comply with AS/ACIF S009, AS 3084.

Conduit diameters may be chosen by the Contractor, subject to a minimum of 32 mm. For an initial installation, conduits shall achieve a fill factor of less than 25% as the ratio of the sum of cable cross sectional areas to the inner cross sectional area of the conduit. (This equates to 50% spare useable capacity).

Conduits can also be sub-ducted if needed using a smooth walled (inside and out) conduit of suitable flexibility.

### 10.2 New Conduits (Station Platform)

Where the Contractor is required to install a backbone network of new power and communications conduits, together with segregated pits, this shall be suitable for the future installation of up to six different cabling systems, each with appropriate spare capacity. The different cabling systems, and the conduit type that shall be used for each, are outlined in the following table.

	<b>PURPOSE</b>	<b>CONDUIT DESCRIPTION</b>
1	240 V AC lighting and power	Heavy-duty rigid PVC Conduit, Orange to AS 2053 <a href="#">Conduits and fittings for electrical installations</a> .
2	PA Speaker cabling – LV telecommunications (100 V line), compliant	Rigid PVC Communications Conduit, White to AS/ACIF S008 and S009.
3	CCTV Security	Rigid PVC Communications Conduit, White to AS/ACIF S008 and S009, 100 mm diameter
4	HIIL and other compliant SELV, ELV and TNV telecommunications cabling	Rigid PVC Communications Conduit, White to AS/ACIF S008 and S009.
5	Future optic fibre communications backbone	Rigid PVC Communications Conduit, White to AS/ACIF S008 and S009.

The Contractor’s design shall include an appropriate conduit layout drawing. These design drawings shall be co-ordinated with the requirements of Parts 129014 “Electrical Infrastructure” and 129015 “Security System”.

Existing conduit paths on platforms may be used where available and suitable.

The conduit design shall provide conduits for the future fibre optic cable that is to replace the existing PTSOM multi-core copper communications system. The installation shall be as follows:



- (1) Two new P5 pits that are to be located in the rail corridor within 25 m of each end of the station on the same side of the corridor as the equipment room; and
- (2) 100 mm diameter Communications conduit between the two pits, terminating in the equipment room located within the station. Refer Part 129017 "Equipment Room".

Where the Contractor's design requires one or more undertrack crossings at a station, one of the undertrack crossings shall have a number of spare conduits installed under both tracks in order to allow for future expansion, as follows:

- (1) Two x 100 mm power conduits and two x 100 mm communications conduits are the minimum requirements.
- (2) Refer to the **Project Design Brief** for the requirement to install an additional Heavy Duty sleeve (50 mm minimum) dedicated to the conveyance of a water supply. This sleeve shall be segregated from all other conduits in accordance with AS 3500. It shall not be terminated in the associated electrical pits but shall be capped and left at the side of the pits.
- (3) Where a station requires multiple undertrack crossings, the spare conduits shall be provided in the one nearest to the main electrical switchboard unless otherwise agreed with the Superintendent.

Notwithstanding any other requirement, conduits installed under track shall be Heavy Duty (i.e. they shall exceed AS/ACIF S008 requirements).

The depth of underground communications conduits relative to the surrounding finished ground levels shall comply with AS/ACIF S008 and S009. All railway station platform and pathway areas are deemed to be "public pathways" and as such the minimum depth for telecommunications conduits in these areas is 450 mm.

Notwithstanding AS 3000, in order to avoid confusion with communications conduits, underground power conduits shall be orange and shall not be grey.

The use of corrugated conduit shall be minimised. In particular, it shall not be used underground except for the purpose of providing additional sheathing (segregation) in pits.

Plastic corrugated conduit that is exposed and above 3 m from finished surface level shall be of the UV-stabilised type.

Unless otherwise specified in the **Project Design Brief**, the conduit diameters specified herein shall be regarded as the minimum required.

Changes in direction shall be achieved using sweep bends or inspection elbows in accessible locations.

Above-ground conduits shall be fixed as follows:

- (1) Each conduit saddle shall be provided with two fixing points and be suitable for use with that conduit;
- (2) Non-metallic conduits at a height greater than 3 m above finished surface level shall be fixed by conduit saddles at intervals not exceeding 500 mm horizontally and 1 000 mm vertically; and
- (3) Metallic conduits at a height less than 3 m below finished surface level shall be fixed by conduit saddles at intervals not exceeding 1 000 mm horizontally and 2 000 mm vertically, except that metallic conduits installed in accessible locations shall be fixed by conduit saddles at intervals not exceeding 500 mm horizontally or vertically.

All new communications works undertaken by the Contractor shall comply with AS/ACIF S008, S009 and AS 3084, and the Contractor shall ensure that:

- (1) Conduit installation is performed by, or supervised by, persons who are appropriately registered in accordance with the ACMA Cabling Provider Rules;



- (2) In the event that the conduit installation is done by persons under supervision of a registered cabler, the Contractor shall demonstrate that those persons have received training on the essentials of communications conduit work; and
- (3) A Certificate of Compliance (form TCA1) is provided to the Superintendent to cover all the conduit, conduit installation, cable, cable installation and cable termination (as applicable) for each separate site.

**10.3 New Pits**

All pits shall be in accordance with Part 253 “Conduits and Pits”.

In locations subject to pedestrian traffic (platforms, pathways, etc.), the Contractor shall employ an arrangement that incorporates the use of a Gatic 301C (concrete in-filled) or equivalent cover finished to the surrounding platform level in order to minimise tripping hazards.

Note that it is assumed that covers will have a power pit, an ELV communications and a LV communications (speaker) pit underneath.

**10.4 Conduits and Pits between RFS and Station Equipment Room or Enclosure.**

For cabling required between an existing RFS and a station platform, existing conduits shall be re-used if they are to current DPTI standards and suitable for the requirements. Where existing conduits are not available and/or un-suitable, a new conduit shall be installed in accordance with the following:

	PURPOSE	CONDUIT DESCRIPTION
1	Fibre optic to connect the existing SGU in the RFS to the NAC in the equipment room, or enclosure; 50 mm min.	White Telecommunications to AS/ACIF S008

Refer to the **Project Design Brief** for the specific requirements to provide the conduit path between the RFS and the equipment room or enclosure that facilitates the future fibre optic cable that is to replace the existing PTSOM multi-core copper communications system.

**10.5 Draw Wires**

Draw-wires shall be provided in all conduits. Polypropylene rope with a minimum diameter of 6 mm shall be used.

Any cables pulled though conduits (regardless of whether these are new or existing conduits) as part of these works shall have another draw-wire pulled through with them, so that a draw-wire remains in every conduit at the completion of the works.

**11. EARTHWORKS, TRENCHING, BORING AND CONCRETE WORKS**

The Contractor shall undertake all trenching (or boring) and other earthworks in such a manner that:

- (1) The work shall comply with the requirements of the PTS Pits and Conduits Standard;
- (2) The work shall comply with the requirements of AS 3000, AS 4799 and AS/ACIF S008 and S009;
- (3) All open trenches, uneven surfaces, holes or other hazards shall be isolated by the erection of temporary barriers, fencing or other means, supplied by the Contractor and compliant with AS 1742.3;
- (4) No trench or other excavation on pedestrian walk-ways or platforms shall be left uncovered over night; and



**12. ELECTRICAL WORKS**

**12.1 General**

The installation of conduits, cabling, wiring and other electrical work shall comply with the requirements of AS 3000.

The installation of conduits, cabling, wiring and other communications work shall comply with the requirements of AS/ACIF S008 and S009 and AS 3084.

**12.2 Work in the RFS Enclosure**

The active equipment in each RFS enclosure/rack is powered by a dedicated 110 VAC UPS-protected signalling power supply circuit. This power circuit is used for vital signalling equipment and shall not be interrupted. The Contractor shall not perform work on the 110 VAC power system unless authorised by the Superintendent and shall take all possible care to ensure its integrity.

The NIU (SGU or equivalent) and the power supply module for its associated optical fibre media converter shall each be connected to the 110 VAC supply via socket outlets (Clipsal 412/110 or equivalent) and plugs (Clipsal 439/110 or equivalent). Most RFS enclosures are already fitted with a number of 110V socket outlets, to which the Contractor may connect. If the NIU is of a type that requires a separate power supply module, it shall not share the power supply module that supplies the optical fibre media converter — each shall have its own dedicated power supply module and 110 V socket outlet.

For any of the above work inside signalling equipment enclosures or relay rooms, including associated pits and civil works involving the installation of conduits the Contractor shall advise the Superintendent prior to any works commencing, this shall constitute a **HOLD POINT**. The Superintendent may nominate signalling staff to be present in a supervisory capacity at the work site.

**12.3 Surge Protection**

The speaker cable, 240 V AC cable and hearing loop cable shall each be fitted with surge protection where they enter a new equipment rack installed the Communications Equipment Room.

The surge protection and its associated earthing shall comply with AS 1768: *Lightning Protection*

The Contractor shall design the surge protection and associated earthing for the site. The design may assume the following:

- Speakers: Category C2 (70 KA+20% 8/20 us minimum)
- 240 V supply: Category C2 (60 KA+20% 8/20 us minimum)
- Hearing Loop: Category C1 (20 KA+20% 8/20 us minimum)

**13. GENERAL CONSIDERATIONS**

**13.1 Vandal Resistance**

All fittings, mounting brackets and arrangements shall be designed to be vandal resistant.

All outdoor equipment such as loudspeakers, antennas and/or wireless receivers shall be installed no less than 3.5 m above ground level.

Wherever equipment is installed on an existing or new pole, the Contractor shall install anti-climb guards below the equipment to reduce the risk of vandalism and theft, with spikes at 30 degrees out to the pole's vertical alignment.



### **13.2            Mechanical Protection**

All PI device housings, fittings, mounting brackets and arrangements shall be dust and weather resistant to at least IP55 rating level.

All equipment installed shall be suitable to withstand the prevailing environmental conditions.

All steel brackets, pipes, tubes, etc., together with their associated fixings, supplied as part of the works and intended for use out of doors shall be hot-dip galvanised unless otherwise approved.

### **14.            COMMISSIONING AND INTERRUPTION OF SERVICES**

The Contractor shall ensure that the works undertaken by or under supervision of the Contractor are conducted so that:

No railway line or part thereof is to be without a working PIS during operational hours. The Contractor shall allow to co-ordinate the connection of the station to the existing SGU with the Superintendent. At least 10 working days notice of the requirement to undertake this connection shall be given and shall constitute a **HOLD POINT**.

Where there is the requirement for a new SGU to be installed in an RFS, a shutdown period shall be required for the connection of the Station PI Controller (SGU) to the 2-wire telecommunications cable. The Contractor shall provide all the necessary components to undertake this work, but the actual connection within the RFS shall be undertaken by a third party provided by the Superintendent. At least 28 working days notice of the requirement to undertake this connection shall be given and shall constitute a **HOLD POINT**.

If the station is not closed to customers during the Contractor's work, the Contractor shall be responsible for the placement of local station signage advising customers of the unavailability of PI during any period in which the PI is unavailable as a result of the Contractor's work, and for covering any VAs or signs that are non-functional to prevent customers from trying to use them.

Station visual and audible devices may be used for customer awareness of the progress of installation after installation of station devices and prior to connection to the Central PI Controller.

Electrical supply to the Station Precinct shall be maintained at all times except by prior arrangement with the Superintendent. Prior to any interruption of supply at minimum of 24 hours notice to the Superintendent is required. Electrical supply to lighting on site may only be interrupted during daylight hours.

The 110 V AC signalling supply is critical infrastructure and shall be maintained at all times.

### **15.            TESTING AND QUALITY REQUIREMENTS**

#### **15.1            General**

The Contractor shall prepare and implement a Quality Plan that includes the following documentation:

- (1) Process to be used by the Contractor to ensure quality during the work; and
- (2) Acceptance test plan, providing full details of tests to be conducted in accordance with the following:

If not submitted beforehand, the documentation required by this Clause shall be submitted at least 28 days prior to the commencement of site work or placing an order for equipment.

Provision of the documentation listed in this Clause shall constitute a **HOLD POINT**.

Prior to testing, the Contractor shall demonstrate the correct functioning and current calibration of all test equipment.



The Contractor shall provide at least 48 hours notice of the time and date that each stage of the testing will be undertaken. Provision of the notification shall constitute a **HOLD POINT**.

Test results shall be submitted within 5 working days of tests being concluded.

## **15.2**            **Test Plan**

The Contractor's test plan shall include tests to demonstrate the correct installation and/or function of each element of the system, including without limitation, tests associated with the following:

- (1)        Earthing and Bonding requirements for high voltage electrified railways as per Part 129002 "Earthing and Bonding".
- (2)            Cabling  
  
          All telecommunications cabling shall be tested in accordance with Part 270 "Telecommunications Cabling".
- (3)            SGU
  - (a)        Wide Area Network connection
  - (b)        Local network connection.
- (4)            VA
  - (a)        Test Operation of Voice Annunciator
  - (b)        Test volume, coverage and quality of the audio.
- (5)            HILL
  - (a)        Test Operation
  - (b)        Test field strength to AS 60118.4.
- (6)            VCU and LCD Displays
  - (a)        Input from NAC - Ethernet
  - (b)        Output to LCD's – DVI and DVI extenders, picture quality
  - (c)        VCU Configuration Version
  - (d)        VCU Configuration operation
  - (e)        Anti-tamper devices.
- (7)            NAC
  - (a)        Network connection
  - (b)        Audio Output including any outputs that are not used in the Contractor's installation.
  - (c)        Zoning and timing functions
  - (d)        Pre recorded Messages
  - (e)        Local Audio Source input
  - (f)        HILL Outputs



- (g) Contact Closure I/O interface
- (h) Audio mixing functionality
- (i) VCU Interface.
- (8) Loudspeakers
  - (a) Volume
  - (b) Quality – target CIS score
  - (c) Coverage.
- (9) UPS and network Power Controller
  - (a) On-load test
  - (b) Remote network functionality
- (10) Earthing
- (11) Inspection of quality of workmanship for physical installation works
- (12) Demonstration that as-built documentation matches installation.

**16. HOLD POINTS**

The following is a summary of Hold Points, vide DPTI Specification: Part 140, “Quality System Requirements”, referenced in this Document:

CLAUSE REF.	HOLD POINT	RESPONSE TIME
1	Approval of persons nominated to conduct cabling works	2 working days
5.8	Inspect HILL cable and conduit before concrete is poured	24 hours
12.2	Work in the RFS Enclosure	5 working days
14	Connection of Existing SGU to Station Infrastructure	24 hours
14	Connection of New SGU to existing RFS	24 hours
15.1	Provision of Quality Plan	5 working days
15.1	Provision of notification of testing	2 working days

**17. RECORDS**

The Contractor shall supply the following records:

CLAUSE REF.	SUBJECT	RECORD TO BE PROVIDED
15	Testing	Test records

Upon completion of the work, the Contractor shall provide to the Principal “As Constructed” Drawings showing in detail the actual location and depth of conduits and pits, size of cabling and all other data required for fault-finding, locating equipment, and ongoing maintenance, repair or replacement of equipment.

The final, ‘As Constructed’ drawings and documentation shall include, where applicable, an update to all pre-existing documents relating to the PIS to ensure that these reflect all changes to the configuration of PIS components arising from the Contractor’s work.

Pre-existing documents may include, but is not limited to:



- (a) the original station Electrical Services drawing(s),
- (b) existing PIS drawings at stations and at the OCC,
- (c) PIS user manuals,
- (d) diagrams,
- (e) component specifications,
- (f) maintenance manuals and other PIS documents originally supplied by Open Access, and
- (g) existing signalling Bonding Plans.

The upgraded PIS drawings shall retain the same format as the existing versions. The updated version(s) shall include:

- (a) Revised circuit and/or connectivity diagram details;
- (b) A tabular listing of circuits;
- (c) The switchboard's and any cabinet's internal layout; and
- (d) A site plan with all accurately located conduit runs and the location of major items of equipment, including all conduit sizes.

The final design and Maximum Demand calculations shall also be supplied where applicable, together with the results of all tests undertaken by the Contractor.

The Contractor shall deliver all documents held by the Contractor that relate to the equipment installed by the Contractor, including user manuals, design documents, technical manuals and manufacturer's data sheets and documentation.

A Provisional Sum has been included in the Schedule of Prices for the supply and installation of the PI Display set mount. The Principal will supply details of the mounts required for the PI Display set to the Contractor.

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