TCS 016: 2023

Specification

Traffic Signal Controllers

Supply and Installation

Version: 5.0
Date: August 2023

VICTORIA State Government | Department of Transport and Planning

Foreword

This specification has been developed by Department of Transport and Planning. It is one of a number of technical specifications, and associated standard drawings, which set out the requirements for roadside ITS devices, traffic signal equipment and other electrical equipment and associated devices and control systems.

This specification is intended for use in all relevant works undertaken by or on behalf of DTP.

DTP Standard Drawings, Specifications and Guidelines are available for downloading from the VicRoads website:
https://www.vicroads.vic.gov.au/business-and-industry/technical-publications/electrical-and-intelligent-transport-systems

Specification updates. DTP specifications and associated standard drawings are subject to periodic review. To keep the specifications up to date, amendments or new editions are issued as necessary. It is therefore important for users of DTP specifications to ensure that they have the latest version and associated amendments.

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Revision History

Version	Revision	Date	Author	Description
2011	A	Jan 2011	ITS	New specification
2011	B	Jul 2011	ITS	- Additional references to Australian Standards and VR Standard Drawings. - Addition of Top Hat requirements.
2011	C	Dec 2013	ITS	- Removal of clauses regarding the presence of nominated VR representative to witness the controller test. - Removal of clauses to have the label signed by nominated VR representative. - Addition of 'Operational Test' in Section 8.
2021	A	Feb 2015	ITS	- New version - Updated format - Requirement for compliance with RMS specification - Updated Pre-qualification requirements - Revised Comms section - Requirement for RMS type approval - Inclusion of ELV, dim by wire dimming and associated hardware - Two door top-hat - Laptop shelf - Inclusion of emergency station I/O and panel - Dedicated socket outlet for modem - Double door extension housing - Expansion of preparation and installation sections
5.0		2023-08-18	ITS	- Update format to DTP template - Replaced reference to DoT with DTP - Updated definitions - Default lantern voltage LV - Bulk of installation section moved to Standard Section 730 - Emergency Station Call Panel details moved from Appendix F to Clause 4.14 or new Standard Drawing TC-1216

Contents

SECTION 1 – SCOPE AND GENERAL

1.1 SCOPE

1.1.1 This specification covers the mechanical, electrical and functional requirements for the control equipment used for the operation of road traffic signals in the State of Victoria.

1.1.2 Requirements covered by this specification include:

a) Manufacture
b) Supply
c) Preparation
d) Installation
e) Modification
f) Updating

1.2 GENERAL

1.2.1 The traffic signal controller processes information from vehicle detectors, pedestrian pushbuttons, internal time clocks, remote master equipment and other external inputs (such as railway signalling equipment) to control the sequence and duration of signal aspects for the control of road traffic.

1.2.2 Traffic signal controllers shall conform to the requirements of Transport for NSW (formerly RMS) Specification TSI-SP-069 together with the requirements detailed in this specification.

1.2.3 Where there is a difference between TSI-SP-069 and this specification, this specification shall take precedence.

1.3 TYPE APPROVAL

1.3.1 Traffic signal controllers shall be type approved for use by Transport for NSW (RMS) prior to being submitted to DTP for evaluation.

1.3.2 All equipment to be supplied under this specification shall hold current DTP (formerly DoT, formerly VicRoads) 'Type Approval' certification.

1.3.3 To obtain DTP 'Type Approval' the supplier must submit evidence of compliance in accordance with Appendix C of this specification and the requirements of individual tender documents.

1.3.4 Compliance with this version of this specification (and subsequent DTP Approval) does not constitute automatic approval against future versions of this specification.

1.3.5 Where it is considered necessary, DTP may withdraw current Type Approval and request that the affected product be re-submitted for evaluation against future versions of this specification.

1.4 PRE-QUALIFICATION

1.4.1 Controller Manufacture

Manufacturers of traffic signal controllers shall hold DTP (VicRoads) Contractor pre-qualification for the Supply of On-road Electronic Devices (SOED).

1.4.2 Controller Preparation

The preparation of controllers as detailed in Section 8 of this specification, shall only be carried out by the controller manufacturer or a Contractor authorised by the controller manufacturer to carry out controller preparation works.

1.4.3 Controller Installation

The installation of controllers as detailed in Section 9 of this specification, shall only be carried out by:

a) the controller manufacturer if the manufacturer holds DTP (VicRoads) Contractor pre-qualification for STS1; or
b) an STS1 Pre-qualified Contractor authorised by the controller manufacturer to install their controllers.

1.4.4 Controller On-Site Modification

The on-site modification of controllers (including PROM changes) shall only be carried out by:

a) the local area traffic signal maintenance contractor's technicians (where the technician certified by at least one controller manufacturer).
b) the controller manufacturer, if the manufacturer holds DTP (VicRoads) Contractor pre-qualification for STS1.
c) an STS1 Pre-qualified Contractor's technician certified by the controller manufacturer to carry out on-site controller works on their controller.

NOTE: A technician 'certified' by a controller manufacturer is a technician that has undergone training with a controller manufacturer and has been 'certified' as competent to carry out controller modifications. Certification may be a letter or a certificate. Certification from one controller manufacturer shall be deemed as evidence of competency to carry out works on any type approved controller.

1.5 LANTERN TECHNOLOGY

1.5.1 LED Lanterns

1.5.1.1 Controllers shall be capable of switching, operating, and monitoring DTP approved LED vehicle and pedestrian lanterns.

1.5.1.2 When operating with LED traffic signal lanterns the controllers shall:

- enable dimming of the LED displays.
- enable full conflict detection as per conventional lamp technologies.
- monitor “insufficient reds” for all vehicle displays, including arrows, B, and T displays, for which a minimum load of not less than 5 watts (undimmed) will be set for any such display aspect.
- detect any fully inoperative display, vehicle and/or pedestrian, and the replacement of same.
- enable display flashing.

1.5.1.3 The wattage load represented by LED lantern aspects varies with colour and luminosity requirements of AS/NZS 2144, as well as the type of display (Roundel, Arrow, Green Walk display, Red Don’t Walk display, Red Flashing Don’t Walk display, etc), representing some 9 different wattage combinations. Further, LED aspects may be driven by step-down transformer or switched mode power supply.

1.5.1.4 The controller shall therefore operate with LED lanterns with the following characteristics:

TABLE 2.1 – Characteristics of LED Lanterns

Description	Value
Maximum Load of LED lamp aspect	20 W
Minimum Load of LED lamp aspect – no dimming	5 W
Maximum Wattage in the “LED failed state”	0.5 W

1.5.1.5 The controller shall have a minimum sensing threshold of **3 Watts**.

1.5.1.6 The controller shall be fully compatible with DTP approved lantern aspects as specified in Section 4.5.3, AS 2144 and DTP Specification TCS 038.

1.5.1.7 Controllers shall be fully compatible with LED aspects which may be driven by step-down transformer or switched mode power supply.

1.5.2 Lantern voltage

1.5.2.1 Unless otherwise specified in individual controller orders, the controller shall switch LV to all signal lanterns and other connected field devices.

1.5.2.2 The controller shall be designed to be capable of switching ELV where specified in individual controller orders.

1.5.2.3 The controller shall be designed to dim traffic signal lanterns and electronic signs as specified in Clause 3.4.

1.6 UNINTERRUPTIBLE POWER SUPPLY

Where specified in individual orders, controllers shall be supplied with a DTP approved Uninterruptible Power Supply (UPS) in accordance with TCS 058.

1.7 ACRONYMS AND DEFINITIONS

The acronyms used in this document shall be interpreted as follows:

AC	Alternating Current
ACMA	Australian Communications and Media Authority
ADSL	Asymmetric Digital Subscriber Line
ANSI	American National Standards Institute
AS	Australian Standard
AS/NZS	Australian Standard / New Zealand Standard
CCTV	Closed Circuit Television
Controller Contractor	The contractor installing the controller on site
Controller Supplier	The company that supplies and prepares the controller ready for installation
DC	Direct Current
DHCP	Dynamic Host Configuration Protocol
DJCS	Department of Justice and Community Safety
DTP	Department of Transport and Planning *(formerly Department of Transport, formerly VicRoads)*
EEPROM	Electrically Erasable Programmable Road Only Memory
ELV	Extra Low Voltage (42V AC)
EMC	Electromagnetic Compatibility
ESLS	Electronic Speed Limit Sign
FTTN	Fibre to the node
GWTP	Give Way to Pedestrians
HHT	Handheld Terminal
IDC	Insulation Displacement Connector
ILAC-MRA	International Laboratory Recognition Arrangement–Mutual Recognition Arrangement
IP	Internet Protocol
ITS	Intelligent Transport Systems
LED	Light Emitting Diode
LTE	Long Term Evolution
LV	Low Voltage (240V AC)
MEN	Multiple Earthed Neutral
Mbps	Megabits per second
NATA	National Association of Testing Authorities
NBN	National Broadband Network
NRT	No Right Turn
PE Cell	Photo Electric Cell
PSTN	Public Switched Telephone Network
RAM	Random Access Memory

RCD	Residual current device
RCS	Ramp control sign
Regional computer	A virtual computer server that contains up to 100 SLOTS for the storage of site-specific SLOT data for up to 100 signal sites
RMS	Roads and Maritime Services of NSW
SAS	SCATS Authentication Server
SCATS	Sydney Coordinated Adaptive Traffic System
SLOT data	Site specific data stored in a specified location (SLOT) in the regional computer.
SNMP	Simple Network Management Protocol
SPIPS	Special Purpose Inputs
SPOPS	Special Purpose Outputs
TCP/IP	Transmission Control Protocol / Internet Protocol
UPS	Uninterruptible Power Supply

SECTION 2 – RELATED SPECIFICATIONS AND DRAWINGS

2.1 AUSTRALIAN STANDARDS

2.1.1 The fabrication and supply of all components shall conform to the latest version of all relevant Australian Standards.

2.1.2 The following related Australian Standards are referenced:

AS 2144: 2014	Traffic Signal Lanterns
AS 2703	Vehicle Loop Detector Sensors
AS 5715: 2015	Uninterruptible Power Systems (UPS) for Roadside Devices
AS 60038: 2012	Standard Voltages
AS 60529	Degrees of Protection Provided by Enclosures (IP Code)
AS 61000.6.3	Electromagnetic Compatibility (EMC) Generic Standards – Emission Standard for Residential, Commercial and Light Industrial Environments
AS 61558	Safety of Power Transformers, Power Supply Units and Similar
AS/NZS 3000	Electrical Installations – Wiring Rules
AS/NZS 61000.6.1	Electromagnetic Compatibility (EMC) Generic Standards – Emission Standard for Residential, Commercial and Light Industrial Environments

2.2 DTP SPECIFICATIONS

2.2.1 The fabrication and supply of all components shall conform to the relevant DTP specifications, and related specifications and standards, as indicated throughout this document.

2.2.2 The following DTP Specifications are referenced:

Contract Standard Section 730	Traffic Signal Installation
Contract Standard Section 732	ITS Devices Installation
Contract Standard Section 736	ITS Device Testing and Integration.
TCG 018	Register of ITS Approved Products
TCS 003	Ramp Control / Metering Signs
TCS 038	Traffic Signal Lanterns
TCS 055	Emergency Vehicle Pre-Emption

TCS 058	UPS for Traffic Signals
TCS 066	Linking Traffic Signals to Rail Crossings

2.3 DTP STANDARD DRAWINGS

The following DTP Standard drawings are referenced:

TC-1203	Traffic Signal Controller Foundation Details
TC-1216	Emergency Station Panel
TC-2100	Standard Cabinet Label

2.4 ADDITIONAL SPECIFICATIONS

2.4.1 The fabrication and supply of all components shall conform to the following specifications and drawings as indicated throughout this document.

2.4.2 The following additional specifications are referenced:

TSI-SP-069: 2018	Transport for NSW (formerly Roads and Maritime Services) Control Equipment for Road Traffic Signals

2.5 EXCEPTIONS AND CLARIFICATIONS TO TSI-SP-069:2018

Changes or clarifications to TSI-SP-069 are summarised in Table 2.1 below.

TSI-SP-069 Clause	Description	TCS 016 Exception / Clarification
Section 6 – Technical Requirements		
6.5.4	Pedestrian WAIT indicator	Clause 3.2
6.5.22	Vehicle detection system	Clause 3.3
6.5.23	SCATS modem	Section 5
6.5.30	Dimming by control wire – Signal and monitor interface	Clause 3.4
6.6.3	Dimming of signal displays	Clause 3.4
6.9	Personality and module interface	Clause 3.5
6.13	Special facility control	Clause 3.6

TABLE 2.1 – Changes and clarifications to TSI-SP-069:2018

Changes or clarifications to TSI-SP-069 are summarised in Table 2.1 continued.

TSI-SP-069 Clause	Description	TCS 016 Exception / Clarification
Section 7 – Wired Housing		
7.2	Housing types	Clause 4.2
7.3.3	Mounting	Clause 4.3
7.3.4	Cable access and telecommunications conduit access	Clause 4.4
7.3.7	Door locks	Clause 4.5
7.5	Switchboard	Clause 4.6
7.5.10	Neutral links	Clause 4.6.1
7.5.11	Earth link	Clause 4.6.2
7.7	Facility switch	Clause 4.7
7.11	Miscellaneous relays and contacts	Clause 4.8
7.13.8	Gas sensor	Clause 4.9
7.14	Telecommunications line transient protection unit	Section 5
7.16	Gas sensor	Clause 4.9
7.17	Lamp dimming signal generator	Clause 4.10
Not used	Service light	Clause 4.11
Not used	Emergency Vehicle Pre-emption	Clause 4.12
Not used	Fold down laptop shelf	Clause 4.13
Not used	Housing top extension (Top Hat)	Clause 4.14

TABLE 2.1 – Changes and clarifications to TSI-SP-069:2018 …continued

SECTION 3 – TECHNICAL REQUIREMENTS

3.1 GENERAL

3.1.1 The controller shall comply with the requirements of TSI-SP-069, and the following requirements.

3.1.2 Where following requirements differ from TSI-SP-069, this section shall take precedence.

3.2 PEDESTRIAN WAIT INDICATORS

Controllers used in Victoria shall include all required facilities to provide Pedestrian Wait indicator outputs as detailed in TSI-SP-069, Clause 6.5.4.

3.3 VEHICLE DETECTORS

3.3.1 Inductive loop vehicle detectors shall be provided in accordance with the requirements of TSI-SP-069.

3.3.2 Inductive vehicle loop detectors shall be capable of operating the loop with up to 200 metres of detector loop feeder cable connected.

3.4 DIMMING METHODS

The controller shall be capable of dimming using the methods described in TSI-SP-069, Clauses 6.5.30 and 6.6.3 and as detailed below.

3.4.1 Dimming by reduced voltage method

Dimming by reduced voltage shall be in accordance with TSI-SP-069, Clause 6.6.3.2.2. The nominated dimming levels and voltages shall be in accordance with Table 3.1 below.

Lamp Voltage	Dimming Level	Dimmed Voltage
$240V_{ac}$	2 (Nominal 80%)	$192V_{ac}$
$42V_{ac}$	2 (Nominal 80%)	$32V_{ac}$

TABLE 3.1 – Reduced voltage dimming

3.4.2 Dimming by control signal (dim-by-wire) method

Dimming by control signal, also referred to as 'dim-by-wire', method shall be in accordance with TSI-SP-069, Clauses 6.5.30 and 6.6.3.2.3. The nominated dimming levels and voltages shall be in accordance with Table 3.2 below.

Lamp Voltage	Undimmed Control Signal Voltage	Dimmed Control Signal Voltage
240V ac	N/A	N/A
42V ac	42V ac	21V ac

TABLE 3.2 – 'Dim-by-wire' dimming

3.4.3 Dimming for VC5 controllers

VC5 controllers shall be capable of dimming as detailed in Table 3.3 below. The dimming method required shall be specified in individual controller orders.

Lamp Voltage	Dimming Method
240V ac	Reduced Voltage
42V ac	Reduced Voltage

TABLE 3.3 – VC5 controller dimming

3.4.4 Dimming for VC6 controllers

VC6 controllers shall be capable of dimming as detailed in Table 3.4 below. The dimming method required shall be specified in individual controller orders.

Lamp Voltage	Dimming Method
240V ac	Reduced Voltage
42V ac	'Dim-by-wire' or Reduced Voltage

TABLE 3.4 – VC6 controller dimming

3.5 PERSONALITY MODULE

3.5.1 The Personality module shall be approved by Transport for NSW.

3.5.2 For VC6 controllers, the Personality module shall be compliant with the requirements of TSI-SP-069, Clause 6.9.

3.5.3 The following existing personality modules will continue to be accepted for existing controllers:

- XPM Dongle (TSI-SP-069, Amd. 3 Approved)
- PCMCIA Cardbus Personality module
- 'C-PERS' EEPROM

3.6 SPECIAL FACILITY CONTROL

The requirements for Special Facility inputs and outputs will be as detailed in individual controller orders.

3.7 PROVISION FOR PUBLIC TRANSPORT PRIORITY MEASURES

Traffic signal controllers supplied under this Specification shall provide public transport priority measures as specified in Appendix A.

3.8 PROVISION FOR SCATS FLEXILINK OPERATION

Traffic signal controllers supplied under this Specification shall be fully compatible with the operation of SCATS FlexiLink as specified in Appendix B.

SECTION 4 – CONTROLLER HOUSING

4.1 GENERAL

4.1.1 The controller housing is to conform to the requirements of TSI_SP-069, Section 7 and the following requirements.

4.1.2 Where the following requirements differ from TSI-SP-069, this section shall take precedence.

4.2 HOUSING TYPE

4.2.1 Ground mounted cabinets shall comply with the requirements of TSI-SP-069, Section 7, except as otherwise specified below.

4.2.2 At the time of this specification, DTP does not use pole mounted traffic signal controller cabinets.

4.3 MOUNTING

The mounting bolt positions shall comply with Standard Drawing TC-1203.

4.4 COMMUNICATION CONDUIT ACCESS

The entry position for the communications conduit shall be in accordance with DTP Standard Drawing TC-1203.

4.5 DOOR LOCKS

4.5.1 The door shall be secured in the closed position with a 3-point locking system.

4.5.2 The locking system shall be actuated by a single ‘swing handle’.

4.5.3 The ‘swing handle’ shall be locked in the closed position using a standard DTP (VicRoads) **Bi-Lock System B9-67, AM 1-5**.

4.6 MODEM SHELF

4.6.1 A modem shelf shall be provided, located above the equipment shelf, and left of the logic module. See Figure 5.2.

4.6.2 The modem shelf shall cover the unused area left of the logic module.

4.6.3 The shelf shall be 75mm above the equipment shelf and set back 30mm from the front edge of the equipment shelf.

4.6.4 The SCATS modem shall be placed on the equipment shelf and under the modem shelf.

Note: The modem shelf is required to allow for unimpeded shelf space to locate the modem and enables the use of the remaining space above the modem to be used for other devices.

4.6.5 Alternative mounting arrangements for the modem may be considered (e.g. a shelf under the equipment shelf).

4.7 SWITCHBOARD

4.7.1 General

The switchboard in the controller shall be configured as a sub-board and not the main switchboard. The main switchboard will be located external of the traffic signal controller.

4.7.2 Circuit breakers

The switchboard shall include circuit breakers as specified in TSI-SP-069, Clause 7.5.

4.7.3 Neutral links

4.7.3.1 Neutral link 1 shall not include a MEN connection.

4.7.3.2 The MEN link is made within the main switchboard which is external of the traffic signal controller.

4.7.4 Earth link

4.7.4.1 The earth link shall not include a MEN connection.

4.7.4.2 The MEN link is made within the main switchboard which is external of the traffic signal controller.

4.7.5 Socket outlet

4.7.5.1 In addition to the standard double socket outlet with integral RCD, the controller shall be supplied with a separate, single socket outlet.

4.7.5.2 The single socket outlet shall:

- Be dedicated for the SCATS modem connection ONLY.
- Be clearly labelled as the modem socket outlet.
- Include a provision to secure the modem plug in the socket outlet to prevent it dislodging.
- Be protected by the same circuit breaker as the double socket outlet.
- Not be protected by an RCD (as allowed under AS/NZS 3000, Clause 2.6.3.2.3).
- Be clearly marked as not protected by an RCD.

4.8 FACILITY SWITCH

A facility switch shall be fitted as specified in TSI-SP-069.

4.9 MISCELLANEOUS RELAYS AND CONTACTORS

The requirements for miscellaneous relays will be as detailed in individual controller orders.

4.10 ITS DEVICES POWERED FROM TRAFFIC SIGNAL CONTROLLER

4.10.1 General

4.10.1.1 Where required in individual controller orders, provision shall be provided to supply power to other ITS devices such as:

- Ramp Control signs
- ESLS
- CCTV

4.10.1.2 It is preferred that any ITS equipment powered from traffic signals is supplied from an additional sub-circuit board installed within an extension housing.

4.10.1.3 If there is an existing single door extension housing being used by a third party, it shall be replaced with a two-door extension housing as specified in clause 4.16.3 below.

4.10.1.4 Where approved, a single CCTV camera may be powered through the CCTV circuit breaker as specified in TSI-SP-069, Clause 7.5.

4.10.1.5 Where a sub-board is installed in an extension housing, it shall be supplied from the controller's switchboard and MUST be de-energised when the controllers main switch is switched 'off' or the main fuse is removed.

Note: When the traffic signal controller's main switch is OFF or the main fuse is removed, all devices attached to any traffic signal pole on the site MUST be de-energised. This excludes Telecommunications equipment installed by others and street lighting.

4.10.1.6 The circuit breaker supplying a sub-board located in an extension housing shall be clearly labelled.

4.10.1.7 All circuit breakers installed to supply any ITS devices shall be clearly labelled.

4.10.1.8 For ELV controllers, the supply voltage to the field for ITS devices shall be ELV. The use of LV ITS devices on an ELV installation shall not be permitted.

4.10.2 Power supplied via traffic signal cable

4.10.2.1 Where power is supplied via a spare core in the traffic signal cable, an unallocated core shall be used (i.e., 33-38).

4.10.2.2 When using a spare core in the traffic signal cable, the load of the connected ITS device must not exceed the current carrying capacity of the cable core.

4.10.3 Power supplied via separate cable

4.10.3.1 Where additional ITS devices are connected via a separate cable, the power shall be provided directly from the associated circuit breaker.

4.10.3.2 The cable shall be clearly and indelibly marked in every cable pit as to its purpose and where it is fed from.

4.10.3.3 Isolating the main switch or main fuse in the controller shall deenergise all additional cables supplying power to any ITS device from the controller.

4.11 GAS SENSOR

A gas sensor shall not be required unless specified in an individual controller order.

4.12 LAMP DIMMING SIGNAL GENERATOR

A lamp dimming signal generator, as described in Clause 7.17 TSI-SP-069, shall be provided for VC6, ELV, dim-by-wire controllers where specified in individual controller orders.

4.13 SERVICE LIGHT

4.13.1 A service light is to be provided within the controller housing.

4.13.2 The light shall be located such that it provides adequate internal cabinet illumination at night.

4.13.3 The light shall be activated by a separate switch.

4.13.4 The light switch shall be clearly marked for easy identification.

4.14 EMERGENCY VEHICLES

4.14.1 Emergency vehicle pre-emption

4.14.1.1 Where specified in individual controller orders, a DTP approved, Emergency Pre-emption system shall be installed in accordance with TCS 055.

4.14.1.2 Typically, this system will be transferred from an existing controller as part of the 'on-site' controller replacement works.

4.14.2 Emergency station input

4.14.2.1 Where specified in individual controller orders, provision shall be made for calling an emergency phase from an associated Emergency Station (i.e., Fire, Ambulance or Police).

4.14.2.2 Emergency Stations use an external input to call an emergency phase to facilitate the efficient and safe exit of emergency vehicles from the station when responding to an emergency call.

4.14.2.3 Depending on site specific conditions, there may be one or two 'emergency phases'. These will typically allow for an emergency vehicle to turn right or left from the station.

4.14.2.4 Each emergency phase shall be called via a separate push button mounted on an Emergency Station Call Panel, located within the Emergency Station.

4.14.2.5 When a CALL input is received, the controller shall provide a CALL RECORDED output to illuminate the CALL RECORDED indicator.

4.14.2.6 When the controller receives a CANCEL input from the emergency station, the request for the emergency phase shall be cancelled.

4.14.2.7 Site specific operation of the emergency phase operation will be detailed in the sites Controller Operation Sheet (Ops Sheet).

4.14.2.8 The push button(s) shall be located on an 'Emergency Station Call Panel' in accordance with Standard Drawing TC-1216.

4.14.2.9 The Emergency Station Call Panel, complete with all buttons and indicators shall typically be supplied and installed by others within the emergency station.

4.14.2.10 The inputs and outputs between the controller and the Emergency Station Call Panel shall be as detailed in Table 4.1.

Controller	Emergency Station Call Panel
Call A – Input	Call A
Call A – call recorded	Call A – call recorded
Call Cancel – Input	Call Cancel
Common	Common
Call B – Input	Call B
Call B – call recorded	Call B – call recorded

Table 4.1 – Emergency Station Call Panel inputs and outputs

4.14.2.11 The connections between the controller and Emergency Station Call Panel shall typically be a hardwired connection.

4.14.2.12 The cable used to connect the controller and the Emergency Station Call Panel shall be 13 core traffic signal cable or other suitable multi-core cable.

4.15 LAPTOP SHELF

4.15.1 A fold down shelf shall be provided on the inside of the door capable of supporting a laptop computer.

4.15.2 The shelf shall be:

a) hinged on the lower edge and fold down from the top.
b) located above the document storage pocket.
c) large enough to hold a laptop computer.
d) A minimum of 400mm wide.

4.15.3 When folded down for use, the shelf shall be held securely in place in a horizontal position.

4.15.4 The underside of the shelf may be used to display one of the cabinet layout drawings when in the up or closed position.

4.15.5 The shelf shall be held in the upright or flat position when not in use allowing the housing door to be closed.

4.16 HOUSING TOP EXTENSION (TOP HAT)

4.16.1 General

4.16.1.1 Where specified in individual controller orders, the controller shall be supplied with a housing top extension “Top Hat”.

4.16.1.2 The extension shall also be available as a separate item for retrofitting onto existing installed controllers.

4.16.1.3 The construction of the extension shall conform to the relevant requirements specified herein for the controller cabinet.

4.16.1.4 The extension shall be designed to exactly fit the top of the controller cabinet with no gap and provide an internal height clearance of at least 450mm.

4.16.1.5 The controller cabinet with the extension fitted shall provide a degree of protection of not less than IP45 as detailed in AS 60529.

4.16.1.6 The extension shall be available in single door and two door options. The type of extension shall be specified in individual contract documents.

4.16.1.7 The door(s) shall be located on the same side as the controller door.

4.16.1.8 The door(s) shall include a separate lock(s).

4.16.1.9 The lock shall be the standard DTP (VicRoads) **Bi-Lock System B9-67, AM 1-5** (the same as a standard traffic signal controller lock).

4.16.2 Single door top extension

4.16.2.1 Where specified, a single door housing top extension “Top Hat” shall be supplied.

4.16.2.2 The extension shall have a full width door hinged on the same side as the controller door using two similar hinges.

4.16.2.3 For DPT use, the lock shall be the standard DPT (VicRoads) **Bi-Lock System B9-67, AM 1-5** (the same as a standard traffic signal controller lock).

4.16.2.4 For Third Party use, the lock shall be supplied by others.

4.16.2.5 The extension shall include a removable panel mounted on the back of the extension housing for mounting hardware.

4.16.2.6 The mounting panel shall, as near as practicable, be the full height and width of the extension housing.

4.16.3 Double door top extension

4.16.3.1 Where specified in individual controller orders, the controller shall be supplied with a two-compartment housing top extension “Top Hat”.

4.16.3.2 Each compartment shall have a separate access door. See Figure 4.1 below.

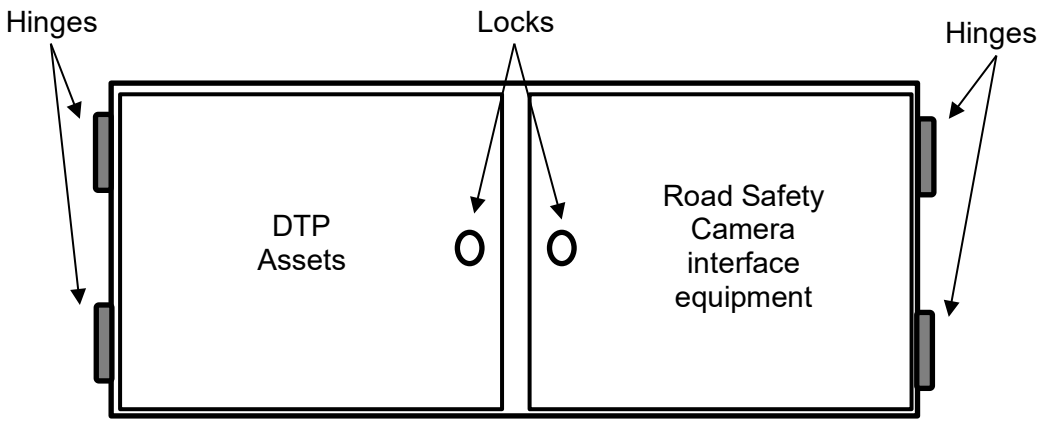

Figure 4.1 – Controller top extension housing

4.16.3.3 The two compartments shall be separated with a dividing panel to prevent access from one compartment to the other.

4.16.3.4 Each compartment shall include a separate access opening into the traffic signal controller for connection of cables.

4.16.3.5 Both doors shall be located on the same side as the controller door.

4.16.3.6 Each door shall hinge from the external sides of the extension housing (see Figure 4.1).

4.16.3.7 The hinges shall be similar to those used on the controller housing door.

4.16.3.8 Each door shall include a separate lock located on the opposite side of the door to the hinge (see Figure 4.1).

4.16.3.9 The locks shall be keyed as follows:

- The left door lock shall be the standard DTP (VicRoads) **Bi-Lock System B9-67, AM 1-5** (the same as a standard traffic signal controller lock).
- The right door lock shall be supplied by others.

4.16.10 Each compartment shall include a removable, full compartment width, panel mounted on the back of the extension for mounting hardware.

4.16.11 The left compartment shall be reserved for DTP use. Typical uses for this compartment include:

- Circuit breaker for ESLS.
- Circuit breaker for CCTV.
- CCTV control equipment.

4.16.12 The right compartment is reserved for Road Safety Camera interface equipment where required.

SECTION 5 – COMMUNICATIONS

5.1 GENERAL

5.1.1 Controllers are to be linked to the SCATS regional computer by modem.

5.1.2 The purpose of this link is to convey co-ordination parameters from the SCATS regional computer, and to feed back to the regional computer confirmation of status of the controller, detector information, logs and faults.

5.2 SCATS COMMUNICATIONS NETWORK

5.2.1 The communications link between the controller and the SCATS regional computer is managed by a SCATS compatible, DTP approved, modem.

5.2.2 The device functions as an integrated modem that actively manages the communication link between the SCATS regional computer and the controller.

5.2.3 This modem is connected to the SCATS regional computer over a TCP/IP network.

5.2.4 The network is typically provided by a telecommunications company that includes the link to every traffic signal controller and to all the SCATS regional computers.

5.2.5 The SCATS compatible modem can use one of two communications mediums to connect to the TCP/IP network. They are:

- ADSL over the PSTN network.
- Fibre (FTTN method) using NBN.
- Wireless using the mobile 4G network.

5.3 SIMPLE NETWORK MONITORING PROTOCOL

5.3.1 The controller shall include SNMP functionality (minimum version 2).

5.3.2 SNMP shall be used to provide data and monitoring.

5.4 MODEM SUPPLY

5.4.1 The modem shall be supplied to the nominated controller supplier under an existing DTP contract with Telstra.

5.4.2 The supplied modem configuration will be specified in individual controller orders. Typical configurations are:

- Dual path fast speed ADSL – to allow enough bandwidth for both SCATS and CCTV and 4G IP Wireless connection.
- Dual path ADSL (256K/64K) and 4G IP Wireless connection.
- Single path 4G IP Wireless connection.
- A modem (as detailed above) with Bluetooth function.

5.4.3 The modem shall be supplied to the controller supplier preconfigured.

5.4.4 Connecting cables, including any required antenna cables, shall be supplied with the modem.

5.5 MODEM CONNECTION

5.5.1 The default modem connection port on the controller's Control Module shall be standard RJ-45 Ethernet port.

5.5.2 Connection of the modem to WAN should be conducted remotely by Telstra under the existing contract.

5.5.3 For Telstra to be able to connect the modem to WAN remotely, a unique 12-digit serial number of the modem together with the site details must be provided to Telstra. This is generally done by the controller supplier.

5.6 SCATS CONNECTION

5.6.1 The traffic signal controller shall be connected using the 'Network' option as defined in the SCATS system.

5.6.2 This option requires the controller or the modem to perform the initial network negotiation phase with the SCATS Central Manager to determine which SCATS Regional Computer is set up to connect to this site. This phase is required before an operational SCATS link can be established between the controller and the regional computer.

5.6.3 The negotiation phase is performed by:

- the traffic signal controller if the Ethernet port is used to connect the controller to the SCATS network; or
- the SCATS compatible modem if the serial port is used to connect the controller to the SCATS network.

5.6.4 The parameters required as part of this SCATS network negotiation phase are to be stored in either the modem or the controller.

5.6.5 These parameters include the IP addresses of SCATS Authentication Server (SAS), the SCATS Central Manager and the TCP port number to use.

5.6.6 The IP addresses to be configured in the controllers are below. They shall be in the same order as shown:

a) SAS 1 – 10.48.51.11.
b) SAS 2 – 10.48.51.202.
c) SAS 3 – 149.176.218.89.

5.6.7 The above IP address parameters shall be stored in the controller processor card. These parameters shall be configurable using an external device, e.g. A HHT or laptop computer.

5.7 ETHERNET COMMUNICATION PORT (NETWORK PORT)

5.7.1 The controller's Control Module shall include an Ethernet port for networking purposes. This port shall be used to provide a network interface to connect to an external network device. This network device can be a modem that has an Ethernet port, a network router or a network switch.

5.7.2 The connection type shall be an RJ45 port using IEEE 802.3 Ethernet standard. It shall be capable of at least both 10 and 100 Mbps connection speed.

5.7.3 The network interface shall be compatible with the TCP/IP protocol. The method of IP address allocation for this Ethernet interface shall be selectable between these two common methods – DHCP or static IP. For the static IP configuration, the IP address, netmask, and default gateway shall be configurable.

5.7.4 The network parameters for this connection shall be configurable. The configuration of these parameters shall be done using an external device, eg. A laptop computer. It is preferable that these parameters are stored in controller processor card.

5.7.5 It is preferable that configuration and operational data be available to a PC connected anywhere within the SCATS network. This data should include the current configuration parameters for the controller and communications setup; and information about the current operational state of the controller.

5.7.6 This Ethernet port will be used to connect the controller to the network for SCATS communication. For this purpose, the controller shall perform the initial network negotiation phase with the SCATS Central Manager as described in Section 5.5 below.

5.7.7 The Ethernet communication port shall also be able to be used for communications other than the SCATS connection.

5.8 SCATS NETWORK DIAGRAM

Figure 5.1 shows the configuration of the SCATS network:

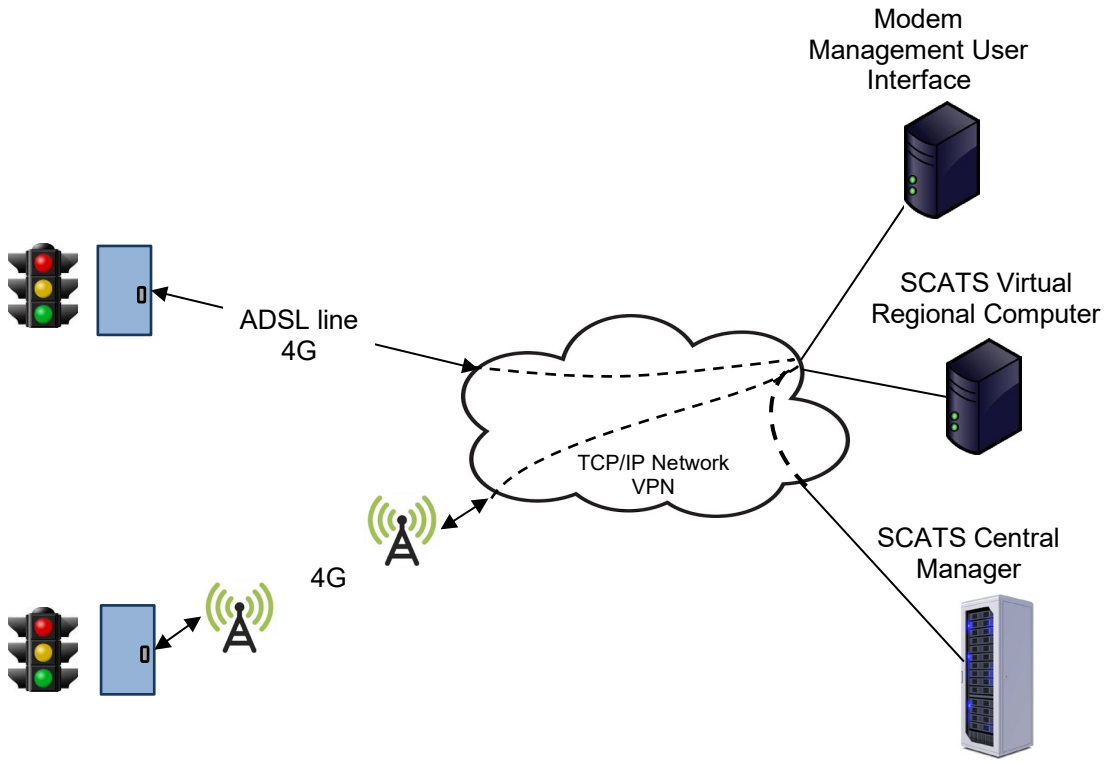

Figure 5.1: SCATS network diagram

5.9 MODEM INSTALLATION

5.9.1 General

5.9.1.1 The controller supplier shall install and connect the modem in the controller as part of the controller preparation works as specified in individual controller orders.

5.9.1.2 The modem shall be configured and tested once installed in the controller as specified in individual controller orders.

5.9.1.3 The modem installation shall include:

- Securing the modem in place.
- Where internal antennas are fitted to the modem, they shall be to the front of the shelf.
- Connection to appropriate controller communications port.
- Installation of external 4G antenna (where required).
- Connection of internal or external 4G antenna to the modem.
- Installation of Bluetooth device.
- Connection of Bluetooth device to SCATS modem and external antenna.

5.9.1.4 Where a 4G antenna is installed, it shall be mounted on the roof of the controller or top-hat (where fitted) and sealed so as not to the compromise the IP rating of the controller housing.

5.9.2 Modem Location

The modem shall be installed securely on the controller equipment shelf, and under the modem shelf with the antennas to the front of the shelf, in accordance with the modem manufacturer's requirements. See Figure 5.2.

5.9.3 Connection to the Controller

The modem shall be connected to the traffic signal controller via an Ethernet port on the controller's logic module. See Figure 5.3.

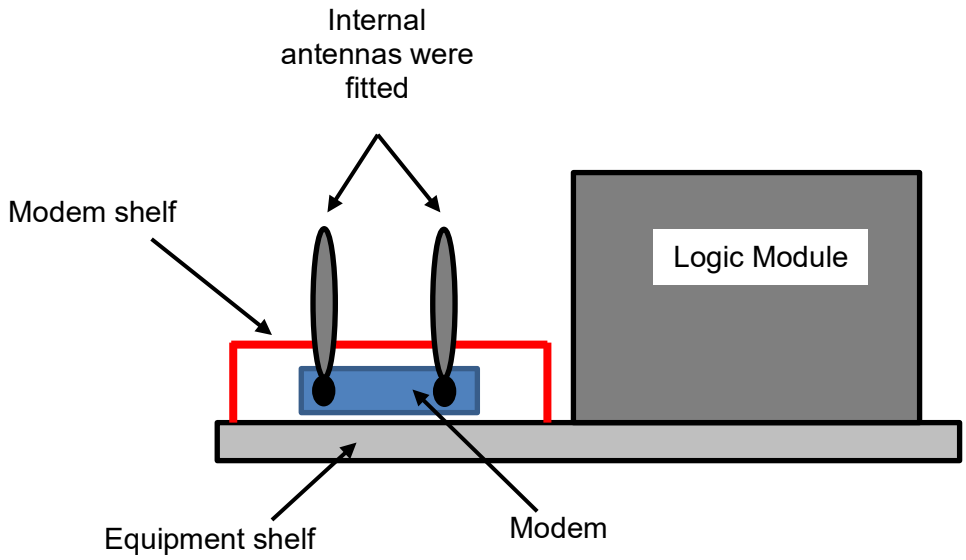

Figure 5.2: Modem Shelf

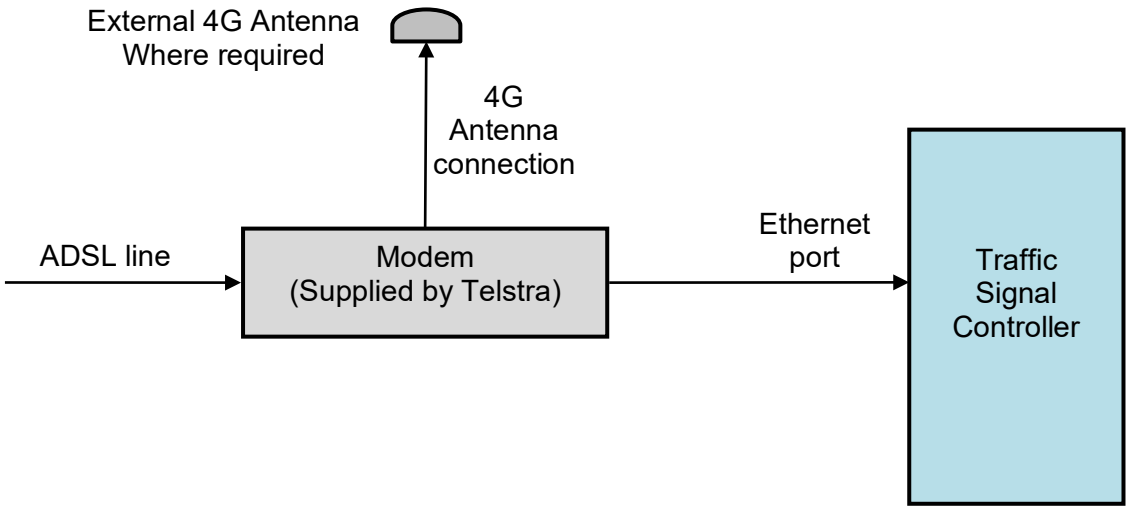

Figure 5.3: Controller connection schematic

5.9.4 Connection to the Telecommunications Network

5.9.4.1 For ADSL connections, the modem shall connect to the telecommunications line within the controller telecommunications hatch via an IDC type connector (e.g., a Krone connector) arrangement.

5.9.4.2 Modems that use the 4G wireless mobile network shall have an external antenna installed on top of the cabinet. This antenna shall be weather and impact resistant and be discrete so as not to attract attention.

5.9.4.3 The antenna shall not be installed directly above the controller rack.

5.9.4.4 The antenna installation shall not compromise the IP rating of the controller housing.

5.9.4.5 The antenna shall be compatible with existing 3/4G mobile networks, and have following specification:

- 2 X Cellular/LTE Cables with 3dBi gain.
- 1 X WiFi cable with 5dBi gain.

5.9.5 Connection for CCTV Camera – Optional

5.9.5.1 Where a CCTV camera is to be installed at the traffic signal site, it shall be connected to a telecommunications service as per one of the following arrangements:

- Via fast speed ADSL using a spare ethernet port on the modem; or
- Via its own 4G modem.

5.9.5.2 The connection type shall be specified in individual controller orders.

SECTION 6 – DOCUMENTATION

6.1 GENERAL

The Supplier shall provide three complete sets of documentation, including circuit diagrams and instruction manuals on all aspects of the operation, hardware, software, maintenance, and diagnostics.

6.2 INSTRUCTION MANUALS

Each set of instruction manuals shall contain:

- A complete set of electrical circuits, including logic and timing diagrams.
- A detailed description of the operation of the equipment.
- Full instructions on the setting up and adjustment of the equipment and the checking or test procedure to be adopted.
- Mechanical details of main cabinets and sub-assemblies.
- Laboratory testing and setup procedures.
- On site diagnostic procedures.
- Strapping options and significance of strapping.
- Diode matrix; significance of diode positions.

6.3 SOFTWARE DOCUMENTATION

The following software documentation shall be provided, if requested by DTP:

- Memory map.
- Functional description of memory map.
- RAM data definition and application.
- Operations and programming manuals.
- Full software listing of the hardware-related software
- Intersection personality tables, including synchronous linking tables, if any, unless such provision would contravene the contractor's pertinent TfNSW SCATS licence obligations.

6.4 UPDATING SERVICE

The Supplier shall have available an updating service covering all controller documentation. Any updates to documentation previously supplied shall be forwarded to DTP within a reasonable time of being released.

SECTION 7 – SITE TEST FACILITIES

7.1 TEST FUNCTIONS

Facilities shall be provided in the Controller for the following test functions to aid in setting up and commissioning of sites, site upgrades and ongoing maintenance:

7.2 GROUP FLASH TEST

7.2.1 The controller shall include a ‘signal group flash facility, that is the facility to briefly flash each colour in each signal group.

7.2.2 The signal group flash facility shall be used to check intersection cabling and lantern connections on site.

7.2.3 The flashing of each signal group shall be done in such a way that it cannot be interpreted by the road user as a genuine signal.

7.2.4 The operator shall select each signal group individually when undertaking the flash test.

7.2.5 The flash test sequence shall be as follows:

a) Green – flash once
b) Yellow – flash twice
c) Red – flash three times

7.2.6 The above sequence shall repeat until terminated by the operator.

Note: The flash test facility shall only be capable of being invoked whilst the controller is in a “Maintenance Mode” (i.e., not controlling traffic).

SECTION 8 – PREPARATION PRIOR TO INSTALLATION

8.1 CONTROLLER PREPARATION

8.1.1 When the Controller Supplier receives an order for the supply and installation of a controller, it shall be supplied, prepared, and configured in accordance with the:

- requirements of this specification.
- individual requirements specified in the controller order.
- site specific Operational Design Sheet provided with the order.

8.1.2 The individual controller order shall specify the controller configuration required including, but not limited to:

- Number of signal groups
- Number of loop detector inputs
- Number of pedestrian detector inputs
- Number and type of 'external' detector inputs
- Number and type of any other detection devices
- Train linking (where required)
- Tram detectors (where required)
- Transfer of demand inputs/outputs (where required)
- Number and type of other ITS devices to be connected to the controller (eg. CCTV, RCS, ESLS, etc)
- If the controller is to switch ELV (LV is the default)
- The dimming method if ELV is being specified.
- The required number of SPIPS and SPOPS

8.2 CONTROLLER PERSONALITY

8.2.1 The controller personality shall be provided by DTP in one of the following formats:

(a) **Default** format will be as a complete personality, pre-loaded onto the appropriate personality media (e.g., EEPROM, Cardbus card or dongle).
(b) **Optional** format shall be as an SFT file, which the Controller Supplier shall load (burn) onto the appropriate personality media.

8.2.2 Unless otherwise specified on Individual site plans, individual contract documents or individual controller orders, the personality will be provided by DTP in accordance with option (a) above.

8.2.3 Where the personality is supplied by DTP as an SFT file, the Controller Supplier shall 'burn' the file onto the appropriate personality media (not provided by DTP).

8.3 CONTROLLER WORKSHOP TESTING

8.3.1 When the Controller Supplier is given an order for the installation of a controller, it shall be prepared and configured for installation at the nominated site in accordance with the Operational Design Sheet provided with the order.

8.3.2 The controller, with the personality module installed, shall be tested "online" to a SCATS Test Region under appropriate load conditions for a period of **not less than 48 hours**.

Note: Controllers that have not been tested 'online' for a minimum of 48 hours **shall not** be installed in the field.

8.3.3 The requirements of Clause 8.2.2 for a minimum of 48 hours 'online' SCATS testing may be waived for controllers being installed as part of an accident damage replacement in accordance with existing supply contracts.

8.3.4 The Controller Supplier shall undertake an Operational Test to verify the correct operation of the controller. The test shall verify that:

a) The controller initiates in the correct start-up sequence and 'reset' in the pivot phase.
b) The controller defaults to flash, or no display for pedestrian operated signals, for all conflicting signal groups in accordance with the Group Conflict Chart.
c) All signal phases identified in the Operational Design Sheets operate when the appropriate detector input is activated.
d) All detector inputs activate the corresponding phase(s).
e) Any SPIS and SPOPS operate correctly.
f) Any train linking operates correctly.
g) Any tram detector inputs operate correctly.
h) Any transfer of demand inputs/outputs operate correctly.
i) The minimum and maximum time settings for each phase complies with the Operational Design Sheets.
j) The facility switch operates correctly.
k) Call-recorded and other outputs (GWTP and NRT signs as examples) operate correctly.

8.3.5 All instruments and testing facilities shall be provided by the Controller Supplier. Such testing facilities shall provide full simulation of all inputs and monitoring of all outputs.

8.3.6 On completion of successful testing, the Controller Supplier shall affix a signed and dated label to the inside of the controller door.

8.3.7 The label detailed in Clause 8.2.6 shall provide the Controller Suppliers name, the printed name and signature of the technician/manager carrying out the operational test and date of signing.

8.3.8 Unless specifically requested, all preparation, testing and pre-commissioning works shall be completed within seven working days of the availability of the Operational Design Sheets and the personality.

8.4 TEST REPORT

8.4.1 The Controller Supplier shall prepare a report on the Operational Test identifying all the key tests undertaken, the outcomes of the tests and the actions taken.

8.4.2 The report shall be provided to the Superintendent at least 24 hours prior to the proposed time of installation of the controller.

8.5 CONTROLLER CABINET LABEL

The Controller Supplier shall supply a standard cabinet label, in accordance with DTP Standard Drawing TC-2100, together with the numerals required for the site number as advised by DTP.

SECTION 9 – INSTALLATION AND COMMISSIONING

9.1 GENERAL

9.1.1 The traffic signal controller shall **ONLY** be installed by the Controller Supplier (if the Controller Supplier holds STS1 pre-qualification) or an STS1 pre-qualified contractor authorised by the Controller Supplier as specified in Clause 1.4.3 above.

Note: An STS contractor that is not certified by at least one Controller Supplier, **shall not** install the traffic signal controller.

9.1.2 Where on-site modifications are required to an existing controller, they shall be carried out by an authorised pre-qualified contractor as specified in Clause 1.4.4 above.

9.1.3 On-site controller modifications include such works as:

a) PROM change.
b) Addition of signal groups.
c) Addition of detection devices.
d) Addition of devices powered and/or controlled by the controller.
e) Addition of devices or cabling that interface with the controller.

Note: An STS contractor that is not authorised by the Controller Supplier, **shall not** carry out any on-site controller modification works.

9.1.4 The Controller Contractor shall organise the installation of the controller once confirmation has been received that all associated site works have been completed.

9.2 INSTALLATION

9.2.1 The contractor shall deliver the controller to site and install it on the controller foundation provided by others.

9.2.2 When the controller cabinet is installed next to the kerb or traffic lane, it shall be oriented so that the door is furthest from the traffic flow.

9.2.3 The Contractor shall carry out all works necessary for the proper installation and operation of the controller including communication with the DTP central SCATS computer.

9.2.2 The Controller Contractor shall carry out the installation of the controller in accordance with the:

a) Requirements of individual controller orders.

b) Relevant clauses of Standard Section 730.
(Table 9.1 provides details of the relevant clauses from Standard Section 730).

Clause	Requirement
730.22	**PRE_COMMISSIONING**
730.22 (a)	Confirmation that all site works are completed
730.22 (a)	Copy of Pre-commissioning report
730.22 (b)	Confirmation that power is available
730.23	**CONTROLLER INSTALLATION**
730.23	Confirmation that SLOT data is available
730.23 (a)	Notification if field works are being carried out during controller installation
730.23 (b)	Test reports provided
730.23 (c)	Installation requirements

Table 9.1 – Controller pre-commissioning and installation clauses from Section 730

9.3 COMMISSIONING

9.3.1 Once the controller installation works have been completed and the site is ready for commissioning, commissioning tests shall be conducted in accordance with the relevant clauses of Standard Section 730.24. Table 9.2 provides details of the relevant clauses from Standard Section 730.

Clause	Requirement
730.24	**COMPLETION OF SITE WORKS AND COMMISSIONING**
730.24 (a)	Commissioning participants
730.24 (b)	Flash test
730.24 (c)	SCATS connection communications confirmation
730.24 (d)	Switch-on / Commissioning
730.24 (e)	Post commissioning
730.24 (e)(3) Attachment H	Copy of Power consumption readings for unmetered sites

Table 9.2 – Controller commissioning clauses from Section 730

APPENDIX A – PUBLIC TRANSPORT PRIORITY MEASURES

(Normative)

PROVISION FOR PUBLIC TRANSPORT PRIORITY MEASURES

CONTENTS

A1 GENERAL

A1.1 Traffic signal controllers supplied under this Specification shall provide public transport priority measures specified below under all modes of operation and any number of the measures may be selected and introduced by special flags or specified inputs.

A1.2 These special flags and inputs may be set or reset by the operating mode, current plan, special tram detectors or time of day.

A2 EXTEND PRIORITY MOVEMENT (LATE EXTENSION)

A2.1 **Strategy** – Provision of an extension to the priority movement beyond the normal termination point.

A2.2 **Operation** – A specific phase called by the public transport vehicle provides time beyond that normally allocated. Other phases scheduled to run are delayed for the duration of the late extension.

A2.3 **Detection:**

Advance – To call the extension phase if the priority vehicle will not be impeded during the extension.

Stop Line – To call the extension phase; when vacated: to cancel unwanted priority time and signal the vehicle's departure.

A3 EARLY START PRIORITY MOVEMENT

A3.1 **Strategy** – The controller allows the early introduction of the priority movement.

A3.2 **Operation** – A specific phase used by the public transport vehicle is introduced at a point in the cycle in advance of its normal introduction point. The running is terminated early.

A3.3 **Detection:**

Advance – To call the phase where traffic queues would otherwise delay the arrival of the public transport vehicle at the signals.

Stop Line – to call the phase where traffic queues are not expected to be a problem (e.g. at safety zones) upon completion of the passenger loading.

A4 SPECIAL PRIORITY PHASE

A4.1 **Strategy** – The introduction of a phase into the normal sequence to cater for priority vehicles only.

A4.2 **Operation** – A phase is provided in the normal operating sequence to cater for public transport vehicles only. Such phases may provide exclusive turning opportunities for priority vehicles. Such a phase may be introduced more than once in a cycle, between other non-public transport phases.

A4.3 **Detection:**

Stop Line – To call the phase upon completion of loading/unloading and extend for successive priority vehicles.

A5 CLEARANCE PHASE

A5.1 **Strategy** – A clearance phase is provided, or extended, to clear the approach of the priority vehicle to the stop line. This is normally a leading right turn phase.

A5.2 **Operation** – A clearance phase, called by the priority vehicle, is provided to remove traffic from the path of the approaching vehicle and allow it access to the intersection stop line. It may be used in association with other options to guarantee the passage of the vehicle through the intersection.

A5.3 **Detection:**

Advance – To call and provide a permanent extension to the clearance phase.

Stop Line – To terminate the clearance phase and initiate further priority options.

A6 OMIT SELECTED PHASES FROM STANDARD CYCLE

A6.1 **Strategy** – The controller permits the skipping of nominated phases from the cycle to preferentially service priority vehicle calls.

A6.2 **Operation** – The receipt of a priority vehicle call blocks the introduction of certain nominated phases and permits the early introduction of the priority vehicle phase. A re-call is placed for the skipped phase.

A6.3 **Detection:**

Advance OR Stop Line – To inhibit the nominated phase(s).

A7 INITIATE SPECIAL SEQUENCE

A7.1 **Strategy** – The priority vehicle call initiates a special sequence of phases to service the priority vehicle.

A7.2 **Operation** – The call from the priority vehicle initiates a sequence, outside the normal cyclic order to service the priority vehicle. The local controller unlinks from the regional computer and starts a sequence of phase changes which may include a clearance phase and priority extension to immediately service the priority vehicle.

A7.3 **Detection:**

Advance – To call the special sequence including clearance phase.

Stop Line – To call subsequent priority phases and/or hold phases during loading / unloading.

Release – To cancel priority once the vehicle has departed the intersection.

A8 VARIABLE PRIORITY

A8.1 Strategy – The local controller can decide, based on a number of priority inputs, which approach (or approaches) is to be serviced at highest priority.

A8.2 Operation – The controller selects the priority phase (or phase sequence) from several alternative phases based on:

- distribution of priority demands around the intersection.
- strategic information supplied by the master.
- time of day.

A8.3 **Detection:**

Advance – To call the special sequence including clearance phase.

Stop Line – To call subsequent priority phases and/or hold phases during loading / unloading.

Release – To cancel priority once the vehicle has departed the intersection.

A8.4 The priority phase(s) are selected based on maximising expected benefit to public transport vehicles and so account needs to be taken of differences in importance attached to various priority movements.

A8.5 This form of priority is particularly useful at nodes in the public transport network where several routes intersect and where importance is attached to several routes each with conflicting phasing requirements.

A9 ACTIVE COMPENSATION

Additional compensatory phases may be scheduled as part of the local controller personality. These may only be called following priority phases and give additional time to disadvantaged movements.

APPENDIX B – FLEXILINK OPERATION

(Normative)

SPECIFICATION FOR SCATS FLEXILINK OPERATION

CONTENTS

B1 INTRODUCTION

Flexilink is a mode of linked operation in which there is a fixed cycle length for each plan. In order to give greater flexibility of efficiency over normal fixed time systems, Flexilink allows a measure of vehicle actuated control so that phases can be allowed to 'gap out' and phases that are not demanded will not run.

Flexilink plans are changed by time of day.

When connected to a SCATS regional computer, the Flexilink data is loaded into the local controller RAM through the master. Flexilink shall operate whenever the master orders Flexilink mode. If the master orders Flexilink or a fallback of Flexilink and then communications with the master are lost, the controller shall operate Flexilink using the RAM data.

B2 PHASE SEQUENCE

The controller shall allow for at least two (and preferably at least four) independent phase sequences. Where there are two sequences, the Y + signal shall select the second sequence. Where there are more than two sequences, there shall be some means of selecting sequences using the presence of any of the general signals (Y +, Z-, Z+, Q-, Q+, XSF) or combinations of these.

The Flexilink program shall check that the phase sequences entered in the personality are valid. A valid sequence must not include phases that are not defined in that personality and must not have any phase listed more than once. If the sequence is not valid, the controller shall operate Flexilink isolated and shall log a fault.

If the phase sequence changes and the running phase is not in the new sequence, then the pivot phase is assumed to be next in sequence.

B3 PIVOT PHASE

The first phase listed in the selected sequence is defined as the pivot phase.

The software shall place a permanent demand on this phase whenever the controller is operating full Flexilink.

The reference point for the start of each cycle is the call pulse for the pivot phase. This pulse may occur at any step of the cycle generator.

B4 PLAN DATA

The controller shall allow storage of at least eleven independent Flexilink plans. Each plan has data in the following format:

CL = Cycle length
A = Call A pulse
B = Call B pulse
C = Call C pulse
D = Call D pulse
E = Call E pulse
F = Call F pulse
G = Call G pulse
R- = Release signal
R+ = Release signal
Y- = Link signal
Y+ = General signal
Z- = General signal
Z+ = General signal
Q- = General/Release signal
Q+ = General/Release signal

B4.1 Cycle Length

The CYCLE LENGTH is expressed in two second steps (and should have the option in the personality of selecting 1 sec steps). Thus, an entry of 30 corresponds to a cycle length of 60 seconds. If the CL entry is zero, Flexilink isolated shall operate. The cycle generator shall increment from 0 to CL-1 in two second steps. The maximum cycle length shall be 253 steps (i.e. 506 seconds).

B4.2 Call Phase

The CALL PHASE entries specify the cycle generator steps at which the call phase pulses occur for each phase. These entries can take any value from 0 to CL-1. Any other value (normally 254) corresponds to an unused phase.

B4.3 Release Signals

The RELEASE SIGNALS (R-, R+, Q-, Q+) may be set to provide either continuous release, pulse release or no release. A value of 255 corresponds to continuous release. A value from 0 to CL-1 corresponds to pulse release. Any other value (normally 254) shall result in no release.

B4.4 Link Signal

The LINK SIGNAL (Y-) entry must be set to 255 to establish full Flexilink operation. Any other value (normally 254) shall invoke Flexilink isolated.

B4.5 General Signals

The GENERAL SIGNALS (Y+, Z-, Z+, Q-, Q+, XSF) shall be able to control at least the following facilities:

a) Time setting substitutions (e.g., walk and delay times).
b) Automatic introductions of pedestrian movements.
c) Placing phase calls.
d) Inhibiting phase calls.
e) Selection of phase sequence.
f) Masking detectors.
g) Stop extension of nominated detectors or approaches.
h) Switching “No Right Turn” or similar lanterns on and off.

These signals may be continuous, pulsed or not active as for the release signals.

B5 CALL PHASE PULSES

The occurrence of a call pulse shall cause the termination of the running phase, subject to minimum timers and movement to the requested phase if and only if:

a) The requested phase is not currently running.
b) The controller is not already proceeding to the requested phase.
c) The requested phase has a demand.
d) The requested phase has not been passed over since the controller last left the pivot phase.
e) The call phase pulse is in the correct order as specified in the selected phase sequence.
f) The transition from the running phase to the requested phase is not prohibited.

A fundamental principle of Flexilink operation shall be to service demanded phases in the same order as the selected sequence even if this means sacrificing linking. In this regard, the following shall apply:

i) Once a call phase pulse has occurred for a phase which is not demanded, it shall not be possible to go to that phase until the pivot phase is passed again.

ii) Once a phase has been passed over, it cannot run until the pivot phase is passed again.

iii) The Flexilink program shall check that the call phase pulses occur in the same order as the selected sequence. If this is not so and there is a demand for any skipped phase, then the controller shall revert to Flexilink isolated. If a call phase pulse is not next in sequence, but the skipped phase(s) have no demand, then the controller shall remain in the full Flexilink.

iv) When a call pulse occurs for a demanded phase, but the running phase is unable to terminate due to the timing of Minimum Green, Walk or Pedestrian Clearance, the call pulse shall be stored. As soon as the running phase is free to terminate, the stored pulse shall be acted on. The controller shall provide for storage of one or two such call pulses so that if call pulses continually arrive within minimum times, the phases will run further and further behind synchronisation. There shall be some means of determining when the controller is running far enough out of synchronisation to justify reverting to Flexilink isolated.

B6 LOOK AHEAD FEATURE

When a call pulse arrives for a phase which has no demand, the controller may remain in the current phase (i.e. False Green) or proceed to a demanded phase that is later in the sequence (i.e. Lookahead).

Provision shall be made in the controller personality to nominate the phases to which each call pulse can 'lookahead'. It would be preferable for the programmer to be able to make this specification independently for each sequence.

When a call phase pulse occurs and the requested phase has no 'lookahead' and no demand, then the controller may remain in the running phase. The time allocated for the requested phase is thus available to the running phase. During False Green, the controller may respond to any release that becomes active.

If the requested phase has a 'lookahead' and no demand, the controller shall proceed to the next demanded phase of those nominated in the personality, provided that no demanded phase would be passed over. If none of the nominated phases are demanded, or if a demanded phase would have to be passed over, then the controller shall remain in the running phase.

If the phase requested by the call phase pulse is the running phase or has been passed over since the controller left the pivot phase, the pulse shall be ignored completely. That is, no Look ahead can occur in such cases.

B7 PSEUDO PHASE

The pseudo phase is defined to be either the running phase or the last phase to receive a call pulse, whichever is the later in the phase sequence.

B8 RELEASE FEATURE

Whenever a release is active, the current phase shall terminate, subject to minimum timers and move to the next demanded phase in sequence if and only if:

a) The next demanded phase has not been passed over since the controller last left the pivot phase.

b) Transition to the next demanded phase is not prohibited.
c) The relevant gap or density timers have expired.

If no release is active the current phase shall not terminate until a call phase pulse occurs.

The control of when releases are active shall be achieved by the following four features:

i) Auto Release
ii) R- Release Signal
iii) R+ Release Signal
iv) Q- Release Signal
v) Q+ Release Signal

The release signals (R-, R+, Q-, Q+) can be set in the Flexilink plan data to be continuous, absent or pulsed (refer Clause A4.3).

The controller personality shall provide for each of the four release features to become active during nominated pseudo phases or the green of nominated signal groups. It would be preferable for the programmer to be able to make this specification independently for each phase sequence. It shall be possible for the release features to apply to one or more pseudo phases and/or one or more signal groups.

Auto releases and continuous release signals shall be active whenever the associated pseudo phase is current or the associated signal group is green.

Pulsed release signals shall become active from the instant the pulse occurs, providing the associated pseudo phase is current or the associated signal groups is green. The release shall remain active whenever these conditions exist.

Notwithstanding the above, if the pivot phase begins early, it shall not be able to release until after the call pivot phase pulse occurs. Thereafter, it shall be able to terminate whenever a release becomes active.

While operating full Flexilink, maximum timers shall have no effect.

B9 SCHEDULE DATA

The schedule data is used to change Flexilink plans by time of day. The controller shall allow storage of at least twenty independent schedules. Each schedule shall have data in the following format:

Date Code: Time (Hours and Minutes); Plan Number

The day code allows the specified plan number to be introduced on one day in the week or in some combination of days in the week. The day codes shall be as follows:

0 = End of Schedules
1 = Sunday
2 = Monday
3 = Tuesday
4 = Wednesday
5 = Thursday
6 = Friday
7 = Saturday

8 = Monday through Friday
9 = Monday through Saturday
10 = Tuesday, Wednesday and Thursday
11 = Monday and Friday
12 = Monday, Friday and Saturday
13 = Saturday and Sunday
14 = All days of the week
15 = No day of the week

A day code of zero shall indicate that the schedule and all subsequent schedules are not used.

The time for plan change is specified in hours and minutes, based on the 24-hour clock. Midnight shall be represented by zero hours, zero minutes.

At the exact time that a plan changes, the Flexilink cycle generator shall be set to zero.

When the controller is powered up or switched to Flexilink mode, it shall analyse the schedule data to determine what Flexilink plan should be running and the time at which the plan would have introduced. The current Flexilink cycle generator step shall be determined on the basis that the plan had been running since the last plan introduction time.

B10 FLEXILINK ISOLATED

Flexilink isolated shall operate whenever the controller is nominally in Flexilink mode under the following conditions:

a) Clock is not calibrated.
b) Phase sequence is not valid.
c) Schedule data or plan data is not valid.
d) Current plan has no Y- signal (i.e. Y- is not 255).
e) Current plan has cycle length of zero.
f) A call pulse arrived that is not in the same order as the selected sequence and there is a demand for any skipped phase.
g) The controller is running a reasonable degree behind synchronisation.

Under conditions (a) to (c) above, the controller shall operate the same phase sequence as for isolated. Under the other conditions, the controller shall adopt the phase sequence selected by the general signals in the current Flexilink plan and the general signals shall be able to invoke any special facilities.

During this mode of operation, demanded phases shall be serviced in order, under normal vehicle actuated operation, including maximum timing. No artificial demand for the pivot phase shall be placed.

The controller shall report Flexilink as the mode of operation to the master.

If the controller reverts to Flexilink isolated under conditions (f) or (g) above, it shall resume full Flexilink as soon as the running phase is synchronised with the call pulses. The Flexilink program shall provide some method of regaining synchronisation as soon as possible but without resting for too long in any phase.

B11 PEDESTRIAN RE-INTRODUCTION

The Pedestrian movements that run in the pivot phase shall be able to re-introduce the pivot phase, subject to demand, when the call pivot phase pulse occurs.

B12 PHASE STRUCTURE

The SCATS Flexilink Plan Data has been designed on the phase philosophy rather than the group philosophy. Thus, for a group controller to comply with SCATS Flexilink operation, the status of the signal groups must always comply with some phase structure. In particular, while a phase is running all the vehicle signal groups that are expected to be green in that phase must be displaying green.

If connected to a SCATS regional computer, the controller shall report the correct phase and the correct phase status.

APPENDIX C – GUIDELINES FOR PURCHASING AND INSTALLATION

(Informative)

C1 GENERAL

Controllers are ordered through a DTP 'VicRoads' Contract. Orders are placed through the ITS Asset Management Team via an approved ordering process.

For details of the approved process to order a controller, contact the ITS Asset Management Team.

C2 DETAILS TO BE INCLUDED WHEN ORDERING

When ordering a controller, the following details need to be considered and included where necessary.

- Address and site number for installation.
- SCATS version VC5, VC6.1 or VC6.2.
- If the site is required to be ELV
- Number of vehicle and pedestrian groups required.
- Number and type of vehicle detector inputs required.
- Number of pedestrian detector inputs required.
- Number of pedestrian 'WALK' (PUFFIN) detector inputs required.
- Number of pedestrian 'Wait Indicator' outputs required.
- Number of 'external input' tram detectors.
- Number of any other external inputs
- Emergency Vehicle Pre-Emption
- Railway interface.
- Special purpose inputs/outputs (SPIPS/SPOPS)
- External sign interface.
- The required dimming method (i.e. voltage dimming or 'dim-by-wire' method).
- If a connection to SCATS is required, and what type of communication network is to be used.
- If an uninterruptible power supply is to be included.
- Extension housing.

C3 PRE-DELIVERY PRODUCTION TESTS

Prior to a controller being delivered, it shall undergo Production tests as detailed in Appendix E.

C4 PRE-INSTALLATION TESTING AND ACCEPTANCE

Prior to a controller being installed, it shall undergo testing and DTP inspection as detailed in Section 8.

APPENDIX D – REQUIREMENTS FOR TYPE APPROVAL

(Normative)

D1 PREREQUISITE

Controllers submitted to DTP for evaluation must hold current approval by Transport for NSW.

D2 GENERAL

The controllers supplied shall conform to a sample previously supplied to, and formally Type Approved by, DTP. Such approval shall be signified by the issue of a Certificate of Type Approval.

No such Certificate will be issued without the Supplier providing documentary evidence of successful inspection and testing of electrical and environmental aspects to which reference is made in this Appendix by an accredited, registered testing authority.

Reference to “approved” within this specification shall mean individual components or methods that have previously been approved by DTP.

Any new item of equipment, including sub-assemblies or modules, or major re-design shall require the Supplier to resubmit the equipment for Type Approval. The Supplier shall not commence production of any new or re-designed item of equipment (including module or sub-assembly) until after receipt of written notification from DTP that type tests/ evaluation have/has been successfully completed.

All tests shall be carried out by the Supplier at his own expense under the supervision of the Superintendent or his representative. All labour and equipment required for the environmental tests shall be supplied by the Supplier.

Upon request from DTP, a sample controller shall be supplied for review, at no cost to DTP.

D3 REQUIRED DOCUMENTATION

The following documentation shall be provided with any application for approval of a controller.

a) Evidence of Transport for NSW approval (e.g. copy of Transport for NSW Type Approval Certificate.
b) Copy of Transport for NSW approval for SCATS compatibility.
c) Evidence of compliance with each clause of TSI-SP-069.
d) Evidence of compliance with each clause of this specification.
e) Evidence of field trial by Transport for NSW.
f) Details how this version of the controller differs from the previous version.
g) Current firmware release notes
h) Copies of testing documents.
i) Cabinet layout drawings
j) Electrical schematic drawing.
k) Controller Field manual.
l) Controller Technical manual.
m) Controller user manual.

n) Details of any required changes to existing test station.
o) Details of any changes to current programming requirements.

D4 REQUIRED TEST REPORTS

The Supplier shall provide the following test reports demonstrating, that the controller conforms to the following requirements.

TSI-SP-069 Clause	Requirements	Report Type
6.7	Lamp monitoring and lamp fault reporting	RMS accepted test report
8.1	Ambient conditions	NATA (or equivalent ILAC-MRA certified) test report
8.4.1	Shock	NATA (or equivalent ILAC-MRA certified) test report
8.4.2	Vibration	NATA (or equivalent ILAC-MRA certified) test report
8.5	EMC Compliance (immunity)	NATA (or equivalent ILAC-MRA certified) test report
8.6	EMC Compliance (emissions)	NATA (or equivalent ILAC-MRA certified) test report
8.7	Weather resistance	NATA (or equivalent ILAC-MRA certified) test report

TABLE D4.1 – Controller Test Report Requirements

DTP reserves the right to request other tests to demonstrate conformity with this specification and to TSI-SP-069.

D5 FIELD TEST

As specified in D3 (e) above, evidence of a successful field trial by Transport for NSW is required.

If a field trial has not been completed, DTP may consider undertaking a its own field trial. Before DTP (Roads) considered a field trial, written confirmation from Transport for NSW would be required to confirm that Transport for NSW:

1) are satisfied that the controller is fully compliant and is considered suitable for a field trial.
2) has no concerns with DTP undertaking a field trial.
3) will allow operating times from DTP field trial to count toward their own time requirements.

If a field trial is agreed to, DTP would purchase and install up to a maximum of four complete controllers at selected sites in the Melbourne Metropolitan area.

During the period of six months when the controllers are installed in the field any faults or failures which occur in the following areas of the equipment shall be repaired by the contractor and recorded by DTP:

- Control module and associated components.
- Any internal connections or connectors.
- Integral wiring of the controller.
- Manually operated switches.
- Operation under the SCATS system.
- Hinges and locks.

Upon completion of the period of evaluation the faults or failures (if any) will be analysed.

If, in the opinion of the DTP, the faults or failures could affect the long-term viability of the controller the trial may be required to continue until such time as a successful corrective action has been undertaken to eliminate any design flaws that are considered to be responsible for the faults or failures.

D6 REMEDIAL ACTION FOLLOWING FIELD TEST

If the equipment fails to pass the field test DTP will advise the Supplier to that effect. In that event the equipment shall be subjected to a second complete field test after the necessary modifications are carried out by the Supplier.

D7 TYPE APPROVAL

If the product is approved a certificate of Type Approval will be issued. Until such time as this certificate is issued, the product is not to be used in the state of Victoria for purposes other than field testing.

APPENDIX E - FACTORY PRODUCTION TESTS

(Normative)

E1 FACTORY PRODUCTION TESTS

The Supplier shall carry out the following factory production tests on each item of equipment at the completion of manufacture and prior to delivery.

a) All printed-circuit cards after assembly shall be pretested at appropriate voltage levels to exercise every available function.

b) Each computer with associated interfacing shall be subject to a heat test under normal operating conditions in the following sequence.

c) Place in an oven and raise to 70 - 75 degrees C.

(i) Once the unit reaches temperature it is to remain at that temperature for 20 minutes.
(ii) Allow unit to cool to ambient temperature.
(iii) Repeat steps (i), (ii) and (iii) twice more (making a total of three cycles).

If failure occurs during any cycle then the whole heat soaking procedure steps (i), (ii), (iii) and (iv) must be repeated. During this heat soak test the computer and the associated interfacing shall be fully exercised and its performance monitored.

Production tests shall form part of the manufacturer's Quality system.

E2 PRODUCTION TEST REPORT

Upon completion of a successful production test, a report shall be prepared. At the time of delivery, the report shall be provided with the controller.