TCS 063 - 2016

Specification for

The Installation of

Freeway Ramp Signal Control Equipment

March 2016

keeping victorians connected

TCS 063 – 2016

Foreword

This specification has been developed by VicRoads. 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 VicRoads.

VicRoads Standard Drawings, Specifications and Guidelines are available for downloading from VicRoads website at the following address under 'Tenders & Suppliers', http://www.vicroads.vic.gov.au/itsspecs

Specification updates. VicRoads 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 VicRoads specifications to ensure that they have the latest version and associated amendments.

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Revision History

Revision	Date	Description
A	March 2016	2016 version released

PREFACE

A. TELECOMMUNICATIONS EQUIPMENT

A.1 All telecommunications equipment shall comply with relevant requirements of the Australian Communications and Media Authority (ACMA). Such equipment shall be labelled with a Regulatory Compliance Mark.

B. CHANGES TO THIS SPECIFICATION

B.1 This edition of the specification has been fully revised and reformatted. The main changes to this specification from the previous version are listed below:

- Updated to reflect current Field Processor in use
- Updated facility switch
- Reformatting

The following table details versions to this specification:

Date	Revision Owner	Purpose of Revision
March 2016	VicRoads ITS	Specification fully revised and reformatted
December 2013 (Original)	VicRoads ITS	Specification first released

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SECTION 1 SCOPE AND GENERAL

1.1 SCOPE

1.1.1 This specification covers the requirements for the installation and commissioning of Ramp Signal Controllers (RSC) and Field Processors (FP) within a ITS Field cabinet for use by VicRoads within the state of Victoria.

1.1.2 This specification only applies to VicRoads approved RSC.

1.1.3 It is assumed that individual contract requirements will specify that VicRoads shall supply the following items:

- Field Processor(s);
- Ramp Signal Controller(s); and
- Site test application software.

1.1.4 The Contractor shall provide all other necessary equipment and materials to install and commission the RSC and the FP.

1.2 GENERAL

1.2.1 Ramp Signal Controllers are used to operate:

- Traffic signals associated with Ramp Metering on freeway entry ramps; and
- Ramp Control Signs, RC1, RC2 and RC3.

1.2.2 Ramp Signal Controllers are connected the VicRoads ITS Platform via an FP.

1.2.3 Typically, RSC and FP are housed within an ITS Field Cabinet together with other ITS related equipment.

1.2.4 This specification assumes that the RSC and FP are being installed within an existing ITS Field Cabinet.

1.2.5 References to ‘cabinet’ within this specification shall be deemed to refer to the ITS Field Cabinet.

1.3 INTELLECTUAL PROPERTY

1.3.1 In relation to all intellectual property used in, or to operate, Freeway Ramp Signals, the contractor grants to VicRoads non exclusive licence to “use, modify and/or sell” or do anything else that without the licence, could be breach of the licensors Intellectual Property. Intellectual Property shall include, but not be limited to, the following:

- Software;
- Source code;
- Schematic diagrams;
- Circuit and wiring diagrams;
- Listings of components and sub-components;
- Any and all operational and maintenance documentation

SECTION 2 RELATED SPECIFICATIONS AND DRAWINGS

2.1 GENERAL

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

2.1.2 All installation works shall conform to the relevant VicRoads specifications and related specifications and standards as indicated throughout this document.

2.1.3 Where no specific reference is made to an Australian Standard, the materials and processes used shall conform to the relevant Australian Standard or generally accepted practice.

2.1.4 The following related Australian Standards are referenced:

AS/NZS 3000	Wiring Rules
AS 60038	Standard voltages

2.1.5 The following VicRoads documents are referenced:

TCS 061	ITS Field Cabinet

2.1.6 The following additional documents are referenced:

STREAMS	VicRoads ITS platform

SECTION 3 ACRONYMS AND ABBREVIATIONS

3.1 ACRONYMS AND ABBREVIATIONS

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

ACMA	Australian Communications and Media Authority
AS	Australian Standard
CMS	Changeable Message Sign
FP	Field Processor
RC1	Ramp Control/Metering Sign Type 1
RC2	Ramp Control/Metering Sign Type 2
RC3	Ramp Control/Metering Sign Type 3
IP	Ingress Protection (degree of protection)
ITS	Intelligent Transport System
LED	Light Emitting Diode
NZS	New Zealand Standard
RSC	Ramp Signal Controller

SECTION 4 PREREQUISITES

4.1 GENERAL

4.1.1 The items listed in Table 4.1 are provided as a guide to the items required when installing a RCS into an existing ITS Field Cabinet.

4.1.2 It is assumed that the existing ITS cabinet has power available.

Item	Notes
Laptop computer with serial interface	Required for testing field access to field processor
Site Test Application Software	A software application that allows the Contractor to perform a site-test, checking the connections of all equipment on site (to be provided to the Contractor by the Superintendent).
Test dongle	May be required to be inserted into the Field Processor, prior to performing site test (to be provided to the Contractor by the Superintendent if required).
DB9F x DB9F cable	Connects laptop to field processor console for field processor configuration changes (if required)
Network Switch	May be required for connecting the laptop to the local network. To allow network connection between the FP and the laptop, and possibly the vehicle detector if it requires a network connection.
Network cable	Cat5e or Cat6 patch cable to connect the laptop to the local network switch
RS232 loopback plug	Testing a field processor SIO port configured for RS232
RS422 loopback plug	Testing a field processor SIO port configured for RS422
Configured site identifier	Required to identify site

Table 4.1 – Items required for installation works

SECTION 5 INSTALLATION

5.1 FIELD PROCESSOR

5.1.1 The FP and associated power supply will be provided as a single unit pre-mounted on a 19" rack shelf.

5.1.2 The assembly will include all cables required to connect the FP to the power supply and the power supply to mains supply.

5.1.3 The shelf with the FP and power supply shall be installed in the top, rear section of the cabinet as shown in Figure 1.

5.1.4 The FP is intended to be accessible through the cabinet's rear door.

5.1.5 Install the FP with four rack nuts and screws that are supplied with the FP assembly.

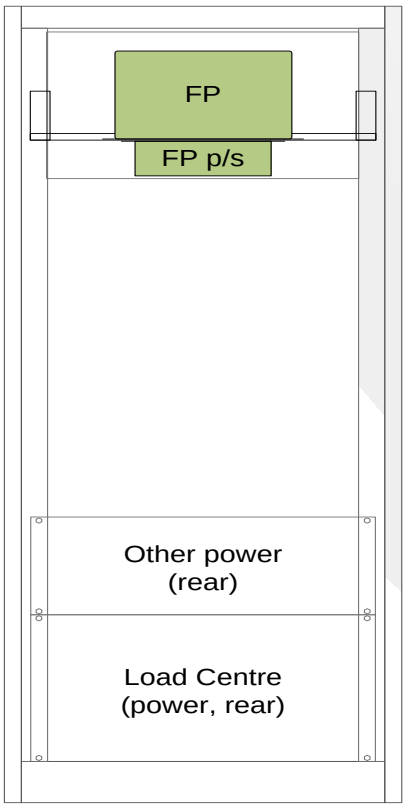

Figure 5.1 - Field Processor Mounted in top rear section of cabinet

5.2 RAMP SIGNAL CONTROLLER

5.2.1 The RSC will be provided complete with a 19” rack frame for installation directly into the cabinet.

5.2.2 The assembly will include all cables required to connect the RSC to associated cabinet equipment.

5.2.3 The RSC shall be installed in the top, front section of the cabinet as shown in Figure 5.2.

5.2.4 The RSC is intended to be accessible through the front cabinet door.

5.2.5 Install the RSC with four rack nuts and screws that are supplied with the RSC.

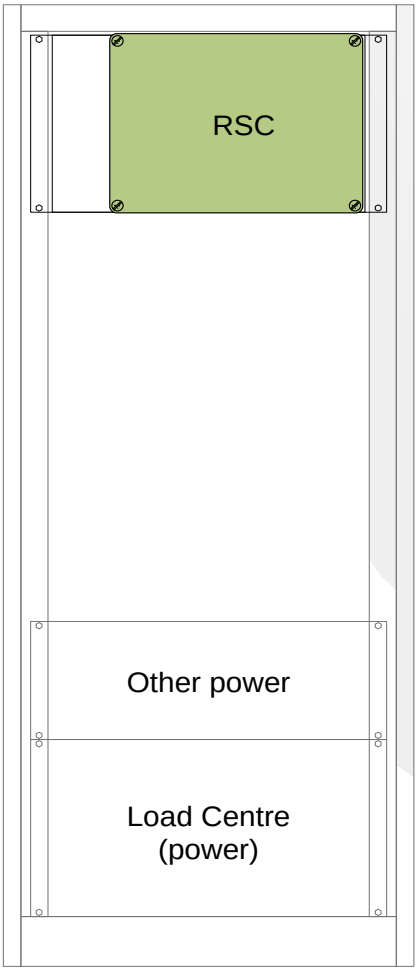

Figure 5.2 - Ramp Signal Controller Mounted in top front section of cabinet

5.3 FACILITY SWITCH

5.3.1 RSC shall incorporate a manual override switch (i.e. facility switch) located on the outside of the ITS Field Cabinet.

5.3.2 The facility switch shall be operated via a standard VicRoads facility key.

5.3.3 The facility switch shall be supplied complete with a wiring harness.

5.3.4 The facility switch shall be located on the left side of the cabinet as shown in Figure 5.3.

5.3.5 The facility switch label shall typically be riveted to the outside of the ITS Field cabinet in the location shown in Figure 5.3.

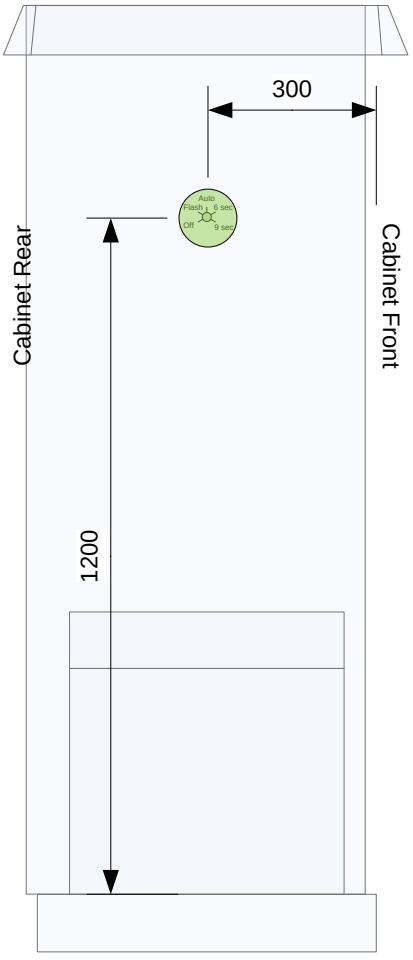

Figure5.3 - Facility Switch

5.3.6 Two types of facility switch are typically used with Ramp Signals. They are a:

- 3 way facility switch (see Figure 5.4); and a
- 5 way facility switch (see Figure 5.5).

5.3.7 The type required will be specified in individual tender documents.

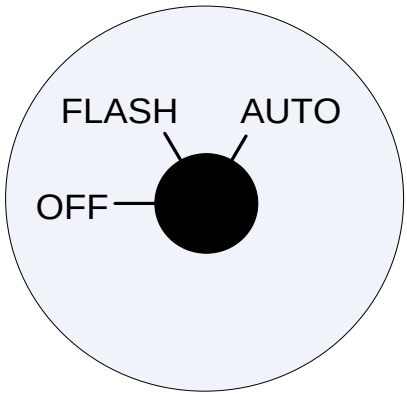

Figure 5.4 - 3-way facility switch

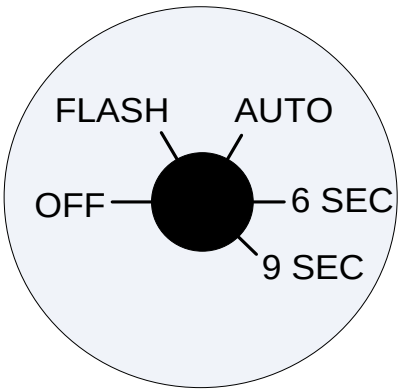

Figure 5.5 - 5-way facility switch

SECTION 6 CONNECTIONS

6.1 CONNECTION DIAGRAM

6.1.1 The connection diagram in Figure 6.1 shows the connections between the field processor, Ramp Signal Controller and other equipment in the cabinet.

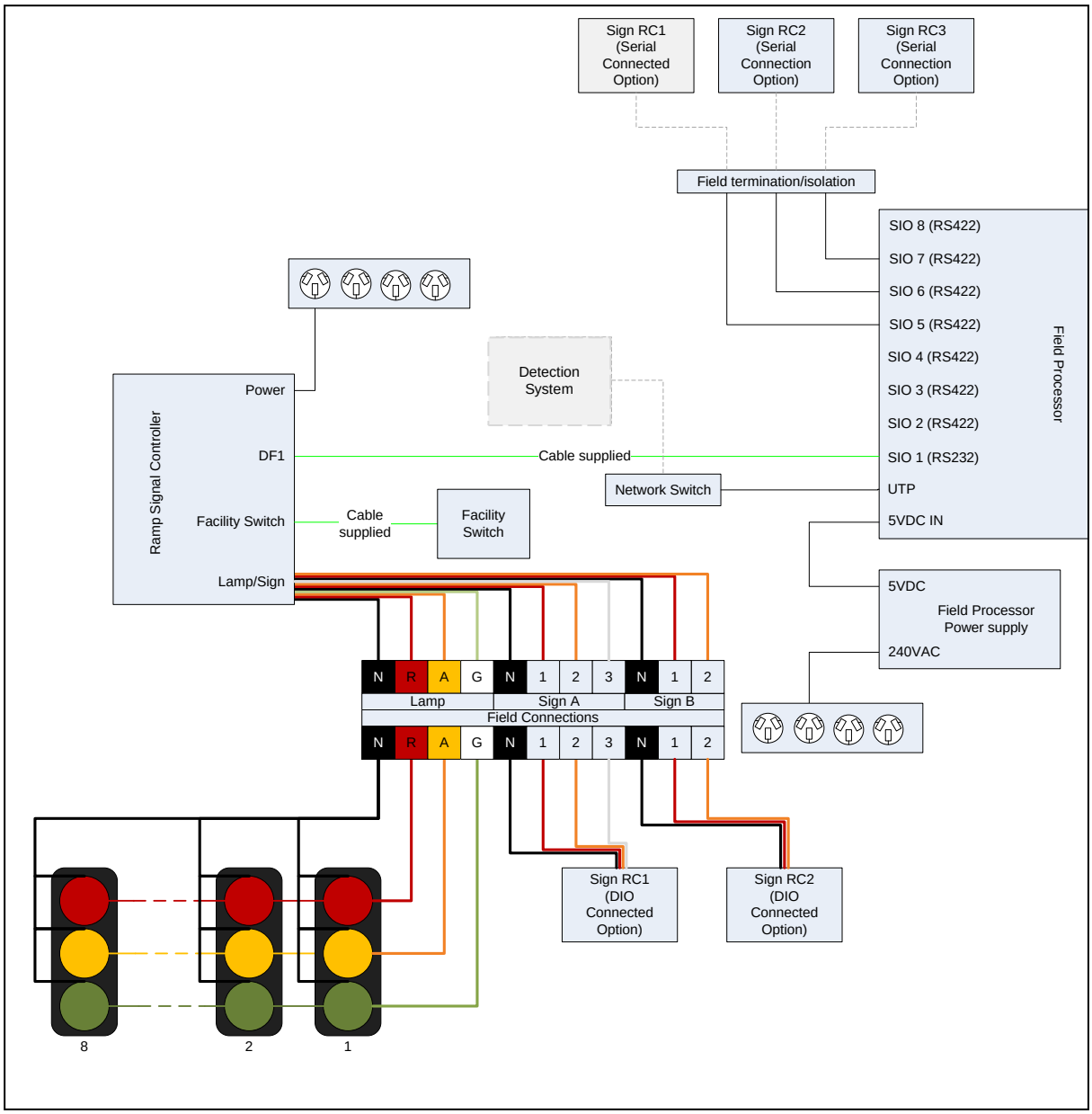

Figure6.1 - Field Processor - Ramp Signal Controller connections

6.1.2 The MM Series Field Processor Connections in Figure 6.2 shows the connections referred to in subsequent sections when making connections to the field processor.

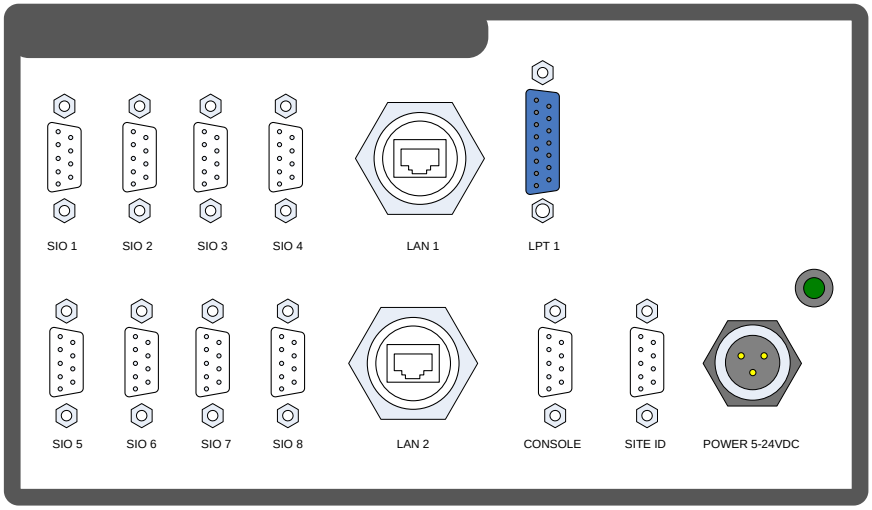

Figure 6.2 – FP.IT-08 Field Processor Connections

6.1.3 The Ramp Signal Controller Connections in Figure 6.3 shows the connections referred to in subsequent sections when making connections to the Ramp Signal Controller.

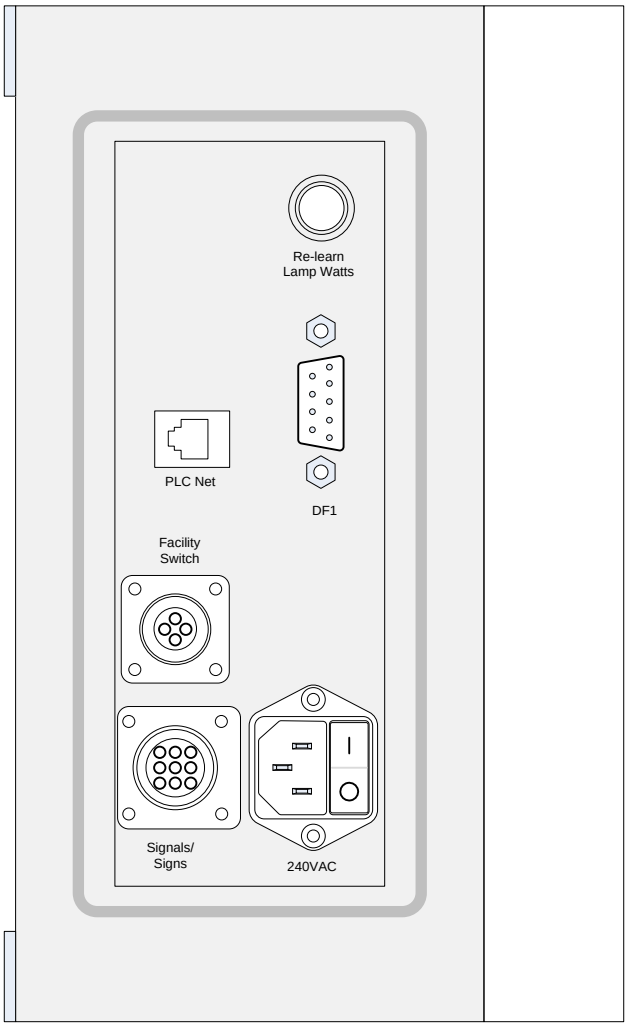

Figure 6.3 - Ramp Signal Controller Connections

6.1.4 Cables supplied with the FP and RSC will be of a suitable length to be routed and loomed as shown in Table 6.1.

From	To	Notes
Field Processor Power Supply – 5VDC	Field Processor 5VDC IN	This connection is made at the factory
Field Processor Power Supply – 240VAC	Socket outlet	Connect the FP power supply cable to the FP plug top and an appropriate socket outlet. This cable is supplied.
Field Processor SIO – other	RC1, RC2 and RC3 serially connected signs	There are eight serial ports available on the FP. From the factory SIO 2 – 8 are configured for the RS422 protocol. Connect signs according to site design.
Field Processor UTP	Existing network switch	The network switch will only be available if the field network has been installed. If the field network has not been installed you must use a network switch for testing (see Section 4 Prerequisites).
Ramp Signal Controller power	Socket outlet	Connect the power supply cable to the RSC plug top and an appropriate outlet. This cable is supplied.
Ramp Signal Controller DF1	Field Processor SIO 1	This cable is supplied with the RSC and is shipped connected to the Ramp Signal Controller. Make the connection to the FP SIO 1.
Ramp Signal Controller facility switch	Facility switch	The facility switch must be installed prior to this connection being made. See Section 5.3 for installation procedures. Attach the connector from the facility switch to the RSC.
Signals / signs	Field connections	Connect signals / signs as per Figure 6.1. The signals / sign cable is fitted to the RSC at the factory. The cable has tails loomed into three groups labelled. 1. Lamps (signals) 2. Sign A (RC1 signs) 3. Sign B (RC2 signs) These outputs are used for driving signs with sign faces that are driven by a voltage input.

SECTION 7 ELECTRICAL REQUIREMENTS

7.1 GENERAL

7.1.1 All works shall comply with the requirements of AS/NZS 3000.

7.1.2 All cables and wires shall be insulated with a material with a degree of protection not inferior to V-90 grade PVC and shall be suitably labelled.

7.2 OPERATING VOLTAGE

7.2.1 The mains supply voltage shall be deemed to be 230Vac +10%, -6% in accordance with AS 60038 Section 2. The system and or sub-elements of the system shall be capable of operating satisfactorily from the same within ±15 %.

7.3 ELECTRICITY SUPPLY

7.3.1 Each RSC and FP shall be powered via the supplied cable connected to a power board.

7.4 INTERNAL PROTECTION

7.4.1 All equipment associated with the RSC shall be protected against damage resulting from:

- Lightning strikes at or near the sign/gantry;
- Electrical transients on power cabling;
- Electrical transients on communications wiring;
- Radio frequency interference;
- Static electrical discharge; and
- Any harmonics arising from the above and any equipment in the cabinet.

7.5 RAMP CONTROL SIGNS - ELECTRICAL SUPPLY

7.5.1 RC1 Signs **shall** be powered by the traffic signal controller.

7.5.2 RC2 Signs shall be powered by a mains supply voltage sourced from the associated Ramp Signal Controller.

7.5.3 RC3 Signs shall be powered by a separate point of supply (POS) as agreed to by the Superintendent.

SECTION 8 SITE TEST

8.1 INTRODUCTION

8.1.1 Upon completion of installation, a site test shall perform by the Contractor. The site test will be used to determine the following:

1. Correct wiring and operation of RSC to all attached elements including lanterns, facility switch, and dynamic signs (if DIO from the RSC is used to drive dynamic signs).

2. Communications established between the FP and the RSC.

3. Communications established between the FP and any dynamic signs connected via the serial ports on the FP.

4. Communications established between the FP and any vehicle detectors.

8.1.2 The site test application software shall be used by the Contractor for the purposes of Subsystem Integration Testing (SIT).

8.1.3 The Contractor shall install the application on a laptop suitable for use in the field; an IP network connection using the temporary network switch (provided by the Contractor) between the laptop and FP shall be required to run this application.

8.1.4 The SIT shall involve a series of sub-tests where various elements are tested.

8.1.5 Following this, a report is to be generated which shall be saved and submitted to the Superintendent.

8.2 SUBSYSTEM INTEGRATION TESTING REQUIREMENTS

8.2.1 The following shall be required to perform the SIT:

a) Site-Test Application software (to be provided to the Contractor by the Superintendent).

b) Ethernet cables and/ or switch to allow network connection between the FP and the laptop (to be provided by the Contractor)

Note: the FP will require a network connection to the laptop and the vehicle detector.

c) Instructions for configuring the application and running the test (to be provided to the contactor by the Superintendent).

d) A test dongle to be inserted into the FP, if it is required (to be provided to the Contractor by the Superintendent).

8.3 SITE-TEST PROCEDURE

8.3.1 General

8.3.1.1 This section describes a typical procedure for undertaking a site test.

8.3.1.2 The following procedure is provided as a guide and not as an exhaustive test procedure.

8.3.2 Site Equipment Connections

8.3.2.1. Prior to testing the equipment on site, the Contractor shall need to determine which devices are connected to particular ports of the FP. The RSC shall always be assigned to serial port SIO1.

8.3.2.2 Through a simple user interface, the Contractor shall be able to choose which device is connected to each serial port from the following list:

- Nothing
- Ramp Signal Controller
- RC1 Sign
- RC2 Sign
- RC3 Sign

8.3.2.3 The Contractor shall also enter an IP address for vehicle detection access point if installed for this site.

8.3.2.4 The application shall then run through tests appropriate for each of the devices installed at this site (see sections below).

8.3.3 Ramp Signal Controller Test Procedure

8.3.3.1 Tests shall be carried out in accordance with Appendix B of this specification.

8.3.4 Site Test Report

8.3.4.1 Once all devices at a site are tested, the application generates a site test report showing details for the test. Upon successful completion of the test, the Contractor must submit a signed copy of the test report to the Superintendent.

APPENDIX A

VICROADS ITS PLATFORM

(Informative)

A1 GENERAL

A1.1 VicRoads ITS communications/control platform currently uses the STREAMS system.

A1.2 STREAMS is owned and maintained by Transmax Pty Ltd, a Queensland based company which is part of Queensland Main Roads.

A1.3 STREAMS is an integrated control system which is being used by VicRoads to operate its ITS Freeway Management Devices on Melbourne's freeway network.

A1.4 All ITS field devices must be compatible with STREAMS.

A1.5 Typical ITS field devices connected to and operated by STREAMS include:

- Variable Message Signs (VMS)
- Freeway Data Stations (FDS)
- Ramp metering/control signs
- Lane Use Signs (LUS)

A1.6 The above devices are typically connected to STREAMS via a Field Processor (FP).

A2 FIELD PROCESSOR

A2.1 The FP is used to interface internet protocol (IP) and serially connected field devices to STREAMS.

A2.2 Communications between the FP and the ITS Field Device is typically RTA protocol.

A2.3 The FP is typically installed within an ITS Field Cabinet.

A2.4 The ITS Field Cabinet is typically located adjacent to the freeway.

A2.5 In some situations, the FP may be located in VicRoads building at Kew.

A2.6 RSC connected to STREAMS typically use fibre optic cable or wireless connection between VicRoads and the Field Processor (FP).

A2.7 A RSC is typically connected to the FP via a copper cable.

A2.8 A typical STREAMS connection schematic is shown in Figure A1.

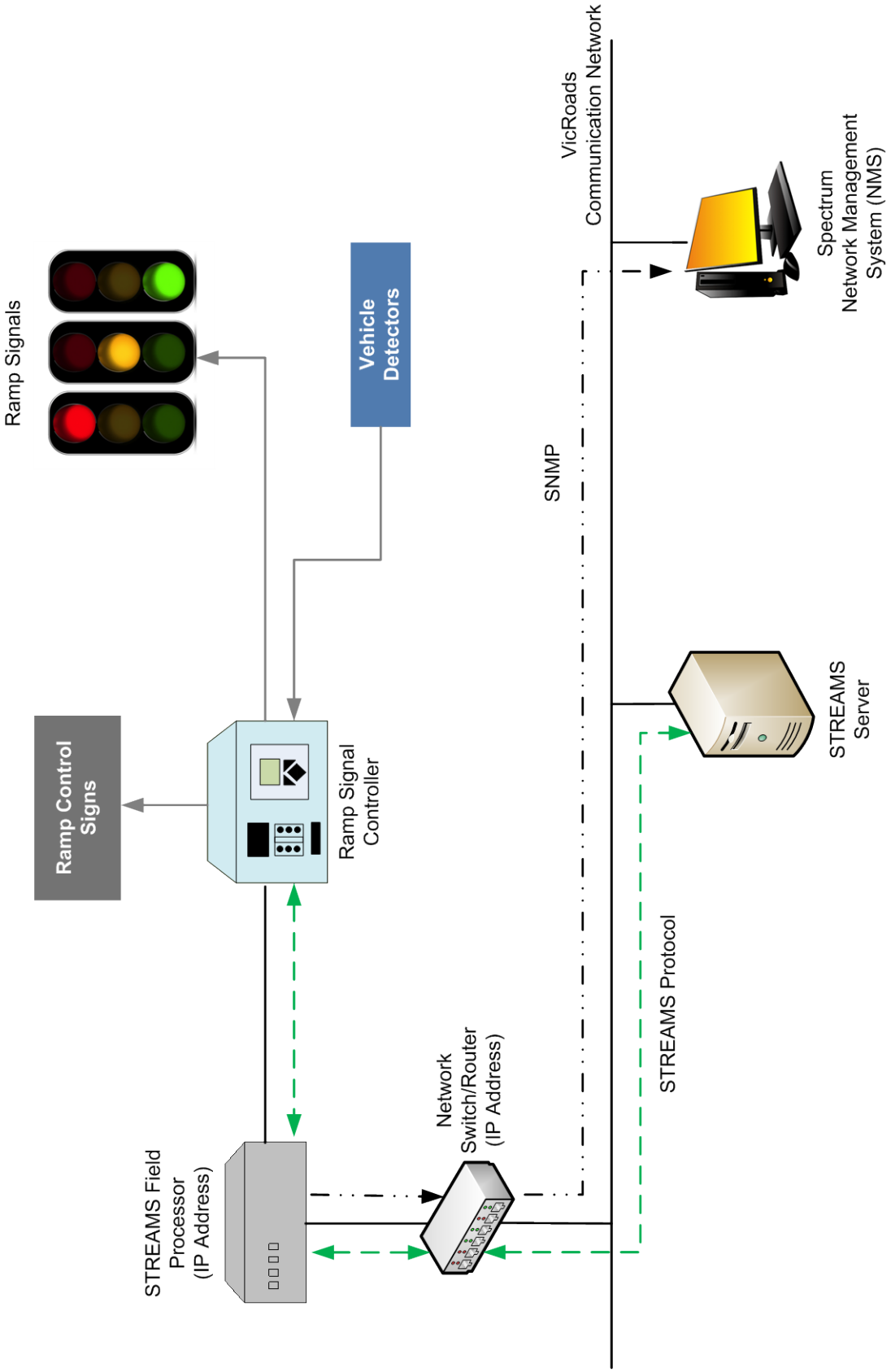

Figure A1 - RSC connected to STREAMS

A3 COMPLIANCE WITH STREAMS

A3.1 RSC must be fully compliant and compatible with STREAMS.

A3.2 To ensure compliance with STREAMS, the supplier shall obtain a compliance certificate from Transmax Pty Ltd for operation on VicRoads system.

A3.3 A copy of Transmax Pty Ltd certification shall be provided to VicRoads.

A4 SPECTRUM NETWORK MANAGEMENT SYSTM

A4.1 The Spectrum Network Management System (Spectrum NMS) is a communications monitoring/management system used to monitor/manage IP addressable devices connected to the VicRoads communication network.

A4.2 Spectrum NMS can be used to monitor/manage any device that has an IP address without any modification required by the device.

APPENDIX B

RAMP SIGNAL CONTROLLER - TEST PROCEDURE

Site Number: _____ Date: _____

Site Name: _____

Ramp Signal Controller Operation Test Report			
Test		**Required Result**	**Test Completed**
Lamp Outputs and Operation Test			
1	Application drives signal group **Red** ON	All signal group **Red** displays ON	
2	Application drives signal group **Yellow** ON	All signal group **Yellow** displays ON	
3	Application drives signal group **Green** ON	All signal group **Green** displays ON	
Facility Switch Operation Test			
4	Facility switch in **OFF** position	Application confirms "**Off**" ok	
5	Facility switch in **AUTO** position	Application confirms "**Auto**" ok	
6	Facility switch in **FLASH** position	Application confirms "**Flash**" ok	
7	Facility switch in **6 SEC** position	Application confirms "**6 Sec cycle**" ok	
8	Facility switch in **9 SEC** position (where provided)	Application confirms "**9 Sec cycle**" ok	
Operation of the RSC via the FP			
9	User prompted to confirm facility switch is in the "Auto" position	Correct operation of ramp signals.	
Operation of Serial Controlled RC1 and RC2 Signs			
10	Application drives blank message to sign	confirm no message is displayed	
11	Application drives message to sign	confirm no message is displayed	
Operation of Serial Controlled RC3 Sign			
12	Application sends test messages to sign in various combinations	confirm no message is displayed	
Communications with Detector Access Point			
13	Application queries access point	Correct response from access point	