

# Roads

## Master Specification

### RD-ITS-S7 Supply and Installation of Vehicle Detector Systems

#### Document Information

K Net Number:	13508277
Document Version:	2
Document Date:	August 2020

DEPARTMENT FOR  
INFRASTRUCTURE  
AND TRANSPORT



Government of South Australia

Department for Infrastructure  
and Transport

## Document Amendment Record

Version	Change Description	Date	Endorsement record (KNet ref.)
1	Initial issue (formerly R69)	02/07/19	
2	Formatting for publishing	August 2020	

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# RD-ITS-S7 Supply and Installation of Vehicle Detector Systems

## 1 General

- 1.1 This part specifies the requirements for the supply and installation of vehicle detector systems, which provide traffic data for analysis by the Principal's traffic management system. It shall be read in conjunction with RD-ITS-S1 "General Requirements for the Supply of ITS Equipment" and if installation is to be undertaken, RD-ITS-C1 "Installation and Integration of ITS Equipment". The vehicle detector systems detect vehicles by recording an inductance change caused when a vehicle passes over a loop buried in the road surface.
- 1.2 Documents referenced in this Part are listed below:
- a) AS 2703 Vehicle Loop Detector Systems.
  - b) AS/NZS 2276.2 Cables for Traffic Signal Installations. Part 2: Feeder Cable for Vehicle Detectors.
  - c) AS 2578 Traffic Signal Controllers.
  - d) AS/NZS 3000 Electrical Installations (known as the Australian/New Zealand Wiring Rules).
  - e) AS/NZS 3100 Approval and Test Specification – General Requirements for Electrical Equipment.
  - f) AS/NZS CISPR 22 Information Technology Equipment – Radio Disturbance Characteristics – Limits and Methods of Measurement.
  - g) AS/NZS ISO 9001 Quality Management Systems – Requirements.
  - h) AS/NZS 61000.6.1 Electromagnetic Compatibility (EMC) – Generic Standards – Immunity for Residential, Commercial and Light-Industrial Environments.
  - i) ANSI/NEMA TS1 Traffic Control Systems.

## 2 Quality Requirements

- 2.1 The Contractor shall prepare and implement a Quality Plan that includes or annexes the following documentation:
- a) design documentation in accordance with RD-ITS-D1 "Design for Intelligent Transport System (ITS)";
  - b) Acceptance Test Plans (refer RD-ITS-S1 "General Requirements for the Supply of ITS Equipment", Clause 13 "Testing and Acceptance"), which provides full details of all tests necessary;
  - c) routine maintenance recommendations;
  - d) Training Plan refer RD-ITS-S1 "General Requirements for the Supply of ITS Equipment", Clause 15 "Training";
  - e) spare part requirements;
  - f) manufacturer's specifications (catalogue extracts) of all major components detailing ratings and performance characteristics; and
  - g) all layout, fabrication, interconnection and assembly drawings and diagrams necessary for this Contract.
- 2.2 The provision of the quality plan documentation shall constitute a **Hold Point**.
- 2.3 The Contractor shall provide evidence of STREAMS compatibility in accordance with RD-ITS-D1 "Design for Intelligent Transport System (ITS)" and RD-ITS-S1 "General Requirements for the Supply

- of ITS Equipment”, Clause 6 “STREAMS”. The evidence of STREAMS compatibility shall constitute a **Hold Point**.
- 2.4 The Contractor shall provide samples for acceptance in accordance with RD-ITS-S1 “General Requirements for the Supply of ITS Equipment”, Clause 3 “Equipment Requirements”. Provision of the samples listed in this Clause shall constitute a **Hold Point**.
  - 2.5 If not submitted beforehand, the samples and documentation required by this Clause shall be submitted at least 20 working days prior to the commencement of site work or placing an order for Equipment.

## 3 Equipment Requirements

### General Configuration

- 3.1 The vehicle detector system shall include Equipment suitable for mounting in a roadside traffic management cabinet with a 10” racking system. The vehicle detector system integrates the vehicle detector module / rack, vehicle loop detector sensor / card, power supply and field processor interface card. The vehicle detector system includes the loop feeder terminal panel and its associated cabling to the vehicle detector module. The vehicle detector system may be rack-mounted.
- 3.2 All detection Equipment shall conform to the functional and operational requirements of AS 2703.

### Vehicle Detector Module

- 3.3 The Vehicle Detector module may be either stand-alone or rack mountable. Rack-mounted vehicle detector systems should be 19” for installing in roadside Traffic Management field cabinets.
- 3.4 The Vehicle Detector module shall have a minimum capacity of 24 vehicle loops. The rack should occupy minimal space in the cabinet. Components in the rack should be connected using industry standard connectors. The Vehicle Detector module should be constructed of Aluminium.

### Vehicle Loop Detector Sensor

#### General

- 3.5 The materials and form of construction of the vehicle detector sensor unit, including the protective enclosures for independent sensor units, shall comply with the requirements of AS2703 Section 2.

#### Dimensions

- 3.6 Rack-mounted sensor units shall comply with the requirements for either ANSI/NEMA TS1 Part 15, Standard Eurocard Format or equivalent.

#### Channels

- 3.7 The sensor unit shall be multi-channel with either 4 channels or 8 channels per sensor unit.

#### Operating Modes

- 3.8 Each individual loop detection channel shall be able to operate in either passage or presence detection mode.

#### Operational Performance

- 3.9 The operational performance of the sensor unit shall comply with AS 2703 Section 4. Presence times and sensitivities should be individually selectable for each channel by DIP switches on the front panel of the sensor unit.
- 3.10 The operating frequencies of the sensor unit shall lie within the range 10 kHz to 150 kHz. The frequency may be selected by a DIP switch mounted on the printed circuit board or an operator terminal. The detector sensor shall automatically tune on power-up and manual reset when the inductance connected across its input terminal lies within the range 50uH to 700uH and a Q-factor in the range of:

- a) 5 to 50 below 60 kHz; and
- b) 3 to 50 above 60 kHz.

3.11 The operating temperature and humidity shall comply with the requirements of AS 2703 Section 4.16.

#### Electrical Requirements

3.12 The power supply shall be suitable for connection to a nominal 230 Volt, 50 Hz earthed-neutral electricity supply.

#### Light Emitting Diodes (LEDs)

3.13 LEDs on the faceplate shall comply with AS 2703 Section 3. The LEDs shall operate on vehicle detection, power failure, or if the loop terminals are short circuited or open circuited. Each channel shall have an associated LED.

#### Interaction (Crosstalk)

3.14 The detector sensor shall comply with the requirements of AS 2703 Section 4. The detector sensor should employ sequential channel sampling or a similar technique to eliminate crosstalk between loops connected to the same module.

#### Reset Pushbutton

3.15 The sensor unit shall have a reset pushbutton on the front panel.

#### Susceptibility to Interference

3.16 The sensor unit shall comply with the requirements of AS 2703 Section 4. The sensor shall be capable of operating without fault in the presence of induced electrical noise introduced via the input terminals.

#### Accuracy

3.17 The required accuracy of traffic count data is  $\pm 2\%$  or better where individual vehicle speeds are between 20 km/hr and 100 km/hr. Accuracy below this speed shall be stated in the manufacturer's specifications.

## Field Processor Interface

#### General

3.18 The vehicle detector system shall provide a serial communications interface for connection to the Field Processor. The serial interface shall use a serial communications protocol compatible with the Field Processor. The serial interface shall provide information about detector status, fault status, all switch settings (including those on the detector) and software version.

#### Field Processor Header Pinouts

3.19 The vehicle detector system may also provide either a solid-state or relay output contact closure to the Field Processor through a 50 way ribbon cable connector. The solid-state or relay output contact closure and 50 way ribbon cable shall be supplied with the vehicle detector system in accordance with this section.

3.20 The 24 TTL digital I/O lines on the Field Processor are provided by an 82C55 chip. Each line can source 2.5 mA in a logic 0 state and sink 2.5 mA in a logic 1 state. The I/O lines are unbuffered – that is, there is a direct connection between the 82C55 and the I/O header. All I/O lines are connected to +5V through 10K $\Omega$  pull-up resistors

3.21 The Digital I/O lines are accessed through 50-pin headers. They provide 24 digital I/O lines, +5, and ground. Pin 1 is in the upper right corner of the board. The keyed part of the connector is on the left hand side. Pin 50 in the lower left hand corner is the +5V. Pin 49 in the upper left corner of the board is ground. The next horizontal pair (pin 47 and pin 48) is loop 1 input.

3.22 The pinouts for the Field Processor Header pinouts shall be Opto 22 Standard.

3.23 Field Processor Header Pinout shall comply with Table RD-ITS-S7 3-1.

**Table RD-ITS-S7 3-1 Field Processor Header Pinouts**

Loop 24	A7	1	2	Gnd
Loop 23	A6	3	4	Gnd
Loop 22	A5	5	6	Gnd
Loop 21	A4	7	8	Gnd
Loop 20	A3	9	10	Gnd
Loop 19	A2	11	12	Gnd
Loop 18	A1	13	14	Gnd
Loop 17	A0	15	16	Gnd
Loop 16	C7	17	18	Gnd
Loop 15	C6	19	20	Gnd
Loop 14	C5	21	22	Gnd
Loop 13	C4	23	24	Gnd
Loop 12	C3	25	26	Gnd
Loop 11	C2	27	28	Gnd
Loop 10	C1	29	30	Gnd
Loop 9	C0	31	32	Gnd
Loop 8	B7	33	34	Gnd
Loop 7	B6	35	36	Gnd
Loop 6	B5	37	38	Gnd
Loop 5	B4	39	40	Gnd
Loop 4	B3	41	42	Gnd
Loop 3	B2	43	44	Gnd
Loop 2	B1	45	46	Gnd
Loop 1	B0	47	48	Gnd
	+5	49	50	Gnd

#### Digital I/O Circuitry

3.24 The Digital I/O Circuitry shall comply with Table RD-ITS-S7 3-2.

**Table RD-ITS-S7 3-2 Digital I/O Circuitry**

Aspect	Details
Chip	82C55A
Number of I/O lines	24
Direction	All lines programmable for input or output in groups of 4/8
Input voltage	Low: 0.5 Vmin, 0.8 Vmax High: 2.0 V min, 5.5 V max
Output voltage	Low: 0.0 V min, 0.4 V max High: 3.0 Vmin, Vcc-0.4 Vmax
Output current	±2.5 mA max, each line
Pullup resistors	10 KΩ all lines

#### Power Supply Card

3.25 The Equipment shall operate on a mains power supply of 230 Vac 50 Hz. The power supply input should be fused, isolated from the detector sensors and operate at 230 Vac ±10%. The power output from the power supply card should be fully protected against short circuit conditions and provide overload voltage protection.

- 3.26 An illuminated main power switch should be located on the front faceplate to indicate primary power. LEDs should be used to indicate regulated output voltages. These shall be located on the front faceplate. A power lead shall be provided.

#### Loop Feeder Terminal Panel

- 3.27 Loop feeder cables shall comply with the requirements of AS 2276.2. The vehicle detector system shall connect to the loop feeder cables via the loop feeder terminal panel. The loop feeder terminal panel shall provide terminal strips for 24 vehicle detector loops.
- 3.28 Cable looms are to connect the loop feeder terminals to the vehicle detector module. The cable loom shall provide a minimum of 24 vehicle detector inputs.
- 3.29 Each set of adjacent terminals is a designated pair, and the conductors of each pair shall be twisted together for the entire length of the loom. All cables within the harness or loom leading from the loop feeder terminal panel or terminal strip to the vehicle detector module shall incorporate screening and / or noise suppression. The loom connecting the loop feeder terminal panel should have a length of 1 metre.

#### Electromagnetic Compatibility

- 3.30 All equipment shall be tested and approved to comply with the electromagnetic compatibility requirements of either AS 4252.1 or AS CISPR 22.

## 4 Configuration of Delivered Equipment

- 4.1 The vehicle detector module / rack, vehicle loop detector sensor, loop feeder termination panel and cable shall be ordered and supplied as separate entities. The vehicle detector module shall include the power supply card, Field Processor interface card and cable, and serial communications card. The vehicle detection Equipment shall be securely packed and sealed to prevent damages.
- 4.2 To facilitate redundant capacity minimisation, the vehicle detection Equipment shall be supplied in a basic configuration than is then expandable if required with the purchase and installation of additional modules.
- 4.3 The optimum basic configuration for the data collection Equipment an processing module is define in terms of the minimum number of vehicle detector loop as follows:

**Table RD-ITS-S7 4-1 Optimum Basic Configurations**

Equipment	Configuration
Vehicle Detector Module / Rack	<ul style="list-style-type: none"> <li>• 24 vehicle detector inputs (minimum)</li> <li>• Min 24 vehicle detector outputs (minimum)</li> </ul>
Vehicle Detector Loop Terminal Panel and Cable	Minimum 48 terminals
Vehicle Detector Sensor	Minimum 4 channels

## 5 Operational Availability

- 5.1 All Equipment supplied shall have an operational availability of 99.8%, excluding down time created by the Principal. In the event of a defect occurring during the defects liability period, the Contractor shall provide the Principal with details on the course of action to be undertaken within four hours of notification of the defect.

## 6 Hold Points

- 6.1 The following is a summary of Hold Points referenced in this Part:

Document Ref.	Hold Point	Response Time
2.2	Quality Plan	10 working days
2.3	Evidence of STREAMS compatibility	5 working days

Document Ref.	Hold Point	Response Time
2.4	Samples for Acceptance	5 working days

## 7 Verification Requirements and Records

**Table RD-ITS-S7 7-1 Verification Requirements**

Document Ref.	Clause and Title	Record to be Provided
RD-ITS-S1	11 "Manuals"	Operation and maintenance manual(s)
RD-ITS-S1	12 "Warranty"	Manufacturer's Warranty
RD-ITS-S1	13 "Testing and Commissioning"	Factory Acceptance Test (FAT) Records
RD-ITS-S1	14 "System Documentation"	As-Built documentation
RD-ITS-C1	6 "Testing and commissioning" (where installation is to occur)	Test Records - refer RD-ITS-C1 "Installation and Integration of ITS Equipment".