

Technical Specification

**Transport and Main Roads Specifications
MRTS255 Traffic Signal Controllers**

July 2017

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1 Introduction

This Technical Specification defines the Department of Transport and Main Roads requirements for traffic signal controllers. The traffic signal controllers are intended to be installed for the control of vehicle and pedestrian traffic at signalised intersections and pedestrian crossings. This Technical Specification covers the design, manufacture, supply, packaging, installation and maintenance of traffic signal controllers and traffic signal controller cabinet extensions for housing ancillary equipment.

Offers may be submitted by manufacturers for evaluation for any item or items thereof and all goods that conform to the Technical Specification.

This Technical Specification shall be read in conjunction with MRTS01 *Introduction to Technical Specifications*, MRTS50 *Quality System Requirements*, MRTS201 *General Equipment Requirements*, AS 2578 *Traffic Signal Controllers*, and other Technical Specifications as appropriate. This Technical Specification forms part of the Transport and Main Roads Specifications Manual.

2 Definition of terms

The terms used in this Technical Specification will be as defined in Clause 2 of MRTS201 *General Equipment Requirements*.

Further traffic engineering terms used in this specification are defined in AS 1348 *Road and Traffic Engineering – Glossary of Terms*. Other terms are as defined in the relevant Australian Standards listed in the Clause 3 below.

Table 2 – Definition of terms

Term	Definition
AS/NZS	Australian and New Zealand Standards
CAT	Customer (field) Acceptance Test(s)
CT	Commissioning Tests
TMR	Queensland Department of Transport and Main Roads
Extra Low Voltage (ELV)	Voltage not exceeding 50V a.c. or 120V d.c.
FAT	Factory Acceptance Test(s)
IAT	Installation Acceptance Test(s)
Low Voltage (LV)	Voltage exceeding extra low voltage but not exceeding 1000 V a.c. or 1500 V d.c.
MRTS	Transport and Main Roads Technical Specifications
SD	Transport and Main Roads Standard Drawings
NATA	National Association of Testing Authorities, Australia
RMS	Roads and Maritime Services (NSW)
STREAMS	STREAMS Integrated Intelligent Transport System
TRAFF	The latest release of the standard NSW Roads and Maritime Services traffic control software
TSC	Traffic Signal Controller
Traffic Signal Controller Cabinet Extension	An electrical enclosure used for ancillary equipment that is placed on the top of a traffic signal cabinet. Also known as a top hat.

3 Reference documents

All equipment and material, where not otherwise specified, shall be in accordance with the appropriate Australian Standards Specifications, where such exist, and in their absence, with BSI, IEC or ISO Standards Specifications.

Where a standard is quoted or implied, the latest version shall be applicable, including its amendments to date.

Traffic signal controllers and ancillary equipment shall comply with the requirements of AS 2578 *Traffic Signal Controllers*. In the event of any conflict between the referenced Technical Specifications, requirements stated in this Technical Specification shall take precedence over those stated in AS 2578.

A list of relevant Australian Standards and other related documents, referred to in this Technical Specification, is shown in Table 3.

Table 3 – Referenced documents

Reference	Title
AS 1348	<i>Glossary of Terms - Road and Traffic Engineering</i>
AS 3112	<i>Approval and test specification – Plugs and socket-outlets</i>
AS 2578	<i>Traffic Signal Controllers</i>
AS/NZS 3000	<i>Electrical Installations (Wiring Rules)</i>
AS/NZS ISO 9000	<i>Quality management systems-Fundamentals and vocabulary</i>
Queensland Workplace Health and Safety Act	Queensland Workplace Health and Safety Act and Workplace Health and Safety Regulation
SD1424	<i>Traffic Signals – Detector Loops Formed Insitu in Asphalt Installation Details</i>
SD1425	<i>Traffic Signals – Detector Loops Placement Details</i>
SD1700	<i>Traffic Signals – Detector Loops Vehicle Identification (VID) Placement Details</i>
SD1701	<i>Traffic Signals – Detector Loops Counting/Right Turn Loops and Diode Connection Details</i>
SD1702	<i>Traffic Signals – Detector Loops Motorways and Ramp Placement, and Installation Details</i>
MRTS01	<i>Introduction to Technical Specifications</i>
MRTS93	<i>Traffic Signals</i>
MRTS201	<i>General Equipment Requirement</i>
MRTS256	<i>Power Cables</i>
MRTS257	<i>Feeder Cable and Loop Cable for Vehicle Detector</i>

4 Quality system requirements

The quality system requirements defined in MRTS201 *General Equipment Requirements* and any requirements of the contact apply to this Technical Specification. Quality system requirements shall be

in accordance with this Technical Specification and the requirements of the Contract (including the requirements of MRTS01).

4.1 Hold Points, Witness Points and Milestones

The Hold Points and Witness Points applicable to this Technical Specification are summarised in Table 4.1. There are no Milestones defined.

Table 4.1 – Hold Points, Witness Points and Milestones

Clause	Hold Point	Witness Point	Milestone
4.3	1. Manufacturing Facility Capability Audit – Australian Manufacturers 2. Manufacturing Facility Capability Audit – Overseas Manufacturers		
4.4	3. Sample for evaluation		
9.1	4. RMS type approval		
9.2	5. QLD Electrical Safety Office (Certificate of approval)		
9.3	6. TMR approval		
12.3	7. Supply of hardware/software manuals		
13	8. Supply of training		
14.1		1. Certificates of routine controller testing	

4.2 Quality documentation

The offeror shall submit information regarding the life and quality of the products offered. All claims in relation to life, reliability, maintainability etc., shall be in accordance with the terms and definitions of AS/NZS ISO 9000 *Quality management systems – Fundamentals and vocabulary*.

4.3 Manufacturer's requirements

Manufacturers shall demonstrate conformance to this Technical Specification.

For Australian manufacturers, the capability of the manufacturing facility shall be audited by a Transport and Main Roads staff member or independent auditor acceptable to the department.

Hold Point 1

For overseas manufacturers, the capability of the manufacturing facility shall be audited by an independent auditor acceptable to the department. **Hold Point 2**

The Transport and Main Roads staff member or independent auditor shall ensure that the manufacturers are able to comply with the requirements of this Technical Specification.

The manufacturer shall provide the department with certified test certificates as required by the Technical Specification.

All products shall be inspected by a qualified department representative. The inspection shall be undertaken in Australia at a place suitable to Transport and Main Roads.

Overseas and Australian manufacturing facilities shall demonstrate conformance to the Queensland Workplace Health and Safety Act.

4.4 Samples for acceptance

Unless the supplier has a current certificate of acceptance issued by Transport and Main Roads, a traffic signal controller and/or cabinet extension shall be submitted to the department for evaluation. Samples submitted for acceptance shall comply with Clause 4.2 of MRTS201. **Hold Point 3**

The sample shall be representative of the product which will be supplied in the event of the offer being awarded.

Each sample shall be marked with the following information:

- a) supplier's name
- b) supplier's product reference code
- c) date of manufacture
- d) reference to this specification
- e) offer number, and
- f) closing date for submission.

On or before the delivery of the first sample, the supplier shall provide two hard copies (or electronic copies if agreed by the department) of both a controller hardware manual(s) and software manual(s) if they are not already in possession of the department.

4.5 Multiple or excessive failures

In addition to the requirements of MRTS201, where the traffic signal controller fails within the first six month period, the manufacturer shall replace the failed controller with a new controller at its expense and within one month. Replacing only modules or individual parts can be done at the discretion of the department.

Where a traffic signal controller has more than two failures in the first three years, the manufacturer shall replace that controller with a new one at its expense and within one month. Replacing only modules or individual parts can be done at the discretion of the department.

4.6 Product life

The traffic signal controller, associated equipment and housing shall be designed for a minimum operational life of 15 years as detailed in AS 2578.

4.7 Documentation

All updates and modifications to the controller hardware, software and manuals over the life of the equipment shall be documented within the manufacturer's quality system. This documentation shall be provided on a periodic basis as specified by the department.

5 Functional requirements

The traffic signal controller hardware shall fully comply with the requirements of AS 2578 *Traffic Signal Controllers* unless otherwise specified in this document.

The traffic signal controller shall be supplied with controller software that comprises both an operating system, based on the controller hardware used, and an associated traffic control software application (TRAFF).

Two revisions of the traffic control software application (TRAFF) in addition to the required hardware-related operating system software are to be supplied.

The first revision of the traffic control software (TRAFF) shall be the current VC5 version. The second revision of the traffic control software (TRAFF) shall be the VC6 version or any later version as it becomes available.

5.1 Logic module

The hardware for the logic module shall be designed in accordance with AS 2578 so that it meets the requirements of the RMS traffic control software (TRAFF).

5.2 Description of inputs

The inputs to the controller shall meet the requirements of AS 2578.

In addition to the requirements of AS 2578, the inputs to the controller shall support:

- co-ordination parameters (for Cableless Linking) to determine the duration of vehicle and pedestrian movements and to select appropriate time settings by time of day.

5.2.1 Personality

The personality data shall be stored on a readily available, removable and reprogrammable non-volatile flash storage device.

CardBus and other PCMCIA standards have been depreciated and have reached end of life. This has made sourcing a reliable supply of compatible cards increasingly difficult. This has necessitated moving away from the now obsolete PCMCIA standards and to adopt better supported memory card technology.

Data shall be copied from the removable storage device to on-board flash memory or system RAM when the controller is initialised.

Data integrity of the personality shall be regularly verified by TRAFF. When errors are detected, the controller shall enter a fault mode and the controller shall re-initialise. To ensure integrity of personality data, the following shall be implemented:

- ECC memory shall be used.
- CRCs and checksums shall be used to verify data integrity.
- High quality host controllers shall be used.

The reprogrammable and non-volatile removable flash storage device shall meet the following minimum requirements:

- MTBF of at least 2,000,000 hours.
- Single Level Cells (SLC) NAND memory.
- Supports ECC.

- Supports SPI data interface mode.
- Operating temperature to be - 25°C to + 85°C.
- Capable of operating with high levels of relative humidity (> 85%).
- Minimum IP rating of IP67 as per AS 60529.
- Operational after being exposed to a 0.1 T magnetic field for one minute.
- Operational after 0.1 Gy of X-ray irradiation as per ISO 7816-1.
- Conformance with electrostatic resistance requirements as per IEC 61000-4-2. Vibration tolerance.
- Shock tolerance.

The personality shall contain parameters, including a site identification number, intersection number, personality revision number and operational definitions, specific to the signal installation.

The controller shall be able to encode a Site Identification number expressed in Binary Coded Decimal format with five digits and the personality revision level which shall take the values of A through I. The controller Site Identification number shall correspond to the Site Identification number stored in the controller personality.

The personality module shall be installed on a separate printed circuit card to that of the processing module and associated circuitry. This card shall also be easily removable to facilitate field servicing.

5.2.2 Time settings

The time settings shall be stored on a readily available, removable and reprogrammable non-volatile flash storage device.

Where RAM is used for the storage of time settings, a standby power source for the RAM shall be provided as detailed in AS 2578.

The software offered shall provide a facility to alter time settings on site and remotely. Mechanisms shall be included to prevent the reduction of safety critical times below predetermined levels.

5.2.3 Co-ordination parameters

Co-ordination parameters (for Cableless Linking) shall consist of the following:

- plan schedule data, and
- plan timing data.

5.2.4 Vehicle loop detector inputs

The traffic controller shall be supplied with all hardware and software required to permit direct connection of vehicle detector loops as detailed in AS 2578. The requirements on the loop detector equipment are defined in Clause 5.5 Vehicle Detection Systems of this Technical Specification.

5.2.5 Pedestrian push button, external detector and auxiliary inputs

The controller shall permit the connection of pedestrian push buttons, external detector units, and any other device that provides a contact signal output (i.e. time switches, etc.) as detailed in AS 2578.

The processing module shall incorporate fixed visual indicators and function selection facility for these inputs similar to those defined for vehicle detector inputs in Clause 5.2.4 Vehicle Loop Detector Inputs.

5.2.6 User interface

A user interface as detailed in AS 2578 shall be provided to allow a user to communicate with the control equipment. The terminal will permit the adjustment of controller data and access to real-time controller status information. The format of data and time settings is determined by the software.

The supplier shall provide information regarding the commands available from the user interface.

The supplier shall provide information on optional user interfaces that provide functionality above that specified in AS 2578.

5.2.7 Timing reference

The timing reference within the controller shall be synchronised from the mains frequency clock or from the Real Time Clock as detailed in AS 2578.

5.2.8 Hardware status

Front Panel LED Indicators shall be provided as detailed in AS 2578.

5.2.9 Serial communication facility

The serial communication facility shall support connection by direct serial link as detailed in AS 2578 and Ethernet.

Facilities to support a dial-up modem are no longer required due to the obsolescence of the technology. An Ethernet interface shall replace the functionality of the modem.

The message protocol for communication from the STREAMS Area Traffic Control (ATC) master to the controller logic module shall be as defined for the standard VC5 TRAFF and the standard VC6 TRAFF (or later).

The data link layer protocol for the communications channel shall conform to the Point to Point Protocol (PPP) High Level Data Link Control (HDLC) Frame encapsulation.

5.3 Description of outputs

5.3.1 Vehicle signal lanterns

Each vehicle signal lantern shall be capable of providing the following states during operation.

Aspect	State
Green	Normal operating state controlled by processor
Yellow	Normal operating state controlled by processor
Red	Normal operating state controlled by processor
Off	Normal operating state controlled by processor
Flashing Yellow	Default state if processor not functioning

The 'Off' state shall be available without modification to the controller internal wiring as supplied.

5.3.2 Pedestrian signal lanterns

Each pedestrian signal lantern shall be capable of the following states.

Aspect	State
Green	Normal operating state controlled by processor
Red	Normal operating state controlled by processor
Flashing Red	Normal operating state controlled by processor
Off	Default state if processor not functioning

5.3.3 Flashing yellow control

The flashing yellow feature shall be controlled by a flasher unit as detailed in AS 2578. The flasher unit is to be delivered with the outputs flashing alternatively.

5.3.4 Lamps off (blackout) control

One output from the controller logic shall be provided to switch off power to all lamps. On return of the controller to normal operation, the signals shall revert automatically to flashing yellow status unless specifically disabled.

5.3.5 User display

Time settings, data and status information shall be displayed on the user interface. The display may take the form of a smart phone, a PC/laptop, tablet or other dedicated device.

5.4 Software requirements

The Traffic Signal Controller shall be provided with both the hardware operating system software and the traffic control software application and shall comply with AS 2578. This software component deals directly with all traffic control parameters and associated control and communications.

Where a CardBus card or CardBus slot is specified, the corresponding requirement shall be compatible with the removable storage device being used with the controller.

The traffic control software shall provide full compliance and compatibility with the Transport and Main Roads control system (STREAMS).

The general traffic operation facilities provided by the software shall be in accordance with the requirements of Clause 6.1.

5.4.1 STREAMS compatibility

STREAMS compatibility is to be obtained through using the documented standard New South Wales RMS SCATS traffic control software (TRAFF) communications protocol for VC5 and VC6.

5.4.2 TRAFF compatibility

A fully documented revision of the standard traffic controller software (VC5 and VC6 TRAFF) as used by RMS NSW shall be made available to Transport and Main Roads. This software shall be capable of providing a cable-less linking system for provision of co-ordination in the absence of STREAMS.

5.5 Vehicle detection systems

Vehicle detection systems shall be included in the controller as detailed in AS 2578. The vehicle detection system may use loop detectors, video camera or other suitable technologies for detection of vehicles.

Provision shall be made for the connection of detector loops to Loop Detector Sensors that are integral to the controller logic module.

All vehicle loop detection equipment purchased and supplied with the controller shall conform to the functional and operational requirements of AS 2703 *Vehicle Loop Detector Sensors*.

5.5.1 Vehicle loop termination

All cables within the harness or loom leading from the loop termination board or terminal strip to the detector unit for processing shall have incorporated screening and/or noise suppression.

5.6 Identification

All removable modules, printed-circuit cards and other plug-in sub-assemblies shall be clearly marked with the following information:

- title, describing the function of the unit
- manufacturer's type number, and
- serial number.

In addition, all switches, indicator lights, push-buttons, fuses, cable plugs and sockets, and plug in components shall be clearly identified and details of their function, switching positions, calibrated dials etc., shall be provided.

All identification shall be engraved, anodised, chemically etched, permanently silk-screened or stencilled to ensure long life.

Unless otherwise stated, punched or painted legends on equipment body and stencilled markings on front panels shall not be acceptable.

5.7 Visual indicators

All visual indicators shall meet the requirements of AS 2578 and:

- be located in a position, which will be readily visible during inspection and servicing
- be a light-emitting diode or other suitable indicating device with equivalent life performance, and
- have a light output and contrast which will ensure adequate visibility in sunlight and at night.

5.8 Switches and adjustment facilities

All switches and facilities provided for adjustment by field staff shall be:

- in the form of a number of discrete steps which shall be durably calibrated, and
- located in a position, which will enable the switching, or adjustment function to be readily performed by authorised staff only.

The spring tensioning of the facility switch as detailed in AS 2578 shall not result in damage to the facility keys due to over tensioning.

5.9 Traffic signal controller cabinet extension

The traffic signal controller cabinet extension shall comply with the requirements of AS 2578 in material, dimensions to allow fitment to a traffic signal controller, finish, Ingress Protection, Impact Protection and Electromagnetic Compatibility unless otherwise specified in this document.

Inside the cabinet extension, there shall be:

- equipment mounting plates on the three fixed sides with a minimum stand off from the adjacent side of 10 mm
- a distribution board with one circuit to be supplied off the controller auxiliary relay
- provision for a service light
- the ability to fit a frame for 19" rack mount equipment, and
- the ability to fit a socket outlet with integrated RCD if required.

5.9.1 Identification

Manufacturer's name, TSC Cabinet Extension model number and date of manufacture shall be clearly labelled on the door. All identification shall be of a durable nature to ensure long life.

6 Operational requirements

6.1 Software requirements

6.1.1 Phase timing

In order to allow safe, efficient and responsive control at a wide variety of intersection layouts, comprehensive facilities shall be provided to allow the traffic engineer to adapt the control strategy to the specific location.

This shall include the division of the signal cycle into a number of periods (or steps) as defined in AS 2578. The duration of these periods shall be traffic responsive in that both the stored timing information and information provided by the detector inputs shall be used in the processing.

The following time ranges shall be provided for each phase.

Phase	Min. range (seconds)
Late Start Period	0–15
Minimum Green	0–15
Increment (Variable Initial Green) (per detection, max. 15)	0–5.0
Maximum Variable Initial Green	0–40
Maximum Green	0–150
Yellow	3–6.4
All-Red	0–15
Early Cut-Off Green	0–20

The following Extension Green time ranges shall be provided for each approach.

Phase	Min. range (seconds)
Gap	0–10
Waste	0–50
Headway	0–5

6.1.2 Pedestrian timing

Timing periods shall be provided for each defined pedestrian phase as listed in AS 2578.

The following time ranges shall be provided for each phase or group.

Phase	Min. range (seconds)
Pedestrian Delay	0–20
Pedestrian Walk	0–15
Pedestrian Clearance 1	0–40
Pedestrian Clearance 2	0–10

6.1.3 Vehicle demands

Detector inputs shall be processed by the processing module to produce demands for vehicular movements and associated phases as defined in AS 2578.

Vehicle demands shall have the following attributes:

- demand a phase or phases not currently running
- demand a phase not currently running if the actuation is present for longer than a presence time set in the range 1–10 seconds
- where an actuation demands more than one phase, it shall be possible for the first running phase to cancel the demands placed for the other phases if the required movement has been serviced
- a feature shall be available to provide automatic demands for phases if required
- a demand shall be automatically registered for a phase in the following cycle if the current phase is terminated by the maximum timer, and
- demands may be cancelled dependant on signal states, detector inputs or timer states.

6.1.4 Pedestrian demands

Pedestrian demands shall be produced as defined in AS 2578.

It shall be possible to register a demand via hardware or software for pedestrian movements if required.

The pedestrian demand shall be cancelled at the commencement of the walk period and no demands for that walk movement shall be registered during this period.

6.1.5 Vehicle and pedestrian movements

When a pedestrian movement is associated with a vehicle movement, the walk period shall commence with the late start period, the minimum green period, or after the pedestrian delay. The "WALK" shall be displayed only for the pedestrian walk time (including extension).

The phase shall not enter the intergreen period until the first clearance stage is finished, unless the next vehicle movement is also associated with the same pedestrian movement. The vehicle movement shall never enter the all-red period if an associated pedestrian is in any stage of the clearance. Two or more pedestrian movements or pedestrian groups shall be able to run concurrently.

6.1.6 Personality data and generation

The format of the personality data for use by the traffic control software shall comply with the NSW RMS Standard Personality – CPERS. It shall be possible for traffic signal staff to develop the required personality data using a computer program run on a standard personal computer.

The supplier may provide as an option a personality generation package suitable for the offered controller.

6.1.7 Data entry and display

The traffic control software shall provide, as a minimum, the following facilities for use with the data entry and display units as defined in Sections 5.2.6 User Interface, 5.3.6 User Display and AS 2578.

1. Monitoring of the current running phase.
2. Monitoring of the last phase and tentative next phase.
3. Monitoring of phase timing in the current phase.
4. Monitoring of current phase demands.
5. Monitoring of stored pedestrian demands.
6. Monitoring of pedestrian timing in the current phase.
7. Monitoring the expiry status of the following timers:
 - a. pedestrian timers
 - b. gap
 - c. headway timers
 - d. waste timers
 - e. sequence timer
 - f. presence timers, and
 - g. maximum timers.
8. Display and change automatic demands for phases and pedestrians
9. Display and change all time settings as defined in Clauses 6.1.1 Phase Timing and 6.1.2 Pedestrian Timing. Changing time settings shall not be permitted when the controller is operating in a communication linked mode.
10. Display any change in current mode.

11. Monitor current co-ordination plan and schedule.
12. Monitor the status of co-ordination signalling pulses.
13. Display of software revision number.
14. Display of personality site identification and revision.

6.1.8 Controller operating system software

The controller operating system software shall incorporate the NSW RMS TRAFF software and the necessary manufacturer's run-time library routines to interface the control program to the hardware.

The controller operating system software is the software component that has direct control of the hardware (i.e. device drivers, etc.) and therefore hardware dependant.

6.1.9 Data entry and display

The controller operating system software shall provide the following facilities for use with the data entry and display units as defined in Sections 5.2.6 User Interface, 5.3.6 User Display and AS 2578.

- Display and change time of day in hours, minutes and seconds
- Display and change day of week
- Display and change date
- Display and change daily event times
- Display error and fault information that has accumulated in a log.

6.1.10 Time of day correction

Following a loss of power, the mains frequency time of day clock shall be corrected from the real time clock as detailed in the AS 2578 and referenced in Section 5.2.7 Timing Reference.

7 Mechanical and physical requirements

7.1 Equipment mounting plate

A section of plate is to be provided above the shelf at the back of the controller (next to the logic module) for the mounting of miscellaneous equipment.

7.2 Circuit boards

In addition to AS 2578, the electronic circuit boards shall be vermin proofed to prevent damage.

7.3 Access door locks

Traffic Signal Controllers typically comprise of three door types: Controller, Extension cabinet and Telecommunications Access doors. The three-point latching system shall only be applicable to Controller and Extension cabinets.

Locking/unlocking of each door shall be effected by single lock operation. The lock shall operate a three-point latching mechanism with pins extending from the top, centre and bottom of the non-hinged side of the door. The door shall house a flush mounting 316 stainless steel handle capable of accepting a half Euro Profile locking cylinder (DIN 18252/EN1303) with CyberLock compatibility. The handle must incorporate a retractable dust cover.

One key shall be provided for the Telecommunications Access door as detailed in AS 2578.

Stainless steel swing handles have been incorporated to enhance the longevity and robustness of the locking system.

7.4 Installation of CyberLocks

Electronic Half Euro Profile CyberLocks are to be installed on cabinet doors where required by the department. Once installed, each CyberLock is required to be labelled with the manufactures designated barcode/serial numbers supplied. These labels are to be located inside the cabinet door adjacent to the CyberLock, with easy accessibility for barcode scanners. Serial identification numbers for both CyberLocks and cabinets shall to be documented and supplied to the Principal upon delivery.

CyberLocks must be configured to be opened anticlockwise.

Cyberkeys are not to be supplied with the cabinet.

7.5 Programing CyberLocks

CyberLocks are to be programmed by Transport and Main Roads' districts. If another entity separate to the department has possession of site during construction, the department has the option to enable third-party access to the site for the duration of the project. Upon project completion/handover, the locks will then be reprogramed to remove third-party access to the cabinets.

7.6 Cyberkeys

Cyberkey can only be programed by Transport and Main Roads. All keys will be assigned to individuals, not corporations or organisations.

All keys used/acquired by any third parties need to be registered/configured by the department before use.

The objective of the CyberLock locking system is to provide significantly improved traceability, tighten access control on Transport and Main Roads' assets and strengthen ITS network security against intrusion.

7.7 Detection system

The controller housing shall include loop termination points and all associated looms and cables as detailed in AS 2578.

7.8 Configuration of delivered controller

The controller housing and the logic module shall be ordered and supplied as separate entities.

As detailed in AS 2578, four sizes of Logic Module shall be made available.

The controllers are to be of a modular construction in both the housing (i.e. field terminal strips, 'wait' transformers, etc.) and the logic module (i.e. inputs, outputs, entry and display unit, etc.) so as to permit minimisation of redundant capacity when installed.

7.9 Cabinet extension housing

The cabinet extension shall increase the overall height of the controller by a minimum of 440 mm and a maximum of 550 mm.

The design and construction of the mechanical and electrical elements of the cabinet extension shall comply with AS 2578.

7.9.1 Cabinet extension access door locks

Access doors shall be fitted with a Euro profile locking cylinder (DIN18254) with restricted keying. One key shall be supplied with each cabinet extension, keyed to the requirements of the Principal. The locking mechanism shall be suitable to prevent unauthorised entry to the enclosure.

7.9.2 Information to be contained within the cabinet extension

As detailed in AS 2578, the controller cabinet extension shall contain Danger Signs.

7.9.3 Configuration of delivered extension cabinet

The offeror shall deliver the extension cabinet in a configuration with either:

- equipment mounting plates on the three fixed sides with a minimum stand off from the adjacent side of 10 mm, or
- a frame for 19" rack mount equipment
- a distribution board (one circuit to be supplied off the controller auxiliary relay), or
- a socket outlet with integrated RCD if requested.

It is desirable for the manufacturer to make provision for the fitting of a service light in the extension cabinet as specified for the controller housing in AS 2578.

8 Electrical requirements

8.1 Telecommunications interface

All controller housings shall be supplied with a telecommunications interface as specified in AS 2578.

8.2 Cabinet conduits

The controller shall be provided with six 20 mm conduits at the back of the cabinet to enable cables to be run from the bottom of the cabinet to the cable access point of the Extension Cabinet.

8.3 Service light

The controller housing shall be fitted with a Service Light as specified in AS 2578.

8.4 Traffic signal controller cabinet extension

The traffic signal controller cabinet extension shall be fitted with a:

- distribution board (one circuit to be supplied off the controller auxiliary relay)
- socket outlet with integrated RCD if requested, and
- service light if requested.

8.5 Stand-by generator connection

The controller housing shall be fitted with all of the facilities required for the connection of an external generator as specified in AS 2578. The controller housing connector for the external generator shall be a male three-pin (flat) 15A connector complying with AS 3112.

It is desirable that the 'presence of power' indicator lights specified in AS 2578 are green to indicate mains supply and yellow to indicate generator supply. The indicator lights should have a design life of at least 15 years.

8.6 Site identification

As detailed in AS 2578, a coding system shall be required to allow controller identification (i.e. site identification and revision).

8.7 Voltage limiting of mains input

The controller shall be designed to permit voltage limiting as specified in AS 2578.

8.8 Earth loop fault impedance

The earth loop fault impedance of the controllers shall be designed to comply with AS 3000. The controller wiring and protection devices shall be as specified in AS 2578.

8.9 Supply voltage for ELV LED lamp

The controllers shall be capable of running LED lanterns at a nominal 42Va.c.

8.10 Regulation and dimming of lamp supply voltage

Facilities shall be available to permit regulation and dimming of the lamp supply voltage as detailed in AS 2578.

8.11 Transport and Main Roads prefer a method of dimming that maintains a sine wave output from the controller (e.g. via the tap changes of a transformer or via the use of a control wire). Power consumption

The supplier is to make available the power consumption for each of the four rack sizes populated with a full set of circuit boards. The measurements are to be supplied with no lantern load on the controller.

8.12 Semi-conductor devices

Semi-conductor devices used shall have internationally recognised type numbers.

9 Approvals

9.1 Roads and maritime services NSW (RMS)

The TSC shall have a current Type Approval certificate from the RMS, confirming that the controller has been fully tested for compliance against the current RMS Controller Equipment Specification and for use with LED lanterns, or proof of current testing with RMS regarding on-street trials for compliance against the current RMS Controller Equipment Specification and for use with LED lanterns. **Hold Point 4**

9.2 Electrical safety

The TSC shall have a Certificate of Approval from the Queensland Electrical Safety Office, Department of Industrial Relations, Queensland, or other equivalent regulatory authority. **Hold Point 5**

9.3 Transport and Main Roads

Transport and Main Roads shall provide the overall approval of the controller and extension cabinet based on the elements of this specification. **Hold Point 6**

In addition to the type testing detailed in the RMS Controller Equipment specification, the controller shall be fully operational when signal groups are either all LED lamps or combinations of LED lamps and ELV or Incandescent lamps. Load characteristics that create induced voltages shall be eliminated.

10 Installation requirements

The installation requirements defined in MRTS201 and MRTS93 apply to this Technical Specification.

The Traffic Signal Controller supplier shall provide both the required operating system software and the traffic control software application. Licence to use, conditions on software modification, resell, etc., for the software shall also be provided.

11 Testing and commissioning

The testing and commissioning requirements of MRTS201 apply to this Technical Specification.

12 Documentation

12.1 Application Programming Interface (API)

A complete specification of the application programming interface between the traffic control software (TRAFF) and the hardware related software (HRS) shall be provided by the traffic signal controller supplier. This interface shall be defined to the extent necessary to enable alternative application software (other than the provided traffic control software) to be developed for the controller.

Suppliers shall confirm the availability of the API definition.

12.2 Information to be contained within the housing

As detailed in AS 2578, the controller housing shall contain:

- Danger Signs
- Layout Diagrams which show the function and location of the controller components
- Wiring Diagrams
- Approval Numbers, and
- Serial Numbers.

12.3 Hardware and software manuals

On or before the delivery of the first order, a copy of all controller hardware manual(s) and software manual(s) shall be supplied in electronic form if not already held by the Principal. The electronic forms acceptable are Adobe PDF and Microsoft Word's .doc and .docx file formats for text documents and AutoCAD 2000 (or later) for drawings and circuit diagrams. **Hold Point 7**

The controller hardware manual(s) shall contain:

- A technical description of the controller hardware and all its various modules and components.
- A full set of instructions to set-up, operate and maintain the controller, including a list of any special devices, tools or equipment required.
- A full fault finding and repair procedure.
- Operational details for any test equipment available for maintenance procedures.

- Comprehensive details on all strapping points and moveable links indicating the facilities that can be provided with these connections.
- Replacement parts lists and descriptions.
- General information, including data summary, accessories and response curves for fuses and circuit breakers, and
- Wiring diagrams, circuit diagrams, component layouts and schedules which clearly show the following:
 - all plug-socket, terminal and relay contact numbers
 - make and type number of every component shown
 - ohmic value and wattage of every resistor
 - capacitance and working voltage (and polarity if applicable) of every capacitor
 - resistance of reed coils and the type of reed contacts
 - colour and size of wiring (cross sectional area in millimetres)
 - type number (including type number of alternative or equivalent types) and pin numbers of transistors and integrated-circuit modules
 - winding voltages and maximum winding currents of transformers used, including fault currents
 - maximum voltage and forward current peak and inverse voltage of all solid-state rectifiers
 - layout of all components on printed circuit boards
 - location of all test points on printed circuit boards or otherwise, including characteristic readings, waveforms or signals, and
 - tolerance of all high tolerance components.

The controller software manual(s) shall contain:

- A detailed description of the operation of controller software in relation to all traffic control parameters and controller hardware.
- Information regarding personality programming and a description of the necessary equipment for this function.
- A complete listing of standard tables used by the programming software and a description of the format of these tables to allow table adaptation.
- A full set of vehicle, pedestrian and detector tables, and associated documentation.
- A set of standard personality templates and documentation, including the following examples:
 - Single Diamond 5 Phase Non Filter
 - Single Diamond 5 Phase Filter Right Turns Permitted
 - Single Diamond 6 Phase Non Filter
 - Single Diamond 6 Phase Filter Right Turns Permitted
 - Single Diamond 7 Phase Non Filter

- Single Diamond 7 Phase Filter Right Turns Permitted
- Double Diamond Non Filter
- Double Diamond Filter Right Turns Permitted
- Two staged Mid-block pedestrian crossing
- A listing of the controller RAM with individual addresses and functions of these locations, and
- The complete specification of the application programming interface between the traffic control software (TRAFF) and the hardware management software (as required by section Application Programming Interface (API)).

13 Training

Training requirements shall be in accordance with MRTS201. In the event of any conflict between MRTS201 and this clause, requirements stated in this Technical Specification shall take precedence.

The supplier shall make available a training course or courses for Transport and Main Roads field maintenance supervisors and/or staff from other bodies who install and maintain the controllers on behalf of the department.

A training course will be required prior to delivery of the first controller for installation by the department. **Hold Point 8**

Training courses will be required at regular intervals across the product life of the controller.

The installation and maintenance staff are to be provided with a level of training that enables them to install and commission the controller and conduct all first line maintenance and routine maintenance on the controller. The first line maintenance will involve the diagnosis of faults and replacement of faulty modules. Faulty modules will be returned to the original equipment manufacturer for repair.

The training shall cover at least the following areas:

- operational capabilities of the controller, including use of the operator interface
- installation and commissioning requirements for the controller
- routine maintenance requirements for the controller
- failure mechanisms and repercussions for the controller, and
- structure and relevant contents of the operations and maintenance manuals.

The supplier shall provide an outline of the training course to be provided prior to delivery of the first controller to Transport and Main Roads.

14 Maintenance

Maintenance requirements shall be in accordance with MRTS201.

14.1 Routine testing

Documentation regarding routine testing performed on all controllers, cabinet extensions and associated hardware during and/or after production shall be made available.

A certificate showing the results of these tests shall accompany all controllers when delivery is made.

Witness Point 1

The certificate shall clearly indicate the controller identification, the date the test was conducted and the identification of the responsible personnel and/or section.

14.2 Test equipment

Test equipment or software shall be available that includes controller simulation equipment (Aids software) or other office or workshop equipment for testing traffic signal controller hardware and operations, including personality programming.

14.3 Tools for installation and maintenance

Any special tools and equipment necessary to install, set-up and/or maintain the traffic signal controller and extension cabinet shall be made available to the Principal.

14.4 Software maintenance

The operating system software and the traffic control software are to be maintained by the offeror as follows:

- a) Repair of operational deficiencies, if and when observed by the department or others.
- b) Upgrades or alterations as provided to, or undertaken for, others (e.g. RMS NSW software alterations or improvements). However, all alterations will require approval by the department prior to implementation, and
- c) Modifications requested by the Principal in response to change requirements of STREAMS.

All modifications shall be provided as a cost to the supplier with the exception of the modifications defined in c) above. Costs for such work would be negotiated on a job-by-job basis with the supplier when required.

14.5 Maintenance support

A module exchange service shall be provided for the repair of faulty circuit boards and modules, with a guaranteed maximum delay of 14 days to replace any faulty module. Such service is to be available for 10 years from the date of first delivery and for a minimum period of five years after cessation of manufacture for the particular equipment type.

14.6 Spare components

The supplier shall hold a complete stock of all parts and modular components, which are not readily available from Brisbane commercial outlets. The successful offeror shall provide this service for a period of not less than 10 years from the date of first delivery and for a minimum period of five years after cessation of manufacture for the particular equipment type.

15 Handover

The handover requirements detailed in MRTS201 apply to this Technical Specification. Additionally, the supplier shall set out in a covering letter all details of the equipment offered that do not comply with this Technical Specification.

