

Technical Specification

**Transport and Main Roads Specifications
MRTS265 Type-2 Portable Traffic Signals**

November 2018

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1 Introduction

This Technical Specification defines the design, supply, installation, testing and commissioning, performance, documentation, training, maintenance and handover requirements for Type-2 Portable Traffic Signals Systems. This Technical Specification shall be read in conjunction with MRTS01 *Introduction to Technical Specifications*, MRTS50 *Specific Quality System Requirements*, MRTS201 *General Equipment Requirements*, Queensland *Manual of Uniform Traffic Control Devices (MUTCD) Part 3 Works on Roads* and other Technical Specifications as appropriate.

Portable Traffic Signal Systems complying with this Technical Specification shall only be used in accordance with the operational requirements of the MUTCD Part 3, Supplement 4.11-1.

This Technical Specification forms part of the Transport and Main Roads Specifications Manual.

2 Definition of terms

The terms defined in MRTS201 *General Equipment Requirements* apply to this Technical Specification. Additional terminology relevant under this Technical Specification are defined in Table 2 below.

Table 2 – Definitions of terms

Term	Definition
Approach	That section of road, consisting of one or more lanes, used by vehicles approaching an intersection or mid-block site.
Display	A signal aspect that is illuminated.
Fixed Time operation	A signal operation mode that allows for only a fixed sequence and fixed duration of displays.
Flashing yellow operation	A signal operation mode where the yellow aspects continually flash.
Manual operation	A signal operation method that allows each phase to be individually controlled by manually entering a demand for the next phase.
Master controller	The internal control processing unit hardware within the Master PTS unit which undertakes all communication and internal processing tasks required for operation. This controller controls the Slave controller operations.
NATA	National Association of Testing Authorities, Australia.
Operation Modes	PTSS operation modes include manual, fixed time, vehicle actuated and flashing yellow.
Portable Traffic Signal Unit (PTSU)	An individual portable traffic signal that consists of the traffic signal lantern, battery, communications equipment, mounting assembly and base.
Portable Traffic Signals System (PTSS)	Traffic light signals and associated equipment that provides signalling for temporary control of traffic at work sites.
RPEQ	Registered Professional Engineer of Queensland.
Hand-held Remote Controller (HRC)	A hand-held remote / device which can control and set the PTSS lanterns at a safe distance. This device may be wired or wireless.
Slave controller	The internal control processing unit hardware within the slave PTSU which undertakes all communication and internal processing tasks required for operation. This unit is subservient to the Master controller to which it is linked.

Term	Definition
Traffic Controller	A person authorised to control traffic movements through site works by means of flags, stop / slow bats or other equipment.
Vehicle actuated operation	An operation mode that allows a variable sequence and variable duration of signal displays depending on vehicle (and pedestrian) traffic demands. All vehicle movements (phases) are actuated in fully-actuated operation in contrast with semi-actuated operation where only minor vehicle movements (e.g. side traffic) are actuated.
Yellow Time	Duration of the yellow signal for a phase or movement. This is static and pre-specified.

3 Reference documents

The requirements of the referenced documents listed in Table 3 of MRTS201 *General Equipment Requirements* and Table 3 below apply to this Technical Specification. Where there are inconsistencies between this Technical Specification and referenced MRTS documents, the requirements specified in this Technical Specification take precedence.

Table 3 – Referenced documents

Reference	Title
AS 1170.2	<i>Structural Design Actions - Wind Actions</i>
AS 2144	<i>Traffic Signal Lanterns</i>
AS 2700	<i>Colour Standards for General Purposes</i>
AS 4191	<i>Portable Traffic Signals</i>
AS 60529	<i>Degrees of Protection Provided by Enclosures (IP Code)</i>
AS/NZS 4509.1	<i>Stand-alone Power Systems – Safety and Installation</i>
AS/NZS 4509.2	<i>Stand-alone Power Systems – System Design</i>
AS/NZS 5033	<i>Installation and Safety Requirements for Photovoltaic (PV) Arrays</i>
AS/NZS CISPR 22	<i>Information Technology Equipment - Radio Disturbance Characteristics – Limits and Methods of Measurement</i>
MRTS02	<i>Provision for Traffic</i>
MRTS50	<i>Specific Quality System Requirements</i>
MRTS61	<i>Mounting Structures for ITS Devices</i>
MRTS201	<i>General Equipment Requirements</i>
MRTS264	<i>Type-1 Portable Traffic Signals</i>
MUTCD Part 3	<i>Queensland Manual of Uniform Traffic Control Devices (MUTCD) – Part 3 Works on Roads</i>
MUTCD Part 3, Supplement 4.11-1	<i>Manual of Uniform Traffic Control Devices (MUTCD) – Part 3 - Supplement 4.11-1 Portable Traffic Signals</i>

4 Quality system requirements

4.1 Hold Points, Witness Points and Milestones

The quality system requirements defined in MRTS201 *General Equipment Requirements* apply to this Technical Specification. Additional 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
4.2	1. Samples for acceptance (design). 2. Photometric performance certification.		
9.1	3. Barrow, tripod or trailer support structure design documentation.		
10	4. Detailed design documentation of the electrical wiring including solar and charging assembly and calculations, signed by RPEQ.		
13		1. Factory Acceptance Test. 2. PTSS Demonstration. 3. ACMA Compliance. 4. Site Acceptance Test.	

4.2 Samples for acceptance

The requirements of MRTS201 *General Equipment Requirements* apply to this Technical Specification.

A sample PTSS for acceptance and photometric performance certification shall be provided 28 days prior to manufacture. **Hold Point 1**

Detailed designs of the PTSS layout, fabrication and assembly drawings, calculations, specifications and certifications of the PTSS and associated components (signed by the Contractor's RPEQ) shall be submitted to the Principal via the Administrator for verification prior to manufacture.

Photometric performance testing methodology and NATA certification confirming the PTSS performance requirements specified in this Technical Specification shall be submitted before delivery to site. **Hold Point 2**

5 Type-2 Overview

The purpose of this clause is to provide an overview of a Type-2 PTSS. For the Technical Specification of a Type-1 PTSS see MRTS264 *Type-1 Portable Traffic Signals*.

The functional requirements of a Type-2 PTSS shall comply with:

- clauses in this document
- the requirements prescribed in AS 4191.

A Type-2 PTSS shall be used in accordance with MUTCD.

5.1 Type-2 Features

The major features of a Type-2 PTSS are listed in Table 5.1 below.

Table 5.1 – Type-2 PTSS features table

Feature	Type-2
Operation	Manual/Unattended
Operator Controls	HRC, Local Control Panel
Battery Technology	Refer AS 4191
Battery Capacity	Seven sun-free days
Solar System	Required
Mass of each PTSU	No limit
Target Board	Required
Data Logging	Optional
Time Settings	Refer AS 4191
Vehicle Actuated Operation	Required
Dimming	Refer AS 4191

5.2 Type-2 control methods

Type-2 control methods such as manual operation, fixed time operation, vehicle actuated operation and flashing yellow operation shall be in accordance with MUTCD.

A Type-2 PTSS shall be operated through:

- Hand-held Remote Controller (HRC) – Where onsite personnel take local control of the PTSS
- Local Control Panel – Where onsite personnel configure and take manual control of the PTSS

5.3 Reliability

Type-2 PTSS shall have a high availability with a minimum of 99.9% operating reliability over the lifetime of the system.

6 Type-2 Functional requirements

The functional requirements of a Type-2 PTSS shall comply with:

- clauses in this document, and
- the requirements prescribed in AS 4191.

6.1 Type-2 PTSS start up sequence

A Type-2 PTSS traffic signal start-up sequence shall not take place until the PTSS has undergone a complete system check to establish that all components are functional, including a self-test of each lantern and that the communication system has been established and verified working to all PTSUs and the master controller.

6.1.1 Type-2 Start-up interlocks

Refer AS 4191.

6.1.2 Type-2 Manual mode of operation start-up sequence

Refer AS 4191.

7 Type-2 Communication requirements

Refer AS 4191 and Clause 7 of this document. Type-2 PTSS communication system shall comply with the requirements specified below and the requirements of the Australian Communications and Media Authority (ACMA) as per AS 4191:2015 Section 1.4.

7.1 Type-2 Hand-held remote controller and Portable Traffic Signals

Communication between the master controller, HRC and PTSUs shall be via a local wired connection or a wireless technology such as Ultra-High Frequency (UHF) radio band or other reliable wireless technology. Wireless communications shall be encrypted.

The manufacturer shall stipulate the maximum communication range between the PTSU and the master controller. Communication shall be reliable under all weather conditions up to the stated distance. It is desirable that the PTSU and the master controller can communicate over distances of 1000 m.

Periodic two second communications (time-out period) polling message (heartbeat) shall be transmitted for the purposes of establishing whether a loss of communications has occurred. When a command is issued, a heartbeat message shall be broadcast. When loss of communications has been detected by the master controller, an alert shall be raised on the HRC.

Where a signal change has been requested on a PTSU, the signal change procedure shall be initiated within 250 ms of the request. The PTSU must acknowledge to the master that the signal change procedure has been initiated within 250 ms of the request being received.

7.2 Type-2 Communications timeout

If communications are disrupted with a Type-2 PTSS, the device shall comply with the requirements prescribed in AS 4191.

7.3 Type-2 Communications identifiers

The HRC, master controller and PTSUs shall each have a unique communications ID which shall be used to ensure messages are sent and received by individual units as intended.

Communications messages between the master controller, HRC and PTSUs shall include a checksum that is based on the message information exchanged to ensure integrity of the communication is upheld.

7.3.1 Type-2 Portable Traffic Signal System ID

Any communications messages transmitted shall embed each PTSU's respective ID.

8 Type-2 PTSS monitoring, reporting and fault requirements

A Type-2 PTSS monitoring, reporting and fault requirements shall comply with the requirements prescribed in AS 4191.

9 Type-2 Mechanical and physical requirements

9.1 Type-2 General

The mechanical and physical requirements defined in MRTS201 *General Equipment Requirements* and MRTS61 *Mounting Structures for ITS Devices* apply to the PTSS and associated control electronics defined by this Technical Specification. Portable traffic signal lanterns shall be capable of being mounted on a pole that connects to a barrow or a trailer support structure.

All compartments that contain any electronic components shall have an ingress protection rating of at least IP45 as defined in AS 60529. A certificate or letter of compliance from a NATA approved testing facility shall be made available to the department upon request.

Support structure design documentation for Type-2 devices, shall be submitted to the Principal's representative for acceptance 28 days prior to manufacture. **Hold Point 3**

The PTSS shall be constructed from durable materials to enable installation and reliable operations.

9.2 Type-2 Design life

Unless otherwise specified, the design life of components shall be as follows:

- a) PTSS mechanical components and structure: a minimum of 20 years.
- b) PTSS and HRC electrical components and systems: a minimum of 10 years.
- c) Lantern body, structural supports and any mechanical accessories, including any protective coatings, are designed for a service life of at least 20 years.

9.3 Type-2 PTS mounting

The vehicle on which the PTSS is mounted or stored shall conform to the requirements of the host vehicle specified in AS 4191 and this Technical Specification.

9.3.1 Type-2 Trailer / Barrow mounts

Where the PTSS is mounted on a trailer or barrow (Figure 9.3.1), the PTSU and solar panel array shall have a mechanical system which allows it to be safely secured for transportation.

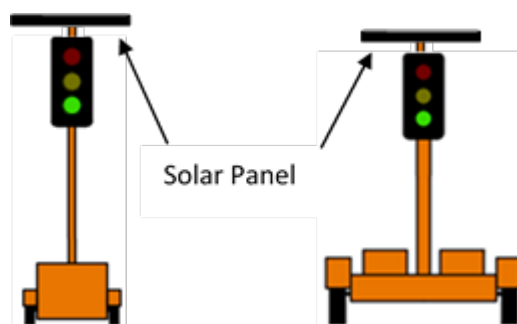
The mechanical system shall also allow for the PTSU and solar panel array to be safely erected on site to ensure the unit is clearly visible. A Type-2 PTSS shall have the capability to use a ballast such as sandbags to stabilise the structure.

The solar panels shall be adjustable to ensure optimum solar exposure and maximum energy generation anywhere in Queensland.

The mechanical systems shall also ensure that the PTSU and solar panel array cannot rotate due to wind gusts up to the ultimate wind speed the structure is designed for.

Any trailers units shall comply with the applicable clauses in AS 4191 and shall be suitable for registration in accordance with the statutory requirements of the State of Queensland.

Figure 9.3.1 – Example Portable Traffic Signal Unit Mountings (for illustrative purposes only)



9.3.2 Type-2 Surface finishes

The external finishes of equipment items shall be resistant to corrosion. All metal surfaces shall be painted in the range of high visibility colours from X15 Orange to X13 Marigold as specified in AS 2700. All surface finishes of PTSSs shall comply with AS 4191. The finish of lanterns, target boards and visors shall comply with AS 2144.

9.3.3 Type-2 Mounting pole

A Type-2 PTSU shall comply with the lantern mounting height requirements prescribed in the MUTCD Part 14, Section 5.2.

9.3.4 Type-2 Dimensions

A Type-2 PTSU shall not exceed dimensions that are unsafe or impractical to mount on a trailer.

9.3.5 Type-2 Wind loading

A Type-2 PTSS, shall have all components certified by a suitably qualified RPEQ to ensure that the PTSS will maintain its intended orientation and position when subjected to the wind loading conditions of the region in which the PTSS is intended to be deployed, in accordance with AS 1170.2.

9.3.6 Type-2 Battery, controller and communications compartment

The storage compartment shall incorporate room for a battery, communications and controller components. The compartment shall be key lockable and comply with applicable OH&S regulations and requirements.

Any storage compartments shall have dust and moisture ingress protection of at least IP45.

9.3.7 Type-2 Stabilisers

The PTSS shall be suitably designed to ensure stability of each PTSU when positioned on site. The type of stabilisers shall:

- a) allow for swivel
- b) be located on the four corners of the trailer or barrow, have fixed locations engineered to stabilise the barrow or tripod with the PTSU fully extended while meeting wind loading conditions
- c) be wind-down and readily storable for safe and secure moving

- d) have a load rating sufficient for levelling of the PTSU, and
- e) have a locking mechanism with removable handles and secure drive nuts.

9.4 Type-2 Traffic signal lantern

The traffic signal lantern requirements indicated below specifically refer to the physical lantern and not the electronic or optical performance requirements.

The traffic signal lantern and associated control electronics shall comply with the relevant requirements of MRTS201 *General Equipment Requirements*. All physical requirements of the lantern shall comply with AS 2144 unless otherwise specified.

9.4.1 Type-2 Target boards

Type-2 PTSSs shall use target boards in accordance with AS 4191. Target boards shall be manufactured from aluminium.

9.4.2 Type-2 Visors

Each aspect of each lantern shall be fitted with a visor in accordance with the requirements of AS 2144.

9.5 Type-2 Hand-held remote controller

The hand-held remote controller shall be lightweight, have a ruggedised construction, and be resistant to mishandling, shock and vibrations. The HRC shall have an ingress protection rating of at least IP65 as defined in AS 60529.

10 Type-2 Electrical requirements

The electrical requirements of MRTS201 *General Equipment Requirements* apply to this Technical Specification unless otherwise specified. Additional electrical requirements for equipment provided under this Technical Specification are given below.

Detailed designs of the electrical wiring, solar and charging assembly shall be reviewed and signed by the Contractor's RPEQ. They shall then be submitted and approved by the Principal or their delegate for verification and acceptance. **Hold Point 4**

10.1 Type-2 Portable traffic signal lanterns

The electrical requirements of traffic signal lantern aspects used in PTSSs shall be in accordance with the requirements of AS 2144, unless otherwise specified.

Only three aspect (green, yellow, red) LED lanterns shall be used.

10.1.1 Type-2 Supply voltage

The PTSS shall only use traffic signal lantern aspects that are 12V Direct Current (D.C.) lanterns as per AS 2144.

10.1.2 Type-2 Dimming

Type-2 PTSS dimming requirements shall comply with the requirements set in AS 4191.

10.2 Type-2 Solar panel array

Type-2 PTSS shall have solar power systems provided.

The selection, configuration, installation and testing of solar panel modules shall be consistent with AS/NZS 4509.1, AS/NZS 4509.2 and AS/NZS 5033. Additionally, Type-2 solar panel arrays shall be compliant with the requirements in AS 4191.

All solar panel module fittings and adjustments shall be designed, manufactured and tested with appropriate theft prevention methods.

The solar panel size shall not exceed the barrow or trailer footprint intended for PTSU mounting.

10.3 Type-2 Batteries

10.3.1 Type-2 Portable Traffic Signal System

Type-2 PTSSs shall be powered by solar, batteries and / or via a generator in accordance with AS 4191. The battery technology used in a Type-2 PTSS shall be as per AS 4191 and subject to the following additional conditions:

- a) Shall operate a PTSS for a minimum of seven sun free days.
- b) Shall not exceed 80% Depth of Discharge (DOD).
- c) Shall be installed to minimise the risk of:
 - i. impact by a motor vehicle
 - ii. theft or vandalism
 - iii. explosion.

Suitable circuit protection shall be fitted between the battery and any connected load. The circuit protection shall be appropriately sized for the rated load.

A switch shall be fitted to safely disconnect the battery from the load in the event of a catastrophic failure or incorrect signal display.

10.3.2 Type-2 Battery charger

Refer AS 4191.

11 Type-2 Portable traffic signal lantern photometric performance

The photometric performance of signal lanterns used with a Type-2 PTSS shall meet the parameters defined in AS 2144. A NATA accredited test report must be provided to the department to ensure photometric compliance.

12 Type-2 Documentation Requirements

Each PTSS shall be supplied with documentation for training, configuration, operation and maintenance detailing how to safely use the system. As a minimum it shall detail:

- a) safe transportation of the PTSU
- b) on-site installation
- c) suitable locations for installation

- d) setting up of the PTSS for operation
- e) HRC operation
- f) starting up
- g) shutting down
- h) safe manual handling procedures for the batteries
- i) routine and preventative maintenance
- j) troubleshooting
- k) Workplace Health and Safety (WH&S) requirements
- l) specific details and calculations of the battery size. The documentation provided on the solar system shall contain all the applicable elements provided in the worked example of Appendix A of AS/NZS 4509.2. The manufacturer specification sheet of the photovoltaic array, batteries and battery charger / regulator shall be provided.

13 Type-2 Testing, commissioning and configuration requirements

After the PTSS is first built and before being used on site, a Factory Acceptance Test (FAT) shall be completed in accordance with the requirements of this Technical Specification. **Witness Point 1**

The PTSS shall be demonstrated to the satisfaction of the Department of Transport and Main Roads. The PTSS is required to operate for one hour without any faults occurring. All functionality shall be tested whilst under demonstration. **Witness Point 2**

A Regulatory Compliance Mark (RCM) prescribed by the ACMA shall be required. **Witness Point 3**

The testing documentation for each PTSS used on site shall be provided to the Principal when submitting the Traffic Guidance Scheme (TGS) in accordance with Clause 5.3.2 of MRTS02 *Provision for Traffic*.

A Site Acceptance Test (SAT) shall also be performed **Witness Point 4** The PTSS is required to operate for 500 hours without any faults occurring whilst being operated by a traffic controller at a work site requiring traffic control and must not be left unattended to be considered valid. After 100 hours, additional PTSSs can be used to contribute towards a higher 600 hour requirement.

Table 13 – PTSS required testing hours

Number of PTSS	Hours per PTSS	Hours Total
1	500	500
2	300	600
3	200	600
4	150	600
5	120	600

Whilst the SAT is being performed a detailed log must be kept and must contain the following information:

- date
- start and end time

- hours used
- company
- location
- name of traffic controller(s) using the PTSS
- number of faults
- description of faults, and
- signature.

14 Type-2 Warranty provisions

The warranty requirements defined in MRTS201 *General Equipment Requirements* apply to this Technical Specification.

15 Type-2 Training requirements

The training requirements defined in MRTS201 *General Equipment Requirements* apply to this Technical Specification.

16 Type-2 Maintenance requirements

The maintenance requirements defined in MRTS201 *General Equipment Requirements* apply to this Technical Specification.

17 Type-2 Handover requirements

The handover requirements defined in MRTS201 *General Equipment Requirements* apply to this Technical Specification.

