

Technical Specification

**Transport and Main Roads Specifications
MRTS227 Changeable Message Signs**

July 2017

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1 Introduction

This Technical Specification defines the design, supply, installation, testing and commissioning, performance, documentation, training and maintenance requirements for Changeable Message Signs (CMS).

A CMS may be used in lieu of a Variable Message Sign (VMS) where three pre-determined alternate messages (which may include a blank sign face) are sufficient and where the functionality of a VMS is not otherwise warranted.

This Technical Specification shall be read in conjunction with MRTS01 *Introduction to Technical Specifications*, MRTS50 *Specific Quality System Requirements* 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 defined in Clause 2 of MRTS01 *Introduction to Technical Specifications* and MRTS201 *General Equipment Requirements* apply to this Technical Specification. Additional terminology relevant to this Technical Specification is defined in Table 2 below.

Table 2 - Definitions

Term	Definition
CMS	Changeable message sign(s)
Message	A pre-determined sign face that complies with the requirements of static signs as specified in the MUTCD
VMS	Variable message sign(s)

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 the referenced MRTS (including those referenced in MRTS201 *General Equipment Requirements*), the requirements specified in this Technical Specification shall take precedence.

Table 3 - Referenced documents

Reference	Title
AS 60529-2004	<i>Degrees of protection provided by enclosures (IP Code)</i>
MRTS01	<i>Introduction to Technical Specifications</i>
MRTS14	<i>Road Furniture</i>
MRTS50	<i>Specific Quality System Requirements</i>
MRTS61	<i>Mounting Structures for ITS devices</i>
MRTS201	<i>General Equipment Requirements</i>
MRTS232	<i>Provision of Field Processors</i>

Reference	Title
MUTCD	Queensland <i>Manual of Uniform Traffic Control Devices</i>
TSI-SP-003	NSW RTA "Communications Protocol For Roadside Devices"

4 Quality system requirements

The quality system requirements defined in MRTS201 *General Equipment Requirements* apply to this Technical Specification. Additional quality system requirements relevant to this Technical Specification are defined in Table 4. There are no Witness Points or Milestones defined.

Table 4 – Hold Point, Witness Point and Milestone

Clause	Hold Point	Witness Point	Milestone
12.1	1. Final proposed CMS design locations shall comply with the guide signs.		

5 Functional requirements

The CMS shall allow for any one of three pre-determined messages (which may include blanks) to be displayed to drivers. The sign shall return to a default message under conditions as specified in this Specification. The CMS shall be suitable for monitoring and control both locally and remotely from the site.

6 Equipment components

The CMS shall include:

- a) a dynamic display and display enclosure
- b) column / mounting support and footings
- c) telecommunications field cabinet (complying with MRTS201 *General Equipment Requirements*) to house all control and communications equipment associated with the CMS
- d) CMS controller
- e) co-located STREAMS field processor
- f) power supply
- g) warning signals
- h) mechanical, electrical and control systems facility switch
- i) where specified, internal lighting, and
- j) where the display enclosure is located above the road surface, a maintenance gantry that complies with MRTS201 *General Equipment Requirements*.

7 Operational requirements

7.1 General

The operational requirements defined in MRTS201 *General Equipment Requirements* apply to equipment provided under this Technical Specification. The minimum additional operational requirements for equipment provided under this Technical Specification are described below.

7.2 Fail safe mechanism

The CMS shall incorporate a fail-safe mechanism that will return the dynamic display to a default message in the event of power failure to the CMS, or loss of communications with STREAMS for at least 30 minutes.

7.3 Control mode

Control shall be in accordance with Clause 8. The motor actuator shall operate in either forward or in reverse to display the required message without displaying an intermediate message.

The CMS shall allow for local and remote control including:

- a) selection of display / required message
- b) enabling the flashing of warning lights, and
- c) disabling the flashing of warning lights.

The CMS shall allow for local and remote status monitoring of:

- a) displayed message
- b) local manual / STREAMS control switch position
- c) communications fault
- d) warning lights faults
- e) warning lights flashing status, and
- f) mains power fault (where alternate power supply provided).

7.4 Default message

The default message as agreed by the Principal shall be as shown in the design documentation.

7.5 Warning signals

Flashing yellow lanterns shall be located on the face of each CMS at the four corners of the display enclosure. At sites with a posted speed limit greater than 60 km/hr, the lantern size shall be 250 mm. At sites with a posted speed limit of less than or equal to 60 km/hr, the lantern size shall be 100 mm.

As a minimum, the flash sequence shall alternate the pair of diagonally opposite lanterns. Where additional flash sequences are provided, these shall allow local and remote selection by the user.

The flash rate parameters shall be selectable via all of the communications ports, with an initial cycle time of one second, and diagonal flashing duty cycle of 50/50 (lit/unlit). Where two or more CMS are visible concurrently, the flashing elements of each sign shall flash in synchronisation.

The flashing lanterns on CMS used exclusively for heavy vehicle management shall be provided with magenta coloured lenses. CMS for broader traffic management shall be provided with yellow coloured lenses.

7.6 Internal clock

Each CMS shall be provided with an internal clock in accordance with MRTS201. The internal clock shall allow for automatic synchronisation with a remote Network Time Protocol (NTP) time server.

8 Control system

The control system requirements defined in MRTS201 *General Equipment Requirements* apply to equipment provided under this Specification. Additional control system requirements for equipment provided under this Specification are described below.

8.1 General

The CMS shall be operated by an integral control system that is controlled in the following order of priority:

- a) local facility switch
- b) hardwired input(s)
- c) maintenance communications port (modem / laptop), and
- d) control communications port (FP).

Software shall be provided in accordance with Clause 8.5.

8.2 Local facility switch

A four position key operated facility switch that complies with MRTS201 *General Equipment Requirements*, shall be provided to enable selection of the following display functions:

- OFF – Message one (default)
 - control via the maintenance communications port or the control communications port inhibited, and
 - status and diagnostic commands via the maintenance communications port and the control communications port remain functional.
- Auto - display active and selected via the maintenance communications port or the control communications port
- Message two, Message three - display either message two or three
 - control via all communications ports inhibited, and
 - status and diagnostic commands via all communications ports remain functional.

8.3 Maintenance communications port

It shall be possible to control and interrogate the CMS via an EIA/RS-232 maintenance communications port at the CMS site. The RS-232 port shall allow local and remote communications via a laptop computer (provided by others). The Contractor shall provide CMS messaging and diagnostics software necessary for local and remote communications. The maintenance communications port shall also allow remote connection of a similar computer via a modem.

Where specified in the contract, a modem shall be provided with each CMS. The modem(s) shall comply with the requirements of MRTS201 *General Equipment Requirements*. Where a leased telecommunications channel is provided, the Contractor shall arrange on behalf of the Principal the installation and connection of the leased telecommunications channel to the CMS site in accordance with MRTS201 *General Equipment Requirements*.

A physical change of connection between remote and local operation shall not require further interaction from the user, nor in anyway interrupt operation or require rebooting of CMS control system or computer/ software. The hardware handshaking lines of the EIA / RS-232 interface shall be used such that connection/ disconnection of the maintenance PC (either locally or by modem) results in the immediate initiation/ termination of the maintenance port communications session with the sign.

The CMS control and diagnostics software shall be capable of operating at all possible modem connection and serial port speeds.

8.4 Control communications port

It shall be possible to control and interrogate the CMS via either of two EIA / RS-422 control communications ports. The control communications port shall allow local connection of a field processor/ modem that complies with MRTS232 for communications with STREAMS.

Where specified in the contract, a modem shall be provided with each CMS for data communications. The modem(s) shall comply with MRTS201 *General Equipment Requirements*. The Contractor shall provide an EIA / RS-422 interface to connect to the modem(s) as necessary.

Complete control and monitoring by STREAMS shall be possible through either or both the control communications ports as determined by telecommunications infrastructure provided at each site.

While a computer (local or remote via modem) is connected to the CMS via the maintenance communications port, control of the CMS via the control ports shall be inhibited. However, status and diagnostic interrogation by STREAMS via the control communications ports shall remain possible.

Where communications equipment is connected to both control communications ports, the primary port shall be used for control commands to/from the CMS, and the secondary port shall be used for status-only communications with the CMS.

Where communications equipment is connected to only one control communications port (or in the case of failure of either communications port or attached equipment) the CMS shall automatically revert to full control and status communications through the active port.

CMS communications software shall be capable of operating at all possible modem connection and/or serial port speeds.

8.5 Control/diagnostics software

The CMS integral control system shall fully implement all CMS functions as required by Clause 8.8 for each of the maintenance communications and control communications ports.

The computers may use Microsoft Windows® operating systems, from XP to those industry standards current at the time of use. Any software provided shall be capable of operating on all such operating systems.

The software shall report the selected position of the facility switch.

8.6 Hardwired inputs

The CMS controller shall have the ability to display a predefined message when it receives a voltage free contact closure or similar input from an external device such as a loop detector or vehicle height detector.

Unless otherwise specified, the CMS controller shall be capable of accepting a minimum of four inputs.

8.7 Temperature control

The CMS shall provide at least one temperature sensor to measure the temperature inside the enclosure near the top centre. The sensor shall not be mounted directly against the top face of the enclosure. The temperature reading shall be available through the use of a protocol message via STREAMS. The temperature shall be in units of degrees centigrade.

8.8 Communication protocol

Communication between the field processor and the CMS shall comply with TSI-SP-003 and MRTS201 *General Equipment Requirements*.

8.9 Bus arbitration

The CMS shall act as a slave on the EIA RS-422A / modem bus.

8.10 Message hierarchy

The CMS controller shall accept multiple message selection inputs and display messages in accordance with the specified message hierarchy.

9 Mechanical and physical requirements of the display enclosure

9.1 Display

The CMS shall consist of fabricated triangular elements mounted in a display enclosure.

The fabricated triangular elements shall rotate and align to display one of three messages. Where a blank message is provided, this shall be shown as a solid, matte black sign face. Each message shall be displayed directly, without showing an intermediate message. Messages shall be displayed using a motor actuator to effect the change, however it shall be possible to automatically display the default message when electric power is unavailable. The fabricated triangular elements may be mounted in either the vertical or horizontal plane. The motor actuator and all necessary mechanical linkages and electrical circuitry shall be installed in the display enclosure.

9.2 Display enclosure

The enclosure requirements defined in MRTS201 *General Equipment Requirements* apply to the display enclosure provided under this Specification. In addition the display enclosure shall:

1. house the display elements
2. include a clear, non-reflective polycarbonate front screen and provide a protection rating of IP56 to AS 60529, and
3. maintenance shall be performed from the rear of the display enclosure.

9.3 Mechanical and physical requirements

The mechanical and physical requirements specified in MRTS201 *General Equipment Requirements* and MRTS01 *Introduction to Technical Specifications* apply to equipment provided under this Technical Specification, except as follows:

- a) exterior colour: matte black, and
- b) interior colour: matte black.

9.4 Columns and footings

Columns and footings shall comply with MRTS201 *General Equipment Requirements* and MRTS61 *Mounting Structures for ITS Devices*.

9.5 Message appearance

The dimensions of the signs and each message shall comply with the MUTCD requirements for static signs. The retro-reflective material for each message shall comply with the requirements for retro-reflective sheeting described in MRTS14.

The MRTS14 requirement for retro-reflectivity supplements the AS/NZS 1906 requirements for retro-reflectivity.

10 Electrical

The electrical requirements defined in MRTS201 *General Equipment Requirements* apply to equipment provided under this Technical Specification.

11 Telecommunications requirements

The telecommunications requirements defined in MRTS201 *General Equipment Requirements* apply to work under this Technical Specification.

12 Installation requirements

12.1 CMS locations

Unless otherwise specified, the CMS may be located either:

- over the carriageway on a gantry
- on the left verge of the carriageway, or
- cantilevered from the left side of the carriageway.

The longitudinal position for the CMS shall be shown in the design documentation. The design location may vary according to the application and require regard to sight distances and other relevant conditions. The final proposed design location shall comply with the guide signs requirements of the MUTCD and be verified by site inspection with the Principal. **Hold Point 1**

Unless otherwise specified, each CMS mounted over the carriageway shall have a minimum clearance of 6.1 m from the bottom of the display enclosure to the finished surface level of the carriageway.

12.2 Column and footings

When installed directly over the carriageway, the display enclosure shall be mounted on a gantry as specified in MRTS201 *General Equipment Requirements* and MRTS61 *Mounting Structures for ITS Devices*.

When cantilevered over the carriageway, the display enclosure shall be mounted onto a large diameter cylindrical column as specified in MRTS201 *General Equipment Requirements*.

When installed in the verge, the display enclosure shall be mounted on supports in accordance with MRTS201 *General Equipment Requirements*.

The mounting method of the CMS enclosure shall permit adjustment of the vertical plane of the enclosure about its horizontal axis.

13 Testing and commissioning

The testing and commissioning requirements defined in MRTS201 *General Equipment Requirements* apply to work under this Technical Specification.

14 Documentation

The documentation requirements defined in MRTS201 *General Equipment Requirements* apply to work under this Technical Specification.

15 Training

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

16 Maintenance

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

17 Handover

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

