

Superseded

Technical Specification

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

March 2023

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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).

CMS defined in this Technical Specification consist of fabricated triangular elements mounted in a display enclosure where the fabricated triangular elements rotate and align to display one of three messages.

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
NTP	Network Time Protocol
ROAR	Transport and Main Roads' Road Operations Asset Register
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 4852.1	<i>Variable Message Signs: 1 Fixed Signs</i>
AS 60529-2004	<i>Degrees of protection provided by enclosures (IP Code)</i>
MRTS01	<i>Introduction to Technical Specifications</i>

Reference	Title
MRTS14	<i>Road Furniture</i>
MRTS50	<i>Specific Quality System Requirements</i>
MRTS61	<i>Gantries and Support Structures for Road Signs, Tolling Systems and ITS Devices</i>
MRTS201	<i>General Equipment Requirements</i>
MRTS226	<i>Telecommunications Field Cabinets</i>
MRTS232	<i>Provision of Field Processors</i>
MRTS245	<i>ITS Telecommunications Network (ITS TN)</i>
MUTCD	<i>Queensland Manual of Uniform Traffic Control Devices</i>
SD1581	<i>ITS – Cantilever – Cantilever Structure</i>
TSI-SP-003	<i>NSW RTA “Communications Protocol For Roadside Devices”</i>

4 Quality system requirements

4.1 Hold Points, Witness Points and Milestones

General requirements for Hold Points, Witness Points and Milestones are specified in Clause 5.2 of MRTS01 *Introduction to Technical Specifications*.

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

Additional quality system requirements defined in MRTS201 *General Equipment Requirements* also apply to this Technical Specification.

Table 4.1 – 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* and MRTS226 *Telecommunications Field Cabinets*, where applicable) 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 MRTS61 *Gantries and Support Structures for Road Signs, Tolling Systems and ITS Devices*.

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

The control system 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 Conspicuity lanterns

Conspicuity lanterns in the form of flashing yellow roundels 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 90 km/hr, the lantern diameter shall be minimum 200 mm. At sites with a posted speed limit of less than or equal to 90 km/hr and greater than 60 km/hr, the lantern diameter shall be minimum 160 mm. At sites with posted speed less than or equal to 60 km/hr, the lantern diameter shall be minimum 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 colour of the conspicuity lanterns shall lie within the yellow region specified by the chromaticity coordinates in AS 4852.1.

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 *General Equipment Requirements*. The internal clock shall allow for automatic synchronisation with a remote Network Time Protocol (NTP) time server to allow regular update of the CMS internal clock. In the absence of network connectivity or outage, the CMS internal clock shall maintain an accuracy better than ± 1 second within a one week period.

The internal clock shall be provided with its own dedicated backup power that will support it for no less than 60 days after the depletion of power backup systems in the CMS.

8 Control system

The control system requirements defined in MRTS201 *General Equipment Requirements* apply to equipment provided under this Technical 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 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 the CMS control system or computer / software. The hardware handshaking lines of the 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 RS-422 control communications ports. The control communications port shall allow local connection of a field processor / modem that complies with MRTS232 *Provision of Field Processors* 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 RS-422 interface to connect to the modem(s) as necessary.

Complete control and monitoring by STREAMS shall be possible through either or both of 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 Windows 10 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 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. be installed such that maintenance is 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* 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 *Gantries and Support Structures for Road Signs, Tolling Systems and 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 *Road Furniture*.

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

10 Electrical

The electrical requirements including power supply and electrical safety requirements defined in MRTS201 *General Equipment Requirements* apply to equipment provided under this Technical Specification.

11 Telecommunications requirements

The CMS shall have provisions for connection to the Principal's telecommunication networks as defined in MRTS245 *ITS Telecommunications Network (ITS TN)* and the telecommunications requirements defined in MRTS201 *General Equipment Requirements*.

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 CMS mounting

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

When cantilevered over the carriageway, the display enclosure shall be mounted onto a large diameter cylindrical column as specified in MRTS61 *Gantries and Support Structures for Road Signs, Tolling Systems and ITS Devices* and shown in SD1581 *ITS – Cantilever – Cantilever Structure*.

When installed in the verge, the display enclosure shall be mounted on supports in accordance with MRTS61 *Gantries and Support Structures for Road Signs, Tolling Systems and ITS Devices*.

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.

14.1 Asset Data

Once each ITS asset type being installed is known, this shall be communicated to the Principal at first opportunity. This is required to ensure assets are recorded in ROAR and have appropriate Asset IDs and Site IDs.

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.

18 Product approval checklist

The checklist for the product approval evaluation is published as Appendix A to this Technical Specification.

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Appendix A – Product Approval Compliance Checklist

Item#	MRTS227 Changeable Message Signs Requirements	MRTS Clause	Verification Method					Compliance (Y, TBC, N, N/A)
			Visual Inspection	NATA Certification	Field OR Bench Test	Detailed Drawings	Other records (Datasheets, internal testing, RPEQ)	
5 Functional requirements								
1	The CMS shall allow for any one of three pre-determined messages (which may include blanks) to be displayed to drivers.	5	X			X	X	
2	The sign shall return to a default message under conditions as specified in this Technical Specification.	5	X		X		X	
3	The CMS shall be suitable for monitoring and control both locally and remotely from the site.	5	X		X		X	
6 Equipment components								
4	The CMS shall include:	6						
5	a) a dynamic display and display enclosure	6	X				X	
6	b) column / mounting support and footings	6	X				X	
7	c) telecommunications field cabinet (complying with MRTS201 <i>General Equipment Requirements</i> and MRTS226 <i>Telecommunications Field Cabinets</i> , where applicable) to house all control and communications equipment associated with the CMS	6	X				X	
8	d) CMS controller	6	X				X	
9	e) co-located STREAMS field processor	6	X				X	
10	f) power supply	6	X				X	
11	g) warning signals	6	X				X	
12	h) mechanical, electrical and control systems facility switch	6	X				X	
13	i) where specified, internal lighting, and	6	X				X	

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			Visual Inspection	NATA Certification	Field OR Bench Test	Detailed Drawings	Other records (Datasheets, internal testing, RPEQ)	
14	j) where the display enclosure is located above the road surface, a maintenance gantry that complies with MRTS61 <i>Gantries and Support Structures for Road Signs, Tolling Systems and ITS Devices</i> .	6	X				X	
7 Operational requirements								
15	The operational requirements defined in MRTS201 <i>General Equipment Requirements</i> apply to equipment provided under this Technical Specification.	7.1					X	
16	The minimum additional operational requirements for equipment provided under this Technical Specification are described below.	7.1						
17	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.	7.2	X		X		X	
18	The control system shall be in accordance with Clause 8.	7.3						
19	The motor actuator shall operate in either forward or in reverse to display the required message without displaying an intermediate message.	7.3	X		X		X	
20	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.	7.3	X		X		X	

Item#	MRTS227 Changeable Message Signs Requirements	MRTS Clause	Verification Method					Compliance (Y, TBC, N, N/A)
			Visual Inspection	NATA Certification	Field OR Bench Test	Detailed Drawings	Other records (Datasheets, internal testing, RPEQ)	
21	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).	7.3	X		X		X	
22	The default message as agreed by the Principal shall be as shown in the design documentation.	7.4	X			X	X	
23	Conspicuity lanterns in the form of flashing yellow roundels shall be located on the face of each CMS at the four corners of the display enclosure.	7.5	X			X	X	
24	At sites with a posted speed limit greater than 90 km/hr, the lantern diameter shall be minimum 200 mm.	7.5	X			X		
25	At sites with a posted speed limit of less than or equal to 90 km/hr and greater than 60 km/hr, the lantern diameter shall be minimum 160 mm.	7.5	X			X		
26	At sites with posted speed less than or equal to 60 km/hr, the lantern diameter shall be minimum 100 mm.	7.5	X			X		
27	As a minimum, the flash sequence shall alternate the pair of diagonally opposite lanterns.	7.5	X		X		X	
28	Where additional flash sequences are provided, these shall allow local and remote selection by the user.	7.5	X		X		X	

Item#	MRTS227 Changeable Message Signs Requirements	MRTS Clause	Verification Method					Compliance (Y, TBC, N, N/A)
			Visual Inspection	NATA Certification	Field OR Bench Test	Detailed Drawings	Other records (Datasheets, internal testing, RPEQ)	
29	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).	7.5	X		X		X	
30	Where two or more CMS are visible concurrently, the flashing elements of each sign shall flash in synchronisation.	7.5	X		X		X	
31	The colour of the conspicuity lanterns shall lie within the yellow region specified by the chromaticity coordinates in AS 4852.1.	7.5		X				
32	The flashing lanterns on CMS used exclusively for heavy vehicle management shall be provided with magenta coloured lenses.	7.5	X				X	
33	CMS for broader traffic management shall be provided with yellow coloured lenses.	7.5	X	X				
34	Each CMS shall be provided with an internal clock in accordance with MRTS201 <i>General Equipment Requirements</i> .	7.6					X	
35	The internal clock shall allow for automatic synchronisation with a remote Network Time Protocol (NTP) time server to allow regular update of the CMS internal clock.	7.6			X		X	
36	In the absence of network connectivity or outage, the CMS internal clock shall maintain an accuracy better than ± 1 second within a one week period.	7.6			X		X	
37	The internal clock shall be provided with its own dedicated backup power that will support it for no less than 60 days after the depletion of power backup systems in the CMS.	7.6	X				X	

Item#	MRTS227 Changeable Message Signs Requirements	MRTS Clause	Verification Method					Compliance (Y, TBC, N, N/A)
			Visual Inspection	NATA Certification	Field OR Bench Test	Detailed Drawings	Other records (Datasheets, internal testing, RPEQ)	
8 Control System								
38	The control system requirements defined in MRTS201 <i>General Equipment Requirements</i> apply to equipment provided under this Specification.	8					X	
39	Additional control system requirements for equipment provided under this Specification are described below.	8						
40	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).	8.1	X		X		X	
41	Software shall be provided in accordance with Clause 8.5.	8.1						
42	A four position key operated facility switch that complies with MRTS201 <i>General Equipment Requirements</i> , shall be provided to enable selection of the following display functions:	8.2	X				X	
43	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.	8.2	X		X		X	
44	Auto - display active and selected via the maintenance communications port or the control communications port.	8.2	X		X		X	

Item#	MRTS227 Changeable Message Signs Requirements	MRTS Clause	Verification Method					Compliance (Y, TBC, N, N/A)
			Visual Inspection	NATA Certification	Field OR Bench Test	Detailed Drawings	Other records (Datasheets, internal testing, RPEQ)	
45	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.	8.2	X		X		X	
46	It shall be possible to control and interrogate the CMS via an RS-232 maintenance communications port at the CMS site.	8.3			X		X	
47	The RS-232 MAINTENANCE port shall allow local and remote communications via a laptop computer (provided by others).	8.3			X		X	
48	The Contractor shall provide CMS messaging and diagnostics software necessary for local and remote communications.	8.3			X		X	
49	The maintenance communications port shall also allow remote connection of a similar computer via a modem.	8.3			X		X	
50	Where specified in the contract, a modem shall be provided with each CMS.	8.3					X	
51	The modem(s) shall comply with the requirements of MRTS201 <i>General Equipment Requirements</i> .	8.3					X	
52	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 <i>General Equipment Requirements</i> .	8.3					X	
53	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 the CMS control system or computer / software.	8.3			X		X	

Item#	MRTS227 Changeable Message Signs Requirements	MRTS Clause	Verification Method					Compliance (Y, TBC, N, N/A)
			Visual Inspection	NATA Certification	Field OR Bench Test	Detailed Drawings	Other records (Datasheets, internal testing, RPEQ)	
54	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.	8.3			X		X	
55	The CMS control and diagnostics software shall be capable of operating at all possible modem connection and serial port speeds.	8.3			X		X	
56	It shall be possible to control and interrogate the CMS via either of two EIA / RS-422 control communications ports.	8.4	X		X		X	
57	The control communications port shall allow local connection of a field processor / modem that complies with MRTS232 <i>Provision of Field Processors</i> for communications with STREAMS.	8.4			X		X	
58	Where specified in the contract, a modem shall be provided with each CMS for data communications.	8.4			X		X	
59	The modem(s) shall comply with MRTS201 <i>General Equipment Requirements</i> .	8.4			X		X	
60	The Contractor shall provide an EIA / RS-422 interface to connect to the modem(s) as necessary.	8.4			X		X	
61	Complete control and monitoring by STREAMS shall be possible through either or both of the control communications ports as determined by telecommunications infrastructure provided at each site.	8.4			X		X	

Item#	MRTS227 Changeable Message Signs Requirements	MRTS Clause	Verification Method					Compliance (Y, TBC, N, N/A)
			Visual Inspection	NATA Certification	Field OR Bench Test	Detailed Drawings	Other records (Datasheets, internal testing, RPEQ)	
62	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.	8.4			X		X	
63	However, status and diagnostic interrogation by STREAMS via the control communications ports shall remain possible.	8.4			X		X	
64	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.	8.4			X		X	
65	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.	8.4			X		X	
66	CMS communications software shall be capable of operating at all possible modem connection and/or serial port speeds.	8.4			X		X	
67	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.	8.5			X		X	
68	The computers may use Microsoft Windows operating systems, from Windows 10 to those industry standards current at the time of use.	8.5			X		X	
69	Any software provided shall be capable of operating on all such operating systems.	8.5			X		X	

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			Visual Inspection	NATA Certification	Field OR Bench Test	Detailed Drawings	Other records (Datasheets, internal testing, RPEQ)	
70	The software shall report the selected position of the facility switch.	8.5	X		X		X	
71	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.	8.6	X		X		X	
72	Unless otherwise specified, the CMS controller shall be capable of accepting a minimum of four inputs.	8.6			X		X	
73	The CMS shall provide at least one temperature sensor to measure the temperature inside the enclosure near the top centre.	8.7	X		X		X	
74	The sensor shall not be mounted directly against the top face of the enclosure.	8.7	X		X		X	
75	The temperature reading shall be available through the use of a protocol message via STREAMS.	8.7			X		X	
76	The temperature shall be in units of degrees centigrade.	8.7	X				X	
77	Communication between the field processor and the CMS shall comply with TSI-SP-003 and MRTS201 <i>General Equipment Requirements</i> .	8.8			X		X	
78	The CMS shall act as a slave on the EIA / RS-422 / modem bus.	8.9			X		X	
79	The CMS controller shall accept multiple message selection inputs and display messages in accordance with the specified message hierarchy.	8.10			X		X	
9 Mechanical and physical requirements of the display enclosure								
80	The CMS shall consist of fabricated triangular elements mounted in a display enclosure.	9.1	X				X	

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81	The fabricated triangular elements shall rotate and align to display one of three messages.	9.1	X		X		X	
82	Where a blank message is provided, this shall be shown as a solid, matte black sign face.	9.1	X				X	
83	Each message shall be displayed directly, without showing an intermediate message.	9.1	X		X		X	
84	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.	9.1			X		X	
85	The fabricated triangular elements may be mounted in either the vertical or horizontal plane.	9.1	X		X		X	
86	The motor actuator and all necessary mechanical linkages and electrical circuitry shall be installed in the display enclosure.	9.1	X		X		X	
87	The enclosure requirements defined in MRTS201 <i>General Equipment Requirements</i> apply to the display enclosure provided under this Specification.	9.2					X	
88	In addition, the display enclosure shall:	9.2						
89	1. house the display elements	9.2	X				X	
90	2. include a clear, non-reflective polycarbonate front screen and provide a protection rating of IP56 to AS 60529, and	9.2	X	X			X	
91	3. be installed such that maintenance is performed from the rear of the display enclosure.	9.2	X				X	

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92	The mechanical and physical requirements specified in MRTS201 <i>General Equipment Requirements</i> apply to equipment provided under this Technical Specification, except as follows: a) exterior colour: matte black, and b) interior colour: matte black.	9.3	X				X	
93	Columns and footings shall comply with MRTS201 <i>General Equipment Requirements</i> and MRTS61 <i>Gantries and Support Structures for Road Signs, Tolling Systems and ITS Devices</i> .	9.4				X	X	
94	The dimensions of the signs and each message shall comply with the MUTCD requirements for static signs.	9.5	X				X	
95	The retro-reflective material for each message shall comply with the requirements for retro-reflective sheeting described in MRTS14 <i>Road Furniture</i> .	9.5	X	X			X	
10 Electrical								
96	The electrical requirements including power supply and electrical safety requirements defined in MRTS201 <i>General Equipment Requirements</i> apply to equipment provided under this Technical Specification.	10	X		X	X	X	
11 Telecommunications requirements								
97	The CMS shall have provisions for connection to the Principal's telecommunication networks as defined in MRTS245 <i>ITS Telecommunications Network</i> and the telecommunications requirements defined in MRTS201 <i>General Equipment Requirements</i> .	11			X	X	X	

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12 Installation requirements								
98	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.							
99	The longitudinal position for the CMS shall be shown in the design documentation.							
100	The design location may vary according to the application and require regard to sight distances and other relevant conditions.							
101	The final proposed design location shall comply with the guide signs requirements of the MUTCD and be verified by site inspection with the Principal.							
102	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.							
103	When installed directly over the carriageway, the display enclosure shall be mounted on a gantry as specified in MRTS201 <i>General Equipment Requirements</i> and MRTS61 <i>Gantries and Support Structures for Road Signs, Tolling Systems and ITS Devices</i> .							
104	When cantilevered over the carriageway, the display enclosure shall be mounted onto a large diameter cylindrical column as specified in MRTS61 <i>Gantries and Support Structures for Road Signs, Tolling Systems and ITS Devices</i> and shown in SD1581.							
105	When installed in the verge, the display enclosure shall be mounted on supports in accordance with MRTS61 <i>Gantries and Support Structures for Road Signs, Tolling Systems and ITS Devices</i> .							

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106	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								
107	The testing and commissioning requirements defined in MRTS201 <i>General Equipment Requirements</i> apply to work under this Technical Specification.							
14 Documentation								
108	The documentation requirements defined in MRTS201 <i>General Equipment Requirements</i> apply to work under this Technical Specification.							
109	Once each ITS asset type being installed is known, this shall be communicated to the Principal at first opportunity.							
110	This is required to ensure assets are recorded in ROAR and have appropriate Asset IDs and Site IDs.							
15 Training								
111	The training requirements defined in MRTS201 <i>General Equipment Requirements</i> apply to work under this Technical Specification.							
112	The maintenance requirements defined in MRTS201 <i>General Equipment Requirements</i> apply to work under this Technical Specification.							
17 Handover								
113	The handover requirements defined in MRTS201 <i>General Equipment Requirements</i> apply to work under this Technical Specification.							

Superseded