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## RECORD OF AMENDMENTS

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<td>0.3</td>
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<td>29/01/2016</td>
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<td>0.4</td>
<td>Modified 6.1.5 to state that viewing windows are not recommended. Clarified requirements around placement of conspicuity lanterns. Fixed grammar, formatting and list numbering issues identified during reviews.</td>
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APPENDIX A – COMMUNICATIONS PROTOCOL MESSAGE SET
1 SCOPE

This specification covers the general requirements for Changeable Message Signs (CMS) that are used in permanent positions above or adjacent to the roadway for lane designation or traffic management applications in New South Wales.

This specification is limited to CMS with electronic sign faces. Electronic-style CMS are defined as signs that satisfy all of the following conditions:

- Appear blank when unpowered;
- Have predefined display elements rather than a programmable matrix;
- Present a sign face to motorists by illuminating one or a combination of the predefined display elements;
- Allow their displayed sign face to be selected locally using switches or contact closures in the control unit, without the need for a computer or other secondary control unit to be connected to the device; and
- May be integrated into a larger, static sign face.

Typically, CMS of this type have black sign faces with elements illuminated using LED or optical fibre technology.

Details relating to the design and layout of the CMS display elements are typically provided within purchasing documentation, and are not covered in this Specification. Approval for all sign face designs should be sought from the Guidance and Delineation Unit, within Network and Safety Section.

The support post or structure for the CMS is not considered an integral part of the CMS, and is accordingly not explicitly detailed in this document. CMS designs of the shutter type or flip signs are excluded from scope. Prismatic or “Trivision” style signs utilising rotating prisms to form a sign face are covered in RMS Specification TSI-SP-034 Changeable Message Signs – Prismatic and are not covered by this specification.
2 REFERENCES AND APPLICABLE DOCUMENTS

2.1 Australian Standards

[1] AS 1170.2 – Structural design actions – Wind actions

2.2 Roads and Maritime Services Documents

[8] TS201 – Approval of ITS Field Equipment

2.3 Other Documents


3 DEFINITIONS AND GLOSSARY OF TERMS

For the purposes of this Specification, the following definitions and abbreviations shall apply:

CMS – Changeable message sign
Conspicuity Device – Yellow LED lights set at perimeter of or adjacent to display
Control Unit – Device which controls the display elements and conspicuity devices contained within the CMS Display Unit.
Display Element – Features of the sign face design (including arrowheads, text or pictograms) which can be lit or unlit, creating different sign face designs
Display Unit – CMS body that houses the background board, display elements and conspicuity devices (where fitted)
IEC – International Electrotechnical Commission
ISO – International Standards Organisation
Master Controller – Remote controller driving and monitoring the CMS.
RCM – Regulatory Compliance Mark
4 GENERAL

4.1 Diagram

An example of an electronic CMS display with a sign face used for lane guidance, including optional conspicuity devices is shown in Figure 1. The left hand arrow is comprised of two display elements, a shaft and arrowhead, both of which are active. The right hand arrow is comprised of five display elements, three of which are active at any given time to display the two different sign faces.

Figure 1 – Example of electronic Changeable Message Sign, showing active and inactive display elements.

Electronic CMS displays used for lane guidance can also be integrated into larger, static sign faces. An example of such a sign is shown below as Figure 2.

Figure 2 – Example of small electronic Changeable Message Signs integrated within a larger static sign
4.2 Main Elements of CMS

The CMS described by this specification comprises a Display Unit and a Control Unit.

The Display Unit houses the non-reflective black sign background board, the display elements comprising the sign face and the electronic circuitry required to power the display elements. The Display Unit may also optionally contain yellow conspicuity lanterns which flash in a predetermined pattern when triggered. The Display Unit may be mounted on a dedicated support structure, or alternatively be fitted onto a pre-existing structure such as a pedestrian bridge or static sign.

The CMS Control Unit controls the Display Unit by activating one or more display elements to create the desired sign face. The control unit also monitors the condition of the sign face elements and door status, and raises fault alarms when anomalous operation or status is detected. The enclosure housing the Control Unit houses all the electrical control items to drive and monitor the status of the Display Unit.

5 OVERALL REQUIREMENTS

5.1 Compliance with Specifications

5.1.1 All equipment and materials, where not otherwise specified, shall be in accordance with Australian Standards where such exist, and in their absence, with appropriate IEC or ISO Standards. The equipment shall comply with the requirements of the NSW Work Health and Safety Act 2011 (Ref. [9]).

5.2 Dimensions and Location

5.2.1 A CMS is normally mounted over the roadway or closely adjacent to it. Sign dimensions, and sign locations will be specified in the purchasing documentation as appropriate to the project and site. Widths between 0.5m and 5m can be expected; most commonly in the middle of this range.

5.3 Operating Life

5.3.1 Designed operating life of Enclosures and Structural components shall be as below:
    – Enclosures of Display Unit and Control Unit – not less than 20 years
    – Structural components including sign mounting – not less than 50 years.

5.3.2 Designed operating life for items not listed above shall be as per TSI-SP-016 (Ref.[7]).

5.4 Environmental Requirements

5.4.1 The environmental requirements shall be as per Section 2 of TSI-SP-016 (Ref.[7]), and also per Section 5 of AS4852.1 - 2009 (Ref.[5]). The ingress protection requirements are summarised below:

    (a) The Display unit shall meet the IP65 requirement of 5.2(a) of AS4852.1 (Ref. [5]), when seated against a support post or equivalent, with respect to external water and dust.
(b) The Control Unit shall meet the IP45 requirement of 5.2(b) of AS4852.1 (Ref. [5]), when seated against a support post or equivalent, with respect to external water and dust.

5.5 **Power Supply Requirements**

5.5.1 Unless explicitly specified in the purchasing documentation, the power supply to all equipment covered by this Specification shall be a nominal 230V, 50Hz mains power supply.

5.5.2 Mains powered equipment shall operate correctly and reliability within specification over a voltage range of 210V – 270V a.c. r.m.s. and for any variations in frequency between 48Hz and 52Hz.

5.5.3 Mains powered equipment shall not be damaged by mains supply voltages over a range from 0V – 280V a.c. r.m.s. and for any variations of frequency in the range between 45Hz and 55Hz.

5.5.4 If solar/battery powered equipment is specified within the purchasing documentation, the approval submission shall be accompanied with analysis of the solar panel output and battery energy storage capacity required to meet the levels of availability and system autonomy specified in the purchasing documentation.

5.5.5 Battery powered equipment shall operate within specification over a voltage range between the lower voltage limit set by the natural failure voltage of the battery specified by the battery manufacturer, and the upper voltage limit when the battery is connected to a charging device and is fully charged.

5.5.6 Battery powered equipment shall not be damaged by battery voltages over a range from 0V to the nominal battery voltage plus 25%, and shall be protected against reversal of the polarity of the supply voltage.

5.6 **Generic Requirements – Technical and Process**

5.6.1 Specification TSI-SP-016 (Ref.[7]) applies. TSI-SP-016 lists generic technical requirements and also describes processes and requirements for Equipment Testing and Inspection, Certification and Approval, Quality Assurance, Documentation, Warranties, and Spares.

5.7 **Packing and Transport**

5.7.1 The CMS and any spare parts, tools and ancillary equipment shall be appropriately packed to minimise risk of damage during transport and facilitate handling.

5.8 **Maintainability**

5.8.1 All major components of the CMS display unit and control unit shall be laid out in a manner that facilitates fault troubleshooting and component replacement. This may include the provision of electrical test points if applicable.

5.8.2 The supplier shall make available field maintenance documentation providing detailed explanation of all routine recurring, preventative, fault finding and rectification activities. Details on documentation to be provided are contained in Section 14.
6  DISPLAY UNIT REQUIREMENTS

6.1  Enclosure

6.1.1 The display unit enclosure shall facilitate direct access to all internal components of the CMS, including the display elements and conspicuity lanterns where fitted, without the use of specialised tools.

6.1.2 The display unit enclosure shall be capable of being locked to prevent unauthorised access and removal of equipment.

6.1.3 The display unit enclosure shall contain a mechanism to inhibit the build-up of moisture within the enclosure due to condensation.

6.1.4 The exterior of the display unit enclosure shall possess a nameplate, conforming to Section 9.

6.1.5 A viewing window covering the sign face is not recommended. Where the display unit enclosure has a viewing window, the covering shall be treated such that reflections are minimal. This shall take into account the intensity and/or the angle of incidence of the sun.

6.2  Structure Attachment

NOTE: Details applicable to the intended site(s), including the dimensions of the CMS and the type of support structure required, are typically provided within the purchasing documentation, and are not defined within this Specification.

6.2.1 The display unit shall possess a robust mounting point or mounting points used to attach the display unit enclosure and any additional sign face elements to the support structure, as appropriate to the dimensions and mass of the display unit and sign face.

6.2.2 Mounting points for the display unit enclosure and any additional sign face elements shall have sufficient strength to satisfactorily withstand the static dead load of the display unit enclosure.

6.2.3 Mounting points for the display unit enclosure and any additional sign face elements shall have sufficient strength to satisfactorily withstand the design wind gust speed in AS1170.2 (Ref. [1]), assuming Region B and a Terrain Category of 2.

6.2.4 Mounting points for the display unit enclosure and any additional sign face elements shall have sufficient strength to satisfactorily withstand forces induced as a result of vibrations or other movement of the support structure.

6.3  Display Elements

6.3.1 The display unit shall contain one or more display elements, combinations of which are activated to present a complete sign face to the motorist.

6.3.2 Active display elements shall be lit, with luminance and luminance ratio in compliance with Table 3.3 of AS4852.1 (Ref. [5]).

6.3.3 When tested in accordance with Appendix D of AS4852.1 (Ref. [5]), the colour of the display elements shall lie within the applicable region specified by the chromaticity coordinates in Table 3.4 of AS4852.1 (Ref. [5]).
6.3.4 The display elements shall provide a minimum of two brightness levels, selection of which shall be controlled by the CMS Control Unit.

6.3.5 Inactive display elements shall remain unlit and appear to be the same colour as the sign background board.

6.3.6 The display element driver shall monitor the status of the display elements. If a display element is unable to be activated, the display shall blank out and a fault indication on that element shall be provided to the CMS Control Unit. A display element is deemed to be active if it is immediately recognisable by a person meeting the minimum visual acuity requirements for driver licensing.

NOTE: Minimum visual acuity requirements for driver licensing are defined in Austroads Document AP-G56-13 (Ref. [10]).

6.3.7 The display element driver shall prevent the display of any sign face utilising a display element with an uncleared fault indication, and shall display a blank sign face if any such display is requested by the CMS Control Unit.

6.3.8 Fault indications raised by the display element driver shall be maintained within the CMS Control Unit until manually cleared by maintenance personnel.

6.4 Conspicuity Lanterns

This sub-section is applicable only where conspicuity lanterns are specified by Roads and Maritime Services as part of the purchasing documentation, and otherwise does not apply.

6.4.1 The conspicuity lanterns shall be a flashing yellow LED display located on the front of the sign display. A sign shall have either two or four conspicuity lanterns.

6.4.2 Where two conspicuity lanterns are fitted, they shall be located in either of the following locations:
   (a) At each of the top two corners of the CMS display unit; or
   (b) At the midpoint of the vertical sides of the CMS display unit.

6.4.3 Where four conspicuity lanterns are fitted, they shall be located at each of the four corners of the CMS display unit.

6.4.4 The conspicuity lanterns shall conform to one of the following shapes:
   (a) Circular; or
   (b) Rectangular, where the longer side of the conspicuity lanterns must be parallel with and adjacent to the CMS display unit enclosure, and the aspect ratio of the lanterns (lantern width divided by lantern height) shall fall between the values of 0.5 and 2.0.

   It is permissible for the corners of a rectangular conspicuity lantern to be rounded off. Where this is done, the curve radius of each corner shall not exceed \( \frac{1}{3} \) of the length of the shortest side of the rectangle.
6.4.5 The size of the conspicuity lanterns shall comply with Table 1 below:

<table>
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<th>Conspicuity Lantern Area</th>
<th>Equivalent side length (where square)</th>
<th>Equivalent diameter (where circular)</th>
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<tr>
<td>v ≤ 60 km/h</td>
<td>7854mm(^2)</td>
<td>88mm</td>
<td>100mm</td>
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<tr>
<td>60 km/h &lt; v ≤ 90km/h</td>
<td>26880 mm(^2)</td>
<td>164mm</td>
<td>185mm</td>
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<tr>
<td>v &gt; 90km/h</td>
<td>49087 mm(^2)</td>
<td>221mm</td>
<td>250mm</td>
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Table 1 – Approach Speed and Diameter of Conspicuity Lanterns

6.4.6 The luminance of the conspicuity lanterns shall comply with Table 3.3 of AS4852.1 (Ref. [5])

6.4.7 When tested in accordance with Appendix D of AS4852.1 (Ref. [5]), the colour of the conspicuity lanterns shall lie within the “Yellow” region specified by the chromaticity coordinates in Table 3.4 of AS4852.1 (Ref. [5])

6.4.8 The conspicuity lanterns shall provide a minimum of two brightness levels, selection of which shall be controlled by the CMS Control Unit.

6.4.9 The flash cycle of the conspicuity lanterns shall have a nominal cycle time of 1 second (±10%), and a duty cycle of 50% (±5%).

6.4.10 Once activated, the flash cycle and duty cycle shall not change during operation by greater than 5% cycle to cycle.

6.4.11 The flash pattern of the conspicuity lanterns shall be controlled by the CMS Control Unit. The conspicuity lanterns shall provide the following flash patterns as a minimum requirement:

(a) Off (no lantern display)
(b) Top/Bottom Paired (up/down flashing)
(c) Left/Right Paired (side/side flashing)
(d) Diagonal Paired (wig/wag flashing)
(e) All flash

7 CMS CONTROL UNIT REQUIREMENTS

The CMS Control Unit is connected to, and controls the display elements and conspicuity lanterns (where fitted) within the CMS Display Unit.

7.1 Enclosure

7.1.1 The CMS Control Unit enclosure shall be lockable and shall be located in one of the following locations, as specified in the purchasing documentation:

(a) ground-mounted;
(b) post-mounted; or
(c) mounted on the back of the sign (not recommended).
7.1.2 The CMS Control Unit enclosure shall comply with Section 2.1.4.1 of AS4852.1 (Ref. [5]) but excluding items ii to viii inclusive.

7.1.3 The exterior of the CMS Control Unit enclosure shall possess a nameplate, conforming to Section 9.

7.1.4 If post-mounted, cable entry to the CMS Control Unit Enclosure shall be from the rear via a corresponding access point in the support post. This cable entry point, and the corresponding access point in the support post shall be sealed such that the CMS Control Unit Enclosure has environmental protection conforming to Section 5.4.

7.1.5 The CMS Control Unit Enclosure shall be supplied complete with the following provisions:
   (a) A main switchboard complying with AS/NZS 3000 (Ref. [3]) for the mains power supply to the CMS installation
   (b) Relays and control circuits, including terminations for all interconnecting cables
   (c) Surge and transient protection devices to withstand the surges specified in AS/NZS 1768 (Ref. [2]), Category B, with medium exposure peak amplitudes.
   (d) CMS Control Unit, as detailed in Section 7.2
   (e) A switch or other control mechanism with three operational positions, allowing a technician to either turn the CMS display off (by switching off all display elements and isolating the CMS display from mains power), or alternatively toggle between local control and automatic control.
   (f) A multi-positional switch or other control mechanism, allowing a technician to manually select each available sign face for display when the switch defined in 7.1.5(e) above is in the “local control” position. Where this switch is used to operate the sign, the display elements should operate at full brightness.
   (g) Where conspicuity lanterns are fitted, a multi-positional switch or other control mechanism, allowing a technician to manually select each available flash pattern of the conspicuity lanterns when the switch defined in 7.1.5(e) above is in the “local control” position. At a minimum, the options listed in Section 6.4.11 shall be selectable. Where this switch is used to operate the conspicuity lanterns, the lanterns should operate at full brightness.
   (h) Vacant shelf area, sufficient for the installation of a modem or other small additional hardware.
   (i) A door switch, allowing the CMS Control Unit to detect when the door of the CMS Control Unit Enclosure is opened.

7.2 Functions

7.2.1 The CMS Control Unit shall interface with the Display Unit (Section 6) and the control switch defined in Section 7.1.5(e).

7.2.2 The CMS Control Unit shall possess a serial (EIA232/EIA485) port for interfacing with, and providing inputs and outputs to other devices and systems (e.g. modem)

7.2.3 The CMS Control Unit shall detect the position of the control switch defined in Section 7.1.5(e).

7.2.4 Where the CMS Control Unit detects that the control switch defined in Section 7.1.5(e) is in the “automatic control” position, the CMS Control Unit shall control the display elements, based on input from an external source connected via a serial port (Section 7.2.2) or contact closure (Section 7.3).
7.2.5 Where the CMS Control Unit detects that the control switch defined in Section 7.1.5(e) is in the "local control" position, the CMS Control Unit shall control the display elements, based on input from the control switch defined in Section 7.1.5(f).

7.2.6 Where the CMS Control Unit detects that the control switch defined in Section 7.1.5(e) is in the "automatic control" position, the CMS Control Unit shall control the flash pattern of the conspicuity lanterns (where fitted), based on configuration data entered or commanded via the serial port (Section 7.2.2). At a minimum, the options listed in Section 6.4.8 shall be supported.

7.2.7 Where the CMS Control Unit detects that the control switch defined in Section 7.1.5(e) is in the "local control" position, the CMS Control Unit shall control the flash pattern of the conspicuity lanterns (where fitted), based on input from the control switch defined in Section 7.1.5(g).

7.2.8 The CMS control unit shall provide an input to control the brightness level of the display elements and conspicuity lanterns (where conspicuity lanterns fitted), when the control switch defined in Section 7.1.5(e) is in the "automatic control" position based on input from an external source connected via a serial port (Section 7.2.2) or contact closure (Section 7.3). A minimum of two options shall be selectable, as defined in Section 6.4.8.

7.2.9 The CMS Control Unit shall provide a visible output indicating the state of the control switch defined in Section 7.1.5(e). Where the control switch defined in Section 7.1.5(e) is in the "local control" position, this shall be reflected in the contact closure outputs (Section 7.3.6(a)), while also returning an override error response over the serial port (Section 7.2.2).

7.2.10 The CMS Control Unit shall provide a visible output indicating which face has currently been selected on the CMS Display Unit. This output shall be sent as a response over the serial port (Section 7.2.2) to a request received from an external source. This output shall also be reflected in the contact closure outputs (Section 7.3.5).

7.2.11 The CMS Control Unit shall provide a visible output indicating the flash pattern of the conspicuity lanterns (where conspicuity lanterns fitted).

7.2.12 The CMS Control Unit shall provide an output indicating when the door of the Control Unit Enclosure is opened. This output shall be reflected in the contact closure output defined in Section 7.3.6(b).

7.2.13 The CMS Control Unit shall provide a visible output indicating when a fault with the system has been detected. This output shall be provided separately for the following fault conditions:

(a) Display element failure; or

(b) Conspicuity lantern failure (where conspicuity lanterns fitted). This should trigger should the failure of one or more conspicuity lanterns be detected by the system.
7.3 **Contact Closure Inputs and Outputs**

This sub-section specifies the contact closure inputs and outputs required to interface the CMS Control Unit with a Roads and Maritime type-approved Traffic Signal Controller.

The requirements under this sub-section shall apply, except where explicitly excluded by Roads and Maritime Services as part of the purchasing documentation.

7.3.1 The CMS Control Unit shall provide contact closure inputs, capable of interfacing with the 240V a.c. signal group outputs provided by a Roads and Maritime type-approved Traffic Signal Controller, or 24V d.c. special purpose outputs provided by a Roads and Maritime type-approved Traffic Signal Controller.

7.3.2 The CMS Control Unit shall provide contact closure outputs, capable of interfacing with the 32V a.c. contact closure Special Facility (SF) or external detector circuit provided by a Roads and Maritime type-approved Traffic Signal Controller.

7.3.3 The CMS Control Unit shall provide one contact closure input corresponding with each non-blank sign face supported by the CMS (i.e. if a CMS supports two different non-blank sign faces, two contact closure inputs shall be provided). If all of these contact closure inputs are inactive, the sign shall present a blank face (all display elements unlit).

7.3.4 In addition to the contact closure inputs defined in Section 7.3.3 above, the CMS Control Unit shall also provide contact closure inputs, as defined below:

(a) Activate conspicuity devices (where conspicuity lanterns fitted – default state is maximum brightness)

(b) Dim display elements and conspicuity devices (where conspicuity lanterns fitted)

7.3.5 The CMS Control Unit shall provide one contact closure output corresponding with each non-blank sign face supported by the CMS (i.e. if a CMS supports two different non-blank sign faces, two contact closure outputs shall be provided). If the sign is displaying a blank face (all display elements unlit), none of these contact closures shall be active.

7.3.6 In addition to the contact closure outputs defined in Section 7.3.5 above, the CMS Control Unit shall provide contact closure outputs, as defined below:

(a) CMS control switch set to “Local Control”

(b) CMS Control Unit enclosure door opened

(c) CMS fault detected

8 **CONNECTION TO HOST CONTROL SYSTEM**

This section is applicable only where the CMS Control Unit is required to connect with a host control system, for example at Transport Management Centre.

8.1 **Communications Link and Protocol**

8.1.1 The communications protocol and message set used to interface the CMS Control Unit with the host control system shall be as described in Appendix A.
8.2  Real-Time Clock

In addition to the requirements for real-time clock in Section 2.4 of AS 4852.1 (Ref. [5]), the following requirements shall apply:

8.2.1 The real-time clock shall be provided with dedicated power backup in addition to any other power backup system in the CMS. The dedicated power backup shall supply only the real-time clock.

8.2.2 This backup source shall have the following characteristics:
(a) Is maintenance-free;
(b) Is rated for operation over an extended range of ambient temperatures up to 70°C;
(c) Has a service life of not less than five (5) years under normal operation.
(d) Shall provide not less than 60 days of support to the real-time clock after the depletion of any other power backup system in the CMS.

8.2.3 The CMS shall update its real-time clock when an update time message is received from the host control system.

8.2.4 The CMS shall provide automatic updates to the real-time clock for daylight-saving related time changes. For the purpose of this requirement, the CMS shall provide user configurable settings for the dates and times to change from standard time to daylight saving time and vice versa. The default settings shall be as follows:
(a) Start of daylight saving time - At 0200 hr on the first Sunday in October;
(b) End of daylight saving time - At 0300 hr on the first Sunday in April.

8.2.5 The CMS shall log all time updates and changes.

8.3  Non-Volatile Memory

8.3.1 The CMS shall provide non-volatile memory for all of its configuration settings, logs and other data and information that need to be preserved when power to the CMS is off or lost.

8.4  Fault, Alarm and Event Logs

8.4.1 Sufficient memory to support the following shall be provided for the fault log, alarm log and event log of the CMS:
(a) For fault log, not less than 50 entries or usage for 12 months, whichever is more;
(b) For alarm log, not less than 500 entries or usage for 12 months, whichever is more;
(c) For event log, not less than 1000 entries or usage for 12 months, whichever is more.

Logs shall use the first-in first-out method in the event the above allocated memory is insufficient.

8.4.2 It shall be possible for a technician to physically connect a computer to the CMS Control Unit to view the log while on site. Where special cables or software are required, the manufacturer shall supply them.
9 NAMEPLATES

Aluminium nameplates shall be affixed in a permanent manner to the exterior of the Display Unit and Control Unit, containing the following information:

(a) Product/model name,
(b) Manufacturer's name,
(c) A unique serial number, and
(d) The approval number or numbers shown on the Certificate of Suitability/Certificate of Compliance, alongside the Regulatory Compliance Mark (RCM), in accordance with AS4417.1 (Ref. [4]).

A high quality process (such as photo engraving, anodising, etc) shall be used to produce the legends on the nameplates. The legends shall be clearly legible, indelible, and non-fading.

10 APPROVAL

10.1 Overall Approval for a specific application

To gain overall approval of a CMS design, the supplier shall follow the process defined in TS201 (ref. [8]).

10.2 Approval of CMS sign face designs

Proposed CMS sign face designs shall be forwarded to the Guidance and Delineation Unit, within Network and Safety Section for review, assessment and approval.

Approval for any CMS implementation will not be granted unless the application is accompanied with written evidence that all presented sign faces have been assessed and approved by the Guidance and Delineation Unit.

10.3 Certificate of Suitability

The equipment manufacturer or Supplier shall obtain a NSW Certificate of Suitability for any equipment capable of being powered from the mains supply to ensure that the equipment meets minimum electrical safety requirements. Once a Certificate of Suitability is issued, it is the manufacturer’s and Supplier’s responsibility to ensure that the equipment complies with any subsequent amendments to State Regulations and Australian Standard Specifications relative to electrical safety.

If the design of the equipment is changed, it is necessary for the manufacturer/Supplier to have the Certificate of Suitability endorsed accordingly.

Where a Certificate of Suitability or an equivalent document is issued in another state, the Supplier shall obtain written evidence from the appropriate NSW government office that such Certificate or document is regarded as fully equivalent to a Certificate of Suitability issued by the NSW government office.
11 QUALITY ASSURANCE

11.1 General

The Supplier and the manufacturer shall operate a quality management system complying with ISO 9001.

11.2 Third Party Accreditation

The quality management system shall be certified by a quality management system certification body either accredited under the criteria laid down in the Joint Accreditation System of Australia and New Zealand (JAS-ANZ), or listed in the International Standards Organisation ISO Directory of ISO 9000 and ISO 14000 Accreditation and Certification Bodies.

11.3 Quality Plan

The manufacturer shall document a quality plan appropriate to the item detailing the quality control tests and assessments the manufacturer will conduct during manufacture prior to release. This shall include sampling plans and test frequency, and a description of the records to be made, as relevant.

A copy of this quality plan shall be provided by the supplier to Roads and Maritime as part of the approval process. Acceptance of this quality plan by Roads and Maritime is a prerequisite to gaining overall approval of a CMS design.

11.4 Quality Audits

Roads and Maritime reserves the right to examine the Manufacturer's quality records pertaining to any order for CMS. Roads and Maritime also reserves the right to arrange for an independent quality audit concerning CMS in contract.

12 TESTING AND INSPECTION

12.1 Routine Production Tests

Tests and assessments shall be carried out by the manufacturer before Pre-delivery Acceptance Test, as defined in the manufacturer’s quality plan.
13 WARRANTY

Purchase of any items under this Specification shall be subject to a warranty period, to be confirmed by the Tenderer, of not less than 24 months following the date of despatch from the Manufacturer's Works or Agent's Premises to the Roads and Maritime store. Any CMS failed in service or found to be defective within 24 months of the date of despatch will be delivered to the Supplier, who shall then make good the defect, arrange to have the defect made good or replace the CMS with another, and subsequently return the good unit to Roads and Maritime at no charge to Roads and Maritime. Unless otherwise agreed, defective CMS shall be processed and returned within 60 calendar days from the date the Supplier is notified by CMS of the defect.

It is expressly understood that any CMS failed as a result of a traffic accident, abuse or act of vandalism after delivery to Roads and Maritime will not be covered by warranty provisions.

14 DOCUMENTATION TO BE SUPPLIED

The Supplier shall submit the following documentation, as a minimum, in support of a submission for approval for the CMS via email to the ITS HelpDesk (ITSHelpDesk@rms.nsw.gov.au) for Approval by the ITS Principal:

(a) A quality plan for the CMS containing details of all tests undertaken during the manufacturing process (ref. Section 11.3).

(b) Installation manual containing all information required for the installation of the CMS and any other associated equipment. This manual shall not depend on the presence of any other (separately bound) documentation or manual and shall present the information in a manner and sequence that is relevant to the installation procedure.

(c) Operations manual detailing the operation of the CMS.

(d) Maintenance manual including preventative (routine) maintenance procedures and recommended maintenance schedules, if any. Fault maintenance procedures covering the replacement of key components in the event of failure shall be provided.

(e) Reference mechanical drawings of all supplied equipment.

(f) Any other documentation requested under the process defined in TS201 (Ref. [8]).

Failure to provide the full information called for in this section shall render the submission liable to rejection.
APPENDIX A – COMMUNICATIONS PROTOCOL MESSAGE SET

A.1 General

A communication link will be provided for communication between each CMS (via the CMS Control Unit) and the host control system.

For communications to a host control system, the CMS shall use a subset of messages from TSI-SP-003 (Ref.[6])

A.2 Message set

For communications to a host control system, the CMS shall use the following subset of messages from TSI-SP-003 (Ref. [6]).

NOTE: This subset has been intentionally selected from those messages used for the control of variable message signs (VMSs). This is so that the CMS can be controlled from the existing facilities provided by the host control system for the control of VMSs.

The applicable Message Information (MI) codes for the control of CMSs are in the following table.

<table>
<thead>
<tr>
<th>Message Name</th>
<th>MI Code (Hex)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reject Message</td>
<td>00</td>
<td></td>
</tr>
<tr>
<td>Acknowledge (*ACK)</td>
<td>01</td>
<td></td>
</tr>
<tr>
<td>Start Session</td>
<td>02</td>
<td></td>
</tr>
<tr>
<td>Password Seed</td>
<td>03</td>
<td></td>
</tr>
<tr>
<td>Password</td>
<td>04</td>
<td></td>
</tr>
<tr>
<td>Heartbeat Poll</td>
<td>05</td>
<td></td>
</tr>
<tr>
<td>Sign Status Reply</td>
<td>06</td>
<td></td>
</tr>
<tr>
<td>End Session</td>
<td>07</td>
<td></td>
</tr>
<tr>
<td>System Reset</td>
<td>08</td>
<td>Refer to Section A.2.1 for details.</td>
</tr>
<tr>
<td>Update Time</td>
<td>09</td>
<td>Required for timestamping of fault log entries.</td>
</tr>
<tr>
<td>Sign Set Text Frame</td>
<td>0A</td>
<td>Sets CMS aspect and conspicuity device state but does not cause the display (until message with MI = 0E received). Refer to Section A.2.2 for details.</td>
</tr>
<tr>
<td>Sign Display Frame</td>
<td>0E</td>
<td>Displays CMS aspect and activates conspicuity device state previously defined in received message with MI = 0A. Refer to Section A.2.3 for details.</td>
</tr>
<tr>
<td>Sign Set Dimming Level</td>
<td>14</td>
<td>Used to control dimming of conspicuity devices Refer to Section A.2.4 for details.</td>
</tr>
<tr>
<td>Sign Request Stored Frame/Message/Plan</td>
<td>17</td>
<td>CMS always responds with a Sign Set Text Frame message (MI = 0A). Refer to Section A.2.5 for details.</td>
</tr>
<tr>
<td>Message Name</td>
<td>MI Code (Hex)</td>
<td>Remarks</td>
</tr>
<tr>
<td>----------------------</td>
<td>---------------</td>
<td>------------------</td>
</tr>
<tr>
<td>Retrieve Fault Log</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>Fault Log Reply</td>
<td>19</td>
<td></td>
</tr>
<tr>
<td>Reset Fault Log</td>
<td>1A</td>
<td></td>
</tr>
</tbody>
</table>

**Table A.1 – TSI-SP-003 MI Codes Applicable to CMSs**

For parts of the TSI-SP-003 protocol that do not apply to CMS items, the CMS shall respond with the appropriate "not supported" error code in accordance with the protocol (MI = 00 hex and application error code 08 hex).

**NOTE:** The pair of MI codes 0A and 0E is retained to maintain logical compatibility with existing control system logic for variable message signs (VMSs). In that case the text frame is sent to the VMS (using message with MI = 0A) but is not actually displayed until the display frame command is sent (using message with MI = 0E).

**A.2.1 System Reset (MI = 08)**

In all cases, a System Reset shall not cause the CMS to change the displayed state. If the reset command is received during the transition between states, the CMS shall complete the transition to the destination state prior to implementing the reset.

(a) A reset level of zero shall turn off the conspicuity devices (if on), and set them to automatic dimming mode.

(b) A reset level of one shall perform all the actions associated with a reset level zero.

(c) A reset level of two shall perform all the actions associated with a reset level one in addition to resetting all faults and the fault log.

(d) A reset level of three shall perform all the actions associated with a reset level two.

(e) A reset level of 255 shall perform all the actions associated with a reset level three in addition to restoring to factory settings. Factory settings shall include the seed offset, password offset, baud rate, parity, etc but not the device address. Reset level 255 shall not cause the device controller to change to the off-line state.

**A.2.2 Sign Set Text Frame (MI = 0A)**

This command is bidirectional and has two functions:

(a) When sent from the control system to the CMS Control Unit, it informs the CMS which aspect to display next. It does not cause that aspect to be displayed.

(b) When sent from the CMS Control Unit to the control system, it informs the control system which aspect is presently being displayed by the CMS.

When sent from the control system to the CMS Control Unit:

(a) Frame 00 hex shall correspond to a blank sign face (i.e. all display elements turned off)

(b) Frame 01 hex shall correspond to the first non-blank sign face supported by the CMS and shall always be implemented

(c) Additional frames from 02 hex onwards shall correspond with all other non-blank sign faces supported by the CMS. Requests to display unsupported frame
numbers (i.e. numbers out of range) shall result in the CMS display remaining unchanged and an Application Error Code of 13 hex returned.

(d) Bytes for revision, font, and colour shall be ignored.
(e) The number of alphanumeric characters in the frame shall be 01 hex.
(f) The contents of the text frame (a single byte) shall agree with the frame number.

When sent from the CMS Control Unit to the control system:
(a) The Frame ID shall correspond to the CMS aspect being displayed.
(b) Bytes for revision, font, and colour shall be set to 00 hex.
(c) The number of alphanumeric characters in the frame shall be 01 hex.
(d) The contents of the text frame (a single byte) shall agree with the frame number.

A.2.3 Sign Display Frame (MI = 0E)
This command instructs the CMS to display the aspect and conspicuity device state previously defined in the Sign Set Text Frame (MI = 0A) message.
The byte for group ID shall be ignored.

A.2.4 Sign Set Dimming Level (MI = 14)
This command controls the dimming level of the display elements and conspicuity devices.
(a) Number of entries shall be 01 hex.
(b) The byte for group ID shall be ignored.
(c) The luminance level byte values 00 to 08 hex shall be interpreted as minimum intensity and values 09 to 10 hex shall be interpreted as maximum intensity.

A.2.5 Sign Request Stored Frame/Message/Plan (MI = 17)
This command instructs the CMS to report the stored aspect.
The frame/message/plan byte value shall be 00 hex.

A.3 Error Codes
For communications to a host control system, the CMS shall use a subset of Application Error Codes and Device Error Codes from TSI-SP-003 (Ref. [6]), Appendix C.

A.3.1 Application Error Codes
If the CMS receives a message to display an aspect which has not been defined, it shall report an application error code of 13 hex.

A.3.2 Controller and Device Error Codes
If the CMS is unable to display the commanded sign face due to the failure of one or more display elements, then it shall report a Device Error Code of 08 hex.
If the CMS detects a failure in one or more of the conspicuity lanterns, it shall report a Device Error Code of 0B hex.
Where the CMS Control Unit receives a message from the host control system while the control switch defined in Section 7.1.5(e) is in the “local control” position, then it shall report a Device Error Code of 10 hex (Facility Switch override).