A Joint Standard of AASHTO, ITE, and NEMA

NTCIP 1203 version v03

National Transportation Communications for ITS Protocol

Object Definitions for Dynamic Message Signs (DMS)

published September 2014

Published by

American Association of State Highway and Transportation Officials (AASHTO)
444 North Capitol Street, N.W., Suite 249
Washington, D.C. 20001

Institute of Transportation Engineers (ITE)
1627 I ("Eye") Street, N.W., Suite 600
Washington, D.C. 20006-4007

National Electrical Manufacturers Association (NEMA)
1300 North 17th Street, Suite 900
Rosslyn, Virginia 22209-3806

file version 1203 v0305p

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ACKNOWLEDGEMENTS

NTCIP 1203 v03 was prepared by the NTCIP Dynamic Message Sign Working Group (DMS WG), a subdivision of the Joint Committee on the NTCIP. The Joint Committee is organized under a Memorandum of Understanding among the American Association of State Highway and Transportation Officials (AASHTO), the Institute of Transportation Engineers (ITE), and the National Electrical Manufacturers Association (NEMA). The NTCIP development effort is guided by the Joint Committee on the NTCIP, which consists of six representatives from each of the above organizations.

When NTCIP 1203 v03 was prepared, the following individuals were active members of the NTCIP DMS WG:

Lesly Bien-Aimé
Russell Brookshire
Patrick Chan
Felix Cuellar
Gene Daigle
Terry Haukom
Ira Huttner
Amit Misra
Mark Morse, chair
Peter Ragsdale
Robert Rausch
Joerg “Nu” Rosenbohm
Ken Smith
Ken Vaughn
Derek Vollmer

Other individuals providing input include:

Steve Alonge
Blake Christie
Tom Kurihara

In addition to the many volunteer efforts, recognition is also given to those organizations who supported the efforts of the working groups by providing comments and funding for the standard, including:

Consensus Systems Technologies
Daktronics
Intelligent Devices, Inc.
McCain
Minnesota DOT
PBS&J
Port Authority of NY & NJ
Skyline
Southwest Research Institute
Telvent Farradyne
TransCore ITS
Trevilon
Ver-Mac
Washington State DOT

The U.S. Department of Transportation Joint Program Office provided funding assistance for the development of NTCIP 1203 v03.

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FOREWORD

NTCIP 1203 v03 uses only metric units.

NTCIP 1203 v03 identifies and defines how a management station may wish to interface with a field device to control and monitor dynamic message signs (DMS). NTCIP 1203 v03 defines requirements that are applicable to all NTCIP DMS and it also contains optional and conditional sections that are applicable to specific environments for which they are intended.

NTCIP 1203 v03 is an NTCIP Device Data Dictionary Standard. Device Data Dictionary Standards provide formal definitions of data elements for use within NTCIP systems.

For more information about NTCIP standards, visit the NTCIP Web Site at www.ntcip.org .

Approvals

NTCIP 1203 v03 was separately balloted and approved by AASHTO, ITE, and NEMA after recommendation by the Joint Committee on the NTCIP. Each organization has approved this standard as the following standard type, as of the date:

AASHTO—Standard Specification; December 2011
ITE–Software Standard; May 2012
NEMA—Standard; March 2012

History

The first version of NTCIP 1203 was published as NTCIP 1203:1997 and was also known as NEMA TS 3.6. In 2001, Amendment 1 was accepted by the Joint Committee on the NTCIP and subsequently Jointly Approved by all three SDOs. The Amendment did not add additional functionality but provided clarifications on object definitions and MULTI tags which have been detected by actual implementations.

NTCIP 1203 v02 was developed to reflect lessons learned, to update the document to the new documentation formats, and to add new features such as the colors, graphics, and a 3-tiered equipment management structure. NTCIP 1203 v02 also follows an established ‘systems engineering’ approach. Several new sections were added to relate user needs identified in a concept of operations, functional requirements, interface specifications and a requirements traceability matrix to the existing sections.

This Version 03 of the NTCIP 1203 standard adds test procedures that satisfy the functional requirements that has been provided. These test procedures, provided in Annex C of this standard, allows agencies procuring dynamic message signs to consistently test for conformance to this standard. Minor corrections and clarifications to the standard are also included. All changes are shown and explained in Annex D (Documentation of Revisions) of this standard.

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Compatibility of Versions

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INTRODUCTION

NTCIP 1203 v03 provides definitions of data elements for use with dynamic message signs. The data is defined using the Simple Network Management Protocol (SNMP) object-type format as defined in RFC 1212 and would typically be exchanged using one of the NTCIP recognized Application Layers (e.g., SNMP). The content of one object, the dmsMessageMultiString object, uses a complex syntax called the Mark-Up Language for Transportation Information (MULTI) format, also defined in NTCIP 1203 v03.

The following keywords apply to this document: AASHTO, ITE, NEMA, NTCIP, DMS, VMS, CMS, data, data dictionary, object, message sign, message board, sign, MULTI.

In 1992, the NEMA 3-TS Transportation Management Systems and Associated Control Devices Section began the effort to develop the NTCIP. The Transportation Section's purpose was to respond to user needs to include standardized systems communication in the NEMA TS 2 standard, *Traffic Controller Assemblies*. Under the guidance of the Federal Highway Administration's NTCIP Steering Group, the NEMA effort was expanded to include the development of communications standards for all transportation field devices that could be used in an Intelligent Transportation Systems (ITS) network. Message signs were identified as one of the highest priority expansion areas. As a result, in August 1995, NEMA created the DMS Technical Subcommittee to standardize DMS equipment. Their first task was the development of this document.

In September 1996, an agreement was executed among AASHTO, ITE, and NEMA to jointly develop, approve, and maintain the NTCIP standards. One of the first tasks of this joint effort was to finalize the work that NEMA had already begun on the object definitions for dynamic message signs.

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Section 1
General [Informative]

1.1 Scope

NTCIP 1203 v03 specifies the logical interface between Dynamic Message Signs (DMS) and the host systems that control them (commonly referred to as "central" systems). NTCIP 1203 v03 describes the supported DMS functionality in terms of user needs and requirements; however, the nature of the interface is determined in part by the operational nature of the devices being controlled, and therefore NTCIP 1203 v03 touches on such operational issues on occasion.

NTCIP 1203 v03 assumes a model of DMS operation in which DMS controllers possess intelligence, and the data used for message display and sign configuration is resident at the DMS controller. In particular, data elements such as fonts, graphics, message text, time-based schedules, and so forth may reside at the DMS controller, and the controller renders messages on the sign face based on this data (This model is typical of existing DMS applications, and may be contrasted with an alternate model in which, for example, the DMS controller only knows how to display static bitmaps, and all message layout and composition is performed by the central system.). We refer to the DMS controller's status, control, and configuration data as the "controller database"; NTCIP 1203 v03 specifies interfaces whereby this data can be manipulated by the central system. There are no imperative commands such as "Display a message" or "Report status"; the central system controls the behavior of the DMS purely through queries of and changes to the controller database using a suite of communication protocols appropriate for the underlying communications infrastructure. These communications protocols are defined in the NTCIP 23xx series (Application Layer protocols), NTCIP 22xx series (Transport Layer protocols), and NTCIP 21xx series (Subnetwork Layer protocols).

1.2 References

For approved amendments, contact:

NTCIP Coordinator
National Electrical Manufacturers Association
1300 North 17th Street, Suite 900
Rosslyn, Virginia 22209-3806
e-mail: ntcip@nema.org

For draft amendments of this document, which are under discussion by the relevant NTCIP Working Group, and recommended amendments of the NTCIP Joint Committee, visit the World Wide Web at http://www.ntcip.org.

The following standards (normative references) contain provisions which, through reference in this text, constitute provisions of this Standard. Other documents and standards (other references) are referenced in these documents, which might provide a complete understanding of the entire protocol and the relations between all parts of the protocol. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this Standard are encouraged to investigate the possibility of applying the most recent editions of the standards listed below.

1.2.1 Normative References

AASHTO / ITE / NEMA NTCIP 1102 v02	*Octet Encoding Rules (OER) Base Protocol* published October 2005
AASHTO / ITE / NEMA NTCIP 1103 v02	*Transportation Management Protocols (TMP)* published July 2010

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AASHTO / ITE / NEMA NTCIP 2301 v02	*Simple Transportation Management Framework (STMF) Application Profile (AP) (AP-STMF)* July 2010
AASHTO / ITE / NEMA NTCIP 1201 v03	*Global Object Definitions* published March 2011

1.2.2 Other References

IAB STD 16 (RFC 1155)	*Structure and Identification of Management Information for TCP/IP based Internets,* M. Rose, K. McCloghrie, May 1990, (RFC 1212) *Concise MIB Definitions*, M. Rose and K. McCloghrie, March 1991
AASHTO / ITE / NEMA NTCIP 8004 v02	*Structure and Identification of Management Information (SMI)* published in June 2010
RFC 1155	*Structure and Identification of Management Information for TCP/IP-based Internets.* K. McCloghrie; M. Rose; May 1990
RFC 1212	*Concise MIB Definitions.* K. McCloghrie; M. Rose; March 1991
AASHTO / ITE / NEMA NTCIP 1103 v02	*Transportation Management Protocols (TMP)* published July 2010
AASHTO / ITE / NEMA NTCIP 21xx series	*Subnetwork Profiles* published December 2001
AASHTO / ITE / NEMA NTCIP 22xx series	*Transport Profiles*
AASHTO / ITE / NEMA NTCIP 8003:2001	Profile Framework
AASHTO / ITE / NEMA NTCIP 9001 v04	*The NTCIP Guide* published July 2009
National ITS Architecture, Version 6.1	*National ITS Architecture, FHWA, 2010*
OMG Unified Modeling Language Specification, Version 1.5	*OMG Unified Modeling Language Specification, Object Management Group, 2003*

Note: NTCIP 2001, which was referenced previously, has been rescinded and superseded by NTCIP 2301, NTCIP 2201, and NTCIP 2101/2102.

Note: NTCIP 1101, which was referenced by a previous version of this standard, is being rescinded and superseded by NTCIP 1102, NTCIP 1103, and NTCIP 8004.

1.2.3 Contact Information

1.2.3.1 National ITS Architecture

The National ITS Architecture may be viewed on-line at http://itsarch.iteris.com/itsarch/

1.2.3.2 NTCIP Standards

Copies of NTCIP standards may be obtained from:

NTCIP Coordinator
National Electrical Manufacturers Association
1300 N.17th Street, Suite 900
Rosslyn, Virginia 22209-3806
e-mail: ntcip@nema.org

1.2.3.3 Object Management Group Documents

Copies of OMG standards may be obtained electronically from the Object Management Group at http://www.omg.org

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1.2.3.4 RFC Documents

Electronic copies of RFC documents may be obtained using anonymous FTP to the host “nic.mil” or “ds.internic.net.” Printed copies are available from:

DDN Network Information Center
14200 Park Meadow Center Suite 200
Chantilly, VA 22021
(800) 365-3642 (703) 802-4535

1.3 General Statements

<In the opinion of the responsible NTCIP working group, this subsection does not apply in the context of this standard publication.>

1.4 Terms

The following glossary exhibits many DMS-related terms and abbreviations used in the ITS industry in an attempt to support the standardization of DMS-related terms. Terms NOT directly referenced in this document are indented. The development of this glossary was closely coordinated with the NEMA TS4 development effort.

activate	The action of placing a message in the current buffer and performing the logic of running the message. Contrast with 'Display', which manipulates the sign display to make the current message visible to the driving public.
Activate Message	The command to direct the sign controller to display the message on the sign face.
Activation priority	A numeric value between 1 and 255 that the controller compares to the Run-time Priority of the current message. If the Activation Priority is greater than or equal to the Run-time Priority of the current message, the controller can replace the message. If the Activation Priority of the new Message is less than Run-time priority of the current message the controller rejects the activation of the new message.
Alternating Message	A message that contains more than one page of information/text.
Ambient Light Level	The amount of light surrounding the sign location.
ASCII	American Standard Code for Information Interchange, a 7-bit wide code used to represent a character set.
attribute	Shorthand notation for Message Attribute. Defines how a Message is displayed. See Message Attribute.
Axial Intensity	The brightness of light on the axis horizontally and vertically perpendicular to the sign face.
Backup Lamp	In a two lamp system, the secondary lamp that is used when the Primary Lamp has failed. Also, it may be turned on with the primary/normal lamp to create an over-bright illumination of the message.
beacon	A device that directs light in one direction and flashes (Similar to a one-section traffic intersection signal head). The device is intended to increase a driver’s attention to a message. The color is undefined (see also Strobe Lights).
bitmap	A digital representation of an image having bit reference pixels.
BITMAP	A subset of the SYNTAX type OCTET STRING where every bit is a representation of a part or function (e.g. lamp 1 = bit 1, lamp 2 = bit 2).
BITMAP16	BITMAP with 16 bits.
BITMAP32	BITMAP with 32 bits.
BITMAP8	BITMAP with 8 bits.

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Blank Message	A message that is devoid of informational content (blank) and the sign face is clear (all pixels off, or shutters closed depending on the display technology).
Blank Sign	A command or condition caused by a user command, error or fault condition, or default state in which a sign is not displaying a message, and depending on the display technology of the sign, has turned off lamps, LED drivers, etc.
Blank-Out Sign	A type of DMS that has the capability to show a blank message or one fixed message.
border	The blank area between the outer most edge of the sign face and the outermost edge of the sign housing.
brightness	See Luminance.
Brightness Control	A term that defines how the light intensity of a sign is determined/set. Automatic control uses local detection of ambient light to determine the brightness level of the sign, whereas manual control defines the brightness level by a control command.
Brightness Level	The intensity of the light used to form a message or that would be used to form a message if one is not currently displayed. Usually selected in one of several ways. Some examples: NONE ON / OFF DAY / NIGHT/ OVERBRIGHT x of y levels a percent of maximum brightness output level
Bulb Matrix	See Lamp Matrix
cabinet	An enclosure that protects the device's controller from the elements.
Candela (cd)	An SI unit of measure for luminance abbreviated cd.
Central Computer	A computer system that operates as a control source for one or more signs in the signage system. A computer/server that is host to its signs, also referred to as the host or central computer. The signage system may be controlled by central computers installed in more than one location. Or, it may be a remotely located central computer capable of managing the operation of one or more signs. Abbreviation is CC.
Central Control Computer	See Central Computer.
Central Control Mode	A state whereby control of the sign from the Central Computer. Preferred term for remote control mode.
Central Override Mode	A state whereby commands from Local Control Panel are ignored.
Central System (Sign Management Software)	The software that operates on the central computer controlling/monitoring signs.
Changeable Memory	A generic term for a type of memory that allows a user to modify the content. The content of the memory is not lost when power is turned off. See also ‘Permanent Memory, Non-Volatile Memory’ and ‘Volatile Memory’.

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Changeable Message Sign	A sign that is capable of displaying one of two or more predefined messages, or a blank message. Abbreviated CMS. The capabilities associated with a CMS are: - drum sign with several faces, or pixel matrix - several predefined message - downloading of new messages, graphics or fonts not possible - uploading of messages and graphic definition possible - blank message possible - all messages are defined - may support more than a monochrome color scheme (each drum face may have a different color scheme, each face may have multi-color text) - error report capabilities similar to VMS - exercising of pixels
Changeable Messages	A library of messages stored in non-volatile, memory/storage devices. See also Permanent Messages and Volatile Messages.
character	One symbol from a specific alphabet, font or character set.
Character Font	See Font.
Character Group	See Character Module.
Character Height	The vertical pitch times the number of pixels in the column of pixels.
Character Matrix Sign	A DMS sign that uses character matrixes with a fixed amount of blank space (no pixels present) between character matrixes to achieve the inter-character spacing. There is also blank space (no pixels present) between lines of characters to achieve the inter-line spacing.
Character Module, N	Component required to display N characters. This includes, but is not limited to, a subset of the following items based on the display technology of the sign: lamps, fiber, shutter, color filter, LED's, and frame to hold all of the above parts together as one unit.
Character Size	See Character Height.
Character Spacing	The spacing, in pixels, between two characters in line matrix or full matrix signs. The fixed amount of space between two characters on a character matrix sign.
Character Width	The horizontal pitch times the number of pixels in the row of pixels.
Characters Per Line	The number of characters that can be displayed on one line. Used in character oriented signs. Line matrix and full matrix signs are described as n columns (pixels) wide.
checksum	A data error-detection scheme. The result of an algorithm performed on a block of data.
Climate-Contol	The ability to control the temperature and other factors affecting the environment in which the DMS electronics operates.
color	The chromaticity specified in terms of the CIE 1931 Colorimetric System. A visually perceived characteristic of light, specified at a particular wavelength in nanometers. Color is one attribute used to display a message. Depending on the display technology of the sign, the color used to display a message may be fixed or selectable.
column	A vertical line of pixels.
Communication Failure	The condition when a central computer cannot communicate with the sign controller due to errors or malfunctions.
Communication Interface	The communication port(s) on the controller used to communicate with other device(s).

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compatible	The ability of two or more systems or components to exchange information (IEEE Std. 610.12-1990: IEEE Standard Glossary of Software Engineering Terminology).
Cone of Vision	The geometric figure (cone) used to define the area in which a message on a sign can be legibly viewed. It is measured in degrees. It is twice the angle from the axis of the pixel to the 50% brightness point on an LED display. The cone of vision is also known as the "viewing angle".
configuration	The setting of the parameters within the controller to operate the sign with a defined set of ranges, parameters and functions.
configure	To change one or more settings in the device.
consistent	The ability of two or more systems or components to exchange information and use the supported information that has been exchanged and gracefully reject any unsupported information according to defined rules.
Contrast Ratio	The amount of measured light emanating from the message divided by the amount of measured light reflected from the background.
Control Mode	Defines the current method by which the sign controller receives instructions.
controller	See Sign Controller.
Controller Address	See Sign Address.
Controller Failure	The condition caused when the DMS Controller does not properly perform its intended functions.
Controller Reset	A function that restarts the controller from an initialization process. This may be activated via time-outs of an event (watchdog, power loss), local reset button, or software command.
current	a.) Reflecting the conditions at the present time (or at the time at which the data is time stamped) as determined by the controller. b.) The amount of electric charge flowing past a specified circuit point per unit time
Cyclical Redundancy Check	A data error-detection scheme. A polynomial algorithm is performed on a block of data. There are different algorithms involving a different number of bits and bytes in the calculation such as CRC-16 and CRC-32. *(see also Frame Checking Sequence)*
Default Message	Under normal operating conditions, this term specifies the neutral message. Under default conditions, communications failure, power loss, power recovery and communications time-out, the default message is the message displayed as defined by the corresponding objects (see Section 5). These may or may not be the same as the neutral message.
Default State	A defined mode of operation assumed when no other instructions have been received.
ceprecated	This term is defined in NTCIP 8004 v02..
cepth	The distance between the front and back of a sign or other enclosure. It can be measured as both inside and outside dimension.
cetermine	To read information from the device.
diagnostics	A set of routines operated in the controller used to verify the proper operation of the DMS components.
display	To reveal a message to the traveling public once it has been activated. Also see related terms: sign face (a DMS component), activate message (a command), and message (the image)

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Display Activation Time	The length of time required to display a page of text on the sign once the complete command has been received by the controller.
Display Module	See Character Module.
Display Technology	The means used to present a message, e.g., shuttered fiber, LED, flip disk, lamp matrix, combination of the two, etc.
Display Times	The time parameters within a message attribute.
DMS Controller	See Sign Controller.
DMS Housing	The enclosure that environmentally protects the components of the Dynamic Message Sign.
DMS Manufacturer	The company that maintains a factory and staff that develops, engineers, and manufacturers the complete DMS sign assembly and DMS Controller from raw materials and components.
dot	One pixel in a display matrix.
download	To transfer information from the central computer into the referenced field device.
drum	The multifaceted cylinder, with associated lighting, motor/brake drive unit and position sensing switches that rotates to display one face to the motorist.
Drum Sign	A type of CMS using one or more drums to display a message.
Dynamic Message Sign	Any sign system that can change the message presented to the viewer such as VMS, CMS and BOS. It includes the following major components: sign face, sign housing, controller, and, if present, the controller cabinet. Abbreviated DMS.
Electrically Erasable Programmable Read Only Memory (EEPROM)	. A variation of an EPROM chip in that instead of erasing the memory by placing it under UV light, portions of the chip can be erased electrically, and thus does not need to be removed from the circuit, provided the circuit supports erasing the chip.
Electromagnetic Shutter	A device that can be positioned via a pulse of electricity, and stay in the desired position due to an internal magnet.
Environmental Controls	Equipment to control the temperature and/or humidity within an enclosure, typically the sign housing and/or controller cabinet. This can include fans, heaters, thermostats, humidistats, override timers, motorized louvers, filters, ducting.
Erasable Programmable Read Only Memory (EPROM)	Erasable Programmable Read Only Memory. A variation of a PROM chip where the contents can be changed by erasing the chip with a UV light eraser and then programming the chip again.
external device	A component that is not normally considered part of a DMS, but is connected to the DMS by some interface.
External Illumination	A light source shining on the face of the sign so that its message may be read by the motorist.
External Input	The communication interface with an external device.
Extinguishable Message Sign (EMS)	See Blank-Out Sign.
Feature	A service provided by / behavior of the device.
Fiber Optic	A slender thread-like strand of material used to carry light.
Fiber Optic Bundle	Many fiber optic strands combined into one larger group. A fiber optic bundle terminates at one end on the sign face, the other end terminates at the light source.
Fiber Optic Harness	A number of fiber optic bundles grouped together with one common end. The common end is inserted in the lamp module.
Fiber Optic Sign	A light emitting sign whose pixels are made of ends of fiber optic bundles.
Fiber Optic/Flip Disk Hybrid	A reflective flip-disk type of sign that employs a fiber optic display technology in addition to the reflective flip disk.

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firmware	The logical programming stored in a controller's memory to operate the controller.
Flash EPROM	A type of EEPROM with rapid programming capability.
flasher	A device that causes beacons to flash.
flashing	A message attribute causing all or parts of a message to turn on and off.
Flashing Beacons	See Beacon.
Flashing Display	A one page message that alternates between on and off.
Flip Disk	A two-state display technology using an electro-mechanically actuated disk for each pixel position. One side of the disk displays the ON state of the pixel and another side represents the pixel's OFF state.
Flip LED	A hybrid display technology that combines flip-disk and LED technology.
font	A type style for a set of characters (letters, numbers, punctuation marks, and symbols).
Forced Air Cooling	A device used to reduce the temperature within an enclosure or housing by moving air.
Forced Air Ventilation	A device used to force out the air inside the enclosure or housing and introduce new air from the outside.
Frame	See Page.
Frame Checking Sequence (FCS)	Defines the value to be used within data packet frames for error detection. Implementations claiming conformance with this standard shall use the default International Telegraph and Telephone Consultative Committee (CCITT) 16-bit FCS as defined in ISO/IEC 13239:2002. Note: Object definitions representing a CRC result in NTCIP 1203 v03 rely on this ISO/IEC 13239:2002 definition and that the FCS is determined most significant byte first, but transmitted least significant octet first.
front	The side of the sign containing the visible message.
Front Access	Access to the internal components of the sign accomplished via access panels or access doors located on the front of the sign.
Full Matrix	A type of VMS with the entire display area containing pixels with the same horizontal pitch and the same vertical pitch without fixed lines or characters. A full matrix sign s characterized by its ability to address and change each pixel independently.
Full Standardized Range	The range of values identified and fully specified within a standard. Values left for proprietary use (e.g., the value 'other' in enumerated lists) are not a part of the Full Standardized Range since the meaning of the value is not 'fully specified'.
graphic	An image that is stored within the controller's memory and can be inserted into a message.
Graphical User Interface	The presentation of information to the user on a screen in graphic format.
Host Computer	See Central Computer.
housing	The enclosure of the sign containing the display elements.
Illumination Power	The energy source for message illumination.
intensity	The brightness of light emanating from the display, expressed in candela per unit area.

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interchangeability	A condition which exists when two or more items possess such functional and physical characteristics as to be equivalent in performance and durability, and are capable of being exchanged one for the other without alteration of the items themselves, or adjoining items, except for adjustment, and without selection for fit and performance. (National Telecommunications and Information Administration, U.S. Department of Commerce)
interoperable	The ability of two or more systems or components to exchange information and use the information that has been exchanged (IEEE Std. 610.12-1990: IEEE Standard Glossary of Software Engineering Terminology).
interface	An interface is a named set of operations that characterize the behavior of an element (Unified Modeling Language Specification)
Inter-Line Spacing	The amount of vertical space between two lines. The distance from the bottom of the bottom pixel on a line to the top of the top pixel on the line immediately below. On full matrix signs, it is measured as the number of pixel rows between lines of characters.
Internal Illumination	A light source within the sign housing that shines through the front of the sign, so that its message may be read by the motorist.
Internal Lighting	The lighting used for maintenance inside an enclosure or housing, independent of message illumination.
interoperability	The ability of two or more systems or components to exchange information and use the information that has been exchanged (IEEE Std. 610.12-1990: IEEE Standard Glossary of Software Engineering Terminology).
lamp	A light source used to illuminate the utilized pixels other than on a pixel-by-pixel basis. Fiber optics technology uses lamps to illuminate bundles of pixels.
Lamp Control Module	The device used to control the power going to the lamps.
Lamp Driver Module	An electronic board that directly supplies or disconnects power to the lamps to turn them on or off.
Lamp Driver System	See Lamp Control Module.
Lamp Matrix	A type of display technology where an incandescent light source is used for each pixel.
Lamp Status	The feedback data which indicates the operational status and condition of the lamp circuit.
LAN	Local Area Network – An intelligent control network that facilitates communication between devices that sense, monitor, communicate and control.
Lane-Use Control Sign	Overhead sign having displays that permit or prohibit the use of a lane or that indicate impending prohibitions of use [excerpted from MUTCD, clause 4E-8]. A sign that contains multiple symbols to indicate the permissive use of the lane in the direction of travel. Abbreviated LCS.
LED Driver Module	An electronic board that contains the control and memory elements to provide the signals to switch the LED pixel state, and which detects the operation of each individual pixel that it controls.
LED Sign	A sign with pixels made from LED's.
LED/Flip-Disk Hybrid	A type of VMS display technology that forms pixels with a combination of LED and flip disk technology. The LED is used for night viewing and the flip disk is used for daytime viewing.
legend	Unchangeable text on a sign face.
Legibility Distance	The 85 percentile distance at which people with 20/20 corrected vision can read the display.

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Light Emitting Diode	A type of display technology using a semi-conductor device that emits a point of light in a controllable manner. The characteristics of the point of light are determined by the type of LED used, e.g. color, cone of vision, luminance, etc. Abbreviated LED.
Light Output Level	See Brightness Level.
line	A horizontal row of character modules (character or line matrix signs) or number of rows of pixels (full matrix signs) used to display text.
Line Matrix	A type of VMS sign that has no hardware defined blank spaces (no pixels) between characters. The entire line contains columns of pixels with a constant horizontal pitch across the entire line.
Local Control Mode	One of several possible control modes to control a DMS. Local control mode is the primary control mode from the local control point (this could be a Local Control Panel or a locally connected device such as a laptop or a Personal Digital Assistant (PDA)).
Local Control Panel	A system of switches or a keyboard located at the DMS that allows a person on-site control of the DMS, as opposed to control from a remote location via external communication.
Locally Activated Messages	Stored messages, which are activated from the local control panel.
Lumen	The unit of luminous flux emitted in a solid angle of one steradian by a uniform point source that has an intensity of one candela.
Luminance	The intensity of light per unit area at its source. Usually measured in candela per square foot or candela per square meter.
Lux	A measurement of light. A unit of luminance produced on a surface area of one square meter by a luminous flux of one lumen uniformly distributed over the surface. (1 lux = 1 lumen per sq. meter)
Magnetic Memory	Memory based on magnetic power to keep an object in a desired position without the use of continuous electrical power.
Maintenance Computer	See Portable Maintenance Computer.
Maintenance Portable Computer	See Portable Maintenance Computer.
Manage	To monitor, command, and/or control.
Management Information Base	Set of object definitions that define the attributes, properties and controllable features of devices on a network, which can be remotely monitored, configured and controlled. The information is provided in a format called Abstract Syntax Notation. 1 (ASN.1), which is an international standard for defining objects.
Management Station	A computer or computer network that can interact with the device via the defined interface to realize the features of the device.
Management System	See Management Station
Mark Up Language for Transportation Information	Name of format of the textual part of a message. The format is defined in Section 6 of NTCIP Standard 1203 version 2 (Section 3 of NTCIP 1203: 1997). Abbreviated MULTI.
Master Computer	See Central Computer.
Master Computer Software	See Central Computer.
Master Controller	Obsolete term for central computer.
Master/Slave	The master is the controlling entity on a data link. It can give permission to any slave on the same link to transmit data. A slave transmits data only in response to permission from the master and it returns control to the master after finishing a transmission.
Matrix	An array of pixels that can display an image.
Matrix Sign	A DMS that uses an array of pixels to display a message or part of a message (e.g., a line or character). Matrix signs are typically VMS because the pixel array allows for a large variety of possible displays.

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Message	The information to be displayed to the traveler and how it is to be displayed.
Message Attribute	The characteristics that define how a message shall be displayed. This includes how many pages of text, the amount of time each page is displayed, any flashing of text, the flashing time characteristics, and color definition. Not all technologies / manufacturers support all display attributes. Specific support for these items is based on the type of display technology and manufacturer.
Message Command	A controller command to activate a message on the sign.
Message Display Time	See Message Duration.
Message Duration	The time from message activation to message deactivation.
Module	One assembly of components, like several similar assemblies, that each fit together to make one larger single unit with a unique purpose.
Multi-Drop	A communications architecture where multiple devices share a common communications channel.
Multi-Message Sign	See Changeable Message Sign.
Multi-Page Message	A message that has more than one page of text / graphics.
Neutral Message	A predefined generic message that is displayed when the sign is not commanded to show time-sensitive information.
Neutral State	When a sign is blank or displaying a neutral message.
Non-Volatile Memory	A generic term for memory that does not lose its content when power is turned off. See also Changeable Memory, Permanent Memory and Volatile Memory.
Normal Lamp	See Primary Lamp.
NTCIP	National Transportation Communications for Intelligent Transportation System Protocol
object	A data structure used to monitor or control one feature, attribute or controllable aspect of a manageable device.
obsolete	This term is defined in NTCIP 8004. .
Off-Axis Angle	The angle from the optical axis of the LED, at which, the luminous intensity is one-half that at the optical center.
operator	An individual who needs to interact / interface with the device via the central system software to control and/or monitor its operations.
Optical Center	The point on an LED or output end of a fiberoptic bundle where luminous intensity is at its maximum.
Optical Fiber	See Fiber Optic.
page	The information that can fit on a sign at one time, together with its message attributes.
Permanent Memory	A generic term for memory that cannot be changed without physically replacing hardware components. See Changeable Memory, Non-Volatile Memory, and Volatile Memory.
Permanent Messages	A library of stored messaged in read-only devices. See also Changeable Messages and Volatile Messages.
Phase	See Page
Photo Sensor	A light measuring device used to quantify the ambient light conditions at the sign.
Photocell	See Photo Sensor.
Photoelectric Cells	See Photo Sensor.
Physical Address	The Data Link identifier which differentiates a field device in a multi-drop or point-to-point communication circuit, to allow the central computer to communicate with a specific field device. Also see ‘sign address’

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pitch	The center-to-center distance between two adjacent pixels, that is measured either horizontally or vertically.
pixel	The smallest independently controllable visual element of a VMS.
Pixel Service	A generic term for a cyclic maintenance service that exercises mechanical pixels to prevent sticking. The service may or may not be enabled during the display of a particular message.
Point-To-Multi Point	A communications architecture that supports communications between a central system and many devices. Also called multi-drop communication.
Point-To-Point	A communications architecture that supports dedicated communications exclusively between two devices.
Portable Maintenance Computer	A portable computer running maintenance software. It can communicate with a sign controller, control activation of the sign, and perform diagnostics on the controller. Abbreviated PMC.
Portable Remote Computer	A portable computer running as a remote computer.
Primary Lamp	In a two-lamp system, the lamp that is turned on first.
Primary/Secondary	See Master/Slave.
PROM	Programmable Read Only Memory. A semiconductor device, memory chip that can be programmed once with a specific data set via a specialized electronic instrument, PROM programmer. The data programmed into the chip cannot be altered once it has been programmed.
Protocol	A specific set of handshaking rules, procedures and conventions defining the format, sequence and timing of data transmissions between devices that must be accepted and used to understand each other.
Random Access Memory	Memory that can be independently accessed at any location in a sequential or non-sequential order. Depending on the technology, the content of memory may be lost when power is turned off. Abbreviated RAM.
Recovery	The action(s) performed by a controller to restore normal operation after an interruption disrupts or terminates the controller's normal operation.
Remaining Message Display Time	The amount of time before the message currently being displayed is turned off.
Remote Computer	A computer that can access the central computer from a remote location.
Remote Computer Software	The application software that runs on the remote computer enabling it to communicate with the central computer's software.
Remote Control Mode	See Central Control Mode.
requirement	A requirement describes a condition or capability to which a system must conform; either derived directly from user needs, or stated in a contract, standard, specification, or other formally imposed document. A desired feature, property, or behavior of a system.
Requirements Traceability	The ability to follow or study the logical progression among the needs, requirements and design details in a step-by-step fashion.
reset	See Controller Reset.
Resident Software	The software located in the controller. See also firmware.

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retired	Within the SYNTAX field of an 'OBJECT-TYPE' macro, a status term used to classify an enumerated value for those values found to be flawed, or not useful, or no longer relevant. The term is only used within object definitions with enumerated values. Retired values shall always be included in the lists of values.
return	When discussing device requirements for providing data when an external system requests it, the term 'return' shall be understood that the data is sent to the requester.
rotate	To move a shutter to its opposite state (open or closed). To move a drum to the next position.
Rotational Shutters	A type of shutter that spins in one direction on an axis perpendicular to the light blocking device.
Rotor	The motor/brake drive unit and position sensing switches that rotates to display one face of a drum to the traveler.
Run-time Priority	A numeric value between 1 and 255 that the Controller uses to determine the importance of a message, 1 lowest and 255 highest. To activate a new message, the Activation Priority of the new message must be greater than or equal to the Run-time Priority of the current message. If the Run-time Priority of the current message is greater than the Activation Priority of the new Message, the controller rejects activation of the new message.
Scenario	A preset plan which assigns specific displays or actions to a specific sign or device when a predefined condition is detected. Also known as sequence.
schedule	A mechanism by which an operator can define times in the future at which the controller performs actions.
Secondary Lamp	The lamp that is turned on to replace a failed primary/normal lamp (see Backup Lamp). Also turned on with the primary/normal lamp to create an over-bright illumination of the message.
Semi-Graphic Character	A character font that contains graphic shapes that fit within a character matrix.
sequence	See Scenario.
Shutdown Power	A type of power that is often referred to as 'last breath power'. The exact number of minutes/seconds associated with this type of power are not defined, but it must be sufficient to allow the device's computer to save the already collected data and to safely boot down.
Shutter	A non-reflective device that either completely occludes or completely allows light from a light emitting pixel. Note: A shutter and a flip disk are not to be intermingled or confused.
Shutter Driver Module	An electronic board that supplies the low voltage pulses to move the shutters into their open or closed positions.
Shutter Power Supply Module	An electronic board that supplies and monitors power to the shutters.
Shuttered Fiber	A type of DMS display technology using shutters and fiber optic.
Sign	The sign housing, all of its contents, and all items attached to the sign housing that are used as part of the sign (e.g. photo sensors, contrast shields, static message signing, beacons, etc.).
Sign Access	The approach direction or mechanism used to gain access to the internal components of the sign, e.g. front, rear, walk-in.
Sign Address	A unique value assigned to each device on a communication channel. Used to identify the device for which the data packet is intended. Also called controller address, drop address.

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Sign Controller	A device used to control and monitor the operations of a sign. It can have a variety of control interfaces, such as a local control panel, a local portable maintenance computer, or a central computer. The equipment within the controller is not specified by this term.
Sign Erasure	The act of clearing a message from the sign face.
Sign Face	The portion of the sign that can be controlled by the user or a management station.
Sign Height	The vertical dimension of the sign face.
Sign Housing	The sign face enclosure.
Sign Off	The state in which the sign is not displaying a message and all message drivers (lamps, LED drivers, etc.) are turned off. This is different from a display that contains all spaces.
Sign Status	The feedback data returned from the sign controller that indicates the operational condition of the sign, or the sign's components.
Sign Subsystem	A primary component of the DMS that can be separately monitored.
Sign Width	The horizontal dimension of the sign face.
Sign Writing	The process of changing a sign from its previous state to displaying a message.
Spacing	The blank area between 2 adjacent characters. This is a hardware defined fixed distance in character matrix signs. In a line matrix sign, the horizontal (inter-character) spacing is variable and controlled by the controller software and the pixel spacing of the sign. In a full matrix sign, both horizontal inter-character and vertical inter-line spacing is variable and controlled by the controller software and pixel spacing of the sign.
Specification	The project-specific detailed requirements for a DMS to be purchased by an agency or a statement by a manufacturer defining the detailed features provided by the DMS. Within NTCIP 1203 v03, 'specification' often refers to the text contained in the 'Additional Project Requirements' column of the PRL.
Start-up State	Either a blank message, a default message or the last valid display before the start-up.
Static Display	A message that uses only one page of text.
Static Message Panel	See Legend.
Status	The current condition of a referenced function or device.
Stored Messages	All messages loaded in a sign controller's memory.
Strobe	A form of a Beacon.
Strobe-Light	See Strobe.
Stroke Width	The width or diameter of a pixel.
Sub-feature	A service that is part of a larger service. A specialization of a more generic feature.
Supplemental Beacon	See Beacon.
Temperature Sensor	A device used to measure the temperature and report it to another device.
Temporary Memory	A sign controller's storage area, or memory, that contains a message or message library that can be manipulated while the controller is operating on-line. This feature enables a central computer to download and update a message or message library into the sign controller.
Text (Sign Text)	The characters used to create a message, without any information on how the characters are displayed.
Traffic Management Center (TMC)	The location of the central computer and equipment which allows operations staff to monitor and manage traffic through roadside field devices (e.g. vehicle detectors, VMS, etc.). Abbreviated TMC.

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Traffic Operations Center (TOC)	See Traffic Management Center. Abbreviated TOC.
Traveler	A person that is using the publicly accessible transportation network.
Upload	To transfer information from the referenced field device to the central computer, or an attached portable computer.
User	A person who uses the system that is developed.
User Need	The business or operational problem (opportunity) that must be fulfilled to justify purchase or use. While this is termed a 'user need' within the NTCIP community, it reflects needs of all stakeholders.
Validate	To ensure that an item of interest is as intended. For example, to ensure that a graphic has been stored without any errors.
Variable Message Sign	A type of DMS, which allows a user to create and download the message to be displayed into the temporary memory area of the sign controller. Abbreviated VMS.
Ventilation	The process of replacing existing air with new air. Typically done to cool the enclosure (sign housing, controller cabinet).
Viewing Angle	See Cone of Vision.
Visibility	The ability to view an object. The greatest distance at which the sign can be seen without the aid of any instruments. This term does not reflect Legibility.
Volatile Memory	A generic term for memory that allows a user to modify the content, however loses its content when power is turned off. See also Changeable Memory, Permanent Memory, and Non-Volatile Memory.
Volatile Messages	A library of messages stored in read-write memory devices that lose their data upon loss of power. See also Changeable Messages and Permanent Messages.
Watchdog	Circuitry that monitors the controller software and firmware for a stall condition. While the DMS Controller is powered on, the software polls the watchdog and resets the timing circuitry. If the watchdog circuitry times out without being reset by the software, the watchdog counter is incremented and the controller hardware is reset to clear the potential stall condition.
X by Y Character Matrix	An array of pixels, X columns wide by Y rows high, used to display a single character. The pixels are based on the display technology of the sign, fiber optic, LED, bulb, flip disk, etc. A single character module having 5 columns and 7 rows of pixels could be called a “5 by 7 character module” or a “5x7 character module”.

1.5 Abbreviations

The abbreviations used in NTCIP 1203 v03 are defined as follows:

ANSI	American National Standards Institute
ASCII	American Standard Code for Information Interchange, a 7-bit wide code used to represent a character set.
ASN.1	Abstract Syntax Notation One
BOS	Blank-Out Sign
CMS	Changeable Message Sign
CRC	Cyclical Redundancy Check
DMS	Dynamic Message Sign
DUT	Device Under Test
EEPROM	Electrically Erasable Programmable Read Only Memory
FCS	Frame Checking Sequence
HOV	High Occupancy Vehicle
IAB STD	Internet Activities Board Standard

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IP	Internet Protocol
ISO	International Organization for Standardization
ITS	Intelligent Transportation Systems
LCS	Lane Use Control Sign
LED	Light Emitting Diode
LUS	Lane-Use Control Sign
MIB	Management Information Base
MULTI	Mark Up Language for Transportation Information
OID	OBJECT IDENTIFIER
OER	Octet Encoding Rules
PMPP	Point to Multi-Point Protocol
PRL	Profile Requirements List
PROM	Programmable Read Only Memory
RAM	Random Access Memory
RFC	Request for Comments
RPM	Revolutions Per Minute
RTM	Requirements Traceability Matrix
SNMP	Simple Network Management Protocol
STMF	Simple Transportation Management Framework
T2	Transportation Transport Profile
TCP	Transmission Control Protocol
TMC	Traffic Management Center
TMP	Transportation Management Protocol
TOC	Traffic Operations Center
UDP	User Datagram Protocol
VMS	Variable Message Sign
WG	Working Group

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Section 2
Concept of Operations [Normative]

Section 2 defines the user needs that subsequent sections within NTCIP 1203 v03 addresses. Accepted system engineering processes detail that requirements are developed to fulfill well-defined user needs. The first stage in this process is to identify the ways in which the system is used. In NTCIP 1203 v03, this entails identifying the various ways in which transportation operations personnel may use DMS information to fulfill their duties.

This concept of operations provides the reader with:

a) A detailed description of the scope of NTCIP 1203 v03;
b) An explanation of how a DMS device is expected to fit into the larger context of an ITS system;
c) A starting point in the procurement process; and
d) An understanding of the perspective of the designers of NTCIP 1203 v03.

Section 2 is intended for all readers of the document, including:

a) Transportation operations managers
b) Transportation operations personnel
c) Transportation engineers
d) System integrators
e) Device manufacturers

The first three categories of readers find this section useful to understand how DMS equipment can be used in their system. For this audience, this section serves as the starting point in the procurement process. They become familiar with each feature covered by NTCIP 1203 v03 and determine whether that feature is appropriate for their implementation. If it is, then the agency specification requires the feature and all of the mandatory requirements related to that feature.

The last two categories of readers find this section useful to gain a more thorough understanding as to why the more detailed requirements (as specified in later sections of NTCIP 1203 v03) exist.

2.1 Tutorial [informative]

While you, the reader and user of this document, have demonstrated an interest in this document, the size of this document might be a bit intimidating. Therefore, this section has been added to make the document more manageable.

A concept of operations describes a proposed system from the users' perspective. Typically, a concept of operations is used on a project to ensure that the system developers understand the users' needs. Within the context of NTCIP standards, it is used to document the intent of each feature for which the standard supports a communications interface. It also serves as the starting point for users to select which features may be appropriate for their project.

The concept of operations starts with a discussion of the current situation and problems that have led to the need to deploy systems covered by the scope of the standard and to the development of the standard itself. This discussion is presented in layman's terms such that both the potential users of the system and the system developers can understand and appreciate the situation.

The concept of operations then documents key aspects about the proposed system, including the:

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a) Reference physical architecture – The reference physical architecture defines the overall context of the proposed system and defines which specific interface is addressed by NTCIP 1203 v03. The reference physical architecture may be supplemented with one or more samples that describe how the reference physical architecture may be realized in an actual deployment.
b) Architectural Needs – The architectural needs section discusses the issues and needs relative to the system architecture that have a direct impact on NTCIP 1203 v03.
c) Features – The features identify and describe the various functions that users may want the device to perform. These features are derived from the high level user needs identified in the problem statement but are refined and organized into a more manageable structure that form the basis of the traceability tables contained in Section 3 and Annex A.

The architectural needs and features are collectively called the user needs. Section 3 uses these user needs in the analysis of the system to define the various functional requirements of a DMS. Each user need must be traced to one or more functional requirements and each functional requirement must be derived from at least one user need. This traceability is shown in the Protocol Requirements List (PRL) as provided in Section 3.3.

While NTCIP 1203 v03 standardizes communications across a wide range of deployments, it is not intended to mandate support for every feature for every deployment. Therefore, the PRL also defines each user need and requirement as mandatory, optional, or conditional. The only items marked mandatory are those that relate to the most basic functionality of the device. To obtain a device that meets specific needs, the user first identifies which optional needs are necessary for the specific project.

Each requirement identified is then presented in the Requirements Traceability Matrix (RTM) in Annex A, which defines how the requirement is fulfilled through the standardized dialogs and data element definitions provided in Sections 4 and 5.

The concept of operations concludes by describing the degree to which security issues have been addressed by NTCIP 1203 v03 and by providing a description of how NTCIP 1203 v03 relates to the National ITS Architecture.

2.1.1 About NTCIP 1203 v03

The NTCIP 1203 v2 specifies the logical interface between Dynamic Message Signs (DMS) and the host systems that control them (commonly referred to as central systems). NTCIP 1203 v03 describes the supported DMS interface functionality in terms of user needs and requirements.

As for limitations, NTCIP 1203 v03 defines the data that could be transmitted between a central system and a conformant DMS, but it does not define the functionalities and functions available within a DMS or a central system. Also, NTCIP 1203 v03 does not claim to address all potential capabilities of a DMS or a controlling/monitoring Central System; if NTCIP 1203 v03 would make this claim, no progress could be made (e.g., if NTCIP 1203 v03 would not allow for the possibility of defining extensions, no additional functionalities could be added, by either NTCIP 1203 v03 itself or by vendors or agencies).

It is also of utmost importance for the reader to understand that not all of the functionalities have to be supported by a DMS (or a Central System) to claim conformance. Instead, the project-specific specifications that do reference and incorporate desired applicable functionalities from NTCIP 1203 v03 (also sometimes represented as NTCIP 1203v3) are the guiding requirements that determine compliance.

2.1.2 Who are you?

In writing NTCIP 1203, the NTCIP DMS Working Group made some assumptions about who you are and what you are seeking from NTCIP 1203. Even if only one of the following describes why you are looking into NTCIP 1203 v03, you are part of the target audience for this document:

a) You have heard about the National Transportation Communications for ITS Protocols (NTCIP) and are interested in its applicability for deploying variable message signs, changeable message signs (drum signs), or blank out signs.

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b) You are involved in writing the specifications to procure these types of signs.
c) You are involved in reviewing submittals to procure these types of signs.
d) You are involved in the software development, be it the firmware of a sign or the software of a central system.
e) You are involved in testing the signs and/or the central system.
f) You are involved in the operational use of these types of signs.

2.1.3 How NTCIP 1203 v03 is Organized

NTCIP 1203 v03 contains the following main sections, each building on the previous section(s):

a) Section 1 – Overview – This section provides the user with references, table of contents, glossary, and other information.
b) Section 2 - Concept of Operations – This section provides a description of user needs (needs for feaures and needs related to the operational environment) applicable to DMS systems.
c) Section 3 – Functional Requirements - This section defines the functional requirements that address the user needs identified in the Concept of Operations. It includes a Profiles Requirements List (PRL) Table that defines conformance requirements thereby allowing users to select the desired options for a particular project. An additional table identifies supplemental requirements that show requirements that are used more than once by different main functional requirements. A third table identifies the supplemental requirements for the MULTI tags and provides an indication of the functional requirement that a particular MULTI tag fulfills.
d) Section 4 – Dialogs and Interface Specificaitons – This section describes how each functional requirement is fulfilled. The dialogs define the standardized procedures for a central system to manage a sign. The interface specifications define the operations that are allowed by the sign and how data elements are inter-related.
e) Section 5 – Management Information Base - This section defines the data elements (object definitions) exchanged during communications (an update of NTCIP 1203:1997 Section 2).
f) Section 6 – Mark-Up Language for Transportation Information (MULTI) – This section defines the language used to communicate to the sign how a message is to be displayed. Similar to HTML, tags are included to specify the attributes of a message and how it is displayed on a sign (an update of NTCIP 1203:1997 Section 3).
g) Annex A - Requirements Traceability Matrix – This annex provides two tables. The first table traces each requirement to a dialog, one or more interfaces, and its associated list of objects. The second table identifies supplemental traces for requirements that are used more than once for various requirements.

There are an additional seven annexes containing mostly informational data. These are:

a) Annex B is informative and provides a depiction of the high-level object tree showing the nodes and some of the scalar objects. The purpose of this object tree is to provide the user with a high-level orientation tool to navigate the data elements.
b) Annex C is standardized test procedures that address the needs and requirements first defined in NTCIP 1203 v02. The test procedures are a normative annex to NTCIP 1203 v03
c) Annex D is informative and documents the (significant) revisions in NTCIP 1203 v03 that have been made since the previous version, NTCIP 1203 v02.
d) Annex E is informative and provides answers to potential questions that a user of this document might have (FAQ)
e) Annex F is informative and provides ASCII tables and the descriptions of the ASCII characters used. The provision here was made to avoid any ambiguities of particularly the extended ASCII character set, since different versions exist.
f) Annex G is NORMATIVE and defines the functionalities associated with the Simple Network Management Protocol (SNMP). This annex is frequently referenced throughout the body of NTCIP 1203 v03.
g) Annex H is informative and serves as a placeholder to define certain details pertaining to the Global Object Definitions (NTCIP 1201) that are likely to be moved to NTCIP 1201 at a future date.

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2.1.4 Intended Audiences for the Sections in NTCIP 1203 v03

NTCIP 1203 v03 has been designed for different audiences. While the following is not be true for every reader, it is a guideline to reduce the number of pages a particular reader interested in particular topics should read / review.

Additionally, you might want to have some understanding and/or documentation with you depending on your function within your organization: If you are a Specification Writer / Purchaser, you need a good understanding of the functional and operational requirements and the contexts for which the overall technical requirements of the signs are to be used. If you are a Submittal Reviewer, a Firmware/Software Developer, and/or a Tester, you need the project-specific specifications (or Technical Provisions).

a) General Interest Users: Review Sections 1, 2, and the Frequently Asked Questions (FAQ) annex.
b) Specifications Writers / Purchasers: Review Sections 1, 2, 3, and the FAQ annex
c) Submittal Reviewers: Review Sections 1, 2, 3, the FAQ annex, and the Requirements Traceability Matrix (RTM) annex.
d) Firmware/Software Developers: Review all Sections and Annexes
e) Testers: Review all Sections and Annexes
f) Operators: Review Sections 1, 2, and the Frequently Asked Questions (FAQ) annex.

2.2 Current Situation and Problem Statement [informative]

Transportation system managers use DMS in a variety of ways to improve transportation system operations. To perform their jobs, transportation system managers need to convey a variety of information to the traveling public. The information can be:

a) Advisory, such as information about transit vehicle arrival times, road closures, traffic congestion, estimated travel times, and weather warnings,
b) Regulatory, such as regulations about speed limits, mandatory detour information, or availability of high occupancy vehicle (HOV) lane access requirements.

Dynamic Message Signs (DMS) are one tool that can be used to convey this information to the traveling public. Based upon their perceived needs, transportation system managers decide what capabilities they may need within their DMS and where these DMS are deployed.

Depending on the needs and the budgets available, the DMS may be deployed in a network to provide coordinated operations or as stand-alone devices to provide information to travelers in areas where no integrated network capability exists.

DMS can be deployed in both stationary deployments, such as the roadside (overhead or side mounted) or on transit platforms, or portable on moveable vehicles. Additionally, different communications technologies such as dial-up (e.g., via land-lines for stationary signs or to portable signs placed on permanent pads where dial-up lines have been provided), serial (mostly provided to stationary signs), or Ethernet (e.g., via hardwire or even over wireless networks) are used to communicate with DMS.

2.3 Reference Physical Architecture [informative]

NTCIP 1203 v03 addresses the communications interface between a management station and a controller. The following paragraphs further explain the typical physical architectures used in conjunction with DMS and addressed by NTCIP 1203 v03.

2.3.1 Typical Physical Architecture

Once installed, the operator is able to control the DMS through one of three mechanisms:

a) Central computer – this type of operation configures and manages DMS from a computer located at a traffic management location, such as a Traffic Management Center (TMC). This is known as either ‘central’ control or ‘remote’ operation.

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b) Local computer – this type of operation performs the same functions as a central computer does, but uses a portable (e.g., laptop) computer connected directly to a port at the DMS sign controller. This is a form of 'local' control.
c) Locally – this type of operation uses the control devices (e.g., keyboard, switches) at the DMS sign controller to perform the functions of configuring and managing the DMS. This is another form of 'local' control.

The connection between the central computer and the DMS runs over a telecommunications network, which can be either wireline or wireless in nature. Figure 1depicts the physical architecture of the key components related to a typical DMS system controlled from a central location.

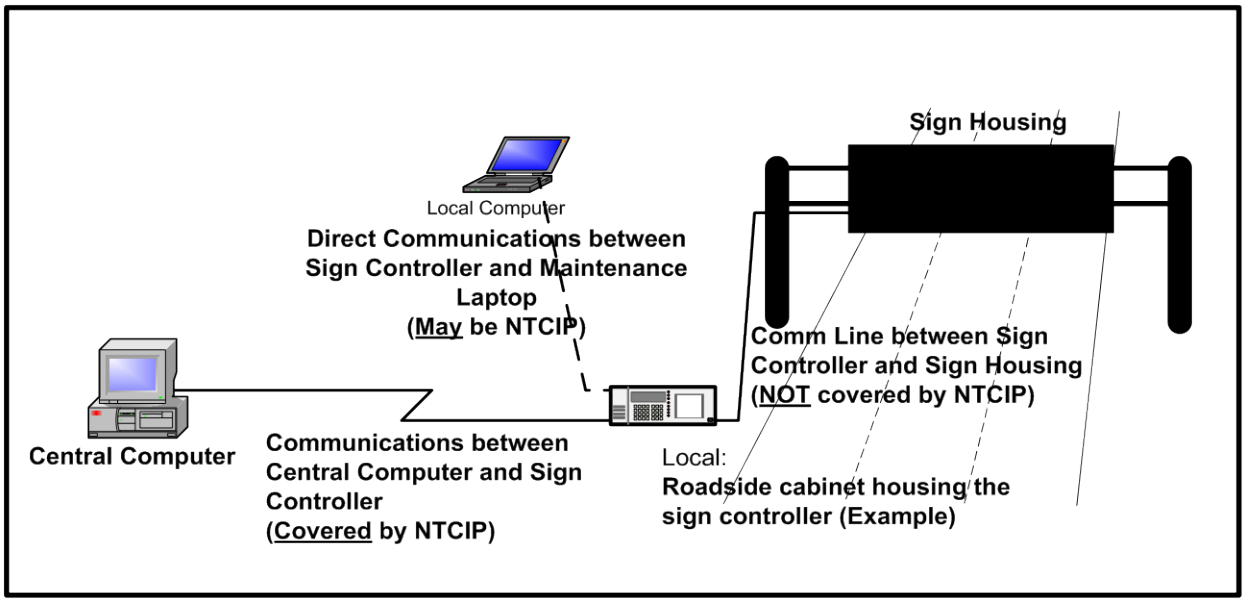

Figure 1 View of a Typical DMS System Architecture

NTCIP 1203 v03 is only concerned with the interface between an external computer and the DMS sign controller. To fulfill all of the end-user services, additional requirements may be necessary for the external computer.

2.3.2 DMS Characteristics

A factor that complicated the development of NTCIP 1203 and that complicates the work of a specification developer is the fact that there are a wide variety of DMS available in the marketplace. To promote interoperability among the different signs, NTCIP 1203 provides a single protocol that is compatible with all of these varied DMS. However, the varied nature of these signs dictates that many of the features first defined within NTCIP 1203 v02 are not applicable to all DMS. Thus, the user must categorize the DMS according to several key characteristics prior to determining which requirements are mandatory for a particular project and/or type of DMS in a way. These characteristics include DMS Type, DMS Technology, and DMS Display Matrix Configuration.

Note: A specification can allow for any of several types, technologies, or display matrix configurations by leaving the selection of these items as optional while noting that the support of the option is left to the manufacturer but that the manufacturer must choose at least one. For example, a specification could allow for either a line matrix or a full matrix sign by:

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a) selecting ‘Yes’ on line 2.3.2.3.2,
b) selecting 'Yes' on lines 2.3.2.3.2.1 and 2.3.2.3.2.2 blank and also entering the required configurations, and
c) selecting ‘No’ on line 2.3.2.3.2.3 in the PRL of Section 3.3.3.

2.3.2.1 DMS Types

There are many types of DMS and they can be characterized in many ways. One way is by the capabilities the DMS offers for handling messages. This characterization places a DMS into one of three major categories:

a) Blank-out Sign (BOS) – this type of DMS can only show one fixed message or nothing.
b) Changeable Message Sign (CMS) – this type of DMS can display one of two or more predefined messages, or be blank.
c) Variable Message Sign (VMS) – this type of DMS is one in which the message to be displayed can be created after the sign is installed in the field. It can also have predefined messages in its library of stored messages. By policy and/or system design, the management system may restrict the rights of selected operators to ensure that only authorized personnel can modify or create messages “on-the-fly”.

2.3.2.2 DMS Technologies

DMS can also be characterized by the technology that is used in the sign. The technologies used can include any combination of the following technologies:

a) Fiber Optic
b) Light emitting diode (LED)
c) Flip disk or Shutter
d) Lamp matrix
e) Drum (rotating, multifaceted cylinder)

2.3.2.3 DMS Display Matrix Configuration

Finally, DMS can be characterized by the type of display layout employed by the sign, as follows:

a) No matrix (i.e., it is not a pixel matrix sign)
b) Matrix sign
c) Full matrix
d) Line matrix
e) Character matrix

Note: Typically, matrix signs are VMS and VMS are matrix signs, but this is not always true; for example, the term VMS would also include: 7-segment displays, electronic ink displays, etc.

2.3.2.4 DMS Display Support (Beacons)

The display of the DMS can also be supported or enhanced by the addition of beacons which are blinking lights attached to the DMS display. They may be activated as part of particular messages.

2.4 Architectural Needs

2.4.1 Fundamental Needs Driving DMS Deployment

The provision of timely and reliable information to the traveling public improves public safety and convenience by providing advance notification of items that may be of interest (e.g., downstream road conditions or the arrival of a transit vehicle). DMS are typically dispersed along interstate highways, arterial roadways, and at transit stops.

2.4.2 Operational Environment

NTCIP 1203 v03 addresses the interface between a DMS and a management station (e.g., a central computer). To enable communications between these components, the transportation system manager

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needs to establish a communication system that links the DMS with a management station. For some systems, the cost of communications may be minimal and as such the system may be designed for constant polling; other systems may encounter significant costs for communicating with the DMS and as such the system may be designed to minimize data exchanges.

When deploying a DMS, the system designer must consider which of the following operational environments need to be supported.

2.4.2.1 Live Data Exchange

The typical operational environment allows the management system to monitor and control the DMS by issuing requests (e.g., requests to access information, alter information, or control the sign). In this environment, the DMS responds to requests from the management station immediately (e.g., through the provision of live data, success/failure notice of information alteration, or success/failure of the command).

2.4.2.2 Logged Data Exchange

Some operational environments do not have always-on connections (e.g., dial-up links). In such environments, a transportation system operator may wish to define conditions under which data is placed into a log, which can then be uploaded at a later time. For example, the operator may wish to maintain a log of all messages posted on the sign, regardless of which management station or algorithm posted the message.

2.4.2.3 Exceptional Condition Reporting

In some operational environments, it may be desirable to have the DMS automatically transmit data to the management station when certain conditions occur. Under this scenario, the transportation system operator can define under what conditions s/he wishes to be notified and the device automatically notifies the management station when the condition occurs. An example may be the transportation system manager who wants to know when the cabinet door is open.

2.5 Features

This section identifies and describes the various standardized user needs addressed by and features that may be offered by a DMS. Section 3 uses these features in the analysis of the system to define the various functional requirements of a DMS.

The operation of a DMS can be categorized into three major areas:

a) Manage the DMS configuration
b) Control the DMS
c) Monitor the status of the DMS

2.5.1 Manage the DMS Configuration

The various sub-features for managing the DMS configuration include:

a) Determine the DMS Identity
b) Determine Sign Display Capabilities
c) Manage Fonts
d) Manage Graphics
e) Manage Brightness
f) Address Backwards Compatibility

The subsequent sections detail these sub-features.

2.5.1.1 Determine the DMS Identity

This feature allows the operator to determine basic information about the DMS, such as the type, technology, manufacturer, model, and version number of the DMS. It includes the ability to access information about both hardware and software elements of the DMS.

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2.5.1.2 Determine Sign Display Capabilities

This feature allows the operator to retrieve the necessary information to produce a rendering of a suggested or active message. This feature also allows the system to ensure that a message can be displayed on the DMS. The feature allows the operator to determine the detailed physical limitations of the DMS as well as details regarding the current fonts and any graphics that are stored.

2.5.1.3 Manage Fonts

This feature allows the operator to define and edit the appearance of the fonts used to display messages on the sign face. This helps an operator ensure that messages have a consistent appearance across many DMS in a large system despite the use of different manufacturers, etc. It allows the operator to manage the height and width of the font, and the color of the font. It allows the operator to edit or delete existing fonts, and to create new fonts in a controller. It also allows an operator to determine the existing configuration of fonts.

Each font supported by the DMS should support a common set of characters (e.g., ASCII codes) to improve interoperability, including letters numbers and various special characters that are frequently used on DMS.

2.5.1.4 Manage Graphics

This feature allows the operator to manage the graphics stored within a DMS. It allows the operator to define a graphic for later use, manage existing graphics, and determine the graphic storage capabilities of the DMS.

2.5.1.5 Manage Automatic Brightness

This feature allows the operator to configure when the sign may automatically switch from one brightness level to the next. This allows the operator to configure how the sign automatically responds to changing lighting conditions to compensate for sun shining in the traveler's vision or 'wash-out' conditions, such as during early morning and pre-sunset conditions.

2.5.1.6 Configure Speed Limit

This feature allows the operator to configure the speed limit applicable to the location of the DMS.

2.5.1.7 Configure Low Fuel Threshold

This feature allows the operator to configure the threshold at which the fuel in a generator is to be considered low. This feature is associated with DMS using generators, which are typically portable signs.

2.5.2 Control the DMS

The various sub-features for controlling the DMS include:

a) Control a DMS from More than One Location
b) Remotely Reset the Sign Controller
c) Control the Sign Face
d) Control External Devices
e) Control the Brightness Outputs
f) Perform Preventative Maintenance

Subsequent sections detail these sub-features.

2.5.2.1 Control a DMS from More than One Location

This feature addresses the need for DMS to be controlled both remotely (e.g., from one or more central computers) and locally (e.g., from the controller directly or from a laptop computer connected to the controller). Whether the DMS is controlled remotely or locally, the features and capabilities are the same. This feature also addresses the need to prevent different sources of control from interfering with one another by attempting to control the DMS simultaneously.

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2.5.2.2 Remotely Reset the Sign Controller

This feature provides the capability to remotely reset the sign controller to attempt to recover from a software failure. This feature might be desired to avoid a field trip to reset the sign controller.

2.5.2.3 Control the Sign Face

This feature addresses the need to place information on or remove information from the sign face to convey proper information to travelers. The feature includes the following sub-features:

a) Activate and Display a Message
b) Prioritize Messages
c) Define a Message
d) Blank the Sign
e) Schedule Messages for Display
f) Change Message Display based on an Internal Events
g) Change Message Display based on External Device Inputs

2.5.2.3.1 Activate and Display a Message

This feature allows an operator to activate a previously defined message to be displayed on the sign face. The message can be a blank message or come from a set of previously defined messages.

When activating the message the operator will need to specify the desired duration for the display and the relative priority for the proposed message to override the currently displayed message.

> Note: Activating a message that is stored in a central system library can be achieved by first downloading the message to the sign controller and then activating the message per this section. A user can also display a message defined "on-the-fly" by the same process.

2.5.2.3.2 Prioritize Messages

This feature allows an operator to prioritize particular messages. For example, a priority scheme will allow an operator to maintain an accident-related message, even if the same operator previously scheduled the display of a non-accident related message.

2.5.2.3.3 Define a Message

This feature enables the operator to create a message and to modify its format and content. The feature includes:

a) Uniquely identifying a message
b) Ensuring that a message is intact
c) Defining the exact contents of the message to be displayed on the sign face.
d) If supported, activating beacons when a message is displayed, to attract the traveler’s attention

2.5.2.3.4 Blank a Sign

This feature enables the operator (or logic within the management station) to remove any messages displayed on a sign (causing the sign to appear blank).

2.5.2.3.5 Schedule Messages for Display

This feature enables the operator to configure the DMS to activate messages at a future time (“scheduling”). The operator can indicate a series of times at which an associated message will be activated. The associated message can be any message stored in the sign controller, including a blank message.

2.5.2.3.6 Change Message Display Based on an Internal Event

This feature allows the operator to indicate which message should be displayed when certain non-scheduled events occur, such as loss of communication or loss of power.

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2.5.2.4 Control External Devices

This feature enables the operator to control simple external devices, such as High Occupancy Vehicle Lane Gates, through the auxiliary ports on the sign controller.

2.5.2.5 Control the Brightness Output

This feature enables the operator to control the sign brightness either directly or through an automated algorithm, depending on the capabilities of the DMS. At a minimum, the operator must be able to control brightness of the sign display manually for light emitting signs. In addition, the operator should be able to control the brightness level through the use of light sensors (photocells) on the DMS, if available, that can detect the ambient light levels and adjust brightness levels in an appropriate fashion. This brightness control is needed to compensate for the external environment's effect on the visibility of the message, such as when the sun is shining in the eyes of travelers.

2.5.2.6 Perform Preventative Maintenance

This feature enables the operator to enable or disable the periodic exercise of pixels (activated either manually or via a schedule) to ensure that they are performing reliably.

2.5.3 Monitor the Status of the DMS

The various sub-features for monitoring the status of the DMS include:

a) Perform Diagnostics
b) Monitor the Current Message

Subsequent sections detail these sub-features.

2.5.3.1 Perform Diagnostics

This feature enables the operator to test the operational status of system components. It consists of the following sub-features:

a) Determine Sign Error Conditions (High-Level Diagnostics)
b) Monitor Sign Subsystem Failures (Mid-Level Diagnostics)
c) Monitor Subsystem Failure Details (Low-Level Diagnostics)
d) Monitor Message Errors
e) Monitor Sign Environment
f) Monitor the Sign Control Source
g) Monitor Attached Devices
h) Monitor Door Status
i) Monitor Controller Software Operations
j) Monitor Automatic Blanking of Sign
k) Monitor Power Source
l) Monitor Power Voltage

2.5.3.1.1 Determine Sign Error Conditions (High-Level Diagnostics)

This feature enables the operator to determine, at a very high level of abstraction, whether a DMS is experiencing any error or warning conditions. Errors and warnings are reported at the level of sign subsystems. For example, a single flag indicates that there are pixel errors.

2.5.3.1.2 Monitor Sign Subsystem Failures (Mid-Level Diagnostics)

This feature enables the operator to determine which component(s) of a subsystem are reporting errors and/or warnings so that the operator can plan a proper response. The operator may need to monitor any of the following subsystems:

a) Power sources
b) Power supplies
c) External Devices such as HOV Gates or external environmental sensors but controlled via the DMS sign controller

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d) Lamps
e) Pixels
f) Light level sensors (commonly referred to as ‘Photocells’)
g) Sign Controller
h) Temperature Sensors
i) Humidity
j) Internal Environmental Systems (Fans and/or Heaters)
k) Drum sign rotors

It is only necessary for the DMS to support information about subsystems actually present in the DMS. For example, a matrix sign need not provide the drum-rotor status items, and a drum sign need not provide the pixel status items. A DMS that contains both matrix and drum display elements should provide both the drum-rotor and pixel status items.

2.5.3.1.3 Monitor Subsystem Failure Details (Low-Level Diagnostics)

This feature enables the operator to obtain detailed information about a reported warning or error condition within a subsystem (detailed-level diagnostics). For example, if the DMS reports that photocell #2 has failed, then this feature enables the operator to determine that photocell #2 is "mounted on top of the sign housing."

2.5.3.1.4 Monitor Message Errors

This feature enables the operator to monitor the errors associated with defining or activating a particular message.

2.5.3.1.5 Monitor Sign Environment

This feature enables the operator to monitor the temperature and humidity within the sign housing and control cabinet. This allows the operator to determine whether the environmental conditions are approaching the environmental limits of the various DMS components.

2.5.3.1.6 Monitor the Sign Control Source

This feature enables the operator to determine the physical location from or mechanism through which the DMS is being controlled. Possible control sources include:

a) Central computer
b) DMS time-based scheduler
c) An individual physically present at the DMS site

2.5.3.1.7 Monitor Attached Speed Detectors

This feature enables the operator to determine the current reading of any speed detectors attached to the DMS.

2.5.3.1.8 Monitor Door Status

This feature enables the operator to determine whether the doors to the sign housing and control cabinet are open or closed. This feature may be used to detect unauthorized physical access to the DMS.

2.5.3.1.9 Monitor Controller Software Operations

This feature enables the operator to determine whether the DMS controller software is operating properly through the use of watchdog timers.

2.5.3.1.10 Monitor Automatic Blanking of Sign

This feature enables the operator to monitor the automatic display of a blank message when diagnostics detect that too many pixels are non-operational or that the light outputs are faulty. This prevents illegible messages from being displayed.

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2.5.3.1.11 Monitor Power Source

This feature enables the operator to monitor the source of power that is being used to operate the DMS sign face.

2.5.3.1.12 Monitor Power Voltage

This feature enables the operator to monitor the voltage of power that is being used to operate the DMS sign face.

2.5.3.1.13 Monitor Fuel Level

This feature enables the operator to monitor the level of fuel within the tank of a generator that is being used to operate the DMS. This feature is typically used in portable signs.

2.5.3.1.14 Monitor Engine RPM

This feature enables the operator to monitor the engine RPM that which a generator that is being used to operate the DMS is currently running. This feature is typically used in portable signs.

2.5.3.2 Monitor the Current Message

This feature enables the operator to determine what message is currently displayed on the sign face.

2.5.4 Provide for Backwards Compatibility of DMS to NTCIP 1203 v1

The following sub-features were modified within NTCIP 1203 v2 and need to be specifically spelled out to achieve backwards compatibility for certain features within a DMS conforming to NTCIP 1203v2

a) Allow a DMS to obtain the number of fan failures using the method defined in NTCIP 1203v1
b) Allow a DMS to initiate the fan test using the method defined in NTCIP 1203v1
c) Allow a DMS to utilize a control mode of 'simulation' as defined in NTCIP 1203v1

2.6 Security

NTCIP 1203 v03 does not address any security issues. Any security pertaining to protecting the communications with a DMS should be implemented either physically by protecting the communications access points, or logically by enabling security features associated with the underlying communications protocols.

2.7 Operational Policies and Constraints

Operational policies are agency-specific and need to be determined and implemented by the agency operating the DMS. NTCIP 1203 v03 does not cover this topic, but instead provides a set of common functions that can support an agency’s operational policies.

If assumptions pertaining to the operations of a DMS have been made, they have been stated clearly at the locations where they apply.

2.8 Relationship to the National ITS Architecture [Informative]

There are three National ITS Architecture Flows associated with the operation of a DMS. These are:

a) Driver Information
b) Roadway Information System Status
c) Roadway Information System Data

The Driver Information flow deals with the message the driver sees on the sign. The other two flows deal with configuring, controlling, and monitoring the DMS.

Each Architecture Flow is associated with one or more interfaces identified within the National ITS Architecture as:

a) Between the DMS (Roadway Subsystem (RS)) and the Maintenance and Construction Management Subsystem (MCMS)

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b) Between the DMS (Roadway Subsystem (RS)) and the Traffic Management Subsystem (TMS)

The National ITS Architecture also identifies the interface between the driver to the DMS (Roadway Subsystem (RS)). This interface is not described in NTCIP 1203 since the focus of NTCIP 1203 is on the electronic interface between a center and the device.

The main user need groups (features), are related to the National ITS Architecture Flows as indicated in Table 1:

User Need Group	Source	Architecture Flow	Destination
Configure the Sign	MCMS	Roadway Information System Data	RS
	RS	Roadway Information System Status	MCMS
	TMS	Roadway Information System Data	RS
	RS	Roadway Information System Status	TMS
Control the Sign	MCMS	Roadway Information System Data	RS
	TMS	Roadway Information System Data	RS
Monitor the Sign	MCMS	Roadway Information System Status	RS
	RS	Roadway Information System Status	MCMS
	TMS	Roadway Information System Data	RS
	RS	Roadway Information System Status	TMS

Table 1 Relationship between Main User Needs Groups and National ITS Architecture Flows

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Section 3
Functional Requirements [Normative]

This section defines the Functional Requirements based on the user needs identified in the Concept of Operations (see Section 2). This section includes:

a) A tutorial
b) The Protocol Requirements List – A Functional Requirement is a requirement of a given function and therefore is only required to be implemented if the associated functionality (e.g., user need) is selected through the use of the Protocol Requirements List (PRL). The PRL also indicates which of the items are mandatory, conditional, or optional. The PRL can be used by procurement personnel to specify the desired features of a DMS or can be used by a manufacturer to document the features supported by their implementation.
c) Operational Environment Requirements – These are requirements related to the Operational Environment User needs defined in Section 2.4.2.
d) Data Exchange Requirements – These are requirements related to the features identified in Section 2.5 that can be realized through a data exchange. For example, this includes the requirement to be able to activate a message on a DMS.
e) Supplemental Requirements – These are additional requirements derived from the Concept of Operations that do not fall into one of the above two categories. For example, they include requirements related to the content of the message to be displayed on a DMS, which may be a supplemental requirement to activating a message, defining a message, etc.

This section is intended for all readers of the document, including:

a) Transportation operations managers
b) Transportation operations personnel
c) Transportation engineers
d) System integrators
e) Device manufacturers

The first three categories of readers will find this section useful to understand the details of what NTCIP 1203 v03 requires of a DMS. For this audience, Sections 3.3.3 and 3.3.4 are likely to be particularly useful in preparing agency (procurement) specifications and in mapping the various rows of this table to the more detailed text contained within the other sections.

For the last two categories of readers, this section is likely to be useful in fully understanding what is required of equipment conformant with NTCIP 1203 v03. For these readers, the table in Sections 3.3.3 and 3.3.4 is also useful to document the capabilities of implementations.

3.1 Tutorial [informative]

The Functional Requirements Section defines the formal requirements that are intended to fulfill the user needs identified in Section 2. This is achieved through the development of a Protocol Requirements List (PRL) that traces each user need to one or more requirements defined in this section. The details of each requirement are then presented following the PRL. The functional requirements are presented in three broad categories as follows:

a) Architectural Requirements – These requirements define the required behavior of the system in exchanging data across the communications interface, including any restrictions to general architectural requirements, based upon the architectural needs identified in the Concept of Operations.

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b) Data Exchange Requirements – These requirements define the required behavior of the system in exchanging data across the communications interface based upon the features identified in the Concept of Operations.
c) Supplemental Requirements – These requirements define additional requirements of the system that are derived from the architectural and/or data exchange requirements, but are not themselves architectural or data exchange requirements. A given supplemental requirement may relate to multiple architectural and/or data exchange requirements. Supplemental requirements frequently include range capabilities of the equipment (e.g., how many messages a VMS is required to support or what the message shall be on a blank-out sign).

3.2 Scope of the Interface [Informative]

<In the opinion of the responsible NTCIP working group, this section does not apply in the context of NTCIP 1203 v03.>

3.3 Protocol Requirements List (PRL)

The PRL, provided in tables defined under Sections 3.3.3, and 3.3.4, map the user needs defined in Section 2 to the requirements defined in Section 3. The table can be used by:

a) A user or specification writer to indicate which requirements are to be implemented in a project-specific implementation.
b) The protocol implementer, as a checklist to reduce the risk of failure to conform to NTCIP 1203 v03 through oversight.
c) The supplier and user, as a detailed indication of the capabilities of the implementation.
d) The user, as a basis for initially checking the potential interoperability with another implementation.

3.3.1 Notation [Informative]

The following notations and symbols are used to indicate status and conditional status in the PRL within all NTCIP standards. Not all of these notations and symbols may be used within NTCIP 1203 v03.

3.3.1.1 Conformance Symbols

The symbols in Table 2are used to indicate status.

Table 2 Conformance Symbols

Symbol	Status
M	Mandatory
M.#	Support of every item of the group labeled by the same numeral # is required, but only one is active at a time
O	Optional
O.# (range)	Part of an option group. Support of the number of items indicated by the '(range)' is required from all options labeled with the same numeral #
C	Conditional
N/A	Not-applicable (i.e. logically impossible in the scope of NTCIP 1203 v03)
X	Excluded or prohibited

The O.# (range) notation is used to show a set of selectable options (e.g., O.2 (1..*) would indicate that one or more of the option group 2 options must be implemented. Two character combinations are used for dynamic requirements. In this case, the first character refers to the static (implementation) status, and the second refers to the dynamic (use); thus "MO" means "mandatory to be implemented, optional to be used."

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3.3.1.2 Conditional Status Notation

The predicate notations in Table 3 may be used.

Table 3 Predicate Notations

Predicate	Notation
<predicate>:	This notation introduces a single item that is conditional on the <predicate>.
<predicate>::	This notation introduces a table or a group of tables, all of which are conditional on the <predicate>.
(predicate)	This notation introduces the first occurrence of the predicate. The feature associated with this notation is the base feature for all options that have this predicate in their conformance column.

The <predicate>: notation means that the status following it applies only when the PRL states that the feature or features identified by the predicate are supported. In the simplest case, <predicate> is the identifying tag of a single PRL item. The <predicate>:: notation may precede a table or group of tables in a section or subsection. When the group predicate is true then the associated section shall be completed. The symbol <predicate> also may be a Boolean expression composed of several indices. "AND", "OR", and "NOT" shall be used to indicate the Boolean logical operations.

The predicates used in NTCIP 1203 v03 map to the sections in Table 4.

Table 4 Predicate to NTCIP 1203 v03 Section Mapping

Predicate	Section
BOS	2.3.2.1.1
CMS	2.3.2.1.2
ControllerOp	2.5.3.1.9
Door	2.5.3.1.8
Drum	2.3.2.2.5
Environment	2.5.3.1.5
Fiber	2.3.2.2.1
Flip/Shutter	2.3.2.2.3
Fonts	2.5.1.3
Graphics	2.5.1.4
Lamp	2.3.2.2.4
LED	2.3.2.2.2
Matrix	2.3.2.3.2
VMS	2.3.2.1.3
AutoBright	3.5.2.5.5
ClimateTest	3.5.3.1.1.3
DoM	3.6.6.2.13.7
DoW	3.6.6.2.13.6
Fields	3.6.6.2.13
Flash	3.6.6.2.10
LampTest	3.5.3.1.1.1
Month	3.6.6.2.13.8
PixelTest	3.5.3.1.1.2
Speed	3.5.3.1.10
Temp	3.6.6.2.13.4

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Predicate	Section
Time	3.6.6.2.13.1 / 3.6.6.2.13.2 / 3.6.6.2.13.3
Year	3.6.6.2.13.9

3.3.1.3 Support Column Symbols

The support column can be used by a procurement specification to identify the required features for the given agency (procurement) specification or by an implementer to identify which features have been implemented. In either case, the user circles the appropriate answer (Yes, No, or N/A) in the support column (see Table 5).

Table 5 Support/Project Requirement Column Entries

Entry	Identifier
Yes	Supported by the implementation.
No	Not supported by the implementation.
N/A	Not applicable

3.3.2 Instructions for Completing the PRL [Informative]

In the ‘project requirements’ column, each response shall be selected either from the indicated set of responses (for example: Yes / No / NA), or it shall reference additional items that are to be attached (for example, list of Permanent DMS Messages to be supported by an implementation).

If a conditional requirement is inapplicable, use the Not Applicable (NA) choice. If a mandatory requirement is not satisfied, exception information must be supplied by entering a reference Xi, where i is a unique identifier, to an accompanying rationale for the non-conformance. When the status is expressed as a two-character combination (as defined in 0 above), the response shall address each element of the requirement; e.g., for the requirement "mo," the possible compliant responses are "yy" or "yn."

The reason that the PRL provides two tables is because the supplemental requirements may relate to multiple architectural and/or data exchange requirements (contained in the first table). This split reduces the amount of repetition that would otherwise increase the size of the first table.

> Note: A user might fill out the first table first before proceeding to the second table. However, it will likely be easier to complete the corresponding rows in the second table when considering a specific items in the first table.
>
> Note: A specification can allow for flexibility in a deliverable by leaving the selection in the Project Requirement column blank for a given row. For example, a specification could require the supporting of graphics by selecting ‘Yes’ on Row 2.5.1.4, and leaving rows 3.5.1.4.1 thru 3.5.1.4.7 as well as 3.6.11 blank (if no additional project requirements needed to be stated).

3.3.2.1 Conformance Definition

To claim "Conformance" to NTCIP 1203 v03, the vendor must minimally satisfy the mandatory requirements as identified in the three (3) tables that compose this PRL. In addition, a conformant device may offer additional (optional) features, as long as they are conformant with the requirements of NTCIP 1203 v03 and the standards it references.

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> Note: The reader and user of NTCIP 1203 v03 is advised that 'conformance' to NTCIP 1203 v03 should not be confused with 'compliance' to a specification. NTCIP 1203 v03 is as broad as possible to allow a very simple device such as a blank-out sign to be 'conformant' to NTCIP 1203 v03. A specification will need to identify the requirements of a particular project and needs to require the support of those requirements. A specification writer is advised to match the requirements of a project with the corresponding standardized requirements defined in NTCIP 1203 v03 to achieve interoperability. This means that functions and requirements defined as 'optional' in NTCIP 1203 v03 might need to be selected in a specification (in effect made 'mandatory' for the project-specific specification).

A conformant device may offer additional features, as long as they are conformant with the requirements of NTCIP 1203 v03 and the standards it references (e.g., NTCIP 1201:2005, NTCIP 2301 v02, and NTCIP 8004 v02). For example, a device may support data that has not been defined by NTCIP 1203 v03; however, when exchanged via one of the NTCIP 2301 protocols, the data must be properly registered with a valid OBJECT IDENTIFIER under the Global ISO Naming Tree.

> Note: Off-the-shelf interoperability and interchangeability can only be obtained through well documented features broadly supported by the industry as a whole. Designing a system that uses features not defined in a standard or not typically deployed in combination with one another will inhibit the goals of interoperability and interchangeability, especially if the documentation of these features is not available for distribution to system integrators. The standards allow the use of additional features to support innovation, which is constantly needed within the industry; but users should be aware of the risks involved with using such features.

3.3.2.2 Backward Compatibility and Support of Different Versions of NTCIP 1203

In NTCIP 1203 v02, the enhancement of certain functions caused corresponding objects to be replaced. A device conformant with NTCIP 1203 v03 shall by default support functions (and resulting objects) from all existing versions, if said device is required to support that particular functionality.

For example, version 1 of NTCIP 1203 contained a set of objects that defined how two devices needed to communicate with each other when exchanging data pertaining to auxiliary input/output devices. These version 01 objects, which were defined as experimental objects, were moved to the global object definition set when version 2 for both NTCIP 1201 and NTCIP 1203 were created, because the functionality is applicable to other field device communications besides DMS. In the process, an alias of each of these objects was created to locate the functionality under a non-experimental node.
to provide maximum backwards compatibility, a field device that is required to support the auxiliary input/output (auxIO) functionality and that wants to claim conformance to NTCIP 1203 v03 is required to support the objects defined in both, version 01 and version 02.

However, a specification writer might determine that support of (an) older version(s) is not required and may state this within the following PRL table (the table contains within the ‘additional specifications requirements’ column statements where a user can de-select the support of any existing version).

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3.3.3 Protocol Requirements List (PRL) Table

In addition to the conformance column and the support/project requirement column, which were discussed in Section 3.3.1, the additional columns in the PRL table are the user needs columns, requirements columns and the additional project requirements column.

3.3.3.1 User Needs Column

The user needs are defined within Section 2 and the PRL is based upon the user need sections within that Section. The section number and user need name are indicated within these columns.

3.3.3.2 Requirements Column

The requirements are defined within Section 3 and the PRL references the traces from user needs to these requirements. The section number and functional requirements name are indicated within these columns.

3.3.3.3 Additional Project Requirements Column

The "Additional Project Requirements" column may (and should) be used by a procurement specification to provide additional notes and requirements for the product to be procured or may be used by an implementer to provide any additional details about the implementation. In some cases, default text already exists in this field, which the user should complete to fully specify the equipment. However, additional text can be added to this field as needed to fully specify a feature.

† Designates that this requirement is composed of several more detailed requirements as defined in the second half of the PRL contained in Section 3.3.9.

Protocol Requirements List (PRL)						
User Need Section Number	**User Need**	**FR Section Number**	**Functional Requirement**	**Conformance**	**Support / Project Requirement**	**Additional Project Requirements**
2.3.2	DMS Characteristics			M	Yes	
2.3.2.1	DMS Type			M	Yes	
2.3.2.1.1 (BOS)	BOS			O.1 (1)	Yes / No	
2.3.2.1.2 (CMS)	CMS			O.1 (1)	Yes / No	
2.3.2.1.3 (VMS)	VMS			O.1 (1)	Yes / No	
2.3.2.2	DMS Technology			M	Yes	Note that certain combinations of the following technologies might not be supported by any product.

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Protocol Requirements List (PRL)						
User Need Section Number	**User Need**	**FR Section Number**	**Functional Requirement**	**Conformance**	**Support / Project Requirement**	**Additional Project Requirements**
2.3.2.2.1 (Fiber)	Fiber			O	Yes / No	
2.3.2.2.2 (LED)	LED			O	Yes / No	
2.3.2.2.3 (Flip/Shutter)	Flip/Shutter			O	Yes / No	
2.3.2.2.4 (Lamp)	Lamp			O	Yes / No	
2.3.2.2.5 (Drum)	Drum			O	Yes / No	
2.3.2.3	DMS Display Matrix Configuration			M	Yes	The DMS shall be ___ millimeters wide (0..65535) and ___ millimeters high (0..65535), inclusive of borders. The Sign's Border shall be at least ___ millimeters wide (0..65535) and ___ millimeters high (0..65535).
2.3.2.3.1	Non-Matrix			O.2 (1)	Yes / No	
2.3.2.3.2 (Matrix)	Matrix			O.2 (1)	Yes / No	The pitch between pixels shall be at least ___ millimeters (0..255).
2.3.2.3.2.1	Full Matrix			O.3 (1)	Yes / No	The sign shall be ___ pixels wide (0..65535) and ___ pixels high (0..65535).
2.3.2.3.2.2	Line Matrix			O.3 (1)	Yes / No	The sign shall have ____ lines with each line being ___ pixels wide and ___ pixels high.
2.3.2.3.2.3	Character Matrix			O.3 (1)	Yes / No	The sign shall be ___ characters wide and ___ characters high with each character being ___ pixels wide (0..255), ___ pixels high (0..255).

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Protocol Requirements List (PRL)						
User Need Section Number	**User Need**	**FR Section Number**	**Functional Requirement**	**Conformance**	**Support / Project Requirement**	**Additional Project Requirements**
2.3.2.4 (Beacons)	DMS Display Support of Beacons			M	Yes	The DMS shall support the following Beacon configuration:_____ Select one from the following (or define your own): - none - one Beacon - two Beacons with Sync-ed Flash - two Beacons with Opposing Flash - four Beacons with Sync-ed Flash - four Beacons with Alternate Row Flash - four Beacons with Alternate Column Flash - four Beacons with Alternate Diagonal Flash - four Beacons with No Sync-ed Flash - one Beacon Strobe - two Beacon Strobe - four Beacon Strobe
2.4.2	Operational Environment			M	Yes	
2.4.2.1	Live Data Exchange			M	Yes	
		3.4.1.1	Retrieve Data	M	Yes	
		3.4.1.2	Deliver Data	M	Yes	
		3.4.1.3	Explore Data	M	Yes	
		3.4.4.1	Determine Current Access Settings	M	Yes	
		3.4.4.2	Configure Access	M	Yes	The DMS shall support at least _____ access levels in addition to the administrator.
2.4.2.2	Logged Data Exchange			O	Yes / No	

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Protocol Requirements List (PRL)						
User Need Section Number	**User Need**	**FR Section Number**	**Functional Requirement**	**Conformance**	**Support / Project Requirement**	**Additional Project Requirements**
		H.2.2.1	Set Time	M	Yes	
		H.2.2.2	Set Time Zone	H.2.2.1:O	Yes / No	Note: Users are cautioned that this object definition has been revised to address interoperability issues in version 01, but remains at the same ObjectID. Pay close attention to the implementation, and interoperability of this object. Place a checkmark below, if the DMS is NOT required to support the major version that is checked. Version v01____ Version v02____
		H.2.2.3	Set Daylight Savings Mode	H.2.2.1:O	Yes / No	
		H.2.2.4	Verify Current Time	M	Yes	
		H.2.6 †	Supplemental Requirements for Event Monitoring	M	Yes	
		3.4.2.1	Determine Current Configuration of Logging Service	M	Yes	
		3.4.2.2	Configure Logging Service	M	Yes	
		3.4.2.3	Retrieve Logged Data	M	Yes	
		3.4.2.4	Clear Log	M	Yes	
		3.4.2.5	Determine Capabilities of Event Logging Service	M	Yes	
		3.4.2.6	Determine Total Number of Events	M	Yes	
2.4.2.3	Exceptional Condition Reporting			X	No	Exception Reporting is not yet supported by NTCIP.
2.5	Features			M	Yes	
2.5.1	Manage the DMS Configuration			M	Yes	

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Protocol Requirements List (PRL)						
User Need Section Number	**User Need**	**FR Section Number**	**Functional Requirement**	**Conformance**	**Support / Project Requirement**	**Additional Project Requirements**
2.5.1.1	Determine the DMS Identity			M	Yes	
		3.5.1.1.1	Determine Sign Type and Technology	M	Yes	
		H.2.1	Determine Device Component Information	M	Yes	
		H.2.4	Determine Supported Standards	M	Yes	
2.5.1.2	Determine Sign Display Capabilities			O	Yes / No	
		3.5.1.2.1.1	Determine the Size of the Sign Face	M	Yes	
		3.5.1.2.1.2	Determine the Size of the Sign Border	M	Yes	
		3.5.1.2.1.3	Determine Beacon Type	M	Yes	
		3.5.1.2.1.4	Determine Sign Access and Legend	M	Yes	
		3.5.1.2.2.1	Determine Sign Face Size in Pixels	Matrix:M	Yes / NA	
		3.5.1.2.2.2	Determine Character Size in Pixels	Matrix:M	Yes / NA	
		3.5.1.2.2.3	Determine Pixel Spacing	Matrix:M	Yes / NA	
		3.5.1.2.3.1	Determine Maximum Number of Pages	VMS:M	Yes / NA	The DMS shall support at least _____ (1..255) pages for a single message.
		3.5.1.2.3.2	Determine Maximum Message Length	VMS:M	Yes / NA	The DMS shall support a Multi-String message of at least _____ (0..65535) bytes.
		3.5.1.2.3.3	Determine Supported Color Schemes	VMS:M	Yes / NA	
		3.5.1.2.3.4	Determine Message Display Capabilities	VMS:M	Yes / NA	

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Protocol Requirements List (PRL)						
User Need Section Number	**User Need**	**FR Section Number**	**Functional Requirement**	**Conformance**	**Support / Project Requirement**	**Additional Project Requirements**
		3.5.1.3.1	Determine Maximum Number of Fonts Supported	Fonts:M	Yes / NA	See PRL 3.6.1.1.
		3.5.1.3.3	Determine Maximum Number of Characters per Font	Fonts:M	Yes / NA	
		3.5.1.3.4	Retrieve a Font Definition	Fonts:M	Yes / NA	
		3.5.1.4.1	Determine Maximum Number of Graphics	Graphics:M	Yes / NA	The DMS shall support at least _____ graphics.
		3.5.1.4.4	Retrieve a Graphic Definition	Graphics:M	Yes / NA	
		3.5.2.3.2.1	Determine Default Message Display Parameters	VMS:M	Yes / NA	
		3.5.3.2.1	Monitor Information about the Currently Displayed Message	O	Yes / No	
		3.5.3.2.2	Monitor Dynamic Field Values	Fields:M	Yes / NA	
		3.6.6 †	Supplemental Requirements for Message Definition	VMS:M	Yes / NA	
2.5.1.3 (Fonts)	Manage Fonts			VMS:O	Yes / No / NA	
		3.5.1.3.1	Determine Maximum Number of Fonts Supported	M	Yes	
		3.5.1.3.2	Determine Maximum Character Size	M	Yes	The DMS shall support at least ____ characters per font (1...65535).

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Protocol Requirements List (PRL)						
User Need Section Number	**User Need**	**FR Section Number**	**Functional Requirement**	**Conformance**	**Support / Project Requirement**	**Additional Project Requirements**
		3.5.1.3.3	Determine Maximum Number of Characters per Font	M	Yes	
		3.5.1.3.4	Retrieve a Font Definition	M	Yes	Note: Users are cautiond that this object definition has been revised to address interoperability issues in version 01. The associated objects were deprecated and replaced by newer objects that have a wider scope or that have been changed to ease implementation. Pay close attention to the implementation and interoperability of these objects. Place a checkmark below, if the DMS is NOT required to support the major version that is checked." Version v01____ Version v02____
		3.5.1.3.5	Configure a Font	O	Yes / No	
		3.5.1.3.6	Delete a Font	O	Yes / No	
		3.5.1.3.7	Validate a Font	O	Yes / No	
		3.6.1 †	Supplemental Requirements for Fonts	M	Yes	If desired, the procurement officer should define the fonts or leave this up to the vendor. If officer defines the font(s), attach sheet(s) with definitions. Note: The Project Specifications may ask vendor to propose the fonts.
2.5.1.4 (Graphics)	Manage Graphics			VMS:O	Yes / No / NA	
		3.5.1.4.1	Determine Maximum Number of Graphics	M	Yes	The DMS shall support at least _____ graphics.
		3.5.1.4.2	Determine Maximum Graphic Size	M	Yes	The DMS shall support a maximum graphic size of _____ bytes.

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Protocol Requirements List (PRL)						
User Need Section Number	**User Need**	**FR Section Number**	**Functional Requirement**	**Conformance**	**Support / Project Requirement**	**Additional Project Requirements**
		3.5.1.4.3	Determine Available Graphics Memory	M	Yes	The DMS shall support a maximum graphic block size of _____ bytes.
		3.5.1.4.4	Retrieve a Graphic Definition	M	Yes	
		3.5.1.4.5	Store a Graphic Definition	O	Yes / No	
		3.5.1.4.6	Delete a Graphic	O	Yes / No	
		3.5.1.4.7	Validate a Graphic	O	Yes / No	
		3.6.11 †	Supplemental Requirements for Graphics	M	Yes	If desired, the procurement officer should define the graphics or leave this up to the vendor. If officer defines the graphic(s), attach sheet(s) with definitions. Note: The Project Specifications may ask vendor to propose the graphics.
2.5.1.5	Manage Automatic Brightness			AutoBright:O	Yes / No / NA	
		3.5.1.5.1	Determine Maximum Number of Light Sensor Levels	M	Yes	
		3.5.1.5.2	Configure Light Output Algorithm	O	Yes / No	
		3.5.1.5.3	Determine Current Light Output Algorithm	O	Yes / No	
		3.5.2.5.1	Determine Number of Brightness Levels	M	Yes	
		3.6.2 †	Supplemental Requirements for General Illumination Brightness	M	Yes	

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Protocol Requirements List (PRL)						
User Need Section Number	**User Need**	**FR Section Number**	**Functional Requirement**	**Conformance**	**Support / Project Requirement**	**Additional Project Requirements**
		3.6.3 †	Supplemental Requirements for Automatic Brightness Control	O	Yes / No	
2.5.1.6	Configure Speed Limit			O	Yes / No	
		3.5.1.6	Configure Current Speed Limit	M	Yes	
2.5.1.7	Configure Low Fuel Threshold			O	Yes / No	
		3.5.1.7	Configure Low Fuel Threshold Value	M	Yes	
2.5.2	Control the DMS			M	Yes	
2.5.2.1	Control a DMS from More than One Location			M	Yes	
		3.5.2.1	Manage Control Source	M	Yes	
		3.6.4 †	Supplemental Requirements for Control Modes	M	Yes	
2.5.2.2	Remotely Reset the Sign Controller			O	Yes / No	
		3.5.2.2	Reset the Sign Controller	M	Yes	
2.5.2.3	Control the Sign Face			M	Yes	
2.5.2.3.1	Activate and Display a Message			M	Yes	
		3.5.2.3.1	Activate a Message	M	Yes	
		3.5.2.3.3.5	Retrieve Message	M	Yes	
		3.5.2.3.6	Activate a Message with Status	Drum:M	Yes / NA	
		3.6.5 †	Supplemental Requirements for Message Activation Request	M	Yes	

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Protocol Requirements List (PRL)						
User Need Section Number	**User Need**	**FR Section Number**	**Functional Requirement**	**Conformance**	**Support / Project Requirement**	**Additional Project Requirements**
		3.6.7 †	Supplemental Requirements for Locally Stored Messages	M	Yes	
2.5.2.3.2	Prioritize Messages			M	Yes	
		3.5.2.3.1	Activate a Message	M	Yes	
		3.5.2.3.3.3	Define a Message	VMS:M	Yes / NA	
		3.5.2.3.6	Activate a Message with Status	Drum:M	Yes / NA	
		3.6.5.4 †	Supplemental Requirements for Message Activation Priority	M	Yes	
		3.6.6.4 †	Priority to Maintain a Message	M	Yes	
2.5.2.3.3	Define a Message			VMS:M	Yes / NA	
		3.5.1.2.1.3	Determine Beacon Type	M	Yes	
		3.5.1.2.3.1	Determine Maximum Number of Pages	M	Yes	
		3.5.1.2.3.2	Determine Maximum Message Length	M	Yes	
		3.5.1.2.3.3	Determine Supported Color Schemes	M	Yes	
		3.5.1.2.3.4	Determine Message Display Capabilities	M	Yes	
		3.5.1.2.4	Delete All Messages of a Message Type with One Command	O	Yes / No	
		3.5.1.3.1	Determine Maximum Number of Fonts Supported	Fonts:M	Yes / NA	

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Protocol Requirements List (PRL)						
User Need Section Number	**User Need**	**FR Section Number**	**Functional Requirement**	**Conformance**	**Support / Project Requirement**	**Additional Project Requirements**
		3.5.1.3.3	Determine Supported Characters	Fonts:M	Yes / NA	
		3.5.1.4.1	Determine Maximum Number of Graphics	Graphics:M	Yes / NA	
		3.5.2.3.2.1	Determine Default Message Display Parameters	M	Yes	
		3.5.2.3.2.2	Configure Default Background and Foreground Color	O	Yes / No	
		3.5.2.3.2.3	Configure Default Flash-On and Flash-Off Times	O	Yes / No	The DMS shall support all flash on times from ____ tenths of a second (0..255) to ____ tenths of a second (0..255) in ____ tenths of a second increments. The DMS shall support all flash off times from ____ tenths of a second (0..255) to ____ tenths of a second (0..255) in ____ tenths of a second increments.
		3.5.2.3.2.4	Configure Default Font	O	Yes / No	
		3.5.2.3.2.5	Configure Default Line Justification	O	Yes / No	
		3.5.2.3.2.6	Configure Default Page Justification	O	Yes / No	
		3.5.2.3.2.7	Configure Default Page On-Time and Page Off-Time	O	Yes / No	The DMS shall support all page on times from ____ tenths of a second (1..255) to ____ tenths of a second (1..255) in ____ tenths of a second increments. The DMS shall support all page off times from ____ tenths of a second (0..255) to ____ tenths of a second (0..255) in ____ tenths of a second increments.

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Protocol Requirements List (PRL)						
User Need Section Number	**User Need**	**FR Section Number**	**Functional Requirement**	**Conformance**	**Support / Project Requirement**	**Additional Project Requirements**
		3.5.2.3.2.8	Configure Default Character Set	O	Yes / No	
		3.5.2.3.3.1	Determine Available Message Types	M	Yes	
		3.5.2.3.3.2	Determine Available Message Space	M	Yes	
		3.5.2.3.3.3	Define a Message	M	Yes	
		3.5.2.3.3.4	Verify Message Contents	M	Yes	
		3.5.2.3.3.5	Retrieve Message	M	Yes	
		H.2.2.1	Set Time	O	Yes / No	Mandatory if time fields tags are used
		H.2.2.2	Set Time Zone	H.2.2.1:O	Yes / No	1) Mandatory if time fields tags are used 2.) Note: Users are cautioned that this object definition has been revised to address interoperability issues in version 01, but remains at the same ObjectID. Pay close attention to the implementation, and interoperability of this object. Place a checkmark below, if the DMS is NOT required to support the major version that is checked." Version v01____ Version V02____
		H.2.2.3	Set Daylight Savings Mode	H.2.2.1:O	Yes / No	
		H.2.2.4	Verify Current Time	H.2.2.1:O	Yes / No	
		3.6.1 †	Supplemental Requirements for Fonts	Fonts: M	Yes / NA	
		3.6.6 †	Supplemental Requirements for Message Definition	M	Yes	
		3.6.7 †	Supplemental Requirements for Locally Stored Messages	M	Yes	

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Protocol Requirements List (PRL)						
User Need Section Number	**User Need**	**FR Section Number**	**Functional Requirement**	**Conformance**	**Support / Project Requirement**	**Additional Project Requirements**
		3.6.8 †	Supplemental Requirements for Color Scheme	M	Yes	
		3.6.11 †	Supplemental Requirements for Graphics	Graphics: M	Yes / NA	
		3.6.13 †	Supplemental Requirements for Page Justification	M	Yes	
		3.6.14 †	Supplemental Requirements for Line Justification	M	Yes	
2.5.2.3.4	Blank a Sign			M	Yes	
		3.5.2.3.1	Activate a Message	M	Yes	
		3.5.2.3.6	Activate a Message with Status	Drum:M	Yes / NA	
		3.6.5 †	Supplemental Requirements for Message Activation Request	M	Yes	
2.5.2.3.5	Schedule Messages for Display			O	Yes / No	
		3.5.2.3.1	Activate a Message	M	Yes	
		3.5.2.3.4.1	Retrieve a Schedule	M	Yes	
		3.5.2.3.4.2	Define a Schedule	M	Yes	
		3.5.2.3.6	Activate a Message with Status	Drum:M	Yes / NA	
		H.2.2.1	Set Time	M	Yes	
		H.2.2.2	Set Time Zone	M	Yes	Note: Users are cautioned that this object definition has been revised to address interoperability issues in version 01, but
		H.2.2.3	Set Daylight Savings Mode	M	Yes	

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Protocol Requirements List (PRL)						
User Need Section Number	**User Need**	**FR Section Number**	**Functional Requirement**	**Conformance**	**Support / Project Requirement**	**Additional Project Requirements**
		H.2.2.4	Verify Current Time	M	Yes	remains at the same ObjectID. Pay close attention to the implementation, and interoperability of this object. Place a checkmark below, if the DMS is NOT required to support the major version that is checked." Version v01____ Version V02____
		H.2.3.1	Determine Maximum Number of Schedules	M	Yes	
		H.2.3.2	Monitor Current Schedule	M	Yes	
		3.6.5 †	Supplemental Requirements for Message Activation Request	M	Yes	
		3.6.10 †	Supplemental Requirements for Scheduling	M	Yes	
		H.2.5 †	Supplemental Requirements for Scheduling	M	Yes	
2.5.2.3.6	Change Message Display based on an Internal Event			O	Yes / No	
		3.5.2.3.5.1.1	Configure Message for Short Power Loss Recovery Event	O.4 (1..*)	Yes / No	
		3.5.2.3.5.1.2	Configure Message for Long Power Loss Recovery Event	O.4 (1..*)	Yes / No	
		3.5.2.3.5.1.3	Configure Message for Power Loss Event	Flip/Shutter OR Drum:O.4 (1..*)	Yes / No / NA	

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Protocol Requirements List (PRL)						
User Need Section Number	**User Need**	**FR Section Number**	**Functional Requirement**	**Conformance**	**Support / Project Requirement**	**Additional Project Requirements**
		3.5.2.3.5.1.4	Configure Message for Controller Reset Event	O.4 (1..*)	Yes / No	
		3.5.2.3.5.1.5	Configure Message for Communications Loss Event	O.4 (1..*)	Yes / No	
		3.5.2.3.5.1.6	Configure Message for End Message Display Duration Event	O.4 (1..*)	Yes / No	
		3.5.3.3.2	Monitor Short Power Recovery Message	3.5.2.3.5.1.1:M	Yes	
		3.5.3.3.3	Monitor Long Power Recovery Message	3.5.2.3.5.1.2:M	Yes	
		3.5.3.3.4	Monitor Power Loss Message	3.5.2.3.5.1.3:M	Yes	
		3.5.3.3.5	Monitor Reset Message	3.5.2.3.5.1.4:M	Yes	
		3.5.3.3.6	Monitor Communications Loss Message	3.5.2.3.5.1.5:M	Yes	
		3.5.3.3.7	Monitor End Duration Message	3.5.2.3.5.1.6:M	Yes	
		3.6.5.1 †	Supplemental Requirements for Internal or External Message Activation	M	Yes	

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Protocol Requirements List (PRL)						
User Need Section Number	**User Need**	**FR Section Number**	**Functional Requirement**	**Conformance**	**Support / Project Requirement**	**Additional Project Requirements**
2.5.2.4	Control External Devices			O	Yes / No	Note: Users are cautioned that the object definitions have been revised to address interoperability issues in version 01. The associated objects were deprecated and replaced by newer objects that have a wider scope or that have been changed to ease implementation. Pay close attention to the implementation and interoperability of this object. Place a checkmark below, if the DMS is NOT required to support the major version that is checked." Version v01____(defined in NTCIP 1203) Version v02____(defined in NTCIP 1201)
		3.5.2.4	Control External Devices	M	Yes	The DMS shall support at least _____ analog ports (0..255) and _____ digital ports (0..255) for auxiliary input and output. The DMS shall be provided with the following external devices: 1. _____ Add another sheet, if necessary
		3.5.2.4.1	Determine Configuration of External Device Ports	M	Yes	
		3.5.2.4.1.1	Determine Base - Configuration of External Device Ports	M	Yes	
		3.5.2.4.1.2	Further Define Ports	O	Yes / No	
		3.5.2.4.1.3	Number of External Devices Supported	M	Yes	
		3.5.2.4.2	Monitoring of External Devices	O.5 (1.. *)	Yes / No	

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Protocol Requirements List (PRL)						
User Need Section Number	**User Need**	**FR Section Number**	**Functional Requirement**	**Conformance**	**Support / Project Requirement**	**Additional Project Requirements**
		3.5.2.4.2.1	Retrieving Data from External Devices	M	Yes	
		3.5.2.4.3	Controlling of External Devices	O.5 (1.. *)	Yes / No	
		3.5.2.4.3.1	Passing Data to External Devices	M	Yes	
		3.5.2.4.3.2	Determine Status of External Devices	M: version 2 NA: version 1	Yes	This functionality is not applicable to Version 1.
		3.5.2.4.4	Controlling of Bi-directionally Connected External Devices	O.5 (1.. *)	Yes / No	
		3.5.2.4.4.1	Retrieving Data from External Devices	M	Yes	
		3.5.2.4.4.2	Passing Data to External Devices	M	Yes	
		3.5.2.4.4.3	Determine Status of External Devices	M: version 2 NA: version 1	Yes	This functionality is not applicable to Version 1.
2.5.2.5	Control the Brightness Output			Lamp OR LED OR Fiber:M	Yes / NA	
		3.5.2.5.1	Determine Number of Brightness Levels	M	Yes	
		3.5.2.5.2	Determine Current Photocell Readings	AutoBright:M	Yes / NA	
		3.5.2.5.3	Manually Direct-Control Brightness	O.6	Yes / No	This functionality is not applicable to Version 1. Select this or the next option (Manually Index-Control Brightness) depending on desired operation.

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Protocol Requirements List (PRL)						
User Need Section Number	**User Need**	**FR Section Number**	**Functional Requirement**	**Conformance**	**Support / Project Requirement**	**Additional Project Requirements**
		3.5.2.5.4	Manually Index-Control Brightness	O.6	Yes / No	This functionality is not applicable to Version 1. Select this or the previous option (Manually Direct-Control Brightness) depending on desired operation.
		3.5.2.5.5	Manually Control Brightness	O	Yes / No	This functionality is only applicable to Version 1. Describe in detail how this operation is supposed to work to achieve backwards compatibilty.
		3.5.2.5.6 (AutoBright)	Switch Brightness Control Modes	O	Yes / No	
		3.6.2 †	Supplemental Requirements for General Illumination Brightness	O	Yes / No	
		3.6.3 †	Supplemental Requirements for Automatic Brightness Control	AutoBright:M	Yes / NA	
2.5.2.6	Perform Preventative Maintenance			Fiber OR Flip/Shutter:O	Yes / No / NA	
		3.4.2.6	Manage the Exercise of Pixels	M	Yes	
		H.2.2.1	Set Time	O	Yes / No	
		H.2.2.2	Set Time Zone	H.2.2.1:O	Yes / No	Note: Users are cautioned that this object definition has been revised to address interoperability issues s in version 01, but
		H.2.2.3	Set Daylight Savings Mode	H.2.2.1:O	Yes / No	

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Protocol Requirements List (PRL)						
User Need Section Number	**User Need**	**FR Section Number**	**Functional Requirement**	**Conformance**	**Support / Project Requirement**	**Additional Project Requirements**
		H.2.2.4	Verify Current Time	H.2.2.1:O	Yes / No	remains at the same ObjectID. Pay close attention to the implementation, and interoperability of this object. Place a checkmark below, if the DMS is NOT required to support the major version that is checked." Version v01____ Version v02____
		3.6.6.6 †	Pixel Service Flag	M	Yes	
2.5.3	Monitor the Status of the DMS			M	Yes	
2.5.3.1	Perform Diagnostics			M	Yes	
2.5.3.1.1	Determine Sign Error Conditions - High-Level Diagnostics			M	Yes	
		3.5.3.1.1.1 (LampTest)	Execute Lamp Testing	Lamp OR Fiber:M	Yes / NA	
		3.5.3.1.1.2 (PixelTest)	Activate Pixel Testing	Matrix:M	Yes / NA	
		3.5.3.1.1.3 (ClimateTest)	Execute Climate-Control Equipment Testing	O	Yes / No	
		3.5.3.1.2	Provide General DMS Error Status Information	M	Yes	
2.5.3.1.2	Monitor Sign Subsystem Failures - Mid-Level Diagnostics			M	Yes	
		3.5.3.1.3.1	Monitor Power Errors	M	Yes	
		3.5.3.1.3.2	Monitor Lamp Errors	LampTest:M	Yes / NA	
		3.5.3.1.3.3	Monitor Pixel Errors	PixelTest:M	Yes / NA	
		3.5.3.1.3.4	Monitor Light Sensor Errors	AutoBright:M	Yes / NA	

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Protocol Requirements List (PRL)						
User Need Section Number	**User Need**	**FR Section Number**	**Functional Requirement**	**Conformance**	**Support / Project Requirement**	**Additional Project Requirements**
		3.5.3.1.3.5	Monitor Controller Software Operations	ControllerOp:M	Yes / NA	
		3.5.3.1.3.6	Monitor Climate-Control System Errors	ClimateTest:M	Yes / NA	
		3.5.3.1.3.7	Monitor Temperature Warnings	M	Yes	
		3.5.3.1.3.8	Monitor Humidity Warnings	O	Yes / No	
		3.5.3.1.3.9	Monitor Drum Sign Rotor Errors	Drum:O	Yes / No / NA	
		3.5.3.1.3.10	Monitor Door Status	Door:M	Yes / NA	
2.5.3.1.3	Monitor Subsystem Failure Details - Low-Level Diagnostics			O	Yes / No	
		3.5.3.1.4.1	Monitor Power Error Details	M	Yes	
		3.5.3.1.4.2	Monitor Lamp Error Details	LampTest:M	Yes / NA	
		3.5.3.1.4.3	Monitor Pixel Error Details	PixelTest:M	Yes / NA	
		3.5.3.1.4.4	Monitor Light Sensor Error Details	AutoBright:M	Yes / NA	
		3.5.3.1.4.5	Monitor Message Activation Error Details	M	Yes	
		3.5.3.1.4.6	Monitor Climate-Control System Error Details	ClimateTest:M	Yes / NA	
		3.5.3.1.4.7	Monitor Sign Housing Temperatures	Environment:M	Yes / NA	
		3.5.3.1.4.8	Monitor Sign Housing Humidity	O	Yes / No	

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Protocol Requirements List (PRL)						
User Need Section Number	**User Need**	**FR Section Number**	**Functional Requirement**	**Conformance**	**Support / Project Requirement**	**Additional Project Requirements**
		3.5.3.1.4.9	Monitor Control Cabinet Temperatures	O	Yes / No	
		3.5.3.1.4.10	Monitor Control Cabinet Humidity	O	Yes / No	
		3.5.3.1.4.11	Monitor Drum Sign Rotor Error Details	Drum:O	Yes / No / NA	
		3.5.3.1.8	Determine Critical Temperature Threshold	Environment:M	Yes / NA	
2.5.3.1.4	Monitor Message Errors			M	Yes	
		3.5.3.1.4.5	Monitor Message Activation Error Details	M	Yes	
2.5.3.1.5 (Environment)	Monitor Sign Environment			O	Yes / No	
		3.5.3.1.4.7	Monitor Sign Housing Temperatures	M	Yes	
		3.5.3.1.4.8	Monitor Sign Housing Humidity	O	Yes / No	
		3.5.3.1.4.9	Monitor Control Cabinet Temperatures	O	Yes / No	
		3.5.3.1.4.10	Monitor Control Cabinet Humidity	O	Yes / No	
		3.5.3.1.7	Monitor Ambient Environment	Temp:M	Yes / NA	
2.5.3.1.6	Monitor the Sign Control Source			M	Yes	
		3.5.3.1.5	Monitor the Sign's Control Source	M	Yes	
2.5.3.1.7	Monitor Attached Speed Detectors			O	Yes / No	
		3.5.3.1.9 (Speed)	Monitor Speed Detector Reading	O	Yes / No	

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Protocol Requirements List (PRL)						
User Need Section Number	**User Need**	**FR Section Number**	**Functional Requirement**	**Conformance**	**Support / Project Requirement**	**Additional Project Requirements**
2.5.3.1.8 (Door)	Monitor Door Status			O	Yes / No	
		3.5.3.1.3.10	Monitor Door Status	M	Yes	
2.5.3.1.9 (ControllerOp)	Monitor Controller Software Operations			O	Yes / No	
		3.5.3.1.3.5	Monitor Controller Software Operations	M	Yes	
2.5.3.1.10	Monitor Automatic Blanking of Sign			O	Yes / No	
		3.5.3.1.1.1 (LampTest)	Execute Lamp Testing	Lamp OR Fiber:M	Yes / NA	
		3.5.3.1.1.2 (PixelTest)	Activate Pixel Testing	Matrix:M	Yes / NA	
		3.5.3.1.2	Provide General DMS Error Status Information	M	Yes	
		3.5.3.1.3.2	Monitor Lamp Errors	LampTest:M	Yes / NA	
		3.5.3.1.3.3	Monitor Pixel Errors	PixelTest:M	Yes / NA	
		3.5.3.1.4.2	Monitor Lamp Error Details	LampTest:M	Yes / NA	
		3.5.3.1.4.3	Monitor Pixel Error Details	PixelTest:M	Yes / NA	
		3.5.3.2.1	Monitor Information about the Currently Displayed Message	O	Yes / No	
		3.5.3.2.2	Monitor Dynamic Field Values	Fields:M	Yes / NA	
		3.6.6 †	Supplemental Requirements for Message Definition	VMS:M	Yes / NA	
2.5.3.1.11	Monitor Power Source			O	Yes / No	
		3.5.3.1.6.1	Monitor Power Source	M	Yes	

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Protocol Requirements List (PRL)						
User Need Section Number	**User Need**	**FR Section Number**	**Functional Requirement**	**Conformance**	**Support / Project Requirement**	**Additional Project Requirements**
2.5.3.1.12	Monitor Power Voltage			O	Yes / No	
		3.5.3.1.6.2	Monitor Power Voltage	M	Yes	
2.5.3.1.13	Monitor Fuel Level			O	Yes / No	
		3.5.3.1.6.3	Monitor Current Fuel Level	M	Yes	
2.5.3.1.14	Monitor Engine RPM			O	Yes / No	
		3.5.3.1.6.4	Monitor Current Engine RPM	M	Yes	
2.5.3.2	Monitor the Current Message			M	Yes	
		3.5.3.2.1	Monitor Information about the Currently Displayed Message	O	Yes / No	
		3.5.3.2.2	Monitor Dynamic Field Values	Fields:M	Yes / NA	
		3.6.6 †	Supplemental Requirements for Message Definition	VMS:M	Yes / NA	
2.5.4	Provide for Backwards Compatibility of the DMS to NTCIP 1203 Version 1			O	Yes / No	Note: Users are cautioned that these object definitions have been revised to address interoperability issues in version 01. The associated objects were deprecated and replaced by newer objects that have a wider scope or that have been changed to ease implementation. Pay close attention to the implementation and interoperability of these objects. Place a checkmark below, if the DMS is NOT required to support the major version that is checked." NTCIP 1203:1997 (version v01) ____

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Protocol Requirements List (PRL)						
User Need Section Number	**User Need**	**FR Section Number**	**Functional Requirement**	**Conformance**	**Support / Project Requirement**	**Additional Project Requirements**
		3.5.4.1	Obtaining Number of Fan Failures	3.5.4.2: M	Yes / No	
		3.5.4.2	Activating Fan Failure Test	O	Yes / No	
		3.5.4.3	Activating the 'Simulation' control mode	O	Yes / No	If the version 01 of the object definitions is to be deployed for backwards compatibility reasons, the specification writer MUST include a detailed description of how the object definitions within the version 01 are to be deployed.

3.3.4 Protocol Requirements List – Supplemental Table

Protocol Requirements List (PRL) Supplemetal Table						
Req ID	**Requirement**	**Req ID**	**Requirement**	**Conformance**	**Support**	**Additional Specifications**
	Supplemental Requirements					
3.6.1	Supplemental Requirements for Fonts					
		3.6.1.1	Support for a Number of Fonts	M	Yes	The DMS shall support at least ____ fonts (1..255). Note: The specification may optionally specify the fonts to be stored in the sign controller upon initial delivery by using an additional attached sheet to define the desired pixel-by-pixel bitmaps of each character of each font.
3.6.2	Supplemental Requirements for General Illumination Brightness					
		3.6.2.1	Support a Number of Brightness Levels	M	Yes	The DMS shall support at least _____ brightness levels (1..255).
3.6.3	Supplemental Requirements for Automatic Brightness					

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Protocol Requirements List (PRL) Supplemetal Table						
Req ID	**Requirement**	**Req ID**	**Requirement**	**Conformance**	**Support**	**Additional Specifications**
	Control					
		3.6.3.1	Automatically Control Brightness	M	Yes	
		3.6.3.2	Inhibit Flickering of Message Brightness	O	Yes / No	
		3.6.3.3	Support a Number of Light Sensor Levels	M	Yes	The DMS shall support at least _____ light sensor levels (0..65535).
3.6.4	Supplemental Requirements for Control Modes					
		3.6.4.1	Support Central Control Mode	M	Yes	
		3.6.4.2	Support Local Control Mode	M	Yes	
		3.6.4.3	Support Central Override Control Mode	O	Yes / No	
		3.6.4.4	Processing Requests from Multiple Sources	M	Yes	
3.6.5	Supplemental Requirements for Message Activation Request					
		3.6.5.1	Supplemental Requirements for Internal Message Activation	M	Yes	
		3.6.5.1.1	Activate Any Message	M	Yes	
		3.6.5.1.2	Preserve Message Integrity	VMS:M	Yes / NA	
		3.6.5.1.3	Ensure Proper Message Content	M	Yes	
		3.6.5.2	Indicate Message Display Duration	M	Yes	
		3.6.5.3	Indicate Message Display Requester ID	M	Yes	
		3.6.5.4	Supplemental Requirements for Message Activation Priority	M	Yes	
3.6.6	Supplemental Requirements for Message Definition					

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Protocol Requirements List (PRL) Supplemental Table						
Req ID	**Requirement**	**Req ID**	**Requirement**	**Conformance**	**Support**	**Additional Specifications**
		3.6.6.1	Identify Message to Define	M	Yes	
		3.6.6.2	Define Message Content	M	Yes	
		3.6.6.2.1	Support Multi-Page Messages	O	Yes / No	The DMS shall support at least ___ pages (1..255) per message.
		3.6.6.2.2	Support Page Justification	O	Yes / No	
		3.6.6.2.2.1	Support for One Page Justification within a Message	O.7 (1)	Yes / No	
		3.6.6.2.2.2	Support for Multiple Page Justifications within a Message	O.7 (1)	Yes / No	
		3.6.6.2.3	Support Multiple Line Messages	O	Yes / No	The DMS shall support at least ___ lines (1..255) per page.
		3.6.6.2.4	Support Line Justification	O	Yes / No	
		3.6.6.2.4.1	Support for a Single Line Justification within a Message	O.8 (1)	Yes / No	
		3.6.6.2.4.2	Support Line Justification on a Page-by-Page Basis	O.8 (1)	Yes / No	
		3.6.6.2.4.3	Support Line Justification on a Line-by-Line Basis	O.8 (1)	Yes / No	
		3.6.6.2.5	Support Color	O	Yes / No	
		3.6.6.2.5.1	Support a Single Color Combination per Message	O.9 (1)	Yes / No	
		3.6.6.2.5.2	Support a Color Combination for each Page	O.9 (1)	Yes / No	
		3.6.6.2.5.3	Support a Color Combination for each Character within a Message	O.9 (1)	Yes / No	
		3.6.6.2.6	Support Font Commands	O	Yes / No	
		3.6.6.2.6.1	Support One Font within a Message	O.10 (1)	Yes / No	

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Protocol Requirements List (PRL) Supplemetal Table						
Req ID	**Requirement**	**Req ID**	**Requirement**	**Conformance**	**Support**	**Additional Specifications**
		3.6.6.2.6.2	Support One Font per Page within a Message	O.10 (1)	Yes / No	
		3.6.6.2.6.3	Support Character-by-Character Selection of Fonts within a Message	O.10 (1)	Yes / No	
		3.6.6.2.7	Support Moving Text	O	Yes / No	
		3.6.6.2.8	Support Character Spacing	O	Yes / No	
		3.6.6.2.9	Support Customizable Page Display Times in a Message	O	Yes / No	
		3.6.6.2.10 (Flash)	Support Flashing	O	Yes / No	
		3.6.6.2.10.1	Support Character-by-Character Flashing	O.11 (1)	Yes / No	
		3.6.6.2.10.2	Support Line-by-Line Flashing	O.11 (1)	Yes / No	
		3.6.6.2.10.3	Support Page-by-Page Flashing	O.11 (1)	Yes / No	
		3.6.6.2.11	Support Customizable Flashing Times within a Message	Flash:O	Yes / No / NA	
		3.6.6.2.12	Support Hexadecimal Character	O	Yes / No	
		3.6.6.2.13 (Fields)	Support Message Data Fields	O	Yes / No	
		3.6.6.2.13.1 (Time)	Support Current Time Field without AM/PM Field	O.12 (1..*)	Yes / No	
		3.6.6.2.13.2	Support Current Time with AM/PM Field	O.12 (1..*)	Yes / No	
		3.6.6.2.13.3	Support Current Time with am/pm Field	O.12 (1..*)	Yes / No	
		3.6.6.2.13.4 (Temp)	Support Current Temperature Field	O.12 (1..*)	Yes / No	

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Protocol Requirements List (PRL) Supplemetal Table						
Req ID	**Requirement**	**Req ID**	**Requirement**	**Conformance**	**Support**	**Additional Specifications**
		3.6.6.2.13.5	Support Detected Vehicle Speed Field	Speed:O.12 (1..*)	Yes / No / NA	
		3.6.6.2.13.6 (DoW)	Support Current Day of Week Field	O.12 (1..*)	Yes / No	
		3.6.6.2.13.7 (DoM)	Support Current Day of Month Field	O.12 (1..*)	Yes / No	
		3.6.6.2.13.8 (Month)	Support Current Month of Year Field	O.12 (1..*)	Yes / No	
		3.6.6.2.13.9 (Year)	Support Current Year Field	O.12 (1..*)	Yes / No	
		3.6.6.2.13.10	Support User-Definable Field	O.12 (1..*)	Yes / No	Note: For interoperability reasons, it is not recommended to use this field.
		3.6.6.2.13.11	Data Field Refresh Rate	M	Yes	The DMS shall update the fields at least every ____ seconds.
		3.6.6.2.14	Support of Graphics	O	Yes / No	
		3.6.6.2.15	Specify Location of Message Display	O	Yes / No	
		3.6.6.2.16	Support of Text	M	Yes	
		3.6.6.2.16.1	Support of Textual Content	M	Yes	
		3.6.6.2.16.2	Support of Message Lengths Compatible with Sign Face	M	Yes	
		3.6.6.2.17	Support of Manufacturer Specific Message Definitions	O	Yes / No	The DMS shall support a manufacturer-specific tag _____ [msx,y]. Note: For interoperability reasons, it is not recommended that this field be selected.
		3.6.6.3	Identify Message Owner	M	Yes	
		3.6.6.4	Priority to Maintain a Message	M	Yes	
		3.6.6.5	Beacon Activation Flag	Beacons:M	Yes / NA	
		3.6.6.6	Pixel Service Flag	Fiber OR Flip/Shutter:M	Yes / NA	

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Protocol Requirements List (PRL) Supplemetal Table						
Req ID	**Requirement**	**Req ID**	**Requirement**	**Conformance**	**Support**	**Additional Specifications**
		3.6.6.7	Message Status	M	Yes	
3.6.7	Supplemental Requirements for Locally Stored Messages					
		3.6.7.1	Support Permanent Messages	VMS:O;M	Yes / No / NA	The DMS shall support at least ___ different permanent messages. (0..65535) The Permanent Messages are: (attach separate sheet defining the message number and the content and layout of each permanent message)
		3.6.7.2	Support Changeable Messages	VMS:O.13 (1..*)	Yes / No / NA	The DMS shall support ____ changeable messages (0..65535) and _____ bytes of changeable memory (0..4294967295).
		3.6.7.3	Support Volatile Messages	VMS:O.13 (1..*)	Yes / No / NA	The DMS shall support ____ volatile messages (0..65535) and _____ bytes of volatile memory (0..4294967295). An equivalent number of changeable messages and memory may be / shall not be (select one) substituted for volatile messages per the requirements of NTCIP 1203 v02.
3.6.8	Supplemental Requirements for Color Scheme					
		3.6.8.1	Support 256 Shades Scheme	O.14 (1)	Yes / No	
		3.6.8.2	Support Classic NTCIP Scheme	O.14 (1)	Yes / No	The sign shall support the following colors: Color Fore/Background/Both _____ _____ _____ _____ _____ _____
		3.6.8.3	Support 24-Bit Color Scheme	O.14 (1)	Yes / No	
		3.6.8.4	Support Single Color	M	Yes	
3.6.9	Supplemental Requirements for Monitoring Subsystems					The primary power source shall be _____ These tests shall be performed at least once every ____ seconds.

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Protocol Requirements List (PRL) Supplemetal Table						
Req ID	**Requirement**	**Req ID**	**Requirement**	**Conformance**	**Support**	**Additional Specifications**
3.6.10	Supplemental Requirements for Scheduling					
		3.6.10.1	Support a Number of Actions	M	Yes	The DMS shall support at least ____ actions (0..255)for the schedule.
		3.6.10.2	Support the Activate Message Action for the Scheduler	M	Yes	
		3.6.10.3	Perform Actions at Scheduled Times	M	Yes	
3.6.11	Supplemental Requirements for Graphics					
		3.6.11.1	Support for a Number of Graphics	M	Yes	The DMS shall support at least ___ graphics (0..255).
		3.6.11.2	Support for Graphic Memory	M	Yes	The DMS shall support at least _____ bytes (0..4294967295) of graphic memory.
H.2.5	Supplemental Requirements for Scheduling					
		H.2.5.1	Support a Number of Day Selection Patterns	M	Yes	The sign shall support at least ____ day patterns.
		H.2.5.2	Support a Number of Day Plan Events	M	Yes	The sign shall support at least ____ day plan events.
		H.2.5.3	Support a Number of Day Plans	M	Yes	The sign shall support at least ____ day plans.
H.2.6	Supplemental Requirements for Event Monitoring					
		H.2.6.1	Record and Timestamp Events	M	Yes	
		H.2.6.2	Support a Number of Event Classes	M	Yes	The sign shall support at least ____ event classes.
		H.2.6.3	Support a Number of Event Types to Monitor	M	Yes	The sign shall support at least ____ event types.
		H.2.6.4	Support Monitoring of Event Types	M	Yes	
		H.2.6.4.1	Support On-Change Events	O.15 (1..*)	Yes / No	
		H.2.6.4.2	Support Greater Than Events	O.15 (1..*)	Yes / No	

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Protocol Requirements List (PRL) Supplemetal Table						
Req ID	**Requirement**	**Req ID**	**Requirement**	**Conformance**	**Support**	**Additional Specifications**
		H.2.6.4.3	Support Less Than Events	O.15 (1..*)	Yes / No	
		H.2.6.4.4	Support Hysteresis Events	O.15 (1..*)	Yes / No	
		H.2.6.4.5	Support Periodic Events	O.15 (1..*)	Yes / No	
		H.2.6.4.6	Support Bit-flag Events	O.15 (1..*)	Yes / No	
		H.2.6.5	Support Event Monitoring on Any Data	M	Yes	
		H.2.7	Support a Number of Events to Store in Log	M	Yes	The sign shall be capable of storing at least ____ events in the event log file.
3.6.12	Supplemental Requirements for Page Justification					
		3.6.12.1	Support top Page Justification	O.16 (1..*)	Yes / No	
		3.6.12.2	Support middle Page Justification	O.16 (1..*)	Yes / No	
		3.6.12.3	Support bottom Page Justification	O.16 (1..*)	Yes / No	
3.6.13	Supplemental Requirements for Line Justification					
		3.6.13.1	Support left Line Justification	O.17 (1..*)	Yes / No	
		3.6.13.2	Support center Line Justification	O.17 (1..*)	Yes / No	
		3.6.13.3	Support right Line Justification	O.17 (1..*)	Yes / No	
		3.5.13.4	Support full Line Justification	O.17 (1..*)	Yes / No	

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3.3.5 MULTI Field Traceability Matrix

MULTI Field Traceability Matrix				
Requirement ID	**Requirement**	**MULTI Tag ID**	**MULTI Tag Name**	**MULTI Tag**
3.6.6.2.1	Support Multi-Page Messages			
		6.4.15	New Page	[np]
3.6.6.2.2	Support Page Justification			
		6.4.11	Justification - Page	[jpx]
		6.4.11	Top Justification	[jp2]
		6.4.11	Middle Justification	[jp3]
		6.4.11	Bottom Justification	[jp4]
3.6.6.2.2.1	Support for One Page Justification within a Message			
		6.4.11	Justification - Page	[jpx]
		6.4.11	Top Justification	[jp2]
		6.4.11	Middle Justification	[jp3]
		6.4.11	Bottom Justification	[jp4]
3.6.6.2.2.2	Support for Multiple Page Justifications within a Message			
		6.4.11	Justification - Page	[jpx]
		6.4.11	Top Justification	[jp2]
		6.4.11	Middle Justification	[jp3]
		6.4.11	Bottom Justification	[jp4]
3.6.6.2.3	Support Multiple Line Messages			
		6.4.14	New Line	[nlx]
3.6.6.2.4	Support Line Justification			
		6.4.10	Justification - Line	[jlx]
		6.4.10	Left Justification	[jl2]
		6.4.10	Center Justification	[jl3]
		6.4.10	Right Justification	[jl4]
		6.4.10	Full Justification	[jl5]

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MULTI Field Traceability Matrix				
Requirement ID	**Requirement**	**MULTI Tag ID**	**MULTI Tag Name**	**MULTI Tag**
3.6.6.2.4.1	Support for a Single Line Justification within a Message			
		6.4.10	Justification - Line	[jlx]
		6.4.10	Left Justification	[jl2]
		6.4.10	Center Justification	[jl3]
		6.4.10	Right Justification	[jl4]
		6.4.10	Full Justification	[jl5]
3.6.6.2.4.2	Support Line Justification on a Page-by-Page Basis			
		6.4.10	Justification - Line	[jlx]
		6.4.10	Left Justification	[jl2]
		6.4.10	Center Justification	[jl3]
		6.4.10	Right Justification	[jl4]
		6.4.10	Full Justification	[jl5]
3.6.6.2.4.3	Support Line Justification on a Line-by-Line Basis			
		6.4.10	Justification - Line	[jlx]
		6.4.10	Left Justification	[jl2]
		6.4.10	Center Justification	[jl3]
		6.4.10	Right Justification	[jl4]
		6.4.10	Full Justification	[jl5]
3. 6.6.2.5	Support Color			
3.6.6.2.5.1	Support a Single Color Combination per Message			
		6.4.1	Color Background (Version 1 only)	[cbx]
		6.4.3	Color Foreground (Version 1 and 2)	[cfx] or [cfr,g,b]
		6.4.2	Page Background Color (Version 2 only)	[pbz] or [pbr,g,b]
3.6.6.2.5.2	Support a Color Combination for each Page			
		6.4.1	Color Background (Version 1 only)	[cbx]

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MULTI Field Traceability Matrix				
Requirement ID	**Requirement**	**MULTI Tag ID**	**MULTI Tag Name**	**MULTI Tag**
		6.4.3	Color Foreground (Version 1 and 2)	[cfx] or [cfr,g,b]
		6.4.2	Page Background Color (Version 2 only)	[pbz] or [pbr,g,b]
3.6.6.2.5.3	Support a Color Combination for each Character within a Message			
		6.4.1	Color Background (Version 1 only)	[cbx]
		6.4.3	Color Foreground (Version 1 and 2)	[cfx] or [cfr,g,b]
		6.4.2	Page Background Color (Version 2 only)	[pbz] or [pbr,g,b]
3.6.6.2.5.4	Color for each Pixel within a Message			
		6.4.1	Color Background (Version 1 only)	[cbx]
		6.4.3	Color Foreground (Version 1 and 2)	[cfx] or [cfr,g,b]
		6.4.2	Page Background Color (Version 2 only)	[pbz] or [pbr,g,b]
		6.4.4	Color Rectangle (Version 2 only)	[crx,y,w,h,r,g,b] or [crx,y,w,h,z]
3.6.6.2.6	Support Font Commands			
		6.4.7	Font	[fox]
3.6.6.2.6.1	Support One Font within a Message			
		6.4.7	Font	[fox]
3.6.6.2.6.2	Support One Font per Page within a Message			
		6.4.7	Font	[fox]
3.6.6.2.6.3	Support Character by Character Selection of Fonts within a Message			
		6.4.7	Font	[fox]
3.6.6.2.7	Support Moving Text			
		6.4.13	Moving Text	[mvtdw,s,r,text]
3.6.6.2.8	Support Character Spacing			
		6.4.17	Spacing - Character	[scx]
3.6.6.2.9	Support Customizable Page Display Times in a Message			
		6.4.16	Page Time	[ptxoy]

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MULTI Field Traceability Matrix				
Requirement ID	**Requirement**	**MULTI Tag ID**	**MULTI Tag Name**	**MULTI Tag**
3.6.6.2.11	Support Customizable Flashing Times within a Message			
		6.4.6	Flash Time	[fltxoy]
3.6.6.2.10	Support Flashing			
		6.4.6	Flash Time	[fltxoy]
3.6.6.2.10.1	Support Character-by-Character Flashing			
		6.4.5 6	Flash Time	[fltxoy]
3.6.6.2.10.2	Support Line-by-Line Flashing			
		6.4.5 6	Flash Time	[fltxoy]
3.6.6.2.10.3	Support Page-by-Page Flashing			
		6.4.5 6	Flash Time	[fltxoy]
3.6.6.2.12	Support Hexadecimal Character			
		6.4.8 9	Hexadecimal Character	[hcx]
3.6.6.2.13	Support Message Data Fields			
		6.4.3 5	Local Time 12 Hour	[f1,y]
		6.4.3 5	Local Time 24 Hour	[f2,y]
		6.4.3 5	Ambient Temperature Celsius	[f3,y]
		6.4.3 5	Ambient Temperature Fahrenheit	[f4,y]
		6.4.3 5	Speed km/h	[f5,y]
		6.4.3 5	Speed mph	[f6,y]
		6.4.3 5	Day of Week	[f7,y]
		6.4.3 5	Date of Month	[f8,y]
		6.4.3 5	Month of Year	[f9,y]
		6.4.3 5	Year 2 Digit	[f10,y]
		6.4.3 5	Year 4 Digit	[f11,y]
		6.4.3 5	Local time, 12 hour format with capital AM/PM indicator present	[f12,y]
		6.4.3 5	Local time, 12 hour format with lowercase am/pm indicator present	[f13,y]

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MULTI Field Traceability Matrix				
Requirement ID	**Requirement**	**MULTI Tag ID**	**MULTI Tag Name**	**MULTI Tag**
3.6.6.2.13.1	Support Current Time Field without AM/PM Field			
		6.4.3 5	Local Time 12 Hour	[f1,y]
		6.4.3 5	Local Time 24 Hour	[f2,y]
3.6.6.2.13.4	Support Current Temperature Field			
		6.4.5	Ambient Temperature Celsius	[f3,y]
		6.4.5	Ambient Temperature Fahrenheit	[f4,y]
3.6.6.2.13.5	Support Detected Vehicle Speed Field			
		6.4.5	Speed km/h	[f5,y]
		6.4.5	Speed mph	[f6,y]
3.6.6.2.13.6	Support Current Day of Week Field			
		6.4.5	Day of Week	[f7,y]
3.6.6.2.13.7	Support Current Day of Month Field			
		6.4.5	Date of Month	[f8,y]
3.6.6.2.13.8	Support Current Month of Year Field			
		6.4.5	Month of Year	[f9,y]
3.6.6.2.13.9	Support Current Year Field			
		6.4.5	Year 2 Digit	[f10,y]
		6.4.5	Year 4 Digit	[f11,y]
3.6.6.2.13.2	Support Current Time with uppercase AM/PM Field			
		6.4.5	Local time, 12 hour format with capital AM/PM indicator present	[f12,y]
3.6.6.2.13.3	Support Current Time with lowercase am/pm			
		6.4.5	Local time, 12 hour format with lowercase am/pm indicator present	[f13,y]
3.6.6.2.13.10	Support User-Definable Field			
		6.4.5	User-Definable Field	[f50,y] to [f99,y]
3.6.6.2.13.11	Data Field Refresh Rate			

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MULTI Field Traceability Matrix				
Requirement ID	**Requirement**	**MULTI Tag ID**	**MULTI Tag Name**	**MULTI Tag**
		6.4.5	Fields	[fx,y]
3.6.6.2.14	Support of Graphics			
		6.4.8	Graphic	[gn] or [gn,x,y] or [gn,x,y,cccc]
3.6.6.2.15	Specify Location of Message Display			
		6.4.18	Cursor Placement / XY LocationText Rectangle	[trx,y,w,h]
		6.4.1	Color Background	[cbx]
		6.4.2	Page Background Color	[pbz] or [pbr,g,b]
		6.4.3	Color Foreground	[cfx]
		6.4.4	Color Rectangle	[crx,y,w,h,r,g,b] or [crx,y,w,h,z]
3.6.8.2	Support Classic NTCIP Scheme			
		6.4.1	Color Background (Version 1 only)	[cbx]
		6.4.2	Page Background Color (Version 2 only)	[pbz] or [pbr,g,b]
		6.4.3	Color Foreground (Version 1 and 2)	[cfx] or [cfr,g,b]
		6.4.4	Color Rectangle (Version 2 only)	[crx,y,w,h,r,g,b] or [crx,y,w,h,z]
3.6.8.3	Support 24-Bit Color Scheme			
		6.4.1	Color Background	[cbx]
		6.4.2	Page Background Color	[pbz] or [pbr,g,b]
		6.4.3	Color Foreground	[cfx]
		6.4.4	Color Rectangle	[crx,y,w,h,r,g,b] or [crx,y,w,h,z]
3.6.8.4	Support Single Color			
		6.4.1	Color Background (Version 1 only)	[cbx]
		6.4.2	Page Background Color (Version 2 only)	[pbz] or [pbr,g,b]
		6.4.3	Color Foreground (Version 1 and 2)	[cfx]
3.6.12	Supplemental Requirements for Page Justification			

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MULTI Field Traceability Matrix				
Requirement ID	**Requirement**	**MULTI Tag ID**	**MULTI Tag Name**	**MULTI Tag**
3.6.12.1	Support top Page Justification			
		6.4.11	Top Justification	[jp2]
3.6.12.2	Support middle Page Justification			
		6.4.11	Middle Justification	[jp3]
3.6.12.3	Support bottom Page Justification			
		6.4.11	Bottom Justification	[jp4]
3.6.13	Supplemental Requirements for Line Justification			
3.6.13.1	Support left Line Justification			
		6.4.10	Left Justification	[jl2]
3.6.13.2	Support center Line Justification			
		6.4.10	Center Justification	[jl3]
3.6.13.3	Support right Line Justification			
		6.4.10	Right Justification	[jl4]
3.6.13.4	Support full Line Justification			
		6.4.10	Full Justification	[jl5]

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3.4 Architectural Requirements

Requirements for communication capabilities are provided in the following subsections.

3.4.1 Support Basic Communications

Requirements for making requests are provided in the following subsections.

3.4.1.1 Retrieve Data

The DMS shall allow the management station to retrieve data from the sign controller.

3.4.1.2 Deliver Data

The DMS shall allow the management station to deliver data (e.g., configuration data, commands, etc.) to the sign controller.

3.4.1.3 Explore Data

The DMS shall allow the management station to dynamically discover what data and data instances are supported by the sign controller.

3.4.2 Support Logged Data

Requirements for managing the logged data are provided in the following subsections.

3.4.2.1 Determine Current Configuration of Logging Service

The DMS shall allow a management station to determine the current configuration of the event logging service, including the classes and types of events that are currently configured.

3.4.2.2 Configure Logging Service

The DMS shall allow a management station to configure the event logging service, including configuration of the event classes and event types to log.

3.4.2.3 Retrieve Logged Data

The DMS shall allow a management station to retrieve data from the event log.

3.4.2.4 Clear Log

The DMS shall allow the management station to clear log entries of a given event class that are less than or equal to a given time.

3.4.2.5 Determine Capabilities of Event Logging Service

The DMS shall allow a management station to determine the capabilities of the event logging service, including the number of classes, number of event types, and number of events that can be supported by the DMS.

3.4.2.6 Determine Total Number of Events

The DMS shall allow a management station to determine the total number of events that the DMS has logged since powerup.

3.4.3 Support Exception Reporting

Exception Reporting is not supported in NTCIP 1203 v03.

3.4.4 Manage Access

Requirements for managing access to the information stored within the sign controller are provided in the following subsections.

3.4.4.1 Determine Current Access Settings

The DMS shall allow the administrator at the management station to determine the current access settings.

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3.4.4.2 Configure Access

The DMS shall allow the administrator at the management station to configure access settings for all access levels. The specification will identify the number of access levels that the DMS shall support. If the specification does not define the number of access levels, the DMS shall support at least one access level in addition to the administrator access level.

> Note: Access Levels are the not the same as number of users, because several users might share the same access level. Access levels are managed within this function (and within the sign controller), while users might be managed within either or both, the sign controller and the central system. For the purpose of this function, the access level definitions manage the access to functions within the sign controller.

3.5 Data Exchange and operational environment Requirements

The operation of a sign has been categorized into three major areas:

a) Manage the DMS configuration
b) Control the DMS
c) Monitor the status of the DMS

In the Concept of Operations (Section 2), each of these major areas has been broken down into sub-items. The Data Exchange Requirements also follow this structure.

3.5.1 Manage the DMS Configuration

Requirements for managing DMS configuration are provided in the following subsections.

3.5.1.1 Identify DMS

Requirements for identifying the DMS are provided in the following subsections.

3.5.1.1.1 Determine Sign Type and Technology

The DMS shall allow a management station to determine its type and technology.

3.5.1.2 Determine Message Display Capabilities

Requirements for determining the message display capabilities of the DMS are provided in the following subsections.

3.5.1.2.1 Determine Basic Message Display Capabilities

Requirements for determining the basic message display capabilities of the sign face are provided in the following subsections.

3.5.1.2.1.1 Determine the Size of the Sign Face

The DMS shall allow a management station to determine the height and width of the sign face.

3.5.1.2.1.2 Determine the Size of the Sign Border

The DMS shall allow a management station to determine the size of the horizontal and vertical border around the sign face.

3.5.1.2.1.3 Determine Beacon Type

The DMS shall allow a management station to determine the configuration of any beacons attached to the DMS, which may be 'none'.

3.5.1.2.1.4 Determine Sign Access and Legend

The DMS shall allow a management station to determine the access mechanism to the sign internal components and whether the DMS has a legend.

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3.5.1.2.2 Determine Matrix Capabilities

Requirements for determining the detailed matrix capabilities of the sign are provided in the following subsections.

3.5.1.2.2.1 Determine Sign Face Size in Pixels

The DMS shall allow a management station to determine the height and width of the sign face in pixels.

3.5.1.2.2.2 Determine Character Size in Pixels

The DMS shall allow a management station to determine the height and width of a character in pixels.

3.5.1.2.2.3 Determine Pixel Spacing

The DMS shall allow a management station to determine the spacing of pixels (pitch).

3.5.1.2.3 Determine VMS Message Display Capabilities

Requirements for determining the detailed capabilities of the VMS are provided in the following subsections.

3.5.1.2.3.1 Determine Maximum Number of Pages

The DMS shall allow a management station to determine the maximum number of pages that can be included in a single message.

3.5.1.2.3.2 Determine Maximum Message Length

The DMS shall allow a management station to determine the maximum length for a downloadable message.

3.5.1.2.3.3 Determine Supported Color Schemes

The DMS shall allow a management station to determine whether the sign supports a color scheme other than the ' monochrome1bit' color scheme.

3.5.1.2.3.4 Determine Message Display Capabilities

The DMS shall allow a management station to determine the MULTI tags supported by the DMS.

3.5.1.2.4 Delete All Messages of a Message Type with One Command

The DMS shall allow a management station to delete all messages of a specific message type in one command. Messages types that can be deleted are either 'volatile' messages or 'changeable' messages.

3.5.1.3 Manage Fonts

Requirements for managing the font information are provided in the following subsections.

3.5.1.3.1 Determine Maximum Number of Fonts Supported

The DMS shall allow a management station to determine the maximum number of fonts that can be defined and the number that are defined within the sign controller.

3.5.1.3.2 Determine Maximum Character Size

The DMS shall allow a management station to determine the maximum size (in bytes) that the DMS allows for each character bitmap.

3.5.1.3.3 Determine Maximum Number of Characters per Font

The DMS shall allow a management station to determine the maximum number of characters that the DMS allows for an individual font.

3.5.1.3.4 Retrieve a Font Definition

The DMS shall allow a management station to upload the fonts defined in the sign controller.

3.5.1.3.5 Configure a Font

The DMS shall allow a management station to modify or create a font definition in the sign controller.

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Note: It is recognized that the message display on the sign could be unpredictable during the download of a font. Those specifying authorities or application developers who are sensitive to this issue can blank the display during a font download.

3.5.1.3.6 Delete a Font
The DMS shall allow a management station to delete a font definition in the sign controller.

3.5.1.3.7 Validate a Font
The DMS shall allow a management station to validate any font stored within the controller to ensure that the font specification is as expected and has not been corrupted during download or changed since last use.

3.5.1.4 Manage Graphics
Requirements for managing the storage of graphics in the DMS are provided in the following subsections.

3.5.1.4.1 Determine Maximum Number of Graphics
The DMS shall allow a management station to determine the number of graphics defined and the maximum number that can be defined within the sign controller.

3.5.1.4.2 Determine Maximum Graphic Size
The DMS shall allow the management station to identify the maximum size (in bytes) allowed for each graphic.

3.5.1.4.3 Determine Available Graphics Memory
The DMS shall allow the management station to identify the maximum memory available for graphics storage.

3.5.1.4.4 Retrieve a Graphic Definition
The DMS shall allow a management station to retrieve any of the graphics defined in the sign controller.

3.5.1.4.5 Store a Graphic Definition
The DMS shall allow a management station to store a graphic in the sign controller.

3.5.1.4.6 Delete a Graphic
The DMS shall allow a management station to delete a graphic in the sign controller.

3.5.1.4.7 Validate a Graphic
The DMS shall allow a management station to validate any graphic stored within the controller to ensure that the graphic is as expected and has not been corrupted during download or changed since last use.

3.5.1.5 Configure Brightness of Sign
Requirements for configuring the sign controller's internal algorithm to set sign brightness are provided in the following subsections.

3.5.1.5.1 Determine Maximum Number of Light Sensor Levels
The DMS shall allow a management station to determine the number of ambient light detection levels supported by the light sensors.

3.5.1.5.2 Configure Light Output Algorithm
The DMS shall allow a management station to configure the relationships between the detection of ambient light (light sensor input reading) and the brightness level of the sign (light output).

3.5.1.5.3 Determine Current Light Output Algorithm
The DMS shall allow a management station to determine the relationships between the detection of ambient light (light sensor input reading) and the brightness level of the sign (light output).

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3.5.1.6 Configure Current Speed Limit
The DMS shall allow a management station to download a current speed limit to the sign controller.

3.5.1.7 Configure Low Fuel Threshold Value
The DMS shall allow a management station to download a threshold that will indicate that the connected DMS has reached the low fuel level.

3.5.2 Control the DMS
Requirements for controlling the DMS operation are provided in the following subsections.

3.5.2.1 Manage Control Source
A DMS shall allow the user to switch between the local and central control modes.

Note: See the corresponding Dialog in Section 4 for further explanations.

3.5.2.2 Reset the Sign Controller
The DMS shall allow a management station to reset the sign controller.

3.5.2.3 Control the Sign Face
Requirements for controlling the sign face are provided in the following subsections.

3.5.2.3.1 Activate a Message
The DMS shall allow a management station to display a message on the sign face, including:

a) Any permanent message supported by the sign
b) Any previously defined message
c) A blank message of any run-time priority
d) A message based on the scheduling logic, if a scheduler is supported by the sign.

3.5.2.3.2 Manage Default Message Display Parameters
Requirements for managing default settings for certain message display parameters are provided in the following subsections.

3.5.2.3.2.1 Determine Default Message Display Parameters
The DMS shall allow a management station to determine the current settings for the following message display defaults:

a) Default background and foreground colors
b) Default font
c) Default flash-on and flash-off times
d) Default line justification
e) Default page justification
f) Default page-on and page-off times
g) Default character set

3.5.2.3.2.2 Configure Default Background and Foreground Color
The DMS shall allow a management station to configure the default background and default foreground colors for a message on the sign face to any color supported by the sign (see Supplemental Requirements for Color Scheme).

Note: Reverse video in monochrome signs may be achieved by setting a color rectangle to the 'on' color and setting the foreground color to 'black'.

3.5.2.3.2.3 Configure Default Flash-On and Flash-Off Times
The DMS shall allow a management station to configure the default on-time and default off-time for

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flashing text or graphics. The specification will identify the range of values that the DMS shall support. If the specification does not indicate the ranges for the flashing rates, the DMS shall at least support all on and off values ranging from 0.0 seconds to 10.0 seconds in 0.5 second increments, inclusive.

3.5.2.3.2.4 Configure Default Font

The DMS shall allow a management station to select any font supported by the sign and configure it as the default font for displaying text.

3.5.2.3.2.5 Configure Default Line Justification

The DMS shall allow a management station to configure the default justification for a line to any type of justification supported by the DMS. The specification will identify the types of line justification that the DMS shall support. If the specification does not indicate the types of justification, the DMS shall support at least left justified.

3.5.2.3.2.6 Configure Default Page Justification

The DMS shall allow a management station to configure the default vertical justification for displaying a page of text on the sign face (e.g., at the top of the sign, in the middle, or at the bottom) to any type of justification supported by the DMS. The specification will identify the types of page justification that the DMS shall support. If the specification does not indicate the types of justification, the DMS shall support at least top justified.

3.5.2.3.2.7 Configure Default Page On-Time and Page Off-Time

The DMS shall allow a management station to configure the default time to display each page of a multi-page message and the default time to blank the sign face between the display of each page of the message. The specification will identify the range of values that the DMS shall support. If the specification does not indicate the ranges for the page times, the DMS shall at least support all page-on and page-off values ranging from 0.0 seconds to 10.0 seconds in 0.5 second increments, inclusive.

3.5.2.3.2.8 Configure Default Character Set

The DMS shall allow a management station to configure the default character set to be used when displaying a message (e.g., ASCII versus UNICODE) to any character set supported by the DMS.

3.5.2.3.3 Manage Message Library

Requirements for managing the contents of a message library are provided in the following subsections.

3.5.2.3.3.1 Determine Available Message Types

The DMS shall allow a management station to determine information about the different message storage memory types available within the sign controller. The different types are:

a) Permanent memory (content cannot be edited and will not be lost upon power failure)
b) Volatile memory (content is editable but will be lost upon power failure)
c) Changeable memory (content is editable but will not be lost upon power failure)

3.5.2.3.3.2 Determine Available Message Space

The DMS shall allow a management station to determine the number of messages that are currently stored and the remaining space within the controller's message library.

3.5.2.3.3.3 Define a Message

The DMS shall allow a management station to download a message for storage in the sign controller's message library.

3.5.2.3.3.4 Verify Message Contents

The DMS shall allow a management station to quickly verify that the contents of a message are as expected through the use of a relatively unique code.

3.5.2.3.3.5 Retrieve Message

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The DMS shall allow a management station to upload any message definition from the sign controller.

3.5.2.3.4 Schedule Messages for Display

Requirements for managing the contents of a schedule to display one or more permanent or previously defined messages are provided in the following subsections.

3.5.2.3.4.1 Retrieve a Schedule

The DMS shall allow a management station to retrieve the schedule as stored within the sign controller.

3.5.2.3.4.2 Define a Schedule

The DMS shall allow a management station to define daily schedules of actions with a time resolution of one minute; the rules for selecting a daily schedule to run shall allow schedule configuration up to a year in advance.

3.5.2.3.5 Configure Event-Based Message Activation

Requirements for configuring the controller to activate a message (including blank or schedule) in response to certain internal events are provided in the following subsections.

3.5.2.3.5.1 Configure Messages Activated by Standardized Events

Requirements for configuring the message to be activated in response to various standardized internal events are provided in the following subsections.

3.5.2.3.5.1.1 Configure Message for Short Power Loss Recovery Event

The DMS shall allow a management station to define which message to display upon recovery from a short power loss.

3.5.2.3.5.1.2 Configure Message for Long Power Loss Recovery Event

The DMS shall allow a management station to define which message to display upon recovery from a long power loss.

3.5.2.3.5.1.3 Configure Message for Power Loss Event

The DMS shall allow a management station to define which message to display upon a loss of power.

> Note: This feature is not applicable to certain DMS technologies that require constant power to display messages such as pure LED, pure fiber optics, or bulb technologies.

3.5.2.3.5.1.4 Configure Message for Controller Reset Event

The DMS shall allow a management station to define which message to display upon the DMS controller being reset.

3.5.2.3.5.1.5 Configure Message for Communications Loss Event

The DMS shall allow a management station to define which message to display upon the detection of a loss of communications to the management station.

3.5.2.3.5.1.6 Configure Message for End Message Display Duration Event

The DMS shall allow a management station to define which message to display upon the expiration of the message display duration.

> Note: Every message is associated with a duration when it is activated, which may be infinite. If the duration expires, the message referenced by this configuration parameter defines the message to display next.

3.5.2.3.6 Activate a Message with Status

The DMS shall adhere to requirement 3.5.2.3.1 "Activate a Message". The DMS shall provide status of any message activation for slow activating message signs such as drum signs.

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3.5.2.4 Control External Devices

The following requirements apply to a DMS supporting control and monitoring of any connected external devices (e.g. gates). Requirements pertaining to usage of any data received by any external devices are outside of the scope of NTCIP 1203 v03. The received data might be used by the DMS or be passed through to the management station.

> Note: Generally, the following requirements are applicable to DMS conforming to either Version 1 or Version 2 of NTCIP 1203. However, one object was added in Version 2 and the object identifiers were modified. Any requirements not applicable to Version 1 have been pointed out below, in the PRL, as well as other sections.

3.5.2.4.1 Determine Configuration of External Device Ports

The following requirements allow a management station to determine the configuration characteristics of any pre-configured ports controlling external devices supported by the DMS.

3.5.2.4.1.1 Determine Base Configuration of External Device Ports

The DMS shall allow a management station to determine the basic configuration characteristics of any pre-configured ports controlling external devices supported by the DMS. These configuration characteristics shall be:

a) type of port - digital or analog
b) port number
c) resolution of the port - the number of bits used for a port controlling an external device
d) direction of the port - input, output, or bi-directional
e) description of the port

3.5.2.4.1.2 Further Define Ports

The DMS shall allow a management station to set the port description of the external device configuration parameter to further define and/or describe the purpose of the supported ports.

3.5.2.4.1.3 Number of External Devices Supported

The DMS shall support the number of external devices as specified in the specification.
Note: this functional requirement is not applicable to version 1.

3.5.2.4.2 Monitoring of External Devices

The following requirements allow a management station to monitor pre-defined external devices via any configured port, if the port is configured for input in the DMS being monitored.

3.5.2.4.2.1 Retrieving Data from External Devices

The DMS shall allow a management station to retrieve data from an external device via any configured port via the ‘as input’-configured ports to support monitoring of the external device.

3.5.2.4.3 Controlling of External Devices

The following requirements allow a management station to control pre-defined external devices via any configured port, if the port is configured for output in the DMS being controlled.

3.5.2.4.3.1 Passing Data to External Devices

The DMS shall allow a management station to send data to an external device via any configured port via the ‘as output’-configured ports to support control of the external device.

3.5.2.4.3.2 Determine Status of External Devices

The DMS shall allow a management station to determine the last commanded state sent to the external device via the ‘as output’-configured ports.

3.5.2.4.4 Controlling of Bi-directionally Connected External Devices

The following requirements allow a management station to monitor and control pre-defined external

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devices via any configured port, if the port is configured for bi-directional data exchange in the DMS being monitored.

3.5.2.4.4.1 Retrieving Data from External Devices

The DMS shall allow a management station to retrieve data from an external device via any configured port via the bi-directionally configured ports to support monitoring of the external device.

3.5.2.4.4.2 Passing Data to External Devices

The DMS shall allow a management station to send data to an external device via any configured port via the bi-directionally configured ports to support control of the external device.

3.5.2.4.4.3 Determine Status of External Devices

The DMS shall allow a management station to determine the last commanded state sent to the external device via the bi-directionally configured ports.
Note: this functional requirement is not applicable to version 1.

3.5.2.5 Control Sign Brightness

Requirements for controlling the brightness of the message on the sign face are provided in the following subsections.

3.5.2.5.1 Determine Number of Brightness Levels

The DMS shall allow a management station to determine the maximum number of (settable) brightness levels.

3.5.2.5.2 Determine Current Photocell Readings

The DMS shall allow a management station to determine the current photocell readings.

3.5.2.5.3 Manually Direct-Control Brightness (Version 2)

The DMS shall allow a management station to manually control the light output of the display by selecting any of the brightness levels supported by the DMS.

3.5.2.5.4 Manually Index-Control Brightness (Version 2)

The DMS shall allow a management station to manually control the light output of the display by selecting any of the brightness levels defined within the brightness table.

> Note: The difference between these two manual modes ('manual direct-control' and 'manual index-control') is that a DMS might support 200 different brightness levels but only has three defined within the brightness table. For these three brightness levels, thresholds to switch from one level to another are defined in the brightness table; however, the DMS offers the possibility to define up to 200 brightness levels within the brightness table.
>
> Note: The previously available control mode 'manual' has been retired to address an ambiguity within NTCIP 1203:1997 and its amendment (2001). Instead the above two manual modes have been introduced to address this ambiguity. See Annex D for further information regarding this change from v1 to v2 of NTCIP 1203.

3.5.2.5.5 Manually Control Brightness (Version 1 Only)

The DMS shall allow a management station to manually control the light output of the display.

> Note: The control mode 'manual' was used in Version 1, but has been retired in Version 2. This replacement was due because two different non-interoperable interpretations of this value were developed and deployed. Should a user require the use of the 'manual' value to address backwards compatibility issues, it should be noted that the user will need to specify in detail how this operations is supposed to work (likely one of the 2 methods defined above: manual-direct or manual-indexed). See Annex D for further information regarding this change from v1 to v2 of NTCIP 1203.\

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3.5.2.5.6 Switch Brightness Control Modes

The DMS shall allow a management station to switch between the defined brightness control modes.

Note: See Section 3.6.2 for Supplemental Requirements related to brightness control modes.

3.5.2.6 Manage the Exercise of Pixels

The DMS shall allow a management station to manage frequency and duration of the exercise of each pixel's physical actuation mechanism.

3.5.3 Monitor the Status of the DMS

Requirements for monitoring the status of the DMS are provided in the following subsections.

3.5.3.1 Perform Diagnostics

Requirements for performing diagnostic functions on the DMS are provided in the following subsections.

3.5.3.1.1 Test Operational Status of DMS Components

Requirements for activating tests are provided in the following subsections.

3.5.3.1.1.1 Execute Lamp Testing

The DMS shall allow a management station to initiate a lamp test.

3.5.3.1.1.2 Activate Pixel Testing

The DMS shall allow a management station to initiate a pixel test.

3.5.3.1.1.3 Execute Climate-Control Equipment Testing

The DMS shall allow a management station to initiate a climate-control equipment test.

3.5.3.1.2 Provide General DMS Error Status Information

The DMS shall allow a management station to retrieve a high-level overview of the operational status of the DMS that includes an indication of the following error and warning conditions:

a) Communications Error
b) Power Error
c) Attached Device Error, if any attached devices are present
d) Lamp Error, if lamp technology is used
e) Pixel Error, if a pixel matrix is used
f) Light Sensor Error, if light sensors are present
g) Message Error
h) Controller Error
i) Temperature Warning, if temperature sensors are present in the sign housing or controller cabinet
j) Climate-Control System Error, if there is a climate control system
k) Critical Temperature Error, if temperature sensors are present in the sign housing or controller cabinet
l) Drum Sign Error, if drum technology is used
m) Open Door Warning, if door sensors are present
n) Humidity Warning, if humidity sensors are present

Note: Allowing the use of vendor defined errors may lead to interoperability problems.

3.5.3.1.3 Identify Problem Subsystem

Requirements for identifying the component within a subsystem that is causing an error or warning are provided in the following subsections.

3.5.3.1.3.1 Monitor Power Errors

The DMS shall allow a management system to determine the status of each power supply (not

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failed/failed). The potential equipment includes AC Power supplies, DC power supplies, UPSs, Solar Power supplies, and batteries.

The DMS shall be accompanied with documentation that maps each individual bit to a specific piece of power equipment.

3.5.3.1.3.2 Monitor Lamp Errors

The DMS shall allow a management system to determine the status of each lamp (not failed/stuck on/stuck off).

The DMS shall be accompanied with documentation that maps each individual bit to a specific lamp.

3.5.3.1.3.3 Monitor Pixel Errors

The DMS shall allow a management system to determine the status of each pixel (not failed/stuck on/stuck off).

The DMS shall be accompanied with documentation that maps each individual bit to a specific pixel.

3.5.3.1.3.4 Monitor Light Sensor Errors

The DMS shall allow a management system to determine the status of each light sensor (not failed/failed).

The DMS shall be accompanied with documentation that maps each individual bit to a specific light sensor.

3.5.3.1.3.5 Monitor Controller Software Operations

The DMS shall allow a management system to determine the status of the DMS controller hardware and software. The following error conditions shall be reported:

a) PROM integrity error
b) RAM integrity error
c) Program/processor error
d) Watchdog failure
e) Other error not enumerated above – this will allow the vendor to report vendor-specific errors
f) Controller to display interface errors

Note: Allowing the use of vendor defined errors may lead to interoperability problems.

3.5.3.1.3.6 Monitor Climate-Control System Errors

The DMS shall allow a management system to determine the status of each climate control system such as fans or heaters (not failed/failed).

The DMS shall be accompanied with documentation that maps each individual bit to a specific piece of climate-control system equipment.

3.5.3.1.3.7 Monitor Temperature Warnings

The DMS shall allow a management system to determine whether the temperature is within acceptable limits, in a warning range (e.g., temperature warning), or outside of acceptable limits (e.g., critical temperature alarm).

The DMS shall be accompanied with documentation that maps each individual bit to a specific temperature sensor.

3.5.3.1.3.8 Monitor Humidity Warnings

The DMS shall allow a management system to determine whether each humidity sensor is reporting a humidity warning.

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The DMS shall be accompanied with documentation that maps each individual bit to a specific humidity sensor.

3.5.3.1.3.9 Monitor Drum Sign Rotor Errors

The DMS shall allow a management system to determine the status of each drum rotor.

The DMS shall be accompanied with documentation that maps each individual bit to a specific drum rotor.

3.5.3.1.3.10 Monitor Door Status

The DMS shall allow a management system to determine which doors of the DMS are open or closed.

The DMS shall be accompanied with documentation that maps each individual bit to a specific door.

3.5.3.1.4 Monitor Subsystems Status Details

Requirements for determining low-level, detailed error status information are provided in the following subsections.

3.5.3.1.4.1 Monitor Power Error Details

The DMS shall allow a management system to identify any detailed errors and information associated with each power supply.

3.5.3.1.4.2 Monitor Lamp Error Details

The DMS shall allow a management system to obtain detailed information for any failed lamp, including:

a) Lamp description
b) Lamp status
c) Location of the topmost row of pixels served by the lamp
d) Location of the leftmost column of pixels served by the lamp
e) Location of the bottommost row of pixels served by the lamp
f) Location of the rightmost column of pixels served by the lamp

3.5.3.1.4.3 Monitor Pixel Error Details

The DMS shall allow a management system to determine the detailed information for any pixels that are not operational, including:

a) Horizontal location of the pixel
b) Vertical location of the pixel
c) The type of failure (stuck on/off, color error, electrical error, mechanical error, error affecting some/all strings of the pixel)

3.5.3.1.4.4 Monitor Light Sensor Error Details

The DMS shall allow a management system to determine the detailed information for any light sensor.

3.5.3.1.4.5 Monitor Message Activation Error Details

The DMS shall allow a management system to obtain detailed information regarding the success or failure of the last message activation, including details related to any message content errors. This information may be overwritten by other actions in the device, but there shall be a way to verify that the error details still apply to the last activation command.

3.5.3.1.4.6 Monitor Climate-Control System Error Details

The DMS shall allow a management system to determine the detailed information for any climate control system such as fans, heaters, or dehumidifiers.

3.5.3.1.4.7 Monitor Sign Housing Temperatures

The DMS shall allow a management system to determine the minimum and maximum temperature of the

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sign housing.

3.5.3.1.4.8 Monitor Sign Housing Humidity

The DMS shall allow a management station to determine the minimum and maximum humidity readings within the sign housing.

3.5.3.1.4.9 Monitor Control Cabinet Temperatures

The DMS shall allow a management system to determine the minimum and maximum temperature of the control cabinet.

If the controller is located in the sign housing without its own distinct cabinet, the values reported by the DMS shall be the same as for the sign housing.

3.5.3.1.4.10 Monitor Control Cabinet Humidity

The DMS shall allow a management station to determine the minimum and maximum humidity readings within the control cabinet.

3.5.3.1.4.11 Monitor Drum Sign Rotor Error Details

The DMS shall allow a management system to determine the particular error associated with a failed drum rotor.

3.5.3.1.5 Monitor the Sign's Control Source

The DMS shall allow a management station to determine the current control source for the DMS. See Supplemental Requirements for Control Modes for a description of the possible control modes.

3.5.3.1.6 Monitor Power Information

Requirements for determining power supply status information are provided in the following subsections.

3.5.3.1.6.1 Monitor Power Source

The DMS shall allow a management station to determine current source of power. The possible sources include:

a) Shutdown Power
b) AC Line
c) Generator
d) Solar
e) Battery - UPS
f) Other power source

3.5.3.1.6.2 Monitor Power Voltage

The DMS shall allow a management system to determine the current voltage of the utilized power source. This could mean AC line voltage and / or battery power voltage.

3.5.3.1.6.3 Monitor Current Fuel Level

The DMS shall allow a management station to obtain the current fuel level within the tank of the connected DMS.

3.5.3.1.6.4 Monitor Current Engine RPM

The DMS shall allow a management station to obtain the current engine RPM of the connected DMS.

3.5.3.1.7 Monitor Ambient Environment

The DMS shall allow a management system to determine the minimum and maximum temperature of the ambient environment (i.e., outside of the sign housing and control cabinet).

3.5.3.1.8 Determine Critical Temperature Threshold

The DMS shall allow a management station to determine the manufacturer's critical temperature, which if

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exceeded in either the sign housing or the controller cabinet, shall generate a critical temperature alarm and cause the sign to turn off.

3.5.3.1.9 Monitor Speed Detector Reading

The DMS shall allow a management station to determine the current travel speed of the traffic.

3.5.3.2 Monitor the Current Message

Requirements for monitoring the information about the currently displayed message and related parameters are provided in the following subsections.

3.5.3.2.1 Monitor Information about the Currently Displayed Message

The DMS shall allow a management station to monitor details about the current message, including:

a) The message content
b) The stored message number used to activate the current message
c) The message display time remaining
d) The process or management station that activated the message
e) The current brightness level of the message, if brightness is supported by the DMS
f) The status of the beacons, if present
g) The status of pixel service, if supported by the DMS

3.5.3.2.2 Monitor Dynamic Field Values

The DMS shall allow a management station to monitor the value(s) currently being displayed within the dynamic fields of the current message.

3.5.3.3 Monitor Status of DMS Control Functions

Requirements for monitoring the status of the various control functions are provided in the following subsections.

3.5.3.3.1 Determine Configuration of Event Trigger

Not supported in this Version of NTCIP 1203.

3.5.3.3.2 Monitor Short Power Recovery Message

The DMS shall allow a management station to determine which message is currently configured to be displayed in response to a power recovery event after a short power loss.

3.5.3.3.3 Monitor Long Power Recovery Message

The DMS shall allow a management station to determine which message is currently configured to be displayed in response to a power recovery event after a long power loss.

3.5.3.3.4 Monitor Power Loss Message

The DMS shall allow a management station to determine which message is currently configured to be displayed during a power loss.

3.5.3.3.5 Monitor Reset Message

The DMS shall allow a management station to determine which message is currently configured to be displayed in response to a software or hardware reset event.

3.5.3.3.6 Monitor Communications Loss Message

The DMS shall allow a management station to determine which message is currently configured to be displayed if communications with the management station are lost for a user-defined period of time. Detection of loss of communications shall be disabled when the DMS is in 'local' control mode.

3.5.3.3.7 Monitor End Duration Message

The DMS shall allow a management station to determine which message is currently configured to be displayed upon the termination of the current message duration.

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3.5.4 Providing for Multi-Version Interoperability

Requirements for providing backwards compatibility with NTCIP 1203 version 1 are provided in the following subsections. Further information regarding the reasons for the deprecation of object definitions can be found in Annex D of NTCIP 1203 v2.

> Note: Selecting the requirements for the version 1 approach below does not mean interoperability with Version 2 or Version 3. It does mean that the device or central system that is required to support these requirements will (likely) be able to interface with v1-compatible central systems or devices (the parenthetical statement is added because compatibility for certain functions cannot be guaranteed).

3.5.4.1 Obtaining the Number of Fan Failures (Multi-Version Interoperability Issue)

The DMS shall allow a management station to retrieve the number of fan failures determined using the method defined in NTCIP 1203 v1. This function shall be used only in conjunction with the 'Fan Failure Test' activation (see Section 3.5.4.2).

3.5.4.2 Activating a Fan Failure Test (Multi-Version Interoperability Issue)

The DMS shall allow a management station to activate a fan failure test using the method defined in NTCIP 1203 v1.

3.5.4.3 Activating the 'Simulation' Control Mode (Multi-Version Interoperability Issue)

The DMS shall allow a management station to activate simulation control mode as defined in NTCIP 1203 v1.

3.6 Supplemental Non-Communications Requirements

Supplemental requirements for the DMS are provided in the following subsections. These requirements do not directly involve communications between the management station and the DMS, but, if the supplemental requirement is selected in the PRL, the DMS must perform the stated functionality to claim conformance to NTCIP 1203 v03.

3.6.1 Supplemental Requirements for Fonts

Supplemental requirements for character set support are provided in the following subsections.

3.6.1.1 Support for a Number of Fonts

The DMS shall support the number of fonts as defined by the specification. If the specification does not define the number of fonts, the DMS shall support at least one font.

3.6.2 Supplemental Requirements for General Illumination Brightness

Supplemental requirements for general illumination brightness support are provided in the following subsections.

3.6.2.1 Support a Number of Brightness Levels

The DMS shall support the number of brightness levels as specified in the specification. If the specification does not define the number of brightness levels, the DMS shall support at least 1 brightness level.

3.6.3 Supplemental Requirements for Automatic Brightness Control

Supplemental requirements for automatically adjusting the brightness of a message are provided in the following subsections.

3.6.3.1 Automatically Control Brightness

The DMS shall automatically manage the light sensor-driven light output of the display when this mode is enabled.

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3.6.3.2 Inhibit Flickering of Message Brightness

The DMS shall allow the Light Output Algorithm to include overlapping values, which shall enable the Light Output Algorithm to avoid flickering of the light output due to small changes in the measured ambient light conditions. If this feature is not supported, the DMS shall return a badValue error whenever the dmsIllumBrightnessValues object is set to a value that includes overlapping brightness ranges.

3.6.3.3 Support a Number of Light Sensor Levels

The DMS shall support the number of light sensor levels as specified in the specification. If the specification does not define the number of light sensor levels, the DMS shall support at least 3 light sensor levels.

3.6.4 Supplemental Requirements for Control Modes

Supplemental requirements for allowing different entities to control the DMS are provided in the following subsections.

3.6.4.1 Support Central Control Mode

A DMS shall allow an operator to control the sign from a remote location (e.g., from central).

3.6.4.2 Support Local Control Mode

The DMS shall allow an operator to control the sign through a local interface.

Note: A ‘local’ interface may include any of the following: a touch panel on the sign controller, a laptop connected directly to a 'local' port on the sign controller, or any other mounted or non-mounted panel that can be used to select a message for display.

3.6.4.3 Support Central Override Control Mode

The DMS shall allow the central system to override the local control mode.

> Note: An implementation may preclude the use of the "central override" mode, if it would pose a safety risk.

3.6.4.4 Processing Requests from Multiple Sources

The DMS shall only allow a single source to control the sign at any one time.

3.6.5 Supplemental Requirements for Message Activation Request

Supplemental requirements for activating a message for display on the sign face based on an external request are provided in the following subsections.

3.6.5.1 Supplemental Requirements for Message Activation

Supplemental requirements for activating a message for display on the sign face are provided in the following subsections.

3.6.5.1.1 Activate Any Message

The DMS shall allow the activation of any valid message that is stored in the sign controller.

3.6.5.1.2 Preserve Message Integrity

The DMS shall prohibit the display of a message that uses memory objects such as fonts or graphics that were altered after the message was composed and saved within the sign’s local message library.

3.6.5.1.3 Ensure Proper Message Content

The DMS shall ensure that the contents of the message are the same as what the requester requests.

3.6.5.2 Indicate Message Display Duration

Each message activation shall be associated with a display duration for the sign controller to display the message. If the request is validated, the DMS shall display the associated message for the indicated duration.

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3.6.5.3 Indicate Message Display Requester ID

Each message activation shall be associated with an indication of the entity that requested the display. The DMS shall store this information while the message is displayed.

3.6.5.4 Supplemental Requirements for Message Activation Priority

The DMS shall only activate the newly requested message if the activation priority is higher than the run-time priority of the currently displayed message.

3.6.6 Supplemental Requirements for Message Definition

Supplemental requirements for defining user-defined messages (e.g., volatile and changeable messages) are provided in the following subsections.

3.6.6.1 Identify Message to Define

Each message stored in the sign controller shall be associated with a unique identifier.

3.6.6.2 Define Message Content

Supplemental requirements for defining the message content are provided in the following subsections.

3.6.6.2.1 Support Multi-Page Messages

The DMS shall allow the message to contain the number of distinct page displays as defined by the specification. If the specification does not define the number of distinct page displays that must be supported, the DMS shall support at least one page per message.

3.6.6.2.2 Support Page Justification

The DMS shall allow the message content to specify all modes of vertical (page) justification supported by the sign (see Section 3.5.2.3.2.6). Supplemental requirements for supporting vertical justification of the message on the display are provided in the following subsections.

3.6.6.2.2.1 Support for One Page Justification within a Message

The DMS shall allow the message content to specify a single vertical (page) justification, which shall apply to all pages of the message.

3.6.6.2.2.2 Support for Multiple Page Justifications within a Message

The DMS shall allow the message content to specify vertical (page) justification on a page-by-page basis.

3.6.6.2.3 Support Multiple Line Messages

The DMS shall allow each page of the message to contain up to the number of lines as defined by the specification. If the specification does not define the number of lines that must be supported, the DMS shall support at least one line per page.

3.6.6.2.4 Support Line Justification

The DMS shall allow the message content to specify all modes of horizontal (line) justification supported by the sign (see Section 3.5.2.3.2.5). Supplemental requirements for horizontal (line) justification are provided in the following subsections.

3.6.6.2.4.1 Support for a Single Line Justification within a Message

The DMS shall allow the message content to specify a single line justification, which shall be used for each line within the message.

3.6.6.2.4.2 Support Line Justification on a Page-by-Page Basis

The DMS shall allow the message content to specify the line justification on a page-by-page basis.

3.6.6.2.4.3 Support Line Justification on a Line-by-Line Basis

The DMS shall allow the message content to specify the line justification on a line-by-line basis.

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3.6.6.2.5 Support Color

The DMS shall allow the message content to specify any color supported by the sign (see Section 3.6.8). Supplemental requirements for foreground and background color commands within a message are provided in the following subsections.

3.6.6.2.5.1 Support a Single Color Combination per Message

The DMS shall allow the message content to specify a single foreground color and a single background color, both of which shall apply to the entire message.

3.6.6.2.5.2 Support a Color Combination for each Page

The DMS shall allow the message content to specify the foreground color and background color on a page-by-page basis.

3.6.6.2.5.3 Support a Color Combination for each Character within a Message

The DMS shall allow the message content to specify the foreground color and background color on a character-by-character basis.

3.6.6.2.5.4 Color Rectangle

The DMS shall allow the message content to specify an area of the sign to display a selected color.

3.6.6.2.6 Support Font Commands

The DMS shall allow the message content to specify any font supported by the sign (see Section 3.5.2.3.2.4). Supplemental requirements for supporting font commands within a message are provided in the following subsections.

Note: For an example of a font, see NEMA TS 4.

3.6.6.2.6.1 Support One Font within a Message

The DMS shall allow the message content to specify a single font, which shall apply to the entire message.

3.6.6.2.6.2 Support One Font per Page within a Message

A DMS shall allow the message content to specify the font on a page-by-page basis.

3.6.6.2.6.3 Support Character by Character Selection of Fonts within a Message

A DMS shall allow the message content to specify the font on a character-by-character basis.

3.6.6.2.7 Support Moving Text

The DMS shall allow the message content to include a 'window' that contains moving text at a defined speed and direction. If this function is supported, all of the configurable parameters of this function shall be fully supported.

3.6.6.2.8 Support Character Spacing

The DMS shall allow the message content to specify the spacing between characters in a text string or between text and a graphic on a character-by-character basis. If this function is supported, all of the configurable parameters of this function shall be fully supported.

3.6.6.2.9 Support Customizable Page Display Times in a Message

The DMS shall allow the message content to specify the time to display each page and the time to blank the sign face between each page when displaying a multi-page message. The allowed range for the display time and the blank time shall be identical to the range identified in the specification for Section 3.4.2.3.2.7.

3.6.6.2.10 Support Flashing

Supplemental requirements for flashing text are provided in the following subsections.

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3.6.6.2.10.1 Support Character-by-Character Flashing
The DMS shall allow the message content to identify portions of text (and/or graphics) to be flashed on a character-by-character basis.

3.6.6.2.10.2 Support Line-by-Line Flashing
The DMS shall allow the message content to identify portions of text (and/or graphics) to be flashed on a line-by-line basis.

3.6.6.2.10.3 Support Page-by-Page Flashing
The DMS shall allow the message content to identify portions of text (and/or graphics) to be flashed on a page-by-page basis.

3.6.6.2.11 Support Customizable Flashing Times within a Message
The DMS shall allow the message content to specify the time to display and the time to blank each section of flashing text. The allowed range for the display time and the blank time shall be identical to the range identified in the specification for Section 3.5.2.3.2.3.

3.6.6.2.12 Support Hexadecimal Character
The DMS shall allow the message content to specify the display of character numbers greater than 255 (0xFF).

> Note: This allows the display of non-Latin-based characters using their standardized UNICODE values, assuming that support for these characters have also been specified by the Supplemental Requirements for Character Sets.

3.6.6.2.13 Support Message Data Fields
Supplemental requirements for defining a message that includes fields that display dynamic data are provided in the following subsections.

3.6.6.2.13.1 Support Current Time Field without AM/PM Field
The DMS shall allow the message content to include field(s) indicating the current time in either 12-hour or 24-hour format, selectable by the user. The 12-hour format shall not include any AM/PM indicator.

3.6.6.2.13.2 Support Current Time with Uppercase AM/PM Field
The DMS shall allow the message content to include field(s) indicating the current time with uppercase AM/PM indicated after the time value.

3.6.6.2.13.3 Support Current Time with Lowercase AM/PM Field
The DMS shall allow the message content to include field(s) indicating the current time with lowercase am/pm indicated after the time value.

3.6.6.2.13.4 Support Current Temperature Field
A DMS shall allow the message content to include field(s) indicating the current ambient air temperature in either Fahrenheit or Celsius, selectable by the user, and using either 2 or 3 character fields, also selectable by the user.

3.6.6.2.13.5 Support Detected Vehicle Speed Field
The DMS shall allow the message content to include field(s) indicating the current travel speed of the traffic in either miles-per-hour or kilometer-per-hour, selectable by the user, and using either 2 or 3 character fields, also selectable by the user.

3.6.6.2.13.6 Support Current Day of Week Field
The DMS shall allow the message content to include field(s) indicating the current day of the week in a 3-character format such as SUN, MON, TUE, etc.

3.6.6.2.13.7 Support Current Day of Month Field

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The DMS shall allow the message content to include field(s) indicating the current date of the month.

3.6.6.2.13.8 Support Current Month of Year Field
The DMS shall allow the message content to include field(s) indicating the current month of the year.

3.6.6.2.13.9 Support Current Year Field
The DMS shall allow the message content to include field(s) indicating the current year.

3.6.6.2.13.10 Support User-Definable Field
The DMS shall allow the message content to include field(s) indicating user-definable parameters.

Note: For interoperability reasons, it is not recommended to require this function.

3.6.6.2.13.11 Data Field Refresh Rate
The DMS shall update each field at a refresh rate as defined in the specification. If the specification does not indicate the refresh rate, the DMS shall update the fields at least every 60 seconds.

Note: An operator or user of a DMS may want to display information based on data received from a device that has a direct interface with the DMS Controller. This is accomplished via fields within the displayed message, where the fields within the message being displayed change based on the data (typically real-time) from the other device. The device could be a clock calendar, a weather station, a speed station, etc. Fields can be defined as time, date, year, day of week, temperature, or speed.

3.6.6.2.14 Support of Graphics
The DMS shall allow the message content to include zero or more graphic(s) at any location of the face of the display.

3.6.6.2.15 Specify Location of Message Display
A DMS shall allow the message content to specify the starting position of text and graphics on the sign face at a one-pixel resolution.

3.6.6.2.16 Support of Text
Supplemental requirements for including text characters in a message are provided in the following subsections.

3.6.6.2.16.1 Support of Textual Content
The DMS shall allow the message content to include any character supported by the DMS in any order, unless otherwise restricted by the specification.

3.6.6.2.16.2 Support of Message Lengths Compatible with Sign Face
The DMS shall allow the message to contain any number of characters per page for each page, up to the physical limits of the sign face.

3.6.6.2.17 Support of Manufacturer Specific Message Definitions
The DMS shall support manufacturer-specific tags.

Note: For interoperability reasons, it is not recommended to require this function.

3.6.6.3 Identify Message Owner
Each message stored in the sign controller shall be associated with an owner name.

3.6.6.4 Priority to Maintain a Message
Each message stored in the sign controller shall be associated with a run-time priority.

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3.6.6.5 Beacon Activation Flag

Each message stored in a sign controller library shall indicate whether any existing attached beacons are to flash while this message is displayed.

3.6.6.6 Pixel Service Flag

Each message stored in a sign controller library shall indicate whether a pixel service can be executed while the message is displayed.

3.6.6.7 Message Status

Each message stored in the sign controller shall be associated with a status to indicate if it is valid for display, being modified, etc.

Note: See Section 4.3 for state transition details.

3.6.7 Supplemental Requirements for Locally Stored Messages

Supplemental requirements for storing local messages are provided in the following subsections.

3.6.7.1 Support Permanent Messages

The DMS shall support the permanent message(s) as defined by the specification. If the procurement specification does not define the permanent messages, the DMS shall support at least one permanent message that can be used for testing the sign operation.

Note: A procurement specification should specify the minimum number of permanent messages that the DMS is required to support and their details (e.g., identification number, MULTI string including MULTI tags, beacon status, etc.).

Note: Refer to Section 1.4 for the definition of Permanent Messages.

3.6.7.2 Support Changeable Messages

The DMS shall support the number of changeable messages and amount of changeable memory as defined by the specification. If the specification does not define the number of changeable messages, the DMS shall support at least one changeable message. If the specification does not define the amount of changeable memory, the DMS shall support an amount of changeable memory that is at least the product of the number of messages multiplied by 100 bytes.

Note: Refer to Section 1.4 for the definition of Changeable Messages.

3.6.7.3 Support Volatile Messages

The DMS shall support the number of volatile messages and amount of volatile memory as defined by the specification. If the specification does not define the number of volatile messages, the DMS shall support at least one volatile message. If the specification does not define the amount of volatile memory, the DMS shall support an amount of volatile memory that is at least the product of the number of volatile messages multiplied by 100 bytes.

Unless otherwise specified in a specification, the DMS may fulfill the requirements of this section by providing additional changeable messages and additional changeable memory. If the DMS implements this option, the total number of changeable messages supported by the DMS shall be at least the sum of the required changeable messages and the required volatile messages; likewise, the total changeable memory supported by the DMS shall be at least the sum of the required changeable memory and the required volatile memory.

Note: Refer to Section 1.4 for the definition of Volatile Messages.

3.6.8 Supplemental Requirements for Color Scheme

Supplemental requirements for supporting color are provided in the following subsections.

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3.6.8.1 Support 256 Shades Scheme

The DMS shall support the Monochrome 8 Bit color scheme where each pixel can be defined using a gray-scale palette with 256 shades ranging form 0 (off) to 255 (full intensity).

3.6.8.2 Support Classic NTCIP Scheme

The DMS shall support the Classic NTCIP color scheme (for single-intensity multi-color signs): The defined colors are:

a) black
b) red
c) yellow
d) green
e) cyan
f) blue
g) magenta
h) white
i) orange
j) amber

3.6.8.3 Support 24-Bit Color Scheme

The DMS shall support the Color 24 Bit color scheme where each pixel can be defined by three bytes, one for each red, green and blue.

3.6.8.4 Support Single Color

The sign face shall support black (or off) and at least one other color.

3.6.9 Supplemental Requirements for Monitoring Subsystems

The DMS shall automatically test and update the internally stored values for the status of the following subsystems without any input from the user at a frequency specified by the specification:

a) Communications
b) Power Supply
c) Attached Device, if any attached devices are present (See Section 3.5.2.4)
d) Photocell, if any photocells are present (See Section 3.5.2.5)
e) Message
f) Controller
g) Temperature, if temperature sensors are present (See Sections 3.5.3.1.4.7 and 3.5.3.1.4.9)
h) Humidity, if humidity sensors are present (See Section 3.5.3.1.4.8 and 3.5.3.1.4.10)
i) Drum Sign Rotor, if drum technology is used (See Section 3.5.3.1.3.9)
j) Door, if door-open sensors are present (See Section 3.5.3.1.3.10)

If the specification does not specify the frequency at which these tests shall be performed, they are performed at least once every minute.

3.6.10 Supplemental Requirements for Scheduling

Supplemental requirements for defining a time-based schedule are provided in the following subsections.

3.6.10.1 Support a Number of Actions

The DMS shall support the number of actions as defined in the specification. If the specification does not define the number of actions, the DMS shall support at least two actions.

> Note: An action is defined as being a unique command that might be called by a day plan event. For example, displaying changeable message number 1 would be one action, displaying changeable message number 2 would be a second action and blanking the sign would be a third action.

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3.6.10.2 Support the Activate Message Action for the Scheduler

The DMS shall allow the scheduler to be configured to activate any message supported by the DMS and currently valid within the message table.

3.6.10.3 Perform Actions at Scheduled Times

The DMS shall perform the actions configured in the scheduler at the times identified. The Activate Message action shall change the state of the scheduled message buffer and shall only cause the display of the message if the current message is the Scheduler.

3.6.11 Supplemental Requirements for Graphics

Supplemental requirements for defining graphics are provided in the following subsections.

3.6.11.1 Support for a Number of Graphics

The DMS shall support the number of graphics as defined by the specification. If the specification does not define the number of graphics, the DMS shall support at least one graphic.

3.6.11.2 Support for Graphic Memory

The DMS shall support the number of bytes of graphic memory as defined in the specification. If the specification does not define the amount of graphic memory, the DMS shall support at least one kilobyte of graphic memory.

3.6.12 Supplemental Requirements for Page Justification

Supplemental requirements for page justification are provided in the following subsections.

3.6.12.1 Support Top Page Justification

The DMS shall support top page justification.

3.6.12.2 Support Middle Page Justification

The DMS shall support middle page justification.

3.6.12.3 Support Bottom Page Justification

The DMS shall support bottom page justification.

3.6.13 Supplemental Requirements for Line Justification

3.6.13.1 Support Left Line Justification

The DMS shall support left line justification.

3.6.13.2 Support Center Line Justification

The DMS shall support center line justification.

3.6.13.3 Support Right Line Justification

The DMS shall support right line justification.

3.6.13.4 Support Full Line Justification

The DMS shall support full line justification.

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Section 4
Dialogs [Normative]

This section is intended for product developers such as DMS manufacturers and system integrators. Other parties might find this section and the following two sections (Object Definitions and MULTI Definitions) helpful to gain a full understanding of the design details of NTCIP 1203.

This section presents the standardized dialogs (i.e., sequence of data exchanges) that fulfill various requirements. As SNMP communications are largely driven by the management station, most of the requirements define how the device must respond to the various possible actions a management station might take.

The NTCIP standards effort is based on SNMP. This protocol offers a high degree of flexibility as to how the management station structures its requests. For example, with SNMP, the management station can do any of the following:

a) Send only those requests that are critical at the current time, whereas a standardized dialog typically sends requests relating to all associated data, regardless of whether it is critical for current purposes
b) Combine a number of requests in a single packet, whereas a standardized dialog dictates the exact contents of each packet
c) Separate a group of requests into multiple packets, whereas a standardized dialog dictates the exact contents of each packet
d) Interweave requests from multiple dialogs, whereas a standardized dialog dictates the exact ordering of messages, which are not interrupted with other messages.

This flexibility can be a powerful tool allowing a management system to optimize the use of communication facilities, which is the primary reason that SNMP was chosen as the core NTCIP protocol. However, the flexibility also means that there are numerous allowable variations in the management process that a management station may choose to use.

Unfortunately, this flexibility presents a challenge to ensuring interoperability. While a conformant DMS is required to support any allowed sequence within NTCIP 1203 v03, ensuring that a given DMS actually supports every possible combination would be impractical. Instead, most agencies will only require that the device be tested to a standard set of procedures, which would use standardized dialogs (as defined in Section 4.2, Annex G, and Annex H). To improve communications efficiency, management stations may use non-standard dialogs (e.g., a combination of GET and/or SET requests that is not defined as a standardized dialog, but which a conformant device is required to support according to the ACCESS and SetConstraint rules defined in Section 4.3 and Section 5). Because these more efficient dialogs may not be known until the acquisition of the management station, which may be years after the acquisition of the device, there is a potential for an interoperability problem to arise.

To overcome this complication, this section defines a lowest common denominator approach to communications between a management station and a DMS. It defines the standardized dialog for each Data Exchange Requirement. Management stations may support other dialogs to fulfill these same requirements, as long as these dialogs are consistent with the rules defined in NTCIP 1203 v03. Such a management station is termed a ‘consistent management station’. A consistent management station will interoperate with any ‘conformant’ device. However, since an agency can not be certain that a device is 100% conformant to every possible scenario (given practical constraints), interoperability problems could still arise.

A ‘conformant management station’ is required to offer a mode in which it will only use the standardized

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dialogs as defined in this section. With this limited definition, there is relatively little variability in what constitutes a conformant management station. Thus, fully testing a management station for conformance is a relatively straight forward process that can be done within the practical constraints faced by most procuring agencies. Thus, a conformant management station will provide an agency with a much greater chance of achieving interoperability with off-the-shelf devices that have been tested against NTCIP 1203 and the designation of such a system is intended to provide a guaranteed base level of interoperability.

The rules for the standardized dialogs are as follows:

a) The dialogs are defined by a sequence of GET or SET requests. These requests shall equate to the GET and SET operations defined in Annex G.1 and Annex G.3 and shall be transmitted as a single message.
b) The contents of each request are identified by an object name. Each object name consists of an object type and an instance identifier. Formal definitions of each object type are provided in Section 5 of NTCIP 1203 v03 and NTCIP 1201. The meaning of the instance identifier is provided by these same definitions coupled with standard SNMP rules (see RFC 1212).
c) Each message shall contain all of the objects as shown, unless otherwise indicated
d) A message shall not contain any other objects
e) The contents of each message sent by the management station may appear in any order
   Note: Ideally, the order of objects should match the order as shown in NTCIP 1203 v03 to provide for the highest probability of interoperability. However, it is recognized that many implementations may use off-the-shelf software, which may prevent the designation of an exact ordering of objects and as a result, this ordering is not a requirement of NTCIP 1203 v03.
f) After sending a message, the management station shall not transmit any other data across the communications channel until the earlier of:
g) The management station receiving a response from the device or
h) The expiration of the response time.
i) If the response indicates an error occurred in the operation, the management station shall exit the process, unless specific error-handling rules are specified by the dialog.
j) Dialogs containing a sequence of only GET requests may request objects in any order.

However, since consistent management stations can alter the order of requests, NTCIP 1203 v03 defines rules for when certain data exchanges are allowed. Unless otherwise indicated, a conformant device shall allow an object to be retrieved (through a GET request) or altered (through a SET request, if the object is write-able) at any time. However, the access to some data is associated with a state machine and Section 4.3 defines the various rules that apply to these state machines.

Finally, Section 4.4 presents an overview of all of the data defined by NTCIP 1203 v03, prior to presenting the complete definition for each piece of data in Section 5.

4.1 Tutorial [Informative]

The Requirements Traceability Matrix (RTM) presented in Annex A identifies the standardized dialog that can be used to achieve each of the data exchange requirements defined in Section 3.5. Simple data exchange requirements reference one of the generic SNMP dialogs along with a list of data elements (see Annex G). These equate to a single message being sent (e.g., a GET request) containing the referenced data elements followed the appropriate response per the generic dialog specification.

This section defines the standardized dialogs for the more complicated data exchange requirements. Each of these dialogs is defined by a number of steps. Many of the steps reference data elements that are defined in Section Section 5. These data elements are also shown in the corresponding row of the RTM along with their precise section number.

The dialogs may also be accompanied by an informative figure that provides a graphical depiction of the normative text. The figures conform to the Unified Modeling Language and depict the management station as an outside actor sending a series of messages to the device and the device returning responses. If there is any conflict between the figure and the text, the text takes precedence.

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Section 4.2 defines how the system is designed to work for a given data exchange requirement. It indicates the sequence of actions that a management station must follow to provide the specific service.

Section 4.3 defines specific state-machine mechanisms used within NTCIP 1203 v03. It describes which states may be present, which transitions are or are not allowed.

Whereas Section 4.2 describes the sequence of actions that must be performed by a management station to use a feature, Section 3.53.5 provides a formal definition of DMS requirements, specifically:

a) What data must be supported
b) The relationships among this data
c) The operations that can be performed on each piece of data
d) The required reaction to any action, which may be dependent upon the current state of the device.

The section is divided into three major subsections. The first major subsection provides a class diagram depicting the relationships among the various data concepts involved in the topic area of the section. The second major subsection indicates major groupings of data that are referenced by the RTM (see Section Annex A) to indicate which data must be supported and what operations may be performed upon this data. The third major subsection defines any special rules for the configuration of the subject data.

4.2 Specified Dialogs

This section provides the standardized data exchange sequences that can be used by management stations to ensure interoperable implementations for the various data exchange requirements identified in Section 3.4. Diagrams and graphical representations are included to supplement the text (i.e., not used as a replacement for the text). This section only includes dialogs that have special semantics or impose special restrictions on the operations that are allowed.

4.2.1 Calculating the Checksum Value

NTCIP 1203 v03 requires the creation and usage of a checksum for several different functions including the graphic ID, font ID, message CRC as well as for the SYNTAX values used by several objects (e.g., MessageActivationCode and MessageCodeID). These checksums shall be calculated the same way in all instances.

The algorithm is based on the CRC-16 algorithm defined in ISO 13239:2002.

The following is provided as an example:

a) Let us assume that the content of the message text to be displayed is "[jp3]TEST [fl]Flashing[/fl]" (=MULTI String content), that the message is to be stored in volatile memory, in slot number 5, and that the sign does not support any beacons and no pixel service.
b) The resulting message ID Code is "04 00 05 95 F9" (see below for details).
c) Let us further assume that this message is to be activated from IP address 103.8.9.10 and is to be displayed for 267 minutes with activation priority 55.
d) Using this and the above information, the resulting message Activation Code is
"01 0B 37 04 00 05 95 F9 67 08 09 0A"
Where:
    01 0B 2-byte duration value of '267' in hex
    37 1-byte priority value of '55' in hex
    04 1-byte message type value of 'volatile (4)' in hex
    00 05 2-byte message number value of '5' in hex
    95 F9 2-byte checksum value for a MULTI-string value of '[jp3]TEST [fl]Flashing[/fl]' in hex
    67 08 09 0A 4-byte IP address value of '103.8.9.10' in hex

4.2.2 Managing the DMS Configuration

Standardized dialogs for managing the DMS configuration and that are more complex than simple GETs

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or SETs are defined in the following subsections.

4.2.2.1 Retrieving a Font Definition

The standardized dialog for a management station to retrieve a font shall be as follows:

a) (Precondition) The management station shall be aware of the number of fonts supported by the DMS, the character set supported by the DMS, and which font definition is being requested.
b) The management station shall GET the fontStatus.x and verify the value is 'inUse', 'readyForUse', 'permanent', or 'unmanaged' or returns a ‘noSuchName’ error. If the value is any other value, the management station shall exit this process as the font is not valid.
c) The management station shall GET the following objects:
   1) fontNumber.x,
   2) fontName.x,
   3) fontHeight.x,
   4) fontCharSpacing.x,
   5) fontLineSpacing.x,
   6) fontVersionID.x,
   7) fontStatus.x.
d) For each character of the font, the management station shall GET the following objects:
   1) characterNumber.x.y
   2) characterWidth.x.y
   3) characterBitmap.x.y.

   Where:
   x = font index
   y = character number

   Note: Since the character table may be sparsely populated, it is impossible to know which character numbers are supported without custom designing the management station to device documentation, doing an exhaustive search until all characters are found (and receiving SNMP noSuchName errors for entries that did not exist), or using GET-NEXT operations. The recommended solution for management stations that have to support this feature is to use a series of GET-NEXT operations to poll the device for each row until all rows of the table are retrieved.

This dialog is being used in conjunction with the State Machine Diagram as defined in Section 4.3.1.

4.2.2.2 Configuring a Font

The standardized dialog for a management station to configure a font shall be as follows (see Figure 2):

a) (Precondition) The management station shall be aware of the number of fonts supported by the DMS, the characters supported by the DMS, the font to be configured, and the characters within the font to be configured.
b) The management station shall GET fontStatus.x. If its value is 'inUse' or 'permanent', the management station shall exit the process. The management station may then change the message and restart this process from the beginning.
c) The management station shall SET fontStatus.x to 'modifyReq' to put the selected font in the 'modifying' state.
d) The management station shall GET fontStatus.x. If its value is 'modifying', it is now safe to modify the font data. If its value is not 'modifying', exit the process. (See Section 4.3.1 for a complete state chart diagram for font status).
e) The management station shall SET fontHeight.x to the new value desired to ensure the font is deleted if height changes.
f) The management station shall SET the following data to the desired values:
   1) fontNumber.x,
   2) fontName.x,

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3) fontCharSpacing.x, and
4) fontLineSpacing.x.

g) The management station shall SET the following data to the desired values for the subject font and the subject character (Repeat for each character to be modified):
   1) characterWidth.x.y and
   2) characterBitmap.x.y.

h) The management station shall SET fontStatus.x to 'readyForUseReq' to allow messages using the font to be displayed successfully.

Where:
x = font index
y = character number

Note: NTCIP 1203:1997 did not include a fontStatus object. Thus, management stations should be designed to gracefully recover if Step b) results in a noSuchNameError by skipping Steps c), d), and h).

Note: The DMS WG recognizes that the message display on the sign could be unpredictable during the download of a font. Those specifying authorities or application developers who are sensitive to this issue can blank the display during a font download.

This dialog is being used in conjunction with the State Machine Diagram as defined in Section 4.3.1.

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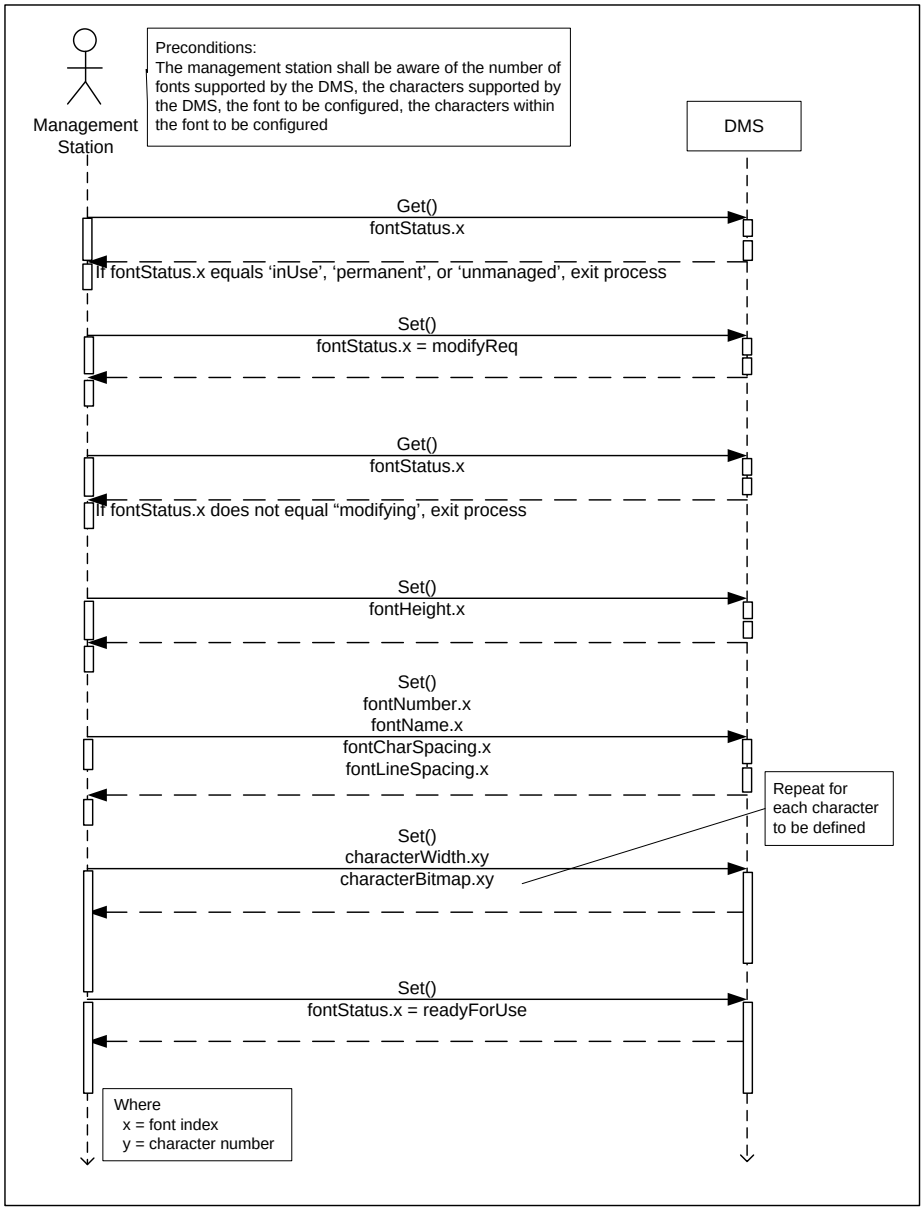

Figure 2 Configuring a Font

4.2.2.3 Deleting a Font

The standardized dialog for a management station to delete a font shall be as follows:

a) (Precondition) The management station will know which font is to be deleted and should ensure that the DMS supports this font.
b) The management station shall GET dmsFontStatus.x. If the value is equal to 'inUse' or 'permanent', the management station shall exit this process as fonts cannot be deleted.
c) The management station shall SET dmsFontStatus.x to 'notUsedReq'.
d) The management station shall GET dmsFontStatus.x and ensure this value is equal to 'notUsed'.
e) The management station shall SET dmsFontStatus.x to 'modifyReq'.
f) The management station shall SET dmsFontHeight.x to zero (0).
g) The management station shall SET dmsFontStatus.x to 'notUsedReq'.

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Where:
x = dmsFontIndex

Note: NTCIP 1203:1997 did not include a fontStatus object. Thus, management stations should be designed to gracefully recover if Step b) results in a noSuchNameError by skipping Steps c), d), and e).

This dialog is being used in conjunction with the State Machine Diagram as defined in Section 4.3.1.

4.2.2.4 Validating a Font

The standardized dialog for a management station to validate a font (i.e., ensure that the font configuration is as expected) shall be as follows:

a) (Precondition) The management station shall be aware of which font it wants to validate and shall ensure that the device supports this font.
b) (Precondition) The management station shall be aware of the expected CRC value for the subject font. The expected CRC value may be based on a previously retrieved value when the font was in a known state, or may be determined directly by calculating the CRC based on the expected font configuration.
c) The management station shall GET fontStatus.x.
d) The management station shall ensure that fontStatus.x equals 'permanent', 'readyForUse', 'unmanaged', or 'inUse'. If fontStatus.x is any other value, the value for fontVersionID.x may not reflect the currently stored data and the management system shall exit this process.
e) The management station shall GET fontVersionID.x.
f) The management station shall compare the expected value for fontVersionID.x to the newly retrieved value. If the values match, the font configuration is (within a very high degree of probability) as expected. If the values are different, the font has changed.

Where:
x = font index

Note: If the fontVersionID values are different, the management station may want to delete the font or download the font again.

Note: NTCIP 1203:1997 did not include a fontStatus object. Thus, management stations should be designed to gracefully recover if Step c) results in a noSuchNameError by skipping Step d).

This dialog is being used in conjunction with the State Machine Diagram as defined in Section 4.3.1.

4.2.2.5 Retrieving a Graphic Definition

The standardized dialog for a management station to retrieve a graphic shall be as follows:

a) (Precondition) The management station shall ensure that the sign supports the graphic to be retrieved.
b) (Precondition) The management station shall ensure that it has the value of dmsGraphicBlockSize so that it can decode the bitmap blocks properly.
c) The management station shall GET dmsGraphicStatus.x. If the value is 'notUsed', 'modifying', or 'calculatingID', exit the process as the graphic is not defined.
d) The management station shall GET the following objects:
   1) dmsGraphicNumber.x
   2) dmsGraphicName.x
   3) dmsGraphicHeight.x
   4) dmsGraphicWidth.x
   5) dmsGraphicType.x
   6) dmsGraphicTransparentEnabled.x,
   7) dmsGraphicTransparentColor.x

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e) The management station shall GET the following objects:
   1) dmsGraphicBlockBitmap.x.y (as needed to retrieve entire graphic)

   Note: Repeat Step d) for number of bitmap blocks that is contained within the index of this entry.

Where:
   x = dmsGraphicIndex, and dmsGraphicBitmapIndex
   y = dmsGraphicBlockNumber

This dialog is being used in conjunction with the State Machine Diagram as defined in Section 4.3.2.

4.2.2.6 Storing a Graphic Definition

The standardized dialog for a management station to download a graphic (see Figure 3) shall be as follows:

a) (Precondition) The management station shall ensure that the row of the graphic table to be changed is within the range of the maximum graphics the DMS can store.
b) (Precondition) The management station shall ensure that it has the value of dmsGraphicBlockSize so that it can encode the bitmap blocks properly.
c) The management station shall GET dmsGraphicStatus.x. If its value is 'inUse', 'permanent', or 'calculatingID', the management station shall exit the process. It may then change the message and then restart this process.
d) The management station shall SET dmsGraphicStatus.x to 'modifyReq' to put the selected graphic in the 'modifying' state.
e) The management station shall GET dmsGraphicStatus.x. If its value is 'modifying', it is now safe to modify the graphic data. If its value is anything other than 'modifying', exit the process. (See Section 4.3.2 for a complete state chart diagram for graphic status.)
f) The management station shall SET the following objects to the desired values:
   1) dmsGraphicNumber.x,
   2) dmsGraphicName.x,
   3) dmsGraphicHeight.x,
   4) dmsGraphicWidth.x,
   5) dmsGraphicType.x,
   6) dmsGraphicTransparentEnabled.x,
   7) dmsGraphicTransparentColor.x.
g) The management station shall SET dmsGraphicBlockBitmap.x.y (as required to store entire graphic).
h) The management station shall SET dmsGraphicStatus.x to 'readyForUseReq' to allow messages using the graphic to be displayed successfully.

Where:
   x = dmsGraphicIndex and dmsGraphicBitmapIndex
   y = dmsGraphicBlockNumber

This dialog is being used in conjunction with the State Machine Diagram as defined in Section 4.3.2.

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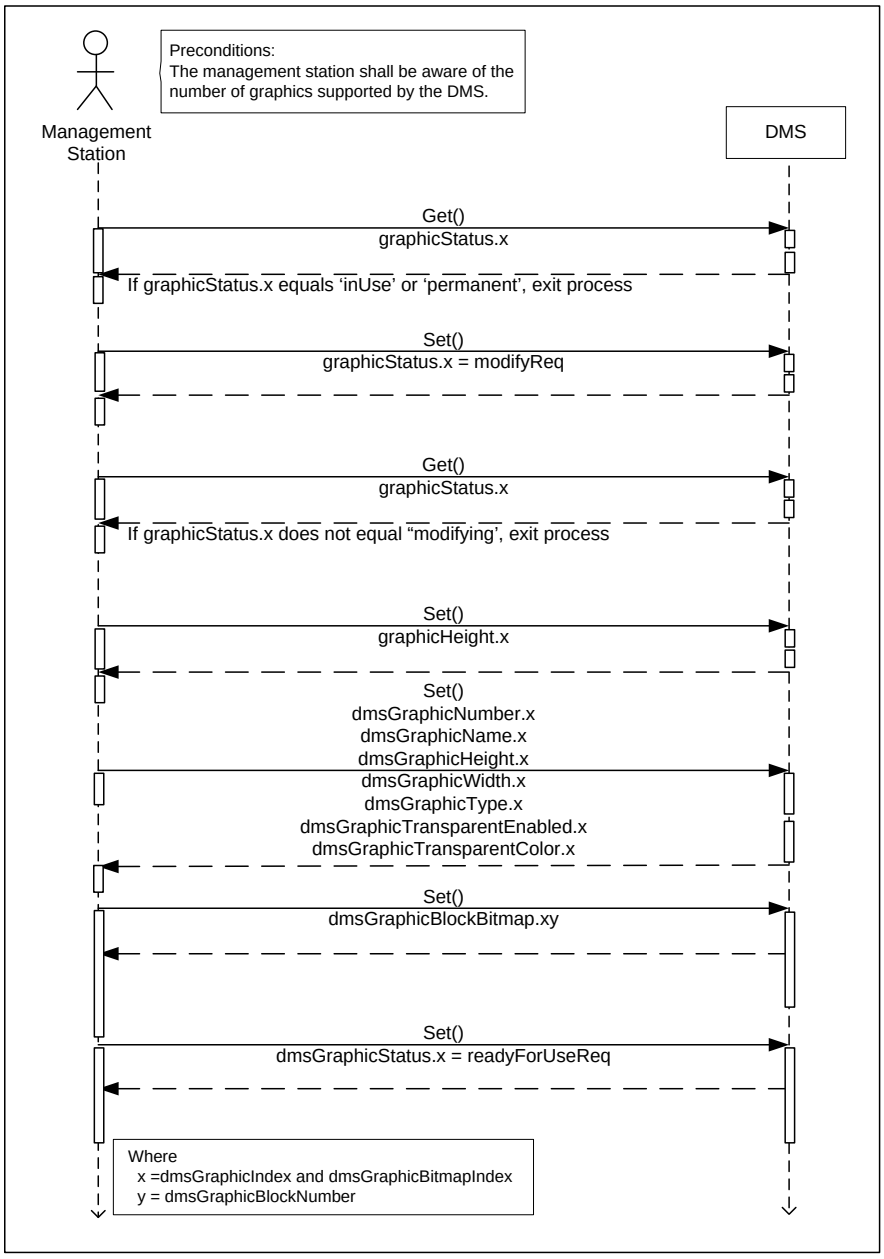

Figure 3 Storing a Graphic

4.2.2.7 Deleting a Graphic

The standardized dialog for a management station to delete a graphic shall be as follows:

a) (Precondition) The management station will know which graphic is to be deleted and should ensure that the DMS supports this graphic.
b) The management station shall GET dmsGraphicStatus.x. If the value is equal to 'inUse' or 'permanent', the management station shall exit this process as graphics can not be deleted when they are in use.
c) The management station shall SET dmsGraphicStatus.x to 'notUsedReq'.
d) The management station shall GET dmsGraphicStatus.x and ensure this value is equal to 'notUsed'.

Where:
x = dmsGraphicIndex

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This dialog is being used in conjunction with the State Machine Diagram as defined in Section 4.3.2.

4.2.2.8 Validating a Graphic

The standardized dialog for a management station to validate a graphic (i.e., ensure that the graphic is as expected) shall be as follows:

a) (Precondition) The management station shall be aware of which graphic it wants to validate and shall ensure that the device supports this graphic.
b) (Precondition) The management station shall be aware of the expected CRC value for the graphic. The expected CRC value may be based on a previously retrieved value when the graphic was in a known state, or may be determined directly by calculating the CRC based on the expected graphic.
c) The management station shall GET dmsGraphicStatus.x and dmsGraphicID.x
d) The management station shall ensure that dmsGraphicStatus.x is equal to 'permanent', 'readyForUse', or 'inUse'. If dmsGraphicStatus.x indicates any other value, the dmsGraphicID.x value may not be valid for the stored information and the management station should exit this process.
e) The management station shall ensure that the retrieved value for dmsGraphicID.x is equal to the expected value. If the values match, the graphic information is (within a very high degree of probability) as expected. If the values are different, the graphic information has changed.
f) (Postcondition) If the values are different, the management station may wish to delete the graphic or download the graphic again.

Where:
x = dmsGraphicIndex

This dialog is being used in conjunction with the State Machine Diagram as defined in Section 4.3.2.

4.2.2.9 Configuring Light Output Algorithm

The standardized dialog for a management station to configure the brightness values (see Figure 4) shall be as follows:

a) (Precondition) The management station shall be aware of the maximum number of photocell levels supported by the device and the desired photocell curve to be stored in the device, which must not contain photocell levels above that supported by the device.
b) The management station shall SET dmsIllumBrightnessValues.0 to the desired value (see Section 5.8.7 for example values).
c) If the response indicates a genErr, the management station shall GET dmsIllumBrightnessValuesError.0 to determine the cause of the error.

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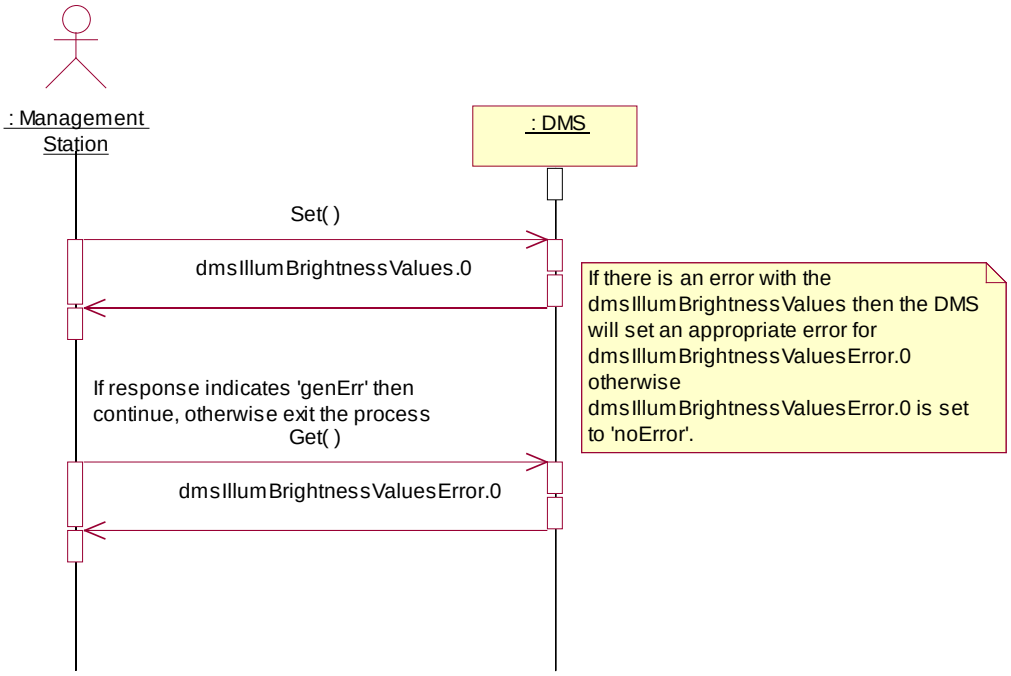

Figure 4 Configuring Light Output Algorithm

4.2.3 Controlling the DMS

Standardized dialogs for controlling the DMS that are more complex than simple GETs or SETs are defined in the following subsections.

4.2.3.1 Activating a Message

The standardized dialog for a management station to activate a message on the sign display shall be as follows:

a) (Precondition) The management station shall ensure that the desired message is supported by the DMS. This may entail downloading the desired message contents to the DMS. (See Section 4.2.3.2)
b) The management station shall SET dmsActivateMessage.0 to the desired value. This will cause the controller to perform a consistency check on the message. (See Section 4.3.5 for a description of this consistency check.)
   Note: dmsActivateMessage.0 is a structure that contains the following information: message type (permanent, changeable, blank, etc.), message number, duration, activation priority, a CRC of the message contents, and a network address of the requester.
c) If the response indicates 'noError', the message has been activated and the management station shall GET shortErrorStatus.0 to ensure that there are no errors preventing the display of the message (e.g. a 'criticalTemperature' alarm). The management station may then exit the process.
d) If the response from Step 2 indicates an error, the message was not activated. The management station shall GET dmsActivateMsgError.0 and dmsActivateErrorMsgCode.0 to determine the type of error.
e) If dmsActivateMsgError equals 'syntaxMULTI' then the management station shall GET the following data to determine the error details:
   1) dmsMultiSyntaxError.0
   2) dmsMultiSyntaxErrorPosition.0
f) If dmsActivateMessageError equals “syntaxMULTI(8)” and dmsMultiSyntaxError equals “other(1)” then the management station shall GET dmsMultiOtherErrorDescription.0 to determine the vendor specific error.

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This process is depicted in Figure 5. This dialog is being used in conjunction with the following State Machine Diagrams as defined in Sections 4.3.4 and 4.3.5.

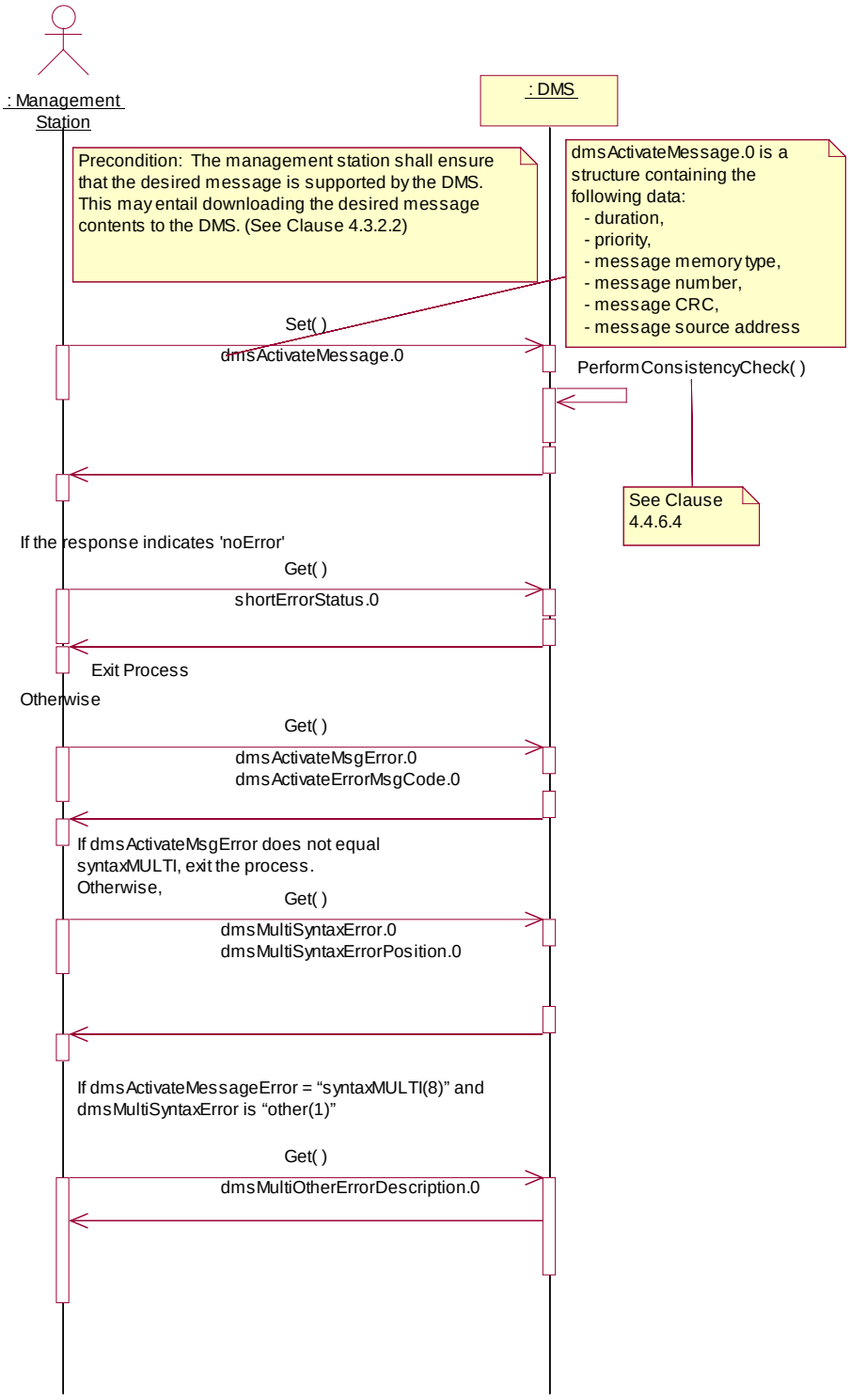

Figure 5 Activating a Message

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4.2.3.2 Defining a Message

According to the NTCIP paradigm, no message can be displayed unless it is defined in the message table within the sign controllers' memory. The standardized dialog for a management station to download a message to the DMS (see

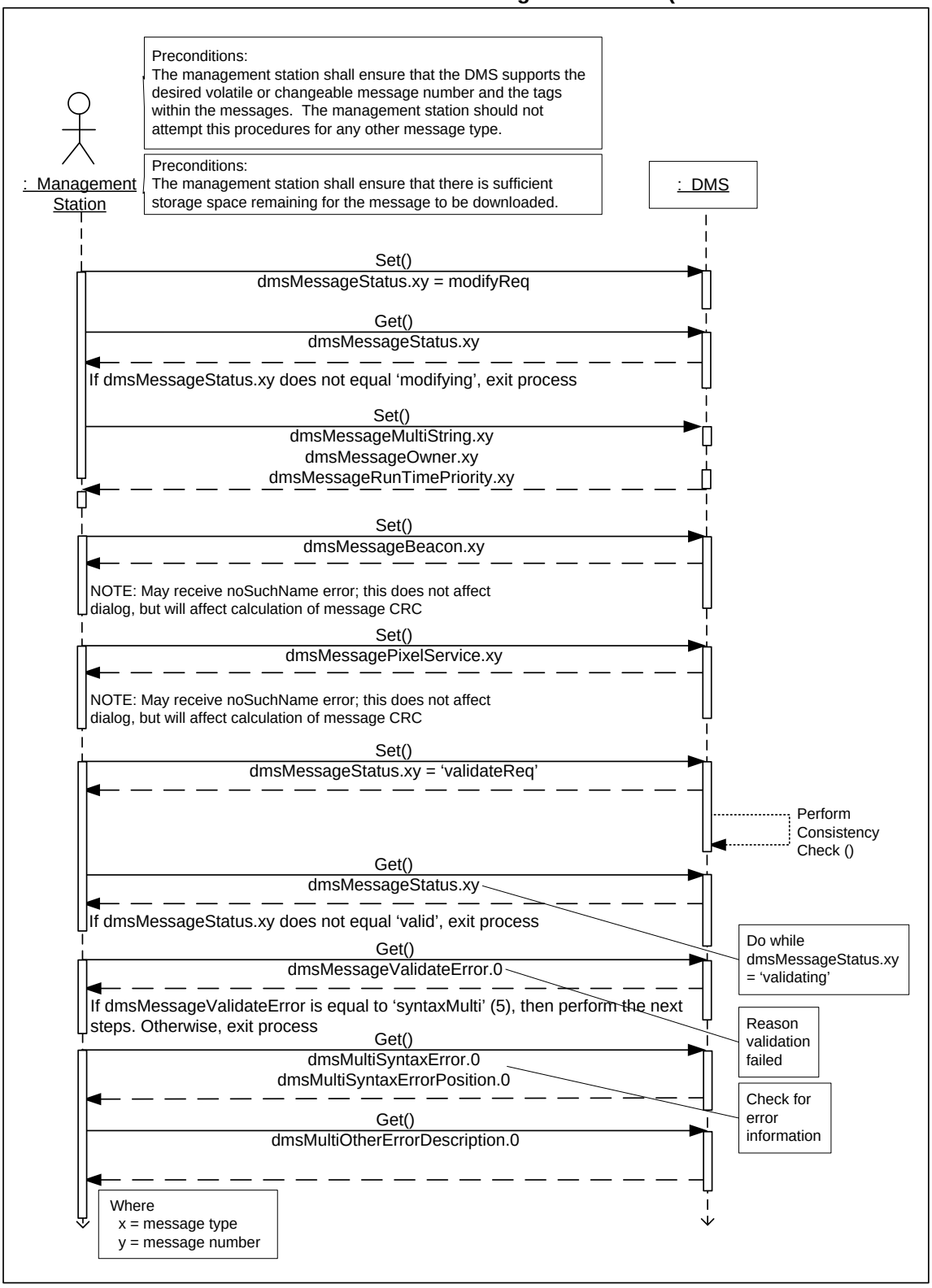

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Figure 6) shall be as follows:

a) (Precondition) The management station shall ensure that the DMS supports the desired volatile or changeable message number and the tags within the message. The management station should not attempt this procedure for any other message type.
b) (Precondition) The management station shall ensure that there is sufficient storage space remaining for the message to be downloaded.
c) The management station shall SET dmsMessageStatus.x.y to 'modifyReq'.
d) The management station shall GET dmsMessageStatus.x.y.
e) If the value is not 'modifying', exit the process. In this case, the management station may SET dmsMessageStatus.x.y to 'notUsedReq' and attempt to restart this process from the beginning. (See Section 4.3.4 for a complete description of the Message Table State Machine.)
f) The management station shall SET the following data to the desired values:
   1) dmsMessageMultiString.x.y
   2) dmsMessageOwner.x.y
   3) dmsMessageRunTimePriority.x.y
g) (Required step only if Requirement 3.6.6.5 Beacon Activation Flag is selected as Yes in PRL) The management station shall SET dmsMessageBeacon.x.y to the desired value.
   Note: The response to this request may be a noSuchName error, indicating that the DMS does not support this optional feature. This error will not affect the sequence of this dialog, but the management station should be aware that the CRC will be calculated with this value defaulted to zero (0).
h) (Required step only if 2.3.2.2.1 Fiber or 2.3.2.2.3 Flip/Shutter is selected as Yes in PRL) The management station shall SET dmsMessagePixelService.x.y to the desired value.
   Note: The response to this request may be a noSuchName error, indicating that the DMS does not support this optional feature. This error will not affect the sequence of this dialog, but the management station should be aware that the CRC will be calculated with this value defaulted to zero (0).
i) The management station shall SET dmsMessageStatus.x.y to 'validateReq'. This will cause the controller to initiate a consistency check on the message. (See Section 4.3.5 for a description of this consistency check.)
j) The management station shall repeatedly GET dmsMessageStatus.x.y until the value is not 'validating' or a time-out has been reached.
k) If the value is 'valid', exit the process. Otherwise, the management station shall GET dmsValidateMessageError.0 to determine the reason the message was not validated.
l) If the value is 'syntaxMULTI', the management station shall GET the following data to determine the error details:
   1) dmsMultiSyntaxError.0
   2) dmsMultiSyntaxErrorPosition.0
m) If the value is 'other', the management station shall GET the following data to determine the error details:
   1) dmsMultiOtherErrorDescription.0

   Where:
   x = message type
   y = message number

   Note: If, at the end of this process, the value of dmsMessageStatus.x.y is 'valid', the message can be activated.

This dialog is being used in conjunction with the State Machine Diagram as defined in Sections 4.3.4.

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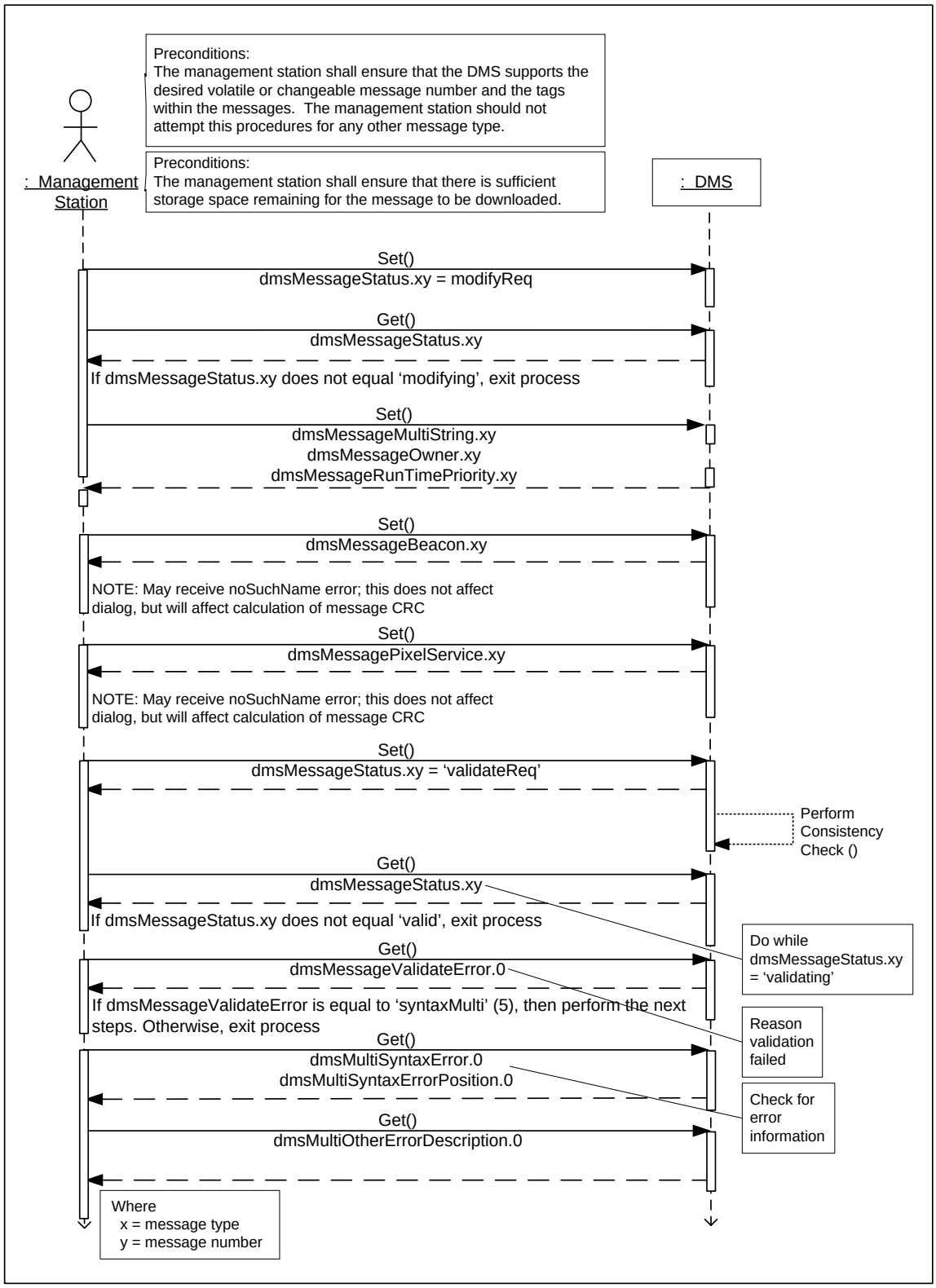

Figure 6 Defining a Message

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4.2.3.3 Retrieving a Message

The standardized dialog for a management station to upload a message from the DMS shall be as follows:

a) (Precondition) The management station shall ensure that the DMS supports the desired message type and number.
b) The management station shall GET the following data:
   1) dmsMessageMultiString.x.y
   2) dmsMessageOwner.x.y
   3) dmsMessageRunTimePriority.x.y
   4) dmsMessageStatus.x.y
c) The management station shall GET dmsMessageBeacon.x.y.
   Note: The response to this request may be a noSuchName error, indicating that the DMS does not support this optional feature. This error will not affect the sequence of this dialog, but the management station should be aware that the CRC will be calculated with this value defaulted to zero (0).
d) The management station shall GET dmsMessagePixelService.x.y.
   Note: The response to this request may be a noSuchName error, indicating that the DMS does not support this optional feature. This error will not affect the sequence of this dialog, but the management station should be aware that the CRC will be calculated with this value defaulted to zero (0).

Where:

x = message type
y = message number

Note: The purpose of the dmsMsgSourceMode object is to determine who (person or mechanism) put up a message, while the dmsMsgTableSource object identifies the actual message displayed.

4.2.3.4 Defining a Schedule

The standardized dialog for a management station to schedule messages for display (see Figure 7) shall be as follows:

a) (Precondition) The management station shall ensure the message(s) to be scheduled for display are downloaded to the DMS (See Section 4.2.3.2)
b) (Precondition) The management station shall ensure that there are sufficient rows in the action, day plan, and time base schedule tables to download the proposed schedule.
c) For each message to be displayed, the management station shall SET dmsActionMsgCode.a to the desired value.
d) For each event within each day plan, the management station shall SET the following data to the desired values:
   1) dayPlanHour.b.c
   2) dayPlanMinute.b.c
   3) dayPlanActionNumberOID.b.c
      Note: A day plan specifies a static message schedule for a 24-hour period (see NTCIP 1201 v03 Section 2 for object descriptions).
e) For each time-base schedule entry, the management station shall SET the following data to the desired values:
   1) timeBaseScheduleMonth.d
   2) timeBaseScheduleDay.d
   3) timeBaseScheduleDate.d
   4) timeBaseScheduleDayPlan.d
   Note: A time-base schedule entry specifies which day plan to use for a particular month, date, and day of the week (see NTCIP 1201 v03 Section 2 for object descriptions).

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Where:
a = Action Index
b = Day Plan Number
c = Day Plan Event Number
d = Time Base Schedule Number

Note: After the actions, day plans, and time-base schedule entries have been downloaded to the DMS, the DMS's scheduler function may be enabled using the "activate message" dialog (see Section 4.2.3.1) to set the message to the scheduler (e.g., dmsActivateMessage = { duration= as appropriate, priority= as appropriate, messageMemoryType=0x06, messageNumber=1, CRC=0x0000, sourceAddress= as appropriate }). The scheduler may also be activated by an event-activated message such as the dmsEndDurationMessage.

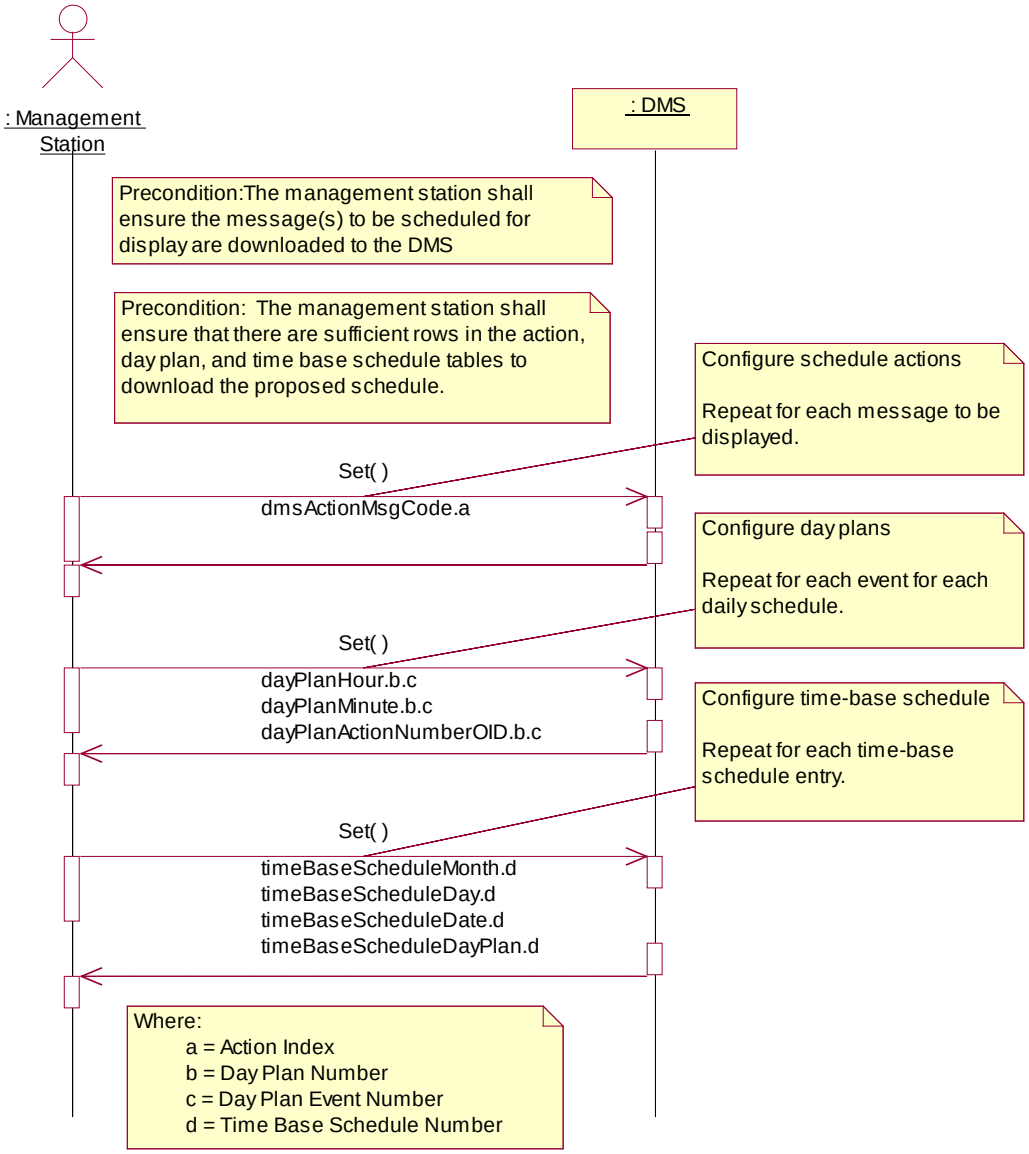

Figure 7 Defining a Schedule

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4.2.3.5 Manually Controlling Sign Brightness

The standardized dialog for a management station to manually control the brightness of the sign face shall be as follows:

a) (Precondition)The management station shall be aware of the number of brightness levels supported by the DMS and is shall be aware of the manual control mode that the DMS supports (either direct or indexed).
b) The management station shall SET dmsIllumControl.0 to 'manualDirect' or 'manualIndexed' depending what is supported by the DMS. The management station shall set this value in a separate data packet (VarBindList) before executing Step c).
   Note: Per the definition of dmsIllumControl, this step causes the value stored in dmsIllumManLevel to change to the current brightness level.
c) The management station shall SET dmsIllumManLevel.0 to the desired level ranging from 0 (off) to maximum number of brightness levels supported by the DMS (if 'manualDirect' is the dmsIllumControl mode) or to the maximum number of brightness levels defined in the dmsBrightnessValues talbe (if 'manualIndexed' is the dmsIllumControl mode).
   Note: The difference between the two manual control modes is due to the fact that different vendors implemented the original 'manual' mode differently pointing either to the number of brightness levels defined in the brightness values table or to the number of brightness levels that the DMS does support (but may not have defined in the brightness level table). To provide maximum backwards compatibility, these new two different values of the dmsIllumControl object was introduced.
   Note: The DMS may implement the new brightness level over a period of time to prevent a visible flicker effect.

4.2.3.6 Manage the Exercise of Pixels

The standardized dialog for a management station to exercise the pixels on a sign face shall be as follows:

a) The management station shall SET vmsPixelServiceTime.0 to the time when the first pixel service is to occur during each day.
b) The management station shall SET the vmsPixelServiceDuration.0 to the length of time the pixel service is to last every time it is initiated. If this value is zero, the pixel service is disabled.
c) The management station shall SET vmsPixelServiceFrequency.0 to the time between pixel services. Set this value to zero for continuous exercising.
d) (Postcondition) The management station shall activate a message that is defined to allow pixel service (e.g., the dmsMessagePixelService object for the message has been set to a value of 1). (See Section 4.2.3.2)

4.2.3.7 Activating a Message with Status

The standardized dialog for a management station to activate a message on the sign display shall be as follows:

a) (Precondition) The management station shall follow the steps 1 through 2 within the section 4.2.3.1 "Activating a Message".
b) If the response indicates 'noError', the message may or may not be activated
c) The management station shall GET dmsActivateMessageState.0.
d) If the response from step 3 indicates 'slowActivating(4)', the DMS is in the process of activating the message. Goto step 3.
e) If the response from step 3 indicates 'slowActivatedError(3)', the management station shall GET shortErrorStatus.0 to determine the source of the error.
f) If the response from step 3 indicates 'fastActivationSign(1)', the message is activated continue with step 8.
g) If the response from step 3 indicates 'slowActivatedOK(2)', the message is activated continue with step 8.
h) The message has been activated and the management station shall GET shortErrorStatus.0 to ensure that there are no errors preventing the display of the message (e.g. a 'criticalTemperature'

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alarm). The management station may then exit the process.

i) If the response from Step 2 indicates an error, the message was not activated. The management station shall GET dmsActivateMsgError.0 and dmsActivateErrorMsgCode.0 to determine the type of error.
j) If dmsActivateMsgError equals 'syntaxMULTI' then the management station shall GET the following data to determine the error details:
   1) dmsMultiSyntaxError.0
   2) dmsMultiSyntaxErrorPosition.0
k) If dmsActivateMessageError equals “syntaxMULTI(8)” and dmsMultiSyntaxError equals “other(1)” then the management station shall GET dmsMultiOtherErrorDescription.0 to determine the vendor specific error.

   Note: The information is only applicable to the manual activation command, if the Source is 'externalActivation' and the dmsActivateErrorMsgCode was identical to the activation code sent to the device.

4.2.4 Monitoring the Status of the DMS

Standardized dialogs for monitoring the DMS configuration that are more complex than simple GETs or SETs are defined in the following subsections.

4.2.4.1 Executing Lamp Testing

The standardized dialog for a management station to command the DMS to execute lamp testing shall be as follows:

a) The management station shall SET lampTestActivation.0 to 'test'.
b) The management station shall repeatedly GET lampTestActivation.0 until it either returns the value of 'noTest' or a maximum time-out is reached. If the time-out is reached, the DMS is apparently locked and the management station shall exit the process.
c) (PostCondition) The following objects will have been updated during the lamp test to reflect current conditions. The management station may GET any of these objects as appropriate.
   1) lampFailureStuckOn
   2) lampFailureStuckOff
   3) any object within the dmsLampStatusTable

4.2.4.2 Activating Pixel Testing

The standardized dialog for a management station to command the DMS to activate pixel testing shall be as follows:

a) The management station shall SET pixelTestActivation.0 to 'test'.
b) The management station shall repeatedly GET pixelTestActivation.0 until it either returns the value of 'noTest' or a maximum time-out is reached. If the time-out is reached, the DMS is apparently locked and the management station shall exit the process.
c) (PostCondition) The following objects will have been updated during the pixel test to reflect current conditions. The management station may GET any of these objects as appropriate.
   1) pixelFailureTableNumRows
   2) any object within the pixelFailureTable

4.2.4.3 Executing Climate-Control Equipment Testing

The standardized dialog for a management station to command the DMS to execute lamp testing shall be as follows:

a) The management station shall SET dmsClimateCtrlTestActivation.x to 'test'.
b) The management station shall repeatedly GET dmsClimateCtrlTestActivation.x until it either returns the value of 'noTest', a value of 'testAborted', or a maximum time-out is reached. If the time-out is reached, the DMS is apparently locked and the management station shall exit the process.
c) If the value of dmsClimateCtrlTestActivation.x is 'testAborted', the management station shall 'GET'

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dmsClimateCtrlAbortReason for a description of the reason for test denial.

d) (PostCondition) The following objects will have been updated during the lamp test to reflect current conditions. The management station may GET any of these objects as appropriate.
   1) dmsClimateCtrlStatusMap
   2) any object within the dmsClimateCtrlStatusTable

   where
   x = dmsClimateCtrlIndex

4.2.4.4 Monitoring Power Error Details

The standardized dialog for a management station to monitor details about any power errors shall be as follows:

a) (Precondition) The management station shall be aware of which power supplies are currently failed.
b) For the desired failed power supply, the management station shall GET the following data:
   1) dmsPowerDescription.x
   2) dmsPowerMfrStatus.x
   3) dmsPowerStatus.x
   4) dmsPowerVoltage.x
   5) dmsPowerType.x

   Where:
   x = power index.

4.2.4.5 Monitoring Lamp Error Details

The standardized dialog for a management station to monitor details about any lamp errors shall be as follows:

a) (Precondition) The management station shall execute lamp testing. (See Section 4.2.4.1)
b) (Precondition) The management station shall be aware of which lamps are currently failed on or failed off.
c) For the desired failed lamp, the management station shall GET the following data:
   1) dmsLampDescription.x
   2) dmsLampMfrStatus.x
   3) dmsLampStatus.x
   4) dmsLampPixelTop.x
   5) dmsLampPixelLeft.x
   6) dmsLampPixelBottom.x
   7) dmsLampPixelRight.x

   Where:
   x = lamp index.

4.2.4.6 Monitoring Pixel Error Details

The standardized dialog for a management station to monitor details about any pixel errors shall be as follows:

a) (Precondition) The management station shall execute pixel testing. (See Section 4.2.4.2)
b) (Precondition) The management station shall be aware of which pixels are currently failed on or failed off.
c) For the desired failed pixel, the management station shall GET the following data:
   1) pixelFailureXLocation.x.y
   2) pixelFailureYLocation.x.y
   3) pixelFailureStatus.x.y

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Where:
x = failure detection type
y = pixel failure index

4.2.4.7 Monitoring Light Sensor Error Details

The standardized dialog for a management station to monitor details about any light sensor errors shall be as follows:

a) (Precondition) The management station shall be aware of which light sensors are currently failed.
b) For the desired failed light sensor, the management station shall GET the following data:
   1) dmsLightSensorDescription.x
   2) dmsLightSensorCurrentReading.x
   3) dmsLightSensorStatus.x

   Where:
   x = light sensor index.

4.2.4.8 Monitoring Message Activation Error Details

The standardized dialog for a management station to monitor details about any message activation errors shall be as follows:

a) The management station shall GET the following data:
   1) dmsActivateMsgError.0
   2) dmsActivateErrorMsgCode.0
   3) dmsMultiSyntaxError.0
   4) dmsMultiSyntaxErrorPosition.0
b) If dmsActivateMessageError equals “syntaxMULTI(8)” and dmsMultiSyntaxError equals “other(1)” then the management station shall GET dmsMultiOtherErrorDescription.0 to determine the vendor specific error.
c) If the dmsActivateMsgError.0 has a value of anything other than 'syntaxMULTI', the full description of the error is given by the value, the remaining data shall be ignored, and the management station shall exit the process.

4.2.4.9 Monitoring Climate-Control System Error Details

The standardized dialog for a management station to monitor details about any climate control equipment errors shall be as follows:

a) (Precondition) The management station shall execute climate control equipment testing. (See Section 4.2.4.3.)
b) (Precondition) The management station shall be aware of which climate control subsystems are currently failed.
c) For the desired failed climate control subsystem, the management station shall GET the following data:
   1) dmsClimateCtrlDescription.x
   2) dmsClimateCtrlMfrStatus.x
   3) dmsClimateCtrlErrorStatus.x
   4) dmsClimateCtrlOn.x
   5) dmsClimateCtrlType.x

   Where:
   x = climate control index.

4.2.4.10 Monitoring Sign Housing Humidity

The standardized dialog for a management station to monitor details about sign housing humidity shall be as follows:

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a) (Precondition) The management station may wish to determine which humidity sensors are reporting warnings.
b) For the desired humidity sensor, the management station shall GET the following data:
   1) dmsHumiditySensorDescription.x
   2) dmsHumiditySensorCurrentReading.x
   3) dmsHumiditySensorStatus.x

   Where:
   x = dmsHumiditySensorIndex

4.2.4.11 Monitoring Control Cabinet Humidity

The standardized dialog for a management station to monitor details about control cabinet humidity shall be as follows:

a) (Precondition) The management station may wish to determine which humidity sensors are reporting warnings.
b) For the desired humidity sensor, the management station shall GET the following data:
   1) dmsHumiditySensorDescription.x
   2) dmsHumiditySensorCurrentReading.x
   3) dmsHumiditySensorStatus.x

Where:
x = humidity sensor index.

4.2.4.12 Monitoring Drum Sign Rotor Error Details

The standardized dialog for a management station to monitor details about any drum sign rotor errors shall be as follows:

a) (Precondition) The management station shall be aware of which sign rotors are currently failed.
b) For the desired failed rotor, the management station shall GET the following data:
   1) dmsDrumDescription.x
   2) dmsDrumMfrStatus.x
   3) dmsDrumStatus.x

   Where:
   x = drum index.

4.2.4.13 Monitoring Attached Devices

The standardized dialog for a management station to monitor attached devices shall be as follows:

a) The management station shall GET the following data to determine the number of auxiliary ports supported by the device:
   1) maxAuxIOv2TableNumDigitalPorts.0
   2) maxAuxIOv2TableNumAnalogPorts.0
b) For each attached device, the management station shall GET the following data:
   1) auxIOv2PortDescription.x.y
   2) auxIOv2PortResolution.x.y
   3) auxIOv2PortValue.x.y
   4) auxIOv2PortDirection.x.y
   5) auxIOv2PortLastCommandedState.x.y

   Where:
   x = auxiliary I/O port type
   y = auxiliary I/O port number

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Note: A device might need to support the version 1 definitions for the auxiliary I/O functionality. However, if required, the specification writer will need to clarify within the specification how this version 1 functionality is to be implemented.

4.2.4.14 Monitoring the Current Message

The standardized dialog for a management station to monitor the current message shall be as follows:

a) The management station shall GET dmsMsgTableSource.0 to determine the message number, message type, and message CRC of the currently displayed message.
b) The management station shall GET dmsMessageTimeRemaining.0.
c) The management station shall GET dmsMsgRequesterID.0 to determine the source address of the controller that activated the currently displayed message.
d) The management station shall GET dmsMsgSourceMode.0 to determine the source from which the message was generated (e.g., default message, communications port, scheduler, etc.).
e) The management station shall GET the following data:
   1) dmsMessageMultiString.5.1
   2) dmsMessageOwner.5.1
   3) dmsMessageRunTimePriority.5.1

   Note: Instance "5.1" is the currentBuffer row of the Message Table.
f) The management station shall GET dmsMesagePixelService.5.1.
   Note: The response to this request may be a noSuchName error, indicating that the DMS does not support this optional feature. This error will not affect the sequence of this dialog, but the management station should be aware that the CRC will be calculated with this value defaulted to zero (0).
g) The management station shall GET dmsMessageBeacon.5.1.
   Note: The response to this request may be a noSuchName error, indicating that the DMS does not support this optional feature. This error will not affect the sequence of this dialog, but the management station should be aware that the CRC will be calculated with this value defaulted to zero (0).
h) The management station shall GET the following data:
   1) dmsIllumBrightLevelStatus.0
   2) dmsIllumLightOutputStatus.0

4.2.4.15 Monitoring Dynamic Field Values

The standardized dialog for a management station to monitor the value of dynamic fields within a message shall be as follows:

a) The management station shall GET statMultiFieldRows.0 to determine the number of dynamic fields used within the current message.
b) For each dynamic field, the management station shall GET the following data:
   1) statMultiFieldCode.x
   2) statMultiCurrentFieldValue.x

   Note: If statMultiFieldRows.0 equals zero (0), step 2 should be skipped.

   Where:
   x = MULTI Field Index

4.3 State Transition Diagrams

State-Transition diagrams are included for those objects that have states or manage states. The State Transition Diagrams include state-transition tables (listing of the possible state transitions), legitimate transitions, and any illegitimate transitions.

“State-transition diagrams describe all of the states that an object can have, the events under which an object changes state (transitions), the conditions that must be fulfilled before the transition will occur (guards), and the activities undertaken during the life of an object (actions).” (Reference: State-Transition Diagrams: Testing UML Models, Part 4 by Lee Copeland)

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The following subsections define the states for various object classes that may be supported by the device.

4.3.1 Font State Machine Definition

The DMS shall allow a management station to manage each font through the dmsFontStatus object. The allowed transitions and explanations associated with this diagram are provided within the table below.

4.3.1.1 General Description of the Font State Machine

When the device is not in the 'unmanaged (11)' state and a user desires to modify anything in a font, the font must be in the 'modifying' state otherwise a GenError shall be returned. A 'modifyReq (7)' must be issued to put the font into the 'modifying (2)' state. A 'modifyRequest (7)' can only be issued from the following states: 'modifying (2)'; 'readyForUse (4)'; 'notUsed (1)'; or 'unmanaged (11)'. A BadValue will be returned, if a 'readyForUseReq (8)' request is attempted from any other state.

The following operations are exclusive to the 'modifying (2)' state:

a) Characters may be set in the dmsCharacterTable.
b) The font's parameters may be changed.
c) Setting the dmsFontStatus object to a value of 'readyForUseReq (8)' switches the state to a value of 'calculatingID (3)' as well as causing the font's CRC to be calculated. After that, the value of the dmsFontStatus shall be set to 'readyForUse (4)'.
d) The font state (value of the dmsFontStatus object) can be changed to 'unmanaged (9)' by issueing a request to the dmsFontStatus object using the value 'unManagedReq (10)'.

Font Status can never be changed from a value of 'permanent (6)' to any other state. If attempted, a BadValue is returned.

At any time it shall be possible to set the dmsFontStatus object to a value of 'notUsedRequest (9)' except when the dmsFontStatus object has a value of 'permanent (6)' or 'inUse (5)'. A value of 'inUse (5)' indicates that the font is used within the currently displayed message on the sign. The first exception case is covered in the previous paragraph, while in the latter two exception cases, a GenError will be returned .

The dmsFontStatus object can only be commanded to 'unmanagedReq (10)', when the current value of this object is either 'modifying (2)' or 'notUsed (1)' or 'unmanaged (11)', otherwise a badValue will be returned.

A managing device shall only be allowed to activate a message if the dmsFontStatus object has a value of 'unmanaged (11)', 'permanent (6)', or 'readyForUse (4)', otherwise a GenError shall be returned and.the dmsActivateMsgError object shall be changed to a value of 'syntaxMULTI' and the dmsMultiSyntaxError object shall be changed to a value of 'fontNotDefined'.

4.3.1.2 Possible Font State Machine Transitions

The following table shows which transitions are allowed by this version of the standard. The table shows the possible transitions, any errors that should be returned, if certain non-allowed transitions are attempted, as well as other information.

Current State	Command or Event	Result
1–notUsed	7–modifyReq	2–modifying
	8–readyForUseReq	badValue
	9–notUsedReq	1–notUsed
	10–unmanagedReq	11–unmanaged
	Set any data of the font (within the dmsFontTable or the dmsCharacterTable)	genErr

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Current State	Command or Event	Result
	Activate a message using font	activateMsgError = syntaxMULTI dmsMultiSyntaxError = fontNotDefined
2–modifying	7–modifyReq	2–modifying
	8–readyForUseReq	3–calculatingID
	9–notUsedReq	1–notUsed
	10–unmanagedReq	11–unmanaged
	Set any data of the font (within the dmsFontTable or the dmsCharacterTable)	process command
	Set dmsFontHeight to a different value	Set characterWidth=0 Set characterBitmap = zero length
	Activate a message using font	activateMsgError = syntaxMULTI dmsMultiSyntaxError = fontNotDefined
3–calculatingID	7–modifyReq	badValue
	8–readyForUseReq	badValue
	9–notUsedReq	1–notUsed
	10–unmanagedReq	badValue
	calculation is finished	4–readyForUse
	Set any data of the font (within the dmsFontTable or the dmsCharacterTable)	genErr
	Activate a message using font	activateMsgError = syntaxMULTI dmsMultiSyntaxError = fontNotDefined
4–readyForUse	7–modifyReq	2–modifying
	8–readyForUseReq	4–readyForUse
	9–notUsedReq	1–notUsed
	10–unmanagedReq	badValue
	Set any data of the font (within the dmsFontTable or the dmsCharacterTable)	genErr
	Activate a message using font	5-inUse
5–inUse	7–modifyReq	badValue
	8–readyForUseReq	badValue
	9–notUsedReq	badValue
	10–unmanagedReq	badValue
	Set any data of the font (within the dmsFontTable or the dmsCharacterTable)	genErr
	Another messsage with the same font is activated	5–inUse
	message is deactivated (“Activate a message not using font”)	4–readyForUse
6–permanent	7–modifyReq	badValue
	8–readyForUseReq	badValue
	9–notUsedReq	badValue
	10–unmanagedReq	badValue
	Set any data of the font (within the dmsFontTable or the dmsCharacterTable)	genErr
	Another messsage with the same font is activated	6–permanent

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Current State	Command or Event	Result
	message is deactivated (“Activate a message not using font”)	6–permanent
11–unmanaged	7–modifyReq	2–modifying
	8–readyForUseReq	badValue
	9–notUsedReq	1–notUsed
	10–unmanagedReq	11–unmanaged
	Set any data of the font (within the dmsFontTable or the dmsCharacterTable)	Manufacturer specific or NTCIP 1203 v1
	Activate a message using font	Manufacturer specific or NTCIP 1203 v1

4.3.1.3 Not Used State

When in the notUsed state, the following rules shall apply to the subject font:

a) The DMS shall allow the management station to SET the subject fontStatus object to 'notUsedReq',r 'modifyReq', or 'unmanagedReq'.
b) The DMS shall return a badValue error for a request to SET the subject fontStatus object to any other value.
c) The DMS shall return a genErr error for any request to SET any other settable font information for the subject font.
d) The DMS shall reject any attempt (internal event or external request) to activate a message using the subject font and shall change the dmsActivateMsgError object to a value of 'syntaxMULTI' and change the dmsMultiSyntaxError object to a value of 'fontNotDefined'.

4.3.1.4 Modifying State

When in the modifying state, the following rules shall apply to the subject font:

a) The DMS shall allow the management station to SET the subject fontStatus object to 'notUsedReq', 'modifyReq', 'readyForUseReq', or 'unmanagedReq'.
b) If the management station SETs the fontStatus to 'readyForUseReq', the DMS shall automatically update the value of fontVersionID prior to setting the state to 'readyForUse' and set the value of the the subject fontStatus object to 'calculatingID'.
c) If the management station SETs the fontStatus to 'readyForUseReq', if the corresponding fontNumber is not unique among all fonts with fontStatus set to ‘permanent’, ‘readyForUse’, ‘inUse’, or ‘unmanaged’, a badValue error will be returned and the fontStatus will change to ‘notInUse’.
d) The DMS shall return a badValue error for a request to SET the subject fontStatus object to any other value.
e) The DMS shall allow a management station to SET any other settable font information for the subject font.
f) The DMS shall reject any attempt (internal event or external request) to activate a message using the subject font and shall change the dmsActivateMsgError object to a value of 'syntaxMULTI' and change the dmsMultiSyntaxError object to a value of 'fontNotDefined'.
g) If the management station SETs the fontHeight to a different value, the DMS shall set all corresponding characterWidth objects to zero (0) and all corresponding characterBitmap objects to zero length.

4.3.1.5 Calculating ID State

When in the calculatingID state, the following rules shall apply to the subject font:

a) The DMS shall update the fontVersionID and then transition to the 'readyForUse' state.
b) The DMS shall allow the management station to SET the subject fontStatus object to 'notUsedReq'.
c) The DMS shall return a badValue error for a request to SET the subject fontStatus object to any other

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value.
d) The DMS shall return a genErr error for any request to SET any other settable font information for the subject font.
e) The DMS shall reject any attempt (internal event or external request) to activate a message using the subject font and shall change the dmsActivateMsgError object to a value of 'syntaxMULTI' and change the dmsMultiSyntaxError object to a value of 'fontNotDefined'.

4.3.1.6 Ready for Use State

When in the readyForUse state, the following rules shall apply to the subject font:

a) The DMS shall allow the management station to SET the subject fontStatus object to 'notUsedReq', 'modifyReq', or 'readyForUseReq'.
b) The DMS shall return a badValue error for a request to SET the subject fontStatus object to any other value.
c) The DMS shall return a genErr error for any request to SET any other settable font information for the subject font.
d) The DMS shall allow the font to be used in a message being activated.
e) Upon the successful activation of a message using the font, the subject fontStatus object shall change to 'inUse'.

4.3.1.7 In Use State

When in the inUse state, the following rules shall apply to the subject font:

a) The DMS shall return a badValue error for a request to SET the subject fontStatus object.
b) The DMS shall return a genErr error for any request to SET any other settable font information for the subject font.
c) Upon the activation of another message using the subject font, the subject fontStatus object shall remain in the 'inUse' state.
d) Upon the successful activation of another message that does not use the subject font, the subject fontStatus object shall change to the 'readyForUse' state.

4.3.1.8 Permanent State

When in the permanent state, the following rules shall apply to the subject font:

a) The DMS shall return a badValue error for any request to SET the subject fontStatus object.
b) The DMS shall return a genErr error for any request to SET any other settable font information for the subject font.
c) The DMS shall allow the font to be used in a message being activated.
d) Upon the successful activation of a message using the font, the fontStatus shall remain 'permanent'.
e) Upon successful activation of a message that does not use the font, the fontStatus shall remain 'permanent'.

4.3.1.9 Unmanaged State

The 'unmanaged' state has been developed to allow for backwards compatibiity allowing a management system to manage both Version 1 and Version 2 signs. When in the 'unmanaged' state, the following rules shall apply to the subject font:

a) The DMS shall allow the management station to SET the subject fontStatus object to 'notUsedReq', 'modifyReq', or 'unmanagedReq'.
b) The DMS shall return a badValue error for a request to SET the subject fontStatus object to any other value.
c) When requesting to SET any other settable font information for the subject font, the DMS is assumed to be a Version 1 sign and to react accordingly, i.e., manufacturer-specific.
d) When requesting to activate a message using this font, the DMS is assumed to be a Version 1 sign and to react accordingly, i.e., manufacturer-specific.

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4.3.1.10 Other Restrictions

The DMS shall return a genErr to any SET request containing a fontStatus object for a subject font and any other settable font information for the subject font.

The DMS shall not impose any restrictions on the operations of a subject font based on the status of any other font supported by the DMS (e.g., Font 1 shall not be disabled because Font 2 is being modified).

The contents of the fontVersionID object shall only be considered valid when the fontStatus is readyForUse, inUse, permanent, or unmanaged (i.e., DMS is assumed to be a Version 1 sign).

> Note: Modifying a font that is associated with a permanent message should be performed with extreme caution to prevent undesirable results.

4.3.1.11 Backwards Compatibility

If a sign supports only Version 1, then the fontStatus object will not exist, and this will be equivalent to fontStatus being set to unmanaged (9). If a font is in the 'unmanaged' state, fonts will be modified exactly as before in Version 1, and it will not be possible for a font to have a 'permanent' state.

> Note: DMS conforming to NTCIP 1203:1997 or its Amendment 1 do not support the fontStatus state machine. Further, the exact time at which the fontVersionID is calculated in such devices is not formally defined, but as the correct value was required upon any poll, most manufacturers updated the fontVersionID upon each change to either the font or the character table.

4.3.2 Graphic State Machine Definition

The DMS shall allow a management station to monitor the current state of each graphic through the dmsGraphicStatus object. Figure 8 depicts the state transition diagram for a graphic; the detailed rules associated with this diagram follow.

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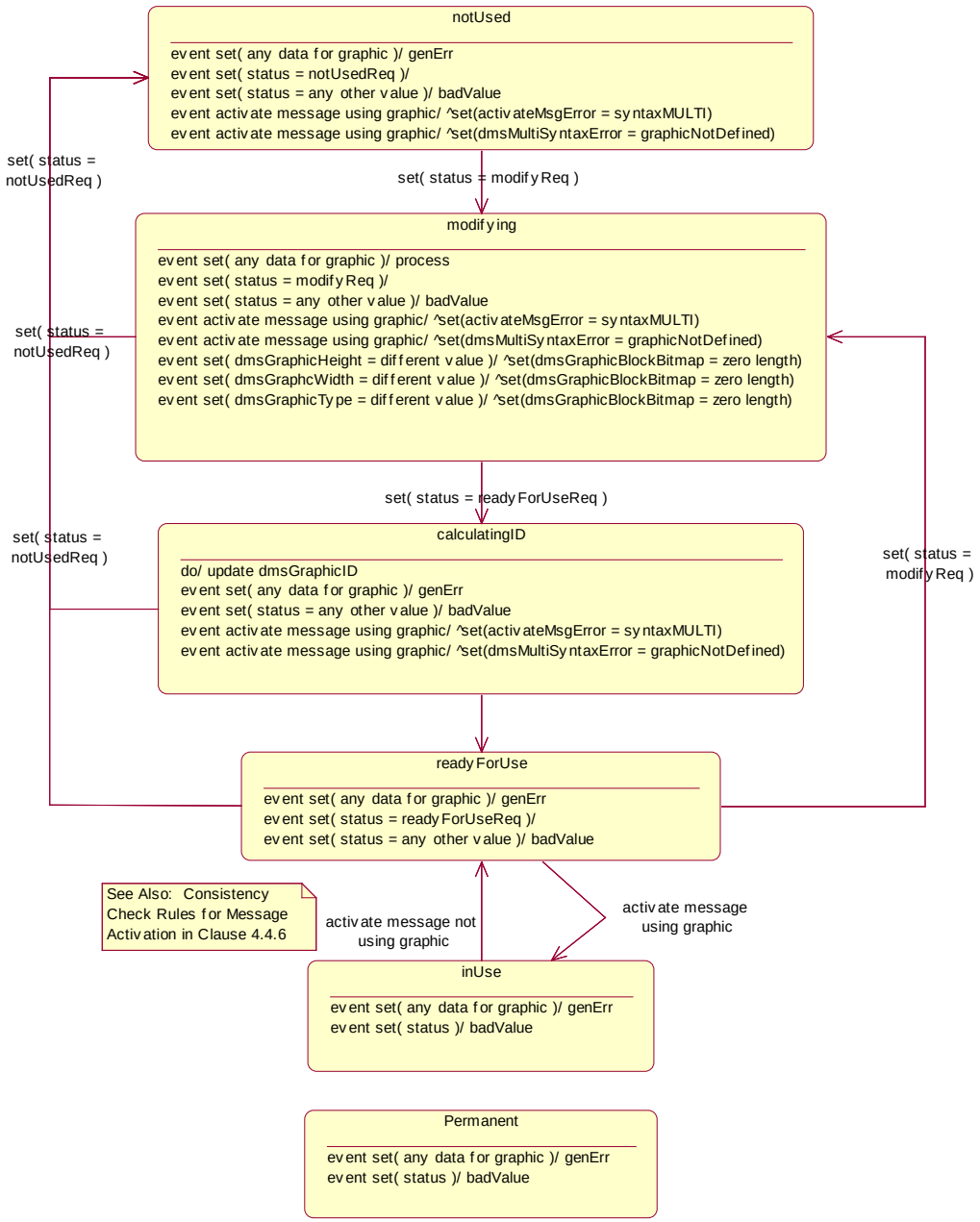

Figure 8 Graphic State Machine

4.3.2.1 Not Used State

When in the notUsed state, the following rules shall apply to the subject graphic:

a) The DMS shall allow the management station to SET the subject dmsGraphicStatus object to 'notUsedReq' or 'modifyReq'.
b) The DMS shall return a badValue error for a request to SET the subject dmsGraphicStatus object to any other value.
c) The DMS shall return a genErr error for any request to SET any other settable graphic information for the subject graphic.
d) The DMS shall reject any attempt (internal event or external request) to activate a message using the

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subject graphic and shall change the dmsActivateMsgError object to a value of 'syntaxMULTI' and change the dmsMultiSyntaxError object to a value of 'graphicNotDefined'.

4.3.2.2 Modifying State

When in the modifying state, the following rules shall apply to the subject graphic:

a) The DMS shall allow the management station to SET the subject dmsGraphicStatus object to 'notUsedReq', 'modifyReq', or 'readyForUseReq'.
b) If the management station SETs the dmsGraphicStatus to 'readyForUseReq', the DMS shall automatically update the value of dmsGraphicID prior to setting the state to 'readyForUse'.
c) The DMS shall return a badValue error for a request to SET the subject dmsGraphicStatus object to any other value.
d) The DMS shall allow a management station to SET any other settable graphic information for the subject graphic.
e) The DMS shall reject any attempt (internal event or external request) to activate a message using the subject graphic and shall change the dmsActivateMsgError object to a value of 'syntaxMULTI' and change the dmsMultiSyntaxError object to a value of 'graphicNotDefined'.
f) If the management station SETs the graphicHeight, graphicWidth, or graphicType to a different value, the corresponding dmsGraphicBlockBitmap objects shall be set to zero length.

4.3.2.3 Calculating ID State

When in the calculatingID state, the following rules shall apply to the subject graphic:

a) The DMS shall update the dmsGraphicID and then transition to the readyForUse state.
b) The DMS shall allow the management station to SET the subject dmsGraphicStatus object to 'notUsedReq'.
c) The DMS shall return a badValue error for a request to SET the subject dmsGraphicStatus object to any other value.
d) The DMS shall return a genErr error for any request to SET any other settable information for the subject graphic.
e) The DMS shall reject any attempt (internal event or external request) to activate a message using the subject graphic and shall change the dmsActivateMsgError object to a value of 'syntaxMULTI' and change the dmsMultiSyntaxError object to a value of 'graphicNotDefined'.

4.3.2.4 Ready for Use State

When in the readyForUse state, the following rules shall apply to the subject graphic:

a) The DMS shall allow the management station to SET the subject dmsGraphicStatus object to 'notUsedReq', 'modifyReq', or 'readyForUseReq'.
b) The DMS shall return a badValue error for a request to SET the subject dmsGraphicStatus object to any other value.
c) The DMS shall return a genErr error for any request to SET any other settable graphic information for the subject graphic.
d) The DMS shall allow the graphic to be used in a message being activated.
e) Upon the successful activation of a message using the graphic, the dmsGraphicStatus shall change to 'inUse'.

4.3.2.5 In Use State

When in the inUse state, the following rules shall apply to the subject graphic:

a) The DMS shall return a badValue error for a request to SET the subject dmsGraphicStatus object.
b) The DMS shall return a genErr error for any request to SET any other settable graphic information for the subject graphic.
c) Upon the activation of another message using the subject graphic, the dmsGraphicStatus shall remain in the 'inUse' state.
d) Upon the successful activation of another message that does not use the subject graphic, the

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dmsGraphicStatus shall change to the ‘readyForUse’ state.

4.3.2.6 Permanent State

When in the permanent state, the following rules shall apply to the subject graphic:

a) The DMS shall return a badValue error for any request to SET the subject dmsGraphicStatus object.
b) The DMS shall return a genErr error for any request to SET any other 'settable' graphic information for the subject graphic.
c) The DMS shall allow the graphic to be used in a message being activated.
d) Upon the successful activation of a message using the graphic, the dmsGraphicStatus shall remain 'permanent'.
e) Upon successful activation of a message that does not use the graphic, the dmsGraphicStatus shall remain 'permanent'.

4.3.2.7 Other Restrictions

The DMS shall return a genErr to any SET request containing a dmsGraphicStatus object for a subject graphic and any other settable graphic information for the subject font.

The DMS shall not impose any restrictions on the operations of a subject graphic based on the status of any other graphic supported by the DMS. (e.g., Graphic 1 shall not be disabled because Graphic 2 is being modified).

The contents of the dmsGraphicID object shall only be considered valid when the dmsGraphicStatus is readyForUse, inUse, or permanent.

> Note: Modifying a graphic that is associated with a permanent message should be performed with extreme caution to prevent undesirable results.
>
> Note: DMS conforming to NTCIP 1203:1997 or its Amendment 1 do not support the graphic feature.

4.3.3 Control Mode State Machine Definition

See Figure 9.

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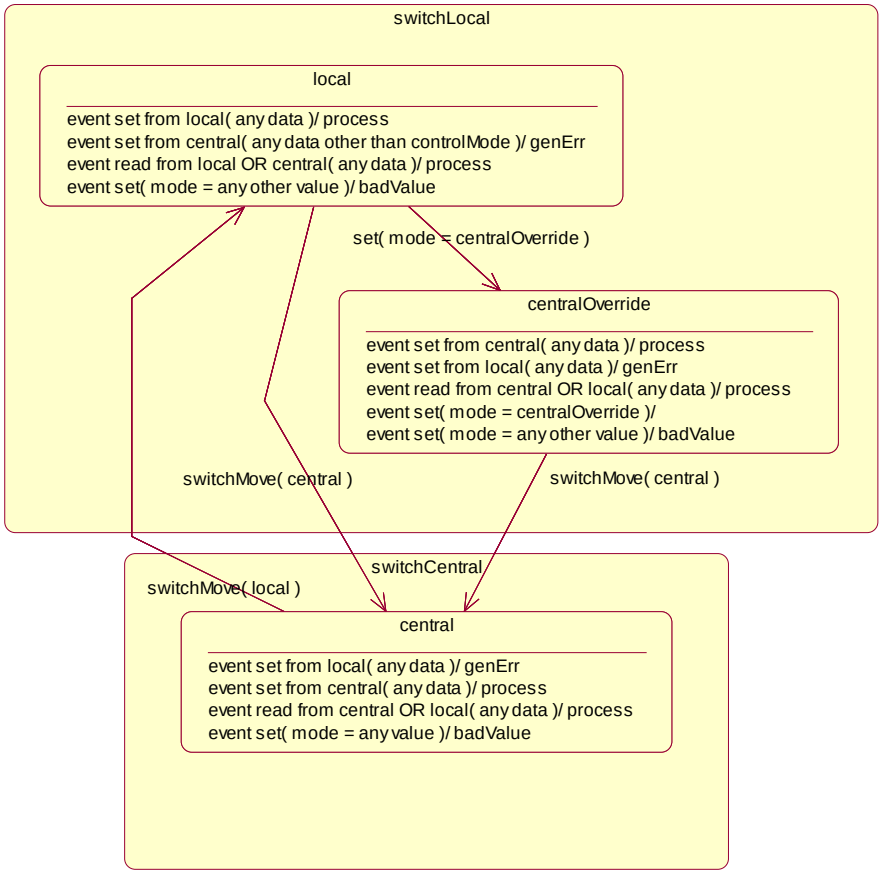

Figure 9 Control Mode State Machine

4.3.3.1 Central Mode

When in the 'central' mode, the following rules shall apply to the DMS:

a) If the Local Control Switch is switched to the 'switchLocal' state, the DMS controlMode shall transfer to the 'local' state.
b) The DMS shall return a badValue error for a request to SET the controlMode to any value.
c) The DMS shall allow a management station to GET any information stored in the DMS.
d) The DMS shall process any SET request from a management station connected via a central port.
e) The DMS shall return a 'genErr' error for any SET request from a management station connected via a local port. If the request included a SET on dmsActivateMessage.0, the DMS shall also update the value of dmsActivateMsgError to 'centralMode', shall update the value of dmsActivateErrorMsgCode to the message code sent in the request, and update the value of dmsMultiSyntaxError to 'none'.

4.3.3.2 Local Mode

When in the 'local' mode, the following rules shall apply to the DMS:

a) If the Local Control Switch is switched to the 'switchCentral' state, the DMS controlMode shall transfer to the 'central' state.
b) The DMS shall allow a management station (either local or central) to SET the controlMode to 'centralOverride'.
c) The DMS shall return a badValue error for a request to SET the controlMode to any other value.
d) The DMS shall allow a management station to GET any information stored in the DMS.

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e) The DMS shall process any SET request from a management station connected via a 'local' port.
f) The DMS shall return a genErr error for any SET request from a management station connected via a 'central' port, except for SETting controlMode to 'centralOverride'. If the request included a SET on dmsActivateMessage.0, the DMS shall also update the value of dmsActivateMsgError to 'localMode', shall update the value of dmsActivateErrorMsgCode to the message code sent in the request, and update the value of dmsMultiSyntaxError to 'none'.

4.3.3.3 Central Override Mode

When in the 'centralOverride' mode, the following rules shall apply to the DMS:

a) If the Local Control Switch is switched to the 'switchCentral' state, the DMS controlMode shall transfer to the 'central' state.
b) The DMS shall allow a management station connected through a 'central' port to SET the controlMode to 'centralOverride'.
c) The DMS shall return a badValue error for a request to SET the controlMode to any other value.
d) The DMS shall allow a management station to GET any information stored in the DMS.
e) The DMS shall process any SET request from a management station connected via a central port.
f) The DMS shall return a genErr error for any SET request from a management station connected via a local port. If the request included a SET on dmsActivateMessage.0, the DMS shall also update the value of dmsActivateMsgError to 'centralOverrideMode', shall update the value of dmsActivateErrorMsgCode to the message code sent in the request, and update the value of dmsMultiSyntaxError to 'none'.

4.3.3.4 Other Restrictions

The DMS shall return a genErr to any SET request containing the controlMode object and any other data.

4.3.4 Message Table State Machine Definition

See Figure 10.

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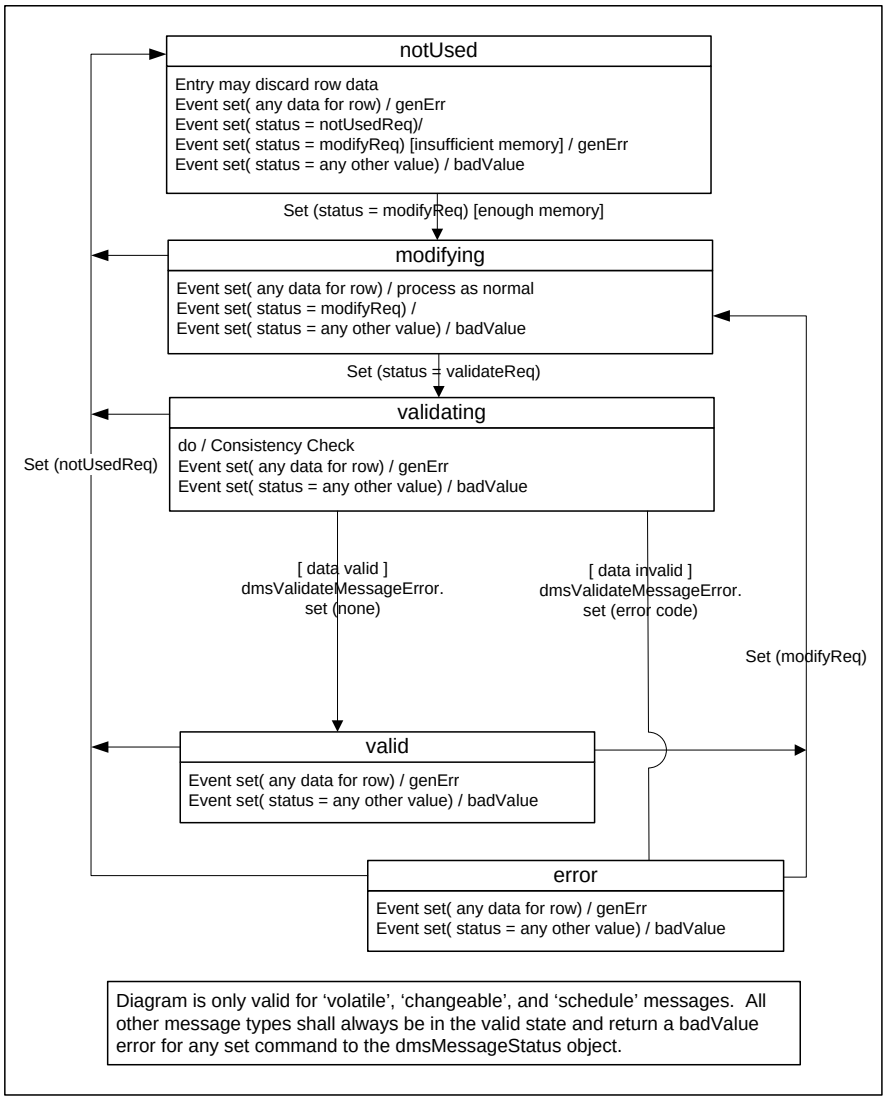

Figure 10 Message Table State Machine

Note: See Consistency Check rules in Section 4.3.5.

4.3.4.1 Not Used State

When in the 'notUsed' state, the following rules shall apply to the subject message:

a) Upon entry into this state, the DMS may discard any data for the message.
b) The DMS shall allow the management station to SET the subject dmsMessageStatus object to 'notUsedReq'.
c) If the management station attempts to SET the the subject dmsMessageStatus object to 'modifyReq', the DMS shall ensure that there is sufficient memory to store at least a minimal message. If the check indicates that there is sufficient memory, the state shall transfer to the 'modifying' state; otherwise it shall remain in the 'notUsed' state and the DMS shall respond with a genErr.
d) The DMS shall return a badValue error for a request to SET the subject dmsMessageStatus object to any other value.
e) The DMS shall return a genErr error for any request to SET any other settable message information for the subject message.

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4.3.4.2 Modifying State

When in the 'modifying' state, the following rules shall apply to the subject message:

a) The DMS shall allow the management station to SET the subject dmsMessageStatus object to 'notUsedReq', 'modifyReq', or 'validateReq'.
b) The DMS shall return a badValue error for a request to SET the subject dmsMessageStatus object to any other value.
c) The DMS shall process any SET request for settable message information for the subject message.

4.3.4.3 Validating State

When in the 'validating' state, the following rules shall apply to the subject message:

a) Upon entry into this state, the DMS shall perform the following consistency check:
    1) If the requested message type is not supported by the sign, the DMS shall return a genErr and shall set the dmsActivateMsgError to 'memoryType'.
    2) If the requested message number is not supported by the sign, the DMS shall return a genErr and shall set the dmsActivateMsgError to messageNumber.
    3) If the object dmsMessageMultiString contains MULTI tags that are not supported by the sign or if the resulting message text (text and/or graphics) could not be displayed on the display panel due excess size, excess length, and/or formatting of the text, the dmsMessageStatus shall automatically transfer to the 'error' state and the DMS shall set the dmsValidateMessageError object to a value of 'syntaxMULTI'. In addition, the DMS shall set proper values for the following objects to the appropriate values: dmsMultiSyntaxError, dmsMultiSyntaxErrorPosition, and dmsMultiOtherErrorDescription.
    4) If object dmsMessageMultiString contains text and/or graphics that can not be supported by the DMS, the DMS shall set the dmsValidateMessageError object to 'syntaxMULTI' and shall set proper values for the dmsMultiSyntaxError, dmsMultiSyntaxErrorPosition, and dmsMultiOtherErrorDescription objects.
    5) If the message is not validated for any other reason, the DMS shall set the dmsValidateMessageError object to 'other'.
    6) Otherwise, the consistency check for this object passes, the dmsMessageStatus shall automatically transfer to the 'valid' state, and the DMS shall: set the dmsValidateMessageError object to 'none', set the dmsMultiSyntaxError object to a value of 'none', and set the dmsMultiSyntaxErrorPosition object to a value of zero (0).
b) The DMS shall allow the management station to SET the subject dmsMessageStatus object to 'notUsedReq'. Upon the receipt of such a request, the DMS shall terminate the validation process and transfer to the 'notUsed' state.
c) The DMS shall return a badValue error for a request to SET the subject dmsMessageStatus object to any other value.
d) The DMS shall return a genErr error for any request to SET any other settable message information for the subject message.

4.3.4.4 Valid State

When in the 'valid' state, the following rules shall apply to the subject message:

a) The DMS shall allow the management station to SET the subject dmsMessageStatus object to 'notUsedReq' or 'modifyReq'.
b) The DMS shall return a badValue error for a request to SET the subject dmsMessageStatus object to any other value.
c) The DMS shall return a genErr error for any request to SET any other settable message information for the subject message.

4.3.4.5 Error State

When in the 'error' state, the following rules shall apply to the subject message:

a) The DMS shall allow the management station to SET the subject dmsMessageStatus object to

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'notUsedReq' or 'modifyReq'.
b) The DMS shall return a badValue error for a request to SET the subject dmsMessageStatus object to any other value.
c) The DMS shall return a genErr error for any request to SET any other settable message information for the subject message.

4.3.4.6 Other Restrictions

The DMS shall return a genErr to any SET request containing a dmsMessageStatus object for a subject message and any other settable message information for the subject message.

The DMS shall not impose any restrictions on the operations of a subject message based on the status of any other message supported by the DMS.

The contents of the dmsMessageCRC object shall only be considered valid when the dmsMessageStatus is 'valid'.

4.3.5 Message Activation Consistency Check Definition

Whenever a message activation is attempted, whether by a management station SETting the dmsActivateMessage.0 object or via an internal message activation attempt (e.g., end duration, trigger event, etc), the DMS shall perform the following consistency checks, in order. If the message activation attempt was due to a management station SETting the dmsActivateMessage.0 object, the DMS shall return the response as indicated (otherwise there is no response message to be sent):

a) If the request is valid and received from a 'central' communications port, and the object dmsControlMode has a value of 'local', the DMS shall return a genErr and shall set the dmsActivateMsgError to 'localMode'.
b) If the request is valid and received from a 'local' communications port, and the object dmsControlMode has a value of 'central', the DMS shall return a genErr and shall set the dmsActivateMsgError to 'centralMode'.
c) If the request is valid and received from a 'local' communications port, and the object dmsControlMode has a value of 'centralOverride', the DMS shall return a genErr and shall set the dmsActivateMsgError to 'centralOverrideMode'.
d) If the requested message type is not supported by the sign, the DMS shall return a genErr and shall set the dmsActivateMsgError to 'memoryType'.
e) If the requested message number is not supported by the sign, the DMS shall return a genErr and shall set the dmsActivateMsgError to messageNumber.
f) If the requested message is supported by the sign but is not currently in the valid state, the DMS shall return a genErr and shall set the dmsActivateMsgError to messageStatus.
g) If the requested message is in the valid state but has a different CRC value than indicated in the set request, the DMS shall return a genErr and shall set the dmsActivateMsgError to messageCRC.
h) If the request is valid, but has insufficient priority to override the current message, the DMS shall return a genErr and shall set the dmsActivateMsgError to priority.
i) If the request is valid and has sufficient priority to override the current message, but cannot be displayed due to some error in presenting the MultiString on the display panel, the DMS shall return a genErr and shall set the dmsActivateMsgError to 'syntaxMULTI'. In addition, the DMS shall set proper values for the dmsMultiSyntaxError, dmsMultiSyntaxErrorPosition, dmsMultiOtherErrorDescription, and dmsActivationErrorMsgCode objects.
j) If the request does not result in activating the requested message for any other reason, the DMS shall return a genErr and shall set the dmsActivateMsgError to 'other'.
k) Otherwise, the consistency check for this object passes and the DMS shall set the dmsActivateMsgError to 'none'.

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Section 5
Management Information Base (MIB) [Normative]

Section 5 defines those objects which are expected to be used by dynamic message signs (DMS). The objects are presented using the OBJECT-TYPE macro as specified in RFC 1212 and NTCIP 8004. The text provided from Section 5.1 through the end of the section (except the section headings) constitutes the NTCIP1203-2005 MIB.

The sections below generally present the objects in lexigraphical order of their OBJECT IDENTIFIERS which correspond to their physical location within the global naming tree. Most of the objects defined in this document reside under the “dms” node of the global naming tree. To aid in object management, the “dms” node has been subdivided into logical categories, each defined by a node under the “dms” node. The individual objects are then located under the appropriate node.

Conformance requirements for any object are determined by the use of the Requirements Traceability Matrix (RTM) in Annex A. To support any defined Requirement, an implementation shall support all objects to which the Requirement traces in the RTM. The value of the STATUS field for every object in the MIB is "mandatory", and indicates that it is mandatory if any associated Requirement is selected.

For all bitmapped objects, if a bit is zero (0), then the referenced function is disabled or not supported, and if a bit is one (1), then the referenced function is enabled or supported.

The full standardized range of all objects defined within NTCIP 1203 v03 shall be supported, except as otherwise noted. This MIB is managed by the NTCIP DMS Working Group and proprietary features should be defined through vendor-specific nodes in vendor-specific extensions to this MIB. All values not explicitly defined (e.g., enumerated values not listed, bits not defined, etc.) are reserved for future use by the DMS Working Group.

A computer readable format of this information, called a Management Information Base, is available from NEMA (ntcip@nema.org). The MIB has been verified using SMICng Version 2.2.07 (Book).

Previous versions of NTCIP 1203 v03 defined data elements that have been replaced to resolve ambiguities; however, central systems may need to interoperate with older equipment and support such data elements. Annex D documents the reason that the WG decided to deprecate the various objects.

5.1 Object Definitions

```
--*****************************************************************************
-- Filename:    1203v0305.MIB
-- Source:
-- Description: This MIB defines the object definitions for dynamic
--              message signs (DMS)
-- MIB Revision History:
-- 03/31/97     NEMA TS 3.6 approved
-- 12/01/99     Changed filename to 1203 (from NEMA TS 3.6)
-- 07/03/01     Amendment 1 approved
-- 11/30/06     Changed filename and updated copyright years
--              Modified header format and wording of copyright and MIB
--              Distribution Notice
--              Incorporated NTCIP 8004 format
-- 9/30/2014    Published NTCIP 1203 v03.05 with revisions
--
```

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--
*******************************************************************************

NTCIP1203 v03.05 DEFINITIONS ::= BEGIN
```

```
IMPORTS
  IpAddress, Counter
      FROM RFC1155-SMI
  OBJECT-TYPE
      FROM RFC-1212
  DisplayString
      FROM RFC1213-MIB
  OwnerString, dms
-- Deleted displayString to reference from RFC 1213
-- and modified references to dms and OerString
FROM NTCIP8004 v02;


MessageIDCode ::= OCTET STRING (SIZE(5))
-- The MessageIDCode consists of those parameters required to define a
-- message within a dmsMessageTable. It is defined as an OCTET STRING
-- containing the OER-encoding of the following ASN.1 structure

-- MessageIDCodeStructure ::= SEQUENCE
-- {
-- messageMemoryType INTEGER (0..255),
-- messageNumber      INTEGER (0..65535),
-- messageCRC         OCTET STRING (SIZE (2))
-- }



MessageActivationCode ::= OCTET STRING (SIZE(12))
-- The MessageActivationCode consists of those parameters required to
-- activate a message on a DMS. It is defined as an OCTET STRING
-- containing the OER-encoding of the following ASN.1 structure.

-- MessageActivationCodeStructure ::= SEQUENCE
-- {
-- duration            INTEGER (0..65535),
-- activatePriority    INTEGER (0..255),
-- messageMemoryType   INTEGER (0..255),
-- messageNumber       INTEGER (0..65535),
-- messageCRC          OCTET STRING (SIZE (2)),
-- sourceAddress       OCTET STRING (SIZE (4))
-- }

-- duration (16 bits) shall indicate the maximum amount of time, in
-- minutes, the message may be displayed prior to activating the
-- dmsDefaultEndDurationMessage. dmsMessageTimeRemaining shall be set to
-- this value upon successful display of the indicated message. A
-- value of 65535 shall indicate an infinite duration.
--
-- activatePriority (8 bits) shall indicate the Activation Priority of
-- the message. If this value is greater than or equal to the
-- dmsMessageRunTimePriority of the currently displayed message, the new
-- message shall be displayed unless errors are detected.
--
-- messageMemoryType (8 bits) shall indicate the dmsMessageMemoryType of
-- the desired message.
--
-- messageNumber (16 bits) shall indicate the dmsMessageNumber of the
```

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```
-- desired message.
--
-- messageCRC (16 bits) shall indicate the dmsMessageCRC of the
-- desired message.
--
-- sourceAddress (32 bits) shall indicate the 4-byte IP address of the
-- device which requested the activation.
--
-- For example, given the MULTI string '[jp3]TEST [fl]Flashing[/fl]',
-- stored in volatile memory slot 5 with no beacons and no pixel
-- service, the message ID Code is '04 00 05 95 F9'. If this message
-- is to be displayed for 267 minutes with activation priority 55 from
-- IP address 103.8.9.10, the message Activation Code is
-- '01 0B 37 04 00 05 95 F9 67 08 09 0A'.

--
-- The dmsActivateMsgError object shall be used to indicate the success
-- or failure of activating any message requested by an object with a SYNTAX
-- of MessageActivationCode.

-- Three special conditions exist with the MessageActivationCode and
-- MessageIDCode structures. The first condition is related to blanking
-- the sign. A blank sign is activated by setting the messageMemoryType
-- to 'blank' and the messageNumber to the desired run time priority.
-- Note that these are actual entries into the message table, but there are
-- only 255 blank messages (because there are only 255 priority levels)
-- and therefore the high-order byte of the messageNumber field shall
-- always be 0x00. Further, to minimize errors in attempting to blank the
-- sign, the messageCRC for all blank messages shall be 0x0000.
--
-- The second condition is related to operating the scheduler. The scheduler
-- is activated in a fashion similar to other messages. The
-- dmsMessageMemoryType is set to 'schedule' (value of 6), the messageNumber
-- is set to '1', and the messageCRC is set to 0x0000. The schedule has a
-- run-time priority, as defined by dmsRunTimePriority.6.1, that overrides
-- the run-time priority of the called message. Thus, the run-time priority
-- is constant for all scheduled messages, and the central system can set
-- this priority by modifying the value of dmsRunTimePriority.6.1. If an
-- invalid message code is received, the sign continues operations as
-- if the code was not received, after the correct response is transmitted.
--
-- The third special condition pertains to selecting the currently displayed
-- message. This condition is only valid for the 'MessageIDCode' SYNTAX, not
-- for the 'MessageActivationCode' SYNTAX. Specifying the currentBuffer.5.1
-- within the messageMemoryType and messageNumber fields of the
-- 'MessageIDCode' SYNTAX is used within default messages such as
-- dmsShortPowerRecoveryMessage. This allows a message that was running
-- prior to a power loss to run after the power loss without changing the
-- contents of dmsShortPowerRecoveryMessage every time the activateMessage
-- is changed. The messageCRC field of the default messages (such as
-- dmsShortPowerRecoveryMessage) shall be 0x0000, when the messageMemoryType
-- field has a value of 'currentBuffer'.
```

5.2 Sign Configuration and Capability Objects

```
dmsSignCfg  OBJECT IDENTIFIER ::= { dms 1 }

-- This node is an identifier used to group all objects for DMS sign
```

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```
-- configurations that are common to all DMS devices.
```

5.2.1 Sign Access Parameter

```
dmsSignAccess  OBJECT-TYPE
SYNTAX  INTEGER (0..255)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the access method to the sign. Methods that are
defined are:
<Format>
  Bit 0- Other
  Bit 1- Walk-in access
  Bit 2- Rear access
  Bit 3- Front access
If a bit is set to one (1), then the associated feature exists; if the bit is
set to zero (0), then the associated feature does not exist.

<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.1.1"
::= { dmsSignCfg 1 }
```

5.2.2 Sign Type Parameter

```
dmsSignType  OBJECT-TYPE
SYNTAX  INTEGER{
                other (1),
                bos (2),
                cms (3),
                vmsChar (4),
                vmsLine (5),
                vmsFull (6),
                portableOther (129),
                portableBOS (130),
                portableCMS (131),
                portableVMSChar (132),
                portableVMSLine (133),
                portableVMSFull (134)}
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the type of sign. The descriptions are:
  other:  Device not specified through any other definition, refer to
     device manual,
  bos: Device is a Blank-Out Sign,
  cms : Device is a Changeable Message Sign,
  vmsChar : Device is a Variable Message Sign with character matrix
     setup,
  vmsLine :  Device is a Variable Message Sign with line matrix setup,
  vmsFull: Device is a Variable Message Sign with full matrix setup.
  Same is true for all portable signs.

<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.1.2"
::= { dmsSignCfg 2 }
```

5.2.3 Sign Height Parameter

```
dmsSignHeight  OBJECT-TYPE
SYNTAX  INTEGER (0..65535)
ACCESS  read-only
```

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```
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the sign height in millimeters including the border
(dmsVerticalBorder).
<Unit>millimeter
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.1.3"
::= { dmsSignCfg 3 }
```

5.2.4 Sign Width Parameter

```
dmsSignWidth  OBJECT-TYPE
SYNTAX  INTEGER (0..65535)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the sign width in millimeters including the border
(dmsHorizontalBorder).
<Unit>millimeter
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.1.4"
::= { dmsSignCfg 4 }
```

5.2.5 Horizontal Border Parameter

```
dmsHorizontalBorder  OBJECT-TYPE
SYNTAX  INTEGER (0..65535)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the minimum border distance, in millimeters, that
exists on the left and right sides of the sign.
<Unit>millimeter
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.1.5"
::= { dmsSignCfg 5 }
```

5.2.6 Vertical Border Parameter

```
dmsVerticalBorder  OBJECT-TYPE
SYNTAX  INTEGER (0..65535)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the minimum border distance, in millimeters, that
exists on the top and bottom of the sign.
<Unit>millimeter
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.1.6"
::= { dmsSignCfg 6 }
```

5.2.7 Legend Parameter

```
dmsLegend  OBJECT-TYPE
SYNTAX  INTEGER {
                --other (1), -retired
                noLegend (2),
                legendExists (3)}
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates if a Legend is shown on the sign.

<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.1.7"
::= { dmsSignCfg 7 }
```

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```
-- In v02, the enumerated value of 'other' is RETIRED to improve
-- interoperability.
```

5.2.8 Beacon Type Parameter

```
dmsBeaconType  OBJECT-TYPE
SYNTAX  INTEGER {
                 other (1),
                 none (2),
                 oneBeacon (3),
                 twoBeaconSyncFlash (4),
                 twoBeaconsOppFlash (5),
                 fourBeaconSyncFlash (6),
                 fourBeaconAltRowFlash (7),
                 fourBeaconAltColumnFlash (8),
                 fourBeaconAltDiagonalFlash (9),
                 fourBeaconNoSyncFlash (10),
                 oneBeaconStrobe (11),
                 twoBeaconStrobe (12),
                 fourBeaconStrobe (13)}
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the configuration of the type, numbers and flashing
patterns of beacons on a sign. The definitions are:
  other: other types, numbers and patterns of beacons attached to the
     sign display.
  none: no beacons attached to the sign display
  oneBeacon: one flashing beacon
  twoBeaconSyncFlash: two beacons, synchronized flashing
  twoBeaconsOppFlash: two beacons, opposing flashing
  fourBeaconSyncFlash:  four beacons, synchronized flashing
  fourBeaconAltRowFlash: four beacons, alternate row flashing
  fourBeaconAltColumnFlash: four beacons, alternate column flashing
  fourBeaconAltDiagonalFlash: four beacons, alternate diagonal
     flashing
  fourBeaconNoSyncFlash: four beacons, no synchronized flashing
  oneBeaconStrobe: one beacon, strobe light
  twoBeaconStrobe: two beacons, strobe light
  fourBeaconStrobe: four beacons, strobe light

<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.1.8"
::= { dmsSignCfg 8 }
```

5.2.9 Sign Technology Parameter

```
dmsSignTechnology  OBJECT-TYPE
SYNTAX  INTEGER (0..65535)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the utilized technology in a bitmap format  (Hybrids
will have to set the bits for all technologies that the sign utilizes).
<Format>
  Bit 0- Other,
  Bit 1- LED,
  Bit 2- Flip Disk,
  Bit 3- Fiber Optics,
  Bit 4- Shuttered,
```

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```
  Bit 5- Bulb,
  Bit 6- Drum
If a bit is set to one (1), then the associated feature exists; if the bit is
set to zero (0), then the associated feature does not exist.

<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.1.9"
::= { dmsSignCfg 9 }
```

5.3 VMS Configuration Objects

```
vmsCfg  OBJECT IDENTIFIER ::= { dms 2 }

-- This subnode is an identifier used to group all objects for support of
-- VMS sign configurations that are common to all VMS devices.
```

5.3.1 Character Height in Pixels Parameter

```
vmsCharacterHeightPixels  OBJECT-TYPE
SYNTAX  INTEGER (0..255)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the height of a single character in Pixels. The value
zero (0) indicates a variable character height, which implies a full-matrix
sign.
<Unit>pixel
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.2.1"
::= { vmsCfg 1 }
```

5.3.2 Character Width in Pixels Parameter

```
vmsCharacterWidthPixels  OBJECT-TYPE
SYNTAX  INTEGER (0..255)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the width of a single character in Pixels. The value
zero (0) indicates a variable character width, which implies either a full-
matrix or line-matrix sign.
<Unit>pixel
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.2.2"
::= { vmsCfg 2 }
-- A full matrix sign is indicated by a height and width of zero (0). A line
-- matrix sign is indicated by a width of zero (0).
```

5.3.3 Sign Height in Pixels Parameter

```
vmsSignHeightPixels  OBJECT-TYPE
SYNTAX  INTEGER (0..65535)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the number of rows of pixels for the entire sign.
<Unit>pixel
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.2.3"
::= { vmsCfg 3 }
-- To determine the number of lines for a line matrix or character matrix
-- sign, divide the vmsSignHeightPixels object value by the
-- vmsCharacterHeightPixels object value. This should result in a whole
-- number, the number of lines in the sign.
```

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5.3.4 Sign Width in Pixels Parameter

```
vmsSignWidthPixels  OBJECT-TYPE
SYNTAX  INTEGER (0..65535)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the number of columns of pixels for the entire sign.
<Unit>pixel
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.2.4"
::= { vmsCfg 4 }
--To determine the number of characters for a character matrix sign,
-- divide the vmsSignWidthPixels object value by the
-- vmsCharacterWidthPixels object value. This results in the number of
characters per line for the sign.
```

5.3.5 Horizontal Pitch Parameter

```
vmsHorizontalPitch  OBJECT-TYPE
SYNTAX  INTEGER (0..255)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the horizontal distance from the center of one pixel
to the center of the neighboring pixel in millimeters. The horizontal pitch
on a character matrix DMS does not apply to the spacing between characters
but does apply to the distance between pixels within a character.
<Unit>millimeter
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.2.5"
::= { vmsCfg 5 }
```

5.3.6 Vertical Pitch Parameter

```
vmsVerticalPitch  OBJECT-TYPE
SYNTAX  INTEGER (0..255)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the vertical distance from the center of one pixel to
the center of the neighboring pixel in millimeters. The vertical pitch on a
line matrix DMS does not apply to the spacing between lines but does apply to
the distance between pixels within a line. The vertical pitch on a character
matrix DMS does not apply to the spacing between characters but does apply to
the distance between pixels within a character.
<Unit>millimeter
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.2.6"
::= { vmsCfg 6 }
```

5.3.7 Monochrome Color Parameter

```
monochromeColor  OBJECT-TYPE
SYNTAX  OCTET STRING (SIZE (6))
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the color supported by a monochrome sign. If the
'monochrome1Bit' or 'monochrome8Bit' scheme is used, then this object will
contain six octets. The first 3 octets shall, in this order, indicate the
red, green, and blue component values of the color when the pixels are turned
'ON'. The last 3 octets shall, in this order, indicate the red, green, and
blue component values of the color when the pixels are turned 'OFF'. If the
```

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```
sign is a non-monochrome sign, then the value of this object shall be an
octet string of six zeros (0x00 0x00 0x00 0x00 0x00 0x00).
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.2.7"
::= { vmsCfg 7 }
```

5.4 Font Definition Objects

```
fontDefinition  OBJECT IDENTIFIER ::= { dms 3 }

-- This node is an identifier used to group all objects for DMS font
-- configurations that are common to DMS devices.
```

5.4.1 Number of Fonts Parameter

```
numFonts  OBJECT-TYPE
SYNTAX  INTEGER (0..255)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the maximum number of fonts that the sign can store.
See the Specification in association with the supplemental requirements for
fonts to determine the number of fonts that the DMS must support.
<Unit>font
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.3.1"
::= { fontDefinition 1 }
```

5.4.2 Font Table Parameter

```
fontTable  OBJECT-TYPE
SYNTAX  SEQUENCE OF FontEntry
ACCESS  not-accessible
STATUS  mandatory
DESCRIPTION "
<Definition> A table containing the information needed to configure/define a
particular font. Changing an object in a font or character table while the
font is used by a displayed message yields unpredictable results.
--Note: The DMS WG recognizes that the message display on the sign could be
--unpredictable during the download of a font when using the unmanaged state
--(V1 compatibility). Those specifying authorities
--or application developers who are sensitive to this issue can blank the
--display during a font download.
<Table Type> static
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.3.2"
::= {fontDefinition 2}

fontEntry OBJECT-TYPE
SYNTAX  FontEntry
ACCESS  not-accessible
STATUS  mandatory
DESCRIPTION "<Definition>Parameters of the Font Table.
"
INDEX {fontIndex}
::= {fontTable 1}

FontEntry ::= SEQUENCE{
   fontIndex       INTEGER,
   fontNumber      INTEGER,
   fontName        DisplayString,
   fontHeight      INTEGER,
   fontCharSpacing INTEGER,
```

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```
   fontLineSpacing INTEGER,
   fontVersionID   INTEGER,
   fontStatus      INTEGER
   }
```

5.4.2.1 Font Index Parameter

```
fontIndex  OBJECT-TYPE
SYNTAX  INTEGER (1..255)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the row number of the entry.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.3.2.1.1"
::= { fontEntry 1 }
```

5.4.2.2 Font Number Parameter

```
fontNumber  OBJECT-TYPE
SYNTAX  INTEGER (1..255)
ACCESS  read-write
STATUS  mandatory
DESCRIPTION
"<Definition> A unique, user-specified number for a particular font which can
be different from the value of the fontIndex-object. This is the number
referenced by MULTI when specifying a particular font.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.3.2.1.2"
::= { fontEntry 2 }
```

5.4.2.3 Font Name Parameter

```
fontName  OBJECT-TYPE
SYNTAX  DisplayString (SIZE (0..64))
ACCESS  read-write
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the name of the font.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.3.2.1.3"
::= { fontEntry 3 }
```

5.4.2.4 Font Height Parameter

```
fontHeight  OBJECT-TYPE
SYNTAX  INTEGER (0..255)
ACCESS  read-write
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the height of the font in pixels. Changing the value
of this object invalidates this fontTable row, sets all corresponding
characterWidth objects to zero (0), and sets all corresponding
characterBitmap objects to zero length. Character Matrix and Line Matrix VMS
shall subrange this object either to a value of zero (0) or the value of
vmsCharacterHeightPixels; a Full Matrix VMS shall subrange this object to the
range of zero (0) to the value of vmsSignHeightPixels or 255, whichever is
less.
<Unit>pixel
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.3.2.1.4"
::= { fontEntry 4 }
```

5.4.2.5 Font Character Spacing Parameter

```
fontCharSpacing  OBJECT-TYPE
```

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```
SYNTAX  INTEGER (0..255)
ACCESS  read-write
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the default horizontal spacing (in pixels) between
each of the characters within the font.  If the font changes on a line, then
the average character spacing of the two fonts, rounded up to the nearest
whole pixel, shall be used between the two characters where the font changes.
Character Matrix VMS shall ignore the value of this object; Line Matrix and
Full Matrix VMS shall subrange this object to the range of zero (0) to the
smaller of 255 or the value of vmsSignWidthPixels.
See also the MULTI tag 'spacing character [sc]'.
<Unit>pixel
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.3.2.1.5"
::= { fontEntry 5 }
```

5.4.2.6 Font Line Spacing Parameter

```
fontLineSpacing  OBJECT-TYPE
SYNTAX  INTEGER (0..255)
ACCESS  read-write
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the default vertical spacing (in pixels) between each
of the lines within the font for Full Matrix VMS. The line spacing for a line
is the largest font line spacing of all fonts used on that line. The number
of pixels between adjacent lines is the average of the 2 line spacings of
each line, rounded up to the nearest whole pixel. Character Matrix VMS and
Line Matrix VMS shall ignore the value of this object; Full Matrix VMS shall
subrange this object to the range of zero (0) to the smaller of 255 or the
value of vmsSignHeightPixels.
See also the MULTI tag 'new line [nl]'.
<Unit>pixel
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.3.2.1.6"
::= { fontEntry 6 }
```

5.4.2.7 Font Version ID Parameter

```
fontVersionID  OBJECT-TYPE
SYNTAX  INTEGER (0..65535)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Each font that has been downloaded to a sign shall have a
relatively unique ID. This ID shall be calculated using the CRC-16 algorithm
defined in ISO 3309 and the associated OER-encoded (as defined in NTCIP 1102)
FontVersionByteStream.
The sign shall respond with the version ID value that is valid at the time.

FontVersionByteStream consists of the main font characteristics followed by n
rows of CharacterInfoList, as shown by the following ASN.1 construct:
  FontVersionByteStream ::= SEQUENCE {
        fontInformation    FontInformation,
        characterInfoList  CharacterInfoList }

FontInformation describes the characteristics of the font which are common to
each character and defines the order in which this information appears when
constructing the byte stream which will be used to calculate the CRC. There
is only one row of data for this SEQUENCE for a specific font, as defined by
```

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```
the following ASN.1 construct:
  FontInformation ::= SEQUENCE {
        fontNumber            INTEGER (1..255),
        fontHeight            INTEGER (0..255),
        fontCharSpacing       INTEGER (0..255),
        fontLineSpacing       INTEGER (0..255) }

CharacterInfoList describes the characteristics of each defined character
(e.g., where characterWidth is greater than 0) for the fontNumber indicated
within the fontInformation field. The CharacterInformation is ordered by the
characterNumber in an increasing format per the following ASN.1 construct:
  CharacterInfoList ::=  SEQUENCE OF CharacterInformation

CharacterInformation describes the characteristics of a single character and
defines the objects and order of the objects within one row of
CharacterInfoList, per the following ASN.1 construct:
  CharacterInformation  SEQUENCE {
      characterNumber         INTEGER (1..65535),
      characterWidth          INTEGER (0..255),
      characterBitmap         OCTET STRING }

Complete definitions for these referenced objects are contained elsewhere in
this document.

The following is an example of developing the FontVersionByteStream value.
Assume the following values for this example, where we only have 2 characters
defined:
fontNumber = 2,
fontHeight = 7,
fontCharSpacing = 1,
fontLineSpacing = 3,
characterWidth.52 = 7,
characterBitmap.52 = 1C 59 34 6F E1 83 00,
characterWidth.65 = 6,
characterBitmap.65 = 7B 3C FF CF 3C C0

The resulting string in hex would be:
FontVersionByteStream = 02 07 01 03 01 02 00 34 07 07 1C 59 34 6F E1 83 00 00
41 06 06 7B 3C FF CF 3C C0

CRC = 0x52ED
fontVersionID = 0xED52

Clarifications:
 a) characterNumber is a two-byte unsigned integer.
 b) characterBitmap is defined as OCTET STRING without a size constraint.
(the length octets shall be present)
 c) CharacterInfoList is defined as SEQUENCE-OF that requires a quantity
field (unconstrained unsigned integer) ‘with a value equal to the number of
times the componentType is repeated within the value field’.

The resulting graphic depictions of those 2 defined characters are:
0001110
0010110
0100110
1000110
1111111
```

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```
0000110
0000110

and

011110
110011
110011
111111
110011
110011
110011
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.3.2.1.7"
::= { fontEntry 7 }
```

5.4.2.8 Font Status Parameter

```
fontStatus  OBJECT-TYPE
SYNTAX  INTEGER {
                notUsed (1),
                modifying (2),
                calculatingID (3),
        readyForUse (4),
        inUse (5),
        permanent (6),
        modifyReq (7),
        readyForUseReq (8),
        notUsedReq (9),
        unmanagedReq (10),
        unmanaged (11) }
ACCESS  read-write
STATUS  mandatory
DESCRIPTION
"<Definition> This object defines a state machine allowing to manage fonts
stored within a DMS. The definitions of the possible values are:
notUsed (1) - a state indicating that this row in this table is currently not
used.
modifying (2) - a state indicating that the objects defined in this row can
be modified.
calculatingID (3) - a state indicating that the  fontVersionID for this row
is currently being calculated.
readyForUse (4) - a state indicating that the font defined in this row can be
used  for message display.
inUse (5) - a state indicating that the font defined in this row is currently
being used for the displayed message.
permanent (6) - a state indicating that the font defined in this row is a
permanent font that cannot be modified. This font is provided by the sign
vendor and can be used for message display.
modifyReq (7) -  command sent to request the transition to the modifying
state..
readyForUseReq (8) -  command sent to request the transition to the
readyForUse state.
notUsedReq (9) -  command sent to request the transition to the notUsed
state.
unmanagedReq (10) -  command sent to request the transition to the unmanaged
state.
unmanaged (11) - a state indicating that the font defined in this row is a
font that is not managed using the fontStatus object. This state can be use
```

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```
to manage the font as in NTCIP 1203 v1. Note: attempts to modify permanent
fonts while in this state shall generate SNMP GenErr.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.3.2.1.8"
DEFVAL {unmanaged}
::= { fontEntry 8 }
-- The Default Value of 'unmanaged' needs to be supported by a version 2
-- signs because a version 1 central did not implement the
-- fontStatus object since it was not defined in version 1 (NTCIP 1203:1997).
-- This default value is needed to ensure that a version 1 central can
-- download and upload font definitions a version 2 sign without using
-- this object. The only exceptions are permanent fonts, which must default
-- to a value of 'permanent'.
```

5.4.3 Maximum Characters per Font Parameter

```
maxFontCharacters  OBJECT-TYPE
SYNTAX  INTEGER (1..65535)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the maximum number of rows in the character table
that can exist for any given font.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.3.3"
::= { fontDefinition 3 }
```

5.4.4 Character Table Parameter

```
characterTable  OBJECT-TYPE
SYNTAX      SEQUENCE OF CharacterEntry
ACCESS      not-accessible
STATUS      mandatory
DESCRIPTION "<Definition> A table containing the information needed to
configure/define each character of a particular font.
<Table Type> static
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.3.4"
::= {fontDefinition 4}

characterEntry OBJECT-TYPE
SYNTAX      CharacterEntry
ACCESS      not-accessible
STATUS      mandatory
DESCRIPTION "<Definition> Parameters of the Character Configuration Table.
"
INDEX {fontIndex, characterNumber}
::= {characterTable 1}

CharacterEntry ::= SEQUENCE {
   characterNumber   INTEGER,
   characterWidth    INTEGER,
   characterBitmap   OCTET STRING}
```

5.4.4.1 Character Number Parameter

```
characterNumber  OBJECT-TYPE
SYNTAX  INTEGER (1..65535)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the binary value associated with this character of
this font. For example, if the font set followed the ASCII numbering scheme,
```

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```
the character giving the bitmap of 'A' would be characterNumber 65 (41 hex).
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.3.4.1.1"
::= { characterEntry 1 }
```

5.4.4.2 Character Width Parameter

```
characterWidth  OBJECT-TYPE
SYNTAX  INTEGER (0..255)
ACCESS  read-write
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the width of this character in pixels. A width of
zero (0) indicates this row is invalid. A Character Matrix VMS shall subrange
this object either to a value of zero (0) or the value of the
vmsCharacterWidthPixels object; a Line Matrix or Full Matrix VMS shall
subrange this object to a range of zero (0) to vmsSignWidthPixels.
<Unit>pixel
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.3.4.1.2"
::= { characterEntry 2 }
```

5.4.4.3 Character Bitmap Parameter

```
characterBitmap  OBJECT-TYPE
SYNTAX  OCTET STRING
ACCESS  read-write
STATUS  mandatory
DESCRIPTION
"<Definition> A bitmap that defines each pixel within a rectangular region as
being either displayed in the foreground color (bit=1) or transparent
(bit=0). If the pixel is transparent, it will remain whatever color existed
in the message before drawing the character. This might be the background
color, a color rectangle (see MULTI tag) or a graphic. The result of this
bitmap is how the character appears on the sign.

The octet string is treated as a binary bit string. The most significant bit
defines the state of the pixel in the upper left corner of the rectangular
region. The rectangular region is processed by rows, left to right, then top
to bottom. The size of the rectangular region is defined by the fontHeight
and characterWidth objects; any remaining bits shall be ignored, except for
use in the calculation of the CRC.

This object shall be subranged by the device to the maximum number of bytes
as indicated by fontMaxCharacterSize.

Note: Version 1 Compatibility:  Version 1 of this standard defined the bits
as ON (foreground color) or OFF (background color).

<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.3.4.1.3"
::= { characterEntry 3 }
```

5.4.5 Maximum Character Size Parameter

```
fontMaxCharacterSize  OBJECT-TYPE
SYNTAX  INTEGER (0..65535)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> An indication of the maximum size, in bytes, that the DMS
supports for each character's characterBitmap object.
```

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```
The largest value of this object must be equal or smaller than the total
number of pixels of the sign.
<Unit>byte
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.3.5"
::= { fontDefinition 5 }
```

5.5 Multi-Configuration Objects

```
multiCfg  OBJECT IDENTIFIER ::= { dms 4 }

-- This subnode is an identifier used to group all objects for support of
-- MULTI language configuration such as all default tag values.
```

5.5.1 Default Background Color Parameter

```
defaultBackgroundColor  OBJECT-TYPE
SYNTAX  INTEGER (0..255)
ACCESS  read-write
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the color of the background shown on the sign for the
'colorClassic' scheme (see the dmsColorScheme object). If a different color
scheme is used, a genErr shall be returned. The allowed values are:
  black (0),
  red (1),
  yellow (2),
  green(3),
  cyan (4),
  blue (5),
  magenta (6),
  white (7),
  orange (8),
  amber (9).
Each of the background colors on a sign shall map to one of the colors
listed. If a color is requested that is not supported, then a genErr shall be
returned.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.4.1"
DEFVAL  {0}
::= { multiCfg 1 }
```

5.5.2 Default Foreground Color Parameter

```
defaultForegroundColor  OBJECT-TYPE
SYNTAX  INTEGER (0..255)
ACCESS  read-write
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the color of the foreground (the actual text) shown
on the sign for the 'colorClassic' scheme (see the dmsColorScheme object). If
a different color scheme is used, a genErr shall be returned. The allowed
values are:
  black (0),
  red (1),
  yellow (2),
  green(3),
  cyan (4),
  blue (5),
  magenta (6),
  white (7),
  orange (8),
  amber (9).
```

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```
Each of the colors on a sign should map to one of the colors listed. If a
color is requested that is not supported, then a genErr shall be returned.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.4.2"
::= { multiCfg 2 }
```

5.5.3 Default Flash On Time Parameter

```
defaultFlashOn  OBJECT-TYPE
SYNTAX  INTEGER (0..255)
ACCESS  read-write
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the default flash on time, in tenths of a second, for
flashing text. If the time is set to zero (0), the default is NO FLASHing but
the text remains visible. This object may be sub-ranged by an implementation;
see Section 3.5.2.3.2.3 for more information.
<Unit>tenth of seconds
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.4.3"
DEFVAL  {5}
::= { multiCfg 3 }
```

5.5.4 Default Flash On Time Parameter at Activation

```
defaultFlashOnActivate  OBJECT-TYPE
SYNTAX  INTEGER (0..255)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the value of defaultFlashOn at activation of the
currently active message for the purpose of determining what the value was at
the time of activation. The value shall be created (overwritten) at the time
when the message was copied into the currentBuffer.
<Unit>tenth of seconds
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.4.17"
::= { multiCfg 17 }
```

5.5.5 Default Flash Off Time Parameter

```
defaultFlashOff  OBJECT-TYPE
SYNTAX  INTEGER (0..255)
ACCESS  read-write
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the default flash off time, in tenths of a second,
for flashing text. If the time is set to zero (0), the default is NO FLASHing
but the text remains visible. This object may be sub-ranged by an
implementation; see Section 3.5.2.3.2.3 for more information.
<Unit>tenth of seconds
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.4.4"
DEFVAL  {5}
::= { multiCfg 4 }
```

5.5.6 Default Flash Off Time Parameter at Activation

```
defaultFlashOffActivate  OBJECT-TYPE
SYNTAX  INTEGER (0..255)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the value of defaultFlashOff at activation of the
currently active message for the purpose of determining what the value was at
```

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```
the time of activation. The value shall be created (overwritten) at the time
when the message was copied into the currentBuffer.
<Unit>tenth of seconds
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.4.18"
::= { multiCfg 18 }
```

5.5.7 Default Font Parameter

```
defaultFont  OBJECT-TYPE
SYNTAX  INTEGER (1..255)
ACCESS  read-write
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the default font number (fontNumber-object) for a
message. This object may be sub-ranged by an implementation; see Section
3.5.2.3.2.4 for more information.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.4.5"
DEFVAL  {1}
::= { multiCfg 5 }
```

5.5.8 Default Font Parameter at Activation

```
defaultFontActivate  OBJECT-TYPE
SYNTAX  INTEGER (1..255)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the value of defaultFont at activation of the
currently active message for the purpose of determining what the value was at
the time of activation. The value shall be created (overwritten) at the time
when the message was copied into the currentBuffer.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.4.19"
::= { multiCfg 19 }
```

5.5.9 Default Line Justification Parameter

```
defaultJustificationLine  OBJECT-TYPE
SYNTAX  INTEGER {
                 --other(1), -retired
                 left(2),
                 center(3),
                 right(4),
                 full(5) }
ACCESS  read-write
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the default line justification for a message. This
object may be sub-ranged by an implementation; see Section 3.5.2.3.2.5 for
more information.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.4.6"
DEFVAL  {center}
::= { multiCfg 6 }
-- In v02, the enumerated value of 'other' is RETIRED to improve
-- interoperability.
```

5.5.10 Default Line Justification Parameter at Activation

```
defaultJustificationLineActivate  OBJECT-TYPE
SYNTAX  INTEGER {
                 left(2),
                 center(3),
```

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```
                right(4),
                full(5) }
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the value of defaultJustificationLine at activation
of the currently active message for the purpose of determining what the value
was at the time of activation. The value shall be created (overwritten) at
the time when the message was copied into the currentBuffer.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.4.20"
::= { multiCfg 20 }
```

5.5.11 Default Page Justification Parameter

```
defaultJustificationPage  OBJECT-TYPE
SYNTAX  INTEGER {
                --other(1), -retired
                top(2),
                middle(3),
                bottom(4) }
ACCESS  read-write
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the default page justification for a message. This
object may be sub-ranged by an implementation; see Section 3.5.2.3.2.6 for
more information.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.4.7"
DEFVAL  {middle}
::= { multiCfg 7 }
-- In v02, the enumerated value of 'other' is RETIRED to improve
-- interoperability.
```

5.5.12 Default Page Justification Parameter at Activation

```
defaultJustificationPageActivate  OBJECT-TYPE
SYNTAX  INTEGER {
                top(2),
                middle(3),
                bottom(4) }
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the value of defaultJustificationPage at activation
of the currently active message for the purpose of determining what the value
was at the time of activation. The value shall be created (overwritten) at
the time when the message was copied into the currentBuffer.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.4.21"
::= { multiCfg 21 }
```

5.5.13 Default Page On Time Parameter

```
defaultPageOnTime  OBJECT-TYPE
SYNTAX  INTEGER (1..255)
ACCESS  read-write
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the default page on time, in tenths (1/10) of a
second. If the message is only one page, this value is ignored, and the page
is continuously displayed. This object may be sub-ranged by an
implementation; see Section 3.5.2.3.2.7 for more information.
```

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```
<Unit>tenth of seconds
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.4.8"
DEFVAL  {30}
::= { multiCfg 8 }
```

5.5.14 Default Page On Time Parameter at Activation

```
defaultPageOnTimeActivate  OBJECT-TYPE
SYNTAX  INTEGER (1..255)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the value of defaultPageOnTime at activation of the
currently active message for the purpose of determining what the value was at
the time of activation. The value shall be created (overwritten) at the time
when the message was copied into the currentBuffer.
<Unit>tenth of seconds
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.4.22"
::= { multiCfg 22 }
```

5.5.15 Default Page Off Time Parameter

```
defaultPageOffTime  OBJECT-TYPE
SYNTAX  INTEGER (0..255)
ACCESS  read-write
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the default page off time, in tenths (1/10) of a
second. If the message is only one page, this value is ignored, and the page
is continuously displayed. This object may be sub-ranged by an
implementation; see Section 3.5.2.3.2.7 for more information.
<Unit>tenth of seconds
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.4.9"
DEFVAL  {0}
::= { multiCfg 9 }
```

5.5.16 Default Page Off Time Parameter at Activation

```
defaultPageOffTimeActivate  OBJECT-TYPE
SYNTAX  INTEGER (0..255)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the value of defaultPageOffTime at activation of the
currently active message for the purpose of determining what the value was at
the time of activation. The value shall be created (overwritten) at the time
when the message was copied into the currentBuffer.
<Unit>tenth of seconds
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.4.23"
::= { multiCfg 23 }
```

5.5.17 Default Background Color RGB Parameter

```
defaultBackgroundRGB  OBJECT-TYPE
SYNTAX  OCTET STRING (SIZE (1 | 3))
ACCESS  read-write
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the color of the background shown on the sign if not
changed by the ‘Page Background Color’ MULTI tag or the ‘Color Rectangle’
MULTI tag. The values are expressed in values appropriate to the color scheme
```

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```
indicated by the dmsColorScheme object. When the 'color24bit' scheme is used,
then this object contains three octets. When 'color24bit' is used, then the
object value contains 3 octets (first octet = red, second = green, third =
blue).
When 'monochrome1bit' is used, the value of this octet shall be either 0 or
1. When 'monochrome8bit' is used, the value of this octet shall be 0 to 255.
In either the 'monochrome1bit' or 'monochrome8bit' scheme, the actual color
is indicated in the monochromeColor object.  When 'colorClassic' is used, the
value of this octet shall be the value of the classic color.
If the ‘colorClassic’ value (see dmsColorScheme object) is used, both
defaultBackgroundColor and defaultBackgroundRGB objects shall return the same
value if queried by a central system..
Each of the background colors on a sign shall map to one of the colors in the
color scheme of the sign.
If a color is requested that is not supported, then a genErr shall be
returned.
This object may be sub-ranged by an implementation; see Section 3.5.2.3.2.2
for more information.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.4.12"
::= { multiCfg 12 }
```

5.5.18 Default Background Color RGB Parameter at Activation

```
defaultBackgroundRGBActivate  OBJECT-TYPE
SYNTAX  OCTET STRING (SIZE (1 | 3))
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the value of defaultBackgroundRGB at activation of
the currently active message for the purpose of determining what the value
was at the time of activation. The value shall be created (overwritten) at
the time when the message was copied into the currentBuffer.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.4.24"
::= { multiCfg 24 }
```

5.5.19 Default Foreground Color RGB Parameter

```
defaultForegroundRGB  OBJECT-TYPE
SYNTAX  OCTET STRING (SIZE (1 | 3))
ACCESS  read-write
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the color of the foreground shown on the sign unless
changed by the ‘Color Foreground’ MULTI tag. This is the color used to
illuminate the ‘ON’ pixels of displayed characters. The values are expressed
in values appropriate to the color scheme indicated by the dmsColorScheme
object. When the 'color24bit' scheme is used, then this object contains three
octets (first octet = red, second = green, third = blue).
When 'monochrome1bit' is used, the value of this octet shall be either 0 or
1. When 'monochrome8bit' is used, the value of this octet shall be 0 to 255.
In either the 'monochrome1bit' or 'monochrome8bit' scheme, the actual color
is indicated in the monochromeColor object.  When 'colorClassic' is used, the
value of this octet shall be the value of the classic color.
If the ‘colorClassic’ value (see dmsColorScheme object) is used, both
defaultForegroundColor and defaultForegroundRGB objects shall return the same
value if queried by a central system.
Each of the foreground colors on a sign shall map to one of the colors in the
color scheme of the sign.
If a color is requested that is not supported, then a genErr shall be
```

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```
returned.
This object may be sub-ranged by an implementation; see Section 3.5.2.3.2.2
for more information.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.4.13"
::= { multiCfg 13 }
```

5.5.20 Default Foreground Color RGB Parameter at Activation

```
defaultForegroundRGBActivate  OBJECT-TYPE
SYNTAX  OCTET STRING (SIZE (1 | 3))
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the value of defaultForegroundRGB at activation of
the currently active message for the purpose of determining what the value
was at the time of activation. The value shall be created (overwritten) at
the time when the message was copied into the currentBuffer.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.4.25"
::= { multiCfg 25 }
```

5.5.21 Default Character Set Parameter

```
defaultCharacterSet  OBJECT-TYPE
SYNTAX  INTEGER {
                other (1),
                eightBit (2)}
ACCESS  read-write
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the default number of bits used to define a single
character in a MULTI string.
  other (1): - a character size other than those listed below, refer to the
     device manual.
  eightBit (2): - each characterNumber of a given font is encoded as
     an 8-bit value.
This object may be sub-ranged by an implementation; see Section 3.5.2.3.2.8
for more information.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.4.10"
DEFVAL  {eightBit}
::= { multiCfg 10 }
-- The intent of this object is to provide a mechanism by which 16-bit
-- character sets (and potentially other character sets ) can be
-- supported in a future version. Currently, this object only provides a
-- standard for 8-bit character encoding.
```

5.5.22 Color Scheme Parameter

```
dmsColorScheme  OBJECT-TYPE
SYNTAX  INTEGER {
                monochrome1bit (1),
                monochrome8bit (2),
                colorClassic (3),
                color24bit(4)}
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the color scheme supported by the DMS. The values are
defined as:
  monochrome1bit (1): - Only two states are available for each pixel: on
      (1) and off (0). A value of 'on (1)' shall indicate that the
```

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```
     defaultForegroundRGB is used and value of 'off(0)' shall indicate
     that the defaultBackgroundRGB is used.
  monochrome8bit (2): - this color palette supports 256 shades ranging
     from 0 (off) to 255 (full intensity). Values between zero and
     255 are scaled to the nearest intensity level supported by
     the VMS. Therefore, it is not required that a VMS have true
     8-bit (256 shade) capabilities.
  colorClassic (3): - as defined in Version 1 of NTCIP 1203, the
     following values are available:
          black (0),
          red (1),
          yellow (2),
          green(3),
          cyan (4),
          blue (5),
          magenta (6),
          white (7),
          orange (8),
          amber (9).
  color24bit (4): - Each pixel is defined by three bytes, one each for
     red, green, and blue. Each color value ranges from 0 (off) to 255
     (full intensity). The combination of the red, green, and blue
     colors equals the 16,777,216 number of colors.
DMS with dmsColorScheme set to color24bit shall interpret MULTI tags with a
single color parameter (e.g. [cfx]) as colorClassic.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.4.11"
DEFVAL  { monochrome1bit }
::= { multiCfg 11 }
```

5.5.23 Supported MULTI Tags Parameter

```
dmsSupportedMultiTags  OBJECT-TYPE
SYNTAX  OCTET STRING (SIZE (4))
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> An indication of the MULTI Tags supported by the device. This
object is a bitmap representation of tag support. When a bit is set (=1), the
device supports the corresponding tag. When a bit is cleared (=0), the device
does not support the corresponding tag.
<Format>
Bit 0 : color background[cbx] / [cbr,g,b]
Bit 1 : color foreground[cfx] / [cfr,g,b]
Bit 2 : flashing[fltxoy] / [floytx]
Bit 3 : font[fox] / [fox,cccc]
Bit 4 : graphic [gn] / [gn,x,y] / [gn,x,y,cccc]
Bit 5 : hexadecimal character[hcx]
Bit 6 : justification line[jlx]
Bit 7 : justification page[jpx]
Bit 8 : manufacturer specific[msx,y]
Bit 9 : moving text[mvtdw,s,r,text]
Bit 10 : new line[nlx]
Bit 11 : new page[np]
Bit 12 : page time[ptxoy]
Bit 13 : spacing character[scx]
Bit 14 : field local time 12 hour[f1]
Bit 15 : field local time 24 hour[f2]
Bit 16 : ambient temperature Celsius[f3]
```

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```
Bit 17 : ambient temperature Fahrenheit[f4]
Bit 18 : speed km/h[f5]
Bit 19 : speed m/h[f6]
Bit 20 : day of week[f7]
Bit 21 : date of month[f8]
Bit 22 : month of year[f9]
Bit 23 : year 2 digits[f10]
Bit 24 : year 4 digits[f11]
Bit 25 : local time 12 hour AM/PM[f12]
Bit 26 : local time 12 hour am/pm[f13]
Bit 27 : text rectangle [trx,y,w,h]
Bit 28 : color rectangle [crx,y,w,h,z] / [crx,y,w,h,r,g,b]
Bit 29 : Page  background [pbz] / [pbr,g,b]
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.4.14"
::= { multiCfg 14 }
```

5.5.24 Maximum Number of Pages Parameter

```
dmsMaxNumberPages  OBJECT-TYPE
SYNTAX  INTEGER (1..255)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the maximum number of pages allowed in the
dmsMessageMultiString.
<Unit>page
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.4.15"
::= { multiCfg 15 }
```

5.5.25 Maximum MULTI String Length Parameter

```
dmsMaxMultiStringLength  OBJECT-TYPE
SYNTAX  INTEGER (0..65535)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the maximum number of bytes allowed within the
dmsMessageMultiString.
<Unit>byte
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.4.16"
::= { multiCfg 16 }
```

5.6 Message Objects

```
dmsMessage  OBJECT IDENTIFIER ::= { dms 5 }

-- This node is an identifier used to group all objects for support of
-- DMS Message Table functions that are common to DMS devices.
```

5.6.1 Number of Permanent Messages Parameter

```
dmsNumPermanentMsg  OBJECT-TYPE
SYNTAX  INTEGER (0..65535)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the current number of Messages stored in non-
volatile, non-changeable memory (e.g., EPROM). For CMS and BOS, this is the
number of different messages that can be assembled.
See the Specifications in association with Requirement 3.6.7.1 to determine
the messages that must be supported.
```

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```
<Unit>message
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.5.1"
::= { dmsMessage 1 }
```

5.6.2 Number of Changeable Messages Parameter

```
dmsNumChangeableMsg  OBJECT-TYPE
SYNTAX  INTEGER (0..65535)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the current number of valid Messages stored in non-
volatile, changeable memory. For CMS and BOS, this number shall be zero (0).
<Unit>message
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.5.2"
::= { dmsMessage 2 }
```

5.6.3 Maximum Number of Changeable Messages Parameter

```
dmsMaxChangeableMsg  OBJECT-TYPE
SYNTAX  INTEGER (0..65535)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the maximum number of Messages that the sign can
store in non-volatile, changeable memory. For CMS and BOS, this number shall
be zero (0).
See the Specifications in association with Requirement 3.5.6.2 to determine
the messages that must be supported.
<Unit>message
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.5.3"
::= { dmsMessage 3 }
```

5.6.4 Free Bytes within Changeable Memory Parameter

```
dmsFreeChangeableMemory  OBJECT-TYPE
SYNTAX  INTEGER (0..4294967295)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the number of bytes available within non-volatile,
changeable memory. For CMS and BOS, this number shall be zero (0).
See the Specifications in association with Requirement 3.5.6.2 to determine
the total memory that must be provided.
<Unit>byte
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.5.4"
::= { dmsMessage 4 }
```

5.6.5 Number of Volatile Messages Parameter

```
dmsNumVolatileMsg  OBJECT-TYPE
SYNTAX  INTEGER (0..65535)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the current number of valid Messages stored in
volatile, changeable memory. For CMS and BOS, this number shall be zero (0).
<Unit>message
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.5.5"
::= { dmsMessage 5 }
```

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5.6.6 Maximum Number of Volatile Messages Parameter

```
dmsMaxVolatileMsg  OBJECT-TYPE
SYNTAX  INTEGER (0..65535)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the maximum number of Messages that the sign can
store in volatile, changeable memory. For CMS and BOS, this number shall be
zero (0).
See the Specifications in association with Requirement 3.5.6.3 to determine
the messages that must be supported.
<Unit>message
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.5.6"
::= { dmsMessage 6 }
```

5.6.7 Free Bytes within Volatile Memory Parameter

```
dmsFreeVolatileMemory  OBJECT-TYPE
SYNTAX  INTEGER (0..4294967295)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the number of bytes available within volatile,
changeable memory. For CMS and BOS, this number shall be zero (0).
See the Specifications in association with Requirement 3.5.6.3 to determine
the total memory that must be provided.
<Unit>byte
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.5.7"
::= { dmsMessage 7 }
```

5.6.8 Message Table Parameter

```
dmsMessageTable  OBJECT-TYPE
SYNTAX      SEQUENCE OF DmsMessageEntry
ACCESS      not-accessible
STATUS      mandatory
DESCRIPTION "<Definition> A table containing the information needed to
activate a Message on a sign. The values of a columnar object (except the
dmsMessageStatus) cannot be changed when the 'dmsMessageStatus'-object of
that particular row is any value other than 'modifying'.
<Table Type> static
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.5.8"
::= {dmsMessage 8}

dmsMessageEntry OBJECT-TYPE
SYNTAX      DmsMessageEntry
ACCESS      not-accessible
STATUS      mandatory
DESCRIPTION "<Definition> Parameters of the Message Table.
"
INDEX {dmsMessageMemoryType, dmsMessageNumber}
::= {dmsMessageTable 1}

DmsMessageEntry ::= SEQUENCE {
   dmsMessageMemoryType      INTEGER,
   dmsMessageNumber          INTEGER,
   dmsMessageMultiString     OCTET STRING,
   dmsMessageOwner           OwnerString,
   dmsMessageCRC             INTEGER,
```

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```
   dmsMessageBeacon          INTEGER,
   dmsMessagePixelService    INTEGER,
   dmsMessageRunTimePriority INTEGER,
   dmsMessageStatus          INTEGER
   }
```

5.6.8.1 Message Memory Type Parameter

```
dmsMessageMemoryType  OBJECT-TYPE
SYNTAX  INTEGER {
                --other (1), -retired
                permanent (2),
                changeable (3),
                volatile (4),
                currentBuffer (5),
                schedule (6),
                blank (7)}
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the memory-type used to store a message. Also
provides access to current message (currentBuffer) and currently scheduled
message (schedule). The rows associated with the 'currentBuffer', 'schedule',
and 'blank' message types cannot be written into, because these are either
filled in by the controller (currentBuffer and schedule) or pre-defined and
not modifiable (blank).

The definitions of the enumerated values are:
  other - any other type of memory type that is not listed within one of
     the values below, refer to device manual;
  permanent - non-volatile and non-changeable;
  changeable - non-volatile and changeable;
  volatile - volatile and changeable;
  currentBuffer - contains the information regarding the currently
     displayed message (basically a copy of the message table row
     contents of the message that was successfully activated).
     Only one entry in the table can have the
     value of currentBuffer and the value of the dmsMessageNumber
     object shall be one (1). The content of the
     dmsMessageMultiString object shall be the currently displayed
     message (including a scheduled message), not the content of a
     failed message activation attempt;
  schedule - this entry contains information regarding the currently
     scheduled message as determined by the time-base scheduler (if
     present). Only one entry in the table can have the value of
     'schedule' and the value of dmsMessageNumber for this entry
     shall be 1. Displaying a message through this table row shall set
     the dmsMsgSourceMode object value to 'timebasedScheduler'.
     When no message is currently active based upon the schedule
     or if the schedule currently does not point to any message within
     the message table, the schedule entry shall contain a copy of
     dmsMessageMemoryType 7 (blank) with a dmsMessageNumber value of 1.
  blank - there shall be 255 (message numbers 1 through 255)
     pre-defined, static rows with this message type. These rows are
     defined so that message codes (e.g., objects with SYNTAX of
     either MessageIDCode or MessageActivationCode) can blank the
     sign at a stated run-time priority. The run-time priority of the blank
     message is equal to the message number (e.g., blank message
```

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```
     number 1 has a run time priority of 1 and so on). The
     dmsMessageCRC for all messages of this type shall be 0x0000 and
     the dmsMessageMultiString shall be an OCTET STRING with a length of
     zero (0). The activation priority shall be determined from the
     activation priority of the MessageActivationCode.

<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.5.8.1.1"
::= { dmsMessageEntry 1 }
-- In v02, the enumerated value of 'other' is RETIRED to improve
-- interoperability.
```

5.6.8.2 Message Number Parameter

```
dmsMessageNumber  OBJECT-TYPE
SYNTAX  INTEGER (1..65535)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Enumerated listing of row entries within the value of the
primary index to this table (dmsMessageMemoryType -object). When the primary
index is 'currentBuffer' or 'schedule', then this value must be one (1). When
the primary index is 'blank', this value shall be from 1 through 255 and all
compliant devices must support all 255 of these 'blank' rows.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.5.8.1.2"
::= { dmsMessageEntry 2 }
```

5.6.8.3 Message MULTI String Parameter

```
dmsMessageMultiString  OBJECT-TYPE
SYNTAX  OCTET STRING
ACCESS  read-write
STATUS  mandatory
DESCRIPTION
"<Definition> Contains the message written in MULTI-language as defined in
Section 6 and as subranged by the restrictions defined by
dmsMaxMultiStringLength and dmsSupportedMultiTags. When the primary index is
'schedule', 'blank', 'currentBuffer' or 'permanent', this object shall return
a genErr to any SET-request. When the primary index is 'schedule', the object
shall return the MULTI string of the currently scheduled message in response
to a GET-request (regardless whether this message is actually being
displayed). The value of the MULTI string is not allowed to have any null
character.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.5.8.1.3"
::= { dmsMessageEntry 3 }
```

5.6.8.4 Message Owner Parameter

```
dmsMessageOwner  OBJECT-TYPE
SYNTAX  OwnerString
ACCESS  read-write
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the owner or author of this row.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.5.8.1.4"
::= { dmsMessageEntry 4 }
```

5.6.8.5 Message CRC Parameter

```
dmsMessageCRC  OBJECT-TYPE
SYNTAX  INTEGER(0..65535)
ACCESS  read-only
```

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```
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the CRC-16 (polynomial defined in ISO/IEC 3309) value
created using the values of the dmsMessageMultiString (MULTI-Message), the
dmsMessageBeacon, and the dmsMessagePixelService objects in the order listed,
not including the OER type or length fields. Note that the calculation shall
assume a value of zero (0) for the dmsMessageBeacon object and/or for the
dmsMessagePixelService object if they are not supported. For messages of the
'blank' message type, the above algorithm shall be ignored and the
dmsMessageCRC value shall always be zero (0). For messages of the 'schedule'
message type, the CRC value of the currently scheduled message shall always
be returned (regardless whether this message is actually being displayed).
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.5.8.1.5"
::= { dmsMessageEntry 5 }
```

5.6.8.6 Message Beacon Parameter

```
dmsMessageBeacon  OBJECT-TYPE
SYNTAX  INTEGER (0..1)
ACCESS  read-write
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates if connected beacon(s) are to be activated when the
associated message is displayed. Zero (0) = Beacon(s) are Disabled ;  one (1)
= Beacon(s) are Enabled. When the primary index is 'schedule', 'blank',
'currentBuffer', or 'permanent', this object shall return a genErr to any
SET-request.
When the primary index is 'schedule', the object shall return the
dmsMessageBeacon setting of the currently scheduled message in response to a
GET-request (regardless whether this message is actually being displayed).
When the dmsMessageMemoryType is 'permanent', the object shall return the
dmsMessageBeacon setting of the factory-preset value in response to a GET-
request.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.5.8.1.6"
DEFVAL  {0}
::= { dmsMessageEntry 6 }
```

5.6.8.7 Message Pixel Service Parameter

```
dmsMessagePixelService  OBJECT-TYPE
SYNTAX  INTEGER (0..1)
ACCESS  read-write
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates whether pixel service shall be enabled (1) or
disabled (0) while this message is active. When the primary index is
'schedule', 'blank', 'currentBuffer', or 'permanent', this object shall
return a genErr to any SET-request.
When the primary index is 'schedule', the object shall return the
dmsMessagePixelService setting of the currently scheduled message in response
to a GET-request (regardless whether this message is actually being
displayed).
When the primary index is 'permanent', the object shall return the
dmsMessagePixelService setting of the factory-preset value in response to a
GET-request.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.5.8.1.7"
DEFVAL  {0}
::= { dmsMessageEntry 7 }
```

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5.6.8.8 Message Run Time Priority Parameter

```
dmsMessageRunTimePriority  OBJECT-TYPE
SYNTAX  INTEGER (1..255)
ACCESS  read-write
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the run time priority assigned to a particular
message. The value of 1 indicates the lowest level, the value of 255
indicates the highest level. When the dmsMessageMemoryType is 'schedule,' the
value set in this object (e.g. dmsMessageRunTimePriority.6.1) shall override
the run-time priority of the scheduled message. When the dmsMessageMemoryType
is 'blank', the value returned shall be equal to the dmsMessageNumber of that
particular message.
When the dmsMessageMemoryType is 'permanent', the object shall return the
dmsMessageRunTimePriority setting of the factory-preset value in response to
a GET-request.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.5.8.1.8"
::= { dmsMessageEntry 8 }
```

5.6.8.9 Message Status Parameter

```
dmsMessageStatus  OBJECT-TYPE
SYNTAX  INTEGER {
                notUsed (1),
                modifying (2),
                validating (3),
                valid (4),
                error (5),
                modifyReq (6),
                validateReq (7),
                notUsedReq (8) }
ACCESS  read-write
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the current state of the message. This state-machine
allows for defining a message, validating a message, and deleting a message.
See Section 4.3.4 for additional details regarding the state-machine.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.5.8.1.9"
::= { dmsMessageEntry 9 }
```

5.6.9 Validate Message Error Parameter

```
dmsValidateMessageError  OBJECT-TYPE
SYNTAX  INTEGER {
                other (1),
                none (2),
                beacons (3),
                pixelService (4),
                syntaxMULTI (5) }
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> This is an error code used to identify why a message was not
validated. If multiple errors occur, only the first value is indicated. The
syntaxMULTI error is further detailed in the dmsMultiSyntaxError,
dmsMultiSyntaxErrorPosition and dmsMultiOtherErrorDescription objects.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.5.9"
::= { dmsMessage 9 }
```

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5.7 Sign Control Objects

```
signControl  OBJECT IDENTIFIER ::= { dms 6 }

-- This node is an identifier used to group all objects for support of
-- DMS sign control functions that are common to DMS devices.
```

5.7.1 Control Mode Parameter

```
dmsControlMode  OBJECT-TYPE
SYNTAX  INTEGER {
                 --other (1), -retired
                 local (2),
                 --external (3), -retired
                 central (4),
                 centralOverride (5)
                 --simulation (6)    -retired
                 }
ACCESS  read-write
STATUS  mandatory
DESCRIPTION
"<Definition> A value indicating the mode that is currently controlling the
sign.
The possible modes are:
  other - (deprecated) Other control mode supported by the device (refer to
device manual);
  local - Local control mode (control is at DMS controller);
  external - (deprecated) External control mode;
  central - Central control mode;
  centralOverride - Central station took control over Local control, even
     though the control switch at the sign was set to Local;
  simulation  - (deprecated) controller is in a mode where it accepts every
     command and it pretends that it would execute them but this does not
     happen because the controller only simulates.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.6.1"
DEFVAL  {central}
::= { signControl 1 }
-- In v02, the enumerated values of 'other', 'external', and 'simulation'
-- were RETIRED to improve interoperability.
```

5.7.2 Software Reset Parameter

```
dmsSWReset  OBJECT-TYPE
SYNTAX  INTEGER (0..1)
ACCESS  read-write
STATUS  mandatory
DESCRIPTION
"<Definition> A software interface to initiate a controller reset. The
execution of the controller reset shall set this object to the value 0.
Setting this object to a value of 1 causes the controller to reset. Value
zero (0) = no reset, value one (1) = reset.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.6.2"
DEFVAL  {0}
::= { signControl 2 }
```

5.7.3 Activate Message Parameter

```
dmsActivateMessage  OBJECT-TYPE
SYNTAX  MessageActivationCode
ACCESS  read-write
STATUS  mandatory
```

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DESCRIPTION
"<Definition> A code indicating the active message. The value of this object may be SET by a management station or modified by logic internal to the DMS (e.g., activation of the end duration message, etc.).

When modified by internal logic with a reference to a message ID code, the duration indicates 65535 (infinite), the activate priority indicates 255, and the source address indicates an address of 127.0.0.1.

If a GET is performed on this object, the DMS shall respond with the value for the last message that was successfully activated.
The dmsActivateMsgError object shall be updated appropriately upon any attempt to update the value of this object, whether from an internal or external source.

If a message activation error occurs (e.g., dmsActivateMsgError is updated to a value other than 'none'), the new message shall not be activated and, if the activation request originated from a SET request, a genErr shall be returned. A management station should then GET the dmsActivateMsgError object as soon as possible to minimize the chance of additional activation attempts from overwriting the dmsActivateMsgError.

If a message is attempted to be activated via the scheduler or any internal message (e.g., end duration message, etc.) and the message to be activated contains an error, than the following objects shall be set to the appropriate values (as defined within these objects):
- dmsActivateMsgError,
- dmsActivateErrorMsgCode,
- dmsMultiSyntaxError,
- dmsMultiSyntaxErrorPosition (if supported),
- dmsMultiOtherErrorDescription (if supported),
- dmsDrumStatus (if supported)

A 'criticalTemperature' alarm shall have no effect on the 'activation' of a message, it will only affect the display of the active message. Thus, a message activation may occur during a 'criticalTemperature' alarm and the sign controller will behave as if the message is displayed. However, the shortErrorStatus will indicate a criticalTemperature alarm and the sign face illumination will be off. As soon as the DMS determines that the 'criticalTemperature' alarm is no longer present, the DMS shall display the message stored in the currentBuffer.

<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.6.3"
::= { signControl 3 }

5.7.4 Message Display Time Remaining Parameter

dmsMessageTimeRemaining OBJECT-TYPE
SYNTAX INTEGER (0..65535)
ACCESS read-write
STATUS mandatory
DESCRIPTION
"<Definition> Indicates the amount of remaining time in minutes that the current message shall be active. The time shall be accurate to the nearest second and rounded up to the next full minute. For example, a value of 2 shall indicate that the time remaining is between 1 minute and 0.1 seconds and 2 minutes.
When a new message is activated with a minute-based duration, or this object

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```
is directly SET, the minute-based duration value shall be multiplied by 60 to
determine the number of seconds that the message shall be active. Thus, if a
message activation is for 2 minutes, the DMS will be assured to display the
message for 120 seconds.
The value 65535 indicates an infinite duration. A value of zero (0) shall
indicate that the current message display duration has expired.

A SET operation on this object shall allow a Central Computer to extend or
shorten the duration of the message. Setting this object to zero (0) shall
result in the immediate display of the dmsEndDurationMessage.
<Unit>minute
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.6.4"
DEFVAL  {65535}
::= { signControl 4 }
```

5.7.5 Message Table Source Parameter

```
dmsMsgTableSource  OBJECT-TYPE
SYNTAX  MessageIDCode
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Identifies the message number used to generate the currently
displayed message. This object is written to by the device when the new
message is loaded into the currentBuffer of the dmsMessageTable. The value of
this object contains the message ID code of the message that was copied into
the 'currentBuffer'. This value can only be of message type 'permanent',
'volatile', 'changeable', or 'blank'.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.6.5"
::= { signControl 5 }
```

5.7.6 Message Requester ID Parameter

```
dmsMsgRequesterID  OBJECT-TYPE
SYNTAX  IpAddress
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> A copy of the source-address field from the dmsActivateMessage-
object used to activate the current message. If the current message was not
activated by the dmsActivateMessage-object, then the value of this object
shall be zero (0).
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.6.6"
REFERENCE  "RFC 1155, May 1990"
::= { signControl 6 }
```

5.7.7 Message Source Mode Parameter

```
dmsMsgSourceMode  OBJECT-TYPE
SYNTAX  INTEGER {
                 other (1),
                 local (2),
                 external (3),
                 --otherCom1( 4), -retired
                 --otherCom2 (5), -retired
                 --otherCom3 (6), -retired
                 --otherCom4 (7), -retired
                 central (8),
                 timebasedScheduler (9),
                 powerRecovery (10),
```

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```
                reset (11),
                commLoss (12),
                powerLoss (13),
                endDuration (14)
                }
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the source that initiated the currently displayed
message. The enumerations are defined as:
  other (1) - the currently displayed message was activated based on a
     condition other than the ones defined below. This would include any
     auxiliary devices.
  local (2) - the currently displayed message was activated at the sign
     controller using either an onboard terminal or a local interface.
  external (3) - the currently displayed message was activated from a locally
connected
    device using serial (or other type of) connection to the sign controller
such as a laptop or
    a PDA. This mode shall only be used, if the sign controller is capable of
distinguishing
    between a local input (see definition of 'local (2)') and a serial
connection.
  central (8) - the currently displayed message was activated from the
central
     computer.
  timebasedScheduler (9) - the currently displayed message was activated from
     the timebased scheduler as configured within the sign controller.
  powerRecovery (10) - the currently displayed message was activated based
     on the settings within the dmsLongPowerRecoveryMessage,
dmsShortPowerRecoveryMessage, and the
     dmsShortPowerLossTime objects.
  reset (11) - the currently displayed message was activated based on the
     settings within the dmsResetMessage object.
  commLoss (12) - the currently displayed message was activated based on
     the settings within the dmsCommunicationsLossMessage object.
  powerLoss (13) - the currently displayed message was activated based on
     the settings within the dmsPowerLossMessage object. Note: it may not be
     possible to point to this message depending on the technology, e.g. it
may
     not be possible to display a message on pure LED or fiber-optic signs
     DURING power loss.
  endDuration (14) - the currently displayed message was activated based on
     the settings within the dmsEndDurationMessage object.

<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.6.7"
::= { signControl 7 }
-- In v02, the enumerated values of 'otherComX' is RETIRED to improve
-- interoperability.
```

5.7.8 Short Power Loss Recovery Message Parameter

```
dmsShortPowerRecoveryMessage  OBJECT-TYPE
SYNTAX  MessageIDCode
ACCESS  read-write
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the message that shall be activated after a power
```

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```
recovery following a short power loss affecting the device (see
dmsActivateMessage). The message shall be activated with:
      – a duration of 65535 (infinite) (if this object points to a value of
      'currentBuffer', the duration is determined by the value of the
      dmsMessageTimeRemaining object minus the power outage time);
      – an activation priority of 255;
      – a source address '127.0.0.1'.
Upon activation of the message, the run-time priority value shall be obtained
from the message table row specified by this object.
The length of time that defines a short power loss is indicated in the
dmsShortPowerLossTime-object.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.6.8"
-- DEFVAL MessageIDCode = messageMemoryType = 7, messageNumber = 1,
-- messageCRC = 0
::= { signControl 8 }
```

5.7.9 Long Power Loss Recovery Message Parameter

```
dmsLongPowerRecoveryMessage  OBJECT-TYPE
SYNTAX  MessageIDCode
ACCESS  read-write
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the message that shall be activated after a power
recovery following a long power loss affecting the device (see
dmsActivateMessage). The message shall be activated with
      – a duration of 65535 (infinite), (if this object points to a value of
      'currentBuffer', the duration is determined by the value of the
      dmsMessageTimeRemaining object minus the power outage time)
      – an activation priority of 255;
      – a source address of '127.0.0.1'.
Upon activation of the message, the run-time priority value shall be obtained
from the message table row specified by this object.
The length of time that defines a long power loss is indicated in the
dmsShortPowerLossTime-object.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.6.9"
-- DEFVAL MessageIDCode = messageMemoryType = 7, messageNumber = 1,
-- messageCRC = 0
::= { signControl 9 }
```

5.7.10 Short Power Loss Time Definition Parameter

```
dmsShortPowerLossTime  OBJECT-TYPE
SYNTAX  INTEGER (0..65535)
ACCESS  read-write
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the time, in seconds, from the start of power loss to
the threshold where a short power loss becomes a long power loss. If the
value is set to zero (0), all power failures are defined as long power
losses.
<Unit>second
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.6.10"
-- DEFVAL 0
::= { signControl 10 }
```

5.7.11 Reset Message Parameter

```
dmsResetMessage  OBJECT-TYPE
SYNTAX  MessageIDCode
```

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```
ACCESS  read-write
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the message that shall be activated after a Reset
(either software or hardware) of the device (see dmsActivateMessage). This
assumes that the device can differentiate between a reset and a power loss.
The message shall be activated with
      - a duration of 65535 (infinite) (if this object points to a value of
      'currentBuffer', the duration is determined by the value of the
      dmsMessageTimeRemaining object minus the power outage time);
      - an activation priority of 255;
      - a source address of '127.0.0.1'.
Upon activation of the message, the run-time priority value shall be obtained
from the message table row specified by this object.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.6.11"
-- DEFVAL MessageIDCode = messageMemoryType = 7, messageNumber = 1,
-- messageCRC = 0
::= { signControl 11 }
```

5.7.12 Communications Loss Message Parameter

```
dmsCommunicationsLossMessage  OBJECT-TYPE
SYNTAX  MessageIDCode
ACCESS  read-write
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the message that shall be activated when the time
since the last communications from a management station exceeds the
dmsTimeCommLoss time (see dmsActivateMessage). The message shall be activated
with
      - a duration of 65535 (infinite) (if this object points to a value of
      'currentBuffer', the duration is determined by the value of the
      dmsMessageTimeRemaining object);
      - an activation priority of 255;
      - a source address of '127.0.0.1'.
If the value referenced by this object is invalid, the sign will display a
blank message.
Upon activation of the message, the run-time priority value shall be obtained
from the message table row specified by this object.
The value of this object shall not be implemented when the value of the
dmsControlMode is set to 2 (local). Once the value of the dmsControl Mode
object is set to 4 (central) or 5 (centralOverride) and the value of the
dmsTimeCommLoss parameter has been reached, the value of this object shall be
implemented.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.6.12"
-- DEFVAL MessageIDCode = messageMemoryType = 7, messageNumber = 1,
-- messageCRC = 0
::= { signControl 12 }
```

5.7.13 Communication Loss Time Definition Parameter

```
dmsTimeCommLoss  OBJECT-TYPE
SYNTAX  INTEGER (0..65535)
ACCESS  read-write
STATUS  mandatory
DESCRIPTION
"<Definition> Defines the maximum time (inclusive), in minutes, between
successive Application Layer messages that can occur before a communication
loss is assumed. If this object is set to zero (0), communications loss shall
```

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```
be ignored.

The countdown timer associated with this parameter shall be suspended while
the sign control parameter has a value of 'local (2)', e.g., the sign is in
local control. The countdown timer shall be restarted (reset and started
again) once the sign control parameter value is switched to 'central (4)' or
'centralOverride (5)'.
<Unit>minute
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.6.13"::= { signControl 13 }
-- This timer differs from the Data Link Layer timers (T1 to T4). A dial-up
-- circuit may have short time-outs at the DL Layer, but central might
-- only dial up once a month to confirm operation, in which case this
-- object would be set to ~ 35 days.
```

5.7.14 Power Loss Message Parameter

```
dmsPowerLossMessage  OBJECT-TYPE
SYNTAX  MessageIDCode
ACCESS  read-write
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the message that shall be activated DURING the loss
of power of the device (see dmsActivateMessage). The message shall be
activated with:
a duration of 65535 (infinite) (if this object points to a value of
'currentBuffer', the duration is determined by the value of the
dmsMessageTimeRemaining object);
an activation priority of 255;
a source address of '127.0.0.1'.
Upon activation of the message, the run-time priority value shall be obtained
from the message table row specified by this object.

Note: Not all technologies support the means to display a message while the
power is off.

<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.6.14"
-- DEFVAL MessageIDCode = messageMemoryType = 7, messageNumber = 1,
-- messageCRC = 0
::= { signControl 14 }
```

5.7.15 End Duration Message Parameter

```
dmsEndDurationMessage  OBJECT-TYPE
SYNTAX  MessageIDCode
ACCESS  read-write
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the message that shall be activated after the
indicated duration for a message has expired and no other Message had been
scheduled (see dmsActivateMessage). The message shall be activated with
      - a duration of 65535 (infinite) (if this object points to a value of
      'currentBuffer', the duration is determined by the value of the
      dmsMessageTimeRemaining object);
      - an activation priority of 255;
      - a source address of '127.0.0.1'.
Upon activation of the message, the run-time priority value shall be obtained
from the message table row specified by this object.

If the end duration message does not activate because this object is an
```

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```
invalid value, the sign shall blank with the default value of this object.

<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.6.15"
-- DEFVAL  MessageIDCode = messageMemoryType = 7, messageNumber = 1,
-- messageCRC = 0
::= { signControl 15 }
```

5.7.16 Memory Management Parameter

```
dmsMemoryMgmt  OBJECT-TYPE
SYNTAX  INTEGER  {
                 --other (1), -retired
                 normal (2),
                 clearChangeableMessages (3),
                 clearVolatileMessages (4) }
ACCESS  read-write
STATUS  mandatory
DESCRIPTION
"<Definition> Allows the system to manage the device's memory. SNMP Get
operations on this object should always return normal (2).

   clearChangeableMessages (3): the controller shall set dmsMessageStatus for
all changeable messages to notUsed (1), and release all memory associated
with changeable messages.  This action does not affect any changeable
graphics or fonts.

   clearVolatileMessages (4): the controller shall set dmsMessageStatus for
all volatile messages to notUsed (1), and release all memory associated with
volatile messages.  This action does not affect any changeable graphics or
fonts.

<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.6.16"
DEFVAL  {normal}
::= { signControl 16 }
-- In v02, the enumerated value of 'other' is RETIRED to improve
-- interoperability.
```

5.7.17 Activate Message Error Parameter

```
dmsActivateMsgError  OBJECT-TYPE
SYNTAX  INTEGER {
                 other (1),
                 none (2),
                 priority (3),
                 messageStatus (4),
                 messageMemoryType (5),
                 messageNumber (6),
                 messageCRC (7),
                 syntaxMULTI (8),
                 localMode (9),
                 centralMode (10),
                 centralOverrideMode (11) }
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> This is an error code used to identify why a message was not
displayed. Even if multiple errors occur, only one error is indicated.
  other (1):  any error not defined below.
  none (2): no error.
```

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```
  priority(3):  the activation priority in the MessageActivationCode is
     less than the run time priority of the  currently displayed message.
     If this error occurs, the corresponding bit (message error) within
     the 'shortErrorStatus' object shall be set.
  messageStatus(4):  the 'dmsMessageStatus' of the message to be
     activated is not 'valid'. If this error  occurs, the corresponding bit
     (message error) within the 'shortErrorStatus' object shall be set.
     Note: In the 1997 version of NTCIP 1203, this bit was assigned
     the name of 'underValidation'. It has been renamed to better
     reflect the fact that this bit can be set due to the message being
     in a number of different states, not just the 'validating' state.
  messageMemoryType(5):  the message memory type in the
     MessageActivationCode is not supported by the  device. If this
     error occurs, the corresponding bit (message error) within the
     'shortErrorStatus' object shall be set.
  messageNumber(6):  the message number in the
     MessageActivationCode is not supported or is not defined
     (populated) by the device. If this error occurs, the corresponding
     bit (message error) within the 'shortErrorStatus' object shall be set.
  messageCRC(7):  the checksum in the MessageActivationCode is
     different than the CRC value  contained in the 'dmsMessageCRC'.
     If this error occurs, the corresponding bit (message error) within
     the 'shortErrorStatus' object shall be set.
  syntaxMULTI(8):  a MULTI syntax error was detected during
     message activation. The error is further detailed in the
     'dmsMultiSyntaxError', 'dmsMultiSyntaxErrorPosition', and
'dmsMultiOtherErrorDescription' objects. If this error occurs, the
corresponding bit (message error)
     within the 'shortErrorStatus' object shall be set.
  localMode(9):  the central system attempted to activate a message
     while the 'dmsControlMode' object is  'local'. This error shall NOT
     be set if the value of the 'dmsControlMode' is set to
     'central',  or 'centralOverride'. If this error occurs, the
     corresponding bit (message error) within the 'shortErrorStatus'
     object shall be set.
  centralMode (10):  a locally connected system attempted to activate
     a message while the 'dmsControlMode' object is 'central'.
     This error shall NOT be set if the value of the 'dmsControlMode'
     is set to 'local'. If this error occurs, the corresponding
     bit (message error) within the 'shortErrorStatus'
     object shall be set.
  centralOverrideMode (11):  a locally connected system attempted to activate
     a message while the 'dmsControlMode' object is 'centralOverride', even
     though the local switch is set to local control.
     If this error occurs, the corresponding bit (message error)
      within the 'shortErrorStatus' object shall be set.

A 'criticalTemperature' alarm shall have no effect on the 'activation' of a
message, it only effects the display of the active message. Thus, a message
activation may occur during a 'criticalTemperature' alarm and the sign
controller behaves as if the message is displayed. However, the
shortErrorStatus indicates a criticalTemperature alarm and the sign face
illumination is off. As soon as the DMS determines that the
'criticalTemperature' alarm is no longer present, the DMS shall display the
message stored in the currentBuffer.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.6.17"
::= { signControl 17 }
```

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5.7.18 MULTI Syntax Error Parameter

```
dmsMultiSyntaxError  OBJECT-TYPE
SYNTAX  INTEGER {
                 other (1),
                 none (2),
                 unsupportedTag (3),
                 unsupportedTagValue (4),
                 textTooBig (5),
                 fontNotDefined (6),
                 characterNotDefined (7),
                 fieldDeviceNotExist (8),
                 fieldDeviceError (9),
                 flashRegionError (10),
                 tagConflict (11),
                 tooManyPages (12),
                 fontVersionID (13),
                 graphicID (14),
                 graphicNotDefined (15) }
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> This is an error code used to identify the first detected
syntax error within the MULTI message.
  other (1):  An error other than one of those listed.
  none (2):  No error detected.
  unsupportedTag (3):  The tag is not supported by this device.
  unsupportedTagValue (4):  The tag value is not supported by this
     device.
  textTooBig (5):  Too many characters on a line, too many lines for a
     page, or font is too large for the display.
  fontNotDefined (6):  The font is not defined in this device.
  characterNotDefined (7):  The character is not defined in the
     selected font.
  fieldDeviceNotExist (8):  The field device does not exist / is not
     connected to this device.
  fieldDeviceError (9):  This device is not receiving input from the
     referenced field device and/or the field device has a  fault.
  flashRegionError (10):  The flashing region cannot be flashed by this
     device.
  tagConflict (11):  The message cannot be displayed with the
     combination of tags and/or tag implementation cannot be resolved.
  tooManyPages (12):  Too many pages of text exists in the message.
  fontVersionID (13):  The fontVersionID contained in the MULTI tag
     [fox,cccc] does not match the fontVersionID for the fontNumber
     indicated.
  graphicID (14):  The dmsGraphicID contained in the
     MULTI tag [gx,cccc] does not match the dmsGraphicID for the
     dmsGraphicIndex indicated.
  graphicNotDefined (15):  The graphic is not defined in this device.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.6.18"
::= { signControl 18 }
```

5.7.19 Position of MULTI Syntax Error Parameter

```
dmsMultiSyntaxErrorPosition  OBJECT-TYPE
SYNTAX  INTEGER (0..65535)
ACCESS  read-only
```

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```
STATUS  mandatory
DESCRIPTION
"<Definition> This is the offset from the first character (e.g. first
character has offset 0, second is 1, etc.) of the MULTI string where the
SYNTAX error occurred.
<Unit>character
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.6.19"
::= { signControl 19 }
```

5.7.20 Other MULTI Error Parameter

```
dmsMultiOtherErrorDescription  OBJECT-TYPE
SYNTAX  DisplayString (SIZE (0..50))
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates vendor-specified error message descriptions.
Associated errors occurred due to vendor-specific MULTI-tag responses. The
value of this object is valid only if dmsValidateMessageError has a value of
‘syntaxMULTI(5)’ or dmsActivateMsgError has a value of ‘syntaxMULTI(8)’ and
dmsMultiSyntaxError is ‘other(1)’.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.6.20"
::= { signControl 20 }
```

5.7.21 Pixel Service Duration Parameter

```
vmsPixelServiceDuration  OBJECT-TYPE
SYNTAX  INTEGER (0..65535)
ACCESS  read-write
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the number of seconds to perform pixel service on an
entire sign. If the vmsPixelServiceDuration expires during a pixel service
routine, that routine shall be completed before stopping or restarting a new
pixel service routine due to vmsPixelServiceFrequency. A value of zero
disables pixel service.
<Unit>second
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.6.21"
::= { signControl 21 }
```

5.7.22 Pixel Service Frequency Parameter

```
vmsPixelServiceFrequency  OBJECT-TYPE
SYNTAX  INTEGER (0..1440)
ACCESS  read-write
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the pixel service cycle time (period) in minutes. A
value of zero indicates continuous pixel service from vmsPixelServiceTime to
the epoch of midnight. A value of 1440 indicates one pixel service in a 24-
hour period.
<Unit>minute
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.6.22"
DEFVAL  {1440}
::= { signControl 22 }
```

5.7.23 Pixel Service Time Parameter

```
vmsPixelServiceTime  OBJECT-TYPE
SYNTAX  INTEGER (0..1440)
ACCESS  read-write
```

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```
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the base time at which the first pixel service shall
occur. Time is expressed in minutes from the epoch of Midnight of each day.
<Unit>minute
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.6.23"
DEFVAL  {1}
::= { signControl 23 }
```

5.7.24 Message Code of the Activation Error Parameter

```
dmsActivateErrorMsgCode  OBJECT-TYPE
SYNTAX  MessageActivationCode
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the MessageActivationCode that resulted in the
current value of the dmsActivateMsgError object.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.6.24"
::= { signControl 24 }
```

5.7.25 Activate Message State Parameter

```
dmsActivateMessageState  OBJECT-TYPE
SYNTAX  INTEGER {
        fastActivationSign(1),
        slowActivatedOK(2),
        slowActivatedError(3),
        slowActivating(4) }
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Signs that are able to change their message with fast
activation always return 'fastActivationSign(1)'. This allows a central to
use this object to determine whether or not the sign does fast activation
(that is, whether the sign can immediately change the display). Signs that do
slow activation (such as a rotary drum sign) shall set this object to
'slowActivating(4)' during the changing of the display and when the message
change has completed shall change it to 'slowActivatedOK(2)' if successful or
'slowActivatedError(3)' if an error occurred during the display change.

A sign with fast activation uses this object only to indicate that it is a
fast activation sign. Such a sign shows an immediate response to a SET of
dmsActivateMessage that is either noError or a genErr. In the case of a
genErr the specific error is found in dmsActivateMsgError.

With a slow activation sign there are two opportunities to detect an error.
The first comes when the SET of dmsActivateMessage is performed, just as in
the fast activation sign. It could be a bad message number or other error. If
such an error is received, the message change does not occur and therefore
this object can be ignored. If the SET of dmsActivateMessage succeeds, then
the central must wait for either slowActivatedOK or slowActivatedError in
this object. If the sign detects an error, it shall set this object to
slowActivatedError and set the ‘message error’ bit in the shortErrorStatus
object. When a central receives slowActivatedError, it shall examine other
status objects specific to the sign, such as the rotary drum status objects,
to determine the precise error.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.6.25"
::= { signControl 25 }
```

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5.8 Illumination/Brightness Objects

```
illum  OBJECT IDENTIFIER ::= { dms 7 }

-- This node is an identifier used to group all objects supporting DMS
-- sign illumination functions that are common to DMS devices.
```

5.8.1 Illumination Control Parameter

```
dmsIllumControl  OBJECT-TYPE
SYNTAX  INTEGER {
                 other (1),
                 photocell (2),
                 timer (3),
                 manual (4), -- retired
                 manualDirect (5),
                 manualIndexed (6) }
ACCESS  read-write
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the method used to select the Brightness Level.
  A DMS may subrange the values supported, as indicated.
  other (1) - indicates that the Brightness Level is based on a
     mechanism not defined by this standard; see manufacturer
     documentation.
  photocell (2) - indicates that the Brightness Level is based on
     photocell status. Support for this mode shall be supported if
     Requirement 3.4.2.5.4 is selected.
  timer (3) - indicates that the Brightness Level is set by an internal
     timer. The details of this timer are not defined by this standard.
  manual (4) - indicates that the Brightness Level must be changed via
     the dmsIllumManLevel object. This mode is DEPRECATED.
  manualDirect (5) - indicates that a user can change the brightness output
to
     any of the brightness levels supported by the sign. This is not the same
     as the number of brightness levels defined within the table of the
     dmsIllumBrightnessValues object. This mode is mandatory, if this is the
     manual mode that the DMS supports.
  manualIndexed (6) - indicates that a user can change the brightness output
     to any of the rows defined within the table of the
     dmsIllumBrightnessValues object. This mode is mandatory, if this is
     the manual mode that the DMS supports.
The DMS must support either one of the manualXxx modes.

When switching to any of the manual modes (manual, manualDirect,
manualIndexed) from any other mode, the current brightness level shall
automatically be loaded into the dmsIllumManLevel object.

<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.7.1"
DEFVAL  {photocell}
::= { illum 1 }
-- In v02, the enumerated value of 'other' is RETIRED to improve
-- interoperability.
```

5.8.2 Maximum Illumination Photocell Level Parameter

```
dmsIllumMaxPhotocellLevel  OBJECT-TYPE
SYNTAX  INTEGER (0..65535)
ACCESS  read-only
```

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```
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the maximum value given by the
dmsIllumPhotocellLevelStatus-object.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.7.2"
::= { illum 2 }
```

5.8.3 Status of Illumination Photocell Level Parameter

```
dmsIllumPhotocellLevelStatus  OBJECT-TYPE
SYNTAX  INTEGER (0..65535)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the level of Ambient Light as a value ranging from 0
(darkest) to the value of dmsIllumMaxPhotocellLevel object (brightest), based
on the photocell detection. The dmsIllumPhotocellLevelStatus object is
considered a virtual photocell level in that it may be algorithmically
determined from one or more photocells and is the value used for calculations
dealing with the brightness table. The algorithm used to determine the
virtual level from the actual photocell readings is manufacturer specific to
accommodate various hardware needs.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.7.3"
::= { illum 3 }
```

5.8.4 Number of Illumination Brightness Levels Parameter

```
dmsIllumNumBrightLevels  OBJECT-TYPE
SYNTAX  INTEGER (0..255)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the number of individually selectable Brightness
Levels supported by the device, excluding the OFF level (=value of zero [0]).
This value indicates the total levels of brightness that this device
supports, not the number of rows defined in the table of the
dmsIllumBrightnessValues object.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.7.4"
::= { illum 4 }
```

5.8.5 Status of Illumination Brightness Level Parameter

```
dmsIllumBrightLevelStatus  OBJECT-TYPE
SYNTAX  INTEGER (0..255)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the current Brightness Level of the device, ranging
from 0 (OFF) to the maximum value given by the dmsIllumNumBrightLevels-
object (Brightest).
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.7.5"
::= { illum 5 }
```

5.8.6 Illumination Manual Level Parameter

```
dmsIllumManLevel  OBJECT-TYPE
SYNTAX  INTEGER (0..255)
ACCESS  read-write
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the desired value of the Brightness Level as a value
```

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```
ranging from 0 to the value of the dmsIllumNumBrightLevels-object when under
manual control.
When the dmsIllumControl object is set to a value of 'manualDirect (5)' then
the maximum value that this object can have is the total levels of brightness
that this device supports. A user can calculate the direct manual light
output as (65535 * (dmsIllumManLevel object value / dmsIllumNumBrightLevels
object value)).
When the dmsIllumControl object is set to a value of 'manualIndexed (6)' then
the maximum value that this object can be set to is the number of rows
defined in the table of the dmsIllumBrightnessValues object.
If the device supports version 1 and the dmsIllumControl object is set to a
value of 'manual (4)', then the deployment could be either (contact your
vendor to determine which way is implemented)
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.7.6"
::= { illum 6 }
```

5.8.7 Illumination Brightness Values Parameter

```
dmsIllumBrightnessValues  OBJECT-TYPE
SYNTAX  OCTET STRING
ACCESS  read-write
STATUS  mandatory
DESCRIPTION
"<Definition> . An OCTET STRING describing the sign's light output in
relationship to the Photocell(s) detection of ambient light. For each light
output level, there is a corresponding range of photocell levels. The number
of light output levels transmitted is defined by the first byte of the data
packet, but cannot exceed the value of the dmsIllumNumBrightLevels object.
Setting the value of this object to a non-supported or erroneous value shall
lead to a genErr. Cause of this error shall be denoted by the
dmsIllumBrightnessValuesError object.
After a SET, an implementation may interpolate these entries to create a
table with as many entries as needed, but the value of the object shall not
be affected by such interpolations.
For each light output level, there are three 16-bit values that occur in the
following order: Light output level, Photocell level down, Photocell level
up.
The light output level is a value between 0 (no light output) and 65535
(maximum light output). Each step is 1/65535 of the maximum light output
(linear scale).
The Photocell-level-down is the lowest photocell level allowed to maintain
the light output level. If the photocell level goes below this point, the
light output level goes down one light output level.
The Photocell-level-up is the highest photocell level for this light output
level. If the photocell level goes above this point, the light output level
goes up one light output level.
The photocell level (Up and Down) values may not exceed the value of the
dmsIllumMaxPhotocellLevel object.
The points transmitted should be selected so that there is no photocell level
which does not have a light output level. Hysteresis is possible by defining
the photocell-level-up at a level higher than the upper level's photocell-
level-down.
The encoding of the structure shall consist of a one byte integer value
indicating the number of rows in the table. This is followed by a series of
OER encoded Strings of the following structure:
  SEQUENCE {
      lightOutput            INTEGER (0..65535),
      photocellLevelDown     INTEGER (0..65535),
```

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```
      photocellLevelUp       INTEGER (0..65535) }

If the sign does not support photocell and the dmsIllumControl object value
is set to 'manualIndexed', then the values for the 'photocellLevelDown' and
'photocellLevelUp' still need to be entered that the table does not cause any
errors as defined in the dmsIllumBrightnessValuesError object. However, since
no photocell is supported, the entered values for 'photocellLevelDown' and
'photocellLevelUp' for the various 'lightOutputs' are meaningless.

<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.7.7"
::= { illum 7 }
```

5.8.8 Brightness Values Error Parameter

```
dmsIllumBrightnessValuesError  OBJECT-TYPE
SYNTAX  INTEGER {
                 other (1),
                 none (2),
                 photocellGap (3),
                 negativeSlope (4),
                 tooManyLevels (5),
                 invalidData (6) }
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the error encountered when the brightness table was
SET.
other(1) - is for a manufacturer specific indication when none of the
     other possible values can be used.
none(2)  - indicates that no error was encountered.
photocellGap(3) - indicates that certain photocell levels do not have
     an associated brightness level.
negativeSlope(4) - indicates that the photocell range used to select a
     brighter brightness level is lower or overlaps the photocell range
     used to select a dimmer brightness level. Note that some signs
     may allow a negative slope for special conditions without
     generating an error; e.g., external illumination for a reflective sign
     may be allowed to turn off during daylight conditions rather than
     getting brighter.
tooManyLevels(5) - indicates that more brightness levels are defined
     than are reported by dmsIllumNumBrightLevels.
invalidData(6) - indicates a manufacturer defined condition of invalid
     data not described by the other options.

<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.7.8"
::= { illum 8 }
```

5.8.9 Status of Illumination Light Output Parameter

```
dmsIllumLightOutputStatus  OBJECT-TYPE
SYNTAX  INTEGER (0..65535)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the current physical light output value ranging from
0 (darkest) to 65535 (maximum output).
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.7.9"
::= { illum 9 }
```

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5.9 Scheduling Action Objects

```
dmsSchedule  OBJECT IDENTIFIER ::= { dms 8 }

-- This node is an identifier used to group all DMS device-specific
-- objects supporting DMS sign timebased scheduling.
```

5.9.1 Action Table Entries Parameter

```
numActionTableEntries  OBJECT-TYPE
SYNTAX  INTEGER (0..255)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the number of rows that are stored in the
dmsActionTable. See the Specification in association with Requirement
3.5.10.4 to determine the number of actions required.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.8.1"
::= { dmsSchedule 1 }
```

5.9.2 Action Table Parameter

```
dmsActionTable  OBJECT-TYPE
SYNTAX      SEQUENCE OF DmsActionEntry
ACCESS      not-accessible
STATUS      mandatory
DESCRIPTION "<Definition> A table containing a list of message codes. The
scheduler (as defined in the dayPlanTable within NTCIP 1201) determines when
a message shall be displayed. This table determines which message shall be
activated.
<Table Type> static
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.8.2"
::= {dmsSchedule 2}

dmsActionEntry OBJECT-TYPE
SYNTAX      DmsActionEntry
ACCESS      not-accessible
STATUS      mandatory
DESCRIPTION "<Definition> Parameters of the DMS Action Table.
"
INDEX {dmsActionIndex}
::= {dmsActionTable 1}

DmsActionEntry ::= SEQUENCE {
   dmsActionIndex        INTEGER,
   dmsActionMsgCode      MessageIDCode }
```

5.9.2.1 Action Index Parameter

```
dmsActionIndex  OBJECT-TYPE
SYNTAX  INTEGER (1..255)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Enumerated listing of row entries. The value of this object
cannot exceed the value of the numActionTableEntries - object.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.8.2.1.1"
::= { dmsActionEntry 1 }
```

5.9.2.2 Action Message Code Parameter

```
dmsActionMsgCode  OBJECT-TYPE
```

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```
SYNTAX  MessageIDCode
ACCESS  read-write
STATUS  mandatory
DESCRIPTION
"<Definition> A number indicating the message memory type, the message number
and the associated message-specific CRC as indicated within the message
table.
Setting the CRC portion of this object to all zeros allows a message to
become activated without the CRC validation process.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.8.2.1.2"
DEFVAL  {'0000000000'h}
::= { dmsActionEntry 2 }
```

5.10 Auxiliary I/O Objects

```
-- The objects originally defined under this node have been moved
-- under the 'global' node. The definition of these objects is now
-- contained in NTCIP 1201 (Version 2-Amendment 2).
```

5.11 Sign Status

```
dmsStatus  OBJECT IDENTIFIER ::= { dms 9 }

-- This node is an identifier used to group all objects supporting DMS
-- sign status monitoring functions that are common to DMS devices.
```

5.11.1 Core Status

5.11.1.1 Number of Rows in MULTI Field Table Parameter

```
statMultiFieldRows  OBJECT-TYPE
SYNTAX  INTEGER (0..255)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the number of rows in the statMultiFieldTable that
are currently being used.
<Unit>row
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.1"
::= { dmsStatus 1 }
```

5.11.1.2 MULTI Field Table Parameter

```
statMultiFieldTable  OBJECT-TYPE
SYNTAX      SEQUENCE OF StatMultiFieldEntry
ACCESS      not-accessible
STATUS      mandatory
DESCRIPTION "<Definition> A table containing the currently displayed value of
a specified Field. The number of rows  is given by the value of
statMultiFieldRows-object.
<Table Type> static
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.2"
::= {dmsStatus 2}

statMultiFieldEntry OBJECT-TYPE
SYNTAX      StatMultiFieldEntry
ACCESS      not-accessible
STATUS      mandatory
DESCRIPTION "<Definition> Parameters of the Status Multi Field Table.
"
INDEX {statMultiFieldIndex}
```

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```
::= {statMultiFieldTable 1}

StatMultiFieldEntry ::= SEQUENCE {
   statMultiFieldIndex        INTEGER,
   statMultiFieldCode         INTEGER,
   statMultiCurrentFieldValue OCTET STRING}
```

5.11.1.2.1 MULTI Field Index Parameter

```
statMultiFieldIndex  OBJECT-TYPE
SYNTAX  INTEGER (1..255)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> The index into this table indicating the sequential order of
the field within the MULTI-string.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.2.1.1"
::= { statMultiFieldEntry 1 }
```

5.11.1.2.2 Code of MULTI Field Parameter

```
statMultiFieldCode  OBJECT-TYPE
SYNTAX  INTEGER (1..255)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the ID of the statMultiCurrentFieldValue-object. The
field codes are indicated under the 'Field'-tag in MULTI.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.2.1.2"
::= { statMultiFieldEntry 2 }
```

5.11.1.2.3 Current Value of the MULTI Field Parameter

```
statMultiCurrentFieldValue  OBJECT-TYPE
SYNTAX  OCTET STRING (SIZE (0..50))
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the value of the field in the currently displayed
MULTI-message.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.2.1.3"
::= { statMultiFieldEntry 3 }
```

5.11.1.3 Current Speed Parameter

```
dmsCurrentSpeed  OBJECT-TYPE
SYNTAX  INTEGER (0..255)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> The current speed value detected by the attached device. The
speed is in kilometers per hour (km/h). This value may vary from the
displayed speed value due to application specific implementation.
<Unit>kilometers per hour
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.3"
::= { dmsStatus 3 }
```

5.11.1.4 Current Speed Limit Parameter

```
dmsCurrentSpeedLimit  OBJECT-TYPE
SYNTAX  INTEGER (0..255)
ACCESS  read-write
```

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```
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the current speed limit in kilometers per hour
(km/h).
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.4"
::= { dmsStatus 4 }
```

5.11.1.5 Watchdog Failure Count Parameter

```
watchdogFailureCount  OBJECT-TYPE
SYNTAX  Counter
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> A counter indicating the number of watchdog failures that have
been detected.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.5"
::= { dmsStatus 5 }
```

5.11.1.6 Open Door Status Parameter

```
dmsStatDoorOpen  OBJECT-TYPE
SYNTAX  INTEGER (0..255)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates whether any of the doors to the controller cabinet or
the sign housing are open. This is a bitmap; if a bit is set (= 1) then the
door is open; if a bit not is not set, then the associated door is closed.
Each door is associated with a bit (bit-door correlation order specified by
manufacturer) allowing for up to 8 doors.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.6"
::= { dmsStatus  6 }
```

5.11.2 Status Error Objects

```
statError  OBJECT IDENTIFIER ::= { dmsStatus 7 }
-- This node is an identifier used to group all objects supporting DMS sign
message error status functions that are common to DMS devices.
```

5.11.2.1 Controller Errors

5.11.2.1.1 Short Error Status Parameter

```
shortErrorStatus  OBJECT-TYPE
SYNTAX  INTEGER (0..65535)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> A bitmap of summary errors. When a bit is set, the error is
presently active. When a bit is clear the error is not currently active. If
no sensor is present or supported (for a corresponding bit), the bit
shall not be set.
  The bits are defined as follows:
<Format>
Bit 0 - reserved
--    The definition contained in Version 1 stated 'other'. However,
--    'other' is no longer allowed as a value.
Bit 1- communications error - this bit shall be set if any error
      associated with the communications between the central
      computer and the device occurs.
```

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```
Bit 2- power error - this bit shall be set if any error associated with the
      power supply to any component occurs (see the objects
      dmsPowerFailureStatusMap and lowFuelThreshold).
Bit 3- attached device error - this bit shall be set if any error
      associated with attached (supported, and enabled) external
      devices occurs.
Bit 4- lamp error - this bit shall be set if any errors associated with any
      lamp occurs (see the objects lampFailureStuckOn and
      lampFailureStuckOff). This bit is only applicable to devices that
      support lamps such as fiber optic signs or front-illuminated
      reflective signs. This bit is not applicable to lamps or fluorescent
      lights illuminating the housing or cabinet.
Bit 5- pixel error - this bit shall be set if any errors associated with any
      pixel occurs (see the objects pixelFailureTableNumRows for NTCIP 1203v1
      deployments, and pixelFailureTableNumRows, and/or
      dmsPixelFailureTestRows and dmsPixelFailureMessageRows for NTCIP 1203v2
      deployments.).
      This bit is only applicable to devices
      that support illumination of individual pixels, but not to drum signs.
      Note that certain sign technologies such as flip disk only sign may
      not be able to determine pixel errors.
Bit 6- photocell error - this bit shall be set if any errors associated with
      the supported light sensors occurs (see the object
      dmsLightSensorStatusMap).
Bit 7- message error - this bit shall be set if any errors associated with
      activating and/or displaying a message occurs (see the object
      dmsActivateMsgError).
Bit 8- controller error - this bit shall be set if any errors associated
      with the controller occurs (see the controllerErrorStatus object)
Bit 9- temperature warning - this bit shall be set if any of the
      temperature values detected by the device exceed
      non-standardized temperature values (see the object
      tempSensorWarningMap). This bit is included to allow
      vendors or agencies to define vendor- or agency-specific
      threshold objects that indicate temperature changes that are of
      interest but not dangerous to the life-expectancy of the device
      (see also the 'critical temperature' bit)
Bit 10- climate-control system error - this bit shall be set if any errors
      associated with the climate control systems such as fans and/or
      heaters occurs (see the object dmsClimateCtrlStatusMap).
Bit 11- critical temperature error - this bit shall be set if the critical
      temperature as defined by the value of the critical temperature
      objects have been exceeded. (see the object
      dmsTempSensorHighCriticalTemperature
      and dmsTempSensorLowCriticalTemperature).
Bit 12- Drum-sign Rotor error - This bit shall be set if any errors
      associated with the rotor of a drum sign occurs.
Bit 13- This bit shall be set if any door to any DMS field component
      (cabinet or housing) is open(see the object
      dmsStatDoorOpen).
Bit 14- Humidity warning - This bit shall be set if any humidity sensor
      sensor is reporting a humidity warning (see the object
      dmsHumiditySensorStatusMap).

-- To track a history of transient error conditions utilize the event
-- logging table located in the Global Objects Definitions (NTCIP 1201).
```

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```
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.1"
::= { statError 1 }
```

5.11.2.1.2 Controller Error Status Parameter

```
controllerErrorStatus  OBJECT-TYPE
SYNTAX  INTEGER (0..255)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> A bitmap of controller related errors where the bits are
defined as follows:
<Format>
  Bit 0- other controller error
  Bit 1- PROM error
  Bit 2- program/processor error
  Bit 3- RAM error
  Bit 4- Controller to display interface error
If a bit is set to one (1), then the associated error is existing; if the bit
is set to zero (0), then the associated error is not existing.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.10"
::= { statError 10 }
```

5.11.2.2 Power Status Data

5.11.2.2.1 Power Failure Status Map Parameter

```
dmsPowerFailureStatusMap  OBJECT-TYPE
SYNTAX  OCTET STRING (SIZE (0..64))
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates whether each power supply within the sign has failed.
If a power supply has failed, its associated bit is set to one (1). The size
of this object shall always present one bit for each power supply supported
by the system, but shall not contain more than seven bits that are not
associated with any power supply.
A power supply is a local supply of subsystem power, such as a voltage
regulator. Further information about each failed subsystem may be found in
the dmsPowerStatusTable. If any bit within this object is set, then the
'power error' bit within the shortErrorStatus object shall also be set.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.11"
::= { statError 11 }
```

5.11.2.2.2 Number of Rows in Power Table Parameter

```
dmsPowerNumRows  OBJECT-TYPE
SYNTAX  INTEGER (0..512)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the number of rows in the dmsPowerStatusTable.
<Unit>row
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.12"
::= { statError 12 }
```

5.11.2.2.3 Power Status Table Parameter

```
dmsPowerStatusTable  OBJECT-TYPE
SYNTAX      SEQUENCE OF DmsPowerStatusEntry
ACCESS      not-accessible
```

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```
STATUS      mandatory
DESCRIPTION "<Definition> A table containing status information for each
power supply within a DMS.
<Table Type> static
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.13"
::= {statError 13}

dmsPowerStatusEntry OBJECT-TYPE
SYNTAX      DmsPowerStatusEntry
ACCESS      not-accessible
STATUS      mandatory
DESCRIPTION "<Definition> An entry in the power status table.
"
INDEX { dmsPowerIndex }
::= {dmsPowerStatusTable 1}

DmsPowerStatusEntry ::= SEQUENCE {
   dmsPowerIndex        INTEGER,
   dmsPowerDescription  DisplayString,
   dmsPowerMfrStatus    DisplayString,
   dmsPowerStatus       INTEGER,
   dmsPowerVoltage      INTEGER,
   dmsPowerType         INTEGER}
```

5.11.2.2.3.1 Power Index Parameter

```
dmsPowerIndex  OBJECT-TYPE
SYNTAX  INTEGER (1..512)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Index of the power supply status table. This index corresponds
to the bit position within the dmsPowerFailureStatusMap bitmap: the row with
index 1 corresponds to the low-order bit of the dmsPowerFailureStatusMap,
etc.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.13.1.1"
::= { dmsPowerStatusEntry 1 }
```

5.11.2.2.3.2 Power Description Parameter

```
dmsPowerDescription  OBJECT-TYPE
SYNTAX  DisplayString (SIZE (0..64))
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Human-readable description of the power supply. This value
should provide enough information for maintenance personnel to identify the
physical location of the power supply within the DMS. The description shall
include a meaningful definition of the location where the power supply
defined in this row is located within the DMS.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.13.1.2"
::= { dmsPowerStatusEntry 2 }
```

5.11.2.2.3.3 Power Manufacturer-Defined Status Parameter

```
dmsPowerMfrStatus  OBJECT-TYPE
SYNTAX  DisplayString (SIZE (0..64))
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
```

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```
"<Definition> Indicates the current manufacturer-defined status of the power
supply. This object allows a vendor to provide the operator with additional
information.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.13.1.3"
::= { dmsPowerStatusEntry 3 }
```

5.11.2.2.3.4 Power Status Parameter

```
dmsPowerStatus  OBJECT-TYPE
SYNTAX  INTEGER {
                 --other (1), -not used
                 noError (2),
                 powerFail (3),
                 -- The power supply is producing no output.
                 voltageOutOfSpec (4),
                 -- The power supply is producing voltage outside
                 -- the vendor specification
                 currentOutOfSpec (5) }
                 -- The power supply is producing current outside of
                 -- the vendor specification.
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the current status of the indicated power supply.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.13.1.4"
::= { dmsPowerStatusEntry 4 }
```

5.11.2.2.3.5 Power Voltage Status Parameter

```
dmsPowerVoltage  OBJECT-TYPE
SYNTAX  INTEGER (0..65535)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> A voltage measurement in units of hundredths (1/100) of a volt.
The maximum value (0xFFFF) corresponds to a voltage of 655.35 volts. AC
voltages are given in RMS (Root Mean Squared) value.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.13.1.5"
::= { dmsPowerStatusEntry 5 }
```

5.11.2.2.3.6 Power Status Type Parameter

```
dmsPowerType  OBJECT-TYPE
SYNTAX  INTEGER {
                  other (1),
                  acLine (2),
                  generator (3),
                  solar (4),
                  battery-UPS (5),
                  ledSupply (6),
                  lampSupply (7) }
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the type of power source or power supply represented
by the table row.
   other: indicates that the power source or supply is not one of the
      types listed  below (see device manual), in which case the
      corresponding dmsPowerDescription field provides a
      description of the entity represented by the row.
```

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```
   acLine: indicates that the row represents a source of AC  power  This
      is also reflected in the lineVolts object.;
   generator: indicates that the row represents a generator;
   solar: indicates that the row represents solar equipment;
   battery-UPS: indicates that the row represents a
      battery or UPS with no significant charging occurring. This
      is also reflected in the signVolts object.
   ledSupply: indicates that the row represents the power supply to
      one or more LED pixels.
   lampSupply: indicates that the row represents the power supply to
      one or more display lamps.

<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.13.1.6"
::= { dmsPowerStatusEntry 6 }
```

5.11.2.3 Climate Control Status Data

5.11.2.3.1 Fan Failure Parameter

```
-- This object has been deprecated. See Annex D for more information.
fanFailures  OBJECT-TYPE
SYNTAX  OCTET STRING (SIZE (0..4))
ACCESS  read-only
STATUS  deprecated
DESCRIPTION
"<Definition> Indicates whether each fan (system) within a DMS is capable of
operating, expressed as a bitmap. If a fan (system) failed, its associated
bit is set to one (1). Each fan system is associated with a bit (bit-fan
correlation order specified by manufacturer) allowing for up to 32 fan
systems to report failure status. A fan system is defined as a single fan,
group of fans, sensors, or filter systems. Whether each bit specifies a fan
or fan system is dependent on the manufacturer.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.8"
::= { statError 8 }
```

5.11.2.3.2 Fan Test Activation Parameter

```
-- This object has been deprecated. See Annex D for more information.
fanTestActivation  OBJECT-TYPE
SYNTAX  INTEGER {
                --other (1), -not used
                noTest (2),
                test (3) }
ACCESS  read-write
STATUS  deprecated
DESCRIPTION
"<Definition> Indicates the state of the fan testing. The actual test routine
can vary among different manufacturers. The results of the fan test shall be
stored in either the fanFailures-objects. Setting the value to test starts
the test, meaning this test is executed once. The sign controller
automatically sets the value of this object back to noTest after completion.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.9"
::= { statError 9 }
```

5.11.2.3.3 Climate-control System Failure Status Map Parameter

```
dmsClimateCtrlStatusMap  OBJECT-TYPE
SYNTAX  OCTET STRING (SIZE (0..64))
ACCESS  read-only
STATUS  mandatory
```

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```
DESCRIPTION
"<Definition> Indicates whether each climate-control subsystem within the
sign has failed. If a subsystem has failed, its associated bit is set to one
(1).  The size of this object shall always present one bit for each climate
control-subsystem supported by the system, but shall not contain more than
seven bits that are not associated with any climate-control subsystem.
Further information about each failed subsystem may be found in the
dmsClimateCtrlStatusTable. If any bit within this object is set, then the
'climate-control system error' bit within the shortErrorStatus object shall
also be set.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.14"
::= { statError 14 }
```

5.11.2.3.4 Number of Rows in Climate-control Status Table Parameter

```
dmsClimateCtrlNumRows  OBJECT-TYPE
SYNTAX  INTEGER (0..512)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the number of rows in the dmsClimateCtrlStatusTable.
<Unit>row
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.16"
::= { statError 16 }
```

5.11.2.3.5 Climate-control System Failure Status Table Parameter

```
dmsClimateCtrlStatusTable  OBJECT-TYPE
SYNTAX      SEQUENCE OF DmsClimateCtrlStatusEntry
ACCESS      not-accessible
STATUS      mandatory
DESCRIPTION "<Definition> A table containing status information for each
climate-control subsystem within a DMS.
<Table Type> static
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.17"
::= {statError 17}

dmsClimateCtrlStatusEntry OBJECT-TYPE
SYNTAX      DmsClimateCtrlStatusEntry
ACCESS      not-accessible
STATUS      mandatory
DESCRIPTION "<Definition> An entry in the climate-control status table.
"
INDEX { dmsClimateCtrlIndex }
::= {dmsClimateCtrlStatusTable 1}

DmsClimateCtrlStatusEntry ::= SEQUENCE {
dmsClimateCtrlIndex          INTEGER,
dmsClimateCtrlDescription    DisplayString,
dmsClimateCtrlMfrStatus      DisplayString,
dmsClimateCtrlErrorStatus    INTEGER,
dmsClimateCtrlOnStatus       INTEGER,
dmsClimateCtrlTestActivation INTEGER,
dmsClimateCtrlAbortReason    DisplayString,
dmsClimateCtrlType           INTEGER}
```

5.11.2.3.5.1 Climate-control Index Parameter

```
dmsClimateCtrlIndex  OBJECT-TYPE
SYNTAX  INTEGER (1..512)
```

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```
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Index of the climate control table. This index corresponds to
the bit position within the dmsClimateCtrlStatusMap bitmap: the row with
index 1 corresponds to the low-order bit of the dmsClimateCtrlStatusMap, etc.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.17.1.1"
::= { dmsClimateCtrlStatusEntry 1 }
```

5.11.2.3.5.2 Climate-control Description Parameter

```
dmsClimateCtrlDescription  OBJECT-TYPE
SYNTAX  DisplayString (SIZE (0..64))
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Human-readable description of the subsystem. This value should
provide enough information for maintenance personnel to identify the type
(AC, dehumidifier, heater, fan, etc) and physical location of the subsystem
within the DMS. The description shall include a meaningful definition of the
location where the sensor defined in this row is located within the DMS.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.17.1.2"
::= { dmsClimateCtrlStatusEntry 2 }
```

5.11.2.3.5.3 Climate-Control Manufacturer-Defined Status Parameter

```
dmsClimateCtrlMfrStatus  OBJECT-TYPE
SYNTAX  DisplayString (SIZE (0..64))
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the current manufacturer-defined status of the
climate-control equipment. This object allows a vendor to provide the
operator with additional information.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.17.1.3"
::= { dmsClimateCtrlStatusEntry 3 }
```

5.11.2.3.5.4 Climate-control System Error Status Parameter

```
dmsClimateCtrlErrorStatus  OBJECT-TYPE
SYNTAX  INTEGER {
                --other (1), -not used
                noError (2),
                fail (3),
                notMonitored (4)}
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the current status of the indicated subsystem.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.17.1.4"
::= { dmsClimateCtrlStatusEntry 4 }
```

5.11.2.3.5.5 Climate-control On Status Parameter

```
dmsClimateCtrlOnStatus  OBJECT-TYPE
SYNTAX  INTEGER (0..1)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates whether the indicated climate-control subsystem is
currently active. The bit orientation of 1 (set) indicates the system is on
```

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```
and a value of 0 (cleared) indicates the system is off.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.17.1.5"
::= { dmsClimateCtrlStatusEntry 5 }
```

5.11.2.3.5.6 Climate-control Test Activation Parameter

```
dmsClimateCtrlTestActivation  OBJECT-TYPE
SYNTAX  INTEGER {
                        noTest(2),
                        test(3),
                        testAborted(4) }
ACCESS  read-write
STATUS  mandatory
DESCRIPTION
"<Definition> Set to test(3) to activate the test for the climate-control
device indicated by this row of the table. If the test completes normally,
upon completion the sign shall set this object to noTest(2), with the results
of the test appearing in the dmsClimateCtrlStatusMap and the
dmsClimateCtrolErrorStatus objects and optionally in the
dmsClimateCtrlMfrStatus object. If the test does not complete normally
(either the sign declined to run the test at all or the test was started but
aborted), the sign shall set this object to testAborted(4) and shall specify
the reason for the abort in the dmsClimateCtrlAbortReason object. In the case
of an abort, the dmsClimateCtrlStatusMap, dmsClimateCtrolErrorStatus,  and
dmsClimateCtrlMfrStatus objects arenot be changed due to the test. At any
time, this object can be set to noTest(2) to end any test in progress (in
this case a subsequent read sees noTest(2) and not testAborted(4)). The value
testAborted(4) is a read-only status—this object cannot be set to
testAborted(4).

<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.17.1.6"
::= { dmsClimateCtrlStatusEntry 6 }
```

5.11.2.3.5.7 Climate-control Test Activation Abortion Parameter

```
dmsClimateCtrlAbortReason  OBJECT-TYPE
SYNTAX  DisplayString (SIZE (0..64))
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> If the dmsClimateCtrlTestActivation object has a value of
testAborted(4), this object indicates the manufacturer-defined reason as to
why the climate-control test was aborted. This object is meaningless if
dmsClimateCtrlTestActivation has any value other than testAborted(4).
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.17.1.7"
::= { dmsClimateCtrlStatusEntry 7 }
```

5.11.2.3.5.8 Climate-control Device Type Parameter

```
dmsClimateCtrlType  OBJECT-TYPE
SYNTAX  INTEGER {
                other (1),
                fansVentilation (2),
                fansSignFace (3),
                dehumidifier (4),
                heatCabinet (5),
                heatHousing (6),
                heatSignFace (7),
                airConditioningCabinet (8),
                airConditioningHousing (9)}
```

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```
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the type of the climate control device described in
this row of the table.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.17.1.8"
::= { dmsClimateCtrlStatusEntry 8 }
```

5.11.2.4 Pixel Failure Data

5.11.2.4.1 Number of Rows in Pixel Failure Table Parameter

```
pixelFailureTableNumRows  OBJECT-TYPE
SYNTAX  INTEGER (0..65535)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> The total number of rows contained in the pixelFailureTable
each indicating failed pixels.
The value is the sum of the dmsPixelFailureTestRows and the
dmsPixelFailureMessageRows objects.
<Unit>row
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.2"
::= { statError 2 }
```

5.11.2.4.2 Pixel Failure Table Parameter

```
pixelFailureTable  OBJECT-TYPE
SYNTAX      SEQUENCE OF PixelFailureEntry
ACCESS      not-accessible
STATUS      mandatory
DESCRIPTION "<Definition> A table containing the X and Y location of a failed
pixel. The number of rows is given by the value of pixelFailureTableNumRows -
object.
<Table Type> static
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.3"
::= {statError 3}

pixelFailureEntry OBJECT-TYPE
SYNTAX      PixelFailureEntry
ACCESS      not-accessible
STATUS      mandatory
DESCRIPTION "<Definition> Parameters of the Pixel Failure Table. The
detection of pixel failures during message displays shall be appended to the
end of the table.
"
INDEX { pixelFailureDetectionType, pixelFailureIndex}
::= {pixelFailureTable 1}

PixelFailureEntry ::= SEQUENCE {
   pixelFailureDetectionType  INTEGER,
   pixelFailureIndex          INTEGER,
   pixelFailureXLocation      INTEGER,
   pixelFailureYLocation      INTEGER,
   pixelFailureStatus         INTEGER}
```

5.11.2.4.2.1 Pixel Failure Detection Type Parameter

```
pixelFailureDetectionType  OBJECT-TYPE
SYNTAX  INTEGER {
```

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```
                --other (1), -retired
                pixelTest (2),
                messageDisplay(3) }
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the type of test/display that leads to the pixel
failure entry.
Once a pixel is detected as failed, it is entered in the table with a type of
either pixelTest or messageDisplay. In either case the failed pixel stays in
the table until pixelTestActivation is set to either test or clearTable.
Detection type pixelTest and messageDisplay are considered different methods
of testing for failed pixels. The pixelTest method is considered a foreground
processing method of failed pixel detection. Failed pixels detected during a
foreground pixel test are entered in the pixelTest pixel failure type. During
a foreground pixel test, the message on the display may or may not stay
present on the display.
The messageDisplay method is considered a background processing method of
failed pixel detection. During a background test, the readability/legibility
of the message shall not be affected by the test. If the manufacturer
supports background pixel test, failed pixels detected during a background
pixel test are entered in the messageDisplay pixel failure type.

<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.3.1.1"
::= { pixelFailureEntry 1 }
-- In v02, the enumerated value of 'other' is RETIRED to improve
-- interoperability.
```

5.11.2.4.2.2 Pixel Failure Index Parameter

```
pixelFailureIndex  OBJECT-TYPE
SYNTAX  INTEGER (1..65535)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Enumerated listing of row entries. Within each
pixelFailureDetectionType, entries shall start with one (1) and be
sequential.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.3.1.2"
::= { pixelFailureEntry 2 }
```

5.11.2.4.2.3 Pixel Failure X Location Parameter

```
pixelFailureXLocation  OBJECT-TYPE
SYNTAX  INTEGER (1..65535)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the X location of the failed pixel. The X direction
is the horizontal direction. The X location is counted from the left-most
pixel in number of pixels.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.3.1.3"
::= { pixelFailureEntry 3 }
```

5.11.2.4.2.4 Pixel Failure Y Location Parameter

```
pixelFailureYLocation  OBJECT-TYPE
SYNTAX  INTEGER (1..65535)
ACCESS  read-only
STATUS  mandatory
```

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```
DESCRIPTION
"<Definition> Indicates the Y location of the failed pixel. The Y direction
is the vertical direction. The Y location is counted from the top-most pixel
in number of pixels.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.3.1.4"
::= { pixelFailureEntry 4 }
```

5.11.2.4.2.5 Pixel Failure Status Parameter

```
pixelFailureStatus  OBJECT-TYPE
SYNTAX  INTEGER (0..255)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the current status of the specified pixel and the
operation which made this determination. This is a bit field with the
following format:
<Format>
Bit 0:   0: Not stuck on / 1: Stuck On
Bit 1:   0: No Color Error / 1: Color Error
Bit 2:   0: no electrical error / 1: electrical error
Bit 3:   0: no mechanical error / 1: mechanical error
Bit 4:   0: Not stuck off / 1: Stuck off
Bit 5:   0: No partial failure / 1: Partial failure - a partial failure
indicates a loss of pixel functionality that does not affect the full
luminance or visible area of a pixel. For example, if an LED DMS uses
multiple redundant LEDs at each pixel, the failure of a single LED at a given
pixel would be flagged as a partial failure. A partial failure indicates that
the pixel is still functioning, but with reduced visibility.

<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.3.1.5"
::= { pixelFailureEntry 5 }
```

5.11.2.4.3 Pixel Test Activation Parameter

```
pixelTestActivation  OBJECT-TYPE
SYNTAX  INTEGER {
                --other (1), -retired
                noTest (2),
                test (3),
                clearTable (4) }
ACCESS  read-write
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the state of the pixel testing. The actual test
routine can vary among different manufacturers. The results of the pixel
failure test shall be stored in the pixel failure table. The pixel failure
table, pixelFailureTableNumRows objects are cleared (both messageDisplay and
pixelTest types), when a pixel test is started (test) or a table is cleared
(clearTable). Setting the value to test starts the test, meaning this test is
executed once. Pixel failures identified by setting this object to test are
entered into the pixelTest type of the pixelFailureDetectionType. The sign
controller automatically sets the value of this object back to noTest after
completion.

<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.4"
DEFVAL  {noTest}
::= { statError 4 }
-- In v02, the enumerated value of 'other' is RETIRED to improve
```

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```
-- interoperability.
```

5.11.2.4.4 Pixel Status Table Parameter

```
pixelStatusTable  OBJECT-TYPE
SYNTAX      SEQUENCE OF PixelStatusEntry
ACCESS      not-accessible
STATUS      mandatory
DESCRIPTION "<Definition> A table containing a bitmap of all pixels. Because
the bitmap may be too large for a single data packet, the bitmap is broken
into blocks (represented by a dmsPixelStatus object). The number of rows is
determined by the number of pixels in the sign and the maximum size of the
dmsPixelStatus object.
<Table Type> static
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.18"
::= {statError 18}

pixelStatusEntry  OBJECT-TYPE
SYNTAX      PixelStatusEntry
ACCESS      not-accessible
STATUS      mandatory
DESCRIPTION "<Definition> Parameters of the Pixel Status Table.
"
INDEX { dmsPixelStatusIndex}
::= {pixelStatusTable 1}

PixelStatusEntry ::= SEQUENCE {
   dmsPixelStatusIndex    INTEGER,
   dmsPixelStatus         OCTET STRING }
```

5.11.2.4.4.1 Pixel Status Index Parameter

```
dmsPixelStatusIndex  OBJECT-TYPE
SYNTAX  INTEGER (1..255)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Index of the pixel status table. This index corresponds to one
entry of maximum size of 400 octets containing the status of each pixel
within the sign.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.18.1.1"
::= { pixelStatusEntry 1 }
```

5.11.2.4.4.2 Pixel Status Parameter

```
dmsPixelStatus  OBJECT-TYPE
SYNTAX  OCTET STRING (SIZE(1..400))
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates whether a pixel within the sign has failed.

Indicates the status of each pixel within the sign. Each bit within this
object is associated with an individual pixel. If a pixel has an error the
associated bit shall be one (1). If a pixel has no error, the associated bit
shall be zero (0).

The lowest-order bit corresponds to the top-left pixel of the sign face; the
next bit corresponds to the next pixel to the right, etc. At the end of a
pixel row, the next bit corresponds to the leftmost bit of the row below. If
```

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```
any bit within this object is set, then the 'pixel error' bit within the
shortErrorStatus object shall also be set. This object value is changed when
any type of pixel test within pixelTestActivation has completed.

Each row entry of this table contains a maximum of 400 octets which is
equivalent to 3200 pixels per row entry. The last entry of this table does
not need to be 400 octets but the preceding entries do. Any remaining bits
within the final byte of the last entry of this table shall be zero.

<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.18.1.2"
::= { pixelStatusEntry 2 }
```

5.11.2.4.5 Number of Pixel Failures from Pixel Test Parameter

```
dmsPixelFailureTestRows  OBJECT-TYPE
SYNTAX  INTEGER (0..65535)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the number of rows in the pixelFailureTable with a
pixelFailureDetectionType of 'pixelTest'.
<Unit>row
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.19"
::= { statError 19 }
```

5.11.2.4.6 Number of Pixel Failures from Message Display Parameter

```
dmsPixelFailureMessageRows  OBJECT-TYPE
SYNTAX  INTEGER (0..65535)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the number of rows in the pixelFailureTable with a
pixelFailureDetectionType of 'messageDisplay'.
<Unit>row
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.20"
::= { statError 20 }
```

5.11.2.5 Lamp Status Data

5.11.2.5.1 Stuck On Lamp Failure Parameter

```
lampFailureStuckOn  OBJECT-TYPE
SYNTAX  OCTET STRING (SIZE (0..255))
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates whether each lamp within the sign is stuck on as a
bitmap. If a lamp is stuck on, its associated bit is set to one (1). The size
of this object shall always present one bit for each lamp supported by the
DMS, but shall not contain more than seven bits that are not associated with
any lamp. The lamp error bit in shortErrorStatus shall be set if any bit in
lampFailureStuckOff is set.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.5"
::= { statError 5 }
-- The size of this object shall always present one bit for each lamp
-- supported by the DMS, regardless of the failure status of the individual
-- lamps.
```

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5.11.2.5.2 Stuck Off Lamp Failure Parameter

```
lampFailureStuckOff  OBJECT-TYPE
SYNTAX  OCTET STRING (SIZE (0..255))
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates whether each lamp within the sign is stuck off as a
bitmap. If a lamp is stuck off, its associated bit is set to one (1). The
size of this object shall always present one bit for each lamp supported by
the DMS, but shall not contain more than seven bits that are not associated
with any lamp. The lamp error bit in shortErrorStatus shall be set if any bit
in lampFailuresStuckOn is set.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.6"
::= { statError 6 }
-- The size of this object shall always present one bit for each lamp
-- supported by the DMS, regardless of the failure status of the individual
-- lamps.
```

5.11.2.5.3 Lamp Test Activation Parameter

```
lampTestActivation  OBJECT-TYPE
SYNTAX  INTEGER {
                --other (1), -retired
                noTest (2),
                test (3) }
ACCESS  read-write
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the state of the lamp testing. The actual test
routine can vary among different manufacturers. The results of the lamp
failure test shall be stored appropriately, in the lampFailureStuckOn- and/or
in the lampFailureStuckOff-objects. Setting the value to test starts the
test, meaning this test is executed once. The sign controller shall
automatically set the value of this object back to noTest after completion.
Activation of lamp test shall clear the object lampFailureStuckOn and
lampFailureStuckOff, the lamp status table, and the 'lamp fail' error bit in
shortErrorStatus. Results of the lamp test shall update these two objects,
the table and the error bit.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.7"
DEFVAL  {noTest}
::= { statError 7 }
-- In v02, the enumerated value of 'other' is RETIRED to improve
-- interoperability.
```

5.11.2.5.4 Number of Rows in Lamp Status Table Parameter

```
dmsLampNumRows  OBJECT-TYPE
SYNTAX  INTEGER (0..2040)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the number of rows in the dmsLampStatusTable. The
number of rows is equal to the total number of lamps contained in the DMS,
regardless of the failure status of the individual lamps.
<Unit>row
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.23"
::= { statError 23 }
```

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5.11.2.5.5 Lamp Status Table Parameter

```
dmsLampStatusTable  OBJECT-TYPE
SYNTAX      SEQUENCE OF DmsLampStatusEntry
ACCESS      not-accessible
STATUS      mandatory
DESCRIPTION "<Definition> A table containing status information for each lamp
within a DMS.
<Table Type> static
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.24"
::= {statError 24}

dmsLampStatusEntry OBJECT-TYPE
SYNTAX      DmsLampStatusEntry
ACCESS      not-accessible
STATUS      mandatory
DESCRIPTION "<Definition> An entry in the lamp status table.
"
INDEX { dmsLampIndex }
::= {dmsLampStatusTable 1}

DmsLampStatusEntry ::= SEQUENCE {
   dmsLampIndex        INTEGER,
   dmsLampDescription  DisplayString,
   dmsLampMfrStatus    DisplayString,
   dmsLampStatus       INTEGER,
   dmsLampPixelTop     INTEGER,
   dmsLampPixelLeft    INTEGER,
   dmsLampPixelBottom  INTEGER,
   dmsLampPixelRight   INTEGER}
```

5.11.2.5.5.1 Lamp Index Parameter

```
dmsLampIndex  OBJECT-TYPE
SYNTAX  INTEGER (1..2040)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Index of the lamp status table. The number of rows in this
table is equal to the value of the dmsLampNumRows object.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.24.1.1"
::= { dmsLampStatusEntry 1 }
```

5.11.2.5.5.2 Lamp Description Parameter

```
dmsLampDescription  OBJECT-TYPE
SYNTAX  DisplayString (SIZE (0..64))
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Human-readable description of the lamp. This value should
provide enough information for maintenance personnel to identify the physical
location of the lamp within the DMS.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.24.1.2"
::= { dmsLampStatusEntry 2 }
```

5.11.2.5.5.3 Lamp Manufacturer-defined Status Parameter

```
dmsLampMfrStatus  OBJECT-TYPE
SYNTAX  DisplayString (SIZE (0..64))
ACCESS  read-only
```

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```
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the current manufacturer-defined status of the lamp.
This object allows a vendor to provide the operator with additional
information.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.24.1.3"
::= { dmsLampStatusEntry 3 }
```

5.11.2.5.5.4 Lamp Status Parameter

```
dmsLampStatus  OBJECT-TYPE
SYNTAX  INTEGER {
                noError (2),
                stuckOff (3),
                stuckOn (4) }
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the current status of the indicated lamp.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.24.1.4"
::= { dmsLampStatusEntry 4 }
```

5.11.2.5.5.5 Lamp - Pixel Mapping Top Parameter

```
dmsLampPixelTop  OBJECT-TYPE
SYNTAX  INTEGER (1..65535)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the topmost row of pixels served by this lamp. The
top-most row on the sign face is row 1.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.24.1.5"
::= { dmsLampStatusEntry 5 }
```

5.11.2.5.5.6 Lamp - Pixel Mapping Left Parameter

```
dmsLampPixelLeft  OBJECT-TYPE
SYNTAX  INTEGER (1..65535)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the leftmost column of pixels served by this lamp.
The left-most column on the sign face is column 1.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.24.1.6"
::= { dmsLampStatusEntry 6 }
```

5.11.2.5.5.7 Lamp - Pixel Mapping Bottom Parameter

```
dmsLampPixelBottom  OBJECT-TYPE
SYNTAX  INTEGER (1..65535)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the bottommost row of pixels served by this lamp. The
top-most row on the sign face is row 1.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.24.1.7"
::= { dmsLampStatusEntry 7 }
```

5.11.2.5.5.8 Lamp - Pixel Mapping Right Parameter

```
dmsLampPixelRight  OBJECT-TYPE
SYNTAX  INTEGER (1..65535)
```

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```
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the rightmost column of pixels served by this lamp.
The left-most column on the sign face is column 1.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.24.1.8"
::= { dmsLampStatusEntry 8 }
```

5.11.2.6 Drum Status Data

5.11.2.6.1 Drum Display Failure Status Map Parameter

```
dmsDrumStatusMap  OBJECT-TYPE
SYNTAX  OCTET STRING (SIZE (0..2))
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates whether each drum display subsystem within the sign
has failed. If a subsystem has failed, its associated bit is set to one (1).
The size of this object shall always present one bit for each drum supported
by the DMS, but shall not contain more than seven bits that are not
associated with any drum.
Further information about each failed subsystem may be found in the
dmsDrumStatusTable. If any bit within this object is set, then the 'drum sign
error' bit within the shortErrorStatus object shall also be set.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.25"
::= { statError 25 }
```

5.11.2.6.2 Number of Rows in Drum Status Table Parameter

```
dmsDrumNumRows  OBJECT-TYPE
SYNTAX  INTEGER (0..16)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the number of rows in the dmsDrumStatusTable.
<Unit>row
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.26"
::= { statError 26 }
```

5.11.2.6.3 Drum Status Table Parameter

```
dmsDrumStatusTable  OBJECT-TYPE
SYNTAX      SEQUENCE OF DmsDrumStatusEntry
ACCESS      not-accessible
STATUS      mandatory
DESCRIPTION "<Definition> A table containing status information for each drum
display unit within a DMS.
<Table Type> static
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.27"
::= {statError 27}

dmsDrumStatusEntry OBJECT-TYPE
SYNTAX      DmsDrumStatusEntry
ACCESS      not-accessible
STATUS      mandatory
DESCRIPTION "<Definition> An entry in the drum status table.
"
INDEX { dmsDrumIndex }
::= {dmsDrumStatusTable 1}
```

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```
DmsDrumStatusEntry ::= SEQUENCE {
   dmsDrumIndex       INTEGER,
   dmsDrumDescription DisplayString,
   dmsDrumMfrStatus   DisplayString,
   dmsDrumStatus      INTEGER}
```

5.11.2.6.3.1 Drum Index Parameter

```
dmsDrumIndex  OBJECT-TYPE
SYNTAX  INTEGER (1..16)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Index of the drum status table. This index corresponds to the
bit position within the dmsDrumStatusMap bitmap: the row with index 1
corresponds to the low-order bit of the dmsDrumStatusMap, etc.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.27.1.1"
::= { dmsDrumStatusEntry 1 }
```

5.11.2.6.3.2 Drum Description Parameter

```
dmsDrumDescription  OBJECT-TYPE
SYNTAX  DisplayString (SIZE (0..64))
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Human-readable description of the drum. This value should
provide enough information for maintenance personnel to identify the physical
location of the drum within the DMS. The description shall include a
meaningful definition of the location where the sensor defined in this row is
located within the DMS.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.27.1.2"
::= { dmsDrumStatusEntry 2 }
```

5.11.2.6.3.3 Drum Manufacturer-defined Status Parameter

```
dmsDrumMfrStatus  OBJECT-TYPE
SYNTAX  DisplayString (SIZE (0..64))
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the current manufacturer-defined status of the drum.
This object allows a vendor to provide the operator with additional
information.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.27.1.3"
::= { dmsDrumStatusEntry 3 }
```

5.11.2.6.3.4 Drum Status Parameter

```
dmsDrumStatus  OBJECT-TYPE
SYNTAX  INTEGER {
                other (1),
                noError (2),
                interlockError (3),
                stuckError (4),
                positionError (5),
                positionUnknownError (6) }
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
```

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```
"<Definition> Indicates the current status of the indicated drum.
  noError - the drum is working properly.
  interlockError - the drum has failed to lock into a correct display
     position. It is hung up between two adjacent drum faces.
  stuckError - the drum cannot be moved from its present position, due
     to a problem with the drum mechanism.
  positionError - the drum has moved to a position other than the
     position requested by the DMS controller.
  positionUnknownError - the DMS controller cannot determine the
     position of the drum.

<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.27.1.4"
::= { dmsDrumStatusEntry 4 }
```

5.11.2.7 Light Sensor Status Data

5.11.2.7.1 Light Sensor Status Map Parameter

```
dmsLightSensorStatusMap  OBJECT-TYPE
SYNTAX  OCTET STRING (SIZE (0..2))
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the operational status of all light sensors. If a
light sensor is failed, the bit corresponding to the light sensor is set to
1; otherwise 0. The size of this object shall always present one bit for each
light sensor supported by the DMS, but shall not contain more than seven bits
that are not associated with any light sensor.
Each bit corresponds to an entry in the dmsLightSensorStatusTable. The low
order bit corresponds to the light sensor with dmsLightSensorIndex = 1.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.28"
::= { statError 28 }
```

5.11.2.7.2 Number of Rows in Light Sensor Status Table Parameter

```
dmsLightSensorNumRows  OBJECT-TYPE
SYNTAX  INTEGER (0..16)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the number of rows in the dmsLightSensorStatusTable.
<Unit>row
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.29"
::= { statError 29 }
```

5.11.2.7.3 Light Sensor Status Table Parameter

```
dmsLightSensorStatusTable  OBJECT-TYPE
SYNTAX      SEQUENCE OF DmsLightSensorStatusEntry
ACCESS      not-accessible
STATUS      mandatory
DESCRIPTION "<Definition> A table containing status information for each
light sensor within a DMS.
<Table Type> static
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.30"
::= {statError 30}

dmsLightSensorStatusEntry OBJECT-TYPE
SYNTAX      DmsLightSensorStatusEntry
ACCESS      not-accessible
```

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```
STATUS      mandatory
DESCRIPTION "<Definition> An entry in the light sensor status table.
"
INDEX { dmsLightSensorIndex }
::= {dmsLightSensorStatusTable 1}

DmsLightSensorStatusEntry ::= SEQUENCE {
   dmsLightSensorIndex          INTEGER,
   dmsLightSensorDescription    DisplayString,
   dmsLightSensorCurrentReading INTEGER,
   dmsLightSensorStatus         INTEGER }
```

5.11.2.7.3.1 Light Sensor Index Parameter

```
dmsLightSensorIndex  OBJECT-TYPE
SYNTAX  INTEGER (1..16)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Index of the light sensor status table. This index corresponds
to the bit position within the dmsLightSensorStatusMap bitmap: the row with
index 1 corresponds to the low-order bit of the dmsLightSensorStatusMap, etc.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.30.1.1"
::= { dmsLightSensorStatusEntry 1 }
```

5.11.2.7.3.2 Light Sensor Description Parameter

```
dmsLightSensorDescription  OBJECT-TYPE
SYNTAX  DisplayString (SIZE (0..64))
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Human-readable description of the light sensor. This value
should provide enough information for maintenance personnel to identify the
physical location of the light sensor within the DMS. The description shall
include a meaningful definition of the location where the sensor defined in
this row is located within the DMS.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.30.1.2"
::= { dmsLightSensorStatusEntry 2 }
```

5.11.2.7.3.3 Light Sensor Current Reading Parameter

```
dmsLightSensorCurrentReading  OBJECT-TYPE
SYNTAX  INTEGER (0..65535)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the current reading of the light sensor. Total
darkness shall cause the current reading to be zero, and full sunlight shall
cause a reading of 65535. The light sensor reading shall be a linear
function; the DMS must perform any required scaling.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.30.1.3"
::= { dmsLightSensorStatusEntry 3 }
```

5.11.2.7.3.4 Light Sensor Status Parameter

```
dmsLightSensorStatus  OBJECT-TYPE
SYNTAX  INTEGER {
                --other (1), -not used
                noError (2),
                fail (3) }
```

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```
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the current status of the indicated light sensor.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.30.1.4"
::= { dmsLightSensorStatusEntry 4 }
```

5.11.2.8 Humidity Data

5.11.2.8.1 Humidity Sensor Status Map Parameter

```
dmsHumiditySensorStatusMap  OBJECT-TYPE
SYNTAX  OCTET STRING (SIZE (0..2))
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the operational status of all humidity sensors. If a
humidity sensor is failed, the bit corresponding to the humidity sensor is
set to 1; otherwise 0.  The size of this object shall always present one bit
for each humidity sensor supported by the DMS, but shall not contain more
than seven bits that are not associated with any humidity sensor.
Each bit corresponds to an entry in the dmsHumiditySensorStatusTable. The low
order bit corresponds to the humidity sensor with dmsHumiditySensorIndex = 1.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.31"
::= { statError 31 }
```

5.11.2.8.2 Number of Rows in Humidity Sensor Status Table Parameter

```
dmsHumiditySensorNumRows  OBJECT-TYPE
SYNTAX  INTEGER (0..16)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the number of rows in the
dmsHumiditySensorStatusTable.
<Unit>row
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.32"
::= { statError 32 }
```

5.11.2.8.3 Humidity Sensor Status Table Parameter

```
dmsHumiditySensorStatusTable  OBJECT-TYPE
SYNTAX      SEQUENCE OF DmsHumiditySensorStatusEntry
ACCESS      not-accessible
STATUS      mandatory
DESCRIPTION "<Definition> A table containing status information for each
humidity sensor within a DMS.
<Table Type> static
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.33"
::= {statError 33}

dmsHumiditySensorStatusEntry OBJECT-TYPE
SYNTAX      DmsHumiditySensorStatusEntry
ACCESS      not-accessible
STATUS      mandatory
DESCRIPTION "<Definition> An entry in the humidity sensor status table.
"
INDEX { dmsHumiditySensorIndex }
::= { dmsHumiditySensorStatusTable 1}
```

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```
DmsHumiditySensorStatusEntry ::= SEQUENCE {
   dmsHumiditySensorIndex          INTEGER,
   dmsHumiditySensorDescription    DisplayString,
   dmsHumiditySensorCurrentReading INTEGER,
   dmsHumiditySensorStatus         INTEGER }
```

5.11.2.8.3.1 Humidity Sensor Index Parameter

```
dmsHumiditySensorIndex  OBJECT-TYPE
SYNTAX  INTEGER (1..16)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Index of the humidity sensor status table. This index
corresponds to the bit position within the dmsHumiditySensorStatusMap bitmap:
the row with index 1 corresponds to the low-order bit of the
dmsHumiditySensorStatusMap, etc.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.33.1.1"
::= { dmsHumiditySensorStatusEntry 1 }
```

5.11.2.8.3.2 Humidity Sensor Description Parameter

```
dmsHumiditySensorDescription  OBJECT-TYPE
SYNTAX  DisplayString (SIZE (0..64))
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Human-readable description of the humidity sensor. This value
should provide enough information for maintenance personnel to identify the
physical location of the humidity sensor within the DMS. The description
shall include a meaningful definition of the location where the sensor
defined in this row is located within the DMS.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.33.1.2"
::= { dmsHumiditySensorStatusEntry 2 }
```

5.11.2.8.3.3 Humidity Sensor Current Reading Parameter

```
dmsHumiditySensorCurrentReading  OBJECT-TYPE
SYNTAX  INTEGER (0..100)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the current reading of the humidity sensor, in
percent relative humidity.
<Unit>percent relative humidity
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.33.1.3"
::= { dmsHumiditySensorStatusEntry 3 }
```

5.11.2.8.3.4 Humidity Sensor Status Parameter

```
dmsHumiditySensorStatus  OBJECT-TYPE
SYNTAX  INTEGER {
                --other (1), -not used
                noError (2),
                fail (3) }
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the current status of the indicated humidity sensor.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.33.1.4"
::= { dmsHumiditySensorStatusEntry 4 }
```

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5.11.2.9 Temperature Sensor Data

5.11.2.9.1 Temperature Sensor Status Map Parameter

```
dmsTempSensorStatusMap  OBJECT-TYPE
SYNTAX  OCTET STRING (SIZE (0..2))
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the operational status of all temperature sensors. If
a temperature sensor is failed, the bit corresponding to the temperature
sensor is set to 1; otherwise 0. The size of this object shall always present
one bit for each temperature sensor supported by the DMS, but shall not
contain more than seven bits that are not associated with any temperature
sensor.

Each bit corresponds to an entry in the dmsTempSensorStatusTable. The low
order bit corresponds to the temperature sensor with dmsTempSensorIndex = 1.

<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.34"
::= { statError 34 }
```

5.11.2.9.2 Number of Rows in Temperature Sensor Status Table Parameter

```
dmsTempSensorNumRows  OBJECT-TYPE
SYNTAX  INTEGER (0..16)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the number of rows in the dmsTempSensorStatusTable.
<Unit>row
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.35"
::= { statError 35 }
```

5.11.2.9.3 Temperature Sensor Status Table Parameter

```
dmsTempSensorStatusTable  OBJECT-TYPE
SYNTAX      SEQUENCE OF DmsTempSensorStatusEntry
ACCESS      not-accessible
STATUS      mandatory
DESCRIPTION "<Definition> A table containing status information for each
temperature sensor within a DMS.
<Table Type> static
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.36"
::= {statError 36}

dmsTempSensorStatusEntry OBJECT-TYPE
SYNTAX      DmsTempSensorStatusEntry
ACCESS      not-accessible
STATUS      mandatory
DESCRIPTION "<Definition> An entry in the temperature sensor status table.
"
INDEX { dmsTempSensorIndex }
::= { dmsTempSensorStatusTable 1}

DmsTempSensorStatusEntry ::= SEQUENCE {
   dmsTempSensorIndex          INTEGER,
   dmsTempSensorDescription    DisplayString,
   dmsTempSensorCurrentReading INTEGER,
```

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```
   dmsTempSensorHighWarningTemperature INTEGER,
   dmsTempSensorLowWarningTemperature INTEGER,
   dmsTempSensorHighCriticalTemperature INTEGER,
   dmsTempSensorLowCriticalTemperature INTEGER,
   dmsTempSensorStatus         INTEGER }
```

5.11.2.9.3.1 Temperature Sensor Index Parameter

```
dmsTempSensorIndex  OBJECT-TYPE
SYNTAX  INTEGER (1..16)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Index of the temperature sensor status table. This index
corresponds to the bit position within the dmsTempSensorStatusMap bitmap: the
row with index 1 corresponds to the low-order bit of the
dmsTempSensorStatusMap, etc.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.36.1.1"
::= { dmsTempSensorStatusEntry 1 }
```

5.11.2.9.3.2 Temperature Sensor Description Parameter

```
dmsTempSensorDescription  OBJECT-TYPE
SYNTAX  DisplayString (SIZE (0..64))
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Human-readable description of the temperature sensor. This
value should provide enough information for maintenance personnel to identify
the physical location of the temperature sensor within the DMS.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.36.1.2"
::= { dmsTempSensorStatusEntry 2 }
```

5.11.2.9.3.3 Temperature Sensor Current Reading Parameter

```
dmsTempSensorCurrentReading
  OBJECT-TYPE
SYNTAX  INTEGER (-128..127)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the current reading of the temperature sensor in full
degrees Celsius.
<Unit>degrees Celsius
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.36.1.3"
::= { dmsTempSensorStatusEntry 3 }
```

5.11.2.9.3.4 Temperature Sensor High Warning Temperature Parameter

```
dmsTempSensorHighWarningTemperature  OBJECT-TYPE
SYNTAX  INTEGER (-128..127)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the high value of the temperature associated with
this temperature sensor that generates a warning, in full degrees Celsius.
This value should not be lower than the value of the
dmsTempSensorLowWarningTemperature object.
<Unit>degrees Celsius
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.36.1.4"
::= { dmsTempSensorStatusEntry 4 }
```

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5.11.2.9.3.5 Temperature Sensor Low Warning Temperature Parameter

```
dmsTempSensorLowWarningTemperature  OBJECT-TYPE
SYNTAX  INTEGER (-128..127)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the low value of the temperature associated with this
temperature sensor that generates a warning, in full degrees Celsius. This
value should not be higher than the value of the
dmsTempSensorHighWarningTemperature object.
<Unit>degrees Celsius
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.36.1.5"
::= { dmsTempSensorStatusEntry 5 }
```

5.11.2.9.3.6 Temperature Sensor High Critical Temperature Parameter

```
dmsTempSensorHighCriticalTemperature  OBJECT-TYPE
SYNTAX  INTEGER (-128..127)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the high value of the critical temperature associated
with this temperature sensor, in full degrees Celsius. This value shall not
be lower than the value of the dmsTempSensorLowCriticalTemperature object.
<Unit>degrees Celsius
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.36.1.6"
::= { dmsTempSensorStatusEntry 6 }
```

5.11.2.9.3.7 Temperature Sensor Low Critical Temperature Parameter

```
dmsTempSensorLowCriticalTemperature  OBJECT-TYPE
SYNTAX  INTEGER (-128..127)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the low value of the critical temperature associated
with this temperature sensor, in full degrees Celsius. This value shall not
be higher than the value of the dmsTempSensorHighCriticalTemperature object.
<Unit>degrees Celsius
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.36.1.7"
::= { dmsTempSensorStatusEntry 7 }
```

5.11.2.9.3.8 Temperature Sensor Status Parameter

```
dmsTempSensorStatus  OBJECT-TYPE
SYNTAX  INTEGER {
              other (1),
              noError (2),
              fail (3) }
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the current status of the indicated temperature
sensor.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.36.1.8"
::= { dmsTempSensorStatusEntry 8 }
```

5.11.2.9.4 Temperature Sensor Highest Critical Temperature Parameter

```
dmsTempSensorHighestCriticalTempThreshold  OBJECT-TYPE
```

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```
SYNTAX  INTEGER (-128..127)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the highest value of the critical temperature
threshold associated with any of the supported temperature sensors in the
DMS, in full degrees Celsius. This value shall not be lower than any of the
high critical values of any of the dmsTempSensorHighCriticalTemperature
objects within the dmsTempSensorStatusTable.
<Unit>degrees Celsius
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.37"
::= { statError 37 }
```

5.11.2.9.5 Temperature Sensor Lowest Critical Temperature Parameter

```
dmsTempSensorLowestCriticalTempThreshold  OBJECT-TYPE
SYNTAX  INTEGER (-128..127)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the lowest value of the critical temperature
threshold associated with any of the supported temperature sensors in the
DMS, in full degrees Celsius. This value shall not be higher than any of the
low critical values of any of the dmsTempSensorLowCriticalTemperature objects
within the dmsTempSensorStatusTable.
<Unit>degrees Celsius
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.7.38"
::= { statError 38 }
```

5.11.3 Power Status Objects

```
statPower  OBJECT IDENTIFIER ::= { dmsStatus 8 }
-- This node is an identifier used to group all objects supporting DMS sign
power status monitoring functions that are common to DMS devices.
```

5.11.3.1 Sign Volts Parameter

```
signVolts  OBJECT-TYPE
SYNTAX  INTEGER (0..65535)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> A voltage measurement in units of hundredth (1/100) of a volt.
The maximum value (0xFFFF) corresponds to a voltage of 655.35 volts. This is
an indication of the sign battery voltage.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.8.1"
::= { statPower 1 }
```

5.11.3.2 Low Fuel Threshold Parameter

```
lowFuelThreshold  OBJECT-TYPE
SYNTAX  INTEGER (0..100)
ACCESS  read-write
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the low fuel level threshold used to alert the user.
The threshold is indicated as a percent (%) of a full tank. When the level of
fuel is below the threshold, the bit for power alarm (bit 2) in the
shortErrorStatus-object shall be set to one (1).
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.8.2"
::= { statPower 2 }
```

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5.11.3.3 Fuel Level Parameter

```
fuelLevel  OBJECT-TYPE
SYNTAX  INTEGER (0..100)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> A number indicating the amount of fuel remaining, specified as
a percent (%) of a full tank.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.8.3"
::= { statPower 3 }
```

5.11.3.4 Engine RPM Parameter

```
engineRPM  OBJECT-TYPE
SYNTAX  INTEGER (0..255)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the engine rpm in units of 100. This provides a range
from 0 rpm to 25500 rpm.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.8.4"
::= { statPower 4 }
```

5.11.3.5 Line Volts Parameter

```
lineVolts  OBJECT-TYPE
SYNTAX  INTEGER (0..255)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> The DMS line voltage measurement in (1.0) volts. The range is 0
volts to 255 volts.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.8.5"
::= { statPower 5 }
```

5.11.3.6 Power Source Parameter

```
powerSource  OBJECT-TYPE
SYNTAX  INTEGER {
                 other (1),
                 powerShutdown (2),
                 noSignPower (3),
                 acLine (4),
                 generator (5),
                 solar (6),
                 battery-UPS (7) }
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the source of power that is currently utilized by the
sign.
  other: indicates that the sign is powered by a method not listed
     below (see device manual);
  powerShutdown: indicates that there is just enough power to perform
     shutdown activities.
  noSignPower: indicates that the sign controller has power but the
     sign display has no power;
  acLine: indicates that the controller and sign is powered by AC
     power;
```

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```
  generator: indicates that the sign and the controller are powered by
     a generator;
  solar: indicates that the sign and the controller are powered by solar
     equipment;
  battery-UPS: indicates that the sign and controller are powered by
     battery or UPS with no significant charging occurring.

<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.8.6"
::= { statPower 6 }
```

5.11.4 Temperature Status Objects

```
statTemp  OBJECT IDENTIFIER ::= { dmsStatus 9 }
-- This node is an identifier used to group all objects supporting DMS sign
temperature status monitoring functions that are common to DMS devices.
```

5.11.4.1 Minimum Temperature of Control Cabinet Parameter

```
tempMinCtrlCabinet  OBJECT-TYPE
SYNTAX  INTEGER (-128..127)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the current temperature (single sensor) or the
current minimum temperature (multiple sensors) within the DMS Control Cabinet
in degrees Celsius.
<Unit>degrees Celsius
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.9.1"
::= { statTemp 1 }
```

5.11.4.2 Maximum Temperature of Control Cabinet Parameter

```
tempMaxCtrlCabinet  OBJECT-TYPE
SYNTAX  INTEGER (-128..127)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the current temperature (single sensor) or the
current maximum temperature (multiple sensors) within the DMS Control Cabinet
in degrees Celsius.
<Unit>degrees Celsius
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.9.2"
::= { statTemp 2 }
```

5.11.4.3 Minimum Ambient Temperature Parameter

```
tempMinAmbient  OBJECT-TYPE
SYNTAX  INTEGER (-128..127)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the current outside ambient temperature (single
sensor) or the current minimum outside ambient temperature (multiple sensors)
in degrees Celsius.
<Unit>degrees Celsius
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.9.3"
::= { statTemp 3 }
```

5.11.4.4 Maximum Ambient Temperature Parameter

```
tempMaxAmbient  OBJECT-TYPE
SYNTAX  INTEGER (-128..127)
```

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```
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the current outside ambient temperature (single
sensor) or the current maximum outside ambient temperature (multiple sensors)
in degrees Celsius.
<Unit>degrees Celsius
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.9.4"
::= { statTemp 4 }
```

5.11.4.5 Minimum Temperature of Sign Housing Parameter

```
tempMinSignHousing  OBJECT-TYPE
SYNTAX  INTEGER (-128..127)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the current temperature (single sensor) or the
current minimum temperature (multiple sensors) in the sign housing in degrees
Celsius.
<Unit>degrees Celsius
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.9.5"
::= { statTemp 5 }
```

5.11.4.6 Maximum Temperature of Sign Housing Parameter

```
tempMaxSignHousing  OBJECT-TYPE
SYNTAX  INTEGER (-128..127)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the current temperature (single sensor) or the
current maximum temperature (multiple sensors) in the sign housing in degrees
Celsius.
<Unit>degrees Celsius
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.9.6"
::= { statTemp 6 }
```

5.11.4.7 Temperature Sensor Warning Parameter

```
tempSensorWarningMap  OBJECT-TYPE
SYNTAX  OCTET STRING (SIZE (0..2))
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates whether each temperature sensor has exceeded a
dmsTempSensorHighWarningTemperature or dmsTempSensorLowWarningTemperature
value. If a temperature sensor has exceeded the defined value, the bit
corresponding to the temperature sensor is set to 1; otherwise 0. The mapping
of bits to individual sensors is manufacturer specific. This bitmap of this
object shall be configured as defined in the dmsTempSensorStatusTable in that
the first bit of this object shall correspond to the first row in that table,
the second bit shall correspond to the second row, and so forth.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.9.7"
::= { statTemp 7 }
```

5.11.4.8 Critical Temperature Map Parameter

```
tempSensorCriticalTempMap  OBJECT-TYPE
SYNTAX  OCTET STRING (SIZE (0..2))
ACCESS  read-only
```

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```
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates whether each temperature sensor has exceeded the
dmsTempSensorHighCriticalTemperature or the
dmsTempSensorLowCriticalTemperature threshold. If a temperature sensor has
exceeded the defined value, the bit corresponding to the temperature sensor
is set to 1; otherwise 0. The mapping of bits to individual sensors is
manufacturer specific. This bitmap of this object shall be configured as
defined in the dmsTempSensorStatusTable in that the first bit of this object
shall correspond to the first row in that table, the second bit shall
correspond to the second row, and so forth.

<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.9.9.8"
::= { statTemp 8 }
```

5.12 Graphic Definition Objects

```
graphicDefinition  OBJECT IDENTIFIER ::= { dms 10 }

-- This node is an identifier used to group all objects for DMS graphic
-- configurations that are common to DMS devices.
```

5.12.1 Maximum Number of Graphics Parameter

```
dmsGraphicMaxEntries  OBJECT-TYPE
SYNTAX  INTEGER (0..255)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the maximum number of graphics that the sign can
store.
<Unit>graphic
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.10.1"
::= { graphicDefinition 1 }
```

5.12.2 Number of Graphics Parameter

```
dmsGraphicNumEntries  OBJECT-TYPE
SYNTAX  INTEGER (0..255)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the number of graphics currently stored within the
sign.
<Unit>graphic
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.10.2"
::= { graphicDefinition 2 }
```

5.12.3 Maximum Graphic Size Parameter

```
dmsGraphicMaxSize  OBJECT-TYPE
SYNTAX  INTEGER (0..65535)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the maximum size (in bytes) of each graphic the sign
is capable of storing. This value shall be an even multiple of the object
dmsGraphicBlockSize.
<Unit>byte
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.10.3"
::= { graphicDefinition 3 }
```

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5.12.4 Available Graphic Memory Parameter

```
availableGraphicMemory  OBJECT-TYPE
SYNTAX  Counter
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> An indication of the amount of memory left, in bytes, to store
graphics.
<Unit>byte
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.10.4"
::= { graphicDefinition 4 }
```

5.12.5 Graphic Block Size Parameter

```
dmsGraphicBlockSize  OBJECT-TYPE
SYNTAX  INTEGER (0..65535)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the size of each block within each graphic bitmap
image. A graphic bitmap may consist of at most
dmsGraphicMaxSize/dmsGraphicBlockSize number of blocks.
<Unit>byte
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.10.5"
::= { graphicDefinition 5 }
```

5.12.6 Graphics Table Parameter

```
dmsGraphicTable  OBJECT-TYPE
SYNTAX      SEQUENCE OF DmsGraphicEntry
ACCESS      not-accessible
STATUS      mandatory
DESCRIPTION "<Definition> A table containing the information needed to
configure/define a particular graphic. The values of a columnar object
(except the dmsGraphicStatus) cannot be changed when the 'dmsGraphicStatus'-
object of that particular row is any value other than 'modifying'.
<Table Type> static
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.10.6"
::= {graphicDefinition 6}

dmsGraphicEntry OBJECT-TYPE
SYNTAX      DmsGraphicEntry
ACCESS      not-accessible
STATUS      mandatory
DESCRIPTION "<Definition> Parameters of the Graphic Table.
"
INDEX {dmsGraphicIndex}
::= {dmsGraphicTable 1}

DmsGraphicEntry ::= SEQUENCE {
      dmsGraphicIndex   INTEGER,
      dmsGraphicNumber  INTEGER,
      dmsGraphicName    DisplayString,
      dmsGraphicHeight  INTEGER,
      dmsGraphicWidth   INTEGER,
      dmsGraphicType    INTEGER,
      dmsGraphicID      INTEGER,
      dmsGraphicTransparentEnabled  INTEGER,
```

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```
      dmsGraphicTransparentColor    OCTET STRING,
      dmsGraphicStatus  INTEGER}
```

5.12.6.1 Graphic Index Parameter

```
dmsGraphicIndex  OBJECT-TYPE
SYNTAX  INTEGER (1..255)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the row number of the entry. This index directly
corresponds to dmsGraphicBitmapIndex located in dmsGraphicBitmapTable. The
storage for each graphic of this table is located in dmsGraphicBitmapTable.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.10.6.1"
::= { dmsGraphicEntry 1 }
```

5.12.6.2 Graphic Number Parameter

```
dmsGraphicNumber  OBJECT-TYPE
SYNTAX  INTEGER (1..255)
ACCESS  read-write
STATUS  mandatory
DESCRIPTION
"<Definition> A unique, user-specified number for a particular graphic which
can be different from the value of the dmsGraphicIndex-object. This is the
number referenced by MULTI when specifying a particular graphic. A device
shall return a badValue error, if this value is not unique.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.10.6.2"
::= { dmsGraphicEntry 2 }
```

5.12.6.3 Graphic Name Parameter

```
dmsGraphicName  OBJECT-TYPE
SYNTAX  DisplayString (SIZE (0..64))
ACCESS  read-write
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the name of the graphic.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.10.6.3"
::= { dmsGraphicEntry 3 }
```

5.12.6.4 Graphic Height Parameter

```
dmsGraphicHeight  OBJECT-TYPE
SYNTAX  INTEGER (1..255)
ACCESS  read-write
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the height of the graphic in pixels. The value of
this object shall not exceed vmsSignHeightPixels.
<Unit>pixel
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.10.6.4"
::= { dmsGraphicEntry 4 }
```

5.12.6.5 Graphic Width Parameter

```
dmsGraphicWidth  OBJECT-TYPE
SYNTAX  INTEGER (1..65535)
ACCESS  read-write
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the width of the graphic in pixels. The value of this
```

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```
object shall not exceed vmsSignWidthPixels.
<Unit>pixel
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.10.6.5"
::= { dmsGraphicEntry 5 }
```

5.12.6.6 Graphic Type Parameter

```
dmsGraphicType  OBJECT-TYPE
SYNTAX  INTEGER {
                monochrome1bit(1),
                monochrome8bit(2),
                colorClassic(3),
                color24bit(4) }
ACCESS  read-write
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the type of the graphic stored in this row.
For definitions of the values see the dmsColorScheme object.  All DMS shall
support the monochrome1bit graphic type.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.10.6.6"
::= { dmsGraphicEntry 6 }
```

5.12.6.7 Graphic ID Parameter

```
dmsGraphicID  OBJECT-TYPE
SYNTAX  INTEGER (0..65535)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Each graphic that has been downloaded to a sign shall have a
relatively unique ID. This ID shall be calculated using the CRC-16 algorithm
defined in ISO 3309 and the associated OER-encoded (as defined in NTCIP 1102)
GraphicInfoList.

The following definitions are used to define the above referenced
GraphicInfoList.

Complete definitions for these referenced objects, including size
information, is contained elsewhere in this document.

GraphicInfoList ::= SEQUENCE {
                    number INTEGER(1..255),
                    -- dmsGraphicNumber of the subject graphic
                    height INTEGER(1..65535),
                    -- dmsGraphicHeight of the subject graphic
                    width INTEGER(1..65535),
                    -- dmsGraphicWidth of the subject graphic
                    type INTEGER (1..4),
                    -- dmsGraphicType of the subject graphic
                    transparentEnabled INTEGER(0..1)
                    -- dmsGraphicTransparentEnabled of the graphic
                    transparentColor OCTET STRING (SIZE(3))
                    -- dmsGraphicTransparentColor of the graphic
                    -- if dmsGraphicType not color24bit, first octet is the
                    -- transparent color and remaining octets are zero
                    bitmap OCTET STRING (SIZE (Z))
                    -- the bitmap of the subject graphic
                    }
```

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```
where      Z = ((height * width) + 7) / 8  -- for monochrome1bit
                                    --(remaining bits are set to zero)
               Z = (height * width) -- for monochrome8bit or colorClassic
               Z = (height * width) * 3 -- for color24bit

This gives a predictable byte stream for the GraphicInfoList:
[number]             -- 1 octet
[height]             -- 2 octets, MSB first
[width]              -- 2 octets, MSB first
[type]               -- 1 octet
[transparentEnabled] -- 1 octet
[transparentcolor]   -- 3 octets (last 2 octets set to 0 if not color24bit)
[bitmap]             -- Z octets, according to height, width & color scheme

Examples:
Given the 10x6 bitmap - 84 92 63 08 C2 48 A1 70 =
@OOOO@OO@O
O@OO@OO@@O
OO@@OOOO@O
OO@@OOOO@O
O@OO@OOO@O
@OOOO@O@@@
OOOO

1)   dmsGraphicNumber = 3
     dmsGraphicHeight = 6
     dmsGraphicWidth = 10
     dmsGraphicType = 1
     dmsGraphicTransparentEnabled = 0
     dmsGraphicTransparentColor = 1
     dmsGraphicBitmap = 84 92 63 08 C2 48 A1 70

GraphicInfoList = 03 00 06 00 0A 01 00 01 00 00 84 92 63 08 C2 48 A1 70
dmsGraphicID = 0xB95A

where               03 = dmsGraphicNumber
                 00 06 = dmsGraphicHeight
                 00 0A = dmsGraphicWidth
                    01 = dmsGraphicType (monochrome1bit)
                    00 = dmsGraphicTransparentEnabled
              01  00 00 = dmsGraphicTransparentColor
84 92 63 08 C2 48 A1 70 = dmsGraphicBitmap

2)   dmsGraphicNumber = 4
     dmsGraphicHeight = 6
     dmsGraphicWidth = 10
     dmsGraphicType = 1
     dmsGraphicTransparentEnabled = 0
     dmsGraphicTransparentColor = 0
     dmsGraphicBitmap = 84 92 63 08 C2 48 A1 70

GraphicInfoList = 04 00 06 00 0A 01 00 00 00 00 84 92 63 08 C2 48 A1 70
dmsGraphicID = 0xBFF5

where               04 = dmsGraphicNumber
                 00 06 = dmsGraphicHeight
                 00 0A = dmsGraphicWidth
```

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```
                    01 = dmsGraphicType (monochrome1bit)
                    00 = dmsGraphicTransparentEnabled
                 00 00 00 = dmsGraphicTransparentColor
84 92 63 08 C2 48 A1 70 = dmsGraphicBitmap

3) A 4x4 pixel color classic graphic of the letter 'Z' in red

     dmsGraphicNumber = 5
     dmsGraphicHeight = 4
     dmsGraphicWidth = 4
     dmsGraphicType = 3
     dmsGraphicTransparentEnabled = 1
     dmsGraphicTransparentColor = 7
     dmsGraphicBitmap = 01 01 01 01 07 07 01 07 07 01 07 07 01 01 01 01

GraphicInfoList = 05 00 04 00 04 03 01 07 00 00 01 01 01 01 07 07 01 07 07 01
07 07 01 01 01 01
dmsGraphicID = 0x8FE0

where                05 = dmsGraphicNumber
                     00 04 = dmsGraphicHeight
                     00 04 = dmsGraphicWidth
                     03 = dmsGraphicType (colorClassic)
                     01 = dmsGraphicTransparentEnabled
                     07 00 00 = dmsGraphicTransparentColor (white)
01 01 01 01 07 07 01 07 07 01 07 07 01 01 01 01 = dmsGraphicBitmap

4) -- a 2x2 pixel square RGB graphic with green as the transparent color in
the lower left pixel
     dmsGraphicNumber = 7
     dmsGraphicHeight = 2
     dmsGraphicWidth = 2
     dmsGraphicType = 4
     dmsGraphicTransparentEnabled = 1
     dmsGraphicTransparentColor = 00 FF 00
     dmsGraphicBitmap = FFFFFF FF00FF 00FF00 FF00FF

GraphicInfoList = 07 00 02 00 02 04 01 00 FF 00 FFFFFF FF00FF 00FF00 FF00FF
dmsGraphicID = 0x078D

where                   07 = dmsGraphicNumber
                     00 02 = dmsGraphicHeight
                     00 02 = dmsGraphicWidth
                        04 = dmsGraphicType (color24bit)
                        01 = dmsGraphicTransparentEnabled
                  00 FF 00 = dmsGraphicTransparentColor (green)
FFFFFF FF00FF 00FF00 FF00FF = dmsGraphicBitmap

<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.10.6.7"
::= { dmsGraphicEntry 7 }
```

5.12.6.8 Graphic Transparent Enabled Parameter

```
dmsGraphicTransparentEnabled  OBJECT-TYPE
SYNTAX  INTEGER (0..1)
ACCESS  read-write
STATUS  mandatory
DESCRIPTION
```

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```
"<Definition> Indicates whether the graphic contains a color that is
considered transparent. A value of 0 means there is no transparent color.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.10.6.8"
::= { dmsGraphicEntry 8 }
```

5.12.6.9 Graphic Transparent Color Parameter

```
dmsGraphicTransparentColor  OBJECT-TYPE
SYNTAX  OCTET STRING (SIZE(1 | 3))
ACCESS  read-write
STATUS  mandatory
DESCRIPTION
"<Definition> If dmsGraphicTransparentEnabled indicates that the graphic
contains a transparent color, this object specifies the color. All pixels in
the graphic that exactly match this color shall be considered transparent
such that when the graphic is displayed on the sign, those transparent pixels
will be left at whatever color exists on the message beneath the graphic (or
before the graphic is ‘painted’ onto the sign). The format of this color
specification depends on the graphic type specified in dmsGraphicType. When
the 'color24bit' scheme is used, then this object will contain three octets.
Otherwise, it will contain a single octet. When 'color24bit' is used, the
first byte in this octet shall be red, the second byte green, and the third
byte blue. For other color schemes, the color is specified by a single byte
as defined in the color scheme.

<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.10.6.9"
::= { dmsGraphicEntry 9 }
```

5.12.6.10 Graphic Status Parameter

```
dmsGraphicStatus  OBJECT-TYPE
SYNTAX  INTEGER {
                notUsed (1),
                modifying (2),
                calculatingID (3),
                readyForUse (4),
                inUse (5),
                permanent (6),
                modifyReq (7),
                readyForUseReq (8),
                notUsedReq (9) }
ACCESS  read-write
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the current state of the graphic. This state-machine
allows for defining a graphic, readying a graphic (making it usable by a
message), and preventing its modification. See Section 4.3.2 for additional
state-machine requirements.

If dmsGraphicStatus is set to a value of notUsedReq (9), as this state-
machine transitions to the state of notUsed (1) the device shall release all
memory space allocated to that graphic bitmap.
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.10.6.10"
::= { dmsGraphicEntry 10 }
```

5.12.7 Graphics Bitmap Table Parameter

```
dmsGraphicBitmapTable  OBJECT-TYPE
SYNTAX      SEQUENCE OF DmsGraphicBitmapEntry
ACCESS      not-accessible
```

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```
STATUS      mandatory
DESCRIPTION "<Definition> A table containing the bitmap information for the
graphic entries within the dmsGraphicTable. The values of a columnar object
in this table cannot be changed when the 'dmsGraphicStatus' object of the
corresponding row (row with the same index) in the dmsGraphicTable is any
value other than 'modifying'.

The dmsGraphicBitmapTable permits a complete bitmap to be downloaded to a
sign in pieces small enough to fit within a single SNMP SET request. Each
dmsGraphicBlockSize-sized chunk within the bitmap is represented by a
distinct row of the bitmap data Table; that is, the table is indexed by (1)
the dmsGraphicIndex, and (2) the dmsGraphicBlockNumber of a particular data
block within the graphic's data. Note that this mechanism is purely a
piecewise transfer method layered atop the bitmap data; when all the blocks
of a graphic image are downloaded, they must, as a group, conform to the
format described below. For a particular value of dmsGraphicIndex, the bitmap
defining the graphic image can be constructed in the following manner:
Concatenate the rows of the dmsGraphicBitmapTable with the matching
dmsGraphicIndex, in order of the dmsGraphicBlockNumber value, until the
resultant OCTET STRING is large enough to contain the entire image as defined
by the dmsGraphicHeight and dmsGraphicWidth values for the dmsGraphicIndex in
question.

The format of a complete bitmap is described here:
A complete bitmap image is defined by the rows in dmsGraphicBitmapTable that
share a common dmsGraphicIndex, as defined above. A bitmap image denotes the
color of each pixel within a rectangular region. The size of the rectangular
region is defined by the dmsGraphicHeight and dmsGraphicWidth objects.

If dmsGraphicType is a value of 'monochrome1bit', each bit within the bitmap
data corresponds to a pixel on the DMS display. Starting with the first byte
of the bitmap data, the most significant bit defines the state of the pixel
in the upper left corner of the rectangular region. Byte 1 through byte N of
the bitmap data corresponds to the rectangular region by rows, left to right,
then top to bottom. If the rectangular region is not divisible by 8, the
remaining bits shall be 0 and contained in the lower bits of the last byte of
the bitmap data. In this case, the total size of the bitmap image in bytes is
given by this formula:
  B = ((dmsGraphicWidth * dmsGraphicHeight) + 7)/8
The first term computes the approximate size of the bitmap in bytes, +/- one
byte. The second term computes whether the size of the bitmap in bits is
divisible by 8; if not, an extra byte is required to hold the remaining few
bits.

If the dmsColorScheme is monochrome8bit, colorClassic, or color24bit, and the
graphic is defined with dmsGraphicType monochrome1bit, then pixels are
displayed with the foreground color (bit = 1) or black (bit = 0).  Note that
if dmsGraphicTransparentEnabled is set to 1 and dmsGraphicTransparentColor is
set to 0 then a monochrome1bit graphic can be displayed in the same manner as
a font character.

If dmsGraphicType is a value of 'monochrome8bit', each byte within the bitmap
data corresponds to a pixel on the DMS display. The first byte of the bitmap
data defines the state of the pixel in the upper left corner of the
rectangular region. Byte 1 through byte N of the bitmap data correspond to
the rectangular region by rows, left to right, then top to bottom. Each byte
is one of 255 shades of the monochrome color. In this case, the formula for
```

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```
the total size of the bitmap in bytes is given by this formula:
  B = (dmsGraphicWidth*dmsGraphicHeight)

If dmsGraphicType is a value of 'colorClassic', each byte within the bitmap
data corresponds to a pixel on the DMS display. The first byte of the bitmap
data defines the state of the pixel in the upper left corner of the
rectangular region. Byte 1 through byte N of the bitmap data correspond to
the rectangular region by rows, left to right, then top to bottom. The data
in each byte shall be one of the values indicated by dmsColorScheme under the
colorClassic type. In this case, the formula for the total size of the bitmap
in bytes is given by this formula:
  B = (dmsGraphicWidth*dmsGraphicHeight)

If dmsGraphicType is a value of 'color24bit, sets of three bytes within the
bitmap data correspond to a pixel on the DMS display. The first three bytes
of the bitmap data define the state of the pixel in the upper left corner of
the rectangular region. Byte 1 through byte N of the bitmap data corresponds
to the rectangular region by rows, left to right, then top to bottom. The
first byte of the bitmap data shall be the value of blue for the upper left
pixel. The second byte of the bitmap data shall be the value of green for the
upper left pixel. The third byte of the bitmap data shall be the value of red
for the upper left pixel. In this case, the formula for the total size of the
bitmap in bytes is given by this formula:
  B = (dmsGraphicWidth*dmsGraphicHeight)*3

All rows of the bitmap data Table must always logically exist (that is, under
no circumstances shall a controller produce a noSuchName error when asked for
a row of the dmsGraphicBitmapTable where
dmsGraphicIndex<=dmsGraphicsMaxEntries and
dmsGraphicBlockNumber<=dmsGraphicMaxSize/dmsGraphicBlockSize). If a GET
request is received for a block for which no corresponding SET request has
been accepted, then the controller shall return a block of length
dmsGraphicBlockSize, each octet of which has the value 0 (zero). Similarly,
when displaying a bitmap, the contents of any block within the bitmap image
that has not been defined by a SET operation shall be assumed to be a
sequence of octets with the value 0 (zero) and length dmsGraphicBlockSize.
--Data Examples
-- 'monochrome1bit' Example 1
--
--  Example 1 shows a graphic of an arrow as it would be shown on the
--  DMS display.
--  Since the graphic size is 24x7 pixels (which is divisible by 8),
--  the bitwise layout below represents how it appears on the display.
--
--               765432107654321076543210
--
--  BYTE1..3    000000000000110000000000
--  BYTE4..6    000000000000011100000000
--  BYTE7..9    000000000000000111100000
--  BYTE10..12  001111111111111111111000
--  BYTE13..15  000000000000000111100000
--  BYTE16..18  000000000000011100000000
--  BYTE19..21  000000000000110000000000
--
--  The following represents the byte stream of the graphic above. The
--  24 by 7 pixel graphic takes 21 bytes to define.
--  00 0C 00 00 07 00 00 01 E0 3F FF F8 00 01 E0 00 07 00 00 0C 00
```

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```
--
--
-- 'monochrome1bit' Example 2
--   The following pattern is what would be displayed. The graphic is
--   10 pixels wide by 6 pixels high. The general appearance of the
--   sample graphic is an X followed by a 1.
--
--  1000010010
--  0100100110
--  0011000010
--  0011000010
--  0100100010
--  1000010111
--
--  Byte stream of example 2
--
--   Example 2 graphic is 8 bytes in length. Only 60 of the 64 bits
--   make up the graphic. The last 4 bits are buffer
--             7654321076543210
--
--  BYTE1..2  1000010010010010
--  BYTE3..4  0110001100001000
--  BYTE5..6  1100001001001000
--  BYTE7..8  1010000101110000
--
--  The following represents the byte stream of the graphic above. The
--  10 by 6 pixel graphic takes 8 bytes to define.
--  84 92 63 08 C2 48 A1 70
--
--
--  'color24bit' Example
--
--   Using the same graphic of an multi-colored arrow as the first example,
--   below is how it would
--   appear on the display. A legend is listed below for color reference.
--
--  0-black, R-red, W-white, B-blue, G-green, P-purple
--
--  0000RW00000000
--  00000RRW000000
--  0000000RRRW000
--  GGGGGGGPPPPPW0
--  0000000PPPB000
--  00000PPB000000
--  0000PB00000000
--
--  The following represents the byte stream of the graphic above. The
--  14 by 7 pixel graphic takes 294 bytes to define. The bytes below
--  are and red, green, blue representation of the pixels to be displayed.
--  In hexadecimal each grouping below represents a pixel.
--    BBGGRR where BB represents a byte of blue in hexadecimal
--       and GG represents a byte of green in hexadecimal
--       and RR represents a byte of red in hexadecimal
--
-- 000000 000000 000000 000000 0000FF FFFFFF 000000 000000 000000 000000
-- 000000 000000 000000 000000 000000 000000 000000 000000 000000 0000FF
-- 0000FF FFFFFF 000000 000000 000000 000000 000000 000000 000000 000000
```

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```
-- 000000 000000 000000 000000 000000 0000FF 0000FF 0000FF FFFFFF 000000
-- 000000 000000 00FF00 00FF00 00FF00 00FF00 00FF00 00FF00 00FF00 FF33CC
-- FF33CC FF33CC FF33CC FF33CC FFFFFF 000000 000000 000000 000000 000000
-- 000000 000000 000000 FF33CC FF33CC FF33CC FF0000 000000 000000 000000
-- 000000 000000 000000 000000 000000 FF33CC FF33CC FF0000 000000 000000
-- 000000 000000 000000 000000 000000 000000 000000 000000 FF33CC FF0000
-- 000000 000000 000000 000000 000000 000000 000000 000000
```

```
<Table Type> static
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.10.7"
::= {graphicDefinition 7}

dmsGraphicBitmapEntry OBJECT-TYPE
SYNTAX      DmsGraphicBitmapEntry
ACCESS      not-accessible
STATUS      mandatory
DESCRIPTION "<Definition> Parameters of the Graphic Bitmap Table.
"
INDEX {dmsGraphicBitmapIndex, dmsGraphicBlockNumber}
::= {dmsGraphicBitmapTable 1}

DmsGraphicBitmapEntry::= SEQUENCE {
      dmsGraphicBitmapIndex   INTEGER,
      dmsGraphicBlockNumber   INTEGER,
      dmsGraphicBlockBitmap   OCTET STRING}
```

5.12.7.1 Graphic Index Parameter

```
dmsGraphicBitmapIndex  OBJECT-TYPE
SYNTAX  INTEGER (1..255)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the row number of the entry. This index directly
corresponds to dmsGraphicIndex, the index of dmsGraphicTable.
<Unit>index
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.10.7.1"
::= { dmsGraphicBitmapEntry 1 }
```

5.12.7.2 Graphic Block Number Parameter

```
dmsGraphicBlockNumber  OBJECT-TYPE
SYNTAX  INTEGER (1..255)
ACCESS  read-only
STATUS  mandatory
DESCRIPTION
"<Definition> Indicates the offset of the corresponding
dmsGraphicBlockBitmap's data within the graphic image, in
dmsGraphicBlockSize-sized chunks.
<Unit>index
<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.10.7.2"
::= { dmsGraphicBitmapEntry 2 }
```

5.12.7.3 Graphic Block Bitmap Parameter

```
dmsGraphicBlockBitmap  OBJECT-TYPE
SYNTAX  OCTET STRING
ACCESS  read-write
STATUS  mandatory
DESCRIPTION
```

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```
"<Definition> The contents of the given block of the bitmap of the graphic
image. Each dmsGraphicBlockBitmap value is a sequence of dmsGraphicBlockSize
octets. If a SET request for dmsGraphicBlockBitmap contains less than
dmsGraphicBlockSize octets, then the supplied data shall be loaded into the
beginning of the block, and the remainder of the block shall be filled with
octets with the value 0 (zero). If a SET request for dmsGraphicBlockBitmap
contains more than dmsGraphicBlockSize octets, the device shall return a SNMP
badValue error. If a GET request is received for a dmsGraphicBlockBitmap
entry for which no SET request has been accepted, then the controller shall
respond with a successful GET reply, and the value returned to the central
system shall be an OCTET STRING of dmsGraphicBlockSize octets, all of which
have the value 0 (zero).

<Object Identifier> 1.3.6.1.4.1.1206.4.2.3.10.7.3"
::= { dmsGraphicBitmapEntry 3 }
END
```

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Section 6
Markup Language for Transportation Information (MULTI) [Normative]

6.1 Scope
The scope of this section includes the identification and description of the “Markup Language for Transportation Information” (MULTI). MULTI is a language (not an object) used to convey a Message (Text and Message Attributes) between two entities. An object that makes use of MULTI has a syntax of octet string. The octet string shall conform to the MULTI language.

6.2 MULTI - Setup and Definition

6.2.1 Definition
The Markup Language for Transportation Information (MULTI) is similar to HTML where text is transmitted, and tags define how the text appears (is displayed). Tags are enclosed within delimiters, contain an ID (one or more characters), and any optional parameters necessary for the tag.

MULTI currently uses 8-bit characters, but there is consideration and planning to allow the selection of either 8-bit or 16-bit characters. The null character (0x00) is not allowed within MULTI strings. All of the MULTI tags are defined in ASCII, 8-bit characters with the most significant bit set to 0.

Each MULTI tag begins with a left bracket ([), and ends with a right bracket (]). The tag ID appears after the left bracket ([), and is one or more case-insensitive letters. If the tag has any parameters, they immediately follow the tag ID and are case-insensitive (except where specified). No space or other separating character shall appear between the tag ID and the parameters.

Some tags may operate in pairs, in which case the standard tag notation is defined as the opening tag. The opening tag defines where the tag's functionality begins. The closing tag defines where the functionality of the tag ends, and is defined as an opening tag with a forward slash preceding the tag ID e.g., the opening flash tag is “[fl],” and the closing flash tag is “[/fl].”

A tag does not need to have all or any of its parameters specified. When this occurs, the Sign Controller uses stored default values to determine the complete attributes of the Message. The default parameter values are determined when the message is activated, not when it is stored. Thus, a message could change if the default attributes it uses are changed between the time the message is stored and the time it is activated. Changes to the default MULTI attributes do not affect the currently displayed message. However, the currently displayed message could be reactivated to reflect the changes.

The left bracket ([ ) and right bracket ( ]) are restricted for tag delimiters. To display either of these symbols, two brackets, e.g., “[[“ or “]],” must appear together and is interpreted as a single bracket that shall be displayed. If a single right bracket is encountered, the device shall return a syntax error with a value of "unsupportedTag". If a single left bracket without a valid MULTI tag attribute is encountered, the device shall return a syntax error with a value of "unsupportedTag".

MULTI allows tags within the text field of another tag (e.g. flashing within moving text), however there are limitations as to the number of tags, use of tags, and complexity of a Message due to the Display Technology of the Sign and the sign manufacturer.

6.3 Rules to apply attribute tags
a) When a closing tag is defined, a closing tag shall turn off that attribute.
b) A closing tag shall not be required to switch from one non-default state to a second non-default state of the same attribute. In other words, nesting of the same attribute tag shall not be allowed.

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c) An opening tag shall apply until the end of the message or until it is changed, meaning that the attribute traverses new line breaks and new page breaks.
d) A message implicitly begins with all attribute tags set to their default states.
e) Any tag transmitted without the parameter value shall use the default parameter value for that tag.
f) Activation of stored messages shall use the values of the MULTI default objects at the time the message is activated and not at the time the message is stored.
    1) Any tag may be placed between the opening and the closing tag of any attribute.

6.4 Defined Tags

Tags are used to describe how the Message shall appear (be displayed). Table 6summarizes the tags defined in MULTI. The conformance column indicates the associated supplemental requirement from which the tag is derived; if the requirement has been selected in the PRL, the associated tag shall be supported.

Table 6 MULTI Tags

Attribute Tag (opening)	Closing Tag (if existing)	Description	Conformance
cbx		Color–background The background color for a message	3.6.6.2.5
pbz or pbr,g,b		Color–page background The page background color for a message	3.6.6.2.5
cfx or cfr,g,b		Color–foreground The foreground color for a message	3.6.6.2.5
crx,y,w,h,r,g,b or crx,y,w,h,z		Color Rectangle Color for a rectangular area of the current page of a message	3.6.6.2.5
fx,y		Field The information to embed within a message that is based on data from some device, e.g., clock calendar, temperature sensor, detector, etc.	3.6.6.2.13 (see 6.4.3 for additional details)
fltxoy or floytx	/fl	Flash Activate flashing of the text, define the flash on and off times, and the order of flashing (on/off or off/on)	3.6.6.2.10 3.6.6.2.11
fox or fox,cccc		Font Select a font number (as specified within the font table) for the message display. Optional cccc indicates the fontVersionID.	3.6.6.2.6
gn or gn,x,y or gn,x,y,cccc		Graphic Select a graphic image to insert into the message. A graphic image is treated as a single displayable character. It may require a few pixels, or the whole sign to display it. The optional cccc indicates the graphicID for the image.	3.6.6.2.14
hcx		Hexadecimal Character The hexadecimal value of the character to display. Value of a character for display	3.6.6.2.12
jlx		Justification–Line Specify line justification: left, center, right, or full	3.6.6.2.4

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Attribute Tag (opening)	Closing Tag (if existing)	Description	Conformance
jpx		Justification–Page Specify page justification: top, middle, or bottom	3.6.6.2.2
msx,y	/msx,y	Manufacturer Specific Tag(s) Specifies a manufacturer specific tag	
mvtdw,s,r, text		Moving Text Specify the parameters of a horizontal moving (scrolling) text	3.6.6.2.7
nlx		New Line Specify the start of a new line	3.6.6.2.3
np		New Page Specify the start of a new page	3.6.6.2.1
ptxoy		Page Time Specify the page times (t = on , o = off)	3.6.6.2.9
scx	/sc	Spacing Character Specify the spacing between characters	3.6.6.2.8
trx,y,w,h		Text Rectangle Specify the placement of a text window on the display	3.6.6.2.15

6.4.1 Color Background

Note: The function of this tag is effectively replaced by the Page Background Color and ColorRectangle MULTI tags. This object has been left in NTCIP 1203 v03 for backwards compatibility.

Tag format: [cbx]

where x is an octet string up to three characters in length. The string shall be a numeric value between 0 and 999 selecting a color.

This tag indicates the background color of the Message. This is the color of the “closed” or “off” pixels. The color for the background color code is defined by the enumerated listing of colors in the defaultBackgroundColor object. The default background color is specified by the defaultBackgroundColor object.

NTCIP 1203 v03 does not require the sign to be able to change the background color; however the Controller must recognize the tag. If the controller can change the background color, but does not support the selected color scheme (as defined in the dmsColorScheme object), then a syntaxMULTI error shall be generated with a dmsMultiSyntaxError value of unsupportedTagValue. If the controller cannot change the background color at all, then a syntaxMULTI error shall be generated with a dmsMultiSyntaxError value of unsupportedTag.

6.4.1.1 EXAMPLES

To display the Message “THIS IS A TEST WITH COLOR CHANGE” where the first two words are displayed in the default background color (black, code 0), the next two words have a background color is green (code 3), and the remaining words use the default color, the MULTI string could read:

“THIS IS [cb3]A TEST [cb]WITH COLOR CHANGE”
“THIS IS [cb3]A TEST [cb0]WITH COLOR CHANGE”
“[cb]THIS IS [cb3]A TEST [cb0]WITH COLOR CHANGE”

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6.4.2 Page Background Color

Tag format: [pbz] or [pbr,g,b]

where z is an octet string up to three characters in length. The string shall be a numeric value between 0 and 9 when using the colorClassic color scheme, between 0 and 1 when using the monochrome1Bit color scheme, or between 0 and 255 when using the monochrome8Bit color scheme (see 5.5.22 Color Scheme Parameter for definitions).

where r is an octet string up to three characters in length. The string shall be a numeric value between 0 and 255 selecting a shade of the color red as defined within section 5.5.22 Color Scheme Parameter.

where g is an octet string up to three characters in length. The string shall be a numeric value between 0 and 255 selecting a shade of the color green as defined within section 5.5.22 Color Scheme Parameter.

where b is an octet string up to three characters in length. The string shall be a numeric value between 0 and 255 selecting a shade of the color blue as defined within section 5.5.22 Color Scheme Parameter.

This tag indicates the page background color of the message before the addition of any text, graphics, or color rectangles. It also specifies the color for bits with a value of zero in 'monochrome1Bit' graphics. The default page background color is specified by the defaultBackgroundRGB object. See the dmsColorScheme object for the definition of color codes (section 5.5.22).

If there is more than one Page Background Color tag on a page, the last one specified will take precedence. The effect of the Page Background Color tag continues across message pages. All Page Background Color tags within a page must appear before any text, graphics or color rectangle specifications for that page. If a Page Background Color tag is specified after text, graphics or color rectangles appear on a page, the controller shall return a syntaxMULTI/tagConflict error.

NTCIP 1203 v03 does not require the sign to be able to change the page background color; however the Controller must recognize the tag. If the controller can change the page background color, but does not support the selected color scheme (as defined in the dmsColorScheme object), then a syntaxMULTI error shall be generated with a dmsMultiSyntaxError value of unsupportedTagValue. If the controller cannot change the page background color at all, then a syntaxMULTI error shall be generated with a dmsMultiSyntaxError value of unsupportedTag

6.4.2.1 Examples

To display a two-page message with a green (code 3) background on the first page and a black (code 0) background on the second page (and assuming a dmsColorScheme value of 'colorClassic (3)'), the MULTI string could read:

"[pb3]GREEN BACKGROUND[np][pb0]BLACK BACKGROUND"

If the defaultBackgroundRGB object specified black, the previous example can be write as:

"[pb3]GREEN BACKGROUND[np][pb]BLACK BACKGROUND"

6.4.3 Color Foreground

Tag format: [cfx] (version 1 and 2) or [cfr,g,b] (version 2 only)

where x is an octet string up to three characters in length. The string shall be a numeric value between 0 and 9 when using the colorClassic color scheme, between 0 and 1 when using the monochrome1Bit color scheme, or between 0 and 255 when using the monochrome8Bit color scheme (see 5.5.22 Color Scheme Parameter for definitions)..

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where r is an octet string up to three characters in length. The string shall be a numeric value between 0 and 255 selecting a shade of the color red as defined within section 5.5.22 Color Scheme Parameter.

where g is an octet string up to three characters in length. The string shall be a numeric value between 0 and 255 selecting a shade of the color green as defined within section 5.5.22 Color Scheme Parameter.

where b is an octet string up to three characters in length. The string shall be a numeric value between 0 and 255 selecting a shade of the color blue as defined within section 5.5.22 Color Scheme Parameter.

This tag indicates the foreground color of font characters or 'monochrome1Bit' graphics in the message. This is the color of the pixels with a '1' bit in the characterBitmap object. The default foreground color is specified by the defaultForegroundRGB object. See the dmsColorScheme object for the definition of color codes (Section 5.5.22).

NTCIP 1203 v03 does not require the sign to be able to change the foreground color, however the Controller must recognize the tag. If the controller can change the foreground color, but does not support the selected color scheme (as defined in the dmsColorScheme object), then a syntaxMULTI error shall be generated with a dmsMultiSyntaxError value of unsupportedTagValue. If the controller cannot change the foreground color at all, then a syntaxMULTI error shall be generated with a dmsMultiSyntaxError value of unsupportedTag.

6.4.3.1 Examples

To display the Message "THIS IS A TEST WITH COLOR CHANGE" where the first two words are displayed in the in white (code 7), the next two words use the default foreground color (Amber, code 9), and the remaining words use the color green (code 3), the MULTI string could read:

"[cf7]THIS IS [cf]A TEST [cf3]WITH COLOR CHANGE"
"[cf7]THIS IS [cf9]A TEST [cf3]WITH COLOR CHANGE"

6.4.4 Color Rectangle

Tag format: [crx,y,w,h,r,g,b]
or
[crx,y,w,h,z]

where x is the left pixel coordinate (beginning with 1) of the upper left corner of a rectangle to receive the color specified in the "rgb" parameters.

where y is the top pixel coordinate (beginning with 1) of the upper left corner of a rectangle to receive the color specified in the "rgb" parameters.

where w is the width in pixels of a rectangle to receive the color specified in the "rgb" parameters. A value of zero (0) specifies that the width is all the pixels from the specified x coordinate to the right edge of the sign. The value range is zero (0) to the width of the sign (as defined in 5.3.4 Sign Width in Pixels parameter.

where h is the height in pixels of a rectangle to receive the color specified in the "rgb" parameters. A value of zero (0) specifies that the height is all the pixels from the specified y coordinate to the bottom edge of the sign. The value range is zero (0) to the height of the sign (as defined in 5.3.3. Sign Height in Pixels parameter).

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where r is an octet string up to three characters in length. The string shall be a numeric value between 0 and 255 selecting a shade of the color red as defined within section 5.5.22 Color Scheme Parameter.

where g is an octet string up to three characters in length. The string shall be a numeric value between 0 and 255 selecting a shade of the color green as defined within section 5.5.22 Color Scheme Parameter.

where b is an octet string up to three characters in length. The string shall be a numeric value between 0 and 255 selecting a shade of the color blue as defined within section 5.5.22 Color Scheme Parameter.

where z is an octet string up to three characters in length. The string shall be a numeric value between 0 and 9 when using the colorClassic color scheme, between 0 and 1 when using the monochrome1Bit color scheme, or between 0 and 255 when using the monochrome8Bit color scheme (see 5.5.22 Color Scheme Parameter for definitions).

This tag indicates a background color for a rectangular area of the current page of a message. There can be multiple instances of this tag on a single page. This tag applies only to the current page of the message, it has no further effect after a new page tag. For rules on the order to display overlapping graphics, text rectangles and color rectangles see “Overlaying Graphics, Text Rectangles and Color Rectangles” in the “Text Rectangle” tag description. If a specified rectangle does not fully fit on the sign or if the specified color is not supported by the sign, the controller shall return a syntaxMULTI/unsupportedTagValue error.

6.4.4.1 Examples

Assume a full-matrix 100 by 27 pixel sign. To display a message with the left half of the sign background being red (code 1) and the right half background being blue (code 5), the MULTI string could read:

“[cr1,1,50,27,1][cr51,1,50,27,5]TWO COLORS SHOWING”

Assume a full-matrix 100 by 27 pixel sign. To create a message with a green (code 3) background for the entire sign along with a white (code 7) rectangle in the middle with black (code 0) text on the white rectangle, the MULTI string could read:

“[cb3][cr10,10,65,11,7][tr10,10,65,11][cf0]EXIT NOW”

6.4.5 Fields

Tag format: [fx,y]

where x is an octet string up to two characters in length, indicating the field ID.

where y is an octet string up to two characters in length, indicating the number of characters used to display the data.

Both strings, x and y, shall be a numeric value between 1 and 99.

An operator or user of a DMS may want to display information based on data received from a device that has a direct interface with the DMS Controller. This is accomplished via the field tag, where the Message being displayed changes based on the data (typically real-time) from the other device. The device could be a clock calendar, a weather station, a speed station, etc.

There are two parameters for the field tag, x and y.

The first parameter, x, is an ID to indicate the type of information. Table 7 shows the information to be displayed for each field ID.

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Table 7 Field Descriptions

ID	Default Field Width	Allowable Widths	Fill Character	Justification	Overflow Fill	Example	Description	Section
1	5	5	space	right	n/a	'_9:00'	Local time, 12 hour format (no AM/PM indicator present) as defined by controller-localTime	3.6.6.2.13.1
2	5	5	0	right	n/a	'09:00'	Local time, 24 hour format as defined by controller-localTime	3.6.6.2.13.1
3	3	2, 3	space	right	space	'-10' or '_10'	Ambient (Outside) Temperature, degrees Celsius (no plus sign)	3.6.6.2.13.4
4	3	2, 3	space	right	space	'-10' or '_10'	Ambient (Outside) Temperature, degrees Fahrenheit (no plus sign)	3.6.6.2.13.4
5	3	2, 3	space	right	'-'	' 90'	Speed, km/h, as defined by dmsCurrentSpeed	3.6.6.2.13.5
6	2	2, 3	space	right	'-'	' 55'	Speed, mph, as defined by dmsCurrentSpeed	3.6.6.2.13.5
7	3	3	n/a	n/a	n/a	'MON'	Day of week, as defined by controller-localTime Shall be one of (SUN, MON, TUE, WED, THU, FRI, SAT)	3.6.6.2.13.6
		4-9	manufacturer specific Note: Use of these manufacturer specific codes inhibits interoperability.					
8	2	2	0	right	n/a	'05'	Date of month (number), as defined by controller-localTime	3.6.6.2.13.7
9	2	2	0	right	n/a	'04'	Month of year (number), as defined by controller-localTime	3.6.6.2.13.8
10	2	2	0	right	n/a	'00'	Year, 2 digits, as defined by controller-localTime	3.6.6.2.13.9
11	4	4	0	right	n/a	'2000'	Year, 4 digits, as defined by controller-localTime	3.6.6.2.13.9
12	8	8	space	right	n/a	'_9:00_AM' '11:00_PM'	Local time, 12 hour format (with capital AM/PM indicator present) as defined by controller-localTime	3.6.6.2.13.2
13	8	8	space	right	n/a	'_9:00_am' '11:00_pm'	Local time, 12 hour format (with lower-case am/pm indicator present) as defined by controller-localTime	3.6.6.2.13.3
14 - 49							Reserved for future assignment	
50 - 99							User-definable	3.6.6.2.13.10

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The second parameter, y, is optional and, if included, must be in the range of 'Allowable Widths'. This defines the width, or number of characters used to display the data.

If the Default Field Width parameter is supplied, and the data requires fewer characters than specified, the data is right justified and the indicated Fill Character (4th column in Table above) will be used to make up the missing characters (e.g., if the local time, 12 hour format is 8:00 and the Default Field Width for Field Tag ID 1 is '5', then the value of this field value would be expressed as '_8:00'). If the Default Field Width parameter is supplied, and the data requires more characters than specified, the indicated Overflow Fill character (6th column in Table above) is used for all characters (e.g., if the speed is larger than 100 km/h (assume 114 km/h), but the Default Field Width for Field Tag ID is '2', then the field value would be expressed as '--').

If the width parameter is not supplied and there are more than one allowable widths, only the characters actually present in the data will be used. Overflow Fill characters will be used if the data is larger than the variable range, for example –100 degrees for field tag 3 or 4.

Specifying widths other than the default width should only be used when you wish to force the fill character to be used, or when you wish to limit the range of displayed data, e.g. to display detected speeds of only 99 miles or kilometers per hour or less.

There is no default object for the field tag. No fields exist in a Message unless explicitly defined in the MULTI Message.

NTCIP 1203 v03 does not require the sign to be able to implement all field IDs, however the Controller must recognize the tag and take appropriate action by implementing the associated functionality or by generating a dmsMultiSyntaxError with a value of unsupportedTag.

If a character immediately precedes or follows a field tag, the current character spacing shall be inserted between the character and the field.

6.4.5.1 Examples

To display the Message "YOUR SPEED IS aa MPH," where aa is filled with the real-time speed (limited to a maximum of 99 mph) from a local device, the MULTI string could read:

"YOUR SPEED IS [f6,2] MPH"

To display the Message "TIME IS aa:aa TEMPERATURE IS bbb F," aa:aa is filled with the current time and bbb is filled with the current temperature (using no fill characters), the MULTI string could read:

"TIME IS [f1] TEMPERATURE IS [f4] F"

6.4.6 Flash Time

Tag format: [fltxoy]
or
[floytx]

where t is a fixed parameter code to indicate following number is the flash on time.

where x follows the parameter code "t" and is an octet string up to two characters in length, and indicating the flash on time in tenths (1/10ths) of a second.

where o is a fixed parameter code to indicate following number is the flash off time.

where y follows the parameter code "o" and is an octet string up to two characters in length, and indicating the flash off time in tenths (1/10ths) of a second.

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Both strings, x and y, shall be a numeric value between 0 and 99. If either value is zero (0), flashing is turned off.

This tag controls the flashing of a Message or part of a Message. The default of this tag is its non-existence, meaning that each time a message or parts of it are to be flashed, this tag needs to be indicated.

The flashing order, on then off or off then on, is performed in the order the tx and oy parameters appear. In the absence of the t and o parameters (no "t" and "o" codes within the tag), the default flashing order is always on then off with their respective default values. If the order of sequence is to be changed, then the parameters t and o can appear without any time values, in which case the default times (specified by the defaultFlashOn- and defaultFlashOff objectss) are used. If time parameters are indicated, the associated "t" and/or "o" code must appear.

NTCIP 1203 v03 does not require what, if anything, a sign can or cannot flash: a specific character, word, line, or page. However, the Controller must recognize the tag and take appropriate action by implementing functionality or by generating a dmsMultiSyntaxError with a value of unsupportedTag.

A graphic shall be flashing using the specified parameters (or the default flashing parameters) when MULTI graphic tag occurs within a flashing MULTI tag. Also, see the rules and limitations defined under 'Overlaying Graphics, Text Rectangles and Color Rectangles'.

6.4.6.1 Examples

To display the Message "THIS IS A TEST," where "IS A" is flashing with an on-time of 1.0 seconds and then an off-time of 0.5 seconds (defaults of on- and off-times are set to 0), the MULTI string could read:

"THIS [flt10o5]IS A [/fl]TEST"
"THIS [flt10o5]IS A [/fl]TEST"

To display the Message "THIS IS A TEST," where "THIS IS A TEST" is flashing with an on-time of 1.0 seconds and then an off-time of 0.5 seconds (defaults: on-time = 1.0; off-time = 0.5), the MULTI string could read:

"[fl]THIS IS A TEST [/fl]"
"[flt10o05]THIS IS A TEST[/fl]"
"[fl]THIS IS A TEST"
"[flt10o05]THIS IS A TEST"

To display the Message "THIS IS A TEST," where "THIS" is flashing, on 1.0 seconds, then off 1.0 seconds, "TEST" is flashing, off 1.0 seconds, then on 1.0 seconds, with the default on and off times set to 0, the MULTI string could read:

"[flt10o10]THIS [/fl]IS A [flo10t10]TEST[/fl]"
"[flt10o10]THIS [/fl]IS A [flo10t10]TEST"

6.4.7 Font

Tag format: [fox] or [fox,cccc]

where x is an octet string up to three characters in length, and indicates the fontNumber. "X" shall be a numeric value between 1 and 255.

where cccc is an optional 4-digit hexadecimal number indicating the fontVersionID from the font table. Each 'c' in "cccc" shall be an ASCII character in the range from 0-9 or A-F.

This tag controls the selection of the font used to display a message. The font is selected using the

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fontNumber, not the fontIndex object from the fontTable. The default font is indicated in the defaultFont-object. When fonts of different heights are displayed on the same line, the bottom-most pixel of each font shall be aligned.

The optional “cccc” is used to compare its value with that of the fontVersionID from the fontTable while dmsMessageStatus is in the validating state, and when the message is activated for display. The “cccc” from the tag and the fontVersionID from the fontTable must match for a successful operation. The fontVersionID from the message table is ignored during these operations when the “cccc” is not included in the tag.

NTCIP 1203 v03 does not require how many fonts are to be supported. If a non-existing font is selected, either the dmsValidateMessageError or dmsActivateMsgError object (depending on whether dmsMessageStatus or dmsActivateMessage is set) must be set to a value of ‘syntaxMULTI’ and the dmsMultiSyntaxError object must be set to a value of ‘fontNotDefined’. If the “cccc” field is included, and its value does not match the value of fontVersionID for that font, then either dmsValidateMessageError or dmsActivateMsgError must be set to a value of ‘syntaxMULTI’ and the dmsMultiSyntaxError object must be set to a value of ‘fontVersionID’. Understanding and acting upon the “cccc” field is required for all devices, but the field does not have to be included in the tag.

6.4.7.1 Examples

To display the Message “THIS IS A TEST,” where “IS A” uses the user font number 2, with the default font set to 1, the MULTI string could read:

“THIS [fo2]IS A [fo]TEST”
“THIS [fo2,E19C]IS A [fo,8AC7] TEST”
“THIS [fo2]IS A [fo1]TEST”
“THIS [fo2,E19C]IS A [fo1,8AC7]TEST”
“[fo1]THIS [fo2]IS A [fo]TEST”
“[fo1,8AC7]THIS [fo2,E19C]IS A [fo,8AC7]TEST”

6.4.8 Graphic

Tag format: [gn] or [gn,x,y] or [gn,x,y,cccc]

where n is an octet string up to three characters in length indicating the dmsGraphicNumber from the graphic table (not the dmsGraphicIndex). “n” shall be a numeric value between 1 and 255.

where x specifies the horizontal displacement in pixels of the graphic image from the left edge of the sign. A value of 1 specifies that the left edge of the graphic image is in the left-most pixel column of the sign. “x” shall be a numeric value ranging from 1 to the width of the sign minus the width of the graphic plus 1.

where y specifies the vertical displacement in pixels of the graphic image from the top edge of the sign. A value of 1 specifies that the top edge of the graphic image is in the top-most pixel row of the sign. “y” shall be a numeric value ranging from 1 to the height of the sign minus the height of the graphic plus 1.

where cccc is an optional 4-digit hexadecimal number indicating the graphicVersionID from the graphic table. Each ‘c’ in “cccc” shall be an ASCII character in the range from 0-9 or A-F.

If the tag format [gn] is used, it is assume that the graphic will start at location 1.1 (upper left hand corner).

This tag controls the selection of a graphic image to insert into a message. The image is selected from the dmsGraphicTable using the dmsGraphicNumber, not the dmsGraphicIndex object.

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The “cccc” is compared to the dmsGraphicID from the dmsGraphicTable while dmsMessageStatus is in the validating state, and when the message is activated for display. The “cccc” from the tag and the dmsGraphicID from the dmsGraphicTable must match for a successful operation. If this match is incorrect, the device shall return a syntaxMULTI / graphicID error. The dmsGraphicID from the dmsGraphicTable is ignored during these operations when the “cccc” is not included in the tag.

NTCIP 1203 v03 does not require how many graphic images are to be supported.

For rules on the order to display overlapping graphics, text rectangles and color rectangles see “Overlaying Graphics, Text Rectangles and Color Rectangles” in the “Text Rectangle” tag description.

If a nonexistent image is selected by defining a message and validating via the dmsMessageStatus object, dmsValidateMessageError must be set to a value of ‘syntaxMULTI’ and dmsMultiSyntaxError object must be set to a value of ‘graphicNotDefined’.

If a nonexistent image is selected by activating a message via the dmsActivateMessage object, dmsActivateMsgError must be set to a value of ‘syntaxMULTI’ and dmsMultiSyntaxError object must be set to a value of ‘graphicNotDefined’.

If the optional “cccc” field is included, and its value does not match the value of dmsGraphicID for that image, then the dmsValidateMessageError or dmsActivateMsgError object (depending whether the message is stored in the message table => dmsValidateMessageError or activated => dmsActivateMsgError) must be set to a value of ‘graphicID’ and the dmsMultiSyntaxError object must be set to a value of ‘graphicID’.

6.4.8.1 Examples

To display a message with a graphic (assume graphic #5) on the left and the word “DETOUR” in the middle (assume default line justification is center for the first example), the MULTI string could read:

“[g5,1,1]DETOUR”
“[jl3][g5,1,1]DETOUR”
“[jl3][g5,1,1,E19C]DETOUR”

If the graphic were to be placed on the right side of the sign (assume a sign width of 105 pixels and a graphic width of 25 pixels), the MULTI string could read:

“[g5,81,1]DETOUR”
“DETOUR[g5,81,1,E19C]”

6.4.9 Hexadecimal Character

Tag format: [hcx]

where x is an octet string up to four characters in length, and indicates the character from the current font using the hexadecimal value of the character code to be displayed. “X” shall be a hexadecimal (0-9, A-F) value between 1 and FFFF.

This tag is intended as a method to select a character from a font that cannot be typed on a keyboard (characters 0 through 31 and 128 through 65535.

If this tag is not supported, but is encountered during a message validation, then dmsMultiSyntaxError shall be set to ‘unsupportedTag’. If this tag is supported, but it contains an unrecognized character, then dmsMultiSyntaxError shall be set to ‘characterNotDefined’.

6.4.9.1 Examples

To display the Message “THIS IS * A TEST,” where “*“ is the hexadecimal code 8A to have all pixels of the character ON, the MULTI string could read:

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"THIS IS [hc8A] A TEST"

6.4.10 Justification—Line

Tag format: [jlx]

where x is a single octet character, and indicates the type of line justification. "X" shall be a have value between 1 and 5, inclusive.

This tag allows the selection of line justification for the text or portion of the text selected. The value of x shall define the justification according to Table 8.

Table 8 Line Justification Codes

Justification Code	Line Justification
1	other
2	left
3	center
4	right
5	full

The centering of text shall be positioned to have the extra space AFTER the text, when exact centering is not possible because of an odd number of remaining spaces. For example, to center NEMA on a seven (7) character sign, the result would be "_ NEMA _ _", one space before the word NEMA and two spaces after the word NEMA.

The default value for this tag is indicated in the defaultJustificationLine- object.

The line justification tag must be used in logical order (from left, center, right), otherwise dmsMultiSyntaxError will be set to "tagConflict". Overlapping of text results in a "textTooBig" value for dmsMultiSyntaxError. No other justification tag may be used in conjunction with full justification on the same line.

If an unsupported justification code is selected, the Controller must recognize the tag and take appropriate action by generating a dmsMultiSyntaxError with a value of unsupportedTagValue.

6.4.10.1 Examples

To display the Message "THIS IS A TEST", left justified with the default line justification being center, the MULTI string could read:

"[jl2]THIS IS A TEST"

To display the Message "THIS IS A TEST", with "THIS IS" left justified and "A TEST" right justified and the default line justification being left, the MULTI string could read:

"THIS IS [jl4]A TEST"
"[jl]THIS IS [jl4]A TEST"
"[jl2]THIS IS [jl4]A TEST"

To display the Message "THIS IS A TEST", with "THIS IS" left justified and "A TEST" right justified and the default line justification being right, the MULTI string could read:

"[jl2]THIS IS [jl]A TEST"
"[jl2]THIS IS [jl4]A TEST"

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To display the Message “THIS IS A TEST”, with center justified and the default line justification being center, the MULTI string could read:

“THIS IS A TEST”
“[jl3]THIS IS A TEST”
“[jl]THIS IS A TEST”

To display the message “LFT _ _ _ _ CNTR _ _ RIGHT” on an 18 character sign (or text rectangle), with left, center, and right justified text, the MULTI string can read:

“[jl2]LFT[jl3]CNTR[jl4]RIGHT]”

Note that the center-justified text is centered in the sign (or text rectangle), not in the remaining space between the left and right justified text.

6.4.11 Justification—Page

Tag format: [jpx]

where x is a single octet character, and indicates the type of line justification. “X” shall be a have value between 1 and 4, inclusive.

This tag allows the selection of page justification for the text or portion of the text selected. The value of x shall define the justification according to the Table 9.

Table 9 Page Justification Codes

Justification Code	Page Justification
1	other
2	top
3	middle
4	bottom

The centering of text shall be positioned to have the extra line BELOW the text, when exact centering is not possible because of odd number of unused lines. For example, to center

NTCIP
BY NEMA

on a five (5) line sign, the result would be

NTCIP
BY NEMA

One line would be above the word NTCIP and two lines would be below the words BY NEMA.

The default value for this tag is indicated in the defaultJustificationPage- object.

For multiple page justification tags, the tags must be used in logical order (from top, middle, bottom), otherwise dmsMultiSyntaxError will be set to “tagConflict”. Overlapping of text results in a “textTooBig” value for dmsMultiSyntaxError.

Any page justification tag on a text line must appear before any plain text, hex character tag, or field tag specifications on that line. If a page justification tag appears on a text line after any plain text, hex character tag, or field tag specifications on that line, the controller shall return a dmsMultiSyntaxError=tagConflict error.

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When an unsupported justification code is selected, the controller must generate a dmsMultiSyntaxError with a value of unsupportedTagValue.

6.4.11.1 Examples

To display the Message “THIS IS[nl]A TEST”, top justified with the default page justification being middle, the MULTI string could read:

“[jp2]THIS IS[nl]A TEST”

To display the Message “THIS IS[nl]A TEST”, middle justified with the default page justification being middle, the MULTI string could read:

“[jp3]THIS IS[nl]A TEST”
“THIS IS[nl]A TEST”
“[jp]THIS IS[nl]A TEST”

To display the following message on an 8-line sign,

TOP
LINE 2
LINE 3
-
MIDDLE
-
-
-
BOTTOM

the MULTI string could read:

“[jp2]TOP[nl]LINE 2[nl]LINE 3[jp3]MIDDLE[jp4]BOTTOM”

Note that the middle-justified line is placed on the middle line of the sign (or text rectangle), not in the middle of the empty lines between the top and bottom justified lines.

6.4.12 Manufacturer Specific Tag

Tag format: [msx,y]

where x is an ASCII number, and indicates the number assigned by NEMA to a specific manufacturer.

where y is a manufacturer specific string. See the manufacturer’s manual for explanations. This string, if present, must be preceded by a comma.

This tag allows manufacturers to implement proprietary or experimental functions.

6.4.13 Moving Text Tag

Tag format: [mvtdw,s,r,text]

where t is a character(s) indicating the type of the moving tag. Two types are available:
c = circular,
lx = linear with “x” optionally indicating the delay in tenths of a second between the end of linear motion and the restarting of the linear motion from the initial state. If x is not present, there shall be no delay.

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where d is a character indicating the direction in which the text is moving with the following possibilities:

l = left moving text
r = right moving text

where w is a number indicating the width, in pixels, of the window in which the 'text' is to be moved/scrolled.

where s is a number indicating the number of pixels that the text shall move at the defined rate 'r.'

where r is a number indicating the time, in tenths of a second, between two steps 's.'

where text is the array of characters that is to be moved/scrolled. The text shall be case-sensitive.

This tag allows the moving (or scrolling) of the text indicated within the brackets. The different parameters indicate different functions that can be associated with the moving/scrolling of text.

For left moving/scrolling, the window shall be initialized with the first character of the text aligned with the left edge of the window.

For right moving/scrolling, the window shall be initialized with the last character of the text aligned with the right edge of the window.

Circular moving/scrolling is the continuous display of the indicated text, including all spaces shown within the text. In this case, the text will appear moving across the window as though multiple copies of the text were appended to itself. The character spacing is applied between the apparent multiple copies of text.

Linear moving/scrolling is the intermittent display of the indicated text, including all spaces shown within the text. In this case, the window initialized with beginning of the text appearing in the window, then moving across the window until all characters have been displayed. The process will repeat again after the indicated delay time defined by the value x when the t-parameter is lx.

The text can only be moved over one line. If text is supposed to be moved over more than one line, then this tag needs to be indicated for each line.

If this tag is unsupported, or if the display would appear incorrect for the selected parameters (e.g., using a value of 's' equals one (1) on a character matrix sign), the sign should report an unsupportedTagValue error.

If a character immediately precedes or follows a moving text tag, the current character spacing shall be inserted between the character and the moving text window.

If necessary, the number of pixel columns in the final shift of a linear move (before repeating) will be reduced such that the last column of the moving text will appear in the rightmost column of the window for left moves or in the leftmost column of the window for right moves.

6.4.13.1 Examples

Although the printed examples show the text moving by whole character positions, the text displayed on the sign will shift by the amount in the MULTI tag (in the following examples, 1 pixel at a time).

To display the moving text "THIS IS A TEST" which moves circularly to the right within a window of 50 pixels and a rate of 1 pixel per 3 tenths of a second, the MULTI string could read:

"[mvcr50,1,3,THIS IS A TEST]"

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Circular right scrolling:

[IS A TEST]
[S IS A TES]
[IS IS A TE]
[HIS IS A T]
[THIS IS A]
[TTHIS IS A]
[STTHIS IS]
[ESTTHIS IS]
[TESTTHIS I]
[TESTTHIS]
[A TESTTHIS]

and so on..

Note: The text string does not include any spaces (character 0x20) between the words THIS and TEST; however, the display will show inter-character spacing between TEST and THIS.

To display the moving text “THIS IS A TEST” (no spaces before and after the text) which moves linearly (with a delay of 0.5 seconds) to the left within a window of 50 pixels and a rate of 1 pixel per 3 tenths of a second, the MULTI string could read:

“[mvl5l50,1,3,THIS IS A TEST]”

Linear left scrolling:

[THIS IS A]
[HIS IS A T]
[IS IS A TE]
[S IS A TES]
[IS A TEST]
<0.5 sec delay occurs here>
[THIS IS A]
[HIS IS A T]

and so on..

The following is an example of what occurs when the text field is smaller than the specified window for a left moving linear effect. Because all of the text in the MULTI string has been displayed, the text does not move.

“[mvl5l50,1,3,TEST]”

Linear left scrolling:

[TEST]
<0.5 sec delay occurs here>
[TEST]

The following is an example of what occurs when the text field is smaller than the specified window for a right moving linear effect.

“[mvl5r50,1,3,TEST]”

Linear right scrolling:

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[TEST]
<0.5 sec delay occurs here>
[TEST]

The following is an example of how to move text where a small string of characters is to be scrolled through a larger window. For readability in this example an asterisk represents the space character.

"[mvl5r50,1,3,********TEST****]"
Linear right scrolling:
[TEST****]
[*TEST***]
[**TEST**]
[***TEST*]
[****TEST]
[*****TES]
[******TE]
[*******T]
[********]
<0.5 sec delay occurs here>
[TEST****]
[*TEST***]

and so on…

6.4.14 New Line

Tag format: [nlx]

where x is an ASCII number, and indicates the spacing, in pixels, between two lines. If "x" is not present, the spacing shall be defined by the result of the font line spacing algorithm.

This tag defines the end of one line of Text and the start of a new line of Text. It can optionally allow the default line spacing to be changed (valid only for this line break). All Text that appears after the [nlx] tag appears on the next line of the sign. There is no closing tag for new line tag.

NTCIP 1203 v03 currently does not allow word wrapping. Each line of Text must be limited to the allowable space for the line. The Controller must recognize the tag and return an error should too many characters appear on a line.

6.4.14.1 Examples

To display the Message "THIS IS A TEST," with "THIS IS" on the top line and "A TEST" on the next line, the MULTI string could read:

"THIS IS[nl]A TEST"

To display the Message "THIS IS A TEST," with "THIS IS" on the second line and "A TEST" on the next line, the MULTI string could read:

"[nl]THIS IS[nl]A TEST"
"[nl]THIS IS[nl]A TEST"

To display another example utilizing different line spacing (assuming that the default is 3 pixels, and the selected new line spacing should be 5 pixels), the MULTI string could read:

"[nl]THIS IS[nl5]A TEST"

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To use another example with 3 lines and different line spacing between the first and the second (spacing of 5 pixels), and the second and the third line (default spacing of 3 pixels), the MULTI string could read:

"THIS IS[nl5]A TEST[nl]ON THREE LINES"

6.4.15 New Page

Tag format: [np]

This tag defines the end of one Page of Text and the start of a new Page of Text. All text that appears after the [np] tag appears on the next Page of the Message. There is no closing tag for new page tag.

If the number of pages used exceeds the number of pages identified by the dmsMaxNumberPages object the Controller must recognize the tag and set dmsMultiSyntaxError object to a value of tooManyPages(12).

6.4.15.1 Examples

To display the Message "THIS IS A TEST," with "THIS IS" on the first page and "A TEST" on the next page, the MULTI string could read:

"THIS IS[np]A TEST"

To display the Message "THIS IS A TEST," with "THIS IS" on the second page and "A TEST" on the next page, the MULTI string could read:

"[np]THIS IS[np]A TEST"
" [np]THIS IS[np]A TEST"
" [np]THIS IS[np]A TEST"

6.4.16 Page Time

Tag format: [ptxoy]

where t is a fixed parameter code to indicate following number is the page on time.
where x follows the parameter code "t" and is an octet string up to three characters in length, and indicating the page on time in tenths (1/10ths) of a second. This shall be a numeric value from 1 to 255. The non-existence of a value indicates that the on-time is the default value.
where o is a fixed parameter code to indicate following number is the page off time.
where y follows the parameter code "o" and is an octet string up to three characters in length, and indicating the page off time in tenths (1/10ths) of a second. This shall be a numeric value from 0 to 255. The non-existence of a value indicates that the on-time is the default value.

This tag controls the amount of time each Page of Text is displayed and turned off before switching to the next Page of Text. The t and/or o parameters can appear without any time values, when the default page times (specified by the defaultPageOnTime and defaultPageOffTime objects) are to be used. If time parameters are indicated, the associated "t" and/or "o" code must appear.

If multiple page on and off times are sent for one page, the value of the last indication shall be used.

NTCIP 1203 v03 does not limit page time values, however, the Controller must recognize the tag and take appropriate action by implementing functionality or by generating a dmsMultiSyntaxError with a value of unsupportedTag.

6.4.16.1 Examples

To display the Message "THIS IS A TEST," where "THIS IS" is on a page with an on-time of 3.0 seconds and an off-time of 0.5 seconds, "A TEST" is on a second page with an on-time of 2.0 seconds and an off-time of 1.0 seconds, with the default page on-time set to 3.0 seconds and page off-time set to 1.0, the MULTI string could read:

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"[pt30o5]THIS IS[np][pt20o10]A TEST"
"[pto5]THIS IS[np][pt20o]A TEST"

To display the Message "THIS IS A TEST," where "THIS IS" is on a page with an on-time of 3.0 seconds and an off-time of 0.5 seconds, "A TEST" is on a second page with a page on-time of 2.0 seconds and an off-time of 1.0 seconds, with the default page on-time set to 3.0 seconds and page off-time set to 0.5, the MULTI string could read:

"[pto]THIS IS[np][pt20o10]A TEST"

To display the Message "THIS IS A TEST," where "THIS IS" is on a page with an on-time of 3.0 seconds and an of- time of 0.5 seconds, "A TEST" is on a second page with a page on-time of 2.0 seconds and an off-time of 1.0 seconds, with the default page on-time set to 2.0 seconds and page off-time set to 1.0, the MULTI string could read:

"[pt30o5]THIS IS[np][pto]A TEST"

6.4.17 Spacing – Character

Tag format: [scx]

where x is an octet string up to two characters in length, and indicates the number of pixels between the characters. "x" is a mandatory parameter and shall be a numeric value between 0 and 99.

This tag controls the spacing between any two adjacent characters. The tag will override the character spacing defined by the result of the font character spacing algorithm.

The default spacing for a character is the default spacing of that character's font. A closing tag shall be required to return to the character's font spacing.

The space indicated shall apply to the space between the last character of the previous spacing and the first character of the new spacing.

NTCIP 1203 v03 does not require support of spacing character values. However, the Controller must recognize the tag and take appropriate action by implementing functionality or by generating a dmsMultiSyntaxError with a value of unsupportedTag.

6.4.17.1 Examples

To display the Message "THIS IS A TEST," where "IS A" uses a different spacing between each character, with an assumed font character spacing of 1 pixel, the MULTI string could read:

"THIS_[sc2]IS_A_[/sc]TEST"

the display would then show:

"T*H*I*S*_**I**S**_**A**_*T*E*S*T"

where an "*" indicates a space of one pixel, and

where a "_" indicates a space character

6.4.18 Text Rectangle

Tag format: [trx,y,w,h]

where x is the left pixel coordinate (beginning with 1) of the upper left corner of a

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rectangle to receive text (font characters).

where y is the top pixel coordinate (beginning with 1) of the upper left corner of a rectangle to receive text (font characters).

where w is the width in pixels of a rectangle to receive text (font characters). A value of zero (0) specifies that the width is all the pixels from the specified x coordinate to the right edge of the sign. The value range is zero (0) to the width of the sign (as defined in 5.3.4 Sign Width in Pixels parameter).

where h is the height in pixels of a rectangle to receive text (font characters). A value of zero (0) specifies that the height is all the pixels from the specified y coordinate to the bottom edge of the sign. The value range is zero (0) to the height of the sign (as defined Section 5.3.3. Sign Height in Pixels parameter).

When text (comprised of font characters) is drawn on a message page, it is drawn within a predefined rectangle of pixel coordinates. By default, that rectangle is the entire face of the sign. This tag allows specification of a different rectangle. Any line justification or page justification tags justify the text relative to the currently specified rectangle.

If specified text does not fully fit within the text rectangle, the controller shall return a syntaxMULTI/textTooBig error.

If the specified text rectangle does not match character boundaries (of a character matrix signs) or line boundaries (of a line matrix sign), the controller shall return a syntaxMULTI/unsupportedTagValue error.

Multiple text rectangles can be specified within a message page. All text following a text rectangle tag is drawn within that rectangle. Text rectangles only apply to the message page in which they are specified. In other words, when a new page tag is encountered, any current text rectangle specification is discarded and the new page begins with the default rectangle of the entire sign face.

If a specified text rectangle does not fully fit on the sign, the controller shall return a syntaxMULTI/ unsupportedTagValue error.

Overlaying Graphics, Text Rectangles and Color Rectangles

Because graphics, text rectangles and color rectangles can be placed at any specified location on a message page, specific rules must be applied if any of these items are supposed to overlap. The order for adding these items to a message is as follows:

a) The default background color or the color specified by a color background tag is applied to all pixels of the message page (sign face).
b) As graphics and color rectangles are encountered, they are added to the message page. Color rectangles overlay or fill the specified color into the entire specified rectangle without regard to what has been previously drawn there. Graphics also overlay any previously drawn pixels unless a portion of the graphic is transparent (see the dmsGraphicTransparentEnabled and dmsGraphicTransparentColor objects).
c) Text shall not be drawn into the message, until a text rectangle (the whole sign, if no rectangle is defined) is ended by one of the following:
   1) End of a page;
   2) New text rectangle tag;
   3) End of a message.
   This is done by coloring the foreground of the text with the foreground color while leaving the background unchanged.
d) At the end of a page, go back to step a). At the end of a text rectangle, go back to step b).

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Note: Graphics and color rectangles are not placed within the area of a text rectangle—they are placed relative to the entire sign face, not a text rectangle.

No portion of a region of text or graphic that flashes or moves (MULTI flash or moving tag) shall be overlaid by other graphics, text rectangles or color rectangles; otherwise the controller shall return a syntaxMULTI/tagConflict error. This flashing or moving region may be only a part of a text rectangle that contains the flashing or moving text.

6.4.18.1 Examples

Assume a full-matrix 105 by 27 pixel sign. To display a 27 by 27 graphic (assume it is graphic #4) on the left side of the sign and place three lines of centered text in the area to the right of the graphic, the MULTI string could read:

"[g4,1,1][tr28,1,78,27]LEFT[nl]EXIT[nl]AHEAD"
"[g4,1,1][tr28,1,0,0][jl3]LEFT[nl]EXIT[nl]AHEAD"

To put the same graphic on the right side of the sign with the text area to its left, the MULTI string could read:

"[g4,79,1][tr1,1,78,27]LEFT[nl]EXIT[nl]AHEAD"
"[tr1,1,78,27][g4,79,1]LEFT[nl]EXIT[nl]AHEAD"
"[tr1,1,78,27]LEFT[nl]EXIT[nl]AHEAD[g4,79,1]"

To create a one-page message with the graphic placed in the middle of the sign with a text area on either side of it, the MULTI string could read:

"[g4,40,1][tr1,1,39,27]LEFT[nl]SIDE[tr67,1,39,27]RIGHT[nl]SIDE"

To place the graphic on the right side of the sign and place the text "65" (5x7 font) over the top and center of the graphic, the MULTI string could read:

"[g4,79,1][tr79,11,27,7]65"
"[g4,79,1][tr79,1,27,27][jl3][jp3]65"

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Annex A
Requirements Traceability Matrix (RTM) [Normative]

The Requirements Traceability Matrix (RTM) links the Functional Requirements as presented in Section 3 with the corresponding Dialogs (Section 4.2) on the same (gray) line. Each Functional Requirement/Dialog relates/uses one or more groups of Objects. The Objects (also known as Data Elements) are listed to the side; the formal definition of each object is contained within Section 5. Using this table, each Functional Requirement can thus be traced in a standardized way.

> Note: The INDEX objects into any of the tables are not explicitly exchanged but are used as index values for other objects that are exchanged.

The audience for this table is implementers (vendors and central system developers) and conformance testers. Additionally, other interested parties might use this table to determine how particular functions are to be implemented using the standardized dialogs, interfaces, and object definitions.

To conform to a Functional Requirement, a DMS shall implement all Objects and Dialogs traced from that Functional Requirement; a Management Station shall implement all Dialogs traced from the Functional Requirement. to be consistent with a Functional Requirement, a Management Station shall be able to fulfill the Functional Requirement using only Objects and Dialogs that a conforming DMS is required to support.

Section 3 defines Supplemental Requirements, which are refining other functional requirements. These functional requirements in turn are generally traced to design elements (e.g., rather than being directly traced to design elements). The Supplemental RTM in Section A.4 below identifies and traces the implied relationships between supplemental requirements and direct requirements.

Section 6 defines the ‘Mark-Up Language for Transportation Information’ (MULTI), which defines tags that can be used within the text of a DMS message to define its display on the face of the DMS display. The Multi Field Traceability Matrix in Section A.5 below identifies and traces the implied relationships between MULTI tags and direct requirements.

A.1 Notation [Informative]

A.1.1 Functional Requirement Columns

The functional requirements are defined within Section 3 and the RTM is based upon the requirements within that Section. The section number and the functional requirement name are indicated within these columns.

A.1.2 Dialog Column

The standardized dialogs are defined within Section 4 and the RTM references the traces from requirements to this dialog. The section number of the dialog is indicated within this column.

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A.1.3 Object Columns

The objects are defined within Section 5 of NTCIP 1203 v3 and Section 2 of NTCIP 1201. The RTM references the data objects that are referenced by the dialog. The section number and object name are indicated within these columns.

A.1.4 Additional Specifications

The "Additional Specifications" column may (and should) be used to provide additional notes and requirements about the dialog or may be used by an implementer to provide any additional details about the implementation.

A.2 Instructions for Completing the RTM [Informative]

To find the standardized design content for a functional requirement, search for the requirement identification number and functional requirement under the functional requirements columns. Next to the functional requirements column will be a dialog identification number, identifying either a generic dialog (found in Section G.3) or a specified dialog (found in Section 4.2) to be used to fulfill that requirement. To the right of the dialog identification number are the identification number and name of the data objects that are referenced or used by the dialog to fulfill the functional requirement. Object definitions specific to NTCIP 1203 v3 can be found in Section 5. If an object is defined in a different standard, that standard shall be listed first, followed by the section number where the object definition can be found. The "Additional Specifications" column will provide additional notes or details about the design content.

A.3 Requirements Traceability Matrix (RTM) Table

Requirements Traceability Matrix (RTM)					
FR ID	**Functional Requirement**	**Dialog ID**	**Object ID**	**Object Name**	**Additional Specifications**
3.4	Architectural Requirements				
3.4.1	Support Basic Communications				
3.4.1.1	Retrieve Data	G.1			
3.4.1.2	Deliver Data	G.3			
3.4.1.3	Explore Data	G.2			
3.4.2	Support Logged Data				
3.4.2.1	Determine Current Configuration of Logging Service	H.3.1.1			
			1103 v02 A.7.3.1	eventClassNumber	
			1103 v02 A.7.3.2	eventClassLimit	
			1103 v02 A.7.3.4	eventClassDescription	

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Requirements Traceability Matrix (RTM)					
FR ID	**Functional Requirement**	**Dialog ID**	**Object ID**	**Object Name**	**Additional Specifications**
			1103 v02 A.7.3.3	eventClassClearTime	
			1103 v02 A.7.5.1	eventConfigID	
			1103 v02 A.7.5.2	eventConfigClass	
			1103 v02 A.7.5.3	eventConfigMode	
			1103 v02 A.7.5.4	eventConfigCompareValue	
			1103 v02 A.7.5.5	eventConfigCompareValue2	
			1103 v02 A.7.5.6	eventConfigCompareOID	
			1103 v02 A.7.5.7	eventConfigLogOID	
			1103 v02 A.7.5.8	eventConfigAction	
			1103 v02 A.7.5.9	eventConfigStatus	
3.4.2.2	Configure Logging Service	H.3.1.2			
			1103 v02 A.7.3.1	eventClassNumber	
			1103 v02 A.7.3.2	eventClassLimit	
			1103 v02 A.7.3.4	eventClassDescription	
			1103 v02 A.7.3.3	eventClassClearTime	
			1103 v02 A.7.5.1	eventConfigID	
			1103 v02 A.7.5.2	eventConfigClass	
			1103 v02 A.7.5.3	eventConfigMode	
			1103 v02 A.7.5.4	eventConfigCompareValue	
			1103 v02 A.7.5.5	eventConfigCompareValue2	
			1103 v02 A.7.5.6	eventConfigCompareOID	
			1103 v02 A.7.5.7	eventConfigLogOID	
			1103 v02 A.7.5.8	eventConfigAction	
			1103 v02 A.7.5.9	eventConfigStatus	
3.4.2.3	Retrieve Logged Data	H.3.1.3			
			1103 v02 A.7.3.5	eventClassNumRowsInLog	
			1103 v02 A.7.3.6	eventClassNumEvents	
			1103 v02 A.7.7.1	eventLogClass	
			1103 v02 A.7.7.2	eventLogNumber	
			1103 v02 A.7.7.3	eventLogID	

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Requirements Traceability Matrix (RTM)					
FR ID	**Functional Requirement**	**Dialog ID**	**Object ID**	**Object Name**	**Additional Specifications**
			1103 v02 A.7.7.4	eventLogTime	
			1103 v02 A.7.7.5	eventLogValue	
3.4.2.4	Clear Log	G.3			
			1103 v02 A.7.3.3	eventClassClearTime	
3.4.2.5	Determine Capabilities of Event Logging Service	G.1			
			1103 v02 A.7.2	maxEventClasses	
			1103 v02 A.7.4	maxEventLogConfigs	
			1103 v02 A.7.6	maxEventLogSize	
3.4.2.6	Determine Total Number of Events	G.1			
			1103 v02 A.7.8	numEvents	
3.4.3	Support Exception Reporting	Not supported in NTCIP 1203 v02			
3.4.4	Manage Access				
3.4.4.1	Determine Current Access Settings	G.1			
			1103 v02 A.8.1	communityNameAdmin	
			1103 v02 A.8.2	communityNamesMax	
			1103 v02 A.8.3.1	communityNameIndex	
			1103 v02 A.8.3.2	communityNameUser	
			1103 v02 A.8.3.3	communityNameAccessMask	
3.4.4.2	Configure Access	G.3			
			1103 v02 A.8.1	communityNameAdmin	
			1103 v02 A.8.2	communityNamesMax	
			1103 v02 A.8.3.1	communityNameIndex	
			1103 v02 A.8.3.2	communityNameUser	
			1103 v02 A.8.3.3	communityNameAccessMask	
3.5	Data Exchange and Operational Environment Requirements				

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Requirements Traceability Matrix (RTM)					
FR ID	**Functional Requirement**	**Dialog ID**	**Object ID**	**Object Name**	**Additional Specifications**
3.5.1	Manage the DMS Configuration				
3.5.1.1	Identify DMS				
3.5.1.1.1	Determine Sign Type and Technology	G.1			
			5.2.2	dmsSignType	
			5.2.9	dmsSignTechnology	
3.5.1.2	Determine Message Display Capabilities				
3.5.1.2.1	Determine Basic Message Display Capabilities				
3.5.1.2.1.1	Determine the Size of the Sign Face	G.1			
			5.2.3	dmsSignHeight	
			5.2.4	dmsSignWidth	
3.5.1.2.1.2	Determine the Size of the Sign Border	G.1			
			5.2.5	dmsHorizontalBorder	
			5.2.6	dmsVerticalBorder	
3.5.1.2.1.3	Determine Beacon Type	G.1			
			5.2.8	dmsBeaconType	
3.5.1.2.1.4	Determine Sign Access and Legend	G.1			
			5.2.1	dmsSignAccess	
			5.2.7	dmsLegend	
3.5.1.2.2	Determine Matrix Capabilities				
3.5.1.2.2.1	Determine Sign Face Size in Pixels	G.1			
			5.3.3	vmsSignHeightPixels	
			5.3.4	vmsSignWidthPixels	
3.5.1.2.2.2	Determine Character Size in Pixels	G.1			

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Requirements Traceability Matrix (RTM)					
FR ID	**Functional Requirement**	**Dialog ID**	**Object ID**	**Object Name**	**Additional Specifications**
			5.3.1	vmsCharacterHeightPixels	
			5.3.2	vmsCharacterWidthPixels	
3.5.1.2.2.3	Determine Pixel Spacing	G.1			
			5.3.5	vmsHorizontalPitch	
			5.3.6	vmsVerticalPitch	
3.5.1.2.3	Determine VMS Message Display Capabilities				
3.5.1.2.3.1	Determine Maximum Number of Pages	G.1			
			5.5.24	dmsMaxNumberPages	
3.5.1.2.3.2	Determine Maximum Message Length	G.1			
			5.5.25	dmsMaxMultiStringLength	
3.5.1.2.3.3	Determine Supported Color Schemes	G.1			
			5.5.22	dmsColorScheme	
			5.3.7	monochromeColor	
3.5.1.2.3.4	Determine Message Display Capabilities	G.1			
			5.5.23	dmsSupportedMultiTags	
3.5.1.2.4	Delete All Messages of a Message Type with One Command	G.3			
			5.7.16	dmsMemoryMgmt	
3.5.1.3	Manage Fonts	The following mapping is Only applicable to NTCIP 1203 v02. (Further below is the mapping for NTCIP 1203:1997 (version v01).		Note: The only difference is that NTCIP 1203 v02 has a fontStatus object that is used to manage the font table.	
3.5.1.3.1	Determine Maximum Number of Fonts Supported	G.1			
			5.4.1	numFonts	

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Requirements Traceability Matrix (RTM)					
FR ID	**Functional Requirement**	**Dialog ID**	**Object ID**	**Object Name**	**Additional Specifications**
3.5.1.3.2	Determine Maximum Character Size	G.1			
			5.4.5	fontMaxCharacterSize	
3.5.1.3.3	Determine Maximum Number of Characters per Font	G.1			
			5.4.3	maxFontCharacters	
3.5.1.3.4	Retrieve a Font Definition	4.2.2.1			
			5.4.2.1	fontIndex	
			5.4.2.2	fontNumber	
			5.4.2.3	fontName	
			5.4.2.5	fontCharSpacing	
			5.4.2.6	fontLineSpacing	
			5.4.2.7	fontVersionID	
			5.4.2.4	fontHeight	
			5.4.4.1	characterNumber	
			5.4.4.2	characterWidth	
			5.4.4.3	characterBitmap	
			5.4.2.8	fontStatus	
3.5.1.3.5	Configure a Font	4.2.2.2			
			5.4.2.1	fontIndex	
			5.4.2.2	fontNumber	
			5.4.2.3	fontName	
			5.4.2.5	fontCharSpacing	
			5.4.2.6	fontLineSpacing	
			5.4.2.4	fontHeight	
			5.4.4.1	characterNumber	
			5.4.4.2	characterWidth	
			5.4.4.3	characterBitmap	
			5.4.2.8	fontStatus	
3.5.1.3.6	Delete a Font	4.2.2.3			
			5.4.2.1	fontIndex	
			5.4.2.4	fontHeight	

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Requirements Traceability Matrix (RTM)					
FR ID	**Functional Requirement**	**Dialog ID**	**Object ID**	**Object Name**	**Additional Specifications**
			5.4.2.8	fontStatus	
3.5.1.3.7	Validate a Font	4.2.2.4			
			5.4.2.1	fontIndex	
			5.4.2.7	fontVersionID	
			5.4.2.8	fontStatus	
3.5.1.3	Manage Fonts	THE FOLLOWING MAPPING IS ONLY APPLICABLE TO NTCIP 1203:1997 (version v01).		Note: The only difference is that NTCIP 1203 v02 has a fontStatus object that is used to manage the font table.	
3.5.1.3.1	Determine Maximum Number of Fonts Supported	G.1			
			5.4.1	numFonts	
3.5.1.3.2	Determine Maximum Character Size	G.1			
			5.4.5	fontMaxCharacterSize	
3.5.1.3.3	Determine Maximum Number of Characters per Font	G.1			
			5.4.3	maxFontCharacters	
3.5.1.3.4	Retrieve a Font Definition	4.2.2.1			
			5.4.2.1	fontIndex	
			5.4.2.2	fontNumber	
			5.4.2.3	fontName	
			5.4.2.5	fontCharSpacing	
			5.4.2.6	fontLineSpacing	
			5.4.2.7	fontVersionID	
			5.4.2.4	fontHeight	
			5.4.4.1	characterNumber	
			5.4.4.2	characterWidth	
			5.4.4.3	characterBitmap	
3.5.1.3.5	Configure a Font	4.2.2.2			
			5.4.2.1	fontIndex	
			5.4.2.2	fontNumber	

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Requirements Traceability Matrix (RTM)					
FR ID	**Functional Requirement**	**Dialog ID**	**Object ID**	**Object Name**	**Additional Specifications**
			5.4.2.3	fontName	
			5.4.2.5	fontCharSpacing	
			5.4.2.6	fontLineSpacing	
			5.4.2.4	fontHeight	
			5.4.4.1	characterNumber	
			5.4.4.2	characterWidth	
			5.4.4.3	characterBitmap	
3.5.1.3.6	Delete a Font	4.2.2.3			
			5.4.2.1	fontIndex	
			5.4.2.4	fontHeight	
3.5.1.3.7	Validate a Font	4.2.2.4			
			5.4.2.1	fontIndex	
			5.4.2.7	fontVersionID	
3.5.1.4	Manage Graphics				
3.5.1.4.1	Determine Maximum Number of Graphics	G.1			
			5.12.1	dmsGraphicMaxEntries	
			5.12.2	dmsGraphicNumEntries	
3.5.1.4.2	Determine Maximum Graphic Size	G.1			
			5.12.3	dmsGraphicMaxSize	
			5.12.5	dmsGraphicBlockSize	
3.5.1.4.3	Determine Available Graphics Memory	G.1			
			5.12.2	dmsGraphicNumEntries	
			5.12.4	availableGraphicMemory	
3.5.1.4.4	Retrieve a Graphic Definition	4.2.2.5			
			5.12.6.1	dmsGraphicIndex	
			5.12.6.2	dmsGraphicNumber	
			5.12.6.3	dmsGraphicName	
			5.12.6.5	dmsGraphicWidth	
			5.12.6.6	dmsGraphicType	

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Requirements Traceability Matrix (RTM)					
FR ID	**Functional Requirement**	**Dialog ID**	**Object ID**	**Object Name**	**Additional Specifications**
			5.12.6.8	dmsGraphicTransparentEnabled	
			5.12.6.9	dmsGraphicTransparentColor	
			5.12.6.4	dmsGraphicHeight	
			5.12.6.10	dmsGraphicStatus	
			5.12.7.1	dmsGraphicBitmapIndex	
			5.12.7.2	dmsGraphicBlockNumber	
			5.12.7.3	dmsGraphicBlockBitmap	
3.5.1.4.5	Store a Graphic Definition	4.2.2.6			
			5.12.6.1	dmsGraphicIndex	
			5.12.6.2	dmsGraphicNumber	
			5.12.6.3	dmsGraphicName	
			5.12.6.5	dmsGraphicWidth	
			5.12.6.6	dmsGraphicType	
			5.12.6.8	dmsGraphicTransparentEnabled	
			5.12.6.9	dmsGraphicTransparentColor	
			5.12.6.4	dmsGraphicHeight	
			5.12.6.10	dmsGraphicStatus	
			5.12.7.1	dmsGraphicBitmapIndex	
			5.12.7.2	dmsGraphicBlockNumber	
			5.12.7.3	dmsGraphicBlockBitmap	
3.5.1.4.6	Delete a Graphic	4.2.2.7			
			5.12.6.1	dmsGraphicIndex	
			5.12.6.4	dmsGraphicHeight	
			5.12.6.10	dmsGraphicStatus	
3.5.1.4.7	Validate a Graphic	4.2.2.8			
			5.12.6.1	dmsGraphicIndex	
			5.12.6.7	dmsGraphicID	
			5.12.6.10	dmsGraphicStatus	
3.5.1.5	Configure Brightness of Sign				

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Requirements Traceability Matrix (RTM)					
FR ID	**Functional Requirement**	**Dialog ID**	**Object ID**	**Object Name**	**Additional Specifications**
3.5.1.5.1	Determine Maximum Number of Light Sensor Levels	G.1			
			5.8.2	dmsIllumMaxPhotocellLevel	
3.5.1.5.2	Configure Light Output Algorithm	4.2.2.9			
			5.8.7	dmsIllumBrightnessValues	
			5.8.8	dmsIllumBrightnessValuesError	
3.5.1.5.3	Determine Current Light Output Algorithm	G.1			
			5.8.7	dmsIllumBrightnessValues	
			5.8.8	dmsIllumBrightnessValuesError	
3.5.1.6	Configure Current Speed Limit	G.3			
			5.11.1.4	dmsCurrentSpeedLimit	
3.5.1.7	Configure Low Fuel Threshold Value	G.3			
			5.11.3.2	lowFuelThreshold	
3.5.2	Control the DMS				
3.5.2.1	Manage Control Source	G.3			
			5.7.1	dmsControlMode	
3.5.2.2	Reset the Sign Controller	G.3			
			5.7.2	dmsSWReset	
3.5.2.3	Control the Sign Face				
3.5.2.3.1	Activate a Message	4.2.3.1			
			5.7.3	dmsActivateMessage	
			5.11.2.1.1	shortErrorStatus	
			5.7.17	dmsActivateMsgError	
			5.7.24	dmsActivateErrorMsgCode	
			5.7.18	dmsMultiSyntaxError	
			5.7.19	dmsMultiSyntaxErrorPosition	
			5.7.20	dmsMultiOtherErrorDescription	

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Requirements Traceability Matrix (RTM)					
FR ID	**Functional Requirement**	**Dialog ID**	**Object ID**	**Object Name**	**Additional Specifications**
3.5.2.3.2	Manage Default Message Display Parameters				
3.5.2.3.2.1	Determine Default Message Display Parameters	G.1			
			5.5.1	defaultBackgroundColor	for multi-version interoperability with NTCIP 1203:1997 (version v01)
			5.5.2	defaultForegroundColor	for multi-version interoperability with NTCIP 1203:1997 (version v01)
			5.5.17	defaultBackgroundRGB	
			5.5.19	defaultForegroundRGB	
			5.5.3	defaultFlashOn	
			5.5.5	defaultFlashOff	
			5.5.7	defaultFont	
			5.5.9	defaultJustificationLine	
			5.5.11	defaultJustificationPage	
			5.5.13	defaultPageOnTime	
			5.5.15	defaultPageOffTime	
			5.5.21	defaultCharacterSet	
			5.5.4	defaultFlashOnActivate	
			5.5.6	defaultFlashOffActivate	
			5.5.8	defaultFontActivate	
			5.5.10	defaultJustificationLineActivate	
			5.5.12	defaultJustificationPageActivate	
			5.5.14	defaultPageOnTimeActivate	
			5.5.16	defaultPageOffTimeActivate	
			5.5.18	defaultBackgroundRGBActivate	
			5.5.20	defaultForegroundRGBActivate	

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Requirements Traceability Matrix (RTM)					
FR ID	**Functional Requirement**	**Dialog ID**	**Object ID**	**Object Name**	**Additional Specifications**
3.5.2.3.2.2	Configure Default Background and Foreground Color	G.3			
			5.5.1	defaultBackgroundColor	for multi-version interoperability with NTCIP 1203:1997 (version v01)
			5.5.2	defaultForegroundColor	for multi-version interoperability with NTCIP 1203:1997 (version v01)
			5.5.17	defaultBackgroundRGB	
			5.5.19	defaultForegroundRGB	
3.5.2.3.2.3	Configure Default Flash-On and Flash-Off Times	G.3			
			5.5.3	defaultFlashOn	
			5.5.5	defaultFlashOff	
3.5.2.3.2.4	Configure Default Font	G.3			
			5.5.7	defaultFont	
3.5.2.3.2.5	Configure Default Line Justification	G.3			
			5.5.9	defaultJustificationLine	
3.5.2.3.2.6	Configure Default Page Justification	G.3			
			5.5.11	defaultJustificationPage	
3.5.2.3.2.7	Configure Default Page On-Time and Page Off-Time	G.3			
			5.5.13	defaultPageOnTime	
			5.5.15	defaultPageOffTime	
3.5.2.3.2.8	Configure Default Character Set	G.3			
			5.5.21	defaultCharacterSet	

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Requirements Traceability Matrix (RTM)					
FR ID	**Functional Requirement**	**Dialog ID**	**Object ID**	**Object Name**	**Additional Specifications**
3.5.2.3.3.	Manage Message Library				
3.5.2.3.3.1	Determine Available Message Types	G.1			
			5.6.1	dmsNumPermanentMsg	
			5.6.3	dmsMaxChangeableMsg	
			5.6.6	dmsMaxVolatileMsg	
3.5.2.3.3.2	Determine Available Message Space	G.1			
			5.6.2	dmsNumChangeableMsg	
			5.6.4	dmsFreeChangeableMemory	
			5.6.5	dmsNumVolatileMsg	
			5.6.7	dmsFreeVolatileMemory	
3.5.2.3.3.3	Define a Message	4.2.3.2			
			5.6.9	dmsValidateMessageError	
			5.6.8.1	dmsMessageMemoryType	
			5.6.8.2	dmsMessageNumber	
			5.6.8.3	dmsMessageMultiString	
			5.6.8.4	dmsMessageOwner	
			5.6.8.8	dmsMessageRunTimePriority	
			5.6.8.6	dmsMessageBeacon	
			5.6.8.7	dmsMessagePixelService	
			5.6.8.9	dmsMessageStatus	
			5.7.18	dmsMultiSyntaxError	
			5.7.19	dmsMultiSyntaxErrorPosition	
			5.7.20	dmsMultiOtherErrorDescription	
3.5.2.3.3.4	Verify Message Contents	G.1			
			5.6.8.1	dmsMessageMemoryType	
			5.6.8.2	dmsMessageNumber	
			5.6.8.5	dmsMessageCRC	
3.5.2.3.3.5	Retrieve Message	4.2.3.3			
			5.6.8.1	dmsMessageMemoryType	
			5.6.8.2	dmsMessageNumber	

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Requirements Traceability Matrix (RTM)					
FR ID	**Functional Requirement**	**Dialog ID**	**Object ID**	**Object Name**	**Additional Specifications**
			5.6.8.3	dmsMessageMultiString	
			5.6.8.4	dmsMessageOwner	
			5.6.8.8	dmsMessageRunTimePriority	
			5.6.8.6	dmsMessageBeacon	
			5.6.8.7	dmsMessagePixelService	
			5.6.8.9	dmsMessageStatus	
3.5.2.3.4	Schedule Messages for Display				
3.5.2.3.4.1	Retrieve a Schedule	G.1			
			1201 v03 Sec. 2.4.3.2.1	timeBaseScheduleNumber	
			1201 v03 Sec. 2.4.3.2.2	timeBaseScheduleMonth	
			1201 v03 Sec. 2.4.3.2.3	timeBaseScheduleDay	
			1201 v03 Sec. 2.4.3.2.4	timeBaseScheduleDate	
			1201 v03 Sec. 2.4.3.2.5	timeBaseScheduleDayPlan	
			1201 v03 Sec. 2.4.4.3.1	dayPlanNumber	
			1201 v03 Sec. 2.4.4.3.2	dayPlanEventNumber	
			1201 v03 Sec. 2.4.4.3.3	dayPlanHour	
			1201 v03 Sec. 2.4.4.3.4	dayPlanMinute	
			1201 v03 Sec. 2.4.4.3.5	dayPlanActionNumberOID	
			5.9.1	numActionTableEntries	
			5.9.2.1	dmsActionIndex	
			5.9.2.2	dmsActionMsgCode	
3.5.2.3.4.2	Define a Schedule	4.2.3.4			
			1201 v03 Sec. 2.4.3.2.1	timeBaseScheduleNumber	
			1201 v03 Sec. 2.4.3.2.2	timeBaseScheduleMonth	
			1201 v03 Sec. 2.4.3.2.3	timeBaseScheduleDay	
			1201 v03 Sec. 2.4.3.2.4	timeBaseScheduleDate	
			1201 v03 Sec. 2.4.3.2.5	timeBaseScheduleDayPlan	
			1201 v03 Sec. 2.4.4.3.1	dayPlanNumber	
			1201 v03 Sec. 2.4.4.3.2	dayPlanEventNumber	
			1201 v03 Sec. 2.4.4.3.3	dayPlanHour	
			1201 v03 Sec. 2.4.4.3.4	dayPlanMinute	
			1201 v03 Sec. 2.4.4.3.5	dayPlanActionNumberOID	
			5.9.2.1	dmsActionIndex	

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Requirements Traceability Matrix (RTM)					
FR ID	**Functional Requirement**	**Dialog ID**	**Object ID**	**Object Name**	**Additional Specifications**
			5.9.2.2	dmsActionMsgCode	
3.5.2.3.5	Configure Event-Based Message Activation				
3.5.2.3.5.1	Configure Messages Activated by Standardized Events				
3.5.2.3.5.1.1	Configure Message for Short Power Loss Recovery Event	G.3			
			5.7.8	dmsShortPowerRecoveryMessage	
3.5.2.3.5.1.2	Configure Message for Long Power Loss Recovery Event	G.3			
			5.7.9	dmsLongPowerRecoveryMessage	
			5.7.10	dmsShortPowerLossTime	
3.5.2.3.5.1.3	Configure Message for Power Loss Event	G.3			
			5.7.14	dmsPowerLossMessage	
3.5.2.3.5.1.4	Configure Message for Controller Reset Event	G.3			
			5.7.11	dmsResetMessage	
3.5.2.3.5.1.5	Configure Message for Communications Loss Event	G.3			
			5.7.12	dmsCommunicationsLossMessage	
			5.7.13	dmsTimeCommLoss	
3.5.2.3.5.1.6	Configure Message for End Message Display Duration Event	G.3			
			5.7.15	dmsEndDurationMessage	
3.5.2.3.6	Activate a Message with Status	4.2.3.7			

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Requirements Traceability Matrix (RTM)					
FR ID	**Functional Requirement**	**Dialog ID**	**Object ID**	**Object Name**	**Additional Specifications**
			5.7.3	dmsActivateMessage	
			5.7.17	dmsActivateMsgError	
			5.7.24	dmsActivateErrorMsgCode	
			5.7.18	dmsMultiSyntaxError	
			5.7.19	dmsMultiSyntaxErrorPosition	
			5.7.20	dmsMultiOtherErrorDescription	
			5.7.25	dmsActivateMessageState	
3.5.2.4	Control External Devices	The following mapping isonly applicable to NTCIP 1203 v02. (Further below is the mapping for NTCIP 1203:1997 (version v01)).			
3.5.2.4.1	Determine Configuration of External Device Ports				
3.5.2.4.1.1	Determine Base Configuration of External Device Ports	G.3			
			1201 v03 Sec. 2.9.3.1	auxIOv2PortType	
			1201 v03 Sec. 2.9.3.2	auxIOv2PortNumber	
			1201 v03 Sec. 2,9.3.3	auxIOv2PortDescription	
			1201 v03 Sec. 2.9.3.4	auxIOv2PortResolution	
			1201 v03 Sec. 2.9.3.6	auxIOv2PortDirection	
3.5.2.4.1.2	Further Define Ports	G.3			
			1201 v03 Sec. 2.9.3.1	auxIOv2PortType	
			1201 v03 Sec. 2.9.3.2	auxIOv2PortNumber	
			1201 v03 Sec. 2.9.3.3	auxIOv2PortDescription	
3.5.2.4.1.3	Number of External Devices Supported	G.1			
			1201 v03 Sec. 2.9.1	maxAuxIOv2TableNumDigitalPorts	
			1201 v03 Sec. 2.9.2	maxAuxIOv2TableNumAnalogPorts	
3.5.2.4.2	Monitoring of External Devices				
3.5.2.4.2.1	Retrieving Data from External Devices	4.2.4.13			
			1201 v03 Sec. 2.9.3.1	auxIOv2PortType	

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Requirements Traceability Matrix (RTM)					
FR ID	**Functional Requirement**	**Dialog ID**	**Object ID**	**Object Name**	**Additional Specifications**
			1201 v03 Sec. 2.9.3.2	auxIOv2PortNumber	
			1201 v03 Sec. 2.9.3.3	auxIOv2PortDescription	
			1201 v03 Sec. 2.9.3.4	auxIOv2PortResolution	
			1201 v03 Sec. 2.9.3.5	auxIOv2PortValue	
			1201 v03 Sec. 2.9.3.6	auxIOv2PortDirection	
3.5.2.4.3	Controlling of External Devices				
3.5.2.4.3.1	Passing Data to External Devices	G.3			
			1201 v03 Sec. 2.9.3.1	auxIOv2PortType	
			1201 v03 Sec. 2.9.3.2	auxIOv2PortNumber	
			1201 v03 Sec. 2.9.3.3	auxIOv2PortDescription	
			1201 v03 Sec. 2.9.3.5	auxIOv2PortValue	
3.5.2.4.3.2	Determine Status of External Devices	G.1			
			1201 v03 Sec. 2.9.3.1	auxIOv2PortType	
			1201 v03 Sec. 2.9.3.2	auxIOv2PortNumber	
			1201 v03 Sec. 2.9.3.7	auxIOv2PortLastCommandedState	
3.5.2.4.4	Controlling of Bi-directionally Connected External Devices				
3.5.2.4.4.1	Retrieving Data from External Devices	4.2.4.13			
			1201 v03 Sec. 2.9.3.1	auxIOv2PortType	
			1201 v03 Sec. 2.9.3.2	auxIOv2PortNumber	
			1201 v03 Sec. 2.9.3.3	auxIOv2PortDescription	
			1201 v03 Sec. 2.9.3.4	auxIOv2PortResolution	
			1201 v03 Sec. 2.9.3.5	auxIOv2PortValue	
			1201 v03 Sec. 2.9.3.6	auxIOv2PortDirection	
3.5.2.4.4.2	Passing Data to External Devices	G.3			
			1201 v03 Sec. 2.9.3.1	auxIOv2PortType	
			1201 v03 Sec. 2.9.3.2	auxIOv2PortNumber	
			1201 v03 Sec. 2.9.3.3	auxIOv2PortDescription	

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Requirements Traceability Matrix (RTM)					
FR ID	**Functional Requirement**	**Dialog ID**	**Object ID**	**Object Name**	**Additional Specifications**
			1201 v03 Sec. 2.9.3.5	auxIOv2PortValue	
3.5.2.4.4.3	Determine Status of External Devices	G.1			
			1201 v03 Sec. 2.9.3.1	auxIOv2PortType	
			1201 v03 Sec. 2.9.3.2	auxIOv2PortNumber	
			1201 v03 Sec. 2.9.3.7	auxIOv2PortLastCommandedState	
3.5.2.4	Control External Devices	The following mapping is only applicable to NTCIP 1203:1997 (version v01).		Note: The following objects were originally contained in NTCIP 1203:1997 (version v01), but have since been moved to NTCIP 1201 v03, but were not modified. Note: References in NTCIP 1201:2005 are not necessarily consistent with references in NTCIP 1201 v03.	
3.5.2.4.1	Determine Configuration of External Device Ports				
3.5.2.4.1.1	Determine Base Configuration of External Device Ports	G.3			
			1201:2005 Sec. 2.8.3.1	auxIOPortType	
			1201:2005 Sec. 2.8.3.2	auxIOPortNumber	
			1201:2005 Sec. 2.8.3.3	auxIODescription	
			1201:2005 Sec. 2.8.3.4	auxIOResolution	
			1201:2005 Sec. 2.8.3.6	auxIOPortDirection	
3.5.2.4.1.2	Further Define Ports	G.3			
			1201:2005 Sec. 2.8.3.1	auxIOPortType	
			1201:2005 Sec. 2.8.3.2	auxIOPortNumber	
			1201:2005 Sec. 2.8.3.3	auxIODescription	
3.5.2.4.1.3	Number of External Devices Supported	G.3			
			1201:2005 Sec. 2.8.1	auxIOTableNumDigitalPorts	
			1201:2005 Sec. 2.8.2	auxIOTableNumAnalogPorts	

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Requirements Traceability Matrix (RTM)					
FR ID	**Functional Requirement**	**Dialog ID**	**Object ID**	**Object Name**	**Additional Specifications**
3.5.2.4.2	Monitoring of External Devices				
3.5.2.4.2.1	Retrieving Data from External Devices	G.1			
			1201:2005 Sec. 2.8.3.1	auxIOPortType	
			1201:2005 Sec. 2.8.3.2	auxIOPortNumber	
			1201:2005 Sec. 2.8.3.3	auxIODescription	
			1201:2005 Sec. 2.8.3.4	auxIOResolution	
			1201:2005 Sec. 2.8.3.5	auxIOValue	
			1201:2005 Sec. 2.8.3.6	auxIOPortDirection	
3.5.2.4.3	Controlling of External Devices				
3.5.2.4.3.1	Passing Data to External Devices	G.3			
			1201:2005 Sec. 2.8.3.1	auxIOPortType	
			1201:2005 Sec. 2.8.3.2	auxIOPortNumber	
			1201:2005 Sec. 2.8.3.3	auxIODescription	
			1201:2005 Sec. 2.8.3.5	auxIOValue	
3.5.2.4.4	Controlling of Bi-directionally Connected External Devices				
3.5.2.4.4.1	Retrieving Data from External Devices	G.1			
			1201:2005 Sec. 2.8.3.1	auxIOPortType	
			1201:2005 Sec. 2.8.3.2	auxIOPortNumber	
			1201:2005 Sec. 2.8.3.3	auxIODescription	
			1201:2005 Sec. 2.8.3.4	auxIOResolution	
			1201:2005 Sec. 2.8.3.5	auxIOValue	
			1201:2005 Sec. 2.8.3.6	auxIOPortDirection	
3.5.2.4.4.2	Passing Data to External Devices	G.3			
			1201:2005 Sec. 2.8.3.1	auxIOPortType	
			1201:2005 Sec. 2.8.3.2	auxIOPortNumber	
			1201:2005 Sec. 2.8.3.3	auxIODescription	
			1201:2005 Sec. 2.8.3.5	auxIOValue	

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Requirements Traceability Matrix (RTM)					
FR ID	**Functional Requirement**	**Dialog ID**	**Object ID**	**Object Name**	**Additional Specifications**
3.5.2.5	Control Sign Brightness				
3.5.2.5.1	Determine Number of Brightness Levels	G.1			
			5.8.4	dmsIllumNumBrightLevels	
3.5.2.5.2	Determine Current Photocell Readings	G.1			
			5.8.3	dmsIllumPhotocellLevelStatus	
3.5.2.5.3	Manually Direct-Control Brightness (Version 2)	4.2.3.5	Note: This function and the following mapping is only applicable to NTCIP 1203 v02		
			5.8.6	dmsIllumManLevel	This may be a value between zero (0) and either the maximum number of brightness levels that the DMS supports (indicated by selecting a control mode of 'manualDirect') or the number of brightness levels defined in the brightness values table (indicated by a control mode of 'manualIndexed').
			5.8.5	dmsIllumBrightLevelStatus	
			5.8.9	dmsIllumLightOutputStatus	
			5.8.1	dmsIllumControl	Set to either 'manualDirect' or 'manualIndexed'

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Requirements Traceability Matrix (RTM)					
FR ID	**Functional Requirement**	**Dialog ID**	**Object ID**	**Object Name**	**Additional Specifications**
3.5.2.5.4	Manually Index-Control Brightness (Version 2)	4.2.3.5	Note: This function and the following mapping is only applicable to NTCIP 1203 v02.		
			5.8.6	dmsIllumManLevel	This may be a value between zero (0) and either the maximum number of brightness levels that the DMS supports (indicated by selecting a control mode of 'manualDirect') or the number of brightness levels defined in the brightness values table (indicated by a control mode of 'manualIndexed').
			5.8.5	dmsIllumBrightLevelStatus	
			5.8.9	dmsIllumLightOutputStatus	
			5.8.1	dmsIllumControl	Set to either 'manualDirect' or 'manualIndexed'
3.5.2.5.5	Manually Control Brightness (Version 1 Only)	4.2.3.5	Note: This function and the following mapping is only applicable to NTCIP 1203:1997 (version v01).		

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Requirements Traceability Matrix (RTM)					
FR ID	**Functional Requirement**	**Dialog ID**	**Object ID**	**Object Name**	**Additional Specifications**
			5.8.6	dmsIllumManLevel	This may be a value between zero (0) and the number of brightness levels that the DMS supports (Note that there is an ambiguity that lead to development of the manualDirect and manualIndexed values. The agency specification is required to indicate which method is to be implemented).
			5.8.5	dmsIllumBrightLevelStatus	
			5.8.9	dmsIllumLightOutputStatus	
			5.8.1	dmsIllumControl	To facilitate multi-version interoperability, the retired value of 'manual' must be used for version 1 implementations.
3.5.2.5.6	Switch Brightness Control Modes	G.3			

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Requirements Traceability Matrix (RTM)					
FR ID	**Functional Requirement**	**Dialog ID**	**Object ID**	**Object Name**	**Additional Specifications**
			5.8.1	dmsIllumControl	Note: Be aware of the difference within the values of this object between NTCIP 1203:1997 (version v01) and NTCIP 1203 v02 deployments.
3.5.2.6	Manage the Exercise of Pixels	4.2.3.6			
			5.7.21	vmsPixelServiceDuration	
			5.7.22	vmsPixelServiceFrequency	
			5.7.23	vmsPixelServiceTime	
3.5.3	Monitor the Status of the DMS				
3.5.3.1	Perform Diagnostics				
3.5.3.1.1	Test Operational Status of DMS Components				
3.5.3.1.1.1	Execute Lamp Testing	4.2.4.1			
			5.11.2.5.3	lampTestActivation	
3.5.3.1.1.2	Activate Pixel Testing	4.2.4.2			
			5.11.2.4.3	pixelTestActivation	
3.5.3.1.1.3	Execute Climate-Control Equipment Testing	4.2.4.3			
			5.11.2.3.5.6	dmsClimateCtrlTestActivation	
			5.11.2.3.5.7	dmsClimateCtrlAbortReason	
3.5.3.1.2	Provide General DMS Error Status Information	G.1			
			5.11.2.1.1	shortErrorStatus	
3.5.3.1.3	Identify Problem Subsystem				
3.5.3.1.3.1	Monitor Power Errors	G.1			
			5.11.2.2.1	dmsPowerFailureStatusMap	
			5.11.2.2.2	dmsPowerNumRows	

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Requirements Traceability Matrix (RTM)					
FR ID	**Functional Requirement**	**Dialog ID**	**Object ID**	**Object Name**	**Additional Specifications**
3.5.3.1.3.2	Monitor Lamp Errors	G.1			
			5.11.2.5.1	lampFailureStuckOn	
			5.11.2.5.2	lampFailureStuckOff	
			5.11.2.5.4	dmsLampNumRows	
3.5.3.1.3.3	Monitor Pixel Errors	G.1			
			5.11.2.4.4.1	dmsPixelStatusIndex	
			5.11.2.4.4.2	dmsPixelStatus	
			5.11.2.4.1	pixelFailureTableNumRows	
			5.11.2.4.5	dmsPixelFailureTestRows	
			5.11.2.4.6	dmsPixelFailureMessageRows	
3.5.3.1.3.4	Monitor Light Sensor Errors	G.1			
			5.11.2.7.1	dmsLightSensorStatusMap	
			5.11.2.7.2	dmsLightSensorNumRows	
3.5.3.1.3.5	Monitor Controller Software Operations	G.1			
			5.11.1.5	watchdogFailureCount	
			5.11.2.1.2	controllerErrorStatus	
3.5.3.1.3.6	Monitor Climate-Control System Errors	G.1			
			5.11.2.3.3	dmsClimateCtrlStatusMap	
			5.11.2.3.4	dmsClimateCtrlNumRows	
3.5.3.1.3.7	Monitor Temperature Warnings	G.1			
			5.11.4.7	tempSensorWarningMap	
			5.11.4.8	tempSensorCriticalTempMap	
3.5.3.1.3.8	Monitor Humidity Warnings	G.1			
			5.11.2.8.1	dmsHumiditySensorStatusMap	
			5.11.2.8.2	dmsHumiditySensorNumRows	
3.5.3.1.3.9	Monitor Drum Sign Rotor Errors	G.1			
			5.11.2.6.1	dmsDrumStatusMap	
			5.11.2.6.2	dmsDrumNumRows	

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Requirements Traceability Matrix (RTM)					
FR ID	**Functional Requirement**	**Dialog ID**	**Object ID**	**Object Name**	**Additional Specifications**
3.5.3.1.3.10	Monitor Door Status	G.1			
			5.11.1.6	dmsStatDoorOpen	
3.5.3.1.4	Monitor Subsystems Status Details				
3.5.3.1.4.1	Monitor Power Error Details	4.2.4.4			
			5.11.2.2.3.1	dmsPowerIndex	
			5.11.2.2.3.2	dmsPowerDescription	
			5.11.2.2.3.3	dmsPowerMfrStatus	
			5.11.2.2.3.4	dmsPowerStatus	
			5.11.2.2.3.5	dmsPowerVoltage	
			5.11.2.2.3.6	dmsPowerType	
3.5.3.1.4.2	Monitor Lamp Error Details	4.2.4.5			
			5.11.2.5.5.1	dmsLampIndex	
			5.11.2.5.5.2	dmsLampDescription	
			5.11.2.5.5.3	dmsLampMfrStatus	
			5.11.2.5.5.4	dmsLampStatus	
			5.11.2.5.5.5	dmsLampPixelTop	
			5.11.2.5.5.6	dmsLampPixelLeft	
			5.11.2.5.5.7	dmsLampPixelBottom	
			5.11.2.5.5.8	dmsLampPixelRight	
3.5.3.1.4.3	Monitor Pixel Error Details	4.2.4.6			
			5.11.2.4.2.1	pixelFailureDetectionType	
			5.11.2.4.2.2	pixelFailureIndex	
			5.11.2.4.2.3	pixelFailureXLocation	
			5.11.2.4.2.4	pixelFailureYLocation	
			5.11.2.4.2.5	pixelFailureStatus	
3.5.3.1.4.4	Monitor Light Sensor Error Details	4.2.4.7			
			5.11.2.7.3.1	dmsLightSensorIndex	
			5.11.2.7.3.2	dmsLightSensorDescription	

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Requirements Traceability Matrix (RTM)					
FR ID	**Functional Requirement**	**Dialog ID**	**Object ID**	**Object Name**	**Additional Specifications**
			5.11.2.7.3.3	dmsLightSensorCurrentReading	
			5.11.2.7.3.4	dmsLightSensorStatus	
3.5.3.1.4.5	Monitor Message Activation Error Details	4.2.4.8			
			5.7.17	dmsActivateMsgError	
			5.7.24	dmsActivateErrorMsgCode	
			5.7.18	dmsMultiSyntaxError	
			5.7.19	dmsMultiSyntaxErrorPosition	
			5.7.20	dmsMultiOtherErrorDescription	
3.5.3.1.4.6	Monitor Climate-Control System Error Details	4.2.4.9			
			5.11.2.3.5.1	dmsClimateCtrlIndex	
			5.11.2.3.5.2	dmsClimateCtrlDescription	
			5.11.2.3.5.3	dmsClimateCtrlMfrStatus	
			5.11.2.3.5.4	dmsClimateCtrlErrorStatus	
			5.11.2.3.5.5	dmsClimateCtrlOnStatus	
			5.11.2.3.5.8	dmsClimateCtrlType	
3.5.3.1.4.7	Monitor Sign Housing Temperatures	G.1			
			5.11.2.9.1	dmsTempSensorStatusMap	
			5.11.2.9.2	dmsTempSensorNumRows	
			5.11.2.9.3.1	dmsTempSensorIndex	
			5.11.2.9.3.2	dmsTempSensorDescription	
			5.11.2.9.3.3	dmsTempSensorCurrentReading	
			5.11.2.9.3.4	dmsTempSensorHighWarningTemperature	
			5.11.2.9.3.5	dmsTempSensorLowWarningTemperature	
			5.11.2.9.3.6	dmsTempSensorHighCriticalTemperature	
			5.11.2.9.3.7	dmsTempSensorLowCriticalTemperature	
			5.11.2.9.3.8	dmsTempSensorStatus	
			5.11.4.5	tempMinSignHousing	

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Requirements Traceability Matrix (RTM)					
FR ID	**Functional Requirement**	**Dialog ID**	**Object ID**	**Object Name**	**Additional Specifications**
			5.11.4.6	tempMaxSignHousing	
3.5.3.1.4.8	Monitor Sign Housing Humidity	4.2.4.10			
			5.11.2.8.1	dmsHumiditySensorStatusMap	
			5.11.2.8.2	dmsHumiditySensorNumRows	
			5.11.2.8.3.1	dmsHumiditySensorIndex	
			5.11.2.8.3.2	dmsHumiditySensorDescription	
			5.11.2.8.3.3	dmsHumiditySensorCurrentReading	
			5.11.2.8.3.4	dmsHumiditySensorStatus	
3.5.3.1.4.9	Monitor Control Cabinet Temperatures	G.1			
			5.11.2.9.1	dmsTempSensorStatusMap	
			5.11.2.9.2	dmsTempSensorNumRows	
			5.11.2.9.3.1	dmsTempSensorIndex	
			5.11.2.9.3.2	dmsTempSensorDescription	
			5.11.2.9.3.3	dmsTempSensorCurrentReading	
			5.11.2.9.3.4	dmsTempSensorHighWarningTemperature	
			5.11.2.9.3.5	dmsTempSensorLowWarningTemperature	
			5.11.2.9.3.6	dmsTempSensorHighCriticalTemperature	
			5.11.2.9.3.7	dmsTempSensorLowCriticalTemperature	
			5.11.2.9.3.8	dmsTempSensorStatus	
			5.11.4.1	tempMinCtrlCabinet	
			5.11.4.2	tempMaxCtrlCabinet	
3.5.3.1.4.10	Monitor Control Cabinet Humidity	4.2.4.11			
			5.11.2.8.1	dmsHumiditySensorStatusMap	
			5.11.2.8.2	dmsHumiditySensorNumRows	
			5.11.2.8.3.1	dmsHumiditySensorIndex	
			5.11.2.8.3.2	dmsHumiditySensorDescription	

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Requirements Traceability Matrix (RTM)					
FR ID	**Functional Requirement**	**Dialog ID**	**Object ID**	**Object Name**	**Additional Specifications**
			5.11.2.8.3.3	dmsHumiditySensorCurrentReading	
			5.11.2.8.3.4	dmsHumiditySensorStatus	
3.5.3.1.4.11	Monitor Drum Sign Rotor Error Details	4.2.4.12			
			5.11.2.6.3.1	dmsDrumIndex	
			5.11.2.6.3.2	dmsDrumDescription	
			5.11.2.6.3.3	dmsDrumMfrStatus	
			5.11.2.6.3.4	dmsDrumStatus	
3.5.3.1.5	Monitor the Sign's Control Source	G.1			
			5.7.1	dmsControlMode	
3.5.3.1.6	Monitor Power Information				
3.5.3.1.6.1	Monitor Power Source	G.1			
			5.11.3.6	powerSource	
3.5.3.1.6.2	Monitor Power Voltage	G.1			
			5.11.3.1	signVolts	
			5.11.3.5	lineVolts	
3.5.3.1.6.3	Monitor Current Fuel Level	G.1			
			5.11.3.3	fuelLevel	
3.5.3.1.6.4	Monitor Current Engine RPM	G.1			
			5.11.3.4	engineRPM	
3.5.3.1.7	Monitor Ambient Environment	G.1			
			5.11.2.9.1	dmsTempSensorStatusMap	
			5.11.2.9.2	dmsTempSensorNumRows	
			5.11.2.9.3.1	dmsTempSensorIndex	
			5.11.2.9.3.2	dmsTempSensorDescription	
			5.11.2.9.3.3	dmsTempSensorCurrentReading	
			5.11.2.9.3.4	dmsTempSensorHighWarningTemperature	

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Requirements Traceability Matrix (RTM)					
FR ID	**Functional Requirement**	**Dialog ID**	**Object ID**	**Object Name**	**Additional Specifications**
			5.11.2.9.3.5	dmsTempSensorLowWarningTemperature	
			5.11.2.9.3.6	dmsTempSensorHighCriticalTemperature	
			5.11.2.9.3.7	dmsTempSensorLowCriticalTemperature	
			5.11.2.9.3.8	dmsTempSensorStatus	
			5.11.4.3	tempMinAmbient	
			5.11.4.4	tempMaxAmbient	
3.5.3.1.8	Determine Critical Temperature Threshold	G.1			
			5.11.2.9.4	dmsTempSensorHighestCriticalTempThreshold	
			5.11.2.9.5	dmsTempSensorLowestCriticalTempThreshold	
3.5.3.1.9	Monitor Speed Detector Reading	G.1			
			5.11.1.3	dmsCurrentSpeed	
3.5.3.2	Monitor the Current Message				
3.5.3.2.1	Monitor Information about the Currently Displayed Message	4.2.4.14			
			5.8.5	dmsIllumBrightLevelStatus	
			5.8.9	dmsIllumLightOutputStatus	
			5.6.8.1	dmsMessageMemoryType	Value of '5' only
			5.6.8.2	dmsMessageNumber	Value of '1' only
			5.6.8.3	dmsMessageMultiString	
			5.6.8.4	dmsMessageOwner	
			5.6.8.8	dmsMessageRunTimePriority	
			5.6.8.7	dmsMessagePixelService	
			5.6.8.6	dmsMessageBeacon	
			5.7.4	dmsMessageTimeRemaining	
			5.7.5	dmsMsgTableSource	
			5.7.6	dmsMsgRequesterID	

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Requirements Traceability Matrix (RTM)					
FR ID	**Functional Requirement**	**Dialog ID**	**Object ID**	**Object Name**	**Additional Specifications**
			5.7.7	dmsMsgSourceMode	
3.5.3.2.2	Monitor Dynamic Field Values	4.2.4.15			
			5.11.1.1	statMultiFieldRows	
			5.11.1.2.1	statMultiFieldIndex	
			5.11.1.2.2	statMultiFieldCode	
			5.11.1.2.3	statMultiCurrentFieldValue	
3.5.3.3	Monitor Status of DMS Control Functions				
3.5.3.3.1	Determine Configuration of Event Trigger	Not Supported in NTCIP 1203 v02.			
3.5.3.3.2	Monitor Short Power Recovery Message	G.1			
			5.7.8	dmsShortPowerRecoveryMessage	
3.5.3.3.3	Monitor Long Power Recovery Message	G.1			
			5.7.9	dmsLongPowerRecoveryMessage	
			5.7.10	dmsShortPowerLossTime	
3.5.3.3.4	Monitor Power Loss Message	G.1			
			5.7.14	dmsPowerLossMessage	
3.5.3.3.5	Monitor Reset Message	G.1			
			5.7.11	dmsResetMessage	
3.5.3.3.6	Monitor Communications Loss Message	G.1			
			5.7.12	dmsCommunicationsLossMessage	
			5.7.13	dmsTimeCommLoss	
3.5.3.3.7	Monitor End Duration Message	G.1			
			5.7.15	dmsEndDurationMessage	

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Requirements Traceability Matrix (RTM)					
FR ID	**Functional Requirement**	**Dialog ID**	**Object ID**	**Object Name**	**Additional Specifications**
H.2	Derived Global Functional Requirements				
H.2.1	Determine Device Component Information	H.3.3			
			1201 v03 Sec. 2.2.2	globalMaxModules	
			1201 v03 Sec. 2.2.3.1	moduleNumber	
			1201 v03 Sec. 2.2.3.2	moduleDeviceNode	
			1201 v03 Sec. 2.2.3.3	moduleMake	
			1201 v03 Sec. 2.2.3.4	moduleModel	
			1201 v03 Sec. 2.2.3.5	moduleVersion	
			1201 v03 Sec. 2.2.3.6	moduleType	
H.2.2	Manage Time	THE FOLLOWING MAPPING IS ONLY APPLICABLE TO DEPLOYMENTS CLAIMING CONFORMANCE TO NTCIP 1203 v02. (Further below is the mapping for NTCIP 1203:1997 (version v01)).		Note: The following objects are different than those that were originally contained in NTCIP 1201:2001. Certain objects, particularly regarding Daylight Savings Time have changed in NTCIP 1201 v03 to address interoperability problems.	
H.2.2.1	Set Time	G.3			
			1201 v03 Sec. 2.4.1	globalTime	
H.2.2.2	Set Time Zone	G.3			
			1201 v03 Sec. 2.4.6	controllerStandardTimeZone	
H.2.2.3	Set Daylight Savings Mode	G.3			
			1201 v03 Sec. 2.4.8.2.1	dstEntryNumber	
			1201 v03 Sec. 2.4.8.2.2	dstBeginMonth	
			1201 v03 Sec. 2.4.8.2.3	dstBeginOccurrences	
			1201 v03 Sec. 2.4.8.2.4	dstBeginDayOfWeek	
			1201 v03 Sec. 2.4.8.2.5	dstBeginDayofMonth	
			1201 v03 Sec. 2.4.8.2.6	dstBeginSecondsToTransition	
			1201 v03 Sec. 2.4.8.2.7	dstEndMonth	
			1201 v03 Sec. 2.4.8.2.8	dstEndOccurrences	
			1201 v03 Sec. 2.4.8.2.9	dstEndDayOfWeek	

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Requirements Traceability Matrix (RTM)					
FR ID	**Functional Requirement**	**Dialog ID**	**Object ID**	**Object Name**	**Additional Specifications**
			1201 v03 Sec. 2.4.8.2.10	dstEndDayofMonth	
			1201 v03 Sec. 2.4.8.2.11	dstEndSecondsToTransition	
			1201 v03 Sec. 2.4.8.2.12	dstSecondsToAdjust	
H.2.2.4	Verify Current Time	G.1			
			1201 v03 Sec. 2.4.1	globalTime	
			1201 v03 Sec. 2.4.6	controllerStandardTimeZone	
			1201 v03 Sec. 2.4.8.1	maxDaylightSavingEntries	
			1201 v03 Sec. 2.4.8.2.1	dstEntryNumber	
			1201 v03 Sec. 2.4.8.2.2	dstBeginMonth	
			1201 v03 Sec. 2.4.8.2.3	dstBeginOccurrences	
			1201 v03 Sec. 2.4.8.2.4	dstBeginDayOfWeek	
			1201 v03 Sec. 2.4.8.2.5	dstBeginDayofMonth	
			1201 v03 Sec. 2.4.8.2.6	dstBeginSecondsToTransition	
			1201 v03 Sec. 2.4.8.2.7	dstEndMonth	
			1201 v03 Sec. 2.4.8.2.8	dstEndOccurrences	
			1201 v03 Sec. 2.4.8.2.9	dstEndDayOfWeek	
			1201 v03 Sec. 2.4.8.2.10	dstEndDayofMonth	
			1201 v03 Sec. 2.4.8.2.11	dstEndSecondsToTransition	
			1201 v03 Sec. 2.4.8.2.12	dstSecondsToAdjust	
			1201 v03 Sec. 2.4.7	controllerLocalTime	
H.2.2	Manage Time	The following mapping is only applicable to deployments claiming conformance to NTCIP 1203:1997 (version v01).		Note: The following objects were originally contained in NTCIP 1201:2001. Certain objects, particularly regarding Daylight Savings Time have changed in NTCIP 1201 v03.	
H.2.2.1	Set Time	G.3			
			1201:2005 Sec. 2.4.1	globalTime	
H.2.2.2	Set Time Zone	G.3			
			1201:2005 Sec. 2.4.5	globalLocalTimeDifferential	
H.2.2.3	Set Daylight Savings Mode	G.3			
			1201:2005 Sec. 2.4.2	globalDaylightSaving	
H.2.2.4	Verify Current Time	G.1			

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Requirements Traceability Matrix (RTM)					
FR ID	**Functional Requirement**	**Dialog ID**	**Object ID**	**Object Name**	**Additional Specifications**
			1201:2005 Sec. 2.4.1	globalTime	
			1201:2005 Sec. 2.4.2	globalDaylightSaving	
			1201:2005 Sec. 2.4.5	globalLocalTimeDifferential	
			1201:2005 Sec. 2.4.2	globalDaylightSaving	
H.2.3	Schedule Device Actions				
H.2.3.1	Determine Maximum Number of Schedules	G.1			
			1201 v03 Sec. 2.4.3.1	maxTimeBaseScheduleEntries	
			1201 v03 Sec. 2.4.4.1	maxDayPlans	
			1201 v03 Sec. 2.4.4.2	maxDayPlanEvents	
			5.9.1	numActionTableEntries	
H.2.3.2	Monitor Current Schedule	G.1			
			1201 v03 Sec. 2.4.4.5	timeBaseScheduleTableStatus	
			1201 v03 Sec. 2.4.4.4	dayPlanStatus	
H.2.4	Determine Supported Standards	G.1			
			1201 v03 Sec. 2.2.4	controllerBaseStandards	
3.5.4	Providing for Multi-Version Interoperability				
3.5.4.1	Obtaining the Number of Fan Failures (Multi-Version Interoperability Issue)	G.1			
			1203:1997 Sec. 2.11.2.1.1.8	fanFailures	
3.5.4.2	Activating a Fan Failure Test (Multi-Version Interoperability Issue)	G.3			
			1203:1997 Sec. 2.11.2.1.1.9	fanTestActivation	

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Requirements Traceability Matrix (RTM)					
FR ID	**Functional Requirement**	**Dialog ID**	**Object ID**	**Object Name**	**Additional Specifications**
3.5.4.3	Activating the 'Simulation' Control Mode (Multi-Version Interoperability Issue)	G.3			
			1203:1997 Sec. 2.7.1.1.1.1	dmsControlMode	

A.4 Supplemental Requirements Traceability Matrix

The following table defines the functional requirements that each given supplemental requirement refines.

Supplemental Requirements Traceability Matrix			
SR Section Number	**Supplemental Requirement (SR)**	**FR Section Number**	**Functional Requirement**
3.6	Supplemental Non-Communications Requirements		
3.6.1	Suppemental Requirements for Fonts		
3.6.1.1	Support for a Number of Fonts	3.5.1.3.1	Determine Maximum Number of Fonts Supported
		3.5.1.3.2	Determine Maximum Character Size
		3.5.1.3.3	Determine Maximum Number of Characters per Font
		3.5.1.3.4	Retrieve a Font Definition
		3.5.1.3.5	Configure a Font
		3.5.1.3.6	Delete a Font
		3.5.1.3.7	Validate a Font
		3.5.2.3.2.4	Configure Default Font
		3.6.6.2.6	Support Font Commands
3.6.2	Supplemental Requirements for General Illumination Brightness		
3.6.2.1	Support a Number of Brightness Levels	3.5.1.5.2	Configure Light Output Algorithm
		3.5.2.5.1	Determine Number of Brightness Levels
		3.5.2.5.3	Manually Control Brightness
3.6.3	Supplemental Requirements for Automatic Brightness Control		
3.6.3.1	Automatically Control Brightness	3.5.2.5.5	Switch Brightness Control Modes
3.6.3.2	Inhibit Flickering of Message Brightness	3.5.1.5.2	Configure Light Output Algorithm

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Supplemental Requirements Traceability Matrix			
SR Section Number	**Supplemental Requirement (SR)**	**FR Section Number**	**Functional Requirement**
		3.5.2.5.5	Switch Brightness Control Modes
3.6.3.3	Support a Number of Light Sensor Levels	3.5.1.5.1	Determine Maximum Number of Light Sensor Levels
		3.5.1.5.2	Configure Light Output Algorithm
3.6.4	Supplemental Requirements for Control Modes		
3.6.4.1	Support Central Control Mode	3.5.2.1	Manage Control Source
3.6.4.2	Support Local Control Mode	3.5.2.1	Manage Control Source
3.6.4.3	Support Central Override Control Mode	3.5.2.1	Manage Control Source
3.6.4.4	Processing Requests from Multiple Sources	3.4.1.2	Deliver Data
3.6.5	Supplemental Requirements for Message Activation Request		
3.6.5.1	Supplemental Requirements for Message Activation		
3.6.5.1.1	Activate Any Message	3.5.2.3.1	Activate a Message
		3.5.2.3.4.2	Define a Schedule
		3.5.2.3.5.1.1	Configure Message for Short Power Loss Recovery Event
		3.5.2.3.5.1.2	Configure Message for Long Power Loss Recovery Event
		3.5.2.3.5.1.3	Configure Message for Power Loss Event
		3.5.2.3.5.1.4	Configure Message for Controller Reset Event
		3.5.2.3.5.1.5	Configure Message for Communications Loss Event
		3.5.2.3.5.1.6	Configure Message for End Message Display Duration Event
		3.5.2.3.6	Activate a Message with Status
3.6.5.1.2	Preserve Message Integrity	3.5.2.3.1	Activate a Message
		3.5.2.3.4.2	Define a Schedule
		3.5.2.3.5.1.1	Configure Message for Short Power Loss Recovery Event
		3.5.2.3.5.1.2	Configure Message for Long Power Loss Recovery Event
		3.5.2.3.5.1.3	Configure Message for Power Loss Event
		3.5.2.3.5.1.4	Configure Message for Controller Reset Event
		3.5.2.3.5.1.5	Configure Message for Communications Loss Event
		3.5.2.3.5.1.6	Configure Message for End Message Display Duration Event

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Supplemental Requirements Traceability Matrix			
SR Section Number	**Supplemental Requirement (SR)**	**FR Section Number**	**Functional Requirement**
		3.5.2.3.6	Activate a Message with Status
3.6.5.1.3	Ensure Proper Message Content	3.5.2.3.1	Activate a Message
		3.5.2.3.4.2	Define a Schedule
		3.5.2.3.5.1.1	Configure Message for Short Power Loss Recovery Event
		3.5.2.3.5.1.2	Configure Message for Long Power Loss Recovery Event
		3.5.2.3.5.1.3	Configure Message for Power Loss Event
		3.5.2.3.5.1.4	Configure Message for Controller Reset Event
		3.5.2.3.5.1.5	Configure Message for Communications Loss Event
		3.5.2.3.5.1.6	Configure Message for End Message Display Duration Event
		3.5.2.3.6	Activate a Message with Status
3.6.5.2	Indicate Message Display Duration	3.5.2.3.1	Activate a Message
		3.5.2.3.4.2	Define a Schedule
		3.5.2.3.5.1.1	Configure Message for Short Power Loss Recovery Event
		3.5.2.3.5.1.2	Configure Message for Long Power Loss Recovery Event
		3.5.2.3.5.1.3	Configure Message for Power Loss Event
		3.5.2.3.5.1.4	Configure Message for Controller Reset Event
		3.5.2.3.5.1.5	Configure Message for Communications Loss Event
		3.5.2.3.5.1.6	Configure Message for End Message Display Duration Event
		3.5.2.3.6	Activate a Message with Status
3.6.5.3	Indicate Message Display Requester ID	3.5.2.3.1	Activate a Message
		3.5.2.3.4.2	Define a Schedule
		3.5.2.3.5.1.1	Configure Message for Short Power Loss Recovery Event
		3.5.2.3.5.1.2	Configure Message for Long Power Loss Recovery Event
		3.5.2.3.5.1.3	Configure Message for Power Loss Event
		3.5.2.3.5.1.4	Configure Message for Controller Reset Event
		3.5.2.3.5.1.5	Configure Message for Communications Loss Event
		3.5.2.3.5.1.6	Configure Message for End Message Display Duration Event

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Supplemental Requirements Traceability Matrix			
SR Section Number	**Supplemental Requirement (SR)**	**FR Section Number**	**Functional Requirement**
		3.5.2.3.6	Activate a Message with Status
3.6.5.4	Supplemental Requirements for Message Activation Priority	3.5.2.3.1	Activate a Message
		3.5.2.3.6	Activate a Message with Status
3.6.6	Supplemental Requirements for Message Defintion		
3.6.6.1	Identify Message to Define	3.5.2.3.3.3	Define a Message
		3.5.2.3.3.4	Verify Message Contents
		3.5.2.3.3.5	Retrieve a Message
3.6.6.2	Define Message Content		
3.6.6.2.1	Support Multi-Page Messages	3.5.1.2.3.1	Determine Maximum Number of Pages
		3.5.1.2.3.4	Determine Message Display Capabilities
		3.5.2.3.3.3	Define a Message
3.6.6.2.2	Support Page Justication		
3.6.6.2.2.1	Support for One Page Justification within a Message	3.5.1.2.3.4	Determine Message Display Capabilities
		3.5.2.3.3.3	Define a Message
3.6.6.2.2.2	Support for Multiple Page Justifications within a Message	3.5.1.2.3.4	Determine Message Display Capabilities
		3.5.2.3.3.3	Define a Message
3.6.6.2.3	Support Multiple Line Messages	3.5.1.2.3.4	Determine Message Display Capabilities
		3.5.2.3.3.3	Define a Message
3.6.6.2.4	Support Line Justification		
3.6.6.2.4.1	Support for a Single Line Justification within a Message	3.5.1.2.3.4	Determine Message Display Capabilities
		3.5.2.3.3.3	Define a Message
3.6.6.2.4.2	Support Line Justification on a Page-by-Page Basis	3.5.1.2.3.4	Determine Message Display Capabilities
		3.5.2.3.3.3	Define a Message
3.6.6.2.4.3	Support Line Justification on a Line-by-Line Basis	3.5.1.2.3.4	Determine Message Display Capabilities
		3.5.2.3.3.3	Define a Message
3.6.6.2.5	Support Color		
3.6.6.2.5.1	Support a Single Color Combination per Message	3.5.1.2.3.3	Determine Supported Color Schemes
		3.5.1.2.3.4	Determine Message Display Capabilities

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Supplemental Requirements Traceability Matrix			
SR Section Number	**Supplemental Requirement (SR)**	**FR Section Number**	**Functional Requirement**
		3.5.2.3.3.3	Define a Message
3.6.6.2.5.2	Support a Color Combination for each Page	3.5.1.2.3.3	Determine Supported Color Schemes
		3.5.1.2.3.4	Determine Message Display Capabilities
		3.5.2.3.3.3	Define a Message
3.6.6.2.5.3	Support a Color Combination for each Character within a Message	3.5.1.2.3.3	Determine Supported Color Schemes
		3.5.1.2.3.4	Determine Message Display Capabilities
		3.5.2.3.3.3	Define a Message
3.6.6.2.5.4	Color Rectangle	3.5.1.2.3.4	Determine Message Display Capabilities
		3.5.2.3.3.3	Define a Message
3.6.6.2.6	Support Font Commands		
3.6.6.2.6.1	Support One Font per Message	3.5.1.2.3.4	Determine Message Display Capabilities
		3.5.2.3.3.3	Define a Message
3.6.6.2.6.2	Support One Font per Page within a Message	3.5.1.2.3.4	Determine Message Display Capabilities
		3.5.2.3.3.3	Define a Message
3.6.6.2.6.3	Support Character by Character Selection of Fonts within a Message	3.5.1.2.3.4	Determine Message Display Capabilities
		3.5.2.3.3.3	Define a Message
3.6.6.2.7	Support Moving Text	3.5.1.2.3.4	Determine Message Display Capabilities
		3.5.2.3.3.3	Define a Message
3.6.6.2.8	Support Character Spacing	3.5.1.2.3.4	Determine Message Display Capabilities
		3.5.2.3.3.3	Define a Message
3.6.6.2.9	Support Customizable Page Display Times in a Message	3.5.1.2.3.4	Determine Message Display Capabilities
		3.5.2.3.3.3	Define a Message
3.6.6.2.10	Support Flashing		
3.6.6.2.10.1	Support Character-by-Character Flashing	3.5.1.2.3.4	Determine Message Display Capabilities
		3.5.2.3.3.3	Define a Message
3.6.6.2.10.2	Support Line-by-Line Flashing	3.5.1.2.3.4	Determine Message Display Capabilities
		3.5.2.3.3.3	Define a Message
3.6.6.2.10.3	Support Page-by-Page Flashing	3.5.1.2.3.4	Determine Message Display Capabilities
		3.5.2.3.3.3	Define a Message
3.6.6.2.11	Support Customizable Flashing Times within a Message	3.5.1.2.3.4	Determine Message Display Capabilities
		3.5.2.3.3.3	Define a Message
3.6.6.2.12	Support Hexadecimal Character	3.5.1.2.3.4	Determine Message Display Capabilities

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Supplemental Requirements Traceability Matrix			
SR Section Number	**Supplemental Requirement (SR)**	**FR Section Number**	**Functional Requirement**
		3.5.2.3.3.3	Define a Message
3.6.6.2.13	Support Message Data Fields		
3.6.6.2.13.1	Support Current Time Field without AM/PM Field	3.5.1.2.3.4	Determine Message Display Capabilities
		3.5.2.3.3.3	Define a Message
3.6.6.2.13.2	Support Current Time Field with uppercase AM/PM Field	3.5.1.2.3.4	Determine Message Display Capabilities
		3.5.2.3.3.3	Define a Message
3.6.6.2.13.3	Support Current Time Field with lowercase am/pm Field	3.5.1.2.3.4	Determine Message Display Capabilities
		3.5.2.3.3.3	Define a Message
3.6.6.2.13.4	Support Current Temperature Field	3.5.1.2.3.4	Determine Message Display Capabilities
		3.5.2.3.3.3	Define a Message
3.6.6.2.13.5	Support Detected Vehicle Speed Field	3.5.1.2.3.4	Determine Message Display Capabilities
		3.5.2.3.3.3	Define a Message
3.6.6.2.13.6	Support Current Day of Week Field	3.5.1.2.3.4	Determine Message Display Capabilities
		3.5.2.3.3.3	Define a Message
3.6.6.2.13.7	Support Current Day of Month Field	3.5.1.2.3.4	Determine Message Display Capabilities
		3.5.2.3.3.3	Define a Message
3.6.6.2.13.8	Support Current Month of Year Field	3.5.1.2.3.4	Determine Message Display Capabilities
		3.5.2.3.3.3	Define a Message
3.6.6.2.13.9	Support Current Year Field	3.5.1.2.3.4	Determine Message Display Capabilities
		3.5.2.3.3.3	Define a Message
3.6.6.2.13.10	Support User Definable Field	3.5.1.2.3.4	Determine Message Display Capabilities
		3.5.2.3.3.3	Define a Message
3.6.6.2.13.11	Data Field Refresh Rate	3.5.2.3.1	Activate a Message
		3.5.2.3.6	Activate a Message with Status
		3.5.3.2.2	Monitor Dynamic Field Values
3.6.6.2.14	Support of Graphics	3.5.1.2.3.4	Determine Message Display Capabilities
		3.5.2.3.3.3	Define a Message
3.6.6.2.15	Specify Location of Message Display	3.5.1.2.3.4	Determine Message Display Capabilities
		3.5.2.3.3.3	Define a Message
3.6.6.2.16	Support of Text		
3.6.6.2.16.1	Support of Textual Content	3.5.2.3.3.3	Define a Message
3.6.6.2.16.2	Support of Message Lengths Compatible with Sign Face	3.5.2.3.3.3	Define a Message

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Supplemental Requirements Traceability Matrix			
SR Section Number	**Supplemental Requirement (SR)**	**FR Section Number**	**Functional Requirement**
3.6.6.2.17	Support of Manufacturer Specific Message Definitions	3.5.2.3.3.3	Define a Message
3.6.6.3	Identify Message Owner	3.5.2.3.3.3	Define a Message
		3.5.2.3.3.5	Retrieve a Message
3.6.6.4	Priority to Maintain Message	3.5.2.3.3.3	Define a Message
		3.5.2.3.3.5	Retrieve a Message
3.6.6.5	Beacon Activation Flag	3.5.2.3.3.3	Define a Message
		3.5.2.3.3.4	Verify Message Contents
		3.5.2.3.3.5	Retrieve a Message
3.6.6.6	Pixel Service Flag	3.5.2.3.3.3	Define a Message
		3.5.2.3.3.4	Verify Message Contents
		3.5.2.3.3.5	Retrieve a Message
3.6.6.7	Message Status	3.5.2.3.3.3	Define a Message
		3.5.2.3.3.4	Verify Message Contents
		3.5.2.3.3.5	Retrieve a Message
3.6.7	Supplemental Requirements for Locally Stored Messages		
3.6.7.1	Support Permanent Messages	3.5.2.3.3.1	Determine Available Message Types
		3.5.2.3.3.4	Verify Message Contents
		3.5.2.3.3.5	Retrieve Message
3.6.7.2	Support Changeable Messages	3.5.2.3.3.1	Determine Available Message Types
		3.5.2.3.3.2	Determine Available Message Space
		3.5.2.3.3.3	Define a Message
		3.5.2.3.3.4	Verify Message Contents
		3.5.2.3.3.5	Retrieve Message
3.6.7.3	Support Volatile Messages	3.5.2.3.3.1	Determine Available Message Types
		3.5.2.3.3.2	Determine Available Message Space
		3.5.2.3.3.3	Define a Message
		3.5.2.3.3.4	Verify Message Contents
		3.5.2.3.3.5	Retrieve Message
3.6.8	Supplemental Requirements for Color Scheme		
3.6.8.1	Support 256 Shades Scheme	3.5.1.2.3.3	Determine Supported Color Schemes
		3.5.2.3.2.2	Configure Default Background and Foreground Color
		3.6.6.2.5	Support Color
3.6.8.2	Support Classic NTCIP Scheme	3.5.1.2.3.3	Determine Supported Color Schemes

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Supplemental Requirements Traceability Matrix			
SR Section Number	**Supplemental Requirement (SR)**	**FR Section Number**	**Functional Requirement**
		3.5.2.3.2.2	Configure Default Background and Foreground Color
		3.6.6.2.5	Support Color
3.6.8.3	Support 24-Bit Color Scheme	3.5.1.2.3.3	Determine Supported Color Schemes
		3.5.2.3.2.2	Configure Default Background and Foreground Color
		3.6.6.2.5	Support Color
3.6.8.4	Support Single Color	3.5.1.2.3.3	Determine Supported Color Schemes
		3.5.2.3.2.2	Configure Default Background and Foreground Color
		3.6.6.2.5	Support Color
3.6.9	Supplemental Requirements for Monitoring Subsystems	3.5.3.1.2	Provide General DMS Error Status Information
		3.5.3.1.3.1	Monitor Power Errors
		3.5.3.1.3.2	Monitor Lamp Errors
		3.5.3.1.3.3	Monitor Pixel Errors
		3.5.3.1.3.4	Monitor Light Sensor Errors
		3.5.3.1.3.5	Monitor Controller Software Operations
		3.5.3.1.3.6	Monitor Climate-Control System Errors
		3.5.3.1.3.7	Monitor Temperature Warnings
		3.5.3.1.3.8	Monitor Humidity Warnings
		3.5.3.1.3.9	Monitor Drum Sign Rotor Errors
		3.5.3.1.3.10	Monitor Door Status
		3.5.3.1.4.1	Monitor Power Error Details
		3.5.3.1.4.2	Monitor Lamp Error Details
		3.5.3.1.4.3	Monitor Pixel Error Details
		3.5.3.1.4.4	Monitor Light Sensor Error Details
		3.5.3.1.4.5	Monitor Message Activation Error Details
		3.5.3.1.4.6	Monitor Climate-Control System Error Details
		3.5.3.1.4.7	Monitor Sign Housing Temperatures
		3.5.3.1.4.8	Monitor Sign Housing Humidity
		3.5.3.1.4.9	Monitor Control Cabinet Temperatures
		3.5.3.1.4.10	Monitor Control Cabinet Humidity
		3.5.3.1.4.11	Monitor Drum Sign Rotor Error Details
		3.5.3.1.6	Monitor Power Information
		3.5.3.1.7	Monitor Ambient Environment

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Supplemental Requirements Traceability Matrix			
SR Section Number	**Supplemental Requirement (SR)**	**FR Section Number**	**Functional Requirement**
		3.5.3.1.8	Monitor Critical Temperature Threshold
3.6.10	Supplemental Requirements for Scheduling		
3.6.10.1	Support a Number of Actions	3.5.2.3.4.1	Retrieve a Schedule
		3.5.2.3.4.2	Define a Schedule
		H.2.3.1	Determine Maximum Number of Schedules
3.6.10.2	Support the Activate Message Action for the Scheduler	3.5.2.3.4.2	Define a Schedule
3.6.10.3	Perform Actions at Scheduled Times	3.5.2.3.1	Activate a Message
		3.5.2.3.6	Activate a Message with Status
3.6.11	Supplemental Requriements for Graphics		
3.6.11.1	Support for a Number of Graphics	3.5.1.4.1	Determine Maximum Number of Graphics
		3.5.1.4.2	Determine Maximum Graphic Size
		3.5.1.4.3	Determine Available Graphics Memory
		3.5.1.4.4	Retrieve a Graphic Definition
		3.5.1.4.5	Store a Graphic Definition
		3.5.1.4.6	Delete a Graphic
		3.5.1.4.7	Validate a Graphic
		3.6.6.2.14	Support of Graphics
3.6.11.2	Support for Graphic Memory	3.5.1.4.3	Determine Available Graphics Memory
3.6.12	Supplemental Requirements for Page Justification		
3.6.12.1	Support Top Page Justification	3.6.6.2.2	Support Page Justification
3.5.12.2	Support Middle Page Justification	3.6.6.2.2	Support Page Justification
3.6.12.3	Support Bottom Page Justification	3.6.6.2.2	Support Page Justification
3.6.13	Supplemental Requirements for Line Justification		
3.6.13.1	Support Left Line Justification	3.6.6.2.4	Support Line Justification
3.6.13.2	Support Center Line Justification	3.6.6.2.4	Support Line Justification
3.6.13.3	Support Right Line Justification	3.6.6.2.4	Support Line Justification
3.6.13.4	Support Full Line Justification	3.6.6.2.4	Support Line Justification
H.2.5	Supplemental Requirements for Scheduling		
H.2.5.1	Support a Number of Day Selection Patterns	3.5.2.3.4.1	Retrieve a Schedule
		3.5.2.3.4.2	Define a Schedule
		H.2.3.1	Determine Maximum Number of Schedules
H.2.5.2	Support a Number of Day Plan Events	3.5.2.3.4.1	Retrieve a Schedule
		3.5.2.3.4.2	Define a Schedule

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Supplemental Requirements Traceability Matrix			
SR Section Number	**Supplemental Requirement (SR)**	**FR Section Number**	**Functional Requirement**
		H.2.3.1	Determine Maximum Number of Schedules
H.2.5.3	Support a Number of Day Plans	3.5.2.3.4.1	Retrieve a Schedule
		3.5.2.3.4.2	Define a Schedule
		H.2.3.1	Determine Maximum Number of Schedules
H.2.6	Supplemental Requirements for Event Monitoring		
H.2.6.1	Record and Timestamp Events	3.4.2.1	Determine Current Configuration of Logging Service
		3.4.2.2	Configure Logging Service
		3.4.2.3	Retrieve Logged Data
H.2.6.2	Support a Number of Event Classes	3.4.2.1	Determine Current Configuration of Logging Service
		3.4.2.2	Configure Logging Service
		3.4.2.3	Retrieve Logged Data
		3.4.2.5	Determine Capabilities of Event Logging Service
H.2.6.3	Support a Number of Event Types to Monitor	3.4.2.1	Determine Current Configuration of Logging Service
		3.4.2.2	Configure Logging Service
		3.4.2.3	Retrieve Logged Data
		3.4.2.5	Determine Capabilities of Event Logging Service
H.2.6.4	Support Montioring of Event Types		
H.2.6.4.1	Support On-Change Events	3.4.2.2	Configure Logging Service
H.2.6.4.2	Support Greater Than Events	3.4.2.2	Configure Logging Service
H.2.6.4.3	Support Less Than Events	3.4.2.2	Configure Logging Service
H.2.6.4.4	Support Hysteresis Events	3.4.2.2	Configure Logging Service
H.2.6.4.5	Support Periodic Events	3.4.2.2	Configure Logging Service
H.2.6.4.6	Support Bit-flag Events	3.4.2.2	Configure Logging Service
H.2.6.5	Support Event Monitoring on Any Data	3.4.2.2	Configure Logging Service
H.2.7	Support a Number of Events to Store in Log	3.4.2.1	Determine Current Configuration of Logging Service
		3.4.2.2	Configure Logging Service
		3.4.2.3	Retrieve Logged Data
		3.4.2.5	Determine Capabilities of Event Logging Service
		3.3.2.6	Determine Total Number of Events

A.5 MULTI Field Traceability Matrix

The following table provides an implementer / tester with the traceability of requirements to particular MULTI Tags (defined in Section 6).

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MULTI Field Traceability Matrix				
Requirement ID	**Requirement**	**MULTI Tag ID**	**MULTI Tag Name**	**MULTI Tag**
3.6.6.2.1	Support Multi-Page Messages			
		6.4.15	New Page	[np]
3.6.6.2.2	Support Page Justification			
		6.4.11	Justification - Page	[jpx]
		6.4.11	Top Justification	[jp2]
		6.4.11	Middle Justification	[jp3]
		6.4.11	Bottom Justification	[jp4]
3.6.6.2.2.1	Support for One Page Justification within a Message			
		6.4.11	Justification - Page	[jpx]
		6.4.11	Top Justification	[jp2]
		6.4.11	Middle Justification	[jp3]
		6.4.11	Bottom Justification	[jp4]
3.6.6.2.2.2	Support for Multiple Page Justifications within a Message			
		6.4.11	Justification - Page	[jpx]
		6.4.11	Top Justification	[jp2]
		6.4.11	Middle Justification	[jp3]
		6.4.11	Bottom Justification	[jp4]
3.6.6.2.3	Support Multiple Line Messages			
		6.4.14	New Line	[nlx]
3.6.6.2.4	Support Line Justification			
		6.4.10	Justification - Line	[jlx]
		6.4.10	Left Justification	[jl2]
		6.4.10	Center Justification	[jl3]
		6.4.10	Right Justification	[jl4]
		6.4.10	Full Justification	[jl5]
3.6.6.2.4.1	Support for a Single Line Justification within a Message			

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MULTI Field Traceability Matrix				
Requirement ID	**Requirement**	**MULTI Tag ID**	**MULTI Tag Name**	**MULTI Tag**
		6.4.10	Justification - Line	[jlx]
		6.4.10	Left Justification	[jl2]
		6.4.10	Center Justification	[jl3]
		6.4.10	Right Justification	[jl4]
		6.4.10	Full Justification	[jl5]
3.6.6.2.4.2	Support Line Justification on a Page-by-Page Basis			
		6.4.10	Justification - Line	[jlx]
		6.4.10	Left Justification	[jl2]
		6.4.10	Center Justification	[jl3]
		6.4.10	Right Justification	[jl4]
		6.4.10	Full Justification	[jl5]
3.6.6.2.4.3	Support Line Justification on a Line-by-Line Basis			
		6.4.10	Justification - Line	[jlx]
		6.4.10	Left Justification	[jl2]
		6.4.10	Center Justification	[jl3]
		6.4.10	Right Justification	[jl4]
		6.4.10	Full Justification	[jl5]
3.6.6.2.5	Support Color			
3.6.6.2.5.1	Support a Single Color Combination per Message			
		6.4.1	Color Background (Version 1 only)	[cbx]
		6.4.3	Color Foreground (Version 1 only)	[cfx]
		6.4.2	Page Background Color (Version 2 only)	[pbz] or [pbr,g,b]
		6.4.3	Color Foreground (Version 2 only)	[cfx]
3.6.6.2.5.2	Support a Color Combination for each Page			
		6.4.1	Color Background (Version 1 only)	[cbx]
		6.4.3	Color Foreground (Version 1 only)	[cfx]

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MULTI Field Traceability Matrix				
Requirement ID	**Requirement**	**MULTI Tag ID**	**MULTI Tag Name**	**MULTI Tag**
		6.4.2	Page Background Color (Version 2 only)	[pbz] or [pbr,g,b]
		6.4.3	Color Foreground (Version 2 only)	[cfx]
3.6.6.2.5.3	Support a Color Combination for each Character within a Message			
		6.4.1	Color Background (Version 1 only)	[cbx]
		6.4.3	Color Foreground (Version 1 only)	[cfx]
		6.4.2	Page Background Color (Version 2 only)	[pbz] or [pbr,g,b]
		6.4.3	Color Foreground (Version 2 only)	[cfx]
3.6.6.2.5.4	Color for each Pixel within a Message			
		6.4.1	Color Background (Version 1 only)	[cbx]
		6.4.3	Color Foreground (Version 1 only)	[cfx]
		6.4.2	Page Background Color (Version 2 only)	[pbz] or [pbr,g,b]
		6.4.3	Color Foreground (Version 2 only)	[cfx]
		6.4.4	Color Rectangle (Version 2 only)	[crx,y,w,h,r,g,b] or [crx,y,w,h,z]
3.6.6.2.6	Support Font Commands			
		6.4.7	Font	[fox]
3.6.6.2.6.1	Support One Font within a Message			
		6.4.7	Font	[fox]
3.6.6.2.6.2	Support One Font per Page within a Message			
		6.4.7	Font	[fox]
3.6.6.2.6.3	Support Character by Character Selection of Fonts within a Message			
		6.4.7	Font	[fox]
3.6.6.2.7	Support Moving Text			
		6.4.13	Moving Text	[mvtdw,s,r,text]
3.6.6.2.8	Support Character Spacing			
		6.4.17	Spacing - Character	[scx]
3.6.6.2.9	Support Customizable Page Display Times in			

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MULTI Field Traceability Matrix				
Requirement ID	**Requirement**	**MULTI Tag ID**	**MULTI Tag Name**	**MULTI Tag**
	a Message			
		6.4.16	Page Time	[ptxoy]
3.6.6.2.10	Support Customizable Flashing Times within a Message			
		6.4.6	Flash Time	[fltxoy]
3.6.6.2.11	Support Flashing			
		6.4.6	Flash Time	[fltxoy]
3.6.6.2.11.1	Support Character-by-Character Flashing			
		6.4.6	Flash Time	[fltxoy]
3.6.6.2.11.2	Support Line-by-Line Flashing			
		6.4.6	Flash Time	[fltxoy]
3.6.6.2.11.3	Support Page-by-Page Flashing			
		6.4.6	Flash Time	[fltxoy]
3.6.6.2.12	Support Hexadecimal Character			
		6.4.9	Hexadecimal Character	[hcx]
3.6.6.2.13	Support Message Data Fields			
		6.4.5	Local Time 12 Hour	[f1,y]
		6.4.5	Local Time 24 Hour	[f2,y]
		6.4.5	Ambient Temperature Celsius	[f3,y]
		6.4.5	Ambient Temperature Fahrenheit	[f4,y]
		6.4.5	Speed km/h	[f5,y]
		6.4.5	Speed mph	[f6,y]
		6.4.5	Day of Week	[f7,y]
		6.4.5	Date of Month	[f8,y]
		6.4.5	Month of Year	[f9,y]
		6.4.5	Year 2 Digit	[f10,y]
		6.4.5	Year 4 Digit	[f11,y]
		6.4.5	Local time, 12 hour format with capital AM/PM indicator present	[f12,y]

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MULTI Field Traceability Matrix				
Requirement ID	**Requirement**	**MULTI Tag ID**	**MULTI Tag Name**	**MULTI Tag**
		6.4.5	Local time, 12 hour format with lowercase am/pm indicator present	[f13,y]
3.6.6.2.13.1	Support Current Time Field without AM/PM Field			
		6.4.5	Local Time 12 Hour	[f1,y]
		6.4.5	Local Time 24 Hour	[f2,y]
3.6.6.2.13.2	Support Current Time with uppercase AM/PM Field			
		6.4.5	Local time, 12 hour format with capital AM/PM indicator present	[f12,y]
3.6.6.2.13.3	Support Current Time with lowercase am/pm			
		6.4.5	Local time, 12 hour format with lowercase am/pm indicator present	[f13,y]
3.6.6.2.13.4	Support Current Temperature Field			
		6.4.5	Ambient Temperature Celsius	[f3,y]
		6.4.5	Ambient Temperature Fahrenheit	[f4,y]
3.6.6.2.13.5	Support Detected Vehicle Speed Field			
		6.4.5	Speed km/h	[f5,y]
		6.4.5	Speed mph	[f6,y]
3.6.6.2.13.6	Support Current Day of Week Field			
		6.4.5	Day of Week	[f7,y]
3.6.6.2.13.7	Support Current Day of Month Field			
		6.4.5	Date of Month	[f8,y]
3.6.6.2.13.8	Support Current Month of Year Field			
		6.4.5	Month of Year	[f9,y]
3.6.6.2.13.9	Support Current Year Field			
		6.4.5	Year 2 Digit	[f10,y]
		6.4.5	Year 4 Digit	[f11,y]
3.6.6.2.13.10	Support User-Definable Field			

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MULTI Field Traceability Matrix				
Requirement ID	**Requirement**	**MULTI Tag ID**	**MULTI Tag Name**	**MULTI Tag**
		6.4.5	User-Definable Field	[f50,y] to [f99,y]
3.6.6.2.13.11	Data Field Refresh Rate			
		6.4.5	Fields	[fx,y]
3.6.6.2.14	Support of Graphics			
		6.4.8	Graphic	[gn] or [gn,x,y] or [gn,x,y,cccc]
3.6.6.2.15	Specify Location of Message Display			
		6.4.18	Text Rectangle	[trx,y,w,h]
		6.4.2	Page Background Color	[pbz] or [pbr,g,b]
		6.4.3	Color Foreground	[cfx]
		6.4.4	Color Rectangle	[crx,y,w,h,r,g,b] or [crx,y,w,h,z]
3.6.6.2.17	Support of Manufacturer Specfiic Message Definitions			
		6.4.12	Manufacturer Specfiic Tag	[msx,y]
3.6.8	Supplemental Requirements for Color Scheme			
3.6.8.2	Support Classic NTCIP Scheme			
		6.4.1	Color Background (Version 1 only)	[cbx]
		6.4.2	Page Background Color (Version 2 only)	[pbz] or [pbr,g,b]
		6.4.3	Color Foreground (Version 1 and 2)	[cfx]
		6.4.4	Color Rectangle (Version 2 only)	[crx,y,w,h,r,g,b] or [crx,y,w,h,z]
3.6.8.3	Support 24-Bit Color Scheme			
		6.4.2	Page Background Color	[pbz] or [pbr,g,b]
		6.4.3	Color Foreground	[cfx]
		6.4.4	Color Rectangle	[crx,y,w,h,r,g,b] or [crx,y,w,h,z]
3.6.8.4	Support Single Color			
		6.4.1	Color Background (Version 1 only)	[cbx]

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MULTI Field Traceability Matrix				
Requirement ID	**Requirement**	**MULTI Tag ID**	**MULTI Tag Name**	**MULTI Tag**
		6.4.2	Page Background Color (Version 2 only)	[pbz] or [pbr,g,b]
		6.4.3	Color Foreground (Version 1 and 2)	[cfx]
3.6.12	Supplemental Requirements for Page Justification			
3.6.12.1	Support Top Page Justification			
		6.4.11	Top Justification	[jp2]
3.6.12.2	Support Middle Page Justification			
		6.4.11	Middle Justification	[jp3]
3.6.12.3	Support Bottom Page Justification			
		6.4.11	Bottom Justification	[jp4]
3.6.13	Supplemental Requirements for Line Justification			
3.6.13.1	Support Left Line Justification			
		6.4.10	Left Justification	[jl2]
3.6.13.2	Support Center Line Justification			
		6.4.10	Center Justification	[jl3]
3.6.13.3	Support Right Line Justification			
		6.4.10	Right Justification	[jl4]
3.6.13.4	Support Full Line Justification			
		6.4.10	Full Justification	[jl5]

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Annex B
Object Tree [Informative]

Figure 11 is a representation of the DMS Object Tree Structure, identifying how object definitions are combined under specific nodes.

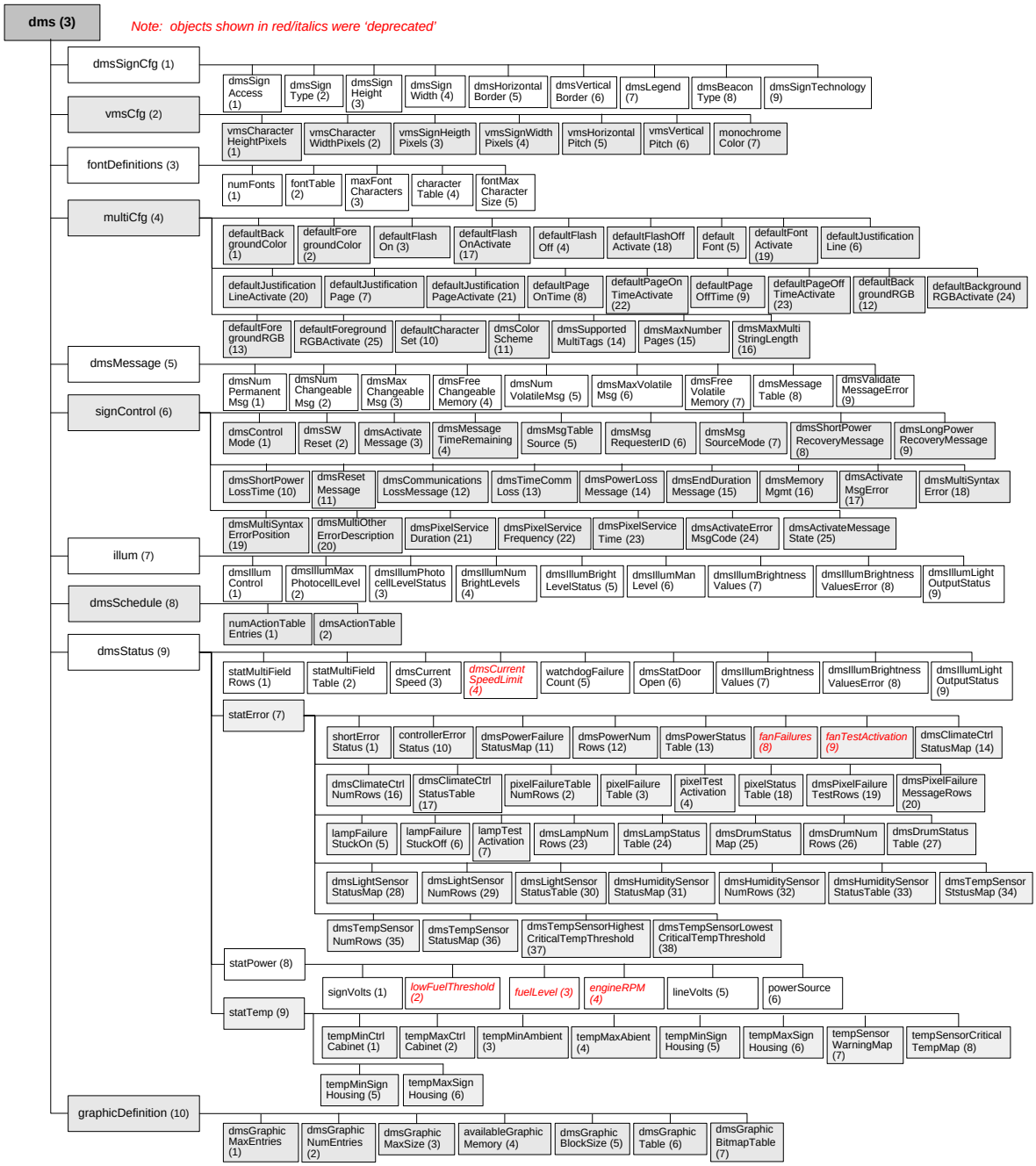

Figure 11 Object Tree for NTCIP 1203 v03

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Annex C
Test Procedures [Normative]

C.1 Purpose

This annex defines the detailed, but generic, test procedures for testing an implementation of this standard.

C.1.1 Scope

Annex C defines test procedures in a format that is consistent with NTCIP 8007 v01 and that covers the entire scope of NTCIP 1203 v03. It includes tests of some of the features defined in NTCIP 1201 v03, but only to the extent that these features have been incorporated by reference in NTCIP 1203 v03.

These test procedures are intended to be used as a portion of the overall set of tests that would be performed during component testing of a management station.

C.1.2 Keywords

C.1.2.1 Additional Keywords

Keywords are words that are presented in all capital letters within the test procedures. Definitions of keywords are presented below. Keywords that are not defined below are defined in NTCIP 8007 v01.

Keyword	Definition
IF	This keyword shall cause the user (or application) to perform a comparison and take one action if the comparison evaluates to true and another action if the comparison evaluates to false. It is comparable to the “if…else…” expression in C.
FOR EACH	This keyword causes the user (or application) to begin a looping process that shall increment through a series of values. It is comparable to the “for…next” expression in C.
GOTO	This keyword shall cause the user (or application) to immediately jump to the indicated location in the test procedure (e.g., to another Step).

C.1.3 Keyword Combinations

These test procedures frequently use the "SET-UP" and "VERIFY" keywords as defined in NTCIP 8007 v01 in the definition of a single step. When used jointly in these procedures, the failure logic of the "SET-UP" keyword shall override that of the "VERIFY" keyword. In other words, a failure of a step that uses both the "SET-UP" and "VERIFY" keywords shall mean that the test case neither passes nor fails, the test case shall EXIT, and the user shall correct the problem and restart the test case.

C.1.4 Rules for Executing Test Procedures

The test procedures contained in this annex are designed to be used for component testing a device for conformance to the NTCIP 1203 v03 interface standard. To component test a device for conformance to the NTCIP 1203 v03 interface standard, the user shall follow the steps as written, filling in the pass/fail information in the ‘Results' column.

A given test procedure may entail multiple steps that may require multiple interactions between the user and the management station to fulfill the complete test procedure. For example, a single test procedure may transfer the definition of a message to the device and then retrieve the contents of the message to ensure that the values were updated; this might require two user interface operations.

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C.2 Testing Requirements

C.2.1 Field Device Test Environment

All Test Cases covered by this Testing Requirements documentation require the Device Under Test (DUT) to be connected to a test application as depicted in Figure 12. A data analyzer may also be used to capture the data exchanged between the two components. The test environment should be designed to minimize any complicating factors that may result in anomalies unrelated to the specific test case. Failure to isolate such variables in the test environment may result in false results to the test. For example, the device may be conformant with the standard, but communication delays could result in timeouts and be misinterpreted as failures.

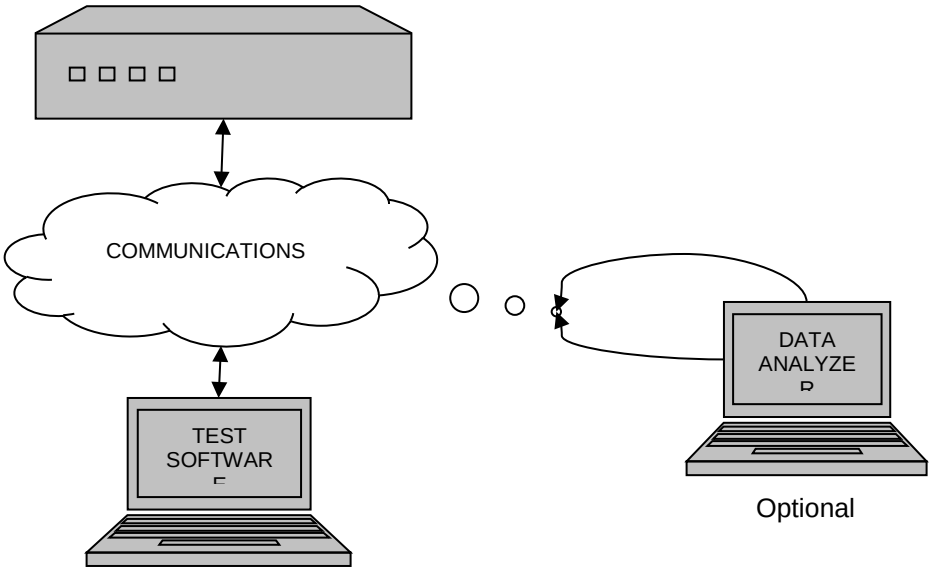

Figure 12 Field Device Test Environment

The following pre-conditions apply to all test cases unless otherwise defined:

a) All components should be turned on and be provided sufficient time to start up prior to starting any test case
b) The test software should be connected to the central port of the DUT and the DUT should be set for central control
c) The test software, data analyzer, and DUT should all be configured to use a common set of communication settings, including data rates, lower layer protocols, community names, etc.
d) The DUT should be exposed to a medium amount of ambient light so that tests can increase or decrease the amount of light as needed
e) The DUT should have definitions for all font sets that it supports
f) The DUT should have a valid illumination brightness curve defined with a positive slope.

C.2.2 Test Case Traceability Table

The Requirements to Test Case Traceability Table (RTCTT) defines the traceability between the requirements in Section 3 and the Test Cases presented in this Annex. This table defines the minimal test procedure(s) that shall be completed to confirm that an implementation fulfills a requirement and still conform to this standard.

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To confirm that an implementation fulfills a requirement, the DUT shall successfully pass all test cases that trace to that requirement.

Table 10 Requirements to Test Case Traceability Table

Requirements to Test Case Traceability Table (RTCTT)			
Requirement		**Test Case**	
ID	**Title**	**ID**	**Title**
3.4	Architectural Requirements		
3.4.1	Support Basic Communications		
3.4.1.1	Retrieve Data		
		C.3.1.1	Determine Sign Type and Technology
3.4.1.2	Deliver Data		
		C.3.7.6	Activate a Message
3.4.1.3	Explore Data		
		C.3.13.9	Explore Data
3.4.2	Support Logged Data		
3.4.2.1	Determine Current Configuration of Logging Service		
		C.3.12.13	Determine Configuration of Logging Service
3.4.2.2	Configure Logging Service		
		C.3.12.2	Configure Event Log
		C.3.12.6	Verify Log Limit Storage
		C.3.12.7	Verify Support for an On-Change Event
		C.3.12.8	Verify Support for a Greater Than Event
		C.3.12.9	Verify Support for a Less Than Event
		C.3.12.10	Verify Support for a Hysteresis Event
		C.3.12.11	Verify Support for a Periodic Event
		C.3.12.12	Verify Support for a Bit-flag Event
3.4.2.3	Retrieve Logged Data		
		C.3.12.3	Retrieve Logged Data
3.4.2.4	Clear Log		
		C.3.12.4	Clear Log
3.4.2.5	Determine Capabilities of Event Logging Service		
		C.3.12.1	Determine Capabilities of Event Logging Service
3.4.2.6	Determine Total Number of Events		
		C.3.12.5	Determine Total Number of Events
3.4.3	Support Exception Reporting		
		N/A	N/A
3.4.4	Manage Access		
3.4.4.1	Determine Current Access Settings		
		C.3.13.10	Determine Current Access Settings
3.4.4.2	Configure Access		
		C.3.13.11	Configure Access
3.5	Data Exchange and Operational Environment Requirements		
3.5.1	Manage the DMS Configuration		
3.5.1.1	Identify DMS		
3.5.1.1.1	Determine Sign Type and Technology		
		C.3.1.1	Determine Sign Type and Technology
3.5.1.2	Determine Message Display Capabilities		
3.5.1.2.1	Determine Basic Message Display Capabilities		
3.5.1.2.1.1	Determine the Size of the Sign Face		
		C.3.1.2	Determine the Size of the Sign Face
3.5.1.2.1.2	Determine the Size of the Sign Border		

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Requirements to Test Case Traceability Table (RTCTT)			
Requirement		**Test Case**	
ID	**Title**	**ID**	**Title**
		C.3.1.3	Determine Size of the Sign Border
3.5.1.2.1.3	Determine Beacon Type		
		C.3.1.4	Determine Beacon Type
3.5.1.2.1.4	Determine Sign Access and Legend		
		C.3.1.5	Determine Sign Access and Legend
3.5.1.2.2	Determine Matrix Capabilities		
3.5.1.2.2.1	Determine Sign Face Size in Pixels		
		C.3.1.6	Determine Sign Face Size in Pixels
3.5.1.2.2.2	Determine Character Size in Pixels		
		C.3.1.7	Determine Character Size in Pixels
3.5.1.2.2.3	Determine Pixel Spacing		
		C.3.1.8	Determine Pixel Spacing
3.5.1.2.3	Determine VMS Message Display Capabilities		
3.5.1.2.3.1	Determine Maximum Number of Pages		
		C.3.1.9	Determine Maximum Number of Pages
3.5.1.2.3.2	Determine Maximum Message Length		
		C.3.1.10	Determine Maximum Message Length
3.5.1.2.3.3	Determine Supported Color Schemes		
		C.3.1.11	Determine Supported Color Schemes
3.5.1.2.3.4	Determine Message Display Capabilities		
		C.3.1.12	Determine Message Display Capabilities
3.5.1.2.4	Delete All Messages of a Message Type with One Command		
		C.3.7.4	Verify Message Deletion by Type
3.5.1.3	Manage Fonts **(Note: Difference between Version 01 and Version 02)**		
3.5.1.3.1	Determine Maximum Number of Fonts Supported		
		C.3.2.1	Determine Number of Fonts
3.5.1.3.2	Determine Maximum Character Size		
		C.3.2.2	Determine Maximum Character Size
3.5.1.3.3	Determine Maximum Number of Characters per Font		
		C.3.2.3	Determine Maximum Number of Characters per Font
3.5.1.3.4	Retrieve a Font Definition		
		C.3.2.4	Retrieve a Font Definition
3.5.1.3.5	Configure a Font		
		C.3.2.5	Configure a Font
		C.3.2.6	Attempt to Configure a Font that is In Use
3.5.1.3.6	Delete a Font		
		C.3.2.7	Delete a Font
		C.3.2.8	Attempt to Delete a Font that is In Use
3.5.1.3.7	Validate a Font		
		C.3.2.4	Retrieve a Font Definition
3.5.1.4	Manage Graphics		
3.5.1.4.1	Determine Maximum Number of Graphics		
		C.3.3.1	Determine Maximum Number of Graphics
3.5.1.4.2	Determine Maximum Graphic Size		
		C.3.3.2	Determine Maximum Graphic Size
3.5.1.4.3	Determine Available Graphics Memory		
		C.3.3.3	Determine Available Graphics Memory
3.5.1.4.4	Retrieve a Graphic Definition		
		C.3.3.4	Retrieve a Graphic Definition

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Requirements to Test Case Traceability Table (RTCTT)			
Requirement		**Test Case**	
ID	**Title**	**ID**	**Title**
3.5.1.4.5	Store a Graphic Definition		
		C.3.3.5	Store a Graphic Definition
		C.3.3.6	Attempt to Store a Graphic Definition when Graphic is In Use
3.5.1.4.6	Delete a Graphic		
		C.3.3.7	Delete a Graphic
		C.3.3.8	Attempt to Delete a Graphic when Graphic is In Use
3.5.1.4.7	Validate a Graphic		
		C.3.3.9	Verify Validation of Graphic CRC Reference
3.5.1.5	Configure Brightness of Sign		
3.5.1.5.1	Determine Maximum Number of Light Sensor Levels		
		C.3.4.1	Determine Maximum Number of Light Sensor Levels
3.5.1.5.2	Configure Light Output Algorithm		
		C.3.4.7	Configure Brightness Curve
		C.3.4.8	Verify Light Curve Gap Error
		C.3.4.9	Verify Light Curve Negative Slope
		C.3.4.10	Verify Light Curve Too Many Levels Error
		C.3.4.11	Configure Light Curve with Overlapping Values
3.5.1.5.3	Determine Current Light Output Algorithm		
		C.3.4.2	Determine Current Light Output Algorithm
3.5.1.6	Configure Current Speed Limit		
		C.3.5.26	Set Speed Limit
3.5.1.7	Configure Low Fuel Threshold Value		
		C.3.5.14	Determine Current Power Source
3.5.2	Control the DMS		
3.5.2.1	Manage Control Source		
		C.3.7.14	Verify Control Mode
3.5.2.2	Reset the Sign Controller		
		C.3.5.15	Reset the Sign Controller
3.5.2.3	Control the Sign Face		
3.5.2.3.1	Activate a Message		
		C.3.7.6	Activate a Message
		C.3.7.7	Verify Priority Activation Error
		C.3.7.8	Verify Status Activation Error
		C.3.7.9	Verify Memory Type Activation Error
		C.3.7.10	Verify Message Number Activation Error
		C.3.7.11	Verify Message CRC Activation Error
		C.3.7.15	Blank the Sign
3.5.2.3.2	Manage Default Message Display Parameters		
3.5.2.3.2.1	Determine Default Message Display Parameters		
		C.3.6.1	Determine Default Message Display Parameters
3.5.2.3.2.2	Configure Default Background and Foreground Color		
		C.3.6.2	Configure Default Background and Foreground Color
3.5.2.3.2.3	Configure Default Flash-On and Flash-Off Times		
		C.3.6.3	Configure Default Flash-On and Flash-Off Times
3.5.2.3.2.4	Configure Default Font		
		C.3.6.4	Configure a Default Font
3.5.2.3.2.5	Configure Default Line Justification		
		C.3.6.5	Configure Default Line Justification
3.5.2.3.2.6	Configure Default Page Justification		
		C.3.6.6	Configure Default Page Justification

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Requirements to Test Case Traceability Table (RTCTT)			
Requirement		**Test Case**	
ID	**Title**	**ID**	**Title**
3.5.2.3.2.7	Configure Default Page On-Time and Page Off-Time		
		C.3.6.7	Configure Default Page-On and Page-Off Times
3.5.2.3.2.8	Configure Default Character Set		
		C.3.6.8	Configure Default Character Set
3.5.2.3.3	Manage Message Library		
3.5.2.3.3.1	Determine Available Message Types		
		C.3.7.1	Determine Message Storage Capabilities
3.5.2.3.3.2	Determine Available Message Space		
		C.3.7.1	Determine Message Storage Capabilities
3.5.2.3.3.3	Define a Message		
		C.3.7.2	Define a Message
		C.3.7.3	Define an Invalid Message
3.5.2.3.3.4	Verify Message Contents		
		C.3.7.5	Retrieve a Message
3.5.2.3.3.5	Retrieve Message		
		C.3.7.5	Retrieve a Message
3.5.2.3.4	Schedule Messages for Display		
3.5.2.3.4.1	Retrieve a Schedule		
		C.3.10.1	Retrieve a Schedule
3.5.2.3.4.2	Define a Schedule		
		C.3.10.2	Define a Schedule
		C.3.10.3	Activate a Schedule
		C.3.10.4	Deactivate a Schedule
		C.3.10.5	Override a Schedule
3.5.2.3.5	Configure Event-Based Message Activation		
3.5.2.3.5.1	Configure Messages Activated by Standardized Events		
3.5.2.3.5.1.1	Configure Message for Short Power Loss Recovery Event		
		C.3.11.1	Configure Message for Short Power Loss Recovery
3.5.2.3.5.1.2	Configure Message for Long Power Loss Recovery Event		
		C.3.11.2	Configure Message for Long Power Loss Recovery
3.5.2.3.5.1.3	Configure Message for Power Loss Event		
		C.3.11.6	Configure Message for Power Loss Event
3.5.2.3.5.1.4	Configure Message for Controller Reset Event		
		C.3.11.3	Configure Message for Controller Reset
3.5.2.3.5.1.5	Configure Message for Communications Loss Event		
		C.3.11.4	Configure Message for Communications Loss
3.5.2.3.5.1.6	Configure Message for End Message Display Duration Event		
		C.3.11.5	Configure Message for End Duration
3.5.2.3.6	Activate a Message with Status		
		C.3.7.6	Activate a Message
		C.3.7.7	Verify Priority Activation Error
		C.3.7.8	Verify Status Activation Error
		C.3.7.9	Verify Memory Type Activation Error
		C.3.7.10	Verify Message Number Activation Error
		C.3.7.11	Verify Message CRC Activation Error
		C.3.7.15	Blank the Sign
3.5.2.4	Control External Devices		
3.5.2.4.1	Determine Configuration of External Devices		
3.5.2.4.1.1	Determine Base Configuration of External Device Ports		
		C.3.5.17	Read I/O Ports

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Requirements to Test Case Traceability Table (RTCTT)			
Requirement		**Test Case**	
ID	**Title**	**ID**	**Title**
3.5.2.4.1.2	Further Define Ports		
		C.3.5.18	Change Port Value
3.5.2.4.1.3	Number of External Devices Supported		
		C.3.5.17	Read I/O Ports
3.5.2.4.2	Monitoring of External Devices		
3.5.2.4.2.1	Retrieving Data from External Devices		
		C.3.5.17	Read I/O Ports
3.5.2.4.3	Controlling of External Devices		
3.5.2.4.3.1	Passing Data to External Devices		
		C.3.5.18	Change Port Value
		C.3.5.19	Verify Error for Changing Input-only Port Value
		C.3.5.20	Verify Error for Changing Port Value with Larger Resolution
3.5.2.4.3.2	Determine Status of External Devices		
		C.3.5.17	Read I/O Ports
3.5.2.4.4	Controlling of Bi-directionally Connected External Devices		
3.5.2.4.4.1	Retrieving Data from External Devices		
		C.3.5.17	Read I/O Ports
3.5.2.4.4.2	Passing Data to External Devices		
		C.3.5.18 C.3.5.20	Change Port Value Verify Error for Changing Port Value with Larger Resolution
3.5.2.4.4.3	Determine Status of External Devices		
		C.3.5.17	Read I/O Ports
3.5.2.5	Control Sign Brightness		
3.5.2.5.1	Determine Number of Brightness Levels		
		C.3.4.3	Determine Number of Brightness Levels
3.5.2.5.2	Determine Current Photocell Readings		
		C.3.4.4	Verify Automatic Brightness Control
3.5.2.5.3	Manually Direct-Control Brightness (Version 2)		
		C.3.4.5	Verify Manual Direct Brightness Control
3.5.2.5.4	Manually Index-Control Brightness (Version 2)		
		C.3.4.6	Verify Manual Indexed Brightness Control
3.5.2.5.5	Manually Control Brightness (Version 1 Only)		
		C.3.4.5	Verify Manual Direct Brightness Control
3.5.2.5.6	Switch Brightness Control Modes		
		C.3.4.4	Verify Automatic Brightness Control
		C.3.4.5	Verify Manual Direct Brightness Control
		C.3.4.6	
3.5.2.6	Manage the Exercise of Pixels		
		C.3.5.16	Pixel Service Test
3.5.3	Monitor the Status of the DMS		
3.5.3.1	Perform Diagnostics		
3.5.3.1.1	Test Operational Status of DMS Components		
3.5.3.1.1.1	Execute Lamp Testing		
		C.3.5.21	Verify Lamp Test with No Errors
		C.3.5.22	Verify Lamp Test with Errors
3.5.3.1.1.2	Activate Pixel Testing		
		C.3.5.1	Pixel Test - No Errors
		C.3.5.2	Pixel Test - Errors
3.5.3.1.1.3	Execute Climate-Control Equipment Testing		
		C.3.5.3	Climate-Control Equipment Test - No Errors

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Requirements to Test Case Traceability Table (RTCTT)			
Requirement		**Test Case**	
ID	**Title**	**ID**	**Title**
		C.3.5.4	Climate-Control Equipment Test - Errors
3.5.3.1.2	Provide General DMS Error Status Information		
		C.3.5.1	Pixel Test - No Errors
		C.3.5.2	Pixel Test - Errors
		C.3.5.3	Climate-Control Equipment Test - No Errors
		C.3.5.4	Climate-Control Equipment Test - Errors
		C.3.5.5	Verify Power Error Detection
		C.3.5.6	Verify Light Sensor Error Detection
		C.3.5.8	Verify Temperature Warning—High
		C.3.5.9	Verify Temperature Warning—Low
		C.3.5.10	Verify Critical Temperature Alarm - High
		C.3.5.11	Verify Critical Temperature Alarm—Low
		C.3.5.12	Verify Humidity Sensor Operations
		C.3.5.13	Verify Door Open Status
3.5.3.1.3	Identify Problem Subsystem		
3.5.3.1.3.1	Monitor Power Errors		
		C.3.5.5	Verify Power Error Detection
3.5.3.1.3.2	Monitor Lamp Errors		
		C.3.5.21	Verify Lamp Test with No Errors
		C.3.5.22	Verify Lamp Test with Errors
3.5.3.1.3.3	Monitor Pixel Errors		
		C.3.5.1	Pixel Test - No Errors
		C.3.5.2	Pixel Test - Errors
3.5.3.1.3.4	Monitor Light Sensor Errors		
		C.3.5.6	Verify Light Sensor Error Detection
3.5.3.1.3.5	Monitor Controller Software Operations		
		C.3.5.7	Verify Controller Software Operation Status
3.5.3.1.3.6	Monitor Climate-Control System Errors		
		C.3.5.3	Climate-Control Equipment Test - No Errors
		C.3.5.4	Climate-Control Equipment Test - Errors
3.5.3.1.3.7	Monitor Temperature Warnings		
		C.3.5.8	Verify Temperature Warning—High
		C.3.5.9	Verify Temperature Warning—Low
		C.3.5.10	Verify Critical Temperature Alarm - High
		C.3.5.11	Verify Critical Temperature Alarm—Low
3.5.3.1.3.8	Monitor Humidity Warnings		
		C.3.5.12	Verify Humidity Sensor Operations
3.5.3.1.3.9	Monitor Drum Sign Rotor Errors		
		C.3.5.23	Verify Drum Sign Rotor Status - No Error
		C.3.5.24	Verify Drum Sign Rotor Status - Error
3.5.3.1.3.10	Monitor Door Status		
		C.3.5.13	Verify Door Open Status
3.5.3.1.4	Monitor Subsystems Status Details		
3.5.3.1.4.1	Monitor Power Error Details		
		C.3.5.5	Verify Power Error Detection
3.5.3.1.4.2	Monitor Lamp Error Details		
		C.3.5.22	Verify Lamp Test with Errors
3.5.3.1.4.3	Monitor Pixel Error Details		
		C.3.5.2	Pixel Test - Errors
3.5.3.1.4.4	Monitor Light Sensor Error Details		

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Requirements to Test Case Traceability Table (RTCTT)			
Requirement		**Test Case**	
ID	**Title**	**ID**	**Title**
		C.3.5.6	Verify Light Sensor Error Detection
3.5.3.1.4.5	Monitor Message Activation Error Details		
		C.3.7.7	Verify Priority Activation Error
		C.3.7.8	Verify Status Activation Error
		C.3.7.9	Verify Memory Type Activation Error
		C.3.7.10	Verify Message Number Activation Error
		C.3.7.11	Verify Message CRC Activation Error
3.5.3.1.4.6	Monitor Climate-Control System Error Details		
		C.3.5.4	Climate-Control Equipment Test - Errors
3.5.3.1.4.7	Monitor Sign Housing Temperatures		
		C.3.5.8	Verify Temperature Warning—High
		C.3.5.9	Verify Temperature Warning—Low
		C.3.5.10	Verify Critical Temperature Alarm - High
		C.3.5.11	Verify Critical Temperature Alarm—Low
3.5.3.1.4.8	Monitor Sign Housing Humidity		
		C.3.5.12	Verify Humidity Sensor Operations
3.5.3.1.4.9	Monitor Control Cabinet Temperatures		
		C.3.5.8	Verify Temperature Warning—High
		C.3.5.9	Verify Temperature Warning—Low
		C.3.5.10	Verify Critical Temperature Alarm - High
		C.3.5.11	Verify Critical Temperature Alarm—Low
3.5.3.1.4.10	Monitor Control Cabinet Humidity		
		C.3.5.12	Verify Humidity Sensor Operations
3.5.3.1.4.11	Monitor Drum Sign Rotor Error Details		
		C.3.5.24	Verify Drum Sign Rotor Status - Error
3.5.3.1.5	Monitor the Sign's Control Source		
		C.3.7.14	Verify Control Mode
3.5.3.1.6	Monitor Power Information		
3.5.3.1.6.1	Monitor Power Source		
		C.3.5.14	Determine Current Power Source
3.5.3.1.6.2	Monitor Power Voltage		
		C.3.5.14	Determine Current Power Source
3.5.3.1.6.3	Monitor Current Fuel Level		
		C.3.5.14	Determine Current Power Source
3.5.3.1.6.4	Monitor Current Engine RPM		
		C.3.5.14	Determine Current Power Source
3.5.3.1.7	Monitor Ambient Environment		
		C.3.5.8	Verify Temperature Warning—High
		C.3.5.9	Verify Temperature Warning—Low
		C.3.5.10	Verify Critical Temperature Alarm - High
		C.3.5.11	Verify Critical Temperature Alarm—Low
3.5.3.1.8	Determine Critical Temperature Threshold		
		C.3.5.10	Verify Critical Temperature Alarm - High
		C.3.5.11	Verify Critical Temperature Alarm—Low
3.5.3.1.9	Monitor Speed Detector Reading		
		C.3.5.25	Verify Speed Detector Reading
3.5.3.2	Monitor the Current Message		
3.5.3.2.1	Monitor Information about the Currently Displayed Message		
		C.3.7.16	Monitor the Current Message
3.5.3.2.2	Monitor Dynamic Field Values		

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Requirements to Test Case Traceability Table (RTCTT)			
Requirement		**Test Case**	
ID	**Title**	**ID**	**Title**
		C.3.7.13	Monitor Dynamic Field Values
3.5.3.3	Monitor Status of DMS Control Functions		
3.5.3.3.1	Determine Configuration of Event Trigger		
		N/A	N/A – Not Supported
3.5.3.3.2	Monitor Short Power Recovery Message		
		C.3.11.1	Configure Message for Short Power Loss Recovery
3.5.3.3.3	Monitor Long Power Recovery Message		
		C.3.11.2	Configure Message for Long Power Loss Recovery
3.5.3.3.4	Monitor Power Loss Message		
		C.3.11.6	Configure Message for Power Loss Event
3.5.3.3.5	Monitor Reset Message		
		C.3.11.3	Configure Message for Controller Reset
3.5.3.3.6	Monitor Communications Loss Message		
		C.3.11.4	Configure Message for Communications Loss
3.5.3.3.7	Monitor End Duration Message		
		C.3.11.5	Configure Message for End Duration
3.5.4	Providing for Multi-Version Interoperability		
3.5.4.1	Obtaining Number of Fan Failures (Multi-Version Interoperatibility Issue)		
		C.3.5.27	Fan Test (NTCIP 1203 v01)
3.5.4.2	Activating Fan Failure Test (Multi-Version Interoperatibility Issue)		
		C.3.5.27	Fan Test (NTCIP 1203 v01)
3.5.4.3	Activating the ‘Simulation’ Control Mode (Multi-Version Interoperatibility Issue)		
		C.3.7.18	Verify Simulation Control Mode
3.6	Supplemental Requirements		
3.6.1	Supplemental Requirements for Fonts		
3.6.1.1	Support for a Number of Fonts		
		C.3.2.1	Determine Number of Fonts
3.6.2	Supplement Requirements for General Illumination Brightness		
3.6.2.1	Support a Number of Brightness Levels		
		C.3.4.3	Determine Number of Brightness Levels
3.6.3	Supplemental Requirements for Automatic Brightness Control		
3.6.3.1	Automatically Control Brightness		
		C.3.4.4	Verify Automatic Brightness Control
3.6.3.2	Inhibit Flickering of Message Brightness		
		C.3.4.11	Configure Light Curve with Overlapping Values
3.6.3.3	Support a Number of Light Sensor Levels		
		C.3.4.1	Determine Maximum Number of Light Sensor Levels
3.6.4	Supplemental Requirements for Control Modes		
3.6.4.1	Support Central Control Mode		
		C.3.7.14	Verify Control Mode
3.6.4.2	Support Local Control Mode		
		C.3.7.14	Verify Control Mode
3.6.4.3	Support Central Override Control Mode		
		C.3.7.14	Verify Control Mode
3.6.4.4	Processing Requests from Multiple Sources		
		C.3.7.14	Verify Control Mode
3.6.5	Supplemental Requirements for Message Activation Request		
3.6.5.1	Supplemental Requirements for Message Activation		
3.6.5.1.1	Activate Any Message		
		C.3.7.6	Activate a Message

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Requirements to Test Case Traceability Table (RTCTT)			
Requirement		**Test Case**	
ID	**Title**	**ID**	**Title**
3.6.5.1.2	Preserve Message Integrity		
		C.3.7.6	Activate a Message
		C.3.7.11	Verify Message CRC Activation Error
		C.3.8.23	Verify Support of Font Reference with ID
		C.3.8.24	Verify Rejection of a Font with an Incorrect ID
		C.3.8.38	Verify Support of Graphic MULTI Tag
		C.3.8.39	Verify Support of Graphic MULTI Tag with Location
		C.3.8.40	Verify Support of Graphic MULTI Tag with Location and ID
3.6.5.1.3	Ensure Proper Message Content		
		C.3.7.6	Activate a Message
		C.3.7.11	Verify Message CRC Activation Error
3.6.5.2	Indicate Message Display Duration		
		C.3.7.6	Activate a Message
3.6.5.3	Indicate Message Display Requester ID		
		C.3.7.6	Activate a Message
		C.3.7.16	Monitor the Current Message
3.6.5.4	Supplemental Requirements for Message Activation Priority		
		C.3.7.6	Activate a Message
		C.3.7.7	Verify Priority Activation Error
3.6.6	Supplemental Requirements for Message Definition		
3.6.6.1	Identify Message to Define		
		C.3.7.2	Define a Message
		C.3.7.9	Verify Memory Type Activation Error
		C.3.7.10	Verify Message Number Activation Error
3.6.6.2	Define Message Content		
3.6.6.2.1	Support Multi-Page Messages		
		C.3.8.1	Verify Support of Multi-Page Message
3.6.6.2.2	Support Page Justification		
3.6.6.2.2.1	Support for One Page Justification within a Message		
		C.3.8.2	Verify Support of Page Justification Tag - Top
		C.3.8.3	Verify Support of Page Justification Tag - Middle
		C.3.8.4	Verify Support of Page Justification Tag - Bottom
3.6.6.2.2.2	Support for Multiple Page Justifications within a Message		
		C.3.8.5	Verify Support of Page-Specific Page Justification
3.6.6.2.3	Support Multiple Line Messages		
		C.3.8.6	Verify Support of Multiple Line Messages with No Spacing Specified
		C.3.8.7	Verify Support of Multiple Line Messages with Spacing Specified
3.6.6.2.4	Support Line Justification		
3.6.6.2.4.1	Support for a Single Line Justification within a Message		
		C.3.8.12	Verify Support of Line Justification - Per Message
3.6.6.2.4.2	Support Line Justification on a Page-by-Page Basis		
		C.3.8.13	Verify Support of Line Justification - Page-by-Page
3.6.6.2.4.3	Support Line Justification on a Line-by-Line Basis		
		C.3.8.14	Verify Support of Line Justification - Line-by-Line
3.6.6.2.5	Support Color		
3.6.6.2.5.1	Support a Single Color Combination per Message		
		C.3.8.15	Verify Support of a Color Combination per Message
		C.3.8.41	Verify Support of a Color Combination per Message – v2
3.6.6.2.5.2	Support a Color Combination for each Page		
		C.3.8.16	Verify Support of a Color Combination per Page

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Requirements to Test Case Traceability Table (RTCTT)			
Requirement		**Test Case**	
ID	**Title**	**ID**	**Title**
		C.3.8.42	Verify Support of a Color Combination per Page – v2
3.6.6.2.5.3	Support a Color Combination for each Character within a Message		
		C.3.8.17	Verify Support of a Color Combination per Character
		C.3.8.43	Verify Support of a Color Combination per Character – v2
3.6.6.2.5.4	Support Color for Each Pixel Within A Message		
		C.3.8.18	Verify Support of a Color Rectangle
3.6.6.2.6	Support Font Commands		
3.6.6.2.6.1	Support One Font within a Message		
		C.3.8.20	Verify Support of One Font per Message
3.6.6.2.6.2	Support One Font per Page within a Message		
		C.3.8.21	Verify Support of One Font per Page
3.6.6.2.6.3	Support Character by Character Selection of Fonts within a Message		
		C.3.8.22	Verify Support of a Font per Character
3.6.6.2.7	Support Moving Text		
		C.3.8.25	Verify Support of Moving Text (Circular Left)
		C.3.8.26	Verify Support of Moving Text (Circular Right)
		C.3.8.27	Verify Support of Moving Text (Linear Left)
		C.3.8.28	Verify Support of Moving Text (Linear Right)
		C.3.8.29	Verify Support of Moving Text (Linear with Pause)
3.6.6.2.8	Support Character Spacing		
		C.3.8.30	Verify Support of Character Spacing
3.6.6.2.9	Support Customizable Page Display Times in a Message		
		C.3.8.31	Verify Support of Customized Page Display Times
3.6.6.2.10	Support Flashing		
3.6.6.2.10.1	Support Character-By-Character Flashing		
		C.3.8.36	Verify Support of Character-by-Character Flashing
3.6.6.2.10.2	Support Line-by-line Flashing		
		C.3.8.35	Verify Support of Line-by-Line Flashing
3.6.6.2.10.3	Support Page-by-Page Flashing		
		C.3.8.34	Verify Support of Page-by-Page Flashing
3.6.6.2.11	Support Customizable Flashing Times within a Message		
		C.3.8.32	Verify Support of Customized Flashing Times (On First)
		C.3.8.33	Verify Support of Customized Flashing Times (Off First)
3.6.6.2.12	Support Hexadecimal Character		
		C.3.8.37	Verify Support of Hexadecimal Character
3.6.6.2.13	Support Message Data Fields		
3.6.6.2.13.1	Support Current Time Field without AM/PM Field		
		C.3.9.1	Verify Support of Current Time Field (12 hour)
		C.3.9.2	Verify Support of Current Time Field (24 hour)
3.6.6.2.13.2	Support Current Time Field with uppercase AM/PM Field		
		C.3.9.3	Verify Support of Current Time Field (12 hour Uppercase AM/PM)
3.6.6.2.13.3	Support Current Time Field with lowercase am/pm Field		
		C.3.9.4	Verify Support of Current Time Field (12 hour Lowercase am/pm)
3.6.6.2.13.4	Support Current Temperature Field		
		C.3.9.10	Verify Support of Current Temperature Field Celsius
		C.3.9.11	Verify Support of Current Temperature Field Fahrenheit
3.6.6.2.13.5	Support Detected Vehicle Speed Field		
		C.3.9.12	Verify Support of Detected Vehicle Speed Field (km/h)
		C.3.9.13	Verify Support of Detected Vehicle Speed Field (mph)
3.6.6.2.13.6	Support Current Day of Week Field		

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Requirements to Test Case Traceability Table (RTCTT)			
Requirement		**Test Case**	
ID	**Title**	**ID**	**Title**
		C.3.9.5	Verify Support of Current Day of Week Field
3.6.6.2.13.7	Support Current Day of Month Field		
		C.3.9.6	Verify Support of Current Day of Month Field
3.6.6.2.13.8	Support Current Month of Year Field		
		C.3.9.7	Verify Support of Current Month of Year Field
3.6.6.2.13.9	Support Current Year Field		
		C.3.9.8	Verify Support of Current Year Field (2 digits)
		C.3.9.9	Verify Support of Current Year Field (4 digits)
3.6.6.2.13.10	Support User-Definable Field		
		C.3.9.14	Verify Support of User Definable Field
3.6.6.2.13.11	Data Field Refresh Rate		
		C.3.9.1	Verify Support of Current Time Field (12 hour)
		C.3.9.2	Verify Support of Current Time Field (24 hour)
		C.3.9.3	Verify Support of Current Time Field (12 hour Uppercase AM/PM)
		C.3.9.4	Verify Support of Current Time Field (12 hour Lowercase am/pm)
		C.3.9.5	Verify Support of Current Day of Week Field
		C.3.9.6	Verify Support of Current Day of Month Field
		C.3.9.7	Verify Support of Current Month of Year Field
		C.3.9.8	Verify Support of Current Year Field (2 digits)
		C.3.9.9	Verify Support of Current Year Field (4 digits)
		C.3.9.10	Verify Support of Current Temperature Field Celsius
		C.3.9.11	Verify Support of Current Temperature Field Fahrenheit
		C.3.9.12	Verify Support of Detected Vehicle Speed Field (km/h)
		C.3.9.13	Verify Support of Detected Vehicle Speed Field (mph)
		C.3.9.14	Verify Support of User Definable Field
3.6.6.2.14	Support of Graphics		
		C.3.8.38	Verify Support of Graphic MULTI Tag
		C.3.8.39	Verify Support of Graphic MULTI Tag with Location
		C.3.8.40	Verify Support of Graphic MULTI Tag with Location and ID
3.6.6.2.15	Specify Location of Message Display		
		C.3.8.39	Verify Support of Graphic MULTI Tag with Location
		C.3.8.40	Verify Support of Graphic MULTI Tag with Location and ID
		C.3.8.44	Verify Support of Text Rectangles
3.6.6.2.16	Support of Text		
3.6.6.2.16.1	Support of Textual Content		
		C.3.7.2	Define a Message
3.6.6.2.16.2	Support of Message Lengths Compatible with Sign Face		
		C.3.7.12	Verify Sign Restricts Messages to Sign Dimensions
3.6.6.2.17	Support of Manufacturer Specific Message Definitions		
		C.3.9.15	Verify Support of Manufacturer-Specific Tag
3.6.6.3	Identify Message Owner		
		C.3.7.2	Define a Message
3.6.6.4	Priority to Maintain a Message		
		C.3.7.2	Define a Message
		C.3.7.7	Verify Priority Activation Error
3.6.6.5	Beacon Activation Flag		
		C.3.7.2	Define a Message
3.6.6.6	Pixel Service Flag		
		C.3.7.2	Define a Message
3.6.6.7	Message Status		

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Requirements to Test Case Traceability Table (RTCTT)			
Requirement		**Test Case**	
ID	**Title**	**ID**	**Title**
		C.3.7.2	Define a Message
		C.3.7.8	Verify Status Activation Error
3.6.7	Supplemental Requirements for Locally Stored Messages		
3.6.7.1	Support Permanent Messages		
		C.3.7.17	Verify Support of Permanent Messages
3.6.7.2	Support Changeable Messages		
		C.3.7.1	Determine Message Storage Capabilities
		C.3.7.2	Define a Message
3.6.7.3	Support Volatile Messages		
		C.3.7.1	Determine Message Storage Capabilities
		C.3.7.2	Define a Message
3.6.8	Supplemental Requirements for Color Scheme		
3.6.8.1	Support 256 Shades Scheme		
		C.3.8.15	Verify Support of a Color Combination per Message
		C.3.8.16	Verify Support of a Color Combination per Page
		C.3.8.17	Verify Support of a Color Combination per Character
		C.3.8.18	Verify Support of a Color Rectangle
		C.3.8.19	Verify Support of a Color Rectangle with Overlap
3.6.8.2	Support Classic NTCIP Scheme		
		C.3.8.15	Verify Support of a Color Combination per Message
		C.3.8.16	Verify Support of a Color Combination per Page
		C.3.8.17	Verify Support of a Color Combination per Character
		C.3.8.18	Verify Support of a Color Rectangle
		C.3.8.19	Verify Support of a Color Rectangle with Overlap
3.6.8.3	Support 24-Bit Color Scheme		
		C.3.8.15	Verify Support of a Color Combination per Message
		C.3.8.16	Verify Support of a Color Combination per Page
		C.3.8.17	Verify Support of a Color Combination per Character
		C.3.8.18	Verify Support of a Color Rectangle
		C.3.8.19	Verify Support of a Color Rectangle with Overlap
3.6.8.4	Support Single Color		
		C.3.8.15	Verify Support of a Color Combination per Message
		C.3.8.16	Verify Support of a Color Combination per Page
		C.3.8.17	Verify Support of a Color Combination per Character
		C.3.8.18	Verify Support of a Color Rectangle
		C.3.8.19	Verify Support of a Color Rectangle with Overlap
3.6.9	Supplemental Requirements for Monitoring Subsystems		
		C.3.5.5	Verify Power Error Detection
		C.3.5.6	Verify Light Sensor Error Detection
		C.3.5.7	Verify Controller Software Operation Status
		C.3.5.8	Verify Temperature Warning—High
		C.3.5.9	Verify Temperature Warning—Low
		C.3.5.10	Verify Critical Temperature Alarm - High
		C.3.5.11	Verify Critical Temperature Alarm—Low
		C.3.5.12	Verify Humidity Sensor Operations
		C.3.5.13	Verify Door Open Status
		C.3.5.14	Determine Current Power Source
		C.3.5.18	Change Port Value
		C.3.5.23	Verify Drum Sign Rotor Status - No Error
		C.3.5.24	Verify Drum Sign Rotor Status - Error

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Requirements to Test Case Traceability Table (RTCTT)			
Requirement		**Test Case**	
ID	**Title**	**ID**	**Title**
		C.3.7.6	Activate a Message
		C.3.7.7	Verify Priority Activation Error
		C.3.7.8	Verify Status Activation Error
		C.3.7.9	Verify Memory Type Activation Error
		C.3.7.10	Verify Message Number Activation Error
		C.3.7.11	Verify Message CRC Activation Error
		C.3.7.15	Blank the Sign
		C.3.11.4	Configure Message for Communications Loss
		C.3.8.24	Verify Rejection of a Font with an Incorrect ID
3.6.10	Supplemental Requirements for Scheduling		
3.6.10.1	Support a Number of Actions		
		C.3.10.6	Verify Support for Number of Schedules
3.6.10.2	Support the Activate Message Action for the Scheduler		
		C.3.10.2	Define a Schedule
		C.3.10.3	Activate a Schedule
3.6.10.3	Perform Actions at Scheduled Times		
		C.3.10.3	Activate a Schedule
3.6.11	Supplemental Requirements for Graphics		
3.6.11.1	Support for a Number of Graphics		
		C.3.3.1	Determine Maximum Number of Graphics
3.6.11.2	Support for Graphic Memory		
		C.3.3.3	Determine Available Graphics Memory
3.6.12	Supplemental Requirements for Page Justification		
3.6.12.1	Support Top Page Justification		
		C.3.8.2	Verify Support of Page Justification Tag - Top
3.6.12.2	Support Middle Page Justification		
		C.3.8.3	Verify Support of Page Justification Tag - Middle
3.6.12.3	Support Bottom Page Justification		
		C.3.8.4	Verify Support of Page Justification Tag - Bottom
3.6.13	Supplemental Requirements for Line Justification		
3.6.13.1	Support Left Line Justification		
		C.3.8.8	Verify Support of Line Justification - Left
3.6.13.2	Support Center Line Justification		
		C.3.8.9	Verify Support of Line Justification - Center
3.6.13.3	Support Right Line Justification		
		C.3.8.10	Verify Support of Line Justification - Right
3.6.13.4	Support Full Line Justification		
		C.3.8.11	Verify Support of Line Justification - Full
H.2	Derived Global Functional Requirements		
H.2.1	Determine Device Component Information		
		C.3.13.1	Determine Device Component Information
H.2.2	Manage Time		
H.2.2.1	Set Time		
		C.3.13.3	Set Time
H.2.2.2	Set Time Zone (Version 2)		
		C.3.13.4	Set Time Zone
H.2.2.3	Set Daylight Savings Mode (Version 2)		
		C.3.13.5	Verify Change into Daylight Savings Period (US DST Enabled)
		C.3.13.6	Verify Change out of Daylight Savings Period (US DST Enabled)
		C.3.13.7	Verify Change into Daylight Savings Period (US DST Disabled)

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Requirements to Test Case Traceability Table (RTCTT)			
Requirement		**Test Case**	
ID	**Title**	**ID**	**Title**
		C.3.13.8	Verify Change out of Daylight Savings Period (US DST Disabled)
H.2.2.4	Verify Current Time (Version 2)		
		C.3.13.5	Verify Change into Daylight Savings Period (US DST Enabled)
		C.3.13.6	Verify Change out of Daylight Savings Period (US DST Enabled)
		C.3.13.7	Verify Change into Daylight Savings Period (US DST Disabled)
		C.3.13.8	Verify Change out of Daylight Savings Period (US DST Disabled)
H.2.3	Schedule Device Actions		
H.2.3.1	Determine Maximum Number of Schedules		
		C.3.10.6	Verify Support for Number of Schedules
H.2.3.2	Monitor Current Schedule		
		C.3.10.3	Activate a Schedule
H.2.4	Determine Supported Standards		
		C.3.13.2	Determine Supported Standards
H.2.5	Supplemental Requirements for Scheduling		
H.2.5.1	Support a Number of Day Selection Patterns		
		C.3.10.6	Verify Support for Number of Schedules
H.2.5.2	Support a Number of Day Plan Events		
		C.3.10.6	Verify Support for Number of Schedules
H.2.5.3	Support a Number of Day Plans		
		C.3.10.6	Verify Support for Number of Schedules
H.2.6	Supplemental Requirements for Event Monitoring		
H.2.6.1	Record and Timestamp Events		
		C.3.12.3	Retrieve Logged Data
		C.3.12.6	Verify Log Limit Storage
H.2.6.2	Support a Number of Event Classes		
		C.3.12.1	Determine Capabilities of Event Logging Service
H.2.6.3	Support a Number of Event Types to Monitor		
		C.3.12.1	Determine Capabilities of Event Logging Service
H.2.6.4	Support Monitoring of Event Types		
H.2.6.4.1	Support On-Change Events		
		C.3.12.7	Verify Support for an On-Change Event
H.2.6.4.2	Support Greater Than Events		
		C.3.12.8	Verify Support for a Greater Than Event
H.2.6.4.3	Support Less Than Events		
		C.3.12.9	Verify Support for a Less Than Event
H.2.6.4.4	Support Hysteresis Events		
		C.3.12.10	Verify Support for a Hysteresis Event
H.2.6.4.5	Support Periodic Events		
		C.3.12.11	Verify Support for a Periodic Event
H.2.6.4.6	Support Bit-flag Events		
		C.3.12.12	Verify Support for a Bit-flag Event
H.2.6.5	Support Event Monitoring on Any Data		
		C.3.12.2	Configure Event Log
H.2.7	Support a Number of Events to Store in Log		
		C.3.12.1	Determine Capabilities of Event Logging Service
		C.3.12.6	Verify Log Limit Storage

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C.3 Test Procedures

C.3.1 Configuration Tests

C.3.1.1 Determine Sign Type and Technology

Test Case: 1.1	**Title:**	**Determine Sign Type and Technology**
	Description:	This test case verifies that the DMS indicates that it is the sign type and uses the technology as required by the specification.
	Variables:	Required_Sign_Type — PRL 2.3.2.1 and 2.3.2.3 Required_Sign_Technology — PRL 2.3.2.2
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the enumerated value for the sign type required by the specification (PRL 2.3.2.1 and 2.3.2.3). RECORD this information as: »Required_Sign_Type Note: Valid enumerated values are defined in Section 5.2.2 (Sign Type Parameter).		
2	CONFIGURE: Determine the enumerated value for the sign technology required by the specification (PRL 2.3.2.2). RECORD this information as: »Required_Sign_Technology Note: Valid enumerated values are defined in Section 5.2.9 (Sign Technology Parameter).		
3	GET the following object(s): »dmsSignType.0 »dmsSignTechnology.0	Pass / Fail (Section 3.5.1.1.1)	
4	VERIFY that the RESPONSE VALUE for dmsSignType.0 is equal to Required_Sign_Type.	Pass / Fail (PRL 2.3.2.1 and 2.3.2.3)	
5	VERIFY that the RESPONSE VALUE for dmsSignTechnology.0 is equal to Required_Sign_Technology.	Pass / Fail (PRL 2.3.2.2)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.1.2 Determine the Size of the Sign Face

Test Case: 1.2	**Title:**	**Determine the Size of the Sign Face**
	Description:	This test case verifies that the DMS indicates that it has physical dimensions that meet those required by the specification.
	Variables:	Required_Sign_Height — PRL 2.3.2.3 Required_Sign_Width — PRL 2.3.2.3
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.

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Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the sign height, in millimeters, as required by the specification (PRL 2.3.2.3). RECORD this information as: »Required_Sign_Height		
2	CONFIGURE: Determine the sign width, in millimeters, as required by the specification (PRL 2.3.2.3). RECORD this information as: »Required_Sign_Width		
3	SET-UP: Determine the actual height of the sign in millimeters. RECORD this information as: »Actual_Sign_Height		
4	SET-UP: Determine the actual width of the sign in millimeters. RECORD this information as: »Actual_Sign_Width		
5	GET the following object(s): »dmsSignHeight.0 »dmsSignWidth.0	Pass / Fail (Section 3.5.1.2.1.1)	
6	VERIFY that the RESPONSE VALUE for dmsSignHeight.0 is equal to Required_Sign_Height.	Pass / Fail (PRL 2.3.2.3)	
7	VERIFY that the RESPONSE VALUE for dmsSignWidth.0 is equal to Required_Sign_Width.	Pass / Fail (PRL 2.3.2.3)	
8	VERIFY that the RESPONSE VALUE for dmsSignHeight.0 is equal to Actual_Sign_Height.	Pass / Fail (Section 3.5.1.2.1.1)	
9	VERIFY that the RESPONSE VALUE for dmsSignWidth.0 is equal to Actual_Sign_Width.	Pass / Fail (Section 3.5.1.2.1.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.1.3 Determine Size of the Sign Border

Test Case: 1.3	**Title:**	**Determine Size of the Sign Border**	
	Description:	This test case verifies that the DMS indicates that the size of the horizontal and vertical borders meet the requirements of the specification.	
	Variables:	Required_Horizontal_Border	PRL 2.3.2.3
		Required_Vertical_Border	PRL 2.3.2.3
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the minimum width of the border, in millimeters, on the left and right sides of the sign display as required by the specification (PRL 2.3.2.3). RECORD this information as: »Required_Horizontal_Border		
2	CONFIGURE: Determine the minimum height of the border, in millimeters, on the top and bottom of the sign display as required by the		

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	specification (PRL 2.3.2.3). RECORD this information as: »Required_Vertical_Border		
3	SET-UP: Determine the minimum width of the border actually present on the right or left of the sign in millimeters. RECORD this information as: »Actual_Horizontal_Border		
4	SET-UP: Determine the minimum height of the border actually present on the top or bottom of the sign in millimeters. RECORD this information as: »Actual_Vertical_Border		
5	GET the following object(s): »dmsHorizontalBorder.0 »dmsVerticalBorder.0.	Pass / Fail (Section 3.5.1.2.1.2)	
6	VERIFY that the RESPONSE VALUE for dmsHorizontalBorder.0 is greater than or equal to Required_Horizontal_Border.	Pass / Fail (PRL 2.3.2.3)	
7	VERIFY that the RESPONSE VALUE for dmsVerticalBorder.0. is greater than or equal to Required_Vertical_Border.	Pass / Fail (PRL 2.3.2.3)	
8	VERIFY that the RESPONSE VALUE for dmsHorizontalBorder.0 is smaller than or equal to Actual_Horizontal_Border.	Pass / Fail (Section 3.5.1.2.1.2)	
9	VERIFY that the RESPONSE VALUE for dmsVerticalBorder.0. is smaller than or equal to Actual_Vertical_Border.	Pass / Fail (Section 3.5.1.2.1.2)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.1.4 Determine Beacon Type

Test Case: 1.4	**Title:**	**Determine Beacon Type**	
	Description:	This test case verifies that the DMS indicates that it supports the beacon type required by the specification.	
	Variables:	Required_Beacon_Type	PRL 2.3.2.4
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the enumerated value corresponding to the beacon type required by the specification (PRL 2.3.2.4). RECORD this information as: »Required_Beacon_Type Note: -Valid enumerated values are defined in Section 5.2.8 (Beacon Type Parameter).		
2	SET-UP: Determine the enumerated value indicating the actual type of beacons on the sign (See Section 5.2.8). RECORD this information as: »Actual_Beacon_Type		
3	GET the following object(s): »dmsBeaconType.0	Pass / Fail (Section 3.5.1.2.1.3)	

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4	VERIFY that the RESPONSE VALUE for dmsBeaconType.0 is equal to Required_Beacon_Type.	Pass / Fail (PRL 2.3.2.4)	
5	VERIFY that the RESPONSE VALUE for dmsBeaconType.0 is equal to Actual_Beacon_Type.	Pass / Fail (Section 3.5.1.2.1.3)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.1.5 Determine Sign Access and Legend

Test Case: 1.5	**Title:**	**Determine Sign Access and Legend**
	Description:	This test case verifies that the DMS indicates that it supports the type of sign access and legend required by the specification.
	Variables:	Required_Sign_Access — From specification Required_Legend — From specification
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the bitmapped value corresponding to the sign access required by the hardware portion of the specification. RECORD this information as: »Required_Sign_Access Note: Valid bitmapped values are defined in Section 5.2.1 (Sign Access Parameter). The sign access should be defined in the hardware specification and is not contained within the PRL.		
2	CONFIGURE: Determine the enumerated value corresponding to the type of legend required by the hardware portion of the specification. RECORD this information as: »Required_Legend Note: Valid enumerated values are defined in Section 5.2.7 (Legend Parameter). The type of legend should be defined in the hardware specification and is not contained within the PRL.		
3	SET-UP: Determine the bitmapped value corresponding to the actual access mechanism for the sign (See Section 5.2.1). RECORD this information as: »Actual_Sign_Access		
4	SET-UP: Determine the enumerated value corresponding to the type of legend that is actually associated with the sign (See Section 5.2.7). RECORD this information as: »Actual_Sign_Legend		
5	GET the following object(s): »dmsSignAccess.0 »dmsLegend.0.	Pass / Fail (Section 3.5.1.2.1.4)	
6	VERIFY that the RESPONSE VALUE for dmsSignAccess.0 is equal to Required_Sign_Access.	Pass / Fail (Per the hardware specification)	

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7	VERIFY that the RESPONSE VALUE for dmsLegend.0 is equal to Required_Legend.	Pass / Fail (Per the hardware specification)	
8	VERIFY that the RESPONSE VALUE for dmsSignAccess.0 is equal to Actual_Sign_Access.	Pass / Fail (Section 3.5.1.2.1.4)	
9	VERIFY that the RESPONSE VALUE for dmsLegend.0 is equal to Actual_Sign_Legend.	Pass / Fail (Section 3.5.1.2.1.4)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.1.6 Determine Sign Face Size in Pixels

Test Case: 1.6	**Title:**	**Determine Sign Face Size in Pixels**	
	Description:	This test case verifies that the DMS indicates that it has a height and width in pixels that meet the requirements of the specifications.	
	Variables:	Required_Sign_Pixel_Height	PRL 2.3.2.3.2.1-2.3.2.3.2.3
		Required_Sign_Pixel_Width	PRL 2.3.2.3.2.1-2.3.2.3.2.3
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the sign height in pixels as required by the specification (PRL 2.3.2.3.2.1-2.3.2.3.2.3). RECORD this information as: »Required_Sign_Pixel_Height		
2	CONFIGURE: Determine the sign width in pixels as required by the specification (PRL 2.3.2.3.2.1-2.3.2.3.2.3). RECORD this information as: »Required_Sign_Pixel_Width		
3	SET-UP: Determine the actual sign height in pixels. RECORD this information as: »Actual_Pixel_Height		
4	SET-UP: Determine the actual sign width in pixels. RECORD this information as: »Actual_Pixel_Width		
5	GET the following object(s): »vmsSignHeightPixels.0 »vmsSignWidthPixels.0	Pass / Fail (Section 3.5.1.2.2.1)	
6	VERIFY that the RESPONSE VALUE for vmsSignHeightPixels.0 is equal to Required_Sign_Pixel_Height.	Pass / Fail (PRL 2.3.2.3.2.1-2.3.2.3.2.3)	
7	VERIFY that the RESPONSE VALUE for vmsSignWidthPixels.0 is equal to Required_Sign_Pixel_Width.	Pass / Fail (PRL 2.3.2.3.2.1-2.3.2.3.2.3)	
8	VERIFY that the RESPONSE VALUE for vmsSignHeightPixels.0 is equal to Actual_Pixel_Height.	Pass / Fail (Section 3.5.1.2.2.1)	

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9	VERIFY that the RESPONSE VALUE for vmsSignWidthPixels.0 is equal to Actual_Pixel_Width.	Pass / Fail (Section 3.5.1.2.2.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.1.7 Determine Character Size in Pixels

Test Case: 1.7	**Title:**	**Determine Character Size in Pixels**
	Description:	This test case verifies that the DMS indicates that it supports a height and width of characters, in pixels, as required by the specification.
	Variables:	Required_Character_Pixel_Height — PRL 2.3.2.3.2.3 Required_Character_Pixel_Width — PRL 2.3.2.3.2.3
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the character height in pixels as required by the specification (PRL 2.3.2.3.2.3). RECORD this information as: »Required_Character_Pixel_Height Note: Record the value zero to represent a variable height, as in the case of a sign with a full matrix configuration.		
2	CONFIGURE: Determine the character width in pixels as required by the specification (PRL 2.3.2.3.2.3). RECORD this information as: »Required_Character_Pixel_Width Note: Record the value zero to represent a variable width, as in the case of a sign with either a line or full matrix configuration.		
3	SET-UP: Determine the actual character height in pixels. RECORD this information as: »Actual_Character_Pixel_Height Note: Record the value zero to represent a variable height.		
4	SET-UP: Determine the actual character width in pixels. RECORD this information as: »Actual_Character_Pixel_Width Note: Record the value zero to represent a variable width.		
5	GET the following object(s): »vmsCharacterHeightPixels.0 »vmsCharacterWidthPixels.0	Pass / Fail (Section 3.5.1.2.2.2)	
6	VERIFY that the RESPONSE VALUE for vmsCharacterHeightPixels.0 is equal to Required_Character_Pixel_Height.	Pass / Fail (PRL 2.3.2.3.2.3)	
7	VERIFY that the RESPONSE VALUE for vmsCharacterWidthPixels.0 is equal to Required_Character_Pixel_Width.	Pass / Fail (PRL 2.3.2.3.2.3)	
8	VERIFY that the RESPONSE VALUE for vmsCharacterHeightPixels.0 is equal to Actual_Character_Pixel_Height.	Pass / Fail (Section 3.5.1.2.2.2)	
9	VERIFY that the RESPONSE VALUE for vmsCharacterWidthPixels.0 is	Pass / Fail	

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	equal to Actual_Character_Pixel_Width.	(Section 3.5.1.2.2.2)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.1.8 Determine Pixel Spacing

Test Case: 1.8	**Title:**	**Determine Pixel Spacing**
	Description:	This test case verifies that the DMS indicates that the pixels are spaced per the specification.
	Variables:	Required_Horizontal_Pitch — PRL 2.3.2.3.2 Required_Vertical_Pitch — PRL 2.3.2.3.2
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the horizontal pitch, in millimeters, as required by the specification (PRL 2.3.2.3.2). RECORD this information as: »Required_Horizontal_Pitch		
2	CONFIGURE: Determine the vertical pitch, in millimeters, as required by the specification (PRL 2.3.2.3.2). RECORD this information as: »Required_Vertical_Pitch		
3	SET-UP: Determine the actual horizontal spacing between the pixels, in millimeters. RECORD this information as: »Actual_Horizontal_Pitch		
4	SET-UP: Determine the actual vertical spacing between the pixels, in millimeters. RECORD this information as: »Actual_Vertical_Pitch		
5	GET the following object(s): »vmsHorizontalPitch.0 »vmsVerticalPitch.0	Pass / Fail (Section 3.5.1.2.2.3)	
6	VERIFY that the RESPONSE VALUE for vmsHorizontalPitch.0 is greater than or equal to Required_Horizontal_Pitch.	Pass / Fail (PRL 2.3.2.3.2)	
7	VERIFY that the RESPONSE VALUE for vmsVerticalPitch.0 is greater than or equal to Required_Vertical_Pitch.	Pass / Fail (PRL 2.3.2.3.2)	
8	VERIFY that the RESPONSE VALUE for vmsHorizontalPitch.0 is equal to Actual_Horizontal_Pitch.	Pass / Fail (Section 3.5.1.2.2.3)	
9	VERIFY that the RESPONSE VALUE for vmsVerticalPitch.0 is equal to Actual_Vertical_Pitch.	Pass / Fail (Section 3.5.1.2.2.3)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

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C.3.1.9 Determine Maximum Number of Pages

Test Case: 1.9	**Title:**	**Determine Maximum Number of Pages**	
	Description:	This test case verifies that the DMS indicates that it supports the number of pages in a message as required by the specification.	
	Variables:	Required_Max_Pages	PRL Supp. 3.6.6.2.1
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the number of pages that the sign is required to support within each message per the specification (PRL Supp. 3.6.6.2.1). RECORD this information as: »Required_Max_Pages		
2	GET the following object(s): »dmsMaxNumberPages.0	Pass / Fail (Section 3.5.1.2.3.1)	
3	VERIFY that the RESPONSE VALUE for dmsMaxNumberPages.0 is greater than or equal to Required_Max_Pages.	Pass / Fail (PRL Supp. 3.6.6.2.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.1.10 Determine Maximum Message Length

Test Case: 1.10	**Title:**	**Determine Maximum Message Length**	
	Description:	This test case verifies that the DMS indicates that it supports MULTI string lengths as required by the specification.	
	Variables:	Required_MULTI_Length	PRL 2.5.1.2 / 3.5.1.2.3.2
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the maximum MULTI string length for each message as required by the specification. RECORD this information as: »Required_MULTI_Length		
2	GET the following object(s): »dmsMaxMultiStringLength.0	Pass / Fail (Section 3.5.1.2.3.2)	
3	RECORD the RESPONSE VALUE for dmsMaxMultiStringLength.0 as: »Actual_Max_MULTI_String_Length		
4	VERIFY that the RESPONSE VALUE for dmsMaxMultiStringLength.0 is greater than or equal to Required_MULTI_Length.	Pass / Fail (PRL 2.5.1.2 / 3.5.1.2.3.2)	
5	CONFIGURE: Define a message that has a length equal to Actual_Max_MULTI_String_Length characters. RECORD this information as: »MULTI_String_Max_Length		

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6	PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = 3 (changeable) or 4 (volatile) »Msg_Number = 1 »Msg_Multi_String = Multi_String_Max_Length »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.3.3)	
7	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = 3 (changeable) or 4 (volatile) »Msg_Number = 1 »Msg_Multi_String = Multi_String_Max_Length »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.1.11 Determine Supported Color Schemes

Test Case: 1.11	**Title:**	**Determine Supported Color Schemes**
	Description:	This test case verifies that the DMS indicates that it supports the color scheme(s) required by the specification. Note: NTCIP 1203 v03 requires all signs to support the monochrome1bit color scheme and allows signs to optionally support one additional scheme. The dmsColorScheme object identifies the additional scheme, if it is supported and identifies monochrome1bit otherwise.
	Variables:	Required_Color_Scheme — PRL Supp. 3.6.8 Required_Monochrome_Color — From Specification
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the enumerated value of the most advanced color scheme required by the specification (PRL Supp. 3.6.8). RECORD this information as: »Required_Color_Scheme Note: Valid enumerated values are defined in Section 5.5.22 (Color Scheme Parameter). Note: All devices are required to support the monochrome1bit scheme and may support one (and only one) other more advanced color scheme.		

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2	CONFIGURE: If Required_Color_Scheme is either 'monochrome1Bit' (1) or 'monochrome8bit' (2), determine the octet string required by the specification for monochromeColor.0. RECORD this information as: »Required_Monochrome_Color Note: -Valid octet values are defined in Section 5.3.7 (Monochrome Color Parameter).		
3	GET the following object(s): »dmsColorScheme.0 »monochromeColor.0	Pass / Fail (Section 3.5.1.2.3.3)	
4	VERIFY that the RESPONSE VALUE for dmsColorScheme.0 is equal to Required_Color_Scheme.	Pass / Fail (PRL Supp. 3.6.8)	
5	If the RESPONSE VALUE for dmsColorScheme is either 'monochrome1Bit' (1) or 'monochrome8bit' (2), VERIFY that the RESPONSE VALUE for monochromeColor.0 is equal to Required_Monochrome_Color, otherwise, VERIFY that the RESPONSE VALUE is an octet string of six zeroes.	Pass / Fail (Section 3.5.1.2.3.3)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.1.12 Determine Message Display Capabilities

Test Case: 1.12	**Title:**	**Determine Message Display Capabilities**	
	Description:	This test case verifies that the DMS indicates that it supports the message display capabilities required by the specification.	
	Variables:	Required_MULTI_Tags	PRL Supp. 3.6.6.2.1 - 3.6.6.2.15
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the bitmapped value corresponding to the MULTI tags that the DMS is required to support based on the features selected by the specification (in Hex) (PRL Supp. 3.6.6.2.1 - 3.6.6.2.15). RECORD this information as: »Required_MULTI_Tags Note: Valid bitmapped values are defined in Section 5.5.23 (Supported MULTI Tags).		
2	GET the following object(s): »dmsSupportedMultiTags.0	Pass / Fail (Section 3.5.1.2.3.4)	
3	VERIFY that the RESPONSE VALUE for dmsSupportedMultiTags.0 supports all of the bits selected in Required_MULTI_Tags.	Pass / Fail (PRL Supp. 3.6.6.2.1 – 3.6.6.2.16)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

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C.3.2 Font Tests

C.3.2.1 Determine Number of Fonts

Test Case: 2.1	**Title:**	**Determine Number of Fonts**	
	Description:	This test case verifies that the DMS indicates that it supports the number of fonts required by the specification.	
	Variables:	Required_Number_Fonts	PRL 3.6.1.1
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the number of fonts that the sign is required to support per the specification (PRL 3.6.1.1). RECORD this information as: »Required_Number_Fonts		
2	GET the following object(s): »numFonts.0	Pass / Fail (Section 3.5.1.3.1)	
3	RECORD the RESPONSE VALUE for numFonts.0 as: »Num_Fonts		
4	VERIFY that Num_Fonts is greater than or equal to Required_Number_Fonts.	Pass / Fail (PRL 3.6.1.1)	
5	RECORD the value 0 for the following: »Num_Permanent_Fonts »Num_Changeable_Fonts		
6	FOR EACH value N, from 1 to Num_Fonts, perform Step 6.1		
6.1	GET the following object(s): »fontStatus.N		
6.2	IF the RESPONSE VALUE for fontStatus.N is equal to ‘permanent’ (6), GOTO Step 6.2.1, otherwise GOTO Step 6.3.		
6.2.1	RECORD the sum of Num_Permanent_Fonts plus 1 as: »Num_Permanent_Fonts GOTO Step 6.		
6.3	IF the RESPONSE VALUE for fontStatus.N is equal to ‘readyForUse’ (4), ‘inUse’ (5), or ‘unmanaged’ (11), GOTO Step 6.3.1, otherwise GOTO Step 6.		
6.3.1	RECORD the sum of Num_Changeable_Fonts plus 1 as: »Num_Changeable_Fonts GOTO Step 6.		

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

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C.3.2.2 Determine Maximum Character Size

Test Case: 2.2	**Title:**	**Determine Maximum Character Size**	
	Description:	This test case verifies that the DMS returns the required value for the maximum character size.	
	Variables:	Required_Max_Character_Size	PRL 2.5.1.3 / 3.5.1.3.2
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the maximum character size (in bytes) required by the specification (PRL 2.5.1.3 / 3.5.1.3.2). RECORD this information as: »Required_Max_Character_Size		
2	GET the following object(s): »fontMaxCharacterSize.0	Pass / Fail (Section 3.5.1.3.2)	
3	VERIFY that the RESPONSE VALUE for fontMaxCharacterSize.0 is greater than or equal to Required_Max_Character_Size.	Pass / Fail (PRL 2.5.1.3 / 3.5.1.3.2)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.2.3 Determine Maximum Number of Characters per Font

Test Case: 2.3	**Title:**	**Determine Maximum Number of Characters per Font**	
	Description:	This test case verifies that the DMS returns the required value for the maximum number of characters per font.	
	Variables:	Required_Max_Num_Chars_Per_Font	PRL 2.5.1.3 / 3.5.1.3.3
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the maximum number of characters per font required by the specification (PRL 2.5.1.3 / 3.5.1.3.3). RECORD this information as: »Required_Max_Num_Chars_Per_Font		
2	GET the following object(s): »maxFontCharacters.0	Pass / Fail (Section 3.5.1.3.3)	
3	VERIFY that the RESPONSE VALUE for maxFontCharacters.0 is greater than or equal to Required_Max_Num_Chars_Per_Font.	Pass / Fail (PRL 2.5.1.3 / 3.5.1.3.3)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

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C.3.2.4 Retrieve a Font Definition

Test Case: 2.4	Title:	Retrieve a Font Definition	
	Description:	This test case verifies that the DMS properly returns the complete definition of a specified font, including all of the character bitmaps that the DMS claims it supports.	
	Variables:	Subject_Font	From the test plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the index of the font to be retrieved (from the test plan). RECORD this information as: »Subject_Font Note: The Subject_Font is limited to fonts supported by the DMS and having a status of 'inUse' (5), 'readyForUse' (4), 'permanent' (6), or 'unmanaged' (11). Note: Valid bitmapped values are defined in Section 5.4.2.8 (Font Status Parameter).		
2	GET the following object(s): »fontStatus.Subject_Font	Pass / Fail (Section 3.5.1.3.4)	Section 4.2.2.1 Step b
3	SET-UP: VERIFY that the RESPONSE VALUE for fontStatus.Subject_Font is 'inUse', 'readyForUse', 'permanent', or 'unmanaged'.		Section 4.2.2.4 Step d
4	GET the following object(s): »fontNumber.Subject_Font »fontName.Subject_Font »fontHeight.Subject_Font »fontCharSpacing.Subject_Font »fontLineSpacing.Subject_Font »fontVersionID.Subject_Font »fontStatus.Subject_Font	Pass / Fail (Section 3.5.1.3.4)	Section 4.2.2.1 Step c
5	Determine the RESPONSE VALUE for each of the objects retrieved in Step 4. RECORD this information as: »Font_Number »Font_Name »Font_Height »Font_Character_Spacing »Font_Line_Spacing »Font_Version_ID »Font_Status		
6	GET the following object(s): »maxFontCharacters.0		
7	RECORD the RESPONSE VALUE for maxFontCharacters.0 as: »Max_Num_Chars_Per_Font		
8	FOR EACH value, N, from 1 to Max_Num_Chars_Per_Font, PERFORM Steps 8.1 through 8.2.		
8.1	PERFORM a GET operation on the following object(s): »characterNumber.Subject_Font.N »characterWidth.Subject_Font.N »characterBitmap.Subject_Font.N	Pass / Fail (Section 3.5.1.3.4)	Section 4.2.2.1 Step d
8.2	RECORD the RESPONSE VALUE for each of the objects retrieved in Step 8.1 as: »Character_Number[N]		

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	»Character_Width[N] »Character_Bitmap[N]		
9	Calculate the CRC on the subject font. RECORD this value as »Expected_CRC. Note: CRC calculation method is defined in Section 5.4.2.7 (Font Version ID Parameter).		
10	GET the following object(s): »fontVersionID.Subject_Font	Pass / Fail (Section 3.5.1.3.7)	Section 4.2.2.4 Step e
11	VERIFY that the RESPONSE VALUE for fontVersionID.Subject_Font is equal to Expected_CRC.	Pass / Fail (Section 3.5.1.3.7)	Section 4.2.2.4 Step f

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.2.5 Configure a Font

Test Case: 2.5	**Title:**	**Configure a Font**	
	Description:	This test case verifies that the DMS allows configuration of a font and that the changes affect both the display and the values returned in a retrieval operation.	
	Variables:	Font_Index	From the Test Plan
		New_Font_Height	From the Test Plan
		New_Font_Number	From the Test Plan
		New_Font_Name	From the Test Plan
		New_Font_Char_Spacing	From the Test Plan
		New_Font_Line_Spacing	From the Test Plan
		New_Font-Version_ID	From the Test Plan
		New_Character_Numbers	From the Test Plan
		New_Character_Widths	From the Test Plan
		New_Character_Bitmaps	From the Test Plan
		Font_Message_Type	From the Test Plan
		Font_Message_Number	From the Test Plan
		Font_Test_Multi_Strings	From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the font information to be configured (e.g., from the test plan). RECORD this information as: »Font_Index (the index of the font to be configured,) »New_Font_Height (the desired height of the font in pixels,) »New_Font_Number (the desired number for the font,) »New_Font_Name (the name to be assigned to the font,) »New_Font_Char_Spacing (the desired spacing between characters on a line, in pixels,) »New_Font_Line_Spacing (the desired spacing between the lines of a display, in pixels.) Note; The font index is limited to those supported by the DMS, and whose associated font status is not 'permanent'.		

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2	CONFIGURE: Determine the following information for each character to be defined for the font (e.g., from the test plan). RECORD this information as: »New_Character_Numbers (a list of each character number to be defined,) »New_Character_Widths (a list of the width of each character, in pixels,) »New_Character_Bitmaps (a list of the desired character bitmap for each character)		
3	CONFIGURE: Determine the number corresponding to the type of message memory and the message number in which to store the message(s) to be used to display the font character(s) (e.g., per the test plan). RECORD this information as: »Font_Message_Type »Font_Message_Number Note: Valid enumerated values for Message Type are defined in Section 5.6.8.1 (Message Memory Type Parameter).		
4	CONFIGURE: Determine the MULTI string(s) for each Message to be activated to display the font character(s) (e.g., from the test plan). RECORD this information as: »Font_Test_Multi_Strings Note: Rules for the creation of a valid MULTI string are defined in Section 6. In order for this test to be valid, either (1) the Character(s) shall be preceded by a MULTI font tag ([fo]) that calls out the New_Font_Number or (2) the default font object (e.g., see Section 5.5.7) shall be set to the Font_Number and the Characters shall not be preceded by a conflicting MULTI font tag.		
5	GET the following object(s): »fontStatus.Font_Index	Pass / Fail (Section 3.5.1.3.4)	Section 4.2.2.1 Step b
6	SET-UP: IF the RESPONSE VALUE for fontStatus.Font_Index is ‘permanent’ (6), EXIT. Note: Valid bitmapped values are defined in Section 5.4.2.8 (Font Status Parameter).		
7	GET the following object(s): »maxFontCharacters.0		
8	RECORD the RESPONSE VALUE for maxFontCharacters.0 as: »Max_Num_Chars_Per_Font		
9	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15). Note: The purpose of this step is to make sure that the font we are attempting to configure is not currently in use by a message being displayed.	Pass / Fail	
10	GET the following object(s): »fontStatus.Font_Index	Pass / Fail (Section 3.5.1.3.5)	
11	VERIFY that the RESPONSE VALUE for fontStatus.Font_Index is neither 'inUse' (5) nor 'permanent (6)'. Note: If the RESPONSE VALUE for fontStatus.Font_Index is 'inUse', the test fails because the sign should be blank and not using the font. If the RESPONSE VALUE is 'permanent', the test fails since the value changed since Step 6.	Pass / Fail (Section 3.5.1.3.5)	Section 4.2.2.2 Step b
12	SET the following object(s) to the value(s) shown: »fontStatus.Font_Index = 'notUsedReq' (9) Note: Valid enumerated values are defined in Section 5.4.2.8 (Font Status Parameter).	Pass / Fail (Section 3.5.1.3.5)	

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13	GET the following object(s): »fontStatus.Font_Index	Pass / Fail (Section 3.5.1.3.5)	
14	VERIFY that the RESPONSE VALUE for fontStatus.Font_Index is equal to 'notUsed' (1).	Pass / Fail (Section 3.5.1.3.5)	
15	SET the following object(s) to the value(s) shown: »fontStatus.Font_Index = 'modifyReq' (7) Note: Valid enumerated values are defined in Section 5.4.2.8 (Font Status Parameter).	Pass / Fail (Section 3.5.1.3.5)	Section 4.2.2.2 Step c
16	GET the following object(s): »fontStatus.Font_Index	Pass / Fail (Section 3.5.1.3.5)	
17	VERIFY that the RESPONSE VALUE for fontStatus.Font_Index is equal to 'modifying' (2).	Pass / Fail (Section 3.5.1.3.5)	Section 4.2.2.2 Step d
18	SET the following object(s) to the value(s) shown: »fontHeight.Font_Index = New_Font_Height	Pass / Fail (Section 3.5.1.3.5)	Section 4.2.2.2 Step e
19	SET the following object(s) to the value(s) shown: »fontNumber.Font_Index = New_Font_Number »fontName.Font_Index = New_Font_Name »fontCharSpacing.Font_Index = New_Font_Char_Spacing »fontLineSpacing.Font_Index = New_Font_Line_Spacing	Pass / Fail (Section 3.5.1.3.5)	Section 4.2.2.2 Step f
20	FOR EACH value, N, for numbers in the array New_Character_Numbers, perform Step 20.1.		
20.1	SET the following object(s) to the value(s) shown: »characterWidth.Font_Index.New_Character_Numbers[N] = New_Character_Widths[N] »characterBitmap.Font_Index.New_Character_Numbers[N] = New_Character_Bitmaps[N]	Pass / Fail (Section 3.5.1.3.5)	Section 4.2.2.2 Step g
21	SET the following object(s) to the value(s) shown: »fontStatus.Font_Index = 'readyForUseReq' (8) Note; Valid enumerated values are defined in Section 5.4.2.8 (Font Status Parameter).	Pass / Fail (Section 3.5.1.3.5)	Section 4.2.2.2 Step h
22	GET the following object(s): »fontStatus.Font_Index	Pass / Fail (Section 3.5.1.3.5)	
23	IF fontStatus.Font_Index is equal to 'calculatingID' (3), then return to Step 22; otherwise, GOTO Step 24. Note: If the device remains in this state for a prolonged period, the test case should be considered failed. Consult the manufacturer's documentation on what may constitute an abnormally long time.		
24	VERIFY that the RESPONSE VALUE for fontStatus.Font_Index is equal to 'readyForUse' (4).	Pass / Fail (Section 3.5.1.3.5)	
25	FOR EACH value, Font_Test_Multi_String, in the array Font_Test_Multi_Strings, perform Steps 25.1 through 25.3.		
25.1	PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Font_Message_Type »Msg_Number = Font_Message_Number »Msg_Multi_String = Font_Test_MultiStrings »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none)	Pass / Fail (Section 3.5.2.3.3.3)	

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	»Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0		
25.2	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Font_Message_Type »Msg_Number = Font_Message_Number »Msg_Multi_String = Font_Test_MultiStrings »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
25.3	VERIFY that the characters displayed on the sign agree with the font that has been transferred to the sign.	Pass / Fail (Section 3.5.1.3.5)	
25.4	GET the following object(s): »fontStatus.Font_Index	Pass / Fail (Section 3.5.1.3.5)	
25.5	VERIFY that the RESPONSE VALUE for fontStatus.Font_Index is equal to 'inUse' (5).	Pass / Fail (Section 3.5.1.3.5)	
25.6	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	
26	GET the following object(s): »fontStatus.Font_Index	Pass / Fail (Section 3.5.1.3.4)	Section 4.2.2.1 Step b
27	VERIFY that the RESPONSE VALUE for fontStatus.Font_Index is equal to 'readyForUse' (4).	Pass / Fail (Section 3.5.1.3.4)	
28	GET the following object(s): »fontNumber.Font_Index »fontName.Font_Index »fontHeight.Font_Index »fontCharSpacing.Font_Index »fontLineSpacing.Font_Index »fontVersionID.Font_Index	Pass / Fail (Section 3.5.1.3.4)	Section 4.2.2.1 Step c
29	VERIFY that the RESPONSE VALUE for fontNumber.Font_Index is equal to New_Font_Number.	Pass / Fail (Section 3.5.1.3.4)	
30	VERIFY that the RESPONSE VALUE for fontName.Font_Index is equal to New_Font_Name.	Pass / Fail (Section 3.5.1.3.4)	
31	VERIFY that the RESPONSE VALUE for fontHeight.Font_Index is equal to New_Font_Height.	Pass / Fail (Section 3.5.1.3.4)	
32	VERIFY that the RESPONSE VALUE for fontCharSpacing.Font_Index is equal to New_Font_Char_Spacing.	Pass / Fail (Section 3.5.1.3.4)	
33	VERIFY that the RESPONSE VALUE for fontLineSpacing.Font_Index is equal to New_Font_Line_Spacing.	Pass / Fail (Section 3.5.1.3.4)	
34	FOR EACH value, N, for numbers in the array New_Character_Numbers, perform Steps 34.1 through 34.3.		
34.1	GET the following object(s): »characterWidth.Font_Index.New_Character_Numbers[N] »characterBitmap.Font_Index.New_Character_Numbers[N]	Pass / Fail (Section 3.5.1.3.4)	Section 4.2.2.1 Step d
34.2	VERIFY that the RESPONSE VALUE for characterWidth.Font_Index.New_Character_Numbers[N] is equal to New_Character_Widths[N].	Pass / Fail (Section 3.5.1.3.4)	

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34.3	VERIFY that the RESPONSE VALUE for characterBitmap.Font_Index.New_Character_Numbers[N] is equal to New_Character_Bitmaps[N].	Pass / Fail (Section 3.5.1.3.4)	
35	POST-CONDITION: A font has been configured in the sign.		

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.2.6 Attempt to Configure a Font that is In Use

Test Case: 2.6	**Title:**	**Attempt to Configure a Font that is In Use**
	Description:	This test case verifies that the DMS does not allow configuration of a font if it is being used by the currently displayed message.
	Variables:	Subject_Font — From the Test Plan Font_Msg_Type — From the Test Plan Font_Msg_Number — From the Test Plan Font_Msg_Multi — From the Test Plan Font_Error_Height — From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the index of the font to be configured (from the test plan). RECORD this information as: »Subject_Font Note: The font is required to have characters that are able to be displayed on the sign.		
2	CONFIGURE: Determine the message (e.g., from the test plan) that shall be used to display at least one character of the subject font. RECORD this information as: »Font_Msg_Type (the memory type used to store the message) »Font_Msg_Number (the message number used to store the message) »Font_Msg_Multi (the MULTI string containing the character(s)) Note: Either the default font shall be set to the Subject_Font or the message shall contain a font tag referencing the Subject Font.		
3	CONFIGURE: Determine the font height to be requested (from the test plan). RECORD this information as: »Font_Error_Height		
4	SET-UP: PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Font_Msg_Type »Msg_Number = Font_Msg_Number »Msg_Multi_String = Font_Msg_MultiString »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Run_Time_Priority = 255 »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.3.3)	

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5	SET-UP: PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Font_Msg_Type »Msg_Number = Font_Msg_Number »Msg_Multi_String = Font_Msg_MultiString »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
6	SET-UP: GET the following object(s): »fontHeight.Subject_Font		
7	Determine the RESPONSE VALUE for fontHeight.Subject_Font. RECORD this information as: »Original_Font_Height		
8	GET the following object(s): »fontStatus.Subject_Font	Pass / Fail (Section 3.5.1.3.5)	
9	VERIFY that the RESPONSE VALUE for fontStatus.Subject_Font is equal to 'inUse' (5). Note: Valid enumerated values are defined in Section 5.4.2.8 (Font Status Parameter).	Pass / Fail (Section 3.5.1.3.5)	
10	SET the following object(s) to the value(s) shown: »fontStatus.Subject_Font = 'modifyReq' (7)	Pass / Fail (Section 3.5.1.3.5)	Section 4.2.2.2 Step c
11	VERIFY that the set fails and the RESPONSE ERROR is equal to 'badValue' (3).	Pass / Fail (Section 3.5.1.3.5)	Section 4.2.2.2 Step b
12	GET the following object(s): »fontStatus.Subject_Font	Pass / Fail (Section 3.5.1.3.5)	
13	VERIFY that the RESPONSE VALUE for fontStatus.Subject_Font is equal to 'inUse' (5).	Pass / Fail (Section 3.5.1.3.5)	
14	SET the following object(s) to the value(s) shown: »fontHeight.Subject_Font = Font_Error_Height	Pass / Fail (Section 3.5.1.3.5)	
15	VERIFY that the RESPONSE ERROR is equal to 'genError'.	Pass / Fail (Section 3.5.1.3.5)	Section 4.2.2.2 Step b
16	GET the following object(s): »fontHeight.Subject_Font	Pass / Fail (Section 3.5.1.3.5)	
17	VERIFY that the RESPONSE VALUE for fontHeight.Subject_Font is equal to Original_Font_Height.	Pass / Fail (Section 4.2.2.2 Step b)	
18	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

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C.3.2.7 Delete a Font

Test Case: 2.7	**Title:**	**Delete a Font**
	Description:	This test case verifies that the DMS allows the deletion of a font.
	Variables:	Deleted_Font — From the Test Plan Deleted_Char — From the Test Plan Deleted_Font_Msg_Type — From the Test Plan Deleted_Font_Msg_Number — From the Test Plan Deleted_Font_Msg_Multi — From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the index of the font to be deleted (from the test plan). RECORD this information as: »Deleted_Font Note: The Deleted_Font is required to be supported by the DMS and cannot have a status of 'permanent'.		
2	CONFIGURE: Determine the character number of the character that this test case shall use to verify that the font has been deleted (from the test plan). RECORD this information as: »Deleted_Char Note: The character is required to contain a non-zero width and a non-null bitmap.		
3	SET-UP: GET the following object(s): »characterWidth.Deleted_Font.Deleted_Char »characterBitmap.Deleted_Font.Deleted_Char		
4	SET-UP: VERIFY that the RESPONSE VALUE for characterWidth.Deleted_Font.Deleted_Char is not equal to 0.		
5	SET-UP: VERIFY that the RESPONSE VALUE for characterBitmap.Deleted_Font.Deleted_Char is not zero-length.		
6	IF the sign is a Version 1 sign, GOTO Step 7. IF the sign is a Version 2 sign, GOTO Step 6.1.		
6.1	SET-UP: GET the following object(s): »fontStatus.Deleted_Font		
6.2	SET-UP: VERIFY that the RESPONSE VALUE for fontStatus.Deleted_Font is equal to 'readyForUse' (4) or 'inUse' (5). Note: Valid enumerated values are defined in Section 5.4.2.8 (Font Status Parameter).		
7	SET-UP: GET the following object(s): »fontNumber.Deleted_Font		

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8	CONFIGURE: Determine the message (e.g., from the test plan) that shall be used to display at least one character of the font to be deleted. RECORD this information as: »Deleted_Font_Msg_Type (the memory type used to store the message) »Deleted_Font_Msg_Number (the message number used to store the message) »Deleted_Font_Msg_Multi (the MULTI string containing the character(s)) Note: The MULTI string is required to start with a font tag referencing the font number of the font to be deleted followed by a character or characters referenced in the font (e.g., '[fo1]A').		
9	SET-UP: PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Deleted_Font_Msg_Type »Msg_Number = Deleted_Font_Msg_Number »Msg_Multi_String = Deleted_Font_Msg_Multi »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.3.3)	
10	SET-UP: PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Deleted_Font_Msg_Type »Msg_Number = Deleted_Font_Msg_Number »Msg_Multi_String = Deleted_Font_Msg_Multi »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
11	SET-UP: VERIFY that the character or characters are properly displayed on the sign.		
12	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15). Note: The font can not be deleted when it is being used.	Pass / Fail (Section 3.5.2.3.1)	
13	IF the sign is a Version 1 sign, GOTO Step 13.1. IF the sign is a Version 2 sign, GOTO Step 14.		
13.1	SET the following object(s) to the value(s) shown: »fontHeight.Deleted_Font = 0	Pass / Fail (Section 3.5.1.3.6)	Section 4.2.2.3 Step f
13.2	GOTO Step 24.		
14	GET the following object(s): »fontStatus.Deleted_Font	Pass / Fail (Section 3.5.1.3.6)	Section 4.2.2.3 Step b
15	VERIFY that the RESPONSE VALUE for fontStatus.Deleted_Font is neither 'inUse' (5) nor 'permanent' (6). Note: If the RESPONSE VALUE for fontStatus.Deleted_Font is 'inUse', the test fails because the sign should be blank and not using the font. If the RESPONSE VALUE is 'permanent', the test fails since it does not meet the PRE-CONDITIONS of this test case.	Pass / Fail (Section 3.5.1.3.6)	
16	SET the following object(s) to the value(s) shown: »fontStatus.Deleted_Font = 'notUsedReq' (9)	Pass / Fail (Section 3.5.1.3.6)	Section 4.2.2.3 Step c

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17	GET the following object(s): »fontStatus.Deleted_Font	Pass / Fail (Section 3.5.1.3.6)	
18	VERIFY that the RESPONSE VALUE for fontStatus.Deleted_Font is equal to 'notUsed' (1).	Pass / Fail (Section 3.5.1.3.6)	Section 4.2.2.3 Step d
19	SET the following object(s) to the value(s) shown: »fontStatus.Deleted_Font = 'modifyReq' (7)	Pass / Fail (Section 3.5.1.3.6)	Section 4.2.2.3 Step e
20	SET the following object(s) to the value(s) shown: »fontHeight.Deleted_Font = 0	Pass / Fail (Section 3.5.1.3.6)	Section 4.2.2.3 Step f
21	SET the following object(s) to the value(s) shown: »fontStatus.Deleted_Font = 'notUsedReq' (9)	Pass / Fail (Section 3.5.1.3.6)	Section 4.2.2.3 Step g
22	GET the following object(s): »fontStatus.Deleted_Font	Pass / Fail (Section 3.5.1.3.6)	
23	VERIFY that the RESPONSE VALUE for fontStatus.Deleted_Font is equal to 'notUsed' (1).	Pass / Fail (Section 3.5.1.3.6)	
24	GET the following object(s): »characterWidth.Deleted_Font.Deleted_Char	Pass / Fail (Section 3.5.1.3.6)	
25	VERIFY that the RESPONSE ERROR is equal to 'noError' or 'noSuchName'.	Pass / Fail (Section 3.5.1.3.6)	
26	IF the RESPONSE ERROR is equal to ‘noSuchName’ GOTO Step 28.		
27	VERIFY that the RESPONSE VALUE for characterWidth.Deleted_Font.Deleted_Char is equal to 0.	Pass / Fail (Section 3.5.1.3.6)	
28	CONFIGURE: Determine the first and last positions in the MULTI string where the font error might be flagged. RECORD this information as: »Font_Error_Position_Min »Font_Error_Position_Max		
29	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Deleted_Font_Msg_Type »Msg_Number = Deleted_Font_Msg_Number »Msg_Multi_String = Deleted_Font_Message_Multi »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 8 (syntaxMULTI) »Expected_Multi_Error_Code = 6 (fontNotDefined) »Expected_Multi_Error_Pos_Min = Font_Error_Position_Min »Expected_Multi_Error_Pos_Max = Font_Error_Position_Max	Pass / Fail (Section 3.5.2.3.1)	
30	POST-CONDITION: The Deleted_Font has been deleted.		
31	POST-CONDITION: The Deleted_Font_Message_MultiString remains in the message table.		
32	Restore the font before continuing to another test.		

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

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C.3.2.8 Attempt to Delete a Font that is In Use

Test Case: 2.8	**Title:**	**Attempt to Delete a Font that is In Use**
	Description:	This test case verifies that the DMS does not allow the deletion of a font that is being used in a message that is currently displayed on the sign.
	Variables:	Font_Index — From the Test Plan Char_Number — From the Test Plan Font_Message_Type — From the Test Plan Font_Message_Number — From the Test Plan Font_Message_MultiString — From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the font index of the font to be deleted (from the test plan). RECORD this information as: »Font_Index Note: The Font_Index is required to be supported by the DMS and cannot have a status of 'permanent', 'notUsed', or 'modifying'.		
2	CONFIGURE: Determine the character number of the character that this test case shall use to verify that the font deletion failed (from the test plan). RECORD this information as: »Char_Number		
3	CONFIGURE: Determine the message to be displayed that uses the Char_Number of the subject font to prevent the font from being deleted (e.g. from the test plan). RECORD this information as: »Font_Message_Type (the number of the message memory type in which the message shall be stored) »Font_Message_Number (the message number in which the message shall be stored) »Font_Message_MultiString (a simple valid MULTI string that contains the character from the font to be deleted)		
4	SET-UP: GET the following object(s): »characterWidth.Font_Index.Char_Number »characterBitmap.Font_Index.Char_Number		
5	SET-UP: VERIFY that the RESPONSE VALUE for characterWidth.Font_Index.Char_Number is not equal to 0.		
6	SET-UP: VERIFY that the RESPONSE VALUE for characterBitmap.Font_Index.Char_Number is not zero-length.		
7	SET-UP: PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Font_Message_Type »Msg_Number = Font_Message_Number »Msg_Multi_String = Font_Message_MultiString »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.3.3)	

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8	SET-UP: PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Font_Message_Type »Msg_Number = Font_Message_Number »Msg_Multi_String = Font_Message_MultiString »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
9	SET-UP: VERIFY that the character corresponding to Char_Number is displayed on the sign as a part of the Font_Message_MultiString.		
10	GET the following object(s): »fontStatus.Font_Index	Pass / Fail (Section 3.5.1.3.6)	
11	VERIFY that the RESPONSE VALUE for fontStatus.Font_Index is equal to 'inUse' (5). Note: Valid enumerated values are defined in Section 5.4.2.8 (Font Status Parameter).	Pass / Fail (Section 3.5.1.3.6)	
12	SET the following object(s) to the value(s) shown: »fontStatus.Font_Index = 'notUsedReq' (9)	Pass / Fail (Section 3.5.1.3.6)	Section 4.2.2.3 Step c
13	VERIFY that the set fails and the RESPONSE ERROR is equal to ‘badValue’ (3).	Pass / Fail (Section 3.5.1.3.6)	Section 4.2.2.3 Step b
14	GET the following object(s): »fontStatus.Font_Index	Pass / Fail (Section 3.5.1.3.4)	Section 4.2.2.1 Step b
15	VERIFY that the RESPONSE VALUE for fontStatus.Font_Index is equal to 'inUse' (5).	Pass / Fail (Section 3.5.1.3.4)	Section 4.2.2.1 Step b
16	GET the following object(s): »characterWidth.Font_Index.Char_Number »characterBitmap.Font_Index.Char_Number	Pass / Fail (Section 3.5.1.3.4)	Section 4.2.2.1 Step d
17	VERIFY that the RESPONSE VALUE for characterWidth.Font_Index.Char_Number is not equal to 0.	Pass / Fail (Section 3.5.1.3.6)	
18	VERIFY that the RESPONSE VALUE for characterBitmap.Font_Index.Char_Number is not zero-length.	Pass / Fail (Section 3.5.1.3.6)	
19	VERIFY that the character corresponding to Char_Number is displayed on the sign as a part of the Font_Message_MultiString.	Pass / Fail (Section 3.5.1.3.6)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.3 Graphic Tests

C.3.3.1 Determine Maximum Number of Graphics

Test Case: 3.1	**Title:**	**Determine Maximum Number of Graphics**	
	Description:	This test case verifies that the DMS indicates that it supports the number of graphics required by the specification.	
	Variables:	Required_Graphics	PRL 3.6.11.1
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

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Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the number of graphics required by the specification (PRL 3.6.11.1). RECORD this information as: »Required_Graphics		
2	GET the following object(s): »dmsGraphicMaxEntries.0 »dmsGraphicNumEntries.0	Pass / Fail (Section 3.5.1.4.1)	
3	VERIFY that the RESPONSE VALUE for dmsGraphicMaxEntries.0 is greater than or equal to Required_Graphics.	Pass / Fail (Section 3.6.11.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.3.2 Determine Maximum Graphic Size

Test Case: 3.2	**Title:**	**Determine Maximum Graphic Size**	
	Description:	This test case verifies that the DMS indicates that it supports graphics of the size required by the specification.	
	Variables:	Required_Graphic_Size	PRL 2.5.1.4 / 3.5.1.4.2
		Required_Graphic_Block_Size	PRL 2.5.1.4 / 3.5.1.4.2
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the size of graphic and the size of a graphic block that the DMS is required to support according to the specification. RECORD this information as: »Required_Graphic_Size »Required_Graphic_Block_Size Note: The specification should specify the size of graphics and block size that the sign should support; however, the PRL does not request this information.		
2	GET the following object(s): »dmsGraphicMaxSize.0 »dmsGraphicBlockSize.0	Pass / Fail (Section 3.5.1.4.2)	
3	VERIFY that the RESPONSE VALUE for dmsGraphicMaxSize.0 is greater than or equal to Required_Graphic_Size.	Pass / Fail (PRL 2.5.1.4 / 3.5.1.4.2)	
4	VERIFY that the RESPONSE VALUE for dmsGraphicBlockSize.0 is greater than or equal to Required_Graphic_Block_Size.	Pass / Fail (PRL 2.5.1.4 / 3.5.1.4.2)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

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C.3.3.3 Determine Available Graphics Memory

Test Case: 3.3	**Title:**	**Determine Available Graphics Memory**
	Description:	This test case verifies that the DMS indicates that it supports the amount of graphics memory required by the specification and that the DMS reports an accurate value for available memory.
	Variables:	Required_Graphic_Memory — PRL 3.6.11.2 Test_Graphic_Index — From the Test Plan Test_Graphic_Number — From the Test Plan Test_Graphic_Name — From the Test Plan Test_Graphic_Height — From the Test Plan Test_Graphic_Width — From the Test Plan Test_Graphic_Type — From the Test Plan Test_Graphic_Transparent — From the Test Plan Test_Graphic_Transparent_Color — From the Test Plan Test_Graphic_Image — From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the programmable graphic memory required by the specification (PRL 3.6.11.2). RECORD this information as: »Required_Graphic_Memory		
2	CONFIGURE: Determine the graphic to be displayed (e.g., from the test plan). RECORD this information as: »Test_Graphic_Index (the index of the graphic to be stored) »Test_Graphic_Number (the number used to reference the graphic within a message) »Test_Graphic_Name (the name of the graphic) »Test_Graphic_Height (the height of the graphic in pixels) »Test_Graphic_Width (the width of the graphic in pixels) »Test_Graphic_Type (the enumerated value indicating the type of the graphic) »Test_Graphic_Transparent (0 if there is no transparent color; 1 if there is a transparent color) »Test_Graphic_Transparent_Color (The encoded transparent color, if transparency is enabled) »Test_Graphic_Image (the encoded byte stream of the graphic according to the encoding rules defined for the Test_Graphic_Type) Note: Valid enumerated values for Test_Graphic_Type are defined in Section 5.12.6.6 (Graphic Type Parameter)		
3	SET-UP: Calculate the size of the Test_Graphic_Image defined in Step 2. RECORD this information as: »Test_Graphic_Size		
4	SET-UP: VERIFY that the Test_Graphic_Size is less than or equal to Required_Graphic_Memory.		
5	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15). Note: The sign is blanked to ensure that no graphics are being displayed, which would prevent their being deleted.	Pass / Fail (Section 3.5.2.3.1)	
6	GET the following object(s): »dmsGraphicMaxEntries.0	Pass / Fail (Section 3.5.1.4.1)	

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7	RECORD the RESPONSE VALUE for dmsGraphicMaxEntries.0 as: »Actual_Graphic_Entries		
8	FOR EACH value, N, from 1 to Actual_Graphic_Entries, perform Steps 8.1 through 8.2.		
8.1	SET-UP: GET the following object(s): »dmsGraphicStatus.N »dmsGraphicID.N		
8.2	IF the RESPONSE VALUE for dmsGraphicStatus.N does not equal 'permanent' (6), then GOTO Step 8.2.1; otherwise, GOTO Step 9. Note: Valid enumerated values are defined in Section 5.12.6.10 (Graphic Status Parameter)		
8.2.1	VERIFY that the RESPONSE VALUE for dmsGraphicStatus.N is not 'inUse' (5).	Pass / Fail	
8.2.2	SET the following object(s) to the value(s) shown: »dmsGraphicStatus.N = 'notUsedReq' (9)		
9	GET the following object(s): »dmsGraphicNumEntries.0 »availableGraphicMemory.0	Pass / Fail (Section 3.5.1.4.3)	
10	VERIFY that the RESPONSE VALUE for dmsGraphicNumEntries.0 is equal to 0.	Pass / Fail (3.5.1.4.1)	
11	VERIFY that the RESPONSE VALUE for availableGraphicMemory.0 is greater than or equal to Required_Graphic_Memory.	Pass / Fail (Section 3.6.11.2)	
12	RECORD the RESPONSE VALUE for availableGraphicMemory.0 as: »Supported_Graphic_Memory		
13	PERFORM the test procedure labeled 'Store a Graphic Definition' (C.3.14.3) with the following parameters: »Test_Graphic_Index = Test_Graphic_Index »Test_Graphic_Number = Test_Graphic_Number »Test_Graphic_Name = Test_Graphic_Name »Test_Graphic_Height = Test_Graphic_Height »Test_Graphic_Width = Test_Graphic_Width »Test_Graphic_Type = Test_Graphic_Type »Test_Graphic_Transparent = Test_Graphic_Transparent »Test_Graphic_Transparent_Color = Test_Graphic_Transparent_Color »Test_Graphic_Image = Test_Graphic_Image	Pass / Fail (Section 3.5.1.4.5)	
14	GET the following object(s): »dmsGraphicNumEntries.0 »availableGraphicMemory.0	Pass / Fail (Section 3.5.1.4.3)	
15	VERIFY that the RESPONSE VALUE for dmsGraphicNumEntries.0 is equal to 1.	Pass / Fail (Section 3.5.1.4.1)	
16	VERIFY that the RESPONSE VALUE for availableGraphicMemory.0 is less than Supported_Graphic_Memory.	Pass / Fail (Section 3.5.1.4.3)	
17	SET the following object(s) to the value(s) shown: »dmsGraphicStatus.N = 'notUsedReq' (9)	Pass / Fail (Section 3.5.1.4.6)	
18	GET the following object(s): »dmsGraphicStatus.N »dmsGraphicNumEntries.0 »availableGraphicMemory.0	Pass / Fail (Section 3.5.1.4.3)	
19	VERIFY that the RESPONSE VALUE for dmsGraphicStatus.N is equal to ‘notUsed’ (1).	Pass / Fail (Section 3.5.1.4.6)	
20	VERIFY that the RESPONSE VALUE for dmsGraphicNumEntries.0 is equal to 0.	Pass / Fail (3.5.1.4.1)	

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21	VERIFY that the RESPONSE VALUE for availableGraphicMemory.0 is greater than or equal to Required_Graphic_Memory.	Pass / Fail (Section 3.6.11.2)	
22	POST-CONDITION: All previous graphics were deleted from memory.		

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

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C.3.3.4 Retrieve a Graphic Definition

Test Case: 3.4	Title:	Retrieve a Graphic Definition	
	Description:	This test case verifies that the DMS returns the definition of a specified graphic and ensures that the CRC value reported is correct and that the graphic displays as configured.	
	Variables:	Subject_Graphic	From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the index of the graphic to be retrieved (from the test plan). RECORD this information as: »Subject_Graphic		
2	GET the following object(s): »dmsGraphicMaxEntries.0	Pass / Fail (Section 3.5.1.4.1)	
3	SET-UP: VERIFY that the RESPONSE VALUE for dmsGraphicMaxEntries.0 is greater than or equal to Subject_Graphic.		Section 4.2.2.5 Step a
4	GET the following object(s): »dmsGraphicMaxSize.0 »dmsGraphicBlockSize.0	Pass / Fail (Section 3.5.1.4.2)	Section 4.2.2.5 Step b
5	RECORD the RESPONSE VALUE for dmsGraphicBlockSize.0 as: »Block_Size		
6	GET the following object(s): »dmsGraphicStatus.Subject_Graphic	Pass / Fail (Section 3.5.1.4.4)	Section 4.2.2.5 Step c
7	SET-UP: VERIFY that the RESPONSE VALUE for dmsGraphicStatus.Subject_Graphic is equal to none of the following: 'notUsed' (1), 'modifying' (2), or 'calculatingID' (3). Note: If the RESPONSE VALUE for dmsGraphicStatus.Subject_Graphic is 'notUsed' (1), 'modifying' (2), or 'calculatingID' (3) then restart this test case with a valid graphic. If none are present on the DMS, a graphic can be stored on the DMS using the test case labeled 'Store a Graphic Definition'. Note: Valid enumerated values are defined in Section 5.12.6.10 (Graphic Status Parameter)		Section 4.2.2.5 Step c
8	GET the following object(s): »dmsGraphicNumber.Subject_Graphic »dmsGraphicName.Subject_Graphic »dmsGraphicHeight.Subject_Graphic »dmsGraphicWidth.Subject_Graphic »dmsGraphicType.Subject_Graphic »dmsGraphicTransparentEnabled.Subject_Graphic »dmsGraphicTransparentColor.Subject_Graphic	Pass / Fail (Section 3.5.1.4.4)	Section 4.2.2.5 Step d
9	RECORD the RESPONSE VALUE for Subject_Graphic, dmsGraphicHeight.Subject_Graphic, dmsGraphicWidth.Subject_Graphic, and dmsGraphicType.Subject_Graphic as: »Retrieved_Graphic_Number »Retrieved_Graphic_Height »Retrieved_Graphic_Width »Retrieved_Graphic_Type		

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10	Calculate the number of blocks necessary to retrieve the graphic. RECORD this information as: »Number_Blocks Ntoe: See Section 5.12.7 (Graphics Bitmap Table Parameter) for the rules on how to calculate the number of blocks.		
11	FOR EACH value, N, from 1 to Number_Blocks, perform Steps 11.1 through 11.2.		
11.1	GET the following object(s): »dmsGraphicBlockBitmap.Subject_Graphic.N	Pass / Fail (Section 3.5.1.4.4)	Section 4.2.2.5 Step e
11.2	RECORD the RESPONSE VALUE for dmsGraphicBlockBitmap.SubjectGraphic.N as: »Retrieved_Graphic[N]		
12	Calculate what the graphic should look like based on the retrieved values (in plain text). RECORD this information as: »Expected_Graphic		
13	RECORD the Message Type, Message Number and MULTI string that shall display the graphic as: »Msg_Type »Msg_Number »Graphic_Multi Note: Graphic_Multi is required to include a graphic tag “[gx]”, where x is Retrieved_Graphic_Number.		
14	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Graphic_Multi »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
15	VERIFY that the graphic displayed on the sign is consistent with Expected_Graphic.	Pass / Fail (Section 3.5.1.4.4)	
16	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

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C.3.3.5 Store a Graphic Definition

Test Case: 3.5	Title:	Store a Graphic Definition	
	Description:	This test case verifies that the DMS allows a graphic to be defined within the controller and that it displays as configured.	
	Variables:	Test_Graphic_Index	From the Test Plan
		Test_Graphic_Number	From the Test Plan
		Test_Graphic_Name	From the Test Plan
		Test_Graphic_Height	From the Test Plan
		Test_Graphic_Width	From the Test Plan
		Test_Graphic_Type	From the Test Plan
		Test_Graphic_Transparent	From the Test Plan
		Test_Graphic_Transparent_Color	From the Test Plan
		Test_Graphic_Image	From the Test Plan
		Graphic_Message_Type	From the Test Plan
		Graphic_Message_Number	From the Test Plan
		Graphic_Message_Multi	From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the graphic to be displayed (e.g., from the test plan). RECORD this information as: »Test_Graphic_Index (the index of the graphic to be stored) »Test_Graphic_Number (the number used to reference the graphic within a message) »Test_Graphic_Name (the name of the graphic) »Test_Graphic_Height (the height of the graphic in pixels) »Test_Graphic_Width (the width of the graphic in pixels) »Test_Graphic_Type (the enumerated value indicating the type of the graphic) »Test_Graphic_Transparent (0 if there is no transparent color; 1 if there is a transparent color) »Test_Graphic_Transparent_Color (The encoded transparent color, if transparency is enabled) »Test_Graphic_Image (the encoded byte stream of the graphic according to the encoding rules defined for the Test_Graphic_Type) Note: Valid enumerated values for Test_Graphic_Type are defined in Section 5.12.6.6 (Graphic Type Parameter)		
4	PERFORM the test procedure labeled 'Store a Graphic Definition' (C.3.14.3) with the following parameters: »Test_Graphic_Index = Test_Graphic_Index »Test_Graphic_Number = Test_Graphic_Number »Test_Graphic_Name = Test_Graphic_Name »Test_Graphic_Height = Test_Graphic_Height »Test_Graphic_Width = Test_Graphic_Width »Test_Graphic_Type = Test_Graphic_Type »Test_Graphic_Transparent = Test_Graphic_Transparent »Test_Graphic_Transparent_Color = Test_Graphic_Transparent_Color »Test_Graphic_Image = Test_Graphic_Image	Pass / Fail (3.5.1.4.5)	

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5	CONFIGURE: Determine the message to be used to display the graphic on the sign (e.g., from the test plan). RECORD this information as: »Graphic_Message_Type (the type of message memory in which to store the message containing the graphic) »Graphic_Message_Number (the message number in which to store the message containing the graphic) »Graphic_Message_Multi (the MULTI string that shall display the sample graphic)		
6	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Graphic_Message_Type »Msg_Number = Graphic_Message_Number »Msg_Multi_String = Graphic_Message_Multi »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
7	VERIFY that the graphic is properly displayed on the DMS sign face.	Pass / Fail (Section 3.5.1.4.5)	
8	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	
9	POST-CONDITION: A graphic is stored in the sign.		

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.3.6 Attempt to Store a Graphic Definition when Graphic is In Use

Test Case: 3.6	**Title:**	**Attempt to Store a Graphic Definition when Graphic is In Use**	
	Description:	This test case verifies that the DMS does not allow a graphic to be redefined within the controller when the graphic is in use.	
	Variables:	Test_Graphic_Index	From the Test Plan
		Test_Graphic_Number	From the Test Plan
		Test_Graphic_Name	From the Test Plan
		Test_Graphic_Height	From the Test Plan
		Test_Graphic_Width	From the Test Plan
		Test_Graphic_Type	From the Test Plan
		Test_Graphic_Transparent	From the Test Plan
		Test_Graphic_Transparent_Color	From the Test Plan
		Test_Graphic_Image	From the Test Plan
		Graphic_Message_Type	From the Test Plan
		Graphic_Message_Number	From the Test Plan
		Graphic_Message_Multi	From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

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Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the index of the graphic to be tested (from the test plan). RECORD this information as: »Test_Graphic_Index		
2	SET-UP: PERFORM the test procedure labeled 'Store a Graphic Definition' (C.3.14.3) with the following parameters: »Test_Graphic_Index = Test_Graphic_Index »Test_Graphic_Number = Test_Graphic_Number »Test_Graphic_Name = Test_Graphic_Name »Test_Graphic_Height = Test_Graphic_Height »Test_Graphic_Width = Test_Graphic_Width »Test_Graphic_Type = Test_Graphic_Type »Test_Graphic_Transparent = Test_Graphic_Transparent »Test_Graphic_Transparent_Color = Test_Graphic_Transparent_Color »Test_Graphic_Image = Test_Graphic_Image	Pass / Fail (Section 3.5.1.4.5)	
3	SET-UP: PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Graphic_Message_Type »Msg_Number = Graphic_Message_Number »Msg_Multi_String = Graphic_Message_Multi »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
4	GET the following object(s): »dmsGraphicStatus.Test_Graphic_Index	Pass / Fail (Section 3.5.1.4.5)	
5	VERIFY that the RESPONSE VALUE for dmsGraphicStatus.Test_Graphic_Index is equal to 'inUse' (5). Note: Valid enumerated values are defined in Section 5.12.6.10 (Graphic Status Parameter).	Pass / Fail (Section 4.3.2.5)	Section 4.2.2.6 Step c
6	SET the following object(s) to the value(s) shown: »dmsGraphicStatus.Test_Graphic_Index = 'modifyReq' (7)	Pass / Fail (Section 3.5.1.4.5)	Section 4.2.2.6 Step d
7	VERIFY that the RESPONSE ERROR is equal to 'badValue' (3).	Pass / Fail (Section 4.3.2.5 Rule a)	
8	GET the following object(s): »dmsGraphicStatus.Test_Graphic_Index	Pass / Fail (Section 3.5.1.4.5)	
9	VERIFY that the RESPONSE VALUE for dmsGraphicStatus.Test_Graphic_Index is equal to 'inUse' (5).	Pass / Fail (Section 4.3.2.5)	
10	SET the following object(s) to the value(s) shown: »dmsGraphicHeight.Test_Graphic_Index = 1	Pass / Fail (Section 4.2.2.6 Step f)	
11	VERIFY that the RESPONSE ERROR is equal to 'genError'.	Pass / Fail (Section 4.3.2.5 Rule b)	
12	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	
13	POST-CONDITION: A graphic is stored in the sign.		

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**

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Test Case Notes:

C.3.3.7 Delete a Graphic

Test Case: 3.7	**Title:**	**Delete a Graphic**	
	Description:	This test case verifies that the DMS allows the deletion of a graphic and that messages that reference this graphic are no longer valid.	
	Variables:	Graphic_Message_Multi	From the Test Plan
		Graphic_Message_Type	From the Test Plan
		Graphic_Message_Number	From the Test Plan
		Test_Graphic_Index	From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the message type, message number, and message MULTI string to use when attempting to display the deleted graphic, along with the index of the graphic to be deleted. RECORD this information as: »Graphic_Message_Type (the type of message memory in which to store the message containing the graphic) »Graphic_Message_Number (the number in which to store the message containing the graphic) »Graphic_Message_Multi (the MULTI string that shall display the sample graphic) »Test_Graphic_Index (the index of the graphic to be deleted) Note: The graphic cannot be permanent.		
2	SET-UP: IF the graphic has not been stored in the controller, PERFORM the test case labeled 'Store a Graphic Definition' (C.3.3.5) Note: This step ensures a graphic is stored in memory.		Section 4.2.2.7 Step a
3	SET-UP: PERFORM the test case labeled 'Blank the Sign' (C.3.7.15). Note: This step ensures that the graphic is not displayed on the sign face so that it may be deleted.	Pass / Fail (Section 3.5.2.3.1)	
4	GET the following object(s): »dmsGraphicBlockSize.0 »dmsGraphicMaxSize.0	Pass / Fail (Section 3.5.1.4.2)	
5	RECORD the RESPONSE VALUE for dmsGraphicBlockSize.0 as: »Block_Size		
6	GET the following object(s): »dmsGraphicStatus.Test_Graphic_Index	Pass / Fail (Section 3.5.1.4.6)	
7	VERIFY that the RESPONSE VALUE for dmsGraphicStatus.Test_Graphic_Index is neither 'inUse' (5) nor 'permanent' (6). Note: Valid enumerated values are defined in Section 5.12.6.10 (Graphic Status Parameter).	Pass / Fail (Section 3.5.1.4.6)	Section 4.2.2.7 Step b
8	GET the following object(s): »availableGraphicMemory.0	Pass / Fail (RFC 1157)	
9	RECORD the RESPONSE VALUE for availableGraphicMemory.0 as: »Current_Graphic_Memory		
10	SET the following object(s) to the value(s) shown: »dmsGraphicStatus.Test_Graphic_Index = 'notUsedReq' (9)	Pass / Fail (Section 3.5.1.4.6)	Section 4.2.2.7 Step c

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11	GET the following object(s): »dmsGraphicStatus.Test_Graphic_Index	Pass / Fail (Section 3.5.1.4.6)	
12	VERIFY that the RESPONSE VALUE for dmsGraphicStatus.Test_Graphic_Index is equal to 'notUsed' (1).	Pass / Fail (Section 3.5.1.4.6)	Section 4.2.2.7 Step d
13	GET the following object(s): »dmsGraphicBlockBitmap.Test_Graphic_Index.1	Pass / Fail (RFC 1157)	
14	VERIFY that the RESPONSE VALUE for dmsGraphicBlockBitmap.Subject_Graphic.1 is a string of dmsGraphicBlockSize.0 octets, all of which have a value of zero (0).	Pass / Fail (Section 3.5.1.4.6)	
15	GET the following object(s): »availableGraphicMemory.0	Pass / Fail (RFC 1157)	
16	VERIFY that the RESPONSE VALUE for availableGraphicMemory.0 is greater than Current_Graphic_Memory.	Pass / Fail (Section 3.6.11.2)	
17	SET-UP: Calculate the message CRC value for the following information: MultiString = Graphic_Message_Multi, Beacon = 0, Pixel Service = 0. RECORD this information as: »Msg_CRC Note: Rules for calculating the CRC are defined in Section 5.6.8.5 (Message CRC Parameter).		
18	SET-UP: Determine the IP address of the computer that is sending the activation request. RECORD this information as: »Msg_Source		
19	SET-UP: Calculate the activation code for the message. RECORD this information as: »Msg_Activation_Code Note: Rules for calculating the activation code are defined in Section 5.1 (Dynamic Message Sign Objects).		
20	SET the following object(s) to the value(s) shown: »dmsActivateMessage.0 = Msg_Activation_Code	Pass / Fail (Section 3.5.2.3.1)	
21	VERIFY that the RESPONSE ERROR is equal to 'genError'.		
22	GET the following object(s): »dmsActivateMsgError.0 »dmsActivateErrorMsgCode.0	Pass / Fail (Section 3.5.2.3.1)	
23	VERIFY that the RESPONSE VALUE for dmsActivateMsgError.0 is equal to 'syntaxMULTI' (8). Note: Valid enumerated values are defined in Section 5.7.17 (Activate Message Error Parameter).	Pass / Fail (Section 3.5.1.4.6)	
24	VERIFY that the RESPONSE VALUE for dmsActivateErrorMsgCode.0 is equal to Msg_Activation_Code. Note: Valid enumerated values are defined in Section 5.7.24 (Message Code of Activation Error Parameter).	Pass / Fail (Section 3.5.2.3.1)	
25	GET the following object(s): »dmsMultiSyntaxError.0 »dmsMultiSyntaxErrorPosition.0	Pass / Fail (Section 3.5.2.3.1)	
26	VERIFY that the RESPONSE VALUE for dmsMultiSyntaxError.0 is equal to 'graphicNotDefined' (15). Note: Valid enumerated values are defined in Section 5.7.18 (MULTI Syntax Error Parameter).	Pass / Fail (Section 3.5.1.4.6)	
27	VERIFY that the RESPONSE VALUE for dmsMultiSyntaxErrorPosition.0 is equal to the position in the MULTI string where the graphic is referenced.	Pass / Fail (Section 3.5.2.3.1)	

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Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

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C.3.3.8 Attempt to Delete a Graphic when Graphic is In Use

Test Case: 3.8	**Title:**	Attempt to Delete a Graphic when Graphic is In Use	
	Description:	This test case verifies that the DMS does not allow a graphic to be deleted within the controller when the graphic is in use.	
	Variables:	Graphic_Message_Type	From the Test Plan
		Graphic_Message_Number	From the Test Plan
		Graphic_Message_Multi	From the Test Plan
		Test_Graphic_Index	From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the message type, message number, and message MULTI string to use to display the graphic, along with the index of the graphic to be deleted. RECORD this information as: »Graphic_Message_Type (the type of message memory in which to store the message containing the graphic) »Graphic_Message_Number (the number in which to store the message containing the graphic) »Graphic_Message_Multi (a MULTI string that includes a graphic tag that references the Test Graphic) »Test_Graphic_Index (the index of the graphic to be deleted) Note: The graphic cannot be permanent.		
2	SET-UP: IF the graphic has not been stored in the controller, PERFORM the test case labeled 'Store a Graphic Definition' (C.3.3.5) Note: This step ensures a graphic is stored in memory.		
3	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Graphic_Message_Type »Msg_Number = Graphic_Message_Number »Msg_Multi_String = Graphic_Message_Multi »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
4	SET-UP: GET the following object(s): »dmsGraphicStatus.Test_Graphic_Index		
5	SET-UP: VERIFY that the RESPONSE VALUE for dmsGraphicStatus.Test_Graphic_Index is equal to 'inUse' (5). Note: Valid enumerated values are defined in Section 5.12.6.10 (Graphic Graphic Status Parameter).		
6	SET the following object(s) to the value(s) shown: »dmsGraphicStatus.Test_Graphic_Index = 'notUsedReq' (9)		Section 4.2.2.7 Step c
7	VERIFY that the RESPONSE ERROR is equal to 'badValue' (3).	Pass / Fail (Section 4.3.2.5 Rule a)	

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8	GET the following object(s): »dmsGraphicStatus.Test_Graphic_Index »dmsGraphicHeight.Test_Graphic_Index RECORD the RESPONSE VALUE for dmsGraphicHeight.Test_Graphic_Index as Test_Graphic_Height.	Pass / Fail (Section 3.5.1.4.4)	
9	VERIFY that the RESPONSE VALUE for dmsGraphicStatus.Test_Graphic_Index is equal to 'inUse' (5).	Pass / Fail (Section 4.3.2.5)	
10	SET the following object(s) to the value(s) shown: »dmsGraphicStatus.Test_Graphic_Index = 'modifyReq' (7)		Section 4.2.2.6 Step d
11	VERIFY that the RESPONSE ERROR is equal to 'badValue' (3).	Pass / Fail (Section 4.3.2.5 Rule a)	
12	GET the following object(s): »dmsGraphicStatus.Test_Graphic_Index	Pass / Fail (Section 3.5.1.4.4)	
13	VERIFY that the RESPONSE VALUE for dmsGraphicStatus.Test_Graphic_Index is equal to 'inUse' (5).	Pass / Fail (Section 4.3.2.5)	
14	SET the following object(s) to the value(s) shown: »dmsGraphicHeight.Test_Graphic_Index = 0		Section 4.2.2.6 Step f
15	VERIFY that the RESPONSE ERROR is equal to 'genError'.	Pass / Fail (Section 4.3.2.5 Rule b)	
16	GET the following object(s): »dmsGraphicHeight.Test_Graphic_Index	Pass / Fail (RFC 1157)	
17	VERIFY that the RESPONSE VALUE for dmsGraphicHeight.Test_Graphic_Index is equal to Test_Graphic_Height.	Pass / Fail (Section 4.3.2.5)	
18	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.3.9 Verify Validation of Graphic CRC Reference

Test Case: 3.9	**Title:**	**Verify Validation of Graphic CRC Reference**	
	Description:	This test case verifies that the DMS properly calculates the CRC value for a graphic and has the ability to accept the valid CRC value and reject an invalid value, if a message references a graphic with a CRC value.	
	Variables:	Test_Graphic_Index	From the Test Plan
		Test_Graphic_Number	From the Test Plan
		Test_Graphic_Name	From the Test Plan
		Test_Graphic_Height	From the Test Plan
		Test_Graphic_Width	From the Test Plan
		Test_Graphic_Type	From the Test Plan
		Test_Graphic_Transparent	From the Test Plan
		Test_Graphic_Transparent_Color	From the Test Plan
		Test_Graphic_Image	From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

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Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the graphic to be stored (e.g., from the test plan). RECORD this information as: »Test_Graphic_Index (the index of the graphic to be stored,) »Test_Graphic_Number (the number used to reference the graphic within a message,) »Test_Graphic_Name (the name of the graphic,) »Test_Graphic_Height (the height of the graphic in pixels,) »Test_Graphic_Width (the width of the graphic in pixels,) »Test_Graphic_Type (the enumerated value indicating the type of the graphic,) »Test_Graphic_Transparent (0 if there is no transparent color; 1 if there is a transparent color,) »Test_Graphic_Transparent_Color (The encoded transparent color, if transparency is enabled,) »Test_Graphic_Image (the encoded byte stream of the graphic according to the encoding rules defined for the Test_Graphic_Type) Note: Valid enumerated values for Test_Graphic_Type are defined in Section 5.12.6.6 (Graphic Type Parameter)		
2	SET-UP: PERFORM the test procedure labeled 'Store a Graphic Definition' (C.14.3) with the following parameters: »Test_Graphic_Index = Test_Graphic_Index »Test_Graphic_Number = Test_Graphic_Number »Test_Graphic_Name = Test_Graphic_Name »Test_Graphic_Height = Test_Graphic_Height »Test_Graphic_Width = Test_Graphic_Width »Test_Graphic_Type = Test_Graphic_Type »Test_Graphic_Transparent = Test_Graphic_Transparent »Test_Graphic_Transparent_Color = Test_Graphic_Transparent_Color »Test_Graphic_Image = Test_Graphic_Image		
3	GET the following object(s): »dmsGraphicBlockSize.0	Pass / Fail (Section 3.5.1.4.2)	
4	Determine the RESPONSE VALUE for dmsGraphicBlockSize.0. RECORD this information as: »Block_Size		
5	SET-UP: Calculate the CRC of the Test_Graphic. RECORD this information as: »Test_Graphic_CRC		Section 4.2.2.8 Step b
6	GET the following object(s): »dmsGraphicStatus.Test_Graphic_Index »dmsGraphicID.Test_Graphic_Index	Pass / Fail (Section 3.5.1.4.7)	Section 4.2.2.8 Step c
7	VERIFY that the RESPONSE VALUE for dmsGraphicsStatus.Test_Graphic_Index is equal to 'permanent' (6), ‘readyForUse' (4), or 'inUse' (5). Note: Valid enumerated values are defined in Section 5.12.6.10 (Graphic Graphic Status Parameter).	Pass / Fail (Section 3.5.1.4.7)	Section 4.2.2.8 Step d
8	VERIFY that the RESPONSE VALUE for dmsGraphicID.Test_Graphic_Index is equal to Test_Graphic_CRC.	Pass / Fail (Section 3.5.1.4.7)	Section 4.2.2.8 Step e

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

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C.3.4 Illumination Tests

C.3.4.1 Determine Maximum Number of Light Sensor Levels

Test Case: 4.1	Title:	Determine Maximum Number of Light Sensor Levels	
	Description:	This test case verifies that the DMS indicates that it supports the number of light sensor levels required by the specification.	
	Variables:	Required_Light_Sensor_Levels	PRL 3.6.3.3
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the number of light sensor levels as required by the project specification (PRL 3.6.3.3). RECORD this information as: »Required_Light_Sensor_Levels		
2	GET the following object(s): »dmsIllumMaxPhotocellLevel.0	Pass / Fail (Section 3.5.1.5.1)	
3	VERIFY that the RESPONSE VALUE for dmsIllumMaxPhotocellLevel.0 is greater than or equal to Required_Light_Sensor_Levels.	Pass / Fail (PRL 3.6.3.3)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.4.2 Determine Current Light Output Algorithm

Test Case: 4.2	Title:	Determine Current Light Output Algorithm	
	Description:	This test case verifies that the DMS allows a user to retrieve the current relationships between the detection of ambient light and the brightness of the sign and ensures that this relationship meets the requirements of the standard.	
	Variables:		
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	GET the following object(s): »dmsIllumBrightnessValues.0 »dmsIllumBrightnessValuesError.0	Pass / Fail (Section 3.5.1.5.3)	
2	VERIFY that the RESPONSE VALUE for dmsIllumBrightnessValues.0 does not contain a photocell level for which there is no corresponding lightOutput level (i.e., ensure no gaps). Note: The rules for decoding this object are defined in Section 5.8.7 (Illumination Brightness Values Parameter).	Pass / Fail (Section 3.5.1.5.3)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

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C.3.4.3 Determine Number of Brightness Levels

Test Case: 4.3	**Title:**	**Determine Number of Brightness Levels**	
	Description:	This test case verifies that the DMS indicates that it supports the number of brightness levels required by the specification.	
	Variables:	Required_Brightness_Levels	PRL 3.6.2.1
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the number of brightness levels as required by the project specification (PRL 3.6.2.1). RECORD this information as: »Required_Brightness_Levels		
2	GET the following object(s): »dmsIllumNumBrightLevels.0	Pass / Fail (Section 3.5.2.5.1)	
3	VERIFY that the RESPONSE VALUE for dmsIllumNumBrightLevels.0 is greater than or equal to Required_Brightness_Levels.	Pass / Fail (PRL 3.6.2.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.4.4 Verify Automatic Brightness Control

Test Case: 4.4	**Title:**	**Verify Automatic Brightness Control**	
	Description:	This test case verifies that the DMS automatically adjusts its brightness based on photocell readings and properly reports the observed photocell readings and current light output.	
	Variables:	Msg_Type	From the Test Plan
		Msg_Number	From the Test Plan
		Msg_Multi_String	From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	SET-UP: PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Msg_Multi_String »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 »Msg_Pixel_Service = 0 »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0 where, Msg_Type is any valid message type Msg_Number is any valid message number for the selected message type Msg_Multi_String is a valid MULTI string	Pass / Fail (Section 3.5.2.3.3.3)	

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2	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Msg_Multi_String »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
3	SET the following object(s) to the value(s) shown: »dmsIllumControl.0 = 'photocell' (2) Note: Valid enumerated values are defined in Section 5.8.1 (Illumination Control Parameter).	Pass / Fail (Section 3.5.2.5.6)	
4	DELAY for 10 seconds. Note: This step allows the sign to adjust its brightness output as needed to accommodate the current lighting levels.		
5	GET the following object(s): »dmsIllumPhotocellLevelStatus.0	Pass / Fail (Section 3.5.2.5.2)	
6	Determine the RESPONSE VALUE for dmsIllumPhotocellLevelStatus.0. RECORD this information as: »Original_Photocell_Level		
7	GET the following object(s): »dmsIllumMaxPhotocellLevel.0	Pass / Fail (Section 3.5.1.5.1)	
8	VERIFY that the RESPONSE VALUE for dmsIllumMaxPhotocellLevel.0 is greater than or equal to Original_Photocell_Level.	Pass / Fail (Section 3.5.2.5.2)	
9	SET-UP: Cover the photocell.		
10	DELAY for 10 seconds. Note: Allows the sign to adjust its light output level to the new lighting conditions.		
11	VERIFY by visual inspection that the display has become dimmer. Note: The brightness curve is defined by the Illumination Brightness Values Parameter, which is the subject of a separate test as its support is not mandatory.	Pass / Fail (Section 3.6.3.1)	
12	GET the following object(s): »dmsIllumPhotocellLevelStatus.0	Pass / Fail (Section 3.5.2.5.2)	
13	VERIFY that the RESPONSE VALUE for dmsIllumPhotocellLevelStatus.0 is less than Original_Photocell_Level.		
14	SET-UP: Uncover the photocell and shine a bright light upon the photocell.		
15	DELAY for 10 seconds. Note: Allows the sign to adjust its light output level to the new lighting conditions.		
16	VERIFY by visual inspection that the sign display has become brighter.	Pass / Fail (Section 3.6.3.1)	
17	GET the following object(s): »dmsIllumPhotocellLevelStatus.0	Pass / Fail (Section 3.5.2.5.2)	
18	VERIFY that the RESPONSE VALUE for dmsIllumPhotocellLevelStatus.0 is greater than Original_Photocell_Level.	Pass / Fail (Section 3.5.2.5.2)	

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19	SET-UP: Remove the light source from the sign.		
20	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.4.5 Verify Manual Direct Brightness Control

Test Case: 4.5	**Title:**	**Verify Manual Direct Brightness Control**
	Description:	This test case verifies that the DMS properly adjusts the light output of the display based upon the manual brightness setting.
	Variables:	Dim_Level — From the Test Plan Bright_Level — From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine a relatively dim brightness level for the sign between 0 and dmsIllumNumBrightLevels.0 (per the test plan). RECORD this information as: »Dim_Level		
2	CONFIGURE: Determine a relatively bright brightness level for the sign greater than Dim_Level but not more than dmsIllumNumBrightLevels.0 (per the test plan). RECORD this information as: »Bright_Level Note: The difference between Dim_Level and Bright_Level is required to be sufficient such that the tester can visually notice the difference between the dim and bright levels.		
3	SET-UP: GET the following object(s): »dmsIllumNumBrightLevels.0		
4	RECORD the RESPONSE VALUE for dmsIllumNumBrightLevels.0 as: »Num_Bright_Levels.		
5	SET-UP: VERIFY that the RESPONSE VALUE for dmsIllumNumBrightLevels.0 is greater than or equal to Dim_Level.		
6	SET-UP: VERIFY that the RESPONSE VALUE for dmsIllumNumBrightLevels.0 is greater than or equal to Bright_Level.		
7	SET-UP: VERIFY that Bright_Level is greater than Dim_Level.		

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8	SET-UP: PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Msg_Multi_String »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 »Msg_Pixel_Service = 0 »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0 where, Msg_Type is any valid message type Msg_Number is any valid message number for the selected message type Msg_Multi_String is a valid MULTI string	Pass / Fail (Section 3.5.2.3.3.3)	
9	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Msg_Multi_String »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
10	GET the following object(s): »dmsIllumBrightLevelStatus.0 »dmsIllumLightOutputStatus.0	Pass / Fail (RFC 1157)	Section 4.2.4.14 Step h
11	RECORD the RESPONSE VALUE for dmsIllumBrightLevelStatus.0 as: »Orig_Level		
12	RECORD the RESPONSE VALUE for dmsIllumLightOutputStatus.0 as: »Orig_Output		
13	IF the sign is a Version 1 sign, GOTO Step 13.1. IF the sign is a Version 2 sign, GOTO Step 13.2.		
13.1	SET the following object(s) to the value(s) shown: »dmsIllumControl.0 = 'manual' (4) Note: Valid enumerated values are defined in Section 5.8.1 (Illumination Control Parameter). GOTO Step 14.	Pass / Fail (Section 3.5.2.5.5)	Section 4.2.3.5 Step b
13.2	SET the following object(s) to the value(s) shown: »dmsIllumControl.0 = 'manualDirect' (5)	Pass / Fail (Section 3.5.2.5.3)	Section 4.2.3.5 Step b
14	VERIFY that the brightness of the sign did not change. Note: The mechanism used to perform this step is outside the scope of this test procedure. Sign brightness may be determined by specialized light meters, by visual observation (if light levels are sufficiently different), or by other means.	Pass / Fail (Section 3.5.2.5.3 or 3.5.2.5.5)	
15	GET the following object(s): »dmsIllumManLevel.0 »dmsIllumLightOutputStatus.0		

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16	VERIFY that the RESPONSE VALUE for dmsIllumManLevel.0 is equal to Orig_Level.	Pass / Fail (Section 3.5.2.5.3 or 3.5.2.5.5)	
17	VERIFY that the RESPONSE VALUE for dmsIllumLightOutputStatus.0 is equal to Orig_Output.	Pass / Fail (Section 3.5.2.5.3 or 3.5.2.5.5)	
18	SET the following object(s) to the value(s) shown: »dmsIllumManLevel.0 = Dim_Level	Pass / Fail (Section 3.5.2.5.3 or 3.5.2.5.5)	Section 4.2.3.5 Step c
19	VERIFY that the light output level of the sign display changed to the value of Dim_Level. Note: The mechanism used to perform this step is outside the scope of this test procedure. Sign brightness may be determined by specialized light meters, by visual observation (if light levels are sufficiently different), or by other means.	Pass / Fail (Section 4.2.3.5)	
20	GET the following object(s): »dmsIllumLightOutputStatus.0	Pass / Fail (RFC 1157)	
21	VERIFY that the RESPONSE VALUE for dmsIllumLightOutputStatus.0 / 65535 is approximately equal to Dim_Level / Num_Bright_Levels.	Pass / Fail (Section 3.5.2.5.3 or 3.5.2.5.5)	
22	SET the following object(s) to the value(s) shown: »dmsIllumManLevel.0 = Bright_Level	Pass / Fail (Section 3.5.2.5.3 or 3.5.2.5.5)	
23	VERIFY that the light output level of the sign display became brighter to the value of Bright_Level. Note: The mechanism used to perform this step is outside the scope of this test procedure. Sign brightness may be determined by specialized light meters, by visual observation (if light levels are sufficiently different), or by other means.	Pass / Fail (Section 4.2.3.5)	
24	GET the following object(s): »dmsIllumLightOutputStatus.0	Pass / Fail (RFC 1157)	
25	VERIFY that the RESPONSE VALUE for dmsIllumLightOutputStatus.0 / 65535 is approximately equal to Dim_Level / Num_Bright_Levels.	Pass / Fail (Section 3.5.2.5.3 or 3.5.2.5.5)	
26	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	
27	SET the following object(s) to the value(s) shown: »dmsIllumControl.0 = ‘photocell’ (2)		

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.4.6 Verify Manual Indexed Brightness Control

Test Case: 4.6	**Title:**	**Verify Manual Indexed Brightness Control**	
	Description:	This test case verifies that the DMS properly adjusts the light output of the display based upon the manual brightness setting.	
	Variables:	Dim_Level	Per the Test Plan
		Bright_Level	Per the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

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Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine a relatively dim brightness level for the sign between 0 and the number of rows in dmsIllumBrightnessValues.0 (per the test plan). RECORD this information as: »Dim_Level		
2	CONFIGURE: Determine a relatively bright brightness level for the sign greater than Dim_Level but not more than the number of rows in dmsIllumBrightnessValues.0 (per the test plan). RECORD this information as: »Bright_Level Note: The difference between Dim_Level and Bright_Level should be sufficient such that the tester can visually notice the difference between the dim and bright levels.		
3	SET-UP: GET the following object(s): »dmsIllumBrightnessValues.0		
4	RECORD the number of rows in the table (the one byte integer value at the beginning of dmsIllumBrightnessValues.0) as: »Num_Brightness_Values		
5	SET-UP: VERIFY that Num_Brightness_Values is greater than or equal to Dim_Level.		
6	SET-UP: VERIFY that Num_Brightness_Values is greater than or equal to Bright_Level.		
7	SET-UP: VERIFY that Bright_Level is greater than Dim_Level.		
8	SETUP: PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Msg_Multi_String »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 »Msg_Pixel_Service = 0 »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0 where, Msg_Type is any valid message type Msg_Number is any valid message number for the selected message type Msg_Multi_String is a valid MULTI string	Pass / Fail (Section 3.5.2.3.3.3)	
9	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Msg_Multi_String »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
10	GET the following object(s): »dmsIllumBrightLevelStatus.0 »dmsIllumLightOutputStatus.0	Pass / Fail (RFC 1157)	

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11	Determine the RESPONSE VALUE for dmsIllumBrightLevelStatus.0. RECORD this information as: »Orig_Level		
12	Determine the RESPONSE VALUE for dmsIllumLightOutputStatus.0. RECORD this information as: »Orig_Output		
13	IF the sign is a Version 1 sign, proceed to Step 13.1. IF the sign is a Version 2 sign, proceed to Step 13.2.		
13.1	SET the following object(s) to the value(s) shown: »dmsIllumControl.0 = 'manual' (4) Note: Valid enumerated values are defined in Section 5.8.1 (Illumination Control Parameter). Proceed to Step 14.	Pass / Fail (Section 3.5.2.5.5)	Section 4.2.3.5 Step b
13.2	SET the following object(s) to the value(s) shown: »dmsIllumControl.0 = 'manualIndexed' (6) Note: Valid enumerated values are defined in Section 5.8.1 (Illumination Control Parameter).	Pass / Fail (Section 3.5.2.5.4)	Section 4.2.3.5 Step b
14	VERIFY that the brightness of the sign did not change. Note: The mechanism used to perform this step is outside the scope of this test procedure. Sign brightness may be determined by specialized light meters, by visual observation (if light levels are sufficiently different), or by other means.	Pass / Fail (Section 3.5.2.5.4 or 3.5.2.5.5)	
15	GET the following object(s): »dmsIllumManLevel.0 »dmsIllumLightOutputStatus.0	Pass / Fail (RFC 1157)	
16	VERIFY that the RESPONSE VALUE for dmsIllumManLevel.0 is equal to Orig_Level.	Pass / Fail (Section 3.5.2.5.4 or 3.5.2.5.5)	
17	VERIFY that the RESPONSE VALUE for dmsIllumLightOutputStatus.0 is equal to Orig_Output.	Pass / Fail (Section 3.5.2.5.4 or 3.5.2.5.5)	
18	SET the following object(s) to the value(s) shown: »dmsIllumManLevel.0 = Dim_Level	Pass / Fail (Section 3.5.2.5.4 or 3.5.2.5.5)	Section 4.2.3.5 Step c
19	VERIFY that the light output level of the sign display changed to the value of Dim_Level. Note: The mechanism used to perform this step is outside the scope of this test procedure. Sign brightness may be determined by specialized light meters, by visual observation (if light levels are sufficiently different), or by other means.	Pass / Fail (Section 3.5.2.5.4 or 3.5.2.5.5)	
20	GET the following object(s): »dmsIllumBrightnessValues.0 »dmsIllumLightOutputStatus.0	Pass / Fail (RFC 1157)	
21	From the RESPONSE VALUE for dmsIllumBrightnessValues.0, determine the lightOutput value for the row that corresponds to Dim_Level. VERIFY that this value is approximately equal to the RESPONSE VALUE for dmsIllumLightOutputStatus.0.	Pass / Fail (Section 3.5.2.5.4 or 3.5.2.5.5)	
22	SET the following object(s) to the value(s) shown: »dmsIllumManLevel.0 = Bright_Level		

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23	VERIFY that the light output level of the sign display became brighter to the value of Bright_Level. Note: The mechanism used to perform this step is outside the scope of this test procedure. Sign brightness may be determined by specialized light meters, by visual observation (if light levels are sufficiently different), or by other means.	Pass / Fail (Section 3.5.2.5.4 or 3.5.2.5.5)	
24	GET the following object(s): »dmsIllumBrightnessValues.0 »dmsIllumLightOutputStatus.0	Pass / Fail (RFC 1157)	
25	From the RESPONSE VALUE for dmsIllumBrightnessValues.0, determine the lightOutput value for the row that corresponds to Bright_Level. VERIFY that this value is approximately equal to the RESPONSE VALUE for dmsIllumLightOutputStatus.0.	Pass / Fail (Section 3.5.2.5.4 or 3.5.2.5.5)	
26	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	
27	SET the following object(s) to the value(s) shown: »dmsIllumControl.0 = 'photocell' (2)		

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.4.7 Configure Brightness Curve

Test Case: 4.7	**Title:**	**Configure Brightness Curve**
	Description:	This test case verifies that the DMS allows the configuration of the brightness curve. Note: Although not explicitly mentioned in the standardized dialog, this test case assumes that the management station is aware of the maximum photocell level prior to configuring the brightness curve.
	Variables:	Brightness_Curve — From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the brightness curve to be used in the test (per the test plan). RECORD this information as: »Brightness_Curve Note: For example, one may want to use a two-point curve with the first setting at half brightness to cover the bottom half of photocell readings and the second setting at full brightness to address the top half of photocell readings. This would be encoded as: » Number of Levels: 2 = 0x02 » Light Output 1: half of maximum brightness = 0x7F FF » photocellLevelDown 1: 0x00 00 » photocellLevelUp 1: dmsIllumMaxPhotocellLevel.0 / 2, e.g., if dmsIllumMaxPhotocellLevel.0 is 65535, then the value would be 0x7F FF » Light Output 2: full brightness = 0xFF FF » photocellLevelDown 2: the photocellLevelUp 1 value + 1 = e.g., 0x80 00 » photocellLevelUp 2: dmsIllumMaxPhotocellLevel.0 = e.g., 0xFF FF » Thus, the full byte stream might be: 0x02 7F FF 00 00 7F FF FF FF 80 00 FF FF		

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2	CONFIGURE: Determine the number of photocells. RECORD this information as: »Num_Photocells		
3	SET-UP: GET the following object(s): »dmsIllumMaxPhotocellLevel.0	Pass / Fail (Section 3.5.1.5.1)	
4	SET-UP: VERIFY that the brightness curve does not contain any photocell levels greater than the RESPONSE VALUE for dmsIllumMaxPhotocellLevel.0.		
5	SET-UP: PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Msg_Multi_String »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 »Msg_Pixel_Service = 0 »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0 where, Msg_Type is any valid message type Msg_Number is any valid message number for the selected message type Msg_Multi_String is a valid MULTI string	Pass / Fail (Section 3.5.2.3.3.3)	
6	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Msg_Multi_String »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
7	SET-UP: SET the following object(s) to the value(s) shown: »dmsIllumControl.0 = 'photocell' (2) Note: Valid enumerated values are defined in Section 5.8.1 (Illumination Control Parameter).		
8	GET the following object(s): »dmsIllumBrightnessValues.0 »dmsIllumBrightnessValuesError.0	Pass / Fail (Section 3.5.1.5.3)	
9	RECORD the RESPONSE VALUE for dmsIllumBrightnessValues.0 as: »Orig_Curve		
10	FOR EACH value, N, from 1 to Num_Photocells, perform Steps 10.1 through 10.5.		
10.1	Shine a light on photocell number N.		
10.2	VERIFY that the sign display becomes brighter. Note: Determine from the manufacturer’s documentation the amount of any delay from a change in ambient lighting to the resultant change in the sign display brightness.	Pass / Fail (Section 3.6.3.1)	
10.3	Cover photocell number N.		

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10.4	VERIFY that the sign display dims compared to step 10.	Pass / Fail (Section 3.6.3.1)	
10.5	Uncover photocell number N.		
11	SET the following object(s) to the value(s) shown: »dmsIllumBrightnessValues.0 = Brightness_Curve	Pass / Fail (Section 3.5.1.5.2)	Section 4.2.2.9 Step b
12	FOR EACH value, N, from 1 to Num_Photocells, perform Steps 12.1 through 12.5.		
12.1	Shine a light on photocell number N.		
12.2	VERIFY that the sign display becomes brighter.	Pass / Fail (Section 3.6.3.1)	
12.3	Cover photocell number N.		
12.4	VERIFY that the sign display dims compared to step 12.	Pass / Fail (Section 3.6.3.1)	
12.5	Uncover the photocell N.		
13	SET the following object(s) to the value(s) shown: »dmsIllumBrightnessValues.0 = Orig_Curve	Pass / Fail (Section 3.5.1.5.2)	Section 4.2.2.9 Step b

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.4.8 Verify Light Curve Gap Error

Test Case: 4.8	**Title:**	**Verify Light Curve Gap Error**
	Description:	This test case verifies that the DMS indicates an error when the light curve contains a gap. Note: Although not explicitly mentioned in the standardized dialog, this test case assumes that the management station is aware of the maximum photocell level prior to configuring the brightness curve.
	Variables:	Brightness_Gap_Curve — From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.

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Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine a brightness curve that contains a gap in the range of photocell readings (per the test plan). RECORD this information as: »Brightness_Gap_Curve Note: For example, the following string contains a gap between the two light output levels: » Number of Levels: 0x02 » Light Output 1: 0x00 C0 » photocellLevelDown 1: 0x00 00 » photocellLevelUp 1: 0x0A 00 » Light Output 2: 0x01 00 » photocellLevelDown 2: 0x0B 00 (i.e., a gap exists between 0x0A 00 and 0x0B 00) » photocellLevelUp 2: 0xFF FF » The entire byte stream would be: 0x02 00 C0 00 00 0A 00 01 00 0B 00 FF FF		
2	SET-UP: GET the following object(s): »dmsIllumMaxPhotocellLevel.0		
3	SET-UP: VERIFY that the Brightness_Gap_Curve does not contain any photocell levels greater than the RESPONSE VALUE for dmsIllumMaxPhotocellLevel.0.		
4	SET-UP: GET the following object(s): »dmsIllumBrightnessValues.0 »dmsIllumBrightnessValuesError.0		
5	SET-UP: RECORD the RESPONSE VALUE for dmsIllumBrightnessValues.0 as: »Original_Curve		
6	SET the following object(s) to the value(s) shown: »dmsIllumBrightnessValues.0 = Brightness_Gap_Curve	Pass / Fail (Section 3.5.1.5.2)	
7	VERIFY that the RESPONSE ERROR is equal to 'genError'.	Pass / Fail (Section 3.5.1.5.2)	
8	GET the following object(s): »dmsIllumBrightnessValuesError.0	Pass / Fail (Section 3.5.1.5.3)	
9	VERIFY that the RESPONSE VALUE for dmsIllumBrightnessValuesError.0 equals 'photocellGap' (3). Note: Valid enumerated values are defined in Section 5.8.8 (Brightness Values Error Parameter).	Pass / Fail (Section 3.5.1.5.3)	
10	SET the following object(s) to the value(s) shown: »dmsIllumBrightnessValues.0 = Original_Curve	Pass / Fail (Section 3.5.1.5.2)	
11	GET the following object(s): »dmsIllumBrightnessValues.0 »dmsIllumBrightnessValuesError.0	Pass / Fail (Section 3.5.1.5.3)	
12	VERIFY that the RESPONSE VALUE for dmsIllumBrightnessValues.0 is equal to Original_Curve.	Pass / Fail (RFC 1157)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

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C.3.4.9 Verify Light Curve Negative Slope

Test Case: 4.9	**Title:**	**Verify Light Curve Negative Slope**
	Description:	This test case verifies that the DMS responds properly when the light curve contains a negative slope. Note: Although not explicitly mentioned in the standardized dialog, this test case assumes that the management station is aware of the maximum photocell level prior to configuring the brightness curve.
	Variables:	Negative_Slope_Allowed — From the Test Plan Brightness_Negative_Curve — From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine if the sign allows a negative slope for the brightness curve. RECORD this information as: »Negative_Slope_Allowed Note: This information should be contained in the manufacturer's documentation. Negative slopes are typically only allowed for reflective sign technologies.		
2	CONFIGURE: Determine a brightness curve that contains a negative slope (per the test plan). RECORD this information as: »Brightness_Negative_Curve Note: For example, the following string contains a negative slope between the two light output levels because the first (dim) output level is used when ambient conditions are brighter: » Number of Levels: 0x02 » Light Output 1: 0x00 A0 » photocellLevelDown 1: 0x0A 00 » photocellLevelUp 1: 0xFF FF » Light Output 2: 0x01 00 » photocellLevelDown 2: 0x00 00 » photocellLevelUp 2: 0x0A 00 » The entire byte stream would be: 0x02 00 A0 0A 00 FF FF 01 00 00 00 0A 00		
3	SET-UP: GET the following object(s): »dmsIllumMaxPhotocellLevel.0		
4	SET-UP: VERIFY that the Brightness_Negative_Curve does not contain any photocell levels greater than the RESPONSE VALUE for dmsIllumMaxPhotocellLevel.0.		
5	SET-UP: GET the following object(s): »dmsIllumBrightnessValues.0 »dmsIllumBrightnessValuesError.0		
6	SET-UP: Determine the RESPONSE VALUE for dmsIllumBrightnessValues.0. RECORD this information as: »Original_Curve		
7	IF Negative_Slope_Allowed is equal to true, then GOTO Step 7.1; otherwise, GOTO Step 8.1.		
7.1	SET the following object(s) to the value(s) shown: »dmsIllumBrightnessValues.0 = Brightness_Negative_Curve	Pass / Fail (Section 3.5.1.5.2)	Section 4.2.2.9 Step b

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7.2	GET the following object(s): »dmsIllumBrightnessValuesError.0	Pass / Fail (Section 3.5.1.5.3)	
7.3	VERIFY that the RESPONSE VALUE for dmsIllumBrightnessValuesError.0 is equal to 'none' (2). Note: Valid enumerated values are defined in Section 5.8.8 (Brightness Values Error Parameter).	Pass / Fail (Section 3.5.1.5.3)	
7.4	Determine the number of photocell(s). RECORD this information as: »Num_Photocells		
7.5	FOR EACH value, N, from 1 to Num_Photocells, perform Steps 7.5.1 through 7.5.5.		
7.5.1	Shine a light on photocell number N.		
7.5.2	VERIFY that the sign illumination has become dimmer.	Pass / Fail (Section 3.5.1.5.2)	
7.5.3	Cover photocell number N.		
7.5.4	VERIFY that the sign illumination has become brighter.	Pass / Fail (Section 3.5.1.5.2)	
7.5.5	Uncover the photocells.		
7.6	SET the following object(s) to the value(s) shown: »dmsIllumBrightnessValues.0 = Original_Curve GO TO EXIT.	Pass / Fail (Section 3.5.1.5.2)	Section 4.2.2.9 Step b
8.1	SET the following object(s) to the value(s) shown: »dmsIllumBrightnessValues.0 = Brightness_Negative_Curve	Pass / Fail (Section 3.5.1.5.2)	Section 4.2.2.9 Step b
8.2	VERIFY that the RESPONSE ERROR is equal to 'genError'.	Pass / Fail (Section 3.5.1.5.2)	
8.3	GET the following object(s): »dmsIllumBrightnessValuesError.0	Pass / Fail (Section 3.5.1.5.2)	Section 4.2.2.9 Step c
8.4	VERIFY that the RESPONSE VALUE for dmsIllumBrightnessValuesError.0 equals 'negativeSlope' (4).		
8.5	SET the following object(s) to the value(s) shown: »dmsIllumBrightnessValues.0 = Original_Curve	Pass / Fail (Section 3.5.1.5.2)	
8.6	GET the following object(s): »dmsIllumBrightnessValues.0 »dmsIllumBrightnessValuesError.0	Pass / Fail (Section 3.5.1.5.3)	
8.7	VERIFY that the RESPONSE VALUE for dmsIllumBrightnessValues.0 is equal to Original_Curve.	Pass / Fail (RFC 1157)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

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C.3.4.10 Verify Light Curve Too Many Levels Error

Test Case: 4.10	**Title:**	**Verify Light Curve Too Many Levels Error**	
	Description:	This test case verifies that the DMS indicates an error when the light curve contains too many levels. Note: Although not explicitly mentioned in the standardized dialog, this test case assumes that the management station is aware of the maximum photocell level prior to configuring the brightness curve.	
	Variables:	Brightness_Too_Many_Curve	From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

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Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine a brightness curve that contains more levels than what is supported by the sign (per the test plan). RECORD this information as: »Brightness_Too_Many_Curve Note: A sign that supports 255 entries in dmsIllumBrightnessValues.0 cannot be made to generate this error. Note: For example, the following string contains 3 levels and is required to be rejected by a sign that only supports 2 levels: » Number of Levels: 0x03 » Light Output 1: 0x01 00 » photocellLevelDown 1: 0x00 00 » photocellLevelUp 1: 0x01 00 » Light Output 2: 0x02 00 » photocellLevelDown 2: 0x01 01 » photocellLevelUp 2: 0x02 00 » Light Output 3: 0x03 00 » photocellLevelDown 3: 0x02 01 » photocellLevelUp 3: 0xFF FF » The entire byte stream would be: 0x03 01 00 00 00 01 00 02 00 01 01 02 00 03 00 02 01 FF FF		
2	SET-UP: GET the following object(s): »dmsIllumMaxPhotocellLevel.0		
3	SET-UP: VERIFY that the Brightness_Too_Many_Curve does not contain any photocell levels greater than the RESPONSE VALUE for dmsIllumMaxPhotocellLevel.0.		
4	SET-UP: GET the following object(s): »dmsIllumBrightnessValues.0 »dmsIllumBrightnessValuesError.0		
5	SET-UP: Determine the RESPONSE VALUE for dmsIllumBrightnessValues.0. RECORD this information as: »Original_Curve		
6	SET the following object(s) to the value(s) shown: »dmsIllumBrightnessValues.0 = Brightness_Too_Many_Curve	Pass / Fail (Section 3.5.1.5.2)	Section 4.2.2.9 Step b
7	VERIFY that the RESPONSE ERROR is equal to 'genError'.	Pass / Fail (Section 3.5.1.5.2)	
8	GET the following object(s): »dmsIllumBrightnessValuesError.0	Pass / Fail (Section 3.5.1.5.2)	Section 4.2.2.9 Step c
9	VERIFY that the RESPONSE VALUE for dmsIllumBrightnessValuesError.0 equals 'tooManyLevels' (5). Note: Valid enumerated values are defined in Section 5.8.8 (Brightness Values Error Parameter).		
10	SET the following object(s) to the value(s) shown: »dmsIllumBrightnessValues.0 = Original_Curve	Pass / Fail (Section 3.5.1.5.2)	
11	GET the following object(s): »dmsIllumBrightnessValues.0 »dmsIllumBrightnessValuesError.0	Pass / Fail (Section 3.5.1.5.3)	
12	VERIFY that the RESPONSE VALUE for dmsIllumBrightnessValues.0 is equal to Original_Curve.	Pass / Fail (RFC 1157)	

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Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.4.11 Configure Light Curve with Overlapping Values

Test Case: 4.11	**Title:**	**Configure Light Curve with Overlapping values**
	Description:	This test case verifies that the DMS allows the light curve to include overlapping values.
	Variables:	Brightness_Overlap_Curve — From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine a brightness curve that contains overlapping photocell levels between the defined brightness levels (per the test plan). RECORD this information as: »Brightness_Overlap_Curve Note: For example, the following string contains 2 levels with an overlapping range: » Number of Levels: 0x02 » Light Output 1: 0x01 00 » photocellLevelDown 1: 0x00 00 » photocellLevelUp 1: 0x80 00 » Light Output 2: 0x02 00 » photocellLevelDown 2: 0x40 00 » photocellLevelUp 2: 0xFF FF » The entire byte stream would be: 0x02 01 00 00 00 80 00 02 00 40 00 FF FF		
2	SET-UP: GET the following object(s): »dmsIllumMaxPhotocellLevel.0		
3	SET-UP: VERIFY that the Brightness_Overlap_Curve does not contain any photocell levels greater than the RESPONSE VALUE for dmsIllumMaxPhotocellLevel.0.		
4	GET the following object(s): »dmsIllumBrightnessValues.0 »dmsIllumBrightnessValuesError.0	Pass / Fail (Section 3.5.1.5.3)	
5	Record the RESPONSE VALUE for dmsIllumBrightnessValues.0 as: »Orig_Curve		
6	SET the following object(s) to the value(s) shown: »dmsIllumBrightnessValues.0 = Brightness_Overlap_Curve	Pass / Fail (Section 3.6.3.2)	Section 4.2.2.9 Step b
7	GET the following object(s): »dmsIllumBrightnessValues.0 »dmsIllumBrightnessValuesError.0	Pass / Fail (Section 3.5.1.5.3)	
8	VERIFY that the RESPONSE VALUE for dmsIllumBrightnessValues.0 equals Brightness_Overlap_Curve.	Pass / Fail (Section 3.6.3.2)	
9	SET the following object(s) to the value(s) shown: »dmsIllumBrightnessValues.0 = Orig_Curve	Pass / Fail (Section 3.5.1.5.2)	Section 4.2.2.9 Step b

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Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.5 Diagnostic Tests

C.3.5.1 Pixel Test - No Errors

Test Case: 5.1	**Title:**	**Pixel Test - No Errors**
	Description:	This test case verifies that the DMS executes a pixel test and verifies that there are no failed pixels.
	Variables:	Pixel_Test_Time — From Manufacturer's Documentation Message_Display_Test_Time — From Manufacturer's Documentation
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the maximum period of time that the pixel test should require (based on manufacturer documentation). RECORD this information as: »Pixel_Test_Time		
2	CONFIGURE: Determine the maximum period of time that the message display pixel test should require (based on manufacturer documentation). RECORD this information as: »Message_Display_Test_Time		
3	SET-UP: Ensure that all pixels are functioning prior to this test.		
4	SET the following object(s) to the value(s) shown: »pixelTestActivation.0 = 'test' (3) Note: Valid enumerated values are defined in Section 5.11.2.4.3 (Pixel Test Activation Parameter).	Pass / Fail (Section 3.5.3.1.1.2)	Section 4.2.4.2 Step a
5	GET the following object(s): »pixelTestActivation.0	Pass / Fail (RFC 1157)	Section 4.2.4.2 Step b
6	IF the RESPONSE VALUE for pixelTestActivation.0 equals 'test' (3), then GOTO Step 5; otherwise, GOTO Step 7. Note: If the RESPONSE VALUE remains at 'test' (3) for more than Pixel_Test_Time seconds, this test fails.		
7	GET the following object(s): »dmsPixelStatus.1 »dmsPixelFailureTestRows.0 »dmsPixelFailureMessageRows.0	Pass / Fail (Section 3.5.3.1.3.3)	Section 4.2.4.2 Step c
8	VERIFY that the RESPONSE VALUE for dmsPixelFailureTestRows.0 is equal to 0.	Pass / Fail (Section 3.5.3.1.3.3)	
9	GET the following object(s): »shortErrorStatus.0	Pass / Fail (Section 3.5.3.1.2)	
10	VERIFY that the RESPONSE VALUE for shortErrorStatus.0 has bit 5 (pixel error) cleared.	Pass / Fail (Section 3.5.3.1.2)	

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11	PERFORM the test case labeled 'Activate a Message' (C.3.7.6).	Pass / Fail (Section 3.5.2.3.1)	
12	DELAY for Message_Display_Test_Time seconds.		
13	GET the following object(s): »dmsPixelFailureTestRows.0 »dmsPixelFailureMessageRows.0 »pixelFailureTableNumRows.0	Pass / Fail (Section 3.5.3.1.3.3)	Section 4.2.4.2 Step c
14	VERIFY that the RESPONSE VALUE for dmsPixelFailureMessageRows.0 is equal to 0.	Pass / Fail (Section 3.5.3.1.3.3)	
15	VERIFY that the RESPONSE VALUE for pixelFailureTableNumRows.0 is equal to 0.	Pass / Fail (Section 3.5.3.1.3.3)	
16	GET the following object(s): »shortErrorStatus.0	Pass / Fail (Section 3.5.3.1.2)	
17	VERIFY that the RESPONSE VALUE for shortErrorStatus.0 has bit 5 (pixel error) cleared.	Pass / Fail (Section 3.5.3.1.2)	
18	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.5.2 Pixel Test - Errors

Test Case: 5.2	**Title:**	**Pixel Test - Errors**
	Description:	This test case verifies that the DMS executes a pixel test and verifies that there are failed pixels to be detected by unplugging the power or signal to the pixel boards.
	Variables:	Pixel_Test_Time — From Manufacturer's Documentation Message_Display_Test_Time — From Manufacturer's Documentation
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the maximum period of time that the pixel test should require (based on manufacturer documentation). RECORD this information as: »Pixel_Test_Time		
2	CONFIGURE: Determine the maximum period of time that the message display pixel test should require (based on manufacturer documentation). RECORD this information as: »Message_Display_Test_Time		
3	SET-UP: Unplug the power or signal to several pixels to simulate failed pixels to detect within this test procedure.		
4	SET the following object(s) to the value(s) shown: »pixelTestActivation.0 = 'test' (3)	Pass / Fail (Section 3.5.3.1.1.2)	Section 4.2.4.2 Step a

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	Note: Valid enumerated values are defined in Section 5.11.2.4.3 (Pixel Test Activation Parameter).		
5	GET the following object(s): »pixelTestActivation.0	Pass / Fail (Section 3.5.3.1.1.2)	Section 4.2.4.2 Step b
6	IF the RESPONSE VALUE for pixelTestActivation.0 equals 'test' (3), then GOTO Step 5; otherwise, GOTO Step 7. Note: If the RESPONSE VALUE remains at 'test' (3) for more than Pixel_Test_Time seconds, this test fails.		
7	GET the following object(s): »shortErrorStatus.0	Pass / Fail (Section 3.5.3.1.2)	
8	VERIFY that the RESPONSE VALUE for shortErrorStatus.0 has bit 5 (pixel error) set.	Pass / Fail (Section 3.5.3.1.2)	
9	GET the following object(s): »vmsSignHeightPixels.0 »vmsSignWidthPixels.0	Pass / Fail (Section 3.5.1.2.2.1)	
10	RECORD the RESPONSE VALUE for vmsSignHeightPixels.0 and vmsSignWidthPixels.0 as: »Actual_Height_Pixels »Actual_Width_Pixels		
11	Calculate the number of pixels in the sign. RECORD this information as: »Total_Pixels Note: In general, the number of pixels in the sign can be determined by multiplying the sign height in pixels by the sign width in pixels. This algorithm is not valid if the pixels on the sign do not form a perfectly rectangular matrix.		
12	Calculate the number of pixel status objects required to be retrieved using the formula: Total_Pixels / 3200, rounded up to the next integer. RECORD this information as: »Num_Pixel_Blocks		
13	GET the following object(s): »dmsPixelFailureTestRows.0 »dmsPixelFailureMessageRows.0		
14	FOR EACH value, N, from 1 to Num_Pixel_Blocks, perform Steps 14.1 through 14.2. Note: For example, if Total_Pixels equals 3201, N shall be assigned a value from 1 to 2.		
14.1	GET the following object(s): »dmsPixelStatus.N	Pass / Fail (Section 3.5.3.1.3.3)	
14.2	RECORD the RESPONSE VALUE for dmsPixelStatus.N, dmsPixelFailureTestRows.0, dmsPixelFailureMessageRows.0 as: »Pixel_Status[N] »Pixel_Failure_Test_Rows »Pixel_Failure_Message_Rows		
15	VERIFY that the number of bits set in all of the Pixel_Status[N] parameters equals Pixel_Failure_Test_Rows.	Pass / Fail (Section 3.5.3.1.3.3)	
16	FOR EACH value, N, from 1 to Pixel_Failure_Test_Rows, perform Steps 16.1 through 16.7.		

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16.1	GET the following object(s): »pixelFailureXLocation.2.N »pixelFailureYLocation.2.N »pixelFailureStatus.2.N	Pass / Fail (Section 3.5.3.1.4.3)	Section 4.2.4.6 Step c
16.2	Determine the X and Y location of the pixel. RECORD this information as: »X »Y		
16.3	Calculate the text string describing the location of the failed pixel. RECORD this information as: »Failed_Pixel_Location		
16.4	VERIFY that the RESPONSE VALUE for pixelFailureXLocation.2.N and pixelFailureYLocation.2.N identify one of the failed pixels that has not been previously identified.	Pass / Fail (Section 3.5.3.1.4.3)	
16.5	VERIFY that the RESPONSE VALUE for pixelFailureStatus.2.N is not equal to 0.	Pass / Fail (Section 3.5.3.1.4.3)	
16.6	Calculate the unique pixel number of the failed pixel. RECORD this information as: »Subject_Pixel Note: The unique pixel number is defined by its position on the sign, where the top and left-most pixel is pixel 0, the next one to the right is pixel 1, etc. Assuming a perfectly rectangular matrix sign, the pixel number can be calculated by multiplying the (Y position minus 1) by the sign width in pixels and adding the X position minus 1.		
16.7	VERIFY that the bit corresponding to the Subject_Pixel in Pixel_Status[N] is set to one.	Pass / Fail (Section 3.5.3.1.4.3)	
17	PERFORM the test case labeled 'Activate a Message' (C.3.7.6). Note: This step is allowed to fail if the sign has internal logic to prevent the display of the message due to an excessive number of pixel failures.	Pass / Fail (Section 3.5.2.3.1)	
18	VERIFY that the disconnected pixels are blank.	Pass / Fail (Section 3.5.3.1.3.3)	
19	DELAY for Message_Display_Test_Time seconds.		
20	GET the following object(s): »shortErrorStatus.0	Pass / Fail (Section 3.5.3.1.2)	
21	VERIFY that the RESPONSE VALUE for shortErrorStatus.0 has bit 5 (pixel error) set.	Pass / Fail (Section 3.5.3.1.2)	
22	GET the following object(s): »dmsPixelFailureTestRows.0 »dmsPixelFailureMessageRows.0	Pass / Fail (Section 3.5.3.1.3.3)	
23	Determine the RESPONSE VALUE. RECORD this information as: »Pixel_Failure_Test_Rows »Pixel_Failure_Message_Rows		
24	FOR EACH value, N, from 1 to Pixel_Failure_Message_Rows, perform Steps 24.1 through 24.7.		
24.1	GET the following object(s): »pixelFailureXLocation.3.N	Pass / Fail (Section 3.5.3.1.4.3)	Section 4.2.4.6 Step c

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	»pixelFailureYLocation.3.N »pixelFailureStatus.3.N		
24.2	Determine the X and Y location of the reported pixel failure. RECORD this information as: »X »Y		
24.3	Calculate the text string describing the location of the failed pixel. RECORD this information as: »Failed_Pixel_Location		
24.4	VERIFY that the RESPONSE VALUE for pixelFailureXLocation.3.N and pixelFailureYLocation.3.N identify one of the failed pixels that has not been previously identified in the message.	Pass / Fail (Section 3.5.3.1.4.3)	
24.5	VERIFY that the RESPONSE VALUE for pixelFailureStatus.3.N is not equal to 0.	Pass / Fail (Section 3.5.3.1.4.3)	
24.6	Calculate the unique pixel number of the failed pixel. RECORD this information as: »Subject_Pixel Note: The unique pixel number is defined by its position on the sign, where the top and left-most pixel is pixel 1, the next one to the right is pixel 2, etc. Assuming a perfectly rectangular matrix sign, the pixel number can be calculated by multiplying the (Y position minus 1) by the sign width in pixels and adding the X position minus 1.		
24.7	VERIFY that the bit corresponding to the Subject_Pixel in Pixel_Status[N] is set to one.	Pass / Fail (Section 3.5.3.1.4.3)	
25	SET-UP: Reconnect the power or signal to the pixels from which it was removed.		
26	GET the following object(s): »shortErrorStatus.0	Pass / Fail (Section 3.5.3.1.2)	
27	VERIFY that the RESPONSE VALUE for shortErrorStatus.0 has bit 5 (pixel error) cleared.	Pass / Fail (Section 3.5.3.1.2)	
28	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.5.3 Climate-Control Equipment Test - No Errors

Test Case: 5.3	**Title:**	**Climate-Control Equipment Test - No Errors**	
	Description:	This test case verifies that the DMS executes a climate-control equipment test and verifies that there are no errors.	
	Variables:	Climate_Test_Unit	From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

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Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the index of the climate control unit to be tested (per the test plan). RECORD this information as: »Climate_Test_Unit		
2	SET-UP: Ensure that climate control system is properly functioning prior to this test.		
3	GET the following object(s): »dmsClimateCtrlStatusMap.0 »dmsClimateCtrlNumRows.0	Pass / Fail (Section 3.5.3.1.3.6)	
4	SET-UP: VERIFY that the RESPONSE VALUE for dmsClimateCtrlNumRows.0 is greater than or equal to Climate_Test_Unit.		
5	SET the following object(s) to the value(s) shown: »dmsClimateCtrlTestActivation.Climate_Test_Unit = 'test' (3) Note: Valid enumerated values are defined in Section 5.11.2.3.5.6 (Climate-control Test Activation Parameter).	Pass / Fail (Section 3.5.3.1.1.3)	Section 4.2.4.3 Step a
6	GET the following object(s): »dmsClimateCtrlTestActivation.Climate_Test_Unit	Pass / Fail (Section 3.5.3.1.1.3)	Section 4.2.4.3 Step b
6.1	IF the RESPONSE VALUE of dmsClimateCtrlTestActivation.Climate_Test_Unit equals 'test' (3), then GOTO Step 6; otherwise, GOTO Step 7. Note: The user should consult the manufacturer's documentation to determine how long this process might take; if the process takes an abnormally long time, the test should fail.		
7	IF the RESPONSE VALUE of dmsClimateCtrlTestActivation.Climate_Test_Unit equals 'testAborted' (4), then GOTO Step 7.1; otherwise, GOTO Step 8.1.		
7.1	GET the following object(s): »dmsClimateCtrlAbortReason.Climate_Test_Unit	Pass / Fail (Section 3.5.3.1.1.3)	Section 4.2.4.3 Step c
7.2	VERIFY that the RESPONSE VALUE for dmsClimateCtrlAbortReason.Climate_Test_Unit indicates a valid reason for the test being aborted. GO TO EXIT.	Pass / Fail (Section 3.5.3.1.1.3)	
8.1	GET the following object(s): »dmsClimateCtrlStatusMap.0 »dmsClimateCtrlNumRows.0	Pass / Fail (Section 3.5.3.1.3.6)	
8.2	VERIFY that the (Climate_Test_Unit minus 1) bit of the RESPONSE VALUE for dmsClimateCtrlStatusMap.0 is equal to 0.	Pass / Fail (Section 3.5.3.1.3.6)	
8.3	GET the following object(s): »shortErrorStatus.0	Pass / Fail (Section 3.5.3.1.2)	
8.4	VERIFY that the bit 10 (climate-control system error) of the RESPONSE VALUE for shortErrorStatus.0 is zero (0).	Pass / Fail (Section 3.5.3.1.2)	

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8.5	GET the following object(s): »dmsClimateCtrlDescription.Climate_Test_Unit »dmsClimateCtrlMfrStatus.Climate_Test_Unit »dmsClimateCtrlErrorStatus.Climate_Test_Unit »dmsClimateCtrlOnStatus.Climate_Test_Unit »dmsClimateCtrlType.Climate_Test_Unit	Pass / Fail (Section 3.5.3.1.4.6)	Section 4.2.4.9 Step c
8.6	VERIFY that the RESPONSE VALUE for dmsClimateCtrlDescription.Climate_Test_Unit contains only valid DisplayString characters. Note: Per RFC 854, the characters are restricted to the ASCII codes of 0, 7 through 13, and 32 through 126.	Pass / Fail (Section 3.5.3.1.4.6)	
8.7	VERIFY that the RESPONSE VALUE for dmsClimateCtrlMfrStatus.Climate_Test_Unit contains only valid DisplayString characters.	Pass / Fail (Section 3.5.3.1.4.6)	
8.8	VERIFY that the RESPONSE VALUE for dmsClimateCtrlErrorStatus.Climate_Test_Unit is equal to 'noError' (2). Note: Valid enumerated values are defined in Section 5.11.2.3.5.4 (Climate-control System Error Status Parameter)	Pass / Fail (Section 3.5.3.1.4.6)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.5.4 Climate-Control Equipment Test - Errors

Test Case: 5.4	**Title:**	**Climate-Control Equipment Test - Errors**
	Description:	This test case verifies that the DMS executes a climate-control equipment test and correctly identifies failed equipment.
	Variables:	Climate_Test_Unit — From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the index of the climate control unit to be tested (per the test plan). RECORD this information as: »Climate_Test_Unit		
2	SET-UP: Unplug the power or signal to the Climate_Test_Unit to simulate a failed climate control unit to detect within this test procedure.		
3	SET the following object(s) to the value(s) shown: »dmsClimateCtrlTestActivation.Climate_Test_Unit = 'test' (3) Note: Valid enumerated values are defined in Section 5.11.2.3.5.6 (Climate-control System Error Status Parameter).	Pass / Fail (Section 3.5.3.1.1.3)	Section 4.2.4.3 Step a
4	GET the following object(s): »dmsClimateCtrlTestActivation.Climate_Test_Unit	Pass / Fail (Section 3.5.3.1.1.3)	Section 4.2.4.3 Step b
4.1	IF the RESPONSE VALUE of dmsClimateCtrlTestActivation.Climate_Test_Unit equals 'test' (3), then GOTO Step 4; otherwise, GOTO Step 5.		

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5	IF the RESPONSE VALUE of dmsClimateCtrlTestActivation.Climate_Test_Unit equals 'testAborted' (4), then GOTO Step 5.1; otherwise, GOTO Step 6.1.		
5.1	GET the following object(s): »dmsClimateCtrlAbortReason.Climate_Test_Unit	Pass / Fail (Section 3.5.3.1.1.3)	Section 4.2.4.3 Step c
5.2	VERIFY that the RESPONSE VALUE for dmsClimateCtrlAbortReason.Climate_Test_Unit indicates a valid reason for the test being aborted. GO TO Step 7.	Pass / Fail (Section 3.5.3.1.1.3)	
6.1	GET the following object(s): »dmsClimateCtrlStatusMap.0 »dmsClimateCtrlNumRows.0	Pass / Fail (Section 3.5.3.1.3.6)	
6.2	VERIFY that the (Climate_Test_Unit minus 1) bit of the RESPONSE VALUE for dmsClimateCtrlStatusMap.0 is equal to 1.	Pass / Fail (Section 3.5.3.1.3.6)	
6.3	GET the following object(s): »shortErrorStatus.0	Pass / Fail (Section 3.5.3.1.2)	
6.4	VERIFY that the RESPONSE VALUE for shortErrorStatus.0 has bit 10 (climate-control system error) equal to one (1).	Pass / Fail (Section 3.5.3.1.2)	
6.5	GET the following object(s): »dmsClimateCtrlDescription.Climate_Test_Unit »dmsClimateCtrlMfrStatus.Climate_Test_Unit »dmsClimateCtrlErrorStatus.Climate_Test_Unit »dmsClimateCtrlOnStatus.Climate_Test_Unit »dmsClimateCtrlType.Climate_Test_Unit	Pass / Fail (Section 3.5.3.1.4.6)	Section 4.2.4.9 Step c
6.6	VERIFY that the RESPONSE VALUE for dmsClimateCtrlDescription.Climate_Test_Unit contains only valid DisplayString characters. Note: Per RFC 854, the characters are restricted to the ASCII codes of 0, 7 through 13, and 32 through 126.	Pass / Fail (Section 3.5.3.1.4.6)	
6.7	VERIFY that the RESPONSE VALUE for dmsClimateCtrlMfrStatus.Climate_Test_Unit contains only valid DisplayString characters and describes a status consistent with the error applied to the test unit (e.g., the status of the test unit should not indicate a status of okay).	Pass / Fail (Section 3.5.3.1.4.6)	
6.8	VERIFY that the RESPONSE VALUE for dmsClimateCtrlErrorStatus.Climate_Test_Unit is equal to 'fail' (3). Note: Valid enumerated values are defined in Section 5.11.2.3.5.4 (Climate-control System Error Status Parameter)	Pass / Fail (Section 3.5.3.1.4.6)	
6.9	VERIFY that the RESPONSE VALUE for dmsClimateCtrlOnStatus.Climate_Test_Unit is equal to 0.	Pass / Fail (Section 3.5.3.1.4.6)	
6.10	VERIFY that the RESPONSE VALUE for dmsClimateCtrlType.Climate_Test_Unit accurately reflects the type of climate control unit. Note: Valid enumerated values are defined in Section 5.11.2.3.5.8 (Climate-control Device Type Parameter).	Pass / Fail (Section 3.5.3.1.4.6)	
7	Reconnect the power or signal to the Climate_Test_Unit.		

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8	GET the following object(s): »shortErrorStatus.0	Pass / Fail (Section 3.5.3.1.2)	
9	VERIFY that the RESPONSE VALUE for shortErrorStatus.0 has bit 10 (climate-control system error) equal to zero (0).	Pass / Fail (Section 3.5.3.1.2)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.5.5 Verify Power Error Detection

Test Case: 5.5	**Title:**	**Verify Power Error Detection**	
	Description:	This test case verifies that DMS correctly identifies failed power systems.	
	Variables:	Status_Update_Delay	PRL 3.6.9
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the frequency, in seconds, at which the DMS is required to update the status variables (PRL 3.6.9). RECORD this information as: »Status_Update_Delay		
2	SET-UP: Unplug one or more power supplies to simulate power supply failures to detect within this test procedure. RECORD the index of the power supplies unplugged.		
3	Determine the index numbers of the power supplies that were unplugged (e.g., {1, 2, 3}). RECORD this information as: »Unplugged		
4	DELAY for Status_Update_Delay seconds.		
5	GET the following object(s): »shortErrorStatus.0	Pass / Fail (Section 3.5.3.1.2)	
6	VERIFY that bit 2 (power error) of the RESPONSE VALUE for shortErrorStatus.0 equals 1.	Pass / Fail (Section 3.5.3.1.2)	
7	GET the following object(s): »dmsPowerFailureStatusMap.0 »dmsPowerNumRows.0	Pass / Fail (Section 3.5.3.1.3.1)	
8	RECORD the RESPONSE VALUE for dmsPowerFailureStatusMap.0 and dmsPowerNumRows.0 as: »Power_Status_Map »Power_Num_Rows		
9	FOR EACH value, N, from 1 to Power_Num_Rows, perform Steps 9.1 through 9.6.		
9.1	GET the following object(s): »dmsPowerDescription.N »dmsPowerMfrStatus.N »dmsPowerStatus.N »dmsPowerVoltage.N »dmsPowerType.N	Pass / Fail (Section 3.5.3.1.4.1)	Section 4.2.4.4 Step b

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9.2	VERIFY that the RESPONSE VALUE for dmsPowerDescription.N contains only valid DisplayString characters. Note: Per RFC 854, the characters are restricted to the ASCII codes of 0, 7 through 13, and 32 through 126.	Pass / Fail (Section 3.5.3.1.4.1)	
9.3	VERIFY that the RESPONSE VALUE for dmsPowerMfrStatus.N contains only valid DisplayString characters and describes a status consistent with the power error applied to the test unit (e.g., the status of the test unit should not indicate a power status of okay).	Pass / Fail (Section 3.5.3.1.4.1)	
9.4	VERIFY that the RESPONSE VALUE for dmsPowerType.N reflects the type of power source for the subject power supply. Note: Valid enumerated values are defined in Section 5.11.2.2.3.6 (Power Status Type Parameter).	Pass / Fail (Section 3.5.3.1.4.1)	
9.5	IF N equals an index of one of the power supplies that was unplugged, then GOTO Step 9.5.1; otherwise, GOTO Step 9.6.1.		
9.5.1	VERIFY that the RESPONSE VALUE for dmsPowerStatus.N is equal to 'powerFail' (3). Note: Valid enumerated values are defined in Section 5.11.2.2.3.4 (Power Status Parameter).	Pass / Fail (Section 3.5.3.1.4.1)	
9.5.2	VERIFY that bit N-1 of Power_Status_Map is equal to 1. GO TO Step 10 (after any looping logic is completed).	Pass / Fail (Section 3.5.3.1.3.1)	
9.6.1	VERIFY that the RESPONSE VALUE for dmsPowerStatus.N is equal to 'noError' (2).	Pass / Fail (Section 3.5.3.1.4.1)	
9.6.2	VERIFY that bit N of Power_Status_Map is equal to 0.	Pass / Fail (Section 3.5.3.1.3.1)	
10	Reconnect the power supplies unplugged in Step 2.		

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.5.6 Verify Light Sensor Error Detection

Test Case: 5.6	**Title:**	**Verify Light Sensor Error Detection**	
	Description:	This test case verifies that DMS correctly identifies failed light sensors.	
	Variables:	Status_Update_Delay	PRL 3.6.9
		Photocell_Support	From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the frequency at which the DMS is required to update the status variables (per PRL 3.6.9). RECORD this information as: »Status_Update_Delay		

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2	CONFIGURE: Determine whether the DMS supports photocell sensors. RECORD this information as: »Photocell_Support		
3	SET-UP: IF Photocell_Support is equal to 1, then GOTO Step 3.1; otherwise, EXIT.		
3.1	SET-UP: Unplug one or more light sensors to simulate light sensor failures to detect within this test procedure.		
3.2	Determine the index(es) of the light sensor(s) that were unplugged (enter in the format of '{1,2,3}'). RECORD this information as: »Unplugged		
3.3	DELAY for Status_Update_Delay.		
3.4	GET the following object(s): »shortErrorStatus.0	Pass / Fail (Section 3.5.3.1.2)	
3.5	VERIFY that bit 6 (photocell error) of the RESPONSE VALUE for shortErrorStatus.0 equals 1.	Pass / Fail (Section 3.5.3.1.2)	
3.6	GET the following object(s): »dmsLightSensorNumRows.0 »dmsLightSensorStatusMap.0	Pass / Fail (Section 3.5.3.1.3.4)	
3.7	RECORD the RESPONSE VALUE for dmsLightSensorNumRows.0 and dmsLightSensorStatusMap.0 as: »Light_Sensor_Num_Rows »Light_Sensor_Status_Map		
3.8	FOR EACH value, N, from 1 to Light_Sensor_Num_Rows, perform Steps 3.8.1 through 3.8.4.		
3.8.1	GET the following object(s): »dmsLightSensorDescription.N »dmsLightSensorCurrentReading.N »dmsLightSensorStatus.N	Pass / Fail (Section 3.5.3.1.4.4)	Section 4.2.4.7 Step b
3.8.2	VERIFY that the RESPONSE VALUE for dmsLightSensorDescription.N contains only valid DisplayString characters. Note: Per RFC 854, the characters are restricted to the ASCII codes of 0, 7 through 13, and 32 through 126.	Pass / Fail (Section 3.5.3.1.4.4)	
3.8.3	IF N equals an index of one of the light sensors that was unplugged, then GOTO Step 3.8.3.1; otherwise, GOTO Step 3.8.4.1.		
3.8.3.1	VERIFY that the RESPONSE VALUE for dmsLightSensorStatus.N is equal to 'fail' (3). Note: Valid enumerated values are defined in Section 5.11.2.7.3.4 (Light Sensor Status Parameter).	Pass / Fail (Section 3.5.3.1.4.4)	
3.8.3.2	VERIFY that bit N-1 of Light_Sensor_Status_Map is equal to 1. GO TO Step 3.9 (after any looping logic is completed).	Pass / Fail (Section 3.5.3.1.3.4)	
3.8.4.1	VERIFY that the RESPONSE VALUE for dmsLightSensorStatus.N is equal to 'noError' (2).	Pass / Fail (Section 3.5.3.1.4.4)	
3.8.4.2	VERIFY that bit N-1 of Light_Sensor_Status_Map is equal to 0.	Pass / Fail (Section 3.5.3.1.3.4)	

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3.9	Reconnect the light sensors unplugged in Step 3.1.		

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.5.7 Verify Controller Software Operation Status

Test Case: 5.7	**Title:**	**Verify Controller Software Operation Status**	
	Description:	This test case verifies that the DMS returns the status of the controller software.	
	Variables:	Status_Update_Delay	PRL 3.6.9
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the frequency at which the DMS is required to update the status variables (per PRL 3.6.9). RECORD this information as: »Status_Update_Delay		
2	GET the following object(s): »watchdogFailureCount.0 »controllerErrorStatus.0	Pass / Fail (Section 3.5.3.1.3.5)	
3	RECORD the RESPONSE VALUE for watchdogFailureCount.0 as: »Orig_Watchdog		
4	Calculate the value of Orig_Watchdog + 1. RECORD this information as: »Next_Watchdog		
5	Create an error that causes the watchdog counter to increment.		
6	DELAY for Status_Update_Delay seconds.		
7	GET the following object(s): »watchdogFailureCount.0 »controllerErrorStatus.0	Pass / Fail (Section 3.5.3.1.3.5)	
8	VERIFY that the RESPONSE VALUE for watchdogFailureCount.0 is equal to Next_Watchdog.	Pass / Fail (Section 3.5.3.1.3.5)	
9	VERIFY that the RESPONSE VALUE for controllerErrorStatus.0 is equal to 0. Note: This assumes that the device is not reporting any errors.	Pass / Fail (Section 3.5.3.1.3.5)	
10	GET the following object(s): »shortErrorStatus.0	Pass / Fail (Section 3.5.3.1.2)	
11	VERIFY that the RESPONSE VALUE for shortErrorStatus.0 has bit 8 (controller error) set to zero (0).	Pass / Fail (Section 3.5.3.1.2)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

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C.3.5.8 Verify Temperature Warning—High

Test Case: 5.8	**Title:**	**Verify Temperature Warning – High**
	Description:	This test case verifies that the DMS reports a temperature warning when the temperature exceeds a defined threshold.
	Variables:	Temp_Sensor — from the test plan Sensor_Location — based on manufacturer documentation Status_Update_Delay — PRL 3.6.9 Temperature_Support — PRL 2.5.3.1.2 / 3.5.3.1.3.7
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the index of a temperature sensor to be tested (from the test plan). RECORD this information as: »Temp_Sensor		
2	CONFIGURE: Determine whether the Temp_Sensor detects 'ambient', 'sign housing', or 'controller cabinet' temperature (based on manufacturer documentation). RECORD this information as: »Sensor_Location		
3	CONFIGURE: Determine the frequency at which the DMS is required to update the status variables (per PRL 3.6.9). RECORD this information as: »Status_Update_Delay		
4	Determine whether the DMS supports temperature sensors. RECORD this information as: »Temperature_Support	Pass / Fail (PRL 2.5.3.1.2 / 3.5.3.1.3.7)	
5	IF Temperature_Support is equal to 0, then EXIT; otherwise, GOTO Step 6.		
6	GET the following object(s): »dmsTempSensorNumRows.0	Pass / Fail (PRL 2.5.3.1.2 / 3.5.3.1.3.7)	
7	SET-UP: VERIFY that the RESPONSE VALUE for dmsTempSensorNumRows.0 is greater than or equal to Temp_Sensor.		
8	IF Sensor_Location is equal to "ambient", then GOTO Step 8.1; otherwise, GOTO Step 9.		
8.1	GET the following object(s): »dmsTempSensorStatusMap.0 »dmsTempSensorNumRows.0 »dmsTempSensorIndex.Temp_Sensor »dmsTempSensorDescription.Temp_Sensor »dmsTempSensorCurrentReading.Temp_Sensor »dmsTempSensorHighWarningTemperature.Temp_Sensor »dmsTempSensorLowWarningTemperature.Temp_Sensor »dmsTempSensorHighCriticalTemperature.Temp_Sensor »dmsTempSensorLowCriticalTemperature.Temp_Sensor »dmsTempSensorStatus.Temp_Sensor »tempMaxAmbient.0 »tempMinAmbient.0	Pass / Fail (Section 3.5.3.1.7)	

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8.2	RECORD the RESPONSE VALUE for dmsTempSensorCurrentReading.Temp_Sensor, dmsTempSensorDescription.Temp_Sensor, dmsTempSensorStatus.Temp_Sensor, dmsTempSensorHighWarningTemperature.Temp_Sensor, and dmsTempSensorStatusMap.0 as: »Current_Reading »Description »Status »High_Warning »Status_Map		
8.3	VERIFY that the RESPONSE VALUE for tempMaxAmbient.0 is greater than or equal to Current_Reading.	Pass / Fail (Section 3.5.3.1.7)	
8.4	VERIFY that the RESPONSE VALUE for tempMinAmbient.0 is less than or equal to Current_Reading.	Pass / Fail (Section 3.5.3.1.7)	
9	IF Sensor_Location is equal to "sign housing", then GOTO Step 9.1; otherwise, GOTO Step 10.		
9.1	GET the following object(s): »dmsTempSensorStatusMap.0 »dmsTempSensorNumRows.0 »dmsTempSensorIndex.Temp_Sensor »dmsTempSensorDescription.Temp_Sensor »dmsTempSensorCurrentReading.Temp_Sensor »dmsTempSensorHighWarningTemperature.Temp_Sensor »dmsTempSensorLowWarningTemperature.Temp_Sensor »dmsTempSensorHighCriticalTemperature.Temp_Sensor »dmsTempSensorLowCriticalTemperature.Temp_Sensor »dmsTempSensorStatus.Temp_Sensor »tempMaxSignHousing.0 »tempMinSignHousing.0	Pass / Fail (Section 3.5.3.1.4.7)	
9.2	RECORD the RESPONSE VALUE for dmsTempSensorCurrentReading.Temp_Sensor, dmsTempSensorDescription.Temp_Sensor, dmsTempSensorStatus.Temp_Sensor, dmsTempSensorHighWarningTemperature.Temp_Sensor, and dmsTempSensorStatusMap.0 as: »Current_Reading »Description »Status »High_Warning »Status_Map		
9.3	VERIFY that the RESPONSE VALUE for tempMaxSignHousing.0 is greater than or equal to Current_Reading.	Pass / Fail (Section 3.5.3.1.4.7)	
9.4	VERIFY that the RESPONSE VALUE for tempMinSignHousing.0 is less than or equal to Current_Reading.	Pass / Fail (Section 3.5.3.1.4.7)	
10	IF Sensor_Location is equal to "control cabinet", then GOTO Step 10.1; otherwise, GOTO Step 11.		

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10.1	GET the following object(s): »dmsTempSensorStatusMap.0 »dmsTempSensorNumRows.0 »dmsTempSensorIndex.Temp_Sensor »dmsTempSensorDescription.Temp_Sensor »dmsTempSensorCurrentReading.Temp_Sensor »dmsTempSensorHighWarningTemperature.Temp_Sensor »dmsTempSensorLowWarningTemperature.Temp_Sensor »dmsTempSensorHighCriticalTemperature.Temp_Sensor »dmsTempSensorLowCriticalTemperature.Temp_Sensor »dmsTempSensorStatus.Temp_Sensor »tempMaxCtrlCabinet.0 »tempMinCtrlCabinet.0	Pass / Fail (Section 3.5.3.1.4.9)	
10.2	RECORD the RESPONSE VALUE for dmsTempSensorCurrentReading.Temp_Sensor, dmsTempSensorDescription.Temp_Sensor, dmsTempSensorStatus.Temp_Sensor, dmsTempSensorHighWarningTemperature.Temp_Sensor, and dmsTempSensorStatusMap.0 as: »Current_Reading »Description »Status »High_Warning »Status_Map		
10.3	VERIFY that the RESPONSE VALUE for tempMaxCtrlCabinet.0 is greater than or equal to Current_Reading.	Pass / Fail (Section 3.5.3.1.4.9)	
10.4	VERIFY that the RESPONSE VALUE for tempMinCtrlCabinet.0 is less than or equal to Current_Reading.	Pass / Fail (Section 3.5.3.1.4.9)	
11	VERIFY that the RESPONSE VALUE for dmsTempSensorDescription.Temp_Sensor contains only valid DisplayString characters. Note: Per RFC 854, the characters are restricted to the ASCII codes of 0, 7 through 13, and 32 through 126.	Pass / Fail (Section 5.11.2.9.3.2)	
12	SET-UP: VERIFY that the RESPONSE VALUE for dmsTempSensorStatus.Temp_Sensor equals 'noError' (2). Note: Valid enumerated values are defined in Section 5.11.2.9.3.8 (Temperature Sensor Status Parameter).		
13	SET-UP: VERIFY that the RESPONSE VALUE for dmsTempSensorCurrentReading.Temp_Sensor is less than the RESPONSE VALUE for dmsTempSensorHighWarningTemperature.Temp_Sensor.		
14	VERIFY that the RESPONSE VALUE for dmsTempSensorStatusMap.0 indicates that all bits are set to zero (0).	Pass / Fail (Section 5.11.2.9.1)	
15	DELAY for Status_Update_Delay seconds.		
16	GET the following object(s): »shortErrorStatus.0	Pass / Fail (Section 3.5.3.1.2)	
17	VERIFY that the RESPONSE VALUE for shortErrorStatus.0 does not have bit 9 (temperature warning) set. Note: Unless it can be shown that it is set due to the reading of some other temperature sensor.	Pass / Fail (Section 3.5.3.1.2)	

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18	GET the following object(s): »tempSensorWarningMap.0 »tempSensorCriticalTempMap.0	Pass / Fail (Section 3.5.3.1.3.7)	
19	VERIFY that the RESPONSE VALUE of tempSensorWarningMap.0 does not have the Temp_Sensor bit set.	Pass / Fail (Section 3.5.3.1.3.7)	
20	RECORD zero (0) as: »Counter		
21.1	Alter the temperature of the Temp_Sensor using a heat gun or other methods of simulating a rise in temperature past the RESPONSE VALUE for dmsTempSensorHighWarningTemperature.Temp_Sensor. Note: Care should be taken to ensure that the temperature does not exceed levels that may cause a permanent hardware failure.		
21.2	IF Sensor_Location is equal to "ambient", then GOTO Step 21.2.1; otherwise, GOTO Step 21.3.		
21.2.1	GET the following object(s): »dmsTempSensorStatusMap.0 »dmsTempSensorNumRows.0 »dmsTempSensorIndex.Temp_Sensor »dmsTempSensorDescription.Temp_Sensor »dmsTempSensorCurrentReading.Temp_Sensor »dmsTempSensorHighWarningTemperature.Temp_Sensor »dmsTempSensorLowWarningTemperature.Temp_Sensor »dmsTempSensorHighCriticalTemperature.Temp_Sensor »dmsTempSensorLowCriticalTemperature.Temp_Sensor »dmsTempSensorStatus.Temp_Sensor »tempMaxAmbient.0 »tempMinAmbient.0	Pass / Fail (Section 3.5.3.1.7)	
21.2.2	RECORD the RESPONSE VALUE for dmsTempSensorCurrentReading.Temp_Sensor, dmsTempSensorDescription.Temp_Sensor, dmsTempSensorStatus.Temp_Sensor, and dmsTempSensorStatusMap.0 as: »Current_Reading »Description »Status »Status_Map		
21.2.3	VERIFY that the RESPONSE VALUE for tempMaxAmbient.0 is greater than or equal to Current_Reading.	Pass / Fail (Section 3.5.3.1.7)	
21.2.4	VERIFY that the RESPONSE VALUE for tempMinAmbient.0 is less than or equal to Current_Reading.	Pass / Fail (Section 3.5.3.1.7)	
21.3	IF Sensor_Location is equal to "sign housing", then GOTO Step 21.3.1; otherwise, GOTO Step 21.4.		

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21.3.1	GET the following object(s): »dmsTempSensorStatusMap.0 »dmsTempSensorNumRows.0 »dmsTempSensorIndex.Temp_Sensor »dmsTempSensorDescription.Temp_Sensor »dmsTempSensorCurrentReading.Temp_Sensor »dmsTempSensorHighWarningTemperature.Temp_Sensor »dmsTempSensorLowWarningTemperature.Temp_Sensor »dmsTempSensorHighCriticalTemperature.Temp_Sensor »dmsTempSensorLowCriticalTemperature.Temp_Sensor »dmsTempSensorStatus.Temp_Sensor »tempMaxSignHousing.0 »tempMinSignHousing.0	Pass / Fail (Section 3.5.3.1.4.7)	
21.3.2	RECORD the RESPONSE VALUE for dmsTempSensorCurrentReading.Temp_Sensor, dmsTempSensorDescription.Temp_Sensor, dmsTempSensorStatus.Temp_Sensor, and dmsTempSensorStatusMap.0 as: »Current_Reading »Description »Status »Status_Map		
21.3.3	VERIFY that the RESPONSE VALUE for tempMaxSignHousing.0 is greater than or equal to Current_Reading.	Pass / Fail (Section 3.5.3.1.4.7)	
21.3.4	VERIFY that the RESPONSE VALUE for tempMinSignHousing.0 is less than or equal to Current_Reading.	Pass / Fail (Section 3.5.3.1.4.7)	
21.4	IF Sensor_Location is equal to "control cabinet", then GOTO Step 21.4.1; otherwise, GOTO Step 21.5.		
21.4.1	GET the following object(s): »dmsTempSensorStatusMap.0 »dmsTempSensorNumRows.0 »dmsTempSensorIndex.Temp_Sensor »dmsTempSensorDescription.Temp_Sensor »dmsTempSensorCurrentReading.Temp_Sensor »dmsTempSensorHighWarningTemperature.Temp_Sensor »dmsTempSensorLowWarningTemperature.Temp_Sensor »dmsTempSensorHighCriticalTemperature.Temp_Sensor »dmsTempSensorLowCriticalTemperature.Temp_Sensor »dmsTempSensorStatus.Temp_Sensor »tempMaxCtrlCabinet.0 »tempMinCtrlCabinet.0	Pass / Fail (Section 3.5.3.1.4.9)	
21.4.2	RECORD the RESPONSE VALUE for dmsTempSensorCurrentReading.Temp_Sensor, dmsTempSensorDescription.Temp_Sensor, dmsTempSensorStatus.Temp_Sensor, and dmsTempSensorStatusMap.0 as: »Current_Reading »Description »Status »Status_Map		
21.4.3	VERIFY that the RESPONSE VALUE for tempMaxCtrlCabinet.0 is greater than or equal to Current_Reading.	Pass / Fail (Section 3.5.3.1.4.9)	
21.4.4	VERIFY that the RESPONSE VALUE for tempMinCtrlCabinet.0 is less than or equal to Current_Reading.	Pass / Fail (Section 3.5.3.1.4.9)	

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21.5	VERIFY that the RESPONSE VALUE for dmsTempSensorDescription.Temp_Sensor contains only valid DisplayString characters. Note: Per RFC 854, the characters are restricted to the ASCII codes of 0, 7 through 13, and 32 through 126.	Pass / Fail (Section 5.11.2.9.3.2)	
21.6	SET-UP: VERIFY that the RESPONSE VALUE for dmsTempSensorStatus.Temp_Sensor equals 'noError' (2).		
21.7	Determine the value of Counter + 1. RECORD this information as: »Counter		
21.8	IF Current_Reading is less than or equal to High_Warning and Counter is less than 5, then GOTO Step 21.1; otherwise, GOTO Step 22. Note: If the user is unable to raise the temperature sufficiently, the user shall EXIT without passing or failing the test.		
22	VERIFY that the RESPONSE VALUE for dmsTempSensorStatusMap.0 indicates that all bits are set to zero (0).	Pass / Fail (Section 5.11.2.9.1)	
23	DELAY for Status_Update_Delay seconds.		
24	GET the following object(s): »shortErrorStatus.0	Pass / Fail (Section 3.5.3.1.2)	
25	VERIFY that the RESPONSE VALUE for shortErrorStatus.0 has bit 9 (temperature warning) set. Note: Unless it can be shown that it is set due to the reading of some other temperature sensor.	Pass / Fail (Section 3.5.3.1.2)	
26	GET the following object(s): »tempSensorWarningMap.0 »tempSensorCriticalTempMap.0	Pass / Fail (Section 3.5.3.1.3.7)	
27	VERIFY that the RESPONSE VALUE of tempSensorWarningMap.0 has bit (Temp_Sensor-1) set.	Pass / Fail (Section 3.5.3.1.3.7)	
28	Remove the heat from the sensor.		

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.5.9 Verify Temperature Warning—Low

Test Case: 5.9	**Title:**	**Verify Temperature Warning—Low**	
	Description:	This test case verifies that the DMS reports a temperature warning when the temperature falls below a defined threshold.	
	Variables:	Temp_Sensor	from the test plan
		Sensor_Location	based on manufacturer documentation
		Status_Update_Delay	PRL 3.6.9
		Temperature_Support	PRL 2.5.3.1.2 / 3.5.3.1.3.7
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

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Step	Test Procedure	Results	Additional References
1	Determine whether the DMS supports temperature sensors. RECORD this information as: »Temperature_Support		
2	IF Temperature_Support is equal to 0, then EXIT.		
3	CONFIGURE: Determine the index of a temperature sensor to be tested (from the test plan). RECORD this information as: »Temp_Sensor		
4	CONFIGURE: Determine whether the Temp_Sensor detects 'ambient', 'sign housing', or 'controller cabinet' temperature (based on manufacturer documentation). RECORD this information as: »Sensor_Location	Pass / Fail (PRL 2.5.3.1.2 / 3.5.3.1.3.7)	
5	CONFIGURE: Determine the frequency at which the DMS is required to update the status variables (per PRL 3.6.9). RECORD this information as: »Status_Update_Delay		
6	SET-UP: GET the following object(s): »dmsTempSensorNumRows.0 Note: This is not defined as a dialog within the standard, but is required to be performed here to prevent a noSuchName error from occurring if the selected sensor is greater than the number of sensors supported.		
7	SET-UP: VERIFY that the RESPONSE VALUE for dmsTempSensorNumRows.0 is greater than or equal to Temp_Sensor.		
8	IF Sensor_Location is equal to “ambient”, then GOTO Step 8.1; otherwise, GOTO Step 9.		
8.1	GET the following object(s): »dmsTempSensorStatusMap.0 »dmsTempSensorNumRows.0 »dmsTempSensorIndex.Temp_Sensor »dmsTempSensorDescription.Temp_Sensor »dmsTempSensorCurrentReading.Temp_Sensor »dmsTempSensorHighWarningTemperature.Temp_Sensor »dmsTempSensorLowWarningTemperature.Temp_Sensor »dmsTempSensorHighCriticalTemperature.Temp_Sensor »dmsTempSensorLowCriticalTemperature.Temp_Sensor »dmsTempSensorStatus.Temp_Sensor »tempMaxAmbient.0 »tempMinAmbient.0	Pass / Fail (Section 3.5.3.1.7)	
8.2	RECORD the RESPONSE VALUE for dmsTempSensorCurrentReading.Temp_Sensor, dmsTempSensorDescription.Temp_Sensor, dmsTempSensorStatus.Temp_Sensor, dmsTempSensorLowWarningTemperature.Temp_Sensor, and dmsTempSensorStatusMap.0 as: »Current_Reading »Description »Status »Low_Warning »Status_Map		

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8.3	VERIFY that the RESPONSE VALUE for tempMaxAmbient.0 is greater than or equal to Current_Reading.	Pass / Fail (Section 3.5.3.1.7)	
8.4	VERIFY that the RESPONSE VALUE for tempMinAmbient.0 is less than or equal to Current_Reading.	Pass / Fail (Section 3.5.3.1.7)	
9	IF Sensor_Location is equal to "sign housing", then GOTO Step 9.1; otherwise, GOTO Step 10.		
9.1	GET the following object(s): »dmsTempSensorStatusMap.0 »dmsTempSensorNumRows.0 »dmsTempSensorIndex.Temp_Sensor »dmsTempSensorDescription.Temp_Sensor »dmsTempSensorCurrentReading.Temp_Sensor »dmsTempSensorHighWarningTemperature.Temp_Sensor »dmsTempSensorLowWarningTemperature.Temp_Sensor »dmsTempSensorHighCriticalTemperature.Temp_Sensor »dmsTempSensorLowCriticalTemperature.Temp_Sensor »dmsTempSensorStatus.Temp_Sensor »tempMaxSignHousing.0 »tempMinSignHousing.0	Pass / Fail (Section 3.5.3.1.4.7)	
9.2	RECORD the RESPONSE VALUE for dmsTempSensorCurrentReading.Temp_Sensor, dmsTempSensorDescription.Temp_Sensor, dmsTempSensorStatus.Temp_Sensor, dmsTempSensorLowWarningTemperature.Temp_Sensor, and dmsTempSensorStatusMap.0 as: »Current_Reading »Description »Status »Low_Warning »Status_Map		
9.3	VERIFY that the RESPONSE VALUE for tempMaxSignHousing.0 is greater than or equal to Current_Reading.	Pass / Fail (Section 3.5.3.1.4.7)	
9.4	VERIFY that the RESPONSE VALUE for tempMinSignHousing.0 is less than or equal to Current_Reading.	Pass / Fail (Section 3.5.3.1.4.7)	
10	IF Sensor_Location is equal to "control cabinet", then GOTO Step 10.1; otherwise, GOTO Step 11.		
10.1	GET the following object(s): »dmsTempSensorStatusMap.0 »dmsTempSensorNumRows.0 »dmsTempSensorIndex.Temp_Sensor »dmsTempSensorDescription.Temp_Sensor »dmsTempSensorCurrentReading.Temp_Sensor »dmsTempSensorHighWarningTemperature.Temp_Sensor »dmsTempSensorLowWarningTemperature.Temp_Sensor »dmsTempSensorHighCriticalTemperature.Temp_Sensor »dmsTempSensorLowCriticalTemperature.Temp_Sensor »dmsTempSensorStatus.Temp_Sensor »tempMaxCtrlCabinet.0 »tempMinCtrlCabinet.0	Pass / Fail (Section 3.5.3.1.4.9)	

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10.2	RECORD the RESPONSE VALUE for dmsTempSensorCurrentReading.Temp_Sensor, dmsTempSensorDescription.Temp_Sensor, dmsTempSensorStatus.Temp_Sensor, dmsTempSensorLowWarningTemperature.Temp_Sensor, and dmsTempSensorStatusMap.0 as: »Current_Reading »Description »Status »Low_Warning »Status_Map		
10.3	VERIFY that the RESPONSE VALUE for tempMaxCtrlCabinet.0 is greater than or equal to Current_Reading.	Pass / Fail (Section 3.5.3.1.4.9)	
10.4	VERIFY that the RESPONSE VALUE for tempMinCtrlCabinet.0 is less than or equal to Current_Reading.	Pass / Fail (Section 3.5.3.1.4.9)	
11	VERIFY that the RESPONSE VALUE for dmsTempSensorDescription.Temp_Sensor contains only valid DisplayString characters. Note: Per RFC 854, the characters are restricted to the ASCII codes of 0, 7 through 13, and 32 through 126.	Pass / Fail (Section 5.11.2.9.3.2)	
12	SET-UP: VERIFY that the RESPONSE VALUE for dmsTempSensorStatus.Temp_Sensor equals 'noError' (2). Note: Valid enumerated values are defined in Section 5.11.2.9.3.8 (Temperature Sensor Status Parameter).		
13	SET-UP: VERIFY that Current_Reading is greater than Low_Warning and less than High_Warning.		
14	VERIFY that the RESPONSE VALUE for dmsTempSensorStatusMap.0 indicates that all bits are equal to zero (0).	Pass / Fail (Section 5.11.2.9.1)	
15	DELAY for Status_Update_Delay seconds.		
16	GET the following object(s): »shortErrorStatus.0	Pass / Fail (Section 3.5.3.1.2)	
17	VERIFY that the RESPONSE VALUE for shortErrorStatus.0 does not have bit 9 (temperature warning) set. Note: Unless it can be shown that it is set due to the reading of some other temperature sensor.	Pass / Fail (Section 3.5.3.1.2)	
18	GET the following object(s): »tempSensorWarningMap.0 »tempSensorCriticalTempMap.0	Pass / Fail (Section 3.5.3.1.3.7)	
19	VERIFY that the RESPONSE VALUE of tempSensorWarningMap.0 does not have the bit (Temp_Sensor – 1) set.	Pass / Fail (Section 3.5.3.1.3.7)	
20	RECORD the value of zero (0) as: »Counter		

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21.1	Alter the temperature of the Temp_Sensor using ice or other methods of simulating a lowering of the temperature beyond the RESPONSE VALUE for dmsTempSensorLowWarningTemperature.Temp_Sensor. Note: Care should be taken to ensure that the temperature does not fall below levels that may cause a permanent hardware failure.		
21.2	IF Sensor_Location is equal to "ambient", then GOTO Step 21.2.1; otherwise, GOTO Step 21.3.		
21.2.1	GET the following object(s): »dmsTempSensorStatusMap.0 »dmsTempSensorNumRows.0 »dmsTempSensorIndex.Temp_Sensor »dmsTempSensorDescription.Temp_Sensor »dmsTempSensorCurrentReading.Temp_Sensor »dmsTempSensorHighWarningTemperature.Temp_Sensor »dmsTempSensorLowWarningTemperature.Temp_Sensor »dmsTempSensorHighCriticalTemperature.Temp_Sensor »dmsTempSensorLowCriticalTemperature.Temp_Sensor »dmsTempSensorStatus.Temp_Sensor »tempMaxAmbient.0 »tempMinAmbient.0	Pass / Fail (Section 3.5.3.1.7)	
21.2.2	Determine the RESPONSE VALUE for dmsTempSensorCurrentReading.Temp_Sensor, dmsTempSensorDescription.Temp_Sensor, dmsTempSensorStatus.Temp_Sensor, and dmsTempSensorStatusMap.0 as: »Current_Reading »Description »Status »Status_Map		
21.2.3	VERIFY that the RESPONSE VALUE for tempMaxAmbient.0 is greater than or equal to Current_Reading.	Pass / Fail (Section 3.5.3.1.7)	
21.2.4	VERIFY that the RESPONSE VALUE for tempMinAmbient.0 is less than or equal to Current_Reading.	Pass / Fail (Section 3.5.3.1.7)	
21.3	IF Sensor_Location is equal to "sign housing", then GOTO Step 21.3.1; otherwise, GOTO Step 21.4.		
21.3.1	GET the following object(s): »dmsTempSensorStatusMap.0 »dmsTempSensorNumRows.0 »dmsTempSensorIndex.Temp_Sensor »dmsTempSensorDescription.Temp_Sensor »dmsTempSensorCurrentReading.Temp_Sensor »dmsTempSensorHighWarningTemperature.Temp_Sensor »dmsTempSensorLowWarningTemperature.Temp_Sensor »dmsTempSensorHighCriticalTemperature.Temp_Sensor »dmsTempSensorLowCriticalTemperature.Temp_Sensor »dmsTempSensorStatus.Temp_Sensor »tempMaxSignHousing.0 »tempMinSignHousing.0	Pass / Fail (Section 3.5.3.1.4.7)	
21.3.2	Determine the RESPONSE VALUE for dmsTempSensorCurrentReading.Temp_Sensor, dmsTempSensorDescription.Temp_Sensor, dmsTempSensorStatus.Temp_Sensor, and dmsTempSensorStatusMap.0 as: »Current_Reading »Description »Status »Status_Map		

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21.3.3	VERIFY that the RESPONSE VALUE for tempMaxSignHousing.0 is greater than or equal to Current_Reading.	Pass / Fail (Section 3.5.3.1.4.7)	
21.3.4	VERIFY that the RESPONSE VALUE for tempMinSignHousing.0 is less than or equal to Current_Reading.	Pass / Fail (Section 3.5.3.1.4.7)	
21.4	IF Sensor_Location is equal to "control cabinet", then GOTO Step 21.4.1; otherwise, GOTO Step 21.5.		
21.4.1	GET the following object(s): »dmsTempSensorStatusMap.0 »dmsTempSensorNumRows.0 »dmsTempSensorIndex.Temp_Sensor »dmsTempSensorDescription.Temp_Sensor »dmsTempSensorCurrentReading.Temp_Sensor »dmsTempSensorHighWarningTemperature.Temp_Sensor »dmsTempSensorLowWarningTemperature.Temp_Sensor »dmsTempSensorHighCriticalTemperature.Temp_Sensor »dmsTempSensorLowCriticalTemperature.Temp_Sensor »dmsTempSensorStatus.Temp_Sensor »tempMaxCtrlCabinet.0 »tempMinCtrlCabinet.0	Pass / Fail (Section 3.5.3.1.4.9)	
21.4.2	Determine the RESPONSE VALUE for dmsTempSensorCurrentReading.Temp_Sensor, dmsTempSensorDescription.Temp_Sensor, dmsTempSensorStatus.Temp_Sensor, and dmsTempSensorStatusMap.0 as: »Current_Reading »Description »Status »Status_Map		
21.4.3	VERIFY that the RESPONSE VALUE for tempMaxCtrlCabinet.0 is greater than or equal to Current_Reading.	Pass / Fail (Section 3.5.3.1.4.9)	
21.4.4	VERIFY that the RESPONSE VALUE for tempMinCtrlCabinet.0 is less than or equal to Current_Reading.	Pass / Fail (Section 3.5.3.1.4.9)	
21.5	VERIFY that the RESPONSE VALUE for dmsTempSensorDescription.Temp_Sensor contains only valid DisplayString characters. Note: Per RFC 854, the characters are restricted to the ASCII codes of 0, 7 through 13, and 32 through 126.	Pass / Fail (Section 5.11.2.9.3.2)	
21.6	SET-UP: VERIFY that the RESPONSE VALUE for dmsTempSensorStatus.Temp_Sensor equals 'noError' (2).		
21.7	Determine the value of Counter + 1. RECORD this information as: »Counter		
21.8	IF Counter is greater than or equal to 5, EXIT without passing or failing the test.		
21.9	IF Current_Reading is greater than or equal to Low_Warning, then GOTO Step 21.1; otherwise, GOTO Step 22.		
21.10	IF Current_Reading is greater than or equal to Low_Warning and Counter is less than 5, then GOTO Step 21.1; otherwise, GOTO Step 22. Note: If the user is unable to lower the temperature sufficiently, the user shall EXIT without passing or failing the test.		

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22	VERIFY that the RESPONSE VALUE for dmsTempSensorStatusMap.0 indicates that all bits are equal to zero (0).	Pass / Fail (Section 5.11.2.9.1)	
23	DELAY for Status_Update_Delay seconds.		
24	GET the following object(s): »shortErrorStatus.0	Pass / Fail (Section 3.5.3.1.2)	
25	VERIFY that the RESPONSE VALUE for shortErrorStatus.0 has bit 9 (temperature warning) set. Note: Unless it can be shown that it is set due to the reading of some other temperature sensor.	Pass / Fail (Section 3.5.3.1.2)	
26	GET the following object(s): »tempSensorWarningMap.0 »tempSensorCriticalTempMap.0	Pass / Fail (Section 3.5.3.1.3.7)	
27	VERIFY that the RESPONSE VALUE of tempSensorWarningMap.0 has bit (Temp_Sensor – 1) set.	Pass / Fail (Section 3.5.3.1.3.7)	
28	Remove the ice from the sensor.		

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.5.10 Verify Critical Temperature Alarm - High

Test Case: 5.10	**Title:**	**Verify Critical Temperature Alarm – High**	
	Description:	This test case verifies that the DMS reports a critical temperature alarm when the temperature exceeds a defined threshold.	
	Variables:	Temp_Sensor	From the Test Plan
		Sensor_Location	Per manufacturer's documentation
		Status_Update_Delay	PRL 3.6.9
		Temperature_Support	PRL 2.5.3.1.2 / 3.5.3.1.3.7
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	Determine whether the DMS supports temperature sensors. RECORD this information as: »Temperature_Support	Pass / Fail (PRL 2.5.3.1.2 / 3.5.3.1.3.7)	
2	IF Temperature_Support is equal to 0, then EXIT.		
3	CONFIGURE: Determine the index of a temperature sensor to be tested (from the test plan). RECORD this information as: »Temp_Sensor		
4	CONFIGURE: Determine whether the Temp_Sensor detects 'ambient', 'sign housing', or 'controller cabinet' temperature (based on manufacturer documentation). RECORD this information as: »Sensor_Location		

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5	CONFIGURE: Determine the frequency at which the DMS is required to update the status variables (per PRL 3.6.9). RECORD this information as: »Status_Update_Delay		
6	SET-UP: GET the following object(s): »dmsTempSensorNumRows.0		
7	SET-UP: VERIFY that the RESPONSE VALUE for dmsTempSensorNumRows.0 is greater than or equal to Temp_Sensor.		
8	IF Sensor_Location is equal to "ambient", then GOTO Step 8.1; otherwise, GOTO Step 9.		
8.1	GET the following object(s): »dmsTempSensorStatusMap.0 »dmsTempSensorNumRows.0 »dmsTempSensorIndex.Temp_Sensor »dmsTempSensorDescription.Temp_Sensor »dmsTempSensorCurrentReading.Temp_Sensor »dmsTempSensorHighWarningTemperature.Temp_Sensor »dmsTempSensorLowWarningTemperature.Temp_Sensor »dmsTempSensorHighCriticalTemperature.Temp_Sensor »dmsTempSensorLowCriticalTemperature.Temp_Sensor »dmsTempSensorStatus.Temp_Sensor »tempMaxAmbient.0 »tempMinAmbient.0	Pass / Fail (Sections 3.5.3.1.7)	
8.2	RECORD the RESPONSE VALUE for dmsTempSensorCurrentReading.Temp_Sensor, dmsTempSensorDescription.Temp_Sensor, dmsTempSensorStatus.Temp_Sensor, dmsTempSensorHighCriticalTemperature.Temp_Sensor, dmsTempSensorHighWarningTemperature.Temp_Sensor, and dmsTempSensorStatusMap.0 as: »Current_Reading »Description »Status »High_Critical »High_Warning »Status_Map		
8.3	VERIFY that the RESPONSE VALUE for tempMaxAmbient.0 is greater than or equal to Current_Reading.	Pass / Fail (Section 3.5.3.1.7)	
8.4	VERIFY that the RESPONSE VALUE for tempMinAmbient.0 is less than or equal to Current_Reading.	Pass / Fail (Section 3.5.3.1.7)	
9	IF Sensor_Location is equal to "sign housing", then GOTO Step 9.1; otherwise, GOTO Step 10.		
9.1	GET the following object(s): »dmsTempSensorStatusMap.0 »dmsTempSensorNumRows.0 »dmsTempSensorIndex.Temp_Sensor »dmsTempSensorDescription.Temp_Sensor »dmsTempSensorCurrentReading.Temp_Sensor »dmsTempSensorHighWarningTemperature.Temp_Sensor »dmsTempSensorLowWarningTemperature.Temp_Sensor »dmsTempSensorHighCriticalTemperature.Temp_Sensor »dmsTempSensorLowCriticalTemperature.Temp_Sensor »dmsTempSensorStatus.Temp_Sensor »tempMaxSignHousing.0 »tempMinSignHousing.0	Pass / Fail (Section 3.5.3.1.4.7)	

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9.2	RECORD the RESPONSE VALUE for dmsTempSensorCurrentReading.Temp_Sensor, dmsTempSensorDescription.Temp_Sensor, dmsTempSensorStatus.Temp_Sensor, dmsTempSensorHighCriticalTemperature.Temp_Sensor, dmsTempSensorHighWarningTemperature.Temp_Sensor, and dmsTempSensorStatusMap.0 as: »Current_Reading »Description »Status »High_Critical »High_Warning »Status_Map		
9.3	VERIFY that the RESPONSE VALUE for tempMaxSignHousing.0 is greater than or equal to Current_Reading.	Pass / Fail (Section 3.5.3.1.4.7)	
9.4	VERIFY that the RESPONSE VALUE for tempMinSignHousing.0 is less than or equal to Current_Reading.	Pass / Fail (Section 3.5.3.1.4.7)	
10	IF Sensor_Location is equal to "control cabinet", then GOTO Step 10.1; otherwise, GOTO Step 11.		
10.1	GET the following object(s): »dmsTempSensorStatusMap.0 »dmsTempSensorNumRows.0 »dmsTempSensorIndex.Temp_Sensor »dmsTempSensorDescription.Temp_Sensor »dmsTempSensorCurrentReading.Temp_Sensor »dmsTempSensorHighWarningTemperature.Temp_Sensor »dmsTempSensorLowWarningTemperature.Temp_Sensor »dmsTempSensorHighCriticalTemperature.Temp_Sensor »dmsTempSensorLowCriticalTemperature.Temp_Sensor »dmsTempSensorStatus.Temp_Sensor »tempMaxCtrlCabinet.0 »tempMinCtrlCabinet.0	Pass / Fail (Section 3.5.3.1.4.9)	
10.2	RECORD the RESPONSE VALUE for dmsTempSensorCurrentReading.Temp_Sensor, dmsTempSensorDescription.Temp_Sensor, dmsTempSensorStatus.Temp_Sensor, dmsTempSensorHighCriticalTemperature.Temp_Sensor, dmsTempSensorHighWarningTemperature.Temp_Sensor, and dmsTempSensorStatusMap.0 as: »Current_Reading »Description »Status »High_Critical »High_Warning »Status_Map		
10.3	VERIFY that the RESPONSE VALUE for tempMaxCtrlCabinet.0 is greater than or equal to Current_Reading.	Pass / Fail (Section 3.5.3.1.4.9)	
10.4	VERIFY that the RESPONSE VALUE for tempMinCtrlCabinet.0 is less than or equal to Current_Reading.	Pass / Fail (Section 3.5.3.1.4.9)	
11	VERIFY that the RESPONSE VALUE for dmsTempSensorDescription.Temp_Sensor contains only valid DisplayString characters. Note: Per RFC 854, the characters are restricted to the ASCII codes of 0, 7 through 13, and 32 through 126.	Pass / Fail (Section 5.11.2.9.3.2)	

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12	SET-UP: VERIFY that the RESPONSE VALUE for dmsTempSensorStatus.Temp_Sensor equals 'noError' (2). Note: Valid enumerated values are defined in Section 5.11.2.9.3.8 (Temperature Sensor Status Parameter).		
13	SET-UP: VERIFY that Current_Reading is greater than Low_Critical and is less than High_Critical.		
14	VERIFY that the RESPONSE VALUE for dmsTempSensorStatusMap.0 indicates that all bits are equal to zero (0).	Pass / Fail (Section 5.11.2.9.1)	
15	DELAY for Status_Update_Delay seconds.		
16	GET the following object(s): »shortErrorStatus.0	Pass / Fail (Section 3.5.3.1.2)	
17	VERIFY that the RESPONSE VALUE for shortErrorStatus.0 does not have bit 11 (critical temperature error) set. Note: Unless it can be shown that it is set due to the reading of some other temperature sensor.	Pass / Fail (Section 3.5.3.1.2)	
18	GET the following object(s): »tempSensorWarningMap.0 »tempSensorCriticalTempMap.0	Pass / Fail (Section 3.5.3.1.3.7)	
19	VERIFY that the RESPONSE VALUE of tempSensorWarningMap.0 does not have bit (Temp_Sensor – 1) set.	Pass / Fail (Section 3.5.3.1.3.7)	
20	RECORD the value of zero (0) as: »Counter		
21.1	Alter the temperature of the Temp_Sensor using a heat gun or other methods of simulating a rise in temperature past the RESPONSE VALUE for dmsTempSensorHighCriticalTemperature.Temp_Sensor. Note: Care should be taken to ensure that the temperature does not exceed levels that may cause a permanent hardware failure.		
21.2	IF Sensor_Location is equal to "ambient", then GOTO Step 21.2.1; otherwise, GOTO Step 21.3.		
21.2.1	GET the following object(s): »dmsTempSensorStatusMap.0 »dmsTempSensorNumRows.0 »dmsTempSensorIndex.Temp_Sensor »dmsTempSensorDescription.Temp_Sensor »dmsTempSensorCurrentReading.Temp_Sensor »dmsTempSensorHighWarningTemperature.Temp_Sensor »dmsTempSensorLowWarningTemperature.Temp_Sensor »dmsTempSensorHighCriticalTemperature.Temp_Sensor »dmsTempSensorLowCriticalTemperature.Temp_Sensor »dmsTempSensorStatus.Temp_Sensor »tempMaxAmbient.0 »tempMinAmbient.0	Pass / Fail (Sections 3.5.3.1.7, 3.5.3.1.8)	

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21.2.2	RECORD the RESPONSE VALUE for dmsTempSensorCurrentReading.Temp_Sensor, dmsTempSensorDescription.Temp_Sensor, dmsTempSensorStatus.Temp_Sensor, dmsTempSensorHighCriticalTemperature.Temp_Sensor, and dmsTempSensorStatusMap.0 as: »Current_Reading »Description »Status »High_Critical »Status_Map		
21.2.3	VERIFY that the RESPONSE VALUE for tempMaxAmbient.0 is greater than or equal to Current_Reading.	Pass / Fail (Section 3.5.3.1.7)	
21.2.4	VERIFY that the RESPONSE VALUE for tempMinAmbient.0 is less than or equal to Current_Reading.	Pass / Fail (Section 3.5.3.1.7)	
21.3	IF Sensor_Location is equal to "sign housing", then GOTO Step 21.3.1; otherwise, GOTO Step 21.4.		
21.3.1	GET the following object(s): »dmsTempSensorStatusMap.0 »dmsTempSensorNumRows.0 »dmsTempSensorIndex.Temp_Sensor »dmsTempSensorDescription.Temp_Sensor »dmsTempSensorCurrentReading.Temp_Sensor »dmsTempSensorHighWarningTemperature.Temp_Sensor »dmsTempSensorLowWarningTemperature.Temp_Sensor »dmsTempSensorHighCriticalTemperature.Temp_Sensor »dmsTempSensorLowCriticalTemperature.Temp_Sensor »dmsTempSensorStatus.Temp_Sensor »tempMaxSignHousing.0 »tempMinSignHousing.0	Pass / Fail (Sections 3.5.3.1.4.7, 3.5.3.1.8)	
21.3.2	RECORD the RESPONSE VALUE for dmsTempSensorCurrentReading.Temp_Sensor, dmsTempSensorDescription.Temp_Sensor, dmsTempSensorStatus.Temp_Sensor, dmsTempSensorHighCriticalTemperature.Temp_Sensor, and dmsTempSensorStatusMap.0 as: »Current_Reading »Description »Status »High_Critical »Status_Map		
21.3.3	VERIFY that the RESPONSE VALUE for tempMaxSignHousing.0 is greater than or equal to Current_Reading.	Pass / Fail (Section 3.5.3.1.4.7)	
21.3.4	VERIFY that the RESPONSE VALUE for tempMinSignHousing.0 is less than or equal to Current_Reading.	Pass / Fail (Section 3.5.3.1.4.7)	
21.4	IF Sensor_Location is equal to "control cabinet", then GOTO Step 21.4.1; otherwise, GOTO Step 21.5.		

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21.4.1	GET the following object(s): »dmsTempSensorStatusMap.0 »dmsTempSensorNumRows.0 »dmsTempSensorIndex.Temp_Sensor »dmsTempSensorDescription.Temp_Sensor »dmsTempSensorCurrentReading.Temp_Sensor »dmsTempSensorHighWarningTemperature.Temp_Sensor »dmsTempSensorLowWarningTemperature.Temp_Sensor »dmsTempSensorHighCriticalTemperature.Temp_Sensor »dmsTempSensorLowCriticalTemperature.Temp_Sensor »dmsTempSensorStatus.Temp_Sensor »tempMaxCtrlCabinet.0 »tempMinCtrlCabinet.0	Pass / Fail (Sections 3.5.3.1.4.9, 3.5.3.1.8)	
21.4.2	RECORD the RESPONSE VALUE for dmsTempSensorCurrentReading.Temp_Sensor, dmsTempSensorDescription.Temp_Sensor, dmsTempSensorStatus.Temp_Sensor, dmsTempSensorHighCriticalTemperature.Temp_Sensor, and dmsTempSensorStatusMap.0 as: »Current_Reading »Description »Status »High_Critical »Status_Map		
21.4.3	VERIFY that the RESPONSE VALUE for tempMaxCtrlCabinet.0 is greater than or equal to Current_Reading.	Pass / Fail (Section 3.5.3.1.4.9)	
21.4.4	VERIFY that the RESPONSE VALUE for tempMinCtrlCabinet.0 is less than or equal to Current_Reading.	Pass / Fail (Section 3.5.3.1.4.9)	
21.5	VERIFY that the RESPONSE VALUE for dmsTempSensorDescription.Temp_Sensor contains only valid DisplayString characters. Note: Per RFC 854, the characters are restricted to the ASCII codes of 0, 7 through 13, and 32 through 126.	Pass / Fail (Section 5.11.2.9.3.2)	
21.6	SET-UP: VERIFY that the RESPONSE VALUE for dmsTempSensorStatus.Temp_Sensor equals 'noError' (2).		
21.7	Determine the value of Counter + 1. RECORD this information as: »Counter		
21.8	IF Counter is greater than or equal to 5, EXIT without passing or failing the test.		
21.9	IF Current_Reading is greater than or equal to Low_Warning, then GOTO Step 21.1; otherwise, GOTO Step 23.		
22	IF Current_Reading is less than or equal to High_Critical and Counter is less than 5, then GOTO Step 21.1; otherwise, GOTO Step 23. Note: If the user is unable to raise the temperature sufficiently, the user shall EXIT without passing or failing the test.		
23	VERIFY that the RESPONSE VALUE for dmsTempSensorStatusMap.0 indicates that all bits are equal to zero (0).	Pass / Fail (Section 5.11.2.9.1)	
24	DELAY for Status_Update_Delay seconds.		

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25	GET the following object(s): »shortErrorStatus.0	Pass / Fail (Section 3.5.3.1.2)	
26	VERIFY that the RESPONSE VALUE for shortErrorStatus.0 has bit 11 (critical temperature error) set. Note: Unless it can be shown that it is set due to the reading of some other temperature sensor.	Pass / Fail (Section 3.5.3.1.2)	
27	GET the following object(s): »tempSensorWarningMap.0 »tempSensorCriticalTempMap.0	Pass / Fail (Section 3.5.3.1.3.7)	
28	VERIFY that the RESPONSE VALUE of tempSensorWarningMap.0 has bit (Temp_Sensor – 1) set.	Pass / Fail (Section 3.5.3.1.3.7)	
29	Remove the heat from the sensor.		

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.5.11 Verify Critical Temperature Alarm—Low

Test Case: 5.11	**Title:**	**Verify Critical Temperature Alarm - Low**	
	Description:	This test case verifies that the DMS reports a critical temperature alarm when the temperature falls below a defined threshold.	
	Variables:	Temp_Sensor	From the Test Plan
		Sensor_Location	Per manufacturer's documentation
		Status_Update_Delay	PRL 3.6.9
		Temperature_Support	PRL 2.5.3.1.2 / 3.5.3.1.3.7
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	Determine whether the DMS supports temperature sensors. RECORD this information as: »Temperature_Support	Pass / Fail (PRL 2.5.3.1.2 / 3.5.3.1.3.7)	
2	IF Temperature_Support is equal to 0, then EXIT.		
3	CONFIGURE: Determine the index of a temperature sensor to be tested (from the test plan). RECORD this information as: »Temp_Sensor		
4	CONFIGURE: Determine whether the Temp_Sensor detects 'ambient', 'sign housing', or 'controller cabinet' temperature (based on manufacturer documentation). RECORD this information as: »Sensor_Location		
5	CONFIGURE: Determine the frequency at which the DMS is required to update the status variables (per PRL 3.6.9). RECORD this information as: »Status_Update_Delay		

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6	SET-UP: GET the following object(s): »dmsTempSensorNumRows.0		
7	SET-UP: VERIFY that the RESPONSE VALUE for dmsTempSensorNumRows.0 is greater than or equal to Temp_Sensor.		
8	IF Sensor_Location is equal to "ambient", then GOTO Step 8.1; otherwise, GOTO Step 9.		
8.1	GET the following object(s): »dmsTempSensorStatusMap.0 »dmsTempSensorNumRows.0 »dmsTempSensorIndex.Temp_Sensor »dmsTempSensorDescription.Temp_Sensor »dmsTempSensorCurrentReading.Temp_Sensor »dmsTempSensorHighWarningTemperature.Temp_Sensor »dmsTempSensorLowWarningTemperature.Temp_Sensor »dmsTempSensorHighCriticalTemperature.Temp_Sensor »dmsTempSensorLowCriticalTemperature.Temp_Sensor »dmsTempSensorStatus.Temp_Sensor »tempMaxAmbient.0 »tempMinAmbient.0	Pass / Fail (Section 3.5.3.1.7)	
8.2	RECORD the RESPONSE VALUE for dmsTempSensorCurrentReading.Temp_Sensor, dmsTempSensorDescription.Temp_Sensor, dmsTempSensorStatus.Temp_Sensor, dmsTempSensorLowCriticalTemperature.Temp_Sensor, dmsTempSensorLowWarningTemperature.Temp_Sensor, and dmsTempSensorStatusMap.0 as: »Current_Reading »Description »Status »Low_Critical »Low_Warning »Status_Map		
8.3	VERIFY that the RESPONSE VALUE for tempMaxAmbient.0 is greater than or equal to Current_Reading.	Pass / Fail (Section 3.5.3.1.7)	
8.4	VERIFY that the RESPONSE VALUE for tempMinAmbient.0 is less than or equal to Current_Reading.	Pass / Fail (Section 3.5.3.1.7)	
9	IF Sensor_Location is equal to "sign housing", then GOTO Step 9.1; otherwise, GOTO Step 10.		
9.1	GET the following object(s): »dmsTempSensorStatusMap.0 »dmsTempSensorNumRows.0 »dmsTempSensorIndex.Temp_Sensor »dmsTempSensorDescription.Temp_Sensor »dmsTempSensorCurrentReading.Temp_Sensor »dmsTempSensorHighWarningTemperature.Temp_Sensor »dmsTempSensorLowWarningTemperature.Temp_Sensor »dmsTempSensorHighCriticalTemperature.Temp_Sensor »dmsTempSensorLowCriticalTemperature.Temp_Sensor »dmsTempSensorStatus.Temp_Sensor »tempMaxSignHousing.0 »tempMinSignHousing.0	Pass / Fail (Section 3.5.3.1.4.7)	

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9.2	RECORD the RESPONSE VALUE for dmsTempSensorCurrentReading.Temp_Sensor, dmsTempSensorDescription.Temp_Sensor, dmsTempSensorStatus.Temp_Sensor, dmsTempSensorLowCriticalTemperature.Temp_Sensor, dmsTempSensorLowWarningTemperature.Temp_Sensor, and dmsTempSensorStatusMap.0 as: »Current_Reading »Description »Status »Low_Critical »Low_Warning »Status_Map		
9.3	VERIFY that the RESPONSE VALUE for tempMaxSignHousing.0 is greater than or equal to Current_Reading.	Pass / Fail (Section 3.5.3.1.4.7)	
9.4	VERIFY that the RESPONSE VALUE for tempMinSignHousing.0 is less than or equal to Current_Reading.	Pass / Fail (Section 3.5.3.1.4.7)	
10	IF Sensor_Location is equal to "control cabinet", then GOTO Step 10.1; otherwise, GOTO Step 11.		
10.1	GET the following object(s): »dmsTempSensorStatusMap.0 »dmsTempSensorNumRows.0 »dmsTempSensorIndex.Temp_Sensor »dmsTempSensorDescription.Temp_Sensor »dmsTempSensorCurrentReading.Temp_Sensor »dmsTempSensorHighWarningTemperature.Temp_Sensor »dmsTempSensorLowWarningTemperature.Temp_Sensor »dmsTempSensorHighCriticalTemperature.Temp_Sensor »dmsTempSensorLowCriticalTemperature.Temp_Sensor »dmsTempSensorStatus.Temp_Sensor »tempMaxCtrlCabinet.0 »tempMinCtrlCabinet.0	Pass / Fail (Section 3.5.3.1.4.9)	
10.2	RECORD the RESPONSE VALUE for dmsTempSensorCurrentReading.Temp_Sensor, dmsTempSensorDescription.Temp_Sensor, dmsTempSensorStatus.Temp_Sensor, dmsTempSensorLowCriticalTemperature.Temp_Sensor, dmsTempSensorLowWarningTemperature.Temp_Sensor, and dmsTempSensorStatusMap.0 as: »Current_Reading »Description »Status »Low_Critical »Low_Warning »Status_Map		
10.3	VERIFY that the RESPONSE VALUE for tempMaxCtrlCabinet.0 is greater than or equal to Current_Reading.	Pass / Fail (Section 3.5.3.1.4.9)	
10.4	VERIFY that the RESPONSE VALUE for tempMinCtrlCabinet.0 is less than or equal to Current_Reading.	Pass / Fail (Section 3.5.3.1.4.9)	
11	VERIFY that the RESPONSE VALUE for dmsTempSensorDescription.Temp_Sensor contains only valid DisplayString characters. Note: Per RFC 854, the characters are restricted to the ASCII codes of 0, 7 through 13, and 32 through 126.	Pass / Fail (Section 5.11.2.9.3.2)	

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12	SET-UP: VERIFY that the RESPONSE VALUE for dmsTempSensorStatus.Temp_Sensor equals 'noError'.		
13	SET-UP: VERIFY that Current_Reading is greater than Low_Critical and less than High_Critical.		
14	VERIFY that the RESPONSE VALUE for dmsTempSensorStatusMap.0 indicates that all bits are equal to zero (0).	Pass / Fail (Section 5.11.2.9.1)	
15	DELAY for Status_Update_Delay seconds.		
16	GET the following object(s): »shortErrorStatus.0	Pass / Fail (Section 3.5.3.1.2)	
17	VERIFY that the RESPONSE VALUE for shortErrorStatus.0 does not have bit 11 (critical temperature error) set. Note: Unless it can be shown that it is set due to the reading of some other temperature sensor.	Pass / Fail (Section 3.5.3.1.2)	
18	GET the following object(s): »tempSensorWarningMap.0 »tempSensorCriticalTempMap.0	Pass / Fail (Section 3.5.3.1.3.7)	
19	VERIFY that the RESPONSE VALUE of tempSensorWarningMap.0 does not have the Temp_Sensor bit (Temp_Sensor – 1) set.	Pass / Fail (Section 3.5.3.1.3.7)	
20	RECORD the value of zero (0) as: »Counter		
21.1	Alter the temperature of the Temp_Sensor using ice or other methods of simulating a lowering of the temperature beyond the RESPONSE VALUE for dmsTempSensorLowCriticalTemperature.Temp_Sensor. Note: Care should be taken to ensure that the temperature does not fall below levels that may cause a permanent hardware failure.		
21.2	IF Sensor_Location is equal to "ambient", then GOTO Step 21.2.1; otherwise, GOTO Step 21.3.		
21.2.1	GET the following object(s): »dmsTempSensorStatusMap.0 »dmsTempSensorNumRows.0 »dmsTempSensorIndex.Temp_Sensor »dmsTempSensorDescription.Temp_Sensor »dmsTempSensorCurrentReading.Temp_Sensor »dmsTempSensorHighWarningTemperature.Temp_Sensor »dmsTempSensorLowWarningTemperature.Temp_Sensor »dmsTempSensorHighCriticalTemperature.Temp_Sensor »dmsTempSensorLowCriticalTemperature.Temp_Sensor »dmsTempSensorStatus.Temp_Sensor »tempMaxAmbient.0 »tempMinAmbient.0	Pass / Fail (Sections 3.5.3.1.7, 3.5.3.1.8)	

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21.2.2	RECORD the RESPONSE VALUE for dmsTempSensorCurrentReading.Temp_Sensor, dmsTempSensorDescription.Temp_Sensor, dmsTempSensorStatus.Temp_Sensor, dmsTempSensorLowCriticalTemperature.Temp_Sensor, and dmsTempSensorStatusMap.0 as: »Current_Reading »Description »Status »Low_Critical »Status_Map		
21.2.3	VERIFY that the RESPONSE VALUE for tempMaxAmbient.0 is greater than or equal to Current_Reading.	Pass / Fail (Section 3.5.3.1.7)	
21.2.4	VERIFY that the RESPONSE VALUE for tempMinAmbient.0 is less than or equal to Current_Reading.	Pass / Fail (Section 3.5.3.1.7)	
21.3	IF Sensor_Location is equal to "sign housing", then GOTO Step 21.3.1; otherwise, GOTO Step 21.4.		
21.3.1	GET the following object(s): »dmsTempSensorStatusMap.0 »dmsTempSensorNumRows.0 »dmsTempSensorIndex.Temp_Sensor »dmsTempSensorDescription.Temp_Sensor »dmsTempSensorCurrentReading.Temp_Sensor »dmsTempSensorHighWarningTemperature.Temp_Sensor »dmsTempSensorLowWarningTemperature.Temp_Sensor »dmsTempSensorHighCriticalTemperature.Temp_Sensor »dmsTempSensorLowCriticalTemperature.Temp_Sensor »dmsTempSensorStatus.Temp_Sensor »tempMaxSignHousing.0 »tempMinSignHousing.0	Pass / Fail (Sections 3.5.3.1.4.7, 3.5.3.1.8)	
21.3.2	RECORD the RESPONSE VALUE for dmsTempSensorCurrentReading.Temp_Sensor, dmsTempSensorDescription.Temp_Sensor, dmsTempSensorStatus.Temp_Sensor, dmsTempSensorLowCriticalTemperature.Temp_Sensor, and dmsTempSensorStatusMap.0 as: »Current_Reading »Description »Status »Low_Critical »Status_Map		
21.3.3	VERIFY that the RESPONSE VALUE for tempMaxSignHousing.0 is greater than or equal to Current_Reading.	Pass / Fail (Section 3.5.3.1.4.7)	
21.3.4	VERIFY that the RESPONSE VALUE for tempMinSignHousing.0 is less than or equal to Current_Reading.	Pass / Fail (Section 3.5.3.1.4.7)	
21.4	IF Sensor_Location is equal to "control cabinet", then GOTO Step 21.4.1; otherwise, GOTO Step 21.5.		

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21.4.1	GET the following object(s): »dmsTempSensorStatusMap.0 »dmsTempSensorNumRows.0 »dmsTempSensorIndex.Temp_Sensor »dmsTempSensorDescription.Temp_Sensor »dmsTempSensorCurrentReading.Temp_Sensor »dmsTempSensorHighWarningTemperature.Temp_Sensor »dmsTempSensorLowWarningTemperature.Temp_Sensor »dmsTempSensorHighCriticalTemperature.Temp_Sensor »dmsTempSensorLowCriticalTemperature.Temp_Sensor »dmsTempSensorStatus.Temp_Sensor »tempMaxCtrlCabinet.0 »tempMinCtrlCabinet.0	Pass / Fail (Sections 3.5.3.1.4.9, 3.5.3.1.8)	
21.4.2	RECORD the RESPONSE VALUE for dmsTempSensorCurrentReading.Temp_Sensor, dmsTempSensorDescription.Temp_Sensor, dmsTempSensorStatus.Temp_Sensor, dmsTempSensorLowCriticalTemperature.Temp_Sensor, and dmsTempSensorStatusMap.0 as:as: »Current_Reading »Description »Status »Low_Critical »Status_Map		
21.4.3	VERIFY that the RESPONSE VALUE for tempMaxCtrlCabinet.0 is greater than or equal to Current_Reading.	Pass / Fail (Section 3.5.3.1.4.9)	
21.4.4	VERIFY that the RESPONSE VALUE for tempMinCtrlCabinet.0 is less than or equal to Current_Reading.	Pass / Fail (Section 3.5.3.1.4.9)	
21.5	VERIFY that the RESPONSE VALUE for dmsTempSensorDescription.Temp_Sensor contains only valid DisplayString characters. Note: Per RFC 854, the characters are restricted to the ASCII codes of 0, 7 through 13, and 32 through 126.	Pass / Fail (Section 5.11.2.9.3.2)	
21.6	SET-UP: VERIFY that the RESPONSE VALUE for dmsTempSensorStatus.Temp_Sensor equals 'noError' (2).		
21.7	Determine the value of Counter + 1. RECORD this information as: »Counter		
21.8	IF Counter is greater than or equal to 5, EXIT without passing or failing the test.		
21.9	IF Current_Reading is greater than or equal to Low_Warning, then GOTO Step 21.1; otherwise, GOTO Step 23.		
22	IF Current_Reading is greater than or equal to Low_Critical and Counter is less than 5, then GOTO Step 21.1; otherwise, GOTO Step 23. Note: If the user is unable to lower the temperature sufficiently, the user shall EXIT without passing or failing the test.		
23	VERIFY that the RESPONSE VALUE for dmsTempSensorStatusMap.0 indicates that all bits are equal to zero (0).	Pass / Fail (Section 5.11.2.9.1)	
24	DELAY for Status_Update_Delay seconds.		

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25	GET the following object(s): »shortErrorStatus.0	Pass / Fail (Section 3.5.3.1.2)	
26	VERIFY that the RESPONSE VALUE for shortErrorStatus.0 has bit 11 (critical temperature error) set. Note: Unless it can be shown that it is set due to the reading of some other temperature sensor.	Pass / Fail (Section 3.5.3.1.2)	
27	GET the following object(s): »tempSensorWarningMap.0 »tempSensorCriticalTempMap.0	Pass / Fail (Section 3.5.3.1.3.7)	
28	VERIFY that the RESPONSE VALUE of tempSensorWarningMap.0 has bit (Temp_Sensor – 1) set.	Pass / Fail (Section 3.5.3.1.3.7)	
29	Remove the ice from the sensor.		

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.5.12 Verify Humidity Sensor Operations

Test Case: 5.12	**Title:**	**Verify Humidity Sensor Operations**	
	Description:	This test case verifies that the DMS properly manages its humidity sensor(s).	
	Variables:	Humidity_Sensor	From the Test Plan
		Status_Update_Delay	PRL 3.6.9
		Humidity_Support	PRL 2.5.3.1.2 / 3.5.3.1.3.8
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	Determine whether the DMS supports humidity sensors. RECORD this information as: »Humidity_Support	Pass / Fail (PRL 2.5.3.1.2 / 3.5.3.1.3.8)	
2	CONFIGURE: Determine the index of a humidity sensor to be tested (from the test plan). RECORD this information as: »Humidity_Sensor		
3	CONFIGURE: Determine whether the Humidity_Sensor detects 'sign housing' or 'controller cabinet' humidity (based on manufacturer documentation). RECORD this information as: »Humidity_Location		
4	CONFIGURE: Determine the frequency at which the DMS is required to update the status variables (per PRL 3.6.9). RECORD this information as: »Status_Update_Delay		
5	SET-UP: VERIFY that all humidity sensors are working.		
6	DELAY for Status_Update_Delay seconds.		
7	GET the following object(s): »shortErrorStatus.0	Pass / Fail (Section 3.5.3.1.2)	

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8	VERIFY that BIT 14 (humidity warning) of the RESPONSE VALUE for shortErrorStatus.0 has a value of zero (0).	Pass / Fail (Section 3.5.3.1.2)	
9	GET the following object(s): »dmsHumiditySensorStatusMap.0 »dmsHumiditySensorNumRows.0	Pass / Fail (Section 3.5.3.1.3.8)	
10	VERIFY that the RESPONSE VALUE of dmsHumiditySensorStatusMap.0 does not have bit (Humidity_Sensor – 1) set.	Pass / Fail (Section 5.11.2.8.1)	
11	SET-UP: VERIFY that the RESPONSE VALUE for dmsHumiditySensorNumRows.0 is greater than or equal to Humidity_Sensor.		
12	GET the following object(s): »dmsHumiditySensorDescription.Humidity_Sensor »dmsHumiditySensorCurrentReading.Humidity_Sensor »dmsHumiditySensorStatus.Humidity_Sensor	Pass / Fail (Section 3.5.3.1.4.8)	Section 4.2.4.10 Step b
13	VERIFY that the RESPONSE VALUE for dmsHumiditySensorDescription.Humidity_Sensor contains only valid DisplayString characters. Note: Per RFC 854, the characters are restricted to the ASCII codes of 0, 7 through 13, and 32 through 126.	Pass / Fail (Section 5.11.2.8.3.2)	
14	VERIFY that the RESPONSE VALUE for dmsHumiditySensorCurrentReading.Humidity_Sensor is greater than or equal to 0.	Pass / Fail (Section 5.11.2.8.3.3)	
15	VERIFY that the RESPONSE VALUE for dmsHumiditySensorCurrentReading.Humidity_Sensor is less than or equal to 100.	Pass / Fail (Section 5.11.2.8.3.3)	
16	VERIFY that the RESPONSE VALUE for dmsHumiditySensorStatus.Humidity_Sensor is equal to 'noError' (2). Note: Valid enumerated values are defined in Section 5.11.2.8.3.4 (Humidity Sensor Status Parameter).	Pass / Fail (Section 5.11.2.8.3.4)	
17	SET-UP: Simulate a failed humidity sensor by disconnecting the power or signal.		
18	DELAY for Status_Update_Delay seconds.		
19	GET the following object(s): »shortErrorStatus.0	Pass / Fail (Section 3.5.3.1.2)	
20	VERIFY that Bit 14 (humidity warning) of the RESPONSE VALUE for shortErrorStatus.0 has a value of one (1).	Pass / Fail (Section 3.5.3.1.2)	
21	GET the following object(s): »dmsHumiditySensorStatusMap.0 »dmsHumiditySensorNumRows.0	Pass / Fail (Section 3.5.3.1.3.8)	
22	VERIFY that the Bit (Humidity_Sensor – 1) of the RESPONSE VALUE of dmsHumiditySensorStatusMap.0 has a value of one (1).	Pass / Fail (Section 5.11.2.8.1)	
23	GET the following object(s): »dmsHumiditySensorDescription.Humidity_Sensor »dmsHumiditySensorCurrentReading.Humidity_Sensor »dmsHumiditySensorStatus.Humidity_Sensor	Pass / Fail (Section 3.5.3.1.4.8)	Section 4.2.4.10 Step b

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24	VERIFY that the RESPONSE VALUE for dmsHumiditySensorStatus.Humidity_Sensor is equal to 'fail' (3).	Pass / Fail (Section 5.11.2.8.3.4)	
25	Reconnect the humidity sensors disconnected in Step 17.		

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.5.13 Verify Door Open Status

Test Case: 5.13	**Title:**	**Verify Door Open Status**
	Description:	This test case verifies that the DMS returns the correct value for door status.
	Variables:	Door_Num — From the Test Plan Status_Update_Delay — PRL 3.6.9 Door_Support — PRL 2.5.3.1.2 / 3.5.3.1.3.10
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.

Step	Test Procedure	Device	Additional References
1	Determine whether the DMS supports door sensors. RECORD this information as: »Door_Support	Pass / Fail (PRL 2.5.3.1.2 / 3.5.3.1.3.10)	
2	IF Door_Support is equal to 0, then EXIT.		
3	CONFIGURE: Determine the index of a door-open sensor to be tested (from the test plan). RECORD this information as: »Door_Num		
4	CONFIGURE: Determine the frequency at which the DMS is required to update the status variables (per PRL 3.6.9). RECORD this information as: »Status_Update_Delay		
5	SET-UP: VERIFY that all of the doors equipped with door-open sensors are closed.		
6	DELAY for Status_Update_Delay seconds.		
7	GET the following object(s): »shortErrorStatus.0	Pass / Fail (Section 3.5.3.1.2)	
8	VERIFY that Bit 13 (door status) of the RESPONSE VALUE for shortErrorStatus.0 has a value of zero (0).	Pass / Fail (Section 3.5.3.1.2)	
9	GET the following object(s): »dmsStatDoorOpen.0	Pass / Fail (Section 3.5.3.1.3.10)	
10	VERIFY that the RESPONSE VALUE for dmsStatDoorOpen.0 is equal to 0.	Pass / Fail (Section 3.5.3.1.3.10)	
11	SET-UP: Open the door associated with the Door_Num door-open sensor.		
12	DELAY for Status_Update_Delay seconds.		

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13	GET the following object(s): »shortErrorStatus.0	Pass / Fail (Section 3.5.3.1.2)	
14	VERIFY that Bit 13 (door status) of the RESPONSE VALUE for shortErrorStatus.0 has a value of one (1).	Pass / Fail (Section 3.5.3.1.2)	
15	GET the following object(s): »dmsStatDoorOpen.0	Pass / Fail (Section 3.5.3.1.3.10)	
16	VERIFY that the bit associated with Door_Num of the RESPONSE VALUE for dmsStatDoorOpen.0 is equal to one (1).	Pass / Fail (Section 3.5.3.1.3.10)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.5.14 Determine Current Power Source

Test Case: 5.14	**Title:**	**Determine Current Power Source**	
	Description:	This test case verifies that the DMS properly indicates the current power source.	
	Variables:	Status_Update_Delay	PRL 3.6.9
		Low_Fuel_Support	PRL 2.5.1.7 / 3.5.1.7
		New_Low_Fuel_Threshold	From the Test Plan
		Power_Voltage_Support	PRL 2.5.3.1.12 / 3.5.3.1.6.2
		Fuel_Level_Support	PRL 2.5.3.1.12 / 3.5.3.1.6.3
		Engine_RPM_Support	PRL 2.5.3.1.12 / 3.5.3.1.6.4
		Selected_Power_Source	From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the frequency at which the DMS is required to update the status variables (per PRL 3.6.9). RECORD this information as: »Status_Update_Delay		
2	CONFIGURE: Determine if the sign is required to support Low Fuel Threshold values per the specification (PRL 2.5.1.7 / 3.5.1.7). RECORD this information as: »Low_Fuel_Support		
3	CONFIGURE: Determine a value for lowFuelThreshold.0 that is lower than the current fuel level. RECORD this information as: »New_Low_Fuel_Threshold Note: Valid values for lowFuelThreshold are defined in Section 5.11.3.2 (Low Fuel Threshold Parameter).		
4	CONFIGURE: Determine if the sign is required to monitor power voltages per the specification (PRL 2.5.3.1.12 / 3.5.3.1.6.2). RECORD this information as: »Power_Voltage_Suppport		
5	CONFIGURE: Determine if the sign is required to monitor current fuel levels per the specification (PRL 2.5.3.1.12 / 3.5.3.1.6.3). RECORD this		

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	information as: »Fuel_Level_Support		
6	CONFIGURE: Determine if the sign is required to monitor current Engine RPM per the specification (PRL 2.5.3.1.12 / 3.5.3.1.6.4). RECORD this information as: »Engine_RPM_Support		
7	CONFIGURE: Determine the enumerated value of one of the power sources that the sign is required to support per the specification. RECORD this information as: »Selected_Power_Source Note: Valid enumerated values are defined in Section 5.11.3.6 (Power Source Parameter).		
8	SET-UP: Configure the sign to use the Selected_Power_Source.		
9	GET the following object(s): »powerSource.0	Pass / Fail (Section 3.5.3.1.6.1)	
10	VERIFY that the RESPONSE VALUE for powerSource.0 is equal to Selected_Power_Source.	Pass / Fail (Section 3.5.3.1.6.1)	
11	IF Low_Fuel_Support is TRUE, then GOTO Step 11.1; otherwise, GOTO Step 12.		
11.1	GET the following object(s): »lowFuelThreshold.0		
11.2	RECORD the RESPONSE VALUE for lowFuelThreshold.0 as: »Orig_Lowfuelthreshold		
11.3	SET the following object(s) to the value(s) shown: »lowFuelThreshold = New_Low_Fuel_Threshold	Pass / Fail (Section 3.5.1.7)	
11.4	GET the following object(s): »lowFuelThreshold.0	Pass / Fail (Section 3.5.1.7)	
11.5	VERIFY that the RESPONSE VALUE for lowFuelThreshold is equal to New_Low_Fuel_Threshold.	Pass / Fail (Section 3.5.1.7)	
11.6	DELAY for Status_Update_Delay seconds.		
11.7	GET the following object(s): »shortErrorStatus.0	Pass / Fail (Section 3.5.3.1.2)	
11.8	VERIFY that bit 2 (power error) of the RESPONSE VALUE for shortErrorStatus.0 equals 0.		
11.9	Cause the fuel level to drop below New_Low_Fuel_Threshold.		
11.10	DELAY for Status_Update_Delay seconds.		
11.11	GET the following object(s): »shortErrorStatus.0	Pass / Fail (Section 3.5.3.1.2)	
11.12	VERIFY that bit 2 (power error) of the RESPONSE VALUE for shortErrorStatus.0 equals 1.		
11.13	SET the following object(s) to the value(s) shown: »lowFuelThreshold = Orig_Lowfuelthreshold	Pass / Fail (Section 3.5.1.7)	

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12	IF Power_Voltage_Suppport is TRUE, then GOTO Step 12.1; otherwise, GOTO Step 13.		
12.1	GET the following object(s): »signVolts.0 »lineVolts.0	Pass / Fail (Section 3.5.3.1.6.2)	
12.2	VERIFY that the RESPONSE VALUE for signVolts.0 and lineVolts.0 agree with the current voltages, in accordance with the manufacturer's documentation.	Pass / Fail (Section 3.5.3.1.6.2)	
13	IF Fuel_Level_Support is TRUE, then GOTO Step 13.1; otherwise, GOTO Step 14.		
13.1	GET the following object(s): »fuelLevel.0	Pass / Fail (Section 3.5.3.1.6.3)	
13.2	VERIFY that the RESPONSE VALUE for fuelLevel.0 is approximately equal to the current level of fuel available.	Pass / Fail (Section 3.5.3.1.6.3)	
14	IF Engine_RPM_Support is TRUE, then GOTO Step 14.1; otherwise, EXIT.		
14.1	SET-UP: Stop the generator.		
14.2	DELAY for Status_Update_Delay seconds.		
14.3	GET the following object(s): »engineRPM.0	Pass / Fail (Section 3.5.3.1.6.4)	
14.4	VERIFY that the RESPONSE VALUE for engineRPM.0 is equal to 0.	Pass / Fail (Section 3.5.3.1.6.4)	
14.5	Start the generator.		
14.6	DELAY for Status_Update_Delay seconds.		
14.7	GET the following object(s): »engineRPM.0	Pass / Fail (Section 3.5.3.1.6.4)	
14.8	VERIFY that the RESPONSE VALUE for engineRPM.0 is approximately equal to the RPM of the generator.	Pass / Fail (Section 3.5.3.1.6.4)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.5.15 Reset the Sign Controller

Test Case: 5.15	**Title:**	**Reset the Sign Controller**	
	Description:	This test case verifies the operation of software reset.	
	Variables:	Reboot_Time	Per Manufacturer's Documentation
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

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Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the amount of time in seconds it takes for the controller to reboot (e.g., from the manufacturer documentation). RECORD this information as: »Reboot_Time		
2	SET the following object(s) to the value(s) shown: »dmsSWReset.0 = 1	Pass / Fail (Section 3.5.2.2)	
3	DELAY for Reboot_Time seconds.		
4	VERIFY that the sign controller reset.	Pass / Fail (Section 3.5.2.2)	
5	GET the following object(s): »dmsSWReset.0	Pass / Fail (RFC 1157)	
6	VERIFY that the RESPONSE VALUE for dmsSWReset.0 is equal to 0.	Pass / Fail (Section 5.7.2)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.5.16 Pixel Service Test

Test Case: 5.16	**Title:**	**Pixel Service Test**
	Description:	This test case verifies that the DMS properly executes pixel service for a message configured for pixel service.
	Variables:	Pixel_Service_Start_Time — From the Test Plan Pixel_Service_Duration — From the Test Plan Pixel_Service_Frequency — From the Test Plan Msg_Type — From the Test Plan Msg_Number — From the Test Plan Msg_Multi_String — From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the pixel service time to begin the pixel service for this test (from the test plan). RECORD this information as: »Pixel_Service_Start_Time		
2	CONFIGURE: Determine the length of time the pixel service is intended to last (per the test plan). RECORD this information as: »Pixel_Service_Duration		
3	CONFIGURE: Determine the number of minutes between the start of each pixel serivce (per the test plan). RECORD this information as: »Pixel_Service_Frequency		
4	CONFIGURE: Determine the message type, number and MULTI string (per the test plan). RECORD this information as:		

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	»Msg_Type »Msg_Number »Msg_Multi_String		
4	SET the following object(s) to the value(s) shown: »vmsPixelServiceTime.0 = Pixel_Service_Start_Time	Pass / Fail (Section 3.5.2.6)	Section 4.2.3.6 Step a
5	SET the following object(s) to the value(s) shown: »vmsPixelServiceDuration.0 = Pixel_Service_Duration	Pass / Fail (Section 3.5.2.6)	Section 4.2.3.6 Step b
6	SET the following object(s) to the value(s) shown: »vmsPixelServiceFrequency.0 = Pixel_Service_Frequency	Pass / Fail (Section 3.5.2.6)	Section 4.2.3.6 Step c
7	SET-UP: PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Msg_Multi_String »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 1 (enabled) »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 »Msg_Pixel_Service = 1 »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.3.3)	
8	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Msg_Multi_String »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 1 (enabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	Section 4.2.3.6 Step d
9	VERIFY that the DMS starts exercising the pixels at the Pixel_Service_Start_Time, plus an integral number of Pixel_Service_Frequency's.	Pass / Fail (Section 3.5.2.6)	
10	VERIFY that the DMS exercises the pixels for Pixel_Service_Duration length of time.	Pass / Fail (Section 3.5.2.6)	
11	VERIFY that the DMS performs a second pixel service Pixel_Service_Frequency minutes after the start of the first pixel service.	Pass / Fail (Section 3.5.2.6)	
12	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

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C.3.5.17 Read I/O Ports

Test Case: 5.17	**Title:**	**Read I/O Ports**
	Description:	This test case verifies that the DMS supports reading values from the auxiliary port(s) of a DMS.
	Variables:	Required_Analog_Ports — PRL 2.5.2.4 / 3.5.2.4 Required_Digital_Ports — PRL 2.5.2.4 / 3.5.2.4
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.

Step	Test Procedure	Results	Additional References
1	CONFIGURE: If Version v02 is checked in Section 2.5.2.4 of the PRL, then EXIT.		
2	CONFIGURE: Determine the number of analog and digital ports required by the specification (PRL 3.5.2.4). RECORD this information as: »Required_Analog_Ports »Required_Digital_Ports		
3	GET the following object(s): »maxAuxIOv2TableNumDigitalPorts.0 »maxAuxIOv2TableNumAnalogPorts.0	Pass / Fail (Section 3.5.2.4.1.3)	Section 4.2.4.13 Step a
4	VERIFY that the RESPONSE VALUE for maxAuxIOv2TableNumAnalogPorts.0 is equal to Required_Analog_Ports.	Pass / Fail (Section 3.5.2.4.1.3)	
5	VERIFY that the RESPONSE VALUE for maxAuxIOv2TableNumDigitalPorts.0 is equal to Required_Digital_Ports.	Pass / Fail (Section 3.5.2.4.1.3)	
6	FOR EACH value, X, from 1 to Required_Analog_Ports, perform Steps 6.1 through 6.10.		
6.1	GET the following object(s): »auxIOv2PortDescription.2.X »auxIOv2PortResolution.2.X »auxIOv2PortValue.2.X »auxIOv2PortDirection.2.X »auxIOv2PortLastCommandedState.2.X	Pass / Fail (Section 3.5.2.4.1.1, 3.5.2.4.1.2)	Section 4.2.4.13 Step b
6.2	VERIFY that the RESPONSE VALUE for auxIOv2PortDescription.2.X contains only valid DisplayString characters.	Pass / Fail (Section 3.5.2.4.1.2)	
6.3	VERIFY that the RESPONSE VALUE for auxIOv2PortResolution.2.X is greater than or equal to 1.	Pass / Fail (Section 3.5.2.4.1.1)	
6.4	VERIFY that the RESPONSE VALUE for auxIOv2PortResolution.2.X is less than or equal to 32.	Pass / Fail (Section 3.5.2.4.1.1)	
6.5	Determine the RESPONSE VALUE for auxIOv2PortResolution.2.X. RECORD this information as: »Resolution		
6.6	VERIFY that the RESPONSE VALUE for auxIOv2PortValue.2.X does not exceed the value defined by the formula [(2^Resolution) - 1].	Pass / Fail (Section 3.5.2.4.2.1 or 3.5.2.4.4.1)	

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6.7	VERIFY that the RESPONSE VALUE for auxIOv2Value.2.X agrees with the input value in accordance with the conversion factor provided by the manufacturer.		
6.8	VERIFY that the RESPONSE VALUE for auxIOv2PortDirection.2.X is greater than or equal to 1.	Pass / Fail (Section 3.5.2.4.1.1)	
6.9	VERIFY that the RESPONSE VALUE for auxIOv2PortDirection.2.X is less than or equal to 3.	Pass / Fail (Section 3.5.2.4.1.1)	
610	VERIFY that the RESPONSE VALUE for auxIOv2PortLastCommandedState.2.X does not exceed the value defined by the formula [(2^Resolution) - 1].	Pass / Fail (Section 3.5.2.4.3.2 or 3.5.2.4.4.3)	
7	FOR EACH value, X, from 1 to Required_Digital_Ports, perform Steps 7.1 through 7.10.		
7.1	GET the following object(s): »auxIOv2PortDescription.3.X »auxIOv2PortResolution.3.X »auxIOv2PortValue.3.X »auxIOv2PortDirection.3.X »auxIOv2PortLastCommandedState.3.X	Pass / Fail (Section 3.5.2.4.1.1, 3.5.2.4.1.2)	Section 4.2.4.13 Step b
7.2	VERIFY that the RESPONSE VALUE for auxIOv2PortDescription.3.X contains only valid DisplayString characters.	Pass / Fail (Section 3.5.2.4.1.2)	
7.3	VERIFY that the RESPONSE VALUE for auxIOv2PortResolution.3.X is greater than or equal to 1.	Pass / Fail (Section 3.5.2.4.1.1)	
7.4	VERIFY that the RESPONSE VALUE for auxIOv2PortResolution.3.X is less than or equal to 32.	Pass / Fail (Section 3.5.2.4.1.1)	
7.5	Determine the RESPONSE VALUE for auxIOv2PortResolution.3.X. RECORD this information as: »Resolution		
7.6	VERIFY that the RESPONSE VALUE for auxIOv2Value.3.X does not exceed the value defined by the formula [(2^Resolution) - 1].	Pass / Fail (Section 3.5.2.4.2.1 or 3.5.2.4.4.1)	
7.7	VERIFY that the RESPONSE VALUE for auxIOv2Value.3.X agrees with the input value in accordance with the conversion factor provided by the manufacturer.		
7.8	VERIFY that the RESPONSE VALUE for auxIOv2PortDirection.3.X is greater than or equal to 1.	Pass / Fail (Section 3.5.2.4.1.1)	
7.9	VERIFY that the RESPONSE VALUE for auxIOv2PortDirection.3.X is less than or equal to 3.	Pass / Fail (Section 3.5.2.4.1.1)	
7.10	VERIFY that the RESPONSE VALUE for auxIOv2LastCommandedState.2.X does not exceed the value defined by the formula [(2^Resolution) - 1].	Pass / Fail (Section 3.5.2.4.3.2 or 3.5.2.4.4.3)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

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C.3.5.18 Change Port Value

Test Case: 5.18	**Title:**	**Change Port Value**	
	Description:	This test case verifies that the DMS supports changing the output value of a port. Note: Referenced Section Numbers reflect the actual Section numbers of NTCIP 1203 v03. Some of these numbers are inconsistent with the Section numbers cited in the NTCIP 1203 v03 PRL and RTM due to editorial errors in these tables.	
	Variables:	Status_Update_Delay	PRL 3.6.9
		Port_Type	From the Test Plan
		Port_Index	From the Test Plan
		Port_Value	From the Test Plan
		Port_Description	From the Test Plan
		Attached_Device_Support	PRL 2.5.2.4 / 3.5.2.4
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

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Step	Test Procedure	Results	Additional References
1	SET-UP: IF Attached_Device_Support is equal to 0, then EXIT.		
2	CONFIGURE: Determine the frequency at which the DMS is required to update the status variables (per PRL 3.6.9). RECORD this information as: »Status_Update_Delay		
3	CONFIGURE: Determine the enumerated value of the type of port (analog (2), or digital (3)) to be tested (from the test plan). RECORD this information as: »Port_Type Note: Valid enumeraged values are defined in NTCIP 1201 Section 2.9.3.1 (Auxiliary Port Type Parameter).		
4	CONFIGURE: Determine the index of the port to be tested (from the test plan). RECORD this information as: »Port_Index		
5	CONFIGURE: Determine the value to which this port shall be set (from the test plan). RECORD this information as: »Port_Value		
6	CONFIGURE: Determine the textual description to associate with the subject port. RECORD this information as: »Port_Description		
7	CONFIGURE: Determine whether the DMS supports attached devices (PRL 2.5.2.4 / 3.5.2.4). RECORD this information as: »Attached_Device_Support		
8	GET the following object(s): »maxAuxIOv2TableNumDigitalPorts.0 »maxAuxIOv2TableNumAnalogPorts.0	Pass / Fail (Section 3.5.2.4.1.3)	Section 4.2.4.13 Step a
9	IF Port_Type is equal to 2 (analog), then GOTO Step 9.1; otherwise, GOTO Step 10		
9.1	SET-UP: VERIFY that the RESPONSE VALUE for maxAuxIOv2TableNumAnalogPorts.0 is greater than or equal to Port_Index. GO TO Step 11.		
10	SET-UP: VERIFY that the RESPONSE VALUE for maxAuxIOv2TableNumDigitalPorts.0 is greater than or equal to Port_Index.		
11	GET the following object(s): »auxIOv2PortDescription.Port_Type.Port_Index »auxIOv2PortResolution.Port_Type.Port_Index »auxIOv2PortValue.Port_Type.Port_Index »auxIOv2PortDirection.Port_Type.Port_Index »auxIOv2PortLastCommandedState.Port_Type.Port_Index	Pass / Fail (Section 3.5.2.4.1.1)	Section 4.2.4.13 Step b
12	SET-UP: VERIFY that the RESPONSE VALUE for auxIOv2PortDirection.Port_Type.Port_Index is equal to 'output' (1) or 'bidirectional' (3). Note: Valid enumerated values are defined in NTCIP 1201 v03, Section 2.9.3.6 (Auxiliary Port Direction Parameter)		
13	SET-UP: VERIFY that Port_Value is less than or equal to the value defined by the formula: (2^auxIOv2Resolution.Port_Type.Port_Index) - 1		
14	SET the following object(s) to the value(s) shown: »auxIOv2PortValue.Port_Type.Port_Index = Port_Value	Pass / Fail (Section 3.5.2.4.3.1)	

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Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.5.19 Verify Error for Changing Input-only Port Value

Test Case: 5.19	**Title:**	Verify Error for Changing Input-only Port Value
	Description:	This test case verifies that the DMS returns an error when attempting to change the output value of an input-only port.
	Variables:	In_Port_Type — From the Test Plan In_Port_Index — From the Test Plan In_Port_Value — From the Test Plan Port_Description — From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.

Step	Test Procedure	Device	Additional References
1	CONFIGURE: Determine the type of port (analog (2) or digital (3)) to be tested (from the test plan). RECORD this information as: »In_Port_Type Note: Valid enumerated values are defined in NTCIP 1201 v03, Section 2.9.3.1 (Auxiliary Port Type Parameter).		
2	CONFIGURE: Determine the index of the input port to test (from the test plan). RECORD this information as: »In_Port_Index		
3	CONFIGURE: Determine the value to which the test shall attempt to set the port (from the test plan). RECORD this information as: »In_Port_Value		
4	CONFIGURE: Determine the textual description to associate with the port. RECORD this information as: »Port_Description		
5	GET the following object(s): »maxAuxIOv2TableNumDigitalPorts.0 »maxAuxIOv2TableNumAnalogPorts.0	Pass / Fail (Section 3.5.2.4.1.3)	
6	IF In_Port_Type is equal to 2 (analog), then GOTO Step 6.1; otherwise, GOTO Step 7.		
6.1	SET-UP: VERIFY that the RESPONSE VALUE for maxAuxIOv2TableNumAnalogPorts.0 is greater than or equal to In_Port_Index. GO TO Step 8.		
7	SET-UP: VERIFY that the RESPONSE VALUE for maxAuxIOv2TableNumDigitalPorts.0 is greater than or equal to In_Port_Index.		

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8	GET the following object(s): »auxIOv2PortDescription.In_Port_Type.In_Port_Index »auxIOv2PortResolution.In_Port_Type.In_Port_Index »auxIOv2PortValue.In_Port_Type.In_Port_Index »auxIOv2PortDirection.In_Port_Type.In_Port_Index »auxIOv2PortLastCommandedState.In_Port_Type.In_Port_Index	Pass / Fail (Section 3.5.2.4.1.1)	
9	SET-UP: VERIFY that the RESPONSE VALUE for auxIOv2PortDirection.In_Port_Type.In_Port_Index is equal to 'input' (2). Note: Valid enumerated values are defined in NTCIP 1201 v03, Section 2.9.3.6 (Auxiliary Port Direction Parameter).		
10	SET-UP: VERIFY that In_Port_Value is less than or equal to the value defined by the formula [(2^auxIOv2Resolution.In_Port_Type.In_Port_Index)-1].		
11	SET-UP: VERIFY that the RESPONSE VALUE for auxIOv2PortValue.In_Port_Type.In_Port_Index is not equal to In_Port_Value.		
12	SET the following object(s) to the value(s) shown: »auxIOv2PortValue.In_Port_Type.In_Port_Index = In_Port_Value. »auxIOv2PortDescription.In_Port_Type.In_Port_Index = Port_Description VERIFY that the RESPONSE ERROR is equal to 'genError'.	Pass / Fail (Sections 3.5.2.4.3.1, 3.5.2.4.1.2)	
13	GET the following object(s): »auxIOv2PortValue.In_Port_Type.In_Port_Index	Pass / Fail (Section 3.5.2.4.2.1)	
14	VERIFY that the RESPONSE VALUE for auxIOv2PortValue.In_Port_Type.In_Port_Index is not equal to In_Port_Value. Note: This is not 100% reliable, but it is likely that there is an error if this step fails. While we ensured that the two values were different earlier in the test, it is conceivable that the input independently changed to match the value used in the invalid set operation, which would cause this test to fail because it would appear that the change was due to the set operation. If a device repeatedly fails this step, there is likely an error.	Pass / Fail (Section 3.5.2.4.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.5.20 Verify Error for Changing Port Value with Larger Resolution

Test Case: 5.20	**Title:**	Verify Error for Changing Port Value with Larger Resolution	
	Description:	This test case verifies that the DMS returns an error when attempting to change the output value of a port with a value that is larger than the port supports.	
	Variables:	Port_Type	From the Test Plan
		Port_Index	From the Test Plan
		Port_Value	From the Test Plan
		Port_Description	From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

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Step	Test Procedure	Device	Additional References
1	CONFIGURE: Determine the type of port (analog (2) or digital (3)) to be tested (from the test plan). RECORD this information as: »Port_Type Note: Valid enumerated values are defined in NTCIP 1201 v03, Section 2.9.3.1 (Auxiliary Port Type Parameter).		
2	CONFIGURE: Determine the index of the port to test (from the test plan). RECORD this information as: »Port_Index		
3	CONFIGURE: Determine the value this test shall attempt to set for the port. The value is required to be greater than that supported by the port (from the test plan). RECORD this information as: »Port_Value		
4	CONFIGURE: Determine the textual description to associate with the port. RECORD this information as: »Port_Description		
5	GET the following object(s): »auxIOv2TableNumDigitalPorts.0 »auxIOv2TableNumAnalogPorts.0	Pass / Fail (Section 3.5.2.4.1.3)	
6	IF Port_Type is equal to 2 (analog), then GOTO Step 6.1; otherwise, GOTO Step 7.1.		
6.1	SET-UP: VERIFY that the RESPONSE VALUE for auxIOv2TableNumAnalogPorts.0 is greater than or equal to Port_Index. GO TO Step 8.		
7.1	SET-UP: VERIFY that the RESPONSE VALUE for auxIOv2TableNumDigitalPorts.0 is greater than or equal to Port_Index.		
8	GET the following object(s): »auxIOv2PortDescription.Port_Type.Port_Index »auxIOv2PortResolution.Port_Type.Port_Index »auxIOv2PortValue.Port_Type.Port_Index »auxIOv2PortDirection.Port_Type.Port_Index »auxIOv2PortLastCommandedState.Port_Type.Port_Index	Pass / Fail (Section 3.5.2.4.1)	
9	SET-UP: VERIFY that the RESPONSE VALUE for auxIOv2PortDirection.Port_Type.Port_Index is equal to 'output' (1) or 'bidirectional' (3). Note: Valid enumerated values are defined in NTCIP 1201 v03, Section 2.9.3.6 (Auxiliary Port Direction Parameter)		
10	SET-UP: VERIFY that Port_Value is greater than the value defined by the formula [(2^auxIOv2Resolution.Port_Type.Port_Index)-1].		
11	Determine the RESPONSE VALUE for auxIOv2LastCommandedState.Port_Type.Port_Index. RECORD this information as: »Orig_Value		
12	Determine the RESPONSE VALUE for auxIOv2Description.Port_Type.Port_Index. RECORD this information as: »Orig_Description		

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13	SET the following object(s) to the value(s) shown: »auxIOv2PortValue.Port_Type.Port_Index = Port_Value »auxIOv2PortDescription.Port_Type.Port_Index = Port_Description VERIFY that the RESPONSE ERROR is equal to 'genError'.	Pass / Fail (Sections 3.5.2.4.3.1, 3.5.2.4.1.2)	
14	GET the following object(s): »auxIOv2PortDescription.Port_Type.Port_Index »auxIOv2PortResolution.Port_Type.Port_Index »auxIOv2PortValue.Port_Type.Port_Index »auxIOv2PortDirection.Port_Type.Port_Index »auxIOv2PortLastCommandedState.Port_Type.Port_Index	Pass / Fail (Section 3.5.2.4.1)	
15	VERIFY that the RESPONSE VALUE for auxIOv2PortLastCommandedState.Port_Type.Port_Index is equal to Orig_Value.	Pass / Fail (Section 3.5.2.4.3.2)	
16	VERIFY that the RESPONSE VALUE for auxIOv2PortValue.Port_Type.Port_Index is not equal to Port_Value.	Pass / Fail (Section 3.5.2.4.3.1 or 3.5.2.4.4.2)	
17	VERIFY that the RESPONSE VALUE for auxIOv2PortDescription.Port_Type.Port_Index is equal to Orig_Description.	Pass / Fail (Section 3.5.2.4.1.2)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.5.21 Verify Lamp Test with No Errors

Test Case: 5.21	**Title:**	**Verify Lamp Test with No Errors**	
	Description:	This test case verifies that the DMS reports no lamp errors when testing lamps known to be working.	
	Variables:	Num_Lamps	By visual inspection
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the number of lamps supported by the DMS (by visual inspection). RECORD this information as: »Num_Lamps		
2	SET-UP: Calculate the number of bytes used to map the lamps by dividing Num_Lamps by 8 and rounding up to the nearest integer. RECORD this information as: »Length		
3	SET-UP: VERIFY that all lamps are functioning prior to this test.		
4	SET the following object(s) to the value(s) shown: »lampTestActivation.0 = 'test' (3) Note: Valid enumerated values are defined in Section 5.11.2.5.3 (Lamp Test Activation Parameter).	Pass / Fail (Section 3.5.3.1.1.1)	Section 4.2.4.1 Step a
5	GET the following object(s): »lampTestActivation.0	Pass / Fail (RFC 1157)	Section 4.2.4.1 Step b

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5.1	IF the RESPONSE VALUE for lampTestActivation.0 is equal to 'test' (3), then GOTO Step 5; otherwise, GOTO Step 6. Note: If this loops for an excessively long time, the test should fail.		
6	GET the following object(s): »shortErrorStatus.0	Pass / Fail (Section 3.5.3.1.2)	
7	VERIFY that Bit 4 (lamp error) of the RESPONSE VALUE for shortErrorStatus.0 is equal to zero (0).	Pass / Fail (Section 3.5.3.1.2)	
8	GET the following object(s): »lampFailureStuckOn.0 »lampFailureStuckOff.0 »dmsLampNumRows.0	Pass / Fail (Section 3.5.3.1.3.2)	Section 4.2.4.1 Step c
9	VERIFY that the RESPONSE VALUE for lampFailureStuckOn.0 is a string of Length bytes, where each byte has the value of 0x00.	Pass / Fail (Section 3.5.3.1.3.2)	
10	VERIFY that the RESPONSE VALUE for lampFailureStuckOff.0 is a string of Length bytes, where each byte has the value of 0x00.	Pass / Fail (Section 3.5.3.1.3.2)	
11	VERIFY that the RESPONSE VALUE for dmsLampNumRows.0 is equal to Num_Lamps.	Pass / Fail (Section 3.5.3.1.3.2)	
12	FOR EACH value, N, from 1 to Num_Lamps, perform Steps 12.1 through 12.8.		
12.1	GET the following object(s): »dmsLampDescription.N »dmsLampMfrStatus.N »dmsLampStatus.N »dmsLampPixelTop.N »dmsLampPixelLeft.N »dmsLampPixelBottom.N »dmsLampPixelRight.N	Pass / Fail (Section 3.5.3.1.4.2)	Section 4.2.4.5 Step c
12.2	VERIFY that the RESPONSE VALUE for dmsLampDescription.N contains only valid DisplayString characters. Note: Per RFC 854, the characters are restricted to the ASCII codes of 0, 7 through 13, and 32 through 126.	Pass / Fail (Section 3.5.3.1.4.2)	
12.3	VERIFY that the RESPONSE VALUE for dmsLampMfrStatus.N contains only valid DisplayString characters.	Pass / Fail (Section 3.5.3.1.4.2)	
12.4	VERIFY that the RESPONSE VALUE for dmsLampStatus.N is equal to 'noError' (2).	Pass / Fail (Section 3.5.3.1.4.2)	
12.5	VERIFY that the RESPONSE VALUE for dmsLampPixelTop.N properly indicates the topmost row of pixels on the sign face that are controlled by this lamp.	Pass / Fail (Section 3.5.3.1.4.2)	
12.6	VERIFY that the RESPONSE VALUE for dmsLampPixelLeft.N properly indicates the left-most column of pixels on the sign face that are controlled by this lamp.	Pass / Fail (Section 3.5.3.1.4.2)	
12.7	VERIFY that the RESPONSE VALUE for dmsLampPixelBottom.N properly indicates the bottom-most row of pixels on the sign face that are controlled by this lamp.	Pass / Fail (Section 3.5.3.1.4.2)	

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12.8	VERIFY that the RESPONSE VALUE for dmsLampPixelRight.N properly indicates the right-most column of pixels on the sign face that are controlled by this lamp.	Pass / Fail (Section 3.5.3.1.4.2)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.5.22 Verify Lamp Test with Errors

Test Case: 5.22	**Title:**	**Verify Lamp Test with Errors**
	Description:	This test case verifies that the DMS reports known lamp errors when conducting a lamp test.
	Variables:	Num_Lamps — By visual inspection Lamp_Index — From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the number of lamps supported by the DMS as determined though visual inspection. RECORD this information as: »Num_Lamps		
2	CONFIGURE: Determine the index of the lamp(s) to test (from the test plan). RECORD this information as: »Lamp_Index		
3	SET-UP: Unplug the power or signal to the Lamp_Index lamp(s) to simulate lamp(s) stuck off to detect within this test procedure.		
4	SET-UP: Calculate the number of bytes used to map the lamps by dividing Num_Lamps by 8 and rounding up to the nearest integer. RECORD this information as: »Length		
5	SET the following object(s) to the value(s) shown: »lampTestActivation.0 = 'test' (3) Note: Valid enumerated values are defined in NTCIP 1203 v03, Section 5.11.2.5.3 (Lamp Test Activation Parameter)	Pass / Fail (Section 3.5.3.1.1.1)	Section 4.2.4.1 Step a
5.1	GET the following object(s): »lampTestActivation.0	Pass / Fail (RFC 1157)	Section 4.2.4.1 Step b
6	IF the RESPONSE VALUE for lampTestActivation.0 is equal to 'test', then GOTO Step 5.1; otherwise, GOTO Step 7. Note: If this loops for an excessively long time, the test should fail.		
7	GET the following object(s): »shortErrorStatus.0	Pass / Fail (Section 3.5.3.1.2)	
8	VERIFY that Bit 4 (lamp error) of the RESPONSE VALUE for shortErrorStatus.0 is equal to one (1).	Pass / Fail (Section 3.5.3.1.2)	

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9	GET the following object(s): »lampFailureStuckOn.0 »lampFailureStuckOff.0 »dmsLampNumRows.0	Pass / Fail (Section 3.5.3.1.3.2)	Section 4.2.4.1 Step c
10	VERIFY that the RESPONSE VALUE for lampFailureStuckOn.0 is a string of Length bytes, where each byte has the value of 0x00.	Pass / Fail (Section 3.5.3.1.3.2)	
11	VERIFY that the RESPONSE VALUE for lampFailureStuckOff.0 is a string of Length bytes, where the Lamp_Index Bit(s) within the string have a value of one (1) and all other bits have a value of zero (0).	Pass / Fail (Section 3.5.3.1.3.2)	
12	VERIFY that the RESPONSE VALUE for dmsLampNumRows.0 is equal to Num_Lamps.	Pass / Fail (Section 3.5.3.1.3.2)	
13	FOR EACH value, N, from 1 to Num_Lamps, perform Steps 13.1 through 13.9.		
13.1	GET the following object(s): »dmsLampDescription.N »dmsLampMfrStatus.N »dmsLampStatus.N »dmsLampPixelTop.N »dmsLampPixelLeft.N »dmsLampPixelBottom.N »dmsLampPixelRight.N	Pass / Fail (Section 3.5.3.1.4.2)	
13.2	VERIFY that the RESPONSE VALUE for dmsLampDescription.N contains only valid DisplayString characters. Note: Per RFC 854, the characters are restricted to the ASCII codes of 0, 7 through 13, and 32 through 126.	Pass / Fail (Section 3.5.3.1.4.2)	
13.3	VERIFY that the RESPONSE VALUE for dmsLampMfrStatus.N contains only valid DisplayString characters.	Pass / Fail (Section 3.5.3.1.4.2)	
13.4	IF N equals one of the defined Lamp_Index values, then GOTO Step 13.4.1; otherwise, GOTO Step 13.5.		
13.4.1	VERIFY that the RESPONSE VALUE for dmsLampStatus.N is equal to 'stuckOff' (3). GO TO Step 13.6. Note: Valid enumerated values are defined in Section 5.11.2.5.5.4 (Lamp Status Parameter)	Pass / Fail (Section 3.5.3.1.4.2)	
13.5	VERIFY that the RESPONSE VALUE for dmsLampStatus.N is equal to 'noError' (2).	Pass / Fail (Section 3.5.3.1.4.2)	
13.6	VERIFY that the RESPONSE VALUE for dmsLampPixelTop.N properly indicates the topmost row of pixels on the sign face that are controlled by this lamp.	Pass / Fail (Section 3.5.3.1.4.2)	
13.7	VERIFY that the RESPONSE VALUE for dmsLampPixelLeft.N properly indicates the left-most column of pixels on the sign face that are controlled by this lamp.	Pass / Fail (Section 3.5.3.1.4.2)	
13.8	VERIFY that the RESPONSE VALUE for dmsLampPixelBottom.N properly indicates the bottom-most row of pixels on the sign face that are controlled by this lamp.	Pass / Fail (Section 3.5.3.1.4.2)	

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13.9	VERIFY that the RESPONSE VALUE for dmsLampPixelRight.N properly indicates the right-most column of pixels on the sign face that are controlled by this lamp.	Pass / Fail (Section 3.5.3.1.4.2)	
14	Restore power and signal to the Lamp_Index lamp(s).		

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.5.23 Verify Drum Sign Rotor Status - No Error

Test Case: 5.23	**Title:**	**Verify Drum Sign Rotor Status - No Error**
	Description:	This test case verifies that the DMS reports no drum rotor errors when the rotors are known to be working.
	Variables:	Num_Drums — By visual inspection Status_Update_Delay — PRL 3.6.9 Drum_Support — PRL 2.5.3.1.2 / 3.5.3.1.3.9
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the number of drums supported by the DMS by visual inspection. RECORD this information as: »Num_Drums		
2	CONFIGURE: Determine the frequency at which the DMS is required to update the status variables (per PRL 3.6.9). RECORD this information as: »Status_Update_Delay		
3	CONFIGURE: Determine whether the DMS supports drums (PRL 2.5.3.1.2 / 3.5.3.1.3.9). RECORD this information as: »Drum_Support		
4	SET-UP: IF Drum_Support is equal to 0, then EXIT; otherwise, GOTO Step 5.		
5	SET-UP: Calculate the number of bytes used to map the drums by dividing Num_Drums by 8 and rounding up to the nearest integer. RECORD this information as: »Length		
6	SET-UP: VERIFY that all drums are functioning prior to this test.		
7	DELAY for Status_Update_Delay seconds.		
8	GET the following object(s): »shortErrorStatus.0	Pass / Fail (Section 3.5.3.1.2)	
9	VERIFY that Bit 12 (drum sign rotor error) of the RESPONSE VALUE for shortErrorStatus.0 is equal to zero (0).	Pass / Fail (Section 3.5.3.1.2)	
10	GET the following object(s): »dmsDrumStatusMap.0 »dmsDrumNumRows.0	Pass / Fail (Section 3.5.3.1.3.9)	

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11	VERIFY that the RESPONSE VALUE for dmsDrumStatusMap.0 is a string of Length bytes, where each byte has the value of 0x00.	Pass / Fail (Section 3.5.3.1.3.9)	
12	VERIFY that the RESPONSE VALUE for dmsDrumNumRows.0 is equal to Num_Drums.	Pass / Fail (Section 3.5.3.1.3.9)	
13	FOR EACH value, N, from 1 to Num_Drums, perform Steps 13.1 through 13.4.		
13.1	GET the following object(s): »dmsDrumDescription.N »dmsDrumMfrStatus.N »dmsDrumStatus.N	Pass / Fail (Section 3.5.3.1.4.11)	Section 4.2.4.12 Step b
13.2	VERIFY that the RESPONSE VALUE for dmsDrumDescription.N contains only valid DisplayString characters. Note: Per RFC 854, the characters are restricted to the ASCII codes of 0, 7 through 13, and 32 through 126.	Pass / Fail (Section 3.5.3.1.4.11)	
13.3	VERIFY that the RESPONSE VALUE for dmsDrumMfrStatus.N contains only valid DisplayString characters.	Pass / Fail (Section 3.5.3.1.4.11)	
13.4	VERIFY that the RESPONSE VALUE for dmsDrumStatus.N is equal to 'noError' (2).	Pass / Fail (Section 3.5.3.1.4.11)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.5.24 Verify Drum Sign Rotor Status - Error

Test Case: 5.24	**Title:**	**Verify Drum Sign Rotor Status - Error**
	Description:	This test case verifies that the DMS reports drum rotor errors when one or more rotors are known to be malfunctioning.
	Variables:	Num_Drums — By visual inspection Drum_Index — From the Test Plan Status_Update_Delay — PRL 3.6.9 Drum_Support — From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the number of drums supported by the DMS by visual inspection. RECORD this information as: »Num_Drums		
2	CONFIGURE: Determine the index of the drum(s) to test (from the test plan). RECORD this information as: »Drum_Index		
3	CONFIGURE: Determine the frequency at which the DMS is required to update the status variables (per PRL 3.6.9). RECORD this information as: »Status_Update_Delay		

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4	CONFIGURE: Determine whether the DMS supports drums. RECORD this information as: »Drum_Support		
5	SET-UP: IF Drum_Support is equal to 0, then EXIT; otherwise, GOTO Step 6.		
6	SET-UP: Unplug the power or signal to the Drum_Index drum(s) to simulate drum failure(s) to detect within this test procedure.		
7	SET-UP: Calculate the number of bytes used to map the drums by dividing Num_Drums by 8 and rounding up to the nearest integer. RECORD this information as: »Length		
8	CONFIGURE: Determine the message number for a permanent message that is intended to cause all of the selected rotors to turn (e.g. per the test plan). RECORD this information as: »Msg_Type »Msg_Number		
9	GET the following object(s): »dmsMessageMulti.Msg_Type.Msg_Number		
10	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Msg_Multi_String »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
8	DELAY for Status_Update_Delay seconds.		
9	GET the following object(s): »shortErrorStatus.0	Pass / Fail (Section 3.5.3.1.2)	
10	VERIFY that Bit 12 (drum sign rotor error) of the RESPONSE VALUE for shortErrorStatus.0 is equal to one (1).	Pass / Fail (Section 3.5.3.1.2)	
11	GET the following object(s): »dmsDrumStatusMap.0 »dmsDrumNumRows.0	Pass / Fail (Section 3.5.3.1.3.9)	
12	VERIFY that the RESPONSE VALUE for dmsDrumStatusMap.0 is a string of Length bytes, where the Drum_Index Bit(s) within the string have a value of one (1) and all other bits have a value of zero (0).	Pass / Fail (Section 3.5.3.1.3.9)	
13	VERIFY that the RESPONSE VALUE for dmsDrumNumRows.0 is equal to Num_Drums.	Pass / Fail (Section 3.5.3.1.3.9)	
14	FOR EACH value, N, from 1 to Num_Drums, perform Steps 14.1 through 14.5.		
14.1	GET the following object(s): »dmsDrumDescription.N »dmsDrumMfrStatus.N »dmsDrumStatus.N	Pass / Fail (Section 3.5.3.1.4.11)	Section 4.2.4.12 Step b

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14.2	VERIFY that the RESPONSE VALUE for dmsDrumDescription.N contains only valid DisplayString characters. Note: Per RFC 854, the characters are restricted to the ASCII codes of 0, 7 through 13, and 32 through 126.	Pass / Fail (Section 3.5.3.1.4.11)	
14.3	VERIFY that the RESPONSE VALUE for dmsDrumMfrStatus.N contains only valid DisplayString characters.	Pass / Fail (Section 3.5.3.1.4.11)	
14.4	IF N equals one of the defined Drum_Index values, then GOTO Step 14.4.1; otherwise, GOTO Step 14.5.1.		
14.4.1	VERIFY that the RESPONSE VALUE for dmsDrumStatus.N is not equal to 'noError' (2). GO TO Step 15 (after any looping logic is completed). Note: Valid enumerated values are defined in Section 5.11.2.6.3.4 (Drum Status Parameter).	Pass / Fail (Section 3.5.3.1.4.11)	
14.5.1	VERIFY that the RESPONSE VALUE for dmsDrumStatus.N is equal to 'noError' (2).	Pass / Fail (Section 3.5.3.1.4.11)	
15	Restore power and signal to the Drum_Index drum(s).		

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.5.25 Verify Speed Detector Reading

Test Case: 5.25	**Title:**	**Verify Speed Detector Reading**
	Description:	This test case verifies that the DMS returns the speed detector reading.
	Variables:	
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.

Step	Test Procedure	Results	Additional References
1	By having a car drive past the sign or by means of simulating the speed, generate a valid speed input.		
2	GET the following object(s): »dmsCurrentSpeed.0	Pass / Fail (Section 3.5.3.1.9)	
3	VERIFY that the RESPONSE VALUE agrees with the speed of the vehicle or the simulated speed input.	Pass / Fail (Section 3.5.3.1.9)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

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C.3.5.26 Set Speed Limit

Test Case: 5.26	**Title:**	**Set Speed Limit**
	Description:	This test case verifies that the DMS is able to set the speed limit.
	Variables:	
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.

Step	Test Procedure	Results	Additional References
1	GET the following object(s): »dmsCurrentSpeedLimit.0		
2	RECORD the RESPONSE VALUE for dmsCurrentSpeedLimit.0 as: » Orig_SpeedLimit		
2	SET the following object(s) to the value(s) shown: » dmsCurrentSpeedLimit.0 = Test_SpeedLimit	Pass / Fail (Section 3.5.1.6)	
3	GET the following object(s): »dmsCurrentSpeedLimit.0		
4	VERIFY that the RESPONSE VALUE for dmsCurrentSpeedLimit.0 is equal to Test_SpeedLimit.	Pass / Fail (Section 3.5.1.6)	
5	SET the following object(s) to the value(s) shown: » dmsCurrentSpeedLimit.0 = Orig_SpeedLimit	Pass / Fail (Section 3.5.1.6)	
6	GET the following object(s): »dmsCurrentSpeedLimit.0		
7	VERIFY that the RESPONSE VALUE for dmsCurrentSpeedLimit.0 is equal to Orig_SpeedLimit.	Pass / Fail (Section 3.5.1.6)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.5.27 Fan Test (NTCIP 1203 v01)

Test Case: 5.27	**Title:**	**Fan Test (NTCIP 1203 v01)**
	Description:	This test case verifies that the DMS properly support monitoring fans using the objects defined in NTCIP 1203 v01.
	Variables:	
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.

Step	Test Procedure	Results	Additional References
1	SET-UP: Verify that all fans are properly operating.		

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2	GET the following object(s): »fanFailures.0 »shortErrorStatus.0	Pass / Fail (Section 3.5.4.1)	
3	VERIFY that the RESPONSE VALUE for fanFailures.0 is 0.	Pass / Fail (Section 3.5.4.1)	
4	VERIFY that Bit 3 of the RESPONSE VALUE for shortErrorStatus.0 is not set.	Pass / Fail (Section 3.5.4.1)	
5	Disconnect the power or signal from one fan, causing it to fail. Wait for the fan to stop turning.		
6	SET the following object(s): »fanTestActivation.0 = 'test' (3) Note: Valid enumerated values are defined in Section 5.11.2.3.2 (Fan Test Activation Parameter).	Pass / Fail (Section 3.5.4.2)	
7	GET the following object(s): »fanTestActivation.0 »fanFailures.0 »shortErrorStatus.0	Pass / Fail (Section 3.5.4.1)	
8	IF the RESPONSE VALUE for fanTestActivation.0 is 'test' (3), GOTO Step 7. Note: If the RESPONSE VALUE does not return to 'noTest' (2) after a reasonable period of time, the test fails.		
9	VERIFY that the RESPONSE VALUE for fanTestActivation.0 is equal to 'noTest' (2).	Pass / Fail (Section 3.5.4.2)	
10	VERIFY that the proper bit associated with the disable fan is set to 1 in the RESPONSE VALUE for fanFailures.0. Refer to the manufacturer's documentation to determine the mapping of the fans to the bits in fanFailures.0.	Pass / Fail (Section 3.5.4.2)	
11	VERIFY that Bit 3 of the RESPONSE VALUE for shortErrorStatus.0 is set to 1.	Pass / Fail (Section 3.5.4.2)	
12	Reconnect the power or signal to the fan.		

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.6 MULTI Default Tests

C.3.6.1 Determine Default Message Display Parameters

Test Case: 6.1	**Title:**	**Determine Default Message Display Parameters**
	Description:	This test case verifies that the DMS returns the correct configuration information for the default message display parameters.
	Variables:	
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.

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Step	Test Procedure	Results	Additional References
1	GET the following object(s): »dmsColorScheme.0 »monochromeColor.0	Pass / Fail (Section 3.5.1.2.3.3)	
2	Determine the RESPONSE VALUE for dmsColorScheme.0. RECORD this information as: »Color_Scheme		
3	VERIFY that the RESPONSE VALUE for dmsColorScheme.0 is greater than or equal to 1. Note: Valid enumerated values are defined in Section 5.5.22 (Color Scheme Parameter).	Pass / Fail (Section 3.5.1.2.3.3)	
4	VERIFY that the RESPONSE VALUE for dmsColorScheme.0 is less than or equal to 4.	Pass / Fail (3.5.1.2.3.3)	
5	GET the following object(s): »defaultBackgroundColor.0 »defaultForegroundColor.0 »defaultBackgroundRGB.0 »defaultForegroundRGB.0 »defaultFlashOn.0 »defaultFlashOff.0 »defaultFont.0 »defaultJustificationLine.0 »defaultJustificationPage.0 »defaultPageOnTime.0 »defaultPageOffTime.0 »defaultCharacterSet.0 »defaultFlashOnActivate.0 »defaultFlashOffActivate.0 »defaultFontActivate.0 »defaultJustificationLineActivate.0 »defaultJustificationPageActivate.0 »defaultPageOnTimeActivate.0 »defaultPageOffTimeActivate.0 »defaultBackgroundRGBActivate.0 »defaultForegroundRGBActivate.0	Pass / Fail (Section 3.5.2.3.2.1)	
6	IF Color_Scheme is equal to ‘monochrome1bit’ (1), then GOTO Step 6.1; otherwise, GOTO Step 7.		
6.1	VERIFY that the RESPONSE VALUE for defaultBackgroundRGB.0 has a length of 1 byte.	Pass / Fail (Section 5.5.17)	
6.2	VERIFY that the RESPONSE VALUE for defaultBackgroundRGB.0 is between 0 and 1, inclusive, when converted to an integer.	Pass / Fail (Section 5.5.17)	
6.3	VERIFY that the RESPONSE VALUE for defaultForegroundRGB.0 has a length of 1 byte.	Pass / Fail (Section 5.5.19)	
6.4	VERIFY that the RESPONSE VALUE for defaultForegroundRGB.0 is between 0 and 1, inclusive, when converted to an integer.	Pass / Fail (Section 5.5.19)	
6.5	VERIFY that the RESPONSE VALUE for defaultBackgroundRGBActivate.0 has a length of 1 byte.	Pass / Fail (Section 5.5.18)	
6.6	VERIFY that the RESPONSE VALUE for defaultBackgroundRGBActivate.0 is between 0 and 1, inclusive, when converted to an integer.	Pass / Fail (Section 5.5.18)	

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6.7	VERIFY that the RESPONSE VALUE for defaultForegroundRGBActivate.0 has a length of 1 byte.	Pass / Fail (Section 5.5.20)	
6.8	VERIFY that the RESPONSE VALUE for defaultForegroundRGBActivate.0 is between 0 and 1, inclusive, when converted to an integer.	Pass / Fail (Section 5.5.20)	
7	IF Color_Scheme is equal to monochrome8bit (2), then GOTO Step 7.1; otherwise, GOTO Step 8.		
7.1	VERIFY that the RESPONSE VALUE for defaultBackgroundRGB.0 has a length of 1 byte.	Pass / Fail (Section 5.5.17)	
7.2	VERIFY that the RESPONSE VALUE for defaultForegroundRGB.0 has a length of 1 byte.	Pass / Fail (Section 5.5.19)	
7.3	VERIFY that the RESPONSE VALUE for defaultBackgroundRGBActivate.0 has a length of 1 byte.	Pass / Fail (Section 5.5.18)	
7.4	VERIFY that the RESPONSE VALUE for defaultForegroundRGBActivate.0 has a length of 1 byte.	Pass / Fail (Section 5.5.20)	
8	IF Color_Scheme is equal to colorClassic (3), then GOTO Step 8.1; otherwise, GOTO Step 9.		
8.1	VERIFY that the RESPONSE VALUE for defaultBackgroundColor.0 is between 0 and 9, inclusive.	Pass / Fail (Section 5.5.1)	
8.2	VERIFY that the RESPONSE VALUE for defaultBackgroundRGB.0 has a length of 1 byte.	Pass / Fail (Section 5.5.17)	
8.3	VERIFY that the RESPONSE VALUE for defaultBackgroundRGB.0 is between 0 and 9, inclusive, when converted to an integer.	Pass / Fail (Section 5.5.17)	
8.4	VERIFY that the RESPONSE VALUE for defaultBackgroundRGB.0 is equal to the RESPONSE VALUE for defaultBackgroundColor.0.	Pass / Fail (Section 5.5.17)	
8.5	VERIFY that the RESPONSE VALUE for defaultForegroundColor.0 is between 0 and 9, inclusive.	Pass / Fail (Section 5.5.2)	
8.6	VERIFY that the RESPONSE VALUE for defaultForegroundRGB.0 has a length of 1 byte.	Pass / Fail (Section 5.5.19)	
8.7	VERIFY that the RESPONSE VALUE for defaultForegroundRGB.0 is between 0 and 9, inclusive, when converted to an integer.	Pass / Fail (Section 5.5.19)	
8.8	VERIFY that the RESPONSE VALUE for defaultForegroundRGB.0 is equal to the RESPONSE VALUE for defaultForegroundColor.0.	Pass / Fail (Section 5.5.19)	
8.9	VERIFY that the RESPONSE VALUE for defaultBackgroundRGBActivate.0 has a length of 1 byte.	Pass / Fail (Section 5.5.18)	
8.10	VERIFY that the RESPONSE VALUE for defaultBackgroundRGBActivate.0 is between 0 and 9, inclusive, when converted to an integer.	Pass / Fail (Section 5.5.18)	
8.11	VERIFY that the RESPONSE VALUE for defaultForegroundRGBActivate.0 has a length of 1 byte.	Pass / Fail (Section 5.5.20)	
8.12	VERIFY that the RESPONSE VALUE for defaultForegroundRGBActivate.0 is between 0 and 9, inclusive, when converted to an integer..	Pass / Fail (Section 5.5.20)	

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9	IF Color_Scheme is equal to color24bit (4), then GOTO Step 9.1; otherwise, GOTO Step 10.		
9.1	VERIFY that the RESPONSE VALUE for defaultBackgroundRGB.0 has a length of 3 bytes. Note: Valid values are defined in NTCIP 1203 v03, Section 5.5.17	Pass / Fail (Section 5.5.17)	
9.2	VERIFY that the RESPONSE VALUE for defaultForegroundRGB.0 has a length of 3 bytes. Note: Valid values are defined in NTCIP 1203 v03, Section 5.5.19	Pass / Fail (Section 5.5.19)	
9.3	VERIFY that the RESPONSE VALUE for defaultBackgroundRGBActivate.0 has a length of 3 bytes.	Pass / Fail (Section 5.5.18)	
9.4	VERIFY that the RESPONSE VALUE for defaultForegroundRGBActivate.0 has a length of 3 bytes.	Pass / Fail (Section 5.5.20)	
10	VERIFY that the RESPONSE VALUE for defaultFlashOn.0 is greater than or equal to 0. Note: Valid values are defined in NTCIP 1203 v03, Section 5.5.3	Pass / Fail (Section 5.5.3)	
11	VERIFY that the RESPONSE VALUE for defaultFlashOn.0 is less than or equal to 255.	Pass / Fail (Section 5.5.3)	
12	VERIFY that the RESPONSE VALUE for defaultFlashOff.0 is greater than or equal to 0. Note: Valid values are defined in NTCIP 1203 v03, Section 5.5.5	Pass / Fail (Section 5.5.5)	
13	VERIFY that the RESPONSE VALUE for defaultFlashOff.0 is less than or equal to 255.	Pass / Fail (Section 5.5.5)	
14	VERIFY that the RESPONSE VALUE for defaultFont.0 is greater than or equal to 1. Note: Valid values are defined in NTCIP 1203 v03, Section 5.5.7	Pass / Fail (Section 5.5.7)	
15	VERIFY that the RESPONSE VALUE for defaultFont.0 is less than or equal to 255.	Pass / Fail (Section 5.5.7)	
16	VERIFY that the RESPONSE VALUE for defaultJustificationLine.0 is greater than or equal to 2. Note: Valid enumerated values are defined in NTCIP 1203 v03, Section 5.5.9	Pass / Fail (Section 5.5.9)	
17	VERIFY that the RESPONSE VALUE for defaultJustificationLine.0 is less than or equal to 5.	Pass / Fail (Section 5.5.9)	
18	VERIFY that the RESPONSE VALUE for defaultJustificationPage.0 is greater than or equal to 2. Note: Valid enumerated values are defined in NTCIP 1203 v03, Section 5.5.11	Pass / Fail (Section 5.5.11)	
19	VERIFY that the RESPONSE VALUE for defaultJustificationPage.0 is less than or equal to 4.	Pass / Fail (Section 5.5.11)	
20	VERIFY that the RESPONSE VALUE for defaultPageOnTime.0 is greater than or equal to 1.	Pass / Fail (Section 5.5.13)	

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	Note: Valid values are defined in NTCIP 1203 v03, Section 5.5.13		
21	VERIFY that the RESPONSE VALUE for defaultPageOnTime.0 is less than or equal to 255.	Pass / Fail (Section 5.5.13)	
22	VERIFY that the RESPONSE VALUE for defaultPageOffTime.0 is greater than or equal to 0. Note: Valid values are defined in NTCIP 1203 v03, Section 5.5.15	Pass / Fail (Section 5.5.15)	
23	VERIFY that the RESPONSE VALUE for defaultPageOffTime.0 is less than or equal to 255.	Pass / Fail (Section 5.5.15)	
24	VERIFY that the RESPONSE VALUE for defaultCharacterSet.0 is greater than or equal to 1. Note: Valid enumerated values are defined in NTCIP 1203 v03, Section 5.5.21	Pass / Fail (Section 5.5.21)	
25	VERIFY that the RESPONSE VALUE for defaultCharacterSet.0 is less than or equal to 2.	Pass / Fail (Section 5.5.21)	
26	VERIFY that the RESPONSE VALUE for defaultFlashOnActivate.0 is greater than or equal to 0.	Pass / Fail (Section 5.5.4)	
27	VERIFY that the RESPONSE VALUE for defaultFlashOnActivate.0 is less than or equal to 255.	Pass / Fail (Section 5.5.4)	
28	VERIFY that the RESPONSE VALUE for defaultFlashOffActivate.0 is greater than or equal to 0.	Pass / Fail (Section 5.5.6)	
29	VERIFY that the RESPONSE VALUE for defaultFlashOffActivate.0 is less than or equal to 255.	Pass / Fail (Section 5.5.6)	
30	VERIFY that the RESPONSE VALUE for defaultFontActivate.0 is greater than or equal to 1.	Pass / Fail (Section 5.5.8)	
31	VERIFY that the RESPONSE VALUE for defaultFontActivate.0 is less than or equal to 255.	Pass / Fail (Section 5.5.8)	
32	VERIFY that the RESPONSE VALUE for defaultJustificationLineActivate.0 is greater than or equal to 2.	Pass / Fail (Section 5.5.10)	
33	VERIFY that the RESPONSE VALUE for defaultJustificationLineActivate.0 is less than or equal to 5.	Pass / Fail (Section 5.5.10)	
34	VERIFY that the RESPONSE VALUE for defaultJustificationPageActivate.0 is greater than or equal to 2.	Pass / Fail (Section 5.5.12)	
35	VERIFY that the RESPONSE VALUE for defaultJustificationPageActivate.0 is less than or equal to 4.	Pass / Fail (Section 5.5.12)	
36	VERIFY that the RESPONSE VALUE for defaultPageOnTimeActivate.0 is greater than or equal to 1.	Pass / Fail (Section 5.5.14)	
37	VERIFY that the RESPONSE VALUE for defaultPageOnTimeActivate.0 is less than or equal to 255.	Pass / Fail (Section 5.5.14)	
38	VERIFY that the RESPONSE VALUE for defaultPageOffTimeActivate.0 is greater than or equal to 0.	Pass / Fail (Section 5.5.16)	

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39	VERIFY that the RESPONSE VALUE for defaultPageOffTimeActivate.0 is less than or equal to 255.	Pass / Fail (Section 5.5.16)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.6.2 Configure Default Background and Foreground Color

Test Case: 6.2	**Title:**	**Configure Default Background and Foreground Color**
	Description:	This test case verifies that the DMS allows configuration of the default background and foreground color. A message is displayed to verify that the DMS displays the configuration correctly.
	Variables:	Required_Color_Scheme: PRL 3.6.8 Test_Background: From the Test Plan Test_Foreground: From the Test Plan Msg_Type: From the Test Plan Msg_Number: From the Test Plan Msg_Default_Colors: From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the enumerated value of the color scheme that the DMS is required to support per the specification (PRL 3.6.8). RECORD this information as: »Required_Color_Scheme Note: Valid enumerated values are defined in Section 5.5.22 (Color Scheme Parameter).		
2	CONFIGURE: Determine the encoded value of an alternate background color that the DMS is required to support per the Required_Color_Scheme (per the test plan). RECORD this information as: »Test_Background Note: Rules for encoding values are defined in Section 5.5.17 (Default Background Color RGB Parameter).		
3	CONFIGURE: Determine the encoded value of an alternate foreground color that the DMS is required to support per the Required_Color_Scheme (per the test plan). RECORD this information as: »Test_Foreground Note: Rules for encoding values are defined in Section 5.5.19 (Default Foreground Color RGB Parameter).		
4	GET the following object(s): »defaultBackgroundRGB.0 »defaultForegroundRGB.0	Pass / Fail (Section 3.5.2.3.2.1)	

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5	RECORD the RESPONSE VALUE for defaultBackgroundRGB.0 and defaultForegroundRGB.0 as: »Orig_Background »Orig_Foreground		
6	SET-UP: VERIFY that the RESPONSE VALUE for defaultBackgroundRGB.0 is not equal to Test_Background.		
7	SET-UP: VERIFY that the RESPONSE VALUE for defaultForegroundRGB.0 is not equal to Test_Foreground.		
8	SET-UP: PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Msg_Default_Colors »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 »Msg_Pixel_Service = 0 »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0		
8.1	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Msg_Default_Colors »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
9	VERIFY that the background of the displayed message is the color specified by Orig_Background.	Pass / Fail (Section 3.5.2.3.2.1)	
10	VERIFY that the foreground of the displayed message (i.e., the text) is the color specified by Orig_Foreground.	Pass / Fail (Section 3.5.2.3.2.1)	
11	GET the following object(s): »defaultBackgroundRGBActivate.0 »defaultForegroundRGBActivate.0	Pass / Fail (Section 3.5.2.3.2.1)	
12	VERIFY that the RESPONSE VALUE for defaultBackgroundRGBActivate.0 is equal to Orig_Background.	Pass / Fail (Section 3.5.2.3.2.1)	
13	VERIFY that the RESPONSE VALUE for defaultForegroundRGBActivate.0 is equal to Orig_Foreground.	Pass / Fail (Section 3.5.2.3.2.1)	
14	SET the following object(s) to the value(s) shown: »defaultBackgroundRGB.0 = Test_Background »defaultForegroundRGB.0 = Test_Foreground	Pass / Fail (Section 3.5.2.3.2.2)	
15	VERIFY that the display did not change.	Pass / Fail (Section 3.5.2.3.2.2)	

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16	GET the following object(s): »defaultBackgroundRGB.0 »defaultForegroundRGB.0 »defaultBackgroundRGBActivate.0 »defaultForegroundRGBActivate.0	Pass / Fail (Section 3.5.2.3.2.1)	
17	VERIFY that the RESPONSE VALUE for defaultBackgroundRGB.0 is equal to Test_Background.	Pass / Fail (Section 3.5.2.3.2.1)	
18	VERIFY that the RESPONSE VALUE for defaultForegroundRGB.0 is equal to Test_Foreground.	Pass / Fail (Section 3.5.2.3.2.1)	
19	VERIFY that the RESPONSE VALUE for defaultBackgroundRGBActivate.0 is equal to Orig_Background.	Pass / Fail (Section 3.5.2.3.2.1)	
20	VERIFY that the RESPONSE VALUE for defaultForegroundRGBActivate.0 is equal to Orig_Foreground.	Pass / Fail (Section 3.5.2.3.2.1)	
21	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Msg_Default_Colors »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
22	VERIFY that the background of the displayed message is the color specified by Test_Background.	Pass / Fail (Section 3.5.2.3.2.2)	
23	VERIFY that the foreground of the displayed message (i.e., the text) is the color specified by Test_Foreground.	Pass / Fail (Section 3.5.2.3.2.2)	
24	GET the following object(s): »defaultBackgroundRGBActivate.0 »defaultForegroundRGBActivate.0	Pass / Fail (Section 3.5.2.3.2.1)	
25	VERIFY that the RESPONSE VALUE for defaultBackgroundRGBActivate.0 is equal to Test_Background.	Pass / Fail (Section 3.5.2.3.2.2)	
26	VERIFY that the RESPONSE VALUE for defaultForegroundRGBActivate.0 is equal to Test_Foreground.	Pass / Fail (Section 3.5.2.3.2.2)	
27	SET the following object(s) to the value(s) shown: »defaultBackgroundRGB.0 = Orig_Background »defaultForegroundRGB.0 = Orig_Foreground	Pass / Fail (Section 3.5.2.3.2.2)	
28	VERIFY that the display did not change.	Pass / Fail (Section 3.5.2.3.2.2)	
29	GET the following object(s): »defaultBackgroundRGB.0 »defaultForegroundRGB.0 »defaultBackgroundRGBActivate.0 »defaultForegroundRGBActivate.0	Pass / Fail (Section 3.5.2.3.2.1)	
30	VERIFY that the RESPONSE VALUE for defaultBackgroundRGB.0 is equal to Orig_Background.	Pass / Fail (Section 3.5.2.3.2.1)	

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31	VERIFY that the RESPONSE VALUE for defaultForegroundRGB.0 is equal to Orig_Foreground.	Pass / Fail (Section 3.5.2.3.2.1)	
32	VERIFY that the RESPONSE VALUE for defaultBackgroundRGBActivate.0 is equal to Test_Background.	Pass / Fail (Section 3.5.2.3.2.1)	
33	VERIFY that the RESPONSE VALUE for defaultForegroundRGBActivate.0 is equal to Test_Foreground.	Pass / Fail (Section 3.5.2.3.2.1)	
34	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Msg_Default_Colors »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
35	VERIFY that the background of the displayed message is the color specified by Orig_Background.	Pass / Fail (Section 3.5.2.3.2.2)	
36	VERIFY that the foreground of the displayed message (e.g., the text) is the color specified by Orig_Foreground.	Pass / Fail (Section 3.5.2.3.2.2)	
37	GET the following object(s): »defaultBackgroundRGBActivate.0 »defaultForegroundRGBActivate.0	Pass / Fail (Section 3.5.2.3.2.1)	
38	VERIFY that the RESPONSE VALUE for defaultBackgroundRGBActivate.0 is equal to Orig_Background.	Pass / Fail (Section 3.5.2.3.2.2)	
39	VERIFY that the RESPONSE VALUE for defaultForegroundRGBActivate.0 is equal to Orig_Foreground.	Pass / Fail (Section 3.5.2.3.2.2)	
40	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.6.3 Configure Default Flash-On and Flash-Off Times

Test Case: 6.3	**Title:**	**Configure Default Flash-On and Flash-Off Times**	
	Description:	This test case verifies that the DMS allows supports the default flash on and off times required by the specification. A message is displayed to verify that the DMS displays the configuration correctly.	
	Variables:	Flash_On_Min	PRL 2.5.2.3.3 / 3.5.2.3.2.3
		Flash_On_Max	PRL 2.5.2.3.3 / 3.5.2.3.2.3
		Flash_On_Res	PRL 2.5.2.3.3 / 3.5.2.3.2.3
		Flash_Off_Min	PRL 2.5.2.3.3 / 3.5.2.3.2.3
		Flash_Off_Max	PRL 2.5.2.3.3 / 3.5.2.3.2.3
		Flash_Off_Res	PRL 2.5.2.3.3 / 3.5.2.3.2.3
		Msg_Type	From the Test Plan

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		Msg_Number	From the Test Plan
		Flashing_Message	From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the minimum default flash-on time required by the specification (PRL 2.5.2.3.3 / 3.5.2.3.2.3). RECORD this information as: »Flash_On_Min		
2	CONFIGURE: Determine the maximum default flash-on time required by the specification (PRL 2.5.2.3.3 / 3.5.2.3.2.3). RECORD this information as: »Flash_On_Max		
3	CONFIGURE: Determine the resolution of the flash-on time as required by the specification (PRL 2.5.2.3.3 / 3.5.2.3.2.3). RECORD this information as: »Flash_On_Res		
4	CONFIGURE: Determine the minimum default flash-off time required by the specification (PRL 2.5.2.3.3 / 3.5.2.3.2.3). RECORD this information as: »Flash_Off_Min		
5	CONFIGURE: Determine the maximum default flash-off time required by the specification (PRL 2.5.2.3.3 / 3.5.2.3.2.3). RECORD this information as: »Flash_Off_Max		
6	CONFIGURE: Determine the resolution of the flash-off time as required by the specification (PRL 2.5.2.3.3 / 3.5.2.3.2.3). RECORD this information as: »Flash_Off_Res		
7	CONFIGURE: Determine the message type, message number, and MULTI string for a flashing message to be displayed on the sign to verify the flash times (per the test plan). RECORD this information as: »Msg_Type »Msg_Number »Flashing_Message		
8	SET-UP: VERIFY that Flash_On_Min is less than Flash_On_Max.		
9	SET-UP: VERIFY that Flash_Off_Min is less than Flash_Off_Max.		
10	SET-UP: VERIFY that the Flashing_Message starts with a '[fl]' tag without any explicit flashing on or off times.		
11	SET-UP: VERIFY that the Flashing_Message ends with a '[/fl]' tag.		

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12	SET-UP: PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Flashing_Message »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 »Msg_Pixel_Service = 0 »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.3.3)	
13	GET the following object(s): »defaultFlashOn.0 »defaultFlashOff.0	Pass / Fail (Section 3.5.2.3.2.1)	
14	Determine the RESPONSE VALUE for defaultFlashOn.0 and defaultFlashOff.0. RECORD this information as: »Flash_On_Orig »Flash_Off_Orig		
15	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Flashing_Message »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
16	VERIFY that the flash on time is as defined by Flash_On_Orig.	Pass / Fail (Section 3.5.2.3.2.3)	
17	VERIFY that the flash off time is as defined by Flash_Off_Orig.	Pass / Fail (Section 3.5.2.3.2.3)	
18	Calculate the number of valid possible settings for defaultFlashOn (i.e., the maximum value minus the minumum value divided by the resolution plus 1). RECORD this information as: »Max		
19	Calculate a random integer value between 0 and Max. RECORD this information as: »X		
20	Calculate the value defined by the formula: Flash_On_Min + X * Flash_On_Res. RECORD this information as: »Flash_On_Current		
21	Calculate the number of valid possible settings for defaultFlashOff (i.e., the maximum value minus the minumum value divided by the resolution plus 1). RECORD this information as: »Max		
22	Calculate a random value between 0 and Max. RECORD this information as: »Y		

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23	Calculate the value defined by the formula: Flash_Off_Min + Y * Flash_On_Res. RECORD this information as: »Flash_Off_Current		
24	SET the following object(s) to the value(s) shown: »defaultFlashOn.0 = Flash_On_Current »defaultFlashOff.0 = Flash_Off_Current	Pass / Fail (Section 3.5.2.3.2.3)	
25	GET the following object(s): »defaultFlashOn.0 »defaultFlashOff.0 »defaultFlashOnActivate.0 »defaultFlashOffActivate.0	Pass / Fail (Section 3.5.2.3.2.1)	
26	VERIFY that the RESPONSE VALUE for defaultFlashOn.0 is equal to Flash_On_Current.	Pass / Fail (Section 3.5.2.3.2.3)	
27	VERIFY that the RESPONSE VALUE for defaultFlashOff.0 is equal to Flash_Off_Current.	Pass / Fail (Section 3.5.2.3.2.3)	
28	VERIFY that the RESPONSE VALUE for defaultFlashOnActivate.0 is equal to Flash_On_Orig.	Pass / Fail (Section 3.5.2.3.2.3)	
29	VERIFY that the RESPONSE VALUE for defaultFlashOffActivate.0 is equal to Flash_Off_Orig.	Pass / Fail (Section 3.5.2.3.2.3)	
30	VERIFY that the flash on time is as defined by Flash_On_Orig.	Pass / Fail (Section 3.5.2.3.2.3)	
31	VERIFY that the flash off time is as defined by Flash_Off_Orig.	Pass / Fail (Section 3.5.2.3.2.3)	
32	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Flashing_Message »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
33	VERIFY that the flash on time is as defined by Flash_On_Current.	Pass / Fail (Section 3.5.2.3.2.3)	
34	VERIFY that the flash off time is as defined by Flash_Off_Current.	Pass / Fail (Section 3.5.2.3.2.3)	
35	GET the following object(s): »defaultFlashOn.0 »defaultFlashOff.0 »defaultFlashOnActivate.0 »defaultFlashOffActivate.0	Pass / Fail (Section 3.5.2.3.2.1)	
36	VERIFY that the RESPONSE VALUE for defaultFlashOn.0 is equal to Flash_On_Current.	Pass / Fail (Section 3.5.2.3.2.3)	

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37	VERIFY that the RESPONSE VALUE for defaultFlashOff.0 is equal to Flash_Off_Current.	Pass / Fail (Section 3.5.2.3.2.3)	
38	VERIFY that the RESPONSE VALUE for defaultFlashOnActivate.0 is equal to Flash_On_Current.	Pass / Fail (Section 3.5.2.3.2.3)	
39	VERIFY that the RESPONSE VALUE for defaultFlashOffActivate.0 is equal to Flash_Off_Current.	Pass / Fail (Section 3.5.2.3.2.3)	
40	SET the following object(s) to the value(s) shown: »defaultFlashOn.0 = Flash_On_Orig »defaultFlashOff.0 = Flash_Off_Orig	Pass / Fail (Section 3.5.2.3.2.3)	
41	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.6.4 Configure a Default Font

Test Case: 6.4	**Title:**	**Configure a Default Font**	
	Description:	This test case verifies that the DMS allows configuration of the default font to a supported font. A message is displayed to verify that the DMS displays the configuration correctly.	
	Variables:	Test_Font_Number	From the Test Plan
		Msg_Type	From the Test Plan
		Msg_Number	From the Test Plan
		Font_Message	From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the number of the font to be tested (cannot be the default font) (from the test plan). RECORD this information as: »Test_Font_Number		
2	CONFIGURE: Determine the message type, message number, and MULTI string for a message to be used to display the font (from the test plan). RECORD this information as: »Msg_Type »Msg_Number »Font_Message Note: The MULTI string CANNOT contain a font tag.		

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3	GET the following object(s): »defaultBackgroundRGB.0 »defaultForegroundRGB.0 »defaultFlashOn.0 »defaultFlashOff.0 »defaultFont.0 »defaultJustificationLine.0 »defaultJustificationPage.0 »defaultPageOnTime.0 »defaultPageOffTime.0 »defaultCharacterSet.0 »defaultFlashOnActivate.0 »defaultFlashOffActivate.0 »defaultFontActivate.0 »defaultJustificationLineActivate.0 »defaultJustificationPageActivate.0 »defaultPageOnTimeActivate.0 »defaultPageOffTimeActivate.0 »defaultBackgroundRGBActivate.0 »defaultForegroundRGBActivate.0	Pass / Fail (Section 3.5.2.3.2.1)	
4	RECORD the RESPONSE VALUE for defaultFont.0 as: »Orig_Font		
5	SET-UP: VERIFY that the RESPONSE VALUE for defaultFont.0 is not equal to Test_Font_Number.		
6	SET-UP: GET the following object(s): »numFonts.0		
7	RECORD the RESPONSE VALUE for numFonts.0 as: »Num_Fonts		
8	SET-UP: Calculate 0. RECORD this information as: »N		
8.1	Calculate N to be N + 1. RECORD this information as: »N		
8.2	SET-UP: VERIFY that N is less than or equal to Num_Fonts.		
8.3	SET-UP: GET the following object(s): »fontNumber.N		
9	SET-UP: IF the RESPONSE VALUE for fontNumber.N does not equal Test_Font_Number and N is less than or equal to Num_Fonts, then GOTO Step 8.1; otherwise, GOTO Step 10.		
10	SET-UP: GET the following object(s): »fontStatus.N		
11	SET-UP: VERIFY that the RESPONSE VALUE for fontStatus.N is equal to 'readyForUse' (4), 'inUse' (5), or 'permanent' (6). Note: Valid enumerated values are defined in Section 5.4.2.8 (Font Status Parameter).		

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12	SET-UP: PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Font_Message »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 »Msg_Pixel_Service = 0 »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.3.3)	
13	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Font_Message »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
14	VERIFY that the message is displayed using the Orig_Font.	Pass / Fail (Section 3.5.2.3.2.1)	
15	GET the following object(s): »defaultBackgroundRGB.0 »defaultForegroundRGB.0 »defaultFlashOn.0 »defaultFlashOff.0 »defaultFont.0 »defaultJustificationLine.0 »defaultJustificationPage.0 »defaultPageOnTime.0 »defaultPageOffTime.0 »defaultCharacterSet.0 »defaultFlashOnActivate.0 »defaultFlashOffActivate.0 »defaultFontActivate.0 »defaultJustificationLineActivate.0 »defaultJustificationPageActivate.0 »defaultPageOnTimeActivate.0 »defaultPageOffTimeActivate.0 »defaultBackgroundRGBActivate.0 »defaultForegroundRGBActivate.0	Pass / Fail (Section 3.5.2.3.2.1)	
16	VERIFY that the RESPONSE VALUE for defaultFont.0 is equal to Orig_Font.	Pass / Fail (Section 3.5.2.3.2.1)	
17	VERIFY that the RESPONSE VALUE for defaultFontActivate.0 is equal to Orig_Font.	Pass / Fail (Section 3.5.2.3.2.1)	
18	SET the following object(s) to the value(s) shown: »defaultFont.0 = Test_Font_Number	Pass / Fail (Section 3.5.2.3.2.4)	
19	VERIFY that the display does not change.	Pass / Fail (Section 3.5.2.3.2.4)	

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20	GET the following object(s): »defaultBackgroundRGB.0 »defaultForegroundRGB.0 »defaultFlashOn.0 »defaultFlashOff.0 »defaultFont.0 »defaultJustificationLine.0 »defaultJustificationPage.0 »defaultPageOnTime.0 »defaultPageOffTime.0 »defaultCharacterSet.0 »defaultFlashOnActivate.0 »defaultFlashOffActivate.0 »defaultFontActivate.0 »defaultJustificationLineActivate.0 »defaultJustificationPageActivate.0 »defaultPageOnTimeActivate.0 »defaultPageOffTimeActivate.0 »defaultBackgroundRGBActivate.0 »defaultForegroundRGBActivate.0	Pass / Fail (Section 3.5.2.3.2.1)	
21	VERIFY that the RESPONSE VALUE for defaultFont.0 is equal to Test_Font_Number.	Pass / Fail (Section 3.5.2.3.2.4)	
22	VERIFY that the RESPONSE VALUE for defaultFontActivate.0 is equal to Orig_Font.	Pass / Fail (Section 3.5.2.3.2.4)	
23	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Font_Message »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
24	VERIFY that the message is displayed using the Test_Font_Number font.	Pass / Fail (Section 3.5.2.3.2.4)	
25	GET the following object(s): »defaultBackgroundRGB.0 »defaultForegroundRGB.0 »defaultFlashOn.0 »defaultFlashOff.0 »defaultFont.0 »defaultJustificationLine.0 »defaultJustificationPage.0 »defaultPageOnTime.0 »defaultPageOffTime.0 »defaultCharacterSet.0 »defaultFlashOnActivate.0 »defaultFlashOffActivate.0 »defaultFontActivate.0 »defaultJustificationLineActivate.0 »defaultJustificationPageActivate.0 »defaultPageOnTimeActivate.0 »defaultPageOffTimeActivate.0 »defaultBackgroundRGBActivate.0 »defaultForegroundRGBActivate.0	Pass / Fail (Section 3.5.2.3.2.1)	

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26	VERIFY that the RESPONSE VALUE for defaultFont.0 is equal to Test_Font_Number.	Pass / Fail (Section 3.5.2.3.2.4)	
27	VERIFY that the RESPONSE VALUE for defaultFontActivate.0 is equal to Test_Font_Number.	Pass / Fail (Section 3.5.2.3.2.4)	
28	SET the following object(s) to the value(s) shown: »defaultFont.0 = Orig_Font	Pass / Fail (Section 3.5.2.3.2.4)	
29	VERIFY that the display does not change.	Pass / Fail (Section 3.5.2.3.2.4)	
30	GET the following object(s): »defaultBackgroundRGB.0 »defaultForegroundRGB.0 »defaultFlashOn.0 »defaultFlashOff.0 »defaultFont.0 »defaultJustificationLine.0 »defaultJustificationPage.0 »defaultPageOnTime.0 »defaultPageOffTime.0 »defaultCharacterSet.0 »defaultFlashOnActivate.0 »defaultFlashOffActivate.0 »defaultFontActivate.0 »defaultJustificationLineActivate.0 »defaultJustificationPageActivate.0 »defaultPageOnTimeActivate.0 »defaultPageOffTimeActivate.0 »defaultBackgroundRGBActivate.0 »defaultForegroundRGBActivate.0	Pass / Fail (Section 3.5.2.3.2.1)	
31	VERIFY that the RESPONSE VALUE for defaultFont.0 is equal to Orig_Font.	Pass / Fail (Section 3.5.2.3.2.4)	
32	VERIFY that the RESPONSE VALUE for defaultFontActivate.0 is equal to Test_Font_Number.	Pass / Fail (Section 3.5.2.3.2.4)	
33	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.6.5 Configure Default Line Justification

Test Case: 6.5	**Title:**	**Configure Default Line Justification**	
	Description:	This test case verifies that the DMS allows configuration of line justification. A message is displayed for each justification method to visually verify each.	
	Variables:	Left	PRL 3.6.13.1
		Center	PRL 3.6.13.2
		Right	PRL 3.6.13.3
		Full	PRL 3.6.13.4
		Msg_Type	From the Test Plan
		Msg_Number	From the Test Plan
		Default_Line_Just_Msg	From the Test Plan
	Pass/Fail	The DUT shall pass every verification step included within the Test Case to pass	

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	Criteria:	the Test Case.

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine if the sign is required to support left-justification per the specification (PRL 3.6.13.1). RECORD this information as: »Left		
2	CONFIGURE: Determine if the sign is required to support center-justification per the specification (PRL 3.6.13.2). RECORD this information as: »Center		
3	CONFIGURE: Determine if the sign is required to support right-justification per the specification (PRL 3.6.13.3). RECORD this information as: »Right		
4	CONFIGURE: Determine if the sign is required to support full-justification per the specification (PRL 3.6.13.4). RECORD this information as: »Full		
5	CONFIGURE: Determine the message type, message number, and MULTI string for a message to be used to test line justification (from the test plan). RECORD this information as: »Msg_Type »Msg_Number »Default_Line_Just_Msg		
6	SET-UP: PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Default_Line_Just_Msg »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 »Msg_Pixel_Service = 0 »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0		
7	GET the following object(s): »defaultBackgroundRGB.0 »defaultForegroundRGB.0 »defaultFlashOn.0 »defaultFlashOff.0 »defaultFont.0 »defaultJustificationLine.0 »defaultJustificationPage.0 »defaultPageOnTime.0 »defaultPageOffTime.0 »defaultCharacterSet.0 »defaultFlashOnActivate.0 »defaultFlashOffActivate.0 »defaultFontActivate.0 »defaultJustificationLineActivate.0 »defaultJustificationPageActivate.0 »defaultPageOnTimeActivate.0 »defaultPageOffTimeActivate.0 »defaultBackgroundRGBActivate.0 »defaultForegroundRGBActivate.0	Pass / Fail (Section 3.5.2.3.2.1)	

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8	RECORD the RESPONSE VALUE for defaultJustificationLine.0 as: »Orig_Justification Note: Valid enumerated values are defined in Section 5.5.9 (Default Line Justification Parameter).		
9	RECORD the RESPONSE VALUE for defaultJustificationLine.0 as: »Current_Justification		
10	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Default_Line_Just_Msg »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
11	VERIFY that the message is displayed using the Orig_Justification.	Pass / Fail (Section 3.5.2.3.2.1)	
12	IF Left is equal to 1, then GOTO Step 12.1; otherwise, GOTO Step 13.		
12.1	SET the following object(s) to the value(s) shown: »defaultJustificationLine.0 = 'left' (2)	Pass / Fail (Section 3.5.2.3.2.5)	
12.2	GET the following object(s): »defaultBackgroundRGB.0 »defaultForegroundRGB.0 »defaultFlashOn.0 »defaultFlashOff.0 »defaultFont.0 »defaultJustificationLine.0 »defaultJustificationPage.0 »defaultPageOnTime.0 »defaultPageOffTime.0 »defaultCharacterSet.0 »defaultFlashOnActivate.0 »defaultFlashOffActivate.0 »defaultFontActivate.0 »defaultJustificationLineActivate.0 »defaultJustificationPageActivate.0 »defaultPageOnTimeActivate.0 »defaultPageOffTimeActivate.0 »defaultBackgroundRGBActivate.0 »defaultForegroundRGBActivate.0	Pass / Fail (Section 3.5.2.3.2.1)	
12.3	VERIFY that the RESPONSE VALUE for defaultJustificationLine.0 is equal to 'left' (2).	Pass / Fail (Section 3.5.2.3.2.5)	
12.4	VERIFY that the RESPONSE VALUE for defaultJustificationLineActivate.0 is equal to Current_Justification.	Pass / Fail (Section 3.5.2.3.2.5)	
12.5	RECORD the RESPONSE VALUE for defaultJustificationLine.0 as: »Current_Justification		
12.6	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number	Pass / Fail (Section 3.5.2.3.1)	

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	»Msg_Multi_String = Default_Line_Just_Msg »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0		
12.7	VERIFY that the message is displayed using left justification.	Pass / Fail (Section 3.5.2.3.2.5)	
13	IF Center is equal to 1, then GOTO Step 13.1; otherwise, GOTO Step 14.		
13.1	SET the following object(s) to the value(s) shown: »defaultJustificationLine.0 = 'center' (3)	Pass / Fail (Section 3.5.2.3.2.5)	
13.2	GET the following object(s): »defaultBackgroundRGB.0 »defaultForegroundRGB.0 »defaultFlashOn.0 »defaultFlashOff.0 »defaultFont.0 »defaultJustificationLine.0 »defaultJustificationPage.0 »defaultPageOnTime.0 »defaultPageOffTime.0 »defaultCharacterSet.0 »defaultFlashOnActivate.0 »defaultFlashOffActivate.0 »defaultFontActivate.0 »defaultJustificationLineActivate.0 »defaultJustificationPageActivate.0 »defaultPageOnTimeActivate.0 »defaultPageOffTimeActivate.0 »defaultBackgroundRGBActivate.0 »defaultForegroundRGBActivate.0	Pass / Fail (Section 3.5.2.3.2.1)	
13.3	VERIFY that the RESPONSE VALUE for defaultJustificationLine.0 is equal to 'center' (3).	Pass / Fail (Section 3.5.2.3.2.5)	
13.4	VERIFY that the RESPONSE VALUE for defaultJustificationLineActivate.0 is equal to Current_Justification.	Pass / Fail (Section 3.5.2.3.2.5)	
13.5	RECORD the RESPONSE VALUE for defaultJustificationLine.0 as: »Current_Justification		
13.6	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Default_Line_Just_Msg »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
13.7	VERIFY that the message is displayed using center justification.	Pass / Fail (Section 3.5.2.3.2.5)	

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14	IF Right is equal to 1, then GOTO Step 14.1; otherwise, GOTO Step 15.		
14.1	SET the following object(s) to the value(s) shown: »defaultJustificationLine.0 = 'right' (4)	Pass / Fail (Section 3.5.2.3.2.5)	
14.2	GET the following object(s): »defaultBackgroundRGB.0 »defaultForegroundRGB.0 »defaultFlashOn.0 »defaultFlashOff.0 »defaultFont.0 »defaultJustificationLine.0 »defaultJustificationPage.0 »defaultPageOnTime.0 »defaultPageOffTime.0 »defaultCharacterSet.0 »defaultFlashOnActivate.0 »defaultFlashOffActivate.0 »defaultFontActivate.0 »defaultJustificationLineActivate.0 »defaultJustificationPageActivate.0 »defaultPageOnTimeActivate.0 »defaultPageOffTimeActivate.0 »defaultBackgroundRGBActivate.0 »defaultForegroundRGBActivate.0	Pass / Fail (Section 3.5.2.3.2.1)	
14.3	VERIFY that the RESPONSE VALUE for defaultJustificationLine.0 is equal to 'right' (4).	Pass / Fail (Section 3.5.2.3.2.5)	
14.4	VERIFY that the RESPONSE VALUE for defaultJustificationLineActivate.0 is equal to Current_Justification.	Pass / Fail (Section 3.5.2.3.2.5)	
14.5	RECORD the RESPONSE VALUE for defaultJustificationLine.0 as: »Current_Justification		
14.6	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Default_Line_Just_Msg »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
14.7	VERIFY that the message is displayed using right justification.	Pass / Fail (Section 3.5.2.3.2.5)	
15	IF Full is equal to 1, then GOTO Step 15.1; otherwise, GOTO Step 16.		
15.1	SET the following object(s) to the value(s) shown: »defaultJustificationLine.0 = 'full' (5)	Pass / Fail (Section 3.5.2.3.2.5)	
15.2	GET the following object(s): »defaultBackgroundRGB.0 »defaultForegroundRGB.0 »defaultFlashOn.0 »defaultFlashOff.0 »defaultFont.0 »defaultJustificationLine.0 »defaultJustificationPage.0	Pass / Fail (Section 3.5.2.3.2.1)	

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	»defaultPageOnTime.0 »defaultPageOffTime.0 »defaultCharacterSet.0 »defaultFlashOnActivate.0 »defaultFlashOffActivate.0 »defaultFontActivate.0 »defaultJustificationLineActivate.0 »defaultJustificationPageActivate.0 »defaultPageOnTimeActivate.0 »defaultPageOffTimeActivate.0 »defaultBackgroundRGBActivate.0 »defaultForegroundRGBActivate.0		
15.3	VERIFY that the RESPONSE VALUE for defaultJustificationLine.0 is equal to 'full' (5).	Pass / Fail (Section 3.5.2.3.2.5)	
15.4	VERIFY that the RESPONSE VALUE for defaultJustificationLineActivate.0 is equal to Current_Justification.	Pass / Fail (Section 3.5.2.3.2.5)	
15.5	RECORD the RESPONSE VALUE for defaultJustificationLine.0 as: »Current_Justification		
15.6	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Default_Line_Just_Msg »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
15.7	VERIFY that the message is displayed using left justification.	Pass / Fail (Section 3.5.2.3.2.5)	
16	SET the following object(s) to the value(s) shown: »defaultJustificationLine.0 = Orig_Justification	Pass / Fail (Section 3.5.2.3.2.5)	
17	GET the following object(s): »defaultBackgroundRGB.0 »defaultForegroundRGB.0 »defaultFlashOn.0 »defaultFlashOff.0 »defaultFont.0 »defaultJustificationLine.0 »defaultJustificationPage.0 »defaultPageOnTime.0 »defaultPageOffTime.0 »defaultCharacterSet.0 »defaultFlashOnActivate.0 »defaultFlashOffActivate.0 »defaultFontActivate.0 »defaultJustificationLineActivate.0 »defaultJustificationPageActivate.0 »defaultPageOnTimeActivate.0 »defaultPageOffTimeActivate.0 »defaultBackgroundRGBActivate.0 »defaultForegroundRGBActivate.0	Pass / Fail (Section 3.5.2.3.2.1)	
18	VERIFY that the RESPONSE VALUE for defaultJustificationLine.0 is equal to Orig_Justification.	Pass / Fail (Section 3.5.2.3.2.5)	

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19	VERIFY that the RESPONSE VALUE for defaultJustificationLineActivate.0 is equal to Current_Justification.	Pass / Fail (Section 3.5.2.3.2.5)	
20	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.6.6 Configure Default Page Justification

Test Case: 6.6	**Title:**	**Configure Default Page Justification**
	Description:	This test case verifies that the DMS allows configuration of page justification. A message is displayed for each justification method to visually verify each.
	Variables:	Top — PRL 3.6.12.1 Middle — PRL 3.6.12.2 Bottom — PRL 3.6.12.3 Msg_Type — From the Test Plan Msg_Number — From the Test Plan Default_Page_Just_Msg — From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine if the sign is required to support top-justification per the specification (PRL 3.6.12.1). RECORD this information as: »Top		
2	CONFIGURE: Determine if the sign is required to support middle-justification per the specification (PRL 3.6.12.2). RECORD this information as: »Middle		
3	CONFIGURE: Determine if the sign is required to support bottom-justification per the specification (PRL 3.6.12.3). RECORD this information as: »Bottom		
4	CONFIGURE: Determine the message type, message number, and MULTI string for a message to be used to test page justification (from the test plan). RECORD this information as: »Msg_Type »Msg_Number »Default_Page_Just_Msg		

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5	SET-UP: PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Default_Page_Just_Msg »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 »Msg_Pixel_Service = 0 »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0		
6	GET the following object(s): »defaultBackgroundRGB.0 »defaultForegroundRGB.0 »defaultFlashOn.0 »defaultFlashOff.0 »defaultFont.0 »defaultJustificationLine.0 »defaultJustificationPage.0 »defaultPageOnTime.0 »defaultPageOffTime.0 »defaultCharacterSet.0 »defaultFlashOnActivate.0 »defaultFlashOffActivate.0 »defaultFontActivate.0 »defaultJustificationLineActivate.0 »defaultJustificationPageActivate.0 »defaultPageOnTimeActivate.0 »defaultPageOffTimeActivate.0 »defaultBackgroundRGBActivate.0 »defaultForegroundRGBActivate.0	Pass / Fail (Section 3.5.2.3.2.1)	
7	SET-UP: Determine the RESPONSE VALUE for defaultJustificationPage.0. RECORD this information as: »Orig_Justification Note: Valid enumerated values are defined in Section 5.5.11 (Default. Page Justification).		
8	SET-UP: Determine the RESPONSE VALUE for defaultJustificationPage.0. RECORD this information as: »Current_Justification		
9	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Default_Page_Just_Msg »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
10	VERIFY that the message is displayed using the Orig_Justification.	Pass / Fail (Section 3.5.2.3.2.1)	
11	IF Top is equal to 1, then GOTO Step 11.1; otherwise, GOTO Step 12.		

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11.1	SET the following object(s) to the value(s) shown: »defaultJustificationPage.0 = 'top' (2)	Pass / Fail (Section 3.5.2.3.2.6)	
11.2	GET the following object(s): »defaultBackgroundRGB.0 »defaultForegroundRGB.0 »defaultFlashOn.0 »defaultFlashOff.0 »defaultFont.0 »defaultJustificationLine.0 »defaultJustificationPage.0 »defaultPageOnTime.0 »defaultPageOffTime.0 »defaultCharacterSet.0 »defaultFlashOnActivate.0 »defaultFlashOffActivate.0 »defaultFontActivate.0 »defaultJustificationLineActivate.0 »defaultJustificationPageActivate.0 »defaultPageOnTimeActivate.0 »defaultPageOffTimeActivate.0 »defaultBackgroundRGBActivate.0 »defaultForegroundRGBActivate.0	Pass / Fail (Section 3.5.2.3.2.1)	
11.3	VERIFY that the RESPONSE VALUE for defaultJustificationPage.0 is equal to 'top' (2).	Pass / Fail (Section 3.5.2.3.2.6)	
11.4	VERIFY that the RESPONSE VALUE for defaultJustificationPageActivate.0 is equal to Current_Justification.	Pass / Fail (Section 3.5.2.3.2.6)	
11.5	RECORD the RESPONSE VALUE for defaultJustificationPage.0 as: »Current_Justification		
11.6	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Default_Page_Just_Msg »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
11.7	VERIFY that the message is displayed using top justification.	Pass / Fail (Section 3.5.2.3.2.6)	
12	IF Middle is equal to 1, then GOTO Step 12.1; otherwise, GOTO Step 13.		
12.1	SET the following object(s) to the value(s) shown: »defaultJustificationPage.0 = 'middle' (3)	Pass / Fail (Section 3.5.2.3.2.6)	

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12.2	GET the following object(s): »defaultBackgroundRGB.0 »defaultForegroundRGB.0 »defaultFlashOn.0 »defaultFlashOff.0 »defaultFont.0 »defaultJustificationLine.0 »defaultJustificationPage.0 »defaultPageOnTime.0 »defaultPageOffTime.0 »defaultCharacterSet.0 »defaultFlashOnActivate.0 »defaultFlashOffActivate.0 »defaultFontActivate.0 »defaultJustificationLineActivate.0 »defaultJustificationPageActivate.0 »defaultPageOnTimeActivate.0 »defaultPageOffTimeActivate.0 »defaultBackgroundRGBActivate.0 »defaultForegroundRGBActivate.0	Pass / Fail (Section 3.5.2.3.2.1)	
12.3	VERIFY that the RESPONSE VALUE for defaultJustificationPage.0 is equal to 'middle' (3).	Pass / Fail (Section 3.5.2.3.2.6)	
12.4	VERIFY that the RESPONSE VALUE for defaultJustificationPageActivate.0 is equal to Current_Justification.	Pass / Fail (Section 3.5.2.3.2.6)	
12.5	RECORD the RESPONSE VALUE for defaultJustificationPage.0 as: »Current_Justification		
12.6	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Default_Page_Just_Msg »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
12.7	VERIFY that the message is displayed using middle justification.	Pass / Fail (Section 3.5.2.3.2.6)	
13	IF Bottom is equal to 1, then GOTO Step 13.1; otherwise, GOTO Step 14.		
13.1	SET the following object(s) to the value(s) shown: »defaultJustificationPage.0 = 'bottom' (4)	Pass / Fail (Section 3.5.2.3.2.6)	

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13.2	GET the following object(s): »defaultBackgroundRGB.0 »defaultForegroundRGB.0 »defaultFlashOn.0 »defaultFlashOff.0 »defaultFont.0 »defaultJustificationLine.0 »defaultJustificationPage.0 »defaultPageOnTime.0 »defaultPageOffTime.0 »defaultCharacterSet.0 »defaultFlashOnActivate.0 »defaultFlashOffActivate.0 »defaultFontActivate.0 »defaultJustificationLineActivate.0 »defaultJustificationPageActivate.0 »defaultPageOnTimeActivate.0 »defaultPageOffTimeActivate.0 »defaultBackgroundRGBActivate.0 »defaultForegroundRGBActivate.0	Pass / Fail (Section 3.5.2.3.2.1)	
13.3	VERIFY that the RESPONSE VALUE for defaultJustificationPage.0 is equal to 'bottom' (4).	Pass / Fail (Section 3.5.2.3.2.6)	
13.4	VERIFY that the RESPONSE VALUE for defaultJustificationPageActivate.0 is equal to Current_Justification.	Pass / Fail (Section 3.5.2.3.2.6)	
13.5	RECORD the RESPONSE VALUE for defaultJustificationPage.0 as: »Current_Justification		
13.6	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Default_Page_Just_Msg »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
13.7	VERIFY that the message is displayed using bottom justification.	Pass / Fail (Section 3.5.2.3.2.6)	
14	SET the following object(s) to the value(s) shown: »defaultJustificationPage.0 = Orig_Justification	Pass / Fail (Section 3.5.2.3.2.6)	

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15	GET the following object(s): »defaultBackgroundRGB.0 »defaultForegroundRGB.0 »defaultFlashOn.0 »defaultFlashOff.0 »defaultFont.0 »defaultJustificationLine.0 »defaultJustificationPage.0 »defaultPageOnTime.0 »defaultPageOffTime.0 »defaultCharacterSet.0 »defaultFlashOnActivate.0 »defaultFlashOffActivate.0 »defaultFontActivate.0 »defaultJustificationLineActivate.0 »defaultJustificationPageActivate.0 »defaultPageOnTimeActivate.0 »defaultPageOffTimeActivate.0 »defaultBackgroundRGBActivate.0 »defaultForegroundRGBActivate.0	Pass / Fail (Section 3.5.2.3.2.1)	
16	VERIFY that the RESPONSE VALUE for defaultJustificationPage.0 is equal to Orig_Justification.	Pass / Fail (Section 3.5.2.3.2.6)	
17	VERIFY that the RESPONSE VALUE for defaultJustificationPageActivate.0 is equal to Current_Justification.	Pass / Fail (Section 3.5.2.3.2.6)	
18	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.6.7 Configure Default Page-On and Page-Off Times

Test Case: 6.7	**Title:**	**Configure Default Page-On and Page-Off Times**	
	Description:	This test case verifies that the DMS allows configuration of the default page on and off times. A message is displayed to verify that the DMS displays the configuration correctly.	
	Variables:	Page_On_Min	PRL 2.5.2.3.3 / 3.5.2.3.2.7
		Page_On_Max	PRL 2.5.2.3.3 / 3.5.2.3.2.7
		Page_On_Res	PRL 2.5.2.3.3 / 3.5.2.3.2.7
		Page_Off_Min	PRL 2.5.2.3.3 / 3.5.2.3.2.7
		Page_Off_Max	PRL 2.5.2.3.3 / 3.5.2.3.2.7
		Page_Off_Res	PRL 2.5.2.3.3 / 3.5.2.3.2.7
		Msg_Type	From the Test Plan
		Msg_Number	From the Test Plan
		Multi_Page_Message	From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

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Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the minimum default page-on time required by the specification (PRL 2.5.2.3.3 / 3.5.2.3.2.7). RECORD this information as: »Page_On_Min		
2	CONFIGURE: Determine the maximum default page-on time required by the specification (PRL 2.5.2.3.3 / 3.5.2.3.2.7). RECORD this information as: »Page_On_Max		
3	CONFIGURE: Determine the resolution of the page-on time as required by the specification (PRL 2.5.2.3.3 / 3.5.2.3.2.7). RECORD this information as: »Page_On_Res		
4	CONFIGURE: Determine the minimum default page-off time required by the specification (PRL 2.5.2.3.3 / 3.5.2.3.2.7). RECORD this information as: »Page_Off_Min		
5	CONFIGURE: Determine the maximum default page-off time required by the specification (PRL 2.5.2.3.3 / 3.5.2.3.2.7). RECORD this information as: »Page_Off_Max		
6	CONFIGURE: Determine the resolution of the page-off time as required by the specification (PRL 2.5.2.3.3 / 3.5.2.3.2.7). RECORD this information as: »Page_Off_Res		
7	CONFIGURE: Determine the message type, message number, and MULTI string for a multi-page message to be displayed on the sign to verify the page times (per the test plan). RECORD this information as: »Msg_Type »Msg_Number »Multi_Page_Message		
8	SET-UP: VERIFY that Page_On_Min is less than Page_On_Max.		
9	SET-UP: VERIFY that Page_Off_Min is less than Page_Off_Max.		
10	SET-UP: VERIFY that the Multi_Page_Message contains at least one '[np]' tag.		
11	SET-UP: PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Multi_Page_Message »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 »Msg_Pixel_Service = 0 »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0		

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12	GET the following object(s): »defaultBackgroundRGB.0 »defaultForegroundRGB.0 »defaultFlashOn.0 »defaultFlashOff.0 »defaultFont.0 »defaultJustificationLine.0 »defaultJustificationPage.0 »defaultPageOnTime.0 »defaultPageOffTime.0 »defaultCharacterSet.0 »defaultFlashOnActivate.0 »defaultFlashOffActivate.0 »defaultFontActivate.0 »defaultJustificationLineActivate.0 »defaultJustificationPageActivate.0 »defaultPageOnTimeActivate.0 »defaultPageOffTimeActivate.0 »defaultBackgroundRGBActivate.0 »defaultForegroundRGBActivate.0	Pass / Fail (Section 3.5.2.3.2.1)	
13	RECORD the RESPONSE VALUE for defaultPageOnTime.0 and defaultPageOffTime.0 as: »Page_On_Orig »Page_Off_Orig		
14	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Multi_Page_Message »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
15	VERIFY that each page displays for a duration defined by Page_On_Orig.	Pass / Fail (Section 3.5.2.3.2.7)	
16	VERIFY that the sign blanks between pages for a duration defined by Page_Off_Orig.	Pass / Fail (Section 3.5.2.3.2.7)	
17	Calculate the number of valid possible settings for defaultPageOnTime (i.e., the maximum value minus the minumum value divided by the resolution plus 1). RECORD this information as: »Max		
18	Calculate a random integer value between 0 and Max. RECORD this information as: »X		
19	SET-UP: Calculate the value defined by the formula: Page_On_Min + X * Page_On_Res. RECORD this information as: »Page_On_Current		
20	Calculate the number of valid possible settings for defaultPageOffTime (i.e., the maximum value minus the minumum value divided by the resolution plus 1). RECORD this information as: »Y		

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21	Calculate a random integer value between 0 and Max. RECORD this information as: »Y		
22	SET-UP: Calculate the value defined by the formula: Page_Off_Min + Y * Page_Off_Res. RECORD this information as: »Page_Off_Current		
23	SET the following object(s) to the value(s) shown: »defaultPageOnTime.0 = Page_On_Current »defaultPageOffTime.0 = Page_Off_Current	Pass / Fail (Section 3.5.2.3.2.7)	
24	GET the following object(s): »defaultBackgroundRGB.0 »defaultForegroundRGB.0 »defaultFlashOn.0 »defaultFlashOff.0 »defaultFont.0 »defaultJustificationLine.0 »defaultJustificationPage.0 »defaultPageOnTime.0 »defaultPageOffTime.0 »defaultCharacterSet.0 »defaultFlashOnActivate.0 »defaultFlashOffActivate.0 »defaultFontActivate.0 »defaultJustificationLineActivate.0 »defaultJustificationPageActivate.0 »defaultPageOnTimeActivate.0 »defaultPageOffTimeActivate.0 »defaultBackgroundRGBActivate.0 »defaultForegroundRGBActivate.0	Pass / Fail (Section 3.5.2.3.2.1)	
25	VERIFY that the RESPONSE VALUE for defaultPageOnTime.0 is equal to Page_On_Current.	Pass / Fail (Section 3.5.2.3.2.7)	
26	VERIFY that the RESPONSE VALUE for defaultPageOffTime.0 is equal to Page_Off_Current.	Pass / Fail (Section 3.5.2.3.2.7)	
27	VERIFY that the RESPONSE VALUE for defaultPageOnTimeActivate.0 is equal to Page_On_Orig.	Pass / Fail (Section 3.5.2.3.2.7)	
28	VERIFY that the RESPONSE VALUE for defaultPageOffTimeActivate.0 is equal to Page_Off_Orig.	Pass / Fail (Section 3.5.2.3.2.7)	
29	VERIFY that each page displays for a duration defined by Page_On_Orig.	Pass / Fail (Section 3.5.2.3.2.7)	
30	VERIFY that the sign blanks between pages for a duration defined by Page_Off_Orig.	Pass / Fail (Section 3.5.2.3.2.7)	
31	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Multi_Page_Message »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	

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32	VERIFY that each page displays for a duration defined by Page_On_Current.	Pass / Fail (Section 3.5.2.3.2.7)	
33	VERIFY that the sign blanks between pages for a duration defined by Page_Off_Current.	Pass / Fail (Section 3.5.2.3.2.7)	
34	GET the following object(s): »defaultBackgroundRGB.0 »defaultForegroundRGB.0 »defaultFlashOn.0 »defaultFlashOff.0 »defaultFont.0 »defaultJustificationLine.0 »defaultJustificationPage.0 »defaultPageOnTime.0 »defaultPageOffTime.0 »defaultCharacterSet.0 »defaultFlashOnActivate.0 »defaultFlashOffActivate.0 »defaultFontActivate.0 »defaultJustificationLineActivate.0 »defaultJustificationPageActivate.0 »defaultPageOnTimeActivate.0 »defaultPageOffTimeActivate.0 »defaultBackgroundRGBActivate.0 »defaultForegroundRGBActivate.0	Pass / Fail (Section 3.5.2.3.2.1)	
35	VERIFY that the RESPONSE VALUE for defaultPageOnTime.0 is equal to Page_On_Current.	Pass / Fail (Section 3.5.2.3.2.7)	
36	VERIFY that the RESPONSE VALUE for defaultPageOffTime.0 is equal to Page_Off_Current.	Pass / Fail (Section 3.5.2.3.2.7)	
37	VERIFY that the RESPONSE VALUE for defaultPageOnTimeActivate.0 is equal to Page_On_Current.	Pass / Fail (Section 3.5.2.3.2.7)	
38	VERIFY that the RESPONSE VALUE for defaultPageOffTimeActivate.0 is equal to Page_Off_Current.	Pass / Fail (Section 3.5.2.3.2.7)	
39	SET the following object(s) to the value(s) shown: »defaultPageOnTime.0 = Page_On_Orig »defaultPageOffTime.0 = Page_Off_Orig	Pass / Fail (Section 3.5.2.3.2.7)	
40	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.6.8 Configure Default Character Set

Test Case: 6.8	**Title:**	**Configure Default Character Set**	
	Description:	This test case verifies that the DMS allows configuration of the default character set.	
	Variables:	Msg_Type	From the Test Plan
		Msg_Number	From the Test Plan
		Msg_Default_Char_Set	From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

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Step	Test Procedure	Results	Additional References
1	SET the following object(s) to the value(s) shown: »defaultCharacterSet.0 = 'eightBit' (2) Note: Valid enumerated values are defined in Section 5.5.21 (Default) Character Set.	Pass / Fail (Section 3.5.2.3.2.8)	
2	SET-UP: PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Msg_Default_Char_set »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 »Msg_Pixel_Service = 0 »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0		
3	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Msg_Default_Char_Set »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
4	VERIFY that the message displays with MULTI string being interpreted as a normal 8-bit character string (i.e., not a multi-byte character string).	Pass / Fail (Section 3.5.2.3.2.8)	
5	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.7 Sign Control Tests

C.3.7.1 Determine Message Storage Capabilities

Test Case: 7.1	**Title:**	**Determine Message Storage Capabilities**	
	Description:	This test case verifies that the DMS indicates that it supports the message storage capabilities required by the specification.	
	Variables:	Required_Permanent_Messages	PRL 3.6.7.1
		Required_Changeable_Messages	PRL 3.6.7.2
		Required_Changeable_Memory	PRL 3.6.7.2
		Required_Volatile_Messages	PRL 3.6.7.3
		Required_Volatile_Memory	PRL 3.6.7.3
		Substitution	PRL 3.6.7.3

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		Memory_Clear_Time	From Manufacturer's Documentation
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the number of permanent messages required by the specification (PRL 3.6.7.1). RECORD this information as: »Required_Permanent_Messages		
2	CONFIGURE: Determine the number of changeable messages required by the specification (PRL 3.6.7.2). RECORD this information as: »Required_Changeable_Messages		
3	CONFIGURE: Determine the amount of changeable message memory required by the specification (PRL 3.6.7.2). RECORD this information as: »Required_Changeable_Memory		
4	CONFIGURE: Determine the number of volatile messages required by the specification (PRL 3.6.7.3). RECORD this information as: »Required_Volatile_Messages		
5	CONFIGURE: Determine the amount of volatile message memory required by the specification (PRL 3.6.7.3). RECORD this information as: »Required_Volatile_Memory		
6	CONFIGURE: Determine whether the specification allows changeable messages and memory to be substituted for volatile messages and memory (PRL 3.6.7.3). RECORD this information as either 1 - "may be" or 0 - "shall not be": »Substitution		
7	CONFIGURE: Determine the maximum amount of time, in milliseconds, that the device might require to clear its message memory. RECORD this information as: »Memory_Clear_Time		
8	GET the following object(s): »dmsNumPermanentMsg.0 »dmsMaxChangeableMsg.0 »dmsMaxVolatileMsg.0	Pass / Fail (Section 3.5.2.3.3.1)	
9	RECORD the RESPONSE VALUE for this information as: »Actual_Permanent_Messages »Actual_Changeable_Messages »Actual_Volatile_Messages		
10	VERIFY that the RESPONSE VALUE for dmsNumPermanentMsg.0 is greater than or equal to Required_Permanent_Messages.	Pass / Fail (PRL 3.6.7.1)	
11	VERIFY that the RESPONSE VALUE for dmsMaxChangeableMsg.0 is greater than or equal to Required_Changeable_Messages.	Pass / Fail (PRL 3.6.7.2)	
12	IF Substitution is equal to 1 – "may be", then GOTO Step 12.1; otherwise, GOTO Step 12.2.		

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12.1	VERIFY that Actual_Volatile_Messages plus Actual_Changeable_Messages is equal to or greater than Required_Volatile_Messages plus Required_Changeable_Messages. GO TO Step 13.	Pass / Fail (PRL 3.6.7.3)	
12.2	VERIFY that the RESPONSE VALUE for dmsMaxVolatileMsg.0 is greater than or equal to Required_Volatile_Messages.	Pass / Fail (PRL 3.6.7.3)	
13	SET the following object(s) to the value(s) shown: »dmsMemoryMgmt.0 = 'clearChangeableMessages' (3) Note: Valid enumerated values are defined in Section 5.7.16 (Memory Management Parameter).	Pass / Fail (Section 3.5.1.2.4)	
14	DELAY for Memory_Clear_Time milliseconds.		
15	SET the following object(s) to the value(s) shown: »dmsMemoryMgmt.0 = 'clearVolatileMessages' (4)	Pass / Fail (Section 3.5.1.2.4)	
16	DELAY for Memory_Clear_Time milliseconds.		
17	GET the following object(s): »dmsNumChangeableMsg.0 »dmsFreeChangeableMemory.0 »dmsNumVolatileMsg.0 »dmsFreeVolatileMemory.0	Pass / Fail (Section 3.5.2.3.3.2)	
18	RECORD the RESPONSE VALUE for dmsFreeChangeableMemory.0 and dmsFreeVolatileMemory.0 as: »Actual_Changeable_Memory (the RESPONSE VALUE for dmsFreeChangeableMemory.0) »Actual_Volatile_Memory		
19	VERIFY that the RESPONSE VALUE for dmsNumChangeableMsg.0 is equal to 0.	Pass / Fail (Section 3.5.1.2.4)	
20	VERIFY that the RESPONSE VALUE for dmsFreeChangeableMemory.0 is greater than or equal to Required_Changeable_Memory.	Pass / Fail (Section 3.5.1.2.4)	
21	VERIFY that the RESPONSE VALUE for dmsNumVolatileMsg.0 is equal to 0.	Pass / Fail (Section 3.5.1.2.4)	
22	IF Substitution is equal to 1, then GOTO Step 22.1; otherwise, GOTO Step 23.1.		
22.1	VERIFY that Actual_Volatile_Memory plus Actual_Changeable_Memory is greater than or equal to Required_Volatile_Memory plus Required_Changeable_Memory. GO TO Step 24.	Pass / Fail (Section 3.5.1.2.4)	
23.1	VERIFY that the RESPONSE VALUE for dmsFreeVolatileMemory.0 is greater than or equal to Required_Volatile_Memory.	Pass / Fail (Section 3.5.1.2.4)	
24	IF Required_Volatile_Messages is greater than 0, then GOTO Step 24.1; otherwise, GOTO Step 25.		
24.1	IF Substitution is equal to 0 or Actual_Volatile_Memory is greater than zero, then GOTO Step 24.1.1; otherwise, GOTO Step 25.		

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24.1.1	PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Volatile (4) »Msg_Number = 1 »Msg_Multi_String = 'A' »Msg_Owner = "OWNER" »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.3.3)	
24.1.2	GET the following object(s): »dmsNumChangeableMsg.0 »dmsFreeChangeableMemory.0 »dmsNumVolatileMsg.0 »dmsFreeVolatileMemory.0	Pass / Fail (Section 3.5.2.3.3.2)	
24.1.3	VERIFY that the RESPONSE VALUE for dmsNumChangeableMsg.0 is equal to 0.	Pass / Fail (Section 3.5.2.3.3.2)	
24.1.4	VERIFY that the RESPONSE VALUE for dmsFreeChangeableMemory.0 is equal to Actual_Changeable_Memory.	Pass / Fail (Section 3.5.2.3.3.2)	
24.1.5	VERIFY that the RESPONSE VALUE for dmsNumVolatileMsg.0 is equal to 1.	Pass / Fail (Section 3.5.2.3.3.2)	
24.1.6	VERIFY that the RESPONSE VALUE for dmsFreeVolatileMemory.0 is less than Actual_Volatile_Memory.	Pass / Fail (Section 3.5.2.3.3.2)	
24.1.7	SET the following object(s) to the value(s) shown: »dmsMemoryMgmt.0 = 'clearVolatileMessages' (4)	Pass / Fail (Section 3.5.1.2.4)	
24.1.8	DELAY for Memory_Clear_Time milliseconds.		
24.1.9	GET the following object(s): »dmsNumChangeableMsg.0 »dmsFreeChangeableMemory.0 »dmsNumVolatileMsg.0 »dmsFreeVolatileMemory.0	Pass / Fail (Section 3.5.2.3.3.2)	
24.1.10	VERIFY that the RESPONSE VALUE for dmsNumChangeableMsg.0 is equal to 0.	Pass / Fail (Section 3.5.2.3.3.2)	
24.1.11	VERIFY that the RESPONSE VALUE for dmsFreeChangeableMemory.0 is equal to Actual_Changeable_Memory.	Pass / Fail (Section 3.5.2.3.3.2)	
24.1.12	VERIFY that the RESPONSE VALUE for dmsNumVolatileMsg.0 is equal to 0.	Pass / Fail (Section 3.5.2.3.3.2)	
24.1.13	VERIFY that the RESPONSE VALUE for dmsFreeVolatileMemory.0 is equal to Actual_Volatile_Memory.	Pass / Fail (Section 3.5.2.3.3.2)	
25	IF Required_Changeable_Messages is greater than zero or (IF Required_Volatile_Messages is greater than zero and Substitution is equal to 1 and Actual_Volatile_Memory is zero), then GOTO Step 25.1; otherwise, EXIT.		

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25.1	PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Changeable (3) »Msg_Number = 1 »Msg_Multi_String = 'A' »Msg_Owner = "OWNER" »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.3.3)	
25.2	GET the following object(s): »dmsNumChangeableMsg.0 »dmsFreeChangeableMemory.0 »dmsNumVolatileMsg.0 »dmsFreeVolatileMemory.0	Pass / Fail (Section 3.5.2.3.3.2)	
25.3	VERIFY that the RESPONSE VALUE for dmsNumChangeableMsg.0 is equal to 1.	Pass / Fail (Section 3.5.2.3.3.2)	
25.4	VERIFY that the RESPONSE VALUE for dmsFreeChangeableMemory.0 is less than Actual_Changeable_Memory.	Pass / Fail (Section 3.5.2.3.3.2)	
25.5	VERIFY that the RESPONSE VALUE for dmsNumVolatileMsg.0 is equal to 0.	Pass / Fail (Section 3.5.2.3.3.2)	
25.6	VERIFY that the RESPONSE VALUE for dmsFreeVolatileMemory.0 is equal to Actual_Volatile_Memory.	Pass / Fail (Section 3.5.2.3.3.2)	
25.7	SET the following object(s) to the value(s) shown: »dmsMemoryMgmt.0 = 'clearChangeableMessages' (3)	Pass / Fail (Section 3.5.1.2.4)	
25.8	DELAY for Memory_Clear_Time milliseconds.		
25.9	GET the following object(s): »dmsNumChangeableMsg.0 »dmsFreeChangeableMemory.0 »dmsNumVolatileMsg.0 »dmsFreeVolatileMemory.0	Pass / Fail (Section 3.5.2.3.3.2)	
25.10	VERIFY that the RESPONSE VALUE for dmsNumChangeableMsg.0 is equal to 0.	Pass / Fail (Section 3.5.2.3.3.2)	
25.11	VERIFY that the RESPONSE VALUE for dmsFreeChangeableMemory.0 is equal to Actual_Changeable_Memory.	Pass / Fail (Section 3.5.2.3.3.2)	
25.12	VERIFY that the RESPONSE VALUE for dmsNumVolatileMsg.0 is equal to 0.	Pass / Fail (Section 3.5.2.3.3.2)	
25.13	VERIFY that the RESPONSE VALUE for dmsFreeVolatileMemory.0 is equal to Actual_Volatile_Memory.	Pass / Fail (Section 3.5.2.3.3.2)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

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C.3.7.2 Define a Message

Test Case: 7.2	**Title:**	**Define a Message**
	Description:	This test case verifies that a message can be defined on the DMS using test case parameters provided by the user and verifies that the message is properly stored.
	Variables:	Msg_Type — From the Test Plan Msg_Number — From the Test Plan Msg_Multi_String — From the Test Plan Msg_Owner — From the Test Plan Msg_Beacon_State — From the Test Plan Msg_Pixel_Service — From the Test Plan Msg_Run_Time_Priority — From the Test Plan Expected_Multi_Error_Code — From the Test Plan Expected_Multi_Error_Pos_Min — From the Test Plan Expected_Multi_Error_Pos_Max — From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the enumerated value for the type of memory in which to store the message (e.g., from the test plan). RECORD this information as: »Msg_Type Note: The type is required to be either 'changeable' or 'volatile'. Valid enumerated values are defined in Section 5.6.8.1 (Message Memory Type Parameter).		
2	CONFIGURE: Determine the number of the message, within the specified memory type, to be stored (e.g., from the test plan). RECORD this information as: »Msg_Number Note: This value is required to be less than or equal to the maximum number of messages for the memory type.		
3	CONFIGURE: Determine the MULTI string describing a message that can be correctly displayed on the sign (e.g., from the test plan). RECORD this information as: »Msg_Multi_String Note: This message should be a text-only message without any MULTI tags other than a new line tag.		
4	CONFIGURE: Determine the text to be stored as the 'owner' of the message (e.g., per the test plan). RECORD this information as: »Msg_Owner		
5	CONFIGURE: Determine whether the beacons are intended to be activated when the message is displayed. RECORD this information as: »Msg_Beacon_State Note: Even if beacons are not supported, this parameter is required to be defined so that the test procedure can ensure that the DMS responds properly to a request to set this value.		

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6	CONFIGURE: Determine whether pixel service is intended to be activated when the message is displayed. RECORD this information as: »Msg_Pixel_Service Note: Even if pixel service is not supported, this parameter is required to be defined so that the test procedure can ensure that the DMS responds properly to a request to set this value.		
7	CONFIGURE: Determine the priority to assign to the message while it is running to prevent another message from overriding it. RECORD this information as: »Msg_Run_Time_Priority Note: The value of 1 represents minimum priority and 255 is maximum priority.		
8	CONFIGURE: No error code is expected, so set this value to 2 (none). RECORD this information as: »Expected_Multi_Error_Code		
9	CONFIGURE: No error is expected, so set these values to 0. RECORD this information as: »Expected_Multi_Error_Pos_Min »Expected_Multi_Error_Pos_Max		
10	PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Msg_Multi_String »Msg_Owner = Msg_Owner »Msg_Beacon_State = Msg_Beacon_State »Msg_Pixel_Service = Msg_Pixel_Service »Msg_Run_Time_Priority = Msg_Run_Time_Priority »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.3.3)	
11	POST-CONDITION: The subject message is stored within the sign controller.		

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.7.3 Define an Invalid Message

Test Case: 7.3	**Title:**	**Define an Invalid Message**	
	Description:	This test case verifies that the DMS rejects an attempt to set the MultiString value of a message to an invalid value and gives a reason for rejection.	
	Variables:	Msg_Type	From the Test Plan
		Msg_Number	From the Test Plan
		Invalid_Multi_String	From the Test Plan
		Msg_Owner	From the Test Plan
		Msg_Beacon_State	From the Test Plan
		Msg_Pixel_Service	From the Test Plan
		Msg_Run_Time_Priority	From the Test Plan
		Expected_Multi_Error_Code	From the Test Plan

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		Expected_Error_Position_Min	From the Test Plan
		Expected_Error_Position_Max	From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the enumerated value for the type of memory in which to store the message (per the test plan). RECORD this information as: »Msg_Type Note: The type is required to be either 'changeable' or 'volatile'. Valid enumerated values are defined in Section 5.6.8.1 (Message Memory.Type Parameter)		
2	CONFIGURE: Determine the number of the message, within the specified memory type, to be stored (per the test plan). RECORD this information as: »Msg_Number		
3	CONFIGURE: Determine the string to tranfer to the sign to ensure that it is rejected (per the test plan). RECORD this information as: »Invalid_Multi_String Note: The string may be either an invalid MULTI string (e.g., containing an undefined tag) or a valid MULTI string that is not supported by the DMS (e.g., containing a defined tag that is not supported by the DMS or a string that places too many characters on a line). However, in the latter case, the tester shall ensure that the DMS under test truly does not support the feature; it is not sufficient to rely on the specification as the DMS may provide additional features not required in the specification.		
4	CONFIGURE: Determine the text to be stored as the "owner" of the message (per the test plan). RECORD this information as: »Msg_Owner		
5	CONFIGURE: Determine whether the beacons are intended to be activated when the message is displayed (per the test plan). RECORD this information as: »Msg_Beacon_State Note: Even if beacons are not supported, this parameter is required to be defined so that the test procedure can ensure that the DMS responds properly to a request to set this value.		
6	CONFIGURE: Determine whether pixel service is intended to be activated when the message is displayed (per the test plan). RECORD this information as: »Msg_Pixel_Service Note: Even if pixel service is not supported, this parameter is required to be defined so that the test procedure can ensure that the DMS responds properly to a request to set this value.		
7	CONFIGURE: Determine the priority to assign to the message while it is running to prevent another message from overriding it (per the test plan). RECORD this information as: »Msg_Run_Time_Priority Note: The value of 1 represents minimum priority and 255 is maximum priority.		

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8	CONFIGURE: Determine the expected error code to be received by trying to set the invalid multi string. RECORD this information as: »Expected_Multi_Error_Code		
9	CONFIGURE: Determine the first and last positions in the MULTI string where the error might be flagged. RECORD this information as: »Expected_Error_Position_Min (the lowest valid value that could be reported to properly identify the position at which the error occurs within the invalid multi string) »Expected_Error_Position_Max (the largest valid value that could be reported to properly identify the position at which the error occurs within the invalid multi string (is required to be greater than or equal to Expected_Error_Position_Min))		
10	PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Msg_Multi_String »Msg_Owner = Msg_Owner »Msg_Beacon_State = Msg_Beacon_State »Msg_Pixel_Service = Msg_Pixel_Service »Msg_Run_Time_Priority = Msg_Run_Time_Priority »Expected_Validate_Error_Code = syntaxMULTI (5) »Expected_Multi_Error_Code = Expected_Multi_Error_Code »Expected_Multi_Error_Pos_Min = Expected_Multi_Error_Pos_Min »Expected_Multi_Error_Pos_Max = Expected_Multi_Error_Pos_Max	Pass / Fail (Section 3.5.2.3.3.3)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.7.4 Verify Message Deletion by Type

Test Case: 7.4	**Title:**	**Verify Message Deletion by Type**	
	Description:	This test case verifies that the DMS allows message deletion of all messages of a selected message type.	
	Variables:	Deleted_Msg_Type	From the Test Plan
		Memory_Clear_Time	From Manufacturer's Documentation
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the enumerated value for the type of memory for which all messages are to be deleted (per the test plan). RECORD this information as: »Deleted_Msg_Type Note: The type is required to be either 'changeable' or 'volatile'. Valid enumerated values are defined in Section 5.6.8.1 (Message Memory Type Parameter).		
2	CONFIGURE: Determine the maximum amount of time, in milliseconds, that the device might require to clear its message memory. RECORD this information as: »Memory_Clear_Time		

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3	GET the following object(s): »dmsNumPermanentMsg.0 »dmsMaxChangeableMsg.0 »dmsMaxVolatileMsg.0	Pass / Fail (Section 3.5.2.3.3.1)	
4	IF Deleted_Msg_Type is equal to 'changeable' (3), then GOTO Step 4.1; otherwise, GOTO Step 5.1.		
4.1	RECORD the RESPONSE VALUE for dmsMaxChangeableMsg.0 as: »Max_Msgs GO TO Step 6.		
5.1	RECORD the RESPONSE VALUE for dmsMaxVolatileMsg.0 as: »Max_Msgs		
6	FOR EACH value, N, from 1 to Max_Msgs, perform Step 6.1.		
6.1	PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Deleted_Msg_Type »Msg_Number = N »Msg_Multi_String = '1' »Msg_Owner = "OWNER" »Msg_Beacon_State = 0 »Msg_Pixel_Service = 0 »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.3.3)	
7	SET the following object(s) to the value(s) shown: »dmsMemoryMgmt.0 = Deleted_Msg_Type	Pass / Fail (Section 3.5.1.2.4)	
8	DELAY for Memory_Clear_Time milliseconds.		
9	GET the following object(s): »dmsMemoryMgmt.0		
10	VERIFY that the RESPONSE VALUE for dmsMemoryMgmt.0 is equal to 'normal' (2).	Pass / Fail (Section 3.5.1.2.4)	
11	FOR EACH value, N, from 1 to Max_Msgs, perform Steps 11.1 through 11.2.		
11.1	GET the following object(s): »dmsMessageStatus.Deleted_Msg_Type.N	Pass / Fail	
11.2	VERIFY that the RESPONSE VALUE for dmsMessageStatus.Deleted_Msg_Type.N is equal to 'notUsed' (1). Note: Valid enumerated values are defined in Section 5.6.8.9 (Message Status Parameter).	Pass / Fail (Section 3.5.1.2.4)	
12	POST-CONDITION: The messages of the subject type have been deleted.		

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

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C.3.7.5 Retrieve a Message

Test Case: 7.5	**Title:**	**Retrieve a Message**
	Description:	This test case verifies that the DMS allows the retrieval of a message definition.
	Variables:	Retrieve_Msg_Type — From the Test Plan Retrieve_Msg_Number — From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the enumerated value for the type of memory from which to retrieve the message (per the test plan). RECORD this information as: »Retrieve_Msg_Type Note: Valid enumerated values are defined in Section 5.6.8.1 (Message Memory Type Parameter).		
2	CONFIGURE: Determine the number of the message, within the specified memory type, to be retrieved (per the test plan). RECORD this information as: »Retrieve_Msg_Number		
3	GET the following object(s): »dmsNumPermanentMsg.0 »dmsMaxChangeableMsg.0 »dmsMaxVolatileMsg.0	Pass / Fail (Section 3.5.2.3.3.1)	
4	IF Retrieve_Msg_Type equals 'changeable' (3), then GOTO Step 5.1; IF Retrieve_Msg_Type equals ‘volatile’ (4), then GOTO Step 5.2; otherwise, GOTO Step 5.3.		
5.1	SET-UP: VERIFY that the RESPONSE VALUE for dmsMaxChangeableMsg.0 is greater than or equal to Retrieve_Msg_Number. GO TO Step 6.		
5.2	SET-UP: VERIFY that the RESPONSE VALUE for dmsMaxVolatileMsg.0 is greater than or equal to Retrieve_Msg_Number. GO TO Step 6.		
5.3	SET-UP: VERIFY that the RESPONSE VALUE for dmsNumPermanentMsg.0 is greater than or equal to Retrieve_Msg_Number. GO TO Step 6.		Section 4.2.3.3 Step b
6	GET the following object(s): »dmsMessageMultiString.Retrieve_Msg_Type.Retrieve_Msg_Number »dmsMessageOwner.Retrieve_Msg_Type.Retrieve_Msg_Number »dmsMessageRunTimePriority.Retrieve_Msg_Type.Retrieve_Msg_Number »dmsMessageStatus.Retrieve_Msg_Type.Retrieve_Msg_Number	Pass / Fail (Section 3.5.2.3.3.5)	
7	RECORD the RESPONSE VALUE for dmsMessageMultiString as: »DMS_Message_Multi_String		
8	VERIFY that the RESPONSE VALUE for dmsMessageRunTimePriority.Retrieve_Msg_Type.Retrieve_Msg_Number is greater than or equal to 1.	Pass / Fail (Section 3.5.2.3.3.5)	
9	VERIFY that the RESPONSE VALUE for dmsMessageRunTimePriority.Retrieve_Msg_Type.Retrieve_Msg_Number is less than or equal to 255.	Pass / Fail (Section 3.5.2.3.3.5)	

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10	VERIFY that the RESPONSE VALUE for dmsMessageStatus.Retrieve_Msg_Type.Retrieve_Msg_Number is greater than or equal to 1. Note: Valid enumerated values are defined in Section 5.6.8.9 (Message Status Parameter).	Pass / Fail (Section 3.5.2.3.3.5)	Section 4.2.3.3 Step c
11	VERIFY that the RESPONSE VALUE for dmsMessageStatus.Retrieve_Msg_Type.Retrieve_Msg_Number is less than or equal to 5.	Pass / Fail (Section 3.5.2.3.3.5)	
12	GET the following object(s): »dmsMessageBeacon.Retrieve_Msg_Type.Retrieve_Msg_Number Note: Valid values are defined in Section 5.6.8.6 (Message Beacon Parameter).	Pass / Fail (Section 3.5.2.3.3.5)	
12.1	VERIFY that the RESPONSE ERROR is equal to ‘noError’ or 'noSuchName'.	Pass / Fail (Section 3.5.2.3.3.5)	
12.2	IF the RESPONSE ERROR is equal to ‘noSuchName’, then GOTO Step 13.	Pass / Fail	
12.3	RECORD the RESPONSE VALUE for dmsMessageBeacon as: »DMS_Message_Beacon		
12.4	VERIFY that the RESPONSE VALUE for dmsMessageBeacon.Retrieve_Msg_Type.Retrieve_Msg_Number is greater than or equal to 0.	Pass / Fail (Section 3.5.2.3.3.5)	
12.5	VERIFY that the RESPONSE VALUE for dmsMessageBeacon.Retrieve_Msg_Type.Retrieve_Msg_Number is less than or equal to 1.	Pass / Fail (Section 3.5.2.3.3.5)	
12.6	GOTO Step 14.		
13	RECORD the value 0 for: »DMS_Message_Beacon		
14	GET the following object(s): »dmsMessagePixelService.Retrieve_Msg_Type.Retrieve_Msg_Number Note: Valid values are defined in Section 5.6.8.7 (Message Pixel Service Parameter).	Pass / Fail (Section 3.5.2.3.3.5)	Section 4.2.3.3 Step d
14.1	VERIFY that the RESPONSE ERROR is equal to ‘noError’ or 'noSuchName'.	Pass / Fail (Section 3.5.2.3.3.5)	
14.2	IF the RESPONSE ERROR is equal to ‘noSuchName’, then GOTO Step 15.	Pass / Fail	
14.3	RECORD the RESPONSE VALUE for dmsMessagePixelService as: »DMS_Message_Pixel_Service		
14.4	VERIFY that the RESPONSE VALUE for dmsMessagePixelService.Retrieve_Msg_Type.Retrieve_Msg_Number is greater than or equal to 0.	Pass / Fail (Section 3.5.2.3.3.5)	
14.5	VERIFY that the RESPONSE VALUE for dmsMessagePixelService.Retrieve_Msg_Type.Retrieve_Msg_Number is less than or equal to 1.	Pass / Fail (Section 3.5.2.3.3.5)	
14.6	GOTO Step 16.		
15	RECORD the value 0 for: »DMS_Message_Pixel_Service		

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16	IF the RESPONSE VALUE for dmsMessageStatus.Retrieve_Msg_Type.Retrieve_Msg_Number is not equal to 'valid' (4), then EXIT. Note: dmsMessageCRC contains a valid CRC only if dmsMessageStatus is 'valid' (4).		
17	SET-UP: Using DMS_Message_Multi_String, DMS_Message_Beacon, and DMS_Message_Pixel_Service, calculate the message CRC value. RECORD this information as: »Msg_CRC Note: Rules for calculating the CRC are defined in Section 5.6.8.5 (Message CRC Parameter).		
18	GET the following object(s): »dmsMessageCRC.Retrieve_Msg_Type.Retrieve_Msg_Number	Pass / Fail (Section 3.5.2.3.3.4)	
19	VERIFY that the RESPONSE VALUE for dmsMessageCRC.Retrieve_Msg_Type.Retrieve_Msg_Number is equal to the Msg_CRC.	Pass / Fail (Section 3.5.2.3.3.4)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.7.6 Activate a Message

Test Case: 7.6	**Title:**	**Activate a Message**	
	Description:	This test case verifies that a message can be activated on the DMS using the test case parameters provided by the user.	
	Variables:	Msg_Type	From the Test Plan
		Msg_Number	From the Test Plan
		Msg_Activation_Priority	From the Test Plan
		Msg_Duration	From the Test Plan
		Status_Update_Delay	PRL 3.6.9
		Expected_Error_Code	From the Test Plan
		Expected_Multi_Error_Code	From the Test Plan
		Expected_Multi_Error_Pos_Min	From the Test Plan
		Expected_Multi_Error_Pos_Max	From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the enumerated value for the type of memory in which the message to be activated is currently stored. RECORD this information as: »Msg_Type Note: The message is required to be either a permanent message or a previously defined, i.e. currently valid message. Valid enumerated values are defined in Section 5.6.8.1 (Message Memory Type Parameter).		

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2	CONFIGURE: Determine the number of the message, within the specified memory type, which is to be activated. RECORD this information as: »Msg_Number Note: The message is required to be either a permanent message or a previously defined, i.e. currently valid, message.		
3	GET the following object(s): »dmsMessageMultiString.Msg_Type.Msg_Number »dmsMessageBeacon.Msg_Type.Msg_Number »dmsMessagePixelService.Msg_Type.Msg_Number	Pass / Fail (Section 3.5.2.3.3.5)	
4	RECORD the RESPONSE VALUE as: »Msg_Multi_String »Msg_Beacon_State »Msg_Pixel_Service Note: This message should be a text-only message without any MULTI tags other than a new line tag.		
5	CONFIGURE: Determine the priority to assign to the message for activation (i.e., the priority assigned in an attempt to override the current message). RECORD this information as: »Msg_Activation_Priority Note: The value of 1 represents minimum priority and 255 is maximum priority. The value of 255 ensures the activation of the message.		
6	CONFIGURE: Determine the duration for which the message is intended to be displayed. RECORD this information as: »Msg_Duration NOTE—Setting this value to 65535 results in the message being displayed forever.		
7	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Msg_Multi_String »Msg_Beacon_State = Msg_Beacon_State »Msg_Pixel_Service = Msg_Pixel_Service »Msg_Activation_Priority = Msg_Activation_Priority »Msg_Duration = Msg_Duration »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.7.7 Verify Priority Activation Error

Test Case: 7.7	**Title:**	**Verify Priority Activation Error**	
	Description:	This test case verifies that the DMS rejects a message activation if the priority of the activation message priority is not sufficient.	
	Variables:	Msg1_Type	From the Test Plan
		Msg1_Number	From the Test Plan
		Msg1_Multi_String	From the Test Plan

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		Msg1_Run_Time_Priority	From the Test Plan
		Msg2_Type	From the Test Plan
		Msg2_Number	From the Test Plan
		Msg2_Multi_String	From the Test Plan
		Msg2_Run_Time_Priority	From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the enumerated value for the type of memory in which to store the first message to be displayed (e.g., per the test plan). RECORD this information as: »Msg1_Type Note: The type is required to be either 'changeable' or 'volatile'. Valid enumerated values are defined in Section 5.6.8.1 (Message Memory Type Parameter).		
2	CONFIGURE: Determine the number of the first message, within the specified memory type (e.g., per the test plan). RECORD this information as: »Msg1_Number Note: This value is required to be less than or equal to the maximum number of messages for the memory type.		
3	CONFIGURE: Determine the MULTI string of the first message (e.g., per the test plan). RECORD this information as: »Msg1_Multi_String Note: This is the first of two messages that are defined for this test case. Both messages should be text-only without any MULTI tags other than a new line tag and should be readily identifiable (e.g., the first message might be "TEST MSG 1", and the second "TEST MSG 2").		
4	CONFIGURE: Determine the run time priority to assign to the first message (e.g., per the test plan). RECORD this information as: »Msg1_Run_Time_Priority Note: This parameter is required to be set to a value greater than 1.		
5	CONFIGURE: Determine the enumerated value for the type of memory in which the second message is to be stored (e.g., per the test plan). RECORD this information as: »Msg2_Type Note: The type is required to be either 'changeable' or 'volatile'.		
6	CONFIGURE: Determine the number of the second message, within the specified memory type (e.g., per the test plan). RECORD this information as: »Msg2_Number Note: This value is required to be less than or equal to the maximum number of messages for the memory type.		
7	CONFIGURE: Determine the MULTI string of the second message (e.g., per the test plan). RECORD this information as: »Msg2_Multi_String		

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	Note: This message should be a text-only message without any MULTI tags other than a new line tag.		
8	CONFIGURE: Determine the run time priority to assign to the second message (e.g., per the test plan). RECORD this information as: »Msg2_Run_Time_Priority		
9	SET-UP: Calculate Msg1_Run_Time_Priority minus one (1). RECORD this information as: »Insufficient_Priority		
10	SET-UP: PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Msg1_Type »Msg_Number = Msg1_Number »Msg_Multi_String = Msg1_Multi_String »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 »Msg_Pixel_Service = 0 »Msg_Run_Time_Priority = Msg1_Run_Time_Priority »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0		
11	SET-UP: PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Msg2_Type »Msg_Number = Msg2_Number »Msg_Multi_String = Msg2_Multi_String »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 »Msg_Pixel_Service = 0 »Msg_Run_Time_Priority = Msg2_Run_Time_Priority »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0		
12	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg1_Type »Msg_Number = Msg1_Number »Msg_Multi_String = Msg1_Multi_String »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0 Note: First message is required to be properly displayed on sign.	Pass / Fail (Section 3.5.2.3.1)	
13	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg2_Type »Msg_Number = Msg2_Number »Msg_Multi_String = Msg2_Multi_String »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = Insufficient_Priority »Msg_Duration = 65535 (forever) »Expected_Error_Code = 3 (priority) »Expected_Multi_Error_Code = 2 (none)	Pass / Fail (Section 3.5.2.3.1)	

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	»Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0 Note: Message displayed from Step 12 is required to have remained on sign.		
14	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg2_Type »Msg_Number = Msg2_Number »Msg_Multi_String = Msg2_Multi_String »Msg_Activation_Priority = Msg1_Run_Time_Priority »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0 Note: Second message is required to be properly displayed on sign.	Pass / Fail (Section 3.5.2.3.1)	
15	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.7.8 Verify Status Activation Error

Test Case: 7.8	**Title:**	**Verify Status Activation Error**	
	Description:	This test case verifies that the DMS rejects a message activation if the message status is not valid.	
	Variables:	Msg_Type	From the Test Plan
		Msg_Number	From the Test Plan
		Msg_Multi_String	From the Test Plan
		Msg_Beacon_State	From the Test Plan
		Msg_Pixel_Service	From the Test Plan
		Msg_Activation_Priority	From the Test Plan
		Msg_Duration	From the Test Plan
		Status_Update_Delay	PRL 3.6.9
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the enumerated value for the type of memory in which the message to be activated is currently stored. RECORD this information as: »Msg_Type Note: The type is required to be either 'changeable' or 'volatile'. Valid enumerated values are defined in Section 5.6.8.1 (Message Memory Type Parameter).		

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2	CONFIGURE: Determine the number of the message, within the specified memory type, which is to be activated. RECORD this information as: »Msg_Number Note: This value is required to be less than or equal to the maximum number of messages for the memory type.		
3	CONFIGURE: Determine the MULTI string of the message to be activated. RECORD this information as: »Msg_Multi_String Note: This message should be a text-only message without any MULTI tags other than a new line tag.		
4	CONFIGURE: Determine the text to be stored as the 'owner' of the message (e.g., per the test plan). RECORD this information as: »Msg_Owner		
5	CONFIGURE: Determine the encoded value of the programmed state of the beacons when the message is activated. RECORD this information as: »Msg_Beacon_State Note: If beacons are not supported, this parameter is required to be set to zero (0). Valid encoded values are defined in Section 5.6.8.6 (Message Beacon Parameter).		
6	CONFIGURE: Determine the encoded value of the programmed state of pixel service when the message is activated. RECORD this information as: »Msg_Pixel_Service Note: If pixel service is not supported, this parameter is required to be set to zero (0). Valid encoded values are defined in Section 5.6.8.7 (Message Pixel Service Parameter).		
7	CONFIGURE: Determine the priority to assign to the message for activation (i.e., the priority assigned in an attempt to override the current message). RECORD this information as: »Msg_Activation_Priority Note: The value of 1 represents minimum priority and 255 is maximum priority. Setting this value to 255 ensures the activation of the message.		
8	CONFIGURE: Determine the duration for which the message is intended to be displayed. RECORD this information as: »Msg_Duration NOTE—Setting this value to 65535 results in the message displaying forever.		
9	CONFIGURE: Determine the frequency at which the DMS is required to update the status variables (PRL 3.6.9). RECORD this information as: »Status_Update_Delay		
10	SET-UP: PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Msg_Multi_String »Msg_Owner = Msg_Owner »Msg_Beacon_State = Msg_Beacon_State »Msg_Pixel_Service = Msg_Pixel_Service »Msg_Run_Time_Priority = Msg_Run_Time_Priority »Expected_Validate_Error_Code = 2 (none)		

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	»Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0		
11	SET-UP: Calculate the message CRC value. RECORD this information as: »Msg_CRC Note: Rules for calculating the CRC are defined in Section 5.6.8.5 (Message CRC Parameter).		
12	SET-UP: Determine the IP address of the computer that is sending the activation request. RECORD this information as: »Msg_Source		
13	SET-UP: Calculate the activation code for the message. RECORD this information as: »Msg_Activation_Code Note: Rules for calculating the activation code are defined in Section 5.1.		
14	SET the following object(s) to the value(s) shown: »dmsMessageStatus.Msg_Type.Msg_Number = 'modifyReq' (6) Note: Valid enumerated values are defined in Section 5.6.8.9 (Message Status Parameter).	Pass / Fail (Section 3.5.2.3.3.3)	
15	GET the following object(s): »dmsMessageStatus.Msg_Type.Msg_Number	Pass / Fail (Section 3.5.2.3.3.3)	
16	VERIFY that the RESPONSE VALUE for dmsMessageStatus.Msg_Type.Msg_Number is equal to 'modifying' (2).	Pass / Fail (Section 3.5.2.3.3.3)	
17	SET the following object(s) to the value(s) shown: »dmsActivateMessage.0 = Msg_Activation_Code	Pass / Fail (Section 3.5.2.3.1)	
18	VERIFY that the RESPONSE ERROR is equal to 'genError'.	Pass / Fail (Section 3.5.2.3.1)	
19	VERIFY that the display did not change.	Pass / Fail (Section 3.5.2.3.1)	
20	GET the following object(s): »dmsActivateMsgError.0 »dmsActivateErrorMsgCode.0	Pass / Fail (Section 3.5.2.3.1)	
21	VERIFY that the RESPONSE VALUE for dmsActivateErrorMsgCode.0 is equal to the Msg_Activation_Code.	Pass / Fail (Section 3.5.2.3.1)	
22	VERIFY that the RESPONSE VALUE for dmsActivateMsgError.0 equals 'messageStatus' (4).	Pass / Fail (Section 3.5.2.3.1)	
23	DELAY for Status_Update_Delay seconds.		
24	GET the following object(s): »shortErrorStatus.0	Pass / Fail (Section 3.5.3.1.2)	
25	VERIFY that the RESPONSE VALUE for shortErrorStatus.0 has bit 7 set to one (1) ‘message error’.	Pass / Fail (Section 3.5.3.1.2)	

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Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.7.9 Verify Memory Type Activation Error

Test Case: 7.9	**Title:**	**Verify Memory Type Activation Error**	
	Description:	This test case verifies that the DMS rejects a message activation if the message memory type is not valid.	
	Variables:	Unsupported_Memory_Type	From the Test Plan
		Msg_Number	From the Test Plan
		Msg_Multi_String	From the Test Plan
		Status_Update_Delay	PRL 3.6.9
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine a message type that the DMS does not support (e.g., per the test plan). RECORD this information as: »Unsupported_Memory_Type Note: The value may be 'permanent', 'changeable', 'volatile', or a code not defined by the standard.		
2	CONFIGURE: Determine the number of the message, within the specified memory type, which is to be activated (e.g., per the test plan). RECORD this information as: »Msg_Number Note: This value is required to be less than or equal to the maximum number of messages for the memory type.		
3	CONFIGURE: Determine the MULTI string of the message to be activated (e.g., per the test plan). RECORD this information as: »Msg_Multi_String Note: Unless otherwise specified by a calling test procedure, this message should be a text-only message without any MULTI tags other than a new line tag.		
4	CONFIGURE: Determine the frequency at which the DMS is required to update the status variables (per PRL 3.6.9). RECORD this information as: »Status_Update_Delay		
5	SET-UP: Calculate the message CRC value based on the Msg_Multi_String, a beacon state of '0' and a pixel service state of '0'. RECORD this information as: »Msg_CRC Note: Rules for calculating the CRC are defined in NTCIP 1203 v03, Section 5.6.8.5.		
6	SET-UP: Determine the IP address of the computer that is sending the activation request. RECORD this information as: »Msg_Source		

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7	SET-UP: Calculate the activation code for the message, based on the previously defined values and an activation priority of 255 and a duration of 65535. RECORD this information as: »Msg_Activation_Code Note: Rules for calculating the activation code are defined in NTCIP 1203 v03, Section 5.1		
8	SET the following object(s) to the value(s) shown: »dmsActivateMessage.0 = Msg_Activation_Code	Pass / Fail (Section 3.5.2.3.1)	
9	VERIFY that the RESPONSE ERROR is equal to 'genError'.	Pass / Fail (Section 3.5.2.3.1)	
10	VERIFY that the display did not change.	Pass / Fail (Section 3.5.2.3.1)	
11	GET the following object(s): »dmsActivateMsgError.0 »dmsActivateErrorMsgCode.0	Pass / Fail (Section 3.5.2.3.1)	
12	VERIFY that the RESPONSE VALUE for dmsActivateErrorMsgCode.0 is equal to the Msg_Activation_Code.	Pass / Fail (Section 3.5.2.3.1)	
13	VERIFY that the RESPONSE VALUE for dmsActivateMsgError.0 equals 'messageMemoryType' (5).	Pass / Fail (Section 3.5.2.3.1)	
14	DELAY for Status_Update_Delay seconds.		
15	GET the following object(s): »shortErrorStatus.0	Pass / Fail (Section 3.5.3.1.2)	
16	VERIFY that the RESPONSE VALUE for shortErrorStatus.0 has bit 7 set to one (1) ‘message error’.	Pass / Fail (Section 3.5.3.1.2)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.7.10 Verify Message Number Activation Error

Test Case: 7.10	**Title:**	**Verify Message Number Activation Error**	
	Description:	This test case verifies that the DMS rejects a message activation if the message number is not valid.	
	Variables:	Msg_Type	From the Test Plan
		Msg_Invalid_Number	From the Test Plan
		Msg_Multi_String	From the Test Plan
		Status_Update_Delay	PRL 3.6.9
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine a message type that the DMS supports (e.g., per the test plan). RECORD this information as: »Msg_Type		

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2	CONFIGURE: Determine a message number that the sign does not support for the specified memory type (e.g., per the test plan). RECORD this information as: »Msg_Invalid_Number		
3	CONFIGURE: Determine the MULTI string of the message to be activated (e.g., per the test plan). RECORD this information as: »Msg_Multi_String		
4	CONFIGURE: Determine the frequency at which the DMS is required to update the status variables (per PRL 3.6.9). RECORD this information as: »Status_Update_Delay		
5	SET-UP: Calculate the message CRC value based on the Msg_Multi_String, a beacon state of '0' and a pixel service state of '0'. RECORD this information as: »Msg_CRC Note: Rules for calculating the CRC are defined in Section 5.6.8.5 (Message CRC Parameter).		
6	SET-UP: Calculate the IP address of the computer that is sending the activation request. RECORD this information as: »Msg_Source		
7	SET-UP: Calculate the activation code for the message, based on the previously defined values and an activation priority of 255 and a duration of 65535. RECORD this information as: »Msg_Activation_Code Note: Rules for calculating the activation code are defined in Section 5.1.		
8	SET the following object(s) to the value(s) shown: »dmsActivateMessage.0 = Msg_Activation_Code	Pass / Fail (Section 3.5.2.3.1)	
9	VERIFY that the RESPONSE ERROR is equal to 'genError'.	Pass / Fail (Section 3.5.2.3.1)	
10	VERIFY that the display did not change.	Pass / Fail (Section 3.5.2.3.1)	
11	GET the following object(s): »dmsActivateMsgError.0 »dmsActivateErrorMsgCode.0	Pass / Fail (Section 3.5.2.3.1)	
12	VERIFY that the RESPONSE VALUE for dmsActivateErrorMsgCode.0 is equal to the Msg_Activation_Code.	Pass / Fail (Section 3.5.2.3.1)	
13	VERIFY that the RESPONSE VALUE for dmsActivateMsgError.0 equals 'messageNumber' (6).	Pass / Fail (Section 3.5.2.3.1)	
14	DELAY for Status_Update_Delay seconds.		
15	GET the following object(s): »shortErrorStatus.0	Pass / Fail (Section 3.5.3.1.2)	
16	VERIFY that the RESPONSE VALUE for shortErrorStatus.0 has bit 7 set to one (1) “message error’.	Pass / Fail (Section 3.5.3.1.2)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

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C.3.7.11 Verify Message CRC Activation Error

Test Case: 7.11	**Title:**	**Verify Message CRC Activation Error**
	Description:	This test case verifies that the DMS rejects a message activation if the message CRC is not valid.
	Variables:	Msg_Type: From the Test Plan Msg_Number: From the Test Plan Status_Update_Delay: PRL 3.6.9
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine a message type and message number for an existing valid message in the sign (e.g. per the test plan). RECORD this information as: »Msg_Type »Msg_Number		
2	GET the following object(s): »dmsMessageMultiString.Msg_Type.Msg_Number		
3	RECORD the response as: »Msg_Multi_String		
4	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Msg_Multi_String »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 7 (messageCRC) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0 The message is required not to have been displayed.	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.7.12 Verify Sign Restricts Messages to Sign Dimensions

Test Case: 7.12	**Title:**	**Verify Sign Restricts Messages to Sign Dimensions**
	Description:	This test case verifies that the DMS rejects a message that is too large for the sign display.
	Variables:	Msg_Type: From the Test Plan Msg_Number: From the Test Plan Too_Large_Multi_String: From the Test Plan Too_Big_Error_Position: From the Test Plan
	Pass/Fail	The DUT shall pass every verification step included within the Test Case to pass

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	Criteria:	the Test Case.

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine a message type and message number supported by the sign (e.g. per the test plan). RECORD this information as: »Msg_Type »Msg_Number Note: The message type is required to be either 'changeable' or 'volatile'.		
2	CONFIGURE: Determine the MULTI string of the message to be activated (e.g., per the test plan). RECORD this information as: »Too_Large_Multi_String Note: The message is required to be too large to fit on the display (e.g., too many characters on a line or too many lines).		
3	CONFIGURE: Determine the position within the Too_Large_Multi_String that first results in an error. RECORD this information as: »Too_Big_Error_Position		
4	PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Too_Large_Multi_String »Msg_Owner = "OWNER" »Msg_Beacon_State = 0 »Msg_Pixel_Service = 0 »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 'syntaxMULTI' (5) »Expected_Multi_Error_Code = 'textTooBig' (5) »Expected_Multi_Error_Pos_Min = Too_Big_Error_Position »Expected_Multi_Error_Pos_Max = Too_Big_Error_Position	Pass / Fail (Section 3.5.2.3.3.3)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.7.13 Monitor Dynamic Field Values

Test Case: 7.13	**Title:**	**Monitor Dynamic Field Values**	
	Description:	This test case monitors the dynamic field values and prompts the user to verify that the reported values agree with the display.	
	Variables:	Msg_Type	From the Test Plan
		Msg_Number	From the Test Plan
		Field_Multi_String	From the Test Plan
		Field_Multi_String_Tags	From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References

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1	CONFIGURE: Determine a message type and message number supported by the sign (e.g. per the test plan). RECORD this information as: »Msg_Type »Msg_Number Note: The message type is required to be either ‘changeable’ or ‘volatile’.		
2	CONFIGURE: Determine the MULTI string of the message to be activated, which contains at least 1 dynamic field (i.e., a MULTI '[fx]' tag) that is nominally supported by the DMS (e.g., per the test plan). RECORD this information as: »Field_Multi_String		
3	CONFIGURE: Determine the number of field tags within the Field_Multi_String. RECORD this information as: »Field_Multi_String_Tags		
4	PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Field_Multi_String »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 »Msg_Pixel_Service = 0 »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.3.3)	
5	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Field_Multi_String »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
6	VERIFY that the message is properly displayed, with each field tag replaced with field values in accordance with Section 6.4.5.	Pass / Fail	
7	GET the following object(s): »statMultiFieldRows.0	Pass / Fail (Section 3.5.3.2.2)	Section 4.2.4.15 Step a
8	VERIFY that the RESPONSE VALUE for statMultiFieldRows.0 is equal to Field_Multi_String_Tags.	Pass / Fail (Section 3.5.3.2.2)	
9	Determine the RESPONSE VALUE for statMultiFieldRows.0. RECORD this information as: »Num_Field_Rows		
10	FOR EACH value, N, from 1 to Num_Field_Rows, perform Steps 10.1 through 10.3.		

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10.1	GET the following object(s): »statMultiFieldCode.N »statMultiCurrentFieldValue.N	Pass / Fail (Section 3.5.3.2.2)	Section 4.2.4.15 Step b
10.2	VERIFY that the RESPONSE VALUE for statMultiFieldCode.N is equal to one of the field codes within Field_Multi_String.	Pass / Fail (Section 3.5.3.2.2)	
10.3	VERIFY that the RESPONSE VALUE for statMultiCurrentFieldValue.N is equal to the value displayed on the sign corresponding to the field code identified in Step 10.2.	Pass / Fail (Section 3.5.3.2.2)	
11	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.7.14 Verify Control Mode

Test Case: 7.14	**Title:**	**Verify Control Mode**
	Description:	This test case verifies that the DMS properly responds to commands when placed in Central, Local, and Central Override Control Modes.
	Variables:	Msg1_Type — From the Test Plan Msg1_Number — From the Test Plan Msg1_Multi_String — From the Test Plan Msg2_Type — From the Test Plan Msg2_Number — From the Test Plan Msg2_Multi_String — From the Test Plan Time_Zone — From the Test Plan New_Time_Zone — From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine a message type and message numbers supported by the sign (e.g. per the test plan). RECORD this information as: »Msg1_Type »Msg1_Number »Msg2_Type »Msg2_Number Note: The message type is required to be either ‘changeable’ or ‘volatile’.		
2	CONFIGURE: Determine the MULTI string of two messages capable of being displayed without error on the sign (e.g., per the test plan). RECORD this information as: »Msg1_Multi_String »Msg2_Multi_String		
3	SET-UP: VERIFY that the device hardware is set for central control and that the test application computer is connected to the central port.		

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4	GET the following object(s): »dmsControlMode.0	Pass / Fail (Section 3.5.3.1.5)	
5	VERIFY that the RESPONSE VALUE for dmsControlMode.0 is equal to 'central' (4). Note: Valid enumerated values are defined in Section 5.7.1 (Control Mode Parameter).	Pass / Fail (Section 3.5.3.1.5)	
6	SET the following object(s) to the value(s) shown: »dmsControlMode.0 = 'central' (4)	Pass / Fail (Section 3.5.2.1)	
7	VERIFY that the RESPONSE ERROR is equal to 'badValue' (3).	Pass / Fail (Section 3.5.2.1)	Section 4.3.3.1 Rule b
8	SET the following object(s) to the value(s) shown: »dmsControlMode.0 = 'centralOverride' (5)	Pass / Fail (Section 3.5.2.1)	
9	VERIFY that the RESPONSE ERROR is equal to 'badValue' (3).	Pass / Fail (Section 3.5.2.1)	Section 4.3.3.1 Rule b
10	SET the following object(s) to the value(s) shown: »dmsControlMode.0 = 'local' (2)	Pass / Fail (Section 3.5.2.1)	
11	VERIFY that the RESPONSE ERROR is equal to 'badValue' (3).	Pass / Fail (Section 3.5.2.1)	Section 4.3.3.1 Rule b
12	GET the following object(s): »dmsControlMode.0	Pass / Fail (Section 3.5.3.1.5)	
13	VERIFY that the RESPONSE VALUE for dmsControlMode.0 is equal to 'central' (4).	Pass / Fail (Section 3.5.3.1.5)	
14	GET the following object(s): »globalTime.0 »controllerStandardTimeZone.0 »globalDaylightSaving.0 »controllerLocalTime.0	Pass / Fail (Section 3.5.2.1)	Section 4.3.3.1 Rule c
15	Determine the RESPONSE VALUE for controllerStandardTimeZone.0. RECORD this information as: »Time_Zone Add 3600 to Time_Zone. RECORD this information as: »New_Time_Zone		
16	SET the following object(s) to the value(s) shown: »controllerStandardTimeZone.0 = New_Time_Zone	Pass / Fail (Section 3.5.2.1)	Section 4.3.3.1 Rule d
17	GET the following object(s): »controllerStandardTimeZone.0	Pass / Fail (Section 3.5.2.1)	
18	VERIFY that the RESPONSE VALUE for controllerStandardTimeZone.0 is equal to New_Time_Zone.	Pass / Fail (Section 3.5.2.1)	

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19	SET-UP: PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Msg1_Type »Msg_Number = Msg1_Number »Msg_Multi_String = Msg1_Multi_String »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 »Msg_Pixel_Service = 0 »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0		
20	SET-UP: PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Msg2_Type »Msg_Number = Msg2_Number »Msg_Multi_String = Msg2_Multi_String »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 »Msg_Pixel_Service = 0 »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0		
21	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg1_Type »Msg_Number = Msg1_Number »Msg_Multi_String = Msg1_Multi_String »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
21.1	GET the following object(s): »dmsMsgSourceMode.0	Pass / Fail (Section 3.5.3.2.1)	
21.2	VERIFY that the RESPONSE VALUE for dmsMsgSourceMode.0 is equal to ‘central’ (4). Note: Valid enumerated values are defined in Section 5.7.7 (Message Source Mode Parameter).	Pass / Fail (Section 3.5.3.2.1)	
22	SET-UP: Connect the test application computer to the local port.		
23	GET the following object(s): »globalTime.0 »controllerStandardTimeZone.0 »globalDaylightSaving.0 »controllerLocalTime.0	Pass / Fail (Section 3.5.2.1)	Section 4.3.3.1 Rule c
24	SET the following object(s) to the value(s) shown: »controllerStandardTimeZone.0 = New_Time_Zone	Pass / Fail (Section 3.5.2.1)	
25	VERIFY that the RESPONSE ERROR is equal to ‘genError’.	Pass / Fail (Section 3.5.2.1)	Section 4.3.3.1 Rule e

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26	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg2_Type »Msg_Number = Msg2_Number »Msg_Multi_String = Msg2_Multi_String »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 10 (centralMode) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.1)	
27	VERIFY that the first message remains displayed on the sign.	Pass / Fail (Section 3.5.2.1)	
28	SET-UP: Switch the DMS to local control using the Local Control Switch Note: The type of Local Control Switch is manufacturer dependent.		
29	GET the following object(s): »dmsControlMode.0	Pass / Fail (Section 3.5.3.1.5)	
30	VERIFY that the RESPONSE VALUE for dmsControlMode.0 is equal to 'local' (2).	Pass / Fail (Section 3.5.3.1.5)	Section 4.3.3.1 Rule a
30.1	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg2_Type »Msg_Number = Msg2_Number »Msg_Multi_String = Msg2_Multi_String »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.1)	
30.2	VERIFY that Message 2 is displayed on the sign.	Pass / Fail (Section 3.5.2.1)	
30.3	GET the following object(s): »dmsMsgSourceMode.0	Pass / Fail (Section 3.5.3.2.1)	
30.4	VERIFY that the RESPONSE VALUE for dmsMsgSourceMode.0 is equal to local (2).	Pass / Fail (Section 3.5.3.2.1)	
31	SET-UP: Switch the DMS to central control using the Local Control Switch Note: The type of Local Control Switch is manufacturer dependent.		
32	GET the following object(s): »dmsControlMode.0	Pass / Fail (Section 3.5.3.1.5)	Section 4.3.3.2 Rule a
33	VERIFY that the RESPONSE VALUE for dmsControlMode.0 is equal to 'central' (4).	Pass / Fail (Section 3.5.3.1.5)	
34	SET-UP: Switch the DMS to local control using the Local Control Switch Note: The type of Local Control Switch is manufacturer dependent.		

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35	SET the following object(s) to the value(s) shown: »dmsControlMode.0 = 'local' (2)	Pass / Fail (Section 3.5.2.1)	Section 4.3.3.2 Rule c
36	VERIFY that the RESPONSE ERROR is equal to 'badValue' (3).	Pass / Fail (Section 3.5.2.1)	
37	SET the following object(s) to the value(s) shown: »dmsControlMode.0 = 'central' (4)	Pass / Fail (Section 3.5.2.1)	
38	VERIFY that the RESPONSE ERROR is equal to 'badValue' (3).	Pass / Fail (Section 3.5.2.1)	Section 4.3.3.2 Rule c
39	GET the following object(s): »dmsControlMode.0	Pass / Fail (Section 3.5.3.1.5)	
40	VERIFY that the RESPONSE VALUE for dmsControlMode.0 is equal to 'local' (2).	Pass / Fail (Section 3.5.3.1.5)	
41	GET the following object(s): »globalTime.0 »controllerStandardTimeZone.0 »globalDaylightSaving.0 »controllerLocalTime.0	Pass / Fail (Section 3.5.2.1)	Section 4.3.3.2 Rule d
42	SET the following object(s) to the value(s) shown: »controllerStandardTimeZone.0 = Time_Zone	Pass / Fail (Section 3.5.2.1)	Section 4.3.3.2 Rule e
43	GET the following object(s): »controllerStandardTimeZone.0	Pass / Fail (Section 3.5.2.1)	
44	VERIFY that the RESPONSE VALUE for controllerStandardTimeZone.0 is equal to Time_Zone.	Pass / Fail (Section 3.5.2.1)	
45	SET-UP: Connect the test application computer to the ‘central’ port.		
46	GET the following object(s): »globalTime.0 »controllerStandardTimeZone.0 »globalDaylightSaving.0 »controllerLocalTime.0	Pass / Fail (Section 3.5.2.1)	Section 4.3.3.2 Rule d
47	SET the following object(s) to the value(s) shown: »controllerStandardTimeZone.0 = New_Time_Zone	Pass / Fail (Section 3.5.2.1)	Section 4.3.3.2 Rule f
48	VERIFY that the RESPONSE ERROR is equal to ‘genError’.	Pass / Fail (Section 3.5.2.1)	
49	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg1_Type »Msg_Number = Msg1_Number »Msg_Multi_String = Msg1_Multi_String »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 9 (localMode) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.1)	Section 4.3.3.2 Rule f

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50	VERIFY that the second message remains on the sign.	Pass / Fail (Section 3.5.2.1)	
51	SET the following object(s) to the value(s) shown: »dmsControlMode.0 = ‘centralOverride’ (5).	Pass / Fail (Section 3.5.2.1)	Section 4.3.3.2 Rules b and f
52	GET the following object(s): »dmsControlMode.0	Pass / Fail (Section 3.5.3.1.5)	
53	VERIFY that the RESPONSE VALUE for dmsControlMode.0 is equal to 'centralOverride' (5).	Pass / Fail (Section 3.5.3.1.5)	
54	SET-UP: Switch the DMS to central control using the Local Control Switch Note: The type of Local Control Switch is manufacturer dependent.		
55	GET the following object(s): »dmsControlMode.0	Pass / Fail (Section 3.5.3.1.5)	Section 4.3.3.3 Rule a
56	VERIFY that the RESPONSE VALUE for dmsControlMode.0 is equal to 'central' (4).	Pass / Fail (Section 3.5.3.1.5)	
57	SET-UP: Switch the DMS to local control using the Local Control Switch Note: The type of Local Control Switch is manufacturer dependent.		
58	SET-UP: Connect the test application computer to the ‘local’ port.		
59	SET the following object(s) to the value(s) shown: »dmsControlMode.0 = ‘centralOverride’ (5).	Pass / Fail (Section 3.5.2.1)	Section 4.3.3.2 Rule b
60	GET the following object(s): »dmsControlMode.0	Pass / Fail (Section 3.5.3.1.5)	
61	VERIFY that the RESPONSE VALUE for dmsControlMode.0 is equal to 'centralOverride' (5).	Pass / Fail (Section 3.5.3.1.5)	
62	SET-UP: Connect the test application computer to the ‘central’ port.		
63	SET the following object(s) to the value(s) shown: »dmsControlMode.0 = 'central' (4)	Pass / Fail (Section 3.5.2.1)	Section 4.3.3.3 Rule c
64	VERIFY that the RESPONSE ERROR is equal to 'badValue' (3).	Pass / Fail (Section 3.5.2.1)	
65	SET the following object(s) to the value(s) shown: »dmsControlMode.0 = 'local' (2)	Pass / Fail (Section 3.5.2.1)	Section 4.3.3.3 Rule c
66	VERIFY that the RESPONSE ERROR is equal to 'badValue' (3).	Pass / Fail (Section 3.5.2.1)	
67	SET the following object(s) to the value(s) shown: »dmsControlMode.0 = 'centralOverride' (5)	Pass / Fail (Section 3.5.2.1)	Section 4.3.3.3 Rule b
68	GET the following object(s): »globalTime.0 »controllerStandardTimeZone.0 »globalDaylightSaving.0 »controllerLocalTime.0	Pass / Fail (Section 3.5.2.1)	Section 4.3.3.3 Rule d
69	SET the following object(s) to the value(s) shown: »controllerStandardTimeZone.0 = New_Time_Zone.	Pass / Fail (Section 3.5.2.1)	Section 4.3.3.3 Rule e)

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70	GET the following object(s): »controllerStandardTimeZone.0	Pass / Fail (Section 3.5.2.1)	
71	VERIFY that the RESPONSE VALUE for controllerStandardTimeZone.0 is equal to New_Time_Zone.	Pass / Fail (Section 3.5.2.1)	
72	SET-UP: Connect the test application computer to the local port.		
73	GET the following object(s): »globalTime.0 »controllerStandardTimeZone.0 »globalDaylightSaving.0 »controllerLocalTime.0	Pass / Fail (Section 3.5.2.1)	Section 4.3.3.2 Rule d
74	SET the following object(s) to the value(s) shown: »controllerStandardTimeZone.0 = Time_Zone	Pass / Fail (Section 3.5.2.1)	Section 4.3.3.2 Rule f
75	VERIFY that the RESPONSE ERROR is equal to ‘genError’.	Pass / Fail (Section 3.5.2.1)	
76	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg1_Type »Msg_Number = Msg1_Number »Msg_Multi_String = Msg1_Multi_String »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 11 (centralOverrideMode) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.1)	Section 4.3.3.2 Rule f
77	VERIFY that the second message remains on the sign.	Pass / Fail (Section 3.5.2.1)	
78	SET-UP: Switch the DMS to central control using the Local Control Switch Note: The type of Local Control Switch is manufacturer dependent.		
79	SET-UP: Connect the test application computer to the ‘central’ port.		
80	SET the following object(s) to the value(s) shown: »controllerStandardTimeZone.0 = Time_Zone		
81	GET the following object(s): »controllerStandardTimeZone.0	Pass / Fail (Section 3.5.2.1)	
82	VERIFY that the RESPONSE VALUE for controllerStandardTimeZone.0 is equal to Time_Zone.	Pass / Fail (Section 3.5.2.1)	
83	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

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C.3.7.15 Blank the Sign

Test Case: 7.15	**Title:**	**Blank the Sign**	
	Description:	This test case verifies that the DMS blanks the sign upon the receipt of an appropriate command.	
	Variables:	Status_Update_Delay	PRL 3.6.9
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the frequency at which the DMS is required to update the status variables (per PRL 3.6.9). RECORD this information as: »Status_Update_Delay		
2	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = 7 (blank) »Msg_Number = 1 »Msg_Multi_String = “” »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	Section 4.2.3.1 Step b
3	DELAY for Status_Update_Delay seconds.		
4	GET the following object(s): »shortErrorStatus.0	Pass / Fail (Section 3.5.3.1.2)	Section 4.2.3.1 Step c
5	VERIFY that the RESPONSE VALUE for shortErrorStatus.0 is equal to zero.	Pass / Fail (Section 3.5.2.3.1)	
6	VERIFY that the sign face blanked.	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.7.16 Monitor the Current Message

Test Case: 7.16	**Title:**	**Monitor the Current Message**	
	Description:	This test case verifies that the DMS is able to indicate the currently active message and meta-data about this message such as an indication of the entity that requested the display of the message.	
	Variables:	Msg_Type	From the Test Plan
		Msg_Number	From the Test Plan
		Msg_Duration	From the Test Plan
		Msg_Multi_String	From the Test Plan

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		Msg_Owner	From the Test Plan
		Msg_Run_Time_Priority	From the Test Plan
		Msg_Beacon_State	From the Test Plan
		Msg_Pixel_Service	From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the enumerated value for the type of memory in which the message to be activated is currently stored. RECORD this information as: »Msg_Type		
2	CONFIGURE: Determine the number of the message, within the specified memory type, which is to be activated. RECORD this information as: »Msg_Number		
3	CONFIGURE: Determine the duration for which the message is intended to be displayed. RECORD this information as: »Msg_Duration		
4	CONFIGURE: Determine the MULTI string of the message to be activated. RECORD this information as: »Msg_Multi_String		
5	CONFIGURE: Determine the text to be stored as the 'owner' of the message (e.g., per the test plan). RECORD this information as: »Msg_Owner		
6	CONFIGURE: Determine the priority to assign to the message while it is running to prevent another message from overriding it. RECORD this information as: »Msg_Run_Time_Priority		
7	CONFIGURE: Determine the encoded value of the programmed state of the beacons when the message is activated. RECORD this information as: »Msg_Beacon_State		
8	CONFIGURE: Determine the encoded value of the programmed state of pixel service when the message is activated. RECORD this information as: »Msg_Pixel_Service		
9	PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Msg_Multi_String »Msg_Owner = Msg_Owner »Msg_Beacon_State = Msg_Beacon_State »Msg_Pixel_Service = Msg_Pixel_Service »Msg_Run_Time_Priority = Msg_Run_Time_Priority »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.3.3)	

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10	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Msg_Multi_String »Msg_Beacon_State = Msg_Beacon_State »Msg_Pixel_Service = Msg_Pixel_Service »Msg_Activation_Priority = Msg_Activation_Priority »Msg_Duration = Msg_Duration »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
11	Calculate the current time. RECORD this information as: »Post_Time		
12	Calculate the expected value for the dmsMsgTableSource.0 based on the message type, message number, and CRC of the Msg activated in the 'Activate a Message' Test Case. RECORD this information as: »Table_Source		
13	GET the following object(s): »dmsMsgTableSource.0	Pass / Fail (Section 3.5.3.2.1)	Section 4.2.4.14 Step a
14	VERIFY that the RESPONSE VALUE for dmsMsgTableSource.0 is equal to Table_Source.	Pass / Fail (Section 3.5.3.2.1)	
15	DELAY for 60 seconds.		
16	GET the following object(s): »dmsMessageTimeRemaining.0	Pass / Fail (Section 3.5.3.2.1)	Section 4.2.4.14 Step b
17	Calculate the amount of time, in minutes, that has elapsed since Post_Time. RECORD this information as: »Elapsed_Time		
18	IF Msg_Duration is equal to 65535, GOTO Step 18.3.		
18.1	VERIFY that the RESPONSE VALUE for dmsMessageTimeRemaining.0 equals the greater of 0 or (Msg_Duration minus Elapsed_Time). NOTE—dmsMessageTimeRemaining is required to have been reduced by the amount of Elapsed_Time, but cannot be less than zero.	Pass / Fail (Section 3.5.3.2.1)	
18.2	GOTO Step 19		
18.3	VERIFY that the RESPONSE VALUE for dmsMessageTimeRemaining.0 is 65535.	Pass / Fail (Section 3.5.3.2.1)	
19	GET the following object(s): »dmsMsgRequesterID.0	Pass / Fail (Section 3.5.3.2.1)	Section 4.2.4.14 Step c
20	Calculate the IP address used in the message activation command. RECORD this information as: »Local_IP_Address		
21	VERIFY that the RESPONSE VALUE for dmsMsgRequesterID.0 is equal to Local_IP_Address.	Pass / Fail (Section 3.5.3.2.1)	
22	GET the following object(s): »dmsMsgSourceMode.0	Pass / Fail (Section 3.5.3.2.1)	Section 4.2.4.14 Step d

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23	VERIFY that the RESPONSE VALUE for dmsMsgSourceMode.0 indicates 'central' (8). Note: Valid enumerated values are defined in Section 5.7.7 (Message Source Mode Parameter).	Pass / Fail (Section 3.5.3.2.1)	
24	GET the following object(s): »dmsMessageMultiString.5.1 »dmsMessageOwner.5.1 »dmsMessageRunTimePriority.5.1 Note: Instance 5.1 is the currentBuffer row of the table.	Pass / Fail (Section 3.5.3.2.1)	Section 4.2.4.14 Step e
25	VERIFY that the RESPONSE VALUE for dmsMessageMultiString.5.1 is equal to Msg_Multi_String.	Pass / Fail (Section 3.5.3.2.1)	
26	VERIFY that the RESPONSE VALUE for dmsMessageOwner.5.1 is equal to Msg_Owner.	Pass / Fail (Section 3.5.3.2.1)	
27	VERIFY that the RESPONSE VALUE for dmsMessageRunTimePriority.5.1 is equal to Msg_Run_Time_Priority.	Pass / Fail (Section 3.5.3.2.1)	
28	GET the following object(s): »dmsMessagePixelService.5.1	Pass / Fail (Section 3.5.3.2.1)	Section 4.2.4.14 Step f
29	VERIFY that the RESPONSE ERROR is equal to ‘noError’ or 'noSuchName'.		
30	IF the RESPONSE ERROR is equal to ‘noError’, then GOTO Step 30.1; otherwise, GOTO Step 35.		
30.1	VERIFY that the RESPONSE VALUE for dmsMessagePixelService.5.1 is equal to Msg_Pixel_Service.	Pass / Fail (Section 3.5.3.2.1)	
31	GET the following object(s): »dmsMessageBeacon.5.1	Pass / Fail (Section 3.5.3.2.1)	Section 4.2.4.14 Step g
32	VERIFY that the RESPONSE ERROR is equal to ‘noError’ or 'noSuchName'.		
33	IF the RESPONSE ERROR is equal to noError, then GOTO Step 33.1; otherwise, GOTO Step 37.		
33.1	VERIFY that the RESPONSE VALUE for dmsMessageBeacon.5.1 is equal to Msg_Beacon_State.	Pass / Fail (Section 3.5.3.2.1)	
34	GET the following object(s): »dmsIllumBrightLevelStatus.0 »dmsIllumLightOutputStatus.0	Pass / Fail (Section 3.5.3.2.1)	Section 4.2.4.14 Step h

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.7.17 Verify Support of Permanent Messages

Test Case: 7.17	**Title:**	**Verify Support of Permanent Messages**
	Description:	This test case verifies that the DMS can activate each of the permanent messages defined in the message table.
	Variables:	

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	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.

Step	Test Procedure	Results	Additional References
1	GET the following object(s): »dmsNumPermanentMsg.0 »dmsMaxChangeableMsg.0 »dmsMaxVolatileMsg.0	Pass / Fail (Section 3.5.2.3.3.1)	
2	Determine the RESPONSE VALUE for dmsNumPermanentMsg.0. RECORD this information as: »Num_Perm_Msgs		
3	FOR EACH value, N, from 1 to Num_Perm_Msgs, perform Steps 3.1 through 3.11.		
3.1	GET the following object(s): »dmsMessageMultiString.2.N »dmsMessageOwner.2.N »dmsMessageRunTimePriority.2.N »dmsMessageStatus.2.N	Pass / Fail (Section 3.5.2.3.3.5)	Section 4.2.3.3 Step b
3.2	RECORD the RESPONSE VALUE for dmsMessageMultiString.2.N as: »Perm_Msg_Multi_String		
3.3	GET the following object(s): »dmsMessageBeacon.2.N	Pass / Fail (Section 3.5.2.3.3.5)	Section 4.2.3.3 Step c
3.4	VERIFY that the RESPONSE ERROR is equal to ‘noError’ or 'noSuchName'.		
3.5	IF the RESPONSE ERROR is equal to ‘noError’, then GOTO Step 3.5.1; otherwise, GOTO Step 3.6.		
3.5.1	RECORD the RESPONSE VALUE for dmsMessageBeacon.2.N as: »Perm_Msg_Beacon GO TO Step 3.7.		
3.6	Calculate the value 0. RECORD this information as: »Perm_Msg_Beacon		
3.7	GET the following object(s): »dmsMessagePixelService.2.N	Pass / Fail (Section 3.5.2.3.3.5)	Section 4.2.3.3 Step d
3.8	VERIFY that the RESPONSE ERROR is equal to ‘noError’ or 'noSuchName'.		
3.9	IF the RESPONSE ERROR is equal to noError, then GOTO Step 3.9.1; otherwise, GOTO Step 3.10.		
3.9.1	RECORD the RESPONSE VALUE for dmsMessagePixelService.2.N as: »Perm_Msg_Pixel GO TO Step 3.11.		
3.10	Calculate the value 0. RECORD this information as: »Perm_Msg_Pixel		
3.11	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2)	Pass / Fail	

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	with the following parameters: »Msg_Type = 2 »Msg_Number = N »Msg_Multi_String = Perm_Msg_Multi_String »Msg_Beacon_State = Perm_Msg_Beacon »Msg_Pixel_Service = Perm_Msg_Pixel »Msg_Activation_Priority = 255 »Msg_Duration = 65535 »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	(Section 3.5.2.3.1)	
4	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.7.18 Verify Simulation Control Mode

Test Case: 7.18	**Title:**	**Verify Simulation Control Mode**	
	Description:	This test case verifies that the DMS properly supports the Simulation Control Mode, as defined in NTCIP 1203 v01.	
	Variables:	Msg_Type	From the Test Plan
		Msg_Number	From the Test Plan
		Msg_Multi_String	From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine a message type and message number supported by the sign (e.g. per the test plan). RECORD this information as: »Msg_Type »Msg_Number Note: The message type is required to be either ‘changeable’ or ‘volatile’.		
2	CONFIGURE: Determine the MULTI string of a message capable of being displayed without error on the sign (e.g., per the test plan). RECORD this information as: »Msg_Multi_String		
3	SET-UP: VERIFY that the device hardware is set for central control and that the test application computer is connected to the central port.		

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4	SET-UP: PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Msg_Multi_String »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 »Msg_Pixel_Service = 0 »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.3.3)	
5	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	
6	GET the following object(s): »dmsControlMode.0		
7	VERIFY that the RESPONSE VALUE for dmsControlMode.0 is equal to 'central' (4). Note: Valid enumerated values are defined in Section 5.7.1 (Control Mode Parameter).	Pass / Fail (Section 3.5.3.1.5)	
8	SET the following object(s) to the value(s) shown: »dmsControlMode.0 = 'simulation' (6)	Pass / Fail (Section 3.5.2.1)	
9	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg1_Type »Msg_Number = Msg1_Number »Msg_Multi_String = Msg1_Multi_String »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
10	VERIFY that the message is NOT displayed on the sign.	Pass / Fail (Section 3.5.4.3)	
11	SET the following object(s) to the value(s) shown: »dmsControlMode.0 = 'central' (4)	Pass / Fail (Section 3.5.2.1)	
12	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.8 MULTI Tag Tests

C.3.8.1 Verify Support of Multi-Page Message

Test Case: 8.1	**Title:**	**Verify Support of Multi-Page Message**
	Description:	This test case verifies that the DMS supports the requirements for multiple page messages.

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	Variables:	Required_Max_Pages	PRL 3.6.6.2.1
		Msg_Type	From the Test Plan
		Msg_Number	From the Test Plan
		MULTI_String_Pages_1 to MULTI_String_Pages_N	From the Test Plan
		MULTI_String_Error_Too_Many_Pages	From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the number of pages that the sign is required to support within each message per the specification (PRL 3.6.6.2.1). Record this information as: »Required_Max_Pages		
2	CONFIGURE: Determine the text that is intended to be displayed on each page of the message followed by the page number (e.g. 'Page '). RECORD the information as: »Page_Text		
3	GET the following object(s): »dmsMaxNumberPages.0	Pass / Fail (Section 3.5.1.2.3.1)	
4	RECORD the RESPONSE VALUE for dmsMaxNumberPages.0 as: »Actual_Max_Pages		
5	VERIFY that the RESPONSE VALUE for dmsMaxNumberPages.0 is greater than or equal to Required_Max_Pages.	Pass / Fail (PRL 3.6.6.2.1)	
6	GET the following object(s): »dmsSupportedMultiTags.0	Pass / Fail (Section 3.5.1.2.3.4)	
7	If the RESPONSE VALUE for dmsMaxNumberPages.0 is greater than 1, verify that Bit 11 of the RESPONSE VALUE for dmsSupportedMultiTags.0 is set to one, indicating that the sign supports the New Page MULTI tag. Otherwise, verify that Bit 11 of the RESPONSE VALUE for dmsSupportedMultiTags.0 is set to zero.	Pass / Fail (Section 3.5.1.2.3.4)	
8	FOR EACH value, N, from 1 to Actual_Max_Pages, perform Steps 8.1 through 8.5.		
8.1	CONFIGURE: Define a message to be transferred to the sign that contains N pages. RECORD this information as: »MULTI_String_Pages_N		
8.2	CONFIGURE: Determine the message (e.g., from the test plan) that shall be used to display the message. RECORD this information as: »Msg_Type (the memory type used to store the message) »Msg_Number (the message number used to store the message)		

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8.3	PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = MULTI_String_Pages_N »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.3.3)	
8.4	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = MULTI_String_Pages_N »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
8.5	VERIFY that all pages of the message display on the sign.	Pass / Fail (Section 3.6.6.2.1)	
9	Calculate the length of MULTI_String_Pages_N, where N is Actual_Max_Pages. RECORD this information as: »MULTI_Length		
10	Define a message to display on the sign that contains one more page than the number of pages recorded in Actual_Max_Pages. RECORD this information as: »MULTI_String_Error_Too_Many_Pages		
11	Calculate the position of the first character after the close bracket of the final [np] tag. RECORD this information as: »MULTI_Length_Plus_Tag		
12	PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = MULTI_String_Error_Too_Many_Pages »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 5 (syntaxMULTI) »Expected_Multi_Error_Code = 12 (tooManyPages) »Expected_Multi_Error_Pos_Min = MULTI_Length »Expected_Multi_Error_Pos_Max = MULTI_Length_Plus_Tag	Pass / Fail (Section 3.5.2.3.3.3)	
13	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**

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Test Case Notes:

C.3.8.2 Verify Support of Page Justification Tag - Top

Test Case: 8.2	**Title:**	**Verify Support of Page Justification Tag - Top**	
	Description:	This test case verifies that the DMS supports the top-justified page-justification tag.	
	Variables:	Top_Justified_Tag_Msg	From the Test Plan
		Msg_Type	From the Test Plan
		Msg_Number	From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the MULTI string of the message to be displayed to demonstrate support for the top-justified requirement (e.g., per the test plan). RECORD this information as: »Top_Justified_Tag_Msg Note: The page justification tag is required to appear before any text. For example: "[jp2]THIS IS[nl]A TEST". If the sign supports multiple pages, the message is required to include multiple pages to verify that the justification is properly applied to all pages of the message.		
2	CONFIGURE: Determine the message (e.g., from the test plan) that is intended to be used to display the message. RECORD this information as: »Msg_Type (the memory type used to store the message) »Msg_Number (the message number used to store the message)		
3	GET the following object(s): »dmsSupportedMultiTags.0	Pass / Fail (Section 3.5.1.2.3.4)	
4	VERIFY that Bit 7 of the RESPONSE VALUE for dmsSupportedMultiTags.0 is equal to one.	Pass / Fail (Section 3.6.6.2.2)	
5	PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Top_Justified_Tag_Msg »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.3.3)	

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6	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Top_Justified_Tag_Msg »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
7	VERIFY that the message is displayed in accordance with Section 6.4.11 (Justification – Page).	Pass / Fail (Sections 3.6.6.2.2.1, 3.6.12.1)	
8	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.8.3 Verify Support of Page Justification Tag - Middle

Test Case: 8.3	**Title:**	**Verify Support of Page Justification Tag - Middle**	
	Description:	This test case verifies that the DMS supports the middle-justified page-justification tag.	
	Variables:	Middle_Justified_Tag_Msg	From the Test Plan
		Msg_Type	From the Test Plan
		Msg_Number	From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the MULTI string of the message to be displayed to demonstrate support for the middle-justified requirement (e.g., per the test plan). RECORD this information as: »Middle_Justified_Tag_Msg Note: The page justification tag is required to appear before any text. For example: "[jp3]THIS IS[nl]A TEST". If the sign supports multiple pages, the message is required to include multiple pages to verify that the justification is properly applied to all pages of the message.		
2	CONFIGURE: Determine the message (e.g., from the test plan) that shall be used to display the message. RECORD this information as: »Msg_Type (the memory type used to store the message) »Msg_Number (the message number used to store the message)		
3	GET the following object(s): »dmsSupportedMultiTags.0	Pass / Fail (Section 3.5.1.2.3.4)	

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4	VERIFY that Bit 7 of the RESPONSE VALUE for dmsSupportedMultiTags.0 is equal to one.	Pass / Fail (Section 3.6.6.2.2)	
5	PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Middle_Justified_Tag_Msg »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.3.3)	
6	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Middle_Justified_Tag_Msg »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
7	VERIFY that the message is displayed in accordance with Section 6.4.11 (Justification – Page).	Pass / Fail (Sections 3.6.6.2.2.1, 3.6.12.2)	
8	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.8.4 Verify Support of Page Justification Tag - Bottom

Test Case: 8.4	**Title:**	**Verify Support of Page Justification Tag - Bottom**	
	Description:	This test case verifies that the DMS supports the bottom-justified page-justification tag.	
	Variables:	Bottom_Justified_Tag_Msg	From the Test Plan
		Msg_Type	From the Test Plan
		Msg_Number	From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References

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1	CONFIGURE: Determine the MULTI string of the message to be displayed to demonstrate support for the bottom-justified requirement (e.g., per the test plan). RECORD this information as: »Bottom_Justified_Tag_Msg Note: The page justification tag is required to appear before any text. For example: "[jp4]THIS IS[nl]A TEST". If the sign supports multiple pages, the message is required to include multiple pages to verify that the justification is properly applied to all pages of the message.		
2	CONFIGURE: Determine the message (e.g., from the test plan) that shall be used to display the message. RECORD this information as: »Msg_Type (the memory type used to store the message) »Msg_Number (the message number used to store the message)		
3	GET the following object(s): »dmsSupportedMultiTags.0	Pass / Fail (Section 3.5.1.2.3.4)	
4	VERIFY that Bit 7 of the RESPONSE VALUE for dmsSupportedMultiTags.0 is equal to one.	Pass / Fail (Section 3.6.6.2.2)	
5	PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Bottom_Justified_Tag_Msg »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.3.3)	
6	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Bottom_Justified_Tag_Msg »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
7	VERIFY that the message is displayed in accordance with Section 6.4.11 (Justification – Page).	Pass / Fail (Sections 3.6.6.2.2.1, 3.6.12.3)	
8	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

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C.3.8.5 Verify Support of Page-Specific Page Justification

Test Case: 8.5	**Title:**	**Verify Support of Page-Specific Page Justification**
	Description:	This test case verifies that the DMS supports page-specific page-justification.
	Variables:	Page_Justified_Tag_Msg — From the Test Plan Msg_Type — From the Test Plan Msg_Number — From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the MULTI string of the message to be displayed to demonstrate support for different page justifications on a page-by-page basis (e.g., per the test plan). RECORD this information as: »Page_Justified_Tag_Msg Note: The message is required to contain at least one new page tag and is required to use two page-justifications, although one could be implicit and use the default justification. For example: "THIS IS[nl]A TEST[np][jp2]TEST PAGE 2", would use the default justification on page 1 and be top justified on page 2.		
2	CONFIGURE: Determine the message (e.g., from the test plan) that shall be used to display the message. RECORD this information as: »Msg_Type (the memory type used to store the message) »Msg_Number (the message number used to store the message)		
3	GET the following object(s): »dmsSupportedMultiTags.0	Pass / Fail (Section 3.5.1.2.3.4)	
4	VERIFY that Bit 7 of the RESPONSE VALUE for dmsSupportedMultiTags.0 is equal to one.	Pass / Fail (Section 3.6.6.2.2)	
5	PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Page_Justified_Tag_Msg »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.3.3)	

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6	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Page_Justified_Tag_Msg »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail(Section 3.5.2.3.1)	
7	VERIFY that the message is displayed in accordance with Section 6.4.11 (Justification – Page).	Pass / Fail (3.6.6.2.2.2)	
8	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.8.6 Verify Support of Multiple Line Messages with No Spacing Specified

Test Case: 8.6	**Title:**	**Verify Support of Multiple Line Messages with No Spacing Specified**	
	Description:	This test case verifies that the DMS supports multiple line messages without explicit line spacing.	
	Variables:	Required_Max_Lines	PRL 3.6.6.2.3
		New_Line_Tag_Msg	From the Test Plan
		Msg_Type	From the Test Plan
		Msg_Number	From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the number of lines per page that the sign is required to support per the specification (PRL 3.6.6.2.3) RECORD this information as: »Required_Max_Lines		
2	CONFIGURE: Determine the MULTI string of the message to be displayed to demonstrate support for multi-line messages (e.g., per the test plan). RECORD this information as: »New_Line_Tag_Msg Note: The tag shall include Required_Max_Lines - 1 instances of the new line tag. For example, if Required_Max_Lines is 3, the message could be "THIS[nl]IS[nl]A TEST".		
3	CONFIGURE: Determine the message (e.g., from the test plan) that shall be used to display the message. RECORD this information as: »Msg_Type (the memory type used to store the message) »Msg_Number (the message number used to store the message)		

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4	GET the following object(s): »dmsSupportedMultiTags.0	Pass / Fail (Section 3.5.1.2.3.4)	
5	VERIFY that Bit 10 of the RESPONSE VALUE for dmsSupportedMultiTags.0 is equal to one.	Pass / Fail (Section 3.6.6.2.3)	
6	PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = New_Line_Tag_Msg »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.3.3)	
7	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = New_Line_Tag_Msg »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
8	VERIFY that the message is displayed with Required_Max_Lines number of lines.	Pass / Fail (Section 3.6.6.2.3)	
9	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.8.7 Verify Support of Multiple Line Messages with Spacing Specified

Test Case: 8.7	**Title:**	**Verify Support of Multiple Line Messages with Spacing Specified**	
	Description:	This test case verifies that the DMS supports multiple line messages with explicitly defined line spacing.	
	Variables:	New_Line_Spacing_Tag_Msg	From the Test Plan
		Msg_Type	From the Test Plan
		Msg_Number	From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

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Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the MULTI string of the message to be displayed to demonstrate support for multi-line messages that contain explicit line spacing commands (e.g., per the test plan). RECORD this information as: »New_Line_Spacing_Tag_Msg Note: The tag is required to include at least one instance of the new line tag that includes a number indicating the required line spacing. For example: "THIS IS[nl3]A TEST"		
2	CONFIGURE: Determine the message (e.g., from the test plan) that shall be used to display the message. RECORD this information as: »Msg_Type (the memory type used to store the message) »Msg_Number (the message number used to store the message)		
3	GET the following object(s): »dmsSupportedMultiTags.0	Pass / Fail (Section 3.5.1.2.3.4)	
4	VERIFY that Bit 10 of the RESPONSE VALUE for dmsSupportedMultiTags.0 is equal to one.	Pass / Fail (Section 3.6.6.2.3)	
5	PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = New_Line_Spacing_Tag_Msg »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.3.3)	
6	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = New_Line_Spacing_Tag_Msg »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
7	VERIFY that the message is displayed with the selected number of blank rows between lines.	Pass / Fail (Section 3.6.6.2.3)	
8	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.8.8 Verify Support of Line Justification - Left

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Test Case: 8.8	**Title:**	**Verify Support of Line Justification - Left**
	Description:	This test case verifies that the DMS supports left-justified line-justification.
	Variables:	Left_Justified_Msg — From the Test Plan Msg_Type — From the Test Plan Msg_Number — From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the MULTI string of the message to be displayed to demonstrate support for left-justified line-justification (e.g., per the test plan). RECORD this information as: »Left_Justified_Msg Note: The message is required to contain at least one left justification tag. For example "[jl2]THIS IS A TEST"		
2	CONFIGURE: Determine the message (e.g., from the test plan) that shall be used to display the message. RECORD this information as: »Msg_Type (the memory type used to store the message) »Msg_Number (the message number used to store the message)		
3	GET the following object(s): »dmsSupportedMultiTags.0	Pass / Fail (Section 3.5.1.2.3.4)	
4	VERIFY that Bit 6 of the RESPONSE VALUE for dmsSupportedMultiTags.0 is equal to one.	Pass / Fail (Section 3.6.6.2.4)	
5	PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Left_Justified_Msg »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.3.3)	
6	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Left_Justified_Msg »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
7	For character-matrix signs, VERIFY that the left-most character of the text is displayed on the sign in the left-most module. For line and full matrix signs, VERIFY that the left-most column of the text is displayed on the sign in the left-most column of pixels.	Pass / Fail (Section 3.6.6.2.4)	

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8	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.8.9 Verify Support of Line Justification - Center

Test Case: 8.9	**Title:**	**Verify Support of Line Justification - Center**	
	Description:	This test case verifies that the DMS supports center-justified line-justification.	
	Variables:	Center_Justified_Msg	From the Test Plan
		Msg_Type	From the Test Plan
		Msg_Number	From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the MULTI string of the message to be displayed to demonstrate support for center-justified line-justification (e.g., per the test plan). RECORD this information as: »Center_Justified_Msg Note: The message is required to contain at least one center justification tag. For example "[jl3]THIS IS A TEST"		
2	CONFIGURE: Determine the message (e.g., from the test plan) that shall be used to display the message. RECORD this information as: »Msg_Type (the memory type used to store the message) »Msg_Number (the message number used to store the message)		
3	GET the following object(s): »dmsSupportedMultiTags.0	Pass / Fail (Section 3.5.1.2.3.4)	
4	VERIFY that Bit 6 of the RESPONSE VALUE for dmsSupportedMultiTags.0 is equal to one.	Pass / Fail (Section 3.6.6.2.4)	
5	PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Center_Justified_Msg »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.3.3)	

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6	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Center_Justified_Msg »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
7	For character-matrix signs, VERIFY that the text is displayed on the sign center-justified, with either an even number of blank modules to the left and right of the text, or an additional blank module to the right of the text. For line and full matrix signs, VERIFY that the text is displayed on the sign center-justified, with either an even number of blank columns to the left and right of the text, or an additional blank column to the right of the text.	Pass / Fail (Section 3.6.6.2.4)	
8	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.8.10 Verify Support of Line Justification - Right

Test Case: 8.10	**Title:**	**Verify Support of Line Justification - Right**	
	Description:	This test case verifies that the DMS supports right-justified line-justification.	
	Variables:	Right_Justified_Msg	From the Test Plan
		Msg_Type	From the Test Plan
		Msg_Number	From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the MULTI string of the message to be displayed to demonstrate support for right-justified line-justification (e.g., per the test plan). RECORD this information as: »Right_Justified_Msg Note: The message is required to contain at least one right justification tag. For example "[jl4]THIS IS A TEST"		
2	CONFIGURE: Determine the message (e.g., from the test plan) that shall be used to display the message. RECORD this information as: »Msg_Type (the memory type used to store the message) »Msg_Number (the message number used to store the message)		
3	GET the following object(s): »dmsSupportedMultiTags.0	Pass / Fail (Section 3.5.1.2.3.4)	

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4	VERIFY that Bit 6 of the RESPONSE VALUE for dmsSupportedMultiTags.0 is equal to one.	Pass / Fail (Section 3.6.6.2.4)	
5	PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Right_Justified_Msg »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.3.3)	
6	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Right_Justified_Msg »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
7	For character-matrix signs, VERIFY that the right-most character of the text is displayed on the sign in the right-most module. For line and full matrix signs, VERIFY that the right-most column of the text is displayed on the sign in the right-most column of pixels.	Pass / Fail (Section 3.6.6.2.4)	
8	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.8.11 Verify Support of Line Justification - Full

Test Case: 8.11	**Title:**	**Verify Support of Line Justification - Full**	
	Description:	This test case verifies that the DMS supports full-justified line-justification.	
	Variables:	Full_Justified_Msg	From the Test Plan
		Msg_Type	From the Test Plan
		Msg_Number	From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the MULTI string of the message to be displayed to demonstrate support for full-justified line-justification (e.g., per the test plan). RECORD this information as: »Full_Justified_Msg		

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	Note: The message is required to contain at least one full justification tag. For example "[jl5]THIS IS A TEST"		
2	CONFIGURE: Determine the message (e.g., from the test plan) that shall be used to display the message. RECORD this information as: »Msg_Type (the memory type used to store the message) »Msg_Number (the message number used to store the message)		
3	GET the following object(s): »dmsSupportedMultiTags.0	Pass / Fail (Section 3.5.1.2.3.4)	
4	VERIFY that Bit 6 of the RESPONSE VALUE for dmsSupportedMultiTags.0 is equal to one.	Pass / Fail (Section 3.6.6.2.4)	
5	PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Full_Justified_Msg »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.3.3)	
6	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Full_Justified_Msg »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
7	For character-matrix signs, VERIFY that the left and right-most characters of the text are displayed on the sign in the left and right-most modules, respectively. For line and full matrix signs, VERIFY that the left and right-most columns of the text are displayed on the sign in the left and right-most columns of pixels.	Pass / Fail (Section 3.6.6.2.4)	
8	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

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C.3.8.12 Verify Support of Line Justification - Per Message

Test Case: 8.12	**Title:**	**Verify Support of Line Justification - Per Message**
	Description:	This test case verifies that the DMS supports line-justification that applies throughout the message.
	Variables:	Line_Justified_Msg_Tag_Msg — From the Test Plan Msg_Type — From the Test Plan Msg_Number — From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.

Step	Test Procedure	Device	Additional References
1	CONFIGURE: Determine the MULTI string of the message to be displayed to demonstrate proper support of a single line justification tag for the entire message. (e.g., per the test plan). RECORD this information as: »Line_Justified_Msg_Tag_Msg Note: The message is required to contain only one line justification tag, which is required to occur before any text. For example: "[jl4]THIS IS[nl]A TEST[np]TEST PAGE 2", results in text being right-justified on all pages and on all lines.		
2	CONFIGURE: Determine the message (e.g., from the test plan) that shall be used to display the message. RECORD this information as: »Msg_Type (the memory type used to store the message) »Msg_Number (the message number used to store the message)		
3	GET the following object(s): »dmsSupportedMultiTags.0	Pass / Fail (Section 3.5.1.2.3.4)	
4	VERIFY that Bit 6 of the RESPONSE VALUE for dmsSupportedMultiTags.0 is equal to one.	Pass / Fail (Section 3.6.6.2.4)	
5	PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Line_Justified_Msg_Tag_Msg »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.3.3)	

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6	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Line_Justified_Msg_Tag_Msg »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
7	VERIFY that the text is properly justified on each page. Refer to Section 6.4.11 (Justification – Page).	Pass / Fail (Section 3.6.6.2.4.1)	
8	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.8.13 Verify Support of Line Justification - Page-by-Page

Test Case: 8.13	**Title:**	**Verify Support of Line Justification - Page-by-Page**	
	Description:	This test case verifies that the DMS supports line-justification on a page-by-page basis.	
	Variables:	Line_Justified_Page_Tag_Msg	From the Test Plan
		Msg_Type	From the Test Plan
		Msg_Number	From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the MULTI string of the message to be displayed to demonstrate support of page-by-page line justifications (e.g., per the test plan). RECORD this information as: »Line_Justified_Page_Tag_Msg Note: The message is required to contain one line justification tag at the start of each page in the message. For example: "[jl4]THIS IS[nl]A TEST[np][jl2]TEST PAGE 2", results in right-justified text on the first page for all lines and left-justified text on page 2.		
2	CONFIGURE: Determine the message (e.g., from the test plan) that is intended to be used to display the message. RECORD this information as: »Msg_Type (the memory type used to store the message) »Msg_Number (the message number used to store the message)		
3	GET the following object(s): »dmsSupportedMultiTags.0	Pass / Fail (Section 3.5.1.2.3.4)	
4	VERIFY that Bit 6 of the RESPONSE VALUE for dmsSupportedMultiTags.0 is equal to one.	Pass / Fail (Section 3.6.6.2.4)	

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5	PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Line_Justified_Page_Tag_Msg »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.3.3)	
6	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Line_Justified_Page_Tag_Msg »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
7	VERIFY that the text is properly justified on each page. Refer to Section 6.4.11 (Justification – Page).	Pass / Fail (Section 3.6.6.2.4.2)	
8	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.8.14 Verify Support of Line Justification - Line-by-Line

Test Case: 8.14	**Title:**	**Verify Support of Line Justification - Line-by-Line**	
	Description:	This test case verifies that the DMS supports line-justification on a line-by-line basis.	
	Variables:	Line_Justified_Line_Tag_Msg	From the Test Plan
		Msg_Type	From the Test Plan
		Msg_Number	From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	**Test Procedure**	**Results**	**Additional References**

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1	CONFIGURE: Determine the MULTI string of the message to be displayed to demonstrate support of line-by-line line justifications (e.g., per the test plan). RECORD this information as: »Line_Justified_Line_Tag_Msg Note: The message is required to contain one line justification tag at the start of each line in the message. For example: "[jl4]THIS IS[nl][jl3]A TEST[np][jl2]TEST PAGE 2", results in right-justified text for the first line of the first page, center-justified text for the second line of the first page, and left-justified text on page 2.		
2	CONFIGURE: Determine the message (e.g., from the test plan) that is intended to be used to display the message. RECORD this information as: »Msg_Type (the memory type used to store the message) »Msg_Number (the message number used to store the message)		
3	GET the following object(s): »dmsSupportedMultiTags.0	Pass / Fail (Section 3.5.1.2.3.4)	
4	VERIFY that Bit 6 of the RESPONSE VALUE for dmsSupportedMultiTags.0 is equal to one.	Pass / Fail (Section 3.6.6.2.4)	
5	PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Line_Justified_Line_Tag_Msg »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.3.3)	
6	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Line_Justified_Line_Tag_Msg »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
7	VERIFY that the text is properly justified on each line of all pages.	Pass / Fail (Section 3.6.6.2.4.3)	
8	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

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C.3.8.15 Verify Support of a Color Combination per Message

Test Case: 8.15	**Title:**	**Verify Support of a Color Combination per Message**
	Description:	This test case verifies that the DMS supports MULTI strings that specify a single color combination for all pages of the message.
	Variables:	Color_Msg_Tag_Msg — From the Test Plan Msg_Type — From the Test Plan Msg_Number — From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the MULTI string of the message to be displayed to demonstrate support for explicitly defined color combinations for the entire message (e.g., per the test plan). RECORD this information as: »Color_Msg_Tag_Msg Note: The MULTI string is required to contain color tags at the start of the MULTI string. For example: "[cb9][cf0]THIS IS A TEST"		
2	CONFIGURE: Determine the message (e.g., from the test plan) that shall be used to display the message. RECORD this information as: »Msg_Type (the memory type used to store the message) »Msg_Number (the message number used to store the message)		
3	GET the following object(s): »dmsSupportedMultiTags.0	Pass / Fail (Section 3.5.1.2.3.4)	
4	VERIFY that Bit 0 of the RESPONSE VALUE for dmsSupportedMultiTags.0 is equal to one.	Pass / Fail (Section 3.6.6.2.5.1)	
5	VERIFY that Bit 1 of the RESPONSE VALUE for dmsSupportedMultiTags.0 is equal to one.	Pass / Fail (Section 3.6.6.2.5.1)	
6	PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Color_Msg_Tag_Msg »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.3.3)	

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7	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Color_Msg_Tag_Msg »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
8	VERIFY that the background of the message is uniformly displayed using the color selected for the background, and the text of the message is uniformly displayed using the color selected for the foreground.	Pass / Fail (Section 3.6.6.2.5.1)	
9	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.8.16 Verify Support of a Color Combination per Page

Test Case: 8.16	**Title:**	**Verify Support of a Color Combination per Page**	
	Description:	This test case verifies that the DMS supports MULTI strings that specify a specific color combination for each page of the message.	
	Variables:	Color_Page_Tag_Msg	From the Test Plan
		Msg_Type	From the Test Plan
		Msg_Number	From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the MULTI string of the message to be displayed to demonstrate support for explicitly defined color combinations for each page of the message (e.g., per the test plan). RECORD this information as: »Color_Page_Tag_Msg Note: The MULTI string is required to contain color tags at the start of each page of the MULTI string. EXAMPLES: colorClassic: "[cb9][cf0]THIS IS A TEST - 1[np][cb0][cf9]THIS IS A TEST - 2" "[pb9][cf0]THIS IS A TEST - 1[np][pb0][cf9]THIS IS A TEST - 2" monochrome1Bit: "[pb1][cf0]THIS IS A TEST - 1[np][pb0][cf1]THIS IS A TEST - 2" monochrome8Bit: "[pb100][cf0]THIS IS A TEST - 1[np][pb0][cf100]THIS IS A TEST - 2" color24bit: "[pb0,0,255][cf255,0,0]THIS IS A TEST – 1[np][pb50,50,50][cf200,200,200]THIS IS A TEST - 2"		

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2	CONFIGURE: Determine the message (e.g., from the test plan) that shall be used to display the message. RECORD this information as: »Msg_Type (the memory type used to store the message) »Msg_Number (the message number used to store the message)		
3	GET the following object(s): »dmsSupportedMultiTags.0	Pass / Fail (Section 3.5.1.2.3.4)	
4	VERIFY that Bit 0 of the RESPONSE VALUE for dmsSupportedMultiTags.0 is equal to one.	Pass / Fail (Section 3.6.6.2.5.2)	
5	VERIFY that Bit 1 of the RESPONSE VALUE for dmsSupportedMultiTags.0 is equal to one.	Pass / Fail (Section 3.6.6.2.5.2)	
6	VERIFY that Bit 29 of the RESPONSE VALUE for dmsSupportedMultiTags.0 is equal to one.	Pass / Fail (Section 3.6.6.2.5.2)	
7	PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Color_Page_Tag_Msg »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.3.3)	
8	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Color_Page_Tag_Msg »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
9	For each page, VERIFY that the background of the message is uniformly displayed using the color selected for the background, and the text of the message is uniformly displayed using the color selected for the foreground.	Pass / Fail (Section 3.6.6.2.5.2)	
10	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.8.17 Verify Support of a Color Combination per Character

Test Case: 8.17	**Title:**	**Verify Support of a Color Combination per Character**
	Description:	This test case verifies that the DMS supports MULTI strings that specify a unique color combination for each character of the message.

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	Variables:	Color_Char_Tag_Msg	From the Test Plan
		Msg_Type	From the Test Plan
		Msg_Number	From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the MULTI string of the message to be displayed to demonstrate support for explicitly defined color combinations for each character within the message (e.g., per the test plan). RECORD this information as: »Color_Char_Tag_Msg Note: The MULTI string is required to contain color tags prior to each character of the MULTI string. The particular area of the sign that is to be displayed using the background color is not clearly defined by the standard. For this reason, the color rectangle tag was implemented in Version 2. For example: "[cb9][cf0]T[cb0][cf9]H[cb9][cf0]I[cb0][cf9]S [cb9][cf0] [cb0][cf9]I[cb9][cf0]S[cb0][cf9] [cb9][cf0]A [cb0][cf9] [cb9][cf0]T[cb0][cf9]E[cb9][cf0]S[cb0][cf9]T"		
2	CONFIGURE: Determine the message (e.g., from the test plan) that shall be used to display the message. RECORD this information as: »Msg_Type (the memory type used to store the message) »Msg_Number (the message number used to store the message)		
3	GET the following object(s): »dmsSupportedMultiTags.0	Pass / Fail (Section 3.5.1.2.3.4)	
4	VERIFY that Bit 0 of the RESPONSE VALUE for dmsSupportedMultiTags.0 is equal to one.	Pass / Fail (Section 3.6.6.2.5.3)	
5	VERIFY that Bit 1 of the RESPONSE VALUE for dmsSupportedMultiTags.0 is equal to one.	Pass / Fail (Section 3.6.6.2.5.3)	
6	PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Color_Char_Tag_Msg »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.3.3)	

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7	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Color_Char_Tag_Msg »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
8	For each character, VERIFY that the background of the message is uniformly displayed using the color selected for the background, and the text of the message is uniformly displayed using the color selected for the foreground. Note: NTCIP 1203 v01 does not define the extent of the area surrounding a character to which the background color is to be applied. This was corrected in Version 2 by means of the Page Background Color and Color Rectangle MULTI tags.	Pass / Fail (Section 3.6.6.2.5.3)	
9	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.8.18 Verify Support of a Color Rectangle

Test Case: 8.18	**Title:**	**Verify Support of a Color Rectangle**	
	Description:	This test case verifies that the DMS supports MULTI strings that include a color rectangle	
	Variables:	Color_Rect_Tag_Msg	From the Test Plan
		Msg_Type	From the Test Plan
		Msg_Number	From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the MULTI string of the message to be displayed to demonstrate support for color rectangles (e.g., per the test plan). RECORD this information as: »Color_Rect_Tag_Msg Note: The MULTI string is required to contain multiple instances of the color rectangle tag, but the color rectangles is required to not overlap, in accordance with the color scheme supported by the sign. EXAMPLES: colorClassic: "[cr1,1,18,25,7][cr19,1,80,25,0]THIS IS A TEST" monochrome1Bit: “[cr5,5,15,20,1][cr20,5,15,20,1][cf0]THIS IS A TEST” monochrome8Bit:		

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	"[cr5,5,15,20,25][cr20,5,15,20,50][cf0]THIS IS A TEST" color24bit: "[cr5,5,15,20,255,0,0][cr20,5,15,20,0,255,0][cf0,0,255]THIS IS A TEST"		
2	CONFIGURE: Determine the message (e.g., from the test plan) that shall be used to display the message. RECORD this information as: »Msg_Type (the memory type used to store the message) »Msg_Number (the message number used to store the message)		
3	GET the following object(s): »dmsSupportedMultiTags.0	Pass / Fail (Section 3.5.1.2.3.4)	
4	VERIFY that Bit 28 of the RESPONSE VALUE for dmsSupportedMultiTags.0 is equal to one.	Pass / Fail (Section 3.6.6.2.5.4)	
5	PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Color_Rect_Tag_Msg »Msg_Owner = "OWNER" »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.3.3)	
6	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Color_Rect_Tag_Msg »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
7	VERIFY that the color rectangles and text are displayed in accordance with the rules given in Section 6.4.4 (Color Rectangle), and in Section 6.4.18 (Overlaying Graphics, Text Rectangles and Color Rectangles).	Pass / Fail (Section 3.6.6.2.5.4)	
8	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.8.19 Verify Support of a Color Rectangle with Overlap

Test Case: 8.19	**Title:**	**Verify Support of a Color Rectangle with Overlap**	
	Description:	This test case verifies that the DMS supports MULTI strings that include color rectangles that overlap	
	Variables:	Color_Rect_Over_Tag_Msg	From the Test Plan
		Msg_Type	From the Test Plan

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		Msg_Number	From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the MULTI string of the message to be displayed to demonstrate support for overlapping color rectangles (e.g., per the test plan). RECORD this information as: »Color_Rect_Over_Tag_Msg Note: The MULTI string is required to contain multiple instances of the color rectangle tag that overlap with one another to ensure that the last command displays on top. EXAMPLES: colorClassic: "[cr1,1,18,25,7][cr10,1,89,20,0]THIS IS A TEST" monochrome1Bit: “[cr1,1,25,25,1][cr5,5,15,15,0][cf1]THIS IS A TEST” monochrome8Bit: “[cr1,1,25,25,25][cr5,5,15,15,50][cf100]THIS IS A TEST” color24bit: “[cr1,1,18,25,255,0,0][cr10,1,89,20,0,255,0][cf0,0,255]THIS IS A TEST”		
2	CONFIGURE: Determine the message (e.g., from the test plan) that shall be used to display the message. RECORD this information as: »Msg_Type (the memory type used to store the message) »Msg_Number (the message number used to store the message)		
3	PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Color_Rect_Over_Tag_Msg »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.3.3)	
4	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Color_Rect_Over_Tag_Msg »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
5	VERIFY that the color rectangles and text are displayed in accordance with the rules given in Section 6.4.18 (Overlaying Graphics, Text Rectangles and Color Rectangles).	Pass / Fail (Section 3.6.6.2.5.4)	

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6	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.8.20 Verify Support of One Font per Message

Test Case: 8.20	**Title:**	**Verify Support of One Font per Message**
	Description:	This test case verifies that the DMS supports MULTI strings that specify a single font for all pages of the message.
	Variables:	Font_Msg_Tag_Msg — From the Test Plan Msg_Type — From the Test Plan Msg_Number — From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the MULTI string of the message to be displayed to demonstrate support for an explicitly defined font for the entire message (e.g., per the test plan). RECORD this information as: »Font_Msg_Tag_Msg Note: The MULTI string is required to contain a font tag at the start of the MULTI string. For example: "[fo2]THIS IS A TEST"		
2	CONFIGURE: Determine the message (e.g., from the test plan) that shall be used to display the message. RECORD this information as: »Msg_Type (the memory type used to store the message) »Msg_Number (the message number used to store the message)		
3	GET the following object(s): »dmsSupportedMultiTags.0	Pass / Fail (Section 3.5.1.2.3.4)	
4	VERIFY that Bit 3 of the RESPONSE VALUE for dmsSupportedMultiTags.0 is equal to one.	Pass / Fail (Section 3.5.1.2.3.4)	
5	PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Font_Msg_Tag_Msg »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.3.3)	

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6	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Font_Msg_Tag_Msg »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
7	VERIFY that the message is displayed using the selected font.	Pass / Fail (Section 3.6.6.2.6.1)	
8	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.8.21 Verify Support of One Font per Page

Test Case: 8.21	**Title:**	**Verify Support of One Font per Page**	
	Description:	This test case verifies that the DMS supports MULTI strings that specify a specific font for each page of the message.	
	Variables:	Font_Page_Tag_Msg	From the Test Plan
		Msg_Type	From the Test Plan
		Msg_Number	From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the MULTI string of the message to be displayed to demonstrate support for explicitly defined fonts for each page of the message (e.g., per the test plan). RECORD this information as: »Font_Page_Tag_Msg Note: The MULTI string is required to contain font tags at the start of each page of the MULTI string. For example: "[fo2]THIS IS A TEST - 1[np][fo1]THIS IS A TEST - 2"		
2	CONFIGURE: Determine the message (e.g., from the test plan) that shall be used to display the message. RECORD this information as: »Msg_Type (the memory type used to store the message) »Msg_Number (the message number used to store the message)		
3	GET the following object(s): »dmsSupportedMultiTags.0	Pass / Fail (Section 3.5.1.2.3.4)	
4	VERIFY that Bit 3 of the RESPONSE VALUE for dmsSupportedMultiTags.0 is equal to one.	Pass / Fail (Section 3.5.1.2.3.4)	

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5	PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Font_Page_Tag_Msg »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.3.3)	
6	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Font_Page_Tag_Msg »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
7	For each page, VERIFY that the message is displayed using the selected font.	Pass / Fail (Section 3.6.6.2.6.2)	
8	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.8.22 Verify Support of a Font per Character

Test Case: 8.22	**Title:**	**Verify Support of a Font per Character**	
	Description:	This test case verifies that the DMS supports MULTI strings that specify a unique font for each character of the message.	
	Variables:	Font_Char_Tag_Msg	From the Test Plan
		Msg_Type	From the Test Plan
		Msg_Number	From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

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Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the MULTI string of the message to be displayed to demonstrate support for explicitly defined fonts for each (or at least many adjacent) character(s) within the message (e.g., per the test plan). RECORD this information as: »Font_Char_Tag_Msg Note: The MULTI string is required to contain font tags prior to each character of the MULTI string. For example: "[fo1]T[fo2]H[fo1]I[fo2]S[fo1] IS A TEST"		
2	CONFIGURE: Determine the message (e.g., from the test plan) that shall be used to display the message. RECORD this information as: »Msg_Type (the memory type used to store the message) »Msg_Number (the message number used to store the message)		
3	GET the following object(s): »dmsSupportedMultiTags.0	Pass / Fail (Section 3.5.1.2.3.4)	
4	VERIFY that Bit 3 of the RESPONSE VALUE for dmsSupportedMultiTags.0 is equal to one.	Pass / Fail (Section 3.5.1.2.3.4)	
5	PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Font_Char_Tag_Msg »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.3.3)	
6	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Font_Page_Tag_Msg »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
7	For each character, VERIFY that the text is displayed using the selected font.	Pass / Fail (Section 3.6.6.2.6.3)	
8	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.8.23 Verify Support of Font Reference with ID

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Test Case: 8.23	**Title:**	**Verify Support of Font Reference with ID**
	Description:	This test case verifies that the DMS supports MULTI strings that use a font tag with the CRC value.
	Variables:	Font_CRC_Tag_Msg — From the Test Plan Test_Font — From the Test Plan Msg_Type — From the Test Plan Msg_Number — From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the number of a valid font to be used in this test. RECORD this information as: »Test_Font		
2	GET the following object(s): »dmsSupportedMultiTags.0	Pass / Fail (Section 3.5.1.2.3.4)	
3	VERIFY that Bit 3 of the RESPONSE VALUE for dmsSupportedMultiTags.0 is equal to one.	Pass / Fail (Section 3.5.1.2.3.4)	
4	GET the following object(s): »fontStatus.Test_Font	Pass / Fail (Section 3.5.1.3.4)	Section 4.2.2.1 Step b
5	SET-UP: VERIFY that the RESPONSE VALUE for fontStatus.Test_Font is equal to 'permanent', 'readyForUse', 'inUse' or 'unmanaged'.		
6	GET the following object(s): »fontVersionID.Test_Font	Pass / Fail (Section 3.5.1.3.4)	Section 4.2.2.1 Step c
7	Determine the hexadecimal representation of the RESPONSE VALUE. RECORD this information as: »Hex_CRC		
8	Calculate the MULTI string containing a font tag for the Test_Font, including its CRC value, of the format [fox,cccc]. RECORD this information as: »Font_CRC_Tag_Msg		
9	CONFIGURE: Determine the message (e.g., from the test plan) that shall be used to display the message. RECORD this information as: »Msg_Type (the memory type used to store the message) »Msg_Number (the message number used to store the message)		

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10	PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Font_CRC_Tag_Msg »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.3.3)	
11	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Font_Page_Tag_Msg »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
12	VERIFY that the message is displayed using the selected font.	Pass / Fail	
13	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.8.24 Verify Rejection of a Font with an Incorrect ID

Test Case: 8.24	**Title:**	**Verify Rejection of a Font with an Incorrect ID**	
	Description:	This test case verifies that the DMS properly rejects MULTI strings that use a font tag with the incorrect CRC value.	
	Variables:	Test_Font	From the Test Plan
		Font_Incorrect_CRC_Tag_Msg	From the Test Plan
		Msg_Type	From the Test Plan
		Msg_Number	From the Test Plan
		Font_Error_Pos_Min	From the Test Plan
		Font_Error_Pos_Max	From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

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Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the number of a valid font to be used in this test. RECORD this information as: »Test_Font		
2	GET the following object(s): »dmsSupportedMultiTags.0	Pass / Fail (Section 3.5.1.2.3.4)	
3	VERIFY that Bit 3 of the RESPONSE VALUE for dmsSupportedMultiTags.0 is equal to one.	Pass / Fail (Section 3.5.1.2.3.4)	
4	GET the following object(s): »fontStatus.Test_Font	Pass / Fail (Section 3.5.1.3.4)	
5	SET-UP: VERIFY that the RESPONSE VALUE for fontStatus.Test_Font is equal to 'permanent', 'readyForUse', 'inUse' or ‘unmanaged’.		
6	GET the following object(s): »fontVersionID.Test_Font	Pass / Fail (Section 3.5.1.3.4)	
7	Determine the hexadecimal representation of the RESPONSE VALUE. RECORD this information as: »Hex_CRC		
8	Calculate the MULTI string containing a font tag of the format [fox,cccc] for the Test_Font, where the fontVersionID does NOT equal Hex_CRC. RECORD this information as: »Font_Incorrect_CRC_Tag_Msg		
9	CONFIGURE: Determine the message (e.g., from the test plan) that shall be used to display the message. RECORD this information as: »Msg_Type (the memory type used to store the message) »Msg_Number (the message number used to store the message)		
10	Determine the first and last positions that the sign may report a MULTI error. RECORD this information as: »Font_Error_Pos_Min »Font_Error_Pos_Max		
11	PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Font_Incorrect_CRC_Tag_Msg »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 5 (syntaxMULTI) »Expected_Multi_Error_Code = 13 (fontVersionID) »Expected_Multi_Error_Pos_Min = Font_Error_Pos_Min »Expected_Multi_Error_Pos_Max = Font_Error_Pos_Max	Pass / Fail (Section 3.5.2.3.3.3)	
12	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

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C.3.8.25 Verify Support of Moving Text (Circular Left)

Test Case: 8.25	**Title:**	**Verify Support of Moving Text (Circular Left)**	
	Description:	This test case verifies that the DMS allows a message to be defined with circular left moving text.	
	Variables:	Circle_Left_Tag_Msg	From the Test Plan
		Msg_Type	From the Test Plan
		Msg_Number	From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the MULTI string of the message (e.g., per the test plan) to be displayed that includes a circular left moving text tag. RECORD this information as: »Circle_Left_Tag_Msg Note: An example of a MULTI string for circular left moving text would be [mvcl50,1,5,THIS IS A TEST], where the window is 50 pixels wide, the text moves one column per step, and the rate is 0.5 seconds per step.		
2	CONFIGURE: Determine the message (e.g., from the test plan) that shall be used to display the message. RECORD this information as: »Msg_Type (the memory type used to store the message) »Msg_Number (the message number used to store the message)		
3	GET the following object(s): »dmsSupportedMultiTags.0	Pass / Fail (Section 3.5.1.2.3.4)	
4	VERIFY that Bit 9 of the RESPONSE VALUE for dmsSupportedMultiTags.0 is equal to one.	Pass / Fail (Section 3.6.6.2.7)	
5	PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Circle_Left_Tag_Msg »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.3.3)	
6	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Circle_Left_Tag_Msg »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	

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7	VERIFY per Section 6.4.13 (Moving Text Tag) that the leftmost column of the text is initially displayed in the leftmost column of the moving text window and the character spacing is applied between the apparent multiple copies of text. VERIFY that the text is moved to the left according to the number of steps selected, and at the rate selected.	Pass / Fail (Section 3.6.6.2.7)	
8	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.8.26 Verify Support of Moving Text (Circular Right)

Test Case: 8.26	**Title:**	**Verify Support of Moving Text (Circular Right)**	
	Description:	This test case verifies that the DMS allows a message to be defined with circular right moving text.	
	Variables:	Circle_Right_Tag_Msg	From the Test Plan
		Msg_Type	From the Test Plan
		Msg_Number	From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the MULTI string of the message (e.g., per the test plan) to be displayed that includes a circular right moving text tag. RECORD this information as: »Circle_Right_Tag_Msg Note: An example of a MULTI string for circular right moving text would be [mvcr50,1,5,THIS IS A TEST], where the window is 50 pixels wide, the text moves one column per step, and the rate is 0.5 seconds per step.		
2	CONFIGURE: Determine the message (e.g., from the test plan) that shall be used to display the message. RECORD this information as: »Msg_Type (the memory type used to store the message) »Msg_Number (the message number used to store the message)		
3	GET the following object(s): »dmsSupportedMultiTags.0	Pass / Fail (Section 3.5.1.2.3.4)	
4	VERIFY that Bit 9 of the RESPONSE VALUE for dmsSupportedMultiTags.0 is equal to one.	Pass / Fail (Section 3.6.6.2.7)	

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5	PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Circle_Right_Tag_Msg »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.3.3)	
6	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Circle_Right_Tag_Msg »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
7	VERIFY per Section 6.4.13 (Moving Text Tag) that the rightmost column of the text is initially displayed in the rightmost column of the moving text window and the character spacing is applied between the apparent multiple copies of text. VERIFY that the text is moved to the right according to the number of steps selected, and at the rate selected.	Pass / Fail (Section 3.6.6.2.7)	
8	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

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C.3.8.27 Verify Support of Moving Text (Linear Left)

Test Case: 8.27	**Title:**	**Verify Support of Moving Text (Linear Left)**	
	Description:	This test case verifies that the DMS allows a message to be defined with linear left moving text.	
	Variables:	Linear_Left_Tag_Msg	From the Test Plan
		Msg_Type	From the Test Plan
		Msg_Number	From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the MULTI string of the message (e.g., per the test plan) to be displayed that includes a linear left moving text tag with no delay. RECORD this information as: »Linear_Left_Tag_Msg Note: An example of a MULTI string for linear left moving text would be [mvll50,1,5,THIS IS A TEST], where the window is 50 pixels wide, the text moves one column per step, and the rate is 0.5 seconds per step.		
2	CONFIGURE: Determine the message (e.g., from the test plan) that shall be used to display the message. RECORD this information as: »Msg_Type (the memory type used to store the message) »Msg_Number (the message number used to store the message)		
3	GET the following object(s): »dmsSupportedMultiTags.0	Pass / Fail (Section 3.5.1.2.3.4)	
4	VERIFY that Bit 9 of the RESPONSE VALUE for dmsSupportedMultiTags.0 is equal to one.	Pass / Fail (Section 3.6.6.2.7)	
5	PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Linear_Left_Tag_Msg »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.3.3)	
6	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Linear_Left_Tag_Msg »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	

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7	VERIFY per Section 6.4.13 (Moving Text Tag) that the leftmost column of the text is initially displayed in the leftmost column of the moving text window. VERIFY that the text is moved to the left according to the number of steps selected, at the rate selected, and continues until the rightmost column of the text is displayed, after which the sequence repeats from the beginning.	Pass / Fail (Section 3.6.6.2.7)	
8	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.8.28 Verify Support of Moving Text (Linear Right)

Test Case: 8.28	**Title:**	**Verify Support of Moving Text (Linear Right)**	
	Description:	This test case verifies that the DMS allows a message to be defined with linear right moving text.	
	Variables:	Linear_Right_Tag_Msg	From the Test Plan
		Msg_Type	From the Test Plan
		Msg_Number	From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

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Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the MULTI string of the message (e.g., per the test plan) to be displayed that includes a linear right moving text tag with no delay. RECORD this information as: »Linear_Right_Tag_Msg Note: An example of a MULTI string for linear right moving text would be [mvlr50,1,5,THIS IS A TEST], where the window is 50 pixels wide, the text moves one column per step, and the rate is 0.5 seconds per step.		
2	CONFIGURE: Determine the message (e.g., from the test plan) that shall be used to display the message. RECORD this information as: »Msg_Type (the memory type used to store the message) »Msg_Number (the message number used to store the message)		
3	GET the following object(s): »dmsSupportedMultiTags.0	Pass / Fail (Section 3.5.1.2.3.4)	
4	VERIFY that Bit 9 of the RESPONSE VALUE for dmsSupportedMultiTags.0 is equal to one.	Pass / Fail (Section 3.6.6.2.7)	
5	PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Linear_Right_Tag_Msg »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.3.3)	
6	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Linear_Right_Tag_Msg »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
7	VERIFY per Section 6.4.13 (Moving Text Tag) that the rightmost column of the text is initially displayed in the rightmost column of the moving text window. VERIFY that the text is moved to the right according to the number of steps selected, at the rate selected, and continues until the leftmost column of the text is displayed, after which the sequence repeats from the beginning.	Pass / Fail (Section 3.6.6.2.7)	
8	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

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C.3.8.29 Verify Support of Moving Text (Linear with Pause)

Test Case: 8.29	**Title:**	**Verify Support of Moving Text (Linear with Pause)**
	Description:	This test case verifies that the DMS allows a message to be defined with linear left moving text including a pause.
	Variables:	Move_Pause_Tag_Msg — From the Test Plan Msg_Type — From the Test Plan Msg_Number — From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the MULTI string of the message to be displayed that includes a linear left or right moving text tag with delay. RECORD this information as: »Move_Pause_Tag_Msg Note: An example of a MULTI string for linear left moving text with a delay would be [mvl5l50,1,5,THIS IS A TEST], where the delay between traverses is 0.5 seconds, the window is 50 pixels wide, the text moves one column per step, and the rate is 0.5 seconds per step.		
2	CONFIGURE: Determine the message (e.g., from the test plan) that shall be used to display the message. RECORD this information as: »Msg_Type (the memory type used to store the message) »Msg_Number (the message number used to store the message)		
3	GET the following object(s): »dmsSupportedMultiTags.0	Pass / Fail (Section 3.5.1.2.3.4)	
4	VERIFY that Bit 9 of the RESPONSE VALUE for dmsSupportedMultiTags.0 is equal to one.	Pass / Fail (Section 3.6.6.2.7)	
5	PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Move_Pause_Tag_Msg »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.3.3)	
6	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Move_Pause_Tag_Msg »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	

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7	VERIFY that the text moves linear left or right, per the selected type, in accordance with Section 6.4.13 (Moving Text Tag), and that the text is displayed for the selected delay period when the final column of text is displayed before the sequence repeats from the beginning.		
8	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.8.30 Verify Support of Character Spacing

Test Case: 8.30	**Title:**	**Verify Support of Character Spacing**	
	Description:	This test case verifies that the DMS allows a message to be defined with the character spacing tag.	
	Variables:	Char_Spacing_Tag_Msg	From the Test Plan
		Msg_Type	From the Test Plan
		Msg_Number	From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the MULTI string of the message to be displayed to demonstrate support for the character spacing and end character spacing tags (e.g., per the test plan). RECORD this information as: »Char_Spacing_Tag_Msg Note: For example: "THIS [sc2]IS A [/sc]TEST".		
2	CONFIGURE: Determine the message (e.g., from the test plan) that shall be used to display the message. RECORD this information as: »Msg_Type (the memory type used to store the message) »Msg_Number (the message number used to store the message)		
3	GET the following object(s): »dmsSupportedMultiTags.0	Pass / Fail (Section 3.5.1.2.3.4)	
4	VERIFY that Bit 13 of the RESPONSE VALUE for dmsSupportedMultiTags.0 is equal to one.	Pass / Fail (Section 3.6.6.2.8)	
5	PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Char_Spacing_Tag_Msg »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.3.3)	

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6	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Char_Spacing_Tag_Msg »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
7	VERIFY that the message is displayed in accordance with Section 6.4.17 (Spacing – Character).	Pass / Fail (Section 3.6.6.2.8)	
8	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.8.31 Verify Support of Customized Page Display Times

Test Case: 8.31	**Title:**	**Verify Support of Customized Page Display Times**	
	Description:	This test case verifies that the DMS allows a message to be defined with customized page display times.	
	Variables:	Page_Time_Tag_Msg	From the Test Plan
		Msg_Type	From the Test Plan
		Msg_Number	From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the MULTI string of the message to be displayed to demonstrate support for page time tag (e.g., per the test plan). RECORD this information as: »Page_Time_Tag_Msg Note: For example: "[pt30o5]THIS IS[np][pt20o10]A TEST".		
2	CONFIGURE: Determine the message (e.g., from the test plan) that shall be used to display the message. RECORD this information as: »Msg_Type (the memory type used to store the message) »Msg_Number (the message number used to store the message)		
3	GET the following object(s): »dmsSupportedMultiTags.0	Pass / Fail (Section 3.5.1.2.3.4)	
4	VERIFY that Bit 12 of the RESPONSE VALUE for dmsSupportedMultiTags.0 is equal to one.	Pass / Fail (Section 3.6.6.2.9)	

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5	PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Page_Time_Tag_Msg »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.3.3)	
6	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Page_Time_Tag_Msg »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
7	VERIFY that each page of the the message is displayed with the page timing selected.	Pass / Fail (3.6.6.2.9)	
8	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.8.32 Verify Support of Customized Flashing Times (On First)

Test Case: 8.32	**Title:**	**Verify Support of Customized Flashing Times (On First)**	
	Description:	This test case verifies that the DMS allows a message to be defined with customized flashing times with the flashing text starting in the on position.	
	Variables:	Flash_Time_On_Tag_Msg	From the Test Plan
		Msg_Type	From the Test Plan
		Msg_Number	From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the MULTI string of the message to be displayed to demonstrate support for flashing text with customized flash times with flash on occurring first, including the support of the end flash tag (e.g., per the test plan). RECORD this information as: »Flash_Time_On_Tag_Msg Note: For example: "THIS [flt10o5]IS A [/fl]TEST".		

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2	CONFIGURE: Determine the message (e.g., from the test plan) that shall be used to display the message. RECORD this information as: »Msg_Type (the memory type used to store the message) »Msg_Number (the message number used to store the message)		
3	GET the following object(s): »dmsSupportedMultiTags.0	Pass / Fail (Section 3.5.1.2.3.4)	
4	VERIFY that Bit 2 of the RESPONSE VALUE for dmsSupportedMultiTags.0 is equal to one.	Pass / Fail (Section 3.6.6.2.10)	
5	PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Flash_Time_On_Tag_Msg »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.3.3)	
6	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Flash_Time_On_Tag_Msg »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
7	VERIFY that the message is displayed, with the text enclosed between the flashing tags initially displayed at the beginning of the page time, and then flashed in accordance with the selected flash on and off times.	Pass / Fail (Section 3.6.6.2.11)	
8	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.8.33 Verify Support of Customized Flashing Times (Off First)

Test Case: 8.33	**Title:**	**Verify Support of Customized Flashing Times (Off First)**	
	Description:	This test case verifies that the DMS allows a message to be defined with customized flashing times with the flashing text starting in the off position.	
	Variables:	Flash_Time_Off_Tag_Msg	From the Test Plan
		Msg_Type	From the Test Plan
		Msg_Number	From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

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Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the MULTI string of the message to be displayed to demonstrate support for flashing text with customized flash times with flash off occurring first, including the support of the end flash tag (e.g., per the test plan). RECORD this information as: »Flash_Time_Off_Tag_Msg Note: For example: "THIS [flo5t10]IS A [/fl]TEST".		
2	CONFIGURE: Determine the message (e.g., from the test plan) that shall be used to display the message. RECORD this information as: »Msg_Type (the memory type used to store the message) »Msg_Number (the message number used to store the message)		
3	GET the following object(s): »dmsSupportedMultiTags.0	Pass / Fail (Section 3.5.1.2.3.4)	
4	VERIFY that Bit 2 of the RESPONSE VALUE for dmsSupportedMultiTags.0 is equal to one.	Pass / Fail (Section 3.6.6.2.10)	
5	PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Flash_Time_Off_Tag_Msg »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.3.3)	
6	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Flash_Time_Off_Tag_Msg »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
7	VERIFY that the message is displayed, with the text enclosed between the flashing tags initially NOT displayed at the beginning of the page time, and then flashed in accordance with the selected flash on and off times.	Pass / Fail (Section 3.6.6.2.11)	
8	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

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C.3.8.34 Verify Support of Page-by-Page Flashing

Test Case: 8.34	**Title:**	**Verify Support of Page-by-Page Flashing**
	Description:	This test case verifies that the DMS allows a message to be defined with page-by-page flashing (different flashing parameters for each page of a message).
	Variables:	Flash_Page_Tag_Msg — From the Test Plan Msg_Type — From the Test Plan Msg_Number — From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the MULTI string of the message to be displayed to demonstrate support for flashing text on a page-by-page basis (e.g., per the test plan). RECORD this information as: »Flash_Page_Tag_Msg Note: The MULTI string is required to contain a font tag at the start of at least one page and an end flash tag at the end of a subsequent page with at least one page not included within the tag-pair. For example: "[fl]THIS IS[np]A TEST[/fl][np]THIS IS A TEST". The flash time is required to be less than the page display time, so as to allow a full flash sequence to display before the page time expires.		
2	CONFIGURE: Determine the message (e.g., from the test plan) that shall be used to display the message. RECORD this information as: »Msg_Type (the memory type used to store the message) »Msg_Number (the message number used to store the message)		
3	GET the following object(s): »dmsSupportedMultiTags.0	Pass / Fail (Section 3.5.1.2.3.4)	
4	VERIFY that Bit 2 of the RESPONSE VALUE for dmsSupportedMultiTags.0 is equal to one.	Pass / Fail (Section 3.6.6.2.10)	
5	PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Flash_Page_Tag_Msg »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.3.3)	

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6	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Flash_Page_Tag_Msg »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
7	VERIFY that the message is displayed, with the text of the pages that are enclosed between the flashing tags flashing in accordance with the selected flash on and off times.	Pass / Fail (Section 3.6.6.2.10.3)	
8	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.8.35 Verify Support of Line-by-Line Flashing

Test Case: 8.35	**Title:**	**Verify Support of Line-by-Line Flashing**	
	Description:	This test case verifies that the DMS allows a message to be defined with line-by-line flashing (different flashing parameters for each line of a message).	
	Variables:	Flash_Line_Tag_Msg	From the Test Plan
		Msg_Type	From the Test Plan
		Msg_Number	From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the MULTI string of the message to be displayed to demonstrate support for line-by-line flashing commands (e.g., per the test plan). RECORD this information as: »Flash_Line_Tag_Msg Note: The MULTI string is required to encapsulate some of the lines of the MULTI string in flash tags. For example: "[fl2]THIS IS[nl]A TEST[/fl][nl]THIS IS A TEST"		
2	CONFIGURE: Determine the message (e.g., from the test plan) that shall be used to display the message. RECORD this information as: »Msg_Type (the memory type used to store the message) »Msg_Number (the message number used to store the message)		
3	GET the following object(s): »dmsSupportedMultiTags.0	Pass / Fail (Section 3.5.1.2.3.4)	
4	VERIFY that Bit 2 of the RESPONSE VALUE for dmsSupportedMultiTags.0 is equal to one.	Pass / Fail (Section 3.6.6.2.10)	

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5	PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Flash_Line_Tag_Msg »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.3.3)	
6	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Flash_Line_Tag_Msg »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
7	VERIFY that the message is displayed, with the lines of text that are enclosed between the flashing tags flashing in accordance with the selected flash on and off times.	Pass / Fail (Section 3.6.6.2.10.2)	
8	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.8.36 Verify Support of Character-by-Character Flashing

Test Case: 8.36	**Title:**	**Verify Support of Character-by-Character Flashing**	
	Description:	This test case verifies that the DMS allows a message to be defined with character-by-character flashing.	
	Variables:	Flash_Char_Tag_Msg	From the Test Plan
		Msg_Type	From the Test Plan
		Msg_Number	From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

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Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the MULTI string of the message to be displayed to demonstrate support for flashing commands on a character-by-character basis (e.g., per the test plan). RECORD this information as: »Flash_Char_Tag_Msg Note: The MULTI string is required to encapsulate characters that form part of words within the flash tag-pair. For example: "TH[fl]IS IS A TE[/fl]ST"		
2	CONFIGURE: Determine the message (e.g., from the test plan) that shall be used to display the message. RECORD this information as: »Msg_Type (the memory type used to store the message) »Msg_Number (the message number used to store the message)		
3	GET the following object(s): »dmsSupportedMultiTags.0	Pass / Fail (Section 3.5.1.2.3.4)	
4	VERIFY that Bit 2 of the RESPONSE VALUE for dmsSupportedMultiTags.0 is equal to one.	Pass / Fail (Section 3.6.6.2.10)	
5	PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Flash_Char_Tag_Msg »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.3.3)	
6	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Flash_Char_Tag_Msg »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
7	VERIFY that the message is displayed, with the characters that are enclosed between the flashing tags flashing in accordance with the selected flash on and off times.	Pass / Fail (Section 3.6.6.2.10.1	
8	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

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C.3.8.37 Verify Support of Hexadecimal Character

Test Case: 8.37	**Title:**	**Verify Support of Hexadecimal Character**	
	Description:	This test case verifies that the DMS allows a message to be defined with the hexadecimal MULTI tag.	
	Variables:	Hex_Tag_Msg	From the Test Plan
		Msg_Type	From the Test Plan
		Msg_Number	From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the MULTI string of the message to be displayed to demonstrate support for hexadecimal characters (e.g., per the test plan). RECORD this information as: »Hex_Tag_Msg Note: The MULTI string is required to include a hexadecimal tag. For example: "THIS IS [hc41] TEST". Ensure that the character being selected is supported by the font.		
2	CONFIGURE: Determine the message (e.g., from the test plan) that shall be used to display the message. RECORD this information as: »Msg_Type (the memory type used to store the message) »Msg_Number (the message number used to store the message)		
3	GET the following object(s): »dmsSupportedMultiTags.0	Pass / Fail (Section 3.5.1.2.3.4)	
4	VERIFY that Bit 5 of the RESPONSE VALUE for dmsSupportedMultiTags.0 is equal to one.	Pass / Fail (Section 3.6.6.2.12)	
5	PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Hex_Tag_Msg »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.3.3)	
6	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Hex_Tag_Msg »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	

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7	VERIFY that the selected character is properly displayed as part of the message.	Pass / Fail (Section 3.6.6.2.12)	
8	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.8.38 Verify Support of Graphic MULTI Tag

Test Case: 8.38	**Title:**	**Verify Support of Graphic MULTI Tag**	
	Description:	This test case verifies that the DMS allows a message to be defined with the graphic MULTI tag.	
	Variables:	Graphic_Tag_Msg	From the Test Plan
		Msg_Type	From the Test Plan
		Msg_Number	From the Test Plan
		Graphic_Num	From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the MULTI string of the message to be displayed to demonstrate support for display of a graphic (e.g., per the test plan). RECORD this information as: »Graphic_Tag_Msg Note: The MULTI string is required to include a graphic tag. For example: "[g1]"		
2	CONFIGURE: Determine the message (e.g., from the test plan) that shall be used to display the message. RECORD this information as: »Msg_Type (the memory type used to store the message) »Msg_Number (the message number used to store the message)		
3	CONFIGURE: Determine the number of the graphic referenced by the Graphic_Tag_Msg. RECORD this information as: »Graphic_Num		
4	GET the following object(s): »dmsSupportedMultiTags.0	Pass / Fail (Section 3.5.1.2.3.4)	
5	VERIFY that Bit 4 (graphic tag) of the RESPONSE VALUE for dmsSupportedMultiTags.0 is equal to one.	Pass / Fail (Section 3.6.6.2.14)	
6	PERFORM the test case labeled 'Store a Graphic Definition' (C.3.3.5) with the following parameters: »Test_Graphic_Number = Graphic_Num	Pass / Fail (Section 3.5.1.4.5)	

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7	PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Graphic_Tag_Msg »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.3.3)	
8	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Graphic_Tag_Msg »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
9	VERIFY that the graphic is displayed with the upper-leftmost pixel of the graphic in the upper-leftmost corner of the sign.	Pass / Fail (Section 3.6.6.2.14)	
10	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.8.39 Verify Support of Graphic MULTI Tag with Location

Test Case: 8.39	**Title:**	**Verify Support of Graphic MULTI Tag**	
	Description:	This test case verifies that the DMS allows a message to be defined with the graphic MULTI tag with location.	
	Variables:	Graphic_Location_Tag_Msg	From the Test Plan
		Msg_Type	From the Test Plan
		Msg_Number	From the Test Plan
		Graphic_Location_Num	From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

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Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the MULTI string of the message to be displayed to demonstrate support for display of a graphic at a specified location on the sign (e.g., per the test plan). RECORD this information as: »Graphic_Location_Tag_Msg Note: The MULTI string is required to include a graphic tag with parameters indicating the location that the graphic is to be displayed on the sign. For example: "[g1,5,10]", which results in the upper-leftmost pixel of the graphic being displayed in column 5 and row 10 of the sign.		
2	CONFIGURE: Determine the message (e.g., from the test plan) that shall be used to display the message. RECORD this information as: »Msg_Type (the memory type used to store the message) »Msg_Number (the message number used to store the message)		
3	CONFIGURE: Determine the number of the graphic referenced by the Graphic_Location_Tag_Msg. RECORD this information as: »Graphic_Location_Num		
4	GET the following object(s): »dmsSupportedMultiTags.0	Pass / Fail (Section 3.5.1.2.3.4)	
5	VERIFY that Bit 4 (graphic tag) of the RESPONSE VALUE for dmsSupportedMultiTags.0 is equal to one.	Pass / Fail (Section 3.6.6.2.14)	
6	PERFORM the test procedure labeled 'Store a Graphic Definition' (C.3.14.3) with the following parameters: »Test_Graphic_Number = Graphic_Location_Num	Pass / Fail (Section 3.5.1.4.5)	
7	PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Graphic_Location_Tag_Msg »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.3.3)	
8	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Graphic_Location_Tag_Msg »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
9	VERIFY that the graphic is displayed with the upper-leftmost pixel of the graphic in the specified row and column of the sign.	Pass / Fail (Section 3.6.6.2.14)	

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10	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.8.40 Verify Support of Graphic MULTI Tag with Location and ID

Test Case: 8.40	**Title:**	**Verify Support of Graphic MULTI Tag**	
	Description:	This test case verifies that the DMS allows a message to be defined with the graphic MULTI tag with location and verification.	
	Variables:	Graphic_ID_Num	From the Test Plan
		Msg_Type	From the Test Plan
		Msg_Number	From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the number of the graphic to be used. RECORD this information as: »Graphic_ID_Num		
2	GET the following object(s): »dmsSupportedMultiTags.0	Pass / Fail (Section 3.5.1.2.3.4)	
3	VERIFY that Bit 4 (graphic tag) of the RESPONSE VALUE for dmsSupportedMultiTags.0 is equal to one.	Pass / Fail (Section 3.6.6.2.14)	
4	PERFORM the test case labeled 'Store a Graphic Definition' (C.3.3.5) with the following parameters: »Test_Graphic_Number = Graphic_ID_Num	Pass / Fail (Section 3.5.1.4.5)	
5	GET the following object: »dmsGraphicID.Graphic_ID_Num		
6	Calculate the MULTI string containing a graphic tag of the format [gn,x,y,cccc], where n is equal to Graphic_ID_Num, and cccc is equal to the value (in hexadecimal) returned in Step 5. RECORD this information as: »Graphic_ID_Tag_Msg		
7	CONFIGURE: Determine the message (e.g., from the test plan) that shall be used to display the message. RECORD this information as: »Msg_Type (the memory type used to store the message) »Msg_Number (the message number used to store the message)		

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8	PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Graphic_ID_Tag_Msg »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.3.3)	
9	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Graphic_ID_Tag_Msg »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
10	VERIFY that the graphic is displayed with the upper-leftmost pixel of the graphic in the specified row and column of the sign.	Pass / Fail (Section 3.6.6.2.14)	
11	Calculate the MULTI string containing a graphic tag of the format [gn,x,y,cccc], where n is equal to Graphic_ID_Num, and cccc is NOT the value (in hexadecimal) returned in Step 5. RECORD this information as: »Graphic_Incorrect_ID_Tag_Msg		
12	Determine the first and last positions that the sign may report a MULTI error. RECORD this information as: »Graphic_ID_Error_Pos_Min »Graphic_ID_Error_Pos_Max		
14	PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Graphic_Incorrect_ID_Tag_Msg »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 5 (syntaxMULTI) »Expected_Multi_Error_Code = 14 (graphicID) »Expected_Multi_Error_Pos_Min = Graphic_ID_Error_Pos_Min »Expected_Multi_Error_Pos_Max = Graphic_ID_Error_Pos_Max	Pass / Fail (Section 3.5.2.3.3.3)	
15	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

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C.3.8.41 Verify Support of a Color Combination per Message – v2

Test Case: 8.41	**Title:**	**Verify Support of a Color Combination per Message – v2**
	Description:	This test case verifies that the DMS supports MULTI strings that specify a single color combination for all pages of the message using the Page Background Color tag introduced in NTCIP 1203 v2.
	Variables:	Color_Msg_Tag_v2_Msg — From the Test Plan Msg_Type — From the Test Plan Msg_Number — From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the MULTI string of the message to be displayed to demonstrate support for explicitly defined color combinations for the entire message (e.g., per the test plan). RECORD this information as: »Color_Msg_Tag_v2_Msg Note: The MULTI string is required to contain, at the start of the MULTI string, Color Foreground tags and, either, Color Background or Page Background tags, in accordance with the color scheme that the sign supports: EXAMPLES: colorClassic: "[pb9][cf0]BLACK ON AMBER" monochrome1Bit: "[pb1][cf0]INVERSE" monochrome8bit: "[pb200][cf45]DARK ON LIGHT" color24bit: "[pb0,0,255][cf255,0,0]RED ON BLUE"		
2	CONFIGURE: Determine the message (e.g., from the test plan) that shall be used to display the message. RECORD this information as: »Msg_Type (the memory type used to store the message) »Msg_Number (the message number used to store the message)		
3	GET the following object(s): »dmsSupportedMultiTags.0	Pass / Fail (Section 3.5.1.2.3.4)	
4	VERIFY that Bit 1 of the RESPONSE VALUE for dmsSupportedMultiTags.0 is equal to one.	Pass / Fail (Section 3.6.6.2.5.1)	
5	VERIFY that Bit 29 of the RESPONSE VALUE for dmsSupportedMultiTags.0 is equal to one.	Pass / Fail (Section 3.6.6.2.5.1)	
6	PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Color_Msg_Tag_v2_Msg »Msg_Owner = "OWNER" »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.3.3)	

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7	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Color_Msg_Tag_v2_Msg »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
8	VERIFY that the background of the message is uniformly displayed using the color selected for the background, and the text of the message is uniformly displayed using the color selected for the foreground.	Pass / Fail (Section 3.6.6.2.5.1)	
9	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.8.42 Verify Support of a Color Combination per Page – v2

Test Case: 8.42	**Title:**	**Verify Support of a Color Combination per Page**	
	Description:	This test case verifies that the DMS supports MULTI strings that specify a specific color combination for each page of the message using the Page Background Color tag introduced in NTCIP 1203 v2.	
	Variables:	Color_Page_Tag_v2_Msg	From the Test Plan
		Msg_Type	From the Test Plan
		Msg_Number	From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

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Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the MULTI string of the message to be displayed to demonstrate support for explicitly defined color combinations for each page of the message (e.g., per the test plan). RECORD this information as: »Color_Page_Tag_v2_Msg Note: The MULTI string is required to contain Page Background and Color Foreground tags at the start of each page of the MULTI string, in accordance with the color scheme that the sign supports: EXAMPLES: colorClassic: "[pb9][cf0]BLACK ON AMBER[np][pb0][cf9]AMBER ON BLACK" monochrome1Bit: “[pb1][cf0]INVERSE[np][pb0][cf1]NORMAL” monochrome8bit: “[pb200][cf45]DARK ON LIGHT[np][pb45][cf200]LIGHT ON DARK” color24bit: “[pb0,0,255][cf255,0,0]RED ON BLUE[np[pb255,0,0][cf0,0,255]BLUE ON RED”		
2	CONFIGURE: Determine the message (e.g., from the test plan) that shall be used to display the message. RECORD this information as: »Msg_Type (the memory type used to store the message) »Msg_Number (the message number used to store the message)		
3	GET the following object(s): »dmsSupportedMultiTags.0	Pass / Fail (Section 3.5.1.2.3.4)	
4	VERIFY that Bit 1 of the RESPONSE VALUE for dmsSupportedMultiTags.0 is equal to one.	Pass / Fail (Section 3.6.6.2.5.2)	
5	VERIFY that Bit 29 of the RESPONSE VALUE for dmsSupportedMultiTags.0 is equal to one.	Pass / Fail (Section 3.6.6.2.5.2)	
6	PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Color_Page_Tag_v2_Msg »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.3.3)	
7	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Color_Page_Tag_v2_Msg »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	

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8	For each page, VERIFY that the background of the message is uniformly displayed using the color selected for the background, and the text of the message is uniformly displayed using the color selected for the foreground.	Pass / Fail (Section 3.6.6.2.5.2)	
9	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.8.43 Verify Support of a Color Combination per Character – v2

Test Case: 8.43	**Title:**	**Verify Support of a Color Combination per Character –v2**	
	Description:	This test case verifies that the DMS supports MULTI strings that specify a unique color combination for each character of the message using the Page Background Color tag introducted in NTCIP 1203 v2.	
	Variables:	Color_Char_Tag_v2_Msg	From the Test Plan
		Msg_Type	From the Test Plan
		Msg_Number	From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the MULTI string of the message to be displayed to demonstrate support for explicitly defined color combinations for each character within the message (e.g., per the test plan). RECORD this information as: »Color_Char_Tag_v2_Msg Note: The MULTI string is required to contain Page Background tags, at a minimum, at the beginning of each page, and Color Foreground tags prior to each character of the MULTI string, in accordance with the color scheme that the sign supports: EXAMPLES: colorClassic: "[pb9][cf0]0[cf1]1[cf2]2[cf3]3[cf4]4[cf5]5[cf6]6[cf7]7[cf8]8[np][pb0][cf9]9" monochrome1Bit: "[pb1][cf0]0[cf1]1[cf0]0" monochrome8bit: "[pb25][cf0]0[cf50]50[cf100]100[cf150]150[cf200]200[cf255]255" color24bit: "[pb25,25,25][cf0,0,0]B[cf255,0,0]R[cf255,255,0]Y[cf0,255,0]G [cf0,255,255]C[cf0,0,255]B[cf255,0,255]M[cf255,255,255]W"		
2	CONFIGURE: Determine the message (e.g., from the test plan) that shall be used to display the message. RECORD this information as: »Msg_Type (the memory type used to store the message) »Msg_Number (the message number used to store the message)		
3	GET the following object(s): »dmsSupportedMultiTags.0	Pass / Fail (Section 3.5.1.2.3.4)	
4	VERIFY that Bit 0 of the RESPONSE VALUE for dmsSupportedMultiTags.0 is equal to one.	Pass / Fail (Section 3.6.6.2.5.3)	

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5	VERIFY that Bit 29 of the RESPONSE VALUE for dmsSupportedMultiTags.0 is equal to one.	Pass / Fail (Section 3.6.6.2.5.3)	
6	PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Color_Char_Tag_Msg »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.3.3)	
7	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Color_Char_Tag_Msg »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
8	For each character, VERIFY that the background of the message is uniformly displayed using the color selected for the background, and the text of the message is uniformly displayed using the color selected for the foreground. Note: NTCIP 1203 v01 does not define the extent of the area surrounding a character to which the background color is to be applied. This was corrected in Version 2 by means of the Page Background Color and Color Rectangle MULTI tags.	Pass / Fail (Section 3.6.6.2.5.3)	
9	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.8.44 Verify Support of Text Rectangles

Test Case: 8.44	**Title:**	**Verify Support of Text Rectangles**	
	Description:	This test case verifies that the DMS supports MULTI strings that specify display of text rectangles.	
	Variables:	Text Rectangle_Tag_Msg	From the Test Plan
		Msg_Type	From the Test Plan
		Msg_Number	From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

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Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the MULTI string of the message to be displayed to demonstrate support for text rectangles (e.g. per the test plan). RECORD this information as: »Text_Rectangle_Tag_Msg Note: The MULTI string is required to contain a text rectangle tag. Additional tags (e.g. line justification, page justification, color foreground, font) may be embedded in the text following the text rectangle tag in accordance with requirements of the specifying authority. EXAMPLES: "[tr1,1,50,7]TOP LINE" “[tr39,21,0,0]LR”		
2	CONFIGURE: Determine the message (e.g., from the test plan) that shall be used to display the message. RECORD this information as: »Msg_Type (the memory type used to store the message) »Msg_Number (the message number used to store the message)		
3	GET the following object(s): »dmsSupportedMultiTags.0	Pass / Fail (Section 3.5.1.2.3.4)	
4	VERIFY that Bit 27 of the RESPONSE VALUE for dmsSupportedMultiTags.0 is equal to one.	Pass / Fail (Section 3.6.6.2.5.2)	
5	PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Text_Rectangle_Tag_Msg »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.3.3)	
6	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Text_Rectangle_Tag_Msg »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
7	VERIFY that the text rectangle is located on the sign in accordance with the rules of Section 6.4.18 (Text Rectangle), and the text is justified in the text rectangle in accordance with the line and page justification tags or default values.	Pass / Fail (Section 3.6.6.2.15)	
8	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	
Test Case Results			

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Tested By:	Date Tested:	Pass / Fail
Test Case Notes:		

C.3.8.45 Verify Rejection of a Text Rectangle that is Too Large for the Sign

Test Case: 8.45	Title:	Verify Rejection of a Text Rectangle that is Too Large for the Sign	
	Description:	This test case verifies that the DMS properly rejects a MULTI string that specifies a text rectangle that is too large for the sign.	
	Variables:	Text Rectangle_Too Large_Msg	From the Test Plan
		Msg_Type	From the Test Plan
		Msg_Number	From the Test Plan
		Text_Rectangle_Too_Large_Error_Position_Min	From the Test Plan
		Text_Rectangle_Too_Large_Error_Position_Max	From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the MULTI string of the message to be displayed to demonstrate that a text rectangle that is too large for the sign is properly rejected (e.g. per the test plan). RECORD this information as: »Text_Rectangle_Too_Large_Msg Note: The MULTI string is required to contain a text rectangle tag with height and/or width parameters that are larger than the respective height and/or width of the sign. Additional tags (e.g. line justification, page justification, color foreground, font) may be embedded in the text following the text rectangle tag in accordance with requirements of the specifying authority. EXAMPLES: For a sign that is 28 pixels high by 48 pixels wide - "[tr1,1,50,7]TOO WIDE" “[tr20,20,20,10]TOO LOW”		
2	CONFIGURE: Determine the first and last positions in the MULTI string where the text rectangle error might be flagged. RECORD this information as: »Text_Rectangle_Too_Large_Error_Position_Min »Text_Rectangle_Too_Large_Error_Position_Max		
3	CONFIGURE: Determine the message (e.g., from the test plan) that shall be used to display the message. RECORD this information as: »Msg_Type (the memory type used to store the message) »Msg_Number (the message number used to store the message)		

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4	PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Text_Rectangle_Too_Large_Msg »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = syntaxMULTI (5) »Expected_Multi_Error_Code = 4 (unsupportedTagValue) »Expected_Multi_Error_Pos_Min = Text_Rectangle_Too_Large_Error_Position_Min »Expected_Multi_Error_Pos_Max = Text_Rectangle_Too_Large_Error_Position_Max	Pass / Fail (Section 3.5.2.3.3.3)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.8.46 Verify Rejection of Text that is Too Large for a Text Rectangle

Test Case: 8.46	**Title:**	**Verify Rejection of Text that is Too Large for a Text Rectangle**	
	Description:	This test case verifies that the DMS properly rejects a MULTI string that specifies text that is too large for the defined text rectangle.	
	Variables:	Text Rect_Text_Too Large_Msg	From the Test Plan
		Msg_Type	From the Test Plan
		Msg_Number	From the Test Plan
		Text_Rect_TTL_Error_Position_Min	From the Test Plan
		Text_Rect_TTL_Error_Position_Max	From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the MULTI string of the message to be displayed to demonstrate that text that is too large to fit in a define text rectangleis properly rejected (e.g. per the test plan). RECORD this information as: »Text_Rectangle_Text_Too_Large_Msg Note: The MULTI string is required to contain a text rectangle tag that includes text that is too big to fit in the defined parameters of the text rectangle. Note that the height and width of the font used to display the text will affect whether the text will properly display within the text rectangle. EXAMPLES: For a sign that is 28 pixels high by 48 pixels wide - "[tr1,1,14,7]TOO WIDE" “[tr20,19,48,7]TOO[NL]HIGH”		
2	CONFIGURE: Determine the first and last positions in the MULTI string where the error might be flagged. RECORD this information as: »Text_Rectangle_TTL_Error_Position_Min »Text_Rectangle_TTL_Error_Position_Max		

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3	CONFIGURE: Determine the message (e.g., from the test plan) that shall be used to display the message. RECORD this information as: »Msg_Type (the memory type used to store the message) »Msg_Number (the message number used to store the message)		
4	PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Text_Rectangle_Text_Too_Large_Msg »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = syntaxMULTI (5) »Expected_Multi_Error_Code = 5 (textTooBig) »Expected_Multi_Error_Pos_Min = Text_Rectangle_TTL_Error_Position_Min »Expected_Multi_Error_Pos_Max = Text_Rectangle_TTL_Error_Position_Max	Pass / Fail (Section 3.5.2.3.3.3)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.9 MULTI Field Tests

C.3.9.1 Verify Support of Current Time Field (12 hour)

Test Case: 9.1	**Title:**	**Verify Support of Current Time Field (12 hour)**	
	Description:	This test case verifies that the DMS allows a message to be defined with current time field in 12-hour format.	
	Variables:	Test_Global_Time	From the Test Plan
		Test_Time_Zone	From the Test Plan
		Test_Daylight_Saving	From the Test Plan
		Expected_Time	From the Test Plan
		Rollover_Time	From the Test Plan
		Time_12_Tag_Msg	From the Test Plan
		Refresh_Rate	PRL 3.6.6.2.13.11
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the values necessary for globalTime, controllerStandardTimeZone and globalDaylightSaving to result in a local time two minutes and 30 seconds before the hour on the date to be tested (e.g. per the test plan). RECORD this information as: »Test_Global_Time »Test_Time_Zone »Test_Daylight_Saving		
2	CONFIGURE: Determine the time to be displayed in 12 hour format corresponding to the time defined in Step 1, and the time that will be display three minutes later. (e.g. per the test plan). RECORD this information as: »Expected_Time »Rollover_Time		

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3	CONFIGURE: Determine the MULTI string of the message to be displayed to demonstrate support for the current time field in the 12-hour (no am/pm indicator) format (e.g., per the test plan). RECORD this information as: »Time_12_Tag_Msg Note: The MULTI string is required to include a tag for the current time in the 12-hour format. For example: "THE TIME IS: [f1]"		
4	CONFIGURE: Determine the data refresh rate as required by the specification, in seconds (PRL 3.6.6.2.13.11). RECORD this information as: »Refresh_Rate		
5	GET the following object(s): »dmsSupportedMultiTags.0	Pass / Fail (Section 3.5.1.2.3.4)	
6	VERIFY that Bit 14 ([f1]) of the RESPONSE VALUE for dmsSupportedMultiTags.0 is equal to one.	Pass / Fail (Section 3.6.6.2.13.1)	
7	SET the following object(s) to the value(s) shown: »globalTime.0 = Test_Global_Time	Pass / Fail (Section H.2.2.1)	
8	SET the following object(s) to the value(s) shown: »controllerStandardTimeZone.0 = Test_Time_Zone	Pass / Fail (Section H.2.2.2)	
9	SET the following object(s) to the value(s) shown: »globalDaylightSaving.0 = Test_Daylight_Saving	Pass / Fail (Section H.2.2.3)	
10	PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = 3 (changeable) or 4 (volatile) »Msg_Number = 1 »Msg_Multi_String = Time_12_Tag_Msg »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.3.3)	
11	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Time_12_Tag_Msg »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
12	VERIFY that the time displayed on the sign agrees with the value recorded in Expected_Time and is shown in 12 hour format with no am or pm indicator.	Pass / Fail (Section 3.6.6.2.13.1)	
13	VERIFY that the field refreshes at a rate that is no slower than Refresh_Rate.	Pass / Fail (Section 3.6.6.2.13.11)	

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14	DELAY for 3 minutes.		
15	VERIFY that the time displayed on the sign agrees with the value recorded in Rollover_Time, and is shown in 12 hour format with no am or pm indicator.	Pass / Fail (Section 3.6.6.2.13.1)	
16	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.9.2 Verify Support of Current Time Field (24 hour)

Test Case: 9.2	**Title:**	**Verify Support of Current Time Field (24 hour)**	
	Description:	This test case verifies that the DMS allows a message to be defined with current time field in 24-hour format.	
	Variables:	Test_Global_Time	From the Test Plan
		Test_Time_Zone	From the Test Plan
		Test_Daylight_Saving	From the Test Plan
		Expected_Time	From the Test Plan
		Rollover_Time	From the Test Plan
		Time_24_Tag_Msg	From the Test Plan
		Refresh_Rate	PRL 3.6.6.2.13.11
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the values necessary for globalTime, controllerStandardTimeZone and globalDaylightSaving to result in a local time two minutes and 30 seconds before the hour on the date to be tested (e.g. per the test plan). RECORD this information as: »Test_Global_Time »Test_Time_Zone »Test_Daylight_Saving		
2	CONFIGURE: Determine the time to be displayed in 24 hour format corresponding to the time defined in Step 1, and the time that will be display three minutes later. (e.g. per the test plan). RECORD this information as: »Expected_Time »Rollover_Time		
3	CONFIGURE: Determine the MULTI string of the message to be displayed to demonstrate support for the current time field in the 24-hour format (e.g., per the test plan). RECORD this information as: »Time_24_Tag_Msg Note: The MULTI string is required to include a tag for the current time in the 24-hour format. For example: "THE TIME IS: [f2]"		
4	CONFIGURE: Determine the data refresh rate as required by the specification, in seconds (PRL 3.6.6.2.13.11). RECORD this information as: »Refresh_Rate		

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5	GET the following object(s): »dmsSupportedMultiTags.0	Pass / Fail (Section 3.5.1.2.3.4)	
6	VERIFY that Bit 15 ([f2]) of the RESPONSE VALUE for dmsSupportedMultiTags.0 is equal to one.	Pass / Fail (Section 3.6.6.2.13.1)	
7	SET the following object(s) to the value(s) shown: »globalTime.0 = Test_Global_Time	Pass / Fail (Section H.2.2.1)	
8	SET the following object(s) to the value(s) shown: »controllerStandardTimeZone.0 = Test_Time_Zone	Pass / Fail (Section H.2.2.2)	
9	SET the following object(s) to the value(s) shown: »globalDaylightSaving.0 = Test_Daylight_Saving	Pass / Fail (Section H.2.2.3)	
10	PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = 3 (changeable) or 4 (volatile) »Msg_Number = 1 »Msg_Multi_String = Time_24_Tag_Msg »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.3.3)	
11	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Time_24_Tag_Msg »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
12	VERIFY that the time displayed on the sign agrees with the value recorded in Expected_Time and is shown in 24 hour format.	Pass / Fail (Section 3.6.6.2.13.1)	
13	VERIFY that the field refreshes at a rate that is no slower than Refresh_Rate.	Pass / Fail (Section 3.6.6.2.13.11)	
14	DELAY for 3 minutes.		
15	VERIFY that the time displayed on the sign agrees with the value recorded in Rollover_Time, and is shown in 24 hour format.	Pass / Fail (Section 3.6.6.2.13.1)	
16	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

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C.3.9.3 Verify Support of Current Time Field (12 hour Uppercase AM/PM)

Test Case: 9.3	**Title:**	**Verify Support of Current Time Field (12 hour Uppercase AM/PM)**
	Description:	This test case verifies that the DMS allows a message to be defined with current time with uppercase am/pm field.
	Variables:	Test_Global_Time — From the Test Plan
		Test_Time_Zone — From the Test Plan
		Test_Daylight_Saving — From the Test Plan
		Expected_Time — From the Test Plan
		Rollover_Time — From the Test Plan
		Time_AMPM_Tag_Msg — From the Test Plan
		Refresh_Rate — PRL 3.6.6.2.13.11
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the values necessary for globalTime, controllerStandardTimeZone and globalDaylightSaving to result in a local time two minutes and 30 seconds before the hour on the date to be tested (e.g. per the test plan). RECORD this information as: »Test_Global_Time »Test_Time_Zone »Test_Daylight_Saving		
2	CONFIGURE: Determine the time to be displayed in 12 hour format with uppercase AM / PM indicator corresponding to the time defined in Step 1, and the time that will be display three minutes later. (e.g. per the test plan). RECORD this information as: »Expected_Time »Rollover_Time		
3	CONFIGURE: Determine the MULTI string of the message to be displayed to demonstrate support for the time with the uppercase AM/PM field (e.g., per the test plan). RECORD this information as: »Time_AMPM_Tag_Msg Note: The MULTI string is required to include a current time tag with AM/PM indications. For example: "THE TIME IS: [f12]"		
4	CONFIGURE: Determine the data refresh rate as required by the specification, in seconds (PRL 3.6.6.2.13.11). RECORD this information as: »Refresh_Rate		
5	GET the following object(s): »dmsSupportedMultiTags.0	Pass / Fail (Section 3.5.1.2.3.4)	
6	VERIFY that Bit 25 ([f12]) of the RESPONSE VALUE for dmsSupportedMultiTags.0 is equal to one.	Pass / Fail (Section 3.6.6.2.13.2)	
7	SET the following object(s) to the value(s) shown: »globalTime.0 = Test_Global_Time	Pass / Fail (Section H.2.2.1)	
8	SET the following object(s) to the value(s) shown: »controllerStandardTimeZone.0 = Test_Time_Zone	Pass / Fail (Section H.2.2.2)	

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9	SET the following object(s) to the value(s) shown: »globalDaylightSaving.0 = Test_Daylight_Saving	Pass / Fail (Section H.2.2.3)	
10	PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = 3 (changeable) or 4 (volatile) »Msg_Number = 1 »Msg_Multi_String = Time_AMPM_Tag_Msg »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.3.3)	
11	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Time_AMPM_Tag_Msg »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
12	VERIFY that the time displayed on the sign agrees with the value recorded in Expected_Time and is shown with capital AM/PM letters as appropriate.	Pass / Fail (Section 3.6.6.2.13.2)	
13	VERIFY that the field refreshes at a rate that is no slower than Refresh_Rate.	Pass / Fail (Section 3.6.6.2.13.11)	
14	DELAY for 3 minutes.		
15	VERIFY that the time displayed on the sign agrees with the value recorded in Rollover_Time, and is shown in with uppercase AM/PM letters as appropriate.	Pass / Fail (Section 3.6.6.2.13.2)	
16	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

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C.3.9.4 Verify Support of Current Time Field (12 hour Lowercase am/pm)

Test Case: 9.4	**Title:**	**Verify Support of Current Time Field (12 hour Lowercase am/pm)**
	Description:	This test case verifies that the DMS allows a message to be defined with current time with lowercase am/pm field.
	Variables:	Test_Global_Time — From the Test Plan Test_Time_Zone — From the Test Plan Test_Daylight_Saving — From the Test Plan Expected_Time — From the Test Plan Rollover_Time — From the Test Plan Time_ampm_Tag_Msg — From the Test Plan Refresh_Rate — PRL 3.6.6.2.13.11
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the values necessary for globalTime, controllerStandardTimeZone and globalDaylightSaving to result in a local time two minutes and 30 seconds before the hour on the date to be tested (e.g. per the test plan). RECORD this information as: »Test_Global_Time »Test_Time_Zone »Test_Daylight_Saving		
2	CONFIGURE: Determine the time to be displayed in 12 hour format with lowercase AM / PM indicator corresponding to the time defined in Step 1, and the time that will be display three minutes later. (e.g. per the test plan). RECORD this information as: »Expected_Time »Rollover_Time		
3	CONFIGURE: Determine the MULTI string of the message to be displayed to demonstrate support for the time with the lowercase am/pm field (e.g., per the test plan). RECORD this information as: »Time_ampm_Tag_Msg Note: The MULTI string is required to include a current time tag with am/pm indications. For example: "THE TIME IS: [f13]"		
4	CONFIGURE: Determine the data refresh rate as required by the specification, in seconds (PRL 3.6.6.2.13.11). RECORD this information as: »Refresh_Rate		
5	GET the following object(s): »dmsSupportedMultiTags.0	Pass / Fail (Section 3.5.1.2.3.4)	
6	VERIFY that Bit 26 ([f13]) of the RESPONSE VALUE for dmsSupportedMultiTags.0 is equal to one.	Pass / Fail (Section 3.6.6.2.13.3)	
7	SET the following object(s) to the value(s) shown: »globalTime.0 = Test_Global_Time	Pass / Fail (Section H.2.2.1)	
8	SET the following object(s) to the value(s) shown: »controllerStandardTimeZone.0 = Test_Time_Zone	Pass / Fail (Section H.2.2.2)	

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9	SET the following object(s) to the value(s) shown: »globalDaylightSaving.0 = Test_Daylight_Saving	Pass / Fail (Section H.2.2.3)	
10	PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = 3 (changeable) or 4 (volatile) »Msg_Number = 1 »Msg_Multi_String = Time_ampm_Tag_Msg »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.3.3)	
11	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Time_ampm_Tag_Msg »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
12	VERIFY that the time displayed on the sign agrees with the value recorded in Expected_Time and is shown with lowercase am/pm letters as appropriate.	Pass / Fail (Section 3.6.6.2.13.3)	
13	VERIFY that the field refreshes at a rate that is no slower than Refresh_Rate.	Pass / Fail (Section 3.6.6.2.13.11)	
14	DELAY for 3 minutes.		
15	VERIFY that the time displayed on the sign agrees with the value recorded in Rollover_Time, and is shown in with lowercase AM/PM letters as appropriate.	Pass / Fail (Section 3.6.6.2.13.3)	
16	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

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C.3.9.5 Verify Support of Current Day of Week Field

Test Case: 9.5	**Title:**	**Verify Support of Current Day of Week Field**
	Description:	This test case verifies that the DMS allows a message to be defined with the current day of week field.
	Variables:	Test_Global_Time — From the Test Plan Test_Time_Zone — From the Test Plan Test_Daylight_Saving — From the Test Plan Expected_Day — From the Test Plan Rollover_Day — From the Test Plan Time_DOW_Tag_Msg — From the Test Plan Refresh_Rate — PRL 3.6.6.2.13.11
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the values necessary for globalTime, controllerStandardTimeZone and globalDaylightSaving to result in a local time two minutes and 30 seconds before midnight on the date to be tested (e.g. per the test plan). RECORD this information as: »Test_Global_Time »Test_Time_Zone »Test_Daylight_Saving		
2	CONFIGURE: Determine the day of the week corresponding to the time defined in Step 1, and the day of the week for the following day. (e.g. per the test plan). RECORD this information as: »Expected_Day »Rollover_Day		
3	CONFIGURE: Determine the MULTI string of the message to be displayed to demonstrate support for the current day of week field (e.g., per the test plan). RECORD this information as: »Time_DOW_Tag_Msg Note: The MULTI string is required to include a tag for the current day of week. For example: "TODAY IS: [f7]"		
4	CONFIGURE: Determine the data refresh rate as required by the specification, in seconds (PRL 3.6.6.2.13.11). RECORD this information as: »Refresh_Rate		
5	GET the following object(s): »dmsSupportedMultiTags.0	Pass / Fail (Section 3.5.1.2.3.4)	
6	VERIFY that Bit 20 ([f7]) of the RESPONSE VALUE for dmsSupportedMultiTags.0 is equal to one.	Pass / Fail (Section 3.6.6.2.13.6)	
7	GET the following object(s): »globalTime.0 »controllerStandardTimeZone.0 »globalDaylightSaving.0 »controllerLocalTime.0	Pass / Fail (Section H.2.2.4)	

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8	Determine the RESPONSE VALUE for controllerStandardTimeZone.0 and globalDaylightSaving.0. RECORD this information as: »Time_Zone »Daylight_Saving		
9	SET the following object(s) to the value(s) shown: »globalTime.0 = Test_Global_Time	Pass / Fail (Section H.2.2.1)	
10	SET the following object(s) to the value(s) shown: »controllerStandardTimeZone.0 = Test_Time_Zone	Pass / Fail (Section H.2.2.2)	
11	SET the following object(s) to the value(s) shown: »globalDaylightSaving.0 = Test_Daylight_Saving	Pass / Fail (Section H.2.2.3)	
12	PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = 3 (changeable) or 4 (volatile) »Msg_Number = 1 »Msg_Multi_String = Time_DOW_Tag_Msg »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.3.3)	
13	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Time_DOW_Tag_Msg »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
14	VERIFY that the day of week displayed on the sign agrees with the value recorded in Expected_Day.	Pass / Fail (Section 3.6.6.2.13.6)	
15	DELAY for 3 minutes.		
16	VERIFY that the field has updated to the value recorded in Rollover_Day.	Pass / Fail (Section 3.6.6.2.13.6)	
17	Calculate the current UTC time. RECORD this information as: »Time		
18	SET the following object(s) to the value(s) shown: »globalTime.0 = Time	Pass / Fail (Section H.2.2.1)	
19	SET the following object(s) to the value(s) shown: »controllerStandardTimeZone.0 = Time_Zone	Pass / Fail (Section H.2.2.2)	
20	SET the following object(s) to the value(s) shown: »globalDaylightSaving.0 = Daylight_Saving	Pass / Fail (Section H.2.2.3)	

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21	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.9.6 Verify Support of Current Day of Month Field

Test Case: 9.6	**Title:**	**Verify Support of Current Day of Month Field**	
	Description:	This test case verifies that the DMS allows a message to be defined with the current day of month field.	
	Variables:	Test_Global_Time	From the Test Plan
		Test_Time_Zone	From the Test Plan
		Test_Daylight_Saving	From the Test Plan
		Expected_Date	From the Test Plan
		Rollover Date	From the Test Plan
		Time_DOM_Tag_Msg	From the Test Plan
		Refresh_Rate	PRL 3.6.6.2.13.11
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the values necessary for globalTime, controllerStandardTimeZone and globalDaylightSaving to result in a local time two minutes and 30 seconds before midnight on the date to be tested (e.g. per the test plan). RECORD this information as: »Test_Global_Time »Test_Time_Zone »Test_Daylight_Saving		
2	CONFIGURE: Determine the date of the month corresponding to the time defined in Step 1, and the date of the month for the following day. (e.g. per the test plan). RECORD this information as: »Expected_Date »Rollover_Date		
3	CONFIGURE: Determine the MULTI string of the message to be displayed to demonstrate support for the current day of month field (e.g., per the test plan). RECORD this information as: »Time_DOM_Tag_Msg Note: The MULTI string is required to include a tag for the current day of the month. For example: "THE DATE IS: [f8]"		
4	CONFIGURE: Determine the data refresh rate as required by the specification, in seconds (PRL 3.6.6.2.13.11). RECORD this information as: »Refresh_Rate		
5	GET the following object(s): »dmsSupportedMultiTags.0	Pass / Fail (Section 3.5.1.2.3.4)	
6	VERIFY that Bit 21 ([f8]) of the RESPONSE VALUE for dmsSupportedMultiTags.0 is equal to one.	Pass / Fail (Section 3.6.6.2.13.7)	

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7	GET the following object(s): »globalTime.0 »controllerStandardTimeZone.0 »globalDaylightSaving.0 »controllerLocalTime.0	Pass / Fail (Section H.2.2.4)	
8	Determine the RESPONSE VALUE for controllerStandardTimeZone.0 and globalDaylightSaving.0. RECORD this information as: »Time_Zone »Daylight_Saving		
9	Calculate the current UTC time. RECORD this information as: »Time		
10	SET the following object(s) to the value(s) shown: »globalTime.0 = Test_Global_Time	Pass / Fail (Section H.2.2.1)	
11	SET the following object(s) to the value(s) shown: »controllerStandardTimeZone.0 = Test_Time_Zone	Pass / Fail (Section H.2.2.2)	
12	SET the following object(s) to the value(s) shown: »globalDaylightSaving.0 = Test_Daylight_Saving	Pass / Fail (Section H.2.2.3)	
13	PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = 3 (changeable) or 4 (volatile) »Msg_Number = 1 »Msg_Multi_String = Time_DOM_Tag_Msg »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.3.3)	
14	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Time_DOM_Tag_Msg »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
15	VERIFY that the sign displays the value corresponding to Expected_Date.	Pass / Fail (Section 3.6.6.2.13.7)	
16	DELAY for 3 minutes.		
17	VERIFY that the field has updated to the value corresponding to Rollover_Date.	Pass / Fail (Section 3.6.6.2.13.7)	
18	Calculate the current UTC time. RECORD this information as: »Time		

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19	SET the following object(s) to the value(s) shown: »globalTime.0 = Time	Pass / Fail (Section H.2.2.1)	
20	SET the following object(s) to the value(s) shown: »controllerStandardTimeZone.0 = Time_Zone	Pass / Fail (Section H.2.2.2)	
21	SET the following object(s) to the value(s) shown: »globalDaylightSaving.0 = Daylight_Saving	Pass / Fail (Section H.2.2.3)	
22	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.9.7 Verify Support of Current Month of Year Field

Test Case: 9.7	**Title:**	**Verify Support of Current Month of Year Field**	
	Description:	This test case verifies that the DMS allows a message to be defined with the current month of year field.	
	Variables:	Test_Global_Time	From the Test Plan
		Test_Time_Zone	From the Test Plan
		Test_Daylight_Saving	From the Test Plan
		Expected_Month	From the Test Plan
		Rollover Month	From the Test Plan
		Time_Month_Tag_Msg	From the Test Plan
		Refresh_Rate	PRL 3.6.6.2.13.11
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the values necessary for globalTime, controllerStandardTimeZone and globalDaylightSaving to result in a local time two minutes and 30 seconds before midnight on the date to be tested (e.g. per the test plan). RECORD this information as: »Test_Global_Time »Test_Time_Zone »Test_Daylight_Saving		
2	CONFIGURE: Determine the month corresponding to the time defined in Step 1, and the month for the following day. (e.g. per the test plan). RECORD this information as: »Expected_Month »Rollover_Month		
3	CONFIGURE: Determine the MULTI string of the message to be displayed to demonstrate support for the current month field (e.g., per the test plan). RECORD this information as: »Time_Month_Tag_Msg Note: The MULTI string is required to include a tag for the current month. For example: "THE MONTH IS: [f9]"		

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4	CONFIGURE: Determine the data refresh rate as required by the specification, in seconds (PRL 3.6.6.2.13.11). RECORD this information as: »Refresh_Rate		
5	GET the following object(s): »dmsSupportedMultiTags.0	Pass / Fail (Section 3.5.1.2.3.4)	
6	VERIFY that Bit 22 ([f9]) of the RESPONSE VALUE for dmsSupportedMultiTags.0 is equal to one.	Pass / Fail (Section 3.6.6.2.13.8)	
7	GET the following object(s): »globalTime.0 »controllerStandardTimeZone.0 »globalDaylightSaving.0 »controllerLocalTime.0	Pass / Fail (Section H.2.2.4)	
8	RECORD the RESPONSE VALUE for controllerStandardTimeZone.0 and globalDaylightSaving.0 as: »Time_Zone »Daylight_Saving		
9	SET the following object(s) to the value(s) shown: »globalTime.0 = Test_Global_Time	Pass / Fail (Section H.2.2.1)	
10	SET the following object(s) to the value(s) shown: »controllerStandardTimeZone.0 = Test_Time_Zone	Pass / Fail (Section H.2.2.2)	
11	SET the following object(s) to the value(s) shown: »globalDaylightSaving.0 = Test_Daylight_Saving	Pass / Fail (Section H.2.2.3)	
12	PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = 3 (changeable) or 4 (volatile) »Msg_Number = 1 »Msg_Multi_String = Time_Month_Tag_Msg »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.3.3)	
13	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Time_Month_Tag_Msg »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
14	VERIFY that the sign displays the value corresponding to Expected_Month.	Pass / Fail (Section 3.6.6.2.13.8)	
15	DELAY for 3 minutes.		

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16	VERIFY that the field has updated to the the value corresponding to Rollover_Month.	Pass / Fail (Section 3.6.6.2.13.8)	
17	Calculate the current UTC time. RECORD this information as: »Time		
18	SET the following object(s) to the value(s) shown: »globalTime.0 = Time	Pass / Fail (Section H.2.2.1)	
19	SET the following object(s) to the value(s) shown: »controllerStandardTimeZone.0 = Time_Zone	Pass / Fail (Section H.2.2.2)	
20	SET the following object(s) to the value(s) shown: »globalDaylightSaving.0 = Daylight_Saving	Pass / Fail (Section H.2.2.3)	
21	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.9.8 Verify Support of Current Year Field (2 digits)

Test Case: 9.8	**Title:**	**Verify Support of Current Year Field (2 digits)**	
	Description:	This test case verifies that the DMS allows a message to be defined with the current year field with 2 digits.	
	Variables:	Test_Global_Time	From the Test Plan
		Test_Time_Zone	From the Test Plan
		Test_Daylight_Saving	From the Test Plan
		Expected_Year	From the Test Plan
		Rollover Year	From the Test Plan
		Time_Year2_Tag_Msg	From the Test Plan
		Refresh_Rate	PRL 3.6.6.2.13.11
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the values necessary for globalTime, controllerStandardTimeZone and globalDaylightSaving to result in a local time two minutes and 30 seconds before midnight of the last day of the year on the date to be tested (e.g. per the test plan). RECORD this information as: »Test_Global_Time »Test_Time_Zone »Test_Daylight_Saving		
2	CONFIGURE: Determine the year corresponding to the time defined in Step 1, and the year for the following day. (e.g. per the test plan). RECORD this information as: »Expected_Year »Rollover_Year		

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3	CONFIGURE: Determine the MULTI string of the message to be displayed to demonstrate support for the current year field in the 2-digit format (e.g., per the test plan). RECORD this information as: »Time_Year2_Tag_Msg Note: The MULTI string is required to include a tag for the current year in the 2-digit format. For example: "THE YEAR IS: [f10]"		
4	CONFIGURE: Determine the data refresh rate as required by the specification, in seconds (PRL 3.6.6.2.13.11). RECORD this information as: »Refresh_Rate		
5	GET the following object(s): »dmsSupportedMultiTags.0	Pass / Fail (Section 3.5.1.2.3.4)	
6	VERIFY that Bit 23 ([f10]) of the RESPONSE VALUE for dmsSupportedMultiTags.0 is equal to one.	Pass / Fail (Section 3.6.6.2.13.9)	
7	GET the following object(s): »globalTime.0 »controllerStandardTimeZone.0 »globalDaylightSaving.0 »controllerLocalTime.0	Pass / Fail (Section H.2.2.4)	
8	RECORD the RESPONSE VALUE for controllerStandardTimeZone.0 as: »Time_Zone		
9	SET the following object(s) to the value(s) shown: »globalTime.0 = Test_Global_Time	Pass / Fail (Section H.2.2.1)	
10	SET the following object(s) to the value(s) shown: »controllerStandardTimeZone.0 = Test_Time_Zone	Pass / Fail (Section H.2.2.2)	
11	SET the following object(s) to the value(s) shown: »globalDaylightSaving.0 = Test_Daylight_Saving	Pass / Fail (Section H.2.2.3)	
12	PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = 3 (changeable) or 4 (volatile) »Msg_Number = 1 »Msg_Multi_String = Time_Year2_Tag_Msg »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.3.3)	

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13	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Time_Year2_Tag_Msg »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
14	VERIFY that the sign displays the last two digits of the value corresponding to Expected_Year.	Pass / Fail (Section 3.6.6.2.13.9)	
15	DELAY for 3 minutes.		
16	VERIFY that the field has updated to the last two digits of the the value corresponding to Rollover_Year.	Pass / Fail (Section 3.6.6.2.13.9)	
17	Calculate the current UTC time. RECORD this information as: »Time		
18	SET the following object(s) to the value(s) shown: »globalTime.0 = Time	Pass / Fail (Section H.2.2.1)	
19	SET the following object(s) to the value(s) shown: »controllerStandardTimeZone.0 = Time_Zone	Pass / Fail (Section H.2.2.2)	
20	SET the following object(s) to the value(s) shown: »globalDaylightSaving.0 = Daylight_Saving	Pass / Fail (Section H.2.2.3)	
21	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.9.9 Verify Support of Current Year Field (4 digits)

Test Case: 9.9	**Title:**	**Verify Support of Current Year Field (4 digits)**	
	Description:	This test case verifies that the DMS allows a message to be defined with the current year field with 4 digits.	
	Variables:	Test_Global_Time	From the Test Plan
		Test_Time_Zone	From the Test Plan
		Test_Daylight_Saving	From the Test Plan
		Expected_Year	From the Test Plan
		Rollover Year	From the Test Plan
		Time_Year4_Tag_Msg	From the Test Plan
		Refresh_Rate	PRL 3.6.6.2.13.11
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

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Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the values necessary for globalTime, controllerStandardTimeZone and globalDaylightSaving to result in a local time two minutes and 30 seconds before midnight of the last day of the year on the date to be tested (e.g. per the test plan). RECORD this information as: »Test_Global_Time »Test_Time_Zone »Test_Daylight_Saving		
2	CONFIGURE: Determine the year corresponding to the time defined in Step 1, and the year for the following day. (e.g. per the test plan). RECORD this information as: »Expected_Year »Rollover_Year		
3	CONFIGURE: Determine the MULTI string of the message to be displayed to demonstrate support for the current year field in the 4-digit format (e.g., per the test plan). RECORD this information as: »Time_Year4_Tag_Msg Note: The MULTI string is required to include a tag for the current year in the 4-digit format. For example: "THE TIME IS: [f11]"		
4	CONFIGURE: Determine the data refresh rate as required by the specification, in seconds (PRL 3.6.6.2.13.11). RECORD this information as: »Refresh_Rate		
5	GET the following object(s): »dmsSupportedMultiTags.0	Pass / Fail (Section 3.5.1.2.3.4)	
6	VERIFY that Bit 24 ([f11]) of the RESPONSE VALUE for dmsSupportedMultiTags.0 is equal to one.	Pass / Fail (Section 3.6.6.2.13.9)	
7	GET the following object(s): »globalTime.0 »controllerStandardTimeZone.0 »globalDaylightSaving.0 »controllerLocalTime.0	Pass / Fail (Section H.2.2.4)	
8	RECORD the RESPONSE VALUE for controllerStandardTimeZone.0 and globalDaylightSaving.0 as: »Time_Zone »Daylight_Saving		
9	SET the following object(s) to the value(s) shown: »globalTime.0 = Test_Global_Time	Pass / Fail (Section H.2.2.1)	
10	SET the following object(s) to the value(s) shown: »controllerStandardTimeZone.0 = Test_Time_Zone	Pass / Fail (Section H.2.2.2)	
11	SET the following object(s) to the value(s) shown: »globalDaylightSaving.0 = Test_Daylight_Saving	Pass / Fail (Section H.2.2.3)	

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12	PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = 3 (changeable) or 4 (volatile) »Msg_Number = 1 »Msg_Multi_String = Time_Year4_Tag_Msg »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.3.3)	
13	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Time_Year4_Tag_Msg »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
14	VERIFY that the sign displays all four digits of the value corresponding to Expected_Year.	Pass / Fail (Section 3.6.6.2.13.9)	
15	DELAY for 3 minutes.		
16	VERIFY that the sign displays all four digits of the the value corresponding to Rollover_Year.	Pass / Fail (Section 3.6.6.2.13.9)	
17	Calculate the current UTC time. RECORD this information as: »Time		
18	SET the following object(s) to the value(s) shown: »globalTime.0 = Time	Pass / Fail (Section H.2.2.1)	
19	SET the following object(s) to the value(s) shown: »controllerStandardTimeZone.0 = Time_Zone	Pass / Fail (Section H.2.2.2)	
20	SET the following object(s) to the value(s) shown: »globalDaylightSaving.0 = Daylight_Saving	Pass / Fail (Section H.2.2.3)	
21	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

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C.3.9.10 Verify Support of Current Temperature Field Celsius

Test Case: 9.10	**Title:**	**Verify Support of Current Temperature Field Celsius**
	Description:	This test case verifies that the DMS allows a message to be defined with the current temperature field in Celsius.
	Variables:	Temp_C_Tag_Msg — From the Test Plan Refresh_Rate — PRL 3.6.6.2.13.11
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the MULTI string of the message to be displayed to demonstrate support for the current temperature in Celsius field (e.g., per the test plan). RECORD this information as: »Temp_C_Tag_Msg Note: The MULTI string is required to include a tag for the current temperature in Celsius. For example: "THE TEMPERATURE IS: [f3,2] C"		
2	CONFIGURE: Determine the data refresh rate as required by the specification, in seconds (PRL 3.6.6.2.13.11). RECORD this information as: »Refresh_Rate		
3	GET the following object(s): »dmsSupportedMultiTags.0	Pass / Fail (Section 3.5.1.2.3.4)	
4	VERIFY that Bit 16 ([f3]) of the RESPONSE VALUE for dmsSupportedMultiTags.0 is equal to one.	Pass / Fail (Section 3.6.6.2.13.4)	
5	PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = 3 (changeable) or 4 (volatile) »Msg_Number = 1 »Msg_Multi_String = Temp_C_Tag_Msg »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.3.3)	
6	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Temp_C_Tag_Msg »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	

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7	GET the following object(s): »tempMaxAmbient.0 »tempMinAmbient.0	Pass / Fail (Section 3.5.3.1.7)	
8	VERIFY that the temperature displayed on the sign is consistent with the RESPONSE VALUE for tempMinAmbient.0 and tempMaxAmbient.0.	Pass / Fail (Section 3.6.6.2.13.4)	
9	VERIFY that the field refreshes at a rate that is no slower than Refresh_Rate.	Pass / Fail (Section 3.6.6.2.13.11)	
10	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.9.11 Verify Support of Current Temperature Field Fahrenheit

Test Case: 9.11	**Title:**	**Verify Support of Current Temperature Field Fahrenheit**	
	Description:	This test case verifies that the DMS allows a message to be defined with the current temperature field in Fahrenheit.	
	Variables:	Temp_F_Tag_Msg	From the Test Plan
		Refresh Rate	PRL 3.6.6.2.13.11
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the MULTI string of the message to be displayed to demonstrate support for the current temperature in Fahrenheit field (e.g., per the test plan). RECORD this information as: »Temp_F_Tag_Msg Note: The MULTI string is required to include a tag for the current temperature in Fahrenheit. For example: "THE TEMPERATURE IS: [f4] F"		
2	CONFIGURE: Determine the data refresh rate as required by the specification, in seconds (PRL 3.6.6.2.13.11). RECORD this information as: »Refresh_Rate		
3	GET the following object(s): »dmsSupportedMultiTags.0	Pass / Fail (Section 3.5.1.2.3.4)	
4	VERIFY that Bit 17 ([f4]) of the RESPONSE VALUE for dmsSupportedMultiTags.0 is equal to one.	Pass / Fail (Section 3.6.6.2.13.4)	

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5	PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = 3 (changeable) or 4 (volatile) »Msg_Number = 1 »Msg_Multi_String = Temp_F_Tag_Msg »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.3.3)	
6	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Temp_F_Tag_Msg »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
7	GET the following object(s): »tempMaxAmbient.0 »tempMinAmbient.0	Pass / Fail (Section 3.5.3.1.7)	
8	VERIFY that the temperature displayed on the sign is consistent with the RESPONSE VALUE for tempMinAmbient.0 and tempMaxAmbient.0.	Pass / Fail (Section 3.6.6.2.13.4)	
9	VERIFY that the field refreshes at a rate that is no slower than Refresh_Rate.	Pass / Fail (Section 3.6.6.2.13.11)	
10	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.9.12 Verify Support of Detected Vehicle Speed Field (km/h)

Test Case: 9.12	**Title:**	**Verify Support of Detected Vehicle Speed Field (km/h)**	
	Description:	This test case verifies that the DMS allows a message to be defined with the detected vehicle speed in kilometers per hour field.	
	Variables:	Speed_KPH_Tag_Msg	From the Test Plan
		Refresh_Rate	PRL 3.6.6.2.13.11
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References

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1	CONFIGURE: Determine the MULTI string of the message to be displayed to demonstrate support for the current speed in kilometers per hour (e.g., per the test plan). RECORD this information as: »Speed_KPH_Tag_Msg Note: The MULTI string is required to include a tag for the current speed in kph. For example: "YOUR SPEED IS: [f5,3]"		
2	CONFIGURE: Determine the data refresh rate as required by the specification, in seconds (PRL 3.6.6.2.13.11). RECORD this information as: »Refresh_Rate		
3	GET the following object(s): »dmsSupportedMultiTags.0	Pass / Fail (Section 3.5.1.2.3.4)	
4	VERIFY that Bit 18 ([f5]) of the RESPONSE VALUE for dmsSupportedMultiTags.0 is equal to one.	Pass / Fail (Section 3.6.6.2.13.4)	
5	PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = 3 (changeable) or 4 (volatile) »Msg_Number = 1 »Msg_Multi_String = Speed_KPH_Tag_Msg »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.3.3)	
6	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Speed_KPH_Tag_Msg »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
7	GET the following object(s): »dmsCurrentSpeed.0	Pass / Fail (Section 3.5.3.1.9)	
8	VERIFY that the speed displayed on the sign is consistent with the RESPONSE VALUE for dmsCurrentSpeed.0.	Pass / Fail (Section 3.6.6.2.13.5)	
9	VERIFY that the field refreshes at a rate that is no slower than Refresh_Rate.	Pass / Fail (Section 3.6.6.2.13.11)	
10	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

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C.3.9.13 Verify Support of Detected Vehicle Speed Field (mph)

Test Case: 9.13	**Title:**	**Verify Support of Detected Vehicle Speed Field (mph)**	
	Description:	This test case verifies that the DMS allows a message to be defined with the detected vehicle speed in miles per hour field.	
	Variables:	Speed_MPH_Tag_Msg	From the Test Plan
		Refresh_Rate	PRL 3.6.6.2.13.11
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the MULTI string of the message to be displayed to demonstrate support for the current speed in miles per hour (e.g., per the test plan). RECORD this information as: »Speed_MPH_Tag_Msg Note: The MULTI string is required to include a tag for the current speed in mph format. For example: "YOUR SPEED IS: [f6,2]"		
2	CONFIGURE: Determine the data refresh rate as required by the specification, in seconds (PRL 3.6.6.2.13.11). RECORD this information as: »Refresh_Rate		
3	GET the following object(s): »dmsSupportedMultiTags.0	Pass / Fail (Section 3.5.1.2.3.4)	
4	VERIFY that Bit 19 ([f6]) of the RESPONSE VALUE for dmsSupportedMultiTags.0 is equal to one.	Pass / Fail (Section 3.6.6.2.13.5)	
5	PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = 3 (changeable) or 4 (volatile) »Msg_Number = 1 »Msg_Multi_String = Speed_MPH_Tag_Msg »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.3.3)	
6	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Speed_MPH_Tag_Msg »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	

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7	GET the following object(s): »dmsCurrentSpeed.0	Pass / Fail (Section 3.5.3.1.9)	
8	VERIFY that the speed displayed on the sign is consistent with the RESPONSE VALUE for dmsCurrentSpeed.0.	Pass / Fail (Section 3.6.6.2.13.5)	
9	VERIFY that the field refreshes at a rate that is no slower than Refresh_Rate.	Pass / Fail (Section 3.6.6.2.13.11)	
10	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.9.14 Verify Support of User Definable Field

Test Case: 9.14	**Title:**	**Verify Support of User Definable Field**	
	Description:	This test case verifies that the DMS allows a message to be defined with a user-definable field.	
	Variables:	User-Definable_Field_Msg	PRL 3.6.6.2.13.10
		Refresh_Rate	PRL 3.6.6.2.13.11
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the MULTI string of the message to be displayed to demonstrate support for the user-definable field required by the specification (PRL 3.6.6.2.13.10). RECORD this information as: » User-Definable_Field_Msg Note: The MULTI string is required to include a user-definable field tag of the form [fx,y], where x is between 50 and 99, and y is optional.		
2	CONFIGURE: Determine the data refresh rate as required by the specification, in seconds (PRL 3.6.6.2.13.11). RECORD this information as: »Refresh_Rate		
3	PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = 3 (changeable) or 4 (volatile) »Msg_Number = 1 »Msg_Multi_String = User-Definable_Field_Msg »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.3.3)	

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4	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = User-Definable_Field_Msg »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
5	VERIFY that the field is properly displayed in accordance with the requirements defined by the manufacturer.	Pass / Fail (Section 3.6.6.2.13.10)	
6	VERIFY that the field refreshes at a rate that is no slower than Refresh_Rate.	Pass / Fail (Section 3.6.6.2.13.11)	
7	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.9.15 Verify Support of Manufacturer-Specific Tag

Test Case: 9.15	**Title:**	**Verify Support of Manufacturer-Specific Tag**	
	Description:	This test case verifies that the DMS allows a message to be defined with a manufacturer-specific MULTI tag.	
	Variables:	Custom_Tag_Msg	PRL 3.6.6.2.17
		Refresh_Rate	PRL 3.6.6.2.13.11
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the MULTI string of the message to be displayed to demonstrate support for the manufacturer specific tag required by the specification (e.g., per the test plan). RECORD this information as: » Custom_Tag_Msg Note: The MULTI string is required to include a manufacturer-specific tag of the form [msx,y].		
2	CONFIGURE: Determine the data refresh rate as required by the specification, in seconds (PRL 3.6.6.2.13.11). RECORD this information as: »Refresh_Rate		
3	GET the following object(s): »dmsSupportedMultiTags.0	Pass / Fail (Section 3.5.1.2.3.4)	

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4	VERIFY that Bit 8 ([msx,y]) of the RESPONSE VALUE for dmsSupportedMultiTags.0 is equal to one.	Pass / Fail (Section 3.6.6.2.17)	
5	PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = 3 (changeable) or 4 (volatile) »Msg_Number = 1 »Msg_Multi_String = Custom_Tag_Msg »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.3.3)	
6	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Custom_Tag_Msg »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
7	VERIFY that the message is displayed in accordance with the parameters specified in the manufacturer-specific tag.	Pass / Fail (Section 3.6.6.2.17)	
8	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.10 Scheduling Tests

C.3.10.1 Retrieve a Schedule

Test Case: 10.1	**Title:**	**Retrieve a Schedule**
	Description:	This test case verifies that the DMS allows a user to retrieve the current schedule as stored in the controller.
	Variables:	
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.

Step	Test Procedure	Results	Additional References
1	GET the following object(s): »maxTimeBaseScheduleEntries.0 »maxDayPlans.0 »maxDayPlanEvents.0 »numActionTableEntries.0	Pass / Fail (Section H.2.3.1)	

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2	RECORD the RESPONSE VALUE for maxTimeBaseScheduleEntries.0, maxDayPlans.0, maxDayPlanEvents.0, and numActionTableEntries.0 as: »Sched_Entries »Max_Day_Plans »Day_Plan_Events »Action_Entries		
3	FOR EACH value, Schedule, from 1 to Sched_Entries, perform Steps 3.1 through 3.4.		
3.1	GET the following object(s): »timeBaseScheduleMonth.Schedule »timeBaseScheduleDay.Schedule »timeBaseScheduleDate.Schedule »timeBaseScheduleDayPlan.Schedule	Pass / Fail (Section 3.5.2.3.4.1)	
3.2	VERIFY that Bits 0 and 13-15 in the RESPONSE VALUE for timeBaseScheduleMonth.Schedule are equal to zero (0).	Pass / Fail (Section 3.5.2.3.4.1)	
3.3	VERIFY that Bit 0 in the RESPONSE VALUE for timeBaseScheduleDate.Schedule is equal to zero (0).	Pass / Fail (Section 3.5.2.3.4.1)	
3.4	VERIFY that the RESPONSE VALUE for timeBaseScheduleDayPlan.Schedule is less than or equal to Max_Day_Plans.	Pass / Fail (Section 3.5.2.3.4.1)	
4	FOR EACH value, Day_Plan, from 1 to Max_Day_Plans, perform Step 4.1.		
4.1	FOR EACH value, Event, from 1 to Day_Plan_Events, perform Steps 4.1.1 through 4.1.3.		
4.1.1	GET the following object(s): »dayPlanHour.Day_Plan.Event »dayPlanMinute.Day_Plan.Event »dayPlanActionNumberOID.Day_Plan.Event	Pass / Fail (Section 3.5.2.3.4.1)	
4.1.2	VERIFY that the RESPONSE VALUE for dayPlanHour.Day_Plan.Event is less than or equal to 23.	Pass / Fail (Section 3.5.2.3.4.1)	
4.1.3	VERIFY that the RESPONSE VALUE for dayPlanMinute.Day_Plan.Event is less than or equal to 59.	Pass / Fail (Section 3.5.2.3.4.1)	
5	FOR EACH value, Action, from 1 to Action_Entries, perform Steps 5.1 through 5.7.		
5.1	GET the following object(s): »dmsActionMsgCode.Action	Pass / Fail (Section 3.5.2.3.4.1)	
5.2	RECORD the first octet of the RESPONSE VALUE for dmsActionMsgCode.Action as: »Message_Type		
5.3	RECORD the second and third octets of the RESPONSE VALUE for dmsActionMsgCode.Action as: »Message_Number		
5.4	RECORD the fourth and fifth octets of the RESPONSE VALUE for dmsActionMsgCode.Action as: »Message_CRC		

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5.5	GET the following objects: »dmsMessageStatus.Message_Type.Message_Number »dmsMessageCRC.Message_Type.Message_Number	Pass / Fail (Section 3.5.2.3.4.1)	
5.6	VERIFY that the RESPONSE VALUE for dmsMessageStatus.Message_Type.Message_Number is equal to 'valid' (4).	Pass / Fail (Section 3.5.2.3.4.1)	
5.7	VERIFY that the RESPONSE VALUE for dmsMessageCRC.Message_Type.Message_Number is equal to Message_CRC.	Pass / Fail (Section 3.5.2.3.4.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.10.2 Define a Schedule

Test Case: 10.2	**Title:**	**Define a Schedule**	
	Description:	This test case verifies that a schedule can be defined on the DMS.	
	Variables:	Num_Events	From the Test Plan
		Sched_Msgs	From the Test Plan
		Sched_Month	From the Test Plan
		Sched_Day	From the Test Plan
		Sched_Date	From the Test Plan
		Day_Plan	From the Test Plan
		Event_Hours	From the Test Plan
		Event_Minutes	From the Test Plan
		Action_Codes	From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the number of events to schedule. RECORD this information as: »Num_Events		
2	CONFIGURE: Determine the text of each message to be included as a part of the schedule (e.g., per the test plan). RECORD this information as: »Sched_Msgs		
3	CONFIGURE: Determine the scheduling information defining when the test plan is intended to run. RECORD this information as: »Sched_Month (the bitmap integer value identifying the month(s) that the test schedule is intended to run) »Sched_Day (the bitmap integer value identifying the day(s) that the test schedule is intended to run) »Sched_Date (the bitmap integer value identifying the date(s) that the test schedule is intended to run) Note: Valid bit-mapped values are defined in Sections 2.4.3.2.2 (Time Base Schedule Month of Year Parameter), 2.4.3.2.3 (Time Base Schedule Day of Week Parameter), and 2.4.3.2.4 (Time Base Schedule Date Parameter) respectively.		

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4	CONFIGURE: Determine the day plan number to use. RECORD this information as: »Day_Plan		
5	CONFIGURE: FOR EACH value, N, from 1 to Num_Events, perform Step 5.1		
5.1	CONFIGURE: Determine the times when scheduled actions are to occur and the actions themselves (e.g., per the test plan). RECORD this information as: »Event_Hours[N] (the local times when the messages are intended to begin displaying) »Event_Minutes[N] (the local times when the messages are intended to begin displaying) »Action_Codes[N] (the action codes identifying the messages to be displayed as a part of the schedule) Note: The formats for these parameters are defined in Sections 2.4.4.3.3 (Day Plan Hour Parameter), 2.4.4.3.4 (Day Plan Minute Parameter), and 5.9.2.2 (Action Message Code Parameter), respectively. Note that the Action Codes can reference any message supported by the DMS and currently valid within the message table.		
6	SET-UP: FOR EACH value, N, from 1 to Num_Events, perform Step 6.1.		
6.1	SET-UP: PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = 3 (changeable) or 4 (volatile) »Msg_Number = N »Msg_Multi_String = Sched_Msgs[N] »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0		
7	GET the following object(s): »maxTimeBaseScheduleEntries.0 »maxDayPlans.0 »maxDayPlanEvents.0 »numActionTableEntries.0	Pass / Fail (Section H.2.3.1)	
8	SET-UP: VERIFY that the RESPONSE VALUE for maxTimeBaseScheduleEntries.0 is greater than or equal to 1.		
9	SET-UP: VERIFY that the RESPONSE VALUE for maxDayPlans.0 is greater than or equal to Day_Plan.		
10	SET-UP: VERIFY that the RESPONSE VALUE for maxDayPlanEvents.0 is greater than or equal to Num_Events.		
11	SET-UP: VERIFY that the RESPONSE VALUE for numActionTableEntries.0 is greater than or equal to Num_Events.		
12	FOR EACH value, N, from 1 to Num_Events, perform Step 12.1.		
12.1	SET the following object(s) to the value(s) shown: »dmsActionMsgCode.N = Action_Codes[N]	Pass / Fail (Section 3.6.10.2)	Section 4.2.3.4 Step c
13	FOR EACH value, Event, from 1 to Num_Events, perform Steps 13.1 through 13.2.		

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13.1	Calculate the OID of 1.3.6.1.4.1.1206.4.2.3.8.2.1.1.Event. RECORD this information as: »Object_OID		
13.2	SET the following object(s) to the value(s) shown: »dayPlanHour.Day_Plan.Event = Event_Hours[Event] »dayPlanMinute.Day_Plan.Event = Event_Minutes[Event] »dayPlanActionNumberOID.Day_Plan.Event = Object_OID	Pass / Fail (Section 3.5.2.3.4.2)	Section 4.2.3.4 Step d
14	SET the following object(s) to the value(s) shown: »timeBaseScheduleMonth.1 = Sched_Month »timeBaseScheduleDay.1 = Sched_Day »timeBaseScheduleDate.1 = Sched_Date »timeBaseScheduleDayPlan.1 = Day_Plan	Pass / Fail (Section 3.5.2.3.4.2)	Section 4.2.3.4 Step e
15	POST-CONDITION: A schedule is defined in the controller.		

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.10.3 Activate a Schedule

Test Case: 10.3	**Title:**	**Activate a Schedule**
	Description:	This test case verifies that the DMS activates a valid schedule and verifies its status. Messages shall be displayed for visual verification of correct messages displayed at the correct time.
	Variables:	Schedule_UTC_Time — From the Test Plan Schedule_Timezone — From the Test Plan Schedule_DST — From the Test Plan Expected_Day_Plan — From the Test Plan Status_Update_Delay — PRL 3.6.9
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the UTC time to which to set the clock to monitor the schedule. RECORD this information as: »Schedule_UTC_Time		
2	CONFIGURE: Determine the time zone to be associated with the schedule test. RECORD this information as: »Schedule_Timezone		
3	CONFIGURE: Determine whether US daylight savings logic is intended to be enabled. RECORD this information as: »Schedule_DST		
4	CONFIGURE: Determine the day plan that is expected to be active based on the Schedule (e.g., per the test plan). RECORD this information as: »Expected_Day_Plan		
5	CONFIGURE: Determine the frequency at which the DMS is required to update the status variables (PRL 3.6.9). RECORD this information as: »Status_Update_Delay		

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6	SET-UP: PERFORM the test case labeled 'Define a Schedule' (C.3.10.2).		
7	SET the following object(s) to the value(s) shown: »globalTime.0 = Schedule_UTC_Time	Pass / Fail (Section H.2.2.1)	
8	SET the following object(s) to the value(s) shown: »controllerStandardTimeZone.0 = Schedule_Timezone	Pass / Fail (Section H.2.2.2)	
9	SET the following object(s) to the value(s) shown: »globalDaylightSaving.0 = Schedule_DST	Pass / Fail (Section H.2.2.3)	
10	GET the following object(s): »controllerLocalTime.0	Pass / Fail (Section H.2.2.4)	
11	VERIFY that the RESPONSE VALUE for controllerLocalTime.0 equals Schedule_UTC_Time + Schedule_Timezone (+ 1 hour if in DST).	Pass / Fail (Section H.2.2.4)	
12	SET the following object(s) to the value(s) shown: »dmsActivateMessage.0 = 'FF FF FF 06 00 01 00 00 A9 01 01 00' Note: The hex string activates the schedule for an indefinite period, overriding any current message. The last 4 bytes of the message could be replaced by the IP address computer hosting the test application, but this is not required.	Pass / Fail (Section 3.5.2.3.1)	Section 4.2.3.1 Step b
13	DELAY for Status_Update_Delay seconds.		
14	GET the following object(s): »shortErrorStatus.0	Pass / Fail (Section 3.5.3.1.2)	Section 4.2.3.1 Step c
15	VERIFY that the RESPONSE VALUE for shortErrorStatus.0 bit 7 (message error) is equal to 0.	Pass / Fail (Section 3.5.3.1.2)	
16	VERIFY that the messages display on the sign per the events defined for the Expected_Day_Plan.	Pass / Fail (Section 3.6.10.3)	
17	GET the following object(s): »timeBaseScheduleTableStatus.0 »dayPlanStatus.0	Pass / Fail (Section H.2.3.2)	
18	VERIFY that the RESPONSE VALUE for timeBaseScheduleTableStatus.0 is equal to 1.	Pass / Fail (Section H.2.3.2)	
19	VERIFY that the RESPONSE VALUE for dayPlanStatus.0 is equal to Expected_Day_Plan.	Pass / Fail (Section H.2.3.2)	
20	GET the following object(s): »dmsMsgSourceMode.0	Pass / Fail (Section 3.5.3.2.1)	
21	VERIFY that the RESPONSE VALUE for dmsMsgSourceMode.0 is equal to timeBasedScheduler.	Pass / Fail (Section 3.5.3.2.1)	
22	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15). Note: To be performed once the tester has verified all of the events.	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

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C.3.10.4 Deactivate a Schedule

Test Case: 10.4	**Title:**	**Deactivate a Schedule**
	Description:	This test case verifies that the DMS de-activates a currently activated schedule using a blank message.
	Variables:	Schedule_UTC_Time — From the Test Plan Schedule_Timezone — From the Test Plan Schedule_DST — From the Test Plan Expected_Day_Plan — From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.

Step	Test Procedure	Results	Additional References
1	PERFORM the test case labeled 'Define a Schedule' (C.3.10.3) with several events configured to occur within a few minutes of the time defined in the Test Plan.	Pass / Fail	
2	PERFORM the test procedure labeled 'Activate a Schedule' (C.3.14.4).		
2	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	
3	VERIFY that no scheduled messages appear on the sign face. Note: The tester shall wait long enough to observe at least two subsequent message activations according to the schedule.	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.10.5 Override a Schedule

Test Case: 10.5	**Title:**	**Override a Schedule**
	Description:	This test case verifies that the DMS de-activates a schedule using another message.
	Variables:	Available_Msg_Type — From the Test Plan Available_Msg_Number — From the Test Plan Override_Multi_String — From the Test Plan Schedule_UTC_Time — From the Test Plan Schedule_Timezone — From the Test Plan Schedule_DST — From the Test Plan Expected_Day_Plan — From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.

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Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine an entry in the message table that is not being used (e.g., per the test plan). RECORD this information as: »Available_Msg_Type (the message type of an available message) »Available_Msg_Number (the message number of an available message) »Override_Multi_String		
2	SET-UP: PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Available_Msg_Type »Msg_Number = Available_Msg_Number »Msg_Multi_String = Override_Multi_String »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.3.3)	
3	SET-UP: PERFORM the Test Case labeled “Define a Schedule” (C.3.10.2) with several events configured to occur within a few minutes of the time defined in the Test Plan.		
4	PERFORM the test procedure labeled 'Activate a Schedule' (C.3.14.4).	Pass / Fail	
5	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Available_Msg_Type »Msg_Number = Available_Msg_Number »Msg_Multi_String = Override_Multi_String »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = 65535 (forever) »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.1)	
6	VERIFY that the message remains on the sign face and is not overridden by any scheduled messages. Note: The tester shall wait long enough to observe at least two subsequent message activations according to the schedule.	Pass / Fail (Section 3.5.2.3.1)	
7	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15). Note: Perform once the tester has verified that the schedule is not overriding the message.	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

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C.3.10.6 Verify Support for Number of Schedules

Test Case: 10.6	**Title:**	**Verify Support for Number of Schedules**
	Description:	This test case verifies that the DMS indicates that it supports the number of schedules as required by the specification.
	Variables:	Required_Day_Selection_Patterns — PRL H.2.5.1 Required_Day_Plans — PRL H.2.5.3 Required_Day_Plan_Events — PRL H.2.5.2 Required_Actions — PRL 3.6.10.1
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the number of day selection patterns required by the specification (PRL H.2.5.1). RECORD this information as: »Required_Day_Selection_Patterns		
2	CONFIGURE: Determine the number of day plans required by the specification (PRL H.2.5.3). RECORD this information as: »Required_Day_Plans		
3	CONFIGURE: Determine the number of day plan events required by the specification (PRL H.2.5.2). RECORD this information as: »Required_Day_Plan_Events		
4	CONFIGURE: Determine the number of schedule actions required by the specification (PRL 3.6.10.1). RECORD this information as: »Required_Actions		
5	GET the following object(s): »maxTimeBaseScheduleEntries.0 »maxDayPlans.0 »maxDayPlanEvents.0 »numActionTableEntries.0	Pass / Fail (Section H.2.3.1)	
6	VERIFY that the RESPONSE VALUE for maxTimeBaseScheduleEntries.0 is greater than or equal to Required_Day_Selection_Patterns.	Pass / Fail (Section H.2.5.1)	
7	VERIFY that the RESPONSE VALUE for maxDayPlans.0 is greater than or equal to Required_Day_Plans.	Pass / Fail (Section H.2.5.3)	
8	VERIFY that the RESPONSE VALUE for maxDayPlanEvents.0 is greater than or equal to Required_Day_Plan_Events.	Pass / Fail (Section H.2.5.2)	
9	VERIFY that the RESPONSE VALUE for numActionTableEntries.0 is greater than or equal to Required_Actions.	Pass / Fail (Section 3.6.10.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

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C.3.11 Event Tests

C.3.11.1 Configure Message for Short Power Loss Recovery

Test Case: 11.1	**Title:**	**Configure Message for Short Power Loss Recovery**
	Description:	This test case verifies that the DMS supports the short power loss recovery message.
	Variables:	Msg_Type — From the Test Plan Short_Power_Loss_Msg — From the Test Plan Short_Power_Msg_Number — From the Test Plan Reboot_Time — From Manufacturer's Documentation
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the enumerated value for the type of memory in which to store the message (e.g., from the test plan). RECORD this information as: »Msg_Type		
2	CONFIGURE: Determine the MULTI string of the message to be displayed upon restoration of power to the sign after a short power loss (e.g., per the test plan). RECORD this information as: »Short_Power_Loss_Msg		
3	CONFIGURE: Determine the message number to use for the storage location of the Short_Power_Loss_Msg (e.g., per the test plan). RECORD this information as: »Short_Power_Msg_Number		
4	CONFIGURE: Determine the amount of time in seconds it takes for the controller to reboot (e.g., from the manufacturer documentation). RECORD this information as: »Reboot_Time		
5	PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Short_Power_Msg_Number »Msg_Multi_String = Short_Power_Loss_Msg »Msg_Owner = "OWNER" »Msg_Beacon_State = 0 »Msg_Pixel_Service = 0 »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.3.3)	
6	GET the following object(s): »dmsShortPowerLossTime.0		
7	RECORD the RESPONSE VALUE for dmsShortPowerLossTime.0 as: »Orig_Time		
8	Calculate the Reboot_Time plus one minute. RECORD this information as: »Reboot_Delay		

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9	IF the RESPONSE VALUE for dmsShortPowerLossTime.0 is less than or equal to Reboot_Delay, then GOTO Step 9.1; otherwise, GOTO Step 10.		
9.1	SET the following object(s) to the value(s) shown: »dmsShortPowerLossTime.0 = Reboot_Delay Note: The additional minute ensures that the message displays after the reboot.		
10	Calculate the CRC of the Short_Power_Loss_Msg. RECORD this information as: »Short_Power_CRC		
11	Calculate the Message ID Code for the Short_Power_Loss_Msg using the Msg_Type, Short_Power_Msg_Number, and Short_Power_CRC. RECORD this information as: »Short_Power_Code		
12	GET the following object(s): »dmsShortPowerRecoveryMessage.0	Pass / Fail (Section 3.5.3.3.2)	
13	RECORD the RESPONSE VALUE for dmsShortPowerRecoveryMessage.0 as: »Orig_Msg		
14	SET the following object(s) to the value(s) shown: »dmsShortPowerRecoveryMessage.0 = Short_Power_Code	Pass / Fail (Section 3.5.2.3.5.1.1)	
15	PERFORM the test case labeled 'Activate a Message' C.3.7.6) to activate the message defined in Step 5.		
16	Briefly disconnect the power from the controller and then reconnect the power.		
17	DELAY for Reboot_Time seconds.		
18	VERIFY that that the sign displays the Short_Power_Loss_Msg.	Pass / Fail (Section 3.5.2.3.5.1.1)	
19	GET the following object(s): »dmsMsgSourceMode.0	Pass / Fail (Section 3.5.3.2.1)	
20	VERIFY that the RESPONSE VALUE for dmsMsgSourceMode.0 is equal to powerRecovery (10).	Pass / Fail (Section 3.5.3.2.1)	
21	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	
22	SET the following object(s) to the value(s) shown: »dmsShortPowerRecoveryMessage.0 = Orig_Msg »dmsShortPowerLossTime.0 = Orig_Time	Pass / Fail (Section 3.5.2.3.5.1.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

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C.3.11.2 Configure Message for Long Power Loss Recovery

Test Case: 11.2	**Title:**	**Configure Message for Long Power Loss Recovery**
	Description:	This test case verifies that the DMS supports the long power loss recovery message.
	Variables:	Msg_Type — From the Test Plan Long_Power_Loss_Msg — From the Test Plan Long_Power_Msg_Number — From the Test Plan Reboot_Time — From Manufacturer's Documentation
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the enumerated value for the type of memory in which to store the message (e.g., from the test plan). RECORD this information as: »Msg_Type		
2	CONFIGURE: Determine the MULTI string of the message to be displayed upon restoration of power to the sign after a long power loss (e.g., per the test plan). RECORD this information as: »Long_Power_Loss_Msg		
3	CONFIGURE: Determine the message number to use for the storage location of the Long_Power_Loss_Msg (e.g., per the test plan). RECORD this information as: »Long_Power_Msg_Number		
4	CONFIGURE: Determine the amount of time it takes for the controller to reboot (e.g., per the manufacturer documentation). RECORD this information as: »Reboot_Time		
5	SET-UP: PERFORM the test case labeled 'Define a Message' (C.3.7.2).		
6	PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Long_Power_Msg_Number »Msg_Multi_String = Long_Power_Loss_Msg »Msg_Owner = "OWNER" »Msg_Beacon_State = 0 »Msg_Pixel_Service = 0 »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.3.3)	
7	GET the following object(s): »dmsShortPowerLossTime.0 »dmsLongPowerRecoveryMessage.0	Pass / Fail (Section 3.5.3.3.3)	
8	RECORD the RESPONSE VALUE for dmsShortPowerLossTime.0 and dmsLongPowerRecoveryMessage.0 as: »Power_Loss_Time »Orig_Msg		

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9	Calculate the CRC of the Long_Power_Loss_Msg. RECORD this information as: »Long_Power_CRC		
10	Calculate the Message ID Code for the Long_Power_Loss_Msg using the Msg_Type, Long_Power_Msg_Number, and Long_Power_CRC. RECORD this information as: »Long_Power_Code		
11	Calculate the Reboot_Time plus one minute. RECORD this information as: »Reboot_Delay		
12	SET the following object(s) to the value(s) shown: »dmsLongPowerRecoveryMessage.0 = Long_Power_Code »dmsShortPowerLossTime.0 = Reboot_Delay	Pass / Fail (Section 3.5.2.3.5.1.2)	
13	PERFORM the test case labeled 'Activate a Message' (C.3.7.6) to activate the message defined in Step 5	Pass / Fail (Section 3.5.2.3.1)	
14	Disconnect the power from the controller for a period of time greater than Power_Loss_Time and then reconnect the power.		
15	DELAY for Reboot_Delay seconds.		
16	VERIFY that that the sign displays the Long_Power_Loss_Msg.	Pass / Fail (Section 3.5.2.3.5.1.2)	
17	GET the following object(s): »dmsMsgSourceMode.0	Pass / Fail (Section 3.5.3.2.1)	
18	VERIFY that the RESPONSE VALUE for dmsMsgSourceMode.0 is equal to powerRecovery (10).	Pass / Fail (Section 3.5.3.2.1)	
19	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	
20	SET the following object(s) to the value(s) shown: »dmsLongPowerRecoveryMessage.0 = Orig_Msg »dmsShortPowerLossTime.0 = Power_Loss_Time	Pass / Fail (Section 3.5.2.3.5.1.2)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.11.3 Configure Message for Controller Reset

Test Case: 11.3	**Title:**	**Configure Message for Controller Reset**	
	Description:	This test case verifies that the DMS allows configuration of reset message.	
	Variables:	Msg_Type	From the Test Plan
		Reset_Msg	From the Test Plan
		Reset_Number	From the Test Plan
		Reboot_Time	From Manufacturer's Documentation
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

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Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the enumerated value for the type of memory in which to store the message (e.g., from the test plan). RECORD this information as: »Msg_Type		
2	CONFIGURE: Determine the MULTI string of the message to be displayed upon a controller reset (e.g., per the test plan). RECORD this information as: »Reset_Msg		
3	CONFIGURE: Determine the message number to use for the storage location of the Reset_Msg (e.g., per the test plan). RECORD this information as: »Reset_Number		
4	CONFIGURE: Determine the amount of time in seconds it takes for the controller to reboot (e.g., from the manufacturer documentation). RECORD this information as: »Reboot_Time		
5	SET-UP: PERFORM the test case labeled 'Define a Message' (C.3.7.2).	Pass / Fail (Section 3.5.2.3.3.3)	
6	PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Reset_Number »Msg_Multi_String = Reset_Msg »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 »Msg_Pixel_Service = 0 »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.3.3)	
7	GET the following object(s): »dmsResetMessage.0	Pass / Fail (Section 3.5.3.3.5)	
8	RECORD the RESPONSE VALUE for dmsResetMessage.0 as: »Orig_Msg		
9	Calculate the CRC code of the Reset_Message. RECORD this information as: »Reset_Msg_CRC		
10	Calculate the Message ID Code for the Reset_Msg using the Msg_Type, Reset_Number, and Reset_Msg_CRC. RECORD this information as: »Reset_Code		
11	SET the following object(s) to the value(s) shown: »dmsResetMessage.0 = Reset_Code	Pass / Fail (Section 3.5.2.3.5.1.4)	
12	PERFORM the test case labeled 'Activate a Message' (C.3.7.6) to activate the message defined in Step 5.	Pass / Fail (Section 3.5.2.3.1)	
13	SET the following object(s) to the value(s) shown: »dmsSWReset.0 = 1	Pass / Fail (Section 3.5.2.2)	

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14	DELAY for Reboot_Time seconds.		
15	VERIFY that that the sign displays the Reset_Msg.	Pass / Fail (Section 3.5.2.3.5.1.4)	
16	GET the following object(s): »dmsSWReset.0	Pass / Fail (Section 5.7.2)	
17	VERIFY that the RESPONSE VALUE for dmsSWReset.0 is equal to 0.	Pass / Fail (Section 5.7.2)	
18	GET the following object(s): »dmsMsgSourceMode.0	Pass / Fail (Section 3.5.3.2.1)	
19	VERIFY that the RESPONSE VALUE for dmsMsgSourceMode.0 is equal to 'reset' (11). Note: Valid enumerated values are defined in Section 5.7.7 (Message Source Mode Parameter).	Pass / Fail (Section 3.5.3.2.1)	
20	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	
21	SET the following object(s) to the value(s) shown: »dmsResetMessage.0 = Orig_Msg	Pass / Fail (Section 3.5.2.3.5.1.4)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.11.4 Configure Message for Communications Loss

Test Case: 11.4	**Title:**	**Configure Message for Communications Loss**
	Description:	This test case verifies that the DMS allows configuration of communications loss message and communications loss time.
	Variables:	Msg_Type — From the Test Plan Comm_Loss_Msg — From the Test Plan Comm_Loss_Number — From the Test Plan Comm_Loss_Time — From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the enumerated value for the type of memory in which to store the message (e.g., from the test plan). RECORD this information as: »Msg_Type		
2	CONFIGURE: Determine the MULTI string of the message to be displayed upon loss of communications (e.g., per the test plan). RECORD this information as: »Comm_Loss_Msg		

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3	CONFIGURE: Determine the message number to use for the storage location of the Comm_Loss_Msg (e.g., per the test plan). RECORD this information as: »Comm_Loss_Number		
4	CONFIGURE: Determine the amount of time to wait, in minutes, before recording a communications loss (e.g., per the test plan). RECORD this information as: »Comm_Loss_Time		
5	SET-UP: GET the following object(s): »dmsControlMode.0		
6	SET-UP: VERIFY that the RESPONSE VALUE for dmsControlMode.0 is equal to 'central' (4) or 'centralOverride' (5).		
7	PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Comm_Loss_Number »Msg_Multi_String = Comm_Loss_Msg »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 »Msg_Pixel_Service = 0 »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.3.3)	
8	GET the following object(s): »dmsCommunicationsLossMessage.0 »dmsTimeCommLoss.0	Pass / Fail (Section 3.5.3.3.6)	
9	RECORD the RESPONSE VALUE for dmsCommunicationsLossMessage.0 and dmsTimeCommLoss.0 as: »Orig_Msg »Time_Comm_Loss		
10	Calculate the CRC of the Comm_Loss_Msg. RECORD this information as: »Comm_Loss_Msg_CRC		
11	Calculate the Message ID Code for the Comm_Loss_Msg using the Msg_Type, Comm_Loss_Number, and Comm_Loss_Msg_CRC. RECORD this information as: »Comm_Loss_Code		
12	SET the following object(s) to the value(s) shown: »dmsCommunicationsLossMessage.0 = Comm_Loss_Code »dmsTimeCommLoss.0 = Comm_Loss_Time	Pass / Fail (Section 3.5.2.3.5.1.5)	
13	SET-UP: PERFORM the test case labeled 'Define a Message' (C.3.7.2).		
14	PERFORM the test case labeled 'Activate a Message' (C.3.7.6) to activate the message defined in Step 5.	Pass / Fail	
15	GET the following object(s): »shortErrorStatus.0	Pass / Fail (Section 3.6.9)	
16	VERIFY that the RESPONSE VALUE for shortErrorStatus.0 has bit 1 (communications error) cleared.	Pass / Fail (Section 3.6.9)	

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17	Multipy Comm_Loss_Time by 60 to calculate the number of seconds to wait for a communications loss error to occur. RECORD this information as: »Comm_Loss_Time_Secs		
18	DELAY for Comm_Loss_Time_Secs seconds.		
19	VERIFY that the sign displays the Comm_Loss_Msg.	Pass / Fail (Section 3.5.2.3.5.1.5)	
20	GET the following object(s): »dmsMsgSourceMode.0	Pass / Fail (Section 3.5.3.2.1)	
21	VERIFY that the sign continues to display the Comm_Loss_Msg.	Pass / Fail (Section 5.7.12)	
22	VERIFY that the RESPONSE VALUE for dmsMsgSourceMode.0 is equal to 'commLoss' (12). Note: Valid enumerated values are defined in Section 5.7.7 (Message Source Mode Parameter).	Pass / Fail (Section 3.5.3.2.1)	
23	GET the following object(s): »shortErrorStatus.0	Pass / Fail (Section 3.6.9)	
24	VERIFY that the RESPONSE VALUE for shortErrorStatus.0 has bit 1 (communications error) set.	Pass / Fail (Section 3.6.9)	
25	SET the following object(s) to the value(s) shown: »dmsCommunicationsLossMessage.0 = Orig_Msg »dmsTimeCommLoss.0 = Time_Comm_Loss	Pass / Fail (Section 3.5.2.3.5.1.5)	
26	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.11.5 Configure Message for End Duration

Test Case: 11.5	**Title:**	**Configure Message for End Duration**	
	Description:	This test case verifies that the DMS supports the end duration message.	
	Variables:	End_Duration_Msg_Type	From the Test Plan
		End_Duration_Msg	From the Test Plan
		End_Duration_Number	From the Test Plan
		End_Duration_Time	From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the enumerated value for the type of memory in which to store the message (e.g., from the test plan). RECORD this information as: »End_Duration_Msg_Type		

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2	CONFIGURE: Determine the MULTI string of the message to be displayed upon the end of a requested message (e.g., per the test plan). RECORD this information as: »End_Duration_Msg		
3	CONFIGURE: Determine the message number to use for the storage location of the End_Duration_Msg (e.g., per the test plan). RECORD this information as: »End_Duration_Number		
4	CONFIGURE: Determine the amount of time, in minutes, for the normal message to display prior to the display of the end duration message (e.g., per the test plan). RECORD this information as: »End_Duration_Time		
5	CONFIGURE: Determine the following parameters for a message to be displayed with a finite duration: »Msg_Type »Msg_Number »Msg_Multi_String		
6	SET-UP: PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Msg_Multi_String »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 »Msg_Pixel_Service = 0 »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0		
7	PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = End_Duration_Msg_Type »Msg_Number = End_Duration_Number »Msg_Multi_String = End_Duration_Msg »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 »Msg_Pixel_Service = 0 »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.3.3)	
8	GET the following object(s): »dmsEndDurationMessage.0	Pass / Fail (Section 3.5.3.3.7)	
9	RECORD the RESPONSE VALUE for dmsEndDurationMessage.0 as: »Orig_Msg		
10	Calculate the CRC code of End_Duration_Msg. RECORD this information as: »End_Duration_CRC		
11	Calculate the Message ID Code for the End_Duration_Msg using the End_Duration_Msg_Type, End_Duration_Number, and End_Duration_CRC. RECORD this information as: »End_Duration_Code		

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12	SET the following object(s) to the value(s) shown: »dmsEndDurationMessage.0 = End_Duration_Code	Pass / Fail (Section 3.5.2.3.5.1.6)	
13	PERFORM the Test Procedure labeled 'Activate a Message' (C.3.14.2) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Msg_Number »Msg_Multi_String = Msg_Multi_String »Msg_Beacon_State = 0 (disabled) »Msg_Pixel_Service = 0 (disabled) »Msg_Activation_Priority = 255 »Msg_Duration = End_Duration_Time »Expected_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail	
14	Multiply End_Duration_Time by 60 to calculate the number of seconds to delay for the End Duration event. RECORD this information as: »End_Duration_Delay		
15	DELAY for End_Duration_Delay seconds.		
16	VERIFY that that the sign displays the End_Duration_Msg.	Pass / Fail (Section 3.5.2.3.5.1.6)	
17	GET the following object(s): »dmsMsgSourceMode.0	Pass / Fail (Section 3.5.3.2.1)	
18	VERIFY that the RESPONSE VALUE for dmsMsgSourceMode.0 is equal to ‘endDuration’ (14).	Pass / Fail (Section 3.5.3.2.1)	
19	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail (Section 3.5.2.3.1)	
20	SET the following object(s) to the value(s) shown: »dmsEndDurationMessage.0 = Orig_Msg	Pass / Fail (Section 3.5.2.3.5.1.6)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.11.6 Configure Message for Power Loss Event

Test Case: 11.6	**Title:**	**Configure Message for Power Loss Event**	
	Description:	This test case verifies that the DMS allows configuration of power loss message. Note that the sign must have the ability to display a message DURING a power loss event for this test to be applicable.	
	Variables:	Msg_Type	From the Test Plan
		Power_Loss_Msg	From the Test Plan
		Power_Loss_Number	From the Test Plan
		Reboot_Time	From Manufacturer’s Documentation
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

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Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the enumerated value for the type of memory in which to store the message (e.g., from the test plan). RECORD this information as: »Msg_Type		
2	CONFIGURE: Determine the MULTI string of the message to be displayed upon the loss of power (e.g., per the test plan). RECORD this information as: »Power_Loss_Msg		
3	CONFIGURE: Determine the message number to use for the storage location of the Power_Loss_Msg (e.g., per the test plan). RECORD this information as: »Power_Loss_Number		
4	CONFIGURE: Determine the amount of time in seconds it takes for the controller to reboot (e.g., from the manufacturer documentation). RECORD this information as: »Reboot_Time		
5	SET-UP: PERFORM the test case labeled 'Define a Message' (C.3.7.2).		
6	PERFORM the Test Procedure labeled 'Define a Message' (C.3.14.1) with the following parameters: »Msg_Type = Msg_Type »Msg_Number = Power_Loss_Number »Msg_Multi_String = Power_Loss_Msg »Msg_Owner = “OWNER” »Msg_Beacon_State = 0 »Msg_Pixel_Service = 0 »Msg_Run_Time_Priority = 255 »Expected_Validate_Error_Code = 2 (none) »Expected_Multi_Error_Code = 2 (none) »Expected_Multi_Error_Pos_Min = 0 »Expected_Multi_Error_Pos_Max = 0	Pass / Fail (Section 3.5.2.3.3.3)	
7	GET the following object(s): »dmsPowerLossMessage.0	Pass / Fail (Section 3.5.3.3.4)	
8	RECORD the RESPONSE VALUE for dmsPowerLossMessage.0 as: »Orig_Msg		
9	Calculate the CRC of the Power_Loss_Msg. RECORD this information as: »Power_Loss_CRC		
10	Calculate the Message ID Code for the Power_Loss_Msg using the Msg_Type, Power_Loss_Number, and Power_Loss_CRC. RECORD this information as: »Power_Loss_Code		
11	SET the following object(s) to the value(s) shown: »dmsPowerLossMessage.0 = Power_Loss_Code	Pass / Fail (Section 3.5.2.3.5.1.3)	
12	PERFORM the test case labeled 'Activate a Message' (C.3.7.6) to activate the message defined in Step 5.	Pass / Fail	
13	Disconnect the power from the sign and controller.		

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14	VERIFY that the sign displays the Power_Loss_Msg.	Pass / Fail (Section 3.5.2.3.5.1.3)	
15	GET the following object(s): »dmsMsgSourceMode.0	Pass / Fail (RFC 1157)	
16	VERIFY that the RESPONSE VALUE for dmsMsgSourceMode.0 is equal to powerLoss (13).	Pass / Fail (Section 3.5.3.2.1, Item d)	
17	Reconnect the power to the sign and controller.		
18	DELAY for Reboot_Time seconds.		
19	PERFORM the test case labeled 'Blank the Sign' (C.3.7.15).	Pass / Fail	
20	SET the following object(s) to the value(s) shown: »dmsPowerLossMessage.0 = Orig_Msg	Pass / Fail (Section 3.5.2.3.5.1.3)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.12 Event Log Tests

C.3.12.1 Determine Capabilities of Event Logging Service

Test Case: 12.1	**Title:**	**Determine Capabilities of Event Logging Service**	
	Description:	This test case verifies that the DMS indicates that it supports the logging capabilities required by the specification	
	Variables:	Required_Event_Classes	PRL H.2.6.2
		Required_Event_Configurations	PRL H.2.6.3
		Required_Event_Log_Size	PRL H.2.7
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the number of event classes required by the specification (PRL H.2.6.2). RECORD this information as: »Required_Event_Classes		
2	CONFIGURE: Determine the number of event configurations required by the specification (PRL H.2.6.3). RECORD this information as: »Required_Event_Configurations		
3	CONFIGURE: Determine the number of events that the log is required to be able to store (PRL H.2.7). RECORD this information as: »Required_Event_Log_Size		
4	GET the following object(s): »maxEventClasses.0 »maxEventLogConfigs.0 »maxEventLogSize.0	Pass / Fail (Section 3.4.2.5)	
5	VERIFY that the RESPONSE VALUE for maxEventClasses.0 is greater than or equal to Required_Event_Classes.	Pass / Fail (Section H.2.6.2)	

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6	VERIFY that the RESPONSE VALUE for maxEventLogConfigs.0 is greater than or equal to Required_Event_Configurations.	Pass / Fail (Section H.2.6.3)	
7	VERIFY that the RESPONSE VALUE for maxEventLogSize.0 is greater than or equal to Required_Event_Log_Size.	Pass / Fail (Section H.2.7)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.12.2 Configure Event Log

Test Case: 12.2	**Title:**	**Configure Event Log**
	Description:	This test case shall configure the event log according to the tester inputs and ensure that the values were accepted and implemented in the device.
	Variables:	Class_Index
		Class_Size_Limit
		Class_Clear_Time
		Class_Description
		Event_Index
		Event_Mode
		Event_Compare_Value1
		Event_Compare_Value2
		Event_Watch_Object: per the test plan
		Event_Log_Object
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the event class to utilize for this test (e.g., per the test plan). RECORD this information as: »Class_Index		
2	CONFIGURE: Determine the log size limit to be imposed for this test on the class (e.g., per the test plan). RECORD this information as: »Class_Size_Limit		
3	CONFIGURE: Determine the time from which all earlier logs are to be cleared (e.g., per the test plan). RECORD this information as: »Class_Clear_Time		
4	CONFIGURE: Determine the description to be used for the log class (e.g., per the test plan). RECORD this information as: »Class_Description		
5	CONFIGURE: Determine the index of the event type to configure as a part of the test (e.g., per the test plan). RECORD this information as: »Event_Index		
6	CONFIGURE: Determine the mode for the event (e.g., the comparison operator) (e.g., per the test plan). RECORD this information as: »Event_Mode		

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7	CONFIGURE: Determine the first comparison value for the event (e.g., per the test plan) (value may need to be changed by event mode). RECORD this information as: »Event_Compare_Value1		
8	CONFIGURE: Determine the second comparison value for the event (e.g., per the test plan) (value may need to be changed by event mode). RECORD this information as: »Event_Compare_Value2		
9	CONFIGURE: Determine the object to which the value shall be compared (the selected object is required to either support all event types supported by the device, such as an integer that changes, or be reconfigured for each type of event) (per the test plan). RECORD this information as: »Event_Watch_Object		
10	CONFIGURE: Determine the object that is intended to be logged upon the detection of the event (e.g., per the test plan). RECORD this information as: »Event_Log_Object		
11	SET-UP: GET the following object(s): »maxEventClasses.0 »maxEventLogConfigs.0 »maxEventLogSize.0		
12	SET-UP: VERIFY that the RESPONSE VALUE for maxEventClasses.0 is greater than or equal to Class_Index.		Section H.3.1.2 Step a
13	SET-UP: VERIFY that the RESPONSE VALUE for maxEventLogConfigs.0 is greater than or equal to Event_Index.		Section H.3.1.2 Step a
14	SET the following object(s) to the value(s) shown: »eventClassLimit.Class_Index = Class_Size_Limit »eventClassClearTime.Class_Index = Class_Clear_Time »eventClassDescription.Class_Index = Class_Description	Pass / Fail (Section 3.4.2.2)	Section H.3.1.2 Step b
15	SET the following object(s) to the value(s) shown: »eventConfigClass.Event_Index = Class_Index »eventConfigMode.Event_Index = Event_Mode »eventConfigCompareValue.Event_Index = Event_Compare_Value1 »eventConfigCompareValue2.Event_Index = Event_Compare_Value2 »eventConfigCompareOID.Event_Index = Event_Watch_Object »eventConfigLogOID.Event_Index = Event_Log_Object »eventConfigAction.Event_Index = 'log' (3) Note: Valid enumerated values for eventConfigMode are defined in NTCIP 1103, Section A.7.5.1.3 (Event Log Configuration Mode Parameter).	Pass / Fail (Section 3.4.2.2)	Section H.3.1.2 Step c
16	GET the following object(s): »eventConfigStatus.Event_Index	Pass / Fail (Section 3.4.2.2)	Section H.3.1.2 Step d
17	VERIFY that the RESPONSE VALUE for eventConfigStatus.Event_Index is equal to 'log' (3). Note: Valid enumerated values for eventConfigMode are defined in NTCIP 1103, Section A.7.5.1.9 (Event Log Configuration Status Parameter).	Pass/Fail (Section 3.4.2.2)	
18	POST-CONDITION: An event type has been configured in the controller.		

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

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C.3.12.3 Retrieve Logged Data

Test Case: 12.3	**Title:**	**Retrieve Logged Data**	
	Description:	This test case verifies that the DMS allows a user to retrieve the logged data.	
	Variables:	Class_Index	From the Test Plan
		Last_Log_Time	From the Test Plan
		Last_Log_ID	From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the class for which the logged data is to be retrieved (e.g., per the test plan). RECORD this information as: »Class_Index		
2	CONFIGURE: Determine the information about the final log entry; if known (otherwise enter zeros). RECORD this information as: »Last_Log_Time (the time at or before which the last event to be logged occurred) »Last_Log_ID (the ID of the last event to be logged)		
3	GET the following object(s): »eventClassNumRowsInLog.Class_Index »eventClassNumEvents.Class_Index	Pass / Fail (Section 3.4.2.3)	Section H.3.1.3 Step b
4	RECORD the RESPONSE VALUE for eventClassNumRowsInLog.Class_Index and eventClassNumEvents.Class_Index as: »Rows »Num_Events		
5	IF Num_Events is equal to 0, then EXIT.		Section H.3.1.3 Step c
5.1	IF Rows is equal to 0, then EXIT.		
6	FOR EACH value, N, from 1 to Rows, perform Steps 6.1-6.3.		
6.1	GET the following object(s): »eventLogID.Class_Index.N »eventLogTime.Class_Index.N »eventLogValue.Class_Index.N	Pass / Fail (Section 3.4.2.3)	Section H.3.1.3 Step e
6.2	IF N is equal to 1, GOTO Step 6.3.		
6.2.1	VERIFY that the RESPONSE VALUE for eventLogTime.Class_Index.N is greater than or equal to Prev_Event_Log_Time	Pass / Fail	
6.3	RECORD the RESPONSE VALUE for eventLogTime.Class_Index.N as: »Prev_Event_Log_Time		
7	IF Last_Log_Time is greater than 0, then GOTO Step 7.1; otherwise, EXIT.		
7.1	VERIFY that the RESPONSE VALUE for eventLogTime.Class_Index.N is greater than or equal to Last_Log_Time.		
7.2	VERIFY that the RESPONSE VALUE for eventLogID.Class_Index.N is equal to Last_Log_ID.		

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Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.12.4 Clear Log

Test Case: 12.4	**Title:**	**Clear Log**
	Description:	This test case verifies that the DMS allows the user to clear the log for a specified class.
	Variables:	Class_Index — From the Test Plan Class_Clear_Time — From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the class of events to be cleared from the log (e.g., per the test plan). RECORD this information as: »Class_Index		
2	CONFIGURE: Determine the time from which all earlier logs shall be cleared (e.g., per the test plan). RECORD this information as: »Class_Clear_Time		
3	SET the following object(s) to the value(s) shown: »eventClassClearTime.Class_Index = Class_Clear_Time	Pass / Fail (Section 3.4.2.4)	
4	GET the following object(s): »eventClassNumRowsInLog.Class_Index	Pass / Fail (Section 3.4.2.3)	
5	Determine the RESPONSE VALUE for eventClassNumRowsInLog.Class_Index. RECORD this information as: »Rows		
6	FOR EACH value, N, from 1 to Rows, perform Steps 6.1 through 6.2.		
6.1	GET the following object(s): »eventLogTime.Class_Index.N	Pass / Fail (Section 3.4.2.3)	
6.2	VERIFY that the RESPONSE VALUE for eventLogTime.Class_Index.N is greater than Class_Clear_Time.	Pass / Fail (Section 3.4.2.4)	
7	POST-CONDITION: Log entries less than or equal to Class_Clear_Time have been deleted from the log.		

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

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C.3.12.5 Determine Total Number of Events

Test Case: 12.5	**Title:**	**Determine Total Number of Events**
	Description:	This test case verifies that the DMS allows the user to determine the total number of events in the log.
	Variables:	
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.

Step	Test Procedure	Results	Additional References
1	GET the following object(s): »maxEventClasses.0	Pass / Fail (Section 3.4.2.5)	
2	RECORD the RESPONSE VALUE for maxEventClasses.0 as: »Max_Event_Classes		
3	RECORD the value of 0 as: »Total_Events		
4	FOR EACH value, N, from 1 to Max_Event_Classes, perform Steps 4.1 through 4.3.		
4.1	GET the following object(s): »eventClassNumRowsInLog.N »eventClassNumEvents.N	Pass / Fail (Section 3.4.2.3)	
4.2	RECORD the RESPONSE VALUE for eventClassNumEvents.N as: »Num_Events		
4.3	Calculate the sum of Total_Events and Num_Events. RECORD this information as: »Total_Events		
5	GET the following object(s): »numEvents.0	Pass / Fail (Section 3.4.2.6)	
6	VERIFY that the RESPONSE VALUE for numEvents.0 is equal to the lower 2-bytes of Total_Events. Note: If an event occurred during this process, this condition does not hold true.	Pass / Fail (Section 3.4.2.6)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

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C.3.12.6 Verify Log Limit Storage

Test Case: 12.6	**Title:**	**Verify Log Limit Storage**
	Description:	This test case verifies that the DMS stores only the latest of the maximum number of events per class.
	Variables:	Class_Index — From the Test Plan Class_Size_Limit — From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the class for which the logged data is to be retrieved (e.g., per the test plan). RECORD this information as: »Class_Index		
2	CONFIGURE: Determine the log size limit that the test shall impose on the class (e.g., per the test plan). RECORD this information as: »Class_Size_Limit		
3	CONFIGURE: GET the following object(s): »globalTime.0		
4	CONFIGURE: RECORD the RESPONSE VALUE for globalTime.0 as: »Class_Clear_Time		
5	PERFORM the test case labeled 'Configure Event Log' (C.3.12.2).	Pass / Fail	
6	GET the following object(s): »numEvents.0	Pass / Fail (Section 3.4.2.6)	
7	RECORD the RESPONSE VALUE for numEvents.0 as: »Num_Events		
8	Create conditions to cause the device to log the event Class_Size_Limit times. Note: This may require physically changing a sensor reading or setting an object within the device.		
9	GET the following object(s): »numEvents.0	Pass / Fail (Section 3.4.2.6)	
10	VERIFY that the RESPONSE VALUE for numEvents.0 is equal to Num_Events plus Class_Size_Limit.	Pass / Fail (Section 3.4.2.6)	
11	RECORD the RESPONSE VALUE for numEvents.0 as: »Num_Events		
12	GET the following object(s): »eventClassNumRowsInLog.Class_Index »eventClassNumEvents.Class_Index	Pass / Fail (Section 3.4.2.3)	Section H.3.1.3 Step b
13	VERIFY that the RESPONSE VALUE for eventClassNumRowsInLog.Class_Index is equal to Class_Size_Limit.	Pass / Fail (Section H.2.6.2)	
14	RECORD the RESPONSE VALUE for eventClassNumRowsInLog.Class_Index as: »Rows		

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15	FOR EACH value, N, from 1 to Rows, perform Steps 15.1 through 15.2.		
15.1	GET the following object(s): »eventLogID.Class_Index.N »eventLogTime.Class_Index.N »eventLogValue.Class_Index.N	Pass / Fail (Section 3.4.2.3)	Section H.3.1.3 Step e
15.2	IF N is equal to 1, then GOTO Step 15.2.1; otherwise, GOTO Step 15.2.2.		
15.2.1	RECORD the RESPONSE VALUE for eventLogTime.Class_Index.N as: »Old_Timestamp GO TO Step 15.		
15.2.2	RECORD the RESPONSE VALUE for eventLogTime.Class_Index.N as: »Limit_Timestamp		
16	Create conditions to cause the device to log the event one more time.		
17	GET the following object(s): »numEvents.0	Pass / Fail (Section 3.4.2.6)	
18	VERIFY that the RESPONSE VALUE for numEvents.0 is equal to Num_Events plus 1.	Pass / Fail (Section 3.4.2.6)	
19	GET the following object(s): »eventClassNumRowsInLog.Class_Index »eventClassNumEvents.Class_Index	Pass / Fail (Section 3.4.2.3)	Section H.3.1.3 Step b
20	VERIFY that the RESPONSE VALUE for eventClassNumRowsInLog.Class_Index is equal to Class_Size_Limit.	Pass / Fail (Section H.2.6.2)	
21	RECORD the RESPONSE VALUE for eventClassNumRowsInLog.Class_Index as: »Rows		
22	FOR EACH value, N, from 1 to Rows, perform Steps 22.1 through 22.2..		
22.1	GET the following object(s): »eventLogTime.Class_Index.N	Pass / Fail (Section 3.4.2.3)	Section H.3.1.3 Step e
22.2	IF N is equal to 1, then GOTO Step 22.2.1; otherwise, GOTO Step 22.		
22.2.1	VERIFY that the RESPONSE VALUE for eventLogTime.Class_Index.N is greater than Old_Timestamp. GO TO Step 22.	Pass / Fail (Section H.2.7)	
23	VERIFY that the RESPONSE VALUE for eventLogTime.Class_Index.N is greater than Limit_Timestamp.	Pass / Fail (Section H.2.7)	
24	POST-CONDITION: The event log has been filled for subject event class.		

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

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C.3.12.7 Verify Support for an On-Change Event

Test Case: 12.7	**Title:**	**Verify Support for an On-Change Event**
	Description:	This test case verifies that the DMS allows configuration of an on-change event and the DMS logs events appropriately.
	Variables:	Event_Index — From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the index of the event type to configure as a part of the test (e.g., per the test plan). RECORD this information as: »Event_Index		
2	PERFORM the test case labeled 'Configure Event Log' (C.3.12.2) with the following parameters: »Event_Mode = ‘onChange’ (2) Note: Valid enumerated values are defined in NTCIP 1103, Section A.7.5.1.3 (Event Log Configuration Parameter).	Pass / Fail (Section H.2.6.4.1)	
3	GET the following object(s): »globalTime.0	Pass / Fail (RFC 1157)	
4	RECORD the RESPONSE VALUE for globalTime.0 as: »Time		
5	SET-UP: Create an event for the device to log. Note: This may require physically changing a sensor reading or setting an object within the device.		
6	PERFORM the test case labeled 'Retrieve Logged Data' (C.3.12.3) with the following parameters: »Last_Log_Time = Time »Last_Log_ID = Event_Index	Pass / Fail (Section H.2.6.4.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.12.8 Verify Support for a Greater Than Event

Test Case: 12.8	**Title:**	**Verify Support for a Greater Than Event**
	Description:	This test case verifies that the DMS allows configuration of a greater than event and the DMS logs events appropriately.
	Variables:	Event_Index — From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the index of the event type to configure as a part of the test (e.g., per the test plan). RECORD this information as: »Event_Index		

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2	PERFORM the test case labeled 'Configure Event Log' (C.3.12.2) with the following parameters: »Event_Mode = 3 (greaterThanValue)	Pass / Fail (Section H.2.6.4.2)	
3	GET the following object(s): »globalTime.0	Pass / Fail (RFC 1157)	
4	RECORD the RESPONSE VALUE for globalTime.0 as: »Time		
5	SET-UP: Either SET the Event_Watch_Object to a value less than or equal to Event_Compare_Value1, or produce a condition such that Event_Watch_Object is changed by the controller to a value less than or equal to Event_Compare_Value1.		
6	SET-UP: Either SET the Event_Watch_Object to a value greater than Event_Compare_Value1, or produce a condition such that Event_Watch_Object is changed by the controller to a value greater than Event_Compare_Value1.		
7	SET-UP: Create an event for the device to log. Note: This may require physically changing a sensor reading or setting an object within the device.		
8	PERFORM the test case labeled 'Retrieve Logged Data' (C.3.12.3) with the following parameters: »Last_Log_Time = Time »Last_Log_ID = Event_Index	Pass / Fail (Section H.2.6.4.2)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.12.9 Verify Support for a Less Than Event

Test Case: 12.9	**Title:**	**Verify Support for a Less Than Event**	
	Description:	This test case verifies that the DMS allows configuration of a less than event and the DMS logs events appropriately.	
	Variables:	Event_Index	From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the index of the event type to configure as a part of the test (e.g., per the test plan). RECORD this information as: »Event_Index		
2	PERFORM the test case labeled 'Configure Event Log' (C.3.12.2) with the following parameters: »Event_Mode = 4 (smallerThanValue)	Pass / Fail (Section H.2.6.4.3)	
3	GET the following object(s): »globalTime.0	Pass / Fail (RFC 1157)	
4	RECORD the RESPONSE VALUE for globalTime.0 as: »Time		

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5	SET-UP: Either SET the Event_Watch_Object to a value greater than or equal to Event_Compare_Value1, or produce a condition such that Event_Watch_Object is changed by the controller to a value greater than or equal to Event_Compare_Value1.		
6	SET-UP: Either SET the Event_Watch_Object to a value less than Event_Compare_Value1, or produce a condition such that Event_Watch_Object is changed by the controller to a value less than Event_Compare_Value1.		
7	SET-UP: Create an event for the device to log. Note: This may require physically changing a sensor reading or setting an object within the device.		
8	PERFORM the test case labeled 'Retrieve Logged Data' (C.3.12.3) with the following parameters: »Last_Log_Time = Time »Last_Log_ID = Event_Index	Pass / Fail (Section H.2.6.4.3)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.12.10 Verify Support for a Hysteresis Event

Test Case: 12.10	**Title:**	**Verify Support for a Hysteresis Event**
	Description:	This test case verifies that the DMS allows configuration of a hysteresis event and the DMS logs events appropriately.
	Variables:	Event_Index — From the Test Plan Class_Index — From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the index of the event type to configure as a part of the test (e.g., per the test plan). RECORD this information as: »Event_Index		
2	CONFIGURE: Determine the number of the class to associate with this event (e.g., per the test plan). RECORD this information as: »Class_Index		
3	PERFORM the test case labeled ‘Clear Log’ (C.3.12.4).		
4	PERFORM the test case labeled 'Configure Event Log' (C.3.12.2) with the following parameters: »Event_Mode = 5 (hysteresisBound)	Pass / Fail (Section H.2.6.4.4)	
5	SET-UP: By means of either performing a SET or modifying an external condition, cause the value of Event_Watch_Object to change to a value less than or equal to the lesser of Event_Compare_Value1 and Event_Compare_Value2.		
6	GET the following object(s): »eventClassNumRowsInLog.Class_Index »eventClassNumEvents.Class_Index	Pass / Fail (Section 3.4.2.3)	Section H.3.1.3 Step b

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7	VERIFY that the RESPONSE VALUE for eventClassNumRowsInLog.Class_Index is equal to zero.	Pass / Fail	
8	VERIFY that the RESPONSE VALUE for eventClassNumEvents.Class_Index is equal to zero,	Pass / Fail	
9	SET-UP: By means of either performing a SET or modifying an external condition, cause the value of Event_Watch_Object to change to a value inclusively between Event_Compare_Value1 and Event_Compare_Value2		
10	GET the following object(s): »eventClassNumRowsInLog.Class_Index »eventClassNumEvents.Class_Index	Pass / Fail (Section 3.4.2.3)	Section H.3.1.3 Step b
11	VERIFY that the RESPONSE VALUE for eventClassNumRowsInLog.Class_Index is equal to zero.	Pass / Fail	
12	VERIFY that the RESPONSE VALUE for eventClassNumEvents.Class_Index is equal to zero.	Pass / Fail	
13	SET-UP: By means of either performing a SET or modifying an external condition, cause the value of Event_Watch_Object to change to a value less than or equal to the lesser of Event_Compare_Value1 and Event_Compare_Value2.		
14	GET the following object(s): »eventClassNumRowsInLog.Class_Index »eventClassNumEvents.Class_Index	Pass / Fail (Section 3.4.2.3)	Section H.3.1.3 Step b
15	VERIFY that the RESPONSE VALUE for eventClassNumRowsInLog.Class_Index is equal to zero.	Pass / Fail	
16	VERIFY that the RESPONSE VALUE for eventClassNumEvents.Class_Index is equal to zero,	Pass / Fail	
17	GET the following object(s): »globalTime.0	Pass / Fail (RFC 1157)	
18	RECORD the RESPONSE VALUE for globalTime.0 as: »Time		
19	SET-UP: By means of either performing a SET or modifying an external condition, cause the value of Event_Watch_Object to change to a value greater than the greater of Event_Compare_Value1 and Event_Compare_Value2.		
20	PERFORM the test case labeled 'Retrieve Logged Data' (C.3.12.3) with the following parameters: »Last_Log_Time = Time »Last_Log_ID = Event_Index	Pass / Fail (Section H.2.6.4.4)	
21	SET-UP: By means of either performing a SET or modifying an external condition, cause the value of Event_Watch_Object to change to a value inclusively between Event_Compare_Value1 and Event_Compare_Value2		
22	GET the following object(s): »eventClassNumRowsInLog.Class_Index »eventClassNumEvents.Class_Index	Pass / Fail (Section 3.4.2.3)	Section H.3.1.3 Step b
23	VERIFY that the RESPONSE VALUE for eventClassNumRowsInLog.Class_Index is equal to 1.	Pass / Fail	

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24	VERIFY that the RESPONSE VALUE for eventClassNumEvents.Class_Index is equal to 1.	Pass / Fail	
25	SET-UP: By means of either performing a SET or modifying an external condition, cause the value of Event_Watch_Object to change to a value greater than the greater of Event_Compare_Value1 and Event_Compare_Value2.		
26	GET the following object(s): »eventClassNumRowsInLog.Class_Index »eventClassNumEvents.Class_Index	Pass / Fail (Section 3.4.2.3)	Section H.3.1.3 Step b
27	VERIFY that the RESPONSE VALUE for eventClassNumRowsInLog.Class_Index is equal to 1.	Pass / Fail	
28	VERIFY that the RESPONSE VALUE for eventClassNumEvents.Class_Index is equal to 1.	Pass / Fail	
29	GET the following object(s): »globalTime.0	Pass / Fail (RFC 1157)	
30	RECORD the RESPONSE VALUE for globalTime.0 as: »Time		
31	SET-UP: By means of either performing a SET or modifying an external condition, cause the value of Event_Watch_Object to change to a value less than or equal to the lesser of Event_Compare_Value1 and Event_Compare_Value2.		
32	PERFORM the test case labeled 'Retrieve Logged Data' (C.3.12.3) with the following parameters: »Last_Log_Time = Time »Last_Log_ID = Event_Index	Pass / Fail (Section H.2.6.4.4)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.12.11 Verify Support for a Periodic Event

Test Case: 12.11	**Title:**	**Verify Support for a Periodic Event**
	Description:	This test case verifies that the DMS allows configuration of a Periodic event and the DMS logs events appropriately.
	Variables:	Event_Index — From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the index of the event type to configure as a part of the test (e.g., per the test plan). RECORD this information as: »Event_Index		
2	PERFORM the test case labeled 'Configure Event Log' (C.3.12.2) with the following parameters: »Event_Mode = 6 (periodic)	Pass / Fail (Section H.2.6.4.5)	
3	GET the following object(s): »globalTime.0	Pass / Fail (RFC 1157)	

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4	RECORD the RESPONSE VALUE for globalTime.0 as: »Time		
5	SET-UP: Create an event for the device to log. Note: This may require physically changing a sensor reading or setting an object within the device.		
6	PERFORM the test case labeled 'Retrieve Logged Data' (C.3.12.3) with the following parameters: »Last_Log_Time = Time »Last_Log_ID = Event_Index	Pass / Fail (Section H.2.6.4.5)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.12.12 Verify Support for a Bit-flag Event

Test Case: 12.12	**Title:**	**Verify Support for a Bit-flag Event**	
	Description:	This test case verifies that the DMS allows configuration of a bit-flag event and the DMS logs events appropriately.	
	Variables:	Event_Index	From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the index of the event type to configure as a part of the test (e.g., per the test plan). RECORD this information as: »Event_Index		
2	PERFORM the test case labeled 'Configure Event Log' (C.3.12.2) with the following parameters: »Event_Mode = 7 (andedWithValue)	Pass / Fail (Section H.2.6.4.6)	
3	GET the following object(s): »globalTime.0	Pass / Fail (RFC 1157)	
4	RECORD the RESPONSE VALUE for globalTime.0 as: »Time		
5	SET-UP: Either SET the Event_Watch_Object to a value such that the AND operation of Event_Compare_Value1 with Event_Watch_Object equals zero, or produce a condition such that Event_Watch_Object is changed by the controller to a value such that the AND operation of Event_Compare_Value1 with Event_Watch_Object equals zero.		
6	SET-UP: Either SET the Event_Watch_Object to a value such that the AND operation of Event_Compare_Value1 with Event_Watch_Object does NOT equal zero, or produce a condition such that Event_Watch_Object is changed by the controller to a value such that the AND operation of Event_Compare_Value1 with Event_Watch_Object does NOT equal zero.		
7	SET-UP: Create an event for the device to log. Note: This may require physically changing a sensor reading or setting an object within the device.		

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8	PERFORM the test case labeled 'Retrieve Logged Data' (C.3.12.3) with the following parameters: »Last_Log_Time = Time »Last_Log_ID = Event_Index	Pass / Fail (Section H.2.6.4.6)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.12.13 Determine Configuration of Logging Service

Test Case: 12.13	**Title:**	**Determine Configuration of Logging Service**
	Description:	This test case verifies that the DMS returns the configuration of the logging service.
	Variables:	
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.

Step	Test Procedure	Results	Additional References
1	GET the following object(s): »maxEventClasses.0 »maxEventLogConfigs.0 »maxEventLogSize.0	Pass / Fail (Section 3.4.2.5)	
2	RECORD the RESPONSE VALUE for maxEventClasses.0, maxEventLogConfigs.0 and maxEventLogSize.0 as: »Max_Event_Classes »Max_Configs »Max_Log_Size		
3	FOR EACH value, N, from 1 to Max_Event_Classes, perform Step 3.1.		
3.1	GET the following object(s): »eventClassLimit.N »eventClassClearTime.N »eventClassDescription.N	Pass / Fail (Section 3.4.2.1)	Section H.3.1.1 Step b
4	FOR EACH value, N, from 1 to Max_Configs, perform Step 4.1.		
4.1	GET the following object(s): »eventConfigClass.N »eventConfigMode.N »eventConfigCompareValue.N »eventConfigCompareValue2.N »eventConfigCompareOID.N »eventConfigLogOID.N »eventConfigAction.N »eventConfigStatus.N	Pass / Fail (Section 3.4.2.1)	Section H.3.1.1 Step c

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

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C.3.13 Global Tests

C.3.13.1 Determine Device Component Information

Test Case: 13.1	Title:	Determine Device Component Information
	Description:	This test case verifies that the data stored in the module table reflects the information about the device.
	Variables:	
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.

Step	Test Procedure	Results	Additional References
1	GET the following object(s): »globalMaxModules.0	Pass / Fail (Section H.2.1)	Section H.3.3 Step a
2	RECORD the RESPONSE VALUE for globalMaxModules.0 as: »Num_Modules		
3	FOR EACH value, N, from 1 to Num_Modules, perform Steps 3.1 through 3.6.		
3.1	GET the following object(s): »moduleDeviceNode.N »moduleMake.N »moduleModel.N »moduleVersion.N »moduleType.N	Pass / Fail (Section H.2.1)	Section H.3.3.Step b
3.2	VERIFY that the RESPONSE VALUE for moduleDeviceNode.N is an appropriate value. Note: Should be equal to '1.3.6.1.4.1.1206.4.2.3' for DMS	Pass / Fail (Section H.2.1 Item a)	
3.3	VERIFY that the RESPONSE VALUE for moduleMake.N indicates the manufacturer's name of the device or component.	Pass / Fail (Section H.2.1 Item b)	
3.4	VERIFY that the RESPONSE VALUE for moduleModel.N indicates the model number of the device or component.	Pass / Fail (Section H.2.1 Item c)	
3.5	VERIFY that the RESPONSE VALUE for moduleVersion.N indicates the correct version number for the component moduleType.N.	Pass / Fail (Section H.2.1 Item d)	
3.6	VERIFY that the RESPONSE VALUE for moduleType.N correctly indicates the type of module (i.e., hardware or software).	Pass / Fail (Section H.2.1 Item e)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.13.2 Determine Supported Standards

Test Case: 13.2	Title:	Determine Supported Standards
	Description:	This test case verifies that the DMS indicates the standards that it supports.
	Variables:	
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.

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Step	Test Procedure	Results	Additional References
1	GET the following object(s): »controllerBaseStandards.0	Pass / Fail (Section H.2.4)	
2	VERIFY that the RESPONSE VALUE for controllerBaseStandards.0 properly identifies the standards that the device supports, and the information is presented in the format defined by NTCIP 1201 v03, Section 2.2.4.	Pass / Fail (Section H.2.4)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.13.3 Set Time

Test Case: 13.3	**Title:**	**Set Time**
	Description:	This test case verifies that the DMS allows a set to globalTime to a new value and ensures that the new value was accepted, implemented and that the device properly updates both UTC and local time.
	Variables:	
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.

Step	Test Procedure	Results	Additional References
1	Determine the time the test started according to the test computer. RECORD this information as: »Test_Time		
2	GET the following object(s): »globalTime.0 »controllerStandardTimeZone.0 »globalDaylightSaving.0 »controllerLocalTime.0	Pass / Fail (Section H.2.2.4)	
3	RECORD the RESPONSE VALUE for globalTime.0 and controllerLocalTime.0 as: »UTC_Time »Local_Time		
4	Calculate the time difference between Local_Time and UTC_Time. RECORD this information as: »Time_Diff		
5	Calculate the value of UTC_Time plus 7200 seconds. RECORD this information as: »New_UTC_Time		
6	SET the following object(s) to the value(s) shown: »globalTime.0 = New_UTC_Time Note: This advances the clock by two hours.	Pass / Fail (Section H.2.2.1)	
7	Calculate UTC_Time plus 7200 plus the amount of time that has elapsed since Step 1. RECORD this information as: »Expected_Time		

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8	GET the following object(s): »globalTime.0 »controllerStandardTimeZone.0 »globalDaylightSaving.0 »controllerLocalTime.0	Pass / Fail (Section H.2.2.4)	
9	VERIFY that the RESPONSE VALUE for globalTime.0 is roughly equal to Expected_Time.	Pass / Fail (Section H.2.2.4)	
10	VERIFY that the RESPONSE VALUE for controllerLocalTime.0 is roughly equal to Expected_Time plus Time_Diff.	Pass / Fail (Section H.2.2.4)	
11	DELAY for 15 seconds.		
12	GET the following object(s): »globalTime.0 »controllerStandardTimeZone.0 »globalDaylightSaving.0 »controllerLocalTime.0	Pass / Fail (Section H.2.2.4)	
13	VERIFY that the RESPONSE VALUE for globalTime.0 is roughly equal to Expected_Time plus 15 seconds.	Pass / Fail (Section H.2.2.4)	
14	VERIFY that the RESPONSE VALUE for controllerLocalTime.0 is roughly equal to Expected_Time plus Time_Diff plus 15 seconds.	Pass / Fail (Section H.2.2.4)	
15	Calculate the time to set in the agent to restore the original value. RECORD this information as: »Restore_UTC_Time		
16	SET the following object(s) to the value(s) shown: »globalTime.0 = Restore_UTC_Time	Pass / Fail (Section H.2.2.1)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.13.4 Set Time Zone

Test Case: 13.4	**Title:**	**Set Time Zone**
	Description:	This test case verifies that the DMS properly handles time zones.
	Variables:	
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.

Step	Test Procedure	Results	Additional References
1	Determine the time the test started according to the test computer. RECORD this information as: »Test_Time		
2	GET the following object(s): »globalTime.0 »globalDaylightSaving.0 »controllerLocalTime.0 »controllerStandardTimeZone.0	Pass / Fail (Section H.2.2.4)	

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3	RECORD the RESPONSE VALUE for globalTime.0, controllerLocalTime.0 and controllerStandardTimeZone.0 as: »UTC_Time »Local_Time »Time_Zone		
4	RECORD the RESPONSE VALUE for globalDaylightSaving.0 as: »DST_Enabled		
5	Determine the correct local standard time by adding the RESPONSE VALUE for globalTime.0 to the RESPONSE VALUE for controllerStandardTimeZone.0. RECORD this information as: »Correct_Local_Time		
6	VERIFY that the RESPONSE VALUE for controllerLocalTime.0 is equal to Correct_Local_Time or Correct_Local_Time plus 3600, if DST is active.	Pass / Fail (Section H.2.2.2)	
7	Calculate the value of Time_Zone plus 7200. RECORD this information as: »New_Time_Zone		
8	SET the following object(s) to the value(s) shown: »controllerStandardTimeZone.0 = New_Time_Zone Note: This advances the local clock by two hours.	Pass / Fail (Section H.2.2.2)	
9	Determine the amount of time that has elapsed since the start of the test. RECORD this information as: »Time_Diff		
10	GET the following object(s): »globalTime.0 »globalDaylightSaving.0 »controllerLocalTime.0 »controllerStandardTimeZone.0	Pass / Fail (Section H.2.2.4)	
11	VERIFY that the RESPONSE VALUE for globalTime.0 is roughly equal to UTC_Time plus Time_Diff.	Pass / Fail (Section H.2.2.4)	
12	VERIFY that the RESPONSE VALUE for controllerLocalTime.0 is roughly equal to Local_Time plus 7200 plus the amount of time that elapsed between Steps 1 and 10. Note: If globalDaylightSaving is enabled and a daylight saving event occurs during the 2-hour time window covered by this test, this value differs by the amount of the DST event.	Pass / Fail (Section H.2.2.4)	
13	VERIFY that the RESPONSE VALUE for controllerStandardTimeZone.0 is equal to Time_Zone plus 7200.	Pass / Fail (Section H.2.2.4)	
14	SET the following object(s) to the value(s) shown: »controllerStandardTimeZone.0 = Time_Zone	Pass / Fail (Section H.2.2.2)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

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C.3.13.5 Verify Change into Daylight Savings Period (US DST Enabled)

Test Case: 13.5	**Title:**	**Verify Change into Daylight Savings Period (US DST Enabled)**
	Description:	This test case verifies that the DMS properly adjusts the time due to time changing from non-daylight savings period to daylight savings period when daylight savings is enabled on the DMS.
	Variables:	DST_Year — From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the year for which the daylight savings operation shall be performed (e.g., per the test plan). RECORD this information as: »DST_Year Note: The periods during which DST is in effect were changed in 2007. This test procedure is only valid for years 2007 and higher.		
2	GET the following object(s): »globalTime.0 »controllerStandardTimeZone.0 »globalDaylightSaving.0 »controllerLocalTime.0	Pass / Fail (Section H.2.2.4)	
3	RECORD the RESPONSE VALUE for globalTime.0, controllerStandardTimeZone.0, and globalDaylightSaving.0 as: »Orig_Time »Orig_DST »Time_Zone		
4	SET the following object(s) to the value(s) shown: »globalDaylightSaving.0 = 'enableUSDST' (3) Note: Valid enumerated values are defined in NTCIP 1201 v03, Section 2.4.2 (Global Daylight Saving Parameter)	Pass / Fail (Section H.2.2.3)	
5	Calculate the local time in seconds for 1:58 am, for the 2nd Sunday in March for the DST_Year, then subtract Time_Zone (2 minutes prior to rollover). RECORD this information as: »Spring_DST		
6	SET the following object(s) to the value(s) shown: »globalTime.0 = Spring_DST Note: Rules for valid values are defined in NTCIP 1201 v03, Section 2.4.1 (Global Time Parameter).	Pass / Fail (Section H.2.2.1)	
7	GET the following object(s): »globalTime.0 »controllerStandardTimeZone.0 »controllerLocalTime.0 »globalDaylightSaving.0	Pass / Fail (Section H.2.2.4)	
8	RECORD the RESPONSE VALUE for globalTime.0 plus Time_Zone as: »Expected_Time		
9	VERIFY that the RESPONSE VALUE for controllerLocalTime.0 is equal to Expected_Time.	Pass / Fail (Section H.2.2.4)	
10	DELAY for 150 seconds.		

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11	GET the following object(s): »globalTime.0 »controllerStandardTimeZone.0 »controllerLocalTime.0 »globalDaylightSaving.0	Pass / Fail (Section H.2.2.4)	
12	Calculate the RESPONSE VALUE for globalTime.0 plus Time_Zone plus 3600. RECORD this information as: »Expected_Time		
13	VERIFY that the RESPONSE VALUE for controllerLocalTime.0 is equal to Expected_Time.	Pass / Fail (Section H.2.2.4)	
14	SET the following object(s) to the value(s) shown: »globalTime.0 = Orig_Time	Pass / Fail (Section H.2.2.1)	
15	SET the following object(s) to the value(s) shown: »globalDaylightSaving.0 = Orig_DST	Pass / Fail (Section H.2.2.3)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.13.6 Verify Change out of Daylight Savings Period (US DST Enabled)

Test Case: 13.6	**Title:**	**Verify Change out of Daylight Savings Period (US DST Enabled)**	
	Description:	This test case verifies that the DMS properly adjusts the time due to time changing from daylight savings period to non-daylight savings period when daylight savings is enabled on the DMS.	
	Variables:	DST_Year	From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the year for which the daylight savings operation shall be performed (e.g., per the test plan). RECORD this information as: »DST_Year Note: The periods during which DST is in effect were changed in 2007. This test procedure is only valid for years 2007 and higher.		
2	GET the following object(s): »globalTime.0 »controllerLocalTime.0 »globalDaylightSaving.0 »controllerStandardTimeZone.0	Pass / Fail (Section H.2.2.4)	
3	RECORD the RESPONSE VALUE for globalTime.0, globalDaylightSaving.0, and controllerStandardTimeZone.0 as: »Orig_Time »Orig_DST »Time_Zone		
4	SET the following object(s) to the value(s) shown: »globalDaylightSaving.0 = 'enableUSDST' (3) Note: Valid enumerated values are defined in NTCIP 1201 v03, Section 2.4.2 (Global Daylight Saving Parameter).	Pass / Fail (Section H.2.2.3)	

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5	Calculate the local time in seconds for 1:58 am (Daylight Time), first Sunday in November for the DST_Year, then subtract Time_Zone and 3600 (for daylight saving time) (2 minutes prior to rollover). RECORD this information as: »Fall_DST		
6	SET the following object(s) to the value(s) shown: »globalTime.0 = Fall_DST Note: Rules for valid values are defined in NTCIP 1201 v03, Section 2.4.1 (Global Time Parameter).	Pass / Fail (Section H.2.2.1)	
7	GET the following object(s): »globalTime.0 »controllerLocalTime.0 »globalDaylightSaving.0 »controllerStandardTimeZone.0	Pass / Fail (Section H.2.2.4)	
8	Calculate the RESPONSE VALUE for globalTime.0 plus Time_Zone plus 3600. RECORD this information as: »Expected_Time		
9	VERIFY that the RESPONSE VALUE for controllerLocalTime.0 is equal to Expected_Time.	Pass / Fail (Section H.2.2.4)	
10	DELAY for 150 seconds.		
11	GET the following object(s): »globalTime.0 »controllerLocalTime.0 »globalDaylightSaving.0 »controllerStandardTimeZone.0	Pass / Fail (Section H.2.2.4)	
12	Calculate the RESPONSE VALUE for globalTime.0 plus Time_Zone. RECORD this information as: »Expected_Time		
13	VERIFY that the RESPONSE VALUE for controllerLocalTime.0 is equal to Expected_Time.	Pass / Fail (Section H.2.2.4)	
14	SET the following object(s) to the value(s) shown: »globalTime.0 = Orig_Time	Pass / Fail (Section H.2.2.1)	
15	SET the following object(s) to the value(s) shown: »globalDaylightSaving.0 = Orig_DST	Pass / Fail (Section H.2.2.3)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

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C.3.13.7 Verify Change into Daylight Savings Period (US DST Disabled)

Test Case: 13.7	**Title:**	**Verify Change into Daylight Savings Period (US DST Disabled)**
	Description:	This test case verifies that the DMS does not adjust the time due to time changing from non-daylight savings period to daylight savings period when daylight savings is disabled on the DMS.
	Variables:	DST_Year
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the year for which the daylight savings operation shall be performed (e.g., per the test plan). RECORD this information as: »DST_Year Note: The periods during which DST is in effect were changed in 2007. This test procedure is only valid for years 2007 and higher.		
2	GET the following object(s): »globalTime.0 »controllerStandardTimeZone.0 »globalDaylightSaving.0 »controllerLocalTime.0	Pass / Fail (Section H.2.2.4)	
3	RECORD the RESPONSE VALUE for globalTime.0, controllerStandardTimeZone.0, and globalDaylightSaving.0 as: »Orig_Time »Time_Zone »Orig_DST		
4	SET the following object(s) to the value(s) shown: »globalDaylightSaving.0 = 'disableDST' (2) Note: Valid enumerated values are defined in NTCIP 1201 v03, Section 2.4.2 (Global Daylight Saving Parameter).	Pass / Fail (Section H.2.2.3)	
5	Calculate the local time in seconds for 1:58 am, 2nd Sunday in March for the DST_Year then subtract Time_Zone (2 minutes prior to rollover). RECORD this information as: »DST_Spring		
6	SET the following object(s) to the value(s) shown: »globalTime.0 = DST_Spring Note: Rules for valid values are defined in NTCIP 1201 v03, Section 2.4.1 (Global Time Parameter).	Pass / Fail (Section H.2.2.1)	
7	GET the following object(s): »globalTime.0 »controllerStandardTimeZone.0 »globalDaylightSaving.0 »controllerLocalTime.0	Pass / Fail (Section H.2.2.4)	
8	Calculate the RESPONSE VALUE for globalTime.0 plus Time_Zone. RECORD this information as: »Expected_Time		
9	VERIFY that the RESPONSE VALUE for controllerLocalTime.0 is equal to Expected_Time.	Pass / Fail (Section H.2.2.4)	
10	DELAY for 150 seconds.		

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11	GET the following object(s): »globalTime.0 »controllerStandardTimeZone.0 »globalDaylightSaving.0 »controllerLocalTime.0	Pass / Fail (Section H.2.2.4)	
12	Calculate the RESPONSE VALUE for globalTime.0 plus Time_Zone. RECORD this information as: »Expected_Time		
13	VERIFY that the RESPONSE VALUE for controllerLocalTime.0 is equal to Expected_Time.	Pass / Fail (Section H.2.2.4)	
14	SET the following object(s) to the value(s) shown: »globalTime.0 = Orig_Time	Pass / Fail (Section H.2.2.1)	
15	SET the following object(s) to the value(s) shown: »globalDaylightSaving.0 = Orig_DST	Pass / Fail (Section H.2.2.3)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.13.8 Verify Change out of Daylight Savings Period (US DST Disabled)

Test Case: 13.8	**Title:**	**Verify Change out of Daylight Savings Period (US DST Disabled)**	
	Description:	This test case verifies that the DMS does not adjust the time due to time changing from daylight savings period to non-daylight savings period when daylight savings is disabled on the DMS.	
	Variables:	DST_Year	From the Test Plan
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the year for which the daylight savings operation shall be performed (e.g., per the test plan). RECORD this information as: »DST_Year Note: The periods during which DST is in effect were changed in 2007. This test procedure is only valid for years 2007 and higher.		
2	GET the following object(s): »globalTime.0 »controllerLocalTime.0 »globalDaylightSaving.0 »controllerStandardTimeZone.0	Pass / Fail (Section H.2.2.4)	
3	RECORD the RESPONSE VALUE for globalTime.0 and controllerLocalTime.0 as: »Orig_Time »Orig_DST »Time_Zone		
4	SET the following object(s) to the value(s) shown: »globalDaylightSaving.0 = 'disableDST' Note: Valid enumerated values are defined in NTCIP 1201 v03, Section 2.4.2 (Global Daylight Saving Parameter).	Pass / Fail (Section H.2.2.3)	

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5	Calculate the time in seconds for 12:58 am (Standard Time), first Sunday in November for the DST_Year then subtract Time_Zone (2 minutes prior to rollover). RECORD this information as: »DST_Fall		
6	SET the following object(s) to the value(s) shown: »globalTime.0 = DST_Fall Note: Rules for defining the values are defined in NTCIP 1201 v03, Section 2.4.1 (Global Time Parameter).	Pass / Fail (Section H.2.2.1)	
7	GET the following object(s): »globalTime.0 »controllerLocalTime.0 »globalDaylightSaving.0 »controllerStandardTimeZone.0	Pass / Fail (Section H.2.2.4)	
8	Calculate the RESPONSE VALUE for globalTime.0 plus Time_Zone. RECORD this information as: »Expected_Time		
9	VERIFY that the RESPONSE VALUE for controllerLocalTime.0 is equal to Expected_Time.	Pass / Fail (Section H.2.2.4)	
10	DELAY for 150 .		
11	GET the following object(s): »globalTime.0 »controllerLocalTime.0 »globalDaylightSaving.0 »controllerStandardTimeZone.0	Pass / Fail (Section H.2.2.4)	
12	Calculate the RESPONSE VALUE for globalTime.0 plus Time_Zone. RECORD this information as: »Expected_Time		
13	VERIFY that the RESPONSE VALUE for controllerLocalTime.0 is equal to Expected_Time.	Pass / Fail (Section H.2.2.4)	
14	Calculate the local time in seconds for 1:58 am (Standard Time), first Sunday in November for the DST_Year then subtract Time_Zone (2 minutes prior to rollover). RECORD this information as: »DST_Fall		
15	SET the following object(s) to the value(s) shown: »globalTime.0 = DST_Fall		
16	GET the following object(s): »globalTime.0 »controllerLocalTime.0 »globalDaylightSaving.0 »controllerStandardTimeZone.0		
17	Calculate the RESPONSE VALUE for globalTime.0 plus Time_Zone. RECORD this information as: »Expected_Time		
18	VERIFY that the RESPONSE VALUE for controllerLocalTime.0 is equal to Expected_Time.		
19	DELAY for 150 seconds.		

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20	GET the following object(s): »globalTime.0 »controllerLocalTime.0 »globalDaylightSaving.0 »controllerStandardTimeZone.0		
21	Calculate the RESPONSE VALUE for globalTime.0 plus Time_Zone. RECORD this information as: »Expected_Time		
22	VERIFY that the RESPONSE VALUE for controllerLocalTime.0 is equal to Expected_Time.		
23	SET the following object(s) to the value(s) shown: »globalTime.0 = Orig_Time	Pass / Fail (Section H.2.2.1)	
24	SET the following object(s) to the value(s) shown: »globalDaylightSaving.0 = Orig_DST	Pass / Fail (Section H.2.2.3)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.13.9 Explore Data

Test Case: 13.9	**Title:**	**Explore Data**
	Description:	This test case verifies that the device properly responds to a GET-NEXT request.
	Variables:	
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.

Step	Test Procedure	Results	Additional References
1	RECORD the OID value of 'NULL' as: »Last_Object		
2.1	Send a GET-NEXT request for the following object(s): »Last_Object	Pass / Fail (RFC 1157)	
2.2	VERIFY that the RESPONSE ERROR is equal to 'noError' or 'noSuchName'.	Pass / Fail (RFC 1157)	
2.3	IF the RESPONSE ERROR is equal to 'noSuchName', then GOTO Step 3		
2.4	VERIFY that the RESPONSE ERROR is equal to 'noError'.	Pass / Fail (RFC 1157)	
2.5	VERIFY that the OID of the returned object is lexicographically larger than the OID contained in the request.	Pass / Fail (RFC 1157)	
2.6	DETERMINE the OID of the retrieved object. RECORD this information as: »Last_Object		
2.7	GOTO Step 2.1.		
3	VERIFY that the returned OID is identical to that sent in the request.	Pass / Fail (RFC 1157)	

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4	VERIFY that all supported objects have been returned in Steps 2.1-2.7	Pass / Fail (Section 3.4.1.3)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.13.10 Determine Current Access Settings

Test Case: 13.10	**Title:**	**Determine Current Access Settings**
	Description:	This test case verifies that the device allows the administrator at the management station to determine the current access settings.
	Variables:	
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.

Step	Test Procedure	Results	Additional References
1	PRECONDITION: Determine the value of the communityNameAdmin.0 object. RECORD this information as: »Community_Name_Admin		
2	Configure the test program to use Community_Name_Admin for the 'community' field of the SNMP message.		
3	GET the following object(s): »communityNamesMax.0 »communityNameAdmin.0	Pass / Fail (Section 3.4.4.1)	NTCIP 1103, Sections A.8.2, A.8.1
4	RECORD communityNamesMax.0 as: »Max_Community_Names		
5	VERIFY that the RESPONSE VALUE for communityNameAdmin.0 is equal to Community_Name_Admin, and consists of an octet string of at least 8 but not more than 16 octets.	Pass / Fail (Section 3.4.4.1)	NTCIP 1103, Section A.8.1
6	FOR EACH value, N, from 1 to Max_Community_Names, perform Steps 6.1 through 6.4.		
6.1	GET the following object(s): »communityNameIndex.N »communityNameUser.N »communityNameAccessMask.N	Pass / Fail (RFC 1157)	
6.2	VERIFY that the RESPONSE VALUE for communityNameIndex.N is equal to N.	Pass / Fail (Section 3.4.4.1)	NTCIP 1103, Section A.8.3.1.1
6.3	VERIFY that the RESPONSE VALUE for communityNameUser.N consists of an octet string of at least 6 but not more than 16 octets.	Pass / Fail (Section 3.4.4.1)	NTCIP 1103, Section A.8.3.1.2
6.4	VERIFY that the RESPONSE VALUE for communityNameAccessMask.N consists of a 32 bit value	Pass / Fail (Section 3.4.4.1)	NTCIP 1103, Section A.8.3.1.3

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Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.13.11 Configure Access

Test Case: 13.11	**Title:**	**Configure Access**
	Description:	This test case verifies that the device allows the administrator at the management station to configure the access settings.
	Variables:	New_User — From the Test Plan Community_Name_Admin — From Manufacturer's Documentation
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine an octet string of not less than 6 nor more than 16 octets in length. RECORD this information as: »New_User		
2	CONFIGURE: Determine the default communityNameAdmin for the device from the manufacturer's documentation. RECORD this information as: »Community_Name_Admin Note: For many devices, this value is "administrator".		
2	Configure the test program to use Community_Name_Admin for the 'community' field of the SNMP message.		
3	GET the following object(s): »communityNamesUser.1 »communityNamesAccessMask.1	Pass / Fail (RFC 1157)	
4	RECORD the RESPONSE VALUE for communityNamesUser.1 and communityNamesAccessMask.1 as: »Saved_User »Saved_Access_Mask		
5	SET the following object(s) to the value(s) shown: »communityNameUser.1 = New_User »communityNameAccessMask.1 = 0 Note: Setting the access mask to zero limits all objects for New_User to read-only access.	Pass / Fail (Section 3.4.4.2)	NTCIP 1103, Sections A.8.3.1.2, A.8.3.1.3
6	Configure the test program to use New_User for the 'community' field of the SNMP message.		
7	GET the following object(s): »globalTime.0	Pass / Fail (RFC 1157)	
8	VERIFY that the RESPONSE VALUE for globalTime.0 is valid.	Pass / Fail (RFC 1157)	
9	SET the following object(s) to the value(s) shown: »globalTime.0 = 100000000.	Pass / Fail (RFC 1157)	

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10	VERIFY that the ErrorStatus is ‘readOnly’ (4).	Pass / Fail (RFC 1157)	
11	GET the following object(s): »globalTime.0	Pass / Fail (RFC 1157)	
12	VERIFY that the RESPONSE VALUE for globalTime.0 is valid, incremented by the time that has elapsed between Steps 7 and 11.	Pass / Fail (RFC 1157)	
13	Configure the test program to use Community_Name_Admin for the ‘community’ field of the SNMP message.		
14	SET the following object(s) to the value(s) shown: »communityNameAccessMask.1 = 4294967295 Note: Setting the access mask to 4294967295 (all bits set to 1) grants the user with read-write access and an individual object’s read-write access clause applies.	Pass / Fail (Section 3.4.4.2)	NTCIP 1103, Section A.8.3.1.3
15	Configure the test program to use New_User for the ‘community’ field of the SNMP message.		
16	GET the following object(s): »globalTime.0	Pass / Fail (RFC 1157)	
17	VERIFY that the RESPONSE VALUE for globalTime.0 is valid.		
18	SET the following object(s) to the value(s) shown: »globalTime.0 = 100000000.	Pass / Fail (RFC 1157)	
19	GET the following object(s): »globalTime.0	Pass / Fail (RFC 1157)	
20	VERIFY that the RESPONSE VALUE for globalTime.0 is 100000000 plus the time that has elapsed between Steps 18 and 20.	Pass / Fail (RFC 1157)	
21	GET the following object(s): »communityNameAdmin.0	Pass / Fail (NTCIP 1103, Section A.8.1)	
22	VERIFY that the ErrorStatus is ‘noSuchName’ (2)	Pass / Fail (NTCIP 1103, Section A.8.1)	
23	GET the following object(s): »communityNamesMax.0	Pass / Fail (NTCIP 1103, Section A.8.1)	
24	VERIFY that the ErrorStatus is ‘noSuchName’ (2)	Pass / Fail (NTCIP 1103, Section A.8.1)	
25	GET the following object(s): »communityNameIndex.1	Pass / Fail (NTCIP 1103, Section A.8.1)	
26	VERIFY that the ErrorStatus is ‘noSuchName’ (2)	Pass / Fail (NTCIP 1103, Section A.8.1)	
27	GET the following object(s): »communityNameUser.1	Pass / Fail (NTCIP 1103, Section A.8.1)	

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28	VERIFY that the ErrorStatus is 'noSuchName' (2)	Pass / Fail (NTCIP 1103, Section A.8.1)	
29	GET the following object(s): »communityNameAccessMask.1	Pass / Fail (NTCIP 1103, Section A.8.1)	
30	VERIFY that the ErrorStatus is 'noSuchName' (2)	Pass / Fail (NTCIP 1103, Section A.8.1)	
31	Configure the test program to use Community_Name_Admin for the 'community' field of the SNMP message.		
32	SET the following object(s) to the value(s) shown: »communityNameUser.1 = Saved_User »communityNameAccessMask.1 = Saved_Access_Mask	Pass / Fail (Section 3.4.4.2)	NTCIP 1103, Sections A.8.3.1.2, A.8.3.1.3
33	Configure the test program to use Saved_User for the 'community' field of the SNMP message.		

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

C.3.14 Test Procedures

C.3.14.1 Define a Message

Test Procedure: 14.1	**Title:**	**Define a Message**	
	Description:	This test procedure is called by a test case and is used to define a message on the DMS using variables provided by the calling test case.	
	Variables:	Msg_Type	Defined by calling test case
		Msg_Number	Defined by calling test case
		Msg_Multi_String	Defined by calling test case
		Msg_Owner	Defined by calling test case
		Beacons_Supported	PRL 2.3.2.4
		Msg_Beacon_State	Defined by calling test case
		Pixel_Service_Supported	PRL 3.6.6.6
		Msg_Pixel_Service	Defined by calling test case
		Msg_Run_Time_Priority	Defined by calling test case
		Expected_Validate_Error_Code	Defined by calling test case
		Expected_Multi_Error_Code	Defined by calling test case
		Expected_Multi_Error_Pos_Min	Defined by calling test case
		Expected_Multi_Error_Pos_Max	Defined by calling test case
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Procedure to pass the Test Procedure.	

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Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine whether beacons are required by the specification (PRL 2.3.2.4). RECORD this information as: »Beacons_Supported		
2	CONFIGURE: Determine whether the DMS is required to support pixel service per the specification (PRL 3.6.6.6). RECORD this information as: »Pixel_Service_Supported		
3	SET-UP: VERIFY that Msg_Type equals either 'changeable' or 'volatile'.		
4	SET-UP: IF Msg_Type equals 'changeable', then GOTO Step 4.1; otherwise, GOTO Step 5.1.		
4.1	GET the following object(s): »dmsMaxChangeableMsg.0 »dmsFreeChangeableMemory.0	Pass / Fail (Section 3.5.2.3.3.3)	
4.2	VERIFY that the RESPONSE VALUE for dmsMaxChangeableMsg.0 is greater than or equal to Msg_Number.	Pass / Fail (Section 3.5.2.3.3.3)	Section 4.2.3.2 Step a
4.3	VERIFY that the RESPONSE VALUE for dmsFreeChangeableMemory.0 is greater than or equal to the length of the Msg_Multi_String. GO TO Step 6.	Pass / Fail (Section 3.5.2.3.3.3)	Section 4.2.3.2 Step b
5.1	GET the following object(s): »dmsMaxVolatileMsg.0 »dmsFreeVolatileMemory.0	Pass / Fail (Section 3.5.2.3.3.3)	-
5.2	VERIFY that the RESPONSE VALUE for dmsMaxVolatileMsg.0 is greater than or equal to Msg_Number.	Pass / Fail (Section 3.5.2.3.3.3)	Section 4.2.3.2 Step a
5.3	VERIFY that the RESPONSE VALUE for dmsFreeVolatileMemory.0 is greater than or equal to the length of the Msg_Multi_String.	Pass / Fail (Section 3.5.2.3.3.3)	Section 4.2.3.2 Step b
6	SET the following object(s) to the value(s) shown: »dmsMessageStatus.Msg_Type.Msg_Number = 'notUsedReq' (8) Note: Valid enumerated values are defined in NTCIP 1203 v03, Section 5.6.8.9 (Message Status Parameter).	Pass / Fail (Section 3.5.2.3.3.3)	Section 4.2.3.2 Step e
7	GET the following object(s): »dmsMessageStatus.Msg_Type.Msg_Number	Pass / Fail (Section 3.5.2.3.3.3)	Section 4.2.3.2 Step d
8	VERIFY that the RESPONSE VALUE for dmsMessageStatus.Msg_Type.Msg_Number is equal to 'notUsed' (1).	Pass / Fail (Section 3.5.2.3.3.3)	
9	SET the following object(s) to the value(s) shown: »dmsMessageStatus.Msg_Type.Msg_Number = 'modifyReq' (6)	Pass / Fail (Section 3.5.2.3.3.3)	Section 4.2.3.2 Step c
10	GET the following object(s): »dmsMessageStatus.Msg_Type.Msg_Number	Pass / Fail (Section 3.5.2.3.3.3)	Section 4.2.3.2 Step d
11	VERIFY that the RESPONSE VALUE for dmsMessageStatus.Msg_Type.Msg_Number is equal to 'modifying' (2).	Pass / Fail (Section 3.5.2.3.3.3)	

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12	SET the following object(s) to the value(s) shown: »dmsMessageMultiString.Msg_Type.Msg_Number = Msg_Multi_String »dmsMessageOwner.Msg_Type.Msg_Number = Msg_Owner »dmsMessageRunTimePriority.Msg_Type.Msg_Number = Msg_Run_Time_Priority	Pass / Fail (Section 3.5.2.3.3.3)	Section 4.2.3.2 Step f
13	SET the following object(s) to the value(s) shown: »dmsMessageBeacon.Msg_Type.Msg_Number = Msg_Beacon_State VERIFY that the RESPONSE ERROR is equal to 'noError' or 'noSuchName'.	Pass / Fail (Section 3.5.2.3.3.3)	Section 4.2.3.2 Step g
14	IF the RESPONSE ERROR is equal to ‘noSuchName’, then GOTO Step 14.1; otherwise, GOTO Step 15.		
14.1	VERIFY that Beacons_Supported is equal to 0. Note: Ensures that beacons were not required by the specification.	Pass / Fail (PRL 2.3.2.4)	
14.2	IF Msg_Beacon_State is not equal to 0, then GOTO Step 14.2.1; otherwise, GOTO Step 15.		
14.2.1	Force the value of the configurable parameter Msg_Beacon_State to zero (0) Note: This is necessary to ensure the correct calculation of the CRC.		
15	SET the following object(s) to the value(s) shown: »dmsMessagePixelService.Msg_Type.Msg_Number = Msg_Pixel_Service		Section 4.2.3.2 Step h
16	VERIFY that the RESPONSE ERROR is equal to 'noError' or 'noSuchName'.	Pass / Fail (Section 3.5.2.3.3.3)	
17	IF the RESPONSE ERROR is equal to ‘noSuchName’, then GOTO Step 17.1; otherwise, GOTO Step 18.		
17.1	VERIFY that Pixel_Service_Supported is equal to 0. Note: Ensures that pixel service was not required by the specification.	Pass / Fail (Section 3.5.2.6)	
17.2	IF Msg_Pixel_Service is not equal to 0, then GOTO Step 17.2.1; otherwise, GOTO Step 18.		
17.2.1	Forcing the value of the configurable parameter Msg_Pixel_Service to zero (0) Note: This is necessary to ensure the correct calculation of the CRC.		
18	SET the following object(s) to the value(s) shown: »dmsMessageStatus.Msg_Type.Msg_Number = 'validateReq' (7)	Pass / Fail (Section 3.5.2.3.3.3)	Section 4.2.3.2 Step i
19	GET the following object(s): »dmsMessageStatus.Msg_Type.Msg_Number	Pass / Fail (Section 3.5.2.3.3.3)	Section 4.2.3.2 Step j
20	IF the RESPONSE VALUE for dmsMessageStatus.Msg_Type.Msg_Number is equal to 'validating' (3), then GOTO Step 19; otherwise, GOTO Step 21. Note: If the DMS stays in the 'validating' state for an excessively long time, the DMS may be considered to fail this test case.		

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21	IF the RESPONSE VALUE for dmsMessageStatus.Msg_Type.Msg_Number is equal to 'valid' (4), then GOTO Step 21.1; otherwise, GOTO Step 22.1.		
21.1	VERIFY that Expected_MULTI_Error_Code is ‘none’ (2).	Pass / Fail (Section 3.5.2.3.3.3)	
21.2	VERIFY that the RESPONSE VALUE for dmsMessageStatus.Msg_Type.Msg_Number is equal to 'valid' (4).	Pass / Fail (Section 3.5.2.3.3.3)	
21.3	Calculate the expected message CRC value. RECORD this information as: »Msg_CRC		
21.4	GET the following object(s): »dmsMessageCRC.Msg_Type.Msg_Number	Pass / Fail (Section 3.5.2.3.3.4)	
21.5	VERIFY that the RESPONSE VALUE for dmsMessageCRC.Msg_Type.Msg_Number is equal to Msg_CRC.	Pass / Fail (Section 3.5.2.3.3.4)	
21.6	GET the following object(s): »dmsValidateMessageError.0	Pass / Fail	Section 4.2.3.2 Step k
21.7	VERIFY that the RESPONSE VALUE for dmsValidateMessageError.0 is equal to 'none'.	Pass / Fail (Section 3.5.2.3.3.3)	
21.8	GET the following object(s): »dmsMessageMultiString.Msg_Type.Msg_Number »dmsMessageOwner.Msg_Type.Msg_Number »dmsMessageRunTimePriority.Msg_Type.Msg_Number »dmsMessageStatus.Msg_Type.Msg_Number	Pass / Fail (Section 3.5.2.3.3.5)	Section 4.2.3.3 Step b
21.9	VERIFY that the RESPONSE VALUE for dmsMessageMultiString.Msg_Type.Msg_Number is equal to Msg_Multi_String.	Pass / Fail (Section 3.5.2.3.3.3)	
21.10	VERIFY that the RESPONSE VALUE for dmsMessageOwner.Msg_Type.Msg_Number is equal to Msg_Owner.	Pass / Fail (Section 3.5.2.3.3.3)	
21.11	VERIFY that the RESPONSE VALUE for dmsMessageRunTimePriority.Msg_Type.Msg_Number is equal to Msg_Run_Time_Priority.	Pass / Fail (Section 3.5.2.3.3.3)	
21.12	GET the following object(s): »dmsMessageBeacon.Msg_Type.Msg_Number VERIFY that the RESPONSE ERROR is equal to 'noError' or 'noSuchName'.	Pass / Fail (Section 3.5.2.3.3.5)	Section 4.2.3.3 Step c
21.13	IF the RESPONSE ERROR is equal to noError, then GOTO Step 21.13.1; otherwise, GOTO Step 21.14.		
21.13.1	VERIFY that the RESPONSE VALUE for dmsMessageBeacon.Msg_Type.Msg_Number is equal to Msg_Beacon_State.	Pass / Fail (Section 3.5.2.3.3.3)	
21.14	GET the following object(s): »dmsMessagePixelService.Msg_Type.Msg_Number VERIFY that the RESPONSE ERROR is equal to 'noError' or 'noSuchName'.	Pass / Fail (Section 3.5.2.3.3.5)	Section 4.2.3.3 Step d

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21.15	IF the RESPONSE ERROR is equal to noError, then GOTO Step 21.15.1; otherwise, GOTO Step 21.16.		
21.15.1	VERIFY that the RESPONSE VALUE for dmsMessagePixelService.Msg_Type.Msg_Number is equal to Msg_Pixel_Service.	Pass / Fail (Section 3.5.2.3.3.3)	
21.16	EXIT.		
22.1	VERIFY that the RESPONSE VALUE for dmsMessageStatus.Msg_Type.Msg_Number is equal to 'error' (5).	Pass / Fail (Section 3.5.2.3.3.3)	
22.2	VERIFY that Expected_Multi_Error_Code is not equal to 'none' (2).	Pass / Fail (Section 3.5.2.3.3.3)	
22.3	GET the following object(s): »dmsValidateMessageError.0	Pass / Fail (Section 3.5.2.3.3.3)	Section 4.2.3.2 Step k
22.4	VERIFY that the RESPONSE VALUE for dmsValidateMessageError.0 is equal to Expected_Validate_Error_Code.	Pass / Fail (Section 3.5.2.3.3.3)	
22.5	IF the RESPONSE VALUE for dmsValidateMessageError.0 is equal to 'syntaxMULTI', then GOTO Step 22.5.1; otherwise, EXIT.		
22.5.1	GET the following object(s): »dmsMultiSyntaxError.0 »dmsMultiSyntaxErrorPosition.0	Pass / Fail (Section 3.5.2.3.3.3)	Section 4.2.3.2 Step l
22.5.2	VERIFY that the RESPONSE VALUE for dmsMultiSyntaxError.0 is equal to Expected_Multi_Error_Code.	Pass / Fail (Section 3.5.2.3.3.3)	
22.5.3	VERIFY that the RESPONSE VALUE for dmsMultiSyntaxErrorPosition.0 is greater than or equal to Expected_Multi_Error_Pos_Min.	Pass / Fail (Section 3.5.2.3.3.3)	
22.5.4	VERIFY that the RESPONSE VALUE for dmsMultiSyntaxErrorPosition.0 is less than or equal to Expected_Multi_Error_Pos_Max.	Pass / Fail (Section 3.5.2.3.3.3)	
22.5.5	IF the RESPONSE VALUE for dmsMultiSyntaxError.0 is equal to 'other' (1), then GOTO Step 22.5.5.1; otherwise, EXIT.		
22.5.5.1	GET the following object(s): »dmsMultiOtherErrorDescription.0	Pass / Fail (Section 3.5.2.3.3.3)	Section 4.2.3.2 Step m
22.5.5.2	VERIFY that the RESPONSE VALUE for dmsMultiOtherErrorDescription.0 agrees with the error condition. Note: This value indicates vendor-specified error message descriptions.	Pass / Fail (Section 3.5.2.3.3.3)	

Test Procedure Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Procedure Notes:		

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C.3.14.2 Activate a Message

Test Procedure: 14.2	**Title:**	**Activate a Message**
	Description:	This test procedure is called by a test case and verifies that a message can be activated on the DMS using the test case parameters provided by the user.
	Variables:	Msg_Type: Defined by calling test case Msg_Number: Defined by calling test case Msg_Multi_String: Defined by calling test case Msg_Activation_Priority: Defined by calling test case Msg_Duration: Defined by calling test case Msg_Beacon_State: Defined by calling test case Msg_Pixel_Service: Defined by calling test case Status_Update_Delay: PRL 3.6.9 Expected_Error_Code: Defined by calling test case Expected_Multi_Error_Code: Defined by calling test case Expected_Multi_Error_Pos_Min: Defined by calling test case Expected_Multi_Error_Pos_Max: Defined by calling test case
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Procedure to pass the Test Procedure.

Step	Test Procedure	Results	Additional References
1	CONFIGURE: Determine the frequency at which the DMS is required to update the status variables (PRL 3.6.9). RECORD this information as: »Status_Update_Delay		
2	SET-UP: Calculate the message CRC value. IF Msg_Type is 7 (blank), set this value to 0x0000. RECORD this information as: »Msg_CRC Note: Rules for calculating the CRC are defined in Section 5.6.8.5 (Message CRC Parameter).		
3	IF Expected_Error_Code is equal to 'messageCRC' (7), then GOTO Step 3.1; otherwise, GOTO Step 4.		
3.1	Calculate the value of Msg_CRC + 1, resulting in an incorrect CRC. RECORD the lowest two bytes of this information as: »Msg_CRC		
4	SET-UP: Determine the IP address of the computer that is sending the activation request. RECORD this information as: »Msg_Source		
5	SET-UP: Calculate the activation code for the message. RECORD this information as: »Msg_Activation_Code Note: Rules for calculating the activation code are defined in Section 5.1		
6	SET the following object(s) to the value(s) shown: »dmsActivateMessage.0 = Msg_Activation_Code	Pass / Fail (Section 3.5.2.3.1)	Section 4.2.3.1 Step b
7	IF the RESPONSE ERROR is equal to 'genError', the message failed to activate. GOTO Step 11.1.		

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8	GET the following object(s): »dmsActivateMessageState.0	Pass / Fail (Section 3.5.2.3.6)	Section 4.2.3.7 Step c
9	IF the RESPONSE VALUE is 'fastActivationSign' (1), GOTO Step 10.1, otherwise GOTO Step 9.1 Note: Valid octet values are defined in Section 5.7.25 (Activate Message State Parameter).		Section 4.2.3.7 Step f
9.1	GET the following object(s): »dmsActivateMessageState.0	Pass / Fail (Section 3.5.2.3.6)	Section 4.2.3.7 Step c
9.2	IF the RESPONSE VALUE indicates 'slowActivating' (4), the DMS is in the process of activating the message. GOTO Step 9.1. Note: If the device remains in this state for a prolonged period, the test case should be considered failed. Consult the manufacturer's documentation on what may constitute an abnormally long time.		Section 4.2.3.7 Step d
9.3	IF the RESPONSE VALUE indicates 'slowActivatedError' (3), GOTO Step 11.1.		Section 4.2.3.7 Step e
9.4	IF the RESPONSE VALUE indicates 'slowActivatedOK' (2), GOTO Step 10.1.		Section 4.2.3.7 Step g
10.1	DELAY for Status_Update_Delay seconds.		
10.2	GET the following object(s): »shortErrorStatus.0	Pass / Fail (Section 3.5.3.1.2)	Section 4.2.3.1 Step c or 4.2.3.7 Step h
10.3	VERIFY that the RESPONSE VALUE for shortErrorStatus.0 bits 7 and 12 (message error and drum-sign rotor error) are both equal to 0.	Pass / Fail (Section 3.5.3.1.2)	Section 4.2.3.1 Step c or 4.2.3.7 Step h
10.4	VERIFY that the RESPONSE VALUE for shortErrorStatus.0 bit 11 (critical temperature error) is equal to 0.	Pass / Fail	
10.5	VERIFY that the message is visible on the sign face.	Pass / Fail (Section 3.5.2.3.1)	
10.6	EXIT.		
11.1	VERIFY that the sign display did not change.	Pass / Fail	-
11.2	DELAY for Status_Update_Delay.		
11.3	GET the following object(s): »shortErrorStatus.0	Pass / Fail	
11.4	VERIFY that the RESPONSE VALUE for shortErrorStatus.0 has bit 7 set to one (1), indicating "message error'.	Pass / Fail	
11.5	GET the following object(s): »dmsActivateMsgError.0 »dmsActivateErrorMsgCode.0	Pass / Fail	Section 4.2.3.1 Step d, 4.2.3.7 Step i, or 4.2.4.8 Steps a1 & a2)
11.6	VERIFY that the RESPONSE VALUE for dmsActivateErrorMsgCode.0 is equal to Msg_Activation_Code.	Pass / Fail (Section 3.5.3.1.4.5)	

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11.7	VERIFY that the RESPONSE VALUE for dmsActivateMsgError.0 is equal to Expected_Error_Code.	Pass / Fail	
11.8	IF the RESPONSE VALUE for dmsActivateMsgError.0 is equal to 'syntaxMULTI' (8), then GOTO Step 11.8.1; otherwise, GO TO EXIT.		Section 4.2.4.8 Step c
11.8.1	GET the following object(s): »dmsMultiSyntaxError.0 »dmsMultiSyntaxErrorPosition.0	Pass / Fail	Section 4.2.3.1 Step e, 4.2.3.7 Step j, or 4.2.4.8 Step a3 & a4)
11.8.2	VERIFY that the RESPONSE VALUE for dmsMultiSyntaxError.0 is equal to Expected_Multi_Error_Code.	Pass / Fail	
11.8.3	VERIFY that the RESPONSE VALUE for dmsMultiSyntaxErrorPosition.0 is greater than or equal to Expected_Multi_Error_Pos_Min.	Pass / Fail	
11.8.4	VERIFY that the RESPONSE VALUE for dmsMultiSyntaxErrorPosition.0 is less than or equal to Expected_Multi_Error_Pos_Max.	Pass / Fail	
11.8.5	IF the RESPONSE VALUE for dmsMultiSyntaxError.0 is equal to 'other' (1), GOTO step 11.8.5.1; otherwise, EXIT.		
11.8.5.1	GET the following object(s): »dmsMultiOtherErrorDescription.0	Pass / Fail	Section 4.2.3.1 Step f, 4.2.3.7 Step k, or 4.2.4.8 Step b)
11.8.5.2	VERIFY that the RESPONSE VALUE agrees with the error that occurred.	Pass / Fail	

Test Procedure Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Procedure Notes:		

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C.3.14.3 Store a Graphic Definition

Test Procedure: 14.3	**Title:**	**Store a Graphic Definition**
	Description:	This test procedure verifies that the DMS allows a graphic to be defined within the controller.
	Variables:	Test_Graphic_Index — Defined by calling test case Test_Graphic_Number — Defined by calling test case Test_Graphic_Name — Defined by calling test case Test_Graphic_Height — Defined by calling test case Test_Graphic_Width — Defined by calling test case Test_Graphic_Type — Defined by calling test case Test_Graphic_Transparent — Defined by calling test case Test_Graphic_Transparent_Color — Defined by calling test case Test_Graphic_Image — Defined by calling test case
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Procedure to pass the Test Procedure.

Step	Test Procedure	Results	Additional References
1	SET-UP: GET the following object(s): »dmsColorScheme.0		
2	SET-UP: VERIFY that the RESPONSE VALUE for dmsColorScheme.0 is equal to Test_Graphic_Type or that Test_Graphic_Type is equal to 'monochrome1bit'.		
3	SET-UP: PERFORM the test case labeled 'Blank the Sign' (C.3.7.15). Note: This step ensures that the graphic and message are not in use and can be edited.		
4	GET the following object(s): »dmsGraphicMaxEntries.0	Pass / Fail (Section 3.5.1.4.1)	
5	SET-UP: VERIFY that the RESPONSE VALUE for dmsGraphicMaxEntries.0 is greater than or equal to Test_Graphic_Index.		Section 4.2.2.6 Step a
6	SET-UP: GET the following object(s): »dmsGraphicMaxSize.0 »dmsGraphicBlockSize.0	Pass / Fail (Section 3.5.1.4.2)	Section 4.2.2.6 Step b
7	Calculate the size of the sample graphic. RECORD this information as: »Test_Graphic_Size		
8	SET-UP: VERIFY that the RESPONSE VALUE for dmsGraphicMaxSize.0 is greater than or equal to Test_Graphic_Size. Note: The size of the proposed graphic can be determined by the following equation: Test_Graphic_Height * Test_Graphic_Width * Pixel_Size, where Pixel_Size is as determined based on the value of Test_Graphic_Type.		
9	SET-UP: Determine the RESPONSE VALUE for dmsGraphicBlockSize.0. RECORD this information as: »Block_Size		

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10	VERIFY that Block_Size is not equal to 0.	Pass / Fail (Section 5.12.5)	
11	GET the following object(s): »dmsGraphicStatus.Test_Graphic_Index	Pass / Fail (Section 3.5.1.4.5)	Section 4.2.2.6 Step c
12	VERIFY that the RESPONSE VALUE for dmsGraphicStatus.Test_Graphic_Index is none of the following: 'inUse', 'permanent', or 'calculating'. Note: If the RESPONSE VALUE for dmsGraphicStatus.Test_Graphic_Index is 'inUse', 'permanent', or 'calculating', this test procedure can not be immediately performed. The user shall exit the test case and neither pass nor fail the test (i.e., see Section 3.2.4 of NTCIP 8007 v01). The user shall then investigate the problem (which may require a reasonable level of knowledge about the device) and shall restart the test after fixing the problem. There is another test case that tests the error of attempting to change a graphic that is 'inUse'.	Pass / Fail	
13	SET the following object(s) to the value(s) shown: »dmsGraphicStatus.Test_Graphic_Index = 'modifyReq' (7) Note: Valid enumerated values are defined in Section 5.12.6.10 (Graphic Status Parameter).	Pass / Fail (Section 3.5.1.4.5)	Section 4.2.2.6 Step d
14	GET the following object(s): »dmsGraphicStatus.Test_Graphic_Index	Pass / Fail (Section 3.5.1.4.5)	
15	VERIFY that the RESPONSE VALUE for dmsGraphicStatus.Test_Graphic_Index is equal to 'modifying' (2).	Pass / Fail (Section 3.5.1.4.5)	Section 4.2.2.6 Step e
16	SET the following object(s) to the value(s) shown: »dmsGraphicHeight.Test_Graphic_Index = Test_Graphic_Height	Pass / Fail (Section 3.5.1.4.5)	Section 4.2.2.6 Step f
17	SET the following object(s) to the value(s) shown: »dmsGraphicNumber.Test_Graphic_Index = Test_Graphic_Number »dmsGraphicName.Test_Graphic_Index = Test_Graphic_Name »dmsGraphicWidth.Test_Graphic_Index = Test_Graphic_Width »dmsGraphicType.Test_Graphic_Index = Test_Graphic_Type »dmsGraphicTransparentEnabled.Test_Graphic_Index = Test_Graphic_Transparent »dmsGraphicTransparentColor.Test_Graphic_Index = Test_Graphic_Transparent_Color	Pass / Fail (Section 3.5.1.4.5)	Section 4.2.2.6 Step g
18	IF Block_Size is not equal to 0, then GOTO Step 18.1; otherwise, GOTO Step 19.1.		
18.1	Calculate the number of blocks for the graphic. RECORD this information as: »Number_Of_Blocks Note: See Section 5.12.7 (Graphics Bitmap Table Parameter) for the rules used to determine this value.		
18.2	FOR EACH value, N, from 1 to Number_Of_Blocks, perform Steps 18.2.1 through 18.2.2.		

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18.2.1	Calculate the byte stream to be stored for the Nth block of the graphic. RECORD this information as: »Graphic_Block Note: This process divides the Test_Graphic_Image into a series of equal-sized blocks, each being the size indicated by the RESPONSE VALUE for dmsGraphicBlockSize.0. The last block is of the same size and padded with octets, each with a value of zero.		
18.2.2	SET the following object(s) to the value(s) shown: »dmsGraphicBlockBitmap.Test_Graphic_Index.N = Graphic_Block	Pass / Fail (Section 3.5.1.4.5)	Section 4.2.2.6 Step h
18.3	SET the following object(s) to the value(s) shown: »dmsGraphicStatus.Test_Graphic_Index = 'readyForUseReq' (8)	Pass / Fail (Section 3.5.1.4.5)	Section 4.2.2.6 Step i
18.4	GET the following object(s): »dmsGraphicStatus.Test_Graphic_Index	Pass / Fail (RFC 1157)	
18.5	VERIFY that the RESPONSE VALUE for dmsGraphicStatus.Test_Graphic_Index is equal to 'readyForUse' (4).		
18.6	POST-CONDITION: A graphic is stored in the sign. GO TO EXIT.		
19.1	Test terminated since Block_Size equals zero.		

Test Procedure Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Procedure Notes:		

C.3.14.4 Activate a Schedule

Test Procedure: 14.4	**Title:**	**Activate a Schedule**	
	Description:	This test procedure verifies that the DMS activates a valid schedule and verifies its status.	
	Variables:	Schedule_UTC_Time	Defined by calling test case
		Schedule_Timezone	Defined by calling test case
		Schedule_DST	Defined by calling test case
		Expected_Day_Plan	Defined by calling test case
		Status_Update_Delay	PRL 3.6.9
	Pass/Fail Criteria:	The DUT shall pass every verification step included within the Test Case to pass the Test Case.	

Step	Test Procedure	Results	Additional References
1	SET the following object(s) to the value(s) shown: »globalTime.0 = Schedule_UTC_Time	Pass / Fail (Section H.2.2.1)	
2	SET the following object(s) to the value(s) shown: »controllerStandardTimeZone.0 = Schedule_Timezone	Pass / Fail (Section H.2.2.2)	
3	SET the following object(s) to the value(s) shown: »globalDaylightSaving.0 = Schedule_DST	Pass / Fail (Section H.2.2.3)	

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4	GET the following object(s): »controllerLocalTime.0	Pass / Fail (Section H.2.2.4)	
5	VERIFY that the RESPONSE VALUE for controllerLocalTime.0 equals Schedule_UTC_Time + Schedule_Timezone (+ 1 hour if in DST).	Pass / Fail (Section H.2.2.4)	
6	SET the following object(s) to the value(s) shown: »dmsActivateMessage.0 = 'FF FF FF 06 00 01 00 00 A9 01 01 00' Note: The hex string activates the schedule for an indefinite period, overriding any current message. The last 4 bytes of the message could be replaced by the IP address computer hosting the test application, but this is not required.	Pass / Fail (Section 3.5.2.3.1)	Section 4.2.3.1 Step b
7	DELAY for Status_Update_Delay seconds.		
8	GET the following object(s): »shortErrorStatus.0	Pass / Fail (Section 3.5.3.1.2)	Section 4.2.3.1 Step c
9	VERIFY that the RESPONSE VALUE for shortErrorStatus.0 bit 7 (message error) is equal to 0.	Pass / Fail (Section 3.5.3.1.2)	
10	GET the following object(s): »timeBaseScheduleTableStatus.0 »dayPlanStatus.0	Pass / Fail (Section H.2.3.2)	
11	VERIFY that the RESPONSE VALUE for timeBaseScheduleTableStatus.0 is equal to 1.	Pass / Fail (Section H.2.3.2)	
12	VERIFY that the RESPONSE VALUE for dayPlanStatus.0 is equal to Expected_Day_Plan.	Pass / Fail (Section H.2.3.2)	

Test Case Results		
Tested By:	**Date Tested:**	**Pass / Fail**
Test Case Notes:		

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Annex D
Documentation of Revisions [Informative]

Annex D identifies the changes that have been made to NTCIP 1203 v02 to develop NTCIP 1203 v03.

The primary purpose of NTCIP 1203 v03 is to provide detailed, but generic test procedures for testing an implementation of this standard. Several minor changes and corrections were also made. Annex D identifies the changes between NTCIP 1203 v02 and NTCIP 1203 v03, and why each of these changes have been made.

D.1 Changes to section headings

Several of the Section Headings have been changed to conform to NTCIP 8002 Annex B1, which defines the content outline and section numbering for NTCIP 1200-series Device Data Dictionary standards publications. See Table 11.

Table 11 Section Heading Revisions

NTCIP 1203 v2	NTCIP 1203 v3
1.4 Terms	1.4 Glossary of Terms
	1.5 Abbreviations
2 DMS Concept of Operations [Normative]	2 Concept of Operations [Normative]
2.4 Architectural Needs / Description of System Environment	2.4 Architectural Needs
2.5 User Needs / Features	2.5 Features
2.7 Operational Policies and Constraints / Assumptions	2.7 Operational Policies and Constraints
3 DMS Functional Requirements [Normative]	3 Functional Requirements [Normative]
3.5 Data Exchange Requirements	3.5 Data Exchange and Operational Environment Requirements
3.6 Supplemental Requirements	3.6 Supplemental Non-Communications Requirements
4 DMS Dialogs and Interface Specifications [Normative]	4 Dialogs [Normative]
5 DMS Object Definitions	5 Management Information Base (MIB)

D.2 Corrections to the PRL

Several corrections were made to the PRL. These corrections are:
PRL 2.5.1.4 / 3.5.1.4.2 – Corrected the text under Additional Project Requirements.
PRL 2.5.1.4 / 3.5.1.4.3 – Added text under Additional Project Requirements.
PRL 2.5.2.3.3 / 3.5.2.3.2.7 – Corrected the valid ranges under Additional Project Requirements.

D.3 Conformance Changes

In Section 3.3.3 – PRL Table, User Need 2.3.2.4 – DMS Display Support of Beacons, is now mandatory. The WG decided to make support for the dmsBeaconType object should be mandatory since the object was mandatory for a Version 1 DMS, to support an upgrade path, and so an implementation can always determine if a DMS support beacons. If a sign does not support beacons, it simply returns “none” for this object.

Requirement 3.6.8.4 – Support Single Color is now mandatory. Logically, all signs must be able to support the monochrome 1bit scheme, thus in Section 3.3.4 Protocol Requirements List - Supplemental Table, Requirement ID 3.6.8.4 is now mandatory.

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D.4 Added New requirements

Added a new requirement, 3.6.6.2.17 – Support of Manufacturer Specific Message Definitions. A manufacturer-specific MULTI tag was added in 1203 v02, but was never traced to a requirement.

D.5 updated requirements

Requirement 3.6.6.2.5.4, “Support Color for each Pixel in a Message” in NTCIP 1203 v02, was updated to “Color Rectangles”. NTCIP 1203 v02 required selection of foreground color on a pixel-by-pixel basis, but was not actually possible. The use of color rectangles provides that capability and additional flexibility, so the requirement was updated. The text in NTCIP 1203 v02 was, “The DMS shall allow the message content to specify the foreground color on a pixel-by-pixel basis.”, and this was changed to, “The DMS shall allow the message content to specify an area of the sign to display a selected color.” in NTCIP 1203 v03.

D.6 Updated dialogs

For dialog, 4.2.2.1, Retrieving a Font Definition, a management station should also be prepared to receive a 'noSuchName' error (i.e., from a v1 device). Thus a change was made to Step b of the dialog so that the standard explicitly considers the operation of v1 signs.

When a font is deleted by changing its fontStatus to ‘notUsed’ the fontNumber remains, and, according to Section 5.4.2.2, values for this object must be unique across all entries, not just valid entries. Thus, for dialog 4.3.1.4, added the following step after Step B, "If the management station SETs the fontStatus to 'readyForUseReq', if the corresponding fontNumber is not unique among all fonts with fontStatus set to permanent, readyForUse, inUse, or unmanaged, a badValue error will be returned and the fontStatus will change to notInUse." Also, removed the last sentence, “A device shall return a badValue error if this value is not unique.” from Section 5.4.2.2, fontNumber.

A change was made to dialog 4.3.5, Message Activation Consistency Check Definition. Steps e-g were moved to the beginning of the dialog so a management station can verify it has permission to set the value before attempting to validate the activation of a message.

D.7 Updated Objects

Corrected the definition of horizontal pitch and vertical pitch for objects 5.3.5, Horizontal Pitch Parameter and 5.3.6, Vertical Pitch Parameter.

Added clarifications to the description for object 5.5.22, Color Scheme Parameter.

Corrected the reference in the description for object 5.6.1, Number of Permanent Messages Parameter.

Added default values for message parameters in objects 5.7.8 to 5.7.14.

Clarified the description for object 5.7.15, End Duration Message Parameter. Previously, reference is made to assigning a new message to replace the previous method, but NTCIP does not support this functionality – only one message may be active at a time. Changed to description to clarify the intent.

A change was made to object 5.7.16, Memory Management Parameter. As the graphic table contents are changeable by the user and must survive a controller reset, by definition, graphics are stored in changeable memory. To preclude ambiguous interpretation of the description of the dmsMemoryMgmt object, this change provides a clear distinction between clearing all changeable memory and clearing messages in changeable memory.

Clarified the description in object 5.8.1, Illumination Control Parameter.

Corrected the formula for calculating the direct manual light output in object 5.8.6, Illumination Manual Level Parameter.

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D.8 Added Clarifications to MULTI-ags

Additional examples and clarifications were made in Section 6.

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Annex E
Frequently Asked Questions [Informative]

Annex E addresses questions that readers of NTCIP 1203 v02 or , in future, NTCIP 1203 v03 might ask. The intent is to clarify issues in NTCIP 1203 v02 and NTCIP 1203 v03 that are not easily understood and to point out features that are intentionally not covered by NTCIP 1203 v02 or NTCIP 1203 v03.

E.1 Does NTCIP 1203 v02 include a feature to automatically blank a sign (or take other action) in the event that the sign becomes illegible due to pixel errors?

The idea here is to have the sign monitor the number of pixel errors and, through some non-standardized, non-defined, vendor-specific algorithm, determine whether the sign is considered "legible." If illegible, the sign could automatically blank itself or take another action. This is conceptually a good idea, but practically very difficult to effectively implement and therefore *not recommended* by the NTCIP DMS Working Group (WG). The difficulty comes in determining what constitutes illegibility. The WG determined that purely basing illegibility on a percentage or number of failed pixels is not sufficient. For example, consider the following cases:

a) A hundred (100) failed pixels in an unused portion of the sign face and the maximum allowable number of pixels is defined as ninety (90) pixels. The message would still be legible, but the number of failed pixels would have been exceeded. However, another message might not be legible depending on line and/or page justification, characters used, etc.
b) Consider an "8" character that appears as a "3" by failing only four pixels in the left column. A more complicated algorithm may be possible, but the computational requirements would likely exceed typical sign controllers.

From a larger perspective, if the displayed message is important, it is not desirable to arbitrarily blank the sign, when the intent of the message may still be discernable even with a large number of failed pixels.

However, there is a solution to this potential user need, which may not be executed via the interface between the central computer and the sign controller (the content of NTCIP 1203 v02), but instead be determined via the central computer software. Such a feature could be implemented in the central (with no interface to the sign) by examining pixel error information that is already provided by NTCIP 1203 v02.

Alternatively, the legibility feature could be implemented in a sign without requiring any interface between central and sign. However, this implementation would necessitate the need for additional (vendor-specific) objects so that the operator at the central computer is alerted, when a sign controller takes a non-operator-recommended action based on the results of a sign controller-internal legibility algorithm.

E.2 Does NTCIP 1203 v02 include a feature to automatically dim an LED sign at a defined high temperature in an attempt to reduce internal heat?

The NTCIP DMS WG does not believe that implementing this feature necessarily requires any interaction between the central and the sign; therefore, no additional MIB objects are defined.

Since dimming a sign will reduce the sign's legibility by some degree, there is a concern that arbitrarily doing so—with no guarantee that the sign's temperature will NOT continue to increase to the point of a sign display shutdown due to exceeding the critical temperature (see dmsTempSensorHighCriticalTemperature and dmsTempSensorLowCriticalTemperature object)—could be counterproductive.

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E.3 Does NTCIP 1203 v02 include a feature to control multiple physical signs from a single controller?

The NTCIP DMS WG has decided that there is no need for additions to NTCIP 1203 v02 to address this issue. It is expected that in such a setup, the controller would respond to multiple addresses with each appearing as a complete, independent sign to the central. In theory, there would be an entirely unique MIB database for each sign, but in practice portions of the MIB data may be shared. However, due to the multitude of possible combinations of the various data elements that could be shared, the WG believes that any attempt to standardize this feature would fail in real-life implementations.

E.4 Does NTCIP 1203 v02 include a testing/training mode whereby a central can operate signs without any messages appearing on the face of the sign?

The NTCIP DMS Working Group does not recommend such a mode, which is the reason why the 'simulation' mode as previously defined within the dmsControlMode object was deprecated. The main concern is that with such a mode, the operator could easily forget that a sign was in the testing/training mode and falsely believe s/he was activating a real message on the face of the sign. It was also decided that there was insufficient demand for such a mode to warrant the time required to carefully defining such a mode and how it would impact all other operations and data in the sign.

E.5 Does NTCIP 1203 v02 include a feature to control external devices such as HOV lane gates?

The NTCIP DMS WG has decided that this functionality is already defined via the 'auxiliary input output' object definitions defined in NTCIP 1201 v2.

E.6 Wouldn't it be useful to have an object to report back the version of NTCIP 1203 v02/MIB that is implemented in the device (e.g. DMS)?

This has to do with compatibility between version 1 and version 2 of the objects. This way the central system would know, without the MIB of the device, what version is implemented in the device.

The NTCIP DMS WG decided to address this functionality in NTCIP 1201 version 2 (Global Objects), because this capability should be universally available. The name of this object definition is 'controller-BaseStandards' defined under NTCIP 1201 v2 Section 2.2.4.

E.7 Does NTCIP 1203 v02 support the control of Lane Use Signals.

NTCIP 1203 v02 allows addressing Lane Use Signals by defining each Signal Head basically as a DMS. Each possible indication (Red X, Green ↓, and potentially other indications) would be defined as a message in the dmsMessageTable.

While the NTCIP DMS WG understands that this is not the most efficient implementation and that coordinated activation of subsequent signal heads over a particular lane cannot be managed via this method, the decision was made not to further complicate NTCIP 1203 v02 by attempting to address this advanced function. Additionally, the coordinated activation could potentially be addressed by a Central System managing the LUS.

E.8 Why is the range of the "brightness output" in the dmsIllumBrightnessValues table 0..65535 instead of 0..dmsIllumNumBrightLevels?

This question points out one confusing aspect of the illumination objects, and their usage. That is the relationship between 'Brightness Levels', 'Light Output' and the brightness table defined by 'dmsIllumBrightnessValues'. Brightness level refers to the values used by the objects dmsIllumNumBrightLevels, dmsIllumBrightLevelStatus and dmsIllumManLevel. There is no direct correlation between the Brightness Level and the amount of light actually used to illuminate the sign (except for level 0, which indicates no illumination, and that numerically higher Brightness levels do not have a Light Output lower than the previous level). The actual amount of light, or Light Output, used for a given Brightness Level is defined using the dmsIllumBrightnessValues (in the fields labeled lightOutput x) and is reported to the user in the dmsIllumLightOutputStatus object. In addition to defining the light output for a given lightOutput n, the dmsIllumBrightnessValues object also defines the photocell readings used to move up or down to other levels when dmsIllumControl is set to photocell (2). When defining the light

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output for the different lightOutput values, it is important to note that the range for these values is always 0 (off) to 65536 (Full brightness), and cannot be sub ranged, thus providing for interoperability and interchangeability. The brightness control system in the DMS can map these values to whatever the hardware requires to generate the selected illumination levels. The table that used to exist within the MIB follows.

```
--  0                   1                   2                   3
--  0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
-- +-+-+-+-+-+-+-+-+
-- |NumEntries = n |
-- +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
-- |      lightOutput 1            |  Photocell-Level-Down point 1   |
-- +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
-- |   Photocell-Level-Up point 1  |     lightOutput 2               |
-- +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
-- |   Photocell-Level-Down point 2 |   Photocell-Level-Up point 2   |
-- +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
--
-- +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
-- |   Photocell-Level-Down point n |   Photocell-Level-Up point n   |
-- +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

E.9 What is the correct way to interpolate a brightness table, and why would you do it?

A system may be designed to interpolate a brightness table when the DMS supports more Brightness Levels than NTCIP 1203 v02 supports, or when the dmsIllumBrightnessValues object specifies fewer Brightness Levels than the DMS supports. This may be done for several reasons, such as making changes to the illumination less visible to the viewer. If a DMS supports fewer levels than what the management station attempts to set, interpolation should not occur and dmsBrightnessValuesError should be set to tooManyLevels (5). The actual method to interpolate the data is manufacturer specific. However, if a system is designed to interpolate the Brightness Table defined by the dmsIllumBrightnessValues object, this interpolation should not be discernable by inspecting the DMS Illumination objects. That is to say that the DMS should 'un-interpolate' data before setting values to the status objects, should not modify the value of dmsIllumBrightnessValues, and should select the correct 'interpolated' level when a level is selected manually. The only exception to this is the dmsIllumLightOutputStatus object, which should report the actual Light Output mapped from the hardware to the 0 to 65535 range.

E.10 Why does NTCIP 1203 v02 not address NTCIP-specific traps?

The main reason is that NTCIP traps (following the scheme defined in SNMP) are not addressed in this standard is that the NTCIP community at large needs to first lay out the framework for traps in general. Traps cannot just be developed in isolation by a particular working group, but need to be considered from an ITS systems point of view. Currently, the NTCIP BSP2 WG is working on such a framework as part of NTCIP 1103, but it is neither clear nor foreseeable when the final solution will be available. From the perspective of NTCIP 1203 v02, it would be dangerous to address traps at this point, since we need to avoid standardizing one method in one standard, and then ask for a change based on the definitions in another, later-developed/upgraded standard.

However, the NTCIP 1103 standard will likely standardize on a method that will allow any implementation to utilize the trap mechanism without the need for device-specific traps. Current plans call for a method that will allow any object/data element standardized to be effectively assignable as a trap. However, we need to wait until NTCIP 1103 included that trap mechanism.

E.11 Does NTCIP 1203 v02 support the capability to provide moving graphics (similar to moving text or arrows)?

At the present time and for this version, the DMS WG did not receive any user needs to provide a standardized approach to such a feature. Therefore, this function is not addressed within NTCIP 1203

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v02.

E.12 How does NTCIP 1203 v02 address inverted fonts?

Version 1 of this standard was silent on this issue, but it was the original intent that another font would be used to achieve the display of an inverted font. However, some implementations have used the foreground color and background color MULTI tags to achieve this function. While both of these methods are valid, the latter method is ambiguous since it is not clear whether the spacing pixel row before and/or after the actual character is inverted. So, the resulting display might be different among implementations. In Version 2, the intended and correct way of creating an inverted font is to use the color rectangle MULTI tag in conjunction with the color foreground MULTI tag.

Another method is to create another font with zero character spacing and zero line spacing; but this is not the preferred method.

E.13 In the User Comment Drafts of NTCIP 1203 v02, there was a mechanism to allow triggers to activate actions. In this version, it has been removed. Why?

During the development of version 2, the WG considered adding a mechanism to provide a mechanism to use certain triggers (both internal and external inputs) to allow activation of actions (again, internal and external outputs). However, after receiving many comments regarding the resulting complexity and subsequent WG discussions, it was concluded that the mechanism will either remain as complex as it was proposed or it will become so simple that it looses the originally desired flexibility. After much discussion, the WG decided to not include this mechanism in NTCIP 1203 v02. Users desiring this functionality may still acquire and implement it by using manufacturer-specific object definitions.

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Annex F
ASCII Table and Description [Informative]

Annex F is provided as a Recommendation. The information was copied from the following homepage:

http://www.ecsu.ctstateu.edu/personal/faculty/whiter/Csc100/ASCII-code/ascii.htm

F.1 Standard ASCII Chart (7 bit = 2^7)

Dec	Hx	Oct	Char	Dec	Hx	Oct	Char	Dec	Hx	Oct	Char	Dec	Hx	Oct	Char
0	00	000	NUL (null)	32	20	040	SPACE	64	40	100	@	96	60	140	`
1	01	001	SOH (start of heading)	33	21	041	!	**65**	**41**	**101**	**A**	97	61	141	a
2	02	002	STX (start of text)	34	22	042	"	66	42	102	B	98	62	142	b
3	03	003	ETX (end of text)	35	23	043	#	67	43	103	C	99	63	143	c
4	04	004	EOT (end of transmission)	36	24	044	$	68	44	104	D	100	64	144	d
5	05	005	ENQ (enquiry)	37	25	045	%	69	45	105	E	101	65	145	e
6	06	006	ACK (acknowledge)	38	26	046	&	70	46	106	F	102	66	146	f
7	07	007	BEL (bell)	39	27	047	'	71	47	107	G	103	67	147	g
8	08	010	BS (backspace)	40	28	050	(	72	48	110	H	104	68	150	h
9	09	011	TAB (horizontal tab)	41	29	051	)	73	49	111	I	105	69	151	i
10	0A	012	LF (NL line feed,new ln)	42	2A	052	*	74	4A	112	J	106	6A	152	j
11	0B	013	VT (vertical tab)	43	2B	053	+	75	4B	113	K	107	6B	153	k
12	0C	014	FF (NP form feed,new pg)	44	2C	054	,	76	4C	114	L	108	6C	154	l
13	0D	015	CR (carriage return)	45	2D	055	-	77	4D	115	M	109	6D	155	m
14	0E	016	SO (shift out)	46	2E	056	.	78	4E	116	N	110	6E	156	n
15	0F	017	SI (shift in)	47	2F	057	/	79	4F	117	O	111	6F	157	o
16	10	020	DLE (data link escape)	48	30	060	0	80	50	120	P	112	70	160	p
17	11	021	DC1 (device control 1)	49	31	061	1	81	51	121	Q	113	71	161	q
18	12	022	DC2 (device control 2)	50	32	062	2	82	52	122	R	114	72	162	r
19	13	023	DC3 (device control 3)	51	33	063	3	83	53	123	S	115	73	163	s
20	14	024	DC4 (device control 4)	52	34	064	4	84	54	124	T	116	74	164	t
21	15	025	NAK (negative acknowledge)	53	35	065	5	85	55	125	U	117	75	165	u
22	16	026	SYN (synchronous idle)	54	36	066	6	86	56	126	V	118	76	166	v
23	17	027	ETB (end of trans. block)	55	37	067	7	87	57	127	W	119	77	167	w
24	18	030	CAN (cancel)	56	38	070	8	88	58	130	X	120	78	170	x
25	19	031	EM (end of medium)	57	39	071	9	89	59	131	Y	121	79	171	y
26	1A	032	SUB (substitute)	58	3A	072	:	90	5A	132	Z	122	7A	172	z
27	1B	033	ESC (escape)	59	3B	073	;	91	5B	133	[	123	7B	173	{
28	1C	034	FS (file separator)	60	3C	074	<	92	5C	134	\	124	7C	174	|
29	1D	035	GS (group separator)	61	3D	075	=	93	5D	135	]	125	7D	175	}
30	1E	036	RS (record separator)	62	3E	076	>	94	5E	136	^	126	7E	176	~
31	1F	037	US (unit separator)	63	3F	077	?	95	5F	137	_	127	7F	177	DEL

F.2 Extended ASCII Codes (8th bit => 2^8)

These were added later, and are not true ASCII. There are different extended sets, but this is the most common.

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128	Ç	144	É	160	á	176	▒	193	┴	209	╤	225	ß	241	±
129	ü	145	æ	161	í	177	▒	194	┬	210	╥	226	Γ	242	≥
130	é	146	Æ	162	ó	178	▓	195	├	211	╙	227	π	243	≤
131	â	147	ô	163	ú	179	│	196	─	212	╘	228	Σ	244	⌠
132	ä	148	ö	164	ñ	180	┤	197	┼	213	╒	229	σ	245	⌡
133	à	149	ò	165	Ñ	181	╡	198	╞	214	╓	230	µ	246	÷
134	å	150	û	166	ª	182	╢	199	╟	215	╫	231	τ	247	≈
135	ç	151	ù	167	º	183	╖	200	╚	216	╪	232	Φ	248	°
136	ê	152	_	168	¿	184	╕	201	╔	217	┘	233	⊗	249	·
137	ë	153	Ö	169	_	185	╣	202	╩	218	┌	234	Ω	250	·
138	è	154	Ü	170	¬	186	║	203	╦	219	▉	235	δ	251	√
139	ï	156	£	171	½	187	╗	204	╠	220	▄	236	∞	252	_
140	î	157	¥	172	¼	188	╝	205	═	221	▌	237	ϕ	253	²
141	ì	158	_	173	¡	189	╜	206	╬	222	▐	238	ε	254	■
142	Ä	159	ƒ	174	«	190	╛	207	╧	223	▀	239	∩	255	
143	Å	192	└	175	»	191	┐	208	╨	224	α	240	≡		

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Annex G
SNMP Interface [Normative]

The DMS shall conform to the requirements for the Simple Network Management Protocol (SNMP) as defined in NTCIP 1103 v02. Annexes G.1 through G.4 provide a description of the key services offered by SNMP assuming no errors. Precise rules and procedures are defined in NTCIP 1103 v02. Annex G.5 extends the requirements of NTCIP 1103 v02 by providing additional requirements that supplement, but do not replace any requirements of NTCIP 1103 v02.

> Note: To promote interoperability and to reflect marketplace realities, NTCIP requires support for SNMP. Use of other protocols defined in NTCIP 1103 v02 (e.g., the Simple Transportation Management Protocol and the Simple Fixed Message Protocol) is discouraged for DMS as these have not been widely implemented in DMS and thus would likely result in decreased interoperability, limited competition, and increased resources for testing, integration, and maintenance.

G.1 Generic SNMP Get Interface

SNMP defines a generic process by which a management station can retrieve data from a device. This process consists of a Get request (GET) and a GetResponse as depicted in Figure 13. Both the Get request and the GetResponse messages contain a list of objects as defined by the varBindingList structure (see Annex G.4).

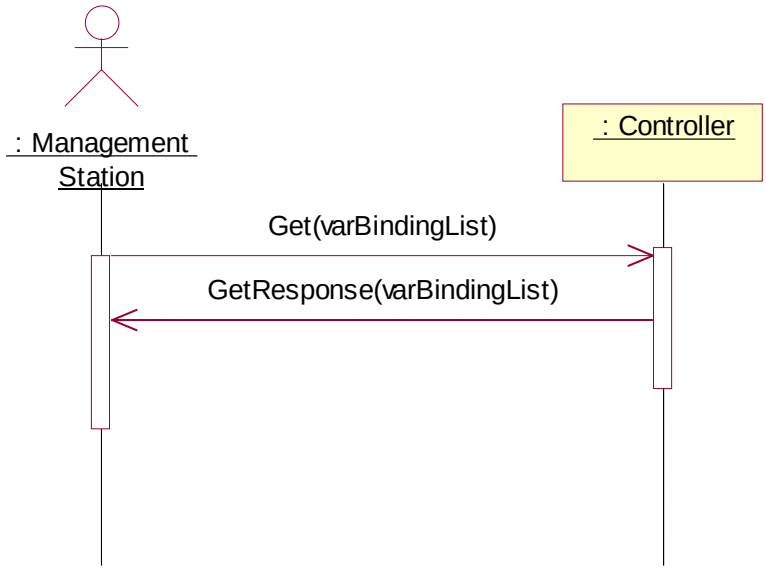

Figure 13 SNMP Get Interface

This generic process is customized by subsequent sections of NTCIP 1203 v03, by referencing the ‘GET’ operation, and directly by the RTM, by section number, to fulfill a wide range of the requirements defined in Section 3.

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G.2 Generic SNMP Get-Next Interface

SNMP defines a process by which a management station can explore data within a device to fulfill the requirement as defined in Section 3.4.1.3. This process consists of a GetNext request and a GetResponse as depicted in Figure 14. Both the GetNext request and the GetResponse messages contain a list of objects as defined by the varBindingList structure (see Annex G.4).

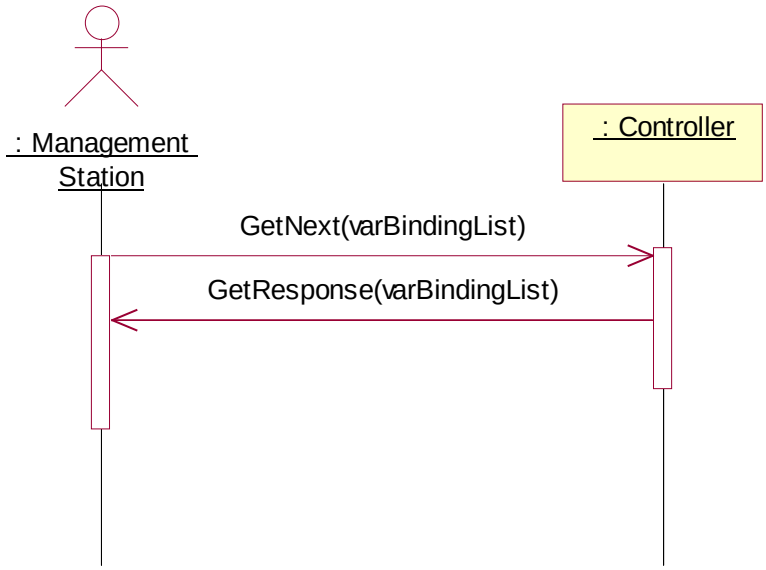

Figure 14 SNMP GetNext Interface

G.3 Generic SNMP Set Interface

SNMP defines a generic process by which a management station can send data to a device. This process consists of a Set request and a GetResponse (sic) as depicted in Figure 15. Both the Set request and the GetResponse messages contain a list of objects as defined by the varBindingList structure (see Annex G.4).

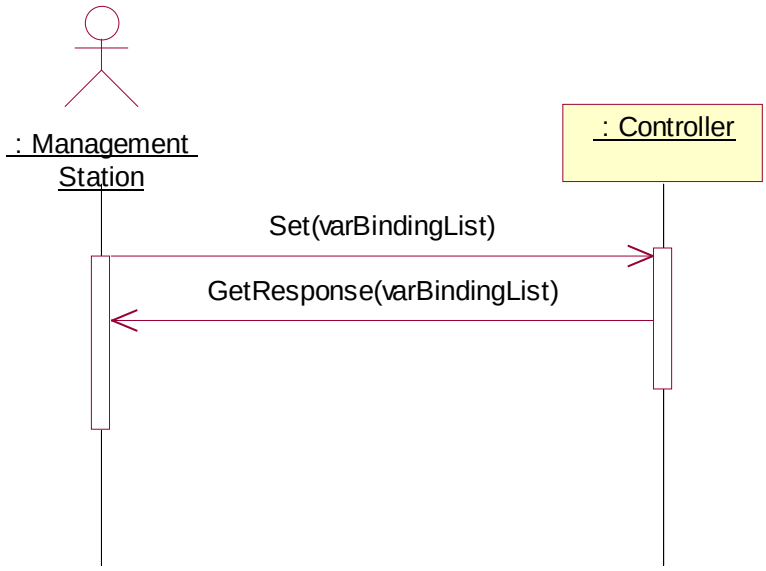

Figure 15 SNMP Set Interface

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Note: The response message issued to an SNMP Set request is the same message structure as used to respond to an SNMP Get request. The SNMP standard calls this response message a GetResponse, but it is in fact a response to either a GET or a SET.

This generic process is customized by subsequent sections of this standard, by referencing the 'SET' operation, and directly by the RTM, by section number, to fulfill a wide range of the requirements defined in Section 3. Additional rules for SETs are defined by the Control Mode State Machine. (See Section 4.3.3.)

G.4 Variable Binding List Structure

The requests and responses for the Get, Get Next and Set operations, all use the varBindingList structure. NTCIP 1103 v02 defines this structure as containing zero or more varBindings, where each varBinding is defined to consist of an object name (as indicated by an Object Identifier (OID)) and the associated object value. This is relationship is depicted in Figure 16.

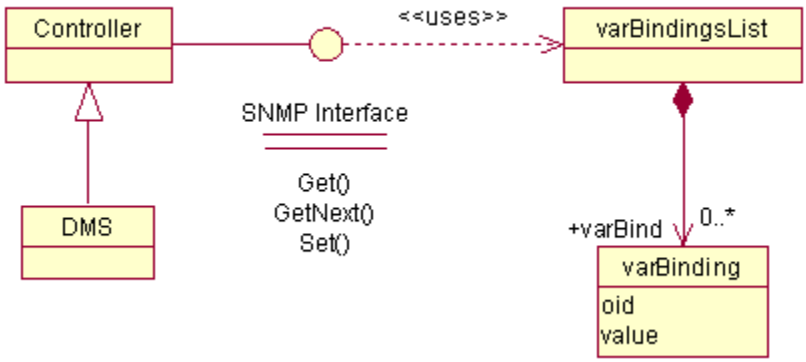

Figure 16 SNMP Interface—View of Participating Classes

G.5 Additional Requirements

G.5.1 Grouping of Objects in a Request

The DMS shall allow the management station to perform a single Get, GetNext, or Set operation on any combination of supported objects with the objects listed in any order within the message, unless otherwise restricted by NTCIP 1203 v03.

The DMS shall not associate any semantics to the ordering of objects within the varBindingsList. As required by RFC 1157, Section 4.1.5, each object shall be affected "as if simultaneously set with respect to all other assignments specified in the same message."

G.5.2 Support of Get

The DMS shall allow the management station to perform the Get operation on any supported object for which support for the Get Operation is indicated in Annex G.4.

G.5.3 Support of Get-Next

The DMS shall allow the management station to perform the GetNext operation on any OBJECT IDENTIFIER.

G.5.4 Support of Set

The DMS shall allow the management station to perform the Set operation on any supported object for which support for the Set Operation is indicated in Annex G.4.

G.5.5 Performance

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The DMS shall process the Get, GetNext, or Set request in accordance with all of the rules of NTCIP 1103 v02, including updating the value in the database and initiating the transmission of the appropriate response (assuming that the DMS has permission to transmit) within 1 second of receiving the last byte of the request.

Note: If a user desires a shorter response time, s/he will need to specify this in the specifications.

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Annex H
NTCIP 1201 v03 Derived User Needs, Functional Requirements, and Dialogs [Informative]

The annex content serves as a reference for NTCIP 1203 v02. Eventually this reference information may be moved to successors of NTCIP 1201 v03 and NTCIP 1103 v02.

> Note: At the time, the DMS WG needed to reference certain information from NTCIP 1201 (Global Object Definitions) such as user needs, functional requirements, and dialogs, NTCIP 1201 did not contain this type of information to the extent necessary NTCIP 1201 v2 does contain a Concept of Operations for 3 relevant functions that might be used in conjunction with DMS). The DMS WG, with support from the NTCIP BSP2 WG and from NEMA, decided to develop and provide the following temporary references within an annex in this standard (NTCIP 1203 v03). Annex H wiill be deleted when NTCIP 1201 supports the information contained within.

H.1 Introduction
Content in Annex H exists to serve as a reference for NTCIP 1203 v02. Eventually this information needed for reference may exist within the standard referenced.

H.2 Derived GLOBAL Functional Requirements
The following functional requirements address features defined in NTCIP 1201:2005.

H.2.1 Determine Device Component Information
The device shall allow a management station to determine identification information for each module contained in the device including:

a) An indication of the type of device
b) The manufacturer of the module
c) The model number or firmware reference of the module
d) The version of the module
e) An indication of whether it is a software or hardware module

H.2.2 Manage Time
Requirements for managing the sign controller's clock are provided in the following subsections.

H.2.2.1 Set Time
The device shall allow a management station to set the coordinated universal time to the nearest second.

H.2.2.2 Set Time Zone
The device shall allow a management station to configure the time zone in which the DMS is located.

H.2.2.3 Set Daylight Savings Mode
The device shall allow a management station to indicate whether or not day light savings time adjustments should be performed when determining local time.

H.2.2.4 Verify Current Time
The device shall allow a management station to determine the current time settings within the controller.

H.2.3 Schedule Device Actions
Requirements for managing the sign controller's scheduling feature are provided in the following subsections.

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H.2.3.1 Determine Maximum Number of Schedules

The device shall allow a management station to determine the maximum number of schedules and day plans supported by the sign controller.

H.2.3.2 Monitor Current Schedule

The device shall allow a management station to monitor the current schedule to determine which schedule entry has been selected.

H.2.4 Determine Supported Standards

The device shall allow a management station to determine the NTCIP standards which it supports.

H.2.5 Supplemental Requirements for Scheduling

Supplemental requirements for defining a time-based schedule are provided in the following subsections.

H.2.5.1 Support a Number of Day Selection Patterns

The device shall support the number of day selection patterns as specified in the specification. If the specification does not define the number of day selection patterns, the device shall support at least one day selection pattern.

> Note: A day selection pattern is a mechanism that selects a day plan to run based on the given day matching a pattern for months, days of week, and dates of month.

H.2.5.2 Support a Number of Day Plan Events

The device shall support the number of day plan events for each supported day plan as defined in the specification. If the specification does not define the number of day plan events, the device shall support at least two day plan events per day plan.

H.2.5.3 Support a Number of Day Plans

The device shall support the number of day plans as defined by the specification. If the specification does not define the number of day plans, the device shall support at least one day plan.

H.2.6 Supplemental Requirements for Event Monitoring

Supplemental requirements for monitoring for the occurrence of certain events are provided in the following subsections.

H.2.6.1 Record and Timestamp Events

The device shall support the capability to record configured event types with timestamps, in a local log (log contained in the device controller), upon request by the user and/or the management station.

H.2.6.2 Support a Number of Event Classes

The device shall support the number of event classes as defined by the specification. If the specification does not define the number of event classes, the device shall support at least one event class.

H.2.6.3 Support a Number of Event Types to Monitor

The device shall support the number of event types as defined by the specification. If the specification does not define the number of event types, the device shall support at least one event type.

H.2.6.4 Support Monitoring of Event Types

Supplemental requirements for monitoring types of events are provided in the following subsections.

H.2.6.4.1 Support On-Change Events

The device shall allow any event type configuration to monitor data for changes in value.

H.2.6.4.2 Support Greater Than Events

The device shall allow any event type configuration to monitor data for values exceeding a defined

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threshold for a period of time.

H.2.6.4.3 Support Less Than Events

The device shall allow any event type configuration to monitor data for values falling below a defined threshold for a period of time.

H.2.6.4.4 Support Hysteresis Events

The device shall allow any event type configuration to monitor data for values exceeding an upper limit or dropping below a lower limit.

H.2.6.4.5 Support Periodic Events

The device shall allow any event type configuration to monitor data on a periodic basis.

H.2.6.4.6 Support Bit-flag Events

The device shall allow any event type configuration to monitor one or more bits of a value becoming true (e.g., obtaining a value of one).

H.2.6.4.7 Support Event Monitoring on Any Data

The device shall allow a management station to configure any event type to monitor any piece of data supported by the device within the logical rules of the type of event (e.g., ASCII strings should not be monitored with greater than or less than conditions).

Note: This allows a user to monitor an event based on the value of any data.

H.2.7 Support a Number of Events to Store in Log

The device event log shall support the number of events as defined by the specification. If the specification does not define the number of events for the log, the device shall support at least one event in the log.

H.3 Derived GLOBAL Dialogs

H.3.1 Manage Communications Environment

Standardized dialogs for managing the communications environment that are more complex than simple GETs or SETs are defined in the following subsections.

H.3.1.1 Determining Current Configuration of Event Reporting/Logging Service

The standardized dialog for a management station to determine the current configuration of the logging service and/or exception reporting events shall be as follows:

a) (Precondition) The management station shall be aware of the number of classes and event configurations supported by the DMS. (See Annex A for Requirement 3.4.2.5)
b) For each row of the event class table, the management station shall GET the following data:
    1) eventClassLimit.x
    2) eventClassClearTime.x
    3) eventClassDescription.x
c) For each row of the event configuration table, the management station shall GET the following data:
    1) eventConfigClass.y
    2) eventConfigMode.y
    3) eventConfigCompareValue.y
    4) eventConfigCompareValue2.y
    5) eventConfigCompareOID.y
    6) eventConfigLogOID.y
    7) eventConfigAction.y
    8) eventConfigStatus.y

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Where:

x = event class number
y = event configuration identifier

H.3.1.2 Configuring Reporting/Logging Service

The standardized dialog for a management station to configure the logging service or events to be reported shall be as follows:

a) (Precondition) The management station shall ensure that there are sufficient rows in the event configuration and event class tables to download the proposed configuration.
b) The management station shall SET the following data to the desired values to configure each desired event class:
   1) eventClassLimit.x
   2) eventClassClearTime.x
   3) eventClassDescription.x

   NOTE—Each event type to be monitored is classified into one event class. For example, critical events may be grouped into Class 1 events and warnings may be grouped into Class 2 events. This step, defines the structure of each class of events.
c) The management station shall SET the following data to the desired values to configure each desired event to be monitored:
   1) eventConfigClass.y
   2) eventConfigMode.y
   3) eventConfigCompareValue.y
   4) eventConfigCompareValue2.y
   5) eventConfigCompareOID.y
   6) eventConfigLogOID.y
   7) eventConfigAction.y

   Note: Depending on the value of eventConfigMode, not all other objects may be necessary for the event to be defined, however, they shall always be SET as a part of the standardized dialog.
d) The management station shall GET eventConfigStatus.y to ensure that there is not an error in the configuration.

Where:

x = event class number
y = event configuration identifier

H.3.1.3 Retrieving Logged Data

The standardized dialog for a management station to retrieve logged data shall be as follows:

a) (Precondition) The management station shall be aware of the number of events that had previously been reported for the device for the subject event class (e.g., from the previous performance of this operation).
b) The management station shall GET the following data:
   1) eventClassNumRowsInLog.x
   2) eventClassNumEvents.x
c) If eventClassNumEvents.x has not changed since the previous reading, the management station shall exit the process. Otherwise, the management station shall determine the additional number of events that have occurred since the last read.
   Note: This is generally determined by subtracting the previous number of events from eventClassNumEvents; however, since this object wraps at 65535, the management station should be prepared to determine the differential if eventClassNumEvents is less than the previous number.
d) The management station shall determine the lesser of eventClassNumRowsInLog and the additional number of events that have occurred since the last read. This number shall be termed the Events to Read.
e) Starting with y = eventClassNumRowsInLog and working down until y = (eventClassNumRowsInLog - Events to Read), the management station shall GET the following data:

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1) eventLogID.x.y
2) eventLogTime.x.y
3) eventLogValue.x.y

f) Repeat the same GET operation with y decremented by one (1) for each set of duplicated values (until y reaches a value of zero (0)).
Note: If the event class is full and another event occurs, the new event is recorded in the last entry and all previously logged data is moved to one index lower with index 1 being deleted from the table. Thus, if a duplicate row is detected (e.g., same event at same time), it is likely an indication that the same event is being read and that a new event was added to the log.
Note: The management station may wish to clear the event log after the read to minimize the above problem.

Where:
x = event log class
y = event log number

H.3.2 Automatic Reporting of Events (SNMP Traps)

Note: Ultimately, the NTCIP-specific handling of traps will be defined in NTCIP 1103. However, the current version (NTCIP 1103 v02) does not contain any trap definitions. Therefore, NTCIP 1203 v03 does not address traps.

H.3.3 Determining Device Component Information

The standardized dialog for a management station to identify the hardware and software configuration of a NTCIP device shall be as follows:

a) The management station shall GET the object globalMaxModules.0.
b) For each row in the module table, the management station shall GET the following objects:
1) moduleDeviceNode.x,
2) moduleMake.x,
3) moduleModel.x,
4) moduleVersion.x,
5) moduleType.x.

Where:
x = module number.

H.3.4 Global Time Data

The following subsection identifies the interface to a field device to obtain and manage time related information.

H.3.4.1 Graphical Depiction of Global Time Data

See Figure 17.

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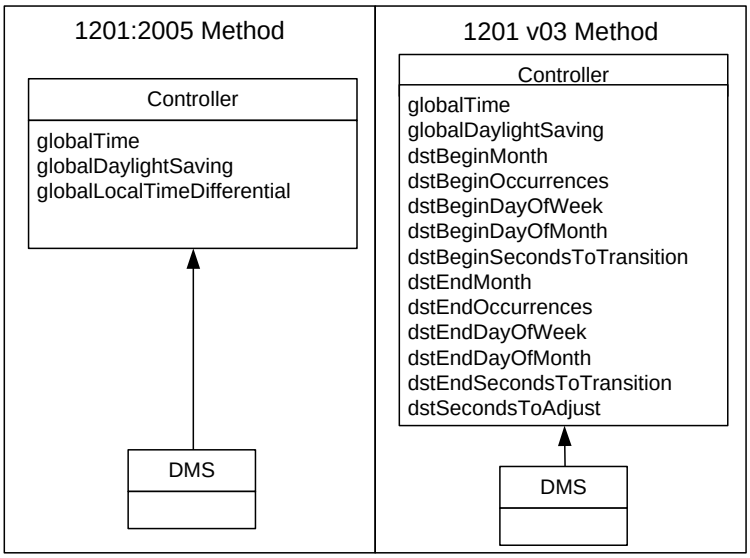

Figure 17 Global Time Data

H.4 External Data Elements

NTCIP 1203 v03 references data elements within Annex H that are physically defined within NTCIP 1201 v03. See NTCIP 1201 v03.

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