VICROADS SPECIFICATION

TCS 060 – 1 – 2012

VicRoads Extensions to RTA Protocol

For

Roadside Devices

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Foreword

This specification has been developed by VicRoads. It is one of a number of technical specifications, and associated standard drawings, which set out the requirements for roadside ITS devices, traffic signal equipment and other electrical equipment and associated devices and control systems.

This specification is intended for use in all relevant works undertaken by or on behalf of VicRoads.

VicRoads Standard Drawings, Specifications and Guidelines are available for downloading from the VicRoads website at the following address under 'Tenders & Suppliers': http://www.vicroads.vic.gov.au/itsspecs

Specification updates. VicRoads specifications and associated standard drawings are subject to periodic review. To keep the specifications up to date, amendments or new editions are issued as necessary. It is therefore important for users of VicRoads specifications to ensure that they have the latest version and associated amendments.

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Revision History

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PREFACE

A. TELECOMMUNICATIONS EQUIPMENT

A.1 All telecommunications equipment shall comply with relevant requirements of the Australian Communications and Media Authority (ACMA). Such equipment shall be labelled with an ACA issued 'A-Tick'  .

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SECTION 1 SCOPE AND GENERAL

1.1 SCOPE

1.1.1 The purpose of this document is to detail VicRoads enhancements to the RTA's Protocol specification TSI-SP-003.

1.1.2 This document is to be read in conjunction with TSI-SP-003.

1.2 GENERAL

1.2.1 The protocol enhancements in this document were developed for the purpose of controlling VicRoads assets used as part of VicRoads Freeway Management system.

1.3 INTELLECTUAL PROPERTY

1.3.1 In relation to all Intellectual Property used in/or to operate, the contractor grants to VicRoads non exclusive license to "use, modify and/or sell" or do anything else that without the license, could be breach of licensors Intellectual Property.

1.3.2 Intellectual Property shall include, but not be limited to, the following:

- Software;
- Source code(s);
- Schematic diagrams;
- Circuit diagrams;
- Wiring diagrams;
- Listings of components and sub-components;
- Any and all operational and maintenance documentation.

SECTION 2 DEFINTIONS

2.1 For the purposes of this document, the following definitions apply:

RTA– means the Roads and Traffic Authority of NSW.

Protocol - means communications complying with RTA document TSI-SP-003, version 2.1, Issued 26 June 2008.

Equipment- means the equipment or services described in this Specification.

LCS- means Lane Control Sign

TIS - means Trip Information Sign.

TMS- means Tunnel Message Sign – a single line VMS designed for tunnel applications.

VMS- means Variable Message Sign.

VSLS-means Variable Speed Limit Sign.

FMP -means Frame, Message and/or Plan

Group Controller or GC – means the device that communicates remotely using RTA protocol and controls one or more local signs, such as LCS or TMS or VMS or VSLS.

TMC – means the client's Traffic Management Centre, which may include a Field Processor through which the GC connects.

SECTION 3 DETAILS OF ENHANCEMENTS TO EXISTING RTA OP-CODES

3.1 CHANGES TO BYTE IN POSITION 2 OF SIGN STATUS REPLY (MI-CODE 0X06)

3.1.1 The byte in Position 2 reports the Off-Line / On-Line State of the communications link in Bit-0 to the TMC. The interpretation of the seven spare bits is changed from "Spare" as follows.

3.2 GROUP CONTROLLER DIGITAL INPUT REPORTING

3.2.1 The GC provides two voltage free digital inputs, which can be used to communicate a Status Indication of other equipment located close to the GC.

3.2.2 These inputs are not a Fault or Alarm condition of the GC itself, and as such, the state changes are not recorded in the Fault Log.

3.2.3 An example use is to report the state of a Road Side Cabinet "Door Open" switch. The Status is to be interpreted by the relevant system control software.

3.2.4 There are other digital inputs in the GC used as inputs (including the raw Facility Switch inputs) to the GC program. If the state of any of these inputs changes, then "Change In Digital I/O" flag is set.

3.2.5 The flag is automatically cleared after the Sign Status Reply packet (MI-Code 0x06) is sent.

3.2.6 All digital inputs can be retrieved using the Retrieve Analog and Digital Input States packet (MI-Code hex FA).

3.2.7 Digital Input Reporting can be disabled or enabled in the configuration.

3.3 IN INTERLOCKING MODE

3.3.1 The GC automatically sets this flag when Interlocking Mode is active.

3.4 CONTROLLER FATAL AND WARNING FLAGS

3.4.1 The GC categorises the current controller faults as either Fatal or Warning. If enabled in the configuration, the GC reports these Fatal and Warning conditions to the TMC.

3.4.2 It is possible, if several faults are current on a GC, for both the Fatal and Warning bits to be set at the same time.

3.4.3 Final Byte Structure

Bit Position	Description	Bit Clear	Bit Set
0	Off-Line / On-Line State	Off-Line	On-Line
1	Digital Input 1	Switch Open	Switch Closed
2	Digital Input 2	Switch Open	Switch Closed
3	Change In Digital Input State	No Input Change	Input Changed
4	-- spare --	Always	Never
5	Current Mode	Normal Mode	Interlocking Mode
6	Controller Warning	No Warning	Warning Present
7	Controller Fatal	No Fatal	Fatal State Present

3.5 CHANGES TO BYTE IN POSITION 17 OF SIGN STATUS REPLY (MI-CODE 0X06)

3.5.1 The byte in Position 17 reports the Disabled / Enabled State of the sign in Bit-0 to the TMC. The interpretation of the seven spare bits is changed from "Spare" as follows.

3.6 SIGN DIGITAL INPUT REPORTING

3.6.1 Each sign may provide up to two voltage free digital inputs, the state of which are transmitted to the GC.

3.6.2 These inputs can be used to communicate a Status Indication of other equipment located close to each sign.

3.6.3 These inputs are not a Fault or Alarm condition of the sign itself, and as such, the state changes are not recorded in the Fault Log.

3.6.4 An example use is to report the state of a sign "Door Open" switch. The Status is to be interpreted by the relevant system control software.

3.6.5 Digital Input Reporting can be disabled or enabled in the configuration.

3.7 CONTROLLER FATAL AND WARNING FLAGS

3.7.1 The GC categorises the current sign faults as either Fatal or Warning. If enabled in the configuration, the GC reports these Fatal and Warning conditions to the TMC.

3.7.2 It is possible, if several faults are current in a sign, for both the Fatal and Warning bits to be set at the same time.

3.8 FINAL BYTE STRUCTURE

Bit Position	Description	Bit Clear	Bit Set
0	Sign Disabled or Enabled	Sign Disabled	Sign Enabled
1	Digital Input 1	Switch Open	Switch Closed
2	Digital Input 2	Switch Open	Switch Closed
3	-- spare --	Always	Never
4	-- spare --	Always	Never
5	-- spare --	Always	Never
6	Sign Warning	No Warning	Warning Present
7	Sign Fatal	No Fatal	Fatal State Present

3.9 TRIP INFORMATION SIGN (TIS)

3.9.1 The TIS displays the expected travel time to between two to five destinations.

3.9.2 Each line on a TIS displays the expected travel time in minutes and one segment of a coloured vertical congestion bar.

3.9.3 This bar indicates to the motorist a simple indication of congestion of a section of roadway.

3.9.4 As well as controlling the two-digit time display for each destination, the colour and status (flashing / non-flashing) of the congestion bar must be conveyed.

3.9.5 The congestion bar between two nodes comprises two sections, an upper and a lower section.

3.10 PROTOCOL CHANGE DETAILS

3.10.1 The Conspicuity byte in Position 6 of the Sign Set Text Frame (MI-Code hex 0A) is modified as follows.

3.10.2 The upper congestion bar is set in bits 0-2 of the Conspicuity byte.

Bit Position			Description	Interpretation
2	1	0		
0	0	0	Off	Blank
0	0	1	Green Steady	Light Congestion
0	1	0	Green Flash	-- unused --
0	1	1	Amber Steady	Medium Congestion
1	0	0	Amber Flash	-- unused --
1	0	1	Red Steady	Heavy Congestion
1	1	0	Red Flash	Motorway Closed
1	1	1	-- invalid --	-

3.10.3 The lower congestion bar is set in bits 3-5 of the Conspicuity byte.

Bit Position			Description	Interpretation
5	4	3		
0	0	0	Off	Blank
0	0	1	Green Steady	Light Congestion
0	1	0	Green Flash	-- unused --
0	1	1	Amber Steady	Medium Congestion
1	0	0	Amber Flash	-- unused --
1	0	1	Red Steady	Heavy Congestion
1	1	0	Red Flash	Motorway Closed
1	1	1	-- invalid --	-

3.10.4 Bits 6 and 7 of the Conspicuity byte must be zero.

3.10.4 The TIS does not support the Sign Set Graphic Frame (MI-Code hex 0B) packet.

3.11 TIS LAYOUT

3.11.1 The layout of the TIS is as shown below. The arrow head at the top is a separate sign and group with its IDs one more than the most distant destination.

Top Arrow Head	Group 4 Sign 4 Lower Congestion Bar (Text and Upper Congestion Bar is ignored)
Destination 3 (Most Distant)	Group 3 Sign 3 Text and Congestion Bar, Upper and Lower
Destination 2	Group 2 Sign 2 Text and Congestion Bar, Upper and Lower
Destination1 (Closest)	Group 1 Sign 1 Text and Upper Congestion Bar (Lower Congestion Bar is ignored)

3.12 LANE CONTROL SIGN

3.12.1 The Lane Control Sign (LCS) is a Variable Speed Limit Sign (VSLS) and a Lane Control Sign (LCS) in one device. (The same piece of equipment is known by many other names and acronyms.)

3.12.2 In addition to the standard speed limit displays, the LCS includes a **red X** and white directional arrows, with the potential of other graphic images.

3.12.3 The LCS does not support the **Sign Set Text Frame** (MI-Code hex 0A) packet.

3.12.4 The Conspicuity byte in **Sign Set Graphic Frame** (MI-Code hex 0B) packet is modified as follows.

3.12.5 The Beacon bits are located in bits 0-2 of the Conspicuity byte, and have the following interpretation.

Bit Position			Beacon Option	
2	**1**	**0**	**RTA Standard**	**Enhanced Version**
0	0	0	Off	Off
0	0	1	Up / Down	Up / Down
0	1	0	Left / Right	Left / Right
0	1	1	Wig / Wag	Wig / Wag
1	0	0	All Flash	All Flash
1	0	1	All On	All On
1	1	0	--- invalid ---	Left Beacons Flash Together
1	1	1	--- invalid ---	Right Beacons Flash Together

3.12.6 The Annulus bits are located in bits 3 and 4 of the Conspicuity byte, and have the following interpretation.

Bit Position		Annulus Option	
4	**3**	**RTA Standard**	**Enhanced Version**
0	0	Off	Off
0	1	Flash	Flash
1	0	On	On
1	1	--- invalid ---	Contra Flash

3.12.7 The Annulus, the Top-Left Beacon and the Cross shall flash ON and OFF together (that is, they are synchronised).

3.12.8 The remaining Beacons shall be ON or OFF as appropriate for the pattern.

3.12.9 With Annulus Contra Flash, the Annulus shall be OFF when the Top Left Beacon is, or would be, ON, and ON when the Top Left Beacon is OFF. The timing is therefore contrary to the normal timing.

3.12.10 The Cross bits are located in bits 5-7 of the Conspicuity byte, and have the following interpretation.

Bit Position			Cross Option	
7	**6**	**5**	**RTA Standard**	**Enhanced Version**
0	0	0	0	Off
0	0	1	--- invalid ---	All cross pixels flash for Test Mode
0	1	0	--- invalid ---	Forward Slash / On
0	1	1	--- invalid ---	Forward Slash / Flash
1	0	0	--- invalid ---	Back Slash \ On
1	0	1	--- invalid ---	Back Slash \ Flash
1	1	0	--- invalid ---	Cross X On
1	1	1	--- invalid ---	Cross X Flash

NOTE: Although the system is capable, the annulus and the beacons shall not be flashed at the same time. Only the annulus or the beacons shall be used but not both together in line with AustRoads guidelines.

SECTION 4 NEW MANUFACTURER SPECIFIC OP CODES PACKET DETAILS

4.1 LIST STORED FMPS AND CHECK CODES REQUEST

4.1.1 This packet requests the list of stored frames, messages or plans, either as a summary or with the associated Check Codes.

4.1.2 The <MI-CODE> and <DATA> sections of the packet are detailed below.

BYTE	Value	Description
MI-Code	0xFF	List Stored FMPs and Check Codes Request
Data 1	0-3	0 = Summary 1 = Frames 2 = Messages 3 = Plans

4.2 LIST STORED FMPS AND CHECK CODES REPLY

4.2.1 This packet lists the stored frames, messages or plans, either as a summary or with the corresponding Check Code.

4.2.2 Frame 0, Message 0 and Plan 0 are reported only if byte Data 1 is zero.

4.2.3 The <OP-CODE> and <DATA> sections of the summary packet are detailed below.

BYTE	Value	Description
Op-Code	0xFE	List Stored FMPs and Check Codes Reply
Data 1	0	0 = Summary
Data 2	0x00-0xFF	Bit 0 is set, bit 1 is set if Frame 1 is stored, bit 2 is set if Frame 2 is stored, … bit 7 is set if Frame 7 is stored
Data 3	0x00-0xFF	Bit 0 is set if Frame 8 is stored, bit 1 is set if Frame 9 is stored, bit 2 is set if Frame 10 is stored, … bit 7 is set if Frame 15 is stored
:	0x00-0xFF	:

Data 33	0x00-0xFF	Bit 0 is set if Frame 248 is stored, bit 1 is set if Frame 249 is stored, bit 2 is set if Frame 250 is stored, … bit 7 is set if Frame 255 is stored
Data 34	0x00-0xFF	Bit 0 is set, bit 1 is set if Message 1 is stored, bit 2 is set if Message 2 is stored, … bit 7 is set if Message 7 is stored
:	0x00-0xFF	:
Data 65	0x00-0xFF	Bit 0 is set if Message 248 is stored, bit 1 is set if Message 249 is stored, bit 2 is set if Message 250 is stored, … bit 7 is set if Message 255 is stored
Data 66	0x00-0xFF	Bit 0 is set, bit 1 is set if Plan 1 is stored, bit 2 is set if Plan 2 is stored, … bit 7 is set if Plan 7 is stored
:	0x00-0xFF	:
Data 97	0x00-0xFF	Bit 0 is set if Plan 248 is stored, bit 1 is set if Plan 249 is stored, bit 2 is set if Plan 250 is stored, … bit 7 is set if Plan 255 is stored

4.2.4 The <OP-CODE> and <DATA> sections of the frame, message and plan packet are detailed below.

BYTE	Value	Description
Op-Code	0xFE	List Stored FMPs and Check Codes Reply
Data 1	1-3	1 = Frames 2 = Messages 3 = Plans
Data 2	0-255	Number of stored frames, messages or plans reported, but not including Frame 0, Message 0 or Plan 0.
Data 3	1-255	* Frame ID, Message ID or Plan ID
Data 4	0x00-0xFF	* High byte of Check Code
Data 5	0x00-0xFF	* Low byte of Check Code

* Field may be repeated depending on the number of stored frames, messages or plans.

4.3 PIXEL FAULT MAP REQUEST

4.3.1 This packet requests the sign pixel fault map.

4.3.2 The <MI-Code> and <DATA> sections of the packet are detailed below.

BYTE	Value	Description
MI-Code	0xFD	Pixel Fault Map Request
Data 1	1-12	Sign ID

4.4 PIXEL FAULT MAP REPLY

4.4.1 This packet reports the fault map of the sign.

4.4.2 The <MI-CODE> and <DATA> sections of the packet are detailed below.

BYTE	Value	Description
MI-Code	0xFC	Pixel Fault Map Reply
Data 1	1-12	Sign ID
Data 2	0x00-0x0F	Beacon fault status bit 0 – Top Left Beacon faulty if set bit 1 – Top Right Beacon faulty if set bit 2 – Bottom Left Beacon faulty if set bit 3 – Bottom Right Beacon faulty if set bits 4-7 – always zero.
Data 3	0x00-0xFF	Fault map of matrix. The data layout is described below.
Data 4	0x00-0xFF	
:	:	
Data N	0x00-0xFF	
Data N+1	0x00-0xFF	Fault map of annulus and cross. This is manufacturer and model specific. Refer to notes below.
Data N+2	0x00-0xFF	
:	:	
Data N+M	0x00-0xFF	

4.4.3 The display on an LCS is comprised of a matrix of white LEDs on which symbols and numbers can be displayed, an annulus of red LEDs circling the matrix, and a cross of red LEDs that passes through the matrix and may pass through parts of the annulus.

4.4.4 The cross is actually comprised of a forward slash part and a back slash part that can either be driven independently or together to make the cross.

4.4.5 Each pixel on the matrix is individually settable, however, as all pixels of the annulus and cross are required to be on, so a global control for each part using the conspicuity byte is sufficient.

4.4.6 For monitoring the fault status of the sign, all pixels, regardless of whether they form part of the matrix or part of the annulus or cross, must be individually reported.

4.4.7 Matrix faults shall be reported slightly differently to the annulus and cross.

4.4.8 For the matrix, assume it is 11 pixels wide and 4 rows high (for clarity purposes).

4.4.9 Each pixel has a name, starting with A1 in the top left corner (as viewed from the front), to A11 in the top right corner, B1 through to B11 in row 2, C1 to C11 in row 3, and D1 to D11 in row 4.

4.4.10 Thus the display, when viewed from the front, looks like this:

A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11
D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11

4.4.11 When transferring the fault data for the matrix, the data is transferred as follows.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	A8	A7	A6	A5	A4	A3	A2	A1
2	-	-	-	-	-	A11	A10	A9
3	B8	B7	B6	B5	B4	B3	B2	B1
4	-	-	-	-	-	B11	B10	B9
5	C8	C7	C6	C5	C4	C3	C2	C1
6	-	-	-	-	-	C11	C10	C9
7	D8	D7	D6	D5	D4	D3	D2	D1
8	-	-	-	-	-	D11	D10	D9

4.4.12 Unused bits (shown as hyphens above) are set to zero.

4.4.13 There is no regular pattern for the annulus or cross. This specification does not detail the format, except that a minimum number of bytes are to be used. For example, if the number of annulus and cross pixels for a section of the display comprises 37 pixels, then five bytes must be used (5 bytes of 8 bits each = 40 bits) for that section. Unused bits must be zero.

4.5 ANALOG AND DIGITAL INPUTS STATES REQUEST

4.5.1 This packet requests the state of all the Digital Inputs states in the Group Controller.

4.5.2 The <MI-CODE> section of the packet is detailed below.

BYTE	Value	Description
MI-Code	0xFB	Analog and Digital Inputs States Request

4.6 ANALOG AND DIGITAL INPUTS STATUS REPLY

4.6.1 This packet returns the state of all the Analog and Digital Inputs states in the Group Controller.

4.6.2 The <MI-CODE> and <DATA> sections of the packet are detailed below.

BYTE	Value	Description
MI-Code	0xFA	Analog and Digital Inputs Status Reply
Data 1	3-20	Number of Analog entries to follow – first three are mandatory
Data 2	0, 0x40, 0x80	* Main power supply state byte – refer table below
Data 3	0-255	* Main power supply voltage 0 for value not available 1-254 for supply voltage between 0.1Vdc to 25.4Vdc 255 for supply voltage exceeds 25.4Vdc
Data 4	0, 0x40, 0x80	* Battery power supply state byte – refer to table below
Data 5	0-255	* Battery power supply voltage 0 for value not available 1-254 for supply voltage between 0.1Vdc to 25.4Vdc 255 for supply voltage exceeds 25.4Vdc
Data 6	0, 0x40, 0x80	* Temperature state byte – refer table below
Data 7	0-255	* Temperature in degrees C 0 for value not available 80-180 – temperature offset by 100 representing –20 to +80 degrees
Data 8	0, 0x40, 0x80	* Analog value state byte – refer table below
Data 9	0-255	* Analog value – interpretation is manufacturer specific
Data 10	0-20	Number of digital inputs to follow
Data 11	0x00-0x01	* Digital input state 0x00 for OFF 0x01 for ON
Data 12	0-12	Number of Facility Switch states to follow
Data 14	0x00-0xFF	* Facility Switch state - refer to table below

* Field may be repeated depending on the number of entries.

4.6.3 The following table categorises the Analog state byte. Bits 0 to 5 must be zero

Bit Position		Description
7	6	
0	0	No fault present
0	1	In WARNING state
1	0	In ALARM state
1	1	--- invalid ---

4.6.4 The following table categorises the value reported in bits 0 to 3 of the Facility Switch State byte.

Bit Position				Description
3	2	1	0	
0	0	0	0	Auto
0	0	0	1	Position 1
0	0	1	0	Position 2
0	0	1	1	Position 3
0	1	0	0	Position 4
0	1	0	1	Position 5
1	1	1	1	Off

4.6.5 Bits 4 to 7 of the Facility Switch State byte contain the raw switch state as recorded by the GC. The information provided is specific to the GC and may be re-interpreted for use by other manufacturers.

Bit Position	Description
4	Pin 2 of the facility switch header is active
5	Pin 3 of the facility switch header is active
6	Pin 4 of the facility switch header is active
7	Pin 5 of the facility switch header is active

4.6.6 This method of reporting assumes that pin 1 of the facility switch header is common. If the facility switch header has less than 5 pins, all excess pins shall always be reported as 0.

4.7 SIGN DISPLAY FRAME MULTI

4.7.1 The SIGN DISPLAY FRAME MULTI command instructs the Group Controller to display pre-stored frames on a group of signs.

4.7.2 The <MI-CODE> and <DATA> sections of the packet are detailed below.

BYTE	Value	Description
MI-Code	0xF0	Sign Display Frame Multi
Data 1	1-12	Group ID
Data 2	1-12	Number of signs in the group
Data 3	1-12	* Sign ID
Data 4	0-255	* Frame ID (if zero, then sign will be blank)

* Field is repeated for every sign in the group. Every sign in the group must be listed (in any order), otherwise the GC will respond with error code 0x1F (Interlocking Reject – Missing Signs).

4.7.3 This MI-Code is only available when interlocking mode is active.

4.7.4 The lowest sign ID is configurable to be located either on the left of the motorway, as viewed by the motorist, or on the right. The sign IDs must increment, not necessarily by one, to the adjacent lane across the motorway for that direction.

4.8 SIGN CONFIGURATION REQUEST

4.8.1 The SIGN CONFIGURATION REQUEST from the TCC requests the GC to respond with its sign configuration.

4.8.2 The <MI-CODE> section of the packet is detailed below.

BYTE	Value	Description
MI-Code	0xF1	Sign Configuration Request

4.9 SIGN CONFIGURATION REPLY

4.9.1 The GC sends the SIGN CONFIGURATION REPLY packet to the TCC in response to a SIGN CONFIGURATION REQUEST.

4.9.2 The <MI-CODE> and <DATA> sections of the packet are detailed below.

BYTE	Value	Description
MI-Code	0xF2	Sign Configuration Reply
Data 1	1-12	Number of Groups
Data 2	1-12	* Group ID
Data 3	1-12	* Number of signs in the group
Data 4	1-12	** Sign ID
Data 5	0-40	* Number of Signature Data bytes
Data 6	0x00-0xFF	** Group Signature Data

* Field is repeated for every group.

** Field is repeated for each group depending on the number of Sign IDs or Signature Data bytes. If not in Interlocking Mode, the number signature data bytes must be zero.
If in Interlocking Mode, the signature data describes the interlocking rules implemented. The data is manufacturer specific

SECTION 5 INTERLOCKING MODE OPERATION DETAILS

5.1 INTRODUCTION

5.1.1 This section details all special features of the GC when in Interlocking Mode.

5.2 DISABLED RTA PROTOCOL OP-CODES

5.2.1 When in Interlocking Mode or in Normal Mode, certain MI-Codes will be disabled. The GC will respond with Application Error Code 0x08 “MI-Code Not Supported”.

5.2.2 When in Interlocking Mode, the following MI-Codes will be disabled.

MI-Code	Direction	Description
0x0A	TCC to GC	Set Text Frame
0x0B	TCC to GC	Set Graphic Frame
0x0C	TCC to GC	Set Message
0x0D	TCC to GC	Set Plan
0x0E	TCC to GC	Display Frame
0x0F	TCC to GC	Display message
0x10	TCC to GC	Enable Plan
0x11	TCC to GC	Disable Plan
0x12	TCC to GC	Request Enabled Plans
0x13	GC to TCC	Report Enabled Plans

5.2.3 When in Normal Mode, the following MI-Codes will be disabled.

MI-Code	Direction	Description
0xF0	TCC to GC	Sign Display Frame Multi

5.3 LIST OF PRE-LOADED FRAMES

5.3.1 The GC shall be pre-configured with a known set of display frames. Frames are divided into two categories: the Speed Limit Category and the Symbols Category.

5.3.2 The Speed Limit Category is defined in TSI-SP-011, Version 1.0. In summary, speed frame IDs are of

the form XXY,

(i) where XX is 01 for 10, 02 for 20, 03 for 30, … 11 for 110 (the maximum speed limit)

(ii) and where Y is as per the following table.

Y	Description
0	Annulus On
1	Annulus Flash
2	Beacons Up/Down
3	Annulus On and Beacons Up/Down
4	Annulus Flash and Beacons Up/Down

5.3.3 The Symbols Category is defined in the following table:

Frame ID		Symbol	Description
Without Beacons	With Beacons		
150	151		Cross – On
152	153		Cross - Flashing
160	161		Lane Open
162	163		Merge Left
164	165		Merge Right
166	167		Merge Left or Merge Right
170	171		Motorway Open Ahead
172	173		Motorway Exit Left
174	175		Motorway Exit Right
176	177		* Motorway Open Ahead or Exit Left
178	179		* Motorway Open Ahead or Exit Right
180	181		* No Left Turn with Steady Annulus and Back Slash
182	183		* No Left Turn with Flashing Annulus and Back
184	185		* No Right Turn with Steady Annulus and Forward
186	187		* No Right Turn with Flashing Annulus and Forward

* Not required for Interlocking version, and maybe omitted.

5.4 NEW ERROR CODES

5.4.1 Application Error Codes

5.4.1.1 The following Application Error Codes have been added for Interlocking Mode.

Error Code	Description
0x1E	Interlocking Reject – Invalid Setting
0x1F	Interlocking Reject – Missing Signs
0x20	Under Local Control
0x21	Interlocking Not Active
0x22	Interlocking Active

5.4.2 Controller Error Codes

5.4.2.1 There are no new Controller Error Codes.

5.4.3 Sign Error Codes

5.4.3.1 There are no new Sign Error Codes