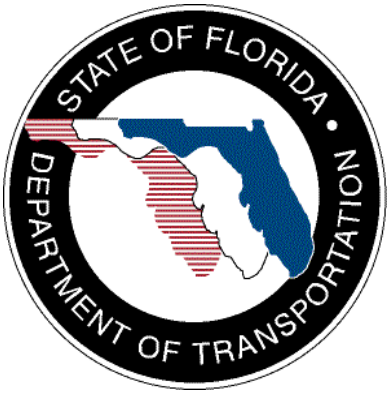
# SunGuide™:

# Ramp Metering Firmware

# Software Users Manual

## SunGuide-RMF-SUM-1.0.4





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# List of Acronyms

ACIA.....Asynchronous Common Interface Adapter
CD.....Compact Disk
DOT .....Department of Transportation
FDOT .....Florida Department of Transportation
ITN.....Invitation to Negotiate
ITS.....Intelligent Transportation Systems
RMF .....Ramp Meter Firmware
SUM.....Software Users Manual
SwRI .....Southwest Research Institute®
TOD .....Time-Of-Day
VPM.....Vehicle Per Minute
W3.....World Wide Web Consortium

## Revision History

| Revision | Date | Changes |
|---|---|---|
| 1.0.0 | March 14, 2007 | Initial Release. |
| 1.0.1 | April 6, 2007 | Added Detector and Input Echo to the firmware parameters table to the Lane 1 parameters page. Added memory map tables to Appendix B. Modified descriptions of keypad display modes to include instructions for memory navigation keys. Added description of keypad display mode for general memory access. |
| 1.0.2 | June 5, 2007 | Added section to describe usage of detector echo and input echo functionality. Added section to describe the display (LED and call light) blanking feature. Added a section describing a typical ramp configuration. This represents the configuration that the firmware design was based on. In Appendix A in the global parameters table, changed the units for the speed trap upstream and downstream loops from pin to detector. In the Appendix B memory maps, moved the memory locations for detector echo and input echo from the F1 Page to the C Page. In the Appendix B memory maps, modified the tables to shade the read-only entries. In the Appendix B memory maps, removed entries and tables that are not used by the RM firmware. |
| 1.0.3 | March 17, 2008 | Modified text in the Volume Adjust description to accurately reflect the algorithm functionality. |
| 1.0.4 | March 5, 2009 | Updated for Footprint issues #1050, #1076 and #1079 |

# 1. Scope

## *1.1 Document Identification*

This document serves as the Software Users Manual (SUM) for the Florida Department of Transportation (FDOT) Ramp Metering firmware.

## *1.2 Project Overview*

FDOT is conducting a program that is developing SunGuide software. The SunGuide software is a set of Intelligent Transportation System (ITS) software that allows the control of roadway devices as well as information exchange across a variety of transportation agencies. The goal of the SunGuide software is to have a common software base that can be deployed throughout the State of Florida. The SunGuide software development effort is based on ITS software available from both the States of Texas and Maryland; significant customization of the software is being performed as well as the development of new software modules. The following figure provides a graphical view of the SunGuide software.

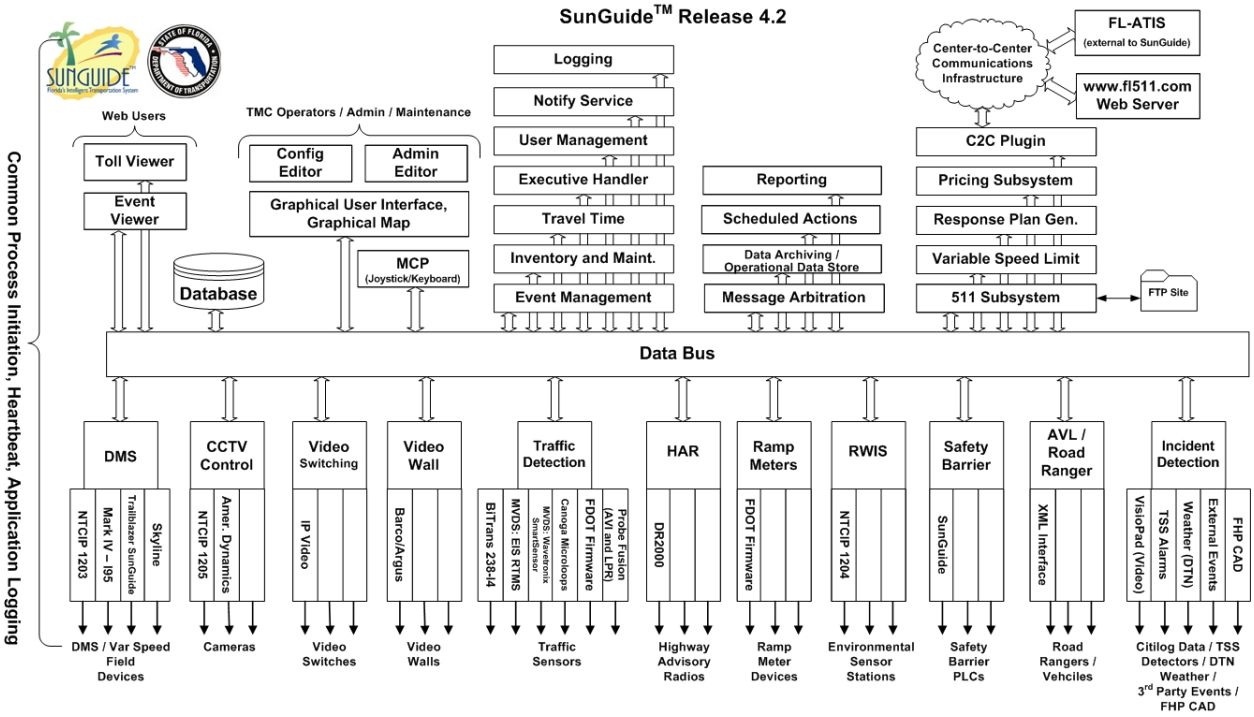


**Figure 1.1 - High-Level Architectural Concept**

The SunGuide development effort spans approximately two years. After the development, the software will be deployed to a number of districts and expressway authorities throughout Florida, and support activities will be performed.

## *1.3 Related Documents*

The following documents were used to develop this document:

- SwRI Qualification Response: *Response to the Invitation to Negotiate (ITN): Statewide Transportation Management Center Software Library System, Negotiation Number: ITN-DOT-02/03-9025-RR,* SwRI Proposal No. 10-35924, dated: November 18, 2002.
- SwRI Technical Proposal: *Technical Proposal for Invitation to Negotiate (ITN): Statewide Transportation Management Center Software Library System, Negotiation Number: ITN-DOT-02/03-9025-RR,* SwRI Proposal No. 10-35924, dated: January 31, 2003.
- SwRI Cost Proposal: *Cost Proposal for Invitation to Negotiate (ITN): Statewide Transportation Management Center Software Library System, Negotiation Number: ITN-DOT-02/03-9025-RR,* SwRI Proposal No. 10-35924, dated: January 31, 2003.
- SwRI BAFO letter: *Southwest Research Institute® Proposal No. 10-35924, "Invitation to Negotiate (ITN): Statewide Transportation Management Center Software Library System," Reference: Negotiation Number: ITN-DOT-02/03-9025-RR,* dated: May 5, 2003.
- FDOT procurement document: *Invitation To Negotiate (ITN), Negotiation Number: ITN-DOT-02/03-9025-RR, Statewide Transportation Management Center Software Library System,* dated: October 21, 2002.
- FDOT Scope of Services: *Statewide Transportation Management Center Software Library System: Scope of Services,* September 22, 2003.
- FDOT Requirements Document: *Statewide Transportation Management Center Software Library System: Requirements Specification,* June 3, 2003.
- Southwest Research Institute, *TMC Software Study,* November 15, 2001.
- Southwest Research Institute, *Introduction to an Operational Concept for the Florida Statewide Library,* FDOT – OCD – 1.0, March 31, 2002.
- Washington State Department of Transportation, *Ramp Meter / Data Collection User's Manual,* Version 4.47, January 28, 2005.
- World Wide Web Consortium (W3) website: http://www.w3.org.
- SunGuide Project website: http://sunguide.datasys.swri.edu.

## 1.4 Contacts

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# 2. Software Summary

## *2.1* Software Application

The FDOT Firmware operates on a Model 170 Controller. The firmware utilizes 2-serial interfaces (asynchronous common interface adapters [ACIAs]). The firmware processes accumulated data from as many as 40 detectors. The program also processes speed, length, and vehicle classification from up to eight dual-detector speed traps. The firmware has the capability to meter up three unique ramps.

The firmware has two communications modes: central or local control. In central mode, configuration parameters are sent from the central system to the controller. The central system periodically polls for surveillance and metering data. In local mode, previously downloaded parameters or user input parameters are used for surveillance and metering functions. Parameters are viewable via the front panel keypad. Communications with Central require the manual entry of the communications address.

## *2.2 Software Organization and Overview of Operation*

### *2.2.1 Ramp Configuration*

The following figure contains a typical configuration of a segment of a Freeway and a Ramp.

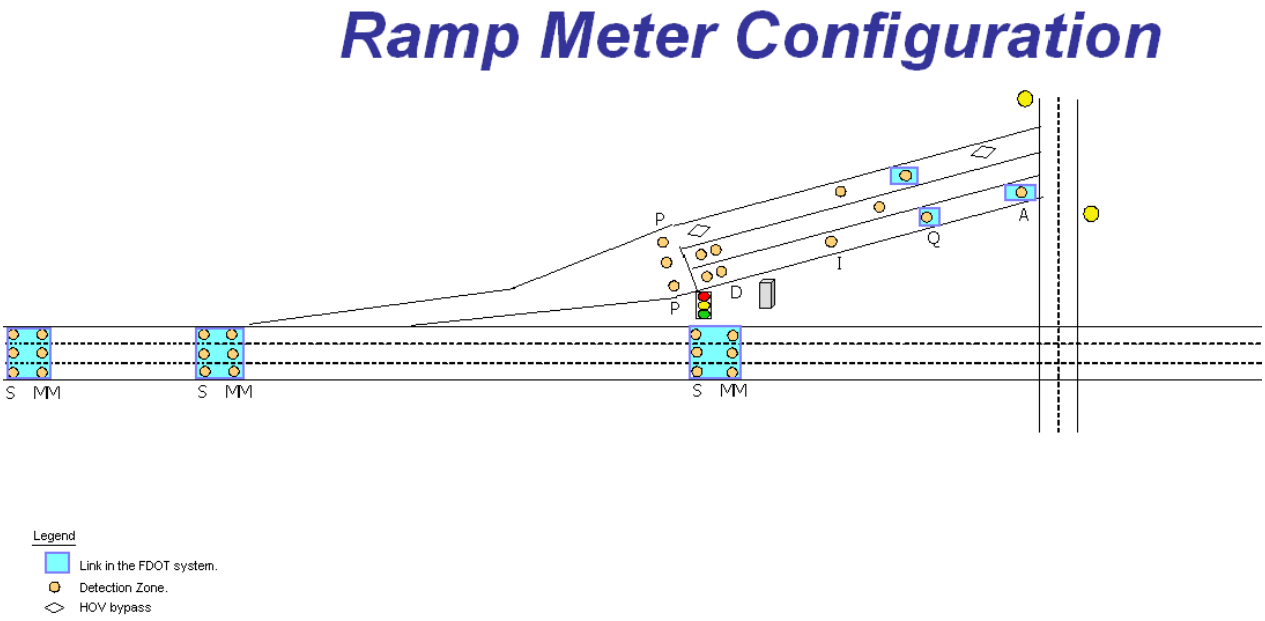


**Figure 2.1 - Ramp Meter Configuration**

Loop Naming Scheme

MM – Mainline Roadway

S – Speed Trap

P – Passage detection zone

D – Demand detection zone

I – Ramp Intermediate detection zone

Q – Ramp Queue detection zone

A – Advance Queue detection zone

The current architecture requires defining several detectors on the ramp to perform the metering and data surveillance functions required by the firmware. The required detectors are the MM, S, P, D, and Q. An I or A detector may be defined if deemed necessary. If an A type detector is not assigned, the Central software may require special configuration of the Fuzzy logic inputs to compensate for its absence.

### *2.2.2 Initialization*

The controller is initialized by erasing memory and loading the default parameters. To accomplish this, turn the STOP TIME switch on and hold any key depressed while turning the controller power on. This initialization process erases RAM locations from 0x0000 to 0x073F.

Default parameter values for date, time, ramp variables and Time of Day (TOD) tables are loaded into RAM.

The controller drop address must be set at **C+0+0**. When communication is established, the central computer will download all operational parameters and Call/Active LED #6 will light.

When the central computer starts up, the device database is read and the central computer initiates communication with the controllers.

The central communication messages are listed below in the startup sequence.

Idle
Reset
Date & Time
Load Param1
Load Param2
Load Param3
Error Request
Meter Command
Poll

The first message sent to all controller addresses is the Idle message. The Idle message is a message a response from the controller. If there is no response, the central computer continues to send the Idle message every polling interval until a response is received at central.

When a response to the Idle message is received, the central computer then sends the Reset message with the parameter set to “detectors.”

The central computer then sends the Date & Time message. The Date & Time message contains the current year, month, date, hour, minute, second, tenth of second and day-of-week code. The controller stores the date and time information. The date and time are used to timestamp power outages. The Time-of-Day algorithm uses the hour, minute, and day of week information.

Load Param1 message follows. The message contains the metering parameters for the three-metered ramps. The controller stores the parameters for all three ramps.

The Load Param2 message follows. This message contains the TOD meter rate table.

After the TOD table, the central computer sends the Load Param3 message, which contains the controller configuration parameters. The configuration parameters are stored on the C page.

Following the successful transfer of parameters, the central computer sends an Error Request message, if the error flag is set. The controller clears the error flag when an Error Request message is received.

The final message is the Meter Control message. This message directs the control to the desired metering state.

After the startup sequence is completed, the central computer sends a Poll message at the beginning of each poll interval (20 seconds). The FDOT Firmware responds with the data message with the attached volume, occupancy, speed, length, and classification data packet. If the controller has detected an error, the error flag is set in each message sent to the central computer until the controller receives an error request message. When the error message is processed, the error flag is cleared and will not be set until a new error is detected.

### *2.2.3 Data Surveillance*

The data surveillance functionality of the Ramp Meter Firmware (RMF) performs three main tasks: volume and occupancy data collection, speed trap calculations, and data validation. Data calculations are stored every 20 seconds and over-written every minute. This provides the firmware with a rolling one-minute data set. Data poll responses are packaged with the current 20-second data set.

Data collection functions process data from up to 40 configurable detectors. Parameters sent from central or manually input define the source and purpose of the inputs. The core purpose of all detectors is to provide volume and occupancy. This data is reported every 20 seconds in response to a poll request.

The C1 connector links the detector inputs to the controller. Each detector is mapped to a pin assignment. The detector actuations occur when the appropriate pin is grounded. The controller firmware scans the pins on a 60Hz cycle.

The firmware calculates the number of scans each pin is grounded over a 20-second period. The maximum number of scans in a 20-second period is 1200. Occupancy is calculated as the following: Occupancy = scans / 12. Volume is calculated as the number of times the detector state changes from actuated to non-actuated.

Speed calculations are computed from the eight configurable dual-detector traps. Two detectors are installed in a lane at a defined distance apart. These detectors are scanned by the speed trap algorithm 120 times a second.

### *2.2.4 Speed Traps*

The speed trap algorithm calculates the number of times the upstream detector is actuated while the downstream detector remains non-actuated. The speed trap length divided by the scan count of the upstream detector provides the vehicle speed.

Vehicles can be classified into any one of 4-bin lengths. The vehicle is classified into the largest bin that is greater than the vehicle's length. Length is calculated by taking the occupancy of the upstream detector multiplied by the speed minus the length of the detector.

The controller computes individual vehicle speed, length, and classification information for up to eight speed traps. With two detectors in the same lane a given distance apart, the controller measures the time between the actuation of the upstream detector and the actuation of the downstream detector. The distance between actuations is divided by the time between upstream and downstream actuations to calculate speed. This is subsequently converted to miles per hour.

Vehicle length is calculated by multiplying the duration of a detector actuation by its speed (distance/time x time = distance) while subtracting the effective length of the detector and converting the results to feet.

The controller does not validate the location of speed trap detectors. Any detector may be entered as a member of the detector pair. Detectors paired from different lanes may produce invalid results.

A speed run begins when a vehicle activates the upstream detector, starting an elapsed time counter. The counter is incremented every 1/120 second and runs until the downstream detector is actuated, at which time a completion flag is set. The occupancy of the downstream detector is compared to the occupancy of the upstream detector. If the downstream occupancy differs by more than 10% from the upstream occupancy, the speed run is discarded.

The speeds collected in a 20-second period are averaged and sent to the central computer as a single speed value for the period.

### *2.2.5 Vehicle Length and Classification*

The length of the vehicle is determined for each valid speed run. The length is calculated based on the vehicle's speed and time to cross over the downstream detector, thus Length = Speed x Time. The lengths collected in a 20-second period are averaged and sent to the central computer as a single length value for the period.

### *2.2.6 Data Validation*

Data Validation falls into two areas: data surveillance validation and speed data validation. Data validity flags are set when an error is verified. These flags are reported in the data packet sent in the data poll response message to Central.

Data surveillance processes valid data in pre-defined volume and occupancy envelopes. For a given volume, a minimum and maximum occupancy must be calculated. The firmware has four defined occupancy envelopes. When volume exceeds 17 vehicles per minute, the firmware sets the chatter flag. The firmware also monitors for minimum presence or absence known as "Short Pulse." For presence less than a 1/15 second the accumulated volume and occupancy are ignored for the current actuation. In the case of absence less than 1/15 second, volume is reduced by one count and the occupancy is increased scan for scan to compensate.

Speed validity monitors several invalid data scenarios. When the occupancy ratio is greater than 10% between the upstream and downstream detector, the speed data is thrown out for the current vehicle. Two in a trap is calculated as a second vehicle entering the trap before the first exits. A lost vehicle is defined as the speed trap timer expiring before the vehicle actuates the downstream detector. The calculated speed exceeds the seed limit parameters set by the operator. The length is greater than the predefined length limit.

### *2.2.7 Detector Reset*

The RMF system supports three types of resets, which can be invoked by the host computer or via the keypad. These include:

- Detector Reset – Resets the loop detectors.
- Comm Reset – Resets the ACIA interface to the host computer.
- Software Reset – Restarts execution of the RMF firmware.

When a detector reset is received, the detector reset output (C1 pin #102) is held high or energized for one second. This causes the amplifiers to reset, and the detector watchdogs are subsequently returned to zero. The detector reset only resets the detector amplifiers, watchdog loops, and counters. Detector failures described in paragraph 2.2.8.11 are automatically reset based on proper sequencing and are not reset via the detector reset command mechanism.

### *2.2.8 Metering*

There are two basic sources for ramp meter control by the FDOT Ramp Metering Firmware: local algorithms using local data or central algorithms using data from the mainline lanes. The central source is normally used for metering, except in special cases and after a communication failure. In special cases, the operator commands the controller to meter using the local algorithms and after a communication failure the controller meters using the local algorithms by default. Refer to the *Ramp Metering Firmware Software Design Document* for a description of specific metering parameters and in-depth metering procedures.

#### 2.2.8.1 Basic Metering Algorithms

The local algorithms or basic metering algorithms include: Time-of-Day Metering Rate, Traffic Metering Rate, and Fuzzy Metering Rate. The controller selects the appropriate algorithm based on firmware parameter settings, detector input, and command from central control.

##### 2.2.8.1.1 Time-Of-Day (TOD) Metering Rate

The TOD rate table contains 32 events that can be activated on any combination of days of the week. Each event has a starting hour and minute, flags for effective days of the week, and an associated metering rate. The metering rate is in the range of 0-25.5 Vehicles Per Minute (VPM), where a value of 0 will cause a Stop Metering event, and a non-zero value will cause a Start Metering event, setting the TOD Metering Rate to the value. A value of 255 (25.5) will cause the TOD Metering Rate to be ignored in favor of the Traffic Metering Rate. The TOD table controls all active ramps in the controller. The rate from the TOD table is multiplied by the ramp *MultiLaneSplit* parameter to determine the TOD rate for that ramp. The multilane split values for all active ramps in a controller do not have to total 100.

A power failure of more than 4 hours and 15 minutes will prevent use of the TOD table to control metering. The controller must receive a time value from the host computer before the TOD metering control can be resumed.

##### 2.2.8.1.2 Traffic Metering Rate

The Traffic Metering Rate is based on mainline occupancy. The traffic algorithm calculates the Traffic Metering Rate using the one-minute moving average occupancy of the defined mainline detectors. The one-minute moving average mainline occupancy is compared to the occupancy

levels in the *TableOcc1-5* and *TableRate1-5* parameter tables. The occupancy/rate pairs specify points on a metering rate vs. mainline occupancy slope. Linear interpolation is used to calculate a metering rate from a given occupancy value. The *MaxMeterRate* parameter is used if the input occupancy is less than the lowest table entry, and the *MinMeterRate* parameter is used if the occupancy is greater than the highest table entry.

#### 2.2.8.1.3 Intermediate Meter Rate

The Intermediate Metering Rate is the more restrictive of the TOD Metering Rate and the Traffic Metering Rate when in Local mode, and is the Traffic Metering Rate when in Central mode.

### 2.2.8.2 Fuzzy Meter Rate

A Fuzzy Metering Rate is provided by the host system for each of the metered ramps. A non-zero Fuzzy Metering Rate will always be used when in Central mode, and no adjustments or overrides are applied to it.

### 2.2.8.3 Metering Rate Adjustments

Once the basic metering algorithms determine the Intermediate Meter Rate, it is adjusted to account for specific ramp conditions. These adjustments are described below.

### 2.2.8.4 Queue Adjusted Metering Rate

If the 20-second queue detector occupancy exceeds the *QOccThresh1* parameter for more than *QOccTimer1* parameter minutes, the Intermediate Metering Rate is adjusted upward by the *QOccAdjust1* parameter. If the 20-second queue detector occupancy exceeds the *QOccThresh1* parameter for more than *QOccTimer2* parameter minutes, the Intermediate Metering Rate is adjusted upward by the *QOccAdjust2* parameter instead. The adjustment will remain in effect until the 20-second queue detector occupancy is less than or equal to the *QOccThresh2* parameter for one minute.

If an intermediate queue detector is used, its 20-second occupancy is used with the same thresholds, timers, and adjustment values. Adjustments due to intermediate queue detector occupancy are added to the adjustments from the queue detector occupancy.

The Intermediate Metering Rate with queue and intermediate queue adjustments applied is called the “Queue Adjusted Metering Rate.” While either the queue detector adjustment or the intermediate queue detector adjustment is in effect, the queue adjustment alarm is set.

### 2.2.8.5 Volume Adjustment

The ramp volume is used to adjust the Queue Adjusted Metering rate due to red signal violations on the ramp. The Queue Adjusted Metering Rate is reduced by the sum of the red signal violations in the last three 20-second periods.

### 2.2.8.6 Advanced Queue Override

If queue adjustment is in effect and the one-minute moving average occupancy of either left or right advance queue detector exceeds the *AdvQOccThresh* parameter value for more than *AdvQOccTimer* parameter seconds, the Queue Adjusted Metering rate is further adjusted by the *AdvQOccOverride* parameter value. If both advanced queue detector occupancies exceed the

threshold, the override values are additive. The advanced queue override remains in effect until the one-minute moving occupancy of the advance queue detector drops below the *AdvQOccThresh* parameter value.

#### 2.2.8.7 High-Occupancy Vehicle Bypass Meter Rate Adjustment

For each actuation of the HOV demand detector or ramp demand detector while the metered lane signal is red, the remaining red signal time of the cycle is compared to the *HOVRedDelay* parameter value, and the larger value is used as the remaining red time.

#### 2.2.8.8 Red Signal Violations

For each actuation of the passage detector during the red signal portion of the cycle, the red signal cycle time is incremented by *RedViolationDelay* parameter value.

#### 2.2.8.9 Adjusted Meter Rate

The Adjusted Metering rate is the basic meter rate adjusted for queue occupancy, adjusted for HOV bypass traffic, adjusted for red signal violations, and adjusted for advanced queue detector occupancy. Finally, the Adjusted Metering rate is bounded by the *MinMeterRate* and *MaxMeterRate* parameter values.

#### 2.2.8.10 Cycle Length

A new cycle length (in seconds) is computed from the selected metering rate, which is expressed in VPM. The selected metering rate will be the Fuzzy Metering rate if it is non-zero; otherwise, the Adjusted Metering rate will be used.

#### 2.2.8.11 Failure Adjustments

Although all detectors can be failed by a watchdog timer due to inactivity, the demand and passage detectors can also be failed by the metering software. The demand detector for a metered ramp will be failed if two consecutive passage detector actuations occur without any presence on the demand detector. The passage detector for a metered ramp will be failed if two consecutive demand detector actuations occur without any presence on the passage detector.

A failed demand detector causes metering to be stopped for the affected ramp. A failed passage detector will cause the use of a fixed 1.5-second green time per allowed vehicle for each demand detector actuation. A failed queue detector will prevent the use of queue detector and advance queue detector occupancy metering adjustments. If the demand detector fails in the actuated state and has not been failed by the watchdog timer, metering will continue as if a continuous demand is present.

Normally, an activation of the demand detector must occur before the signal light can cycle to green. A short stop condition occurs when a vehicle stops before reaching the demand detector. In this case, the signal light will remain red until the cycle times out and the occupancy of the queue detector exceeds the *ShortStopQOcc* parameter value. The short stop condition will cause the signal to cycle to green until a passage is detected.

Normally, an activation of the passage detector is used to cycle the signal light from green back to yellow or red. A long stop condition occurs when a vehicle crosses the stop line and causes a premature passage detector actuation. In this case, the signal light will remain red until the cycle

times out and the *LongStopTime* parameter value is reached. The long stop condition will cause the green signal to be timed. A fixed 1.5 seconds per allowed vehicle will be used.

## 2.3 Contingencies and Alternative States and Modes of Operation

During operation the controller will detect various errors. These errors occur when detectors fail or during communications processing. There are several different methods errors are reported to the system. A flag is sent in a data message to alert the central system to request an error report. Detectors fail or data validation flags are set in data messages to alert central system that detectors have failed. The following is a list of potential errors reported by the controller:

- Detector Failure
- Loop Locked ON/OFF
- Conflict Monitor Tripped
- Police Switch Active
- Memory Check error
- Short Pulse
- Chatter (> 3 counts/second)

The controller may operate in two different modes: Rampmeter or Data Collector. Switching between the two modes is done by setting the control switch setting in the firmware.

In Data Collector mode, the controller monitor loops as a loop detector. The controller compiles volume, occupancy, and speed data. The data is sent to the central system every 20 seconds.

In Rampmeter mode, the controller operates as before in Data Collector mode, but also meters a configurable number of metering lanes up to three lanes. The controller can be set to meter as controlled from the central system or from a TOD table defined on the controller. In TOD metering mode, the controller will not respond to commands to start, stop, or modify metering.

## 2.4 Security and Privacy

In the event that the RMF system detects a fatal error, it will enter a safe mode in which the signal lights are all turned off and no metering is done. The Timing LEDs will flash **EEEE** to indicate that the controller is in this fatal error state. The controller will remain in this state until it is power cycled or the RMF firmware is restarted by turning the Stop Time switch ON and pressing any key on the keypad.

The controller will only respond to requests formatted as defined by the *VAX-170-DOC05* protocol document. The controller will return a communications error if it receives any unknown or mal-formatted messages.

# 3. Operation

The FDOT Ramp Meter Firmware runs on a McCain Model 170E rack mountable controller. The controller incorporates various input and display devices for interfacing to the system. The usage/operation of these devices for viewing and controlling the operation of the FDOT RMF is described in the following sections.

## *3.1 Front Panel Controls and Displays*

The McCain Model 170E controller is shown in Figure 3.1. The specification sheet for this controller is available at www.mccain-inc.com.


**Figure 3.1 - McCain Model 107E Controller**

The controller front panel incorporates the controls and displays described below.

### *3.1.1 Ten Call / Active Single Element LEDs*

The front panel includes ten single element LEDs arranged vertically to the left of the 7-segment LED display and keypad. These are referred to as the controller call lights. For the RMF, the call lights indicate the operational status of the system as described in Section 3.3.1.

### *3.1.2 Six 7-Segment Numeric LEDs*

The six 7-segment LEDs are combined in a single display above the keypad. The top two LEDs are referred to as the phase and interval LEDs. The lower four LEDs are referred to as the timing LEDs. For the RMF, the LED display is used to indicate the RMF metering status as described in Section 3.3.2.

### *3.1.3 Sixteen Key Numeric Keypad*

The keypad includes 16 hexadecimal keys numbered 0-F. The keypad is used to change the operational display mode as described in Section 3.3 and to configure and control the RMF as described in Section 3.4.

### *3.1.4 Stop Time Switch*

The stop time switch is a two position toggle switch located to the right of the LED display. For the RMF it is used for special operational modes as described in Section 3.5.

### *3.1.5 Power Switch*

The power switch is a two position toggle switch located at the far right side of the controller front panel. Power cycling the controller restarts the ramp meter firmware.

## *3.2 Power Up Display*

Immediately after the RMF is reset or powered up, a series of diagnostics are executed to verify the functionality of the front panel displays. Each of the six 7-segment LEDs are cycled through each possible display value and each of the call lights is turned on in sequence. The display and call lights are then blanked before entering base mode display.

## *3.3 Base Display Modes*

The base display modes are the front panel display modes for normal operation of the RMF. Each of the three ramps controlled by the RMF has a base mode display. On startup, the default display is the base display mode for ramp one. To switch to the base display for another ramp, the number of the ramp (1, 2 or 3) is selected by pressing that key on the keypad. In the base mode displays, the call lights and LEDs display information regarding the state of the system as described in the following sections.

### *3.3.1 Base Display Mode - Call Lights*

In the base mode display for each ramp, the call lights indicate the RMF status information as defined in Table 3.1.

**Table 3.1 - Base Mode Call Light Functionality**

| Light # | Name | Function |
|---|---|---|
| 0 | Metering | Indicates that metering is active. |
| 1 | Signal Red | Indicates the state of the red signal light for the selected ramp. |
| 2 | Signal Yellow | Indicates the state of the yellow signal light for the selected ramp. |
| 3 | Signal Green | Indicates the state of the green signal light for the selected ramp. |
| 4 | Central Control | Indicates that metering (start/stop) is controlled by the host. |
| 5 | Local Control | Indicates that metering (start/stop) is controlled via the time of day tables. |
| 6 | Telemetry | Indicates that host communication is active. |
| 7 | Echo | Indicates the state of a specified detector or digital input. |
| 8 | Conflict | Indicates a conflict with two signal lights active simultaneously. |
| 9 | Failure | Indicates that a detector failure has occurred. |

### *3.3.2 Base Display Mode - LEDs*

In the base mode display for each ramp, the LEDs indicate the RMF status information as defined in Table 3.2 and Table 3.3.

**Table 3.2 - Base Mode LED Functionality**

| LED | Function |
|---|---|
| Phase | Displays the currently selected ramp (1, 2 or 3). |
| Interval | Displays the metering status (0 - F). Refer to Table 3.3. |
| Timing | Displays the seconds remaining in the current metering cycle. |

**Table 3.3 - Metering Status Definitions**

| Metering Value | Definition |
|---|---|
| 0 | Not metering |
| 1 | Local metering |
| 2 | Local metering, queue adjustment |
| 3 | Local metering, advance queue override |
| 4 | Bottleneck |
| 5 | Bottleneck, queue adjustment |
| 6 | Bottleneck, advance queue override |
| 7 | Prediction |
| 8 | Prediction, queue adjustment |
| 9 | Prediction, advance queue override |
| A | Time of day |
| B | Time of day, queue adjustment |
| C | Time of day, advance queue override |
| D | Pre-empt |
| E | Communication status |
| F | Fuzzy meter control |

## *3.4 Keypad Display Modes*

The keypad can be used to view or modify the operational parameters of the RM firmware. When the keypad is used for this purpose, the base display modes are disabled and the call lights and LEDs are used to display information relevant to the keypad operation performed. The keypad has six different modes of operation:

- Date and time viewing/modification; accessed via the **8** key
- Global parameter viewing/modification; accessed via the **C** key
- TOD table parameter viewing/modification; accessed via the **9** key
- Ramp meter parameters viewing/modification; accessed via the **F** key
- General memory viewing; accessed via the **E** key
- Reset mode operation; accessed via the **A** key

Note that in the keypad display modes, various key sequences are used to change the state of the display for the data being viewed or modified. The **B** key is used to return the previous mode or

state without altering data. Pressing the **B** key three times consecutively will return to the base display mode from any of the keypad display modes.

### *3.4.1 Keypad Display Mode – Date and Time*

To view or modify the date/time, the date/time mode is selected by pressing the **8** key on the keypad from any of the base display modes. This will cause all of the LEDs to go blank and call light 8 to flash indicating date/time mode active. Once the **8** key has been pressed, the **0** key is pressed to view/modify the current time, or the **1** key is pressed to view/modify the current date.

**8**+**0** displays the current hour, minute, second, and day of the week. The Phase LED is set to **0** to indicate time display mode. The hour (00-23) and minute (00-59) are displayed in the Timing LEDs. The one's digit of the second is displayed in the Interval LED. The ten's digit is not displayed. The day of the week is displayed using call lights 1 through 7 with Sunday starting at 1 and Saturday ending at 7.

To modify the time, the hour (00-23) is entered, followed by the minute (00-59), the one's digit of the second (0-9) and finally the day of the week (1-7). When the first key is pressed, the high order digit of the hour is displayed in the left-most Timing LED and the remaining LEDs are changed to **C** to indicate that the time is being modified. As additional keys are pressed, the LEDs are changed to the value entered. Note that invalid values entered for day of the week (less than 1 or greater than 7) are ignored by the system. At any time during modification of the time, the **B** key can be pressed to return to the base display mode. When the final entry (the day of the week) has been made, the **E** key is pressed to enter the new time.

If the time entered is valid, the new time is saved and the LEDs flash to indicate that the save was successful. The **B** key can then be pressed to return to the base display mode. If the time is invalid, the time is not saved and **E** is displayed in the Interval and Timing LEDs to indicate the error. In this event, the **B** key is pressed to return to the time display from which the time can again be modified or the **B** key can be pressed again to return to the base display mode.

**8**+**1** displays the current date. The Phase LED is set to **1** to indicate date display mode. The day of the month (01-31) and the year (00-99) are displayed in the Timing LEDs. The month (1-12) is displayed as a single hexadecimal value (1-C) in the Interval LED.

To modify the date, the day (01-31) is entered, followed by the year (00-99) and finally the month (1-C). When the first key is pressed, the high order digit of the day is displayed in the left-most Timing LED and the remaining LEDs are changed to **C** to indicate that the date is being modified. As additional keys are pressed, the associated LEDs are changed to the value entered. At any time during modification of the date (other than entering the month), the **B** key can be pressed to return to the base display mode. When the final entry (the month) has been made, the **E** key is pressed to enter the new date.

If the date entered is valid, the new date is saved and the LEDs flash to indicate that the save was successful. The **B** key can then be pressed to return to the base display mode. If the date is invalid, the date is not saved and **E** is displayed in the Interval and Timing LEDs to indicate the error. In this case, the **B** key is pressed to return to the date display from which the date can again be modified or the **B** key can be pressed again to return to the base display mode.

### *3.4.2 Keypad Display Mode – Global Parameters*

To view or modify the global parameters, the global parameter mode is selected by pressing the **C** key on the keypad from any of the base display modes. This will cause all of the LEDs and the call lights to go blank. Two additional keys are then pressed to specify first the column (0-F) and then the row (0-F) of the global parameter on the global parameter memory page (referred to as the C memory page). Refer to Appendix B – Memory Maps for a description of the contents of the C memory page. Refer to Appendix A – Default Firmware Parameters for the default values of the global parameters.

Once the column and row values have been entered, the column number is displayed in the Phase LED, the row number is displayed in the Interval LED, **C** is displayed in the left-most digit of the Timing LEDs (to indicate global parameter mode) and the value (base 10) of the global parameter at that address is displayed in the other three Timing LEDs. For example, **C**+**0**+**1** displays the value at column 0, row 1 of the C page. This is the firmware Program Number and the value displayed should be 170.

To select a different parameter within the global parameters page, the memory page navigation keys, **A**, **C**, **D** and **F,** can be used to move to a different memory location within the page. These keys function as shown in Figure 3.2.

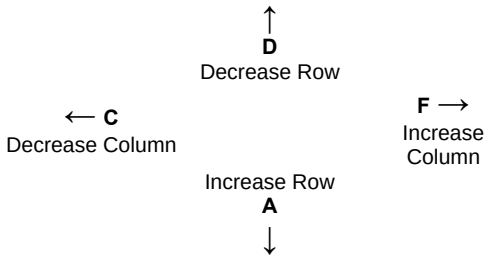


**Figure 3.2 - Memory Page Navigation Keys**

To modify the value of a parameter, the new value (base 10) is entered starting with the most significant digit. When the first key is pressed, the high order digit of the parameter is displayed in the Timing LEDs and the lower order digits are changed to **C** to indicate that the parameter is being changed. As additional digits are entered, the next lower order digit is changed from **C** to the value entered. When the least significant digit of the parameter has been entered, the value is considered to be complete; any further values entered are ignored and the LEDs will not be modified. At any time during modification of the parameter value, the **B** key can be pressed to return to the base display mode. When the parameter modification is complete, the **E** key is pressed to enter and save the new value.

If the parameter value entered is valid (no greater than 255), the new value is saved and the Timing LEDs flash to indicate that the save was successful. The **B** key can then pressed to return to the base display mode, or the navigation keys can be used to select another parameter.

If the parameter value is invalid, the value is not saved and **E** is displayed in the Timing LEDs to indicate the error. In this case, the **B** key is pressed to return to the parameter display. The value can then again be modified, the navigation keys can be used to select another parameter, or the **B** key can be pressed again to return to the base display mode.

### *3.4.3 Keypad Display Mode – Time of Day Table*

To view or modify the TOD table, the TOD table mode is selected by pressing the **9** key on the keypad from any of the base display modes. This will cause all of the LEDs to go blank and call light 9 to flash indicating TOD table mode active.

Once the **9** key has been pressed, the number of the TOD table entry (01-32) is entered. If the TOD entry number is valid (greater than 00 and less than 33), the number is briefly flashed in the Phase/Interval LEDs and then the TOD entry values are displayed as described below. For example, **9**+**0**+**1** displays TOD table entry 1.

For TOD entries, the start time (hour and minute) is displayed in the Timing LEDs, the metering rate is displayed in the Phase/Interval LEDs as a hexadecimal value, and the active days of the week are displayed using call lights 1 through 7, starting at 1 (Sunday) and ending at 7 (Saturday). Refer to Appendix B – Memory Maps for a description of the contents of the TOD Table memory page. Refer to Appendix A – Default Firmware Parameters for the default values of the time of day table entries.

To select a different TOD entry, the TOD navigation keys **A** and **D** can be used to move to the next or previous entry in the table. These keys function as shown in Figure 3.3. Each time that a different entry is selected, the TOD entry number is briefly flashed in the Phase/Interval LEDs and then the TOD entry values are displayed. Also, at any time that the TOD values are displayed, the TOD entry number for those values can be viewed by pressing the **F** key, which causes the TOD entry number to be briefly flashed in the Phase/Interval LEDs.

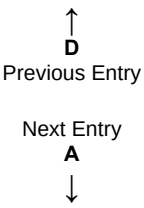


**Figure 3.3 - Time of Day Table Navigation Keys**

To modify the TOD entry, the hour (00-23) is entered, followed by the minute (00-59), the metering rate (00 – FF) and finally the days of the week (1-7). When the first key is pressed, the high order digit of the hour is displayed in the left-most Timing LED and all remaining LEDs are changed to **C** to indicate that the TOD entry is being modified. As additional keys are pressed, the associated LEDs are changed to the value entered. When modifying the days of the week, each key press toggles the state of the associated call light, allowing for specification of multiple days of the week. At any time during modification of the TOD entry (other than entering the metering rate), the **B** key can be pressed to return to the base display mode. Once modification of the TOD entry is complete, the **E** key is pressed to enter the new values.

If the TOD entry is valid (the hour and minute are valid), the TOD entry is saved and the LEDs flash to indicate that the save was successful. The **B** key can then be pressed to return to the base display mode, or the navigation keys can be used to select another entry.

If the entry is invalid, the entry is not saved and **E** is displayed in the Timing LEDs to indicate the error. In this case, the **B** key is pressed to return to the TOD entry display. The TOD entry can then again be modified, the navigation keys can be used to select another parameter, or the **B** key can be pressed again to return to the base display mode.

### *3.4.4 Keypad Display Mode – Ramp Meter Parameters*

To view or modify the ramp meter parameters, the ramp meter parameter mode is selected by pressing the **F** key on the keypad from any of the base display modes. This will cause all of the LEDs and the call lights to go blank.

Once the **F** key has been pressed, the ramp number (1-3) is entered to select the F memory page for the parameters, followed by the column and then the row of the desired parameter. An **F** is displayed in the left-most Timing LED to indicate ramp meter parameter mode, the ramp number is displayed using call lights 1-3 and the column and row are displayed in the Phase/Interval LEDs. For example, **F**+**1**+**1**+**1** displays the parameter for ramp 1 at column 1, row 1, which is the Multilane Split parameter.

Note that using the **F** Key mode, only the modifiable ramp lane parameters are accessible on the ramp lane parameter pages. These parameters reside in memory at ramp lane page indices 0x10 through 0x2B. These are depicted in row/column format in Table 3.4.

**Table 3.4 - Valid Ramp Lane Parameter Addresses**

| Ramp | Column | Rows |
|---|---|---|
| 1, 2 or 3 | 1 | 0-F |
| 1, 2 or 3 | 2 | 0-B |

If the ramp page, column and row are valid, the value of the parameter at that address is displayed (in base 10) in the lower 3 Timing LEDs; otherwise, **E** is displayed in the Phase/Interval LEDs to indicate the address error. The **B** key is then pressed to return to the base display mode. Refer to Appendix B – Memory Maps for a description of the contents of the ramp lane parameter pages. Refer to Appendix A – Default Firmware Parameters for the default values of the ramp lane parameters.

To select a different parameter within the selected ramp meter parameters page, the memory page navigation keys, **A**, **C**, **D** and **F,** can be used to move to a different memory location within the ramp meter parameters page. These keys function as shown in Figure 3.2.

To modify the value of a parameter, the new value (base 10) is entered starting with the most significant digit. When the first key is pressed, the high order digit of the parameter is displayed in the Timing LEDs and the lower order digits are changed to **C** to indicate that the parameter is being changed. As additional digits are entered, the next lower order digit is changed from **C** to the value entered. When the least significant digit of the parameter has been entered, the value is considered to be complete; any further values entered are ignored and the LEDs will not be modified. At any time during modification of the parameter value, the **B** key can be pressed to return to the base display mode. When the parameter modification is complete, the **E** key is pressed to enter and save the new value.

If the parameter value entered is valid, the new value is saved and the Timing LEDs flash to indicate that the save was successful. The **B** key can then be pressed to return to the base display mode, or the navigation keys can be used to select another parameter.

If the parameter value is invalid, the value is not saved and **E** is displayed in the Timing LEDs to indicate the error. In this case, the **B** key is pressed to return to the parameter display. The value

can then again be modified, the navigation keys can be used to select another parameter, or the **B** key can be pressed again to return to the base display mode.

### *3.4.5 Keypad Display Mode – General Memory Access*

The RAM used by the ramp meter firmware is located at addresses 0x0000 through 0x7FFF. Part of this RAM is used to store user modifiable parameters as described in Sections 3.4.2, 3.4.3 and 3.4.4. Other sections of the RAM are reserved for memory mapped I/O and also for parameters that are used by the system but are not user modifiable.

The E memory pages at addresses 0x7600 – 0x7A00 are used to store system parameters that are not modifiable by the user. The contents of these memory pages are documented in Appendix B. While the values of these parameters are not modifiable, they can be viewed using the keypad E page memory access mode.

In order to view the contents of an E memory page, the E page number must first be stored to the E page entry in the C memory page which is at column 0, row E (see Appendix A). This is done as described in Section 3.4.2. Since each E memory page contains 255 bytes (0xFF), the E page number is the value (in base 10) of the two high order hexadecimal digits of the E page memory address. For example, the E page number for the E memory page at address 0x7600 is 118 (0x76 hexadecimal). Also, note that the page number for each memory page is shown above the table for that page in Appendix B.

Once the E page number has been specified, the E page memory access mode is selected by pressing the **E** key on the keypad from any of the base display modes. This will cause all of the LEDs and the call lights to go blank. Two additional keys are then pressed to specify first the column (0-F) and then the row (0-F) of the E page memory location.

Once the column and row values have been entered, the column number is displayed in the Phase LED, the row number is displayed in the Interval LED, **E** is displayed in the left-most digit of the Timing LEDs (to indicate E page access mode) and the value (base 10) of the data at that address is displayed in the other three Timing LEDs. For example, if E page 118 is currently selected (118 stored to the E page entry in the C page), then the key sequence **E**+**1**+**0** will display the data value at memory page address 0x7600, column 1, row 0, which is the ramp 1 meter rate.

Note that the value of the data displayed in the timing LEDs is updated in real time, so that if the value of the data changes while it is being viewed, the timing LEDs are automatically updated to display the change.

This mode allows only for viewing memory values, not for modification. To select a different memory value for viewing, the memory page navigation keys, **A**, **C**, **D** and **F,** can be used to move to a different memory location within the currently selected E page. These keys function as shown in Figure 3.2. To exit the E page memory access mode, the **B** key is pressed to return to the base display mode.

### *3.4.6 Keypad Display Mode – Reset Functions*

The RMF system supports three types of resets, which can be invoked by the host computer or via the keypad. These include:

- Detector Reset – Resets the loop detectors.
- Comm Reset – Resets the ACIA interface to the host computer.

- Software Reset – Restarts execution of the RMF firmware.

The reset mode is selected by pressing the **A** key on the keypad from any of the base display modes. This will cause all of the LEDs and the call lights to go blank. The reset type is then specified, **1** for Detector Reset, **2** for Comm Reset, or **3** for Software Reset. **A** is displayed in the Phase LED to indicate reset mode and the reset type is displayed in the interval LED. At any point during entry of reset mode values, the **B** key can be pressed to return to the base display mode. Once the reset mode and type have been specified, the **E** key is pressed to execute the reset. For example, the key sequence **A**+**1**+**E** will reset the loop detectors.

For the Detector and Comm Resets, **dddd** is then flashed in the Timing LEDs to indicate that the reset was done. For the Software Reset, the RMF will restart execution and the Power Up display described in Section 3.2 will be initiated.

## *3.5 Special Keypad and Display Modes*

### *3.5.1 Detector Echo and Input Echo*

The RMF system provides for echoing the state of a specified detector or C1 connector input to a dedicated call light, call light 7 (refer to Table 3.2).

Detector echo is enabled by entering the number of the detector (1-40) to be monitored in the C Page memory address 0x0C08 (refer to the C Page memory map in Appendix B). This is done via the keypad global parameter modification procedure as described in Section 3.4.2.

Input echo is enabled by entering the number of the C1 connector input (39-82) to be monitored in the C Page memory address 0x0C09 (refer to the C Page memory map in Appendix B). This is done via the keypad global parameter modification procedure as described in Section 3.4.2.

Note that if non-zero values are entered for both detector echo and input echo, detector echo will take precedence. If zero values are entered for both, the echo functionality is disabled.

### *3.5.2 Memory Reset*

The RMF system provides for clearing (resetting to 0) all memory in the address range of 0x0000 to 0x04FF (the system parameters, the ramp lane parameters, and the global parameters). This is done by powering up the controller with the Stop Time switch ON and any key pressed on the keypad.

WARNING: This action will clear the drop address for the controller causing communications with the host computer to be disabled. The Controller Drop Address is stored at column 0, row 0 of the C (global parameters) memory page. Refer to Section 3.4.2 for instructions on assigning the drop address.

### *3.5.3 Fatal Error Detection*

In the event that the RMF system detects a fatal error, it will enter a safe mode in which the signal lights are all turned off and no metering is done. The Timing LEDs will flash **EEEE** to indicate that the controller is in this fatal error state. The controller will remain in this state until it is power cycled or the RMF firmware is restarted by turning the Stop Time switch ON and pressing any key on the keypad.

### *3.5.4 Display Blanking Feature*

In the event that there is no keypad activity for a period of 30 minutes, the phase/interval LEDs, timing LEDs and call lights are blanked (turned off) to preserve the lamps. In this mode, the normal ramp metering functions continue, but the display is not updated. To restore the display to an active state, any key on the keypad is pressed. The single key press will only activate the display; it will not initiate any keypad function.

# 4. Notes

None.

## Appendix A

# Default Firmware Parameters

# Appendix A – Default Firmware Parameters

## Description of Parameters

The following tables contain information on all parameters that are sent to the RMDC program via communication.

Note that all memory addresses are hexadecimal values. Hexadecimal values in the range column are preceded by x.

Units Key
% = percent
vpm = vehicles per minute
min = minute
sec = second
hr = hour
n/a = not applicable
pin# = C1 cable pin number
vp20 = vehicles per 20-second period
#sc = number of 60hz scans
bitmask = 1 1 1 1 1 1 1 0

```
          | | | |  | | | `--  not used
          | | | |  | | `----  x02=Sunday
          | | | |  | `------  x04=Monday
          | | | |  `--------  x08=Tuesday
          | | | `------------  x10=Wednesday
          | | `--------------  x20=Thursday
          | `----------------  x40=Friday
          `------------------  x80=Saturday
```

Parameter Block 1: Ramp specific variables = 84

| Parameter | Definition | Range | Units | Default Value | Memory Address | Size |
|---|---|---|---|---|---|---|
| MultiLane Split1 | Percentage for Bottleneck adjustment distribution | 0-100 | % | 100 | 0110 | 1 |
| TableRate1Lane1 | First rate point in meter rate table | 0.0-25.5 | vpm | 18.0 | 0111 | 1 |
| TableRate2Lane1 | Second rate point in meter rate table | 0.0-25.5 | vpm | 16.0 | 0112 | 1 |
| TableRate3Lane1 | Third rate point in meter rate table | 0.0-25.5 | vpm | 13.0 | 0113 | 1 |
| TableRate4Lane1 | Fourth rate point in meter rate table | 0.0-25.5 | vpm | 10.0 | 0114 | 1 |
| TableRate5Lane1 | Final rate point in meter rate table | 0.0-25.5 | vpm | 7.0 | 0115 | 1 |

| Parameter | Definition | Range | Units | Default Value | Memory Address | Size |
|---|---|---|---|---|---|---|
| TableOcc1Lane1 | First occupancy point in meter rate table | 0-100 | % | 15 | 0116 | 1 |
| TableOcc2Lane1 | Second occupancy point in meter rate table | 0-100 | % | 17 | 0117 | 1 |
| TableOcc3Lane1 | Third occupancy point in meter rate table | 0-100 | % | 19 | 0118 | 1 |
| TableOcc4Lane1 | Fourth occupancy point in meter rate table | 0-100 | % | 21 | 0119 | 1 |
| TableOcc5Lane1 | Final occupancy point in meter rate table | 0-100 | % | 23 | 011A | 1 |
| MaxMeterRate1 | Maximum meter rate | 0.0-25.5 | vpm | 20.0 | 011B | 1 |
| MinMeterRate1 | Minimum meter rate | 0.0-25.5 | vpm | 5.0 | 011C | 1 |
| QueueOcc1Lane1 | Occupancy threshold to begin adjustment | 0-100 | % | 30 | 011D | 1 |
| QueueOcc2Lane1 | Occupancy threshold to terminate adjustment | 0-100 | % | 25 | 011E | 1 |
| QTimer1Lane1 | Timer to implement first adjustment | 0.0-25.5 | min | 1.0 | 011F | 1 |
| QTimer2Lane1 | Timer to implement second adjustment | 0.0-25.5 | min | 3.0 | 0120 | 1 |
| QAdjust1Lane1 | First meter rate increment for queue adjustment | 0.0-25.5 | vpm | 2.0 | 0121 | 1 |
| QAdjust2Lane1 | Second meter rate increment for queue adjustment | 0.0-25.5 | vpm | 4.0 | 0122 | 1 |
| AdvQOccupancy1 | Occupancy threshold to begin override | 0-100 | % | 25 | 0123 | 1 |
| AdvQTimer1 | Timer to implement override | 0-255 | sec | 80 | 0124 | 1 |
| AdvQOverride1 | Meter rate adjustment for override | 0.0-25.5 | vpm | 12.0 | 0125 | 1 |
| LongStopTime1 | Passage occupancy time to trigger long stop green | 0.0-25.5 | sec | 2.0 | 0126 | 1 |
| RedViolatorDly1 | Delay time added to red time for red violations | 0.0-25.5 | sec | 1.0 | 0127 | 1 |
| NormalYellow1 | Duration of yellow interval of meter cycle | 0.0-25.5 | sec | 0.0 | 0128 | 1 |
| HOVRedDelay1 | Minimum red time for HOV bypass | 0.0-25.5 | sec | 0.0 | 0129 | 1 |
| ShortStopQOcc1 | Queue occupancy to trigger short stop green | 0-100 | % | 15 | 012A | 1 |
| QStartMeterGap1 | Gap required at queue detector for startup red | 0.0-25.5 | sec | 3.0 | 012B | 1 |

| Parameter | Definition | Range | Units | Default Value | Memory Address | Size |
|---|---|---|---|---|---|---|
| MultiLane Split2 | Percentage for Bottleneck adjustment distribution | 0-100 | % | 100 | 0210 | 1 |
| TableRate1Lane2 | First rate point in meter rate table | 0.0-25.5 | vpm | 18.0 | 0211 | 1 |
| TableRate2Lane2 | Second rate point in meter rate table | 0.0-25.5 | vpm | 16.0 | 0212 | 1 |
| TableRate3Lane2 | Third rate point in meter rate table | 0.0-25.5 | vpm | 13.0 | 0213 | 1 |
| TableRate4Lane2 | Fourth rate point in meter rate table | 0.0-25.5 | vpm | 10.0 | 0214 | 1 |
| TableRate5Lane2 | Final rate point in meter rate table | 0.0-25.5 | vpm | 7.0 | 0215 | 1 |
| TableOcc1Lane2 | First occupancy point in meter rate table | 0-100 | % | 15 | 0216 | 1 |
| TableOcc2Lane2 | Second occupancy point in meter rate table | 0-100 | % | 17 | 0217 | 1 |
| TableOcc3Lane2 | Third occupancy point in meter rate table | 0-100 | % | 19 | 0218 | 1 |
| TableOcc4Lane2 | Fourth occupancy point in meter rate table | 0-100 | % | 21 | 0219 | 1 |
| TableOcc5Lane2 | Final occupancy point in meter rate table | 0-100 | % | 23 | 021A | 1 |
| MaxMeterRate2 | Maximum meter rate | 0.0-25.5 | vpm | 20.0 | 021B | 1 |
| MinMeterRate2 | Minimum meter rate | 0.0-25.5 | vpm | 5.0 | 021C | 1 |
| QueueOcc1Lane2 | Occupancy threshold to begin adjustment | 0-100 | % | 30 | 021D | 1 |
| QueueOcc2Lane2 | Occupancy threshold to terminate adjustment | 0-100 | % | 25 | 021E | 1 |
| QTimer1Lane2 | Timer to implement first adjustment | 0.0-25.5 | min | 1.0 | 021F | 1 |
| QTimer2Lane2 | Timer to implement second adjustment | 0.0-25.5 | min | 3.0 | 0220 | 1 |
| QAdjust1Lane2 | First meter rate increment for queue adjustment | 0.0-25.5 | vpm | 2.0 | 0221 | 1 |
| QAdjust2Lane2 | Second meter rate increment for queue adjustment | 0.0-25.5 | vpm | 4.0 | 0222 | 1 |
| AdvQOccupancy2 | Occupancy threshold to begin override | 0-100 | % | 25 | 0223 | 1 |
| AdvQTimer2 | Timer to implement override | 0-255 | sec | 80 | 0224 | 1 |
| AdvQOverride2 | Meter rate adjustment for override | 0.0-25.5 | vpm | 12.0 | 0225 | 1 |

| Parameter | Definition | Range | Units | Default Value | Memory Address | Size |
|---|---|---|---|---|---|---|
| LongStopTime2 | Passage occupancy time to trigger long stop green | 0.0-25.5 | sec | 2.0 | 0226 | 1 |
| RedViolatorDly2 | Delay time added to red time for red violations | 0.0-25.5 | sec | 1.0 | 0227 | 1 |
| NormalYellow2 | Duration of yellow interval of meter cycle | 0.0-25.5 | sec | 0.0 | 0228 | 1 |
| HOVRedDelay2 | Minimum red time for HOV bypass | 0.0-25.5 | sec | 0.0 | 0229 | 1 |
| ShortStopQOcc2 | Queue occupancy to trigger short stop green | 0-100 | % | 15 | 022A | 1 |
| QStartMeterGap2 | Gap required at queue detector for startup red | 0.0-25.5 | sec | 3.0 | 022B | 1 |
| MultiLane Split3 | Percentage for Bottleneck adjustment distribution | 0-100 | % | 100 | 0310 | 1 |
| TableRate1Lane3 | First rate point in meter rate table | 0.0-25.5 | vpm | 18.0 | 0311 | 1 |
| TableRate2Lane3 | Second rate point in meter rate table | 0.0-25.5 | vpm | 16.0 | 0312 | 1 |
| TableRate3Lane3 | Third rate point in meter rate table | 0.0-25.5 | vpm | 13.0 | 0313 | 1 |
| TableRate4Lane3 | Fourth rate point in meter rate table | 0.0-25.5 | vpm | 10.0 | 0314 | 1 |
| TableRate5Lane3 | Final rate point in meter rate table | 0.0-25.5 | vpm | 7.0 | 0315 | 1 |
| TableOcc1Lane3 | First occupancy point in meter rate table | 0-100 | % | 15 | 0316 | 1 |
| TableOcc2Lane3 | Second occupancy point in meter rate table | 0-100 | % | 17 | 0317 | 1 |
| TableOcc3Lane3 | Third occupancy point in meter rate table | 0-100 | % | 19 | 0318 | 1 |
| TableOcc4Lane3 | Fourth occupancy point in meter rate table | 0-100 | % | 21 | 0319 | 1 |
| TableOcc5Lane3 | Final occupancy point in meter rate table | 0-100 | % | 23 | 031A | 1 |
| MaxMeterRate3 | Maximum meter rate | 0.0-25.5 | vpm | 20.0 | 031B | 1 |
| MinMeterRate3 | Minimum meter rate | 0.0-25.5 | vpm | 5.0 | 031C | 1 |
| QueueOcc1Lane3 | Occupancy threshold to begin adjustment | 0-100 | % | 30 | 031D | 1 |
| QueueOcc2Lane3 | Occupancy threshold to terminate adjustment | 0-100 | % | 25 | 031E | 1 |
| QTimer1Lane3 | Timer to implement first adjustment | 0.0-25.5 | min | 1.0 | 031F | 1 |

| Parameter | Definition | Range | Units | Default Value | Memory Address | Size |
|---|---|---|---|---|---|---|
| QTimer2Lane3 | Timer to implement second adjustment | 0.0-25.5 | min | 3.0 | 0320 | 1 |
| QAdjust1Lane3 | First meter rate increment for queue adjustment | 0.0-25.5 | vpm | 2.0 | 0321 | 1 |
| QAdjust2Lane3 | Second meter rate increment for queue adjustment | 0.0-25.5 | vpm | 4.0 | 0322 | 1 |
| AdvQOccupancy3 | Occupancy threshold to begin override | 0-100 | % | 25 | 0323 | 1 |
| AdvQTimer3 | Timer to implement override | 0-255 | sec | 80 | 0324 | 1 |
| AdvQOverride3 | Meter rate adjustment for override | 0.0-25.5 | vpm | 12.0 | 0325 | 1 |
| LongStopTime3 | Passage occupancy time to trigger long stop green | 0.0-25.5 | sec | 2.0 | 0326 | 1 |
| RedViolatorDly3 | Delay time added to red time for red violations | 0.0-25.5 | sec | 1.0 | 0327 | 1 |
| NormalYellow3 | Duration of yellow interval of meter cycle | 0.0-25.5 | sec | 0.0 | 0328 | 1 |
| HOVRedDelay3 | Minimum red time for HOV bypass | 0.0-25.5 | sec | 0.0 | 0329 | 1 |
| ShortStopQOcc3 | Queue occupancy to trigger short stop green | 0-100 | % | 15 | 032A | 1 |
| QStartMeterGap3 | Gap required at queue detector for startup red | 0.0-25.5 | sec | 3.0 | 032B | 1 |

Parameter Block 2: Time-Of-Day Table = 128 bytes

| Parameter | Definition | Range | Units | Default Value | Description of Values |
|---|---|---|---|---|---|
| Hour1 | Entry start hour | 0-23 | hr | 00 | |
| Hour2 | Entry start hour | 0-23 | hr | 00 | |
| Hour3 | Entry start hour | 0-23 | hr | 00 | |
| Hour4 | Entry start hour | 0-23 | hr | 00 | |
| Hour5 | Entry start hour | 0-23 | hr | 00 | |
| Hour6 | Entry start hour | 0-23 | hr | 00 | |
| Hour7 | Entry start hour | 0-23 | hr | 00 | |
| Hour8 | Entry start hour | 0-23 | hr | 00 | |
| Hour9 | Entry start hour | 0-23 | hr | 00 | |
| Hour10 | Entry start hour | 0-23 | hr | 00 | |
| Hour11 | Entry start hour | 0-23 | hr | 00 | |
| Hour12 | Entry start hour | 0-23 | hr | 00 | |
| Hour13 | Entry start hour | 0-23 | hr | 00 | |
| Hour14 | Entry start hour | 0-23 | hr | 00 | |
| Hour15 | Entry start hour | 0-23 | hr | 00 | |
| Hour16 | Entry start hour | 0-23 | hr | 00 | |
| Hour17 | Entry start hour | 0-23 | hr | 00 | |
| Hour18 | Entry start hour | 0-23 | hr | 00 | |
| Hour19 | Entry start hour | 0-23 | hr | 00 | |
| Hour20 | Entry start hour | 0-23 | hr | 00 | |
| Hour21 | Entry start hour | 0-23 | hr | 00 | |
| Hour22 | Entry start hour | 0-23 | hr | 00 | |
| Hour23 | Entry start hour | 0-23 | hr | 00 | |
| Hour24 | Entry start hour | 0-23 | hr | 00 | |
| Hour25 | Entry start hour | 0-23 | hr | 00 | |
| Hour26 | Entry start hour | 0-23 | hr | 00 | |
| Hour27 | Entry start hour | 0-23 | hr | 00 | |
| Hour28 | Entry start hour | 0-23 | hr | 00 | |
| Hour29 | Entry start hour | 0-23 | hr | 00 | |
| Hour30 | Entry start hour | 0-23 | hr | 00 | |
| Hour31 | Entry start hour | 0-23 | hr | 00 | |
| Hour32 | Entry start hour | 0-23 | hr | 00 | |
| Minute1 | Entry start Minute | 0-59 | min | 00 | |
| Minute2 | Entry start minute | 0-59 | min | 00 | |
| Minute3 | Entry start minute | 0-59 | min | 00 | |
| Minute4 | Entry start minute | 0-59 | min | 00 | |
| Minute5 | Entry start minute | 0-59 | min | 00 | |
| Minute6 | Entry start minute | 0-59 | min | 00 | |
| Minute7 | Entry start minute | 0-59 | min | 00 | |
| Minute8 | Entry start minute | 0-59 | min | 00 | |

| Parameter | Definition | Range | Units | Default Value | Description of Values |
|---|---|---|---|---|---|
| Minute9 | Entry start minute | 0-59 | min | 00 | |
| Minute10 | Entry start minute | 0-59 | min | 00 | |
| Minute11 | Entry start minute | 0-59 | min | 00 | |
| Minute12 | Entry start minute | 0-59 | min | 00 | |
| Minute13 | Entry start minute | 0-59 | min | 00 | |
| Minute14 | Entry start minute | 0-59 | min | 00 | |
| Minute15 | Entry start minute | 0-59 | min | 00 | |
| Minute16 | Entry start minute | 0-59 | min | 00 | |
| Minute17 | Entry start minute | 0-59 | min | 00 | |
| Minute18 | Entry start minute | 0-59 | min | 00 | |
| Minute19 | Entry start minute | 0-59 | min | 00 | |
| Minute20 | Entry start minute | 0-59 | min | 00 | |
| Minute21 | Entry start minute | 0-59 | min | 00 | |
| Minute22 | Entry start minute | 0-59 | min | 00 | |
| Minute23 | Entry start minute | 0-59 | min | 00 | |
| Minute24 | Entry start minute | 0-59 | min | 00 | |
| Minute25 | Entry start minute | 0-59 | min | 00 | |
| Minute26 | Entry start minute | 0-59 | min | 00 | |
| Minute27 | Entry start minute | 0-59 | min | 00 | |
| Minute28 | Entry start minute | 0-59 | min | 00 | |
| Minute29 | Entry start minute | 0-59 | min | 00 | |
| Minute30 | Entry start minute | 0-59 | min | 00 | |
| Minute31 | Entry start minute | 0-59 | min | 00 | |
| Minute32 | Entry start minute | 0-59 | min | 00 | |
| DOW Mask1 | Entry Day of Week mask | 0-7F | bitmask | 1111 1110 | x02=Sunday, |
| DOW Mask2 | Entry Day of Week mask | 0-7F | bitmask | 1111 1110 | x04=Monday, |
| DOW Mask3 | Entry Day of Week mask | 0-7F | bitmask | 1111 1110 | x08=Tuesday, |
| DOW Mask4 | Entry Day of Week mask | 0-7F | bitmask | 1111 1110 | x10=Wednesday, |
| DOW Mask5 | Entry Day of Week mask | 0-7F | bitmask | 1111 1110 | x20=Thursday, |
| DOW Mask6 | Entry Day of Week mask | 0-7F | bitmask | 1111 1110 | x40=Friday, |
| DOW Mask7 | Entry Day of Week mask | 0-7F | bitmask | 1111 1110 | x80=Saturday, |
| DOW Mask8 | Entry Day of Week mask | 0-7F | bitmask | 1111 1110 | |
| DOW Mask9 | Entry Day of Week mask | 0-7F | bitmask | 1111 1110 | |
| DOW Mask10 | Entry Day of Week mask | 0-7F | bitmask | 1111 1110 | |
| DOW Mask11 | Entry Day of Week mask | 0-7F | bitmask | 1111 1110 | |
| DOW Mask12 | Entry Day of Week mask | 0-7F | bitmask | 1111 1110 | |
| DOW Mask13 | Entry Day of Week mask | 0-7F | bitmask | 1111 1110 | |
| DOW Mask14 | Entry Day of Week mask | 0-7F | bitmask | 1111 1110 | |
| DOW Mask15 | Entry Day of Week mask | 0-7F | bitmask | 1111 1110 | |
| DOW Mask16 | Entry Day of Week mask | 0-7F | bitmask | 1111 1110 | |
| DOW Mask17 | Entry Day of Week mask | 0-7F | bitmask | 1111 1110 | |

| Parameter | Definition | Range | Units | Default Value | Description of Values |
|---|---|---|---|---|---|
| DOW Mask18 | Entry Day of Week mask | 0-7F | bitmask | 1111 1110 | |
| DOW Mask19 | Entry Day of Week mask | 0-7F | bitmask | 1111 1110 | |
| DOW Mask20 | Entry Day of Week mask | 0-7F | bitmask | 1111 1110 | |
| DOW Mask21 | Entry Day of Week mask | 0-7F | bitmask | 1111 1110 | |
| DOW Mask22 | Entry Day of Week mask | 0-7F | bitmask | 1111 1110 | |
| DOW Mask23 | Entry Day of Week mask | 0-7F | bitmask | 1111 1110 | |
| DOW Mask24 | Entry Day of Week mask | 0-7F | bitmask | 1111 1110 | |
| DOW Mask25 | Entry Day of Week mask | 0-7F | bitmask | 1111 1110 | |
| DOW Mask26 | Entry Day of Week mask | 0-7F | bitmask | 1111 1110 | |
| DOW Mask27 | Entry Day of Week mask | 0-7F | bitmask | 1111 1110 | |
| DOW Mask28 | Entry Day of Week mask | 0-7F | bitmask | 1111 1110 | |
| DOW Mask29 | Entry Day of Week mask | 0-7F | bitmask | 1111 1110 | |
| DOW Mask30 | Entry Day of Week mask | 0-7F | bitmask | 1111 1110 | |
| DOW Mask31 | Entry Day of Week mask | 0-7F | bitmask | 1111 1110 | |
| DOW Mask32 | Entry Day of Week mask | 0-7F | bitmask | 1111 1110 | |
| Rate1 | Entry meter rate | 0.0-25.5 | vpm | 0.0 | 0.0 == Off |
| Rate2 | Entry meter rate | 0.0-25.5 | vpm | 0.0 | 25.5 == Traffic |
| Rate3 | Entry meter rate | 0.0-25.5 | vpm | 0.0 | 0.1 – 25.4 == rate |
| Rate4 | Entry meter rate | 0.0-25.5 | vpm | 0.0 | |
| Rate5 | Entry meter rate | 0.0-25.5 | vpm | 0.0 | |
| Rate6 | Entry meter rate | 0.0-25.5 | vpm | 0.0 | |
| Rate7 | Entry meter rate | 0.0-25.5 | vpm | 0.0 | |
| Rate8 | Entry meter rate | 0.0-25.5 | vpm | 0.0 | |
| Rate9 | Entry meter rate | 0.0-25.5 | vpm | 0.0 | |
| Rate10 | Entry meter rate | 0.0-25.5 | vpm | 0.0 | |
| Rate11 | Entry meter rate | 0.0-25.5 | vpm | 0.0 | |
| Rate12 | Entry meter rate | 0.0-25.5 | vpm | 0.0 | |
| Rate13 | Entry meter rate | 0.0-25.5 | vpm | 0.0 | |
| Rate14 | Entry meter rate | 0.0-25.5 | vpm | 0.0 | |
| Rate15 | Entry meter rate | 0.0-25.5 | vpm | 0.0 | |
| Rate16 | Entry meter rate | 0.0-25.5 | vpm | 0.0 | |
| Rate17 | Entry meter rate | 0.0-25.5 | vpm | 0.0 | |
| Rate18 | Entry meter rate | 0.0-25.5 | vpm | 0.0 | |
| Rate19 | Entry meter rate | 0.0-25.5 | vpm | 0.0 | |
| Rate20 | Entry meter rate | 0.0-25.5 | vpm | 0.0 | |
| Rate21 | Entry meter rate | 0.0-25.5 | vpm | 0.0 | |
| Rate22 | Entry meter rate | 0.0-25.5 | vpm | 0.0 | |
| Rate23 | Entry meter rate | 0.0-25.5 | vpm | 0.0 | |
| Rate24 | Entry meter rate | 0.0-25.5 | vpm | 0.0 | |
| Rate25 | Entry meter rate | 0.0-25.5 | vpm | 0.0 | |
| Rate26 | Entry meter rate | 0.0-25.5 | vpm | 0.0 | |

| Parameter | Definition | Range | Units | Default Value | Description of Values |
|---|---|---|---|---|---|
| Rate27 | Entry meter rate | 0.0-25.5 | vpm | 0.0 | |
| Rate28 | Entry meter rate | 0.0-25.5 | vpm | 0.0 | |
| Rate29 | Entry meter rate | 0.0-25.5 | vpm | 0.0 | |
| Rate30 | Entry meter rate | 0.0-25.5 | vpm | 0.0 | |
| Rate31 | Entry meter rate | 0.0-25.5 | vpm | 0.0 | |
| Rate32 | Entry meter rate | 0.0-25.5 | vpm | 0.0 | |

Parameter Block 3: Global parameters = 115 bytes

| Parameter | Definition | Range | Units | Default Value | Description of Values |
|---|---|---|---|---|---|
| Det1 | Pin 1 assignment | 00-FF | n/a | 0 | See Loop Function Codes, below. |
| Det2 | Pin 2 assignment | 00-FF | n/a | 0 | See Loop Function Codes, below. |
| Det3 | Pin 3 assignment | 00-FF | n/a | 0 | See Loop Function Codes, below. |
| Det4 | Pin 4 assignment | 00-FF | n/a | 0 | See Loop Function Codes, below. |
| Det5 | Pin 5 assignment | 00-FF | n/a | 0 | See Loop Function Codes, below. |
| Det6 | Pin 6 assignment | 00-FF | n/a | 0 | See Loop Function Codes, below. |
| Det7 | Pin 7 assignment | 00-FF | n/a | 0 | See Loop Function Codes, below. |
| Det8 | Pin 8 assignment | 00-FF | n/a | 0 | See Loop Function Codes, below. |
| Det9 | Pin 9 assignment | 00-FF | n/a | 0 | See Loop Function Codes, below. |
| Det10 | Pin 10 assignment | 00-FF | n/a | 0 | See Loop Function Codes, below. |
| Det11 | Pin 11 assignment | 00-FF | n/a | 0 | See Loop Function Codes, below. |
| Det12 | Pin 12 assignment | 00-FF | n/a | 0 | See Loop Function Codes, below. |
| Det13 | Pin 13 assignment | 00-FF | n/a | 0 | See Loop Function Codes, below. |
| Det14 | Pin 14 assignment | 00-FF | n/a | 0 | See Loop Function Codes, below. |
| Det15 | Pin 15 assignment | 00-FF | n/a | 0 | See Loop Function Codes, below. |
| Det16 | Pin 16 assignment | 00-FF | n/a | 0 | See Loop Function Codes, below. |
| Det17 | Pin 17 assignment | 00-FF | n/a | 0 | See Loop Function Codes, below. |

| Parameter | Definition | Range | Units | Default Value | Description of Values |
|---|---|---|---|---|---|
| Det18 | Pin 18 assignment | 00-FF | n/a | 0 | See Loop Function Codes, below. |
| Det19 | Pin 19 assignment | 00-FF | n/a | 0 | See Loop Function Codes, below. |
| Det20 | Pin 20 assignment | 00-FF | n/a | 0 | See Loop Function Codes, below. |
| Det21 | Pin 21 assignment | 00-FF | n/a | 0 | See Loop Function Codes, below. |
| Det22 | Pin 22 assignment | 00-FF | n/a | 0 | See Loop Function Codes, below. |
| Det23 | Pin 23 assignment | 00-FF | n/a | 0 | See Loop Function Codes, below. |
| Det24 | Pin 24 assignment | 00-FF | n/a | 0 | See Loop Function Codes, below. |
| Det25 | Pin 25 assignment | 00-FF | n/a | 0 | See Loop Function Codes, below. |
| Det26 | Pin 26 assignment | 00-FF | n/a | 0 | See Loop Function Codes, below. |
| Det27 | Pin 27 assignment | 00-FF | n/a | 0 | See Loop Function Codes, below. |
| Det28 | Pin 28 assignment | 00-FF | n/a | 0 | See Loop Function Codes, below. |
| Det29 | Pin 29 assignment | 00-FF | n/a | 0 | See Loop Function Codes, below. |
| Det30 | Pin 30 assignment | 00-FF | n/a | 0 | See Loop Function Codes, below. |
| Det31 | Pin 31 assignment | 00-FF | n/a | 0 | See Loop Function Codes, below. |
| Det32 | Pin 32 assignment | 00-FF | n/a | 0 | See Loop Function Codes, below. |
| Det33 | Pin 33 assignment | 00-FF | n/a | 0 | See Loop Function Codes, below. |
| Det34 | Pin 34 assignment | 00-FF | n/a | 0 | See Loop Function Codes, below. |

| Parameter | Definition | Range | Units | Default Value | Description of Values |
|---|---|---|---|---|---|
| Det35 | Pin 35 assignment | 00-FF | n/a | 0 | See Loop Function Codes, below. |
| Det36 | Pin 36 assignment | 00-FF | n/a | 0 | See Loop Function Codes, below. |
| Det37 | Pin 37 assignment | 00-FF | n/a | 0 | See Loop Function Codes, below. |
| Det38 | Pin 38 assignment | 00-FF | n/a | 0 | See Loop Function Codes, below. |
| Det39 | Pin 39 assignment | 00-FF | n/a | 0 | See Loop Function Codes, below. |
| Det40 | Pin 40 assignment | 00-FF | n/a | 0 | See Loop Function Codes, below. |
| SpdTrap1Upst# | Upstream loop # in trap 1 | 0-40 | det # | 0 | |
| SpdTrap1Dnst# | Downstream loop # in trap 1 | 0-40 | det # | 0 | |
| SpdTrap1Dist | Distance between loops | 0-255 | feet | 17 | |
| SpdTrap1LoopL | Effective loop length, trap 1 | 0-255 | feet | 7 | |
| SpdTrap2Upst# | Upstream loop # in trap 2 | 0-40 | det # | 0 | |
| SpdTrap2Dnst# | Downstream loop # in trap 2 | 0-40 | det # | 0 | |
| SpdTrap2Dist | Distance between loops | 0-255 | feet | 17 | |
| SpdTrap2LoopL | Effective loop length, trap 2 | 0-255 | feet | 7 | |
| SpdTrap3Upst# | Upstream loop # in trap 3 | 0-40 | det # | 0 | |
| SpdTrap3Dnst# | Downstream loop # in trap 3 | 0-40 | det # | 0 | |
| SpdTrap3Dist | Distance between loops | 0-255 | feet | 17 | |
| SpdTrap3LoopL | Effective loop length, trap 3 | 0-255 | feet | 7 | |
| SpdTrap4Upst# | Upstream loop # in trap 4 | 0-40 | det # | 0 | |
| SpdTrap4Dnst# | Downstream loop # in trap 4 | 0-40 | det # | 0 | |
| SpdTrap4Dist | Distance between loops | 0-255 | feet | 17 | |
| SpdTrap4LoopL | Effective loop length, trap 4 | 0-255 | feet | 7 | |
| SpdTrap5Upst# | Upstream loop # in trap 5 | 0-40 | det # | 0 | |
| SpdTrap5Dnst# | Downstream loop # in trap 5 | 0-40 | det # | 0 | |
| SpdTrap5Dist | Distance between loops | 0-255 | feet | 17 | |
| SpdTrap5LoopL | Effective loop length, trap 5 | 0-255 | feet | 7 | |
| SpdTrap6Upst# | Upstream loop # in trap 6 | 0-40 | det # | 0 | |
| SpdTrap6Dnst# | Downstream loop # in trap 6 | 0-40 | det # | 0 | |
| SpdTrap6Dist | Distance between loops | 0-255 | feet | 17 | |
| SpdTrap6LoopL | Effective loop length, trap 6 | 0-255 | feet | 7 | |
| SpdTrap7Upst# | Upstream loop # in trap 7 | 0-40 | det # | 0 | |
| SpdTrap7Dnst# | Downstream loop # in trap 7 | 0-40 | det # | 0 | |
| SpdTrap7Dist | Distance between loops | 0-255 | feet | 17 | |

| Parameter | Definition | Range | Units | Default Value | Description of Values |
|---|---|---|---|---|---|
| SpdTrap7LoopL | Effective loop length, trap 7 | 0-255 | feet | 7 | |
| SpdTrap8Upst# | Upstream loop # in trap 8 | 0-40 | det # | 0 | |
| SpdTrap8Dnst# | Downstream loop # in trap 8 | 0-40 | det # | 0 | |
| SpdTrap8Dist | Distance between loops | 0-255 | feet | 17 | |
| SpdTrap8LoopL | Effective loop length, trap 8 | 0-255 | feet | 7 | |
| Occupancy 1 | Occupancy of 1st Envelope pt | 0-100 | % | 5 | |
| LowerVol1 | Lower limit volume point 1 | 0-17 | vp20 | 1 | |
| UpperVol1 | Upper limit volume point 1 | 0-17 | vp20 | 5 | |
| Occupancy 2 | Occupancy of 2st Envelope pt | 0-100 | % | 10 | |
| LowerVol2 | Lower limit volume point 2 | 0-17 | vp20 | 2 | |
| UpperVol2 | Upper limit volume point 2 | 0-17 | vp20 | 10 | |
| Occupancy 3 | Occupancy of 3st Envelope pt | 0-100 | % | 15 | |
| LowerVol3 | Lower limit volume point 3 | 0-17 | vp20 | 3 | |
| UpperVol3 | Upper limit volume point 3 | 0-17 | vp20 | 17 | |
| Occupancy 4 | Occupancy of 4st Envelope pt | 0-100 | % | 20 | |
| LowerVol4 | Lower limit volume point 4 | 0-17 | vp20 | 3 | |
| UpperVol4 | Upper limit volume point 4 | 0-17 | vp20 | 17 | |
| DataSwitch | Ramp meter or data collector | 0, 1 | n/a | 0 | 0=DS,1=RM, 2=Other |
| # ActiveLoops | Number of defined loops | 0-40 | n/a | 0 | |
| #MeteredLanes | Number of demand loops | 0-3 | n/a | 0 | |
| #SpeedTraps | Number of speed traps | 0-8 | n/a | 0 | |
| ControlSwitch | Control by TOD or remote | 0, 1 | n/a | 0 | 0==Central, !0==TOD |
| PoliceSwitch | Pre-empt metering | | n/a | 0 | !0 == pre-empt |
| MeterEndGreen | End of Meter green interval | 0-255 | sec | 90 | |
| DemandEndGap | Length of demand gap to end | 0.0-25.5 | sec | 10.0 | |
| MinimumSpeed | Lower speed limit | 0-255 | mph | 5 | |
| MaximumSpeed | Upper speed limit | 0-255 | mph | 100 | |
| MinimumLength | Lower length limit | 0-255 | feet | 5 | |
| MaximumLength | Upper length limit | 0-255 | feet | 100 | |
| Bin1Length | Bin 1 upper boundary | 0-255 | feet | 26 | 26 |
| Bin2Length | Bin 2 upper boundary | 0-255 | feet | 39 | 39 |
| Bin3Length | Bin 4 lower boundary | 0-255 | feet | 65 | 65 |
| RampDetOn | Ramp detector On limit | 0-255 | min | 30 | |
| RampDetOff | Ramp detector Off limit | 0-255 | min | 255 | |
| MainlineDetOn | Mainline detector On limit | 0-255 | min | 10 | |
| MainlineDetOff | Mainline detector Off limit | 0-255 | min | 60 | |
| HOVDetOn | HOV detector On limit | 0-255 | min | 5 | |
| HOVDetOff | HOV detector Off limit | 0-255 | min | 255 | |
| REVDetOn | Reversible detector On limit | 0-255 | min | 10 | |

| Parameter | Definition | Range | Units | Default Value | Description of Values |
|---|---|---|---|---|---|
| REVDetOff | Reversible detector Off limit | 0-255 | min | 255 | |
| StartYellow | Yellow time for start metering | 0.0-25.5 | sec | 5.0 | |
| MeterOffDisplay | Display when not metering | 0, 1 | n/a | 0 | 0 == dark, !0 == green |
| FilterThML | Short hit/gap limit for mainline | 0-255 | #sc | 3 | |
| FilterThRamp | Short hit/gap limit for ramps | 0-255 | #sc | 3 | |
| FilterThHOV | Short hit/gap limit for HOV | 0-255 | #sc | 3 | |
| FilterThRev | Short hit/gap limit for reversible | 0-255 | #sc | 3 | |
| CarsPerGreen | # of cars allowed each green | 1, 2 | veh | 1 | |
| IgnoreBulbOut | Current monitor | 0, 1 | n/a | 1 | !0 == Ignore (Not implemented) |

Date / Time Block: 8 bytes

| Parameter | Definition | Range | Memory Address | Size | Description of Values |
|---|---|---|---|---|---|
| DOM | Day of the current month | 1-31 | 0741 | 1 | |
| DOW | Day of the week | x1-x40 | 0760 | 1 | x1=Sunday, x40=Saturday |
| HOUR | Hour of the current day | 0-23 | 0740 | 1 | |
| MINUTE | Minute of the current hour | 0-59 | 0750 | 1 | |
| MONTH | Month of the current year | 1-12 | 0771 | 1 | |
| N100M | Tenth of seconds | 0-9 | 0101 | 1 | |
| SECOND | Second of the current minute | 0-59 | 0770 | 1 | |
| YEAR | Year of the current Millennium | 0-99 | 0751 | 1 | |

Loop function codes

| Function Code | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Category** | **Detector Type** | **Detector Name** | **Function 8 7 6 5** | **Res 4** | **Lane# 3 2 1** | **Hex Code** | **Dec Code** | **Notes** |
| Ramp Control Loops | AdvQue L | xxdLA_n | 1 0 1 1 | 0 | 0 0 1 | Bn | 177 | n = lane # (1-7)<br>d = direction (NESW)<br>x = don't care |
| | AdvQue R | xxdRA_n | 1 1 1 1 | 0 | | Fn | 241 | |
| | Intmdt Q | xxd_I_n | 1 1 1 0 | 0 | | En | 225 | |
| | Queue | xxd_Q_n | 1 0 1 0 | 0 | | An | 161 | |
| | Demand | xxd_D_n | 1 0 0 0 | 0 | . . . | 8n | 129 | |
| | Passage | xxd_P_n | 1 0 0 1 | 0 | | 9n | 145 | |
| | HOV D | xxdHD_n | 1 1 0 0 | 0 | | Cn | 193 | |
| | HOV P | xxdHP_n | 1 1 0 1 | 0 | 1 1 1 | Dn | 209 | |
| Ramp Data Loops | Exit | xxd_X_n | 0 1 1 1 | 0 | 0 0 1 | 7n | 113 | |
| | On | xxd_O_n | 0 1 1 1 | 0 | . . . | 7n | 113 | |
| | HOV Exit | xxdHX_n | 0 1 1 1 | 0 | | 7n | 113 | |
| | HOV On | xxdHO_n | 0 1 1 1 | 0 | 1 1 1 | 7n | 113 | |
| Mainline Roadway Loops | M/L-Data | _Md___n | 0 0 0 1 | 0 | 0 0 0 | 10 | 016 | |
| | - Speed | _Md__Sn | 0 0 0 1 | 0 | 0 0 0 | 10 | 016 | |
| | - Meter | MMd___n | 1 0 0 1 | 0 | 0 0 0 | 90 | 144 | |
| | CD–Data | _Cd___n | 0 0 0 1 | 0 | 0 0 0 | 10 | 016 | |
| | -Speed | _Cd__Sn | 0 0 0 1 | 0 | 0 0 0 | 10 | 016 | |
| | -Meter | MCd___n | 1 0 0 1 | 0 | 0 0 0 | 90 | 144 | |
| | Rv-Data | _Rd___n | 0 0 1 0 | 0 | 0 0 0 | 20 | 032 | |
| | -Speed | _Rd__Sn | 0 0 1 0 | 0 | 0 0 0 | 20 | 032 | |
| | -Meter | MRd___n | 1 0 1 0 | 0 | 0 0 0 | A0 | 160 | |
| | HOV-Data | _MdH__n | 0 0 1 1 | 0 | 0 0 0 | 30 | 048 | |
| | -Speed | _MdH_Sn | 0 0 1 1 | 0 | 0 0 0 | 30 | 048 | |
| | -Meter | MMdH__n | 1 0 1 1 | 0 | 0 0 0 | B0 | 176 | |
| | Aux-Data | Axdx__n | 0 0 0 1 | 0 | 0 0 0 | 10 | 016 | |
| | -Speed | Axdx_Sn | 0 0 0 1 | 0 | 0 0 0 | 10 | 016 | |

## Appendix B

# Memory Maps

## Global Parameters

### C Page

| 0400 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A | B | C | D | E | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | Drop Address | Det 1 Loop Func Code | Det 17 Loop Func Code | Det 33 Loop Func Code | ST 3 Upstream Detector | ST 7 Upstream Detector | UpperVol3 | Bin1 Length | FilterTh Rev | | | | | | | |
| 1 | Program Number | Det 2 Loop Func Code | Det 18 Loop Func Code | Det 34 Loop Func Code | ST 3 Dnstream Detector | ST 7 Dnstream Detector | Occupancy4 | Bin2 Length | Cars per Green | | | | | | | |
| 2 | Version Number | Det 3 Loop Func Code | Det 19 Loop Func Code | Det 35 Loop Func Code | ST 3 Distance | ST 7 Distance | LowerVol4 | Bin3 Length | Ignore CurrMon | | | | | | | |
| 3 | Release Number | Det 4 Loop Func Code | Det 20 Loop Func Code | Det 36 Loop Func Code | ST 3 Eff Loop Length | ST 7 Eff Loop Length | UpperVol4 | Ramp DetOn | | | | | | | | |
| 4 | | Det 5 Loop Func Code | Det 21 Loop Func Code | Det 37 Loop Func Code | ST 4 Upstream Detector | ST 8 Upstream Detector | Data Switch | Ramp DetOff | | | | | | | | |
| 5 | | Det 6 Loop Func Code | Det 22 Loop Func Code | Det 38 Loop Func Code | ST 4 Dnstream Detector | ST 8 Dnstream Detector | # Active Loops | Mainline DetOn | | | | | | | | |
| 6 | | Det 7 Loop Func Code | Det 23 Loop Func Code | Det 39 Loop Func Code | ST 4 Distance | ST 8 Distance | # Metered Lanes | Mainline DetOff | | | | | | | | |
| 7 | | Det 8 Loop Func Code | Det 24 Loop Func Code | Det 40 Loop Func Code | ST 4 Eff Loop Length | ST 8 Eff Loop Length | # Speed Traps | HOV DetOn | | | | | | | | |
| 8 | Detector Echo | Det 9 Loop Func Code | Det 25 Loop Func Code | ST 1 Upstream Detector | ST 5 Upstream Detector | Occupancy1 | Control Switch | HOV DetOff | | | | | | | | |
| 9 | Input Echo | Det 10 Loop Func Code | Det 26 Loop Func Code | ST 1 Dnstream Detector | ST 5 Dnstream Detector | LowerVol1 | Police Switch | Rev DetOn | | | | | | | | |
| A | | Det 11 Loop Func Code | Det 27 Loop Func Code | ST 1 Distance | ST 5 Distance | UpperVol1 | Meter End Green | Rev DetOff | | | | | | | | |
| B | | Det 12 Loop Func Code | Det 28 Loop Func Code | ST 1 Eff Loop Length | ST 5 Eff Loop Length | Occupancy2 | Demand End Gap | Start Yellow | | | | | | | | |
| C | | Det 13 Loop Func Code | Det 29 Loop Func Code | ST 2 Upstream Detector | ST 6 Upstream Detector | LowerVol2 | Minimum Speed | Meter Off Display | | | | | | | | |
| D | | Det 14 Loop Func Code | Det 30 Loop Func Code | ST 2 Dnstream Detector | ST 6 Dnstream Detector | UpperVol2 | Maximum Speed | FilterTh ML | | | | | | | | |
| E | E Page Entry | Det 15 Loop Func Code | Det 31 Loop Func Code | ST 2 Distance | ST 6 Distance | Occupancy3 | Minimum Length | FilterTh Ramp | | | | | | | | |
| F | | Det 16 Loop Func Code | Det 32 Loop Func Code | ST 2 Eff Loop Length | ST 6 Eff Loop Length | LowerVol3 | Maximum Length | FilterTh HOV | | | | | | | | |

Note: Shaded entries are not global parameters, but are included for user reference.

## Lane 1 Parameters

**F/1 Page**

| | | Lane Parameters structure | | | | | | Lane Data structure | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0100 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A | B | C | D | E | F |
| 0 | | Multilane Split (0-100) | Queue Timer 2 (0.0-25.5) | | | | | Cycle Length (0.0 – 25.5) | Queue Rate Adj State | | | | | | | |
| 1 | | TableRate1 (0.0-25.5) | Queue Adjust 1 (0.0-25.5) | | | | | | Int Queue Rate Adj State | | | | | | | |
| 2 | | TableRate2 (0.0-25.5) | Queue Adjust 2 (0.0-25.5) | | | | | Fuzzy MR (0.0-25.5) | Queue Adjustment Alarm | | | | | | | |
| 3 | | TableRate3 (0.0-25.5) | Adv Queue Occ (0-100) | | | | | Traffic MR (0.0-25.5) | Adv Queue Occ Time | | | | | | | |
| 4 | | TableRate4 (0.0-25.5) | Adv Queue Timer (0-255) | | | | | Time of Day MR (0.0-25.5) | Adv Queue Adj Count | | | | | | | |
| 5 | | TableRate5 (0.0-25.5) | Adv Queue Override (0.0-25.5) | | | | | Bottleneck MR (0.0-25.5) | Adv Queue Adj Alarm | | | | | | | |
| 6 | | TableOcc1 (0-100) | Long Stop Time (0.0-25.5) | | | | | Intermediate MR (0.0-25.5) | Red Signal Violations | | | | | | | |
| 7 | | TableOcc2 (0-100) | Red Violator Delay (0.0-25.5) | | | | | Queue Adj MR (0.0-25.5) | | | | | | | | |
| 8 | | TableOcc3 (0-100) | Normal Yellow (0.0-25.5) | | | | | Adjusted MR (0.0-25.5) | | | | | | | | |
| 9 | | TableOcc4 (0-100) | HOV Red Delay (0.0-25.5) | | | | | Adjusted Rate Last (0.0-25.5) | | | | | | | | |
| A | | TableOcc5 (0-100) | Short Stop Queue Occ (0-100) | | | | | Adjusted Rate Prev (0.0-25.5) | | | | | | | | |
| B | | Max Meter Rate (0.0-25.5) | Queue Start Meter Gap (0.0-25.5) | | | | | Adjusted Rate Old (0.0-25.5) | | | | | | | | |
| C | | Min Meter Rate (0.0-25.5) | CMD RESET | | | | | Volume Adjust 0.0-25.5) | | | | | | | | |
| D | | Queue Occ 1 (0-100) | | | | | | Remote Adjust (12.7 - -12.8) | | | | | | | | |
| E | | Queue Occ 2 (0-100) | | | | | | Queue Occ Time (0.0-25.5) | | | | | | | | |
| F | | Queue Timer 1 (0.0-25.5) | | | | | | Int Queue Occ Time (0.0-25.5) | Test Data | | | | | | | |

Note: Shaded entries are read only.

## Lane 2 Parameters

**F/2 Page**

| | | Lane Parameters structure | | | | | | Lane Data structure | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0200 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A | B | C | D | E | F |
| 0 | | Multilane Split | Queue Timer 2 | | | | | Cycle Length | Queue Rate Adj State | | | | | | | |
| 1 | | TableRate1 | Queue Adjust 1 | | | | | | Int Queue Rate Adj State | | | | | | | |
| 2 | | TableRate2 | Queue Adjust 2 | | | | | Fuzzy MR | Queue Adjustment Alarm | | | | | | | |
| 3 | | TableRate3 | Adv Queue Occ | | | | | Traffic MR | Adv Queue Occ Time | | | | | | | |
| 4 | | TableRate4 | Adv Queue Timer | | | | | Time of Day MR | Adv Queue Adj Count | | | | | | | |
| 5 | | TableRate5 | Adv Queue Override | | | | | Bottleneck MR | Adv Queue Adj Alarm | | | | | | | |
| 6 | | TableOcc1 | Long Stop Time | | | | | Intermediate MR | Red Signal Violations | | | | | | | |
| 7 | | TableOcc2 | Red Violator Delay | | | | | Queue Adj MR | | | | | | | | |
| 8 | | TableOcc3 | Normal Yellow | | | | | Adjusted MR | | | | | | | | |
| 9 | | TableOcc4 | HOV Red Delay | | | | | Adjusted Rate Last | | | | | | | | |
| A | | TableOcc5 | Short Stop Queue Occ | | | | | Adjusted Rate Prev | | | | | | | | |
| B | | Max Meter Rate | Queue Start Meter Gap | | | | | Adjusted Rate Old | | | | | | | | |
| C | | Min Meter Rate | | | | | | Volume Adjust | | | | | | | | |
| D | | Queue Occ 1 | | | | | | Remote Adjust | | | | | | | | |
| E | | Queue Occ 2 | | | | | | Queue Occ Time | | | | | | | | |
| F | | Queue Timer 1 | | | | | | Int Queue Occ Time | | | | | | | | |

Note: Shaded entries are read only.

## Lane 3 Parameters

**F/3 Page**

| | | Lane Parameters structure | | Detector Failure Flags | | | | Lane Data structure | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0300 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A | B | C | D | E | F |
| 0 | | Multilane Split | Queue Timer 2 | DetFail1 | DetFail17 | DetFail33 | | Cycle Length | Queue Rate Adj State | | | | | | | |
| 1 | | TableRate1 | Queue Adjust 1 | DetFail2 | DetFail18 | DetFail34 | | | Int Queue Rate Adj State | | | | | | | |
| 2 | | TableRate2 | Queue Adjust 2 | DetFail3 | DetFail19 | DetFail35 | | Fuzzy MR | Queue Adjustment Alarm | | | | | | | |
| 3 | | TableRate3 | Adv Queue Occ | DetFail4 | DetFail20 | DetFail36 | | Traffic MR | Adv Queue Occ Time | | | | | | | |
| 4 | | TableRate4 | Adv Queue Timer | DetFail5 | DetFail21 | DetFail37 | | Time of Day MR | Adv Queue Adj Count | | | | | | | |
| 5 | | TableRate5 | Adv Queue Override | DetFail6 | DetFail22 | DetFail38 | | Bottleneck MR | Adv Queue Adj Alarm | | | | | | | |
| 6 | | TableOcc1 | Long Stop Time | DetFail7 | DetFail23 | DetFail39 | | Intermediate MR | Red Signal Violations | | | | | | | |
| 7 | | TableOcc2 | Red Violator Delay | DetFail8 | DetFail24 | DetFail40 | | Queue Adj MR | | | | | | | | |
| 8 | | TableOcc3 | Normal Yellow | DetFail9 | DetFail25 | | | Adjusted MR | | | | | | | | |
| 9 | | TableOcc4 | HOV Red Delay | DetFail10 | DetFail26 | | | Adjusted Rate Last | | | | | | | | |
| A | | TableOcc5 | Short Stop Queue Occ | DetFail11 | DetFail27 | | | Adjusted Rate Prev | | | | | | | | |
| B | | Max Meter Rate | Queue Start Meter Gap | DetFail12 | DetFail28 | | | Adjusted Rate Old | | | | | | | | |
| C | | Min Meter Rate | | DetFail13 | DetFail29 | | | Volume Adjust | | | | | | | | |
| D | | Queue Occ 1 | | DetFail14 | DetFail30 | | | Remote Adjust | | | | | | | | |
| E | | Queue Occ 2 | | DetFail15 | DetFail31 | | | Queue Occ Time | | | | | | | | |
| F | | Queue Timer 1 | | DetFail16 | DetFail32 | | | Int Queue Occ Time | | | | | | | | |

Note: Shaded entries are read only.

## Time of Day Table Data

**E/7 Page**

| 0700 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A | B | C | D | E | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | | | | Year (1-99) | | | | Hour 1 | Minute 1 | DOW 1 | Rate 1 | Hour 17 | Minute 17 | DOW 17 | Rate 17 |
| 1 | | | | | Month (1-12) | | | | Hour 2 | Minute 2 | DOW 2 | Rate 2 | Hour 18 | Minute 18 | DOW 18 | Rate 18 |
| 2 | | | | | Day (1-31) | | | | Hour 3 | Minute 3 | DOW 3 | Rate 3 | Hour 19 | Minute 19 | DOW 19 | Rate 19 |
| 3 | | | | | DOW (1-7) | | | | Hour 4 | Minute 4 | DOW 4 | Rate 4 | Hour 20 | Minute 20 | DOW 20 | Rate 20 |
| 4 | | | | | Hour (0-23) | | | | Hour 5 | Minute 5 | DOW 5 | Rate 5 | Hour 21 | Minute 21 | DOW 21 | Rate 21 |
| 5 | | | | | Minute (0-59) | | | | Hour 6 | Minute 6 | DOW 6 | Rate 6 | Hour 22 | Minute 22 | DOW 22 | Rate 22 |
| 6 | | | | | Second (0-59) | | | | Hour 7 | Minute 7 | DOW 7 | Rate 7 | Hour 23 | Minute 23 | DOW 23 | Rate 23 |
| 7 | | | | | | | | | Hour 8 | Minute 8 | DOW 8 | Rate 8 | Hour 24 | Minute 24 | DOW 24 | Rate 24 |
| 8 | | | | | | | | | Hour 9 | Minute 9 | DOW 9 | Rate 9 | Hour 25 | Minute 25 | DOW 25 | Rate 25 |
| 9 | | | | | | | | | Hour 10 | Minute 10 | DOW 10 | Rate 10 | Hour 26 | Minute 26 | DOW 26 | Rate 26 |
| A | | | | | | | | | Hour 11 | Minute 11 | DOW 11 | Rate 11 | Hour 27 | Minute 27 | DOW 27 | Rate 27 |
| B | | | | | | | | | Hour 12 | Minute 12 | DOW 12 | Rate 12 | Hour 28 | Minute 28 | DOW 28 | Rate 28 |
| C | | | | | | | | | Hour 13 | Minute 13 | DOW 13 | Rate 13 | Hour 29 | Minute 29 | DOW 29 | Rate 29 |
| D | | | | | | | | | Hour 14 | Minute 14 | DOW 14 | Rate 14 | Hour 30 | Minute 30 | DOW 30 | Rate 30 |
| E | | | | | | | | | Hour 15 | Minute 15 | DOW 15 | Rate 15 | Hour 31 | Minute 31 | DOW 31 | Rate 31 |
| F | | | | | | | | | Hour 16 | Minute 16 | DOW 16 | Rate 16 | Hour 32 | Minute 32 | DOW 32 | Rate 32 |

Note: Shaded entries are read only.

## Data Status Packet

**E/118 Page**

| 7600 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A | B | C | D | E | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | Ramp 1 Meter Rate | DET 6 Packed Volume and Occupancy | DET 14 Packed Volume and Occupancy | DET 22 Packed Volume and Occupancy | DET 30 Packed Volume and Occupancy | DET 38 Packed Volume and Occupancy | Flags DET 21&22 | **Speed Trap 2** Flags | Length BINS 1 & 4 | Average Speed | | | | | |
| 1 | | Ramp 2 Meter Rate | | | | | | Flags DET 23&24 | High Bits Speed/Length | Length BINS 2 & 3 | Average Length | | | | | |
| 2 | | Ramp 3 Meter Rate | | | | | | Flags DET 25&26 | Average Speed | **Speed Trap 5** Flags | Length BINS 1 & 4 | | | | | |
| 3 | | Ramp 1 Status | DET 7 | DET 15 | DET 23 | DET 31 | DET 39 | Flags DET 27&28 | Average Length | High Bits Speed/Length | Length BINS 2 & 3 | | | | | |
| 4 | | Ramp 2 Status | | | | | DET 40 Packed Volume and Occupancy | Flags DET 29&30 | Length BINS 1 & 4 | Average Speed | **Speed Trap 8** Flags | | | | | |
| 5 | | Ramp 3 Status | DET 8 | DET 16 | DET 24 | DET 32 | | Flags DET 31&32 | Length BINS 2 & 3 | Average Length | High Bits Speed/Length | | | | | |
| 6 | | DET 1 Packed Volume and Occupancy | | | | | Flags DET 1 & 2 | Flags DET 33&34 | **Speed Trap 3** Flags | Length BINS 1 & 4 | Average Speed | | | | | |
| 7 | | | DET 9 | DET 17 | DET 25 | DET 33 | Flags DET 3 & 4 | Flags DET 35&36 | High Bits Speed/Length | Length BINS 2 & 3 | Average Length | | | | | |
| 8 | | | | | | | Flags DET 5 & 6 | Flags DET 37&38 | Average Speed | **Speed Trap 6** Flags | Length BINS 1 & 4 | | | | | |
| 9 | | DET 2 | DET 10 | DET 18 | DET 26 | DET 34 | Flags DET 7 & 8 | Flags DET 39&40 | Average Length | High Bits Speed/Length | Length BINS 2 & 3 | | | | | |
| A | | | | | | | Flags DET 9 & 10 | **Speed Trap 1** Flags | Length BINS 1 & 4 | Average Speed | | | | | | |
| B | | DET 3 | DET 11 | DET 19 | DET 27 | DET 35 | Flags DET 11 & 12 | High Bits Speed/Length | Length BINS 2 & 3 | Average Length | | | | | | |

| 7600 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A | B | C | D | E | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C | | | | | | | Flags DET 13 & 14 | Average Speed | **Speed Trap 4** Flags | Length BINS 1 & 4 | | | | | | |
| D | | DET 4 | DET 12 | DET 20 | DET 28 | DET 36 | Flags DET 15 & 16 | Average Length | High Bits Speed/Length | Length BINS 2 & 3 | | | | | | |
| E | | DET 5 Packed Volume and Occupancy | DET 13 Packed Volume and Occupancy | DET 21 Packed Volume and Occupancy | DET 29 Packed Volume and Occupancy | DET 37 Packed Volume and Occupancy | Flags DET 17 & 18 | Length BINS 1 & 4 | Average Speed | **Speed Trap 7** Flags | | | | | | |
| F | | | | | | | Flags DET 19 & 20 | Length BINS 2 & 3 | Average Length | High Bits Speed/Length | | | | | | |

Note: Shaded entries are read only.

## Volume Data

**E/119 Page**

| | Min Absence/Presence Count | | | Current 20 Sec Volume | | | Last 20 Sec Volume | | | Previous 20 Sec Volume | | | Oldest 20 Sec Volume | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 7700 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A | B | C | D | E | F |
| 0 | Det 1 | Det 17 | Det 33 | Det 1 | Det 17 | Det 33 | Det 1 | Det 17 | Det 33 | Det 1 | Det 17 | Det 33 | Det 1 | Det 17 | Det 33 | |
| 1 | Det 2 | Det 18 | Det 34 | Det 2 | Det 18 | Det 34 | Det 2 | Det 18 | Det 34 | Det 2 | Det 18 | Det 34 | Det 2 | Det 18 | Det 34 | |
| 2 | Det 3 | Det 19 | Det 35 | Det 3 | Det 19 | Det 35 | Det 3 | Det 19 | Det 35 | Det 3 | Det 19 | Det 35 | Det 3 | Det 19 | Det 35 | |
| 3 | Det 4 | Det 20 | Det 36 | Det 4 | Det 20 | Det 36 | Det 4 | Det 20 | Det 36 | Det 4 | Det 20 | Det 36 | Det 4 | Det 20 | Det 36 | |
| 4 | Det 5 | Det 21 | Det 37 | Det 5 | Det 21 | Det 37 | Det 5 | Det 21 | Det 37 | Det 5 | Det 21 | Det 37 | Det 5 | Det 21 | Det 37 | |
| 5 | Det 6 | Det 22 | Det 38 | Det 6 | Det 22 | Det 38 | Det 6 | Det 22 | Det 38 | Det 6 | Det 22 | Det 38 | Det 6 | Det 22 | Det 38 | |
| 6 | Det 7 | Det 23 | Det 39 | Det 7 | Det 23 | Det 39 | Det 7 | Det 23 | Det 39 | Det 7 | Det 23 | Det 39 | Det 7 | Det 23 | Det 39 | |
| 7 | Det 8 | Det 24 | Det 40 | Det 8 | Det 24 | Det 40 | Det 8 | Det 24 | Det 40 | Det 8 | Det 24 | Det 40 | Det 8 | Det 24 | Det 40 | |
| 8 | Det 9 | Det 25 | | Det 9 | Det 25 | | Det 9 | Det 25 | | Det 9 | Det 25 | | Det 9 | Det 25 | | |
| 9 | Det 10 | Det 26 | | Det 10 | Det 26 | | Det 10 | Det 26 | | Det 10 | Det 26 | | Det 10 | Det 26 | | |
| A | Det 11 | Det 27 | | Det 11 | Det 27 | | Det 11 | Det 27 | | Det 11 | Det 27 | | Det 11 | Det 27 | | |
| B | Det 12 | Det 28 | | Det 12 | Det 28 | | Det 12 | Det 28 | | Det 12 | Det 28 | | Det 12 | Det 28 | | |
| C | Det 13 | Det 29 | | Det 13 | Det 29 | | Det 13 | Det 29 | | Det 13 | Det 29 | | Det 13 | Det 29 | | |
| D | Det 14 | Det 30 | | Det 14 | Det 30 | | Det 14 | Det 30 | | Det 14 | Det 30 | | Det 14 | Det 30 | | |
| E | Det 15 | Det 31 | | Det 15 | Det 31 | | Det 15 | Det 31 | | Det 15 | Det 31 | | Det 15 | Det 31 | | |
| F | Det 16 | Det 32 | | Det 16 | Det 32 | | Det 16 | Det 32 | | Det 16 | Det 32 | | Det 16 | Det 32 | | |

Note: Shaded entries are read only.

## Occupancy Data

**E/120 Page**

| | | | | | | | | | | | | | Cur 20 Second OccCounts | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 7800 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A | B | C | D | E | F |
| 0 | | | | | | | | | | | | | Det 1 | Det 9 | Det 17 | Det 25 |
| 1 | | | | | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | | Det 2 | Det 10 | Det 18 | Det 26 |
| 3 | | | | | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | | Det 3 | Det 11 | Det 19 | Det 27 |
| 5 | | | | | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | | Det 4 | Det 12 | Det 20 | Det 28 |
| 7 | | | | | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | Det 5 | Det 13 | Det 21 | Det 29 |
| 9 | | | | | | | | | | | | | | | | |
| A | | | | | | | | | | | | | Det 6 | Det 14 | Det 22 | Det 30 |
| B | | | | | | | | | | | | | | | | |
| C | | | | | | | | | | | | | Det 7 | Det 15 | Det 23 | Det 31 |
| D | | | | | | | | | | | | | | | | |
| E | | | | | | | | | | | | | Det 8 | Det 16 | Det 24 | Det 32 |
| F | | | | | | | | | | | | | | | | |

Note: Shaded entries are read only.

## Occupancy Data cont.

**E/121 Page**

| | Cur 20 | Last 20 Second Occupancy Counts | | | | | Previous 20 Second Occupancy Counts | | | | | Old 20 Second Occupancy Counts | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 7900 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A | B | C | D | E | F |
| 0 | Det 33 | Det 1 | Det 9 | Det 17 | Det 25 | Det 33 | Det 1 | Det 9 | Det 17 | Det 25 | Det 33 | Det 1 | Det 9 | Det 17 | Det 25 | Det 33 |
| 1 | | | | | | | | | | | | | | | | |
| 2 | Det 34 | Det 2 | Det 10 | Det 18 | Det 26 | Det 34 | Det 2 | Det 10 | Det 18 | Det 26 | Det 34 | Det 2 | Det 10 | Det 18 | Det 26 | Det 34 |
| 3 | | | | | | | | | | | | | | | | |
| 4 | Det 35 | Det 3 | Det 11 | Det 19 | Det 27 | Det 35 | Det 3 | Det 11 | Det 19 | Det 27 | Det 35 | Det 3 | Det 11 | Det 19 | Det 27 | Det 35 |
| 5 | | | | | | | | | | | | | | | | |
| 6 | Det 36 | Det 4 | Det 12 | Det 20 | Det 28 | Det 36 | Det 4 | Det 12 | Det 20 | Det 28 | Det 36 | Det 4 | Det 12 | Det 20 | Det 28 | Det 36 |
| 7 | | | | | | | | | | | | | | | | |
| 8 | Det 37 | Det 5 | Det 13 | Det 21 | Det 29 | Det 37 | Det 5 | Det 13 | Det 21 | Det 29 | Det 37 | Det 5 | Det 13 | Det 21 | Det 29 | Det 37 |
| 9 | | | | | | | | | | | | | | | | |
| A | Det 38 | Det 6 | Det 14 | Det 22 | Det 30 | Det 38 | Det 6 | Det 14 | Det 22 | Det 30 | Det 38 | Det 6 | Det 14 | Det 22 | Det 30 | Det 38 |
| B | | | | | | | | | | | | | | | | |
| C | Det 39 | Det 7 | Det 15 | Det 23 | Det 31 | Det 39 | Det 7 | Det 15 | Det 23 | Det 31 | Det 39 | Det 7 | Det 15 | Det 23 | Det 31 | Det 39 |
| D | | | | | | | | | | | | | | | | |
| E | Det 40 | Det 8 | Det 16 | Det 24 | Det 32 | Det 40 | Det 8 | Det 16 | Det 24 | Det 32 | Det 40 | Det 8 | Det 16 | Det 24 | Det 32 | Det 40 |
| F | | | | | | | | | | | | | | | | |

Note: Shaded entries are read only.