



**FOR A WINDOWS BASED
TRAFFIC MANAGEMENT
AND CENTRAL MONITORING SYSTEM**

This Specification is fully met by the following Econolite models:

Aries - 35400G1 Full System

Aries - 35400G2 Upgrade from Zone Monitor

Aries - 35400G3 Workstation Version



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1 Introduction

1.1 System Preface

This specification sets forth the minimum requirements for a Windows[®]-based traffic management system capable of controlling and monitoring system components.

1.1.1 Primary system objectives shall be as follows:

- a. Provide Windows-based multitasking system
- b. Coordinate traffic flow in an arterial zone
- c. Select multiple traffic plans
- d. Back-up coordination
- e. Monitor system in real-time
- f. Manage controller and zone master database
- g. Diagnose system malfunction
- h. Report diagnostic events and operational data
- i. Expand capability as needed

1.1.2 The principal system components shall be as follows:

- a. *Aries*-central office software
- b. On-street zone master controller
- c. Intersection controller
- d. Communication links

1.1.3 The system shall feature on-street microprocessor-based zone masters with the ability to select traffic signal coordination plans in a zone of intersections, based on actual traffic conditions. Alternatively, zone operation shall be controlled by Time-Of-Day (TOD) external commands or manual commands. The zone master shall also monitor system performance and provide feedback to *Aries* indicating zone operational status.

1.1.4 Intersection controllers shall be microprocessor-based and shall include coordination, time-based control, preemption, and communications capability.

1.1.5 System design shall provide backup capabilities to allow continuation of a satisfactory level of coordinated zone operation should *Aries*, zone master, intersection controller, or communications link failures occur. Additionally, the system shall provide for coordinated traffic flow between crossing arterial zones.

1.1.6 *Aries* consists of one single computer or a network of personal computers and peripheral equipment and shall communicate with the zone masters. The personal computer shall contain an *Aries* communications server to receive and store diagnostic events and detector data. While monitoring information from zone masters, *Aries* shall simultaneously allow the system operator to:

- a. Generate and display in real-time, intersection graphics, and zone maps
- b. Issue manual commands to zone masters and intersection controllers
- c. Provide zone master and intersection controller database management as follows:
 - (1) Upload database from zone masters and intersection controllers
 - (2) Edit database and save on disk
 - (3) Download database to zone masters and intersection controllers



- (4) Retrieve detector logs and event logs from local controllers (*ASC/2* & *ASC/3* series controllers only)
- d. Print event reports from monitor and data is saved onto a disk
- e. Print or plot multiple system detector data from data stored on a disk to a common window or page
- f. Provide facility for traffic analysis programs

1.1.7 *Aries* shall be designed to enable expansion without redesign of any of the system components.

1.2 Design Requirements

1.2.1 *Aries* shall be defined as a Windows-based Traffic Management and Central Monitoring System.

1.2.2 *Aries* shall provide a Graphical User Interface (GUI) and the system shall utilize a point-and-click operation and icons will indicate active status of a function.

1.2.3 *Aries* shall provide a Client-Server Architecture.

1.2.4 The *Aries* communications server computer provided for this project shall provide up to 16 active communications ports.

1.2.5 *Aries* shall provide full multitasking operation and shall use Windows NT, Windows 2000, Vista, or Windows XP for its operating system.

1.2.6 *Aries* shall consist of a Personal Computer (PC) or network of computers, with peripheral and communications equipment (as required by these specifications) as well as all necessary operating and traffic control software. A complete list of hardware and software is outlined in Section 7.0.

1.2.7 *Aries* shall provide distributed network support and the communications server shall handle all communications tasks. System operations shall be capable from any work station.

1.2.8 The system operator shall have full operational access to as many as 16 active masters at one time (based on computer hardware and operating system supplied). *Aries* shall offer the freedom to run non-system related programs while continuing to run any of the *Aries* program modules.

1.3 System Structure

1.3.1 A zone shall be defined as an operating area that contains up to 24 intersection controllers linked to one zone master, with each zone master linked to *Aries*.

1.3.2 A zone shall contain actuated system type intersection controllers of the same manufacturer. This feature shall permit mixing and integrating new TS-2 and existing TS-1 intersection controllers or 2070 controllers with either *ASC/2070* or *ASC/3 2070* software.

1.3.3 *Aries* shall have the capacity to control and monitor from 1 to 255 zone masters. Maximum system monitoring capacity shall be 6,120 intersection controllers using 255 zone masters.

1.3.4 Each zone master and intersection controller shall meet, as a minimum requirement, the applicable sections of NEMA Standards Publication No. TS2-2003. Where differences occur, these specifications shall govern.



- 1.3.5 Each zone master shall be designed for on-street operation.
 - 1.3.5.1 Each shall coordinate vehicular traffic flow within a zone by selecting traffic signal timing plans based on actual traffic conditions, manual commands, external commands, or by TOD.
 - 1.3.5.2 Each zone master shall monitor its zone performance and provide operational status to *Aries*. Each zone master shall have the capacity to process data from up to 32 system detectors.
- 1.3.6 Each intersection controller shall be capable of a system interface to the zone master through telemetry. Each shall be capable of coordination as directed by the zone master. Each controller shall have the capacity, at a minimum, to process data from up to 16 system detectors and a minimum of 16 local detectors.
- 1.3.7 The *ASC/2M* master shall be capable of communicating to an *ASC/2(S)*, *ASC/3*, *ASC-8000*, *2070L* controllers with either *ASC/2070* or *ASC/3 2070* software, *KMC* or *KFT* controller. It shall be possible to communicate with a mixture of controllers.
- 1.3.8 The system shall provide back-up capabilities which shall allow the continuation of system coordination should *Aries*, zone master, or communication link failures occur.
- 1.3.9 *Aries* shall be capable of connecting to the master through either dial-up, direct connection, or through RS232 connection to a wireless or fiberoptic link.
- 1.3.10 *Aries* shall be capable of connection directly to an *ASC/2(S)* or *ASC/3* controller for uploading and downloading purposes.

2 *Aries* Description

Aries shall be a Windows-based traffic management and central monitoring system for a hard-disk supported IBM personal computer (or compatible) or network of computers and peripheral equipment.

2.1 *Local Area Network (LAN) Compatibility*

- 2.1.1 The *Aries* software shall be capable of operating in a LAN configuration that supports a Microsoft® network. The *Aries* LAN configuration shall support a minimum of one communications server computer and eight work stations. LAN operation shall provide the capability of having multiple users and multiple workstations working simultaneously on a common database.
- 2.1.2 The actual LAN software shall be provided by the operating agency unless specified in the bidding documents to be provided as part of this bid.

2.2 *Software Description*

- 2.2.1 *Aries* software shall be loaded into the specified personal computer(s) and operationally verified by the supplier. Backup software shall be supplied on a CD ROM and an installation program shall be provided for loading the software.
- 2.2.2 The furnishing supplier of the *Aries* software shall license the agency for its use on a single computer, or multiple computers as required by these specifications. Software improvements and enhancements which occur within one year of the contract date shall be furnished to this agency at no additional cost.



2.3 Graphical User Interface (GUI)

- 2.3.1 The programming displays on the PC screen shall provide the GUI and will aid the operator in entering data from the PC keyboard. A Windows based user interface shall be provided as a standard feature. *Aries* application programs shall include, at a minimum, Menu Bars, Minimize/Maximize buttons, Scroll bar and Scroll arrows. Icons shall allow the user to point-and-click to start *Aries* program modules. Toolbars with tool tips shall be provided for most commonly used program functions.
- 2.3.2 *Aries* software shall provide rapid movement through programming screens; pull down-menus and data base pages. Returning to the *Aries* application tree shall require no more than a sequence of Alt-Tab or a mouse click.
- 2.3.3 Traffic engineering terminology shall be used throughout all *Aries* programming display screens. Display organization and data entry approach shall allow system operators to program *Aries* without using reference cards or manuals. Mnemonic usage shall be minimized and limited to recognized traffic engineering terms.

3 Software Features

Aries shall provide ten basic program modules of operation for the operator to choose from. An icon or pull down menu shall be provided to the operator to initiate any or all of these procedures.

- a. *Aries* Zone Manager
- b. *Aries* Communications Server
- c. *Aries* Zone-Intersection Displays
- d. Operations Scheduler
- e. *Aries* Data Entry
- f. *Aries* Log File Manager
- g. *Aries* Split Monitor
- h. *Aries* Green Band Display
- i. Zone Master Speed Trap Viewer
- j. Autoscope Browser (optional purchase)

3.1 *Aries* Zone Manager

- 3.1.1 The *Aries* Zone Manager shall allow selection of all functions associated with zone masters and intersection controllers that will launch (start) all *Aries* program modules. The Zone Manager shall include a directory of all zones and intersections. This directory shall be displayed in a tree format with each zone being a displayed node of the tree. Each zone (node) of the tree shall be capable of being expanded or contracted to display intersections (elements). A zone or intersection shall be selected by highlighting it (left click) in the tree display. Right clicking on the highlighted zone or intersection shall cause a pop-up menu of the functions that can be performed for the type of zone master or controller selected.
- 3.1.2 *Aries* shall provide the data base management functions outlined in section 3.5 *Data Entry*.
- 3.1.3 Upload/Download
 - 3.1.3.1 All devices shall use upload/download techniques for data base programming.
 - 3.1.3.2 Upload/download shall transfer the entire programmable data base from/to the zone master and any programmable section of an intersection controller via the zone master, with the exception of



intersection controller configuration/sequence, preemptor, and overlap configurations. It shall be possible to select segments of the local controller data to be uploaded/downloaded.

- 3.1.3.3 All upload/download of data shall use block transfer techniques and be verified by block checksum and word parity. Non verified data shall cause termination of the upload/download with no data transfer taking place. It shall not be possible to load erroneous interval and configuration information to the controller.
- 3.1.3.4 Upload techniques shall not cause the system or intersection controller to go off-line. Traffic control operation shall remain intact in all respects.
- 3.1.3.5 It shall be possible to compare the data base of any zone master or intersection controller to the data base on file. The compare function shall be executed by a simple point-and-click process and shall identify any differences between uploaded and file data. The system operator shall be able to correct, use, or substitute data values and proceed with further comparison.

3.1.4 Status Events and Reports shall be generated by the zone master controller in response to one of the following:

- a. Manual command at *Aries* Zone Manager
- b. *Aries* Operations Scheduler

3.1.4.1 These reports shall present an immediate record of system operational status on the *Aries* communications server display. Provisions shall be made for hard copy printout. Status report contents are described in **section 3.9**.

3.1.4.2 *Aries* shall provide a means to transfer stored events in the zone master (up to 255 events) to the *Aries* computer hard drive. These events shall be displayed on the *Aries* communications server display in the order recorded. The user shall be able to print all or selected portions of the events received by the *Aries* communications server. If the event storage memory in the zone master becomes full, the newest event shall overwrite the oldest event. Overwritten events shall be not retrievable.

3.1.4.3 *Aries* shall provide a means to transfer *ASC/2* and *ASC/3* controller stored events, Malfunction Management Unit (MMU) log, and detector logs to the *Aries* computer. In addition, it shall be possible to display and print these logs.

3.1.5 Security

3.1.5.1 System security at *Aries* shall be ensured through three levels of access, the levels are as follows:

- a. Supervisor
- b. Data change
- c. Viewer

3.1.5.2 The supervisor and data change levels shall have separate access codes that must be entered prior to making database changes.

3.1.5.3 The supervisor level shall permit access code number assignments and database changes, this allows database changes. If an incorrect code is entered, database changes are denied. Viewer level shall not permit any database changes.



3.1.5.4 For an added level of security, zone access codes shall be provided. Each zone shall be assigned a code in the zone master. Without the proper zone access code, upload/download transfers shall not be possible.

3.1.6 Directories

3.1.6.1 Zone and intersection directories shall be provided to locate zone masters, associated intersection controllers, and intersection surveillance units, by name or number.

3.1.6.2 Zone directory text shall describe each of the 255 zones. A zone name may be entered and shall identify the zone in report titles and zone master database pages.

3.1.6.3 Intersection directory text shall list intersection names and telephone numbers for each associated zone master and intersection surveillance unit. An intersection name may be entered and shall identify the intersection in menus, intersection displays, and intersection data base pages. It shall be possible to reverse street names on intersection displays by placing an asterisk (*) after the street names.

3.1.6.4 It shall be possible for the user to assign names to the intersection controller alarm inputs. These names shall identify alarms in event reports. Each alarm name shall be up to 20 characters.

3.1.7 Zone - Intersection Notes

3.1.7.1 A notepad feature shall be included that allows a user to enter notes to record a history of database changes, actions taken, or any other text information. This feature shall allow the creation of a separate notes file for each defined zone and intersection.

3.1.7.2 The notepad feature shall allow the entry and editing of any standard keyboard entered text. In addition, the user shall be able to print the contents of the notes file, plus cut, copy, or paste selected portions of the file to other Windows applications.

3.2 *Aries Communications Server*

3.2.1 The *Aries* software shall include a communications server to provide communications services to the *Aries* client application programs. The *Aries* communications server shall be capable of running on the same computer with all other *Aries* programs in a single computer application or on a separate computer for a networked application. Multi-channel and multi-tasking capabilities shall be provided by the *Aries* communications server. Each channel shall be able to handle either a dial-up or direct connection to the zone master, local controller, or intersection surveillance unit.

3.2.2 The *Aries* communications server shall provide an event and status window to receive status change and operational failure event reports from zone masters and intersection surveillance units.

3.2.3 Once the computer power-up routine is complete, the *Aries* communications server shall be in operation. It shall be possible for the operator to enter a non system user mode at anytime without affecting the *Aries* communications server operation.

3.2.4 By default, *Aries* shall provide a pop-up window informing an operator of an incoming alarm or event if the operator is in another *Aries* program or in another Windows program. Operator acknowledgment shall be required to cancel this window.



- 3.2.5 *Aries* communications server reports shall be shown on the *Aries* PC display as they are received. The user shall be able to select all or portions of the reported events to be sent to a printer. Printed events shall consist of zone identification, time and date of event occurrence, device identification (if a device diagnostic event), and event description.
- 3.2.6 Status changes and operating failure events at any intersection controller and zone master shall be recorded by the zone master at the time of failure or event occurrence. Events shall be reported to *Aries* on a priority basis.
- 3.2.7 Reporting priority shall be selectable by event or failure and shall be programmable as immediate, delayed (0-255 minutes), report with higher priority, or not at all. This programming scheme shall reduce the amount of telephone line usage for this agency, thus, minimizing telephone costs while maximizing system operation.
- 3.2.8 Telephone number entries shall be programmable from *Aries* to allow event reporting to *Aries* and to report device failures to another maintenance computer or terminal. Device failure reports to a maintenance computer or terminal shall be done only when scheduled by a TOD entry.
- 3.2.9 If the *Aries* communications server is busy or off-line, a reporting zone master unit shall repeatedly attempt to call at a user-programmable retry interval.
- 3.2.10 Program and mode changes shall occur automatically as a result of Traffic Responsive (TR) plan computations, TOD scheduling, external, and manual commands. Program and mode event changes shall include the following:
 - a. In effect program change
 - b. TR program change
 - c. Special function change
 - d. Time-of-day interval change
 - e. Controller command mode change
- 3.2.11 System events shall be zone master self diagnostics. The diagnostic messages include:
 - a. Power-off
 - b. Power-on
 - c. Power interrupts
 - d. Clock error
 - e. Back-up
- 3.2.12 All device diagnostic failures shall be reported as events.
- 3.2.13 Two types of detector data shall be processed by *Aries*:
 - 1. Real-time logs
 - 2. Buffered data
- 3.2.14 The user shall be able to select to print real-time log reports after they have been received by *Aries*. The user shall also be able to select to print these reports after they are received. System detector and/or speed logs and sample period logs shall be scheduled, formatted, and output from the zone master.
- 3.2.15 Buffered data from system detectors shall be accumulated in the zone master at 15, 30, or 60-minute intervals. Buffered data shall be transferred to *Aries* each 6, 12, or 24 hours, as scheduled in the zone master.



- 3.2.16 *Aries* shall store buffered system detector on hard disk files for use in producing log and plot reports. Provisions shall be made for transferring buffered data files to a diskette for historical record keeping. Buffered data files shall be removed from hard disk after file transfer to a storage diskette to prevent overflowing the hard disk.

3.3 *Aries Zone-Intersection Displays*

- 3.3.1 *Aries* shall be capable of displaying the following in real-time color graphics:
- Zone map displays
 - Intersection displays
- 3.3.2 Maps from more than one zone shall be capable of being displayed simultaneously when multiple communication channels are used. Only one type of map (zone or intersection) is required to be active in each zone.
- 3.3.3 All text data shall be displayed in traffic engineering terms and mnemonics shall be acceptable. However, the need for reference guides and manuals shall not be acceptable. All information shall be shown simultaneously and continuously displayed until canceled by the operator. Displays shall not affect system on-street operation. Both displays shall have a maximum one-second resolution.
- 3.3.4 Zone Display
- 3.3.4.1 *Aries* shall provide the capability for a zone map display. The zone map display shall simultaneously provide 12 phase and 4 overlap green indications for up to 24 intersections. The display shall also indicate the relative placement and activity for up to 32 system detectors. Display data shall include current system operating parameters, special function status, cycle countdown, zone control mode of operation, and consolidated intersection status.
- 3.3.4.2 Consolidated intersection status shall indicate if an intersection is on-line, free, has a coordination fault, is in preemption or flash, or has a telemetry failure.
- 3.3.4.3 Master and intersection status shall be capable of being displayed in user-selected pop-up status windows.
- 3.3.4.4 The zone map display shall also enable usage of external graphics software images. Screen images may be from files generated from a customer provided, Personal Computer Format (PCX), "Paint," "CAD," or "Scanner" software packages. Signal data shall be assignable to shapes representing the signal heads, traffic movements, or system detectors.
- 3.3.4.5 *Aries* shall allow the user to launch into an intersection display by clicking on the intersection while in the zone map display.
- 3.3.5 Intersection Display
- 3.3.5.1 Each display shall be operator-created in high resolution graphics to indicate the intersection configuration, including any "T," standard diamond, standard quad, or other intersection configuration required on a single screen display. The operator shall have a set of standard high resolution intersection templates in VGA graphics, or the operator can create a custom intersection display using a graphics screen image stored in PCX format. It shall be possible to import images into *Aries* using customer's supplied PCX formatted "Paint," "CAD," or "Scanner" software packages. The intersection display shall show the following, as a minimum, in real time:



- a. Intersection configuration layout for up to twelve phases, four overlaps, dual-ring operation
 - b. All vehicle signal indications (R, Y, G) for each active phase
 - c. All pedestrian signal indications (walk, flashing, and solid don't walk) for twelve active phases
 - d. Vehicle and pedestrian detector actuations for each displayed phase
 - e. Up to four overlap signal indications
 - f. Zone master and intersection controller identifier numbers, including intersection street names
- 3.3.5.2 The displays shall also include dynamic status information for the zone master and the intersection controller. This status information shall be capable of being displayed as part of the map and user-selected pop-up status windows. Zone master status shall consist of operational status: cycle, offset, split or plan in effect, cycle length, cycle countdowns, and status of special functions. Zone control mode status shall include manual, external, TOD, or TR operation.
- 3.3.5.3 Intersection controller dynamic data shall consist of operational status: non-interconnected coordination, coordination offset value or free/plan indicator, split values based on cycle and split in effect, preemption status, and diagnostic indications. Operational status shall include on-line, off-line, failed, or disabled. If the intersection controller is off-line or failed, the conditions causing that failure shall also be displayed with alarms, preempt call numbers, and preemptors in effect will also be shown.

3.4 *Aries Operations Scheduler*

- 3.4.1 *Aries* shall provide a TOD scheduler operation. An icon or pull-down menu item from the menu bar shall be provided to enter the *Aries* Operations Scheduler. The scheduler shall allow the user to create new scheduled operations, display a list of schedule items, including their status, print, and clearing the schedule progress list.
- 3.4.2 The scheduler shall provide a time out feature, user settable from 1 to 60 minutes. At the conclusion of this timer, *Aries* shall stop trying to perform a scheduled operation.
- 3.4.3 The *Aries* scheduler shall include a progress window that displays the progress of scheduled operations and the user shall be able to print or clear the progress list.
- 3.4.4 The *Aries* scheduler shall provide a Create New Operation; this shall allow the operator to schedule the following items:
- a. Auto-Time set
 - b. Auto compare
 - c. Auto upload
 - d. Auto download
 - e. ASC/2 event, MMU, and detector log transfer
 - f. ASC/3 event, MMU, and detector log transfer
 - g. Zone Master status
 - h. Zone Master system detector log transfer
 - i. Zone Master event transfer
 - j. Intersection Monitor status
 - k. Intersection Monitor event, detector, and snapshot log transfer
 - l. Split monitor reports



For all scheduled operations, the user shall be able to select the date, time, priority and report interval of the operation to be scheduled.

- 3.4.4.1 The auto-time set shall allow the operator to automatically set the NIC time clocks in all or selected zone masters. Selections shall be made by highlighting the desired zone master listed.
- 3.4.4.2 A programmed upload and compare shall be provided. The operator shall be able to select the time and repeat interval, which intersections to upload and compare, which segments shall be uploaded and compared for the entire zone, and whether the operator would like to do a byte or quick compare. The byte compare shall check all bytes from the controller to the database on file. Quick compare shall perform a Cycle Redundancy Check (CRC). The quick compare is only available for ASC/2 and ASC/3 controllers.
- 3.4.4.3 An auto upload shall allow the entire zone master database and selected intersections to be automatically uploaded and stored to the existing database on disk or create a new database if one does not already exist.
- 3.4.4.4 An automatic download shall allow the entire zone master database and selected controllers to be automatically downloaded.
- 3.4.4.5 An automatic ASC/2 and ASC/3 log transfer shall allow the operator to schedule retrieval of ASC/2 and ASC/3 event, MMU, and detector log information. The user shall have the ability to select intersections to transfer logs from a list of available intersections.
- 3.4.4.6 An automatic zone master status report shall be capable of being scheduled and the user shall have the ability to select the zone(s) to report status from a list of available zones.
- 3.4.4.7 An automatic zone master system detector log transfer shall be capable of being scheduled and the user shall have the ability to select the zone(s) to transfer detector logs from a list of available zones.
- 3.4.4.8 An automatic zone master event log transfer shall be capable of being scheduled and the user shall have the ability to select the zone(s) to transfer event logs from a list of available zones.
- 3.4.4.9 An automatic intersection surveillance unit event, detector, and snap-shot log transfer shall be capable of being scheduled. The user shall have the ability to select the type of data to be transferred and which units to perform the transfer from a selection list.
- 3.4.4.10 Split Monitor reports shall be capable of being scheduled using the *Aries* Operation's Scheduler (see section 3.7). The user shall have the ability to select intersects to monitor from a list of available intersections.

3.5 *Aries Data Entry*

- 3.5.1 Database management shall allow programming of zone master and intersection controllers in a zone and intersection controllers in a direct zone. Each zone master and intersection controller shall have separate data base programming pages, these pages shall contain all the programming options unique to each device type.
- 3.5.2 Data entry fields shall be selected using a mouse. In addition, once a data entry field has been selected, the TAB key shall allow advancing to the next data entry field.
- 3.5.3 Once database management has been selected, a programming window shall be presented listing the database pages available for programming. It shall be possible for the user to scroll through the data pages of a device



and then to select a data page by highlighting it. Once a page has been selected, a window shall be displayed that shall allow the operator to select the data area they want to view or modify (via a tabular selection at the top of the window).

- 3.5.4 All programming entries shall primarily consist of numerical values or with a mouse, checking a box to toggle from yes-no or on-off. During program entry, the new data shall overwrite the old data. If the new data is in error, changes shall not be permitted and the user shall be alerted by either an error message on the display or a warning tone.

3.6 *Aries Log File Manager*

- 3.6.1 *Aries* shall provide a Log File Manager operation. An icon or pull-down menu item from a menu bar shall be provided to enter *Aries* Log File Manager. A log file tree shall be provided to allow the operator to display and print either:
- Event logs
 - Detector volume or occupancy reports
 - Detector volume or occupancy plots
- 3.6.2 *Aries* shall include an iterative operation for preparing an event report for any combination of event type and system device.
- 3.6.2.1 A directory search capability shall be provided that lists in a tree format, years, months, days, and zone numbers. The operator shall point-and-click with a mouse to highlight the date and zone to be included in a report. This procedure shall present to the operator, a Log Data Window which will provide the user with an Event Filter. The Event Filter shall allow the operator the ability to select one of the following areas:
- All events
 - Zone Master
 - Intersection controller
 - System detector
 - Intersection detector
 - Speed Trap/Speed Sign
 - Miscellaneous
- 3.6.2.2 The operator shall be able to point, click, and drag another date and zone to add to an existing Log Data Window event report. This event report shall provide the operator with another Event Filter for this new date/zone combination.
- 3.6.2.3 The Event Filter shall make it possible to display and print events as received or sorted by event type. If event type selected is for a system device, it shall be possible to specify all devices or a single device.
- 3.6.3 Detector Reports and Plots
- 3.6.3.1 *Aries* shall provide the capability to present detector log reports and plots, on demand by the operator, for any period for which buffered data is available on a hard disk of the *Aries* computer.
- 3.6.3.2 The operator can specify a zone over time and day, this will provide actual volume and occupancy for all detectors assigned. Actual volume shall be the number of vehicle counts accumulated for the



log interval. Occupancy shall be the percentage of time vehicle presence was detected during the log interval.

3.6.3.3 *Aries* shall provide the following log report and plot from buffered data files:

- a. System detector Volume and Occupancy log report
- b. System detector Volume and Occupancy plot

3.6.3.4 A directory search capability shall be provided that lists in a tree format, years, months, days, zone number, and detector numbers. The operator shall point and click with a mouse to highlight the correct date, zone and detector number to be included in a log report or plot. This procedure shall allow the operator the ability to select the following:

- a. Volume Plot
- b. Volume Log Report
- c. Occupancy Plot
- d. Occupancy Log Report
- e. Export Detector Data

3.6.3.5 *Aries* shall provide a plot that shall allow the operator to either plot the volume and/or occupancy of up to eight detectors. The first detector can be selected as described above. The remaining seven detector plots shall be capable of being selected by dragging one detector at a time to the Log Data window.

3.6.3.5.1 *Aries* shall provide the operator the choice of Detector Volume or Occupancy to be plotted with the first detector. System detector plots shall present a profile of actual volume or actual occupancy for each log interval on file for a selected system detector. Each detector shall be plotted using a different color.

3.6.3.5.2 *Aries* detector plots shall provide the user a plot legend. The plot legend shall provide the user with a color coded detector plot legend, the date of the data, zone number, detector number, and whether it is a volume or occupancy plot.

3.6.3.5.3 Once a volume or occupancy plot has been created it shall be possible to right click on the plot and bring up a menu of plot options. These shall include at a minimum:

- a. Shows data as a text report
- b. Change plot scales
- c. Show plot data sources
- d. Set limit indicators
- e. Turn on/off volume or occupancy plot grids
- f. Print plotted data
- g. Save plot as a profile for later retrieval

3.7 *Aries Split Monitor*

3.7.1 *Aries* shall include the capability to display, in real time, a split monitor report. This report shall also be able to be printed as selected by the user. This report shall be utilized in optimizing system operation on an intersection-by-intersection basis.

3.7.2 The split monitor report shall consist of an on-line report, which gets updated every cycle; this gives the operator a comparison of actual programmed split percentages versus the actual split percentages utilized by each phase during the last cycle. At the end of each cycle, a split report shall be sent to *Aries* from the



controller via the zone monitor. The report shall be displayed on the screen of the *Aries* computer and the report can be sent to a printer for later analysis.

- 3.7.3 The split monitor report shall show, as a minimum, the following:
- Intersection number and zone master number
 - Time and date report was started
 - Programmed split percentages for each phase
 - Cycle/split in effect
 - Status of coordinator (i.e., coordinated or transitioning)
 - Local NIC time
 - Actual split used: a negative number indicates the phase terminated prior to being forced off and used x percent less than the programmed split, and a positive number indicates the phase started early and the phase timed x percent more than the programmed split h. An F shall be displayed if a phase was forced off.
- 3.7.4 *Aries* shall support collecting split monitor reports from multiple intersections within a selected zone simultaneously. Intersections to report shall be selected by highlighting the desired intersection from an available list of intersections.
- 3.7.5 Split Monitor reports shall also be capable of being selected on a scheduled basis.

4 System Controllers

This section sets forth the minimum requirements for a shelf-mountable, two through twelve phases, fully actuated, digital, solid-state traffic controller. The controller shall meet, at a minimum, all applicable sections of the NEMA Standards Publication No. TS2-2003. Controller versions shall be available to comply with NEMA TS2 Types 1 and 2. Type 2 versions of the controller shall be capable of operating as a Type 1 or in a TS1 cabinet. Also a 2070 controller with either ASC/2070 or ASC/3 2070 software shall operate on the system.

4.1 Design

- 4.1.1 A 32-bit microprocessor shall be used for all timing and control functions. Continuing operation of the microprocessor shall be verified by an independent monitor circuit, which shall set an output to FALSE and indicate an error message if a pulse is not received from the microprocessor within a selectable period.
- 4.1.2 User-programmed settings and intersection configuration data shall be stored in an Electrically Erasable Programmable Read-Only Memory (EEPROM). Designs using a battery to maintain user data shall not be acceptable. Write-protection shall be provided for the portion of the EEPROM used to store intersection configuration data.

To facilitate the transfer of data from one controller to another, an EEPROM shall be mounted on an easily removable sub-module, which shall be connected to the processor module via a DIN printed circuit board connector, alternately data shall be transferred using a data key.

- 4.1.3 A 16-line by 40-character/line alphanumeric Liquid Crystal Display (LCD) shall show program and status information. The display area shall have nominal measurements of 2 1/2" x 4 1/2" (H x W) or larger. For ease of viewing, backlighting by light emitting diodes and multiple levels of contrast adjustment shall be provided.



The display shall provide two modes of operation, program, and dynamic. The programming mode shall display user programming information, while the dynamic display shall provide a visual status of real-time operations for the major functions of the controller.

- 4.1.4 Programming shall be via a front panel keyboard and shall use a menu driven approach. Cursor keys shall allow the user to scroll through data entries.

The keyboard shall provide tactile and programmable audio feedback when depressed. The keyboard shall also be capable of entering vehicle, pedestrian, and preemption calls during test.

4.2 Operation

- 4.2.1 The controller shall, at a minimum, provide the following functions as standard features:

- a. Actuated control
- b. Coordination
- c. Time-based control
- d. Multiple railroad and fire lane preemptors
- e. Bus preemptors
- f. Communications capability

- 4.2.2 A minimum of 32 vehicle detector inputs shall be provided by the controller. Each input shall be assignable to any phase and be programmable as to detector function, including, delay, extend, stop bar, dilemma zone, and cross switching.

- 4.2.3 The controller shall be capable of logging and reporting detector activity, detector failures, MMU events, and the occurrence of selected controller events or alarms. Logs shall be capable of being printed or displayed on the front of the controller and transferred on command to *Aries*.

5 Zone Master System Capabilities

This section sets forth the minimum requirements for a shelf-mountable, digital, solid state zone master. The zone master shall meet, at a minimum, all applicable sections of the NEMA Standards Publication No TS2-2003.

5.1 Design Requirements

- 5.1.1 The zone master shall be a microprocessor-based device that shall control and supervise a zone of intersection controllers. It shall also provide the communications link between *Aries* and each of the intersection controllers within the zone.

- 5.1.2 The zone master shall have the capability to generate system commands to its associated intersection controllers, either in response to prevailing traffic conditions as indicated by system detectors or by TOD, external command input, or manual input.

- 5.1.3 Up to 64 traffic plans shall be constructed from the following options:

- a. 6 cycle lengths
- b. 5 offsets/cycle
- c. 4 splits/cycle



- d. 4 special functions
 - e. Free
 - f. Plan command
- 5.1.4 The synchronization point for the cycle selected by the current traffic plan shall be computed using user-specified resync time and cycle length. The synchronization point shall occur whenever the present time is such that an even number of cycle length periods has occurred since the resync time. Computing the synchronization point based on event changes or similar methods shall not be acceptable.
- 5.1.5 The cycle/offset/split options shall provide capability for up to 64 or 120 user-specified traffic plans.
- 5.1.6 The zone master shall monitor the operation of all the associated intersection controllers, local detectors, system detectors, and speed traps. Should malfunctions occur, it shall initiate alarms and failure reports to the zone monitor.
- 5.1.7 Zone master shall provide:
- a. Traffic plan selection
 - b. Crossing arterial synchronization
 - c. Diagnostics
 - d. Events
 - e. Logs
 - f. Reports
 - g. Data entry
- 5.1.8 The traffic plan shall be selected on a priority basis. The highest priority shall be manual commands, followed by external commands, time-of-day/day-of-week/week-of-year scheduled commands, and traffic responsive commands. Plan Command feature shall be provided that will allow the controllers in a common zone to be controlled under different plans.
- 5.1.8.1 TR operation shall be the primary operating mode of the zone master. Traffic plans shall be automatically selected in response to real-time system detector input data. These commands shall be transmitted to and implemented by the intersection controllers within its zone to coordinate light to heavy traffic flow.
 - 5.1.8.2 Up to 32 system detectors shall provide volume and occupancy data, processed into scaled values. The volume and occupancy scale factors shall be user-specified for each detector; otherwise a user-specified system value shall be used.
 - 5.1.8.3 Plan commands shall implement up to 32 user-determined plans stored in the local intersection controllers. When plan command is specified by the traffic plan, the zone master shall issue a command to initiate selection of a local plan. Intersection controllers may contain the same or different programs which shall allow sub-zone coordination or independent operation under time-base control.



5.2 Diagnostics

- 5.2.1 Diagnostic tests shall be continuous checks performed on system detector data, telemetry communications, and telemetry connected devices. Detected faults shall produce event failures at the zone master and the zone monitor.
- 5.2.2 Device Diagnostics – if operating in a system, diagnostic failures shall be reported to the zone monitor as events. The following devices shall be monitored:
 - a. Telemetry
 - b. Local intersection controllers
 - c. System detectors
 - d. Local detectors
 - e. Speed traps

5.3 Zone Status

- 5.3.1 The zone status report shall describe the zone operating conditions.
- 5.3.2 The report shall be a concise printout including the following categories and status:
 - a. Traffic responsive program (computed values)
 - b. Traffic responsive plan
 - c. Program-in-effect and source
 - d. Special function status
 - e. Telemetry status:
 - (1) Channel on-line
 - (2) Zone master transceiver failure
 - (3) Channel loop failure
 - (4) Local intersection controller telemetry failure
 - (5) Channel disabled
 - f. Intersection controller status:
 - (1) On-line
 - (2) Off-line
 - (3) Failed
 - g. System detector status:
 - (1) On-line
 - (2) Failed
 - h. Speed trap status:
 - (1) On-line
 - (2) Failed
 - i. Local detector status (failed only)

6 Communication Links

Data communications shall be provided between system components as follows:

- a. Bi-directional data transfer between *Aries* and all zone master units in the system through commercial telephone dial-up techniques (1200 or 2400bps) or by direct connection (1200, 2400, 4800, or 9600bps).



- b. Bi-directional data transfer between a zone master and all intersection controller(s) within its zone by customer-owned or leased communication wire pairs or Fiberoptic (single mode or multi mode) communication cable. Data transmission shall utilize Time-Division-Multiplex/Frequency-Shift-Keyed (TDM/FSK) method operating in the full duplex mode with rates of 1200bps minimum for customer owned or leased communication wire pairs. Alternately, data rates of up to 9600bps shall be supported with external fiber optic or short-range modems. Also with addition of an optional Ethernet module to the master shall communicate to the local controllers equipped with Optional Ethernet modules, through Ethernet communications.
- c. Bi-directional data can be transferred between *Aries* and all intersection surveillance units in the system through commercial telephone dial-up techniques with data transfer rates at a minimum of 1200bps.

6.1 Communications between *Aries* and Zone Masters

- 6.1.1 Communications between *Aries* and zone masters shall be accomplished by either a dial-up or direct connection. The *Aries* communications server shall be capable of supporting up to 16 channels of communications, simultaneously (when using Windows NT or Windows WP or Windows Vista operating system).
- 6.1.2 Each communication channels on the *Aries* computer shall be connected to the zone master using one of the following methods:
 - a. Dial-up modems
 - b. Direct cable
 - c. Direct cable with short range modems
 - d. Direct cable with fiber optic modems
- 6.1.3 All data transmissions, regardless of the communications method used, shall use block transfer techniques verified by block checksum, and word parity. Non-verified data shall cause termination of the transmission and no data change shall take place.
- 6.1.4 The *Aries* software shall provide a 1-19 digit zone master telephone number. It shall be possible to induce delays required by the private telephone system interface in order to link with a telephone's company trunk circuits.
- 6.1.5 Each zone master shall initiate communications to the *Aries* computer over the above described circuits. In addition, each zone master shall provide three independent telephone numbers for reporting system readiness, programmable by the *Aries* software. The telephone numbers shall be provided for the following:
 - a. Event reporting
 - b. Log reporting
 - c. Maintenance call reporting
- 6.1.6 The maintenance call telephone number shall provide for priority one or device event reports to a maintenance facility printer or *Aries* computer monitor when enabled by TOD scheduling.
- 6.1.7 The *Aries* computer shall answer telephone calls from any zone master only when the *Aries* communications server is active. If a reporting zone master receives a busy signal, it shall attempt to re-dial or reconnect the *Aries* computer at user-specified intervals.



6.1.8 When a telephone call is answered by the *Aries* computer, the zone master shall be connected long enough to transfer the data and at the end of the transmission, the call shall be terminated.

6.2 *Communications between Zone Master and Intersection Controllers*

6.2.1 Communications between zone masters and intersection controllers shall be accomplished via telemetry. Data transmissions shall utilize the Broadcast Polling Multi-Point Method.

6.2.2 The zone master shall poll the intersection controllers by telemetry address or IP (Internet Protocol) . Each intersection controller shall be assigned an address between 1 and 24. This address shall be programmable from the intersection controller front panel or cabinet hardwired.

6.2.3 Interconnect between the zone master and the intersection controllers shall be accomplished by one of three methods:

- a. Leased twisted pair unconditioned 3002 lines, or equivalent
- b. User-owned dedicated twisted-pair interconnect
- c. User-owned fiber-optic (single-mode or multi-mode) interconnect

6.2.4 If user-owned dedicated hardwired interconnect is to be used, then this interconnect shall be, at a minimum, 6-pair shielded cable for telemetry use meeting either REA-39, REA-89, - BJFA/BJFC or IMSA Spec 40-2-1984, IMSA Spec 39-2-1984 (for overhead figure eight, 40-4-1984 or 39-4-1984). The system supplier shall direct final hook-up of the interconnect in each intersection controller cabinet.

6.2.5 If user-owned, a fiber-optic interconnect cable is to be used, then this interconnect shall be, at a minimum, 4-fiber, 62.5/125 micron cable (multi-mode) or 8/125 micron cable (single-mode) with a Kevlar pull sheathing. Termination connectors shall be as called for by the equipment supplier.

6.2.6 If fiber-optic interconnect is specified, the equipment manufacturer/supplier must supply references from three (3) locations with at a minimum of one (1) year satisfactory field operational experience each.

7 *Aries* Computer Equipment

7.1 *Equipment Minimums*

All necessary cables and any other hardware necessary to install *Aries* shall be furnished. At a minimum the *Aries* computer shall consist of:

- a. Pentium 133 MHz compatible computer with the following features:
 - 1 gigabyte hard disk drive
 - 1.44 megabyte 3-1/2 inch diskette drive
 - 16 megabytes RAM
 - Battery-backed clock/calendar
 - Rocketport multiport serial board
 - SVGA graphics adapter with 2 megabytes of memory and support for 800 x 600 pixels
 - Parallel port
 - Keyboard
 - 17" SVGA color monitor
 - Windows 2000, Vista, or XP operating system software



- b. Windows compatible printer
- c. Microsoft mouse or equivalent
- d. U.S. Robotics 28,800 bps modems with power supply and cable, external, or internal
- e. Power strip with a minimum of six receptacles containing transient suppression

7.2 Recommended Equipment

To ensure the *Aries* computer is capable of operating future system software enhancements or system upgrades, the following hardware is recommended:

- a. Pentium 200 MHz compatible computer
 - 2 gigabyte hard disk drive
 - 1 CD-Rom drive
 - 1.44 megabyte 3-1/2" diskette drive
 - 32 megabyte RAM
 - 1 Rocketport multiport serial board
 - 1 extra RS-232 cable
 - 1 null modem adapter
 - SVGA color graphics adapter with 2 megabytes of memory and support for 1024 x 768 pixels
 - 19" SVGA color monitor
 - Windows 2000, Vista, or XP operating system software
- b. A Windows compatible laser or color inkjet printer
- c. Microsoft mouse or equivalent
- d. U.S. Robotics 28,800 bps modems with power supply and cable
- e. Power strip with a minimum of six receptacles containing transient suppression

8 Documentation

Manuals shall be supplied for all equipment and components of the system. The manuals supplied for *Aries*, peripherals, and the modem shall be supplied from the equipment manufacturer. *Aries* and control equipment manuals shall contain, at a minimum:

- a. *Aries* Users Guide
 - (1) Installation procedures
 - (2) Operating instructions
 - (3) System set up procedures
 - (4) Explanations and descriptions of data entry procedures
 - (5) Menu item descriptions
- b. Equipment installation and maintenance manual for each zone master and intersection controller
 - (1) Technical descriptions
 - (2) Operating instructions
 - (3) Theory of operation
 - (4) Detailed schematic diagrams
 - (5) Assembly drawings
 - (6) Wiring diagrams
 - (7) Troubleshooting procedures to assist the maintenance staff in the identification and isolation of malfunctions
 - (8) Parts list



- c. Wiring diagrams for each intersection cabinet

9 Training

Formal classroom training and "hands-on" operations training shall be provided for personnel designated by this agency. Training shall be provided on *Aries* software, zone masters, intersection controllers, intersection surveillance unit (if supplied), and any computer or communications equipment.

9.1 Classroom Training

- 9.1.1 Classroom training shall be provided for up to ten people designated by this agency. Copies of course materials shall be supplied to be retained by this agency. Training shall be provided for:
 - a. System operation
 - b. System maintenance
- 9.1.2 Personnel shall be trained to operate the system, analyze system performance, and revise system operating parameters based on the analysis. In addition, maintenance personnel shall be given training on maintenance and repair of all customer serviceable equipment. Training shall include field level troubleshooting and bench repair.

9.2 Hands-on Training

Hands-on training shall be provided to the agency personnel assigned to the project. The training shall consist of, at a minimum:

- a. Familiarity with construction details of all field equipment including but not limited to zone masters, intersection controllers, and interconnect plant (disconnect locations, cable routing etc.)
- b. Explanation of the telemetry system
- c. Operation of all devices
- d. How to enter commands
- e. Generation and editing of zone masters and intersection controllers data bases
- f. Uploading/downloading of zone masters and intersection controllers data bases
- g. Procedure for enabling dynamic displays
- h. Basic troubleshooting procedures to isolate malfunctions
- i. Proper loading of paper, printer ribbons, disks, etc. into peripherals

9.3 Training Schedule

The training shall be conducted by a qualified factory employee of the equipment manufacturer. The training shall be a minimum of 40 hours and will be separated into two sessions. The training shall cover, at a minimum the, items covered above. The first training shall be three days; the second training shall be for two days and will primarily cover TR operations and questions from the first training. The training shall be held in offices supplied by owner of the system.



10 Warranty

Aries software and *Aries* computer equipment shall be warranted for one year. All warranty periods shall begin at the date of shipment.