RTMS™ User Manual

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Issue 3.2.1

Scope of the Document

This issue of the RTMS User Manual is limited in scope to installation, setup and troubleshooting of the RTMS sensor. Deeper and detailed information on its operation, applications and installation design can be found in the ITS Designers Guide to EIS products.

- The setup procedures rely on the new RTMS Setup Utility program, running under MS Windows. They apply to Models X2/K2 and the newer Models X3/K3.
- Features specific to Model X3/K3 are identified.

Revision History

Issue No.	Issue date	Reason for issue
Issue 3.0	September 2002	Revised as described in Purpose of the Document
Issue 3.1	March 2003	• Adds details of RTMS F/W Rev 6.1 features • Adds Appendix 1 – Miscellaneous Cabling Requirements
Issue 3.2	April, 2004	• Add information on RTMS options • Add Wizard setup feature of the RTMS Setup Utility Ver. 3.0 • Show reduced set-back requirements for Model X3 • Revise cabling details of RS-485 option • Add details for TCP/IP interface option

NOTE

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

WARNING

Changes or Modifications not expressly approved by EIS Electronic Integrated Systems Inc. could void the user's authority to operate the equipment.

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1 OPERATION OF RTMS

The RTMS (Remote Traffic Microwave Sensor) is a true RADAR (RAdio Detection And Ranging) device, specially designed for traffic sensing applications. It measures the distance to objects in the path of its microwave beam. The ranging capability allows the RTMS to detect stationary and moving vehicles in multiple detection zones.

The RTMS microwave beam is approximately 40° high and 15° wide. Its range of 60m (200 feet) is divided into 32 range-slices, each 2m (7ft.) wide. When pointed onto a roadway, it projects an oval footprint, in which detection zones can be defined using the range slices.

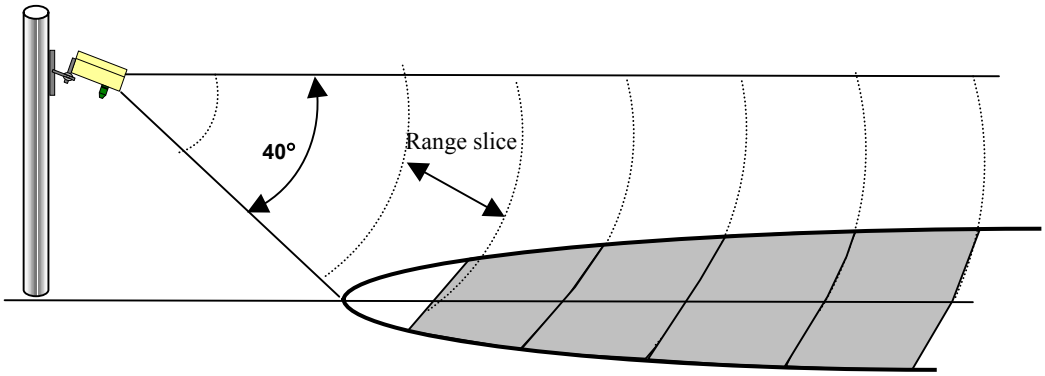
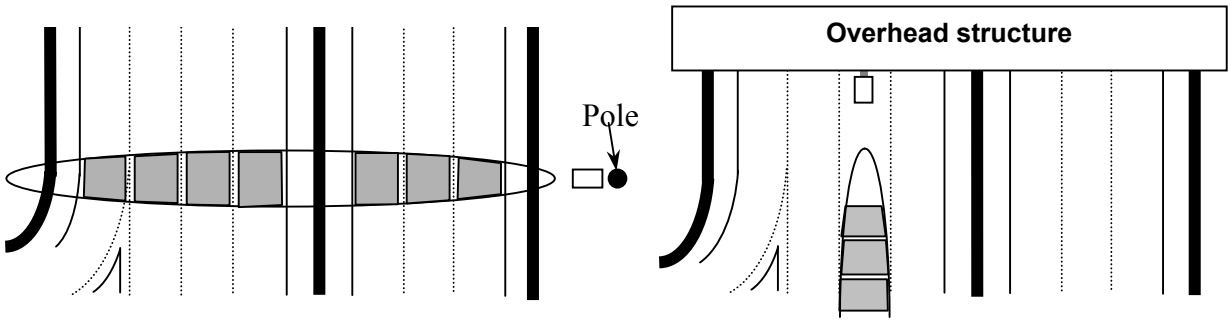


Fig 1. RTMS microwave beam and its footprint

The RTMS has two mounting configurations and several operating modes.

SIDEFIRED configuration, mounted on a roadside pole, aimed perpendicular to the traffic lanes. Range-slices corresponding to the location of traffic lanes are defined as detection zones as part of the setup process. A maximum of 8 detection zones can be defined. Each detection zone may consist of one or more range slices. Its length is determined by the width of the beam's footprint.

FORWARD-LOOKING configuration, RTMS is mounted on an overhead structure aimed parallel to the lane. In this configuration the sensor cannot discriminate between lanes and the aiming angle must be carefully adjusted to confine the footprint to a single lane.



Sidefired Configuration **Forward-Looking Configuration**

Fig 2. RTMS Mounting Configurations

Vehicle Detection

Use of long-wave microwave and ranging, enables accuracy in severe weather, strong vibrations and detection of vehicles completely occluded by other vehicles. Mounting can be relatively low.

The RTMS receives reflected signals from all surfaces within its beam - pavement, barriers, vehicles and trees. It maintains a background signal level from fixed objects in each range slice. Vehicles are detected when their reflected signal exceeds the background level in their range slice by a certain threshold level. If that range slice is part of a defined detection zone, its contact is closed during the detection time to indicate detection and internal counters are incremented.

The background level "capture" requires 30 seconds to fully settle during setup. It is continually adjusted during normal operation. As an example, signals from a stalled vehicle will be incorporated into the background after about 30 minutes and detection will cease (zone contact will open). However, when the vehicle is removed, the background level falls rapidly to the original level, resuming detection at full sensitivity within seconds.

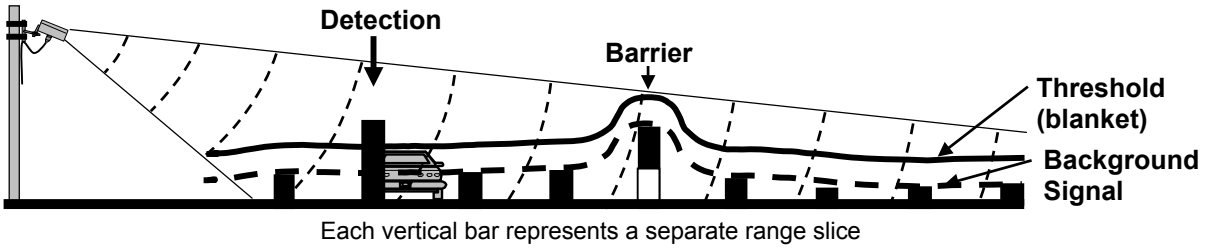


Fig 3. Reflected signals within the RTMS beam

The strongest signals are reflected from vertical surfaces of vehicles. Horizontal surfaces (e.g. roofs) tend to scatter the microwaves away from the sensor, reflecting weaker signal.

Signal levels from vehicles vary depending on the shape of the vehicle and can dip below the detection threshold during brief intervals called nulls. To prevent multiple counting due to nulls, the RTMS signal processing includes an Extension Delay Time (EDT) to bridge the nulls and hold the presence indication. The RTMS system corrects for the effects of EDT to obtain the correct Occupancy measurement. RTMS X3/K3 Rev 6.1 and up can emulate a 6 ft loop.

The Threshold level and EDT are two of several parameters, set to default values when the Mode of Operation is selected. These parameters optimize the operation for the selected application.

Outputs

The detection of a vehicle in any zone is registered in two independently operating outputs:

- **Zone Contacts:** 8 contact pairs corresponding to the detection zones are closed for as long as detection persists. They can be connected to Traffic Controllers to indicate presence (in intersection applications) or to Counters for traffic measurement. An external Interface Card can add Fail-Safe operation, EDT correction and Dual-loop speed trap emulation.
- **Data Port:** Detection status in each range slice is transmitted via "target" messages sent 10 times per second. RTMS internal firmware uses vehicle detection to accumulate Volume, Occupancy, Average Speed and Classification by length over a user-defined Period. At the end of the period the accumulated data, containing measurements for all zones, is transmitted.
- **Data Port Options:** Besides RS-232, RS-485 and TCP/IP Ethernet interface options, Model X3/K3 units support an optional internal DSS wireless modem, which can transmit either statistic measurements or contact closure information directly from the unit.

2 RTMS OPTIONS

The RTMS may be ordered with the following options

Power options

- Low voltage 12-24V AC or DC ---------- Standard

Data Communication Options

- Serial Port
  - RS-232 ---------- Standard
  - RS-485 Serial Port ---------- Factory setting option
- Integrated Digital Spread Spectrum (DSS) transceiver ------- Optional
- Integrated TCP/IP Ethernet Interface ---------- Optional

Note: The DSS and TCP/IP communication options are incompatible with 115VAC power option

3 RTMS INSTALLATION

Incoming Inspection

The RTMS standard shipment contains:

- The RTMS sensor with lynch pin.
- Ball-joint mounting bracket
- Connector kit: MS and DB-9F connectors with female crimp pins, backshells and pin insertion/extraction tool.
- RTMS Setup Utility software on CD
- If an internal DSS modem is included (indicated by labels), a small whip antenna is added

If the contents are incomplete or there is mechanical damage, please notify EIS Inc. immediately.

Installation steps

- Secure mounting bracket to the pole or overhead structure facing the traffic lanes to be monitored, using stainless steel bands or bolts. See RTMS **Mounting and Aiming** section for the required set-back and mounting height.
- The ball-joint must point downwards as illustrated.

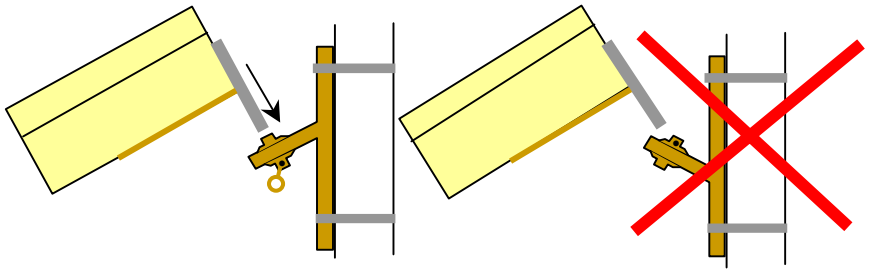


Fig 4. Installation of RTMS bracket

- Insert the RTMS mounting pin into the ball-joint, taking care not to kink the rubber grommet. Lubrication is recommended (e.g. WD40).

- Align the holes in the bracket with the RTMS mounting-pin holes and insert the lynch pin. Do not use undue force or tools. When fully inserted, flip its ring to snap into place around the ball-joint
- Using a 7/16" wrench, loosen the bracket bolt to release the ball-joint and aim the RTMS per the Mounting and Aiming section. Tighten the locking bolt firmly. Once properly aimed, RTMS can be quickly replaced without need to repeat the aiming process.
- Mate the cable's MS Connector (see Section 5 for Cabling instructions) to the RTMS with the wide connector key pointing to the front of the sensor. Twist the MS Connector outer ring clockwise half a turn until it locks with a click. If an internal DSS modem is included, screw on the supplied antenna.
- Connect the RTMS cable data port connector to a laptop PC and perform Setup per instructions in Section 3. During setup, aiming corrections may be required.
- Recording details of the RTMS setup and location is recommended. See **Appendix 2** for completed samples of forms, which can be made available.

RTMS Mounting and Aiming

The mounting site selection should take into consideration the set-back and height requirements. For best results, mount the sensor at the correct height and aim it initially as shown below.

Sidefired Configuration

Set-back and Mounting Height

To include all lanes of interest within its beam footprint, the RTMS must be set back from the detection zones.

For set-backs less than 20 feet (6m) RTMS should be mounted at 17 foot (5m) height above the road surface. Minimum set-backs for monitoring the required number of equivalent lanes are as shown by **Fig. 5.**

Equivalent lanes include median strips, e.g. an eight lane road with a two lane wide median strip has 10 equivalent lanes. The span of 13 equivalent lanes plus the required minimum 25 foot set-back approaches the range limit of the RTMS.

If the set-back is more than 20 ft, the height may be increased approximately 3 feet per 5 foot increase in set-back to a maximum of 30 feet, as shown by the graph. The 30 foot set-back and 23 foot height represents an ideal location for any highway application.

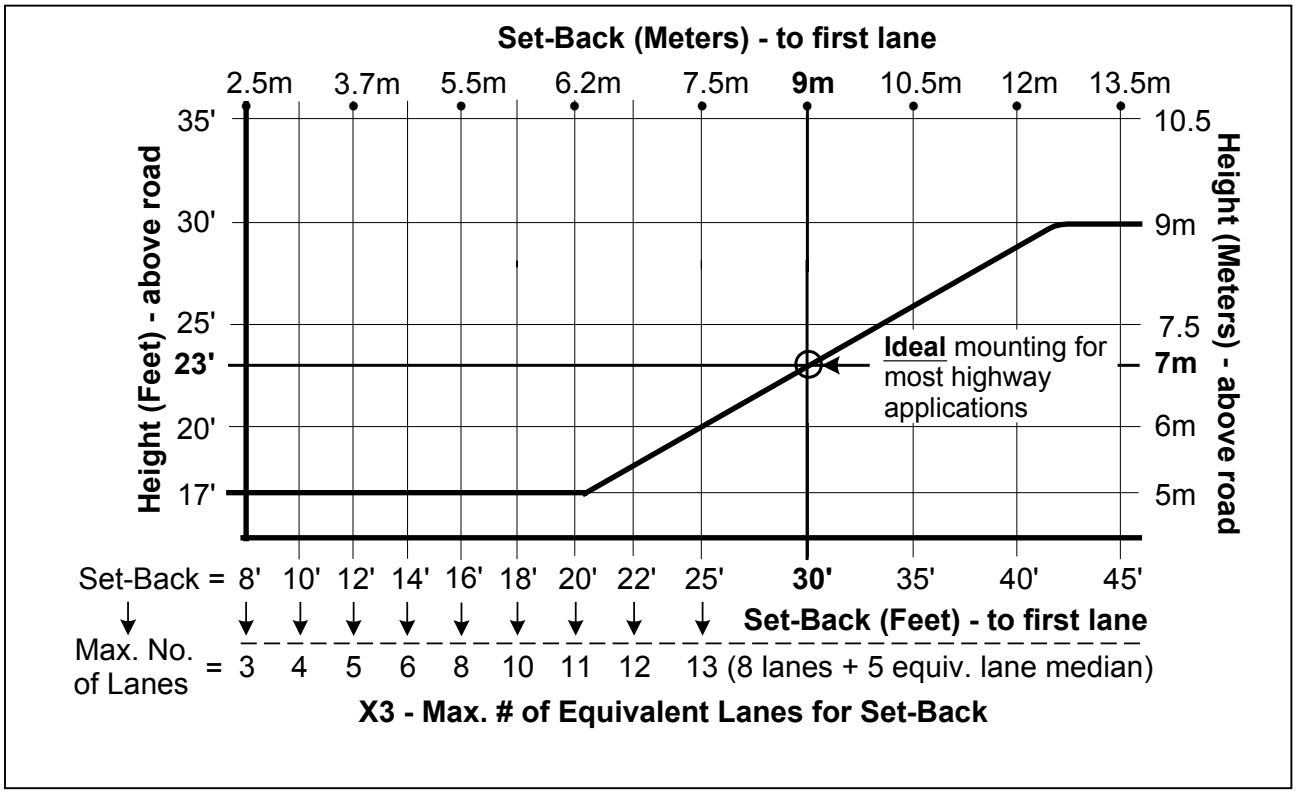


Fig 5. Set-back and Height requirements

Initial Aiming Instruction

The following guidelines are recommended for good coverage of all lanes to be monitored.

- Look from behind the unit and use the top and sides as a guide to "eyeball" its boresight direction:
- Adjust the sideways sway of the RTMS to be perpendicular to the travel lanes.
- Tilt down so that the top of the RTMS is aimed to the first 1/3 of the monitored lanes.
- Keep the RTMS level, side to side.

Note: Final verification of aiming is performed during the setup procedure (See Section 3)

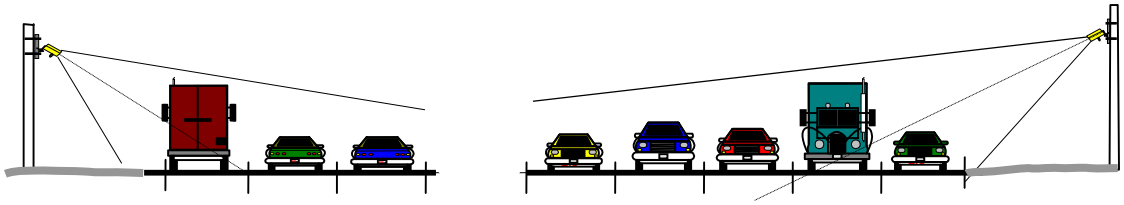


Fig 6. Aiming to the first 1/3 of the monitored lanes

Pointing RTMS away from heavy structures

When deploying RTMS on heavy structures such as overpasses and some sign-bridges, mount them so that the microwave beam clears the structures to avoid multi-path distortion of the beam:

- Do not mount directly on perpendicular (or preferably angled) overpasses. Use separate poles at least 7m (20 feet) away.
- When having to mount on angled overpasses, take advantage of the angle, as shown and use 5 ft extension arms.
- Mount sensors on the "clean" side of heavy-structured sign bridges, away from catwalks and lighting at a small angle as shown (not exceeding 15°). Extension arms are also recommended.
-

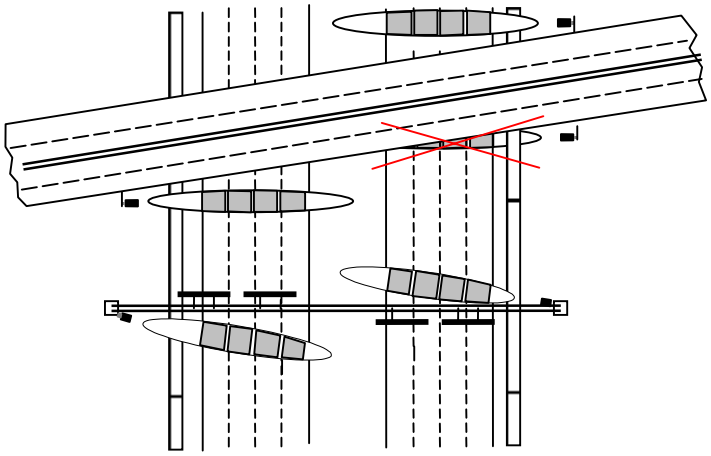


Fig 7. Sidefired mounting on heavy structures

Sidefired mounting in Intersection Stop Bar Detection

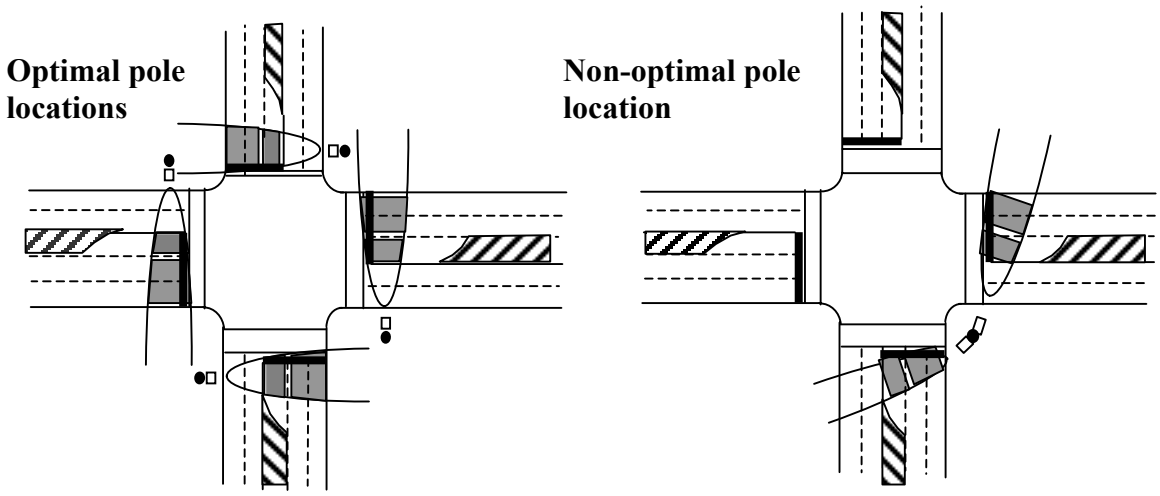


Fig 8. Mounting RTMS at intersections

- Poles at optimal locations allow aiming at the stop bar while perpendicular to the traffic lanes
- Mounting across the road from the detection zones widens the footprint by increasing the set-back, makes the beam more perpendicular and ensures no occlusion of Left-turn lane.

When existing poles are not in optimal position, use of extension arms is recommended to alleviate outlined problems and improve performance

- Mounting of sensors on poles close to the detection zones, narrows the footprint due to limited set-back and increases occlusion in the Left-turn lane.
- The larger offset angle (over 15° from perpendicular) scatters the microwave beam and causes detection misalignment into unwanted areas.
- It reduces the reflected signal, and therefore, the performance.
-

Forward-looking configuration

In highway traffic monitoring applications, sensors are mounted on a sign-bridge or overpass away from interfering structures, as shown below. The sensor can be aimed at approaching or receding traffic, but aiming at receding traffic is preferable.

- Mount the sensor above the center of the lane at the recommended height of 5m (17 feet) but not exceeding 6m (20 feet).
- Point it parallel to the monitored lane
- Mount it level side to side

Looking from behind the unit, "eyeball" - aim it to a point about 10m (30 – 35 feet) from the sensor. This will ensure a sufficiently long footprint but restrict its width to a single lane.

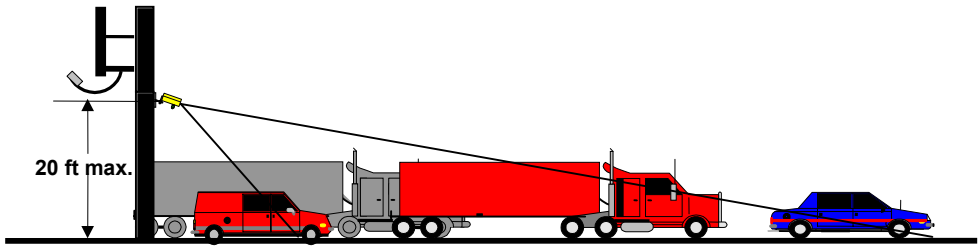


Fig 9. Mounting on overhead structure in Forward-looking configuration.

Incorrect aiming will result in poor accuracy. Aiming adjustments may be needed during setup, where verification is performed using a PC.

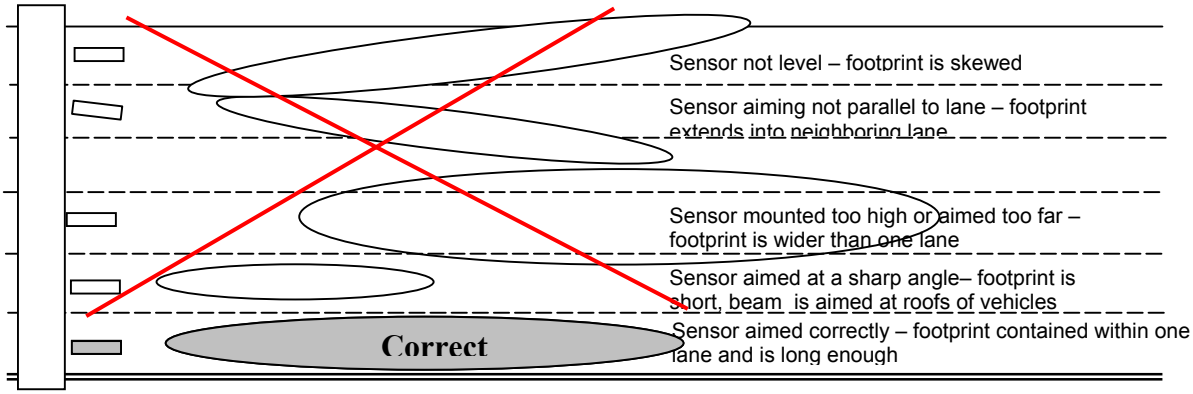


Fig 10. Correct and incorrect aiming in Forward-looking configuration

Offset of RTMS in Forward-looking configuration

Forward-looking RTMS may be mounted on a roadside pole, if the offset (distance from sensor to lane centerline) is less than 3m (10 feet). Extension arms can be used to reduce offset.

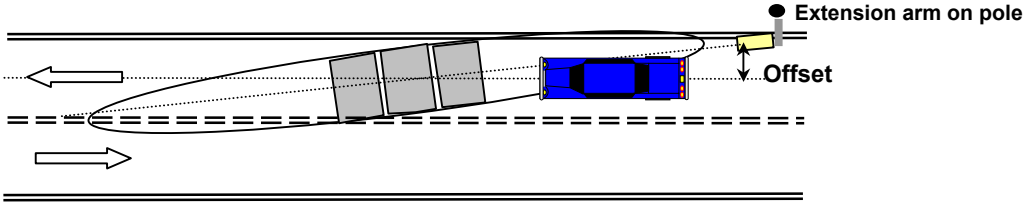


Fig 11. Offset Forward-Looking RTMS Mounting

4 SETUP OF THE RTMS

The PC requirements

Installed RTMS sensors are calibrated using a laptop PC operating under MS Windows. The operator connects the PC to the RTMS Serial port and runs the interactive RTMS Setup Utility "WinRtms" program while viewing the monitored road traffic. Therefore, cabling arrangements must provide access to that port within view of the monitored lanes.

A PC equipped with a USB port only, requires a converter to RS-232. Care must be taken that the converter driver is correct for the Operating System employed, e.g. driver for Windows 2000 may not work with Windows XP.

The RTMS Setup Utility (WinRtms)

Installation

RTMS Setup Utility program is provided on a CD. Insert CD into your CD-ROM. If "Autorun" is enabled, the content of the CD will be shown. For Windows 98/2000/NT4/2000/Me system, open the 'Software' folder, double click 'WinRTMSInst.exe" icon and follow installation instructions.

The WinRtms install utility will install the WinRtms program and two files in the RTMS folder. Rtms.ini configuration file retains the main program settings (e.g. speed, mode of operation, etc). The Rtmslng.txt file contains all screen legends and can be edited to accommodate other languages. See **Section 5 - Non-setup Functions of the Setup Utility** for further details

Direct and Multi-drop Communication Modes

The WinRtms program communicates in **Direct** and **Multi-drop** modes**.**

- **Direct** mode is employed for individual RTMS setup, outlined in this section.
- **Multi-drop** mode allows communication with several RTMS sensors connected to a common communication line, e.g. for the purpose of data collection. See **Section 5 - Non-setup Functions of the Setup Utility** to configure WinRtms program for this function
- An RTMS equipped with TCP/IP interface (identified by a label on the bottom of the enclosure), may be accessed via the Internet. Winrtms must be set to communicate using an IP address rather than the Serial Port. See **Section 5 - Non-setup Functions of the Setup Utility** to configure WinRtms program for this function

  For direct access, the RTMS must be unplugged from the hub and connected to the PC network card. PC networking setup must be changed to static IP address. **See Appendix 2 on PC setup and setting of the RTMS IP address.**

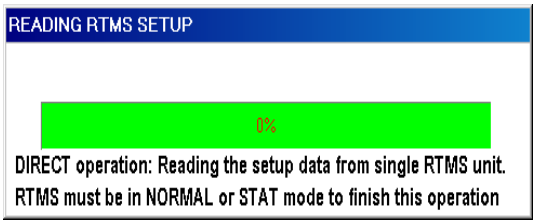
The WinRtms program is designed for use outdoors, where screen visibility is reduced by the sun glare. While supporting "point and click" mouse functionality, most functions may be performed using the **UP/DOWN, LEFT/RIGHT** arrow keys, the **ENTER** key and keyboard shortcuts (keying underlined letters). Setup actions are identified by ⇒

RTMS equipped with higher revisions of firmware, may require latest versions of WinRtms. WinRtms Ver. 3.0 and up features automated or assisted setup through its **Wizard**.

Getting Started

With the RTMS sensor connected to the PC as appropriate to the data interface, click the **WinRtms.exe** icon to launch the RTMS Setup Utility program.

The RTMS Setup program, initially set to its **Direct** mode, attempts to establish communication with the RTMS and displays the message on the right, while attempting to read the current RTMS setup.

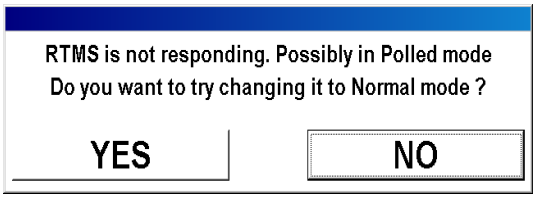


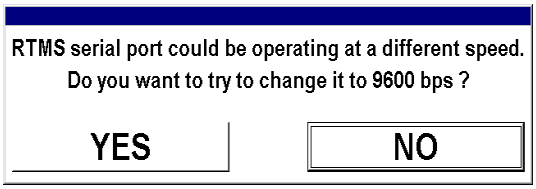
If WinRtms is set to its **Multi-drop** mode, it will display a window presenting a polling range of first and last Sensor IDs. **See Section 5, Non-Setup Functions of the Setup Utility** on changing the mode of communication to **Direct.**

If WinRtms in **Direct** Mode is unable to read the RTMS setup, it will display the messages below suggesting a course of action to recover. Possible reasons for failure to read may be:

- RTMS is not connected to the PC or is not powered
- PC RS-232 Serial port is not working or is not free (e.g. used by another application) or wrong cable is used to connect other data interfaces
- RTMS is set to Polled mode

⇒ Select **YES** on these windows to try reading again after attempting to change Data mode or port speed.





Selecting **NO** will display a default RTMS Setup screen with COM Port and Speed settings shown at the bottom right corner of the screen. They may be changed, if incorrect. **See Section 5, Non-setup Functions of the Setup Utility** for details.

Once communication with RTMS is established **(**Data mode is **NORMAL)**, the main screen display will show the following:

- A blinking circle/square messaging "lamp" in the lower-right screen-corner indicates that WinRtms is receiving data from RTMS. (RTMS transmits "Target" messages 10 times per second)
- Sensor parameter settings are shown on the Setup screen buttons. If not, Select **READ RTMS**. If unsuccessful, See **Section 9 – Trouble Shooting.**
- Detection zone icons below the range scale, based on the present setup
- Target "blips" are displayed in their correct range when vehicles cross the sensor beam
- Per zone traffic data is updated at the end of every Message Period, along with a distinctive sound.

WinRtms Setup Utility Screen

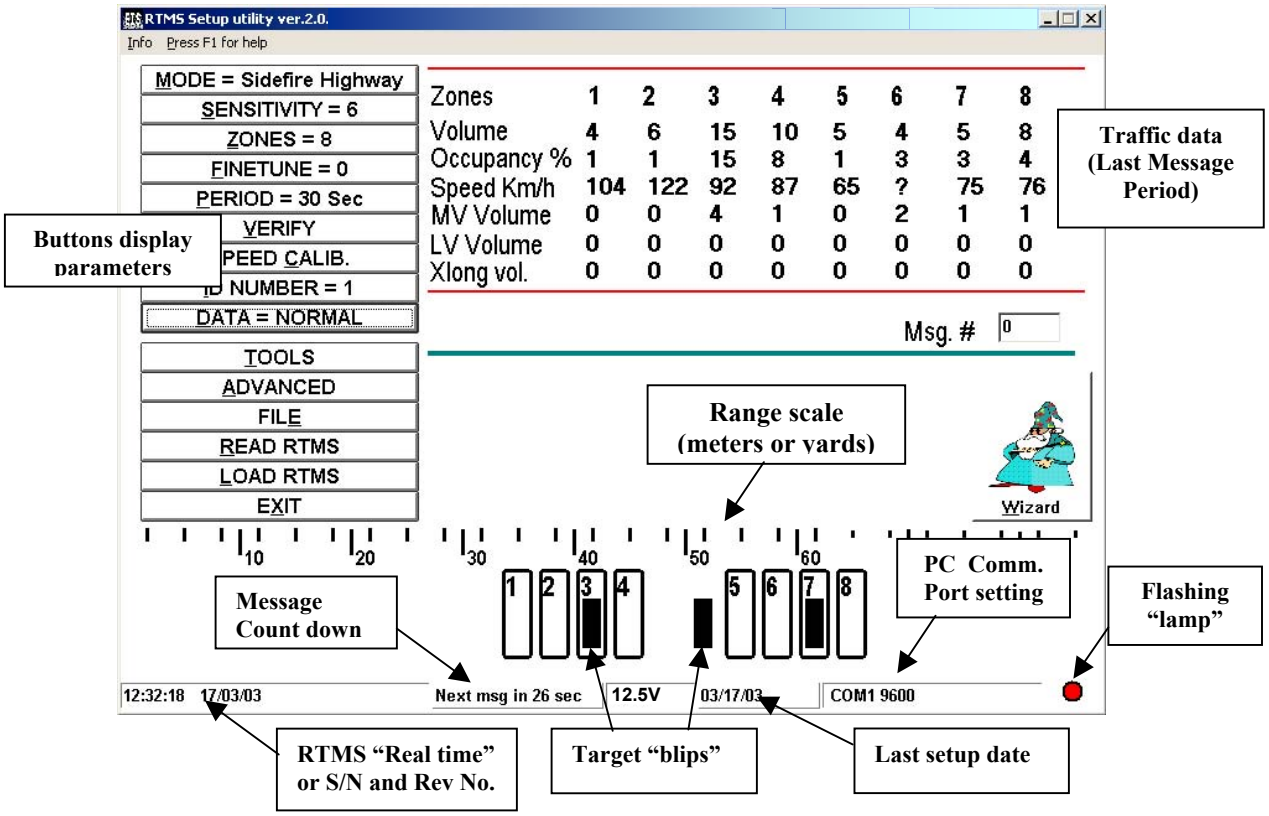


Fig 12. RTMS Setup Utility communicating with the sensor

The screen bottom line display depends on the Model and Revision version of the RTMS.

Always shown are the PC COM port, its speed and the setup date.

RTMS Model X3/K3 with Rev 6.1 or higher displays additional info at the bottom of the screen:

- RTMS serial number and Rev. version whenever the RTMS setup is read
- If RTMS output includes real time clock, the above is displaced by date and time of day,
- Time remaining to next message
- Input power voltage.

  Note: The displayed voltage is the DC measured at the input (if powered by AC, its voltage multiplied by 1.4). If voltage exceeds 25.5V, the Model identification will be displayed instead, e.g. X3

⇒ Date of last setup change in the RTMS.

Traffic data for RTMS X3/K3 with Rev. 6.1 and higher (shown) reflects expanded vehicle classification. See **Section 4 -The Traffic Statistics Display Area** for further details

Setup Sequence

The automated **Wizard** can execute or assist setup of Steps 2 to 5 (RTMS X3/K3 Rev. 6.1 and up only), just verify aiming first. (See **Wizard** for details)

The manual setup procedure follows the sequence shown below. Further details of each step are provided in referenced sections of this Manual.

#	Action	Procedure
1 2	Verify aiming and set Sensitivity	Ensure that all vehicles in first and last lanes of the detection range are detected (showing blips). See **Aiming Verification and Sensitivity setting** for details.
3	Set RTMS operating Mode	Select **MODE** button. Select the required application from the list. See **RTMS Operating Modes** section, or press **F1** for onscreen **HELP** tips. If Forward-looking mode is selected, see **Additional Forward-look Parameters** for details.
4	Perform zone setup	Select **ZONES** button. Set the number, position and size of all detection zones interactively. Zone setup procedure differs between Sidefired and Forward-looking modes. Alternately, click the **Auto** button to initiate automatic zone setup. See **Zone Setup** section for details.
5	Fine Tune to correct "splashing"	Select **FINE TUNE** button. Use the Fine Tune control to correct "splashing" (single vehicle causing two blips in adjacent detection zones). Alternately, click the **Auto** button to initiate automatic Fine tune setup. Correct zone location if necessary. See **Fine Tune** section for details
6	Verify count accuracy	Select **PERIOD.** Set to 30 seconds. Select **VERIFY** button and verify setup by comparing to manual vehicle counts on each lane. See **Count Verification** for details **** If your application uses the RTMS Serial Data, continue. Otherwise Exit.***
7	Select Speed units	If Speed units need changing, select **ADVANCED** button, then select **Km/h – MPH,** to set the desired speed unit.
8	Calibrate Speed	Select **SPEED CALIB.** Button. Calibration compares measured speeds to a reference speed in each lane. See **Speed Calibration** for details
9	Set Message Period	Select **PERIOD** button and set the message period to the desired value (range 10-600sec.) using **UP/DOWN** and **ENTER** keys.
8	Set the Data Mode	Select **DATA** to set the required Data mode. It may be different than the **Normal** mode required for setup, depending on the communications system and application. See section on **Data Mode** for details
9	Set ID number	Select **ID NUMBER** button. To set the displayed ID to desired number use **UP/DOWN** and **ENTER** keys
12	Exit	Select the **EXIT** button when setup is finished

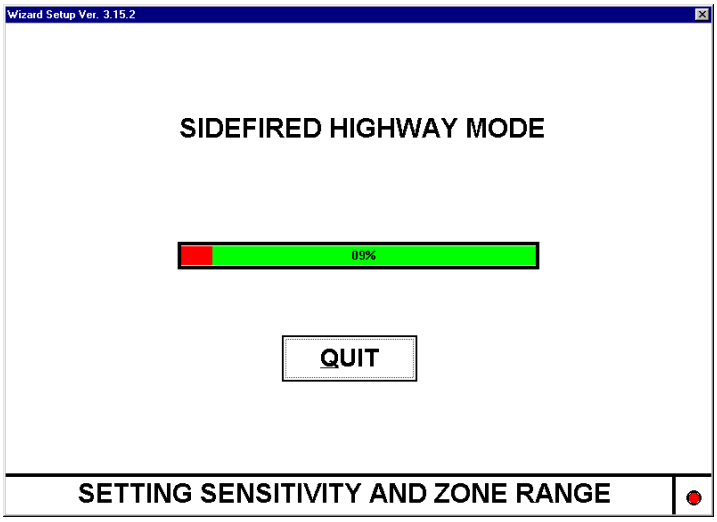
Automated Wizard setup

The WinRTMS **Wizard** feature (RTMS X3/K3 Rev.6.1 and up only) automates the setup stages: Sensitivity, Fine tune and Zone setup, allowing the operator to make interactive corrections in SideFired mode. Before proceeding to full Wizard setup, ensure that aiming is correct, i.e. target blips corresponding to vehicles in lanes of interest are visible on the screen.

⇒ Click the **Wizard** icon to initiate automatic setup.

⇒ Select the RTMS operating mode from the presented window (see next page for details of the RTMS modes)

The Wizard will proceed to set Sensitivity and initial Zone Setup, defining up to 8 zones in range slices where traffic is detected, presenting its recommendation for approval.



Verify visually (using vehicle blips) whether zones were placed on all lanes of interest. If they are, press **SKIP**. If not, press **OK** to manually change the number of zones and their location. Specifically, correct the position of the closest and farthest zones, then Click **OK** to proceed. This step ensures optimization of the setup on the lanes of interest only. See **Zone Setup** section.

NOTE: Don't worry about some splashing at this point. The **Wizard** will continue the automatic setup with Fine Tune and final Zone Setup.

At the conclusion of the **Wizard** setup, some lane reconfiguration may be required due to traffic conditions. Finally speed calibration or other additional parameters can be executed.

Aiming Verification and Manual Sensitivity setting

Select the **SENSITIVITY** button to open the **RTMS SENSITIVITY SETUP** window.

⇒ Use **UP/DOWN** keys or click UP/DOWN arrows on screen to set to a medium value of 7. (Set to 5 if only a few close lanes are monitored)

⇒ Increase Sensitivity if needed to detect small vehicles in the middle lanes of interest. Reduce setting if a "Sensitivity too High" warning is displayed continuously.

If small vehicles in either close or far lanes are missed, aiming should be adjusted. Tilt the sensor towards the zones of poor detection.

Do not increase Sensitivity to compensate for improper aiming**.**

⇒ For manual setup, to force the "capture" of a new background quickly after aiming changes, increase the Sensitivity by one and restore it back.

⇒ Press **ENTER** or click **OK** to activate the new value and exit this window

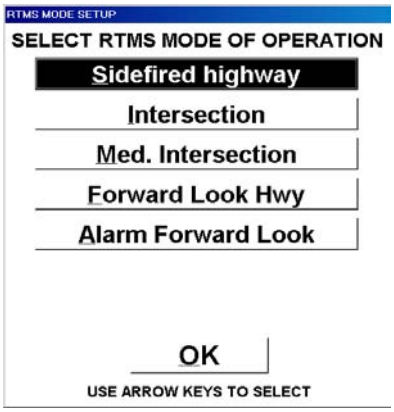
RTMS Operating Modes

⇒ Select **MODE** button to open the **RTMS MODE SETUP** window.

⇒ Select the required mode for your application.

The Mode selection loads the RTMS with several parameters, optimizing its performance for the selected application.

The characteristics of available modes and their default settings are:



Sidefired Highway Sidefired sensor detects presence and generates traffic data in up to 8 zones. Used in highway and counting applications.

RTMS X2/K2 to X3/K3 Rev 6.0 provided two length classifications. Rev 6.1 and up provide two more classes. See **Advanced Parameters** for further details.

Default settings: EDT = 200 msec, Threshold = Normal

Intersection Sidefired sensor detects presence only (no traffic data is generated) in multiple zones. Used in Stop-bar detection

Default settings: EDT = 1000 msec, Threshold =Low.

Mid. Intersection Similar to Sidefired Highway mode, this mode is for use in mid-block detection in urban settings.

Default settings: EDT= 1000 msec for up to Rev 5.5,
300 msec for Rev 6.1 and up
Threshold = Medium.

Forward Look Hwy Used in applications demanding high accuracy of speed measurements such as Speed Enforcement. Zones 1, 2 and 3 are set as a speed trap for accurate speed measurements.

RTMS X2 Rev 4.3 or higher, provide per vehicle Doppler-based speed measurement when speeds exceed 15Km/h (10MPH). Volume data in up to 7 speed-bins is available. See **Advanced Parameters** for further details

Default settings: EDT= 200 msec, Threshold = Normal

Alarm Forward Look Similar to Forward-Looking Hwy mode in RTMS firmware version 5.X and higher. Adds programmable Speed threshold and real time contact #8 closure (for 20ms) when a vehicle exceeds threshold. Intended for use in speed enforcement and warning applications.

Default settings: EDT= 200 msec, Threshold = Normal.

Zone Setup – Sidefired Modes

Vehicle target "blips" are displayed along the range scale in real time. The objective of zone setup is to use these blips to identify the correct range slices as detection zones. Only detection of vehicles inside the configured zones will close contacts (zone numbers correspond to contact numbers) and generate traffic data. Targets blips outside of configured zones are ignored.

Automatic Zone Setup

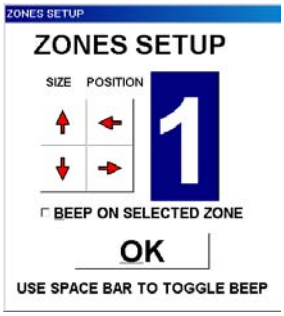
The **AUTO** button (RTMS X3/K3 Rev. 6.1 and up only) initiates automatic setup of detection zones to all detected traffic lanes (up to 8). The automated process requires sufficient traffic levels and is aborted if it is too low to determine position of lanes.

⇒ Select **ZONES** button. The **NUMBER OF ZONES** window will be displayed.

⇒ Click **AUTO** for automated zone setup (number and position of zones). This will be done with a fine tune of zero only.

When the process is completed, Zone numbers will be in ascending order as the distance increases. Make zone and fine tune changes using the Manual procedure.

Manual Zone Setup – Side-fired Mode



⇒ Use the **UP/DOWN** keys (or click the arrows) to change the number of zones. In a side-fired mode, the number of zones is set to the number of lanes to be monitored by the RTMS.

⇒ Press **ENTER**, click **OK** or type **O** to progress to the next stage, zone positioning and sizing**.**

⇒ Select any zone by typing its number, e.g. type "1" to select Zone 1. The zone icon starts flashing and can be moved. The setup utility allows full flexibility in assigning a number to the detection zone, e.g. Zone #1 may correspond to the lane closest to the sensor or farthest away from the sensor. Zone numbers do not have to be in sequence.

⇒ Glance at the screen when vehicles cross the RTMS beam in the lane intended as the detection zone. Use **LEFT/RIGHT** arrows (in the ZONES SETUP window or on keyboard) to move the zone icon to its desired position along the range scale, to surround the vehicle blips. Repeat the process for each of the lanes to be monitored.

Press the Space-bar to toggle a "presence indication" beep, which sounds when a blip is detected in the selected zone. The beep allows detection confirmation in a zone without looking at the screen.

In most cases, each lane requires a single range-slice zone. Multiple range-slice zones can be employed in intersection applications, e.g. to combine through-lanes into a single detection zone. A contact corresponding to the zone number is closed as long as presence is detected in any lane inside the zone.

If two blips show simultaneously in a wide zone, they will be counted as one. Thus in highway and counting applications multiple slice zones are useful in rare cases where it is necessary to cover a wide lane.

⇒ Use **UP/DOWN** keys (or click **SIZE** arrows) to increase or decrease the size of the zone (to multiple range slices).

⇒ After all zones are positioned, Press **ENTER,** click **OK** or type **O** to close the window.

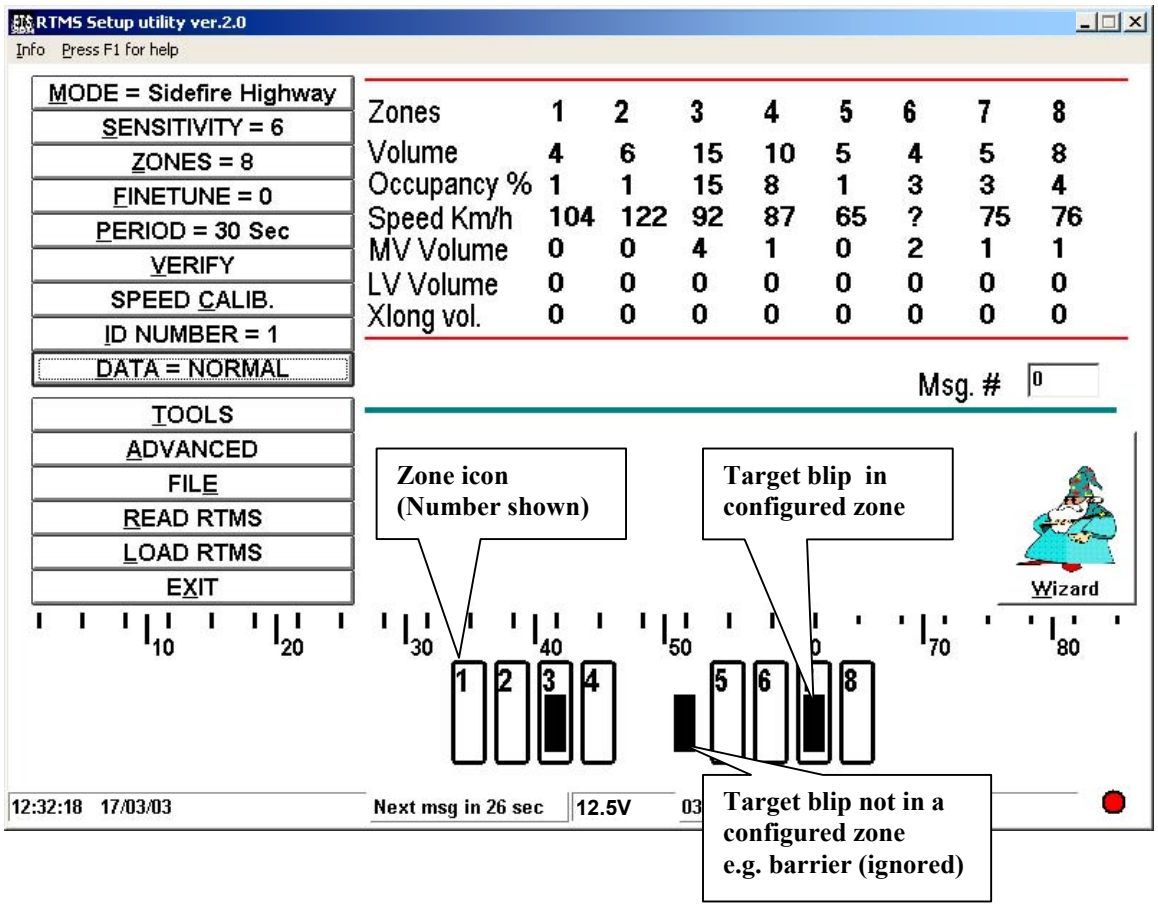


Fig 13. Zone icons and target blips

Fine Tune

"Splashing" is defined as a single vehicle (mainly trucks) causing two blips in adjacent detection zones. A vehicle straddling two lanes or the detection zone straddling two lanes may be the cause. It results in over-counting and is undesirable.

Fine Tuning minimizes splashing, by making small adjustments to the size of all range slices (about 2% of the range per step for a maximum of ±10%). Farther range slices are affected more than closer ones. When the Fine Tune setting is changed to correct a splash, some vehicle blips may shift out of the defined zones. It may be necessary to re-enter **ZONE SETUP** to redefine zone positions, particularly further zones. Fine Tune is also used to reduce the effects of barriers on detection in nearby lanes. Adjust Fine Tune to confine barrier signals to a single range slice.

Note: The effect of Fine Tune is only shown on the screen by the behavior of vehicle blips.

Typically, a "splash" into a lower range slice (closer to the sensor), is corrected by increasing the Fine Tune number (blips are pushed up-range – into the correct slice). Conversely, a "splash" into a higher range slice can be pulled down, by reducing the Fine Tune number.

The diagram below illustrates how Fine Tune setting affects the position of range slices and detection zones. In this example, at FT=0 the range-slices straddle two lanes and produce splashing. Both FT= +5 and FT= -4 yield acceptable results.

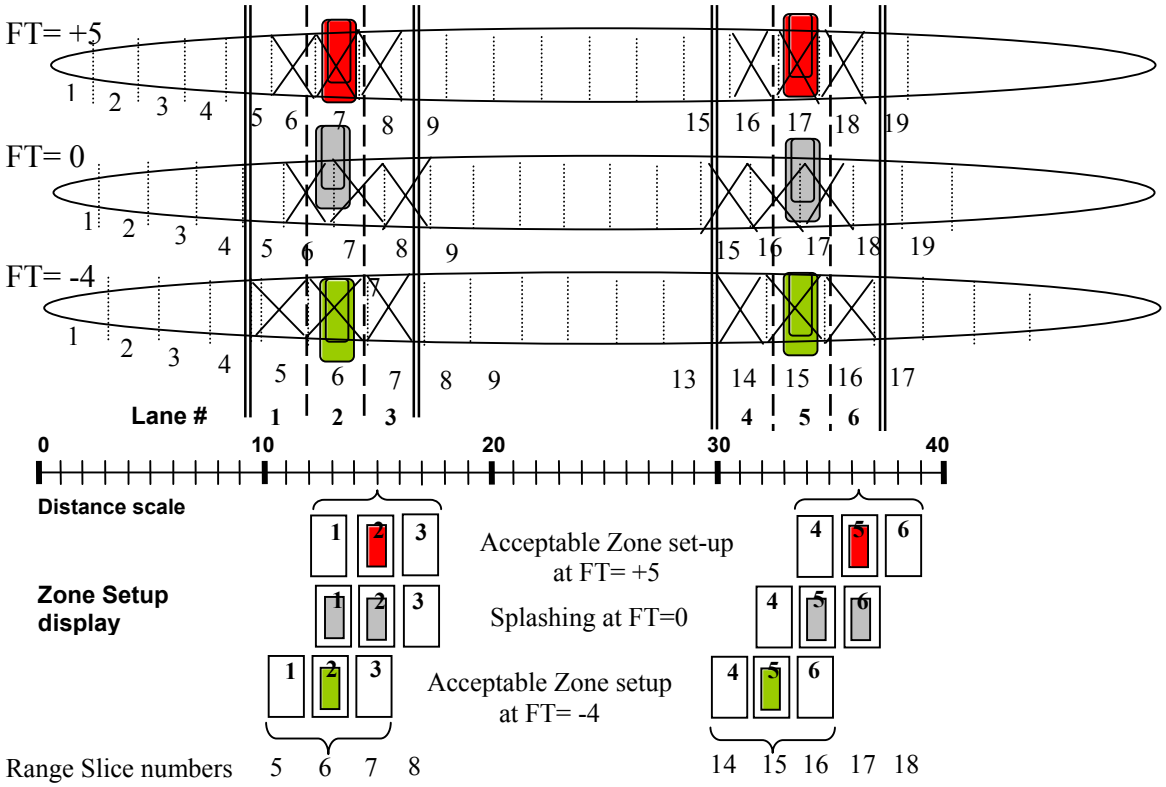


Fig 14. The effect of Fine Tune Control on vehicle blips

When dealing with a few detection zones, it is easier to find a correct fine tune setting to satisfy all traffic lanes. Attempting to monitor many lanes with a single sensor may require a compromise on the counting accuracy in some lanes due to splashing.

Whenever Fine Tune changes are made, the RTMS "captures" the new background and requires about 30 seconds to "settle".

Fine Tune Setup

Automated or manual setup procedure can be selected

⇒ If the first and last zones are well defined, you can click **AUTO** (RTMS X3/K3 Rev. 6.1 and up) to initiate automatic Fine Tune (Zone setup included). When the process is completed, further changes can be made using manual procedure.

⇒ For manual Fine tune setup start with setting of "0". Observe the incidence of splashes and determine whether the Fine Tune number should be increased or decreased. Use the arrows in the window or the Up/Down keyboard keys. To ensure the best Fine Tune value was found and protect the performance against small drifts,find the Fine Tune "sweet spot" by modifying FT +/-1 and visually verify that the changes have very little effect.

⇒ Click **OK** when satisfied with the setting to save it in the RTMS

Zone Setup – Forward-looking Mode

Use of **Wizard** for Forward-Looking mode zone setup.

Initiate the automated zone setup either by clicking the **Wizard** icon or **AUTO** button on the Zone Setup window.

⇒ Enter the **Height** and **Offset** parameters when prompted.

⇒ The **Wizard** will determine, based upon traffic, the best location for the 3-zone speed-trap. If it cannot find a good speed trap due to incorrect RTMS aiming, low volume or other causes, it will display Warnings.

Manual Zone Setup – Forward-looking Mode

⇒ Set Number of Zones to 8 and position all zones in sequence with the first zone at approximately at 8m (8 yards) from the sensor (farther if the sensor is higher than 5M)

Observe approaching (or receding) vehicles in the lane as "waves" of blips and adjust the tilt and sway angles so that blip waves from small vehicles go through at least 5 of the 8 zones and so that vehicles in adjacent lanes do not show blips in the zones. Detection of vehicles from an adjacent lane indicates that the sensor is angled in that direction.

⇒ Fine Tune control affects the size of the zones and may be used to improve smooth passage through all three detection zones. Set it to +5.

⇒ Perform count vefication over 50 vehicles or more. Find three consecutive zones, with vehicle counts in close agreement with each other and with the manual count.

The location of these three zones will form the speed-trap. Note their position on the range scale and using ZONES, move zones No. 1, 2 and 3 over these three consecutive zone positions (ie. zones 5, 6 and 7), then reduce the number of zones to 3.

Only Zone #1 is used for Volume and Occupancy data. Zone #2 and #3 complete the speed trap and help monitor the direction of travel.
The per vehicle speed measurement (it has a distinctive beep), is made only if the vehicle is detected in all three zones. It is displayed if the **Per Vehicle Speed** box is check-marked.

Advanced Parameters.

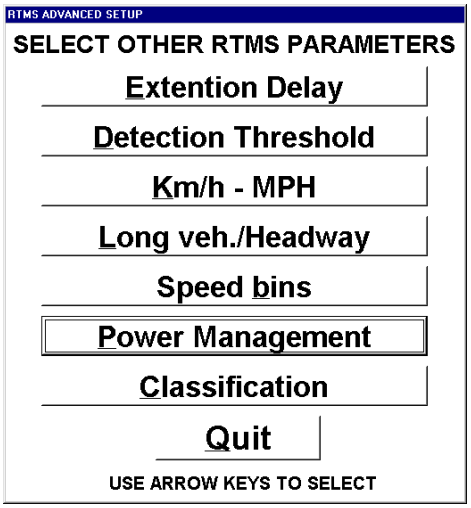
⇒ Select the **ADVANCED** button to display **RTMS ADVANCED SETUP** window to change default parameters or set other features.

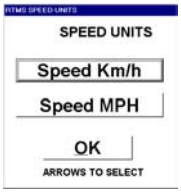
The number of displayed functions depends on the version of RTMS. Shown here is a maximum set (RTMS X3/Ks Rev 6.1 and up).

⇒ Select the desired parameter (click the button or highlight it using any of the arrow keys then press **ENTER).**

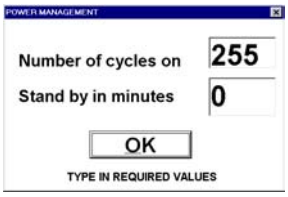
⇒ Make changes to the parameters and save them by clicking **OK**

⇒ Select **Quit** to exit this window without changing any parameters



Parameter	Description
Extension Delay 	Allows setting of Extension Delay Time to other than Mode default. ⇒ Use **UP/DOWN** keys to change it in steps of 10 ms and 100 ms up to 3 seconds. Larger delay times can combine vehicles. ⇒ Press **ENTER** (or click OK) to accept the displayed value.
Detection Threshold 	Allows setting of the Detection threshold to other than the Mode default. Lower thresholds effectively increase the sensitivity. Note: Setting not shown elsewhere on screen. ⇒ Select **Normal, Medium** or **Low** (mouse click or use **UP/DOWN** keys followed by **ENTER).** The window will close automatically. ⇒ Select **OK** to exit without change to this parameter
Km/h – MPH 	The speed data generated by the RTMS is always in km/h. The PC uses this setting to display speed data in the desired units on the screen or in saved text files. Current selection is highlighted ⇒ Select required units. Observe the change in screen display in the traffic statistics area. ⇒ Select **OK** to exit window without changes
Long Veh./Headway 	This parameter applies to the Sidefired Mode only. Headway is the average time-gap between vehicles in units of 100ms. ⇒ Select either **Long Vehicles**, or **Headway** as required. ⇒ Select **OK** to exit the window without changes For further details on definition of Long Vehicles, see **Classification** below.

Parameter	Description
Speed Bins	Opens a window used only in Forward-Looking mode. See section on **Additional Forward-Look Parameters** below
Power Management (Model X3/K3 only)	Power Management allows conservation of battery power in battery or solar-powered applications by operating the RTMS in programmable cycles. The RTMS must be factory-ordered with this option.



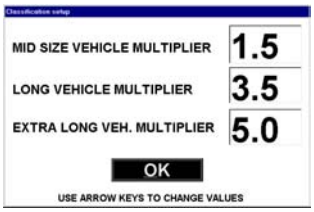
Two parameters are defined:

- Number of Message Periods (min of 3 suggested) the sensor operates (0-254). It will go into standby 1-second after the last period.
- Number of minutes the sensor is in standby and draws minimal power (0 to 254).

⇒ Set the above as desired or set **Number of cycles** and **Standby** time to 0 or 255 to turn Power Management off.

Classification

RTMS X2/K2 to X3/K3 Rev. 6.0 define only two vehicle classes, with Long Vehicles being at least three times longer than average small vehicles.



RTMS X3/K3 Rev. 6.1 and up add length classes: Mid-size and Extra Long vehicles. All length classes are now user definable by specifying a multiplier based on average small vehicle.

⇒ Click to open a window displaying multipliers

⇒ Use **LEFT/RIGHT** keys to highlight a selection

⇒ Use **UP/DOWN** keys to adjust multiplier in steps of 0.1

Note: Vehicle class counters are incremented when vehicles passing the detection zone fall between class limits, e.g. if Long Vehicle multiplier is 3.5 and Extra Long Vehicle multiplier is 5.0, only vehicles with length between these multipliers will be reported as Long Vehicles.

All classes are included in the volume count. Deduct the three classes and the remainder are average vehicles (fourth class).

Note: Long Vehicle volumes will not be reported if Headway is selected or if Message Period is higher than 300 seconds.

Additional Forward-Looking Parameters

Setting of additional parameters is required when any Forward-Looking mode is selected.

Height and Offset

The **SPEED CORRECTION** window showing Height and Offset parameters is opened automatically when these modes are selected. These parameters provide data for correction to the Doppler speed measurements due to the angle of the beam:

Height Mounting height of the sensor above the road surface (e.g. 50 dcm or 17 feet).
Note: Doppler not active if set to "0"

Offset Distance from the sensor to the centerline of the monitored lane

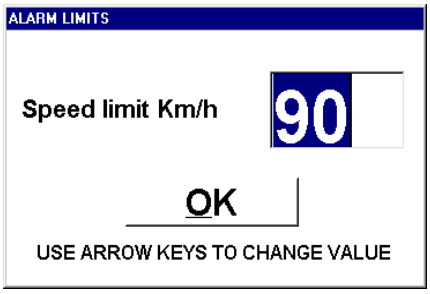
⇒ Use **LEFT/RIGHT** keys to highlight a parameter

⇒ Use **UP/DOWN** keys to change the value

⇒ key **ENTER** (or click **OK**) to exit the screen when desired values are displayed.

Alarm Speed Limit

When Alarm Forward-Looking mode is selected, an additional **ALARM LIMITS** window opens automatically:



⇒ Use **UP/DOWN** keys to set the alarm speed limit

⇒ Key **ENTER** or click **OK** when desired limit is displayed.

Speed bins

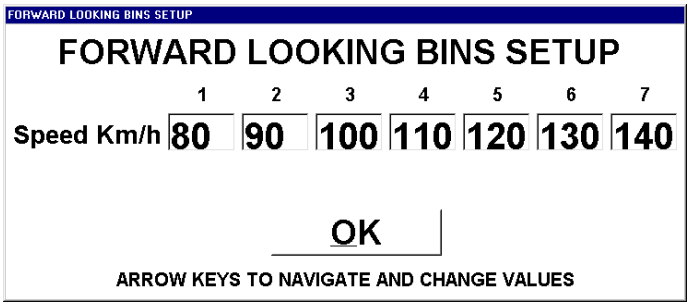
The user can specify up to 7 speed-bins for data collection. Bin counters will be incremented by vehicles traveling between the specified speed limits. The count of vehicles for which the sensor was unable to determine speed is placed in the 8th bin.

⇒ Make sure the English/metric selection is as required before proceeding

⇒ Use **LEFT/RIGHT** keys or mouse click to highlight a bin.

⇒ Use **UP/DOWN** keys to set the bin's upper speed limit. The upper limit setting of a bin automatically defines the lower limit of the next bin. To reset previous settings, reduce each bin to minimum and set to desired level.

⇒ Key **ENTER** or click **OK** to confirm when all required values are displayed



Count Verification

To verify the setup correctness, one must compare RTMS detection to the presence of vehicles in each lane. In Intersection mode applications, this is done visually over a period of time.

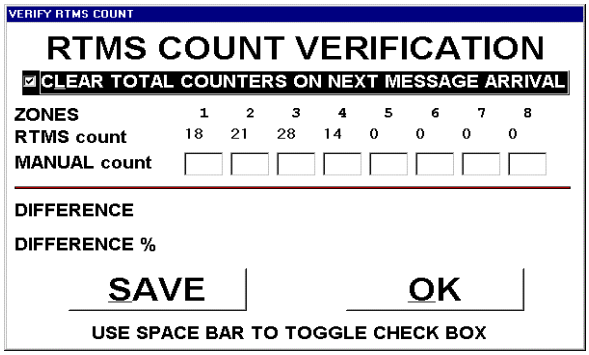
In highway modes (Sidefired or Forward-Looking) the Count Verification procedure compares RTMS volumes in each detection zone to manual counts performed over the exact same interval. Use of a hand-held tally counter for manual counting is recommended.

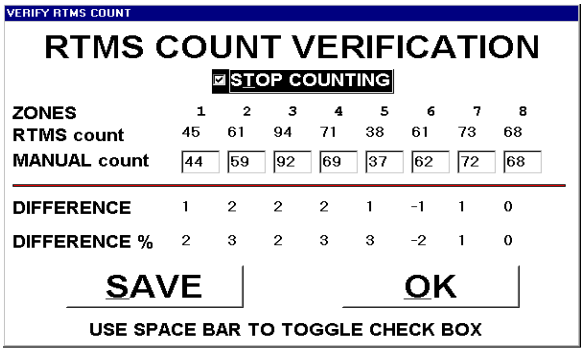
Perform the following steps:

⇒ Select **PERIOD** and set the Message Period to 30 seconds

⇒ Select **VERIFY** button

⇒ When the left-side window opens, tap the Space bar to checkmark the box in the **CLEAR TOTAL COUNTERS ON NEXT MESSAGE ARRIVAL** field and get ready to start counting.





⇒ At the end of the current Message Period the window background blinks, the PC beeps and the RTMS count line is cleared, signaling the precise time to start the manual count.

⇒ Start counting vehicles in the selected lane as they cross the RTMS beam. Several people may be involved, each counting traffic in an assigned lane.

⇒ At the end of each Message Period, signaled by a background blink and a beep, the RTMS count in each zone is incremented by this period's volume

⇒ Keep counting through several periods, until reaching at least 50 vehicles in that lane, then stop counting precisely at the end of the Period.

⇒ Tap the space bar to checkmark the **STOP COUNTING** box, freezing the RTMS Count.

⇒ Enter the manual-count data in the corresponding detection zone boxes.

⇒ The PC displays the difference between the RTMS and the manual count reference in absolute and % deviation. Deviation in beyond approx. +/-5% may require setup correction (e.g. zones, Fine Tune or Sensitivity) to improve accuracy. The verification process should then be repeated.

⇒ Successive Space bar tap recycles to the left hand window to repeat the process, if necessary.

⇒ In Forward-Looking modes, only Zone 1 (representing the RTMS count) needs verification.

⇒ Select **SAVE** to save the results of verification in a text file.

⇒ Select **OK** to exit to the main screen

Speed Calibration

This process adjusts internal coefficients used by the sensor to calculate the average speed of traffic in each lane. It can be accomplished in two ways:

- **Automatic Speed Calibration** is intended for high-volume traffic, flowing at stable speed. It requires entering per-lane reference speeds, which may be estimated or measured (e.g. by a police radar) and setting the procedure duration as a number of Message Period cycles. 5 minutes (10 cycles of 30 seconds) is recommended.
- **Manual Speed Calibration** is intended for low-volume traffic (e.g. volume less than 5) or when there are a high number of trucks. Here the coefficients are directly changed to bring the calculated speed closer to the reference (estimated) speed.

Sidefired Speed Calibration

In Sidefired Highway mode, the RTMS uses the dwell-time of vehicles in their detection zones for speed calculation. The zone's "speed coefficient" is proportional to the zone length plus the average car length.

Vehicles with dwell-time exceeding twice that of an average car are excluded from speed averaging calculations. Good speed calibration is necessary for accurate average speed calculation and truck classification.

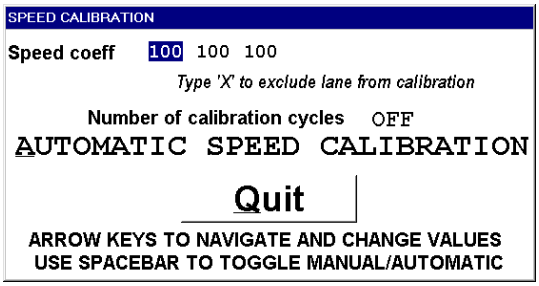
Sidefired Automatic Speed Calibration

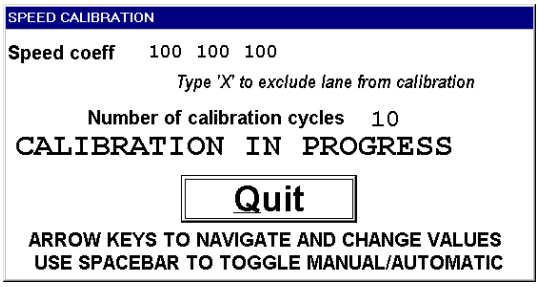
⇒ Select the **SPEED CALIB**. button to open the window to define a Speed Reference for each configured detection zone.

⇒ Use the **LEFT/RIGHT** keys to highlight the zone references,**calibration cycles** or the **Quit** button.

⇒ Use **UP/DOWN** keys (or keyboard entry) to set the desired reference speed in the highlighted zone box lane. Reference speed is your estimate of the current average speed in this lane. Type an "X" to exclude that lane.

⇒ Select **Number of calibration cycles** and use **UP** key to increase it in multiples of 5. CALIBRATION IN PROGRESS will flash.





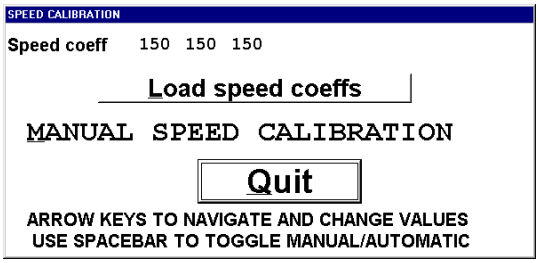
⇒ At the end of each Message Period, the Setup Utility adjusts the values of all active zone coefficients to converge to the reference speeds. The number of cycles is counted down.

⇒ To block further changes in a zone coefficient, highlight the zone and type "X".

⇒ When all speed measurements are reasonable or if traffic flow changes during calibration, terminate the Calibration by clearing the number of calibration cycles to **OFF** (use **DOWN** key). Continue when traffic flow resumes.

⇒ Select **Quit** (click or highlight and press **ENTER**). This will terminate speed calibration.

Sidefired Manual Speed Calibration



⇒ Select **SPEED CALIB** button and tap the space bar. The displayed Manual Speed Calibration window will show the current coefficients for each zone.

⇒ Compare the displayed speed measurement to your estimated average speed in each lane.

⇒ Use **LEFT/RIGHT** keys to select zone and **UP/DOWN** keys to adjust coefficients (in 150 to 640 range) proportionately to the required change (e.g. if speed readings are 10% too low, increase that lane coefficient value by 10%).

⇒ Select **Load speed coeffs** or press **L** and key **ENTER** to update all RTMS coefficients.

⇒ Observe the effect on average speed measurements displayed on the screen at the end of the next message period.

⇒ Click **Quit** to exit

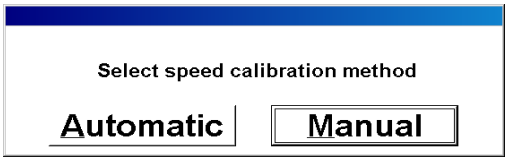
Forward-Looking Speed calibration

Per Vehicle Speed

Per vehicle speed measurements is required for Forward-Looking mode speed calibration. Ensure that the main screen box **Per Vehicle Speed** is check-marked while performing forward-looking speed calibration. Click this box to suppress transmission of per vehicle data, if desired, after completion of speed calibration.

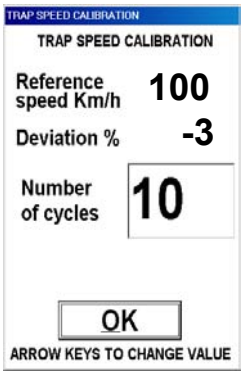
The Forward-Looking Highway mode uses the averaged, per vehicle Doppler speed, as the reference speed to calibrate the length of the speed trap to assure accuracy of "trap" speed measurements at low speeds (below 15 Km/h).

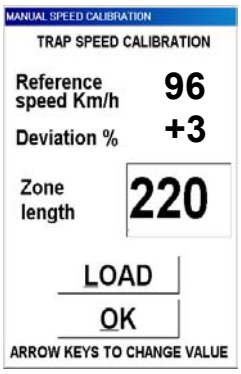
Automatic speed calibration is included in the **Wizard** automated zone setup for the Forward-Looking mode. It may also be independently initiated.



When **SPEED CALIB** is selected, a choice of Automatic or Manual calibration is presented:

⇒ Select the required mode of calibration





In Automatic calibration, the recommended number of cycles is 10 (at 30 sec. Period). The Doppler reference speed and % deviation of the average speed from the reference are updated at the end of each Message Period. When deviation is less than 10%, exit the program.

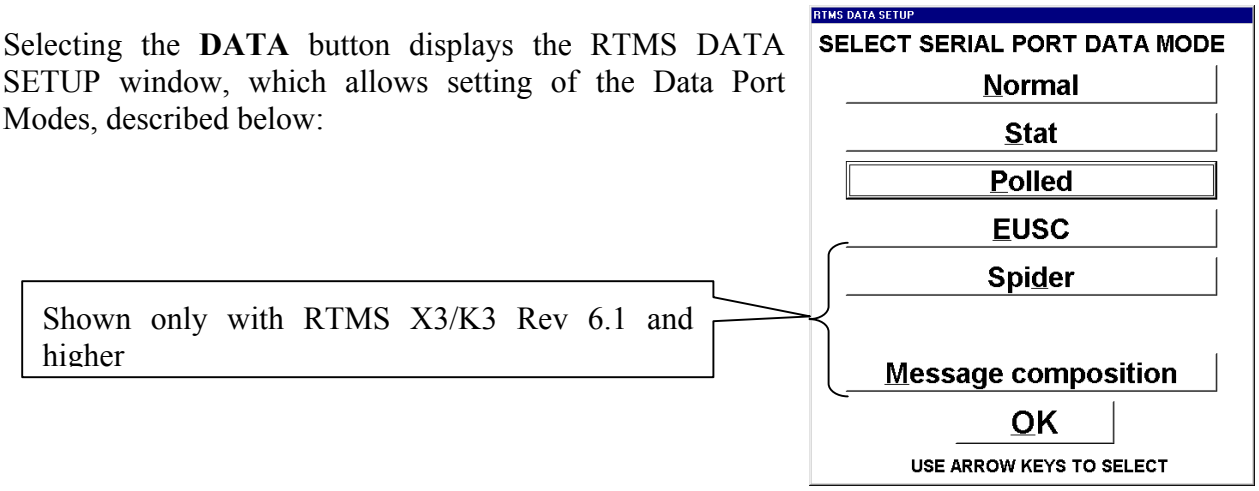
In Manual calibration the zone length coefficient must be adjusted up or down (range 150 to 500)

⇒ Click **LOAD** and wait to get acceptable deviation from the Reference speed .

⇒ Click **OK** to exit

Data Mode

Selecting the **DATA** button displays the RTMS DATA SETUP window, which allows setting of the Data Port Modes, described below:



Normal This mode is required for setup. Another mode may be selected, as required after completion of setup.

In this mode the sensor is in constant two-way communication with the PC. Data transmitted consists of target blips every 100 msec, per vehicle speed data in Forward-looking mode, and the traffic data at the end of each Message Period.

Stat For use in non-polling applications where reduced number of messages is desired.

Sensor transmits statistic traffic data only, at the end of each Message Period. Lamp at the lower right corner is flashing only during transmission.

Zones and blips are not displayed on the screen in this mode ("target" blip messages are not received). Sensor setup can be read with WinRtms.

Polled Sensor transmits statistic traffic data for the last Message Period stored in its buffer only on receipt of a polling message with its ID Number.

The RTMS Setup Utility, set to the Multi-Drop communication mode, can poll, display and record traffic data. See **Communication Setup** for further details

EUSC Presence event information is transmitted in this "polled-type" mode.

Zones and blips are not displayed on the screen in this mode.

Spider This mode operates in conjunction with the internal DSS modem. Detection event information is transmitted at 0.5 sec intervals to a SPIDER controller

Zones and blips are not displayed on the screen in this mode.

Message Composition WinRtms utility allows you to expand the data generated by RTMS X3 Rev 6.1 and up. The minimum default data will match earlier revisions of RTMS.

Customization of traffic data (RTMS X3/K3 Rev 6.1 and up)

⇒ Click **MESSAGE COMPOSITION** button of the **DATA MODE** window to open the **STATISTICAL MESSAGE SETUP** window, checkmark all the data types you wish to receive and press **OK** to set them

New Data available with Rev 6.1 and up are:

- Two New Classes

  Mid-size and XLong Vehicle volumes

- High Resolution Occupancy

  Occupancy measurements with 0.1% resolution, . If not selected, 1% resolution is used as with RTMS X2/K2 and X3/K3 Rev 6.0 (which can be upgraded).

- 6 ft Loop Emulation

  Corrects occupancy measurements to be equivalent to the 6-foot loop data. If not selected, Occupancy measurements are compatible with RTMS Model X2/K2 data.

- Tick clock

  Adds a 4-byte time-mark message based on 10ms time-ticks, counted from the last sensor power-up.

- Real time clock

  Adds a message with time and date stamp, from the internal RTMS real-time clock.

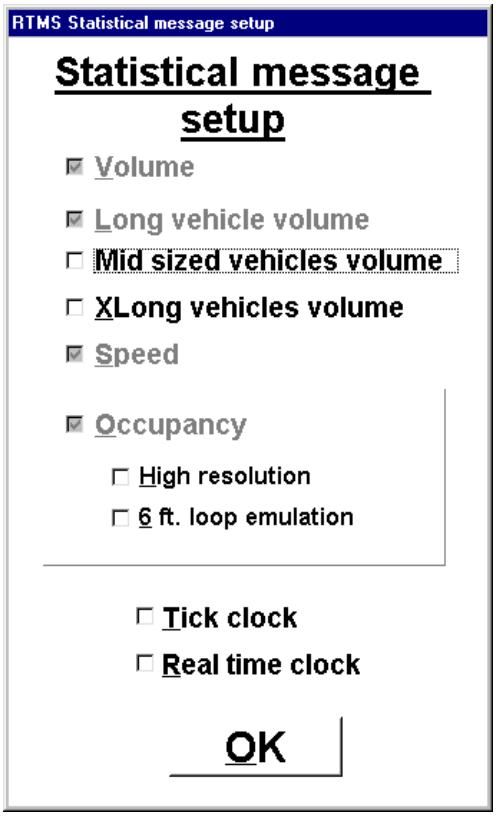


Fig 15. Customization of Traffic Data

Note: The RTMS real-time clock is set by the PC during setup. If real-time clock messages are requested, it is essential that the PC clock is correct.

The Traffic Statistics Display Area

The Statistics area displays zone-by-zone traffic data accumulated during the last Message Period. Screen displays depend on the modes of operation. The definition of some traffic data is common to all modes:

Volume Number of all vehicles that passed through the detection zone during the last Message Period.

Occupancy % of time vehicles dwelled in the detection zone during the last Message Period. It is rounded down to a whole number unless high resolution is specified (RTMS X3/K3 Rev 6.1 or higher only)

Sidefired Data Definitions

Speed Average Speed of vehicles in the detection zone during the last Message Period. The measurement does not include speed of larger vehicles (Medium, Long, Extra long)

The speed measurement may display "?" (unknown) when no vehicles were detected during the Message Period (e.g. Volume = 0)

The last recorded speed will be displayed if no legitimate speed was received, or if only trucks were detected for the period.

LV Volume Count of Long Vehicles. In RTMS X2/K2 & X3/K3 Rev 6.0, Long vehicles are defined as 3 times the average length. In revision 6.1 and higher LV length is user-defined.

When Message Period is higher than 300 seconds, the LV Volume data byte is used as overflow for total volume. Actual volume is equal to Volume plus 256*value of LV Volume

MV and Xlong RTMS X3/K3 Rev 6.1 and up gives volumes for user-defined Mid-size and Extra-long vehicles.

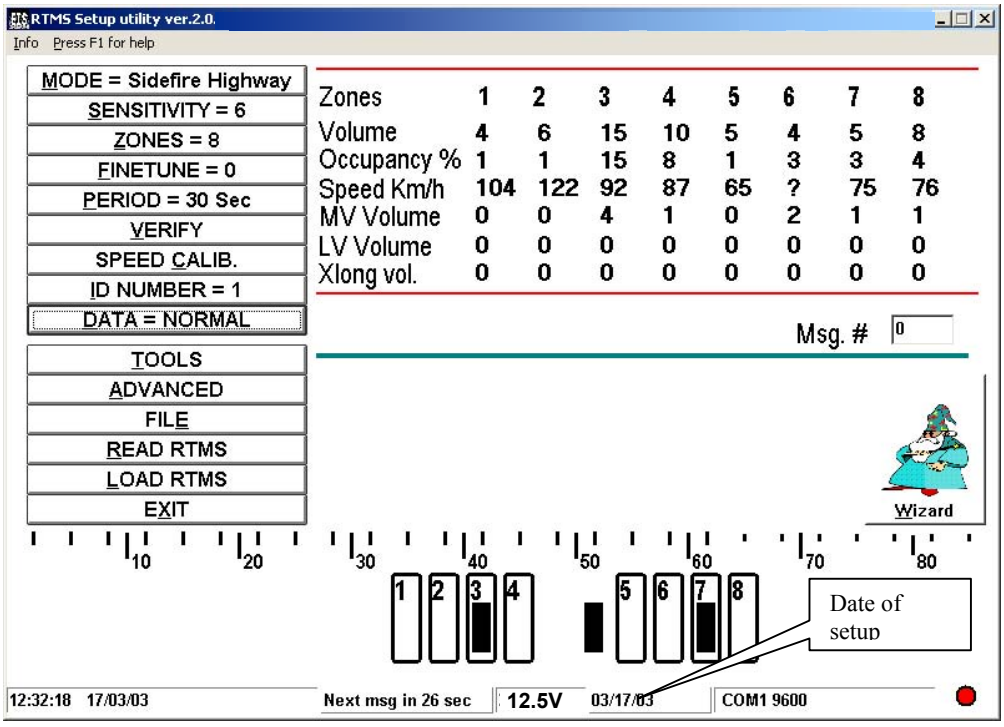


Fig 16. Sidefired Statistical Traffic Data

Forward-looking Data Definitions

Volume, Occupancy Although Volume and Occupancy data are available for each of the three zones of the speed trap. Zone 1 Volume and Occupancy shall be used as valid measurements

Speed Bins Vehicle Volume in each of the speed bins, defined under **Additional Forward-Looking Mode Parameters** (shown 4 bins defined). Bin 8 shows the number of vehicles for which per vehicle speed could not be determined (Presence not detected in all 3 zones of the speed trap).

Av. Speed Average of Forward-looking speed for all vehicles

Direction Direction of travel relative to the sequence of speed trap zones. IN= Vehicle traverses the zone in the order of 3-2-1; OUT= in order of 1-2-3

Per vehicle Speed/ Per vehicle speed measurement for vehicles traversing all three zones at speeds above 10 mph, 15 Km/h.

Per vehicle speed must be checkmarked for this measurement to be displayed Alarm mode speed limit is shown if Alarm mode is selected

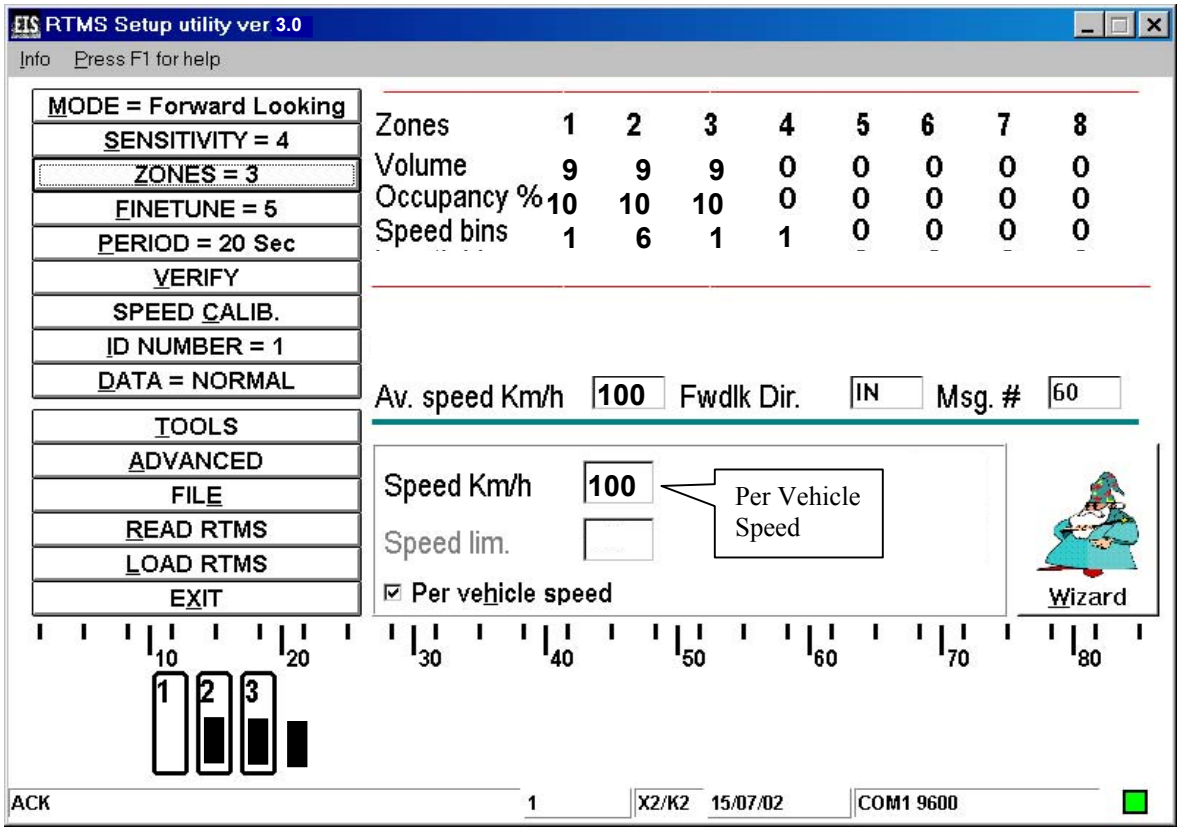


Fig 17. Forward-Looking Mode traffic data

5 NON-SETUP FUNCTIONS OF THE RTMS SETUP UTILITY

Setting the RTMS Setup Utility Communication Mode

Note: The RTMS Setup Utility starts in the last mode selected. To change mode, an RTMS need not be connected. Do the following

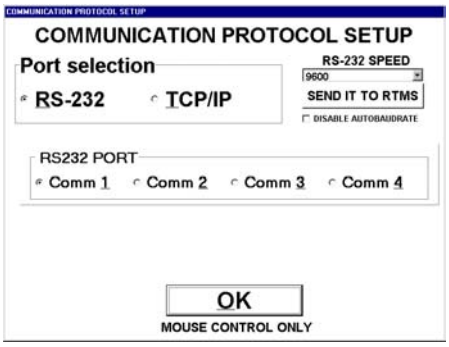
⇒ Respond with **NO** to any messages presented on start-up

⇒ Open **TOOLS** window (highlight button and key **Enter**)

⇒ Select **Direct** mode when PC is connected to a single RTMS

⇒ Select **Multi Drop** mode to communicate with several sensors. See Section on **Communicating with Multiple RTMS units** on the next page.

Setting the PC Communication



⇒ Select **PC COMM** from the **TOOLS** window **COMMUNICATION PROTOCOL SETUP** window opens.

The default **RS-232** setting applies if the RTMS is equipped with RS-232 or RS-485 interface (identified by a label on the underside of the sensor).

If RTMS is equipped with Ethernet interface as identified by RJ45 connector and label on the underside of the sensor, see **TCP/IP** below

Serial Port only

⇒ Ensure correct **COM port** is selected

To communicate, the PC and RTMS serial ports must be set to the same speed. RTMS models up to X2/K2 support only 9600 bits/sec. Model X3/K3 supports additional speeds up to 115200 bps. The RTMS Setup Utility attempts to adjust the PC COM speed to that of the RTMS unless disabled by clicking the **DISABLE AUTOBAUDRATE** box.

Speeds lower than 9600 are useful where high quality transmission lines are not available. They are, however, unsuitable for setup and must be set after completion of setup. If lower speeds must be used, the RTMS data mode must be set to STAT to reduce the amount of data and prevent communication problems.

⇒ Select the desired speed, suitable for the application from the drop-down menu and click the **SEND IT TO RTMS** button to change both PC port and RTMS port speeds.

⇒ If the RTMS Model X3/K3 is equipped with the DSS modem a **DSS MODEM SETUP** button will be on the window. Click it to display the setup window, shown in next section. The DSS modem option forces the RTMS serial port to a speed of 115200 bps .

TCP/IP only

⇒ Click box if the RTMS is equipped with an Ethernet interface Set the displayed fields (protocol (TCP or UDP), Local and Remote Port and Remote Host network address). Consult **Appendix 2** for instructions on re-programming the default IP address of the RTMS.

⇒ Click **OK** to save settings as displayed and to close the window.

Setup of Integral Digital Spread Spectrum Modem

A green rectangle displayed next to the data activity flashing "lamp" in the screen's lower right corner indicates that the RTMS is equipped with a DSS modem and that the modem is communicating (synchronized) to a master. If the rectangle is red, there is no synchronization.

Internal DSS modems are setup at the factory according to the requirements of the installation and should not require further setup. If changes are required refer to Appendix 3.

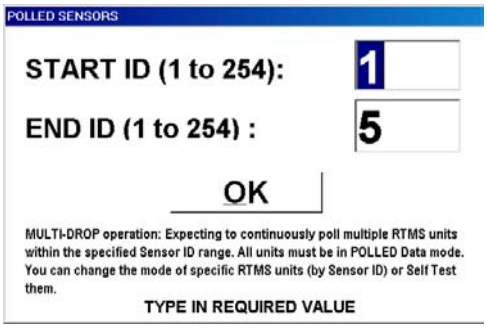
Communicating with multiple RTMS units in Multi-Drop Mode

The RTMS Setup Utility, when set into the Multi-drop mode, communicates with several RTMS units connected to the COM port. The sensors will be in Polled Data mode. (Not applicable to sensors with Ethernet (TCP/IP) interface).

The RTMS Setup Utility Multi-drop mode, selected via the **TOOLS** menu (see Setting the RTMS Setup Utility Communication Mode), will present the **POLLED SENSORS** window shown:

⇒ Edit the required ID range limits of the com. line.

⇒ Select **OK** to activate



On restart, the RTMS setup Utility will present the **POLLED SENSORS** window with last entered range of sensor IDs for acceptance or changes and force all RTMS units on the communication link into the Polled mode.

Next it will generate sequential polling commands for all IDs in that range. The received data is displayed in the Traffic Statistics area and the polled sensor ID in the lower left corner of the screen. The received data can be stored as indicated in Data Recording.

Accessing a specific sensor in Multi-Drop Mode

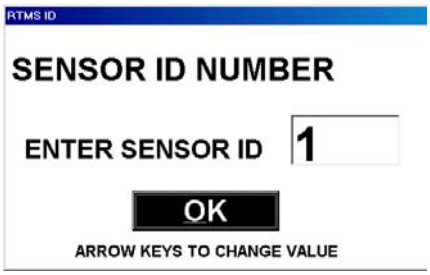
To access a specific sensor, it is necessary to disable polling and change its data mode to Normal:

⇒ Confirm that RTMS Setup Utility is polling (Polled Sensor IDs are displayed at the lower left corner)

⇒ Select the **DATA** button on the main screen and select the **NORMAL** mode.

⇒ Specify the **SENSOR ID** Number in the presented window using **UP/DOWN** keys only

⇒ Select **OK** (click it or use **LEFT/RIGHT** keys to highlight followed by **Enter**)



The specified sensor's Data mode is changed to **Normal** and polling of other sensors stops. The RTMS Setup Utility communicates with that unit, automatically reading its setup and displaying its parameters, blips and statistical data. Setup can be changed, as required.

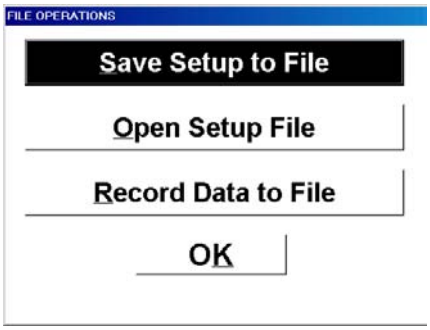
⇒ To select another sensor for access, repeat the above steps. Only one sensor is allowed to be in Normal mode to avoid message collisions. The previous sensor is forced into Polled.

⇒ To resume polling, change the last sensor's data mode to Polled or exit the RTMS Setup Utility. It will automatically open in **Multi-drop** mode and display the **POLLED SENSORS** window.

⇒ To change the Setup Utility communications mode from **Multi-drop**, select **TOOLS**, then **Direct**. The utility will now assume that the PC is connected to a single sensor in Normal Data mode and will attempt to read its setup.

Saving and Retrieving Setup files

An RTMS setup can be saved on the PC as a disk-file.



⇒ Select **FILE** button opens the **FILE OPERATIONS** window (shown)

⇒ Select **Save Setup to File**.

A Windows **Save As** dialog box, opens to allow folder selection and file naming. The file will be saved with a ".**dat**" extension.

To retrieve a saved file from a PC directory

⇒ Select **Open Setup File** Retrieved parameters are displayed on main screen buttons. At this point they are not yet loaded into the RTMS.

Caution: The "dat" file loaded into an RTMS must be generated by a sensor with the same Model and Revision to be compatible. Ensure that the RTMS ID is changed to the correct one if loading another sensors setup.

⇒ Click **YES** to load displayed settings into RTMS. **LOAD RTMS** button on the main screen can also do it.

⇒ Click **NO** or **READ RTMS** button to **cancel** retrieved screen and view current RTMS setup.

Data Recording

The RTMS Setup utility can record RTMS data onto a PC text file.

⇒ Select **Record Data to File**.

A Windows **Save As** dialog box will open for folder selection and file naming. The displayed **RECORDING DATA** window indicates that recording is in progress

The generated file will have extension ".**asc**". The sample file format below shows data generated by RTMS with Rev 6.1 with maximum information selected. Speed units and Occupancy definition are identified in the header .

```
RTMS STAT. MESSAGES   ZONE:    1   2   3   4   5   6   7   8
 SPEED IN Km/h.  Occupancy 6 ft loop normalized.

11 03 2003 19:32:02
MESSAGE NO. 6        VOLUME:   5   8   19  17  6   9   11  16
                   LONG VEH:   0   0   0   0   1   2   2   0
STATION ID. 8     OCCUPANCY:   5   7   18  13  8   14  15  13
                    MID SIZE:   1   0   1   0   0   0   1   1
                   XLONG VEH:   0   0   0   0   1   0   0   0
FWDLK SPEED ?   SIDEFRD SPD:   81  102 124 112 77  103 128 125      Dir. 128 V. 125 H. 80

11 03 2003 19:32:32
MESSAGE NO. 7        VOLUME:   6   8   10  11  11  12  14  17
                   LONG VEH:   0   0   0   0   0   3   2   0
STATION ID. 8     OCCUPANCY:   4   7   8   8   9   19  20  11
                    MID SIZE:   0   0   0   0   0   1   0   0
                   XLONG VEH:   0   0   0   0   0   0   1   0
FWDLK SPEED ?   SIDEFRD SPD:   94  102 126 120 80  102 119 118      Dir. 128 V. 125 H. 80

11 03 2003 19:33:02
MESSAGE NO. 8        VOLUME:   6   7   16  12  6   11  11  13
                   LONG VEH:   0   0   0   0   0   0   0   0
STATION ID. 8     OCCUPANCY:   4   5   14  9   5   11  9   7
                    MID SIZE:   0   0   0   0   1   0   0   0
                   XLONG VEH:   0   0   0   0   0   0   0   0
FWDLK SPEED ?   SIDEFRD SPD:   89  111 118 109 79  100 124 125      Dir. 128 V. 125 H. 80
```

Direction (Applicable to FwdLk mode, 0 =In, 128= Out)

Power voltage (x 10), i.e. 12.5V

Diagnostic byte. Consult EIS if second digit is not equal to "0"

Fig 18. Sample Recorded File Format

Self-Test diagnostic

The RTMS sensor can be tested any time to confirm that it is in working order. Select **Self Test** from the **TOOLS** window. The PC sends a Self-test command to the sensor. During the 20 seconds required by the RTMS to complete the test, a progress bar is displayed, ending with a display of the diagnostic results, including the RTMS firmware revision when the test is completed. Self-Test should be performed with the sensor monitoring real traffic.

Support for Other Languages

The RTMS Setup Utility program allows replacement of the default English button legends and menu labels to other languages.

A Notepad file "Rtmslng.txt" (partially shown below), is included in the same folder with the "WinRtms.exe" program. Its default labels may be altered. To adapt the operation to your language, edit this text file, replacing English legends by text in your language, after "=" using a character set provided by your PC. Use character "&" to identify the next character as keyboard shortcut.

```
[MainForm]
FormTitle=RTMS Setup utility ver.
MenuInfo=&Info
MenuHelp=Press F1 for help
ButtonMode=&MODE
ButtonSensitivity=&SENSITIVITY
ButtonZones=&ZONES
ButtonFineTune=&FINETUNE
ButtonPeriod=&PERIOD
ButtonVerify=&VERIFY
ButtonSpeedCalibration=SPEED &CALIB
ButtonIDnumber=&ID NUMBER
ButtonData=&DATA
ButtonTools=&TOOLS
ButtonAdvanced=&ADVANCED
ButtonFile=FIL&E
```

6 CABLES

The RTMS cable

RTMS uses a single 32-pin MS connector for power and all outputs.

The RTMS is shipped with all required connectors, crimp pins and back-shells. Cables may require on site preparation if their length is unknown or to pass them through conduits. The installer must assemble the connector back-shell, crimp pins to cable wires and insert them into the connector shells.

The RTMS cable should be UV protected where exposed. It should be overall shielded and furnish sufficient number of stranded gauge #20 or #22 twisted pairs (e.g. Belden 95xx) to provide the following:

Description	# of pairs
Power	1 pair
Communication Port (one of 3 choices below)	
RS-232 (standard)	2 pairs, 3 pairs when DSS option is provided
RS-485 (option)	3 pairs
TCP/IP (option)	2 pairs, max 10m (30')- Use CAT5 for cable up to 100m (300')
Zone Contacts	1 pair per zone.
Fail safe	1 pair
Auxiliary 12V DC power out	1 pair

For more details on wiring of the Communication port see the section on **RTMS Serial Communication and Cabling.**

Fail safe is provided in conjunction with the use of the RTMS Interface Card (RIC) by contact #9, which is closed when RTMS is powered, operational and in **Normal** data mode.

In preparing a cable:

⇒ Use the Daniels Manufacturing Corporation crimping tool M225200/1-01 AF8 with head no. M22520/1-02) or equivalent. **Do not solder pins!**

⇒ Thread cable through the backshell before insertion of wires into shell is started.

⇒ Use the Insertion tool (red) to insert wires with crimped pin into shell.

⇒ Use the Extraction tool (white) to remove a crimped wire to correct an error

WARNING: DO NOT connect the cable shield or ground wire to the MS Connector's shell

RTMS MS Connector pin out

Pin No.	Function
A,B	Zone #1 contact
C,D	Zone #2 contact
E,F	Zone #3 contact
G,H	Zone #4 contact
J,K	Zone #5 contact
L,M	Zone #6 contact
N,P	Zone #7 contact
R,S	Zone #8 contact
T	Serial Port Input to RTMS RS-232 Rx or RS-485 Rx -
V	Serial Port Output from RTMS RS-232 Tx or RS-485 Tx -
U,W	Serial Port Signal Ground
X	RS-485 Tx + or Ethernet Rx +
Y	RS-485 Rx + or Ethernet Rx -
a	DTR (DSS option only)
b	+12V DC accessory power out
c	Accessory power ground
d	Contact #9 or Ethernet Tx +
e	Contact #9 or Ethernet Tx -
f, g	Low Voltage power 12-24V AC or DC

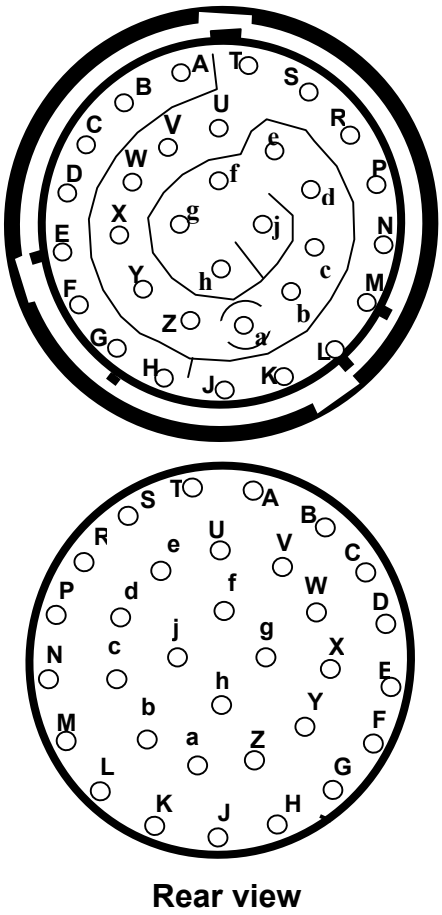


Fig 19. MS Connector Views

Power Cabling notes

- Standard low voltage 12-24V AC or DC

Low voltage power can be derived from:

- Controller cabinet 24VDC, if available
- Transformer in Controller or pole-mounted cabinet, 16-20V AC 10W recommended
- 12V Battery - Recharged by a solar panel or from lighting supply

The range of standard low voltage RTMS power at the input is 10.5V to 34V. Voltage outside this range will cause the sensor to shut down. Cable resistance must not reduce available voltage below the lower limit.

Peak voltage at 24VAC is approximately 34V i.e. at upper cutoff. The use of 24V AC should be avoided where cable runs are short.

Model X3/K3 includes internal cutoff switch at 11.5 V to prevent battery damage due to deep discharge.

RTMS Serial Communications and Cabling

Standards and Nomenclature

Data communication equipment is classified as Data Terminal Equipment (DTE), which generates and stores data (e.g. PC) or Data Communication Equipment (DCE), e.g. modems.

RS-232 Serial ports use two types of RS-232 connectors, the 25-pin DB25 and the 9-pin DB9. DTEs employ male connectors and DCEs employ female connectors. 8 essential functions and their corresponding pin assignments are shown below.

Abbreviation & Full Name		Direction	Function	DB9 pin #	DB25 pin #
DCD	Data Carrier Detect	DCE to DTE	Carrier received	1	8
Rx	Receive data	DCE to DTE	Receive Data (by DTE)	2	3
Tx	Transmit data	DTE to DCE	Transmit Data (by DTE)	3	2
DTR	Data Terminal Ready	DTE to DCE	DTE ready to receive data	4	20
DSR	Data Set Ready	DCE to DTE	DCE in communication mode	6	6
RTS	Request To Send	DTE to DCE	DTE has data to send	7	4
CTS	Clear To Send	DCE to DTE	DCE ready to receive data	8	5
Gnd	Signal Ground		Return path for Tx and Rx	5	7

Note that while a DTE transmits on Tx and receives on Rx, a DCE does the reverse, i.e. receives on Tx and transmits on Rx. Control signals may be ON (Positive Voltage level in 5-15V range) or OFF (negative voltage level in 5-15V range). To transmit, RTS, CTS, DSR, and DTR are required to be in the ON state, where implemented (Note: not all signals are implemented by DTEs and DCEs).

For convenience of cable preparation, rear views of pin layout of 9 and 25 pin connectors are shown below.

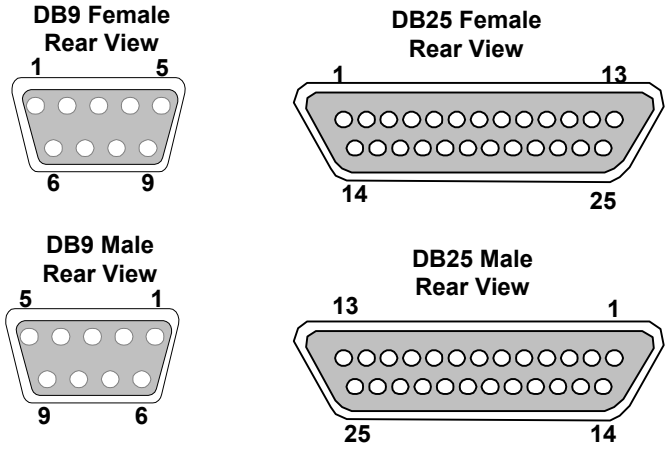


Fig 20. Pin numbering of D-type connectors

RTMS Serial Port Wiring

RTMS Models X2/K2 have an isolated RS-232 port with a range up to 250m (800 feet) at a speed of 9600 bits/sec. Modems are required if this range is exceeded.

RTMS models X3/K3 have a variable speed Serial port with speeds up to 115.2 kbits/sec selected by the user during the setup. The serial port can also be configured as RS-485 (optional) for an extended range up to 4000 ft. with multi-drop capabilities without the use of modems.

RS-232 Port wiring

The RTMS cable wiring is configured to provide a null modem function for direct connection of the sensor to a PC for setup purposes using a standard extension cable.

To do this the RS-232 port is wired as a DCE, i.e. transposes transmit and receive lines and uses a female 9-pin connector.

⇒ Connect as follows:

Twisted Pair 1

- MS pin V (red) to DB-9 pin 2 (Rx)
- MS pin U (black) to DB9 pin 5 (Gnd)

Twisted Pair 2

- MS pin T (red) to DB-9 pin 3 (Tx)
- MS pin W (black) to DB-9 Pin 5

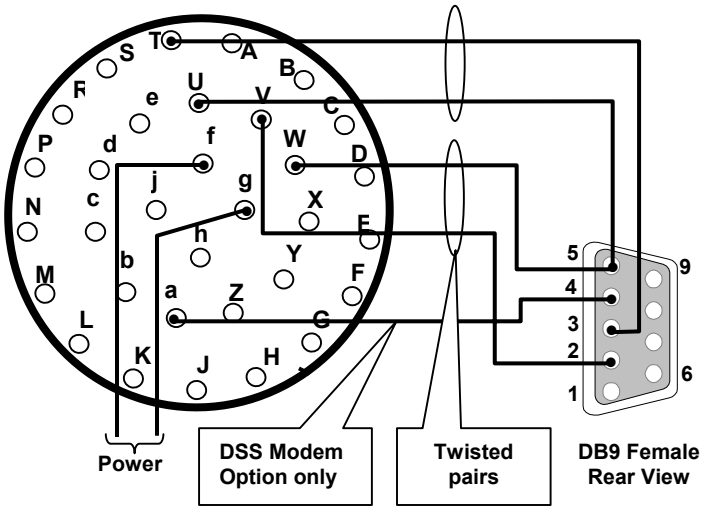


Fig 21. RTMS RS-232 Port Wiring

RS-232 Port wiring – for RTMS with DSS Option

When the internal DSS Modem option is included, the RS-232 port wiring requires another wire.

⇒ Connect MS connector pin "a" to DB9F pin 4 (DTR).

During normal operation the RS-232 port feeds the DSS modem. On direct connection to a PC, RTMS detects the positive voltage on pin "a" from the COM Port (DTR ON) and switches its RS-232 Rx line to the PC. Upon disconnecting from the PC COM port, the RTMS will re-connect it back to the DSS modem.

Without the above modification, the receive line will be connected to DSS, the RTMS Setup Utility will be unable to send any commands to the RTMS and setup will not be possible.

RS-485 Serial Port Wiring (Models X3/K3 only)

MS connector pins V, X, T, Y, U and W are assigned as RS-485 Tx-/ Tx+, Rx-/ Rx+ and ground respectively.

⇒ Cable as three twisted pairs with Rx- and Tx- connected to red wires

⇒ Connect MS pins to DB9F as follows:

Pin V (Tx-)	to pin 2
Pin T (Rx-)	to pin 3
Pin U/W (Gnd)	to pin 5
Pin X (Tx+)	to pin 4
Pin Y (Rx+)	to pin 1

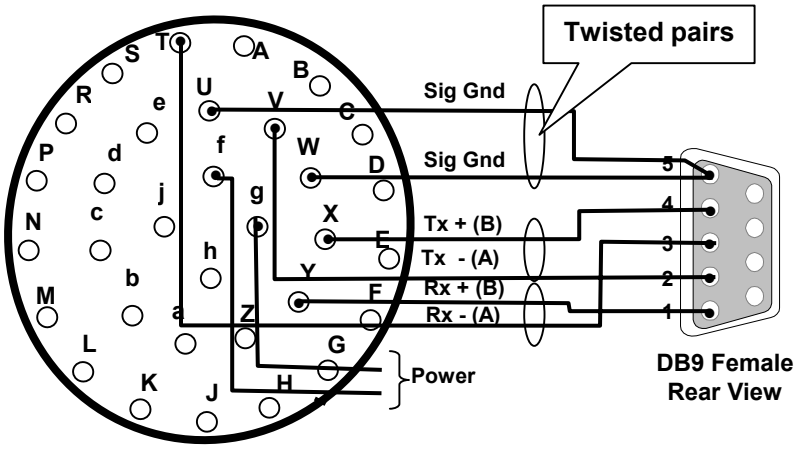


Fig 22. RTMS RS-485 Port Wiring

Note: This pin-out allows the cable to be compatible with RS-232 for a direct connection (max. 30 feet) to a laptop for setup.

See **Appendix 1** for further details on multi-drop configuration wiring.

TCP/IP (Ethernet) Port Wiring

MS Connector pins X, Y, d and e are assigned as the TCP/IP port Rx+/ Rx-, Tx+/ Tx- leads respectively. Two twisted pair ethernet wiring standards employing RJ-45 connectors are in common use, T568A and B. These differ by interchanging transmit and receive pairs. CAT5 stranded-wire cable must be used for lengths exceeding 10m (30 feet) to a **max.** of 100m (300 ft).

The shown MS connector to RJ-45 wiring conforms to T568B standard.

Twisted pair 1 (Tx)
Pin d to pin 1 (White/orange)
Pin e to pin 2 (Orange/white)

Twisted pair 2 (Rx)
Pin X to pin 3(White/green)
Pin Y to pin 6 (Green/white)

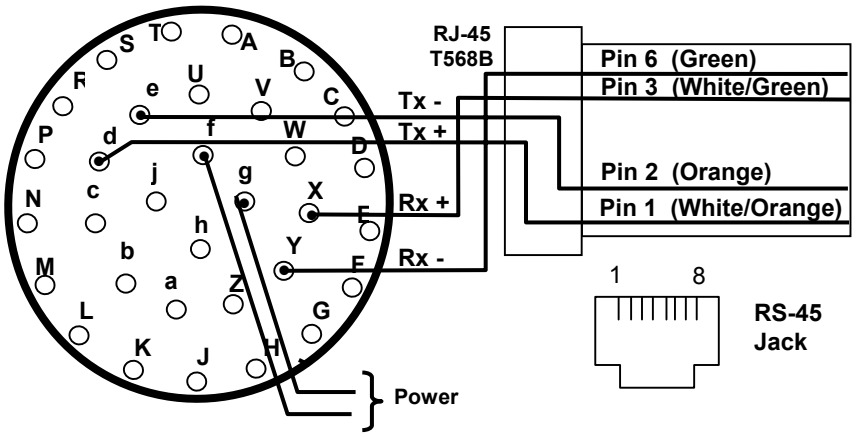


Fig 23. RTMS Ethernet Port Wiring

Note: Ethernet devices connect to hubs of the same standard using a straight networking patch cable. Two ethernet devices of the same standard may be connected using a crossover cable. RTMS connection to a PC or to an Ethernet bridge requires crossover cable if both employ the same standarad. Carrying both types of cables is recommended when setting up an RTMS equipped with TCP/IP interface.

Modem cabling

Modems may be wireless (CDPD, CDMA, Spread Spectrum) or wire-line (fiber or telephone line). Most wireless modems use 9 pin connectors. Most line modems use 25 pin connectors. Their connectors are female.

A cable connecting the RTMS Serial port to a modem must employ male connectors at both ends and must transpose the Rx and Tx lines.

Since the RTMS serial port does not include any control lines, some modems may also require looping of their own control lines (RTS, CTS, DTR, DSR) to always receive data.

The modem cable instructions below, show maximum requirements designed to meet the needs of all modems. Connect pins of the male connectors as shown by the table and diagram below:

Connection function	DB9 to DB9 (modem side)	DB9 to DB25 (modem side)
⇒ Transpose Tx and Rx	Pin 2 to Pin 3 Pin 3 to Pin 2	Pin 2 to Pin 2 Pin 3 to Pin 3
⇒ Connect Ground	Pin 5 to Pin 5	Pin 5 to Pin 7
⇒ Connect RTS to CTS	Pin 7 to Pin 8 on modem side DB9	Pin 4 to Pin 5 on modem side DB25
⇒ Connect DTR to DSR	Pin 4 to Pin 6 on modem side DB9	Pin 6 to Pin 20 on modem side DB25

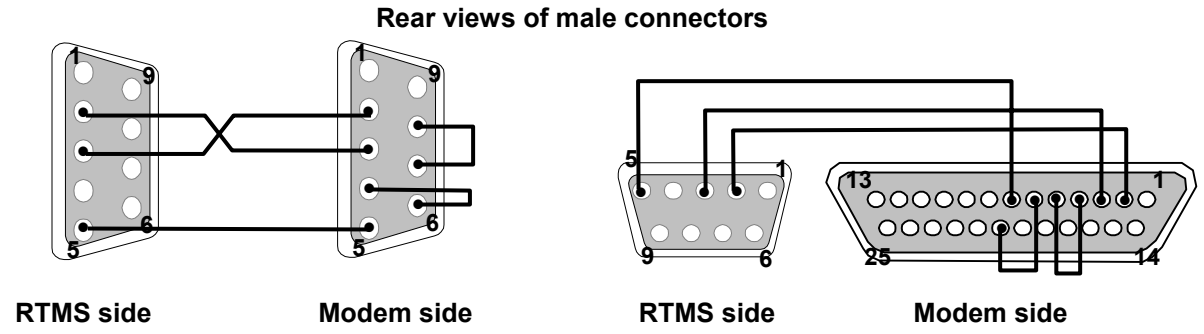


Fig 24. RTMS to Modem cables

7 SERVICE AND WARRANTY

Service Information

The RTMS does not require routine maintenance. It is recommended that the Self-Test is included in the installation procedure. Self-Test should be invoked with the unit installed and aimed at a road. If the unit fails to operate, please refer to the troubleshooting guide or call EIS technical support.

EIS Warranty

EIS Electronic Integrated Systems Inc. warrants this product to be free from defects in material and workmanship for a period of two years from date of delivery. Damage due to accident, abuse by the buyer, or unauthorized modification or operation outside the specifications is not covered by the warranty.

CAUTION
Do not attempt to open, repair or disassemble the RTMS unit.
Such action (breaking the seal) will void their warranty.
Contact EIS if the unit requires servicing

EIS warrants that its software and firmware designated for use with the instrument will execute its programming instructions when properly installed. EIS does not warrant that operation of software or firmware will be uninterrupted or error free.
EIS Inc. will repair or replace at its option, any components, which prove to be defective during the warranty period. Buyer shall pay for shipping charges to EIS. EIS will pay shipping charges and insurance for warranty repaired product. Buyer will be invoiced for repair and shipping of product repaired outside of warranty or when no fault found.

Units returned to EIS for service should include the following information with the shipment

Name and address of owner
Model number, serial number and software revision number
A complete description of the problem. e.g. under what conditions did the problem occur? What equipment was attached? The Self Test indication.
Name and telephone number of someone familiar with the problem who may be contacted by EIS personnel for further information if necessary.
Shipping address for the return.

The unit should be shipped in the original container. If it is unavailable, there should be approximately one inch of packing material between the unit and inner carton e.g. plastic bubble-wrap. The carton should be sealed with strong tape or strapping.

Note: Shipping papers, i.e. Commercial Invoices and Way Bills, should include the statement "Shipped to Manufacturer for Repair" to avoid repayment of duties and taxes.

8 TECHNICAL SPECIFICATIONS

Microwave Signal and Coverage area

	Model X	Model K
Center Frequency	10.525 GHz	24.125 GHz
Bandwidth	45MHz	45MHz
Power Output	10mW	10mW
Beam width – horizontal (azimuth)	15°	12°
Beam width – vertical (elevation)	40°	40°
Range	3-60m (10-200feet)	3-45m (10-150feet)
Number of detection zones	8	8

Measurements, their Accuracies and Ranges

Measurement	% Error *		Range
Per lane Volume (Sidefired)	5%		0-255
Per lane Occupancy (Sidefired)	5%		0-100 %
Per lane Classification by length (Sidefired)	±10%		0-255
Per lane Average Speed (Sidefired)	±10%	X-band	0-160 km/h (0-100mph)
		K-band	0-250 km/h (0-150mph)
Volume and Occupancy (Forward-looking)	2%	Same as Sidefired	
Average speed (Forward-looking)	2%	X-band	0-160 km/h (0-100mph)
		K-band	0-250 km/h (0-150mph)
Range Resolution	2-m (7 Ft.)		
Time events resolution	10 msec.		

* See Accuracy Performance Conditions

Mechanical

Enclosure dimensions	16x24x12 cm (6 x 9.5x 4.5 in.)
Overall dimensions	16x27x18 cm (6 x 10.5 x 7 in.)
Weight	2.2 Kg (5 Lbs.)
Enclosure	Polycarbonate
Weatherproofing	NEMA-4X and IP-65

Mounting Zinc plated steel universal ball-joint bracket. Vertical or Horizontal brackets available. Lynch pin locking allows quick sensor replacement without disturbing the aiming.

Allowable pole flexing less than 5 degrees.

Interfaces

Contacts

RTMS has 8 Opto-isolated contacts for presence indication and a 9th contact used for RS-232 RTS or Power-On indication.

Peak contact ratings are 100mA, 400V, 300mW.

Data Ports

- RTMS optically isolated serial port operates at No parity, 8 bit, 1 stop bit:
  - Models X2 and K2 RS-232 interface operates at fixed 9600 bits/sec rate with a range up to 250m (800 feet).
  - Model X3/K3 (Rev. 6.1 and up) offer adjustable speed in 2400 to 115200 bits/sec range. Operating distance depends on selected speed.
  - Model X3/K3 RS-485 option extends range up to 1200m (4000 feet).
- Models X3 and K3 offer an optional ethernet port.
  Maximum distance to hub or bridge - 100m (300 feet) when using CAT5 cable

Power requirements and consumption

RTMS Standard power requirement		12-24V AC or DC
Maximum voltage (Overvoltage shutdown limit)		34VDC or 24VAC
	Not compatible with Ethernet or DSS options	
Power consumption (Standard Power)	Model X2 - 6 Watts	Model K2 – 8 Watts
	Model X3 –5 Watts	Model K3 – 4 Watts
Additional Power consumption of options	DSS	1.5 W
	TCP/IP	1.2 W
Automatic recovery from power failure	Within 5 seconds	with DSS – 20 seconds

Surge immunity

The RTMS withstands ± 1kV surge (rise time = 1.2 μsec, hold = 50μsec) applied in differential mode to all lines, power and output, as defined by IEC 1000-4-5 and EN 61000-4-5 standards

Environmental Conditions

	Operating limits	Shipping and Storage
Temperature range	-37 to +74°C (-35 to 165°F)	-40° to 80°C (-40° to 171°F)
Humidity	Up to 95% Relative Humidity	Up to 95% Relative Humidity
Vibration	2g up to 200Hz sinusoidal	
Shock	5g 10ms half sine wave	
Wind	Winds up to 160 km/h (100mph) will not degrade performance	
Precipitation (rain or snow)	Up to 100mm/h	

Electromagnetic Interference

The RTMS meets US FCC Rule part 15 Class A and Canadian CSA C108.8 M1983 Class A.

Reliability

Mean time between failures (MTBF) of the RTMS in its operating environment is 90000 hours (10 years)

Accuracy Performance Conditions!

Error performance parameters outlined above are achieved under normal, high-flow traffic conditions and are subject to proper installation and setup. Reduced accuracy (higher errors) will be experienced under the following conditions:

- Low speed, high congestion conditions: The RTMS tends to over-count under low speed conditions (below 1mph) as the setting of the EDT parameter may not bridge nulls in the reflected signals adequately resulting in multiple counts.
- Low vehicle volumes in Sidefired configuration (as experienced during night time) may result in higher speed data fluctuations due to the small statistical sample.
- Improper selection of installation site: insufficient set-back, height beyond the recommendation, obstruction by barriers or high fences before monitored lanes.
- Improper Fine Tune setting for the road geometry (lane width, barriers, etc.) will result in "splashing" and, therefore, over-counting. In some cases, attempts to cover too many traffic lanes with a single RTMS may result in inability to find correct Fine Tune setting and compromised performance.
- In Forward-Looking Hwy configuration, high variance between the volumes in the speed-trap zones due to improper aiming or obstructions within the trap range or incorrect Height or Offset parameters may result in higher speed and length measurement errors.

9 RTMS TROUBLESHOOTING GUIDE

Field troubleshooting of the RTMS consists mostly of ensuring that the unit is powered and communicating and running the Self-Test (two-way communication is required to run Self-Test).

Communication from a sensor in **Normal** mode is indicated by flickering of the "lamp" in the lower right corner of the screen, denoting target data transmission activity.

The Self-Test is invoked using the RTMS Setup Utility by selecting **TOOLS** and **Self-Test.** The test checks internal functions and locates hardware faults. The "All tests complete System OK!" message is displayed on the screen if no faults are found. The following is a list of Self-Test messages describing a fault and corrective action.

"Power supply fault!"	Send back
"Modulator signal fault!"	Send back
"Microwave module fault!"	Call EIS
"Temperature calibrator fault!"	Send back
"Modulator memory fault!"	Send back
"Program memory fault!"	Send back
"DSP fault!"	Send back
"Gain too low or ADC fault!"	Call EIS
"Logic failure"	Call EIS
"No signal"	Call EIS
"Saturation signal level"	Call EIS

The Self-Test cannot test the Opto-pairs. It will, however, close the zone contacts for one second in sequence. Operation of opto-isolated contacts can then be verified using the controller display, ohm-meter or any other suitable device showing continuity.

The table below outlines symptoms and suggested action in troubleshooting power and communication problems:

Symptom	Possible causes	Suggested action
"RTMS is not responding…" message continues to be displayed after attempts to set the sensor to Normal mode	Power failure Cable problem Hardware	• Check that the supply voltage is within limits at source and at the MS connector as defined in Section 6. Voltage outside the limits (too low or too high) will cause power supply shut down. • With power applied to the RTMS and DB9F disconnected from PC, check the RTMS serial Port by measuring approx –10V between pins 2 and 5 of the DB9F RS-232 connector. If the voltage is not present there could be a hardware fault in the RTMS serial port or power supply. If neg voltage is there. • Check cable pin-out and continuity particularly between MS connector pin T and COM port's pin 3 (Tx line) • Alternate serial option (see cabling sections)

Symptom	Possible causes	Suggested action
"RTMS is not responding…" message continues to be displayed after attempts to set the sensor to Normal mode	PC unable to communicate with the RTMS due to Serial port setup or H/W problems	• Check that the PC COM1 port is selected via the default screen. • Check that COM1 port is available and not used by another application (e.g. serial mouse) • Check that PCs serial port is operational (-5V present between pins 3 and 5)
Polling range window is displayed on start of RTMS Setup Utility	RTMS Setup Utility is in Multi-drop Mode	• Click **OK** on the polling range window; RTMS Setup default screen will be displayed. • Select **TOOLS**, Change to **Direct** mode, if direct access to one RTMS is desired
Target "blips " are not shown on the main screen displayed on program initiation (PC and sensor are communicating)	RTMS is not in **NORMAL** mode Unit is not aimed properly Low Sensitivity Internal parameters corrupted	• Ensure the unit is in the Normal mode • Generate a target by waving a hand in front of the unit. If a blip does not appear a hardware fault may be present. • Check sensitivity setting. See if targets appear when sensitivity is increased • Recycle power to unit. Load a prepared file on supplied software disks (e.g. FWDLK) and then edit parameters (mode, sensitivity, zone setup, etc) • Run Self-Test if above not successful. Report findings to EIS
Main screen shows target blips but no zone icons, parameters on buttons and all zero statistics. Self-Test initiated but results are not displayed on PC screen	PC receives but does not send any commands and has not received the RTMS setup.	• Check cable to ensure continuity between MS connector pin T and COM port's pin 3 (Tx line) •
The setup program is unable to read an RTMS with DSS modem (Messages displayed; sensor settings are not displayed)	Pin "a" is not cabled. PC cannot send any commands and has not received setup data	• Examine cable and correct to include pin "a" cabling to DB9F pin 4 (DTR) if omitted

APPENDIX 1 WIRING CONFIGURATIONS FOR MULTIPLE RTMS

Modem Sharing

A limited number of RTMS units in polled mode, located within a short distance, may share a single modem. While models X2/K2 require use of contact #9 (see RTMS Cable modification below) , models X3/K3 Serial port design allows two or more transmit lines to be connected directly without interference.

A cable for modem sharing will have Y-cable construction and will consist of one DB-9M connector per RTMS and one DB-9M or DB-25M connector at the modem, as shown below:

Modem-sharing Cable Construction

Connection type	DB9 to DB9 (modem side)	DB9 to DB25 (modem side)
⇒ Transpose Tx and Rx	Pins 2 to Pin 3 Pins 3 to Pin2	Pins 2 to Pin 2 Pins 3 to Pin 3
⇒ Connect Signal Ground	Pins 5 to Pin 5	Pins 5 to Pin 7
⇒ Strap RTS to CTS	Pin 7 to Pin 8 on modem side DB9	Pin 4 to Pin 5 on modem DB25
⇒ Strap DTR to DSR	Pin 4 to Pin 6 on modem side DB9	Pin 6 to Pin 20 on modem side DB25
⇒ Connect a 100kΩ resistor from Tx to ground to prevent noise	Pin 3 to Pin 5 on modem side DB9	Pin 2 to Pin 7 on modem side DB25

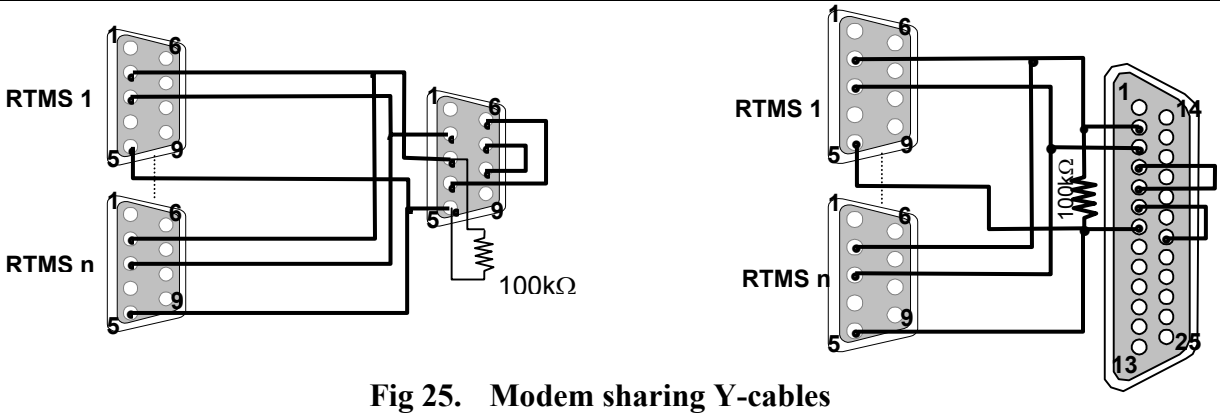


Fig 25. Modem sharing Y-cables

RTMS Model X2 Cable Modification

The design of the RTMS Serial port of the Model X2/K2 requires that only one transmit line is connected to the modem at a time. This is achieved by using the Opto-isolator contact #9. The RTMS closes this contact on receipt of its ID number in the polling message. The RTMS cable must be modified to insert this contact in the transmit path, as outlined below:

⇒ Ensure pins **d** and **e** are present in the MS connector of each RTMS

⇒ Loop the RTMS transmit line (pin V) to pin "e" inside the MS connector back-shell

⇒ Connect pin "d" to pin 2 of RTMS DB9F connector. Note: pins "d" and "e" are interchangeable. Looping pin V to pin "d" and cabling pin "e" to DB9 pin 2 is also correct

Multi-drop Wiring

Multiple RTMS stations operating in Polled mode may be connected to a single communication line or channel for transmission of data. Each must have its own modem when separated by more than the limits of the serial port. Each RTMS receives the poll commands but transmits data only on receipt of its own ID. See **RTMS RS-232 port to Modem cables** per **Fig. 24**

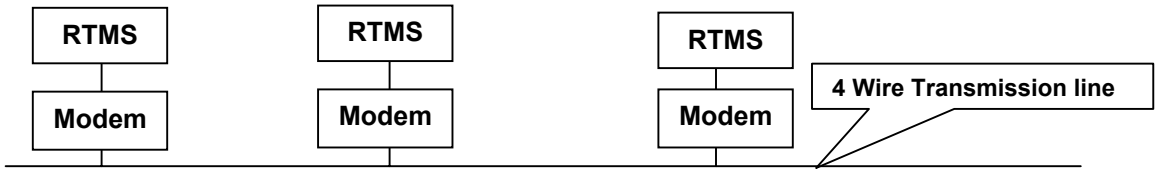


Fig 26. Multi-drop wiring configuration

For distances up to 4000 feet multi-drop configuration may employ the RS-485 Serial Port option. Maximum number of units is 32. The communication line can be configured as 4-Wire (shown in Fig. 27) or 2-Wire half-duplex (RTMS cannot transmit while its receiving) suitable for data collection operation only. Consult RS-485/422 Application Guides for details on 2-Wire configuration

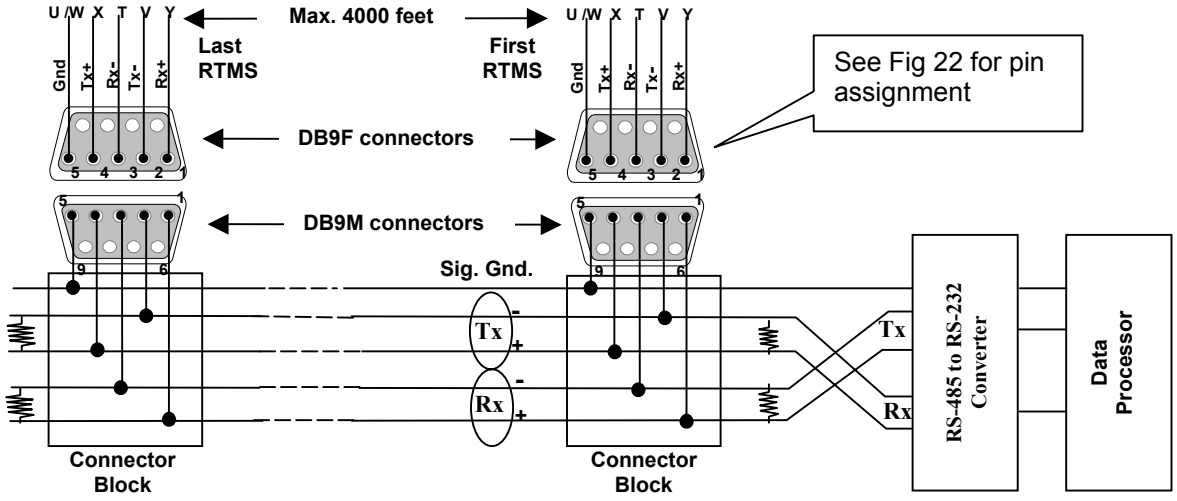


Fig 27. RS-485 Port Multi-drop Wiring

Notes:

1. The use of DB9F connectors, as shown, allows direct connection to the laptops COM port for setup. Wiring must allow for unplugging the RTMS from the transmission line. Use of terminal blocks to connect the DB9M connectors to the transmission line is recommended.
2. Terminating resistors (100-120 ohms) are required at the extreme ends of the Receive and Transmit transmission pairs.
3. Transmit and receive pairs must be transposed when connecting to a RS-485/232 converter for direct interface with a DTE (Data processing System).
4. RS-485/232 converter pin assignment varies between models as it is not standardized.

APPENDIX 2 SETTING RTMS IP ADDRESS

Programming an IP address

The RTMS Micro-Server is programmed with a default IP address 128.100.101.254. This address may be changed using a directly connected PC, as follows (note slight differences between versions of Windows):

⇒ Set PC network address in the range 128.100.x.x in the following steps

- Access the Control Panel as applicable to your operating system
- Open "Network" (win 98) or Network Connections and Local Area Connections/properties (Win XP)
- From the list of installed network components select and open "TCP/IP → xxx " (Win 98) or "Internet Protocol (TCP/IP" (Win XP) that is installed on this PC. Check System/Device Manager/Network Adapters under Control Panel to identify the correct device
- Click Properties and "Specify an IP address" (Win 98) or Use Following IP Address (WinXP)
- Enter 128.100.101.1, and Subnet = 255.255.0.0 . Click **OK** and Close

⇒ Power the RTMS and connect it to the PC network port using a network cable. Verify that a correct cable is used by observing the PCs Network port Link and Activity indicator lights, which should light

⇒ Open MS DOS prompt (under Programs) to ping the RTMS

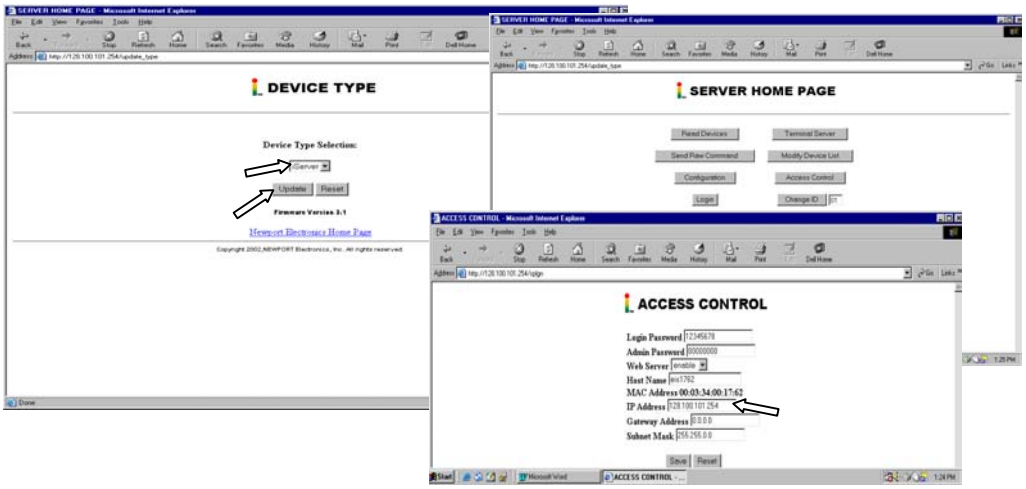
Type C: \>ping 128.100.101.254 and observe response

⇒ If ping is successful, access the RTMS via a web browser (using the above network address)

On successful connection the Device Type page will be displayed. Select **iServer** from the drop down menu and click **Update** to go to the home page, shown below.

⇒ Click **Access Control**

⇒ Enter Login password = 12345678 and Admin password = 00000000 when prompted (ensure cursor is in the field before typing)



⇒ Overwrite the IP Address and the Subnet Mask with the desired settings and click **Save.**

Do not open and make changes in any other settings accessible from the Server Home page

⇒ De-power the RTMS to allow the microserver to reset itself

⇒ Connect RTMS to a network hub (or Ethernet bridge)

⇒ Repeat ping routine over the network using the new IP address to verify (use an opposite cable type to connect to a hub)

Recovery Procedures

The MAC (Media Access Control) is a unique hardware number associated with each ethernet interface. This 6 byte number (12 hexadecimal characters) is furnished with RTMS shipping documents.

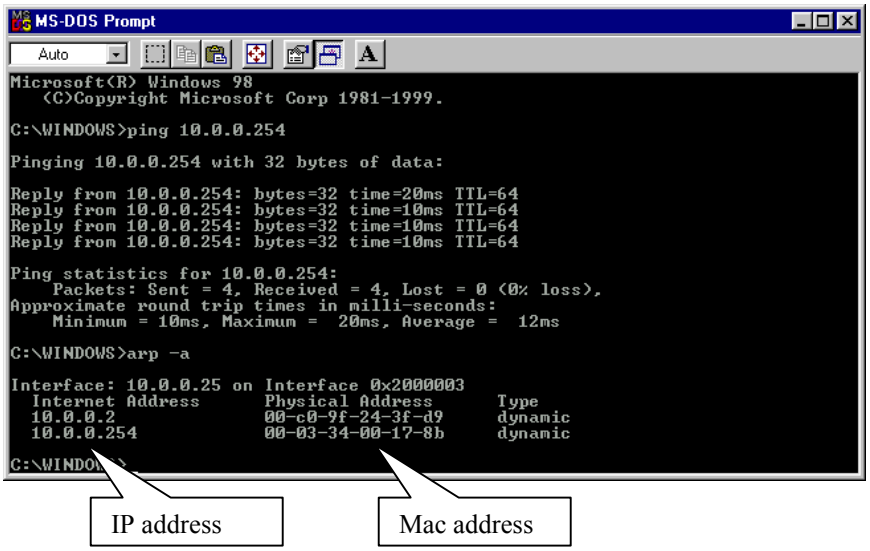
Lost MAC or IP address can be recovered from the RTMS if one of them is known. If both are lost, the sensor must be returned to EIS for recovery.

Recovery of MAC address

The MAC address can be obtained using a similar procedure to changing the default IP address. Note that MAC address is included in the Access Control page.
An alternate method uses the ARP (Address Resolution Protocol) protocol supported by the microserver. The ARP Internet layer protocol, which uses MS DOS Prompt, is responsible for determining the MAC (hardware) address that corresponds to a particular IP address.

The "arp –a" command allows the user to view the current contents of the ARP cache of the local computer (residing on the same network) or remote computer (residing on the different network) through a router.

A device should be "pinged" using IP address before using "arp –a" command as shown by the sample session



Recovery of IP address (MAC address known)

DNS (Domain Name System) enables individual devices to be recognized over a network based on a Host name instead of an IP address. The default Host name for the microserver is "eis" followed by the last four characters of the MAC address, e.g. eis178b.

APPENDIX 3 INTERNAL DSS MODEM SETUP

If the internal DSS modem fails to communicate with the master, as indicated by the red DSS rectangle it may be necessary to view and make changes in the DSS setup. To view setup

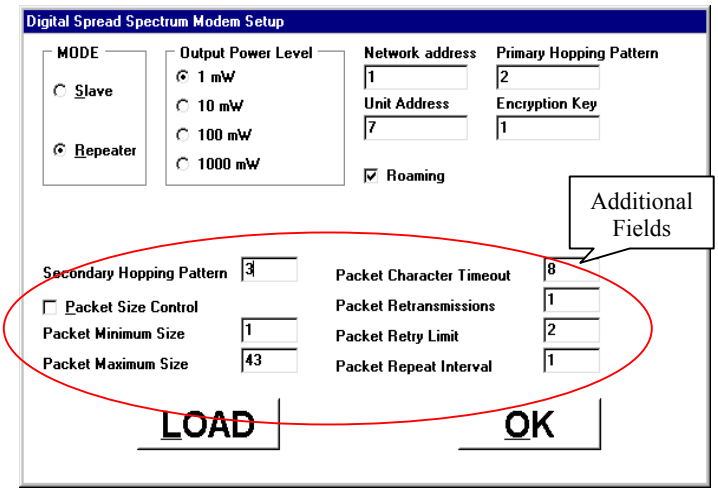
⇒ Click **TOOLS** button and **PC COMM**

⇒ Click **DSS Modem** button on the **Communication Protocol Setup** window

⇒ Ensure settings are:

Slave mode for a simple line of sight communication to the master.

Repeater if this modem relays data from another DSS modem, which is not in line of sight with the master. Additional fields will be displayed (shown)



Roaming is on. This feature of the transceiver allows Slaves and repeaters to locate a master by the network address and encryption key and adopt its primary hopping pattern

The DSS parameters and their ranges should be as follows:

Advanced Par.	Description
Network Address	This address must be same for all RTMS units and the Master in a specific system. Range 1-65535
Encryption Key	This field must be set to the same value for all modems in a specific system, including Master. Range 1-65535
Hopping Patterns	The **Primary Hopping Pattern** field must be filled with a hopping sequence (Range 1-63) for communication between the slave (or repeater) and the system master. The **Secondary Hopping Pattern,** displayed when **Repeater** is clicked, applies to communication between a repeater and its slave(s). It must be different than the **Primary Hopping Pattern**
Unit Address	Each modem must be set to a unique ID number within the system.
Output Power Level	Output power should be kept at the lowest setting, which provides reliable operation. 100 mW meets requirements of most applications. 1 mW or 10 mW may be sufficient in SPIDER applications at short ranges.
Packet Size control	Allows packets generated by slaves and repeaters to be of different size than masters.
Packet fields	Effective only if Packet Control is clicked.
Min/Max Packet size	Applicable to slaves and repeaters only if Packet size control is clicked. Otherwise Master settings take precedence.

Click **LOAD** to save displayed settings, Click **OK** to exit without changes to settings

APPENDIX 4 RECOMMENDED RTMS SETUP SHEETS

RTMS SET UP SHEET – HIGHWAY - Completed sample

RTMS ID #	*1*		**NOTES**		*20 foot Median between Fast N and Fast S*			
LOCATION	*Mile 15*				*Trucks in Slow N*			
FINE TUNE	*-1*							
SENSITIVITY	*5*							
SAVED FILE NAME	*May2002Mile15*		When verifying counts a minimum of 50 vehicles must be counted					
BARRIER/TYPE	**YES / NO**	*yes*	**BETWEEN WHICH LANES**		*Jersey barrier between 2 and 3. 7 foot shoulders*			
ZONE	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
DIRECTION	*N*	*N*	*S*	*S*				
LANE (FAST MID SLOW)	*Slow*	*Fast*	*Fast*	*Slow*				
MANUAL COUNT	*50*	*50*	*50*	*50*				
RTMS COUNT	*51*	*48*	*49*	*51*				
% ERROR	*+2*	*-4*	*-2*	*+2*				

MESSAGE PERIOD *30* **[SECS]** **POLL MODE (Y/N)** *Y* **TECH. INITIALS** _____

APPROVED _____

RTMS SET UP SHEET – INTERSECTION - Completed sample

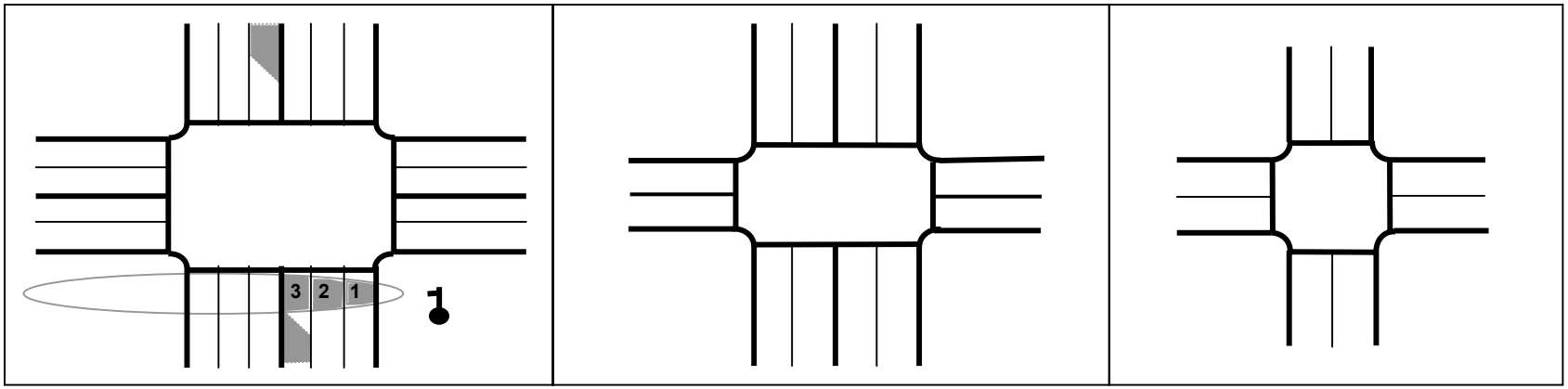
CITY / JURISTRICTION	*City of ABC*							
LOCATION / INTERSECTION	*Main & 1st Ave.*							
RTMS ACTIVE CORNER	*Main – Northbound*							
RTMS MOUNTED ON	*Existing pole 15 feet forward of stop bar. Extension arm used*							
RTMS ANGLE TO SIDE OF VEHICLES	(Max 10 degrees) *Less than 5 degrees*							
FINE TUNE	*-3*	**NOTES**						
SENSITIVITY	*11*	*6 foot extension arm mounted on the pole to correct the position of the RTMS*						
RTMS EXTENSION DELAY TIME (A)	*2 sec*							
DESIRED DELAY (B)	*3 sec*							
CONTROLLER DELAY (A + B)	*5 sec*							
SAVED FILE NAME	*Sep22 (main-1st)*							
OBSTRUCTIONS	**YES / NO**	***No***	**NAME OBSTRUCTIONS**			*Clear line of sight*		
ZONE	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
DIRECTION	*N*	*N*	*N*					
LANE (LEFT TURN THROUGH RIGHT TURN)	*Thru/right*	*Thru*	*Left*					
VEHICLES DETECTED AND HELD								

INSTALLATION COMPANY ***XYZ Electric*** **TECH INITIALS** _____

APPROVED _____

Show RTMS locations, Control Cabinet and specific lanes being detected.

For more info refer to RTMS User Manual



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