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Record of Revisions

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Preface

Introduction

The RTMS (Remote Traffic Microwave Sensor) measures the distance to objects in the path of its microwave beam. This ranging capability allows it to detect moving and stationary vehicles in multiple detection zones.

A single RTMS can monitor traffic in up to 12 lanes. The RTMS can be mounted on road-side poles and aimed perpendicular to the road; this is referred to as the “side-fired” configuration.

The internal processor calculates volume, occupancy, average speed, and vehicle classifications for each lane and transmits the information using its communication interfaces. Note, other data is also available, for a full list, see “Define Message Composition” on page 4-15.

Safety Information

Please review the following information before installation.

• Read all instructions before using.
• Heed all warnings in these instructions.
• Save these instructions for future reference.
• RTMS units must be installed and adjusted in accordance with the installation instructions contained in this manual.
• Use the RTMS only for its intended purposes as described in this manual. Changes or modifications not expressly approved by the manufacturer could void the user's authority to operate the equipment.
• Consult Technical Support before using the RTMS or other RTMS-related products for any purpose not expressly described in this manual or any other RTMS product manual. Do not use the RTMS to control or operate a gate-opening mechanism. Use of the RTMS for any unauthorized purpose may cause injury to personnel or damage to equipment.
• For optimal accuracy, it is strongly recommended that only trained personnel survey the sites and install all RTMS-related products.
• For more information about our installation, surveying, and training programs, contact your RTMS sales representative.
Installer Qualifications

If you are installing RTMS hardware you must perform the following tasks:

- Choose an appropriate installation location.
- Manage your own personal safety and safety of other personnel.
- Assemble a list of the required equipment.
- Have experience creating cables.

If you are using the RTMS Setup Utility you must perform the following tasks:

- Operate a mouse.
- Operate a keyboard.
- Start Windows.
- Install new software.
- Save and open file using Windows common file dialog.
Technical Support

If you cannot correct the problem, do the following before contacting Technical Support:

- Return to the beginning of the entire installation process and review the steps. Be sure that you followed all of the instructions provided.
- If you reviewed the installation instructions and you are still encountering a problem, document:
  - What is happening. Example: Unable to set up networking.
  - When the problem started. Example: During software installation.
  - Any error messages that were shown including the exact words and any numbers in the message.
- If possible, have another person try the installation to the stage where you encountered problems.
- If the attempts to correct the problem fail, call Technical Support.

North American Users’ Resource

North and South American customers call Econolite Control Products, Inc. at:

Toll Free: 1.800.225.6480
Main telephone: 1.714.630.3700
Fax questions to: 1.714.630.6349

All Other Users’ Resources

Customers outside Northern and Southern America may call Image Sensing Systems, Inc. headquarters at:

Main telephone: 651.603.7700
Fax questions to: 651.305.6402
Or contact one of our international offices:

ISS Europe Ltd.

Phone: +44.1707.378870
Fax: +44.1707.378875
City Park
Swiftfields
Welwyn Garden City
Hertfordshire AL7 1LY United Kingdom

ISS Europe Ltd. Poland Branch

Phone: +48.12.410.11.40
Fax: +48.12.410.11.41
31-431 Krakow
ul. Czerwonego Pradnika 6
Poland
Flow Traffic Limited - Hong Kong Office
Phone: +852.2827.1123
Fax: +852.2827.0056
Suite 1513, 15/F.,
Chevalier Commercial Centre
8 Wang Hoi Road
Kowloon Bay, Hong Kong

Flow Traffic Limited - China Office
Phone: +86.755.8217.8853, 8235.0131, 8235.0132
Fax: +86.755.8221.9565
Room 712, Kerry Centre
Renminnan Road
Shenzhen, China 518001

Image Sensing Systems Canada Ltd.
Phone: +1.416.785.9248
Fax: +1.416.785.9332
150 Bridgeland Ave, Suite 204
Toronto, Ontario
Canada M6A 1Z5
Chapter 1: Introduction

General

The RTMS G4 (Remote Traffic Microwave Sensor—4th Generation) is a true RADAR device, 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. When pointed onto a roadway, the RTMS microwave beam projects an oval footprint. Its range is divided into multiple micro-slices, in which vehicles are detected.

The RTMS receives reflected signals from all surfaces within its beam—pavement, barriers, vehicles and trees. Vehicles are detected when their reflected signal exceeds the background level in their micro slice by a certain threshold. If that detection is part of a defined zone, its contact (optional) is closed during the detection period to indicate detection.

Multiple operating modes optimize internal parameter settings for highway (mainly free flowing traffic) and urban (mainly congested traffic) applications. A user can select how the RTMS is configured by setting these modes in the RTMS Setup Utility.

For mounting:

- The RTMS is located on a roadside pole and is aimed perpendicular to the traffic lanes.
- Micro-slices corresponding to the location of traffic lanes are allocated as detection zones during the setup process.
- Each detection zone consists of multiple micro slices.
- The length of the detection zone is determined by the width of the beam's footprint.
Vehicle Detection

RTMS technology allows accuracy in the following conditions, even with a relatively low mounting-height:

- Severe weather and fog
- At night
- Strong vibrations common to roadways that carry large vehicles
- When vehicles are completely occluded by other vehicles

RTMS Options

The standard RTMS G4 Model (G4-STD) offers the following:

- K-band (24.125 GHz)
- Low Voltage Power 12-24 V AC or DC
- Eight MB Internal Data Storage Memory
- Serial RS-232/485
- Bluetooth Wireless

The following RTMS model are also available (each comes equipped with Contact Closure for up to 12 Zones):

- G4-CAM (base unit with IP Camera)
- G4-DSS (base unit with Digital Spread Spectrum (DSS) radio)
- G4-SSP (base unit with a second serial port)
- G4-TCP (base unit with TCP/IP Ethernet)

For information about the above options, see the RTMS Optional Configurations User Guide.
RTMS Technical Specifications

Table 1-1: Mechanical Specifications

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enclosure Dimensions</td>
<td>20x20x15cm (8x8x6 in.)</td>
</tr>
<tr>
<td>Weight (Without Optional Equipment)</td>
<td>1.6kg (3.5 lbs)</td>
</tr>
<tr>
<td>Enclosure Material</td>
<td>Polycarbonate</td>
</tr>
<tr>
<td>Weatherproofing</td>
<td>NEMA-4X</td>
</tr>
<tr>
<td>Mounting</td>
<td>Gold chromate plated cast aluminum bracket capable of supporting a load of up to 9.1 kg (20 lbs). (Vertical or horizontal). Lynch-pin locking allows quick RTMS replacement without disturbing the aiming.</td>
</tr>
<tr>
<td>Allowable pole flexing</td>
<td>Less than 5 degrees</td>
</tr>
</tbody>
</table>

Table 1-2: Power Requirements and Consumption

<table>
<thead>
<tr>
<th>Component</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTMS standard power requirement</td>
<td>12-24 VAC or DC (see the “Notes on Power:” on page 2-1.</td>
</tr>
<tr>
<td>Polarity protection</td>
<td>Not polarity sensitive</td>
</tr>
<tr>
<td>Over-voltage shutdown limit</td>
<td>34 VDC or 24 VAC</td>
</tr>
<tr>
<td>Recommended fusing (external)</td>
<td>2A slow blow minimum</td>
</tr>
<tr>
<td>Power consumption (Without optional equipment)</td>
<td>3 Watts</td>
</tr>
<tr>
<td>Automatic recovery from power failure</td>
<td>Within 20 seconds</td>
</tr>
</tbody>
</table>
Introduction

Chapter 1:

Accuracy Performance Conditions

Error performance parameters outlined above are achieved under normal, high-flow traffic conditions and are subject to proper installation and setup. Lower accuracy is expected under the following conditions:

Table 1-3: Microwave Signal and Coverage Area Specification

<table>
<thead>
<tr>
<th>Specification</th>
<th>Model K4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Center Frequency</td>
<td>24.125 GHz</td>
</tr>
<tr>
<td>Bandwidth</td>
<td>50 or 75 MHz (depending on settings)</td>
</tr>
<tr>
<td>Power Output</td>
<td>100 mW</td>
</tr>
<tr>
<td>Beam Width: Vertical (Elevation)</td>
<td>50°</td>
</tr>
<tr>
<td>Beam Width: Horizontal (Azimuth)</td>
<td>12°</td>
</tr>
<tr>
<td>Side Lobes</td>
<td>&gt;-20 dB</td>
</tr>
<tr>
<td>Range</td>
<td>0-76m (0-250 ft)</td>
</tr>
<tr>
<td>Number Of Detection Zones (Lanes)</td>
<td>12</td>
</tr>
</tbody>
</table>

Table 1-4: Accuracy of Measurement & Error Rates

<table>
<thead>
<tr>
<th>Measurement</th>
<th>% Error *</th>
</tr>
</thead>
<tbody>
<tr>
<td>Per Lane Volume: Side-Fired</td>
<td>5%</td>
</tr>
<tr>
<td>Volume Range</td>
<td>0-65535</td>
</tr>
<tr>
<td>Per Lane Occupancy: Side-Fired</td>
<td>5%</td>
</tr>
<tr>
<td>Occupancy Range &amp; Resolution</td>
<td>0-100%, 0.1%</td>
</tr>
<tr>
<td>Per Lane Classification By Length (6 classes)</td>
<td>10%</td>
</tr>
<tr>
<td>Class Lengths Limits range and resolution</td>
<td>25.5m 0.1m (83.6 ft)</td>
</tr>
<tr>
<td>Average Per Vehicle Speed: Side-Fired</td>
<td>10%</td>
</tr>
<tr>
<td>Speed range and resolution</td>
<td>0-160 Km/h, 1.6 Km/h (100 mph, 1 mph)</td>
</tr>
<tr>
<td>Resolution of time events</td>
<td>1.25mS</td>
</tr>
<tr>
<td>Voltage readout resolution</td>
<td>0.1v</td>
</tr>
</tbody>
</table>

*Accuracy Performance Conditions

Error performance parameters outlined above are achieved under normal, high-flow traffic conditions and are subject to proper installation and setup. Lower accuracy is expected under the following conditions:
• Low speed, high congestion conditions: The RTMS tends to be less accurate under very low speed conditions.
• 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.
• Large trucks may occlude smaller vehicles. If there is a high number of trucks in traffic, the potential of occlusion increases, which may affect accuracy.

**Electromagnetic Interference**

Certified under US FCC Rule part 15 Class A; Canadian CSA C108.8 M1983 Class A; CE.

**Surge Immunity**

The RTMS withstands ± 1kV surge (rise time = 1.2 µsec, hold = 50 µsec) 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**

<table>
<thead>
<tr>
<th>Item</th>
<th>Operating Limits</th>
<th>Shipping &amp; Storage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature Range</td>
<td>-37 to +74°C (-35 to 165°F)</td>
<td>-40° to 77°C (-40° to 171°F)</td>
</tr>
<tr>
<td>Humidity</td>
<td>Up to 95% Relative Humidity</td>
<td>Up to 95% Relative Humidity</td>
</tr>
<tr>
<td>Vibration</td>
<td>2 g up to 200 Hz</td>
<td></td>
</tr>
<tr>
<td>Shock</td>
<td></td>
<td>5 g 10 ms sine wave</td>
</tr>
<tr>
<td>Wind</td>
<td>Winds up to 161 km/h (100 MPH) will not degrade</td>
<td></td>
</tr>
<tr>
<td></td>
<td>performance</td>
<td></td>
</tr>
<tr>
<td>Precipitation</td>
<td>Up to 100 mm/h</td>
<td></td>
</tr>
</tbody>
</table>

Printed circuit boards are conformally coated for protection against humidity and corrosion.

Except as may be other stated herein for a particular item, no item, component, or subassembly shall emit a noise level exceeding the peak level of 55 dBA when measured at a distance of one meter away from its surface.
Reliability

The RTMS is designed for Mean Time Between Failures (MTBF) in its operating environment of 90000 hours (10 years).

Upgrade Capability

User upgrades of both hardware and firmware available. Units can be upgraded through direct connection or remotely. Direct connection is done using the RS-232/485 connection at the site. If going to the site is not feasible, the RTMS does support remote firmware upgrade through our optional communications modules (see “RTMS Options” on page 1-2). If the remote communication link is unstable, it is recommended that you use the direct connection method.
Chapter 2: Hardware Installation

General

This chapter describes the installation and set up of the hardware components of the RTMS. The following information should be taken into consideration prior to installing the RTMS.

Notes on Power:

The RTMS is a constant power device that requires in its basic configuration 3 watts of power. Electrical power has two components, voltage and current; both must be available in the correct ranges to operate the RTMS. The voltage must be between 12 and 24 volts (DC or AC RMS) with the voltage level read at the RTMS. Voltages below 12 volts will be insufficient to power the RTMS; voltages above 24 volts will cause the RTMS to shut down to protect itself from an overvoltage condition. Losses in the cable must be addressed in setting the voltage to be supplied to the unit.

Current in sufficient quantity must be available: at 12 volts, the RTMS will draw 250 mA of current; at 24 volts 125 mA (base model, higher for units with additional communications options). Using an adaptor that provides 12 volts and 100 mA of current means that the total power to the RTMS will be 12*0.1 = 1.2 watts, or roughly 40% of the power needed to turn on the RTMS.

On power up, there will be an inrush current that will be several times higher than the operating current. The power supply must be able to handle this temporary current flow. If the power supply is unregulated (such as a simple step-down supply from 120 VAC to 24 volts (AC or DC)), the output voltage may be higher than specified when the current draw is less than maximum available from the supply. This may cause the RTMS to sense an overvoltage condition and shut down to protect itself.

If additional hardware (such as optional communications modules) is added to the RTMS, the power required to operate the RTMS will increase. The voltage seen by the RTMS will remain the same, but the current will increase to meet the new power requirement.

Note on Cabling:

The design of an RTMS installation should include a breakout box close to the RTMS that can be used for setup and maintenance purposes, and can include surge suppression circuitry and external communications devices as required. Reference designs are available.

Notes on Communications:

The communication method that comes standard on all RTMS units is serial, which can be configured for RS-232 or RS-485 and Bluetooth. Port 1 is the main port that is connected to the outside world, Port 2 (optional) is installed to communicate with other internal communication devices (for a complete list, see “RTMS Options” on page 1-2).

It is recommended that serial port 1 be accessible to the outside world for maintenance purposes, even if the primary communication with the RTMS will use another method.
The serial port can support hardware handshaking. It is critical that hardware handshaking (RTS/CTS) not be enabled by the software if the wires are not installed in the cable. Enabling RTS/CTS without the wires being in the cable will prevent the RTMS from communicating with the outside world.

**RTMS Placement in Side-Fired Highway Configuration**

RTMS is designed to mount on existing poles and road structures. Figure 2-1 shows typical cases of RTMS side-fired/highway sites. The design considerations for each case are:

- **Case 1** — Maximal utilization of the RTMS zone capability. Limitations are as follows:
  - A 12-zone coverage requires a larger setback (the distance to the first lane. If setback is insufficient, two RTMS units may be required (see “Height and Setback Requirements” on page 2-4).
  - Limitations in mapping range slices to lanes will cause decreased accuracy. The site designer must weigh the trade-off between required level of accuracy and cost.
  - In almost all cases, the RTMS can resolve the barrier signal from that of the vehicles in the lane immediately behind it as long as 50% of vehicle can be seen (see “Guardrails and Barriers” on page 2-7).

- **Case 2** — Overpass installations: Do not mount the RTMS on a perpendicular overpass. Instead use poles located at least 5m (17 feet) from the overpass to avoid multi-path. Multi-path is a situation in which the reflected signals from vehicles can also reach the RTMS by a secondary reflection from a large flat surface (such as a sign or overpass). If the overpass is at an angle to the road, take advantage of the angle to point the RTMS at the monitored roadway and away from the overpass. Do not aim the beam under it.

- **Case 3** — Using median poles to mount two RTMS sensors, one per direction may save poles but the designer should verify available set-back (see “Height and Setback Requirements” on page 2-4).

- **Case 4** — Sign-structure installations (see “Installing RTMS on Sign Structures” on page 2-9).

- **Case 5** — Typical ramp metering site.
Figure 2-1: RTMS Side-Fired Highway Sites
**Height and Setback Requirements**

The RTMS has a detection area of 76m (250 ft), and is able to detect up to 12 lanes of traffic within that distance. Make sure that all lanes of traffic are within 76m (250 ft) of the RTMS.

Setback is the distance between the close edge of the first lane of traffic to be monitored and the front of the structure on which the RTMS is mounted. Setback is a limiting installation parameter of the RTMS. More lanes can be covered with a larger setback.

**Zero Setback**

The RTMS has the ability to detect vehicles in lanes with zero setback, i.e., pole location immediately beside the first lane of detection. Many Midblock detection sites, as well as bridges, have limited setback.

![Figure 2-2: Zero Setback](image)

Zero setback operation is limited to a maximum of four lanes and the mounting height would be approximately 4 m (14 ft).

It is always recommended to obtain as much setback as possible as this may improve the overall detection. The zero setback feature is available with all G4 units and should only be used if the situation dictates. Where significant setback is available please refer to the standard installation charts.

**Standard Setback**

The RTMS should be mounted at a minimum height of 5m (17 ft) to minimize occlusion of vehicles even by the tallest trucks.

It must be set back from the first monitored lane to ensure it includes all required lanes within its field of view. The amount of setback varies with the width of the road to be covered.

Use the diagrams in Figures 2-3, 2-4, and 2-5 to determine the setback required to monitor a given number of lanes. The correct installation height can be determined once the setback is set. Height is measured relative to the road surface of the detection area. Do not measure height from the bottom of the mounting pole.
NOTES:

- It is almost always better to be further back from the minimum. If real estate is available, move the RTMS further back.
- The mounting height is based on the setback. Using the correct height value allows the RTMS to be aimed so that it receives maximum return signal while covering all required lanes. Mounting the RTMS at an incorrect height will reduce accuracy.
- Median strips must be included in the total detection area. For example: You may be able to set up 12 zones, but they must be within 76m (250 ft).

![Figure 2-3: RTMS Initial Aiming](image)

The amount of setback you have will determine your actual detection area. As shown in Figure 2-2, a setback of 0 to 1.6m (0 to 5 ft) will allow the RTMS to detect vehicles up to about 15m (50 ft). A setback of 7m (23 ft) allows the RTMS to detect vehicles up to 61m (200 ft) of the RTMS.
A setback greater than the minimum is desirable if room is available. Set the proper mounting height based upon actual setback distance.

**Figure 2-4: Setback Distance Chart**

**Figure 2-5: Mounting Height Chart.**
Figure 2-6 shows the effect of restricted setback on the number of lanes that can be monitored by a single RTMS. Depending on the total area of detection required and the available setback the need for a second unit may be required. The same pole can be used to install the unit; however, a minimum of 1m (3.3 ft) is required between the units.

Guardrails and Barriers

In almost all cases, median guard-rails or barriers do not interfere with traffic detection. In the few cases in which such interference may occur, e.g. large metal barrier, very tall barriers or movable metal fences, a good solution is to use a second sensor on the other side of the road. Each of the sensors can monitor lanes on its side of the barrier, requiring a smaller setback to cover fewer lanes, as shown below.
Elevated Roadway

On elevated or sunken roadways with insufficient outside shoulders, it may be an impossible job for a single sensor. Two RTMS units, configured as shown by Figure 2-8, will cover all lanes if detection zones are defined as shown in Figure 2-8.

![Figure 2-8: RTMS on Elevated Roadway](image)

RTMS can also monitor elevated highways from tall poles erected on the lower level. However, in this case the setback should be less than 8m (26 ft), to avoid the strong reflection from the side of the structure.

![Figure 2-9: Pole Location for an Elevated Roadway](image)
Sunken Road and Roadside Walls

When vertical surfaces reflecting microwaves (e.g., dense chain link fences or retaining walls of a sunken roadway) are present, multi-path reflections from large vehicles in close lanes cause additional false (ghost) detection in farther detection zones.

![False Target Generated by Fence Or Wall](image)

**Figure 2-10: False Target Generated by Fence Or Wall**

To avoid this problem install the RTMS higher and aim it higher to detect the other side of road and not to illuminate close lanes, as shown (RTMS on the right in Figure 2-10).

Installing RTMS on Sign Structures

The installation of the RTMS on Message Sign structures is acceptable only if the RTMS is mounted away from beneath the structure. Structures can reflect the microwave signal and distort the accuracy of detection. Some structures such as DMS units have very wide, flat metal bottoms to the structure that are similar in nature to bridges, these type can cause more interference than other “open air” type and may require consult with Technical Support.

The best way to mount the RTMS is to place a horizontal mast arm or pipe approximately 1.3m (4 ft) away from the structure (1.8-2.4m [6-8 ft] if DMS), ideally on the back of the structure away from any lighting or signs. Ensure the detector is aimed perpendicular to the traffic flow.

![RTMS on Sign Structures](image)

**Figure 2-11: RTMS on Sign Structures**
Grade Differentials

When grade differences are small, a single unit on the high side may work, provided all lanes are within range.

![Figure 2-12: Small Grade Differentials](image)

When the grade differential is large enough to put a part of the lower level in a “shadow”, two RTMS units are required as shown by the following.

![Figure 2-13: Large Grade Differential](image)

Trees

Trees and bushes in the path of the microwave beam (in the setback or in medians) must be avoided. RTMS units must be relocated or a gap in vegetation maintained in the path of the beam.
RTMS Placement in Midblock Application

Placement in Midblock application is similar to Side-fired Highway. Since the lanes of interest are upstream/downstream of an intersection, the RTMS should be placed across the road and use the lanes in opposite direction to provide setback or cover the entire roadway if there is sufficient setback.

![Figure 2-14: Midblock Placement](image)

Mounting and Aiming Procedure

**Warning**

Installation of RTMS hardware may require that you work above the ground on a ladder or bucket truck. Please make sure you have all the required equipment and are aware of potential safety issues before starting any installation. DO NOT install any RTMS hardware if you are unsure how to complete the installation or lack appropriate safety equipment. It is recommended that you do NOT install this hardware during inclement weather.

The following equipment is required to mount and aim the RTMS unit:

- Provided: RTMS unit, bracket, lynch pin and conductors or optional ready cable.
- Not Provided: Bolts or stainless steel banding. The bolt specifications depend on the mounting requirements: for example, different bolts may be required when the RTMS unit is mounted on a wooden pole than when the RTMS unit is mounted on a concrete wall. 7/16” wrench, 1/2” wrench, assorted tools to be determined by mounting specifications.

To mount and aim the RTMS unit, do the following.

1. Attach the bracket to the roadside pole (or another specified location) using bolts or stainless steel banding.
2. Secure the RTMS to the mounting bracket by inserting the lynch pin.
3. Aim the RTMS as indicated in Figure 2-1 on page 2-3. A 7/16” wrench is required to release/tighten the ball-joint bolt.

4. Adjust the RTMS to be perpendicular to the travel lanes and level side to side.

5. Look from behind the unit and use the top sight-ridge as a guide to align the bore sight.

6. Tilt so that the top of the RTMS is aimed to the first 1/3 of the monitored lanes (see Figure 2-3 on page 2-5).

7. Secure the position by tightening the bolt.

**NOTE:** Steps 3 and 6 are general guidelines. Actual mounting and tilt may need to be adjusted based on multiple factors such as obstacles and number of lanes.

### Cabling

For information about cables, see Appendix A: “Cabling and Connectors”.
General

The RTMS Setup Utility is the program that is used to interface with the RTMS. It can communicate with a single RTMS (Direct) or with multiple RTMS units (Multidrop) when they are on the same communications channel and Polled Data Mode is active.

The application has numerous screens that you use to configure and operate the system.

This chapter:

• Describes how to install the RTMS Setup Utility.
• Describes how to start the RTMS Setup Utility application.
• Describes how to start the RTMS Setup Utility in Demo mode.

System Requirements

The RTMS Setup Utility must be installed on a computer that has the following:

• Operating System: Microsoft® Windows XP® operating system
• Software: Microsoft .NET Framework 3.5 SP1
• Hardware: Serial (preferred), or USB with a USB-to-serial adapter

NOTE: The RTMS Setup Utility runs with Microsoft .NET 2.0 and higher. Run the software with Microsoft .NET 3.5.1 for optimal performance. In most cases the software performs acceptably but you may notice visual differences in the graphical user interface. A warning message is displayed if the .NET version is incompatible. Click Ignore to proceed.
Installing the RTMS Setup Utility

To install the RTMS Setup Utility, do the following.

1. Locate and double-click the installation file named `RTMS Setup Utility xxx.msi` (xxx is the version number).

   The following window appears.

2. Click Next.

   The following window appears.

   ![Select Installation Folder](image-url)
NOTE: The default location is recommended.

3. Do you want the files installed in the default location?

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proceed to Step 7</td>
<td>Continue with Step 4</td>
</tr>
</tbody>
</table>

4. Click Browse.
   The following window appears.

5. Select a new location for the files to be installed.
6. Click OK.
7. Click Next.
The following window appears.

![Confirm Installation Window]

8. Click Next.

When the installation is completed the following window appears.

![Installation Complete Window]

9. Click Close.

An icon appears on your desktop as a shortcut to starting the RTMS Setup Utility application.
Starting the RTMS Setup Utility

To connect to the RTMS and start the RTMS Setup Utility, do the following.

---

Caution

Windows may disable the COM port if port activity is detected during the boot process. DO NOT connect the RTMS to the COM port before Windows startup is complete.

---

1. Using a serial cable, connect the RTMS to the serial port of the laptop that has the RTMS Setup Utility installed.

2. Power up the RTMS.

3. Select **Start>All Programs>ISS>RTMS Setup Utility>RTMS Setup Utility** or double-click the shortcut icon on the desktop.

   The following window appears.
If communication is established with the RTMS, the Main Screen will appear. If communication could not be established or if multiple units are located, the Start screen will appear.

4. Did the Main Screen or Start screen appear?

<table>
<thead>
<tr>
<th>Main Screen</th>
<th>Start Screen</th>
</tr>
</thead>
<tbody>
<tr>
<td>The connection is established and the Main Screen is displayed (see Figure 3-2 on page 3-12.</td>
<td>Troubleshoot the connection. See symptom “Could not establish communications with the RTMS” in Chapter 6: “Troubleshooting”.</td>
</tr>
</tbody>
</table>
Navigating the RTMS Setup Utility

The RTMS Setup Utility buttons and menus may be operated by any method listed below. The terms select and click are used throughout this manual to describe actions you can complete using the mouse or keyboard.

- The interface consists of buttons and text displays.
- Point and click to select a button.
- Navigate using up/down/left/right keys and ENTER keys. Select by the arrow keys and take action by hitting ENTER.
- In some cases the TAB key can be used to navigate between the two main panels.

For a complete description of the Main Screen, see “Main Screen” on page 3-12

Running the RTMS Setup Utility in Demo Mode

The following describes the procedure for operating the utility in demo mode.

**NOTE:** Before running Demo mode, verify that the computer is NOT connected to an RTMS unit.

1. Start the RTMS Setup Utility; see “Starting the RTMS Setup Utility” on page 3-5.

   The following window appears.

2. Press the ESC key to halt the search.
The Start screen appears.

3. Click **Demo Mode**.
   The Open window appears.
4. Double-click the sample file named `demo.dtb` or any other saved RTMS setup file.

   This initializes the program with sample data and displays the Main Screen.

5. You can now operate most of the things in the software just as if you were viewing live traffic. For information on how to operate the software, see the sections that follow in this manual.
Start Screen

The Start screen is most often used to run Demo Mode and to test sensors in a polled mode. This screen only appears during the start up of the RTMS Setup Utility when:

- You press the ESC key.
- No sensors are found.
- Port 1 is set in the polled mode.

![Start Screen Diagram]

Figure 3-1: Start Screen

The following provides a brief description of each of the function buttons.

- **Help** — Opens a second screen with a link to manual pages on your computer.
- **Single RTMS** — This option is used to connect to a single RTMS selected from the list in the right pane generated from a Search for Sensors operation. The Main Screen will appear with the settings for that RTMS.
• **Demo Mode** — This option is used to run Demo Mode. For more information, see “Running the RTMS Setup Utility in Demo Mode” on page 3-7.

• **Communication** — This option allows you to specify the connection method between the RTMS and your computer. For more information see “Communication Screen” on page 5-21.

• **Firmware Upgrade** — This option is used to upgrade the firmware. For more information, see “Firmware Upgrade Screen” on page 5-20.

• **Close** — Used to exit the RTMS Setup Utility.

• **Search for Sensors** — This option is used to search for RTMS units. For more information, see “Searching For Sensors” on page 5-38.

• **Poll Selected Sensors** — This option is used to poll the selected units. For more information, see “Polling Sensors” on page 5-40.
Main Screen

The Main Screen is vertically divided into two separate panels. The left panel consists of function buttons. The right panel displays the detection map with the current detection zones and the real-time detections indicated by moving vehicles. The title bar runs horizontally across the top of the screen. The status bar runs horizontally across the bottom.

The following provides a brief description of each of the function buttons.

- **Help** — Opens a second screen with a link to manual pages on your computer.
• **Wizard Setup** — This option is an automated Zone setup process. It scans the range of the RTMS microwave beam and configures up to 12 zones automatically. For more information, see “Run the Wizard” on page 4-4.

• **Manual Settings** — This option displays a screen that allows you to configure the RTMS. For more information, see “Manual Settings Screen” on page 5-10.

• **Per Vehicle** — When this option is turned ON, it adds the time stamp, lane number, classification, speed, and dwell time of every vehicle in real-time data output. For more information, see “Per Vehicle ON/OFF” on page 5-1.

**NOTE:** This added information can create a huge file in a short time if saving statistical information.

• **Common Settings** — This option displays a screen that allows you to save configuration settings from one RTMS and load them into other RTMS units. For more information see “Common Settings Screen” on page 5-2.

• **Statistics** — This option displays a screen that allows you to monitor key data on the user interface. For more information see “Statistics Screen” on page 5-3.

• **Verify Counts** — This option displays a screen that allows you to compare manual vehicle counts with RTMS vehicle counts. For more information see “Verify Vehicle Counts” on page 4-9.

• **Speed Calibration** — This option displays a screen that allows you to match actual speeds with the RTMS calculated speed. For more information see:
  – “Calibrate Speed” on page 4-13
  – “Manual Speed Calibration” on page 5-4

• **Internal Memory** — This option displays a screen that allows you to store data inside the RTMS unit. The data can then be downloaded at a later time. For more information see “Internal Memory Screen” on page 5-7.

• **Self Test** — This option displays a screen that allows you to initiate an internal diagnostic test of the RTMS. For more information see “Self Test Screen” on page 5-8.

• **Exit Program** — This option closes the RTMS Setup Utility.
Manual Setup Screen

This screen displays options that allow you to manually configure the RTMS.

![Manual Setup Screen](image)

Figure 3-3: Manual setup Screen

The options on this screen are:

- **Application** — This option displays a list of different sensing modes such as side-fired and midblock. Select the mode that best matches your hardware configuration and detection requirements. See “Set the Application Mode” on page 4-2.

- **Sensitivity** — This option displays sensitivity adjustment parameters used to calibrate the sensitivity for a variety of vehicle sizes and sensing applications. For more information see “Sensitivity Screen” on page 5-11.

- **Zones** — This option allows you to alter lane numbers, labeling, and to manually adjust zone position and width. For more information see the following:
  - “Adjust the Zones” on page 4-7
  - “Fine Tuning Zones” on page 5-12
  - “Labelling Zones” on page 5-14
• **Message Period** — This option allows you to configure the message period for which statistical reports are generated. For more information see “Message Period Screen” on page 5-16.

• **Sensor ID** — This option allows you to set the Sensor ID parameter. For more information see “Sensor ID Screen” on page 5-17.

• **Verify** — This option allows you to manually verify traffic count results and determine the percentage error. For more information see “Verify Vehicle Counts” on page 4-9.

• **Data** — This option allows you to control the basic data mode for a single RTMS device. For more information see “Data Mode Screen” on page 5-18.

• **Advanced** — This option accesses advanced features such as vehicle classification options, Contact Closure configuration (if available) and firmware upgrade management. For more information see “Advanced Screen” on page 5-19.

• **Communication** — This option allows you to specify the connection method between the RTMS and your computer. For more information see “Communication Screen” on page 5-21.

• **Message Composition** — This option allows you to configure the content and format of each statistical message. For more information see “Define Message Composition” on page 4-15.

• **Read RTMS** — This option transfers the current setup parameters from the RTMS to the software. For more information see “Read RTMS Option” on page 5-31.

• **File** — This option allows you to save and load configuration files as well as record traffic statistical information. For more information see “File Screen” on page 5-32.

• **Load To RTMS** — Clicking this button loads the current configuration running in the RTMS Setup Utility to the RTMS. For more information see “Open a Setup File” on page 5-33.

• **Exit** — Returns to the Main Screen.
Chapter 4: Configuration and Setup

General

This chapter describes the procedures for configuring the RTMS system using the RTMS Setup Utility.

Configuration Process

After the RTMS hardware and software are installed (see Chapters 2 and 3), you must set up and configure each of the RTMS units in the system.

The configuration process requires you to physically connect the laptop where the RTMS Setup Utility is installed to each RTMS in the system. Once connected, you must start the RTMS Setup Utility (see “Starting the RTMS Setup Utility” on page 3-5).

Each RTMS must be set up (configured) according to the following eight step process.

- Step 1: Set the Application Mode
- Step 2: Run the Wizard
- Step 3: Adjust the Zones
- Step 4: Verify Vehicle Counts
- Step 5: Calibrate Speed
- Step 6: Define Message Composition
- Step 7: Define Vehicle Classifications
- Step 8: Save the Configuration File
Step 1: Set the Application Mode

You must define what mode of detection the RTMS is to operate in.

1. On the Main Screen, click **Manual Settings**.

   The following screen appears.

   ![Manual Setup Screen]

2. Click **Application =**.
The following screen appears.

3. Select the application the RTMS will be used for.
   - **Side Fired Highway** — in general, used when:
     - traffic is mainly free-flowing
     - farther detection distance needed
     - lanes are wide
   - **Midblock** — in general, used when:
     - traffic is mainly urban (can be congested)
     - shorter detection distance needed
     - lanes are narrow

**NOTES:**

- Click on the application to be used even if it already appears to be selected. This will ensure that all settings are sent to the RTMS.
- If you get a message indicating that the application requires a new wizard setup, click Yes.

4. To return to the Main Screen, click Exit.
5. Continue with “Run the Wizard” on page 4-4).
Step 2: Run the Wizard

The automated zone setup process requires free flowing traffic in all lanes of interest. It scans the range of the RTMS microwave beam and positions up to 12 detection zones, representing lanes where vehicles are detected.

The RTMS Setup Utility automatically detects traffic in its detection area and configures lane parameters accordingly. This is a two-stage process.

- Initial setup: The Wizard finds zones which match up to the lanes of traffic.
- Final setup: The Wizard fine tunes the zone boundaries and detection parameters.

NOTE: You may receive warnings while detecting traffic in low-volume lanes. The warning asks if you would like to continue detection for one additional minute. In some cases, when there is sparse traffic such as when the detector overlaps an exit ramp, continuing the Wizard provides little benefit.

1. On the Main Screen, click **Wizard Setup**.

   The following screen appears.

   2. Click **Start Wizard**.

<table>
<thead>
<tr>
<th>Zone Setup</th>
<th>DETECTION MAP</th>
<th>Dist Bar</th>
</tr>
</thead>
<tbody>
<tr>
<td>248-255</td>
<td></td>
<td></td>
</tr>
<tr>
<td>240-247</td>
<td></td>
<td></td>
</tr>
<tr>
<td>232-239</td>
<td></td>
<td></td>
</tr>
<tr>
<td>224-231</td>
<td></td>
<td></td>
</tr>
<tr>
<td>216-223</td>
<td></td>
<td></td>
</tr>
<tr>
<td>200-215</td>
<td></td>
<td></td>
</tr>
<tr>
<td>200-207</td>
<td></td>
<td></td>
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<tr>
<td>192-199</td>
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<tr>
<td>194-191</td>
<td></td>
<td></td>
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<tr>
<td>186-183</td>
<td></td>
<td></td>
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<tr>
<td>188-175</td>
<td></td>
<td></td>
</tr>
<tr>
<td>180-177</td>
<td></td>
<td></td>
</tr>
<tr>
<td>165-159</td>
<td></td>
<td></td>
</tr>
<tr>
<td>144-151</td>
<td></td>
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<tr>
<td>136-143</td>
<td></td>
<td></td>
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<tr>
<td>126-135</td>
<td></td>
<td></td>
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<tr>
<td>120-127</td>
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<tr>
<td>112-119</td>
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<tr>
<td>104-111</td>
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</tr>
<tr>
<td>96-103</td>
<td></td>
<td></td>
</tr>
<tr>
<td>88-95</td>
<td></td>
<td></td>
</tr>
<tr>
<td>80-87</td>
<td></td>
<td></td>
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<tr>
<td>72-79</td>
<td></td>
<td></td>
</tr>
<tr>
<td>64-71</td>
<td></td>
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<tr>
<td>56-63</td>
<td></td>
<td></td>
</tr>
<tr>
<td>48-55</td>
<td></td>
<td></td>
</tr>
<tr>
<td>40-47</td>
<td></td>
<td></td>
</tr>
<tr>
<td>32-39</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24-31</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16-23</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8-15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-7</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. Click **Start Wizard**.
When the progress indicator reaches 100% the Wizard initial setup is complete. The resulting zone setup is presented for approval.

3. Using the blips, confirm visually that the proposed location of lanes corresponds to the zones you wish to include in the setup.

4. Add or delete zones until desired number and position are left. **Note**, zones can be added or deleted by fine tuning later as well (see “Fine Tuning Zones” on page 5-12).

5. To complete the setup, click **Continue Wizard**.

   The Wizard continues the automatic setup to a final Zone Setup.

   If traffic slows down momentarily or there is a large gap in the traffic flow, click **Pause**. Pausing during moments of non-free-flow traffic will help the Wizard extend its time.
To cancel the Wizard, click Exit. This will return you to the Main Screen.

6. On completion, the RTMS Setup Utility will return to the Main Screen.

7. Continue with “Adjust the Zones” on page 4-7).
Step 3: Adjust the Zones

A zone is an area that is monitored, and is usually equivalent to a lane of traffic.

1. On the Main Screen, click **Manual Settings**.
2. On the Manual Setup screen, click **Zones** =.

The following screen appears.

3. If needed, change the zone direction.
   a) Click on the zone number.
   b) To change the direction, press **Enter**.
4. If you want to provide labels for each zone, see “**Labelling Zones**” on page 5-14.
5. Watch the vehicle icons on the right side of the screen and compare them with what you are physically seeing on the road.
6. Do the vehicle icons on the screen match what you are physically seeing on the road?

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continue with <strong>Step 9</strong>.</td>
<td>The situation must be fixed. Continue with <strong>Step 7</strong>.</td>
</tr>
</tbody>
</table>

7. Is the utility detecting more or fewer vehicles than what you are actually seeing on the road?

<table>
<thead>
<tr>
<th>More</th>
<th>Fewer</th>
</tr>
</thead>
</table>

8. Repeat Steps 2 - 5 of this procedure.
9. Click **OK** to save your settings and return to the Manual Setup screen.
10. To return to the Main Screen, click **Exit**.
11. Continue with “**Verify Vehicle Counts**” on page 4-9).

**IMPORTANT:** DO NOT proceed to Verifying Vehicle Counts until you are confident that the physical vehicle detections match the detections of the software.
Step 4: Verify Vehicle Counts

The verification of a good zone setup is an essential part of the installation. In it we compare RTMS volume counts over a period of time to a manual (visual) count for the same interval. Use of a hand-held tally counter is recommended.

NOTE: You may want to enlist several observers for this process, with each observer counting traffic in a different lane.

1. On the Main Screen, click Verify Counts.

   The following screen appears.

   ![Verify Counts Screen]

2. Are you counting all zones or just selected zones?

<table>
<thead>
<tr>
<th>All Zones</th>
<th>Selected Zones</th>
</tr>
</thead>
</table>
   | Click Clear All and immediately begin counting vehicles as they cross the RTMS beam. | a) Select the check box to the left of each zone.  
b) Click Clear Selected and immediately begin counting vehicles as they cross the RTMS beam. |
The Elapsed time counter starts automatically, and the count for each selected zone is updated as vehicles pass.

3. Continue counting until each lane has a count of at least 50 vehicles (more than 50 is recommended). This will usually take several minutes.

4. Click **Stop** when there is a gap in the traffic and immediately stop your manual counting on all lanes.

5. For each zone, select the box in the **Manual** column and enter the manual count for the zone.

![Image of the Verify Counts window with data entries]

The difference between the RTMS and the manual counts in absolute and percent deviation terms is immediately displayed. Deviation of more than 5% requires zone setup correction to improve detection accuracy.

If the RTMS count is greater than 5% of the manual count, this could be caused by:
- “Splashing”
- Lane changing
- Reflections from fixed objects
- Sensitivity set too high
If the RTMS count is less than 5% of the manual count (negative percentage), this could be caused by:
- Missed small vehicles (sensitivity is too low)
- Occlusions
- Incorrect aiming

6. Are any of the percentages over five percent (either plus or minus)?

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>
| You should make corrections before continuing. Possible corrections are:  
  - Adjust sensitivity (see “Sensitivity Screen” on page 5-11).  
  - Fine tune zones (see “Fine Tuning Zones” on page 5-12)  
  After adjustments have been made, repeat the verification process. | Continue with Step 7. |

7. (Optional) If you want save the accumulated results of verification in a text file, click **Save to File**.

The following window appears.

8. In the **Save in** field, select the folder where the file is to be saved.

   The default location, **RTMS Setup Utility**, is recommended.
9. In the **File name** field, type a name for the file.
10. Click **Save**.
11. To return to the Main Screen, click **Exit**.
12. Continue with “**Calibrate Speed**” on page 4-13).
**Step 5: Calibrate Speed**

In this step you will try to match the RTMS calculated speed of vehicles with actual speed. To perform speed calibration, do the following.

1. Using a radar gun (LIDAR), check the speed of 20 random vehicles in a single lane.
2. Calculate the average speed of the 20 vehicles. This becomes the “reference” speed for the lane.
3. Repeat Steps 1 and 2 for every lane.
4. On the RTMS Setup Utility Main Screen, click **Speed Calibration**.
   
The following screen appears.

   ![Speed Calibration Screen](image)

   **NOTE:** Make sure that **Auto Speed Cal** shows in the screen header and **Manual** shows in the button field.

5. To the left of each lane number, enter the reference speed as calculated in Step 2.
6. Set the run time to 5 minutes.
   a) Click in the time field.
   b) Use the Right and Left Arrow keys to increase or decrease the value.
7. Click **Start**.
   
   Statistical speed values are displayed in each of the lanes.

8. After the time period elapses, use the radar gun and check the speed of 40 random vehicles per lane.

9. Calculate the average speed per lane.

10. Check the actual average with the RTMS value.

11. Is the RTMS value within ±10 Km/h (±6 MPH) of the actual value?

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calibration passes. Continue with <strong>Step 12</strong>.</td>
<td>Calibration fails. Either rerun the entire procedure or try calibrating manually (see “Manual Speed Calibration” on page 5-4).</td>
</tr>
</tbody>
</table>

12. To return to the Main Screen, click **Exit**.

**Step 6: Define Message Composition**

Defines the content and format of the statistical messages that are sent from the RTMS.

1. On the Main Screen, click **Manual Settings**.
2. On the Manual Setup screen, click **Message Composition**.

The following screen appears.

3. Select options as appropriate for your site.
   - **G4 STAT** — Transmit the data using the G4 protocol (message format).
   - **X3 STAT** — Transmit the data using the X3 protocol (legacy message format).
     
     **Note**, if you change from G4 STST to X3 STAT, a message appears indicating that the contents of memory will be erased.
   - **Volume** — The total number of vehicles in each message period.
   - **Occupancy** — The percentage of time a lane is occupied by a vehicle during the message period.
     - **High Resolution**: Uses decimal place in the output results. Example: If selected, 87.7 = 87.7; if not selected, 87.7 = 88.
6 ft Loop: Adds the loop length to the vehicle length for occupancy calculation.

- **Speed** — The average vehicle speed during the message period.
  - *Km/h*: Transmits average vehicle speed data in kilometers per hour.
  - *MPH*: Transmits average vehicle speed data in miles per hour.
    *Note*, in X3 STAT mode, the data output is always in Km/h units. The RTMS Setup Utility will display in MPH, but the output is always Km/h.

- **Classification** — The class lengths are set in Classification Options.
  The number selected determines what appears on the Classifications screen:
  - *2 Classes*: Small and Truck
  - *4 Classes*: Small, Medium, Large and Truck
  - *6 Classes*: Small, Regular, Medium, Large, Truck and Extra Large

- **Gap/Headway** — The average time between vehicles during a Message Period.
  - **Gap**: The average time between the trailing edge of the previous vehicle and leading edge of the current vehicle.
  - **Headway**: The average time between the leading edge of the previous vehicle and leading edge of the current vehicle.

- **85% Speed** — 85% of the vehicles are at or below this speed.
  *Note*, not available for X3 STAT mode.

- **Real Time Clock** — When selected, the RTMS sends its time stamp with the data.
  *Note*, in G4 STAT mode, the real time clock is always selected.

4. To save the options and return to the Manual Setup screen, click **OK**. Otherwise, click **Exit** to return without saving.

5. Continue with “Define Vehicle Classifications” on page 4-17).
Step 7: Define Vehicle Classifications

The correct classification of vehicles by length requires good breakpoints. The Classification screen allows the editing of these breakpoints.

   The following screen appears.

2. Click Classification.
The following screen appears.

![Vehicle Classification Screen](image)

**NOTE:** The number of classifications shown and the length measurement unit (meters or feet) are determined by the selections for Classification and Speed on the Message Comp screen (see “Define Message Composition” on page 4-15).

3. Enter the estimated size of the vehicle lengths.

   For best results, ensure that differences between length breakpoints are greater than 3 m (10 ft) especially for larger vehicles. Small separation values increase potential for “merging” of classes (vehicle counting errors are the result).

4. Click **Load Limits**.

   This will set the limits you entered to the RTMS.

5. Check the correctness of the breakpoints by comparing the accumulated per vehicle classification counts to manual counts for a period of at least two minutes.

6. Click **Start Count**.
The following screen appears.

7. Watch the actual traffic and compare what you see with the RTMS counts.
8. Click Stop Count.

NOTE: The set limits do not necessarily match the required limits set by you, but should achieve the correct results.

9. Click Exit twice to return to the Manual Setup screen.
10. Continue with “Save the Configuration File” on page 4-20.
Step 8: Save the Configuration File

After you have completed the configuration you should save it to a file on your hard drive for backup purposes.

1. On the Manual Setup screen, click **File**.
   The following screen appears.

2. Click **Save Setup to File**.

![Diagram of Manual Setup Screen with options for Save Setup to File, Open Setup File, Record Data, Save Common Settings, Lane No, DETECTION MAP, and Exit.]
The following window appears.

3. In the **Save in** field, select the location where the file is to be saved.

4. In the **File name** field, enter a name for the file.

   The following format is recommended: `RTMSxxx_date.dtb`

   where:

   - `xxx` = location ID
   - `date` = date the file was created in YYYY_MM_DD format
   - `dtb` = file type (mandatory)

5. Click **Save**.

6. Click **Exit** twice to return to the Main Screen.

7. Make adjustments and setup other options as required (see **Chapter 5: “Adjustments and Other Setup Options”**).
Chapter 5: Adjustments and Other Setup Options

General

This chapter provides a description of all RTMS Setup Utility screens.

When the RTMS Setup Utility starts up the first screen that appears is dependent on whether or not communication could be established with a single RTMS unit.

If communication is established with the RTMS, the Main Screen will appear (see “Main Screen” on page 3-12). If communication could not be established or if multiple units are located, the Start screen will appear (see “Start Screen” on page 3-10).

The Main Screen provides access to most of the functions that can be performed with the RTMS Setup Utility.

The following sections provide a description of the various options/screens that are used during RTMS Setup Utility operations.

Wizard Setup

For use of this screen see “Run the Wizard” on page 4-4.

Per Vehicle ON/OFF

Turns On or OFF a per vehicle message that is sent every time a vehicle is detected. A Per Vehicle message is different from a statistical message as it contains information only about each passing vehicle.

In the messages file (see Appendix C: “Data Files and Message Formats”) the Per Vehicle data is listed between the statistical messages that are sent for each message period (see Figure C-4 on page C-5). If you have Per Vehicle ON, you will get a compiled statistical message every message period (total volume, OCC, speed, etc.) with the Per Vehicle data in between each message. The Per Vehicle data will add up to the same values that are listed in the statistical message.
Common Settings Screen

Setup Parameters are often common to all sensors on a single site. For example, the sensors in a mid-block deployment or string of detection stations along the same highway. To save the installer time and effort in repeatedly entering the same parameters in each site, a group of settings is defined as common settings. Common settings allow you to specify the basic parameters for an entire group of sensors.

In order to use these common settings, you must first create (save) them, then apply them. For information on saving the settings, see “Saving Common Settings” on page 5-37.

To select and load common settings into the RTMS, do the following.

1. Start the utility (see “Starting the RTMS Setup Utility” on page 3-5).
2. On the Main Screen, click Common Settings.
   
   The following screen appears.

3. To see what the current setting is for a parameter or to change it, click on the parameter (Application, Data, etc.).
4. To use a parameter as a common setting, select the check box to the left.
5. To set the common parameters and return to the Main Screen, click Load.
Statistics Screen

This option enables you to display traffic count information. The displayed information is:

- 30 Sec — Indicates the number of seconds in the message period.
- Vol — The total number of vehicles per lane.
- Occ — The percentage of lane occupancy for the message period.
- Spd — The average speed of traffic in the lane.
- Lane No — Displays the lane number.
- Detection Map — Displays a real-time visualization of traffic.

1. Start the utility (see “Starting the RTMS Setup Utility” on page 3-5).
2. On the Main Screen, click Statistics.

The following screen appears.

3. Select the appropriate option:

- **Per Vehicle** — Provides classification and speed information for each vehicle as the vehicles are detected.
- **Classes** — Displays the number of vehicles from each class that are detected during the message period.
• **Sp85** — Displays the 85th percentile speed for the most recent message period.

• **Record** — Records a stream of data that can typically be used for troubleshooting. The data can be saved in one of two formats:
  – human-readable ASCII text format (.asc file)
  – machine readable, binary format (.bin file)

  **Note**, on the Save screen you have the option of saving the data in both file formats at the same time.

• **Exit** — Returns to the Main Screen.

### Verify Counts Screen

For use of this screen see “Verify Vehicle Counts” on page 4-9.

### Speed Calibration Screen

The speed calibration process sets the internal speed coefficients used to calculate the average speed of traffic in each zone. The calibration procedure used depends on traffic conditions.

#### Automatic Speed Calibration

For information about this function, see “Calibrate Speed” on page 4-13.

#### Manual Speed Calibration

Before using this procedure you should do the speed calibration automatically (see “Calibrate Speed” on page 4-13).

To calibrate the speed setting manually, do the following.

1. Using a radar gun (LIDAR), check the speed of 20 random vehicles in a single lane.

2. Calculate the average speed of the 20 vehicles. This becomes the “reference” speed for the zone.

3. Repeat Steps 1 and 2 for every zone.

4. Start the utility (see “Starting the RTMS Setup Utility” on page 3-5).

5. On the Main Screen, click **Speed Calibration**.
The following screen appears.

The following screen appears.

7. Select the box to the left of the zone number for which speed is to be calculated.
8. Use the right and left arrow keys on your keyboard to select the difference (plus or minus) that the reference speed is above or below the RTMS speed.
9. Repeat Steps 7 and 8 for each zone that requires calibration.
10. Wait for two minutes to let the RTMS speeds adjust.
11. Click **Exit**.
Internal Memory Screen

The RTMS includes internal memory — Please note:

- Deselect the Store Into Memory option prior to Downloading large volumes of data.
- Download at the highest connection speed available when directly connected to the RTMS. A full memory will take just over 12 minutes to download at 115200 bps.

1. Start the utility (see “Starting the RTMS Setup Utility” on page 3-5).
2. On the Main Screen, click Internal Memory.

The following screen appears.

3. The options on this screen are:
   - **Refresh** — Updates the Memory Used parameter. Verifies data is being stored.
   - **Download** — Downloads the internal memory from the RTMS to the computer. The data can be saved in one of two formats:
     - human-readable ASCII text format (.asc file)
     - machine readable, binary format (.bin file)
For a description of the file see Appendix C: “Data Files and Message Formats”.

- **Clear Memory** — Clears the memory on the RTMS.
- **Store Into Memory** — This enables storage of RTMS data in the RTMS onboard memory.

**NOTE:** It is recommended that this option always be enabled if there are communications issues caused by the network. This allows data to be retrieved from the time period when the communications was down.

- **FIFO** — (First In, First Out.) When memory is full, selecting this option instructs the RTMS to overwrite the earliest stored message.

4. Click **Exit**.
   
The changes are saved and you are returned to the Main Screen.

**Note**, activation of memory automatically selects Real Time Clock in message composition for X3 STAT mode.

### Set Clock Option

This option is used to synchronize the RTMS clock with the clock on your computer.

1. Start the utility (see “Starting the RTMS Setup Utility” on page 3-5).
2. On the Main Screen, click **Set Clock**.

   The RTMS clock is synchronized to the clock on the computer.

### Self Test Screen

The RTMS provides a diagnostic test of its internal functions. The test checks internal functions and locates hardware faults. Please note:

- The All System OK message is displayed on the screen if no faults are found.
- The Self-Test will also close the (Optional) zone contacts for one second each in sequence. Operation of the contacts can then be verified using the controller display, ohm-meter or any other suitable device showing continuity.

The following is a list of Self-Test messages describing a fault:

- Power supply fault
- Modulator signal fault
- Microwave module fault
- Modulator memory fault
- Program memory fault
- DSP fault
- Gain too low or ADC fault
- Logic failure
• No signal
• Saturation signal level

To perform the self test, do the following.
1. Start the utility (see “Starting the RTMS Setup Utility” on page 3-5).
2. On the Main Screen, click **Self Test**.
   
   The following screen appears.

3. To begin the test, click **Start**.
4. To stop the test and return to the Main Screen, click **Exit**.
Manual Settings Screen

This screen displays options that allow you to configure the RTMS.

Application Screen

This screen is used to set the sensing mode. For use of this screen, see “Set the Application Mode” on page 4-2.
Sensitivity Screen

Sensitivity adjustments may be necessary to detect small vehicles, or to reduce splashing.

1. Start the utility (see “Starting the RTMS Setup Utility” on page 3-5).
2. On the Main Screen, click Manual Settings.
   The following screen appears.

4. If needed, click the arrows to increase sensitivity to detect small vehicles, or reduce sensitivity if a vehicle is causing “ghost” vehicles to be detected in adjacent zones (splashing).
   The initial starting level is about 7. The value is automatically set when you run the Wizard.
   Adjust sensor aim if small vehicles in close or far lanes are missed. Tilt the sensor towards the zones with poor detection.

   **NOTE:** Do not increase sensitivity to compensate for improper aiming.

5. To save the setting and exit the screen, click OK.
Zone Setup Screen

This screen is used to alter lane numbers, labeling, and to manually adjust zone position and width. For initial use of this screen, see “Adjust the Zones” on page 4-7.

Fine Tuning Zones

There might be time when you will have adjust zones, such as when “splashing” occurs or for accommodating wider merge lanes, etc. This screen is used to slightly move zone boundary positions. The minimum zone width for Side-Fired Highway mode is five microslices. For Midblock Mode it is seven microslices.

Splashing occurs when a vehicle from one lane triggers a detection in another lane. Lane changes are one cause of splashing. Narrow lanes or incorrect boundaries are other common causes.

1. Start the utility (see “Starting the RTMS Setup Utility” on page 3-5).
2. On the Main Screen, click Manual Settings.

The following screen appears.

4. Click Fine Tune.
The following screen appears.

5. Select the zone number that needs to be fixed.
6. If needed, click on the zone again to select the other side of the zone.
7. To change the boundary by a single micro slice at a time, click **Move Away** or **Move Closer**.
   
   Observe the effect on detection on the Fine Tune or Manual Setup Screen.
   
   The boundary move affects the zones on either side, reducing one and enlarging the other.
   
   - A counter shows the amount of shift at any time. This counter resets when you select the next boundary.
   
   - By selecting **Add/Remove Zone** you can change the number of zones and create wider zones spanning more than one lane.
   
   - The same two mechanisms allow you to perform the entire zone setup process manually, by adding zones and moving their boundaries manually.

8. To insert a space between zones, click **Separate**.
   
   This can be used for things like barriers (see between zone 4 and 5 above).

9. Repeat Steps 5 - 8 for each zone to be fixed.
10. When finished, click **OK**.

**Labelling Zones**  
To add a label (name) to each of the zones, do the following.

1. Start the utility (see “Starting the RTMS Setup Utility” on page 3-5).
2. On the Main Screen, click **Manual Settings**.
3. On the Manual Setup screen, click **Zones**.
   The following screen appears.

4. Click **Labeling**.
The following screen appears.

5. Type or select a label for each lane.
   The label can be up to 16 characters in length. Labels are stored in the RTMS, but are not transmitted in the statistical data message.

6. After all lanes have been labeled, click OK.
   You are returned to the Zone Setup screen.

7. To return to the Manual Setup screen, click OK.

8. To return to the Main Screen, click Exit.
Message Period Screen

The message period is the amount of time between sending statistical reports from the RTMS. A 30 second message period is generally used for Real-Time traffic data and 300 to 900 sec (5 to 15 min) for counting applications.

1. Start the utility (see “Starting the RTMS Setup Utility” on page 3-5).
2. On the Main Screen, click Manual Settings.
   The following screen appears.

4. Click the Up and Down arrows or use the arrow keys on your computer to set Message Period to the desired interval.
   For G4 mode the range is 5 to 3600 seconds. For X3 mode it is 5 to 900 seconds.
5. To synchronize the message with the RTMS clock, select the Sync check box.
   Example: If the message period is set to 30 seconds, the message will be sent out at 00:00:00 and 00:00:30; not at 00:00:03 or 00:00:33.
6. Click OK.
   The new value is set to the RTMS and you are returned to the Manual Setup screen.
Sensor ID Screen

This function is used to set the Sensor ID parameter. (Please consult your sales/service representative for assistance when designing large serial networks.)

The Sensor ID must be set if Polled data mode is used — Units should be assigned unique ID numbers to avoid data corruption.

It is recommended that you number all RTMS units with consecutive numbers, starting at 1.

1. Start the utility (see “Starting the RTMS Setup Utility” on page 3-5).
2. On the Main Screen, click Manual Settings.
3. On the Manual Setup screen, click Sensor ID.

   The following screen appears.

   ![Sensor ID Screen Diagram]

4. Click the Up and Down arrows (or the arrow keys on your computer) to increase or decrease the number.
   - For X3 mode, the Sensor ID range is 1 - 254.
   - For G4 mode, the Sensor ID range is 1 - 65534

   **NOTE:** 255 and 65,535 are reserved and should not be used for sensor IDs.

5. Click OK.
Verify Screen

This screen allows you to manually verify traffic count results and determine the percentage error. For use of this screen, see “Verify Vehicle Counts” on page 4-9.

Data Mode Screen

The Data Mode determines whether data is Pushed to or Pulled from the RTMS unit.

1. Start the utility (see “Starting the RTMS Setup Utility” on page 3-5).
2. On the Main Screen, click Manual Settings.

The following screen appears.

4. Select the appropriate options.
   - Normal — Normal mode sends statistic messages at the end of every Message Period and all per vehicle information to display vehicle icons, speeds etc.
   - Stat — Stat mode allows only the statistical messages to be sent at the end of every Message Period.
• **Polled** — Polled mode only allows the RTMS to upload the statistical data that is currently stored in its buffer when a specific Sensor ID request is received from an outside source.

• **Spider** — Spider mode configures the RTMS to send data, via the SPIDER protocol, through port 2 — This option only works with SPIDER systems.

• **High-Z** — This option leaves the transmit pin in high-impedance mode. This is only available in Polled mode.

5. Click **OK**. The new value is set to the RTMS and you are returned to the Manual Setup screen.

### Advanced Screen

This screen provides access to advanced features such as vehicle classification options, Contact Closure configuration (if available) and firmware upgrade management.

**Classification Screen**

This screen is used to specify length limits for each vehicle class being counted. For use of this screen see “Define Vehicle Classifications” on page 4-17.

**Contact Closures Screen**

For information about this screen, see the *RTMS Optional Configurations User Guide*. 
Complete the following procedure to upgrade firmware.

1. Start the utility (see “Starting the RTMS Setup Utility” on page 3-5).
2. On the Main Screen, click **Manual Settings**.
3. On the Manual Setup screen, click **Advanced**.
4. On the Advanced screen, click **Firmware Upgrade**.

The following screen appears.

![Firmware Upgrade Screen](image)

**NOTE:** You can also get to this screen by clicking the **Firmware Upgrade** button on the Start screen.

5. Check that current firmware version is displayed on screen.
6. Click **File**.
7. Select the firmware file to upload into the RTMS.
8. Click **Upload**.

During upgrade, the progress bar advances and indicates Percentage Complete.

**NOTE:** **Do not** attempt to upgrade without a solid communication channel.

9. Wait for the message “Upgrade Succeeded”.
10. To return to the Manual Setup screen, click **Exit** twice.
Communication Screen

This screen allows you to define the communication method used between your computer and the RTMS. This screen is also used to troubleshoot data connections, and if need be, to modify an existing connection.

The types of communication that can be defined are:

- Serial — See “Defining a Serial Connection” on page 5-22.
- Dialup — See “Defining a Dialup Connection” on page 5-26.
- TCP/IP — This option can be used when the RTMS serial port is connected to an external Ethernet modem that the RTMS Setup Utility can communicate with (see “Defining a TCP/IP Connection” on page 5-28). This option can also be used with the G4-CAM or the G4-TCP models (see the RTMS Optional Configurations User Guide).
- DSS radio — this option requires the G4-DSS model. For information about setting up this type of communication, see the RTMS Optional Configurations User Guide.

**NOTE:** When the Communication screen appears, the left side of the screen is used to define the connection you would like to make; the right side is used after you are connected to modify parameters.
Defining a Serial Connection

To define a serial connection, do the following.

1. Start the utility (see “Starting the RTMS Setup Utility” on page 3-5).
2. On the Main Screen, click **Manual Settings**.
3. On the Manual Setup screen, click **Communication**.

   The following screen appears.

![Communication setup screen](image)

**NOTE:** You can also get to this screen by clicking the **Communication** button on the Start screen.

4. Select **PC Serial** as the type of communication.
5. For **Serial Port**, select the computer port that will be used for communicating with the RTMS.
6. For **Baudrate**, select the speed, in bits per second (bps) at which communication is to take place.

   The minimum is 2400, the maximum is 115200. The most common setting is 9600.
7. If handshaking is required, select the **RTS/CTS Handshake** check box.

**NOTE:** Make sure you have four wires for your serial cable if you use this option.
8. For **Timeout, ms**, enter the number of milliseconds to wait for communication from the RTMS before the connection times out.

9. When finished, click **OK**.
   
   If a connection is established, the green COM indicator in the bottom right of the screen will be blinking.

10. To return to the Manual Setup screen, click **Exit**.
Defining a Bluetooth Connection

The following describes how to define a bluetooth connection in the RTMS Setup Utility. For additional information on Bluetooth operations, see Appendix D: “Bluetooth Device Operations”.

1. Start the utility (see “Starting the RTMS Setup Utility” on page 3-5).
2. On the Main Screen, click Manual Settings.

The following screen appears.

NOTE: You can also get to this screen by clicking the Communication button on the Start screen.

4. Select PC Serial as the type of communication.
5. For Serial Port, select the serial port that was assigned to the Bluetooth serial port interface (see Appendix D: “Bluetooth Device Operations”).
6. For Baudrate, select 115200 (this is mandatory for Bluetooth).
7. If your connection requires handshaking, select the **RTS/CTS Handshake** check box.

**NOTE:** Make sure you have four wires for your serial cable if you use this option.

8. For **Timeout, ms**, enter the number of milliseconds to wait for communication from the RTMS before the connection times out.

9. When finished, click **OK**.

   If a connection is established, the green COM indicator in the bottom right of the screen will be blinking.

10. To return to the Manual Setup screen, click **Exit**.
Defining a Dialup Connection

To define a dialup connection, do the following.

1. Start the utility (see “Starting the RTMS Setup Utility” on page 3-5).
2. On the Main Screen, click Manual Settings.

The following screen appears.

![Communication Screen](image)

**NOTE:** You can also get to this screen by clicking the Communication button on the Start screen.

4. Select **PC Dialup** as the type of communication.
5. For **Modem Port**, select the serial port that your dialup modem is configured to use.
6. For **Baudrate**, select the speed, in bits per second (bps) of the dialup modem.
7. If your connection requires handshaking, select the **RTS/CTS Handshake** check box.

**NOTE:** Make sure you have four wires for your serial cable if you use this option.
8. For **Timeout, ms**, enter the number of milliseconds to wait for communication from the RTMS before the connection times out.

**NOTE:** The default value (7000) is recommended.

9. In the **Phone Number** field, enter or select the phone number that your modem needs to call.

10. If your modem requires an initialization string, enter it in the **Initialization String** field.

11. When finished, click **OK**.

   If a connection is established, the green COM indicator in the bottom right of the screen will be blinking.

12. To return to the Manual Setup screen, click **Exit**.
Defining a TCP/IP Connection

NOTE: This type of connection can only be made when the RTMS serial port is connected to an external Ethernet modem that the RTMS Setup Utility can communicate with, or when used with the G4-CAM or G4-TCP models (see the RTMS Optional Configurations User Guide).

To define a TCP/IP connection, do the following.

1. Start the utility (see “Starting the RTMS Setup Utility” on page 3-5).
2. On the Main Screen, click Manual Settings.

The following screen appears.

NOTE: You can also get to this screen by clicking the Communication button on the Start screen.

4. Select PC TCP/IP as the type of communication.
5. For Remote server, select Address.
6. Enter the IP address or name of the RTMS.
7. For Remote port, enter the port number to be used. Default is 2000.
8. For **Local port**, use the default of 0.

9. For **Timeout, ms**, enter the number of milliseconds to wait for communication from the RTMS before the connection times out.

   **NOTE:** The default value (3000) is recommended.

10. Click **OK**.

11. To return to the Manual Setup screen, click **Exit**.
Changing an Existing Connection

To make changes to an existing connection, do the following.

1. Start the utility (see “Starting the RTMS Setup Utility” on page 3-5).

2. On the Main Screen, click Manual Settings.


The following screen appears.

4. Once a connection is made, in the right pane you can:
   
   - Alter communication speed (baudrate).
     
     - 9600 bits per second (bps) is the factory default for serial units.
     
     - Data rates below 9600 are useful where high quality transmission lines are not available. They are however, unsuitable for setup and must be selected after setup has been completed. When using data rates below 9600 bps, the RTMS data mode must be set to STAT to reduce the amount of data and prevent communication problems. See “Data Mode Screen” on page 5-18 for further details.

   - Activate RTS/CTS handshake when necessary.

5. When finished, click Send.

6. Once you change the settings, you may lose the connection to the RTMS. If this happens, enter the connect parameters on the left side of the screen and click OK.
Message Composition Screen

This screen allows you to configure the content and format of each statistical message. For information on the use of this screen, see “Define Message Composition” on page 4-15.

Read RTMS Option

This function enables you to read the configuration on the connected RTMS and update the RTMS Setup Utility with the information.

1. Start the utility (see “Starting the RTMS Setup Utility” on page 3-5).
2. On the Main Screen, click Manual Settings.
3. On the Manual Setup screen, click Read RTMS.

The RTMS Setup Utility is updated with the configuration from the RTMS.
File Screen

This screen allows you to:

- Save a setup file
- Open a setup file
- Record data
- Save common settings

Save a Setup File  This function allows you to save the configuration you have setup for the RTMS. For use of this function, see “Save the Configuration File” on page 4-20.
**Open a Setup File**  
This option enables you to open a saved setup file and load it into the RTMS.

1. Start the utility (see “Starting the RTMS Setup Utility” on page 3-5).
2. On the Main Screen, click **Manual Settings**.
3. On the Manual Setup screen, click **File**.
4. On the File screen, click **Open Setup File**.
   
The Open window appears.

5. Locate and select the setup file.
6. Click **Open**.
The following screen appears.

![Manual Setup Screen]

The greyed out options show the settings in the file that will be loaded into the RTMS.

7. If everything is OK, click **Load to RTMS**.

The setup file is sent to the RTMS.
Recording Data
The RTMS Setup Utility can record statistical data to a file on the PC's hard disk.

1. Start the utility (see “Starting the RTMS Setup Utility” on page 3-5).
2. On the Main Screen, click Manual Settings.
4. On the File screen, click Record Data.

The following window appears.

5. In the Save in field, select the folder where the file is to be saved.
   Note, the default location is recommended.
6. In the File name field, type a name for the file.
7. In the Save as type field, select the format the file is to be saved as.
   The data can be saved in one of two formats:
   • human-readable ASCII format (.asc file)
   • machine readable, binary format (.bin file)
   You have the option of saving the data in both file formats at the same time.
8. Click Save.
A window similar to the following appears.

![Recording data window]

9. To stop recording, click **Stop**.
10. To return to the Manual Setup screen, click **Exit**.
## Saving Common Settings

To save common settings, do the following.

1. Start the utility (see “Starting the RTMS Setup Utility” on page 3-5).
2. On the Main Screen, click **Manual Settings**.
3. On the Manual Setup screen, click **File**.
4. On the File screen, click **Save Common Settings**.

   All common setting are saved and you are returned to the Manual Setup screen.

**NOTES:**

- The common settings are stored on your computer. You are **NOT** asked to save these to a file.
- To load the common settings into an RTMS, see the procedure for Common Settings on page 5-2.
Start Screen Options

The following sections describe the options on the Start screen for conducting a search and for polling RTMS units. For additional information about the Start screen, see “Start Screen” on page 3-10.

Searching For Sensors

This option is used when an RTMS unit is not found by the RTMS Setup Utility when it starts up.

1. Start the utility (see “Starting the RTMS Setup Utility” on page 3-5).
   If an RTMS unit is not found the Start screen appears.

   2. To begin the search, click Search for Sensors.
      The search is conducted using the current communications options. Any RTMS units found appear in a list in the space above “Multiple Sensors.”
3. If the unit you are searching for appears in the list, or if no units appear after one minute, click Stop Search.

4. Does the unit you are searching for appear in the list?

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continue with Step 5.</td>
<td>a) Troubleshoot the connection. See symptom “Could not establish communications with the RTMS” in Chapter 6: “Troubleshooting”.</td>
</tr>
<tr>
<td></td>
<td>b) If the problem is resolved, continue with Step 5; otherwise, contact Technical Support.</td>
</tr>
</tbody>
</table>

5. Select the unit from the list and click Single RTMS.

The main Screen will appear with the settings for the selected RTMS.
Polling Sensors

This option can be used to test the RTMS units in a polled mode.

1. Start the utility (see “Starting the RTMS Setup Utility” on page 3-5).

2. Did the Start screen or Main Screen appear?

3. In the Poll Range field, enter the starting and ending ID numbers, separated by a dash, of the units to be polled.

4. Click Poll Selected Sensors.
Statistics information is displayed, in turn, for each polled unit.

For more information about the statistics, see “Statistics Screen” on page 5-3.
Field troubleshooting of the RTMS consists mainly of ensuring that the unit is powered and communicating. Communication with the sensor in Normal mode is confirmed by presence of the moving vehicles and menu buttons, and by the flashing of the indicator in the lower right corner of the screen, denoting data transmission activity. The following outlines symptoms and suggested action in troubleshooting power and communication problems. Further information on problems with the power supplied to the unit, with the wiring, or with the communications parameters not being set correctly is provided below the table.

### Symptom: Could not establish communications with the RTMS

**Description:** If you are unable to establish communications between an RTMS unit and the RTMS Setup Utility, the utility opens the Start screen to allow you to direct a search for the RTMS. Possible causes are:

- RTMS is not powered.
- RTMS is not connected to the PC.
- RTMS connection cable is faulty.
- COM port is being used by another program.
- Wrong COM port is selected.
- Communication to RTMS is IP.
- Tx & Rx lines are crossed.

**Suggested Action:** Do the following in the order provided.

1. Check that:
   - RTMS is powered on.
   - RTMS is connected to the serial port of the laptop.
   - No other program is using the COM port. Close down any other application that is running on the laptop.

2. Try re-connecting (see “Communication Screen” on page 5-21).

3. Check the voltage:
   a) Disconnect the DB9 cable from your computer.
   b) Using a Voltmeter, measure the voltage between pins 2 and 5 of the connector. It should read between 5 - 10 VDC.
   c) If the voltage is not present, there could be a hardware fault.

4. If the problem persists, contact Technical Support.
Symptom: Main screen shows target blips but no zone icons or parameters on buttons.
Description: RTMS transmits and displays received data but RTMS has not received the READ command.
Suggested Action: Do the following.
1. Check cable to ensure continuity between MS connector pin T and COM port's pin 3.
2. If the problem persists, contact Technical Support.

Symptom: PC and sensor are communicating (Sensor settings are displayed on buttons) but target “blips” are not shown on the main screen.
Description: Possible causes are:
- RTMS is not in Normal mode.
- Unit is improperly aimed.
- Internal parameters corrupted.
- MW module fault.
Suggested Action: Do the following.
1. Ensure the unit is in the Normal mode.
2. Check sensitivity setting. See if targets appear when sensitivity is increased.
3. Cycle power to the unit and then edit parameters (mode, sensitivity, zone setup, etc.).
4. Run Self-Test if the above is not successful.
5. Report findings to Technical Support.

Symptom: RTMS Setup Utility will not start
Description: Microsoft .NET Framework 3.5 is not installed.
Suggested Action: Do the following.
1. Check that .NET Framework 3.5 is installed on the computer. If not, install it and retry the operation.
2. If the problem persists, contact Technical Support.
Symptom: Timeout has expired and the main Communication Screen is displayed

Description: Possible causes are:

- RTMS is not powered
- Cable problem

Suggested Action: Do the following.

1. Check that the supply voltage is within limits at the source and at the MS connector. Voltage outside the limits (too low or too high) will cause the power supply to shut down.
2. Check cable pin-out and continuity.
3. If the problem persists, contact Technical Support.
Do’s and Don’ts

Table 6-1: Do’s and Don’ts

<table>
<thead>
<tr>
<th>Do’s</th>
<th>Don’ts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ensure setback is sufficient and height</td>
<td>Attempt to mount a Side-fired RTMS closer than 10 feet to the first monitored lane</td>
</tr>
<tr>
<td>is not over recommendations (see “Height and Setback Requirements” on page 2-4).</td>
<td>without reviewing the following: “Zero Setback” on page 2-4.</td>
</tr>
<tr>
<td>Use extension arms where needed to improve sensor placement on exiting structures.</td>
<td>Place RTMS units where overhead structures can interfere with the microwave beam, e.g. under overpass bridges and heavy structures.</td>
</tr>
<tr>
<td>Aim the RTMS perpendicular to the lane direction.</td>
<td>Aim the RTMS at an angle exceeding five degrees from parallel or perpendicular to the monitored lane.</td>
</tr>
<tr>
<td>Place RTMS in intersections to approximate the ideal. Use extension mast-arms to achieve this goal if pole placement is not flexible.</td>
<td>Place the RTMS in less than ideal position without testing the detection zone coverage. Zones may overlap into undesired areas, producing false calls.</td>
</tr>
<tr>
<td>Aim RTMS according to the 1/3 rule, then verify aiming interactively with the RTMS Setup Utility by checking detection in all lanes.</td>
<td>Separate installation and aiming from the setup stage.</td>
</tr>
<tr>
<td>Pay attention to site cabling design. Ensure serial port access is available for set up. If necessary, add a pole-mounted junction box.</td>
<td>Increase sensitivity to offset poor aiming.</td>
</tr>
<tr>
<td>When powering with low voltage input AC transformer, design for 16 VAC.</td>
<td>Run the RTMS cable directly to cabinets out of visual range of the sensor’s detection footprint.</td>
</tr>
<tr>
<td>Evaluate power arrangements vs. distance. Use 1. Heavy gauge power wires to reduce voltage drop, or 2. Higher supply voltage.</td>
<td>Specify use of Controllers in new applications requiring data only.</td>
</tr>
<tr>
<td>Use wireless communication for:</td>
<td>Use thin power wires with low voltage supply.</td>
</tr>
<tr>
<td>• Long distances, to offset trenching cost.</td>
<td>Attempt connecting wires thicker than #18 with the RTMS MS connector.</td>
</tr>
<tr>
<td>• Quick deployment and portability.</td>
<td>Specify dial-up communication in applications requiring real time data. It is applicable to infrequent downloads of traffic counting data.</td>
</tr>
</tbody>
</table>
Appendix A: Cabling and Connectors

General

The RTMS ships with all required connectors, crimp pins, and back-shells.

- RTMS units use a single 32-pin MS connector for power and communications. For information about the MS pinouts, see “MS Connector Pin Out” on page A-3.
- The RTMS cable should be made from 20 or 22 gauge stranded wire arranged in twisted pairs.
- Cables exposed to outdoor conditions should be UV shielded.

The number of pairs required depends on the G4 model.

Table A-1: Required Wiring Pairs

<table>
<thead>
<tr>
<th>Model</th>
<th>Number of Pairs</th>
</tr>
</thead>
<tbody>
<tr>
<td>G4-STD (Base RTMS Unit)</td>
<td>Standard RS-232/485 plus power: 3 pair</td>
</tr>
<tr>
<td></td>
<td>If using RTS/CTS option for RS-232: 4 pair</td>
</tr>
<tr>
<td></td>
<td>If using RS-485: 4 pair</td>
</tr>
<tr>
<td>G4-SSP (Base RTMS Unit plus Second Serial Port)</td>
<td>If using without RTS/CTS option for RS-232: 1 additional pair</td>
</tr>
<tr>
<td></td>
<td>If using RTS/CTS option for RS-232: 2 additional pair</td>
</tr>
<tr>
<td></td>
<td>If using RS-485: 2 additional pair</td>
</tr>
<tr>
<td>G4-CAM (Base RTMS Unit plus IP Camera)</td>
<td>2 additional pair</td>
</tr>
<tr>
<td>G4-TCP (Base RTMS Unit plus TCP/IP)</td>
<td>2 additional pair</td>
</tr>
<tr>
<td>Contact Closures: The G4-CAM, G4-DSS, G4-SSP and G4-TCP models all have built in Contact Closures. If you are utilizing them you will need:</td>
<td>8 additional pair. <strong>Note</strong>, Up to 8 additional only if all Contact Closures are used.</td>
</tr>
</tbody>
</table>
Preparing a Cable

Use cable such as the Belden number 95xx (xx indicates number of pairs. For example: 9516 is a 16-pair cable. In preparing a cable note the following:

- Decide whether or not to install extra cable pairs for growth purposes.
- The crimp pins are designed for stranded wire only.
- **Do not** use cable employing solid wires.
- The Daniels Manufacturing Corporation crimping tool M22520/1-01 AF8 with head number M22520/1-02 or equivalent is recommended.
- **Do not** solder MS connector pins to the cable. They must be properly crimped.

The following table lists the maximum length of the cable based on the type.

<table>
<thead>
<tr>
<th>Protocol</th>
<th>Max Cable Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>RS-232</td>
<td>For baud rate of 19,200 or 115,200: 15m (50 ft)</td>
</tr>
<tr>
<td></td>
<td>For baud rate of 9600: 152m (500 ft) is the recommended maximum. However, you can go up to 244m (800 ft) when the:</td>
</tr>
<tr>
<td></td>
<td>• Cable has a minimum gauge of 20 AWG</td>
</tr>
<tr>
<td></td>
<td>• Baud rate is 9600</td>
</tr>
<tr>
<td></td>
<td>• Environment is ideal</td>
</tr>
<tr>
<td></td>
<td>• Cable is continuous</td>
</tr>
<tr>
<td>RS-485/RS-422</td>
<td>1219m (4000 ft) for all baud rates.</td>
</tr>
<tr>
<td>TCP/IP over CAT 5</td>
<td>91m (300 ft)</td>
</tr>
</tbody>
</table>

Connecting a Cable to the RTMS

To connect a cable to the RTMS device, do the following.

1. Thread cable through the backshell before inserting pins into shell.
2. Use the insertion tool (red) to insert wires with crimped pin into shell.
3. Use the extraction tool (white) to remove a crimped wire to correct an error.
4. Access to the serial connection should be available within view of the monitored lanes.
   - For example: inside an access panel or cabinet on the pole.
   - Verifying the sensor's calibration is easy when the user sees the RTMS data together with manual counts.
Surge Suppression/Protection

Each RTMS unit has built-in surge-suppression hardware. For complete information see Appendix B: “Surge Protection”

Wiring Notes

The DB9 connectors and terminal blocks serve as a disconnect point, which allows disconnecting the RTMS from the transmission line for direct connection to the laptop's COM port for setup.

Terminating resistors (100-120 ohms) are required at the extreme ends of the Receive and Transmit transmission pairs.

Transmit and receive pairs must be transposed when connecting to a DTE (PC, Data processing System). To interface with a PC an RS-485/232 converter may be required as PCs typically do not have RS-485 interfaces.

RS-485/232 converter connector type and pin assignment are not shown as these are not standardized and vary between models.

MS Connector Pin Out

Pin labeling in Figure A-1 is a guideline only. Verify pin location on actual connector before inserting wire.

NOTE: The RTMS unit can be configured for a variety of communication options. It is important to know which options are included with your unit prior to preparing cables. MS connector pins cannot be shared. Take note of the individual wiring instructions provided in this manual.

Figure A-1: MS Connector
Table A-3: Cable Pair Requirements

<table>
<thead>
<tr>
<th>Pin #</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOTE:</td>
<td>Pins A- S are used only for Contact Closure.</td>
</tr>
<tr>
<td></td>
<td>Pins W, Z, d and e are only used for secondary</td>
</tr>
<tr>
<td></td>
<td>communication options. For information on</td>
</tr>
<tr>
<td></td>
<td>cable pair requirements for these pins, see</td>
</tr>
<tr>
<td></td>
<td>the appropriate chapters in the RTMS Optional</td>
</tr>
<tr>
<td></td>
<td>Configurations User Guide.</td>
</tr>
<tr>
<td>T</td>
<td>Rx (Serial Port RS-232)</td>
</tr>
<tr>
<td></td>
<td>Rx- (Serial Port RS-485)</td>
</tr>
<tr>
<td>U</td>
<td>Ground (all Serial Ports and Contact Closures)</td>
</tr>
<tr>
<td>V</td>
<td>Tx (Serial Port RS-232)</td>
</tr>
<tr>
<td></td>
<td>Tx- (Serial Port RS-485)</td>
</tr>
<tr>
<td>X</td>
<td>CTS (Serial Port RS-232)</td>
</tr>
<tr>
<td></td>
<td>Tx+ (Serial Port RS-485)</td>
</tr>
<tr>
<td>Y</td>
<td>RTS (Serial Port RS-232)</td>
</tr>
<tr>
<td></td>
<td>Rx+ (Serial Port RS-485)</td>
</tr>
<tr>
<td>f, g</td>
<td>Low voltage power 12-24 VAC or DC</td>
</tr>
<tr>
<td>h, j</td>
<td>Reserved</td>
</tr>
</tbody>
</table>

Standard Serial Port

The RTMS comes with a Serial Port that can be configured as RS-232 or RS-485. For information about how to set the communications configuration, see “Communication Screen” on page 5-21.
Standard RS-232 Port Wiring

The standard RTMS RS-232 port wiring consists of Transmit (Tx), Receive (Rx), Request to Send (RTS), Clear to Send (CTS) and Ground lines wired to the MS pins respectively. The use of a female DB9 connector and wiring shown allows the use of standard serial cable for direct connection to the PC for setup purposes. For the maximum cable length, see Table A-2 on page A-2).

Rear views of connectors are shown to assist in cable preparation. The RTMS is configured as a Data Communications Equipment (DCE) device.

![DB9 Female Rear View](image)

Figure A-2: RS-232 Wiring Diagram

Table A-4: RS-232 Wiring Matrix

<table>
<thead>
<tr>
<th>DB9 Pin</th>
<th>Signal</th>
<th>MS Connector Pin</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>NC</td>
<td>N/A</td>
</tr>
<tr>
<td>2</td>
<td>Tx</td>
<td>V</td>
</tr>
<tr>
<td>3</td>
<td>Rx</td>
<td>T</td>
</tr>
<tr>
<td>4</td>
<td>NC</td>
<td>N/A</td>
</tr>
<tr>
<td>5</td>
<td>SGnd</td>
<td>U</td>
</tr>
<tr>
<td>6</td>
<td>NC</td>
<td>N/A</td>
</tr>
<tr>
<td>7</td>
<td>RTS</td>
<td>Y</td>
</tr>
<tr>
<td>8</td>
<td>CTS</td>
<td>X</td>
</tr>
<tr>
<td>9</td>
<td>NC</td>
<td>N/A</td>
</tr>
</tbody>
</table>
RS-485 Port Wiring

There is no standard pin configuration for RS-485 on a DB9 connector, so we suggest the following configuration. The wiring diagram shown will connect directly to a RS-232 configured DB9 without the need for an RS-232/RS-485 converter. The maximum cable length is 1219m (4000 ft). Over short distances (9m (30 ft) the wiring diagram shown below is compatible with an RS-232 port.

A disconnect point is recommended to allow the RTMS to be detached from the transmission line without disruption of communications with other sensors on the line. See “Connecting RTMS to External Modems” on page A-8 for details.

![Figure A-3: RS-485 Wiring Diagram](image)

Table A-5: RS-485 Wiring Matrix

<table>
<thead>
<tr>
<th>DB9 Pin</th>
<th>Signal</th>
<th>MS Connector Pin</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>NC</td>
<td>N/A</td>
</tr>
<tr>
<td>2</td>
<td>Tx-</td>
<td>V</td>
</tr>
<tr>
<td>3</td>
<td>Rx-</td>
<td>T</td>
</tr>
<tr>
<td>4</td>
<td>NC</td>
<td>N/A</td>
</tr>
<tr>
<td>5</td>
<td>SGnd</td>
<td>U</td>
</tr>
<tr>
<td>6</td>
<td>NC</td>
<td>N/A</td>
</tr>
<tr>
<td>7</td>
<td>Rx+</td>
<td>Y</td>
</tr>
<tr>
<td>8</td>
<td>Tx+</td>
<td>X</td>
</tr>
<tr>
<td>9</td>
<td>NC</td>
<td>N/A</td>
</tr>
</tbody>
</table>
RS-485 Multi-Drop Wiring

The RS-485 setting of the RTMS Serial Port allows up to 32 RTMS units to be employed on the same serial bus over distances up to 1219m (4000 ft).

RS-485 is used for multipoint communications. This allows more devices to be connected to a single cable, similar to an Ethernet network which uses a coaxial cable. Most RS-485 use a Master/Slave architecture, where each slave unit has its own unique address and responds only to packets addressed to it. The packets are generated by a master (e.g., PC) which periodically polls all connected slave units.

The following diagram shows the use of a 4-Wire line. The use of a half-duplex 2-Wire line is feasible but it is suitable for data collection only.

![Diagram](image)

**Figure A-4: RS-485 Multi-Drop Wiring**
Connecting RTMS to External Modems

The RTMS may be connected to a remote traffic data collection system over private telephone lines using modems. Multiple RTMS units connecting to remote systems, including the Cluster Hub or NEWS Hub systems must be placed in Polled mode and may require the use of modems.

Modem Cables

A cable connecting the RTMS RS-232 port to the modem's RS-232 port must provide a Male connectors at both ends (null cable) and the cable must operate within the parameters provided below.

A modem's RS-232 ports will usually employ DB9 or DB25 connectors.

<table>
<thead>
<tr>
<th>Function</th>
<th>From RTMS DB9</th>
<th>To Modem DB9</th>
<th>To Modem DB25</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transpose Tx and Rx</td>
<td>Pin 2</td>
<td>Pin 3</td>
<td>Pin 2</td>
</tr>
<tr>
<td></td>
<td>Pin 3</td>
<td>Pin 2</td>
<td>Pin 3</td>
</tr>
<tr>
<td>Connect ground</td>
<td>Pin 5</td>
<td>Pin 5</td>
<td>Pin 7</td>
</tr>
<tr>
<td>RTS to RTMS</td>
<td>Pin 7</td>
<td>Pin 8</td>
<td>Pin 5</td>
</tr>
<tr>
<td>Modem Side Control Looping</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DCD to CTS</td>
<td>Pin 1 to Pin 7</td>
<td>Pin 4 to Pin 8</td>
<td></td>
</tr>
<tr>
<td>DSR to DTR</td>
<td>Pin 4 to Pin 6</td>
<td>Pin 6 to Pin 20</td>
<td></td>
</tr>
</tbody>
</table>
Modem Sharing

NOTE: Downloading of the internal memory is not available with this configuration.

RTMS units located in close proximity may connect to a single modem. A modem sharing cable will have “Y” 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 side strapping provides required flow control functions, not provided by the standard RTMS RS-232 port.

![Modem sharing “Y” cables](image)

**Figure A-6: Modem sharing “Y” cables. (No Memory Download.)**

<table>
<thead>
<tr>
<th>Connection/Function</th>
<th>From RTMS DB9</th>
<th>To Modem DB9</th>
<th>To Modem DB25</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transpose Tx and Rx</td>
<td>Pin 2</td>
<td>Pin 3</td>
<td>Pin 2</td>
</tr>
<tr>
<td></td>
<td>Pin 3</td>
<td>Pin 2</td>
<td>Pin 3</td>
</tr>
<tr>
<td>Connect ground</td>
<td>Pin 5</td>
<td>Pin 5</td>
<td>Pin 7</td>
</tr>
<tr>
<td>Modem Side Strapping</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RTS to CTS</td>
<td><em>pin 1 to pin 7</em></td>
<td><em>pin 4 to pin 8</em></td>
<td></td>
</tr>
<tr>
<td>DSR to DTR</td>
<td><em>pin 4 to pin 6</em></td>
<td><em>pin 6 to pin 20</em></td>
<td></td>
</tr>
<tr>
<td>Connect a 4.7 kΩ resistor from Tx to ground to prevent noise.</td>
<td><em>pin 3 to pin 5</em></td>
<td><em>pin 2 to pin 7</em></td>
<td></td>
</tr>
</tbody>
</table>

**Table A-7: Modem Sharing “Y” Cabling**
Appendix B: Surge Protection

General

RTMS sensors are deployed in locations where the quality of power lines can be questionable. Industrial machinery and environmental factors can cause excess noise and voltage/current spikes on power lines. Additionally, poor grounding of equipment can amplify the effects these disturbances. It is recommended that all lines connected to the RTMS sensor (i.e., power and communication) have surge protection and each sensor be sufficiently grounded as outlined in this appendix.

The purpose of this appendix is to provide an understanding of why proper grounding and surge protection is important to a successful RTMS sensor deployment and provide guidelines for grounding of equipment and installing surge protection devices to protect each RTMS sensor.

Breakaway Boxes

Every sensor should have a breakaway box on the same pole that the RTMS sensor is mounted (see Typical Installation). The breakaway box should be no more than 6 meters (20 ft) from the RTMS sensor (see Figure B-1).

![Figure B-1: Typical Installation](image)

Each breakaway box should contain a manufacturers approved surge suppression package, which includes a power supply and all the necessary surge protection devices.
Cabling to the Breakaway Box

The Mains power should enter the breakout box and go directly to the surge protection package as described in the wiring diagram provided with the package. The earth ground wire from the Mains power should tie to the breakout box, the surge protection package, and directly to the grounding rod as described in the grounding section of this appendix.

**IMPORTANT:** The Mains earth ground conductor MUST come with the Mains power conductors from the utility. The local ground rod is only for suppression of surge and must be tied to the earth ground reference from the power source.

Cabling From the Breakaway Box

The only cable leaving the breakout box should be the low voltage power cable going directly to the sensor.

**IMPORTANT:** The cable from the breakout box to the RTMS sensor should be routed up the pole directly to the sensor and should not share conduits with or be routed next to high voltage/high current (AC or DC) power lines.

Parts of the Surge Suppression Package

**Power Line Protection**

The first part of a surge suppression package is providing a barrier between the incoming power lines and the power provided to the RTMS sensor. A Circuit breaker (CB) and a power transient suppressor (PTS) provide this protection. The incoming power line should go through the circuit breaker, then to the PTS device. In this configuration, if a surge occurs the PTS will shunt excessive current to earth ground and subsequently trigger the CB. This opens the circuit and prevents damage to the sensor and the PTS. The CB must have a 2A rating.

![Figure B-2: Power Lines Protection](image-url)
**IMPORTANT:** The negative terminal of the low voltage side of the power supply, battery, or solar controller must be connected to the earth ground in order to provide a reference point for the RTMS built-in surge protection.

**Communication Line Protection**

Communication lines to the RTMS sensor are sensitive lines that must be protected from external influences to prevent damage to the communication interface on the sensor and ensure uncorrupted data flow to and from the sensor. Each communication line should be protected by a device that will shunt excess current on the line to earth ground rather than sending that current through the RTMS sensor and causing damage to the device. Care must be taken when providing protection on communication lines to ensure the device chosen will not add excess capacitance or inductance that could cause disruptions to the integrity of the data. Figure B-3 and Figure B-4 show the protections provided by the manufacturers approved surge suppression packages on the communications interfaces for the RTMS sensor.

![Figure B-3: Serial Port Protection](image)

Cable’s shield (drain wire)
Figure B-4: Ethernet Port Protection
Grounding

Providing a Proper Ground

Providing a low resistance earth ground connection is essential to achieving effective surge protection. Total resistance from the protected circuit to the earth should be <5 ohms.

![Grounding conductor](image.png)

6 foot metal rod

Figure B-5: Earth Ground Connection

A grounding rod (see Figure B-5) should be at least 1.83m (6 ft) in length and placed as close as possible to the base of the RTMS mounting pole. The grounding conductor should be flexible copper braid or copper wire 12AWG or larger.
Why Grounding is Important

The earth grounding rod, together with proper ground of the breakaway box, and surge protecting devices installed in close proximity of the mounting pole, create a barrier or ‘sink hole’ for any charges and surges coming towards the sensor from the surrounding area (see Figure B-6). These charges and surges may be caused by industrial noise, power surges, or lightning.

Thunderstorm lightning is in its own class of destructive forces to sensors. Typically, it can generate 30 to 300 kA of current, far beyond the capabilities of any surge protecting devices. Therefore, a direct or near direct lightning hit may cause equipment damage even in the presence of surge/transient protecting devices.

Because lightning is a major influence on power line surge, it is important to understand the exposure to thunderstorms in the area where the RTMS sensor is being installed. In areas that are exposed to large number of thunderstorms, protecting sensors will be more challenging.

Figure B-7 is a climatological map of the United States showing the average number of days per year that thunderstorms occur.
Figure B-7: Average Number of Thunderstorm Days Per Year in the United States
Low Voltage Power

The manufacturers approved surge suppression packages include a 24VDC power supply. The output of this supply is tied to the cable that powers the RTMS sensor. This cable should not be longer than 6m (20 ft) in length and should only be run directly from the breakout box at the mounting pole for each RTMS sensor up the mounting pole to the RTMS sensor.

**IMPORTANT:** The cable from the breakout box to the RTMS sensor should be routed up the pole directly to the sensor and should not share conduits with or be routed next to high voltage/high current (AC or DC) power lines.

You should not power RTMS sensors from low voltage sources (either AC or DC) over cables longer than 6m (20 ft) for the following reasons:

- Long low voltage lines act as an antenna for all sorts of disturbances, noise, and surges.
- Significant power loses can occur at long distances.
- 305 m (1000 ft) of typical 18 AWG stranded wire introduces resistance of about 6.6Ω per wire. The base RTMS unit draws 0.25A at 12V. The power loss can be calculated as:
  \[ V_{device} = I_{RTMS} \times R_{cable} = 0.25A \times (2 \times 6.6\Omega) = 3.3V \]

  Note:
  \[ R_{cable} = 2 \times \text{resistance per wire} \] because the current travels to the device on the power wire and returns from the device on the ground wire.

  A 3.3V cable loss means the voltage at the RTMS input will be 8.7V. This is less than the minimum voltage requirement of the RTMS sensor (12V).

The manufacturer cannot guarantee proper operation of the unit and/or its longevity if low voltage power over long line is used to power an RTMS sensor, and does not recommend or support providing power in this configuration. However, the following are some things to help limit the risks.

- Use an isolated 24VDC power source.
- Increase the gauge of the power wires to reduce voltage drop. Reference the datasheet for the wire you are installing or an American Wire Gauge lookup table for resistance per foot of each wire gauge.
- Mount low voltage surge protection at the base of mounting pole and ensure the protection device has a low resistance reference (<5 ohms) to earth ground.
- Avoid running RTMS sensor cables parallel or close to high voltage/high current power lines (including in conduits).
Appendix C: Data Files and Message Formats

Traffic Data Files

The text file that is created is identified by the extension “.asc”. The file is formatted in a table form.

The files contain Time/Date stamped data from one or more sensors. The format of the file is shown below.

The available Data Analyst program provides the following functions:

- Segregates data based on Sensor ID (Station ID).
- Formats data as into text file to present the Volume, Long Vehicle Volume, Occupancy, and Speed as columns.
- Aggregates measurements per Message Period.

<table>
<thead>
<tr>
<th>RTMS STAT. MESSAGES</th>
<th>ZONE: 1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPEED IN Units.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Occupancy 6 ft loop normalized.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DDMMYYYY HH:MM:SS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MESSAGE NO. #</td>
<td>VOLUME:</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>REG:</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>MED:</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>LARGE:</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>TRUCK:</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>XLARGE:</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>STATION ID. #</td>
<td>OCCUPANCY:</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>FWDLK SPEED ?</td>
<td>SIDEFRD SPD:</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>GAP:</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

Figure C-1: RTMS .asc File Format (X3 STAT mode)

Table C-1: File Format Description

<table>
<thead>
<tr>
<th>Line</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Header for the following Rows</td>
</tr>
<tr>
<td>2</td>
<td>Header information.</td>
</tr>
<tr>
<td></td>
<td>Speed in units — The speed values in the table are in these units.</td>
</tr>
<tr>
<td></td>
<td>Occupancy ... — If the 6ft emulation is turned this message is displayed.</td>
</tr>
<tr>
<td>3</td>
<td>Time Date Stamp</td>
</tr>
</tbody>
</table>

(Table continues on the next page)
### Table C-1: File Format Description (Cont’d)

<table>
<thead>
<tr>
<th>Line</th>
<th>Description</th>
</tr>
</thead>
</table>
| 4    | **Message No.** — The message number. It will go from 0 to 255. On the 256th message it will be message 0 again.  
Volume — This is the total volume for each zone.  
**Note:** To calculate “Small” classification, add up the individual classifications listed below and subtract that number from the total volume. |
| 5    | Volume counts for each zone for the Regular Class size. |
| 6    | Volume counts for each zone for the Medium Class size. |
| 7    | Volume counts for each zone for the Large Class size. |
| 8    | Volume counts for each zone for the Truck Class size. |
| 9    | Volume counts for each zone for the Extra Large Class size. |
| 10   | Station ID — This is the sensor ID. Set in Manual Settings -> Sensor ID  
Occupancy — The occupancy value for each zone. |
| 11   | FWDLK SPEED — This is the speed value when using the forward looking mode.  
SideFrd SPD — The is the speed value for each zone when using the Side-Fired or Midblock modes.  
Dir — This is the direction value when using the forward looking mode (this value is sometimes needed when troubleshooting with Technical Support personnel).  
V — This is the voltage reading at the RTMS. This is real number reported as a whole number. For example 239 equals 23.9 V.  
H — This is a Health Byte value. This is only used for troubleshooting purposes with Technical Support personnel. |
| 12   | The Gap or Headway values for each zone. |
Sample X3 Compatible Statistical Message

The X3 message format will:

- Always display all eight zones even if fewer zones are setup.
- Always displays speed values in Km/h.
- The designation vehicle classes will only display the number of classifications shown in the RTMS Setup Utility.

The following is a sample X3 STAT file with six length classes reporting.

```
RTMS STAT. MESSAGES     ZONE: 1     2     3     4     5     6     7     8
SPEED IN Km/h.  Occupancy 6 ft loop normalized.
03 28 2011 13:40:00
MESSAGE NO. 4        VOLUME:  0     3     14    12    14    10    13    0
  REG:  0     0     2     5     3     2     2     0
  MED:  0     1     2     0     1     1     1     0
  LARGE:  0     0     3     0     1     1     0     0
  TRUCK:  0     0     1     0     1     1     0     0
  XLARGE:  0     0     0     0     0     1     1     0
STATION ID. 1     OCCUPANCY:  0.0   1.8   12.2  10.6  11.7  13.0  14.1  0.0
FWDLK SPEED ?   SIDEFRD SPD:  ?     131   135   92    111   111   97    ?      Dir. 0   V.239   H.0
  GAP:  0.0   1.2   0.0   0.0   0.0   0.0   0.0   0.0
03 28 2011 13:41:00
MESSAGE NO. 5        VOLUME:  2     2     15    13    9     12    11    0
  REG:  0     0     0     2     1     0     3     0
  MED:  0     1     3     1     0     0     0     0
  LARGE:  0     1     3     1     0     0     0     0
  TRUCK:  0     0     0     0     0     3     2     0
  XLARGE:  1     0     0     0     0     1     0     0
STATION ID. 1     OCCUPANCY:  2.9   1.7   13.0  13.3  6.2   15.4  15.2  0.0
FWDLK SPEED ?   SIDEFRD SPD:  127  131  133  94   118  107  89    ?      Dir. 0   V.239   H.0
  GAP:  1.2   1.2   0.0   0.0   0.0   0.0   0.0   0.0
```

Figure C-2: Sample X3 STAT
G4 Statistical Message

Please note:

- G4 Statistics Message will have a variable length based on how many lanes are configured.
- The designation of vehicle classes will also be the same as shown in the RTMS Setup Utility.
- If Per Vehicle is ON, their data will be ahead of each message period’s statistics.

The following is a sample G4 STAT file with all 12 lanes and 6 length classes reporting.

```
RTMS STAT. MESSAGES   ZONE: 1  2  3  4  5  6  7  8  9 10  11  12
SPEED IN Km/h.  Occupancy 6 ft loop normalized.

03 27 2011 1:40:00
MESSAGE NO. 250       VOLUME: 8  8 11  7 10 12 14  9 11 13 11
                      REG: 2  0  0  0 1  1 1  1 1 3  1
                      MED: 0  0  1  0 1  2 0  0 0 1  1
                      LARGE: 0  1  0  0 0  1 0  0 0 2  2
                      TRUCK: 0  0  1  0 0  0 0  2 0 1  0
                      X_LARGE: 0  0  2  0 0  0 0  0 0 2  0
STATION ID. 1   OCCUPANCY: 5.6 5.1 12.4 4.4 17.5 11.5 9.3 13.0 6.3 8.7 16.6 10.0
FWDLK SPEED ?   SIDEFRD SPD: 52 65 60 58 50 57 55 63 48 66 63 62 Dir. 0 V.239 H.0

03 27 2011 1:41:00
MESSAGE NO. 251       VOLUME: 7  9 11 10 18 12 10 12  8 7  6
                      REG: 1  3  2  0 7  3 3  2 1 0  2
                      MED: 1  0  1  0 0  0 0  0 1 2  3
                      LARGE: 0  0  1  0 0  0 1  0 0 0  0
                      TRUCK: 0  0  1  0 0  0 0  3 0 0  0
                      X_LARGE: 0  0  0  1 0  1 0  0 1 0  1
STATION ID. 1   OCCUPANCY: 5.4 5.2 12.4 11.5 16.8 9.4 11.5 10.9 7.4 7.8 4.4 4.1
FWDLK SPEED ?   SIDEFRD SPD: 53 64 58 60 52 54 58 64 47 66 66 64 Dir. 0 V.239 H.0
```

Figure C-3: Sample G4 STAT File
Statistical Message with Per Vehicle On

For more information about the Per Vehicle setting, see “Per Vehicle ON/OFF” on page 5-1.

<table>
<thead>
<tr>
<th>RTMS STAT. MESSAGES</th>
<th>ZONE: 1 2 3 4 5 6 7 8</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPEED IN Km/h.</td>
<td>Occupancy 6 ft loop normalized.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>RTMS_ID Lane Class Speed [units] Length [units] Dwell</th>
</tr>
</thead>
<tbody>
<tr>
<td>pv DDMMYYYY HH:MM:SS.ms # # Sm # # #</td>
</tr>
<tr>
<td>pv DDMMYYYY HH:MM:SS.ms # # Reg # # #</td>
</tr>
<tr>
<td>pv DDMMYYYY HH:MM:SS.ms # # Med # # #</td>
</tr>
<tr>
<td>pv DDMMYYYY HH:MM:SS.ms # # Lg # # #</td>
</tr>
<tr>
<td>pv DDMMYYYY HH:MM:SS.ms # # Trk # # #</td>
</tr>
<tr>
<td>pv DDMMYYYY HH:MM:SS.ms # # Xlg # # #</td>
</tr>
</tbody>
</table>

03 28 2011 13:40:00
MESSAGE NO. 4 VOLUME: # # # # # # # # |
REG: # # # # # # # # |
MED: # # # # # # # # |
LARGE: # # # # # # # # |
TRUCK: # # # # # # # # |
XLARGE: # # # # # # # # |
STATION ID. 1 OCCUPANCY: # # # # # # # # |
FWDLK SPEED 7 SIDEFRD SPD: # # # # # # # # # Dir. 0 V.239 H.0

<table>
<thead>
<tr>
<th>RTMS_ID Lane Class Speed [units] Length [units] Dwell</th>
</tr>
</thead>
<tbody>
<tr>
<td>pv DDMMYYYY HH:MM:SS.ms # # Sm # # #</td>
</tr>
<tr>
<td>pv DDMMYYYY HH:MM:SS.ms # # Reg # # #</td>
</tr>
<tr>
<td>pv DDMMYYYY HH:MM:SS.ms # # Med # # #</td>
</tr>
<tr>
<td>pv DDMMYYYY HH:MM:SS.ms # # Lg # # #</td>
</tr>
<tr>
<td>pv DDMMYYYY HH:MM:SS.ms # # Trk # # #</td>
</tr>
<tr>
<td>pv DDMMYYYY HH:MM:SS.ms # # Xlg # # #</td>
</tr>
</tbody>
</table>

03 28 2011 13:40:00
MESSAGE NO. 4 VOLUME: # # # # # # # # |
REG: # # # # # # # # |
MED: # # # # # # # # |
LARGE: # # # # # # # # |
TRUCK: # # # # # # # # |
XLARGE: # # # # # # # # |
STATION ID. 1 OCCUPANCY: # # # # # # # # |
FWDLK SPEED 7 SIDEFRD SPD: # # # # # # # # # Dir. 0 V.239 H.0

Figure C-4: Sample File With Per Vehicle ON
Appendix D: Bluetooth Device Operations

General

Before you can set up Bluetooth communications with the RTMS, use the manufacturer’s instructions to install a Bluetooth device on your computer.

Some computers come with pre-installed Bluetooth capabilities. We recommend that you determine the specifications of the internal Bluetooth adapter prior to establishing a link to the RTMS. Using the internal Bluetooth adapter may not give you adequate range to establish a reliable link to the RTMS.

NOTES:

• The manufacturer suggests at least Bluetooth 2.0+EDR Class 1, and strongly recommends the Sena Parani UD100-G01 USB Bluetooth adapter.

• Bluetooth requires that the baud rate for port 1 in the RTMS be set to 115,200.

There are three classes of Bluetooth devices. The different classes have different ranges as follows:

• Class 3 radios – 1 meter (3 feet)
• Class 2 radios – 10 meters (33 feet): most commonly found in mobile devices
• Class 1 radios – 100 meters (328 feet): used primarily in industrial use cases

Bluetooth is not a line-of-sight connection, so it can be used through walls and floors. However, things such as walls, people, poles and vehicles can reduce the range.

The following sections describe how to locate and connect to a Bluetooth device when using recommended Sena Parani adapter or through Microsoft Windows.
Method 1: Using the Sena Parani UD100-G01 USB Adapter

This is the Bluetooth adapter that is recommended for communicating with the RTMS.

Determining if Your Computer Has Bluetooth Installed

To determine whether your computer has a bluetooth device, look for the Bluetooth icon in the system tray at the lower right of your screen.

If it does not appear, follow the manufacturer’s instruction for installing the Bluetooth device.

Pairing With and Connecting to the RTMS

**IMPORTANT:** Before performing this procedure you must set up the RTMS to communicate with a Bluetooth device (the Communication screen must be set to PC serial and the Baudrate must be set to 115,200). For additional information see “Defining a Bluetooth Connection” on page 5-24.

To connect to the RTMS using Bluetooth communication, do the following.

1. Make sure the RTMS is powered up and within range of your computer.
2. Double-click the Bluetooth icon in the system tray.
The following window appears.

3. Click **New Connection**.
The following window appears.

![Add New Connection Wizard]

4. Select **Express Mode**.

5. Click **Next**.

   The computer will search for Bluetooth devices.
When a device is located the following window appears.

6. Select the RTMS to which you want to connect.
7. Click Next.

The following window appears.

8. In the Bluetooth Passkey (PIN) field, type admin.
9. Click OK.
The following window appears.

![Add New Connection Wizard](image)

Setup of COM40 complete.
Setup application software and driver if needed.

10. Make note of the COM Port number.
   This is the COM Port you will use to connect to the RTMS sensor. (Note, in the figure above, the COM Port is COM40.)

11. Click **Next**.
The following window appears.

The RTMS appears in the connection window.

12. Start the Setup Utility (see “Starting the RTMS Setup Utility” on page 3-5).


The following screen appears.
NOTE: You can also get to this screen by clicking the Communication button on the Start screen.

15. Select PC Serial as the type of communication.

16. For Serial Port, select the serial port that you made note of in Step 10.

17. For Baudrate, select 115200 (this is mandatory for Bluetooth).

18. For Timeout, ms, enter the number of milliseconds to wait for communication from the RTMS before the connection times out.

19. Click OK.

   If a connection is established, the green COM indicator in the bottom right of the screen will be blinking.

20. You can now perform any of the Setup Utility operations.

**IMPORTANT:** After you are through with the RTMS Setup Utility, it is strongly recommended that you disconnect and delete the Bluetooth connection. If not, Windows will retain the COM Port settings, which could cause issues with the COM port settings on your computer. See “Disconnecting Bluetooth” on page D-9.
Disconnecting Bluetooth

To disconnect from the RTMS and delete the Bluetooth connection, do the following.

1. Exit the RTMS Setup Utility.
2. Double-click the Bluetooth icon in the System tray.
   The Bluetooth Settings window appears.

3. Select the RTMS sensor.
4. Click Delete.
   The following window appears.

5. Click Yes.
Finding the Bluetooth COM Port Assignment

To find out what COM port the Bluetooth adapter is assigned to, do the following.

6. Double-click the Bluetooth icon in the System tray.

   The Bluetooth Settings window appears.

7. Select the RTMS sensor.

8. Click Detail.
The following window appears.
Method 2: Using Microsoft Windows

Determining if Your PC has Bluetooth Installed

To find out if your computer already has Bluetooth hardware and software installed, do the following.

1. Select **Start > Control Panel**.
   The following window appears.

2. Are **Bluetooth Configuration** and **Bluetooth Devices** listed?

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continue with <strong>Step 3</strong>.</td>
<td>Install a Bluetooth adapter and software according to the manufacturer’s instructions. <strong>Note</strong>, you may need to restart the computer after installation.</td>
</tr>
</tbody>
</table>

3. Double-click **Bluetooth Devices**.
The Bluetooth Devices window appears.

4. Click the **Hardware** tab.

**NOTE:** Many computers may have the Bluetooth icon but do not have factory installed Bluetooth hardware.

5. Are there devices listed?

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>You can set up Bluetooth communications with the RTMS (see “Defining a Bluetooth Connection” on page 5-24)</td>
<td>There is no Bluetooth adapter installed. Install a Bluetooth adapter and software according to the manufacturer’s instructions. <strong>Note</strong>, you may need to restart the computer after installation.</td>
</tr>
</tbody>
</table>
How to Search for Bluetooth Devices

The following describes how to see if the RTMS is setup as a Bluetooth device.

1. Make sure the RTMS (with internal Bluetooth option) is powered up and within range of your computer.
2. Select **Start>Control Panel**.
3. Double-click **Bluetooth Devices**.

   The Bluetooth Devices window appears.

4. Click **Add**.
The following window appears.

5. Select the **My Device is set up and ready to be found** check box.

6. Click **Next**.

A search for Bluetooth devices is conducted. When the search is complete, the following window appears.
7. Is the RTMS listed in the window?

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>
| Continue with Step 8 | a) Make sure the RTMS is on, that this model of RTMS has the Bluetooth option, and you are within the specified range.  
b) Click Search Again.  
c) Continue with Step 8. |

8. Select the RTMS in the list.
9. Click Next.

The following window appears.

![Add Bluetooth Device Wizard](image)

10. Select **Use the passkey found in the documentation**.
11. Type **admin** as the passkey.

   This is the default passkey for RTMS. To set up a new passkey, see “Changing the Bluetooth Password/Passkey” on page D-19.
12. Click Next.
The following window appears.

13. Click Next.

The following window appears.

**NOTE:** Be sure to note the **Outgoing COM port** number. You will need this when trying to connect to the RTMS with the RTMS Setup Utility. If you forget what the port assignment is, see “Finding the Bluetooth COM Port Assignment” on page D-18.

14. Click Finish.
Finding the Bluetooth COM Port Assignment

The following describes how to find out what COM port the Bluetooth adapter is assigned to.

1. Select **Start>Control Panel**.
2. Double-click **Bluetooth Devices**.

   The Bluetooth Devices window appears.

3. Click the **COM Ports** tab.

   The Outgoing port number is the one used when trying to connect to the RTMS.
Changing the Bluetooth Password/Passkey

The default password/passkey for the RTMS Bluetooth connection is admin. If you would like to change, use the following procedure.

1. Connect to the RTMS through Direct serial connection (see “Defining a Serial Connection” on page 5-22).

   NOTE: DO NOT use the Bluetooth connection.

2. Make sure the Baudrate is set to 115200.

3. Click Password.
The following window appears.

4. Type the new password.
5. Click OK.

**NOTE:** The connection to the RTMS is discontinued.

6. To activate the new password, cycle power on the RTMS.
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