

# **APOLLO**

## Counter/Classifier

### **Field Unit Instruction Manual**



DIAMOND TRAFFIC PRODUCTS  
PO BOX 1455  
76433 ALDER STREET  
OAKRIDGE, OR 97463

**VERSION: 1.21**

ISSUE DATE: 09/01/2006

# TABLE OF CONTENTS

<b>I. INTRODUCTION</b>	<b>Page 5</b>
I.A.    HOW TO USE THIS MANUAL	7
I.B.    COMMUNICATION WITH THE APOLLO	8
I.C.    SYSTEMS COMPONENTS	8
I.D.    FEATURES NOT AVAILABLE FROM THE KEYPAD	9
<b>II. HARDWARE</b>	<b>Page 10</b>
II.A.    KEYPAD	10
II.B.    LCD DISPLAY	11
II.C.    SERIAL PORT	11
II.D.    ROAD TUBES	12
<b>III. QUICK SETOUT MODES</b>	<b>Page 14</b>
III.A.    THE TWO BASIC OPERATION MODES	14
III.B.    RAW PER VEHICLE STORAGE AND SPECIFIC FUNCTIONS	15
III.C.    COUNT STORAGE AND SPECIFIC FUNCTIONS	17
<b>IV. ADVANCED SELECTION MODE</b>	<b>Page 18</b>
IV.A.    NOT COLLECTING DATA MENU	18
IV.B.    COLLECTING DATA MENU	19
IV.C.    START COLLECTING	19
IV.c.1    Questions Asked With Any Storage Mode	21

<b>IV. ADVANCED SELECTION MODE Continued</b>
--

<b>IV.D. SHOW STATUS</b>	<b>22</b>
<b>IV.E. DELETE FILES</b>	<b>23</b>
<b>IV.F. VIEW LANE TOTALS</b>	<b>24</b>
<b>IV.G. CONFIGURE SYSTEM</b>	<b>25</b>
<b>IV.H. COLD RESTART</b>	<b>26</b>
<b>IV.I. MONITOR LANES</b>	<b>28</b>
<b>IV.J. MONITORING RAW OR BINNED DATA COLLECTION</b>	<b>28</b>
<b>IV.K. MONITORING COUNT DATA COLLECTION</b>	<b>29</b>

<b>APPENDIX A. TROUBLE SHOOTING</b>	<b>Page 30</b>
-------------------------------------	----------------

<b>APPENDIX B. MEMORY USAGE</b>	<b>Page 31</b>
---------------------------------	----------------

<b>B.1. RAW DATA COLLECTION</b>	<b>31</b>
<b>B.2. COUNT DATA COLLECTION</b>	<b>32</b>

<b>APPENDIX C. PLUGS &amp; CONNECTORS</b>	<b>Page 32</b>
---	----------------

<b>APPENDIX D. DEFAULT BIN TABLES</b>	<b>Page 33</b>
---------------------------------------	----------------

<b>APPENDIX E. ROAD TUBE PROBLEMS &amp; SOLUTIONS</b>	<b>Page 35</b>
---	----------------

<b>E.1. MISSED AXLES</b>	<b>35</b>
<b>E.2. EXTRA AXLES</b>	<b>38</b>
<b>E.3. BAD SPEED AND/OR LENGTH</b>	<b>38</b>
<b>E.4. SNMIS (SENSOR MISS) FOR ENTIRE VEHICLE</b>	<b>39</b>
<b>E.5. ONE VEHICLE SHOWN AS TWO</b>	<b>39</b>
<b>E.6. TWO VEHICLES SHOWN AS ONE</b>	<b>40</b>
<b>E.7. ROAD TUBE SETUP THAT DOES NOT CAUSE ERRORS</b>	<b>40</b>

<b>APPENDIX F GPS SETUP</b>	<b>Page 41</b>
-----------------------------	----------------

# I. INTRODUCTION

Thank you for purchasing the Apollo Field Unit. You have purchased one of the finest traffic classification counters available. This manual describes the operation and programming of the Apollo Field Unit. Please read this manual before attempting full operation. The Apollo Quick Start guide is available as an appendix to this manual.

## What is an "Apollo Field Unit"?

The Apollo is a traffic data-gathering instrument for use in the field. Speed, Length, and Number of Axles are a few types of data that can be gathered with this instrument.

The cast aluminum case is durable, light, and weather resistant. The interior keypad & display are both sealed to prevent moisture from damaging them. In addition, a rubber seal is installed around the lid to further protect the unit from the weather.

The case also contains a lid securing mechanism and aluminum carrying handle. The outside rear of the case contains two or four Air switches. The Battery Charger and the Serial Interface plug are on the face panel of the counter.

The electronic circuit board inside the case contains the microprocessor, backup battery, battery charger network, memory, and all other support circuitry for the unit.

## Some Tips to Prolong the Life of Your Apollo

- ❖ When collecting data avoid placing unit in drainage ditches or areas prone to flooding.
- ❖ Always dry the unit out completely after removing from the field.
- ❖ Always push on the dust caps onto unused plugs.
- ❖ Keeping the battery fully charged will prolong its service life. Recharge the battery every six weeks when not in use.
- ❖ Disconnect the serial interface plug if serial communication is not required. This will substantially reduce power consumption and prolong battery life.

***Do not attempt service without qualified personnel. The components of the Apollo are very static sensitive, and improper handling can damage boards. All hardware is covered in the Apollo Hardware Manual.***

# FCC Compliance

## FCC Compliance

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- ❖ Reorient or relocate the receiving antenna.
- ❖ Increase the separation between the equipment and receiver.
- ❖ Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- ❖ Consult the dealer or an experienced radio/TV technician for help.

The user is cautioned that changes or modifications not expressly approved by Diamond Traffic Products could void the user's authority to operate the equipment.

## I.A. HOW TO USE THIS MANUAL

This manual completely describes the use of the Apollo. The only thing not covered in this manual is programming & retrieving data from the serial port with a PC Computer. This is covered in the *Centurion Windows Software*.

### Do I Have To Read The Whole Manual?

For Quick operation please refer to the Apollo Quick Start Guide. Anybody using an Apollo should read all of Section I, II, and III of this manual. This will familiarize you with the basic equipment provided, what types of data you can collect. From that point there are three methods of operation:

**Method 1 - To operate the Apollo entirely from its built in keypad.**

All setup and configuration can be done from the keypad and is recommended as the easy 4 Step Wizard is the quickest setup Method. Data maybe collected by a DATA HOG, a laptop computer or PDA running CENTURION WINDOWS software. If this is the method you want to use, first read section IV.a and IV.b. Also Refer to the Apollo Quick Start Guide when using simple 4 Step Wizard.

**Method 2 - To operate the Apollo only from a computer (using Centurion Windows Software).**

Setup and configuration can be done from a computer (in addition to retrieving the collected data). If this is the method you want to use, simply refer to the Software help screens for more information. Use this field unit manual for clarification and technical information on the Apollo.

**Method 3 - To operate the Apollo using both a computer and its built in keypad.**

This is the most common method since you might not always have a computer with you, and becoming familiar with the keypad operation is always useful. We suggest run the counter using the built in keypad (first read section IV.a and IV.b) After collecting some data with the Apollo, move on to using the software to collect your data.

## I.B. COMMUNICATION WITH THE APOLLO

Communicating with the Apollo is done through the built in Keypad/Display, or through the serial port to an IBM PC compatible computer or laptop. Our Centurion software package allows such advanced features as:

- ❖ "Wizard style" windows and "User-Friendly" menus.
- ❖ Complete Database functions with viewing and editing of all collected data.
- ❖ XMODEM transfers for data file retrieval, with later file format conversion utilities & detailed printouts with analysis (hourly and daily summaries).
- ❖ Complete monitoring and configuration.

To learn more about using these programs, refer to the Software Instruction Manual. Note that the Apollo serial access is not restricted to use with any particular type of computer. Any computer that supports a standard serial communications (RS232) will suffice. In the case of newer PC computers that do not have a serial port, USB to serial adapters are widely available from computer retailers and provide a serial port to these newer laptops and PC's.

## I.C. SYSTEM COMPONENTS

You must have the following equipment to use the Apollo. All of this equipment can be purchased from Diamond Traffic Products.

- ❖ Apollo Field Unit Instruction Manual / Apollo Quick Start Guide.
- ❖ *Centurion Windows Software*
- ❖ A Battery Charger or counter fitted with a solar panel on the lid.
- ❖ A Serial Interface Cable between the counter and a computer (DB9 pin).
- ❖ Road tube sensors and assorted hardware for securing to road. (i.e. nails, road tube grips, hammer and tape measure.)
- ❖ Computer. Ideally, this would be one of the many IBM-PC type computers available to use the Centurion software.

## I.D. FEATURES NOT AVAILABLE FROM THE KEYPAD

The Apollo has some features which are not available directly from the counter keypad. Some features require too much internal firmware to use from the keypad and therefore are only accessible through the serial port, also some of these features only relate to serial port use, and therefore are not needed from the keypad.

The following features are available from the serial port using the software package.

- ❖ **Data Retrieval** - The most important serial counter function, the retrieval of collected data.
- ❖ **Daylight Savings Time Adjust** - You can manually or automatically have software set the Apollo to handle daylight savings time changes. The Apollo will change the time and adjust data appropriately, if you choose automatic.
- ❖ **Counter Serial Number** - The counter contains a built in firmware serial number, This serial number, usually set by us at the factory, is included with all data files so that the specific counter that collected the data can be easily identified. You can optionally set your own serial number using the Alt+F10 function from the main counter link screen in the software.
- ❖ **GPS Coordinates** - The Apollo is equipped to read GPS coordinates from any NMEA compatible receiver with a serial output. Connecting to the GPS receiver will allow the unit to download the coordinated straight into the Apollo information lines for later site identification. Refer to Appendix F.1

## II. HARDWARE

This section describes the hardware components associated with the Apollo counter.

### II.A. KEYPAD

The Apollo contains a built in 16-key keypad. With this keypad and the built in four (4) line twenty (20) characters per line LCD display (section III.b.) you can completely program and operate the Apollo. When the ALT key is held down while you are pressing another key, an alternate set of keys is available to the user. The table below shows the alternate keys.

**Table 1 – Alternate Keypad Entry**

	0	1	2	3	4	5	6	7	8	9	Clear	↔
ALT	ABC	DEF	GHI	JKL	MNO	PQR	STU	VWX	YZ[	-/	Abort	A...

Note that if the ALT key is continuously held and the number key is pressed, again, the letter will scroll through the following possibilities of letters:

**ABCDEFGHIJKLMNOPSRSUVWXYZ[]^abcdefghijklmnopqrstuvwxy{|!"#\$%&'()  
\*+,-./0123456789:;?@**

For example, if you wanted the letter "W" you would press "ALT" and "7" simultaneously. Note that "V" appears in the space, as Table 1 shows. While still holding the "ALT" key, press the "7" key again, and the letter "W" will appear. Release the "ALT" key and the letter remains. You can also press the right and left arrow keys (while the ALT key is down) to scroll through the alphabet.

The rest of the keys are explained below:

**ENTER** Used as a means of indicating to the Apollo that an option is complete, and ready to be acted upon.

**CLEAR** Used as means of backing up one question in a menu.

**SPACE** The <<Space>> key inserts a space at the cursor location and will also allow scrolling through options in ascending order.



This key allows viewing/selection of options in a descending order. Also used as a non-destructive backspace key when entering a line of data.



This key allows viewing selection of options in ascending order. Also used to move non-destructively one position to the right when entering a line of data.

**ALT**

Used only in conjunction with other keys; ALT allows existing keys to perform alternate functions. Use of the ALT key is similar to the SHIFT key on a typewriter keyboard, in that the ALT key must be pressed and held for the duration of the associated keypress.

## II.B. LCD DISPLAY

The Apollo is equipped with a four-line LCD display (Liquid Crystal Display). Each line displays up to 20 letters or numbers. This display is used in conjunction with the keypad to program and operate the Apollo. You will see various questions and information displayed at different times. Please refer to the appropriate section of this manual for more information on specific questions and displays.

The LCD type of display used in the Apollo consumes very little power, thereby minimizing battery drain during setup and monitoring procedures. To further save battery power, the Apollo will turn off power to the display when data collection is active and the display is not being used.

Road dust will inevitably cover the display from time to time, and the display will need to be brushed off. When cleaning the display, it is best to attempt blowing off as much dust as possible before wiping the surface with a soft damp cloth. This method limits the chances of scratches being caused by the abrasive found in the dust.

## II.C. SERIAL PORT

The serial port is used for the retrieval of traffic data that has been collected by the Apollo. All serial devices are connected to the Apollo through the DB-9 Serial Port plug (located on the lower right side of the face panel). Note that the Apollo can be completely programmed and operated from the serial port. ( a PC USB to Serial adapter may be needed for newer PC's)

The serial port supports 19200 : 8N1 Communication.

The retrieval of data must be done through the serial port, and the method of transfer is 1K XMODEM with CRC error checking. An automatic switch to 128 Byte XMODEM transfer occurs when the system gets 10 or more errors, indicating a noisy line. Data will transfer faster with smaller blocks.

**Computer -** You will need to connect a computer or PDA to the Apollo to retrieve your data.

## II.D. ROAD TUBES

Road Tubes (or just "Tubes") refer to hollow rubber tubes usually ranging from 30 to 100 feet in length. These Tubes are stretched across the roadway so that oncoming vehicle traffic drives over them. This generates a sound-wave (or an "air impulse"), which travels down the tube and allows the electronics of the Apollo to determine that a vehicle axle has passed. **Note: there will be loss of counts if road tubes longer than 60' (20 meters) are used.**

Tubes offer the advantage of being easily movable, quick to install, inexpensive, and capable of detecting individual axles of a vehicle. Their disadvantages include rapid wear, hard to secure for long periods, and drivers noticing the tubes and possibly changing speed, lanes, etc.

### Follow these guidelines when using Tubes with the Apollo:

- ❖ The counter will work with road tubes between 30' and 100' long. (note: tubes shorter than 30' will work but will damage the air switch over time)
- ❖ If collecting Raw or Per Vehicle data, make sure each lane's tubes (two per lane) are the SAME LENGTH. Also, try to stretch the tubes the same amount when securing them to the roadway.
- ❖ Make sure the Tubes are placed as squarely as possible to the oncoming traffic (so that both wheels of a vehicle strike the tube simultaneously).
- ❖ After each use, check the tubes for punctures or other damage.
- ❖ Plug the end of the tube with a suitable device to keep dirt and water out.

### How to connect the Tubes to a Apollo when collecting Raw Per Vehicle:

- ❖ Get two equal length road tubes for each lane desired.
- ❖ Install one road tube perpendicular to the direction of traffic across a Single lane of traffic. You can string road tubes across multiple lanes using the "Lane Overlap" function or the "Directional" mode. This is fully covered under Section III.c.).
- ❖ Install the second road tube perpendicular to the direction of traffic from four feet or 122cm from the first tube.

- ❖ Connect the road tube, which will be hit first by oncoming traffic into the 1st Input Nozzle for the particular lane you are using.
- ❖ Connect the road tube, which will be hit second by oncoming traffic to the 2nd Input Nozzle for the particular lane you are using.

**How to connect Tubes to a Apollo when collecting Count Data:**

- ❖ Install a road tube perpendicular to oncoming traffic across a single or dual lane of traffic.
- ❖ Connect the road tube to the Nozzle on the Apollo for the lane you are using.
- ❖ If you are using at least two lanes and you want to use Lane Subtraction or Directional function, you may want to read about these functions in Section II.e for more information on how to correctly install and connect tubes.

***FOR IMPORTANT INFORMATION REGARDING TUBES AND POTENTIAL ERRORS, SEE APPENDIX - E.***

## III. QUICK SET OUT MODES

This section of the manual discusses the three methods the Apollo can collect data.

### III.A. THE TWO BASIC OPERATION MODES

The two modes are: 1) The Quick Set Out Mode and; 2) Advanced Selection (Operation Mode).

You should first become familiar with the three fundamental modes of operation. The mode that you select determines the type of data that will be collected, and whether the information will be combined with other entries or stored individually.

**Raw (per vehicle)** This mode will store each vehicle in memory as it passes by. The following information about each vehicle can be stored in memory: time, speed, number of axles, spacing between each axle, overall length, and bin classifications.

**Count** The count mode is the simplest mode of operation. It is used when just a vehicle count is desired. When using road Tubes or other Axle Sensors, the Apollo provides the total number of axles detected, optionally divided by two. Users specify a time interval, such as 15 minutes or every hour, in which these total counts will be stored in memory.

The Apollo supports (2) two or (4) four Road Tube Airswitches. Road Tube Sensors are considered "axle" sensors, since individual vehicle axles activate them.

This Apollo also contains many advanced sensor analysis routines to improve data accuracy, including examining both sets of axle sensors and the tossing out of too short spacings (for example: eliminating a road tube bounce, which can cause a false count), and the determination of missed axles.

The Apollo has an added feature that lets the counter search for cars that tailgate other cars or trucks. This will prevent two or three closely spaced cars from appearing as a class 8 truck or a class 13 unidentified vehicle.

## III.B. RAW PER VEHICLE STORAGE AND SPECIFIC FUNCTIONS

In this mode, an individual record is kept for each vehicle encountered. Any combination of one to two lanes can be enabled. If any lane is configured for directional mode (the ability to classify traffic in either direction), an additional lane of traffic data is created. For example, if lane #1 is enabled and is configured in directional mode, the counter would create lane #3 for vehicles traveling in the opposite direction on lane #1.

Physical Lane	Opposite Direction Lane
Lane #1	Lane #3
Lane #2	Lane #4

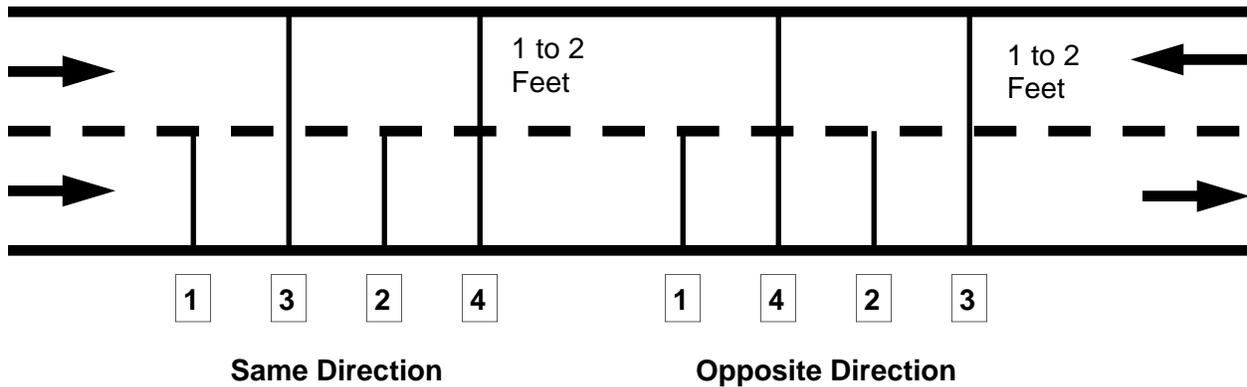
The directional lane is not an actual separate lane - it is the same physical lane but simply traffic moving in the opposite direction. It is recommended that the directional option be used whenever the possibility of two-way traffic exists, such as a one-lane road or an area on a two-lane highway where there is much passing of slower vehicles, thereby using the oncoming lane.

Appendix B gives an approximation of the number of vehicles that can be stored in memory depending upon which data format you choose.

While in Raw per vehicle Storage, the system uses 4 feet or 122 cm, sensor spacing.

The Apollo, raw storage supports "Lane Overlap". If axle sensors are used to collect data from two lanes of traffic, the lanes can be configured as shown in the figure below. Note that the shorter tube is in the near lane (lane #1), and is activated first by oncoming traffic. This configuration will allow you to collect data from two lanes using 4 road tubes where one set of tubes crosses both lanes. Note: that lane overlap can support lanes where vehicles are going same or opposite direction.

To view all available road tube configuration, use the right and left arrow keys (← →).



**IMPORTANT NOTE:** You must make sure that for each road tube pair that the **longer tube is always equal to or longer than the shorter tube** in the pair when **measured from the edge of the pavement** closest to the counter. For example, when doing Same Direction road tube 3 (of pair 1 & 3) must be equal to or longer from the edge of the pavement to the counter than road tube 1 is from the edge of the pavement to the counter. The same is true for pairs 2 & 4. In the Opposite Direction, the pairs change to 1 & 4 and 2 & 3 where road tube 4 must be longer from the edge than road tube 1 and road tube 3 must be longer than road tube 2.

Raw data is stored in a straightforward fashion. As vehicles are detected and the information (speed, length, etc.) is gathered, the data is stored sequentially in memory in one long record. During collection, or during testing, the Apollo will allow you to monitor any or all lanes.

## III.C. COUNT STORAGE AND SPECIFIC FUNCTIONS

In **count** storage mode, the only information stored is the number of vehicles that have been detected in each lane.

There are three sensor configurations for **Count** data. They are Lane Normal, Subtraction, and Directional. To view all available road tube configuration, use the right and left arrow keys (← →).

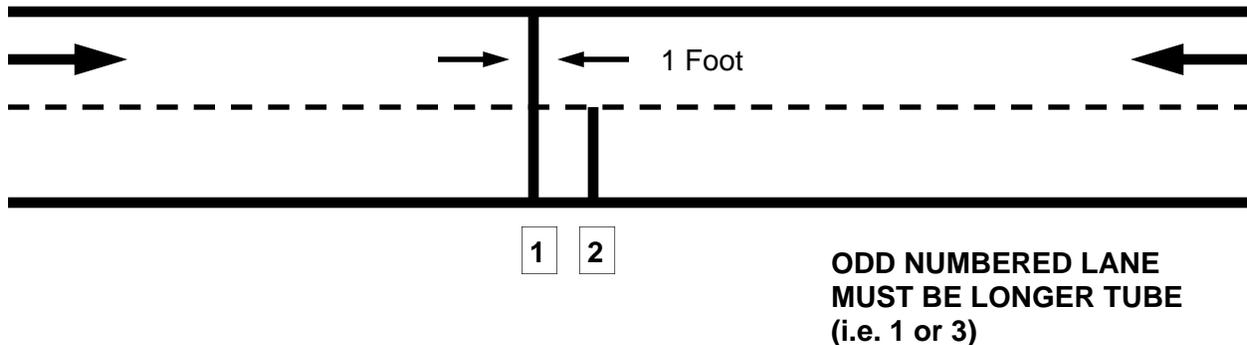
### Normal

This sensor configuration would be used when the counter can be located in a center median of a roadway and road tube is counting traffic. On one side of the median another road tube is counting traffic on the other side. The data from each road tube is stored and in no way affects data from the other road tube. If the Apollo has four airswitches, it is possible to count all four lanes if they are divided by a center medium

### Lane

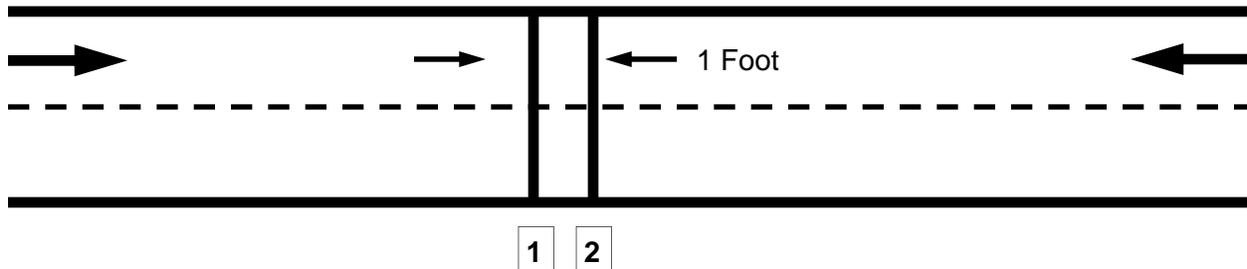
### Subtraction

This road tube configuration is used when you want to get individual lane count from two different lanes of traffic from one side of the road. The road tube attached to Lane 1 (or any other ODD numbered lane) is laid out across both lanes. The road tube attached to Lane 2 (or the next even numbered lane) is laid out across one lane. The Apollo will subtract the even lanes from the odd lane's count to obtain the proper directional count for the odd numbered lane.



### Directional

This road tube configuration is used for counting two-way traffic on a narrow road. A road tube pair (such as 1-2 or 3-4) is laid out across both lanes of a road one foot apart. The Apollo will determine (from the order of actuation) the proper directional count for each lane.



You can monitor any or all lanes during collection or testing, with the system showing you the current lane totals for the record interval.

## IV. ADVANCED SELECTION MODE

The Apollo has a mode that allows the field personnel to make more choices and control of various functions in the counter. In this mode, there are two basic main menus that appear depending on whether you are currently collecting data or not. To enter Advanced Menu mode, Using the Keypad on the counter you need to hold down <ALT> and Press **←**.

### IV.A. NOT COLLECTING DATA MENU

This menu appears when you first power the counter and are ready to begin collection. It contains the following options:

- 1 **Start Collecting** The main option. It will ask a series of questions to determine the lanes and format for data collection. Once completed, it allows you to test your configuration, and then start collecting data. Once this option is finished, you will be in the Collecting Data menu (see next section, IV.b.2).
- 2 **Show Status** Displays current memory usage & availability, number of files in memory, current time and date, battery voltage and temperature inside counter.
- 3 **Delete Files** Used to delete any files currently in memory. If no files are in memory, Apollo will display "No Files In Memory" if selected.
- 4 **View Lane Totals** This option displays the total number of vehicles (Raw per vehicle & Binned) or counts.
- 5 **Configure System** Configure System allows the user to configure options such as Storage Mode, Date and Time Formats, File Handling, Speed Formats, and Maximum Allowable Axle Spacing, etc.
- 6 **Cold Restart** Cold Restart will completely restart the counter. All data files, configurations, and setups will be erased. The option has a confirmation to avoid accidental data loss.

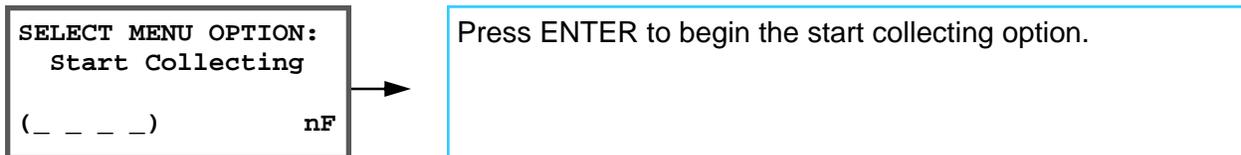
## IV.B. COLLECTING DATA MENU

After the Apollo has been configured and data collection started, the *collecting data* menu is used. To reach the menu, press the ENTER key from sleep mode. To return to sleep mode, press the CLEAR key. The *collecting data* menu contains the following options:

- Stop Collecting**      Closes the current file and stop collection of data. This option has a confirmation to avoid accidental file closure.
- Show Status**        Same as option in Not Collecting Data menu.
- Delete Files**        Same as option in Not Collecting Data menu.
- View Lane Totals**    Same as option in Not Collecting data menu.
- Monitor Lanes**        Allows monitoring of Traffic Data while collecting. As vehicles are detected, the data will appear on the display, while concurrently being stored in the open file.

## IV.C. START COLLECTING

The Start Collecting option asks many questions, depending on what type of Storage Mode you plan on using. Press the "1" key from the menu and the display will show:



Note that pressing the CLEAR key will back you up one question. Holding down the ALT key and pressing the ENTER key will skip all questions and immediately begin Testing Lanes under the last used Start Collecting Options. This is useful to collect data under previously entered setup conditions.

Before you use the Apollo to actually start collecting data, verify the following things:

- ❖ The battery is fully charged (or will last as long as you plan on collecting data)
- ❖ You have enough free memory in the counter to hold all of the data you plan on collecting. Use the Show Status option to verify the amount of free memory. Appendix B contains tables that will give you an idea of how much memory you need for different collection options and modes.
- ❖ You have used the configure system option to tell the counter what type of data you want to collect (Raw per vehicle, Count). Note that if you have previously set the counter, you will not need to Configure System again as long as you plan to collect the same type of data.

## IV.c.1. Questions Asked With Count (Volume) Storage Mode

The following questions are asked:

<pre>SETUP STEP #1 OF 3: Enter a Site ID and Press &lt;Enter&gt; key: - - - - -</pre>	→	Enter the appropriate information for this site, up to 15 characters.
---	---	---

<p><b>NOTE:</b> at any time you may enter in GPS coordinates or Download them from a GPS device by holding down the &lt;ALT&gt; and press the →.</p>	<pre>LAT=    °      .    m LON=    °      .    m ***** Site:_____</pre>
--	---

<pre>SETUP STEP #2 OF 3: Check Clock! &lt;Enter&gt; If Ok, &lt;0&gt; To Change: HH:MM:SS  MM/DD/YR</pre>	→	Enter the correct time and date here as needed.
--	---	---

<pre>SETUP STEP #3 OF 3:  Waiting For Any Vehicle...</pre>	→	Enter the correct time and date here as needed.
--	---	---

## IV.D. SHOW STATUS

The Show Status option in the Advanced Menu allows display of the Unicorn Limited System Status. This should always be performed prior to Starting Collection to ensure that there is enough memory free to collect files. From the menu, press "2" and the display will show:

```
SELECT MENU OPTION:
  Show Status
(_ _ _ _)      nF
```

Press ENTER to show system status.

First, the counter displays the amount of memory in the system:

```
Total Mem : 461000
Amount Used:    0
               _____
                461000
```

Displays the total amount of memory in your counter and how much is left for use.

Next, how many files are in the memory is displayed:

```
n Files In Memory.
Of these files, n
have been retrieved.
```



"n" is number of files.

If there are no files, the screen displays:

```
There are No Files
In Counter Memory.
```

Next, the current time and date are shown:

```
Clock Time: HH:MM:SS
Clock Date: DD/MM/YY
Battery   : x.x.v
Temp.    : xx.x F
```



The current time, date, battery and temperature are displayed. Note that the date will be displayed in the currently selected format. The time and date can only be programmed from Start Collecting sequence.

## IV.E. DELETE FILES

The delete files option allows you to delete any or all files in the current memory. Press "3" from the menu and the display will show:

```
SELECT MENU OPTION:
Delete Files
( _ _ _ _ )      nF
```



Press ENTER to begin deleting files.

If there have been no files created in memory, the counter shows:

```
There Are No Files
In Counter Memory.
```

If files have been created, the display will show:

## IV.F. VIEW LANE TOTALS

This option allows you to view the total amount of vehicles that have occurred from the last time you Started collection.

When you select this option, a screen will appear similar to the following:

```
< View Lane Totals >
Lane #a :          x
Lane #b :          y
```

OR

```
< View Lane Totals >
Lane #a :          x
```

**a** and **b** are the lane numbers of enabled lanes and **x** and **y** are the total vehicles.

## IV.G. CONFIGURE SYSTEM

Configure system will set the system configuration for installation. Press the number "5" from the menu and the display will show:

<pre>SELECT MENU OPTION:   Configure System (_ _ _ _ )      nF</pre>	<p>Press ENTER to begin system configuration.</p>
<pre>&lt; CONFIGURE SYSTEM &gt; Select Date Display Format: MM/DD/YY</pre>	<p>This asks which format you require for the date. Options are: <b>MM/DD/YY</b>, <b>DD-MM-YY</b>, and <b>YY-MM-DD</b>.</p>
<pre>&lt; CONFIGURE SYSTEM &gt; Erase The First File When Out Of Mem? Yes</pre>	<p>This asks if you want to continue collecting data when the memory is full, or should the counter delete the oldest file to make space for new data. If you select <b>No</b> the Unicorn Limited will stop collecting when the memory is full.</p>
<pre>&lt; CONFIGURE SYSTEM &gt; Auto Create New File When? Daily</pre>	<p>The user may select to create new files Manually, Daily, or Weekly. <b>Manually</b> means that the counter will only create a file when you specifically tell it to. <b>Daily</b> means the counter will automatically create a new file each day at midnight. <b>Weekly</b> means the counter will automatically create a new file once per week.</p>

```
< CONFIGURE SYSTEM >
SnMis Memory Storage
Mode: View Only
```

This option is used to select what the counter should do with sensor miss information. Sensor misses occur when a vehicle does not cross both sensors (see lid instructions on Unicorn Limited field unit for a description of each sensor miss code). **View Only** will display sensor misses on the screen when monitoring, but not store these misses to memory. **View & Store** displays the misses and stores them for later retrieval into memory. Note that storing sensor misses in memory does use up memory that could be used for data. **Disabled** causes the counter to ignore sensor

```
< CONFIGURE SYSTEM >
m
Select Maximum Axle
Spacing: 40.0'
```

This option determines the longest spacing between any two axles to be allowed when collecting Raw or Binned data using two axle sensors. The counter uses this length to determine where the end of a vehicle is, and the start of a new vehicle begins. Most trucks do not exceed 35' between axles, and most vehicles do not travel closer than 35' to each other. You should change this value if you have many tailgating vehicles, which have short axle spacings (such as rush hour car traffic), or if you have trucks with very long spacings between axles. Note that the longer the spacing, the greater the chance two vehicles close to each other will

## IV.H. COLD RESTART

Cold restart will perform the same function as removing backup power. The system will restart with **ALL** memory clean. Note that time and date, along with **ALL** configuration parameters **WILL BE LOST**. Do not use this option if the system contains any data that has not been retrieved for use. **ALL DATA WILL BE LOST.**

Doing a cold restart is useful if you notice the counter is not working correctly. There is about one million possible programs that can be keyed into the counter. Some of these programs make no sense from a data collection point but we do not have programming space to prevent them being entered. If you key one of these in accidentally the counter will not operate correctly until a cold restart is performed.

Press 6 from the menu and the screen will show:

```
SELECT MENU OPTION:  
Cold Restart  
  
( _ _ _ _ )      nF
```



Press ENTER to select the option.

```
Cold Restart Erases  
All Memory Contents!  
  
ARE YOU SURE? No
```



If you are SURE you want to do this, use the arrow keys to toggle to **Yes**. Press ENTER.

```
**** Unicorn-L ****  
  
Doing Cold Restart..
```

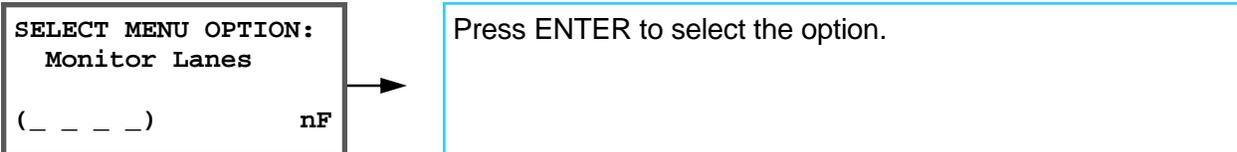


The system has now been completely reset to the factory defaults.

```
SELECT MENU OPTION:  
Start Collecting  
  
( _ _ _ _ )      0F
```

## IV.I. MONITOR LANES

Monitor Lanes allows the real-time monitoring of lanes. This option is intended for the user to monitor traffic to ensure the installation is working properly. Press 4 from the menu and the display will show:

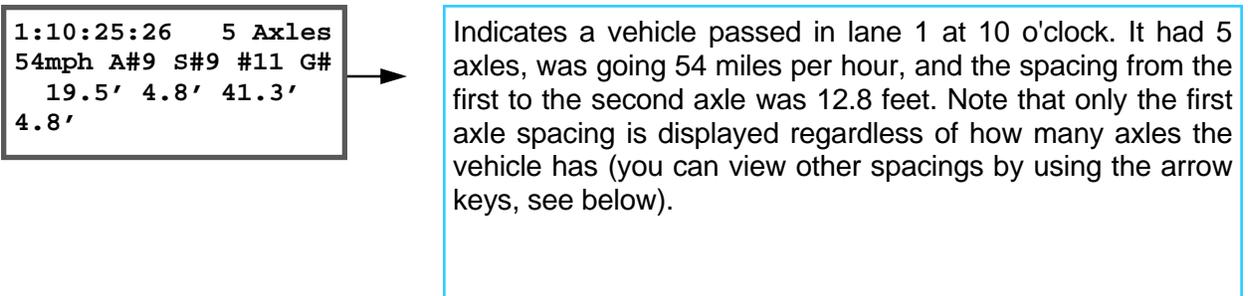


## IV.J. MONITORING RAW PER VEHICLE COLLECTION

The counter displays this when first waiting for a vehicle:

```
Waiting For Any
Vehicle...
```

As a vehicle crosses the installation, the display will show the vehicle as it crosses:



While monitoring, you may press the following keys:

- ❖ CLEAR - Aborts and returns to the menu.
- ❖ SPACE - Freezes the display. This allows you to view a vehicle for a longer period of time. Press SPACE again to un-freeze the display.
- ❖ ← → Allows you to see other spacings. Press either arrow key again and the screen will return to the original display. These keys work even when the Freeze Key (Space) has been pressed.

If an asterisk character appears before the lane number, this indicates that collection has not actually started yet, and the vehicles shown are not being stored in memory.

## IV.K. MONITORING COUNT DATA COLLECTION

The counter displays the first four count lanes you have enabled. Note the counter only displays the lanes you have enabled:

< Lane #1:	0 >
Lane #2:	0
Lane #3:	0
Lane #4:	0

While monitoring data collection, the following keys can be used:

- ❖ 0 - If just Testing Lanes (i.e. from the Start Collecting option) this key zeros all totals.
- ❖ CLEAR - Aborts and returns to the menu.

An asterisk on the screen indicates that data collection has not started yet.

# APPENDIX A. TROUBLE SHOOTING

This Section is intended as a guide towards installation trouble shooting. It is in no way intended for the service or repair of any type of Apollo system.

Some basic problems can always occur during operation. Generally, they will be some small error in setup or sensor installation. Listed are some basic problems and possible solutions. If you cannot solve an installation problem, or if you find a new solution to an old problem, please call Diamond Traffic Products. We are glad to help solve any type of installation problem or receive new installation information.

## Problem

Tubes are installed to collect Raw or per vehicle, but errors keep occurring in data collection.

## Solution

Are the tubes the same length? Are they stretched tight (both the same amount if using two per lane) across the roadway? Are there holes in the tubes (you can check this by plugging the tube and putting it under air pressure)? Is the end of the tube which is not being connected plugged properly?

## Problem

I've installed tubes to collect raw vehicle data, but I keep getting errors. I check the "Test Sensor" option, and the tubes are functioning.

## Solution

Are the tubes in the correct order? Remember, the tubes must be connected in sequence depending on your lane assignment and configuration. Check the Tables in Section II.a for conformation. You may have a lane installed backwards. Another possible problem is bi-directional traffic. Do you have the Directional Option enabled?

## Problem

I have installed a Apollo in a busy roadway. The counter has stopped collecting data when I arrive. Everything seems to be working.

## Solution

Check the Show Status option. Is the memory full? You may need to retrieve the data from the counter more often.

## APPENDIX B. MEMORY USAGE

Each mode uses a different amount of memory for storing traffic data. This appendix is intended to give the user an approximation of how long a Apollo Field Unit may collect data before retrieval must be performed. Note that this is only a guide – it is recommended to retrieve data as often as is practical from the units, and deleting retrieved files from the memory. Different configurations may store different amounts of data. For example, the amount of memory to store a single 2 axle vehicle in Raw Mode is 7 bytes if you are using axle sensors, and 7 if you are using presence sensors (loops). A 5 axle vehicle in the same mode will take 13 bytes if you are using axle sensors, but still seven if you are using presence sensors (the individual axle lengths are not stored).

The following tables give you formulas for calculating how much memory any particular storage mode might take. Simply find the table that most closely matches your application, and follow the steps described.

### APPENDIX B.1. RAW DATA COLLECTION

Raw per vehicle data stores each individual vehicle in memory, therefore the amount of memory used is directly dependent on how many vehicles pass the sensors. Another important factor is the number of axles per vehicle (more axles require more memory).

Generally, you can use the average of 2.75 axles per vehicle for most highways. If your site differs from this, you may wish to increase or decrease the numbers given below.

To calculate how many vehicles you can store with the Apollo follow the below steps:

SENSOR CONFIGURATION
----------------------

Axle-Axle
-----------

- ❖ Divide the Total Memory of your counter minus 2000 (for overhead) by the base number of bytes from the chart above. The total amount of memory in your counter can be found using the Show Status option.

## APPENDIX B.2. COUNT DATA COLLECTION

Count data stores the total number of vehicles that crossed the sensors for each 15 minutes period.

With the standard 8 megabytes of memory, recording four lanes on 15 minute intervals, the counter should operate for an average of 8000 days.

## APPENDIX C. PLUGS & CONNECTORS

This section describes the physical hardware connections for connectors on the Unicorn Limited.

<b>APOLLO 9 PIN FEMALE SERIAL INTERFACE CABLE</b>	
<b>Unicorn Limited 9 Pin Connector</b>	<b>9 Pin Female Sub-D Connector</b>
#1 – Receive Data (RXD)	#3 – Transmit Data (TXD)
#2 – Carrier Detect (DCD)	#4 – Data Terminal Ready (DTR)
#3 – Data Terminal Ready (DTR)	#6 – Data Set Ready (DSR) #
#4 – Ready To Send (RTS)	#8 – Clear to Send (CTS)
#5 – Serial Port Enable (ENA)	#5 – Signal Ground (GND)
#6 – Signal Ground (GND)	(Shield)
#8 – Transmit Data	#2 – Receive Data (RXD)
#9 – Clear To Send (CTS)	#7 – Ready to Send (RTS)

## APPENDIX D. DEFAULT BIN TABLES

This appendix describes the default bins categories that are used with the Apollo. These "Bins" are used to total up all vehicles meeting a predetermined set of criteria.

<b>Default Axle Bin Classification Table (Scheme—'F')</b>		
<b>Bin Number</b>	<b>Axle Range</b>	<b>Bin Category Name</b>
#1	2	Motorcycles
#2	2-4	Passenger Cars (w/wo trailer)
#3	2-5	Other two axle, 4 tire vehicles (w/wo trailer)
#4	2-3	Buses
#5	2-5	Two axle, six tire, single trailer trucks
#6	3	Three axle, single unit trucks
#7	4	Four axle, single unit trucks
#8	3-4	Four or less axle, single trailer trucks
#9	5	Five axle, single trailer trucks
#10	6-10	Six or more axle, single trailer trucks
#11	5	Five axle, multi-trailer trucks
#12	6	Six axle, multi-trailer trucks
#13	7-13	All Other Vehicles

<b>Default Speed &amp; Length Bin Classification Table</b>		
<b>Bin Number</b>	<b>Speed Range</b>	<b>Length Range</b>
<b>#1</b>	<b>0.0 - 19.9 mph</b>	<b>0.0 – 5.9 feet</b>
<b>#2</b>	<b>20.0 – 24.9 mph</b>	<b>6.0 – 10.0 feet</b>
<b>#3</b>	<b>25.0 – 29.9 mph</b>	<b>10.1 – 14.9 feet</b>
<b>#4</b>	<b>30.0 – 34.9 mph</b>	<b>15.0 – 19.9 feet</b>
<b>#5</b>	<b>35.0 – 39.9 mph</b>	<b>20.0 – 24.9 feet</b>
<b>#6</b>	<b>40.0 – 44.9 mph</b>	<b>25.0 – 29.9 feet</b>
<b>#7</b>	<b>45.0 – 49.9 mph</b>	<b>30.0 – 39.9 feet</b>
<b>#8</b>	<b>50.0 – 54.9 mph</b>	<b>40.0 – 49.9 feet</b>
<b>#9</b>	<b>55.0 – 59.9 mph</b>	<b>50.0 – 59.9 feet</b>
<b>#10</b>	<b>60.0 – 64.9 mph</b>	<b>60.0 – 69.9 feet</b>
<b>#11</b>	<b>65.0 – 69.9 mph</b>	<b>70.0 – 79.9 feet</b>
<b>#12</b>	<b>70.0 – 74.9 mph</b>	<b>80.0 – 89.9 feet</b>
<b>#13</b>	<b>75.0 – 79.9 mph</b>	<b>All Other Lengths</b>
<b>#14</b>	<b>80.0 – 84.9 mph</b>	
<b>#15</b>	<b>85.0 – 89.9 mph</b>	
<b>#16</b>	<b>All Other Speeds</b>	

# APPENDIX E. ROAD TUBE PROBLEMS & SOLUTIONS

This appendix discusses the various problems that road tubes can cause. Road tubes present their own unique set of problems for automatic vehicle classifiers & counters. Being aware of these potential problems before installing your road tubes can greatly reduce the frequency of these problems.

This appendix divides each problem (or "error") into a separate section, and then lists the known causes of the problem.

## APPENDIX E.1. MISSED AXLES

Missed axles are the most frequent errors seen. They are caused, very simply, by the hardware (airswitch) inside the counter not reporting an actuation of the road tube when there is one. Some of the reasons for this are as follows:

- ❖ **Speed and Spacing.** The airswitch in the Apollo is undoubtedly the best in the business, however, even it is limited to 30 activations per second, or about 33ms per activation. If a second strike of the road tube occurs faster than 33ms, then the airswitch will not report the second activation.

Does this ever happen? Yes, take for example a car towing a 2 axle travel trailer at 65mph. A travel trailer typically has a spacing of 2.5ft between axles, and 65mph is about 95 feet per second. Therefore, how long does it take between the first road tube hit by the travel trailer, and the second. This is  $(2.5\text{ft}/(95\text{ft}/\text{sec}))$  26ms. The airswitch would not report the second axle of the travel trailer and this axle would be missed by the Apollo.

- ❖ **Lifted wheels.** Some trucks have an optional axle which may be raised slightly off the ground (to save on tread wear). The Apollo will probably miss it, but sometimes it can show up as an error if human observation data is being compared to the counter and the observer is not aware that the wheel is lifted.
- ❖ **Bouncing Vehicles.** Although uncommon, roads with dips or other irregular surface features can cause some truck axles to bounce slightly. This can occasional lead to missed axles. Note that the Apollo looks at both sets of road tube activations, so this problem is minimized.
- ❖ **Improper Road Tubes or Installation.** The type, length, and method of installation of your road tubes can lead to increasing the number of missed axles; Always plug the end of tube with a suitable device (unless the road tube is shorter than 25 feet, and then DON'T plug it); always plug the road tube onto the counter nozzle all the way; always use an approved brand, size, and type of material for all of your road tubes; don't over

stretch the road tubes because the diameter shrinks the more you stretch it.

- ❖ **Weak Signal With Longer Road Tubes.** Very simply, the longer the road tube, the farther the "sound" of an axle striking the road tube has to travel. Make sure you use road tube lengths as recommended in the next section.
- ❖ **Sound Wave Interference.** To understand why this is a problem, you should understand that the Apollo airswitch (like all airswitches) uses a "sound wave" to detect an axle hit. This wave is very similar to a water wave, in that it starts at a point and moves down the road tube to the round piezo disk sensor in the airswitch. It travels down the road tube at the speed of sound, which is about 767 MPH at 20 degrees celsius, or 1125 feet per second. The force of this "wave" of sound bends the piezo disk in the counter which causes a voltage spike to be generated. It is this voltage spike which the Apollo detects as an axle strike on the road tube.

The following example shows how very close axle hits (such as with tandem axles on a truck) can actually interfere with each other and cause a missed axle.

1. Assume you have a 50' road tube stretched across a single lane of traffic. The road tube has been stretched 50" to make it tight. The end of the tube on the roadway is plugged and the other end is plugged into a Apollo.
2. A 5 axle single trailer truck traveling 55mph crosses the road tube.
3. The first axle is detected with no problem.
4. The second axle (the first axle of first tandem pair) hits the road tube. This causes FOUR sound waves to be generated, TWO from each tire.
5. The Left Tire will send two sound wave from it (1 in each direction) and the Right Tire will send two wave from it as well. The sound waves look something like the following:

<< A o B >>                      << C o D >>                      (to Apollo)

Each Letter represents a sound wave and the arrow next to the letter shows the direction the sound wave is traveling.

6. At this point the following things will happen: Sound "A" will travel to the end of the road tube and be absorbed by the plug. Sound "B" and "C" will travel towards each other, collide, and be seriously weakened. Sound "D", however, will be uninhibited and travel down the road tube towards the airswitch on the Unicorn Limited. Since all of the sound waves except "D" have been destroyed, we will only talk about sound wave "D" for the rest of this section, and it will be called the Wave.
7. The road tube has been stretched about 50", so it is now 54.16' long. Presuming the truck is in the center of the lane (lane being 12' feet wide) and the truck is 8 feet wide, the Wave should start at the 44' mark.
8. The Wave will travel down the road tube towards the Apollo and contact the airswitch in about 39ms (ms stands for milliseconds, or thousandths of a second).

9. After the Wave hits the airswitch, it will bounce back and return up the road tube towards the vehicle. Thus, we have a weakened returning wave going back up the road tube.
10. The next axle on the truck hits the road tube about 56ms after the first (a 4.5ft spacing typical, on a 55mph vehicle). Once again, another Sound Wave "D" is generated and travels down the road tube towards the airswitch.
11. At this point we have the following:

————- D2 >> ————— << D1 ————— Apollo

One wave traveling down, and one weaker wave returning. They will, of course, collide into each other at some point in the road tube, weakening both waves so that the second wave is too weak to register as an axle strike.

The question then becomes, if this is causing missed axles, why does a shorter road tube work better? If you take a 30' road tube, stretch it 50". Sound Wave "D" will start at about the 24' mark, and therefore will take only 21ms to reach the airswitch. Similarly, Sound Wave "D" will only take 21ms to return to the starting point (at the 24' mark). This makes the total time only 42ms for the first Sound Wave "D" to strike the airswitch and return to the starting point. This time is BEFORE the 56ms time it takes for the next axle to hit. Therefore, the first Sound Wave "D" is past the point of origin and cannot interfere with the next axle strike.

In summary, you are better off using shorter road tubes for faster speed vehicles. You are also better off using shorter road tubes for vehicles which have closer axle spacings (such as truck tandem axles). To minimize missing axles and maximize accuracy we suggest using the following road tube lengths:

Speed	Road Tube Length
0-25mph	60 ft
26-35mph	50 ft
36-45mph	40 ft
46+	30 ft

While a shorter road tube at faster speeds is always more accurate, we do not suggest using road tubes shorter than 30' due to the potential damage to an airswitch by very strong "sounds" (or signals).

## APPENDIX E.2. EXTRA AXLES

This error, while not frequent, does happen. It is almost always a problem with the actual road tube installation, or with the road surface. Causes of extra axles are listed below:

- ❖ **Road Tube Bounce (Slap).** Since the road tubes are made of flexible rubber, they move when they are hit. Depending on how tightly they are stretched, how far apart the anchors to the roadway are, and how heavy the vehicle crossing the tubes is, the road tube may move only slightly, or may move a lot. When a tire hits the road tube normally, the airswitch is activated by the sound of that tire. If the road tube is moved a lot, it will return quickly enough to its original position and may "Slap" the road with enough force to actually "sound" like another axle. This error is minimized by the fact that the airswitch will not re-activate for at least 33ms, and the road tube should be stabilized by then (but not always). You can also help this problem by taping the road tube to the road at short intervals along its length.
- ❖ **Rutted Pavement. DO NOT INSTALL ROAD TUBES OVER BADLY RUTTED PAVEMENT.** This will cause the road tube to bounce wildly when driven over by heavy vehicles. If you must install the road tubes in rutted pavement, tape them down heavily.
- ❖ **Road Tubes Not Perpendicular to Traffic.** This error (usually only at slow speeds) is caused by a vehicle not hitting the road tubes squarely. If the vehicle is going slow enough, the left tire (or tires) and the right tire (or tires) will cause an individual activation. This problem is most commonly seen in intersections, where vehicles are turning across the road tubes at slow speeds.

## APPENDIX E.3. BAD SPEED AND/OR LENGTH

This problem is infrequent, but can occur sometimes when the counter misses axles. For example, assume a 2 axle, 8 foot axle spacing, vehicle traveling 60 mph crosses two road tubes spaced 8 feet apart. The spacings and timings occurred as below:

1. Road Tube #1 hit by first axle at 10:00:00.00000.
2. Road Tube #2 and #1 hit almost simultaneously by first and second axles at 10:00:00.09090. Counter missed the Road Tube #2 hit (for whatever reason).
3. Road Tube #2 hit by second axle at 10:00:00.18181.

Since the counter waits for the first hit on #1, and the first hit on #2 to determine the speed, the speed will be determined by the second road tube #2 hit. This gives (8ft/.18181sec) 44ft/sec, or 30mph. This is only 1/2 the actual vehicle speed! Since the speed is calculated wrong, the counter will also give an incorrect length value for the vehicle.

Note that this error is really caused by a missed axle, the only difference was that the Apollo was still able to create a vehicle from the data, so it gave the values it could.

## APPENDIX E.4. SNMIS (SENSOR MISS) FOR ENTIRE VEHICLE

Like the previous error, this problem only occurs as a result of missed axles. "SnMis" (for sensor miss) is the Apollo's way of indicating that it did not have enough sensor data, or got sensor data not in the right order, to make a vehicle. Once a sensor miss occurs, the Apollo blocks out all further sensor activations on that lane for 1 second.

- This
1. SnMis #0 occurs only with Axle Pres Axle or Pres Axle Pres combinations. error indicates a improper sequence of sensor activations or missing one or more activations.
  2. SnMis #1 is that the counter only got a road tube 1 strike, with no further road tube activations. This can happen if a vehicle hits the first road tube, but misses the second, while changing lanes.
  3. SnMis #2 is that the counter only got a road tube 2 strike, without first getting a road tube 1 strike. This, like SnMis #1, can happen if a vehicle crosses into the lane but misses road tube #1.
  4. SnMis #3 is an overspeed or underspeed vehicle, and can optionally be used to indicate vehicles which only hit road tube 1 and road tube 2 once, with no further activations. Note that the counter will normally turn these types of activations into two axle vehicles with the axle length equal to the sensor spacing.

## APPENDIX E.5. ONE VEHICLE SHOWN AS TWO

This error is normally caused by a vehicle with an axle spacing greater than the maximum axle spacing setting in the configure system option. The counter defaults to 35.0'. This value can be increased or decreased.

If you increase this value, you run the risk of counting vehicles traveling close together as one vehicle (two tailgating cars become one vehicle, usually turned into a four axle Scheme F Class #8).

This error can also be caused by missed axles. The Apollo only resets its time out value after each axle hit, if you miss some and the counter does not reset its value, then the vehicle will be ended prematurely.

## APPENDIX E.6. TWO VEHICLES SHOWN AS ONE

This is a rare occurrence if you have tailgating function enabled. If Tailgating is not enabled, this will occur in vehicles that are following closer than the “maximum axle spacing”. This can be more common in slower urban areas; in these application turning on the tailgating vehicles option is highly recommended.

## APPENDIX E.7. ROAD TUBE SETUP THAT DOES NOT CAUSE ERRORS

The following section describes various road tube issues which do not cause errors. This is included to dispel any suspicions about these issues causing problems.

- ❖ **Coiled road tubes.** The effect of coiled road tubes versus non coiled road tubes does not have a noticeable effect.

## APPENDIX F.1. GPS SETUP

The Unicorn-Limited and Apollo series of traffic counters (starting with V1.40) support the direct connection of a GPS device to the counter. Once connected, the current longitude and latitude can be programmed into the counter automatically.

The communication between the GPS device and the traffic counter is done using the NMEA protocol. This is a widely supported protocol and virtually any GPS device with an RS232 port can be setup to output positioning with this format.

The following demonstrates the correct procedure for using a Magellan Meridian Platinum GPS device. This is an excellent device to use as it offers many features and works well with the traffic counter. Other GPS devices will work, however the exact setup steps may be different:

### ***Setting up the Magellan Meridian Platinum GPS:***

1. Power your GPS unit on and complete all first time setup and initialization (refer to the instruction manual).
2. Press the **Menu** key and select **Setup**.
3. Scroll down to **NMEA** and select it.
4. Select **V2.1 GSA**. Actually, any of the modes will work but this one gives the greatest resolution of measurement.
5. From the Setup menu select **Baud Rate**. Choose either **4800** or **19200** as follows:
  - a. **4800** is the standard baud rate for NMEA devices. However, the traffic counter defaults to 19200 operation and cannot automatically recognize a GPS device connected to it that is operating at this rate.  
If you select 4800 (or if your GPS device only operates NMEA at that speed), then you will have to manually press <Alt+Right> on the counter keypad to download position data from the GPS to the traffic counter (see next section).
  - b. **19200** is generally a better selection because the counter will automatically recognize the GPS device being connected and start downloading GPS position data immediately (you don't have to press anything on the counter keypad).
6. Exit the menus and return to the main navigation screen.
7. This completes the Magellan GPS setup.

### ***Using your GPS system with the Unicorn-Limited or Apollo:***

1. Travel to your data collection location.
2. Turn on the GPS unit and give it a few minutes to get a fix. *Important Note: Until the GPS unit accurately acquires a fix, it will not send the data to the traffic counter. Wait 3 to 5 minutes after turning on before connecting to counter to insure position is known.*
3. Connect a 9 Pin Male-Male Null Modem adapter onto the end of the GPS cable (which should be a female connector). This cable allows you to plug GPS unit into traffic counter.

- 4. Turn on the traffic counter (if off) and make sure data collection hasn't started. For the Apollo you should be at the "STEP #1" screen for collecting data. For the Unicorn-Limited, you should be seeing the "Not Collecting Data" menu (which includes the Start Collecting menu option).
- 5. *If your GPS unit is operating at 4800 baud:* Press the <Alt+Right> key on the counter keypad. A window will appear similar to this:

```

LAT=      °      .      m
LON=      °      .      m
*****
Site:_____
```

You can then connect the GPS unit to the counter serial port.

*If your GPS unit is operating at 19200 baud:* Don't press the <Alt+Right> key (it will not work correctly) and instead simply directly connect the GPS device to the counter (it will automatically call up the above window).

- 6. The latitude (LAT) and longitude (LON) values will be filled in automatically by the GPS unit. You can enter in the correct Site ID at any time. The following show a typical screen after the GPS data has been retrieved:

```

LAT=  44° 03.2327m N
LON= 123° 05.2698m W
*****
Site:098112_____
```

- 7. When the LAT, LON, and Site values are correct, **disconnect the GPS unit**. This is important to do before moving on because the constant data from the GPS unit will cause the counter either restart this screen or to flicker "Serial Active" over and over again.
- 8. Press <Enter> to go directly to the Start Collecting data function or press <Clear> to return to the main menu. If you press <Enter>, then the Unicorn-Limited will skip the Site and Info Line questions (although you can back up through them if desired). For the Apollo, you will begin with the "STEP #2" screen.
- 9. Your setup with the GPS unit is complete.

**GPS with Centurion:**

Starting with Centurion V1.25 (build #0003) the software checks to see if the "Info Line 1" and "Info Line 2" values are GPS coordinates. If they are, the following occurs:

- a) If the site already exists in the database, the coordinates are checked to see if they are the same as previously recorded for this site. If they differ by more than a hundredth of a second, then a warning message appears during import asking you to verify they are the same location or if you want to store the data under a different site ID.
- b) The GPS coordinates are also stored in a new Latitude and Longitude field in the database and appear on reports separately from the Info Line 1 and Info Line 2 values.

The GPS data is also compatible with TrafMan, but no special checks are made to insure the coordinates match previous values. In addition, TrafMan displays the GPS location just like any other data on the Info 1 & Info 2 lines.

---

*Example of a connected device to an Apollo Counter:*

---



**Notes:**

1. All null-modem cable (not in picture) connects the GPS device to the counter.
2. When the Lat/Lon read correctly, disconnect the GPS device.
3. The Site ID can be entered at anytime. When it is correct, press <Enter> on the counter keypad. To cancel, press the <Clear> key.