DIAMOND TRAFFIC PRODUCTS

Users Guide

Omega X3

V 1.44

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1. Introduction

The Omega X3 is a highly accurate timestamp data recorder. Each tube activation is stored at a resolution of .0000305us (micro seconds). At this resolution, the Omega X3 can store over 150 million unique timestamp entries.

A new feature that sets the Omega X3 apart from other data collection devices is its ability to store MAC addresses of active Bluetooth devices. This affords the possibility of determining Destination/Origin calculations. Using multiple Omega X3 units along with our Centurion CC (City/County) or Centurion Gold software allows for the reporting of Destination/Origin times along a known path.

1.a Keypad & Display

The Omega has a build in Keypad & Display that allows you the user to interact with the counter for basic programming and vehicle monitoring.

There are several sections to be aware of:

Keypad: these 12 buttons, located directly below the display, provide primary input. With the keypad, you can program and operate the Omega X3. 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 a sample of the alternate keys.

	1	2	3	4	5	6	7	8	9	0
ALT	!”#$%	ABC	DEF	GHI	JKL	MNO	PQRS	TUV	WXYZ	SPACE

Table 1 – Alternate Keypad Entry

Note that if the ALT key is continuously held and the number is pressed, again, the key will scroll through the following possibilities of letters from the repeating key starting point (i.e. Pressing the 6 key 4 times would show a ‘P’):

!”#$%&’()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}→←

For example, if you wanted the letter “X” you would press and hold the “ALT” key and press the “9” key. Note that “W” appears in the space, as shown in Table 1. While still holding the “ALT” key, press the “9” key again, and the letter “X” will appear. Release the “ALT” key and the letter remains while the cursor is advanced to the next position.

The rest of the keys are explained below:

Enter	Used as a means of indicating to the Omega X3 that an option is complete and to advance to the next menu item.
Clear	Used as a means of backing up one configuration option or menu item. When using this key on a text field, it will act like a backspace key and erase the previous character.
Space	The <Space> key inserts a space at the cursor location and will also allow scrolling through options in ascending order. Requires the use of the ALT key, (see below).
Left Arrow	This key allows for the changing of a cursor position while on a text field. Other locations it will allow you to step through editable fields. While monitoring traffic, you can cycle through the available screens to view data in various formats. When verifying date and time, use the left arrow to begin changing these values.
Right Arrow	This key allows for the changing of a cursor position while on a text filed. Other locations it will allow you to step through editable fields. While monitoring traffic, you can cycle through the available screens to view the activations in different formats.
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 keyboard, in that the ALT key must be pressed and held for the duration of the associated key press.

Display: directly above the keypad, this will be the primary way for the Omega X3 to provide information to the user. When the counter is collecting data, the display is put into a sleep mode allowing the counter to conserve power. Pressing any key, except ALT, will wake up the unit and active the display.

Tube Indicators: Directly to the LEFT of the display will indicate tube activations. These will light-up, providing a quick indication of which input has been activated. This can also be a visual aid to indicate if the tube is plugged into the correct input.

USB: Directly to the RIGHT of the display, these ports provide communication to and from the Omega X3. The top port allows for insertion of a USB thumb drive for data retrieval. The bottom port provides communication to and from a computer. The USB button (grey) just to the right of these ports, will activate the transfer sequence of data to a provided USB thumb drive. Follow the on-screen instructions to complete the process.

Arrow keys: Directly to the RIGHT of the keypad. The arrow keys provide a method of moving between menu options as well as selecting menu options.

Cancel key: Red, this option cancels the current menu item, generally stepping backwards a single step to the previous option or screen.

Enter key: Green, this option accepts the current menu item and generally steps forward to the next step or screen.

1.b Road Tubes

Road tubes, or "Tubes", refer to hollow rubber tubes usually ranging from 30 to 60 feet in length. These Tubes are stretched across the roadway so that oncoming vehicle traffic drives over them. This generates a sound/pressure wave (or an "air pulse"), which travels down the inside of the tube and allows the electronics of the Omega X3 to determine that an axle strike has occurred. We recommend a spacing of 4 feet between Road Tubes used for data collection in the same lane.

NOTE: There will be some loss of count if road tubes longer than 60' are used.

Tubes offer the advantage of being easily movable, quick to install, inexpensive, and are capable of being used to detecting individual axles of a vehicle. Their disadvantages include rapid wear, hard to secure for prolonged periods of time, and drivers notice the tubes and can change their speed, lane, etc.

Follow these guidelines when using tubes with the Omega X3:

- The Omega X3 will work with road tubes between 30' and 60' long. Be sure that the tubes are of the same overall physical length (as measured when not stretched). When stretching the tubes, try to stretch them the same amount when securing them to the roadway (i.e. not too tight that they vibrate like a guitar string & not too loose that the tread of a tire can grip them and tear them down the road.

NOTE: Tubes shorter than 30' are *NOT* recommended as the signal they produce will cause damage to the internal air switch over time.
Tubes longer than 60' may not register activations, causing missed counts.

- Make sure the tubes are placed as squarely as possible to the oncoming traffic (so that both sides of the axle will strike the tube simultaneously).
- After each use, check the tubes for punctures or other damage that may have occurred.
- Plug the far end of the tube with a suitable device such as an end plug to keep dirt and other debris out, including water.

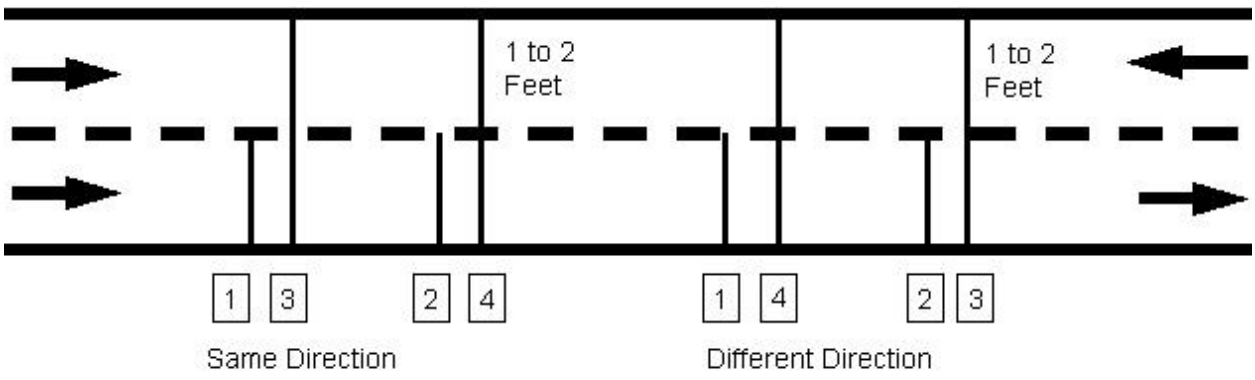
1.b.1 Connecting Road Tubes

As the Omega X3 records a timestamp for each axle strike, it is highly important that the tubes be of similar overall length. This will provide an equal distance for the sound/pressure wave to travel inside of the tube. Having different lengths will cause the sound to travel a different distance and will skew the recorded data. A vehicle's recorded speed and or length can be affected when using tubes of a different overall length.

For Per Vehicle type data:

Use 2 tubes of equal length for sites with an expected ADT of less than 4500, use 4 tubes for those sites that are expected to have an ADT higher than 4500, deploying the tubes in a short, long, short, long configuration.

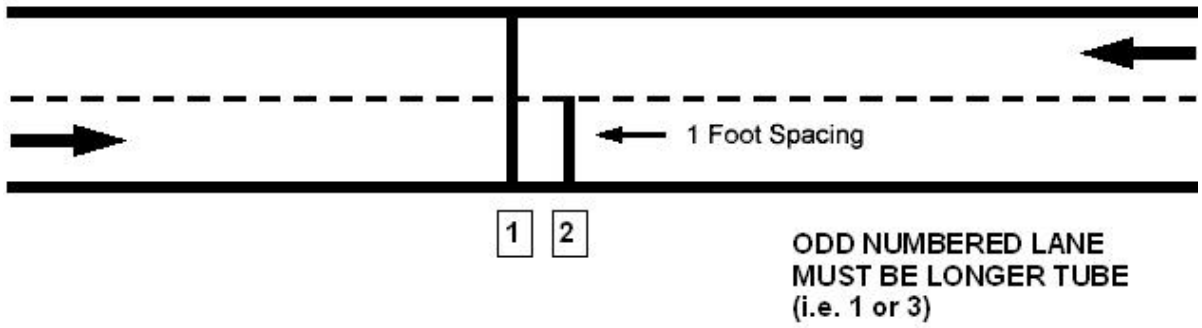
2 tubes	• Install one road tube perpendicular to the direction of traffic across both lanes of traffic, one if you only want to collect data on a single lane. • Install a second tube 4 feet from the first tube. (We do NOT recommend spacing closer than 4 feet when classifying due to potential loss of accuracy). Connect the road tube, which will be struck first by oncoming traffic (near lane) into the 'A' port. • Connect the other road tube, which will be hit second by oncoming traffic into the 'B' port.
4 tubes	• Install one road tube perpendicular to the direction of traffic across a single lane of traffic (short tube). • Install a second tube 1 foot away from the first, crossing both lanes of traffic (long). • Install a third tube 3 feet away from the second, crossing only one lane of traffic (short). • Install a fourth tube 1 foot away from the third, crossing both lanes of traffic (long). Tube connection is vitally important with this setup and will be dependent on vehicle traffic in reference to the lane nearest the counter location. If Opposite direction: The first tube (short) will be plugged into port 'A' The second tube (long) will be plugged into port 'D' The third tube (short) will be plugged into port 'B' The fourth tube (long) will be plugged into port 'C' If Same direction: The first tube (short) will be plugged into port 'A' The second tube (long) will be plugged into port 'C' The third tube (short) will be plugged into port 'B' The fourth tube (long) will be plugged into port 'D'



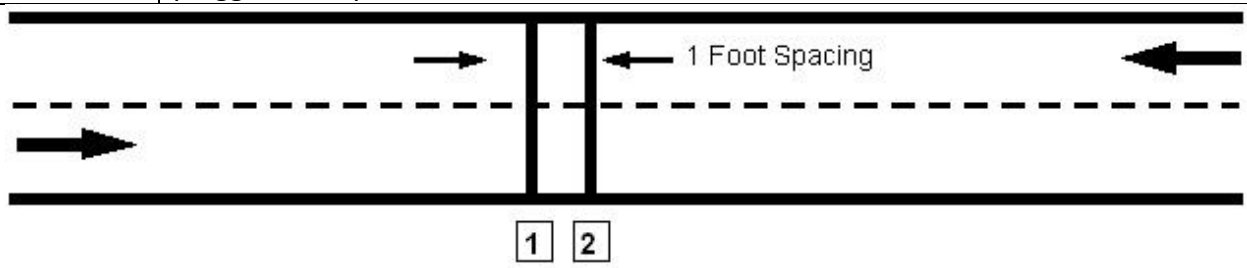
For Volume type data:

There are three possible tube layouts:

Normal	This sensor configuration will be used when the counter can be located in a center median of a roadway. Road tube can be stretched across each lane of travel on either side of the median.
Lane Subtraction	This road tube configuration is used when you want to get individual lane counts from two different lanes of traffic from one side of the road. The long tube that crosses both lanes of traffic will be connected to port 'A'. While the short tube will be cross only the near lane will be connected to port 'B'. Both tubes will be of the same overall length.



Directional	This road road tube configuration is used for counting two-way traffic on a narrow road. Two road tubes are used with a 1-foot spacing. The tube that is struck first in the lane nearest to the counter will be plugged onto port 'A' while the second tube will be plugged onto port 'B'.



For ease of setup and data recording (as well as for safety) it is recommended that a minimum of two (2) tubes be deployed at a four (4) foot spacing. This will allow the operator or data processor to create and import per-vehicle data which will result in an accurate vehicle volume being stored in the internal database. This will also allow the operator to reduce the amount of time working in an active lane of travel.

1.c Basic Setup

Basic setup will include the following:

- Select Axle Collection Mode
- Entering in the Station or Site ID
- Acquiring GPS coordinates for the study site
- Verifying the correct Date and Time
- Selecting a road tube layout
- Verification of displayed vehicle information to the traffic seen crossing the collection site
- Followed by completing the study setup.

Should the display be blank, press the ENTER key to wake up the unit. If needed, use the left or right arrow to the icon 'Start Recording' and press ENTER to begin.

Using the keypad, enter in your Site ID, use the ALT & key combination to select letters. After entry of the Site ID is complete, press ENTER. Although the Omega X3 does not require a Site or Station ID to begin data collection, including it here will make processing data files much smoother at the end of the day.

1.d GPS Reception

The Omega X3 has an internal GPS sensor that will be activated as a part of the setup process, and then again, every 6 hours after data collection has begun. After receiving a good GPS signal and position, the Omega X3 will power down the GPS module to reduce power draw. For best results, place the Omega X3 in an area with a clear view of the sky. Tall buildings and or trees can block the GPS signal from reaching the Omega X3.

During GPS acquisition, the counter will display a series of dots. The dots will continue to cycle until the GPS has locked onto satellite information. Once a GPS lock has been made, the Omega X3 will change the screen to show additional information. As the GPS chip locks onto additional satellites, the display will update the 'STATS' (line) to indicate how many satellites signals are currently locked on. When a quality position has been obtained, the Omega X3 will automatically advance to the next screen. If you elect to skip acquiring a GPS position, simply press the ENTER button to manually advance to the next screen.

When you are satisfied that a good GPS coordinate has been achieved, press ENTER.

1.e Date and Time Verification

During this step, the user can verify that the date, time and time zone are correct. Note that Time is in Military format, 3pm would be displayed as 15:00. During GPS acquisition, the counter should have updated the Date and Time to the correct values. If that step was skipped over, or you have moved across time zone boundaries you may need to set these manually. If they are incorrect, press the Left Arrow to advance to the Hours block. Use the Left & Right arrows to move the cursor about the screen and type over the incorrect data using the keypad, you may also use the keypad to key in a new value. When you have changed all needed values, press ENTER to step through the remaining entries and to advance to the next screen.

1.f Road Tube Layout

The next screen will allow you to specify a road tube layout. Use a tube layout that best matches your installation type. The correct selection will inform the Omega X3 how to process vehicle data when displayed using the On-the-fly classification. This will also help when importing data into the Centurion PC application. Press the Left or Right arrows to scroll to the layout that best matches your needed layout, press ENTER to indicate your selection and to advance to the next screen.

1.g Monitor Vehicles

This step allows the user to verify vehicles as they cross the data collection site to what is shown on the display. The Omega X3 offers FHWA vehicle classification 'On-The-Fly' so that the user can compare on-screen data with the vehicle that has crossed the collection site. The display will indicate vehicle specifics such as speed, lane, and axle pair spacing's. The display will also provide a graphical representation of the detected axles as a wheel and under carriage. Once you are satisfied that what you see on screen matches the vehicles crossing the site, press ENTER. Please note that this information is based on a 4-foot tube spacing. If you use a different tube spacing, you will need to provide the Centurion import tool the correct spacing at the end of the study. Centurion will then calculate the correct speed and wheel spacing as well as overall vehicle length (first axle to last axle).

It is important to note that the displayed on-the-fly classification/vehicle information is secondary to the primary function of recording data to memory. This delay is to be expected and is normal.

1.h Completing Setup

When completing the data collection steps, it is necessary to press the green 'Enter' key until you see 'Data Recording Has Started!'. Shortly after this is displayed, the counter will change menu settings/structure to allow the operator to then view traffic, or to use other available menu options.

To conserve battery life, the display can be turned off and put to sleep. To put the display to sleep is really easy, press the 'Cancel' key until there is no information on the screen. This process does not stop data collection. When the display is needed again, simply press any button; the only key that will not cause the display to wake-up is the 'ALT' key. No matter how many times the 'ALT' key is pressed, it will NOT wake the display up.

2. Viewing Traffic

Using the monitor lanes function, the field tech can return to the site and verify that the displayed vehicle information matches that of vehicles crossing over the collection site.

Enabling the View Traffic option will allow the field tech to view data in several different formats. Those formats:

Raw Vehicles (On-the-fly classification)
Sensor activation
Volume counts

Each mode offers distinct types of data that can be displayed. To start this process, you will need to activate the Omega X3 display by pressing any key. The correct menu option is 'View Traffic', press ENTER to start viewing traffic. As each vehicle crosses the collection site, the Omega X3 will display various information. To change the type of data being displayed, use the Left or Right arrow keys. This is a circular menu and will automatically wrap around and redisplay the various display types. When finished, press the CANCEL button multiple times to return the display to a sleep mode (powered off).

2.a Waiting for Vehicle

This mode is unique in that the counter is actually storing each timestamp for each axle activation as well as displaying vehicle information & graphics along with vehicle specific speed, length, and FHWA Classification bin number. *Note that this information is not being stored into the data file.* When this data file is processed, Centurion will generate this same type of information along with other details such as headway and gap type data. An example of this display will be:

DC: 17:05:25
2ax 11mph 7.7'

This indicates that tube D was activated followed by tube C at 17:05:25 by a 2-axle vehicle traveling at 11mph with an axle 1-2 pair spacing of 7.7'.

2.b Waiting for Sensor

Sensor activations allow the user to view the activation times in a second & sub-second format (SS.sssss). This format will show each sensor activation after it has been saved into the internal data file. These activations will be used later by Centurion to generate Raw Per-Vehicle or Count records that will be imported into Centurion's internal database. This display is formatted into two columns. Each line will include the sensor that was activated and the second & sub-second time (i.e. D-15.14068 or B-15.23205).

2.c Volume

Volume simply display each sensor and the number of times it was activated by a passing vehicle. This screen can be reset by using the zero (0) key. This does not affect the recorded data or quality of that data and will not zero out the data file, it simply resets the displayed values to zero.

3. Show Status

The Show Status menu option allows the field tech to receive a quick overview of the Omega X3 unit. The displayed data will contain such information as:

System Status	Amount of free memory and expected battery life. Note that since the Omega X3 uses lithium batteries, that the value will be close to the same value for the life of the batteries. Only when the batteries have depleted their energy will the value drop. When the value drops, it will drop rapidly. This is common for all lithium batteries. The will simply run at their full rated value and then they quit.
Temperature	The Omega X3 displays temperature in both Celsius and Fahrenheit. The Omega X3 will store the Celsius value and then compute the Fahrenheit value.
Battery Voltage(s)	Both the Primary and Secondary batteries are displayed down to a one-hundredth of a volt (.01). The secondary batteries value will be that of the 8 D-cell battery pack. This pack will be strictly used to power the Bluetooth radio when Bluetooth data collection has been enabled. Note that the system can and will power the Bluetooth radio from the primary batteries. Doing so will dramatically shorten the primary battery life. Using the Primary batteries to power the Bluetooth radio is not covered in the expected 5-year battery life of the counter. If the Omega X3 is equipped with an Iris Cellular Modem, the external battery pack will also power the modem. Depending upon modem usage the batteries will need to be checked and changed at regular intervals.

4. Files

The Omega X3 can store up to 65k files in its internal memory. This should afford the field tech the option of deploying the Omega X3 to several separate locations and then retrieving the data file(s) for processing at a later time, or to retain those studies till end of season. It is not recommended to use the Omega X3 as a backup device.

It is always recommended to retrieve and process any study file(s) as soon as possible, this ensures that you have sufficient time to correct any errors or address issues that may have occurred during data collection.

It is not recommended to use the Omega X3's memory as a backup of study files. Also, there is a direct correlation between the number of files and the time it takes to read and return the file information when a directory request has been issued. For backup purposes, it is recommended that a quality backup be made at the computer level and to not rely on the counter to hold data files long term.

4.a File List

From the main menu, use the Left or Right arrows to locate 'Files'. Once this option is in the middle of the screen, press ENTER.

This screen will display a brief overview of the counters internal storage or memory. The top line indicates the number of files that are presently stored in the counter and how many of those have yet to be retrieved as noted by the number between the brackets (x) – where 'x' is number of new files.

The second line indicates how much memory is used by all files as well as the nearest full percentage of overall memory.

The third line indicates the counters current state, whether it is actively recording data or in standby mode.

Pressing the Down arrow will allow for the displaying of specific file information, should there be more files than can be listed on the screen multiple presses of the Down arrow may be necessary as you scroll through the list. Some basic information will be displayed, including the Entered Site ID, the starting Date of the Study and the duration of that study.

The other available option is 'Erase'. This will erase ***ALL*** files within the Omega X3 including those files that have not yet been retrieved.

Note: Once the erase function has started there is no stopping it and all erased data is completely lost.

5. Data Study

It may be necessary to check the status of the current study. Should the display be blank, press the Enter key to activate the display and then right or left arrow to 'Show Status' and press Enter. Using the Right or left arrow locate Data Study and press enter.

Using the data study function will allow the field tech to verify the current programmed Site ID along with viewing the starting time and date in MM/YY HH:MM format. It will also display the current size of the file along with the current duration of the study, rounded to the nearest whole value.

Cycling through the display will yield grand total of vehicles, breaking out passenger cars and trucks. Also included is a calculated ADT (Average Daily Traffic, on-the-fly) for those studies longer than 2 days.

The next screen will also display the Average speed, Peak volume, Peak time and a percentage of classification.

Pressing Next will return you to the Status Menu.

6. Stopping Data Recording

When it comes time to wrap up a study, the field tech can use the Stop Recording function to finish the current study; appending an end of study record to the data file. Selecting this menu option and answering a verification question(s) will complete the study and afford the field tech to view the study specifics:

Starting Date and Time
Ending Date and Time
Study file size and duration
Grand Total of Vehicles
Total Cars
Total Trucks
ADT (# of days)
Average (Avg) Speed
Peak Volume
Peak time
Class percentage

7. Data Retrieval

Data retrieval can be accomplished by several methods. One method is via thumb drive; another would be via a standard 'USB A to B' cable see appendix B for specifics (no driver needed for the cable). These files would then be processed by a computer running Centurion software (1.42 build 16 or newer).

7.1 Retrieving Data Via Thumb Drive

This method is by far the easiest way to retrieve any previously un-retrieved data files from the counter. Simply press the USB key on the counters faceplate and insert a thumb drive into the correctly sized slot.

This starts the creation of a date specific folder in which any copied data files will be stored. After retrieving data files with the thumb drive, the field tech can simply email those raw data files to the office for processing.

In order to use a thumb drive with the Omega X3 it must conform to a known standard. The thumb drive must have these specifications:

- **Can only be formatted in FAT16 or FAT32**
- **Sector size must be 512 bytes**
- **Long names are not used (all file and directory names are in 8.3 format)**
- **No extensions to the USB Mass Storage Specification are allowed**

To verify operation of a thumb drive:

Create a short data study, you can even leave the counter on an office desk over lunch.
Stop data collection and then press the USB button on the Omega X3, following the screen prompts.
When finished, remove the thumb drive from the Omega X3 and plug it into a Windows based computer that has Centurion installed. Use the manual open option, navigating to the thumb drive and dated folder to select the correct file.

You should see a new window appear with a yellow background (default color) with human readable text. If you entered in a Site ID during the study setup, it should be clearly readable at the top of the window.

7.2 Retrieving Data via USB Cable

This method, while simple, require the Omega X3 counter be located within cables reach of a computer running Diamond Traffic's Centurion software. We recommend Centurion CC to make the most use of the recorded data.

Simply plug in the USB cable into the computer, then into the Omega X3. There will be a slight delay while Windows finds, configures, and makes the Omega X3 available for use. Should Windows not be able to locate the newest drivers on Windows Update servers, a basic driver is included under the 'USB\Diamond USB Drivers' folder.

After the drivers have been installed for the first time, start Centurion CC.

NOTE: In order for Centurion to communicate with the Omega X3, it will need to be plugged into the computer first, then start Centurion.

This affords your Windows computer to make the hardware available so that Centurion can then communicate with it. Once Centurion is started, Centurion will begin looking for any connected counter or device. When that counter or device has been found, Centurion will, by default, download new data files. After those files have been downloaded, the Timestamp Data Processor (TSProcess) will open to begin the import process.

For data processing steps, refer to the section 9.0 Data Processing.

7.2.1 Driver Installation

With the release of Centurion 1.48 build 8, the required drivers are automatically installed with the full software installer. These drivers are also available for manual reinstallation should there be a need.

Driver installation files can be found in one of the folders:

32-bit - C:\Program Files\Diamond\USB\Diamond USB Drivers
64-bit - C:\Program Files (x86)\Diamond\USB\Diamond USB Drivers

For proper driver installation, administrative permissions will be needed. Should your account only have standard permissions, please consult with your IT department.

8. Iris Cellular Modem

When the Omega X3 is equipped with an Iris Cellular Modem, data files can be uploaded to the Diamond Data Server (DDS). This allows for quick retrieval of data files by Centurion in the office. The Iris Cellular Modem can also be used to send SMS messages to a preprogrammed number to alert a field technician of any potential problems, this could include not seeing an activation on an input for a predetermined amount of time.

The Iris modem is designed to be a low power device, as such it will draw its power from the 8 D-cell battery pack. Depending on modem usage, you may need to replace these batteries at regular intervals.

The information below is to give you an idea of what to expect with normal usage, should your usage vary from these examples, expect your battery life to also vary.

When the Iris Modem used to upload its collected data each night:

In this mode, the modem will be powered on and immediately connect to the Diamond Data Server (DDS), uploadng any new file(s), and then turn off. It is assumed that the Iris modem will be actively transmitting all the time it is on. With an average upload time of 15 minutes, the 8 D-cell battery pack will last approximately 9 months.

When the Iris Modem is put into "Listen" mode and is on all the time:

In this situation, the modem is turned on and immediately links to the cellular network (Service). From there, power draw depends on how much communication goes back and forth between it and the host connecting computer.

1. Modem in "Listen" mode but never linked to: Power draw will average 35mA over the life of a fresh battery pack, which gives a useful life for an 8 D-cell battery pack of about 8 days.

2. Modem in "Listen" mode, linked to, and constantly transmitting: Power draw will average about 100mA over the life of a fresh battery pack, which gives a useful life for an 8 D-cell battery pack of about 2.9 days.

3. Modem in "Listen" mode, linked to, and transmitting 50% of the time: Power draw will average 67.5mA over the life of a fresh battery pack, which gives a useful life for an 8 D-cell battery pack of about 4.3 days.

NOTE: The above assumes the batteries are operating in ideal conditions. Extreme cold, heat, age of battery, and type of battery can all affect a batteries life. It is best to count on no more than 2/3 of the estimated time, and to always use new high-quality batteries.

8.1 Settings

To configure the Iris settings, wake up the Omega X3 and use the Left or Right arrow and select Iris Modem and press ENTER. Press ENTER on the menu item 'Settings'. The Omega X3 will present the user 2 options to select from for DDS Transfer Files:

At 1am Each Night	This option will upload files to the Diamond Data Server every night @ 1am.
When User Chooses	This option will disable the automatic uploading of data files. Instead it will only upload data files to the DDS when a field technician activates this process.
Either options selected will then ask which files to transfer to the DDS	
All files in Mem	This option will upload all files in memory at the time of upload.
Unsent Files Only	This option will upload only those files that have not been previously retrieved or sent to the DDS.
The next question deals with what to do with those files after they have been sent to the DDS: Erase After Transfer?	
Yes (If all are sent)	If all files have been successfully uploaded to the DDS, then the Omega X3 will erase all files on the unit.

No, Never Erase	This option will not allow the Omega X3 to automatically erase any data files. Note these files still can be erased by the user at a later time.
The next question tells the Omega X3 what to do when the key combination 'ALT+USB' is used:	
Send files to DDS	This option, when selected, will cause the Omega X3 to send files to the DDS at the time the key combination is used.
Enter Listen Mode	This option will cause the Omega X3 to monitor the cellular connection for any valid incoming commands or inquiries. This is typically initiated through our Centurion Gold software.
Note you will need to select a file recording format of either Daily or Manually	
Daily	When selected the Omega X3 will close and create a new file at midnight proper. Each file will only have a single days' worth of data. Normally the current days' data is not available till either the next day or after data collection has stopped.
Manually	When selected the Omega X3 will only create or close files with the

8.2 Enter Listen Mode

Entering this specific mode will require that the external battery pack be populated with batteries. Should the voltage of that battery pack be too low the Omega X3 will not allow this function to be activated.

It should be noted that this mode is power hungry and the batteries should be checked and replaced frequently.

8.3 Send Files to DDS

Selecting this option will cause the Omega X3 to upload data files to the Diamond Data Server (DDS). If there are no files to send to the DDS, the Omega X3 will display an error message 'ERROR: There are no files in memory!'

8.4 Files (DDS)

This option informs the field technician how many files are presently in the Omega X3's memory that are New, how much memory is currently be used by those files.

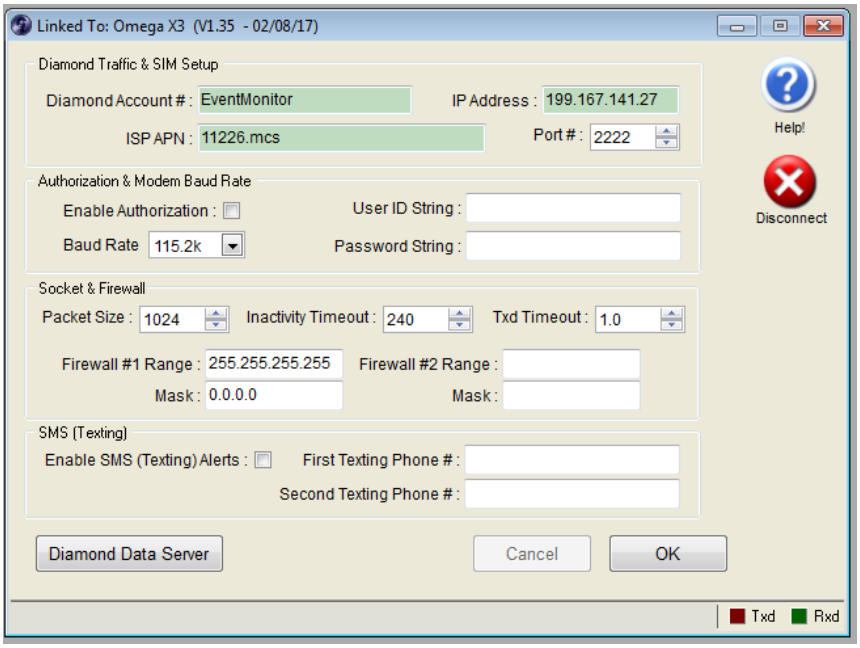
This function does not interact with the Diamond Data Server; it simply provides information about the current file state of the Omega X3. Pressing any key will return you to the previous menu.

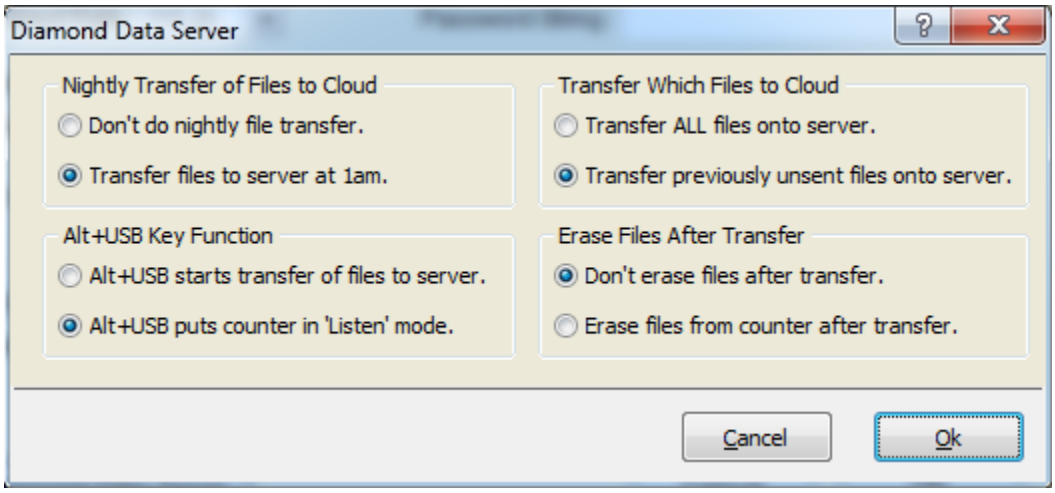
8.5 Re-initialize Modem

This option will cause the Iris modem to be re-initialized. This is a useful troubleshooting step should the unit not be responding in an expected manor.

8.6 Iris Configuration Via Centurion

Centurion can also be used to configure the Iris modem. You will need to connect the Omega X3 to a computer running the Centurion software (1.43 build 5 or newer).





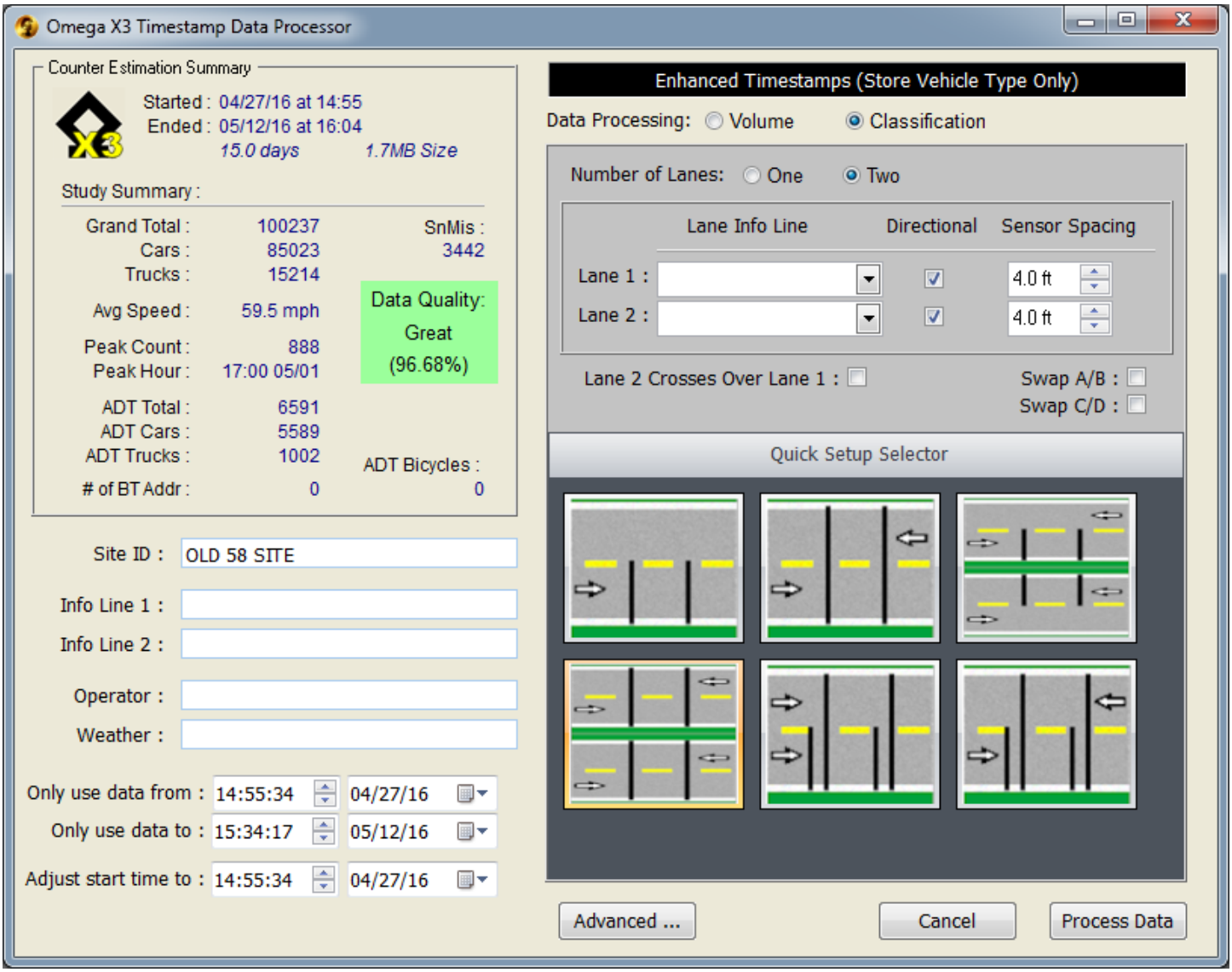
9. Data Processing

In order to convert the Omega X3's timestamp records (data file), the data must be processed through Centurion's Timestamp Data Processor (TSProcess). Using TSProcess is quick and easy, it will allow you to verify or edit any of your site information and will allow you to select starting/ending Time & Date, select a road tube layout, and then approve a data summary prior to importing the new data into Centurion's internal database.

Please note that while we cover the processing/importing of data, this section is not intended to be a replacement of the Centurion Users Guide.

9.1 Initial import screen

The screen capture below is a typical screen:



There are 4 major sections to this screen, the upper left, lower left, upper right, & lower right.

The upper left is a summary of the data file as it was recorded. The data quality is a cursory indicator of what the data could be. Note that Volume only data should have a data quality of Great/100%.

The lower left allows for the changing/editing of Site ID, Info Line 1, Info Line 2, Operator, & Weather. You also have the ability to select a time and date range to import. Changing the date and or time will 'Trim' the data to only a defined range. If at any time you need/want the data surrounding your selected date/time range, you will need to manually import this study file again and either specify a different range or import the complete file. Centurion has the ability to 'Trim' data used in its reports or exports.

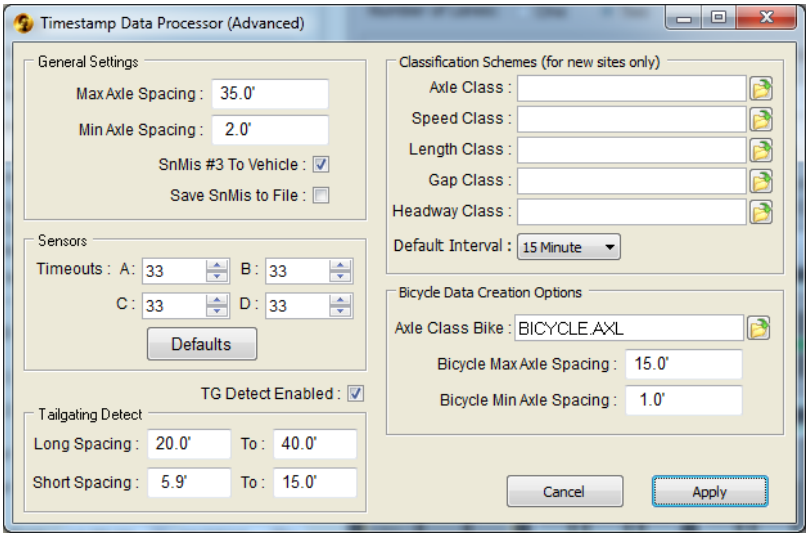
NOTE: This action will only impact the way you process or view the report. It will have no effect on the *original* raw binary data file from the Omega X3.

The upper right allows the user to override the selected type of data (volume vs classification) and to select the number of lanes/tube that were deployed. By default, the TSProcess will use the saved configuration located within the data/study file. You are able to change/edit the lane information, indicate if the lane had directional traffic and to adjust the road tube spacing if different than what was used during data collection. If a non-standard tube layout was used, you can swap tube input sequence as well; for example, if Tube B was used in the near lane instead of Tube A, you can place a check mark in the 'Swap A/B' checkbox. Changing any of these options may change the lower right portion of this screen. This is to give you a graphical representation of how the tubes should have been deployed. If the diagram selected, as indicated by a yellow selection box, matches the road tube deployment then no additional changes/adjustments are needed.

The lower right allows you to select a tube layout that was used to collect data. Doing so will change/update the upper right portion of the window and any of the changes made previously may be lost depending on your selection.

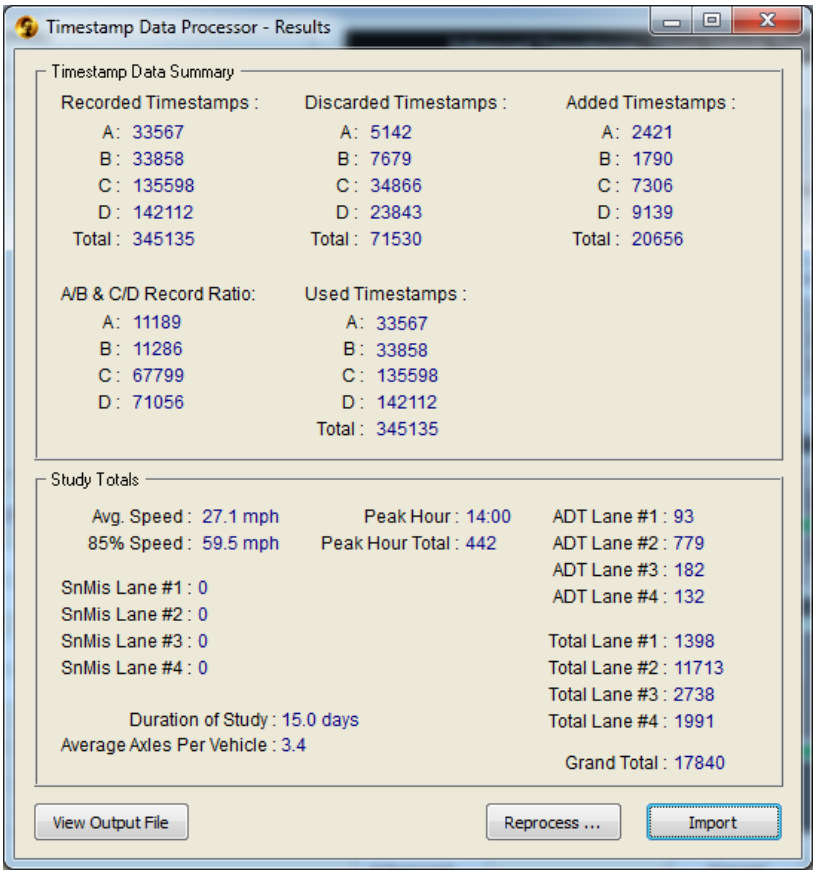
9.2 Advanced Processing

The Advanced button allows for the changing of processing defaults. Changing these settings *will* have an impact on processing the recorded timestamp data as well as overriding system defaults such as Classification schemes for new sites, to the internal database. Note that these options are returned to default for each new file that is processed, in other words, if you will have to make changes on a file by file basis.



9.3 Process Data

Pressing the Process Data button will begin the conversion of Timestamp data into either Per-Vehicle or Volume only data. A Summary screen will be generated and be presented prior to importing the resulting data into the internal database.



There are 2 sections to this summary screen, the Top section and the Bottom section. The top section will contain timestamp summary information.

Recorded Timestamps	This section displays the total number of timestamps for each road tube input that was saved/recorded within the data file.
Discarded Timestamps	This section displays the total number of timestamps that were discarded/not used in data processing. These timestamps did not 'fit' a defined vehicle classification. As such they were not used to generate Per-Vehicle type data. If you are processing Volume only data, you should have no discarded timestamps. Otherwise this number should be very low for Per-Vehicle data. This would be a good indication of data quality and matching configuration from the previous screen.
Added Timestamps	This section indicated the number of timestamps that were added in order to complete a Per-Vehicle record. The TSProcessor is matching timestamps to predefined vehicle classification, when it does not 'see' a complete record that matches a definition, it will add missing timestamp(s) to make a complete record.

The bottom section provides a study summary total. This is also a good indication of the quality of data prior to importing the Per-Vehicle or Volume data into Centurion's internal database. Here you can verify average speed, Duration of Study and see calculated values such as 85th percentile, ADT and peak hour data.

If everything looks good, simply click the Import button to write this data to the internal database. Depending on the number of days, the type of data, and the amount of data the writing process can take some time. A progress bar in the lower right corner of Centurion monitors the progress.

After the writing process has finished, a simple summary report will be displayed. You can select the type of data that you want to see a summary on, Vehicle, Classification, or Volume. Saving or printing the report(s) as needed. Should you need a more detailed report, select the Report generator on the right side of the window, if you need to export the data into another supported format, select the Export Data also on the right side of the window.

Should you need to regenerate reports or re-export the data use the Yellow Cylinder at the top of the Centurion program, locate the site and repeat the steps in the previous paragraph.

For additional information and or details on the reporting or exporting functionality see the Centurion Users Guide included with the Centurion Installation.

10. Bluetooth

The Omega X3 has the ability to communicate with a computer for of programming and data retrieval without the need to use a standard USB cable or thumb drive.

There are two (2) supported methods for connecting to a Windows based computer using standard Bluetooth adapters. Those methods involve what are called Bluetooth stacks. These stacks provide communication to the Omega X3. One stack is provided with your Windows installation and the other is provided by 3rd parties.

10.1 Microsoft Bluetooth Stack

Simply plugging in a quality Bluetooth dongle (USB adapter) will start the search for the needed drivers as provided through Windows Update. This process can take some time to complete, patience is needed here as the installation should not be interrupted. Once complete, a new Bluetooth ICON is added to the system tray.

To add a device to the computer is a fairly simple process, simply right click on the Bluetooth adapter and select 'Add Device'. Make sure that the Omega X3 display is active and then proceed with the on-screen steps needed to complete the process.

10.2 3rd Party Bluetooth stacks

Other hardware vendors may include their own implementation of the needed Bluetooth stack. Their software will normally be installed prior to inserting the USB adapter into the computer. Note this process usually replaces the included Windows Bluetooth stack.

Please reference the adapters installation instructions for their complete setup sequence.

Once finished with the setup process, open their software and proceed to search for and add the Omega X3. Be sure to have the display activated prior to starting their process.

10.3 Bluetooth Pairing Code

When it comes to Bluetooth security you will be asked to provide a 'pairing' code. This code is normally unique from device to device. To offer a smooth transition from device to device, Diamond has set a default pairing code for the Omega X3. To help maintain communication with the Omega X3 this pairing code cannot be changed.

The pairing code for the Omega X3 is: '0000'

10.4 Bluetooth Address Recording

The Omega X3 can be configured to record passing Bluetooth MAC Address type data. This data has no personably identifiable information. The specific data that will be recorded is:

The time is seconds (Second.sub-second)
Bluetooth Address in HEX values (11:22:33:44:55:66)
Type of address (Standard, Low Energy, Random)
Signal strength (in dBm)

When a device comes within range of the Omega X3, that device is recorded along with any other devices in the area. Clusters of devices could be thought of as an event. Seeing those clusters at another collection site would be a good indication of commute time between those points.

Note that in order for the Omega X3 to record Bluetooth MAC Addresses from passing objects, that object needs to have its Bluetooth radio turned on. Since we do not 'Pair' to the passing device there is no need to provide any pairing codes. The Omega X3 simply listens for those devices to pass within the detection field, about 100' (feet).

This data can then be used in destination/origin calculations. Note that multiple Omega X3 units will be needed to collect this information. Centurion can then use multiple sites to correctly calculate these times.

When recording Bluetooth addresses, it is recommended to populate the external battery holder with 8 new alkaline D-cell batteries. These batteries will power the Bluetooth radio for about 10 - 14 days before they are too weak to continue. The internal batteries can and do provide power to the Bluetooth radio, however they do not have the reserve capacity to power the radio for lengthy periods. ***Powering the Bluetooth radio from the internal batteries will severely shorten the expected primary battery life and is highly discouraged.***

11. Bicycle Data Collection

The Omega X3 is specially designed to be a bicycle data collector, while at the same time maintaining the ability to handle regular vehicles driving over the road tubes. There are three basic situations where road tubes are used with the Omega X3:

1. Vehicles Only – In this situation, road tubes are placed across one or more regular vehicle traffic lanes where you want to collect vehicle traffic counts. The Omega X3 calls this "Normal" Axle Collection mode.
2. Bicycles Only – This is where road tubes (usually physically shorter compared to those used for vehicles) are placed across a single or dual lane bike path and you want the Omega X3 to record each time a bicycle crosses the tubes. This is the ideal situation for the "Enhanced" Axle Collection mode of the Omega X3.
3. A mixture of Vehicles and Bicycles are crossing the tubes and you want to collect just Vehicles, just Bicycles, or Both/Mixed at the same time - This situation is the most complex and difficult, both for the Omega X3 and for the user. The counter has three different Axle Collection Modes for this situation that are called:
    - "All/Mixed" – When you want to collect both vehicle and bicycle data and you want the Omega X3 to figure out which hits on the tubes are which.
    - "Vehicle Only" – When you want the Omega X3 to only report those hits on the tubes which come from vehicles.
    - "Bicycle Only – When you want the Omega X3 to only report those hits on the tubes which come from bicycles.

<table>
<tr><td colspan="2">When collecting data in Situation #1 – Vehicle Only – you have a lot of setup flexibility.</td></tr>
<tr><td>The basic process is:</td><td>• Set the counter to "Normal" mode (more on how to do that in the next section below).
• Connect up standard road tubes (natural or synthetic, usually 9/16" OD & 1/4" ID) that can be anywhere from 20' to 100' long, with the ideal length around 60' to make sure you don't miss any really light axles.</td></tr>
<tr><td colspan="2">This configuration works excellent with almost every regular vehicle traffic counting situation. You can use a variety of road tube types and length, although you should always use the same physical length of road tube when using two tubes in a lane (to make sure speed/length accuracy is not compromised). A bicycle crossing the tubes is unlikely to be detected, unless it crosses the tubes close to the Omega X3.</td></tr>
<tr><td colspan="2">Situation #2, Bicycle Only, is also fairly simple.</td></tr>
<tr><td>The basic process is:</td><td>• Set the counter to "Enhanced" mode. This mode differs from the Normal mode in that it is more sensitive and can detect very light hits on the road tube.
• Connect standard road tubes to the Omega X3, their length should be as short as possible. Anything over about 30 feet when using 9/16" tube will likely miss very light or slow bicycles.
• Although the Omega X3 is very sensitive, there are situations where a bicycle axle may be missed. Typically, if someone goes very slowly over the tube or if that person/bike is very light, they may be missed by the Omega X3. This situation can be improved by using shorter tubes, narrower tubes (3/8" instead of 9/16"). It is also important to put the tubes over a hard, even, surface for maximum effectiveness. Users are encouraged to experiment with different lengths for their sites.</td></tr>
</table>

Situation #3, Mixed traffic Vehicles & Bicycles, and you want the Omega X3 to determine which hits on the tube are vehicles and which are bicycles is the most complex setup.	
The basic process is:	• Set the counter to "All/Mixed", "Bicycle Only", or "Vehicle Only" mode depending on what you want to collect. Each of these modes uses the same improved sensitivity of the "Enhanced" mode but takes the extra step to analyze the strength along with other characteristics of the road tube strike to determine what type of device that made the activation. • Road tube length is *very critical*. The goal is to set the length so that a bicycle is not too strong (i.e. a fast-moving bicycle hitting a road tube at 15 feet looks pretty much identical to a car) but is not too weak so that the Omega X3 misses it. Many users come up with an ideal road tube length. As a place to start, set a tube at 30 feet with the bicycles and vehicles all hitting in the last 10 feet of the tube (in reference to the counter location). • Road tube length can, and likely will, need to be adjusted so that bicycles and vehicles are correctly identified. • When in the modes "All/Mixed", "Bicycle Only", and "Vehicle Only" you can tell on the display, bicycles are displayed in inverted characters (white on black), and in Centurion bicycles are displayed in white on green background. This helps to dial in your road tube lengths and make sure you get the counter setup to collect data in the best way for your sites.
Note that it is always best to put the tubes where bicycles and/or vehicles are free flowing and moving quickly. Stop and go traffic in addition to very slow traffic is much harder to detect reliably, which makes setting the ideal road tube length more difficult.	
For specific instructions on how to setup the Omega X3 to collect data in one of the five Axle Collection modes (Normal, Enhanced, All/Mixed, Vehicle Only, and Bicycle Only), refer to the next section. Below is a more detailed description of each of the modes.	
Normal Mode / O.C. Input	This mode uses only hardware to detect axles from vehicles striking the tubes, or to accept Open Collector (or "O.C.") inputs from a remote source like a passive Infra-Red sensor. This mode operates the Omega X3 in exactly the same way other Diamond Traffic counters detect axles and is especially useful for customers who are only collecting vehicle data and do not care about bicycle detection. Normal mode does not detect bicycles reliably but is excellent at vehicles and is also very low power in comparison to the other collection methods.
Enhanced	This mode switches the Omega X3 from a strictly hardware detection of road tube hits to a process called Analog to Digital (or "A/D") conversion to detect axles. The word "Enhanced" means that the counter is using advanced logic and scanning the road tube sensor at more than a thousand times per second to see if there is any activity. When a change is detected in one "sample" of the sensor, the counter records the amount of change in real time to its internal memory (this is referred to as "capturing the signal"). From there advanced signal processing algorithms consider the strength, width, average,

	and other aspects of the captured signal. When it meets certain programmed criteria, the Omega X3 reports an axle has been detected. This process is much more sensitive than the straight hardware method of the "Normal" mode, and for this reason it is ideal for bicycle only data collection. "Enhanced" does draw more power than "Normal" mode (because it uses active A/D processing), and is slightly less accurate for speed calculations, so it should only be used in situations where it is required. There is a small disadvantage of using "Enhanced" mode to collect bicycle data in that the data itself is not specifically marked as "Bicycles". This means that in later processing Centurion does not know this is bicycle data, so it isn't shown in the distinct way bicycle data is shown with the other modes. However, "Enhanced" mode is easier to use than the other modes for collecting bicycle data and as such many users prefer it despite this difference.
All/Mixed	When this mode is selected, the Omega X3 uses the same improved A/D process that "Enhanced" uses to detect axles. However, it takes it a step further and looks at the captured signal to determine if a particular road tube hit came from the tire of a "Bicycle" or a "Vehicle". While in "All/Mixed" mode, 2 bytes of data are added to every hit that is stored in the data file. These extra bytes indicate if the axle was a bicycle or a vehicle, and also store the peak signal received from the strike (or optionally the average signal received, see below).
Vehicles Only	This uses the same improved A/D process that "All/Mixed" uses, except that *only* those activations that are determined to be from a vehicle are displayed, counted on the totals screen, and shown in Centurion's monitor mode. This does not actually affect the data storage, ALL the hits (Bicycles included) are store in the data file to preserve the integrity of the data and to give the customer the option of recovering bicycle data later on. When Centurion processes the data, the bicycle hits will be stripped out automatically in "Vehicle Only" mode unless otherwise selected by the user.
Bicycles Only	Just the reverse of "Vehicle Only", *only* the axle hits that are determined to be bicycles are displayed on the counter screen and shown in Centurion when monitoring the counter. All hits are still stored in the data file, with Centurion automatically stripping out the vehicle hits during post processing unless otherwise selected by the user.

As previously mentioned, road tube length selection is important for getting quality data to the Omega X3. It is recommended that customers perform some initial testing with various lengths and types of road tubes placed in different situations to determine their ideal requirements before primary data collection begins. As a base guide, the following lengths are a good place to start when using 9/16" O.D. synthetic road tube:

Type of Data you are collecting	Best Mode	Road Tube Length
Vehicles on standard roadways	Normal	60' ideal
Bicycles on a bike path	Enhanced	20' ideal
A mix of vehicles and bicycles, and you want the counter to identify and separate them into two different datasets	All/Mixed	30' with vehicles and bicycles hitting the last 10' (one lane only!).

A mix of vehicles and bicycles and you only want the data from the Vehicles	Vehicles Only	Go Shorter if missing bicycles. Go longer if bicycles are being misidentified as vehicles.
A mix of vehicles and bicycles and you only want the data from the bicycles	Bicycle Only	

Appendix A. Specifications

- **Sensor Inputs:**
  - Four watertight piezo air switches (Road Tube)
  - 1-4096 millisecond programmable timeout value
  - On board sensor diagnostics
  - 5-120MPH normal operating range
  - Metal nozzles accept 1/4" Standard road tube and Mini Tube 3/16”
  - Four Open Collector inputs onboard

- **Outputs:**
  Four channel optically isolated outputs
  I/O expansion port for integrated designs

- **Lane Sensor Configurations:**
  Count:
  - Normal
  - Median (2 or 4 tube Normal)
  - Short/Long
  - Directional

  Class
  - 1 Lane Directional
  - 2 Lane Bi-Directional
  - 2 Lane Same Direction
  - 4 Lane Bi-Directional with Median

- **Display**
  128x64 graphic liquid crystal display with backlight. LED four channel detect indicators.

- **GPS**
  Onboard GPS for location storage, clock calibrations and data tampering security features.

- **Keypad**
  19 button membrane keypad

- **Firmware:**
  Flash upgradable firmware via USB communication port

- **Memory:**
  512MB flash (up to150 million timestamp records)

- **Files:**
  Unit stores up to 65,000 files in flash memory

- **Communications:**
  - USB A Host
  - USB B Peripheral
  - Bluetooth Serial Port
  - Bluetooth Low Energy

- **Timestamp Record Resolution**
  Sensor resolution is performed and stored at 30.5 Microseconds (0.0000305 sec)

- **Power:**
  - Main Battery: Lithium 3.6v
    - Battery Life: 5+ years
  - Secondary Battery: 8 D cell Alkaline 12v
    - Bluetooth Origin/Destination Data
    - Battery Life: 10 - 14 days of recording

- **Physical:**
  - Size – 4.29”H x 7.8”W x 9.44”L (10.9cm x 19.8cm x 24cm)
  - Weight - 3lbs (1.36 kg)
  - Case – Polypropylene molded case with lid and thumb latches. O-ring seal with sealed sensor inputs and carry handle. Crush and Impact resistant.

- **Environmental:**
  Watertight IP67
  Operating Range:
  - -40°F (-40°C) to 165°F (72°C)

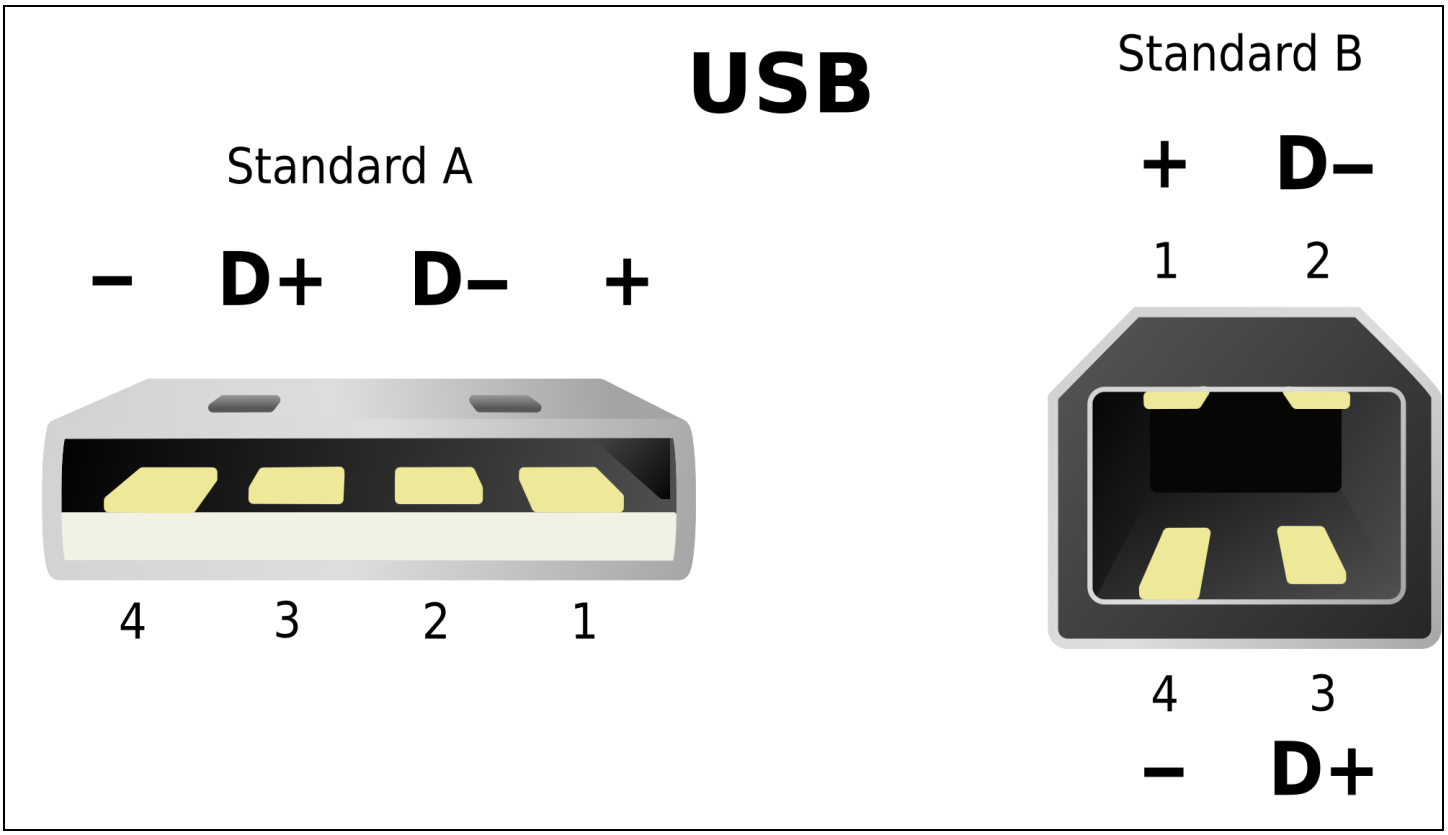
Diamond Traffic Products
P.O. Box 1455, 76433 Alder Oakridge, OR 97463
P: 541.782.3903 F: 541.782.2053
sales@diamondtraffic.com http://diamondtraffic.com

Appendix B. Data port pin outs

The Omega X3 uses 2 industry standard connections: USB A & USB B ports.

The type ‘A’ port can be used for connecting such devices as a Thumb drive. Note not all devices plugged into this port may operate.

The type ‘B’ port can be used for connecting the Omega X3 to a standard computer running the Windows operating system. Drivers will need to be installed prior to initial connection and are supplied during Centurion software installation. Typically, those drivers are found under the installation folder, specified during the installation dialog boxes, and within the USB sub-folder.



Appendix C. Menu Structure

There are two main menu layouts, those for when the unit is in standby mode and for when the unit is in record mode.

For standby mode, the main menu items are:

Start Recording

Settings
- Clock
- Display
- USB Reset
- Bluetooth
- Factory Reset
- About

Show Status
- System Status
- Files
- Data Study

Diagnostics
- Volume
- Sensor
- Vehicle

Files
- List
- Erase

Iris Modem (only available if the Omega X3 contains an Iris modem)
- Settings
- Enter Listen Mode
- Send Files to DDS
- Test Text Message
- Files (DDS)
- Re-initialize Modem