

# **Instruction Manual for Operating the Sensys System for Temporary Traffic Counts**

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**Abbreviations:**

AP: Access Point

FTP: File Transfer Protocol

RF: Radio Frequency

**Notations:**

Hyperlinks, or selectable buttons and tabs will be in bold italics (e.g. ***Hyperlink***).

Labels on web pages or in software will be in italics (e.g. *Labels*).

Data to be entered into a field on a web page or in software will be in Lucida Console font (e.g. 192. 168. 2. 99).

## 1. Introduction

This Instruction Manual provides information and the procedures for using the Sensys System, which was initially designed to operate in a server controlled network, for temporary traffic counts.

The instructions will allow the user to fully understand the Sensys Networks Vehicle Detection System, properly configure the Sensys access point (AP) for the traffic count site, and retrieve the traffic count data from the access point.

The instructions provided here are to accomplish the following tasks:

1. System Components and Requirements
2. Configuration of Field Laptop Computer
3. Configuration of the Sensors
4. Initial set up of Access Point
5. Backup and Restore of Access Point for multiple site application
6. Downloading Statistical Data & Exiting TrafficDOT Application

### *Notes:*

1. Some of the contents have been summarized from the Sensys Online Reference Manual. If more clarification will be needed, view the Sensys Online Reference Manual at [www.sensysnetworks.com](http://www.sensysnetworks.com) in the Dealer Login section or the Sensys Reference Guide in the Technical Docs section..
2. These instructions are applicable to the Windows XP operating system.

## **2. System Components and Requirements**

The implementation of the Sensys system for temporary traffic counts requires the following components for its basic operation:

➤ **Sensys Wireless Sensors**

These are pavement mounted magnetometers equipped with wireless radio transmitters to detect the presence and movement of vehicles.

➤ **Sensys Access Point**

This is an intelligent device that establishes overall time synchronization of the system, transmits configuration commands and message acknowledgements and receives and processes data from the sensors. For the statistics –processing purpose of this project, the version of access point to be used should be AP240 including the upgraded S version such as the AP240US or AP240ES. Any other S-version could be used as well.

➤ **TrafficDOT Software**

This is monitoring application software from Sensys network that provides graphical user interface (GUI) to the components of Sensys Traffic count system. (Installation will be explained in Section 2).

➤ **Laptop Computer with an Ethernet port.**

The instructions on this manual are based on Windows XP Operating System. The Mac, Unix, Linux or other Windows can also be used based on a different instruction set. Minimum requirements are: 40GB HDD, 1.8GHz CPU, 1024MB Memory, and the Mozilla Firefox web browser.

➤ **Ethernet Cable**

Use a Cat 5 or a better Ethernet cable that is at least 1.5m long terminated with male RJ 45 connectors on both ends.

### 3. Configuration of the Field Laptop Computer

The laptop computer used to communicate with the Sensys access point must meet the following requirements:

1. Laptop must be configured to a fixed IP address.
2. Laptop must have TrafficDOT application software installed

#### 3.1 Configuring the Laptop to a Fixed IP Address

The IP Address is found under *Network Connections*.

- On the laptop computer click on *Start* menu → *My Network Places* and then click on the link *View Network Connections* which is on the left side of *My Network Places* window.

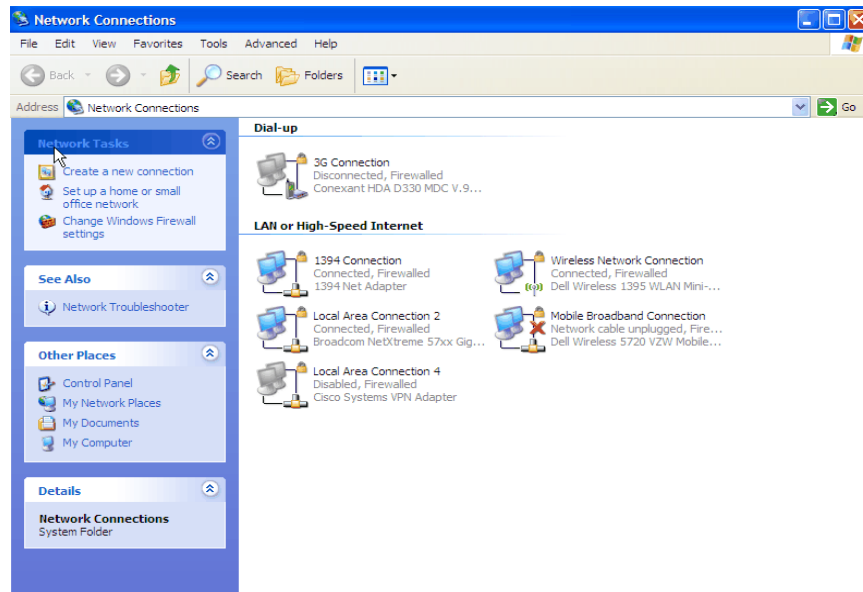


Figure 3.1: Network Connection Window

- Right click on the desired Local Area Connection (LAN) and select *Properties* (see Figure 3.1).

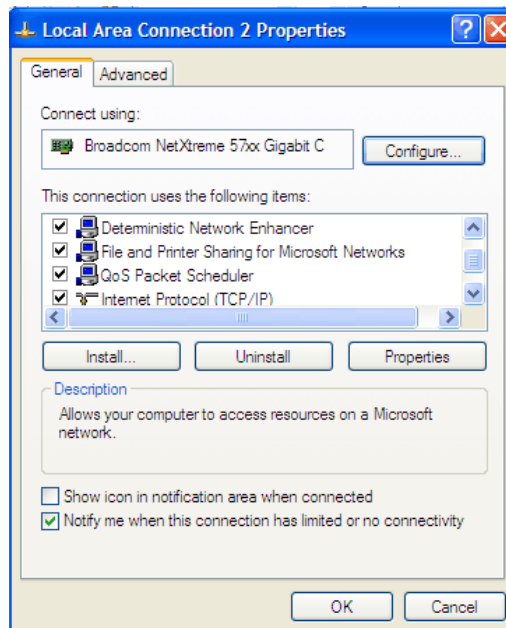


Figure 3.2: Local Area Connection Properties Window

- Double Click on **Internet Protocol (TCP/IP)** (see Figure 3.2).

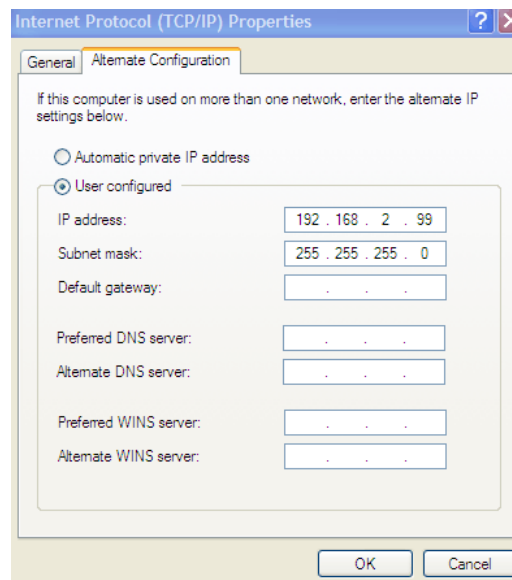


Figure 3.3: Internet Protocol Properties Window

- If the **Alternate Configuration** (see Figure 3.3) tab is available, select **User Configured**, and fill out the **IP Address** and the **Subnet mask** as shown. Click **Ok**.

This will enable you to connect up at any time without needing to reconfigure the IP port in the future.

- If the **Alternate Configuration** is not available, then you will need to change the **IP address** as shown Figure 3.4. Note the original settings prior to making any changes.

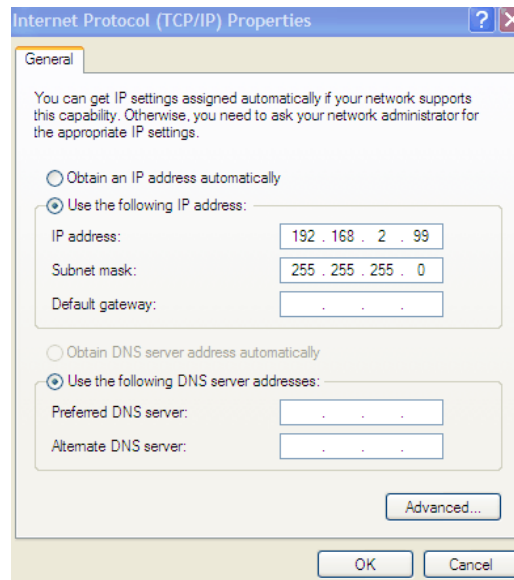


Figure 3.4: Internet Protocol Properties/General Window

You will need to perform this step (and reverse it back after completing use of TrafficDOT) every time you use the laptop with the system.

### 3.2 Installation Procedure for TrafficDOT Application Software

- Put the TrafficDOT software media (CD) for windows version in the CD drive of the laptop.

Note: The Software can also be downloaded from the Dealer's page on Sensys website.

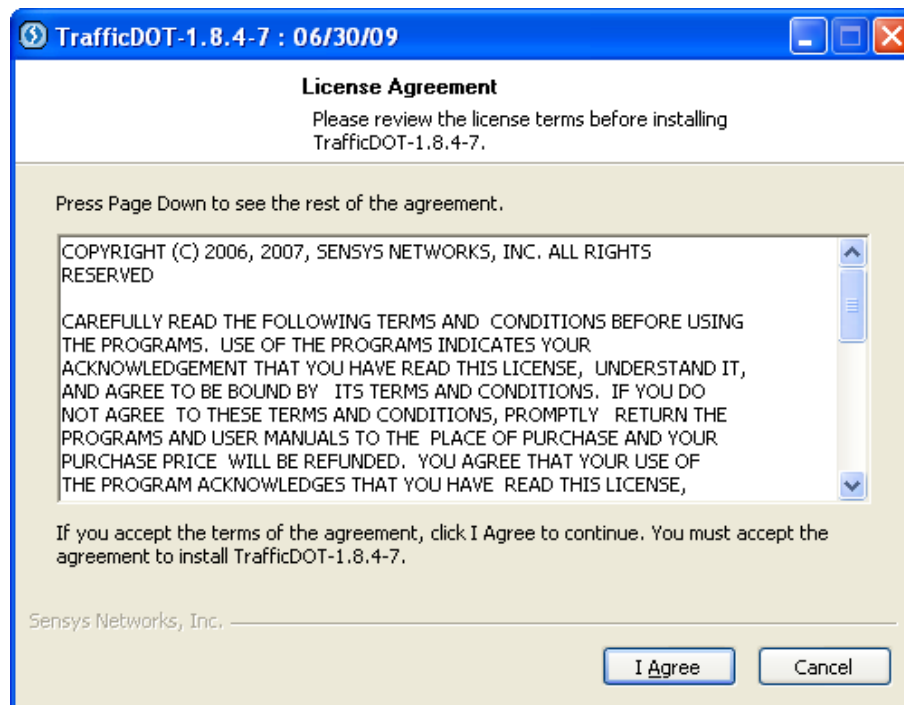


Figure 3.5: Installation License Agreement



- Continue by clicking on the **I Agree** button (see Figure 3.5).
- Install all components of TrafficDOT by checking all the boxes in the *Choose Components* screen (see Figure 3.6).

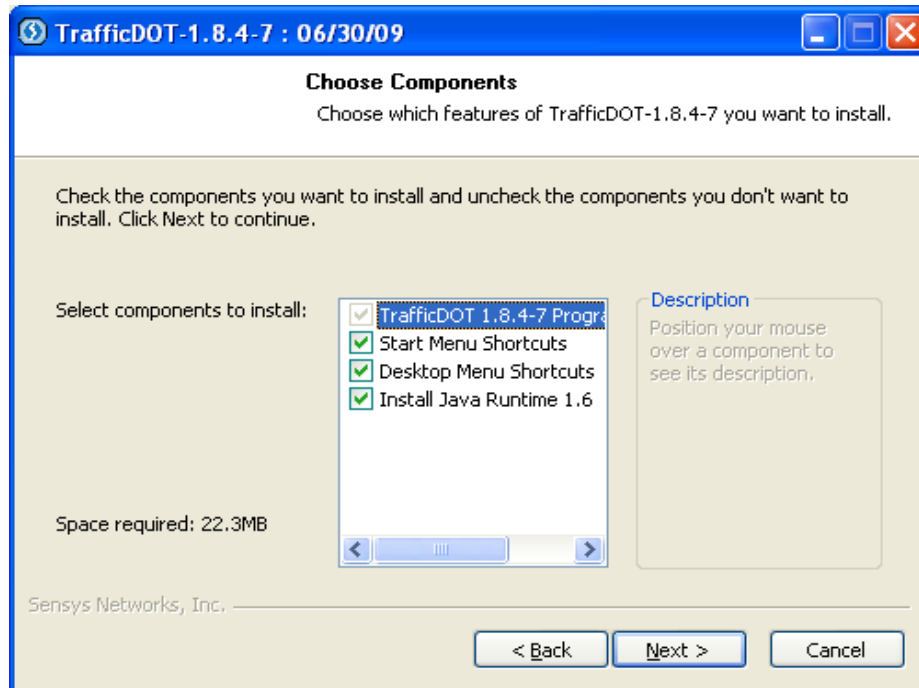


Figure 3.6: Choose Installable Components Windows

- Click the **Next** button.
- If desired, change the *Destination Folder* for the software on the *Choose Install Location* window (see Figure 3.7).

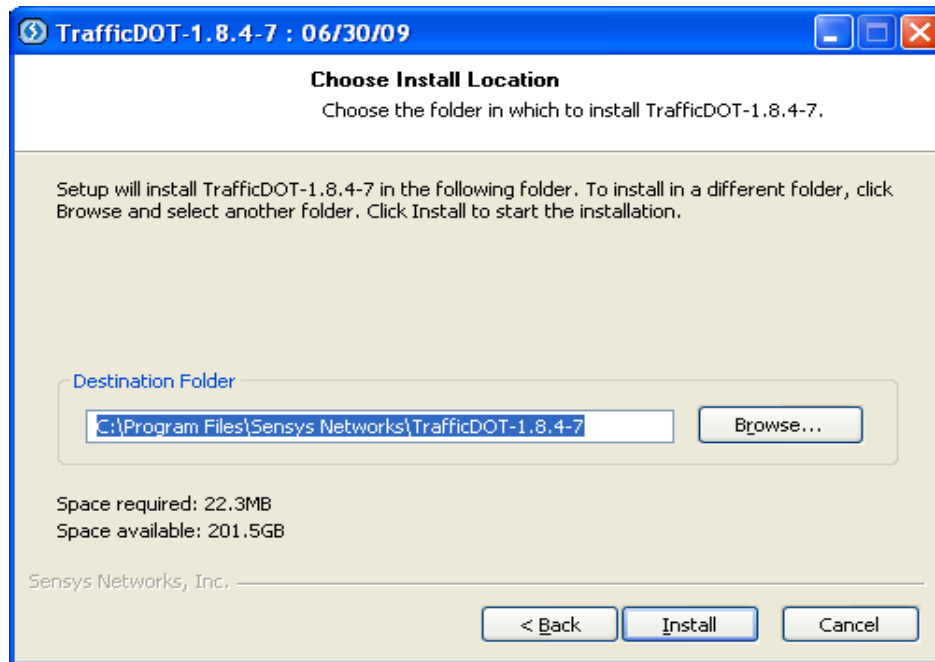


Figure 3.7: Choose Install Location Window

- Click the **Install** button to begin the installation.
- The progress of the installation will be reported on the *Installing* window (see Figure 3.8).

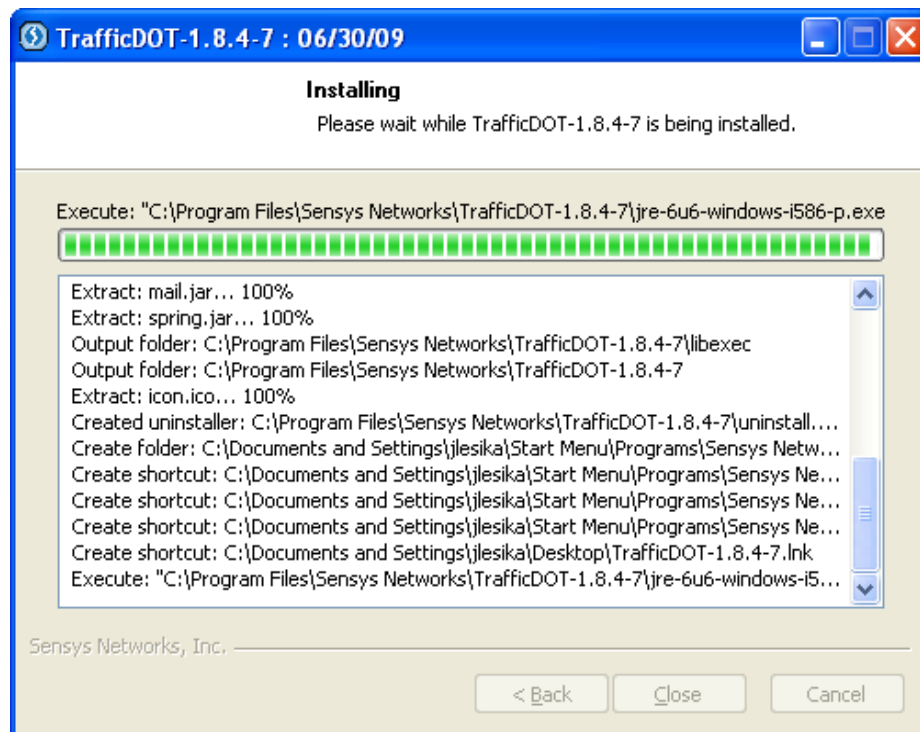


Figure 3.8: Installation Status Window

Note: If the Java Runtime Environment is required, a separate installation process occurs. Accept the Terms and Conditions to continue. Wait for the installation to complete. Click on the **Finish** button.

- The results of the installation will appear on the installation window (see Figure 3.9).

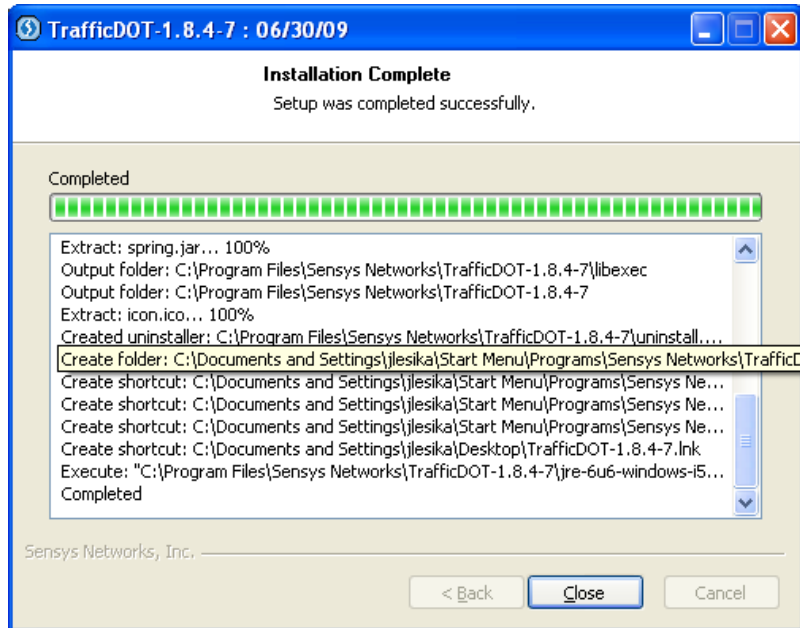


Figure 3.9: Installation Completion Window

- Complete the TrafficDOT software setup wizard by clicking on the **Close** button.

## 4. Configuring the Sensors Using the TrafficDOT Application Software

Sensors ship with a factory default configuration for count applications. In most cases, the configuration is modified to fit the specific needs of an installation. However, once set, a sensor's configuration typically requires no further changes.

Sensor configuration involves selecting values for the following parameters:

- Operating mode
- Radio Frequency Channel

From the main TrafficDOT window, select the **Configure** menu and click **Sensors** (see Figure 4.1).

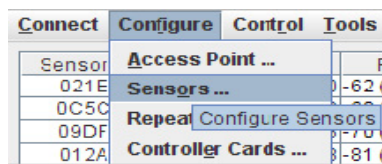


Figure 4.1: Configure Sensors Window

The *Sensor Configuration* window appears (see Figure 4.2).

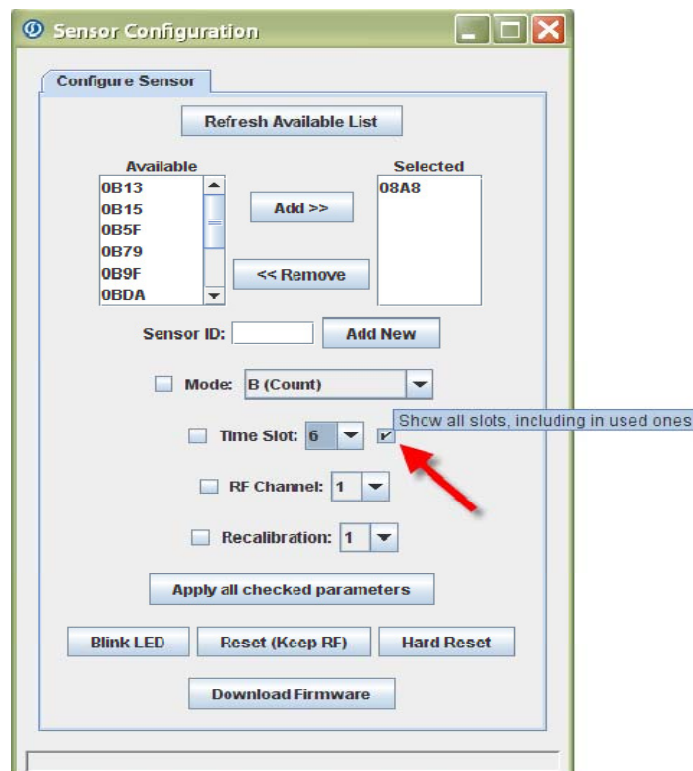


Figure 4.2: Sensor Configuration Window

Click **Refresh Available List** button and all the available sensors will be displayed.

## 4.1 Selecting Sensors to Configure

Sensors are selected by moving their IDs from the *Available* list to the *Selected* list as follows:

From the *Available* list, click one or more sensor IDs. (Note: On Windows platforms hold down the SHIFT key while clicking to select multiple entries in series.)

- Click the button labeled **Add >>**. The sensor ID(s) appear in the *Selected* list.

To remove IDs from the *Selected* list, do the following:

- From the *Selected* list, click one or more sensor IDs.
- Click << **Remove**. The sensor IDs are removed from the *Selected* list and appear in the *Available* list.

## 4.2 Setting a Sensor's Operating Mode

The sensor's operating mode defines the type of detection data it transmits. To set the operating mode, do the following after selecting the sensors to be configured:

- Fill the check box to the left of the label *Mode* by clicking it.  
(The entries on the *Mode* drop-down list are the operating modes available for sensors.)
- Select an entry from the list by clicking it.  
(Select *Count (B)*, for the statistical count application).

## 4.3 Setting a Sensor's RF Channel

All sensors associated with an Access Point must use the same frequency as the Access Point. To set the RF channel, do the following:

- Fill the check-box to the left of the label *RF Channel* by clicking it.
- The entries in the *RF Channel* drop-down list correspond to the 16 frequencies available for use. Select an entry from the list by clicking it. Note: The factory default channel is zero.
- Click **Apply all checked parameters**.

## 4.4 Managing Sensor Tables and Lane Names

Access Points store information describing sensor locations and relative positions in two databases. The databases are:

- Sensor Table – also referred to as the “dots” configuration table. This database stores an entry for each sensor in the network including its lane position.
- Sensor-Pair Table – also referred to as the “dot pairs” configuration table. This database includes one entry for each sensor-to-sensor relationship forming a speed pair (pair of sensors used to measure vehicle speed).

#### 4.4.1 Adding a Dot (Sensor Table) Configuration Entry

To add a new entry, do the following:

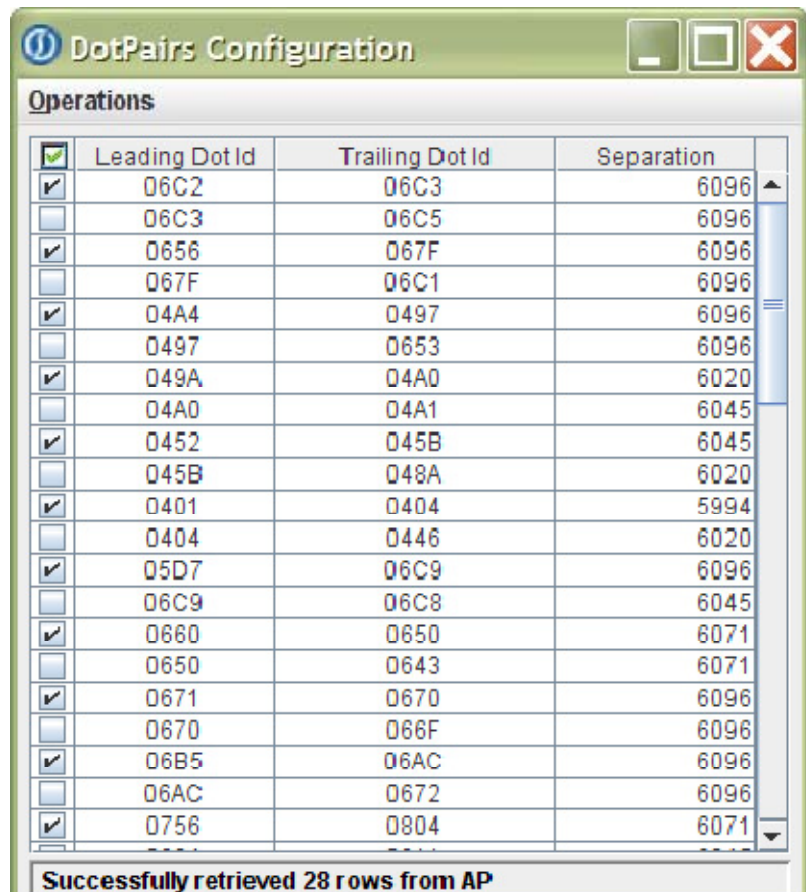
From the **Configure** menu, navigate to **Sensors** and then click on the **Dot Table** in order to display the table (see Figure 4.3).

- Position the cursor in the *DotId16* column on a blank row. Type the 4-character HEX Id (hexadecimal identification number) of the sensor.
- If the sensor is used with a traffic controller, supply the card address in the column *Address 170*. If the sensor is not used with a signal controller, type a zero into the field.
- Type into the *Lane* field a short text description of the lane in which the sensor resides.
- Type into the *Position* field an integer between 0 and 2 that indicates the sensor's relative position in the lane.

Note: Positions are determined by counting up from zero in the direction of the traffic's travel. That is, a vehicle will first drive over sensor zero, then sensor one and then sensor two. There is a maximum of three sensors per lane. The sensor in position zero must be defined before the sensor in position one, and position one must be defined before position two.

- The check box at the left edge of the row designates the sensor as being included (or ignored) by statistical or other applications. The check box is filled by default which indicates the sensor will be included hence do not uncheck.)
- Click **Apply** from the *Operations* menu to add the entry.





<input checked="" type="checkbox"/>	Leading Dot Id	Trailing Dot Id	Separation
<input checked="" type="checkbox"/>	06C2	06C3	6096
<input type="checkbox"/>	06C3	06C5	6096
<input checked="" type="checkbox"/>	0656	067F	6096
<input type="checkbox"/>	067F	06C1	6096
<input checked="" type="checkbox"/>	04A4	0497	6096
<input type="checkbox"/>	0497	0653	6096
<input checked="" type="checkbox"/>	049A	04A0	6020
<input type="checkbox"/>	04A0	04A1	6045
<input checked="" type="checkbox"/>	0452	045B	6045
<input type="checkbox"/>	045B	048A	6020
<input checked="" type="checkbox"/>	0401	0404	5994
<input type="checkbox"/>	0404	0446	6020
<input checked="" type="checkbox"/>	05D7	06C9	6096
<input type="checkbox"/>	06C9	06C8	6045
<input checked="" type="checkbox"/>	0660	0650	6071
<input type="checkbox"/>	0650	0643	6071
<input checked="" type="checkbox"/>	0671	0670	6096
<input type="checkbox"/>	0670	066F	6096
<input checked="" type="checkbox"/>	06B5	06AC	6096
<input type="checkbox"/>	06AC	0672	6096
<input checked="" type="checkbox"/>	0756	0804	6071

**Successfully retrieved 28 rows from AP**

Figure 4.4 - DotPairs Configuration Window

- Click *Apply* from the *Operations* menu to add the entry.



## 5. Initial Set up of the Access Point

The Access Point has to be correctly configured so as to be able to perform the statistics count application.

### 5.1. Connecting the Laptop to the Access Box

Before you can set up/configure an Access Point, a connection between the laptop computer and the access point (AP) must be established.

- Turn on the laptop.
- Plug one end of the Ethernet cable to the Ethernet -port of the laptop and the other end to the Ethernet port of Access Box (See Figure 5.1).

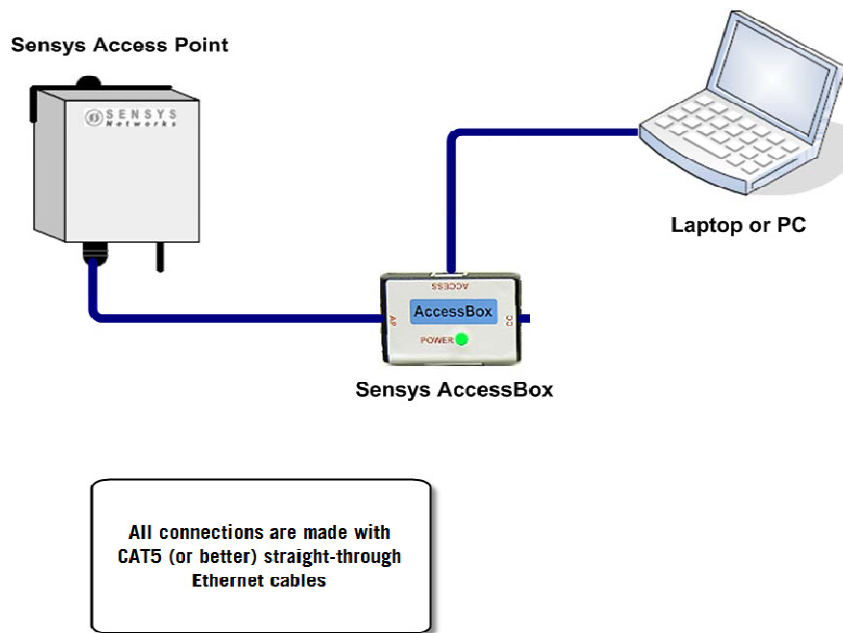


Figure 5.1: Connecting an IP Device (Laptop) to a Sensys Access Box

### 5.2. Connecting to the Access Point via TrafficDOT Application

- Double-click on the TrafficDOT icon on the desktop (shortcut).
- Type the access point's *IP Address* and *TCP Port* (See Figure 5.2).
  - Default IP address: 192. 168. 2. 100
  - Default TCP port: 10000

Note: It is recommended to use the default IP address and port number.

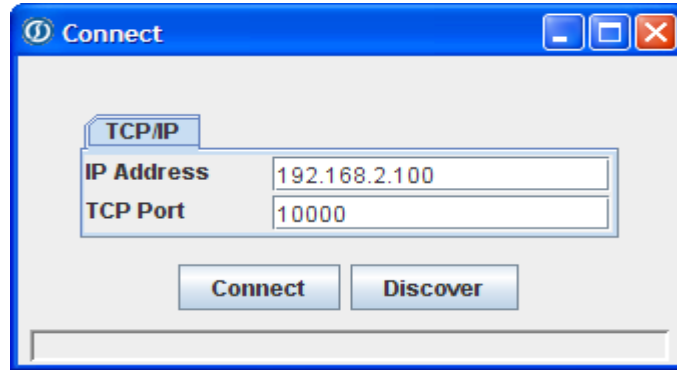


Figure 5.2: TrafficDOT Application Connection Window

- Click the **Connect** button.

Note: If the IP address of the access point is not known, click on **Discover** button. The **Discover** button queries the local network and opens a window that lists All the Access points on the network. Make a note of the IP address of the access point you wish to connect to. Click on **Dismiss** button to close the window and return to connect window.

### 5.3 Configuring the Access Point

- To configure an Access Point, access the **Configure** menu and click **Access Point** (See Figure 5.3).

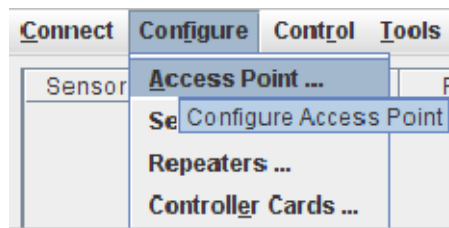


Figure 5.3: Configure Access Point Menu

The *Access Point Configuration* window appears with the current configuration data loaded into its tabular display (See Figure 5.4).

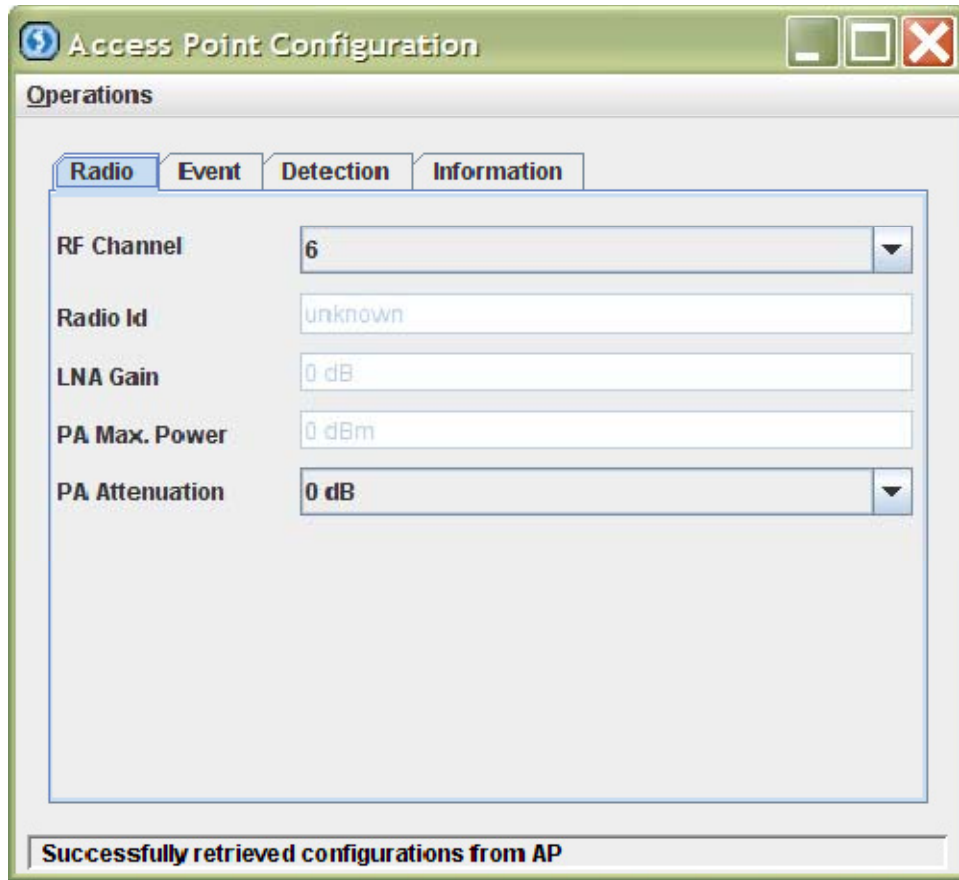


Figure 5.4: Access Point Configuration Window

### 5.3.1 Setting the RF Channel

To set the RF channel, do the following:

- The entries in the *RF Channel* drop-down list correspond to the 16 frequencies available for use. Select an entry from the list by clicking it. Note that the factory default channel is zero. The value set on this section should correspond to the value set on the sensors' configuration in Section 3.
- Click **Apply** from the *Operations* menu to apply the change or continue configuring the Access Point.

### 5.3.2 Setting User ID and Password for FTP Services Hosted by the Access Point

Access points contain a local ftp server to provide a means of file transfer and disk access to authorized users. The *Access Point* tab collects the user identifier and password string for the ftp user.

- From the *Configure* menu, click **Preference** (See Figure 5.5).

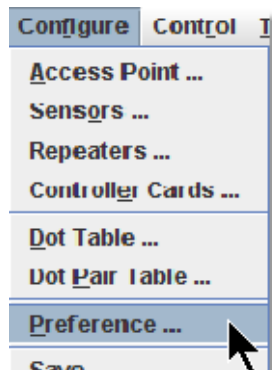


Figure 5.5: TrafficDOT Configure / Preference Menu

- Click on the **Access Point** tab (See Figure 5.6).

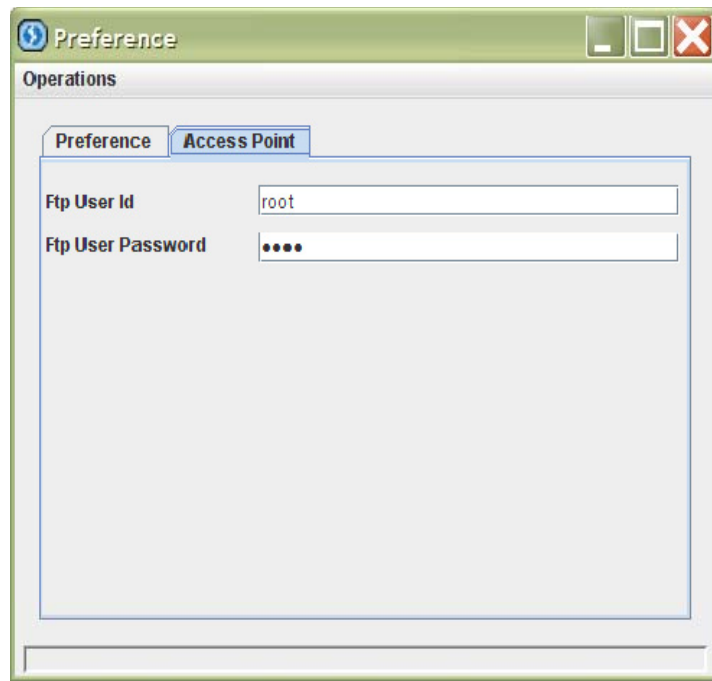


Figure 5.6: User ID and Password

- Set the desired *User ID* and *Password*.
- Go to *Operations* then click **Save**.

### 5.3.3 Setting Up the Configuration for Bin Data Collection

After all the connections and set ups for the sensors have been completed, the configurations for bin data collection can then be performed. From the main window of TrafficDOT go to the **System** -> **Configuration** menu and perform the following:

- Go to the **Push** tab (see Figure 5.7).  
Push refers to movement of processed sensor statistical data from one host to another initiated by an access point.
- Enter the *1st Destination IP*. Enter the fixed IP address of the laptop as configured in Section 3 “Configuration of the Field Laptop Computer.” The IP address used was 192. 168. 2. 99.
- Specify the *Destination Port (required)* (typically 10250 however any other port above 10000 can be used).

The screenshot shows the 'System Configuration' window with the 'Push' tab selected. The window has a blue title bar and standard Windows window controls. Below the title bar is a tabbed interface with 'Caltrans D4 Poll', 'Marksman Poll', 'Advanced', and 'Others'. The 'Advanced' tab is active, and within it, the 'Push' sub-tab is selected. The configuration fields are as follows:

Field	Value
1st Destination Server (required)	192.168.2.99
Destination Port (required)	10250
Buffer Reports	<input checked="" type="checkbox"/>
Stay Connected	<input checked="" type="checkbox"/>
Use Acknowledged Message Passing	<input checked="" type="checkbox"/>
1st Acknowledgement Timeout (s)	
2nd Destination Server	
Destination Port	
Buffer Reports	<input checked="" type="checkbox"/>
Stay Connected	<input checked="" type="checkbox"/>
Use Acknowledged Message Passing	<input checked="" type="checkbox"/>
2nd Acknowledgement Timeout (s)	
Units	Imperial
Individual Car Reports	Disabled
Report Interval	15 minutes
Maximum File Size	100000
Average Speed	<input type="checkbox"/>

Figure 5.7: System Configuration Window

- Verify that the following options are checked:
  - *Buffer Reports*
  - *Stay Connected*
  - *Use Acknowledged Message Passing*
- The following entries should be left blank:
  - *1<sup>st</sup> Acknowledgement Timeout (s)*
  - *2<sup>nd</sup> Destination Server*
  - *Destination Port*
  - *2<sup>nd</sup> Acknowledgement Timeout (s)*
- Uncheck *Average Speed*.
- Set the *Units* to *Imperial*.
- Verify that the *Individual Car Reports* entry is set to *Disabled*.
- Set the *Report Interval* for bin collection to *15 minutes*.
- Set the *Maximum file size* to 300kB by entering 300000.  
Note: Maximum file can be set up to 500kB. File size is determined by the number of lanes and the length of time to be recorded.
- While still on the *System Configuration* window, click on the ***Poll*** Tab (see Figure 5.8).
- Set the *TCP Port (required)* to 1050.
- Set the *Operating Mode* as *Connection-based Polls* using the dropdown menu.
- Set the *Units* to *Imperial*
- Set the *Report Interval* to *15 minutes*.
- Set the *Individual Car Reports*, the *Speed Histogram*, and the *Length Histogram* to *Disable*.
- Set the *Timestamp Option* to *End of Interval*.
- Set the *Maximum file size* to 300kB by entering 300000.  
Note: Maximum file can be set up to 500kB. File size is determined by the number of lanes and the length of time to be recorded.
- Verify that the following are unchecked:
  - *Average Speed*
  - *Use Diagnostic to correct Averages*
  - *Display Diagnostics*

**System Configuration**

**Operations**

Caltrans D4 Poll    Marksmen Poll    Advanced    Others

Network    VPN    Push    **Poll**    Caltrans D3 Poll

**Note: Valid AP-E License required**

**Sensys Poll Server:**

TCP Port (required)    10250

Operating Mode    Connection-based Polls

Units    Imperial

Individual Car Reports    Disabled

Report Interval    15 minutes

Maximum File Size    100000

Average Speed    ☐

Speed Histogram    Disable

Length Histogram    Disable

Timestamp Option    End of Interval

Use Diagnostic to Correct Averages    ☐

Display Diagnostics    ☐

Figure 5.8: System Configuration Window

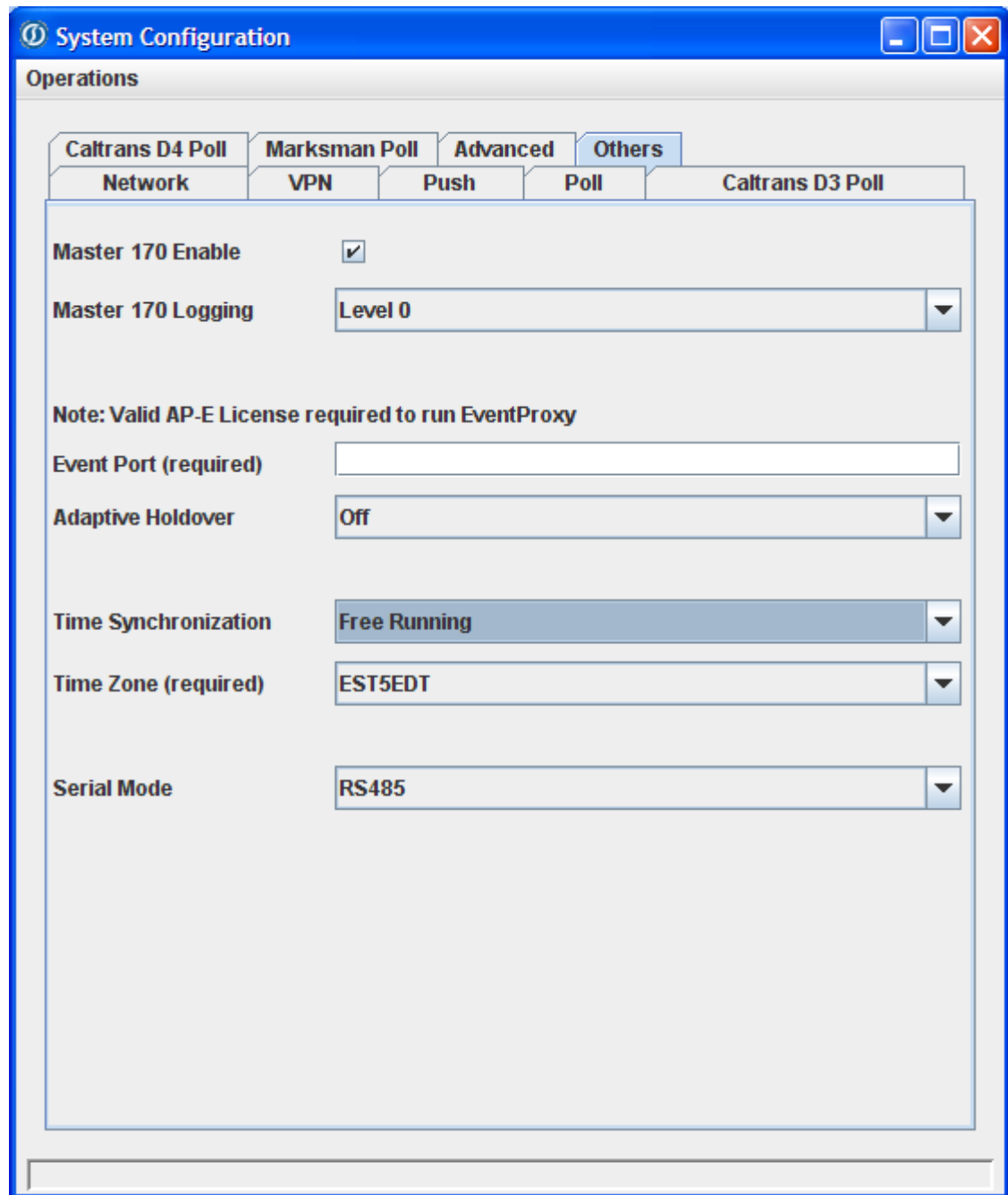
### 5.3.4 Setting the Date via TrafficDOT

Click on the **Others** tab (see Figure 5.9) and do the following:

- Specify *Free running* in the *Time Synchronization* drop down menu.
- Set the correct time zone.

- Set *Serial Mode* to RS485.

Note: RS485 sets the port for communications with traffic signal control equipment via a contact closure card from Sensys Networks. This setting is mandatory for using the access point with signal controllers.



The image shows a screenshot of the 'System Configuration' window, specifically the 'Others' tab. The window has a blue title bar with the text 'System Configuration' and standard window controls. Below the title bar is a tabbed interface with the following tabs: 'Caltrans D4 Poll', 'Marksman Poll', 'Advanced', 'Others' (selected), 'Network', 'VPN', 'Push', 'Poll', and 'Caltrans D3 Poll'. The 'Others' tab contains several configuration options:

- Master 170 Enable:** A checkbox that is checked.
- Master 170 Logging:** A dropdown menu set to 'Level 0'.
- Note:** A text note stating 'Valid AP-E License required to run EventProxy'.
- Event Port (required):** An empty text input field.
- Adaptive Holdover:** A dropdown menu set to 'Off'.
- Time Synchronization:** A dropdown menu set to 'Free Running'.
- Time Zone (required):** A dropdown menu set to 'EST5EDT'.
- Serial Mode:** A dropdown menu set to 'RS485'.

Figure 5.9: System Configuration Window->Others



### 5.3.5 Saving the Configurations

- Click on *Operations*.
- Click on *Save*.
- Click on *Dismiss* when finished saving (see Figure 5.10).

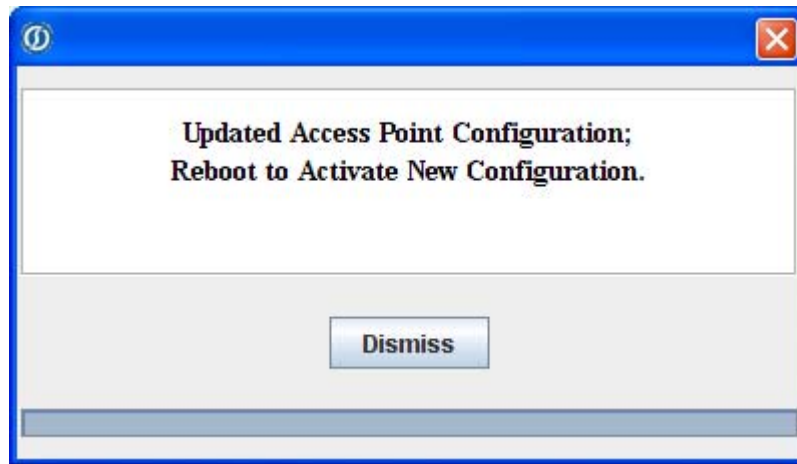


Figure 5.10: Successfully Saved Configuration Window

### 5.3.6 Rebooting the Access Point.

After all the configurations have been made to the access point, it has to be rebooted so as the changes to take effect. This is very important and it is done via TrafficDOT's *Control* menu (see Figure 5.11).

- Click on *Control* from main window and then select *Reboot*.

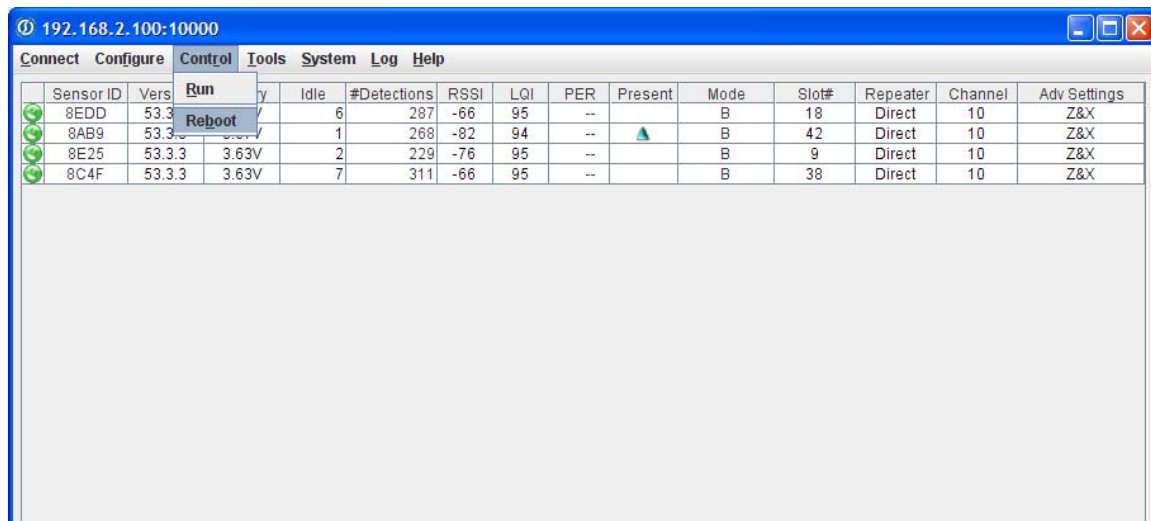


Figure 5.11: System Control Window

### 5.3.7 Setting Date and Time via Telnet

- Reconnect the access point via TrafficDOT Application.
- Click on windows **Start** button and then click **Run**.
- Type tel net 192. 168. 2. 100 into the *Open* dialog box (see Figure 5.12) and then click **OK**. This should open a new DOS window with prompt to log in (see Figure 5.13).

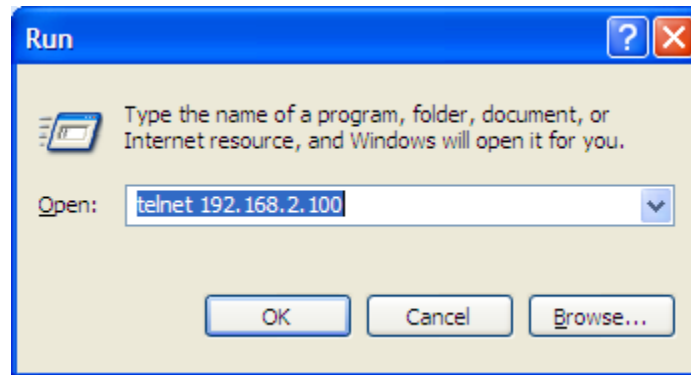


Figure 5.12: Performing a Telnet Connection in the Run Window

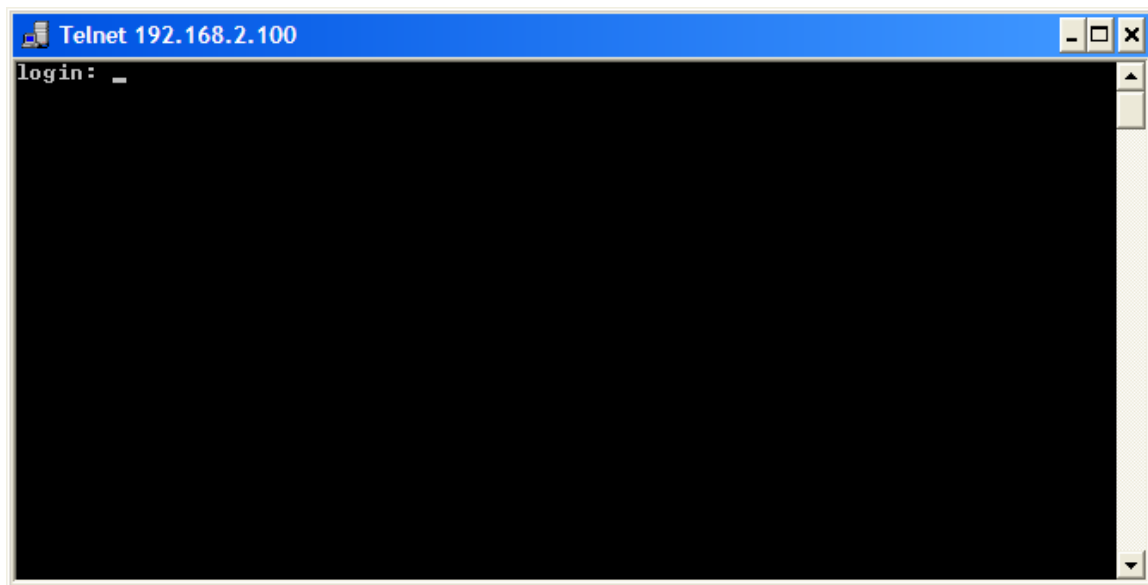


Figure 5.13: Telnet Login Window 1

- Type the username (default login username is root) and then press ENTER on the keyboard.
- Type the correct password (see Figure 5.14).

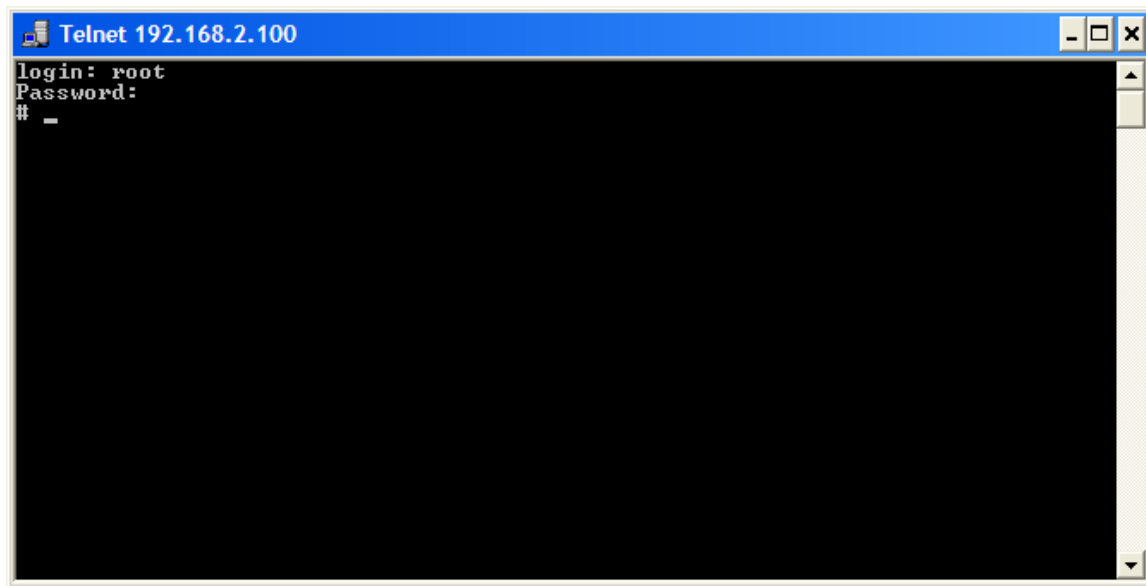


Figure 5.14: Telnet Login Window 2

- To set the date and time type “date-s YYYY.MM.DD-HH.MM” substituting YYYY, MM, DD, HH and MM with the correct year, month, day, hour (24 hour clock) and minute, respectively. The time entered should be in Greenwich Mean Time (GMT). For example, to set the date and time to October 13, 2009 at 3:15PM EDT (Eastern Daylight Savings Time), type date-s 2009. 10. 13-19: 15 at the prompt (see Figure 5.15).

To adjust eastern time zone to GMT use the following:

1. For EST, add 5 hours (1 PM EST is 18:00)
2. For EDT, add 4 hours (1 PM EDT is 17:00)

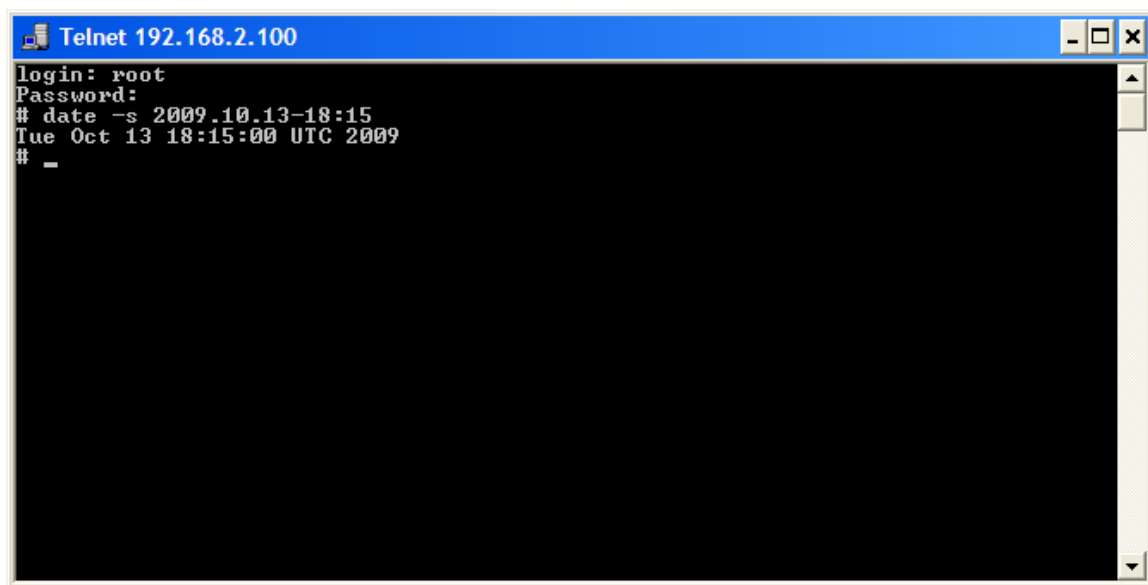


Figure 5.15: Telnet Window for Date and Time Set Up

## 6. Backing Up and Restoring the Access Point for Multiple Sites

This section is very important as it will enable the user to be able to store (back-up) a site configuration to use the access point at another site. When returning to the original site, the user can restore the configuration of the original site without having to repeat the lengthy setup. This can be extended to storing the configurations for multiple temporary traffic count sites by using a naming convention that allows the user to identify the back-up files from each traffic count site.

### 6.1 Backup of the Access Point Configuration

Backup activities are initiated from the *System* menu. Once the settings for a certain location have been backed up, they can be retrieved next time when collecting data from that particular backed up site. *Note:* Always perform back up for every first time site visit. To backup the current access point configuration, do the following:

- Go to the TrafficDOT main window and select *System* -> *Backup* (see Figure 6.1).

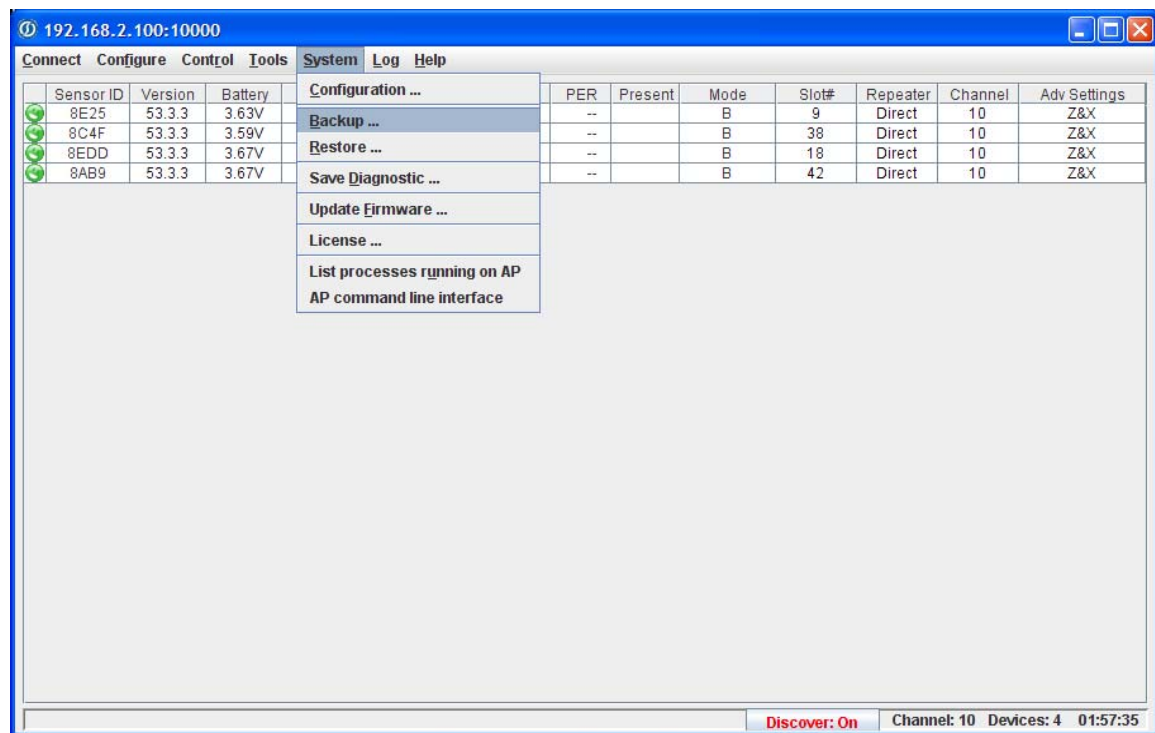


Figure 6.1: TrafficDOT's System Menu

The *Backup VDS240* window will appear (see Figure 6.2).

- Name the file by typing the site name on the *File Name* text box. A good choice of file name should identify the data collection site such as *AP\_site\_3041*. Optionally, store the file to a different folder than the default.
- Click *Save* to backup the access point configuration to the file.

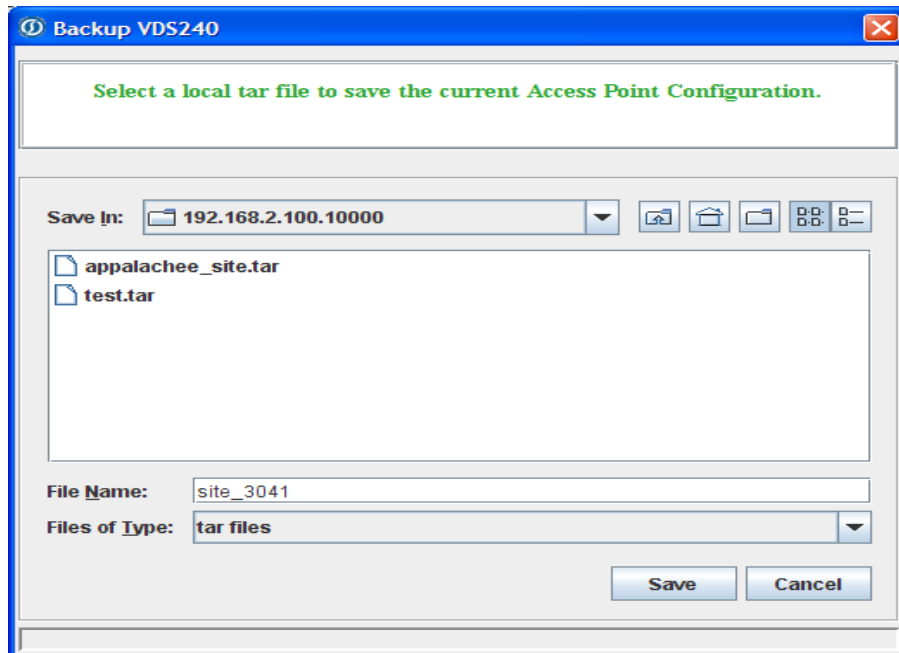


Figure 6.2: Back-up VDS window

- Wait for back up to complete and click *Dismiss* (see Figure 6.3).

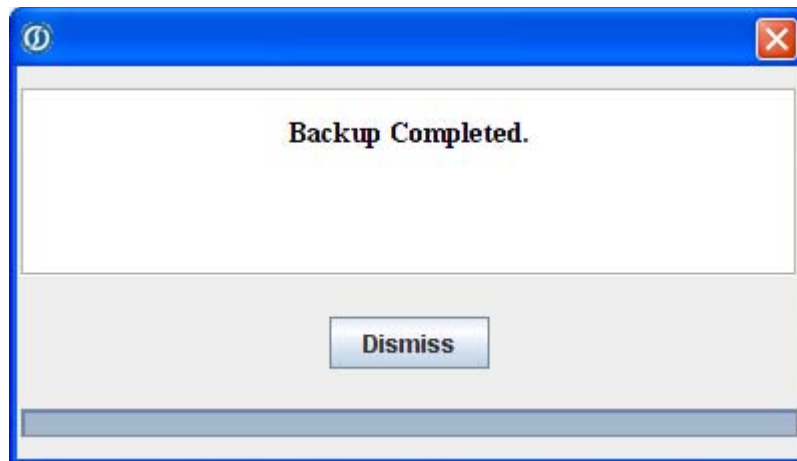


Figure 6.3: Back-up Completion Window

Note: The same procedure will be followed when backing up the configurations for all other temporary traffic count sites. Using unique filenames including the site number will simplify identifying the correct file to restore when the access point is again used at each site.

## 6.2 Restoring the Configurations

The restore function in TrafficDOT can be used to quickly restore an access point to a site configuration that has been saved using the backup function. To restore a previously saved site configuration, connect to the access point using TrafficDOT and perform the following steps:

- Click **Restore** from the **System** menu. The *Restore VDS240* window appears (see Figure 6.4).

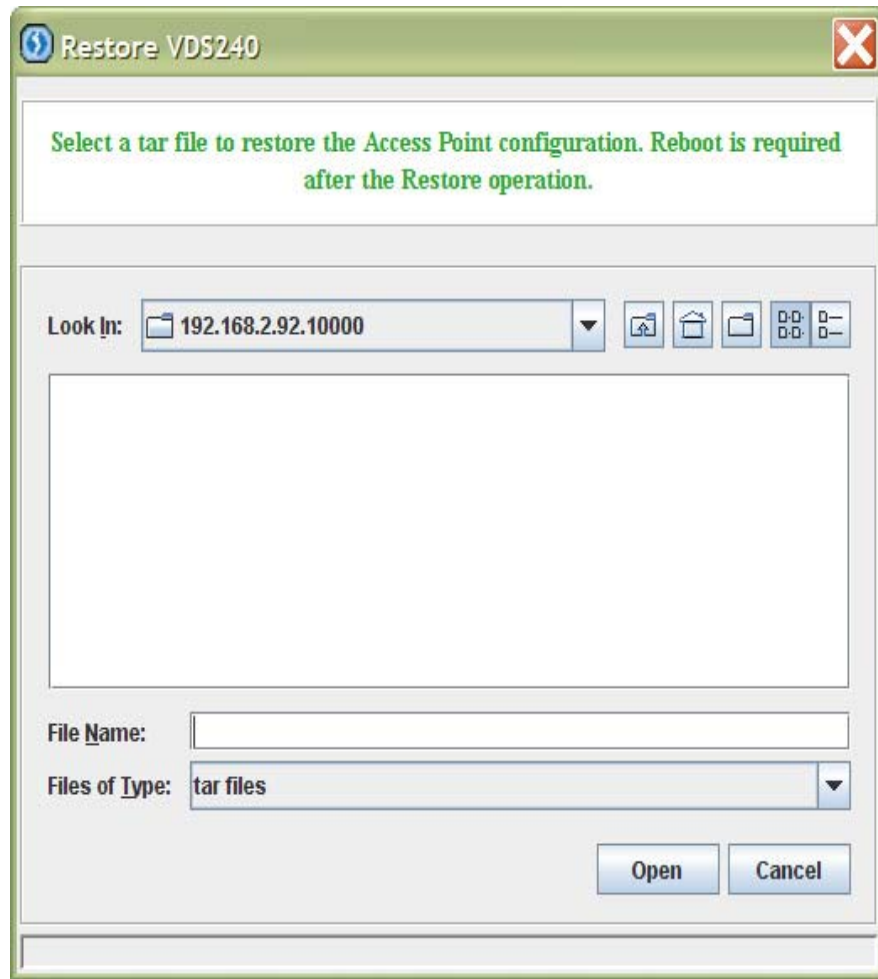


Figure 6.4: Restore VDS240 Window

- Select the file that contains the backup that will serve as the source for the restore. Optionally, navigate to a different folder than the default.
- Click **Open** to restore the Access Point from the file.
- Reboot the access point by clicking on **Control** from main window and then selecting **Reboot**.

## 7. Downloading Statistical Data and Exiting TrafficDOT

The Statistical data collected by the access point can be downloaded for the analysis via the web browser using ftp connection between the laptop computer and the Access point.

### 7.1 Downloading Data

- Go to your Web browser (Recommended: Mozilla Firefox web browser).

*Note:* Microsoft Internet explorer could also be used. Prior to using the Microsoft Internet Explorer for downloading the data, perform the following:

- Open Internet Explorer. Select **Tools > Internet Options** from the menu bar (see Figure 7.1).

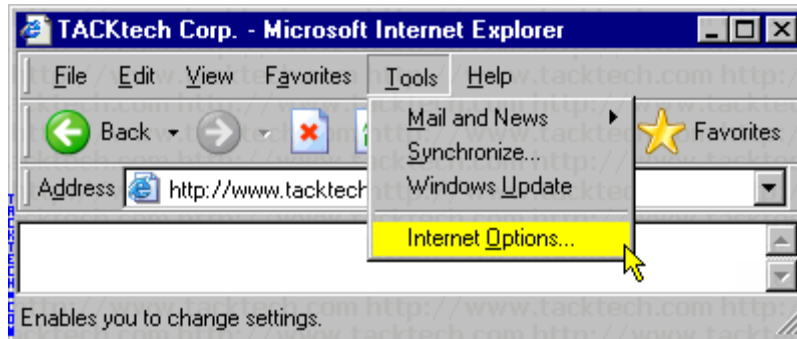


Figure 7.1: Internet Options

- Click on the **Advanced** tab. Uncheck the *Enable folder view for FTP sites* option. Click the **OK** button (see Figure 7.2).
- Close Internet Explorer.
- Re-open Internet Explorer to apply the changes.

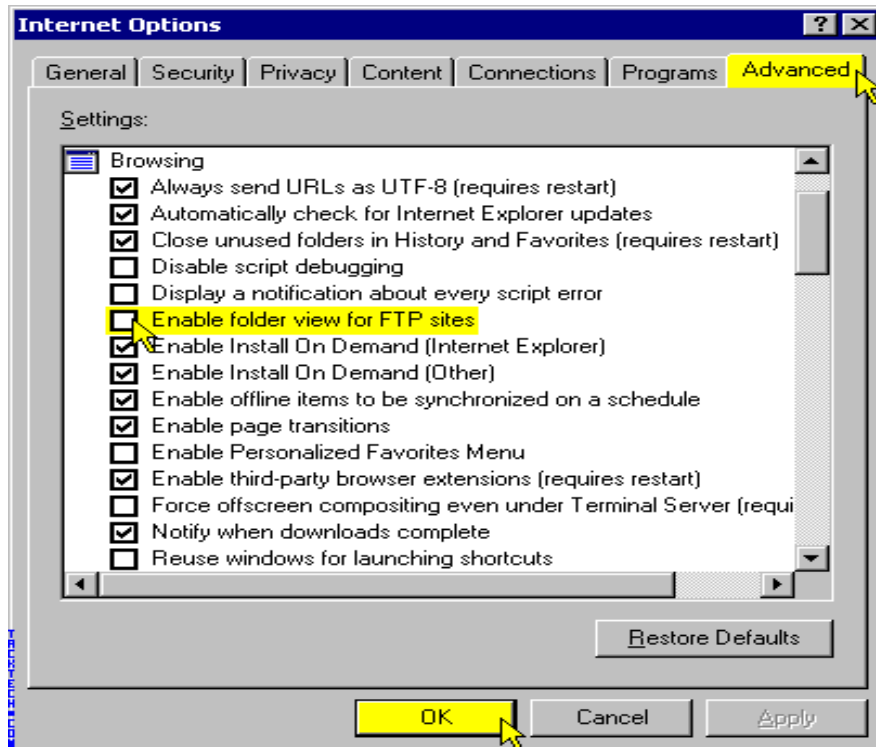


Figure 7.2: *Enable folder view for FTP Sites* option.

- On the web browser address bar, type “ftp://<username>@<ip address>” substituting <username> with the username configured for the access point and <ip address> with the configured IP address of the access point. For example, if the default IP address and username were configured in the access point then type “ftp://root@192.168.2.100” into the address bar.
- A pop up window asking for password should appear (see Figure 7.3).

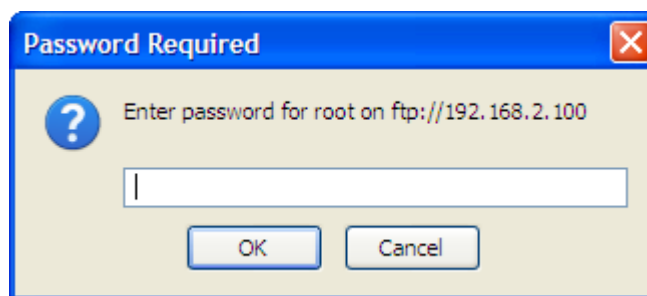


Figure 7.3: Password Request Pop up Window

- Type the correct password and click **OK**. A list of folders will be displayed (see Figure 7.4).
- Navigate to *var/apstat\_poll\_tcp*. A list of files will be available labeled using date format, double click a file to open.
- Select all the text in the file by pressing Ctrl+A on the keyboard, and then copy the text by pressing Ctrl+C on the keyboard.



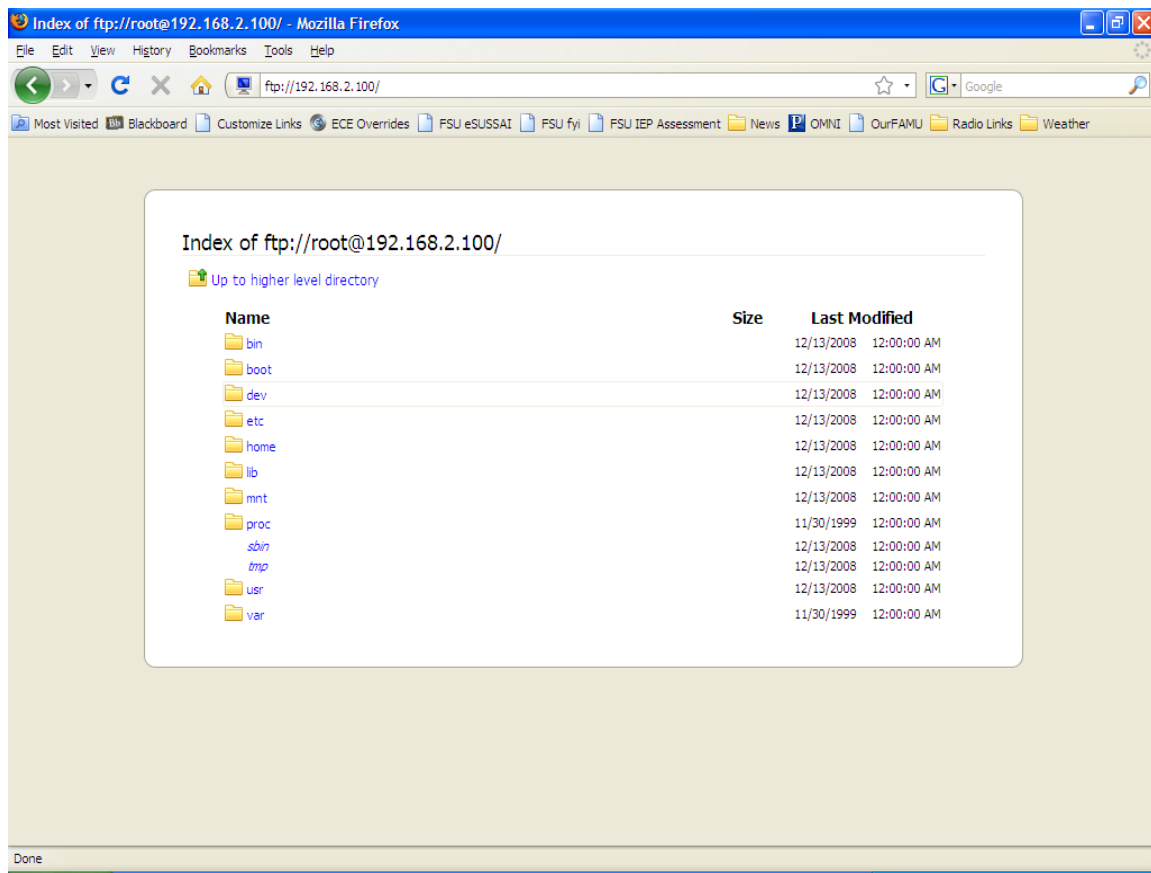


Figure 7.4: Available Folders List Window

- Open a new file using notepad or Microsoft Word
- Paste the text into the file by pressing Ctrl+V on the keyboard.
- Save the file and close it.

*Note:* The files should be saved one after the other according to the dates they were created.

## 7.2 Exiting TrafficDOT

To end TrafficDOT session, do the following:

- From the **Connect** menu on the TrafficDOT main window, click **Disconnect**.
- Then click **Exit**.

Alternatively, you can close TrafficDOT by clicking the close window control in the upper right-hand corner of the *Access Point Control Center* window.