

# *Vantage*<sup>®</sup> *Velocity*

## Field Unit User Guide



# iteris<sup>®</sup>

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#### **FCC, Class A Statement**

This product has been tested and found to comply with the limits for a Class A digital device pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment.

This product generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the manufacturer's instruction manual, may cause harmful interference with radio communications.

Operation of this product in a residential area is likely to cause harmful interference, in which case you will be required to correct the interference at your own expense.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

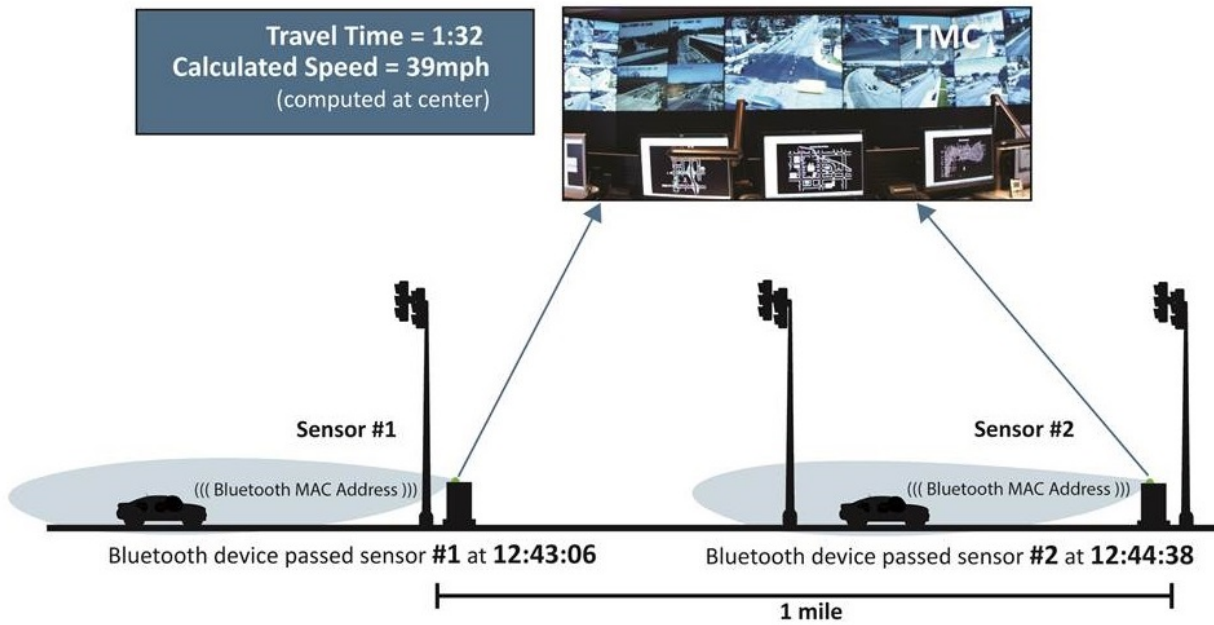
- 1) This device may not cause harmful interference.
- 2) This device must accept any interference received, including interference that may cause undesired operation.

## 1. INTRODUCTION

The Vantage Velocity™ travel time monitoring technology is based on the use of wireless MAC address collection a robust, low power, and low cost wireless communications method. *Bluetooth* technology is standardized and used worldwide, so that travel time monitoring technology may be deployed anywhere.

The Velocity system detects vehicles equipped with enabled *Bluetooth* networking devices, including cellular phones, mobile GPS systems, telephone headsets, and in-vehicle navigation and hands-free systems.

Every *Bluetooth* device has a unique 48-bit address, known as a MAC address, used to identify it to other network devices. Each Velocity field processor senses MAC addresses emitted by enabled devices as they pass the reader station. The Velocity field processor then transmits the time and location of the device to the Velocity host software. As addresses are detected at successive Velocity field processors, the Velocity host system calculates average travel times and speeds for a roadway segment.

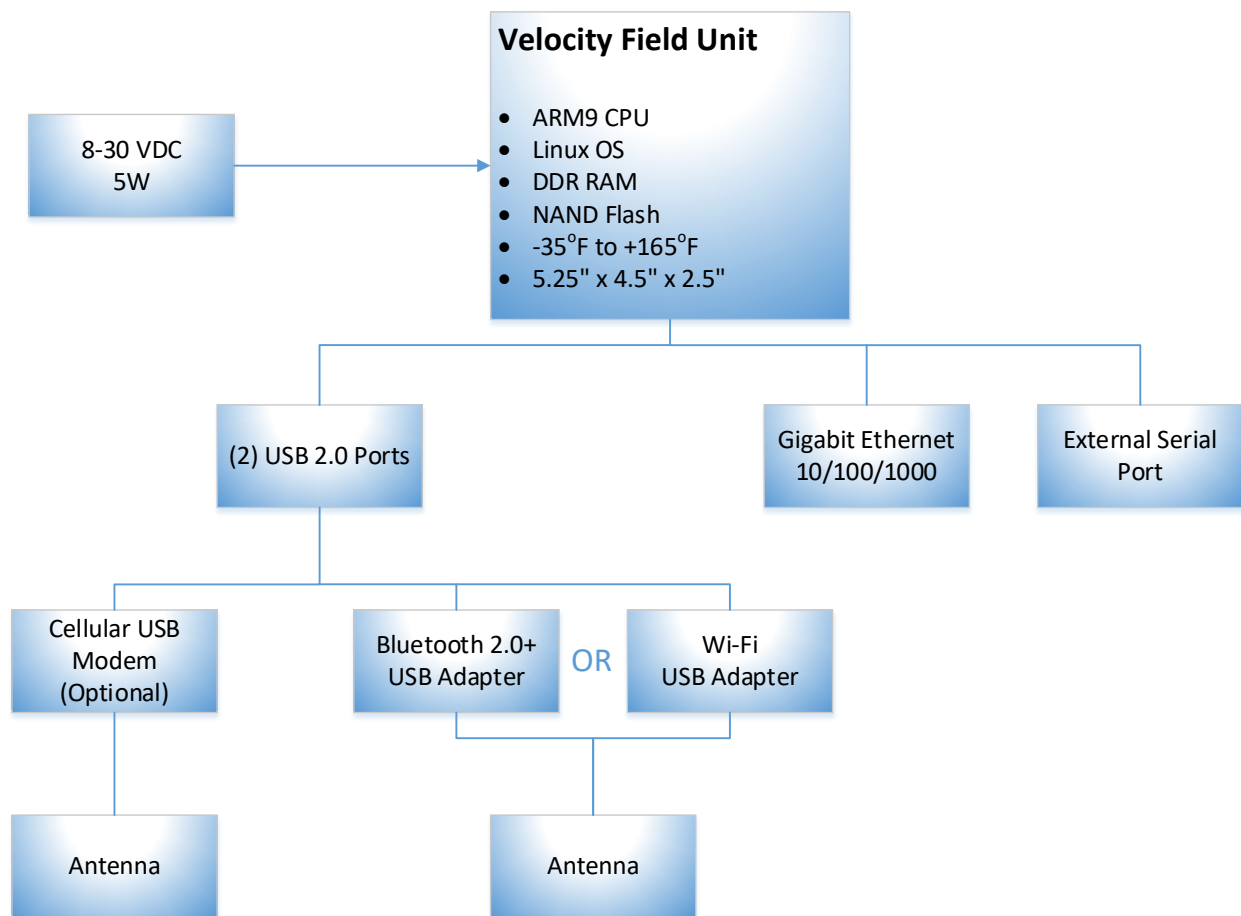


*Vantage Velocity™ Traffic Monitoring Concept*

## 2. VANTAGE VELOCITY FIELD UNIT OVERVIEW

The Vantage Velocity™ Field Unit is the system that resides on the roadside and detects wireless *Bluetooth* or Wi-Fi MAC addresses from passing vehicles. The addresses are immediately relayed to the Velocity Host software at a central location for the purpose of estimating vehicle travel times on roadway segments instrumented with Velocity Field Units.

Central to the operations of the Velocity Field Unit is an embedded Linux device with a standard set of peripherals including USB, Ethernet, and serial ports. The device is responsible for running the Velocity Field Software and for providing connectivity for the peripherals necessary to detect and relay wireless MAC addresses. Detailed specifications of the Velocity Field Unit are shown in the figure below.



Velocity Field Unit Overview

This User Guide will walk you through the installation, setup and startup of the Vantage Velocity™ Field Unit. Follow the sections in the order laid out within this guide. If you have questions once you have completed the steps within this guide, refer to [SECTION 7: TROUBLESHOOTING](#) or call the product support using the number listed in [SECTION 8: PRODUCT SUPPORT](#).

## 3. HARDWARE INSTALLATION

This section covers the installation of the Vantage Velocity™ Field Unit, as well as the software setup, controller configuration and download of stored data.

### 3.1 Connecting the Controller

The Velocity Field Unit showing the different connection options is shown in the figure below.



*Velocity Process Controller - Shelf Mount and Rack Mount*

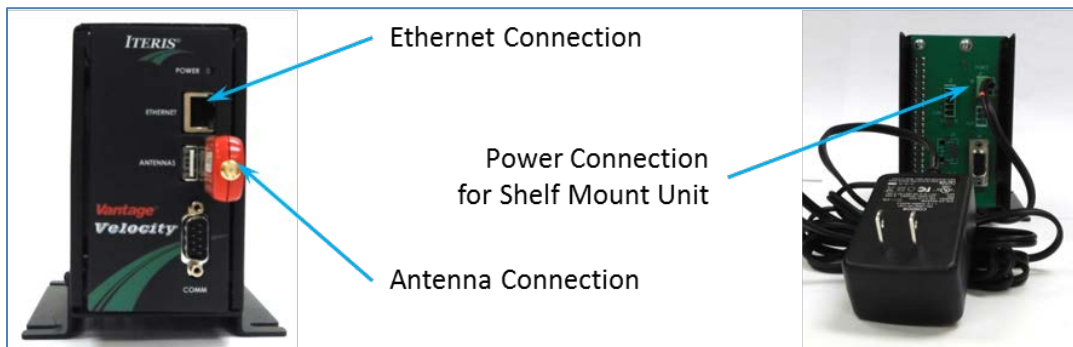
To begin using the Velocity Field Unit, three connections are necessary.

1. Power, which is connected using the standard power cable shipped with the device or supplied from the input file in the traffic cabinet

**⚠ Important:** Do not plug the shelf mount unit's power supply into the GFCI in the cabinet. The GFCI is designed to power items temporarily installed in the traffic cabinet.

2. The *wireless* adapter, also shipped with the device, which is connected to one of the two external USB ports on the device (it doesn't matter which one, labeled Antennas).
3. Communications, which can be connected to the Ethernet port (labeled ETHERNET) or one of the USB ports using a cellular modem (labeled Antennas).

Correctly installed, the back of a Velocity Field Unit connected to an Ethernet cable should look similar to the figure below.



*Velocity Field Unit Connections*

## 3.2 Installing the Antenna

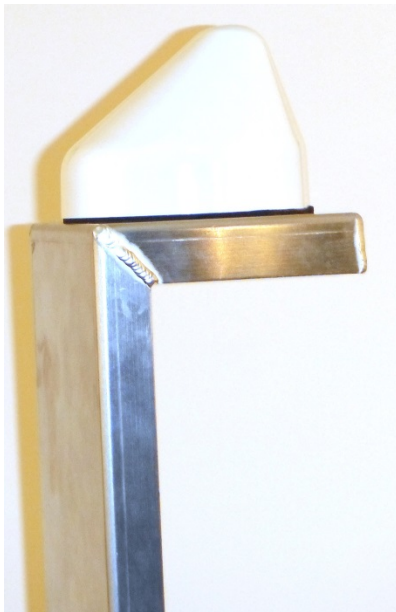
Four different antenna types are offered with the Velocity system:

1. A short elbow
2. A long elbow
3. A direct mount
4. A uni-directional

The first three of the supplied antenna assembly contains two separate antennas:

1. A wireless antenna for connection to the USB adapter (2400-2700 MHz)
2. A Cellular Modem antenna for connection to an optional cellular USB modem

The uni-directional only contains the wireless antenna.



Elbow mount



Direct mount

Uni-Directional

The first three antenna types are mounted on the side to the traffic cabinet. One or two sets of mounting points are provided to allow for various cabinet types and sizes. The cables from the antennas can be run through the door of the cabinet or for a more permanent installation a hole can be made in the side of the cabinet. The direct attach is normally mounted on the top of the cabinet.

The uni-directional antenna has three adjustments to allow of optimal aiming at the desired area of interest.

**⚠ Important:** Ensure any hole made in the cabinet is properly sealed to ensure no water can get inside the cabinet and cause damage.

### 3.3 Optimizing Installation

For optimal reading of the traffic stream, several best practices should be applied regarding placement of the Velocity Process Controller and *Bluetooth* antenna.

1. The antenna on the *Bluetooth* adapter should ideally be as close to a standard vehicle windshield height as possible.
2. The *Bluetooth* antenna should be placed outside of any metal cabinet.
3. The read range of the *Bluetooth* antenna shipped with the device is typically a 100 meter (328 foot) radius. Optionally, users can outfit the *Bluetooth* adapter with a different antenna by unscrewing the one already on the device. This may be necessary to reduce or increase read ranges.
4. To reduce errors, reader spacing should typically be no closer than one minute of travel time apart. A general rule of thumb is that readers should be no closer than one mile apart on freeways and a half mile apart on arterials.

## 4. SOFTWARE SETUP AND MAINTENANCE

This section describes the software operating environment that Velocity field software operates in and the parameters used in the software configuration.

**Note:** *The interface described in this document enables users to configure basic parameters necessary for running the Velocity field software.*


### 4.1 Accessing the Velocity Process Controller Configuration

The Velocity Process Controller can be configured using a web browser such as Mozilla Firefox or Microsoft Internet Explorer. Out of the factory, the controller is given an IP address of 192.168.1.103. To access the configuration interface using your computer, connect the controller to a router, switch, or your computer using a standard Ethernet crossover cable. Then, enter the following URL in your web browser.

<http://192.168.1.103:8089>

The number 8089 is the port number that the web configuration interface resides on. If you change the IP address of the device, the port number of 8089 will still be valid. For example, if the IP address changes to 10.1.0.2, the URL of the web configuration interface would be <http://10.1.0.2:8089>.

**Note:** *If the cable is connected and you are unable to access the URL above, you may need to temporarily change the IP address on your computer to something with a 192.168.1.\* convention.*

 **Important:** *It is important to type the 'http://' before the IP address failure to do so may cause the connection to the device to fail.*

Four screens are provided upon entering the URL above. Three are for configuration and one for testing and diagnostics

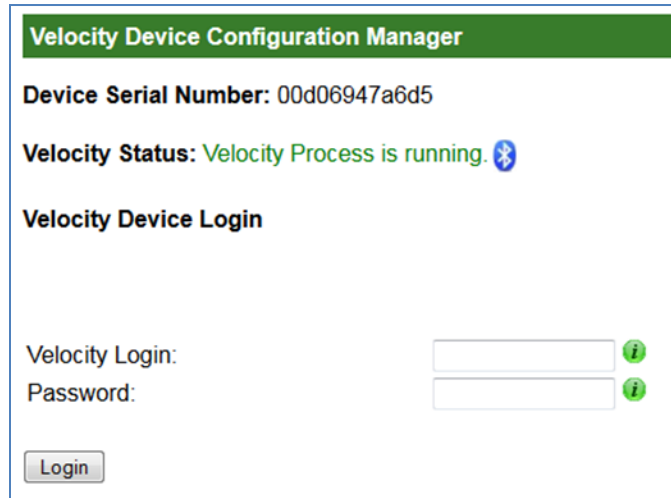
1. Software Settings
2. Network Settings
3. Time Settings
4. Wireless Address Data

### 4.2 User Authentication

The Velocity Field Unit has an optional security setting to block unauthorized access. This feature is enabled in the Software Settings screen. If this function is enabled the screen in the figure below will be displayed. The default credentials are:

	Up to Version 2.3	Version 2.4
Username	admin	velocity
Password	dash1133	velocity

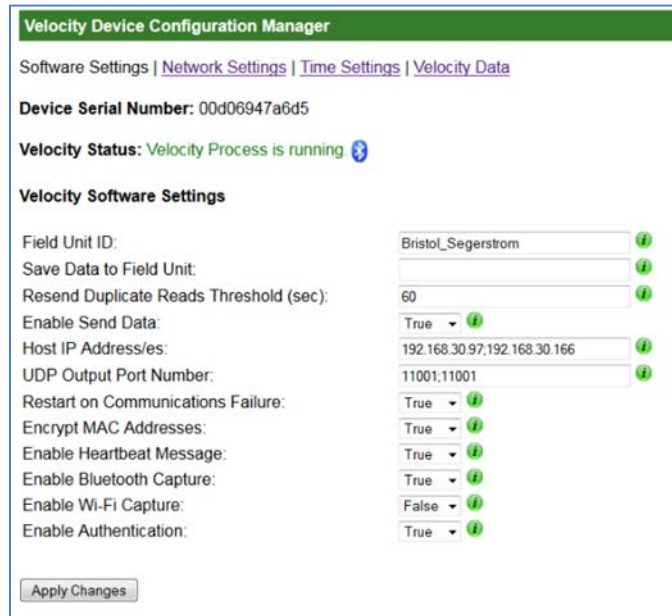




This screen also provides the Velocity Field Unit’s serial number (MAC Address) and confirmation that the system is running.

### 4.3 Software Configuration Screen

The Software Settings screen is shown in the figure below.



Software Setting Screen

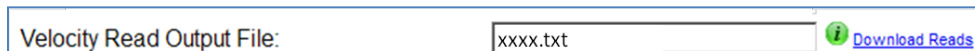
Each configuration setting above is described in the table below.

Setting	Description
Field UnitID	<p>This is the identifier that contains the name of the Velocity Processor card. This identifier is used by the host software to determine where the <i>Bluetooth</i> MAC addresses have originated from. The name is typically based on the device's location but can be generic if the reader is to be mobile. This string must be exactly specified in the host software for traffic data to be collected. Do you name the processor also or is the ID what the software looks at?</p> <p><i>Example:</i> <span style="float: right;"><i>mainst_crossst</i></span></p> <p><i>Example:</i> <span style="float: right;"><i>i45_mainst</i></span></p>
Save Data to Field Unit	<p>If left blank, data will not be stored locally on the field unit, but will be sent to the host software only</p> <p>You can enter <i>data.txt</i> so the field unit will save the data to its file and send the data to the host software. This can be used for data collection if there is no real-time communication to the device or to store data on the device as a backup. Note that it is critical for the time to be exactly synchronized across devices to produce accurate travel times. See the section on Downloading Stored Data for more information.</p> <p><i>Example: data.txt</i></p> <p><i>* The software on the field unit implements an archival method that prevents the device from running out of space. The archival method renames the address file when it reaches a certain size threshold. Each device will typically store at least 30 days of data when the Duplicate Read Resend Threshold (described below) is set to 60 seconds or more. A more frequent Duplicate Read Resend Threshold will require more space.</i></p>
Duplicate Read Resend Threshold (seconds)	<p>This entry sets the time in seconds that the field unit will wait to send duplicate <i>Bluetooth</i> MAC addresses to the host software.</p> <p>The Velocity field unit will typically read identical MAC addresses multiple times in a roadside environment. This is the time in seconds the software will wait to send duplicate <i>Bluetooth</i> MAC addresses to the host software. This should typically be set to 60 seconds or more to avoid sending duplicate MAC address reads to the host software.</p> <p>This value may be set at 0 to send all MAC address reads back to the host. However, depending on the host software configuration, typically on the first MAC address read at a location will be used to match reads at subsequent locations. Setting this value at greater than 0 will not only help to eliminate duplicate MAC address reads and will free up bandwidth necessary to transmit the duplicates.</p>
Enable Send Data	<p>This is a <i>True</i> or <i>False</i> value that tells the software whether to send the <i>Bluetooth</i> MAC addresses to a host server using the User Datagram Protocol (UDP). This is typically always set to "True" when network connectivity is available. If there is no network connectivity, this should be set to <i>False</i>.</p>
Host IP Address/es	<p>When "UDP Output" above is set to <i>True</i> an IP address for the host software will need to be entered here. If you are sending the data to multiple hosts, each IP address shall be separated by a semi-colon.</p>

UDP Output Port Number	When “UDP Output” above is set to <i>True</i> , enter port number 11001 in both the field unit and the host software. If your network is equipped with a firewall, port 11001 on the firewall will need to be opened to allow communication between the host software and the field unit. Your IT department may choose to use another port, if they do make sure that port number is programmed in both the host software and the field unit.
Restart On Communications Failure	This is a <i>True</i> or <i>False</i> value that tells the Velocity field software, whether to direct the device to restart when network communications failures occur. Many times, a device restart will reinitiate and/or correct failures. The device typically takes less than a minute to restart.
Encrypt MAC Addresses	This is a <i>True</i> or <i>False</i> value that tells the software to encrypt each MAC address as it is read. Assigning this value to <i>True</i> will encode each MAC address so the actual MAC address is not transmitted over a communications network or stored locally.  <i>Note:</i> the host system matches actual MAC addresses (or the encrypted MAC addresses) between separate field devices. If this value is <i>True</i> on one field unit, all field units should be assigned the same value.  <i>Example of MAC address:</i> 00:00:00:01:01:01 <i>Example of encrypted MAC address:</i> MDA6MDA6MDA6MDE6MDE6MDE=
Enable Heartbeat Message	This is a <i>True</i> or <i>False</i> value that tells the software to send a small message to the host software every minute to allow the host to easily monitor the status of the field unit. The message is a standard Velocity message with a MAC address of 00:00:00:00:00:00
Enable Bluetooth Capture	This is a <i>True</i> or <i>False</i> value. Set to true if you are using the Bluetooth adapter to capture wireless devices.
Enable Wi-Fi Capture	This is a <i>True</i> or <i>False</i> value. Set to true if you are using the Wi-Fi adapter to capture wireless devices,
Enable Authentication	This is a <i>True</i> or <i>False</i> value that enables or disables the login screen to the Velocity Field Unit.

### Downloading Stored Data

When there is a filename specified in the Velocity Read Output File setting, the controller will save all address reads to a comma delimited file on the device. Users may download the data saved on the device using the web configuration interface. Whenever data is being saved to the device, a Download Reads hyperlink will appear next to the Velocity Read Output File textbox on the Software Settings Configuration screen. Users can download the reads collected by the device by clicking on the link as shown in the figure below.



*Download Reads Hyperlink*

## 4.4 Network Configuration Screen

The Network Settings Page shown below allows users to configure the network interface to the field unit. The field unit is capable of using USB based cellular modems or the Ethernet port for network communications. Selecting the appropriate option on the Network Settings page configures the f with that option. Clicking Apply Changes forces the system to reset to save the settings. Once the system has been reset, you will need to reconnect to the web interface using the new network settings. The figure below shows the network settings screen with the default values displayed.

*Example of Network Settings Page*

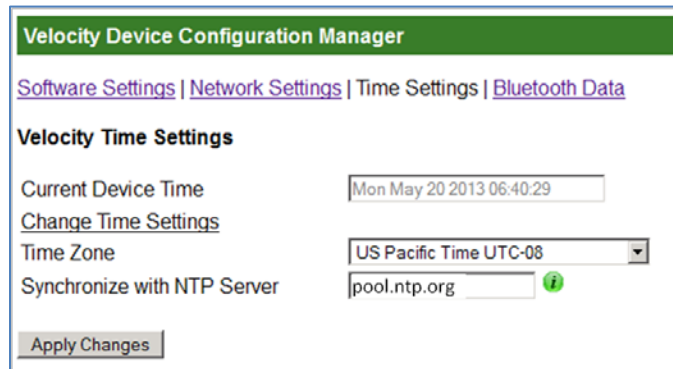
Each configuration setting above is described in the table below.

### Network Settings

Setting	Description
Network Type	Cellular Modem Using USB (PPP) DHCP Using Ethernet Static IP Using Ethernet
IP Address	This is the IP Address assigned to the field device.
Network Address	The network address is the network identifier. Normally set to address x.x.x.0.
Network Mask	Sometimes call the subnet mask. A subnetwork, or subnet, is a logically visible subdivision of an IP network.
Broadcast Address	The broadcast address is a logical address at which all devices connected to a multiple-access communications network are enabled to receive datagrams. A message sent to a broadcast address is typically received by all network-attached hosts, rather than by a specific host. Normally set to address x.x.x.255.
Gateway Address	The gateway address is a router interface connected to the local network that sends packets out of the local network.

### 4.5 Time Configuration Screen

When using the timestamp on the field device to determine travel times and speeds, time synchronization among Velocity field devices is critical. Best practice is to synchronize all devices with a reliable time source using the NTP protocol. Using the Time Settings screen, the time zone can be configured along with synchronization to a NTP server. Once an NTP server is specified, the device will attempt to synchronize its time every few hours. A successful time synchronization will also force the device to program its battery backed hardware clock so that time is kept through power interruptions. A screenshot of the Time Settings screen is shown in the figure below.

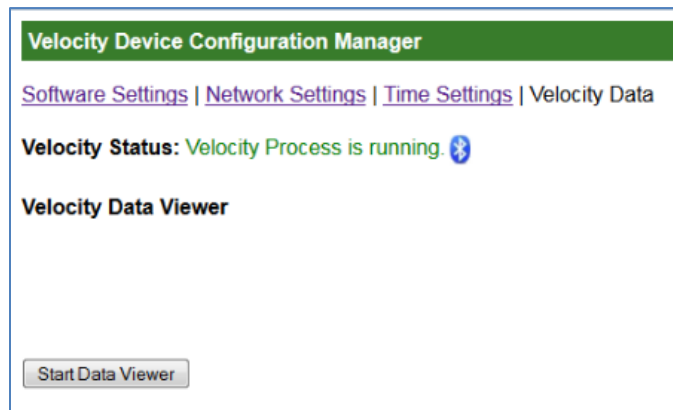


Example of Time Settings Page

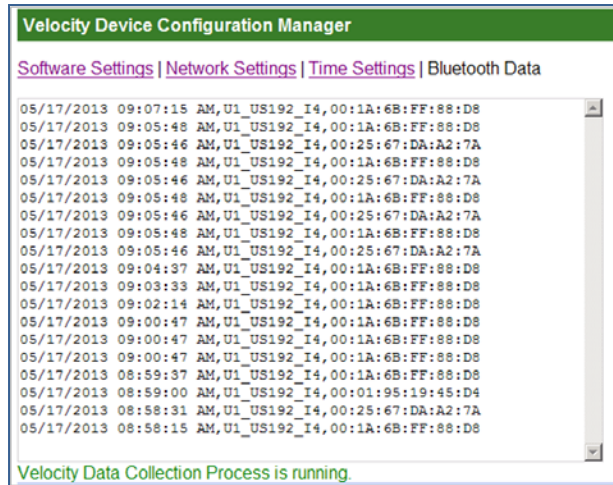
### 4.5 Velocity Data Screen

This screen is used for local testing and diagnostics. It provides a live display of wireless device captures. This is the same data that is sent back to the Host software for matching and analysis. This gives the technician confidence during installation that the Velocity Field Unit is working properly.

To start the local data collection display click on the 'Start Data Viewer'



The page will begin to display wireless device reads that are being collected.



**Note:** When viewing this data in Internet Explorer set the page refresh setting to "Every time I visit the webpage". This setting can be found in Tools → Internet Options → Browsing History → Settings.

## 5. VELOCITY PROTOCOL

Each individual field device sends the addresses it detects to a central host software component for the purpose of travel time and speed estimation. If the Velocity Save Data to Field Unit setting includes a filename, the address records are also saved to the device. The host software determines the “matching” of addresses between locations to derive traffic data. Each individual record is sent as a single UDP (User Datagram Protocol) packet to a specified network host and port. To accept a record as valid, the host software requires that each detection record obtained from the field devices conform to a specific format. The format is an ASCII string of text with each data element separated by a comma. Note each record is terminated by a linefeed character (0x0A). Each data element is described in the Table 2.

**Table 1 - Data Element Descriptions**

Element	Description
Detection Timestamp	<p>The exact time the address was detected as determined by the field device. The format is “mm/dd/yyyy hh:mm:ss p”.</p> <p>Host software should have the option of either using this timestamp or the reception timestamp of each packet for travel time estimation. If the timestamp on each packet is used, it is critical that the time is synchronized frequently among the field devices to provide accurate travel time estimation. The Velocity controller does have a method for using the Network Time Protocol (NTP) for synchronizing it’s time. Conversely, if the timestamp on the host is used, efforts should be made to ensure that minimal delay (less than a second) is present between the time the packet is sent by the device and received by the host software.</p>
Field Unit Location	<p>Specifies the defined location of the field device. The current standard is to utilize the primary street and the nearest cross street with the street names separated by the underscore character. For example, a reader located at the corner of Westheimer and Dairy-Ashford would be defined as Westheimer_DairyAshford. The order of the streets is not relevant to the calculation of travel times and is only used to identify the location.</p>
Address Identifier	<p>The unique identifier for each device detected. This is the 48-bit MAC identifier used by each wireless device. For example, 00:1E:7D:E&amp;:6E:6D. Note the hexadecimal numbers are separated by the “:” character.</p> <p>To address privacy issues, the field software also has the option to encrypt each MAC address upon reception at the field unit. If encrypting is enabled on the field software, each address will be comprised of a base64 encoded string. For instance the address 00:1E:7D:E&amp;:6E:6D will be encoded and sent to the host as MDA6MUU6N0Q6RTc6NkQ=.</p>

An example of several detection records is shown below.

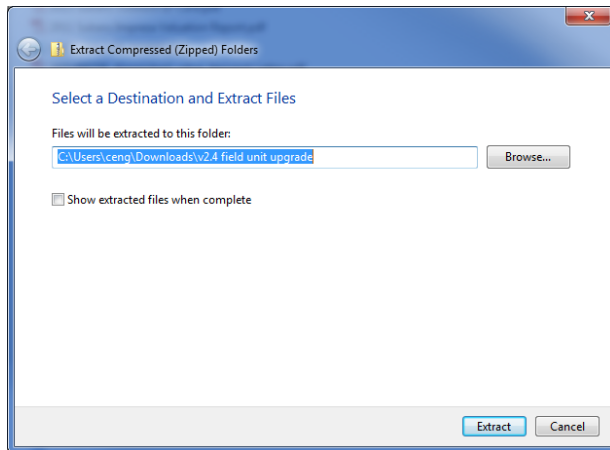
```
01/01/2010 10:00:00 AM,Westheimer_Kirkwood,00:1E:7D:E7:6E:6D[line feed character 0x0A]
01/01/2010 10:00:01 AM,BriarForest_SH-6,04:1E:74:E7:6E:64[line feed character 0x0A]
01/01/2010 10:00:07 AM,IH-10_Bingle,01:14:7D:E7:6E:6D0x0A[line feed character 0x0A]
```

## 6. VELOCITY FIELD UNIT UPGRADE

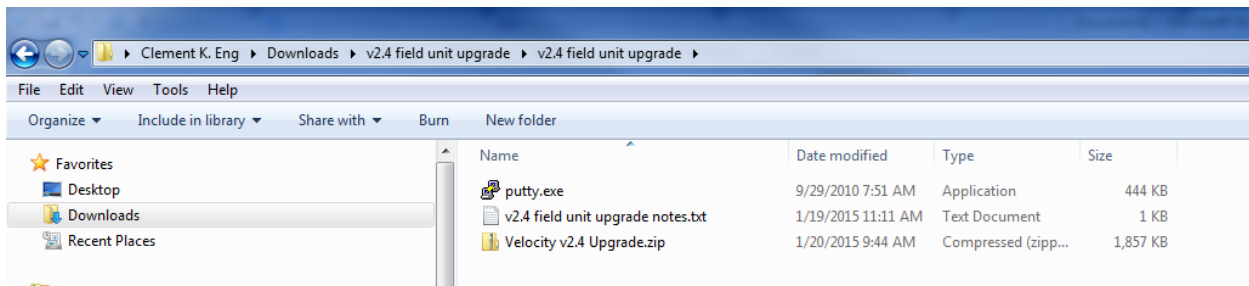


**CAUTION!** Before starting the upgrade process, it is recommended record all of the existing Field Unit settings.

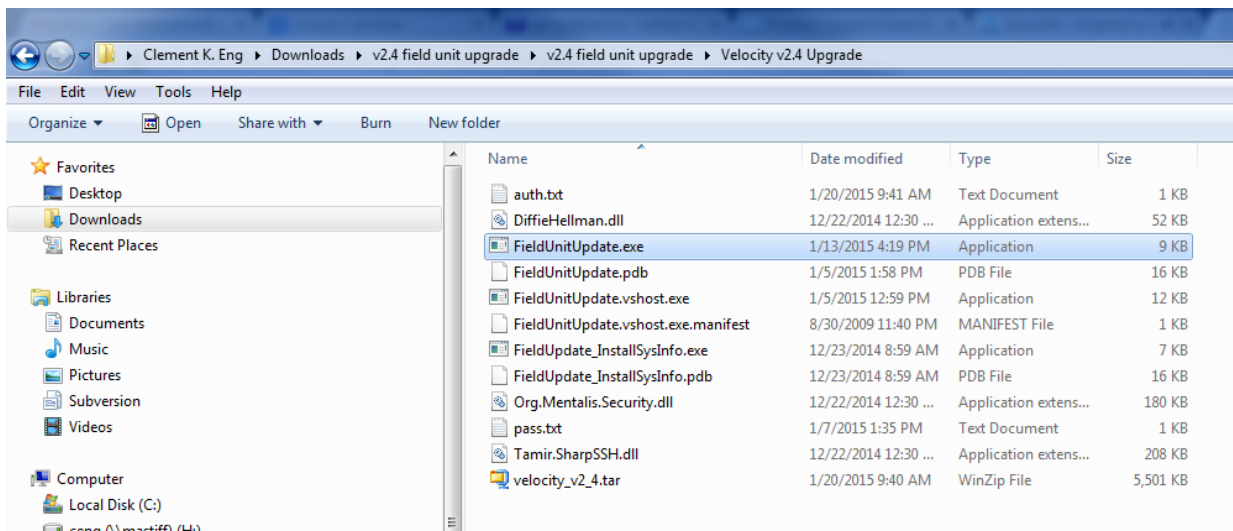
Step 1: Unzip the upgrade wrapper package.



Step 2: Unzip the Velocity Upgrade package.



Step 3: In the unzipped Velocity field unit upgrade package, run the 'FieldUnitUpdate.exe' app.





Step 4: Enter the IP address of the field unit and hit the <enter> key.

```

C:\Users\ceng\Downloads\v2.4 field unit upgrade\v2.4 field unit upgrade\Velocity v2.4 Upgrade\Fi...
Velocity Field Update v2.4
//Installs new web interface files
-----
Enter the IP address of the device to update: 192.168.30.214
    
```

The following information messages will be displayed upon successful upgrade.

```

C:\Users\ceng\Downloads\v2.4 field unit upgrade\v2.4 field unit upgrade\Velocity v2.4 Upgrade\Fi...
Velocity Field Update v2.4
//Installs new web interface files
-----
Enter the IP address of the device to update: 192.168.30.214
3/17/2015 3:19:05 PM - Connecting to reader with address 192.168.30.214
Updating script... 192.168.30.214
transfer to field unit complete
creating a snapshot of the configuration settings
extracting the package
upgrade complete
restoring the settings
Update process complete for 192.168.30.214. Update another (y/n)?
    
```

**Note:** If, prior to upgrade, the field unit's software version was older than version 2.3, there will be a system reboot message. This is necessary to complete the upgrade successfully.

Step 5: Hit <y> or <n> and <enter> to upgrade another field unit or quit the upgrade program.

## 7. TROUBLESHOOTING

### Symptom: Improper reads or no reads

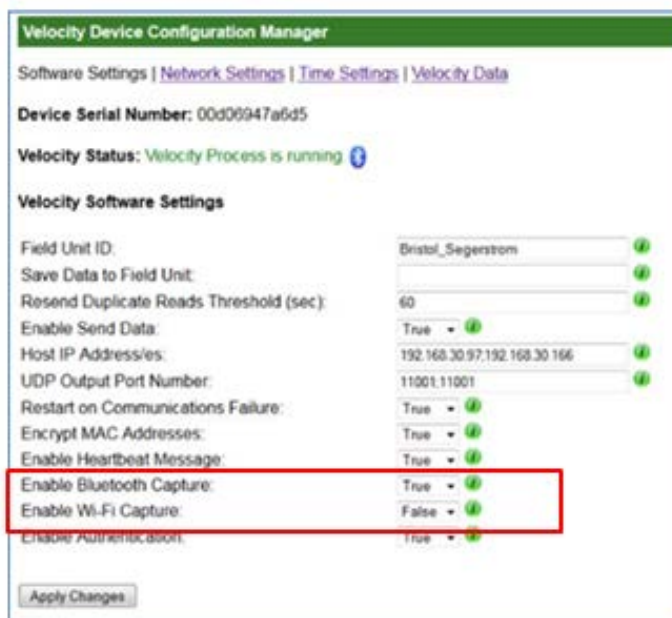
- I. Check antenna connections to velocity processor field unit. A loose connection could result in no reads or under reading.
- II. Make sure nothing is obstructing the antennas view in the area you are collecting data.
- III. Check the USB dongle.
  - a. Is the blue-light off, reseal the dongle and check if the blue-light turns on. If the light still does not turn on, try using the other USB port on the field unit.
  - b. If the dongle still does not turn on, plug an optical mouse into the USB port to test if the port is bad. If the port works, try changing the USB dongle.

### IV. Wi-Fi /Bluetooth Setting

The Velocity field unit is set to Bluetooth by default. If you are going to be using Wi-Fi you will need to change the setting in the field unit from Bluetooth to Wi-Fi. An improper setting will result in No Reads.

Refer to the [SECTION 4.1: ACCESSING THE VELOCITY PROCESS CONTROLLER CONFIGURATION](#) to connect to the field unit.


Once you access the field unit check the WiFi and Bluetooth settings. Only one of them should be on at a time. Choose either WiFi or Bluetooth based on the your application.



## 8. PRODUCT SUPPORT

### Product Support Team

The Iteris® Product Support Team consists of a group of highly skilled individuals that are knowledgeable and readily available to answer your questions or assist you with any of our Vantage products. Please do not hesitate to contact us at:

 Toll free: (888) 254-5487

For more information on Iteris, as well as the products and services that we provide, visit our website at:

 [www.iteris.com](http://www.iteris.com)

### Iteris Resource Center

This site contains additional training and technical support information covering the whole range of Vantage products. Registration is easy. Visit the address below to register and begin enjoying the benefits immediately.

 [www.iteris.com/support](http://www.iteris.com/support)

The Resource Center app is available from the Apple App Store or the Google Play store.



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