User's Manual
922
Field Retroreflectometer

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INSTRUMENT CERTIFICATION

If anyone has comments or suggestions regarding this manual, its format, content, or otherwise, please direct them to:

RoadVista
9925 Carroll Canyon Rd.
San Diego, CA 92131
1-800-637-2758
or
www.roadvista.com

Your input is appreciated

INSTRUMENT CERTIFICATION

RoadVista, certifies that this instrument was thoroughly tested, inspected and found to meet its published specifications when it was shipped from the factory. RoadVista, further certifies that its calibration measurements are traceable to the U.S. National Institute of Standards and Technology (NIST) formerly National Bureau of Standards to the extent permitted by the Bureau's calibration facility.

WARRANTY AND CUSTOMER SERVICE

All products manufactured by RoadVista are warranted to be free from defects in material or workmanship subject to the following terms and conditions. All other products sold by RoadVista are warranted only to the extent of that offered by the manufacturer.

(a) PERIOD OF WARRANTY:

This warranty shall terminate one year after the date of shipment.

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Seller's obligations under this clause shall be limited to repair or correction of any defect of material or workmanship in any such product or to replacement of any defective product or part or unit thereof, notice of which shall have been given to Seller within the warranty period specified in subdivision (a) above.

(c) LIMITATION AS TO REPLACEABLE COMPONENTS WHO'S LIFE IS A FUNCTION OF USAGE TIME:

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RoadVista, provides repair services for all RoadVista products. A complete, modern Service Department, Stock Room and Calibration Facility are employed at the factory.

In the event the instrument does not function properly or is damaged, RoadVista should be contacted

with regard to the specific symptoms of the problem.

NOTE

For all service requirements, please ask for the Customer Service Department. RoadVista must be contacted prior to any return shipment of equipment. Failure to do so will result in delayed return to the customers.

(e) SCHEDULED MAINTENANCE

The 922 should be returned to RoadVista on a yearly basis to verify all aspects of the measurement system are within specification and perform standard routine maintenance. Standard maintenance includes the following;

- Replace lamp
- Verify optical alignment
- Update firmware with newest version
- Full system check

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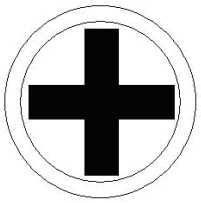
FIGURES

SAFETY FIRST



Protect yourself. Follow these precautions:

- This Manual contains information about the proper procedures for preparing this product for its use and care.
- Follow the instructions of other manufacturer's equipment when used in conjunction with this product.
- Explosion Hazard. Do not use in the presence of flammable liquids, vapors, gases or dusts.
- FIRE HAZARD: DO NOT DRAPE OR COVER ANY LIGHT SOURCE WHILE IT IS OPERATING.
- Pay attention to **WARNING** statements. They point out situations that can cause injury or death.
- Pay attention to CAUTION statements. They point out situations that can cause equipment damage.
- The user of this product should be thoroughly familiar in the set-up, use, and care of this product.
- The user should carefully study this manual before using the equipment. Instructions should be followed, with special attention given to warnings, controls and user specifications. This manual should be available to the appropriate personnel.
- Before every procedure, carefully inspect the equipment to ensure it has been properly maintained and cleaned, and that it is fully functional. DO NOT use if inspection reveals anything unusual, including case damage or loose connectors.
- SAFETY PRECAUTIONS MUST ALWAYS BE EXERCISED WHEN USING ELECTRICAL EQUIPMENT TO PREVENT OPERATOR SHOCK, FIRE HAZARD OR EQUIPMENT DAMAGE.
- Don't touch any exposed wiring.
- All electrical equipment must be used with approved power cords and power plugs inserted properly into grounded AC power outlets.
- Don't plug in the power cord until directed to by the installation instructions.
- Don't bypass the power cord's ground lead with two-wire extension cords or plug adaptors.
- Don't disconnect the green and yellow safety-earth-ground wire that connects the ground lug of the power receptacle to the chassis ground terminal (marked with ⏚ or ⚠).
- To reduce the risk of fire and electric shock, do not expose electrical equipment to moisture. When cleaning, do not immerse any electrical device in liquid.
- Do not use or store liquids on or above the equipment.
- Electric shock hazard. If unit is not functioning properly, DO NOT OPEN. Please refer to the Maintenance and Troubleshooting section of this manual.
- Use only properly functioning cables that are made for system instrument connectors.
- Light sources produce high intensity light. Thermal burns can result from improper use of the light source.
- Use care not to point any operating light source directly at the eye.
- When light source is not in use, turn off the power.
- Keep any cooling vents and fans free of obstructions.

922 Portable Retroreflectometer

SECTION 1 INTRODUCTION

1.1 GENERAL INFORMATION

The RoadVista 922 Field Retroreflectometer measures the retroreflection (R_A) of road signs and other materials in the field. Since a significant portion of the vehicles on the road in the USA are now SUVs and pickup trucks, ASTM has created a specification to require measurements to be performed at an observation angle of 0.5 degrees. The 922 meets or exceeds this change-over specification. The 922 allows you to know, with the press of a button, exactly how bright your sign will appear to most drivers.

The light sensor meets ASTM E1709 and E2540 requirements with the CIE standard human eye response in conjunction with the CIE illuminant "A" lamp. The photometric filter accurately measures colors without the need to calculate correction factors.

The user has the option of performing a calibration prior to taking measurements. Two standard observation angle readings are taken simultaneously at one entrance angle. An optional attachment to vary the entrance angle is available. The readings are taken locally, or remotely using an IrDA remote trigger. It maintains all these readings, but displays only the last four readings (for both the legend and background), and the average reading. (One or more incorrect readings may be deleted on the spot.)

When moving to a new sign, the unit saves only the current sign average reading (both angles, in either Metric or English units) but not individual readings. In addition, the 922 also records the following items with each sign:

- Global Positioning System (GPS) coordinates.
- Current date and time.
- The sign barcode number, if captured by the user.
- Up to six user-selected common sign faults.
- A user-entered comment of up to 17 characters.

The internal memory has the capacity to store readings and accompanying data for 2800 measurements. A long-life internal battery maintains the data in memory when power is turned off and when the external battery is removed.

The date and time clock is set for Coordinated Universal Time (UTC), but may be set for local time.

An internal Bluetooth transceiver can be enabled to allow communications with other Bluetooth devices via the standard Serial Port Protocol (SSP). This allows wireless expansion of the instrument's capabilities, such as sub-meter-accuracy GPS, and is limited to only what is available on the market.

Data may be uploaded to a Windows-based computer using the Graphical User Interface (GUI) that comes with the 922. Uploading is accomplished through a USB interface, and stored in ASCII delimited format.

1.2 SPECIFICATIONS

ASTM E1709 and E2540 Annular Geometry

Entrance Angle (922): -4°
Entrance Angle (922D): +5°
Entrance Angle (922E): +5°
Observation Angle (922): 0.2° and 0.5°
Observation Angle (922D): 0.33°
Observation Angle (922D): 0.2° and 0.5°

Light Source Angular Subtense: 0.1 degrees.
Receiver Angular Aperture (Annular): 0.1 degrees.
Field Measurement: 1 inch (25mm) diameter spot.

Optical Specifications

Range (cd/lx/m^2): 0-9999.
Data Memory: 2800 measurements.
Computer Interface: USB, Bluetooth (SPP)

Power

Power Supply: Removable 12 VDC, 2.4Ah NiMH battery.
(DeWalt P/N DC9071)
Charger: Optional 12 VDC with cigarette lighter adapter.

Environmental

Operating Temperature: 0^{o}C to 50^{o}C (32^{o}F to 122^{o}F)
Operating Humidity: 0 to 90% non-condensing.

Dimensions

922 Field Retroreflectometer
3.6 in. (91 cm) wide; 12 in. (305 cm) high; 11 in. (280 cm) long.
Weight (without battery): 4.6 lbs (2.1 kg).
Weight (with battery): 5.75 lbs (2.6 kg).

Carry Case
20.5 in. (52.1 cm) wide; 8.5 in. (21.6 cm) high; 17 in. (43.2 cm) long.

Accessories and Options

Standard Accessories:

- Two (2) Batteries.
- 110 VAC Battery Charger.
- 10mm and 15mm Measurement Area (Aperture) Reducers.
- Calibration Standard.
- Calibration Certificate.
- Windows-Based Software.
- USB Cable
- Carrying Case.
- Shoulder Strap.

Additional Options:

- Annual Calibration Service
- Adjustable Entrance Angle Attachment (922-EAA)
- 12 VDC Car Battery Charger
- Extension Pole Kit (922-EPK)

1.3 ENVIRONMENTAL CONSTRAINTS

The RoadVista 922 is capable of operating between 0 and 50 degrees Celsius at altitudes up to 10 000 feet. Relative humidity must remain between 0 and 90 percent, non-condensing. By keeping the instrument within these limits, heat and moisture damage to the circuit boards can be prevented.

WARNING: While the Model 922 Field Retroreflectometer functions to 0^{o}C, do not place excessive pressure on the touch screen if the air temperature is $+5^{o}$C or below. Doing so could cause the touch screen to crack. Before using at an air temperature of $+5^{o}$C or below, make sure the instrument has been in a warm area. Periodically return the instrument to a warm area to raise the screen temperature when taking readings.

SECTION 2 INITIAL SETUP

This section includes all the procedures required to place the 922 Field Retro-reflectometer into service. It begins with unpacking and inspecting the components, followed by the operating procedure.

2.1 UNPACKING AND INSPECTION

RoadVista has taken special care in packaging the instrument for shipment. Your 922 was shipped in a pressurized carry case. It is important that you carefully inspect the equipment for any damage that might have occurred during shipping. Visually inspect all the 922 components for dents or other signs of damage. If the instrument appears have to be damage free, proceed to operating instructions.

If damage is discovered, ascertain whether the shipping container shows damage caused by rough handling, making the shipper liable for damage. If a Polaroid or digital camera is available, take a picture of the shipping container and the instrument. Carefully re-package the instrument in its shipping container and include the photographs and/or comments in a separate envelope. Notify the shipper that the instrument needs to be returned because of shipping damage. Notify RoadVista of the damage. A RoadVista representative will explain how to return the equipment. This procedure will expedite the replacement of the damaged instrument.

2.2 INTRODUCTION

The main features of the 922 are shown in figure 2.1

Figure 2-1 ***Main Features***

USB & software installation

2.2.1 Windows GUI System Requirements

Before making any electrical connections, verify that your computer is configured with the following minimum requirements:

- Operating System: Windows XP, Windows 7
- Hard Disk Space: Minimum required; 100 MB.
- Random Access Memory (RAM): Minimum required; 128 MB.

2.2.2 USB Installation

1. Plug the USB cable into the computer and then into the 922.
2. Apply power to the 922.
3. The computer will immediately recognize that something has been plugged into the USB port.
4. Many computers will automatically install the USB drivers. In the case that does not happen, use the included drivers and continue using the following instructions.

Figure 2-2 *Hardware Wizard Recognition*

5. Select the settings as shown above and click "Next."

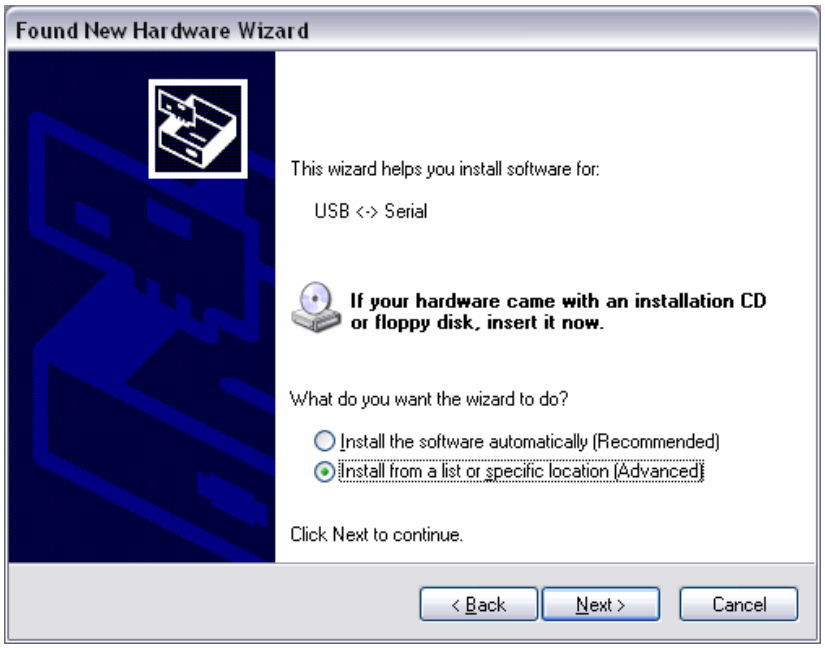


Figure 2-3 *Installation Location Selection*

6. Select "Install from a list or specific location," and click "Next"

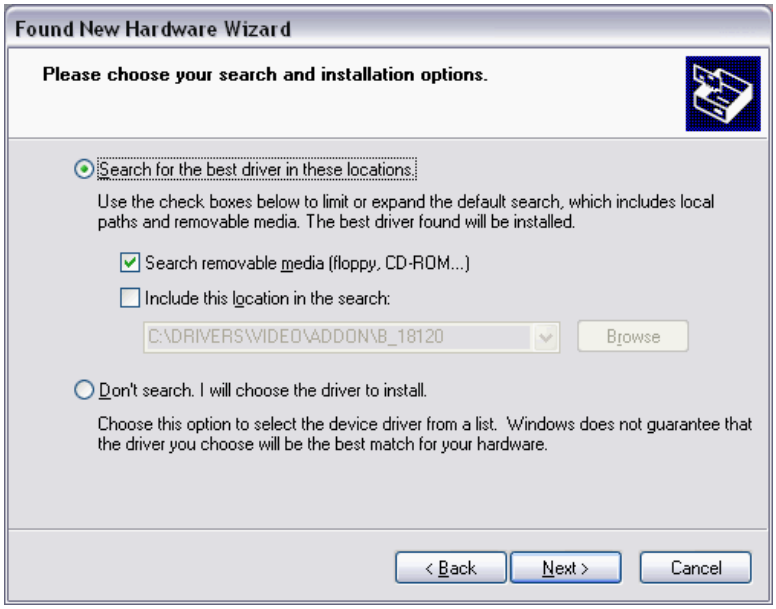


Figure 2-4 *USB Driver Location*

7. Select the above noted location for the USB driver location and click "Next."

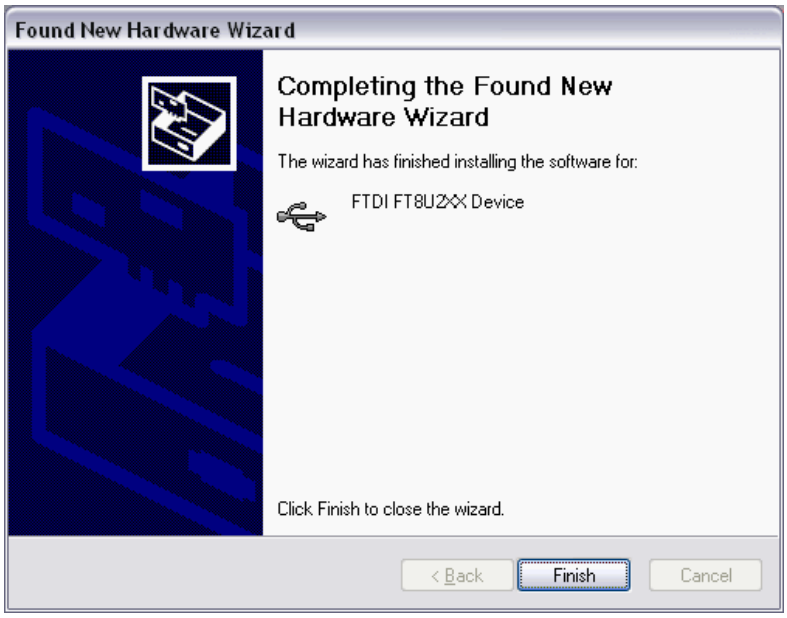


Figure 2-5 *Initial Driver Completion*

8. When the initial installation is complete you should see the above screen.
9. The operating system may have you install the drivers a second time, if so, repeat the above steps until the system is successfully installed the drivers and the system recognizes the hardware.

2.2.2.1 Windows Software Installation

1. Place installation CD into drive and select "Setup.exe."
2. The 922 download manager will intall itself.

SECTION 3 SYSTEM OPERATION

3.1 SYSTEM POWER UP

1. Power-up the 922 by using the ON/OFF rocker switch. The logo screen is displayed briefly. When the system has completed the boot up sequence the 922 will go directly to the measurement screen.
    - Reminder: Fully charge batteries before each use.
    - Reminder: The green LED will pulse when functioning properly

3.1.1 Road Vista 922 gui flow chart

The following flow chart shows how the menus in the 922 are interconnected. By default the 922 will boot up and start in the "Measure" page. A button is located in the lower left corner of each screen that allows the user to return to the menu above the one that they are currently in. The 922 utilizes a touch screen interface and therefore all references to buttons refer location on the 922 screen.

CAUTION

Use only a finger or Stylus pen provided, to press the touch screen buttons. Using any hard, pointed device to press the touch screen will damage the screen.

NOTE: The "Number Pad" and "Alpha/Numeric Keypad" require the user to either "Enter" the current value or "Cancel" the changes made in the window.

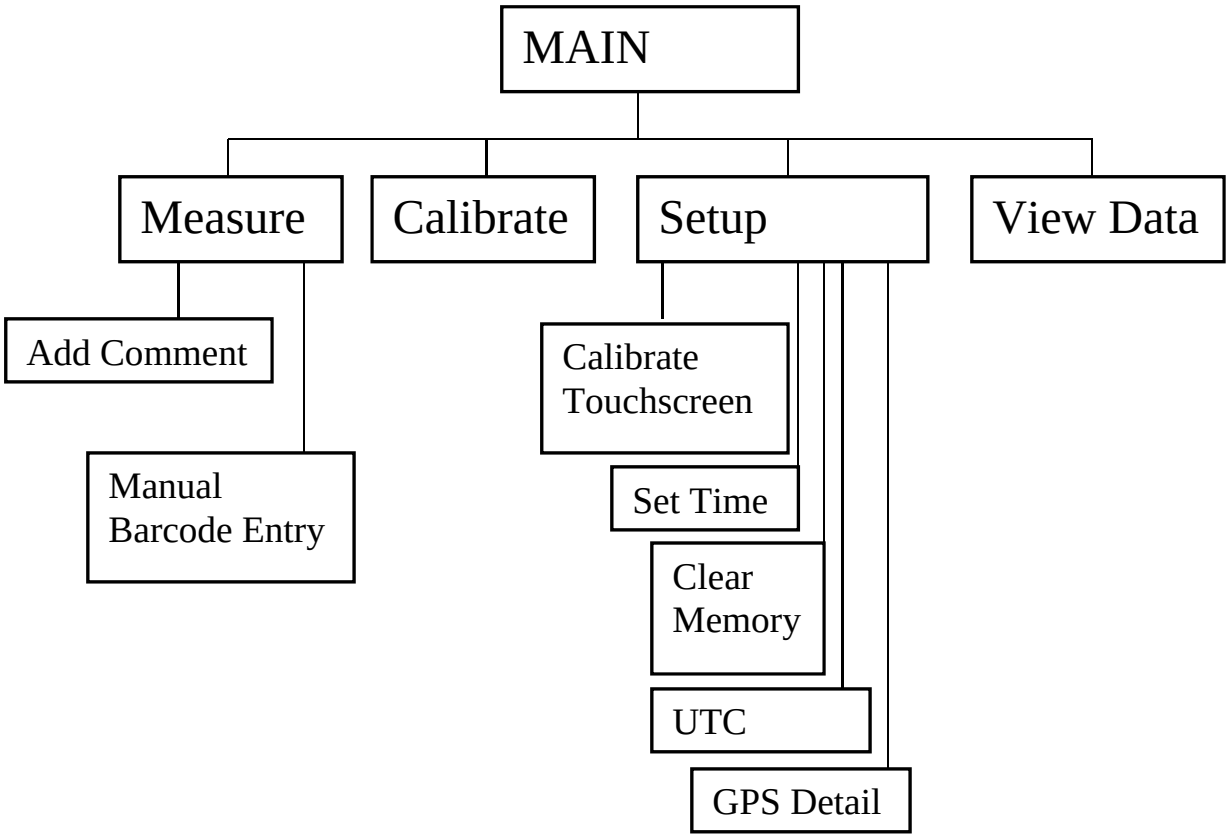


Figure 3-1 *922 Flowchart*

3.2 CALIBRATING THE 922

1. Enter the "Calibration" menu. This will require you to return to the main screen.

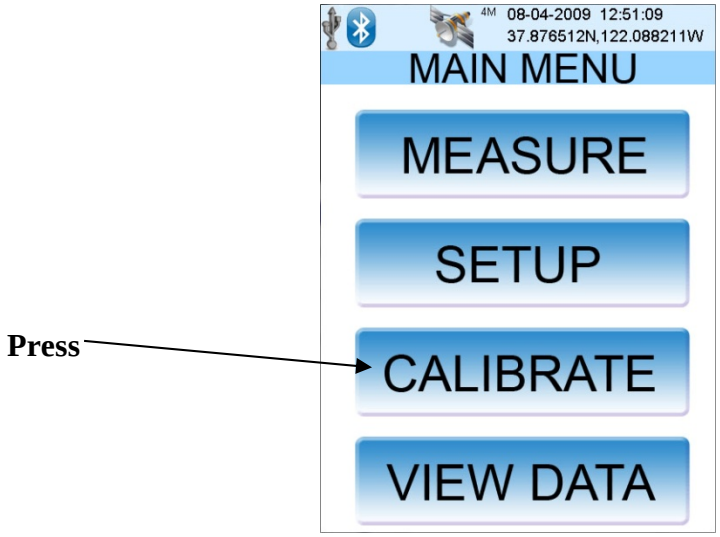


Figure 3-2 *Main Screen*

2. From the Main screen the user can now enter the Calibrate screen

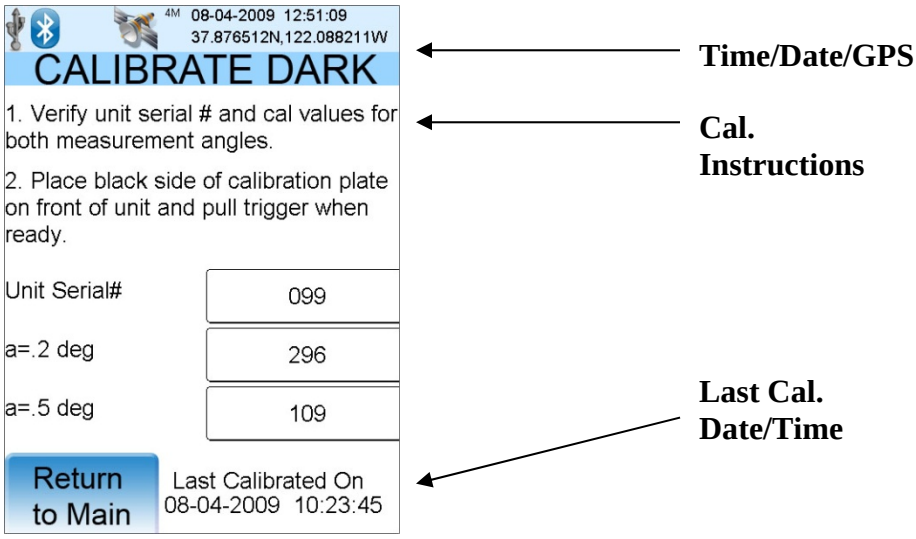


Figure 3-3 *Calibrate Dark Screen*

3. The menu allows the user to enter all the applicable data for the calibration standard that is going to be used from the 922 calibration. The values are entered by pressing the button associated with the value that the user desires to change.
   - Calibration Value for α = .2
   - Calibration Value for α = .5
   - Serial Number of the Calibration Standard

4. Once all applicable data is entered, the user places the black side of the standard against the front of the 922 and presses the trigger to take the initial background measurement.

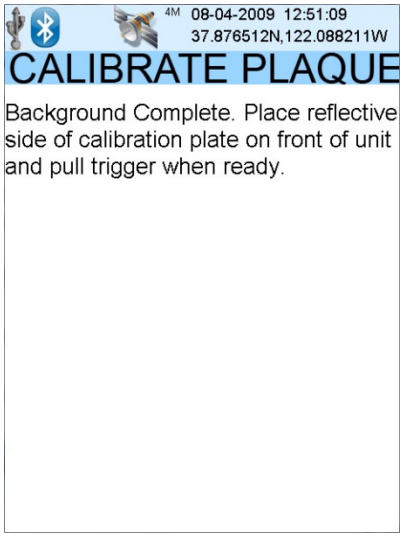


Figure 3-4 *Background Complete*

5. When the background is complete the user is prompted to place the reflective side of the standard against the front of the 922. Be sure to center the sample for more repeatable and accurate calibrations. Press the trigger when ready to calibrate unit.
6. After the unit has completed the calibration the system will automatically enter the measure screen and the user may now begin to take measurements.

3.3 MEASURING SAMPLES

3.3.1 Taking a measurement

1. If a calibration has just been completed the 922 will automatically enter the measurement screen. If however you are not in the Measurement screen please refer to the flow chart, Figure 3.1, on how to navigate to this screen.

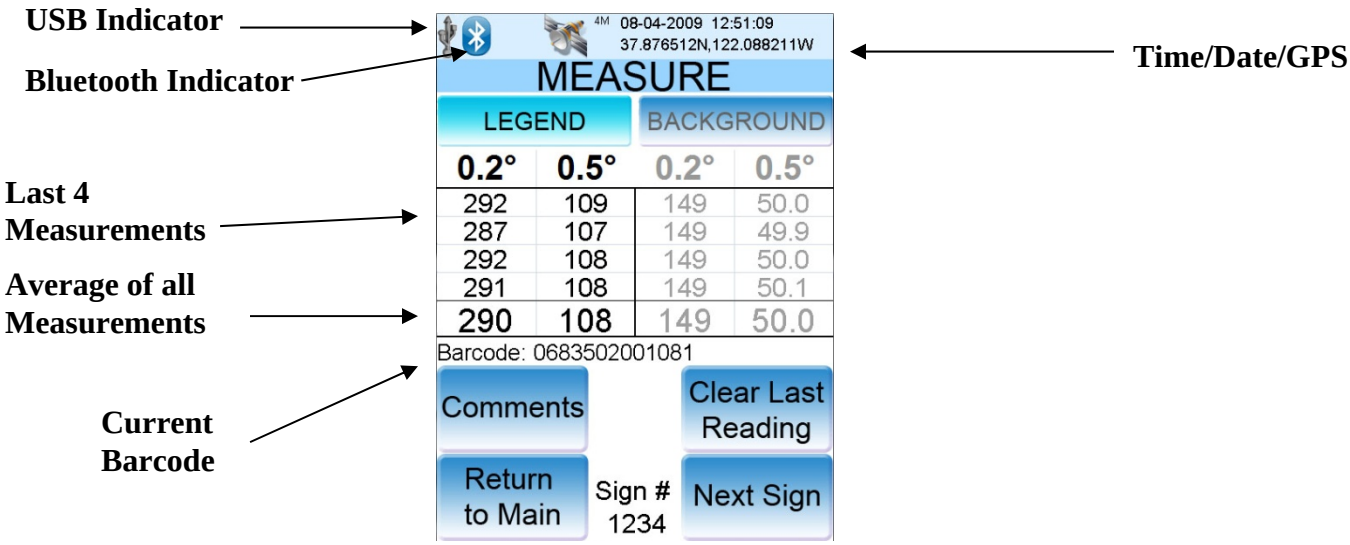


Figure 3-5 *Measure Screen*

2. Place the front of the 922 against the legend of the sign being tested. Press either "LEGEND" or "BACKGROUND" depending on which part of the sign is being measured. On signs that do not require separate legend and background measurements, set the instrument to only read legend data. Be sure to locate the correct location of the measurement area within the lamp output port.

CAUTION

When placing the front of the instrument on the test surface, be sure the front plunger switch is perpendicular to the surface to avoid damaging it.

NOTE:

- Front plunger switch must be depressed for the system to take a measurement.
- Sample must be larger than 1" in diameter. If the sample under test is not larger than this, an aperture reducer that is smaller than the sample must be used. If an aperture reducer is required, the 922 MUST be calibrated with the aperture reducer in place.

- Long arrow on side of unit points to the center of the output port. This may help with alignment.

3. Press the trigger to perform a measurement. The last value will be shown in the small window to the right of the running average (see Figure 3-5 *Measure Screen*). The user may take as many as 20 measurements for both the legend and the background. The 922 will continually use all of the available data for the average.

NOTE:

- When the unit has reached 20 measurements the 922 will no longer take any more measurements until the data is either cleared or saved

4. Press the "Next Sign" button when all the sign legend and background measurements have been completed. This will take you to the readings screen for the next sign.

NOTE:

- The 922 **will** only store the average of all values for both angles. All individual data readings will be deleted after the average has been saved.

3.3.2 Adding comments and additional information to a measurement

3.3.2.1 Barcode

1. A barcode value may be scanned by pressing the trigger while the front plunger is NOT depressed.
2. The barcode will remain on as long as the trigger is depressed. A short audible beep will sound when a valid barcode measurement has been taken.
3. The scanned barcode value will then be displayed on the measurement screen. (See Figure 3-5 *Measure Screen*)
4. The barcode value can be modified or entered manually by pressing the barcode label. Refer to Figure 3-6 *Manual Barcode Entry Screen*.
5. Please see appendix for additional barcode symbologies and how to activate them with the 922.

Figure 3-6 ***Manual Barcode Entry Screen***

3.3.2.2 Comments

1. A comment can be added to any measurement saved in memory by pressing the "Add Com" button within the measurement window.

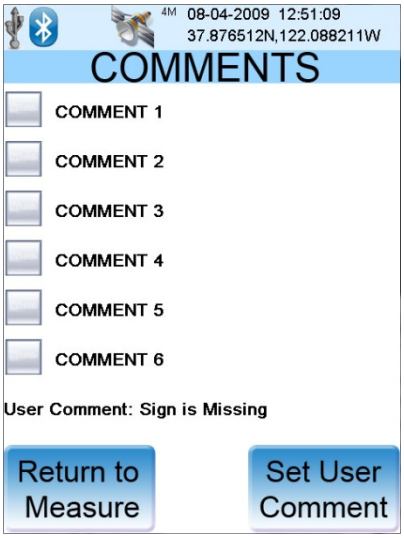


Figure 3-7 ***Standard Comments Screen***

2. This screen allows the user to add anything from 0 to 6 different standard comments to any sign (these comments can be set through the computer interface software). Any or all comments can be selected at any one time. A 17 digit alpha/numeric user comment can also be added by selecting "Set User Comment"
3. When all comments are entered and the user would like to save the data to memory, press "Next Sign."

3.4 SETUP PARAMETERS

1. Enter the setup screen through the main screen (refer to Figure 3.1)

2. The user has the ability to access the following information and features by entering the "Setup System Parameters" menu (Figure 3.8);
   - Backlight adjustment
   - Contrast Adjustment
   - Firmware Revision
   - Touch Screen Calibration
   - Manually set the time of day
   - Number of measurements in memory (bottom middle of screen)
   - Clear memory
   - Time Zone offset correction
   - GPS (Global Positioning System) detail information
   - Bluetooth Enable/Disable
   - Internal GPS Enable/Disable
   - GPS NMEA Mode
   - 0.5 Deg Observation Angle Enable/Disable

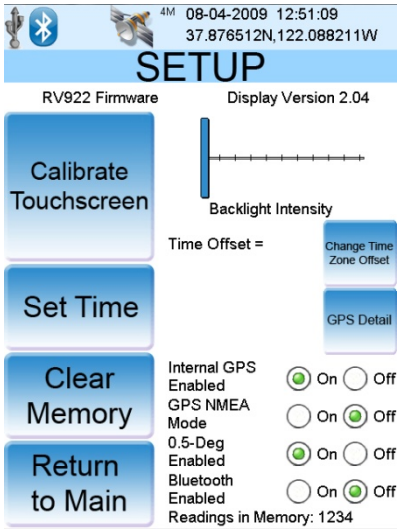


Figure 3-8 *Setup Screen*

3. Brightness and Contrast

   1) The user can adjust both the contrast and brightness by selecting the respective indicators and dragging them to a new location. Notice that unlike some competitors units which may only go to 10, the Road Vista 922's contrast and brightness settings go to 11.
   2) The new settings will be stored as the preferred setting when the "Return To Main" button is pressed

4. Touch Cal

    1) If the touch screen appears to be out of sync, press the "Touch Cal" button and follow the on-screen instructions to recalibrate the touch screen. You will be asked to touch 3 different areas of the screen.

5. Set Time Zone

NOTE: The internal CPU uses UTC time and therefore requires an offset for local time correction. The hour is based on a 0-24 scale.

    1) Press the "Set Time Zone" button to access the correction page.

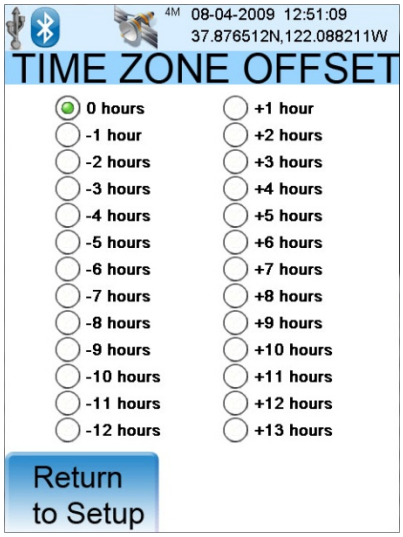


Figure 3-9 *Time Zone Offset Screen*

    2) Determine the local Time Zone with respect to UTC Time and select the correct offset. The internal CPU will use this setting to adjust the time for this new location.

6. If you do not have a GPS fix (if using the instrument indoors, for example), you may manually set the time. Touch the "Set Time" button. This will take you to a new screen. Enter in the Year, Month, Day, Hour and Minute by touching the appropriate areas on the screen. Once you have entered in the information, touch the "Set Time" button. Touch the "Return to Setup" button

NOTE: The time will still use the Time Zone offset from the previous step. If you do not know your time zone, enter in the local time and set the Time Zone Offset to be zero "0" hours.

NOTE: The time will update itself from the GPS clock once a GPS position lock has been achieved.

7. If it is desired to clear the entire memory, press "Clear Mem." You will be prompted only once if this action is truly desired. Once cleared the memory cannot be restored.

Figure 3-10 ***Clear Memory Warning Screen***

3.5 GPS STATUS INFORMATION

1) Access additional GPS information by pressing the "GPS Detail" button within the setup screen.

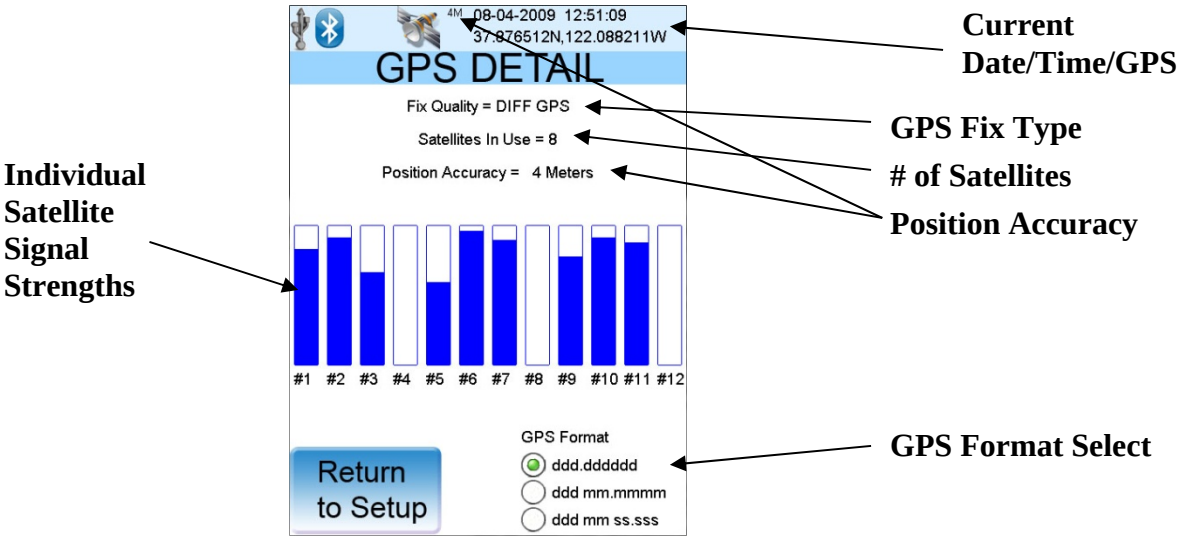


Figure 3-11 *GPS Detail Screen*

2) The GPS detail screen gives the user the ability to view detailed information about the following
   - Type of GPS: N/A, Normal GPS, Differential GPS (WAAS enabled)
   - # of satellites currently being used to determine location
   - Positional accuracy based on the satellite information
   - Individual satellite strength

NOTE: Not all satellites returning signal are being used for positional calculation.

3) The GPS position format can be selected in the lower left corner. This allows the user to choose how the GPS position is displayed and stored in memory.
   - ddd.dddddd - displays positional information in decimal degress
   - ddd mm.mmmm – displays positional information in degrees and decimal minutes. Note: Use this format when exporting data to Google Earth.
   - ddd mm ss.sss – displays positional information in degrees, minutes, and decimal seconds

3.6 VIEW DATA

This page allows the user to view any data that has been previously saved and is currently in the memory.

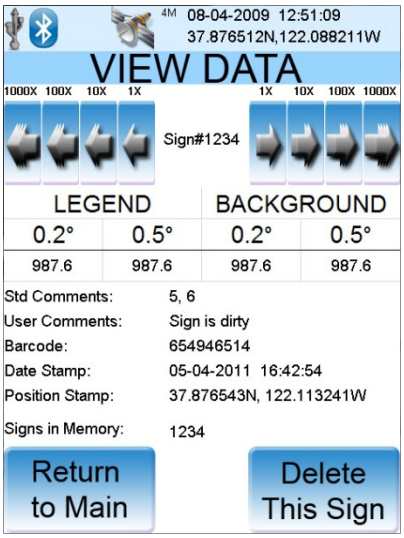


Figure 3-12 *View Data Screen*

1) The data can be scrolled through using the left and right arrows. The single arrows increment or decrement the sign # by 1, the double arrows increment or decrement the sign # by 10, the triple arrows increment or decrement the sign # by 100, and the quadruple arrows increment or decrement the sign # by 1000.
2) The currently selected sign can be deleted by pressing "Delete This Sign". After going through a confirmation screen, the record will be permanently deleted and the remaining data will be moved forward.

3.7 BLUETOOTH

The 922 is equipped with a Bluetooth transceiver on version 2.0 and above. The Bluetooth transceiver can be enabled or disabled on the setup screen (Figure 3-8 *Setup Screen*).

In order to connect with a remote device via Bluetooth, the remote device must support Serial Port Protocol (SPP), and be able to initiate a Bluetooth Connection.

1) Enable the Bluetooth on the 922.
2) On the remote device, do a search for Bluetooth devices. The 922 will show up as "RV922"
3) Pair the two devices, using "0000" as the passkey.
4) Open a serial connection on the remote device with the 922. When the serial connection is correctly initiated, a Bluetooth icon on the 922 will appear at the top of the screen next to the GPS data.

When an active SPP connection has been established with a remote device, the 922 will send out all of the data for each sign when "Next Sign" is pushed. This is the same data that is stored in memory. Additionally, sending the hex character "0x4d" (ascii "m") will initiate a measurement or turn on the barcode reader depending on whether the front button is pressed. This is the equivalent of pulling the trigger. The hex character "0x4e" will save the data and advance the memory to the next sign, which is equivalent to pressing the "Next Sign" button.

If situations where the 922 is being used with an automatic data collection system via Bluetooth, it may be desirable to switch the Bluetooth output to NMEA compatible formatting. This option (Enable GPS NMEA Mode) can be selected in the setup screen.

3.8 WINDOWS INTERFACE

The windows download interface gives the end user the ability to do the following:

- Adjust Communication settings
- Download data stored on any 922 or 922D
- Open existing data files
- View individual data points and all applicable information
- Download current standard comment settings
- Save data in an Excel comma delimited format
- Export data to a Google Earth format (Please refer to all Google's requirements for conformity when using this external software package)
- Clear 922 Memory

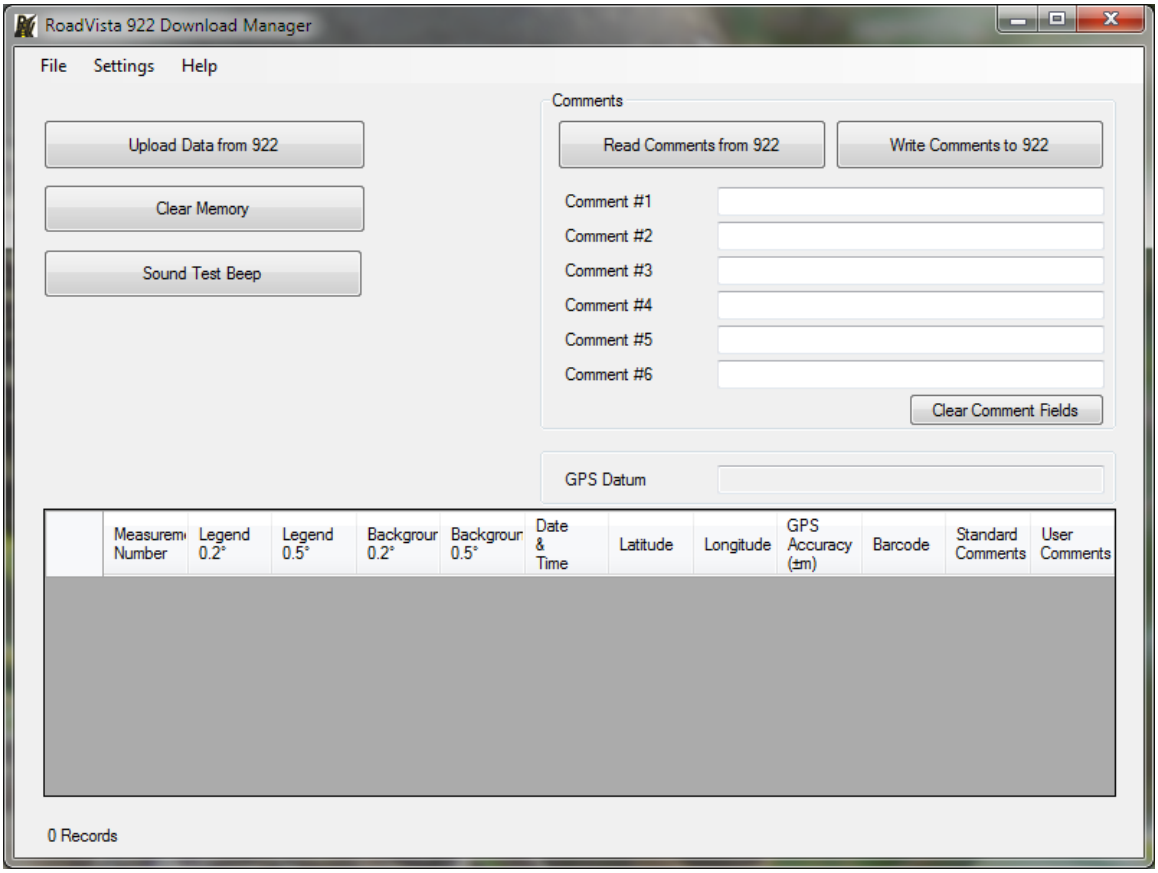


Figure 3-13 *Windows Interface Main Page*

1. Communication Setup
    a. The communication settings are accessed through the "Communications" drop down menu

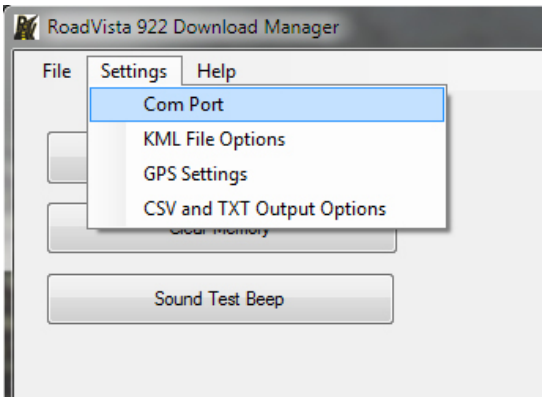


Figure 3-14 *Settings Drop Down Menu*

b. The user must first search for the appropriate communication port. The USB drivers must have already been installed, and the 922 should be connected to the computer and turned on.

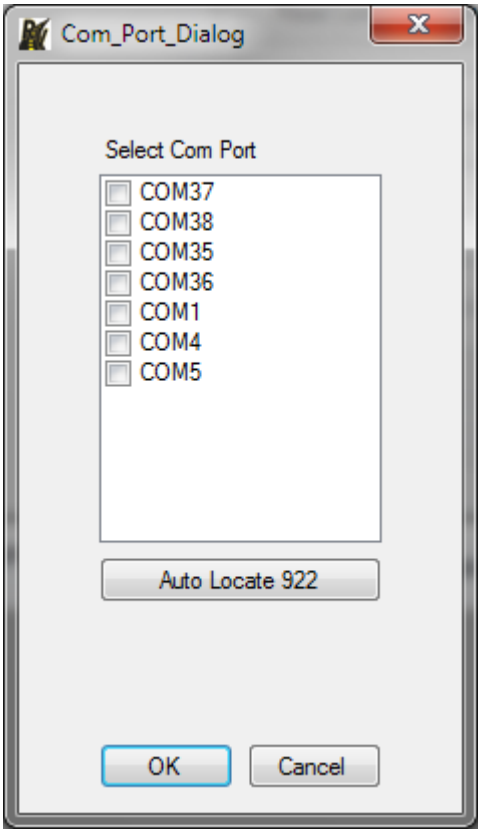


Figure 3-15 *Com Port Selection*

c. Once the correct communication port is found, click "Done." Click on the "Beep" button (refer to Figure 3.13) in the software to verify the

communication with the 922.

2. Uploading Data
    a. The data within a 922 is uploaded by pressing the "Upload Data from 922" button.
    b. When the upload is complete, all measurements stored within the 922 will be displayed within the Windows software

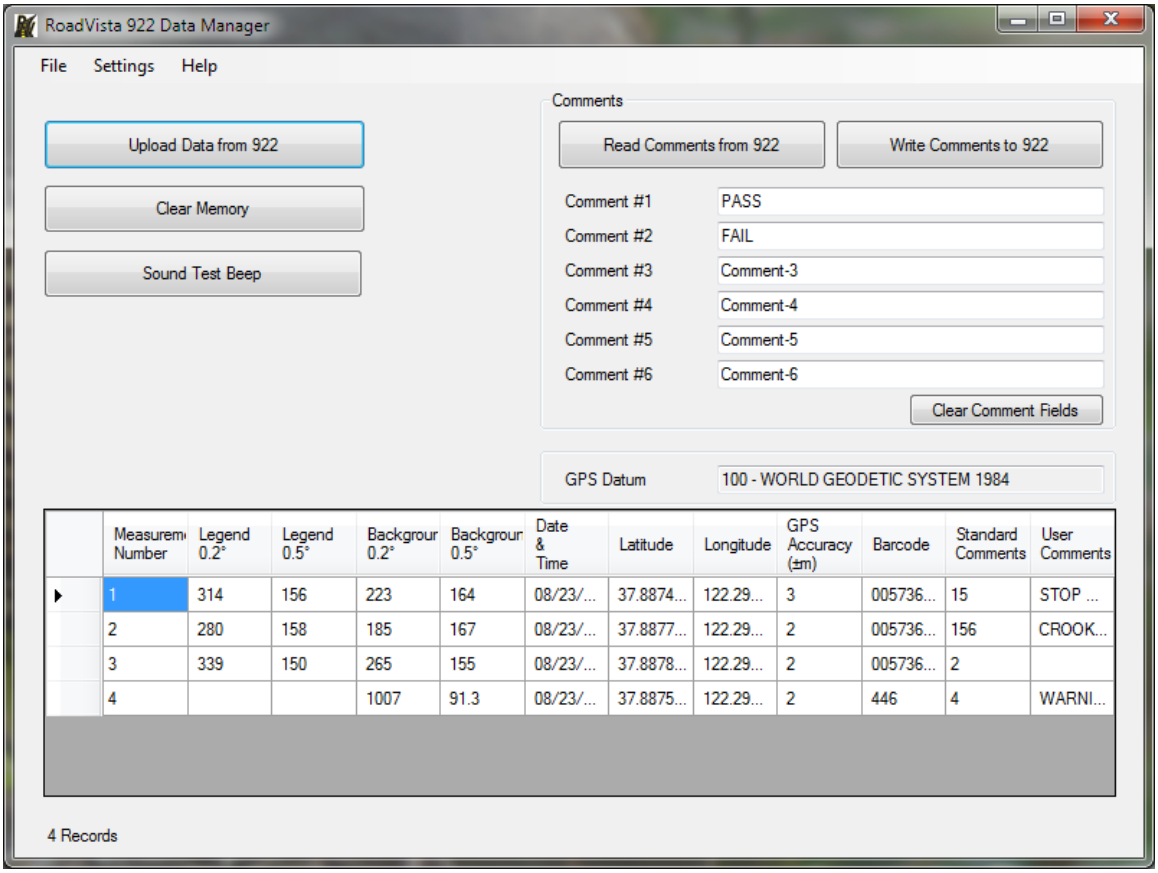


Figure 3-16 *Uploaded Data*

3. Save Data
    a. This option is selected from the "File" drop down menu. Data can be saved as a .csv (Excel or database import), .txt (same as .csv), .kml (Google Earth), or .shp (GIS format). See Appendix C for more information regarding these formats.

4. Open Data File
    a. This option is selected from the "File" drop down menu. The user will be prompted to locate the file of interest
    b. After the file has been loaded, all data points will be displayed within the

software

5. Comments
    a. The 6 comment fields will populate each time data is uploaded to the 922.
    b. Each individual comment (or all simultaneously) can be adjusted and written to the attached 922 by pressing the "Write Comments to 922" button. Each comment can be up to 19 characters.
    c. In order to utilize the pass/fail color coding option in Google Earth, define comment #1 as "PASS", and comment #2 as "FAIL". When the data is exported to Google Earth, data points marked as PASS will show up as green, failures will shows up as red, and measurements that have neither pass or fail will show as yellow.

6. KML File Options

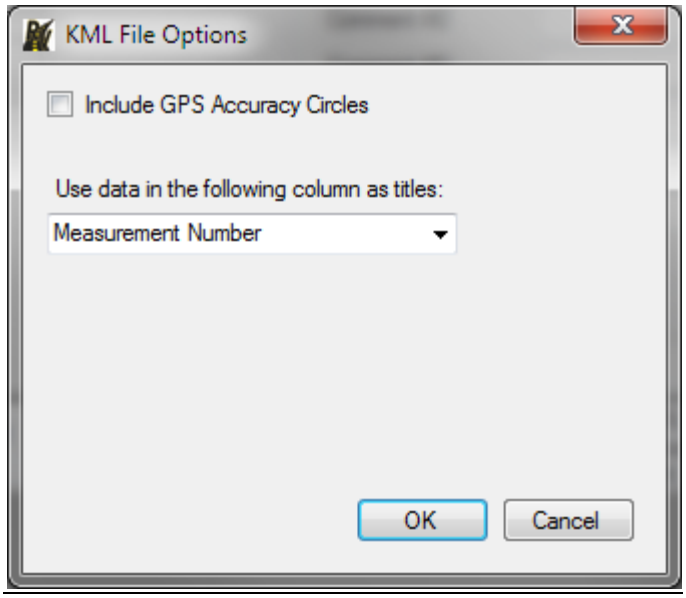


Figure 3-17 *KML File Options*

    a. The KML (Google Earth) Options can be accessed under the Settings drop down menu.
    b. Selecting "Include GPS Accuracy Circles" will cause Google Earth to draw circles around each data point to indicate the estimated positional error.
    c. Any data field can be chosen to be used as the titles in Google Earth by selecting the field from the drop down menu.

7. GPS Settings

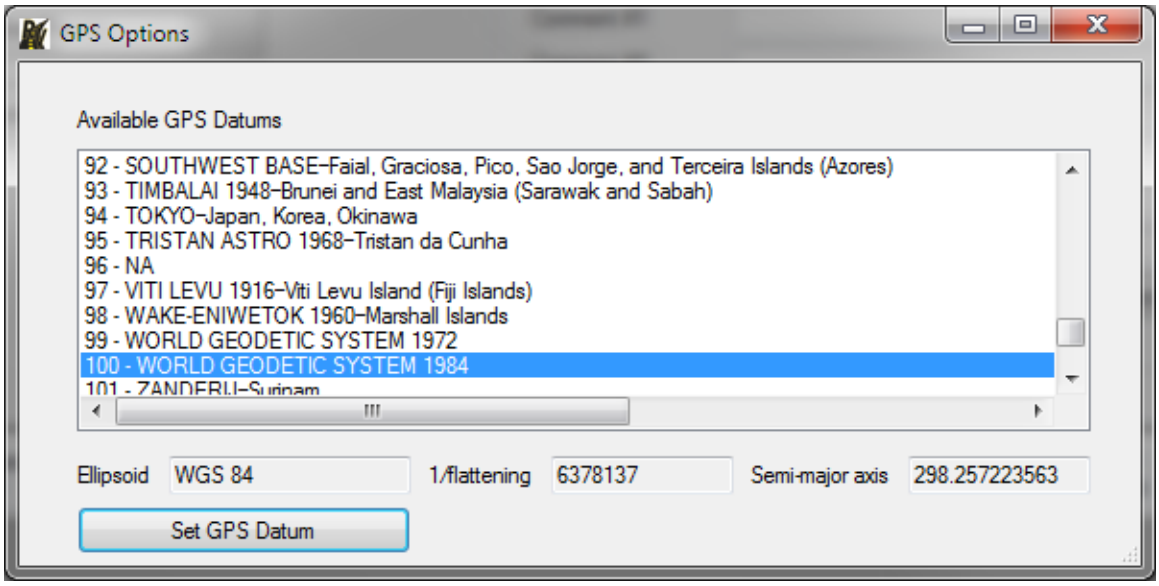


Figure 3-18 *GPS Options*

a. The GPS Settings can be accessed under the Settings drop down menu.
b. Choose the Datum you wish to use with the 922. The default datum is 100 (World Geodetic System 1984).

8. CSV and TXT output options

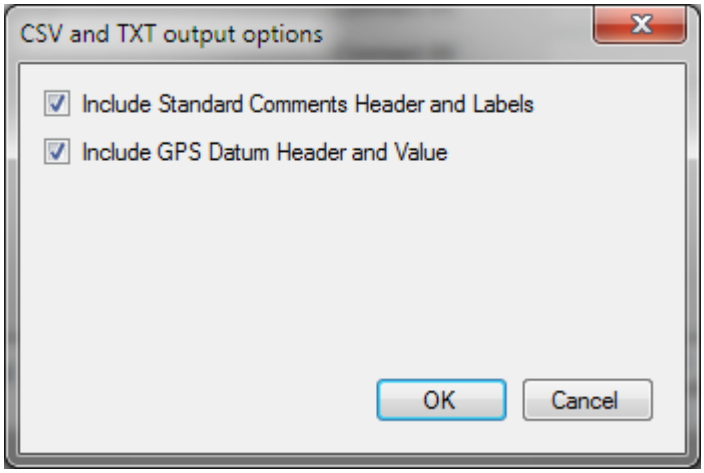


Figure 3-19 *CSV and TXT Output Options*

a. CSV and TXT output options can be accessed under the Settings drop down menu
b. When the Standard Comments Header and Labels option is selected, the output file will contain an additional header and information at the bottom

of the file pertaining to the standard comments

c. When the GPS Datum Header and Value option is selected, the output file will contain an additional header and information pertaining to the GPS Datum

9. Clear Memory
    a. The software will prompt once to verify that this is desired. Once the memory is deleted it can no longer be recovered.

SECTION 4 MAINTENANCE AND TROUBLESHOOTING PROCEDURES

4.1 SECTION OVERVIEW

The 922 Field Retroreflectometer has **no user-serviceable components**. If the green LED is not pulsing, the 922 internal CPU has malfunctioned. If this occurs, cycle the 922 power off, then on. If the problem persists, or if any other problem develops, refer to paragraph 4.2, Factory Repair.

4.2 FACTORY REPAIR

RoadVista maintains a factory repair department to return the 922 Field Retroreflectometer to within specification. If returning any portion of the 922 Field Retroreflectometer for calibration or repair, please contact the factory for a Return Material Authorization (RMA) number prior to shipment. Please use the following to contact the factory:

Phone (858) 279-8034
FAX (858) 576-9286
www.roadvista.com

Attach a detailed description of the specific problem (to minimize turnaround time), repack the instrument in its original case (if available), and ship it to the factory at the following address:

RoadVista
9925 Carroll Canyon Rd.
San Diego, CA 92131

Attn: Repair Department

4.3 SCHEDULED MAINTENANCE

The 922 should be returned to RoadVista on a yearly basis to verify all aspects of the measurement system are within specification and perform standard routine maintenance. Standard maintenance includes the following;

- Replace lamp
- Verify optical alignment
- Update firmware with newest version
- Full system check

4.4 STORAGE

When not in use, the 922 should be stored in its original shipping carton to protect it from damage, dust particles, and other potentially harmful environmental conditions.

4.5 CLEANING

Only the 922 exterior surface and touch screen may be cleaned.

CAUTION

When cleaning the 922, keep all cleaning materials and fingers away from the touch screen and lenses.

DO NOT use chemical cleaning agents that may damage the plastics, paint, or metal.

To clean the exterior surface, create a cleaning solution by combining water and a mild detergent. Dampen a soft cloth in the solution, and wring out the excess liquid. Wipe the 922 in a circular motion, making sure that the solution does not seep into any crevices.

To clean the touch screen, use only a new, dry, delicate task wiper, moving it in a circular motion.

SECTION 5 BARCODE SYMBOLOGIES

The barcode engine that exists within the 922 by default comes with several active symbologies. The engine also has several symbologies that must be activated before use. Below is a procedure for activating the symbology along with a list of the standard symbologies included with this engine.

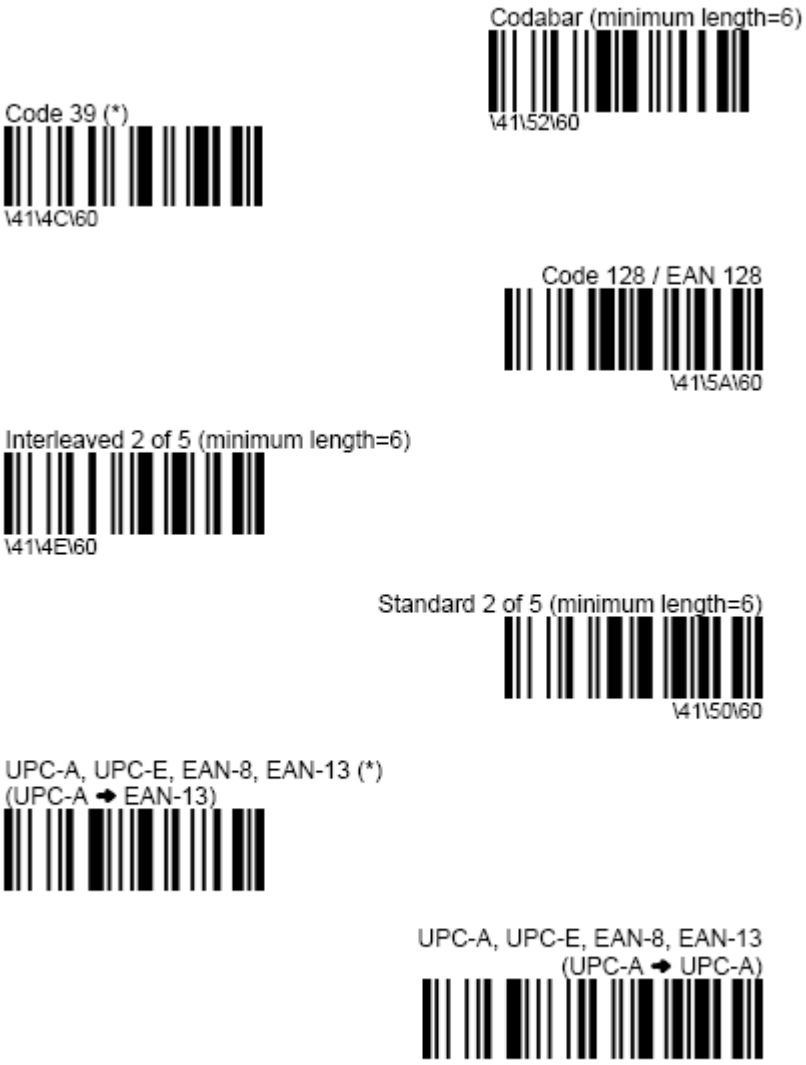


Figure 5-1 *Barcode Symbologies*

1. Using the 922, scan barcode of the desired symbology from Figure 5-1 *Barcode Symbologies*
2. Cycle power on the 922 unit

3. Scan the supplied example symbology from Figure 5-2 *Example Symbology*to verify that it is activated.

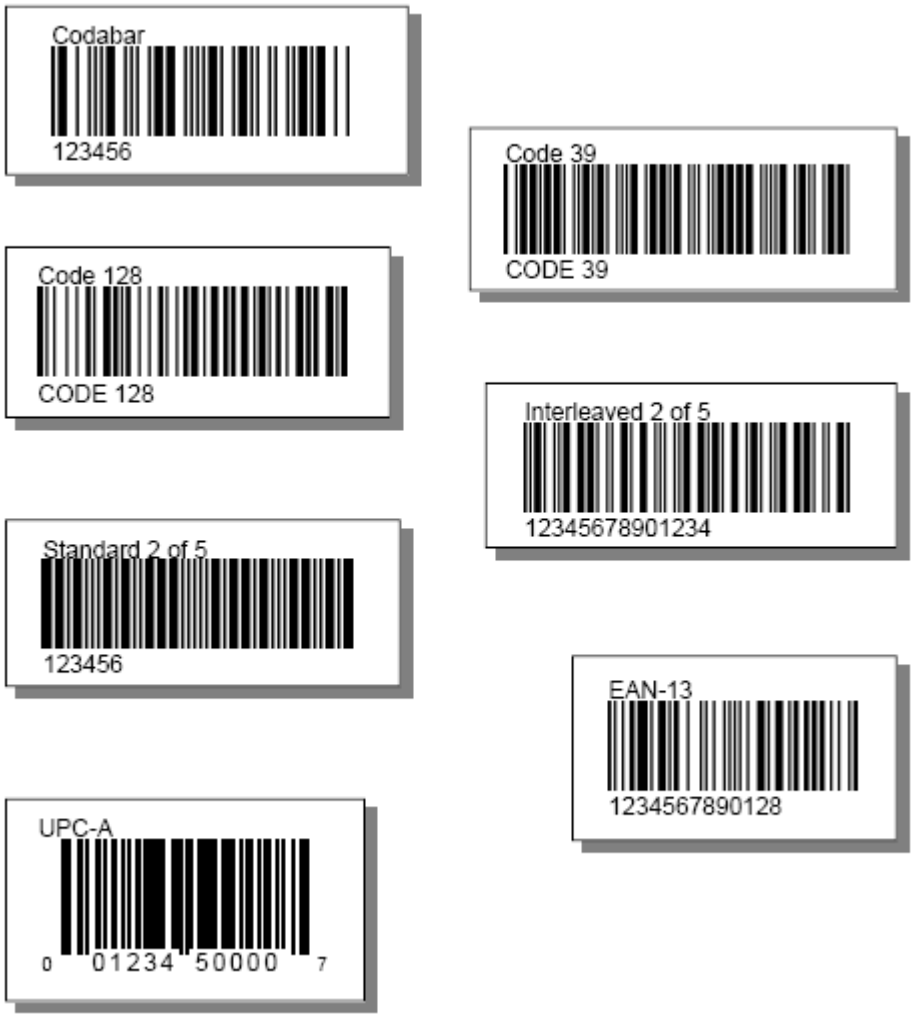


Figure 5-2 *Example Symbology*

SECTION 6 EXTENSION POLE KIT

The Extension Pole Kit allows the user to measure signs that are beyond reach. An infrared transmitter mounted on the base of the pole serves as the trigger. To use the extension pole kit, follow these steps:

1. Remove the pole kit from the case. The pole can be extended and retracted by twisting the telescoping sections.

Figure 6-1 *Extension Pole*

2. Mount the 922 by screwing on the pole to the bottom tripod mount. Tighten securely. **Note: Do not allow the 922 to twist on the pole once it is mounted, as it could unscrew itself.**
3. Put the 922 into the measure screen, and press the IR transmitter button. If the front plunger on the 922 is not depressed, the 922 will attempt to read a bar code, and if the front button is depressed, the 922 will take a measurement.

Figure 6-2 ***Taking a Measurement with the Pole Kit***

SECTION 7 DATA FORMATS

This section explains the raw data format used by the 922. This data can be accessed by using the download interface and selecting File, Save Data, and selecting either .csv or .txt formatting.

Here is an example file, with 4 data points, opened in a text editor:

```
Msrmt Number,0.2 Alpha Legend,0.5 Alpha Legend,0.2 Alpha Bkgrnd,0.5 Alpha Bkgrnd,Date/Time,Latitude,Longitude,Position Accuracy (m),Barcode,Standard Comments,User Comment
1, 314, 156, 223, 164, 08/23/2012 16:50:27, 37.887455N, 122.293437W, 3, 00573641,15, STOP SIGN
2, 280, 158, 185, 167, 08/23/2012 16:53:10, 37.887702N, 122.293650W, 2, 0057364104,156, CROOKED!
3, 339, 150, 265, 155, 08/23/2012 16:54:13, 37.887858N, 122.293698W, 2, 005736415772,2,
4, , , 1007, 91.3, 08/23/2012 16:55:42, 37.887520N, 122.293243W, 2, 446,4, WARNING SIGN

Standard Comments
PASS
FAIL
Comment-3
Comment-4
Comment-5
Comment-6

GPS Datum
100
```

Here is the same file opened in Excel:

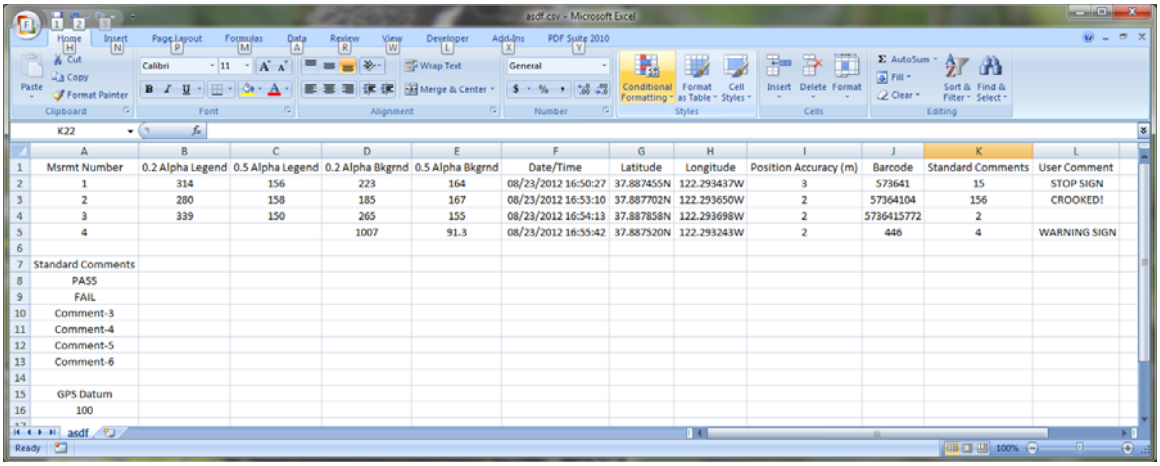


Figure 7-1 *Example Data in Excel*

Column 1: Measurement number
Column 2: 0.2° Alpha Legend
Column 3: 0.5° Alpha Legend
Column 4: 0.2° Alpha Background
Column 5: 0.5° Alpha Background
Column 6: Date and Time, expressed in month/day/year hour:minute:second
Column 7: Latitude, expressed in format selected under the GPS detail page
Column 8: Longitude, expressed in format selected under the GPS detail page
Column 9: Position Accuracy, in meters
Column 10: Barcode reading
Column 11: Standard Comments, shown as a list of the selected comments.
Column 12: User Comment

Here is the same data, saved as a KML file (with error circles enabled) and opened in Google Earth. Notice that the measurements with comment #1 checked (which was defined as PASS) show up as green icons, and measurement #3 which was defined as FAIL, shows up as a red icon. Measurement #4, which had neither, shows up as yellow.

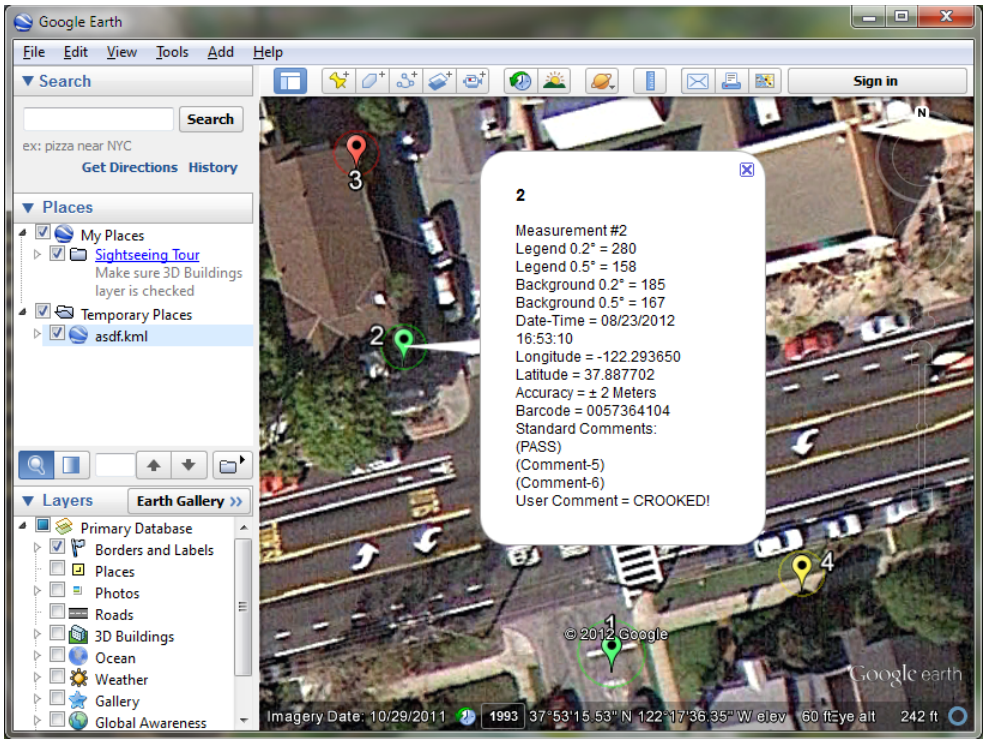


Figure 7-2 *Example Data in Google Earth*

This is an example output stream utilizing the Bluetooth connection with NMEA mode enabled. The various GPS sentences can be configured to be shown or hidden; please call RoadVista for details.

$PRV92,SN,5,L1,159,L2,168,B1,158,B2,167,BC,14567,SC,1,UC,BLUETOOTH!*09
$GPRMC,183050,V,3753.2499,N,12217.5754,W,,,240812,015.1,E*74
$GPGGA,183050,3753.2499,N,12217.5754,W,0,00,,,M,,M,,*40
$GPGSA,A,1,,,,,,,,,,,,,,*1E
$GPGSV,3,1,12,01,21,069,00,04,02,171,00,07,13,124,00,08,51,108,00*73
$GPGSV,3,2,12,09,05,311,00,11,16,052,00,15,31,299,35,17,69,177,00*7E
$GPGSV,3,3,12,26,53,249,00,27,20,313,00,28,63,023,00,48,45,198,00*72
$GPVTG,,T,,M,,N,,K*4E
$PGRME,,M,,M,,M*00

Revision #	Changes Made	Effective Date	ECN #
A	Initial Release.	01 DEC 05	5534
B	Update information in paragraph 3.3.1 item 2.	28 DEC 05	5573
C	Update manual to reflect new firmware	18 JUN 07	6049
D	Update manual to reflect new features	19 FEB 09	6318
E	Update Manual to reflect color display	12/2/11	6448
F	Updated CAUTION/WARNING notes in Section 3.	2/17/12	6465
G	Updated Manual for use with Firmware 2.52, Display-Code 2.04, Software 3.06	8/09/13	6561