Elkins Earthworks, LLC

Envision 200B™ Landfill Gas Analyzer

User Manual

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2 Introduction

Elkins Earthworks® would like to welcome you to the Envision® gas analyzer system. The Envision® gas analyzer, designed by Elkins Earthworks® is manufactured in the United States. The equipment was designed for the field technician as well as project managers. The Envision® gas analyzer is a two-part system, the sensor unit (Envision®) and the handheld computer. This unique pairing makes field activities more productive by giving the user the ability to expand functionality by using GPS, bar-coding, and other features that the operating system can offer.

There are currently 3 models of Envision gas analyzer:

ENV100 – has internal heating pads and is not certified intrinsically safe.

ENV200 – does not have internal heating pads and is certified intrinsically safe.

ENV200 “B” – same as ENV200 with added capability to measure barometric pressure.

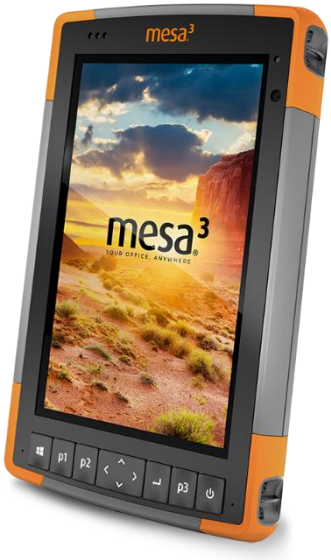
2.1 Handheld Computers

Elkins Earthworks® currently offers 2 models of tablet computers that can run the Gas Analyzer proprietary software to operate the Envision® sensor unit.

2.1.1 Juniper Mesa 2

Juniper's Mesa 2, 8.5" x 5.5", IP68 ruggedized tablet comes with the Windows 10 operating system and runs 8 – 10 hours on a single charge. It has options for Bluetooth, Wi-Fi, 4G LTE, camera, GPS, barcode scanner, RFID, and hot-swappable batteries.

2.1.2 Juniper Mesa 3



Juniper's Mesa 3 Ruggedized tablet features a 7" display and updated processor. The table is IP68 rated and runs Windows 10 with hot-swappable battery and battery life of 8 – 10 hours. The Mesa 3 offers Wi-Fi, USB and GPS connectivity. Barcode scanner, RFID, 4G LTE are available as options.

2.1.3 Envision® Gas Analyzer

The Envision® gas analyzer houses the gas and pressure sensors. The gas analyzer utilizes infrared sensors to measure CH_4 and CO_2. The Envision® uses an electrochemical cell to measure O_2 concentration and an accurate thermistor temperature probe or BlueProbe to measure wellhead gas temperatures. The Envision® HCH model includes additional sensors to measure CO, H_2S and H_2 gases (see separate manual). Data generated by the Envision® gas analyzer is relayed to the handheld PC via Bluetooth several times per second.

2.1.3.1 Gas Ports

The Envision® gas analyzer ENV100, ENV200 and ENVHCH models have four (4) ports located on the front of the unit.

Port listing from right to left:

Calibrate/Static/Sample port – This port is used to calibrate the unit with calibration gas, to measure static wellhead pressure, and to sample for gas quality.

Impact Port – This port is used to generate a differential pressure for calculating flow. Do not connect pressurized calibration gases to this port.

Available – This port is used to acquire an available (system) vacuum at the monitoring port. Do not connect pressurized calibration gases to this port.

Exhaust – This port is used to exhaust the gases that are pumped through the sample train for measurement. Only connect an exhaust hose to this port. Do not apply pressure to the exhaust port.

2.1.3.2 Cable Ports

Charger port – This port is used to charge the unit with the supplied wall charger. The Envision should run a full, normal working day without needing to be recharged. Plug the charger in overnight to charge the unit. It usually takes about 4 hours to fully charge an Envision. The charging circuit will turn off automatically when the unit has reached a full charge. Do not plug the charger into the unit in an explosive environment.

Thermistor Port – The wired thermistor plugs in to this port. If you have purchased a wireless (Bluetooth) thermometer from Elkins Earthworks, it may be used in place of the wired thermistor.

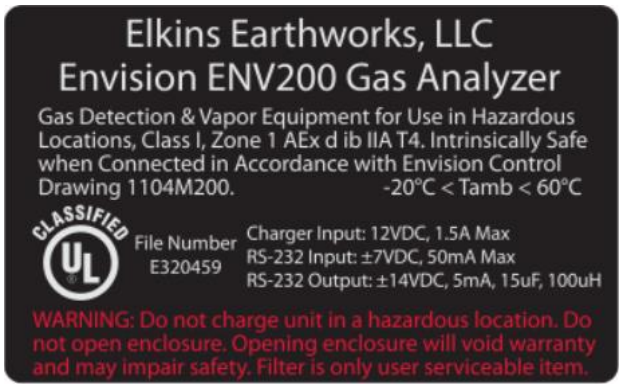
PDA Port – Used for factory/lab purposes only. Should not be connected in the field.

3 Safety

Landfill gas is normally safely extracted from landfills and conveyed to appropriate control devices. However, during the course of monitoring each extraction point, exposure may occur. As such, it is important to follow all site-specific safety protocols when monitoring. Working at a landfill typically requires site specific health and safety plans. While performing monitoring at a landfill, the user should be aware of the items included in the site specific health and safety plan. It is important to know that all personal protection equipment and safety protocols as appropriate must be used when using this instrument. All vents on the meter are designed to exhaust to the atmosphere and not in the included backpack. Since landfill gas contains methane, no smoking is permitted while using the instrument. Calibration gases must be handled with utmost care and with adequate ventilation.

It is the sole responsibility of the user of the Envision® sensor unit and handheld PC to determine the appropriate location that either unit can be utilized within as monitoring conditions may change. The Envision® sensor unit handheld PC are not intended for use in confined space entries but for the continuous monitoring of gases within a landfill gas collection system.

4 Certification



Envision® model ENV200 has been UL certified for use in hazardous locations (Class 1, Zone 1, AEx d ib IIA T4) when connected in accordance with control drawing 1104M200. Although models ENV100 and ENVAUS are based on a similar design, these models have not been certified for use in explosive atmospheres. It is important that this manual be followed closely and that any repair to the Envision® gas analyzer is made at the approved Elkins Earthworks® repair facility. Opening the Envision® gas analyzer and breaking the housing warranty seals may result in voiding the unit's warranty as well as compromising the unit's safety. The charger should not be connected when an explosive atmosphere is present.

The Envision® sensor unit also meets FCC regulations for a Class A Digital Device Part 15, Subpart B, Sections 15.107b & 15.109b

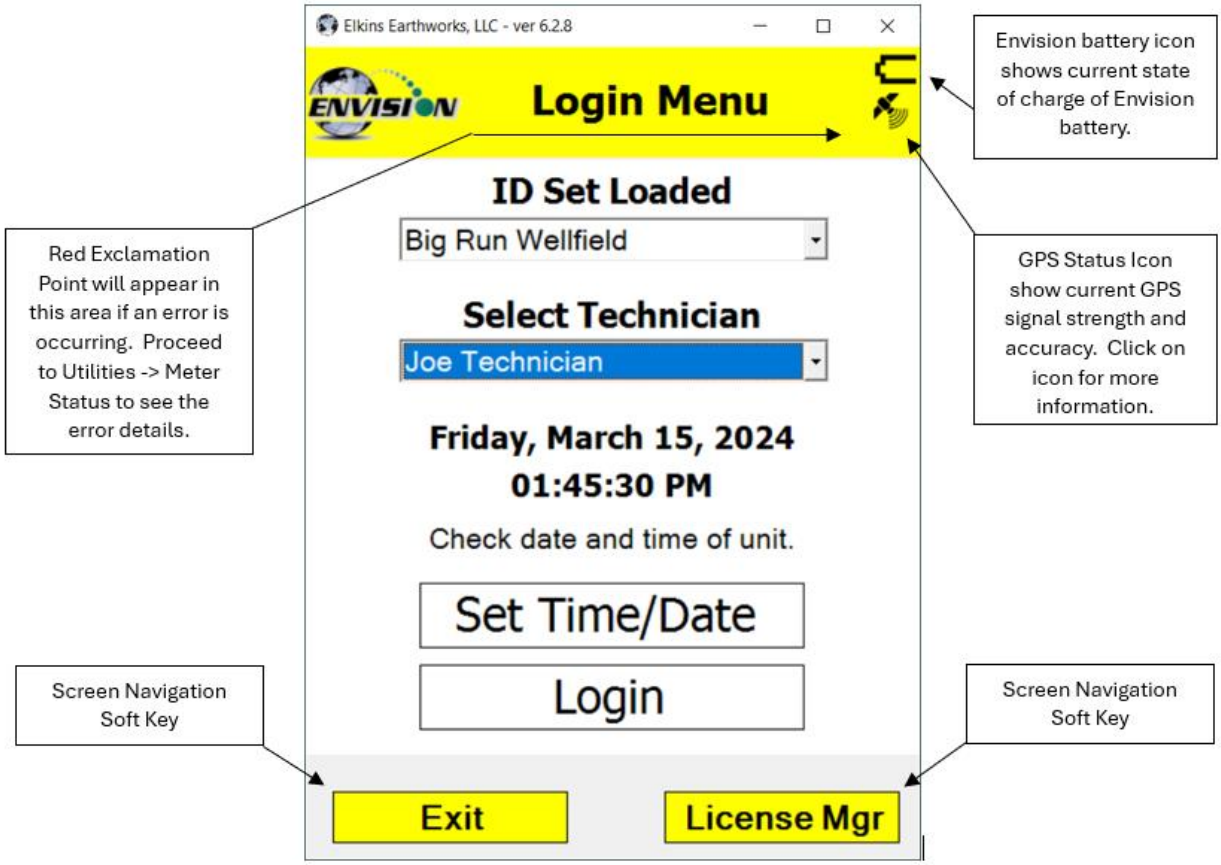
5 Envision® Gas Analyzer Application

The "Elkins Gas Analyzer" program is the software developed to run the Envision® gas analyzer. To activate the Gas Analyzer program, follow the steps below:

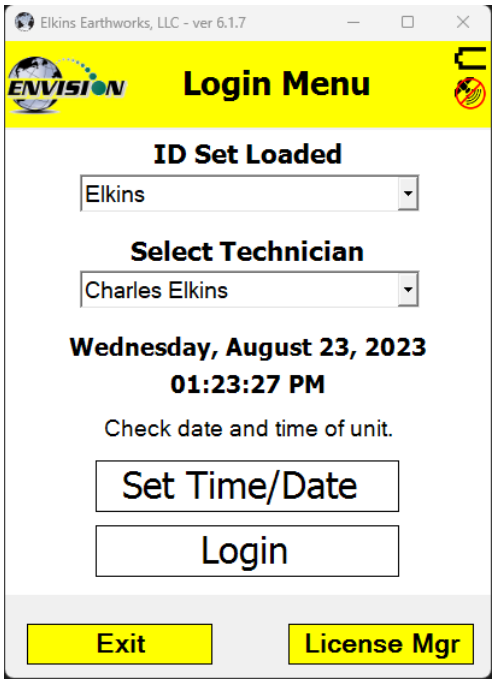
A desktop shortcut will automatically be added when the EGA software is installed. Alternately, the application will be listed in the programs list in a folder called "Elkins Earthworks LLC". Click either of these shortcuts to start the program.

5.1 Software Screen Properties

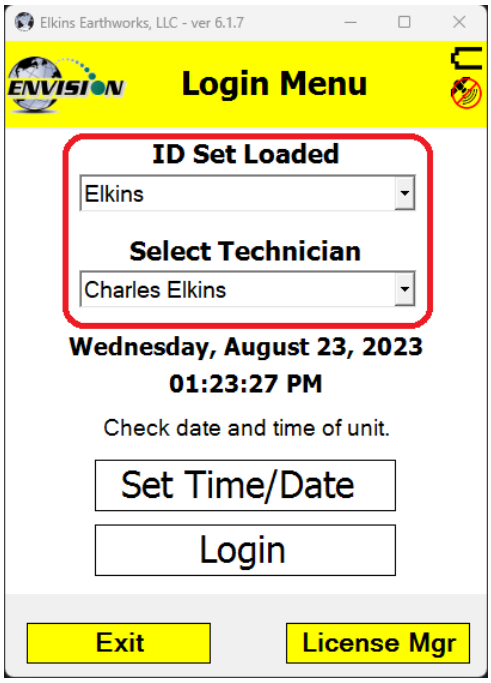
The detail below illustrates the main features common to each screen of the Elkins Gas Analyzer Program.



5.2 "Login Screen" – Logging in to the Elkins Gas Analyzer Software

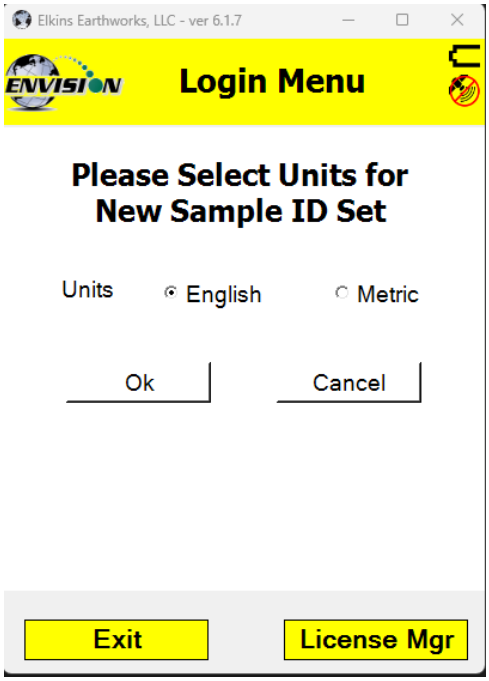


Once the Elkins Gas Analyzer program is started from the "Start Menu" the "Login Menu" will appear. This screen is intended to allow the user to login to the Elkins Gas Analyzer program.

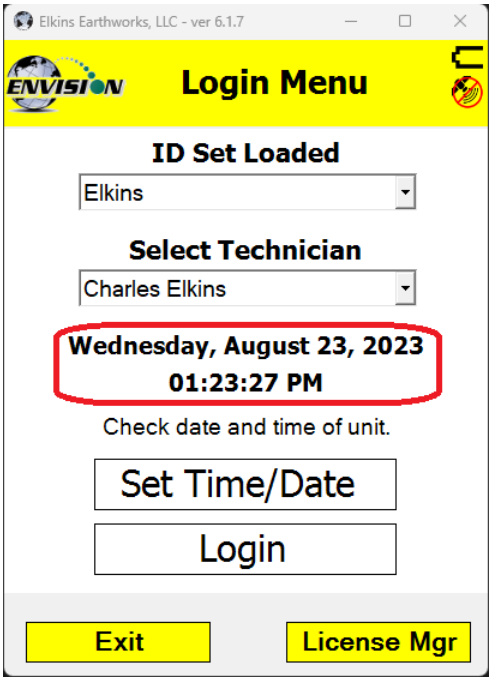


1) Select the Desired ID set and the name of the Technician who will be using the Envision® gas analyzer from the drop down menu located at the center of the "Login Menu" screen. ID sets may be added to this drop down menu by utilizing the "Elkins Earthworks® Configuration Editor" software that may be installed on your personal computer. The "Elkins Earthworks® Configuration Editor" software is provided on the Elkins Earthworks® software Flash drive included in the original packaging of the Envision® gas analyzer. Both ID sets and technician names may also be added directly from the drop down list on the Login Menu.

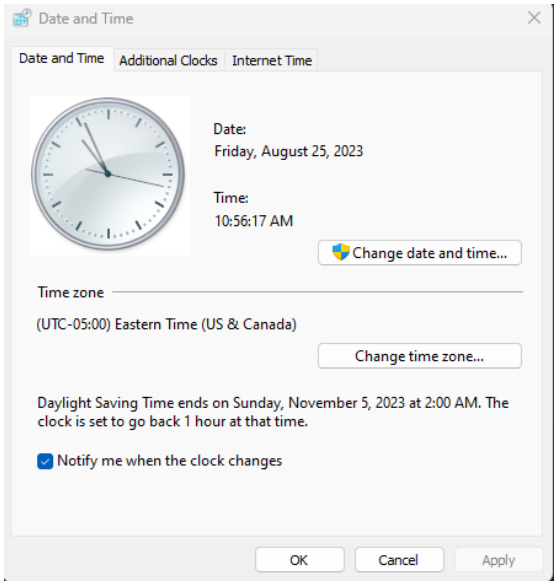
2) Select the Desired ID set and the name of the Technician who will be using the Envision® gas analyzer from the drop down menu located at the center of the "Login Menu" screen. ID sets may be added to this drop down menu by utilizing the "Elkins Earthworks® Configuration Editor" software that may be installed on your personal computer. The "Elkins Earthworks® Configuration Editor" software is provided on the Elkins Earthworks® software Flash drive included in the original packaging of the Envision® gas analyzer. Both ID sets and technician names may also be added directly from the drop down list on the Login Menu.



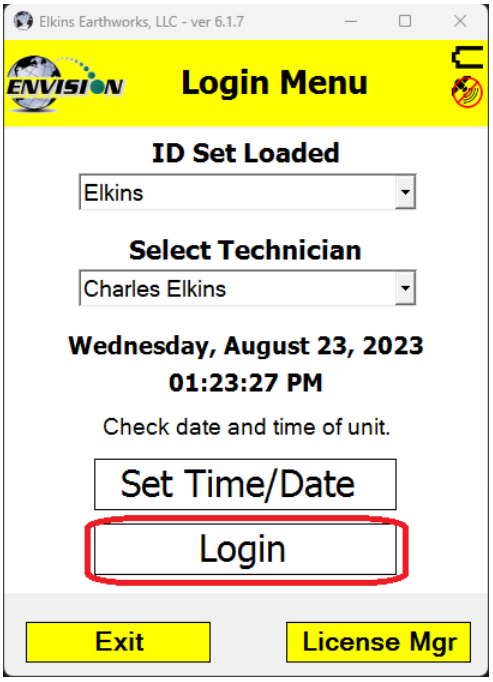
When adding a new ID set, the user may be prompted to choose either English or Metric units of measurement.



3) Verify that the date and time is correct as displayed on the login screen.



4) If date and/or time is incorrect then tap the “Set Time/Date” button
5) The “Set Time/Date” screen will appear and you may then adjust to the correct date and/or time
6) Tap the “Set” button when the date and time have been corrected. This will return the user to the Login Screen.



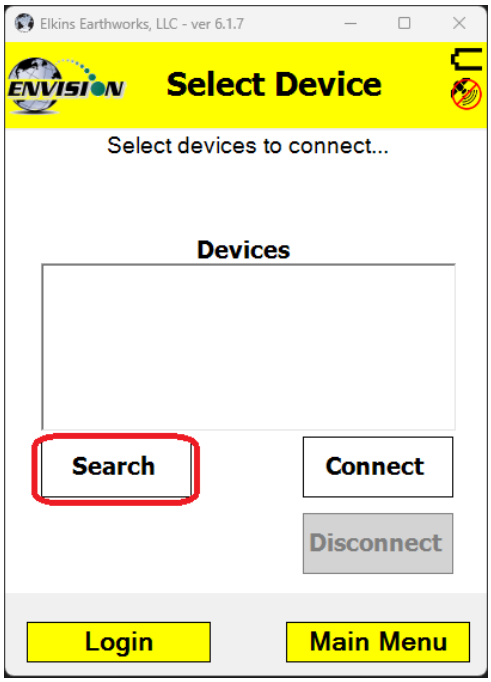
7) If the user name and time are now correct, then tap the “Login” button at the bottom of the screen.

5.3 Connecting and Disconnecting the Envision® Gas Analyzer

5.3.1 Bluetooth Connection

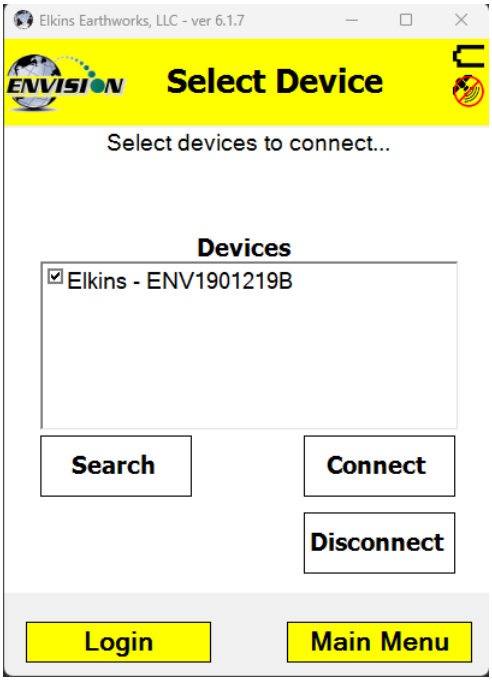
Once the user is logged in, the user can now search for and connect to an Envision® gas analyzer.

1) On the handheld computer make sure that the "Select Meter" screen is displayed
2) Turn on the Envision® gas analyzer by pressing the power button on the front of the Envision® gas analyzer
3) The Envision® gas analyzer will maintain a solid green light next to the power button
4) Next press the Bluetooth® button on the face of the Envision® gas analyzer. The blue light on the Envision® gas analyzer will blink now that it is discoverable and can allow the handheld computer to find it.



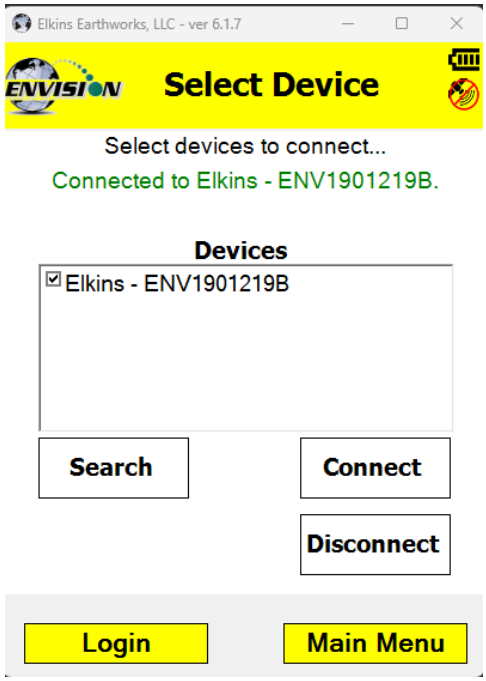
5) The user should now tap the "Search" button on the "Select meter" screen on the handheld computer.

6) The handheld computer screen will display "Searching…" above the "Meters" box and will change to "Select Meter to connect" once the Envision® gas analyzer is discovered.



7) The Envision® gas analyzer should be displayed in the box titled “Devices”. Each discoverable Envision® unit should appear and will be defined by the name Elkins Envision® followed by the unit’s serial number.

8) Select the desired analyzer by tapping the Envision® Meter ID and then tapping “Connect”. If you are using a Bluetherm® temperature probe, you may also select it and connect to it at this time.

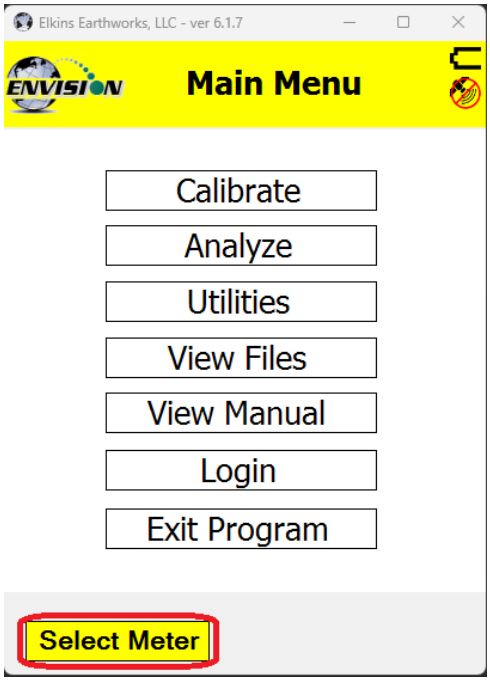


9) Once the connection is made the words “Connected to ….” will be displayed in green above the “Meters” screen. The blinking blue light on the Envision® gas analyzer will stop blinking and will now show solid blue. The connection symbol in the yellow header box on the Trimble handheld computer screen will now be multicolored indicating a connection with the Envision® gas analyzer. The battery strength indicator located in the yellow header box will now display the approximate battery level of the Envision® gas analyzer.

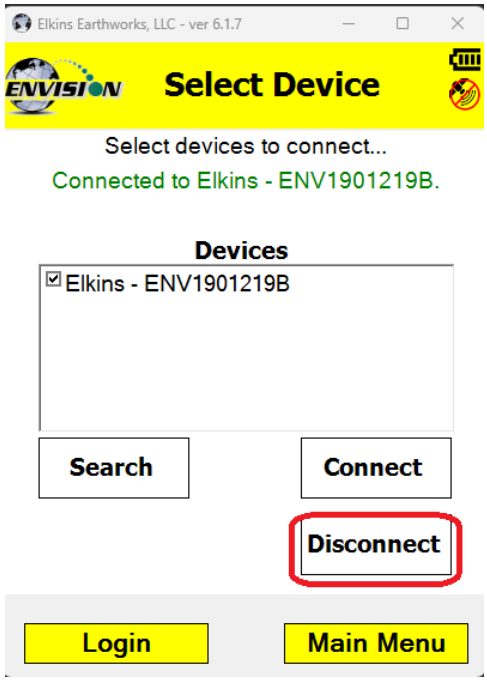
10) Once connected, tap the “Main Menu” button on the lower right hand corner of the screen.

5.3.2 Disconnecting from the Envision®

To disconnect from the Envision® gas analyzer follow the steps listed below:

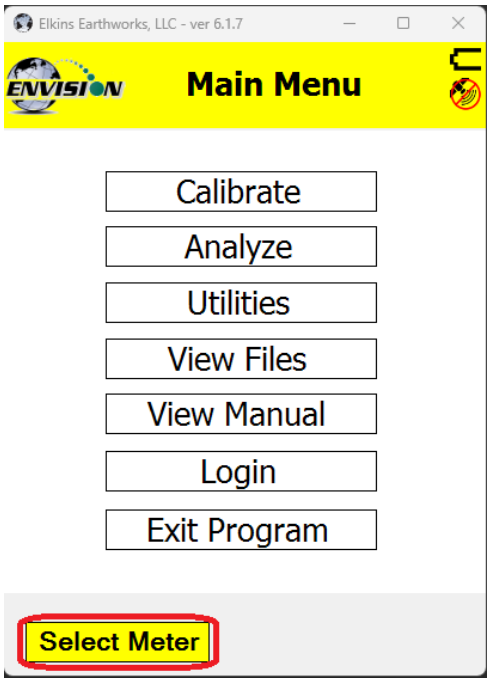


1) From the "Main Menu" tap the "Select Meter" button on the lower left corner of the touch screen.



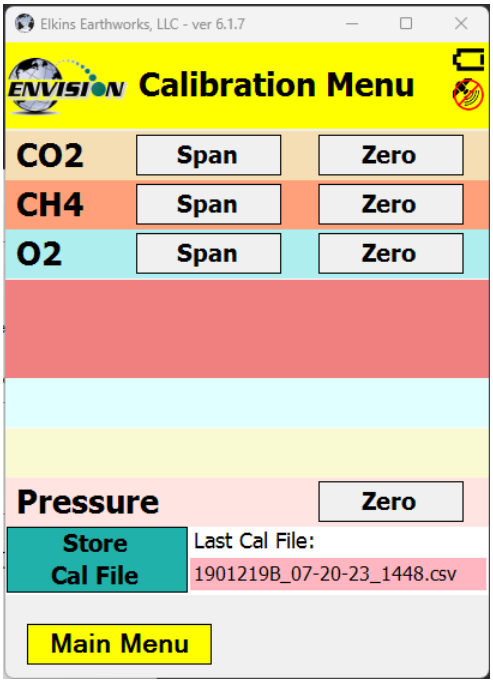
2) Uncheck any devices intended to be disconnected from
3) Tap the "Disconnect" button

5.4 Main Menu



The “Main Menu” is the user’s access point for all of the features included in the Elkins Gas Analyzer software. On this screen the user may select any one of the functions indicated on the buttons or the user may return to the “Select Meter” screen by tapping the “Select Meter” button in the lower left corner of the touch screen. The following sections will walk the user through each of the functions indicated on the “Main Menu” screen.

5.5 Calibration



The ENV200 gas analyzer has 3 internal gas measurement sensors (CH_4, CO_2 , O_2) and five pressure sensors that have been calibrated in the factory. The factory calibration results are stored within the Envision® gas analyzer and can only be altered in the factory. The Envision® gas analyzer should be field calibrated prior to each monitoring event. The field calibration file is stored within the handheld computer.

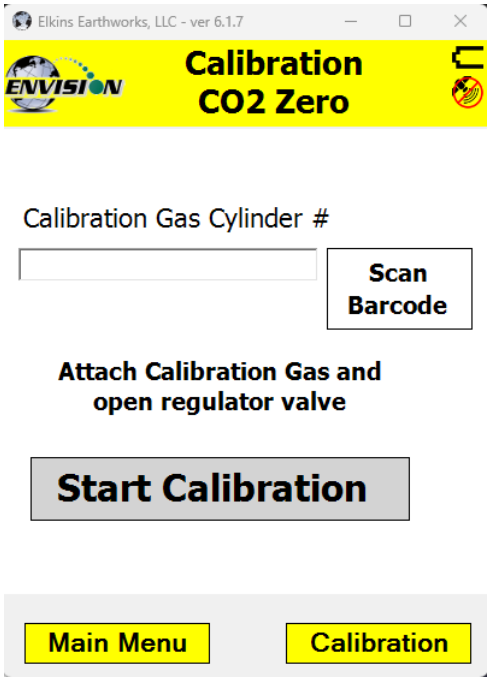
To enter the calibration area of the software, tap the "Calibrate" button on the "Main Menu" screen. The calibration process of the Envision® gas analyzer was built to be simple for the field user. Follow the calibration procedure described below to accurately calibrate the Envision® gas analyzer.

Each gas sensor should be calibrated with a zero gas and a span gas. The technician may calibrate sensors in any order. However, for greatest accuracy, CO2 span should be calibrated before CH4 span (minimizes cross-sensitivity). It is also recommended that when one gas sensor is calibrated that all sensors should be calibrated for zero and span.

The calibration menu for ENV200 models is shown below. The CSV (comma separated variable) file containing the last calibration information is stored on the handheld PC. This file may be opened in any text editor (or Microsoft Excel).

5.5.1 Zero Gas Calibration

The typical order of calibration is to do all zero gases first, followed by span gases.



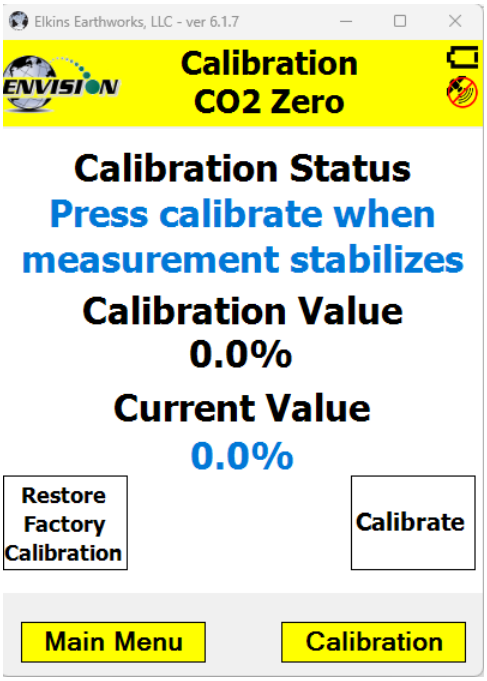
1) Tap the "Zero" button of the gas that is to be calibrated. This action will take the software to the "Calibration … Zero" screen

2) The user now has the ability to scan the barcode on the calibration cylinder. Tap the "Scan Barcode" button and aim the scanner laser or camera at the barcode on the calibration gas cylinder being utilized. The barcode number will automatically populate the "Calibration Gas Cylinder #" text box. The user can manually type in the bottle lot# using the numeric keypad on the Trimble or the user may proceed without entering a cylinder number. This data will be recorded in the calibration .csv file that is stored during the calibration process.

3) Attach the calibration gas to the Static sample port located on the front of the Envision® gas analyzer and open the regulator valve. Elkins Earthworks® strongly recommends the use of a Demand Flow regulator.

Warning – If using a tunable regulator, use a setting of .5 LPM and attach the calibration gas only to the Static port. Do not attach the calibration gas to the Exhaust, Impact or Available ports. Pressures above 200" H_20 on any port may result in a damaged pressure sensor.

4) Tap the "Start Calibration" button. This action will turn on the sample pump and will change the handheld computer display.



5) When the "Current Value" is less than 1% the Calibration status will display "Press calibrate when measurement stabilizes". This does not mean that the sensor has fully stabilized but that the unit is within the 1% tolerance allowed when zeroing. Tap the "Calibrate" button once the current value has stabilized.

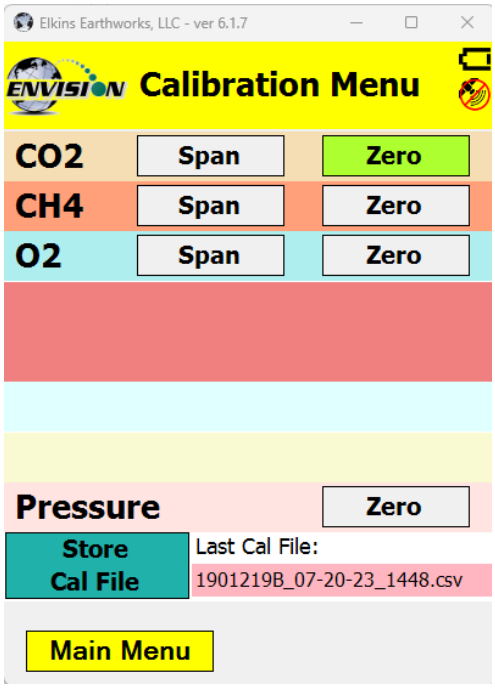
If this button is pressed before the measurement is fully stabilized, the calibration will be inaccurate and, in some cases, make the Envision unable to pass a span calibration.

If the measurement continues to fall after the button is pressed, it is ok to press the calibrate button a second (or third) time to get a better zero.

Errors that may occur:

a. If the "Current Value" is greater than 1% then the handheld computer will display the following message "Current measurement is outside of expected range. Please verify calibration gas value and/or restore factory calibration." The technician may discard the field calibration value and restore the factory calibration value by tapping the "Restore Factory Calibration" button on the "Calibration … Zero" screen. The technician should then try to recalibrate. If the unit will not calibrate then the user should contact technical support at Elkins Earthworks® at 330-725-7766.
b. If the "Current Value" is between 0% and 1% then the handheld computer will adjust and store your calibration once the user taps the "calibrate" button.

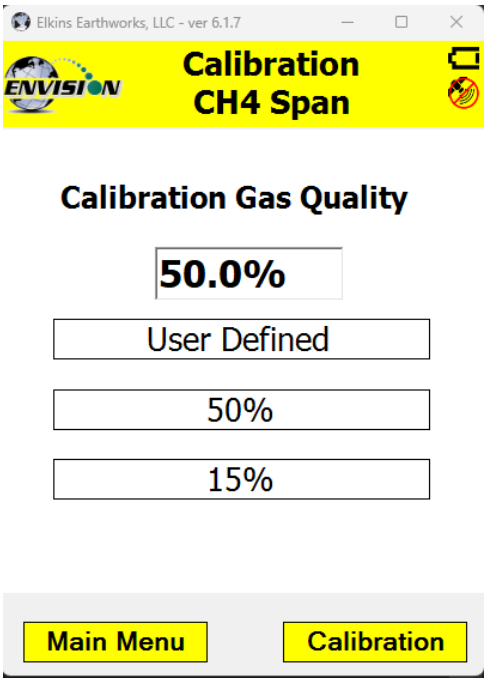
6) The pump will continue to run and the sensors will continue to monitor until the user returns to the “Calibration” menu by tapping the “Calibration” button in the lower right hand corner of the touch screen.



7) Now that the handheld computer has returned to the “Calibration Menu” the user will notice that the parameter that has been calibrated is now highlighted in green. The user may now select the next gas to calibrate.

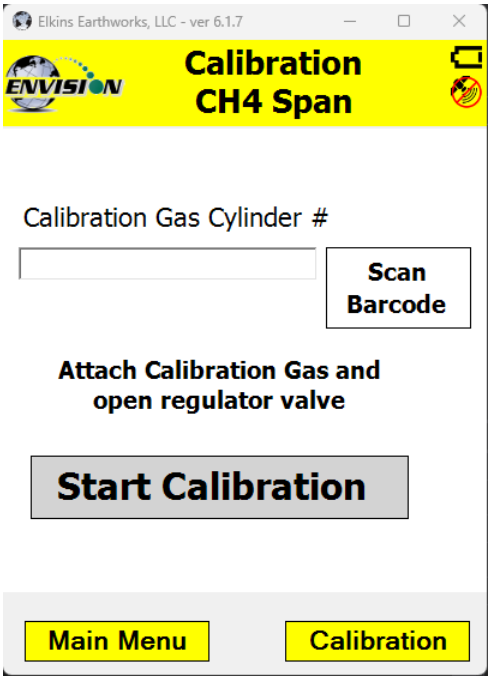
5.5.2 Span Gas Calibration

1) On the “Calibration Menu” tap the “Span” button of the gas that is to be calibrated. This will take the user to the “Calibration … Span” screen.



2) On this screen there are two preset calibration gas values and one text box that the user can type in a user defined calibration gas value using the touch screen keyboard or numeric keypad. If selecting a user defined gas quality, the user must enter a value 0.1% to 100%.

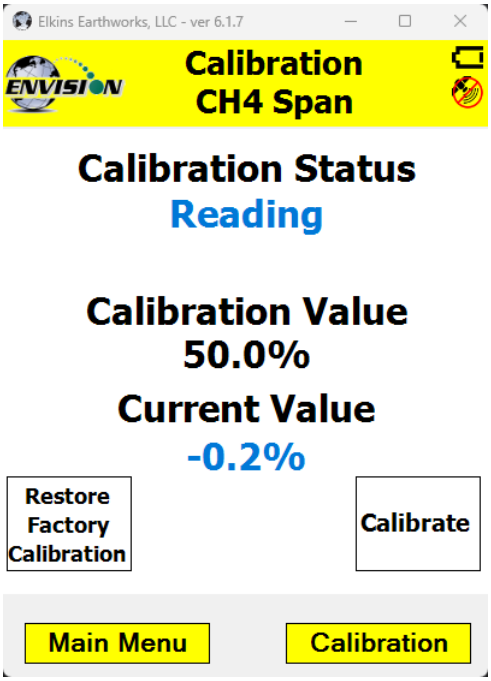
   If the user types in a span gas value, he must first type in the desired gas quality then tap the “User Defined” button. Once the user taps “User Defined” or either one of the two predetermined gas qualities, the screen will then change to the “Calibration … Span” screen.



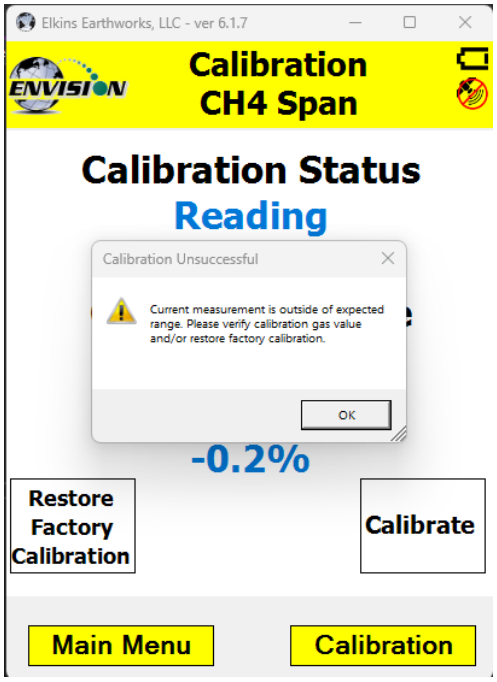
3) The user now has the ability to scan the barcode on the calibration cylinder. Tap the “Scan Barcode” button and aim the Camera at the barcode on the calibration gas cylinder being utilized. The label number will automatically populate the “Calibration Gas Cylinder #” text box. The user can manually type in the bottle lot number using the numeric keypad on the tablet or proceed without entering the cylinder number. This data will be recorded in the calibration .csv file that is stored at the end of the calibration process.

4) Attach the calibration gas to the Static sample port located on the front of the Envision® gas analyzer and open the regulator valve. Elkins Earthworks® strongly recommends the use of a Demand Flow regulator. Warning – If using a tunable regulator, use a setting of .5 LPM and attach the calibration gas only to the Static port. Do not attach the calibration gas to the Exhaust, Impact or Available ports. Pressures above 200" H20 on any port may result in a damaged pressure sensor.

5) Tap the "Start Calibration" button. This action will turn on the sample pump and will change the display. The "Calibration Value" located in the middle of the touch screen should be the same as the gas quality that is being used for calibration and will not fluctuate.



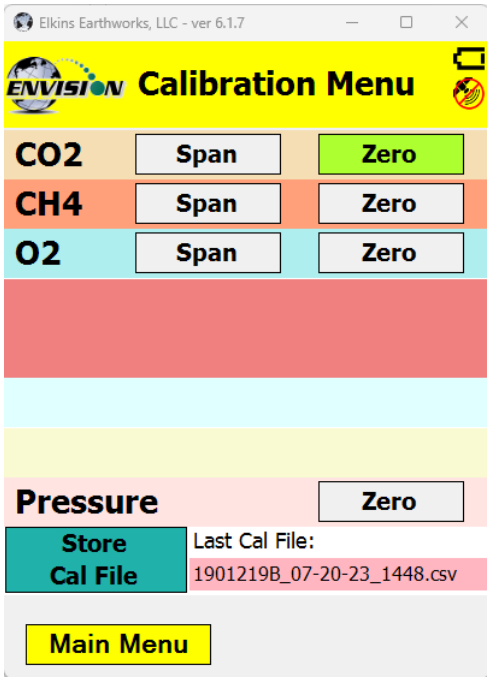
6) Once the sensors are initiated and warmed up the "Current Value" will fluctuate. When the "Current Value" is between 0% and 20% (relative) of the calibration gas value the Calibration status will display "Press calibrate when measurement stabilizes". Tap the "Calibrate" button once the current value has stabilized. If this button is pressed before the measurement is fully stabilized, the calibration will be inaccurate. If the measurement continues to change after the button is pressed, it is ok to press the calibrate button a second (or third) time to get a better span.



Errors that may occur:

a. If e "Current Value" is between 0% and 20% (relative) of the calibration gas value, then the handheld computer will adjust and store the calibration value once the user taps the "calibrate" button.

b. If the "Current Value" is greater than 20% (relative) of the calibration gas value, then the handheld computer will display the following message "Current measurement is outside of expected range. Please verify calibration gas value and/or restore factory calibration." The technician may discard the field calibration value and restore the factory calibration value by tapping the "Restore Factory Calibration" button on the "Calibration … Span" screen. The technician should then try to recalibrate. If the unit will not calibrate then the user should contact technical support at Elkins Earthworks® at 330-725-7766.

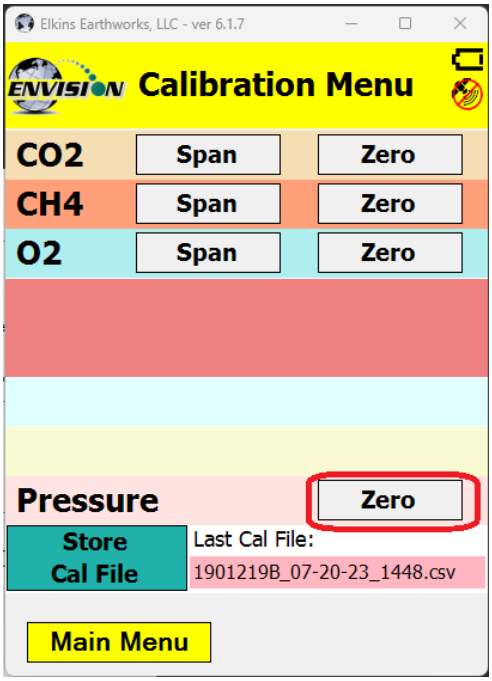


7) Now that the handheld computer has returned to the "Calibration Menu" the user will notice that the parameter that has been calibrated is now highlighted in green. The user may now select the next gas to calibrate.

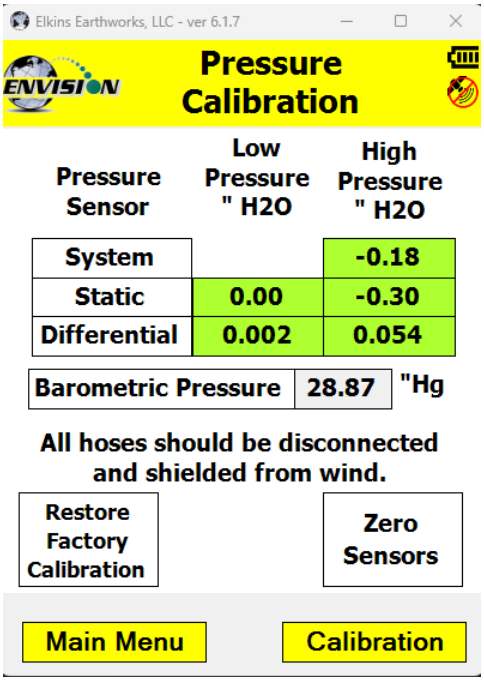
5.5.3 Pressure Sensor Calibration

The Envision® gas analyzer has 5 internal pressure sensors. These sensors should be field calibrated at the beginning and periodically during the monitoring event. The pressure sensors may be zeroed from two different locations in the Elkins Earthworks® Analyzer software.

From the "Calibration Menu":



1) Tap the "Pressure Zero" button. The screen will change to the "Pressure Calibration" screen.



2) On the “Pressure Calibration” screen allow the pressures in the 5 pressure blocks to stabilize. The ENV100/200 screen is shown to the left.

Note: ENV100 and ENV200 models without a barometric upgrade will not show a barometric pressure reading.

3) Ensure that the sample fittings are disconnected from the wellhead and shielded from wind.

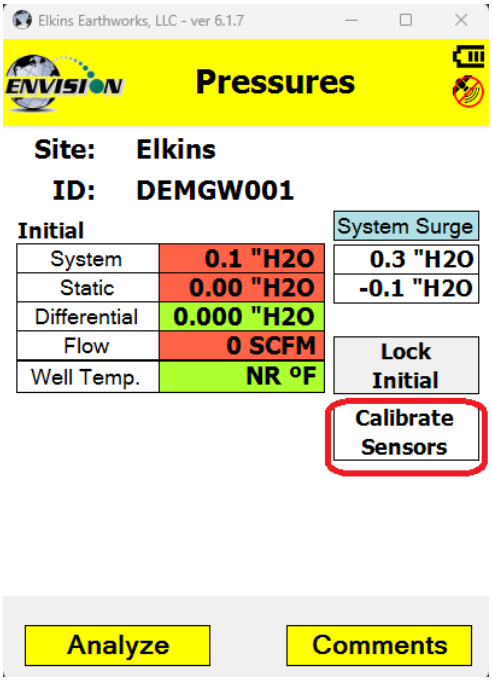
4) Tap the “Zero Sensors” button on the lower center part of the touch screen.

5) The values in the green pressure boxes should now read close to 0.00” H2O. Due to the high sensitivity of the sensors the values may still fluctuate but they should be close to the target value.

6) The user may also restore the factory calibration by tapping the “Restore Factory Calibration” button.

7) Tap the “Calibration” button on the lower right of the screen to return to the main “Calibration” screen. The pressure sensor calibration menu is also accessible from the pressure measurement screen in the analyze portion of the software. On the read “Pressures” screen tap the “Calibrate Sensors” button. This action will take you to the pressure sensor calibration screen that was just described in the previous section.

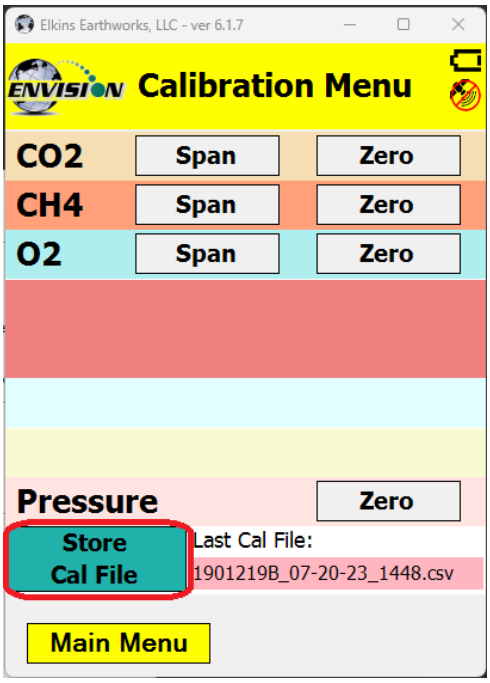
From the “Pressures Screen”:



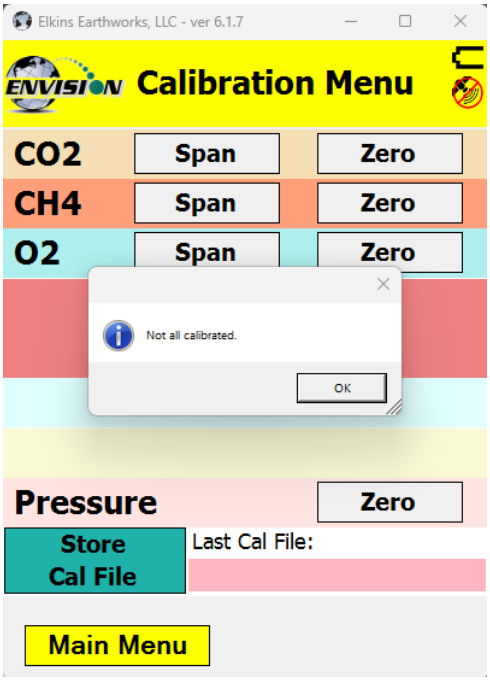
Follow the same pressure calibration procedure as detailed in the previous section then tap the Analyze button in the lower right corner of the screen.

Warning: Never apply vacuums greater than -200” H_20 or pressure greater than +200” H2O to any of the pressure sensors during calibration or measurement activities. These extreme pressures can damage the pressure sensors within the Envision® gas analyzer.

5.5.4 Storing a Calibration File

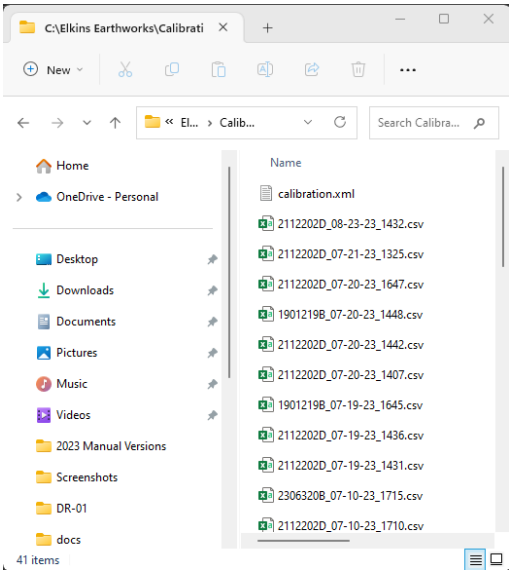


Once all of the calibration gases have been calibrated the user can select the option to "Store Calibration File". This feature will generate a .csv file with all of the calibration information generated during the calibration activity.



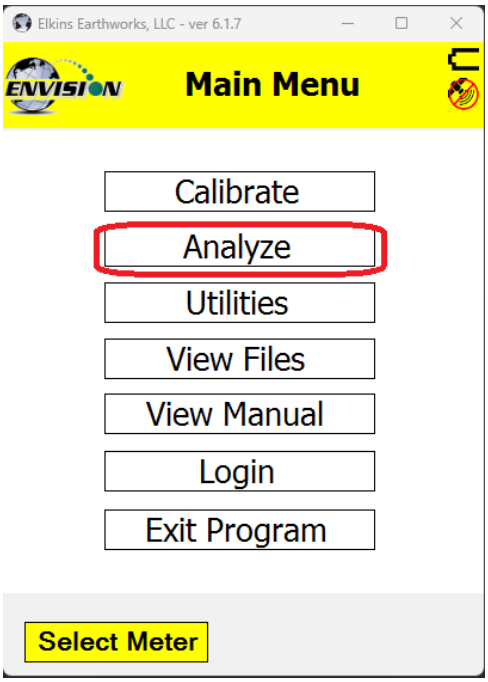
If the user has failed to calibrate all of the parameters a warning screen will appear and will indicate "Not all calibrated".

This is a warning box so that the user can go back and calibrate the remaining parameters, if desired. If the user taps the "OK" box in the warning message it will return the screen back to the "Calibration Menu" so that the remaining parameters can be calibrated. If the user does not calibrate the remaining parameters and taps the "Store Calibration File" button again the unit will store a "Calibration File" but will place NA in the fields that were not calibrated. Elkins Earthworks® recommends that each parameter be calibrated at least once during each monitoring event.



Once the "Store Calibration File" button is selected the handheld computer will store the calibration file in the Trimble handheld computer in File Explorer: my documents/Elkins Earthworks/calibration. The file is named as such: meter serial number_month-day-year_time (i.e. 000108_7-20-2008_1028).

5.6 Analyze

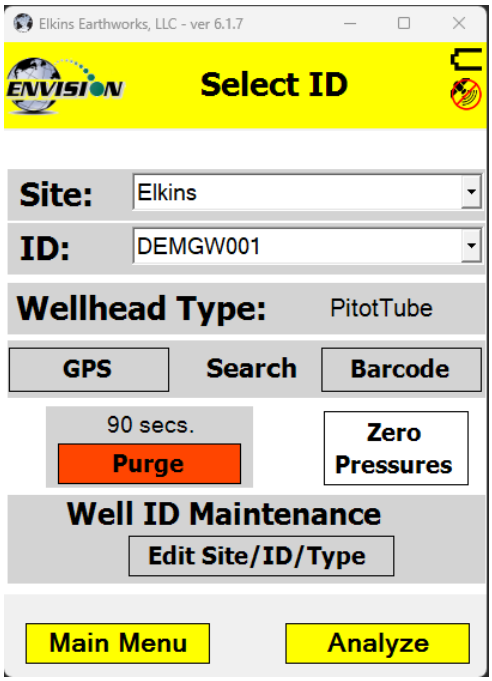


The Analyze feature of the Envision® software allows the user to measure and record gas qualities, associated pressures and comments for selected monitoring points. To enter the "Analyze" portion of the software go to the main menu and tap the "Analyze" button. The handheld computer will automatically progress to the "Select ID" screen.

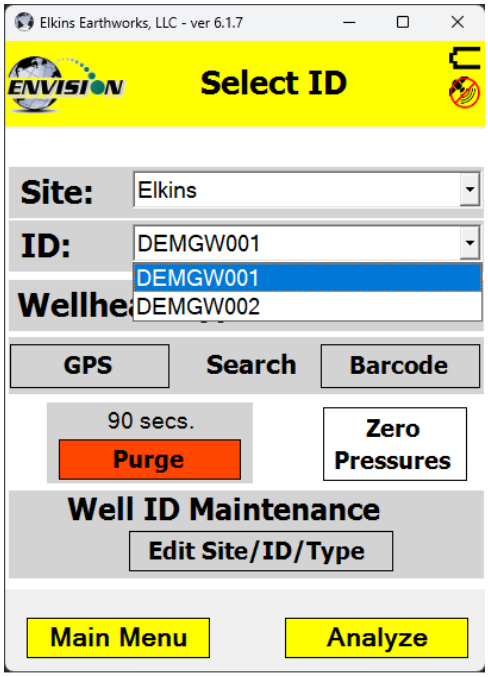
5.6.1 Select ID

To make it easier for a user to locate and identify a well or location to monitor, the Envision® software utilizes three different search methods: manual, GPS or barcode scanner. In Section 0 there are specific instructions on how to configure an ID set utilizing the "Elkins Earthworks® Gas Analyzer Configuration Editor".

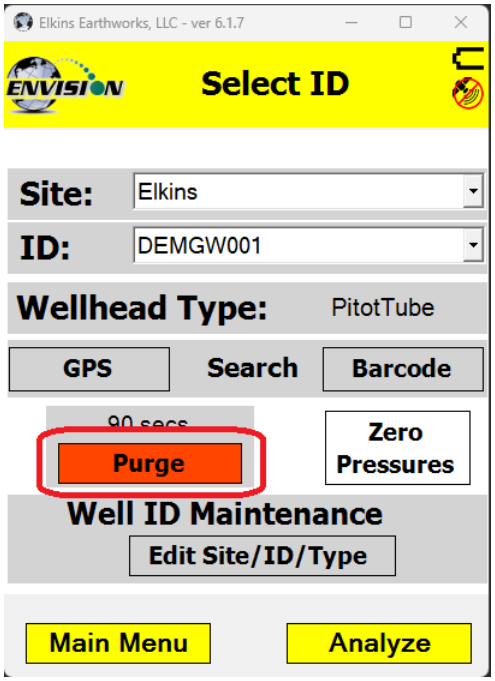
5.6.1.1 Manually Select ID



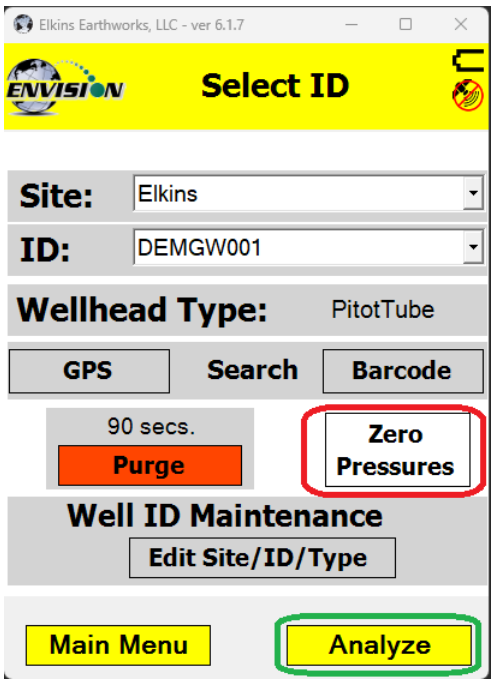
On the "Select ID" screen you may manually select the monitoring point by following the instructions below:



1) Use the combo boxes labeled "Site" and "ID" to locate the monitoring point that is to be monitored.



2) Once the correct ID is selected the user should tap the "Purge" button. The sample pump will turn on and the button will turn green. The timer will count down 90 seconds or until the O_2 percent in the meter is at least 18% then the pump will turn off. The purge cycle may end if either the Envision® meter detects that the sample train is clear of methane or the user taps the "Purge" button again.

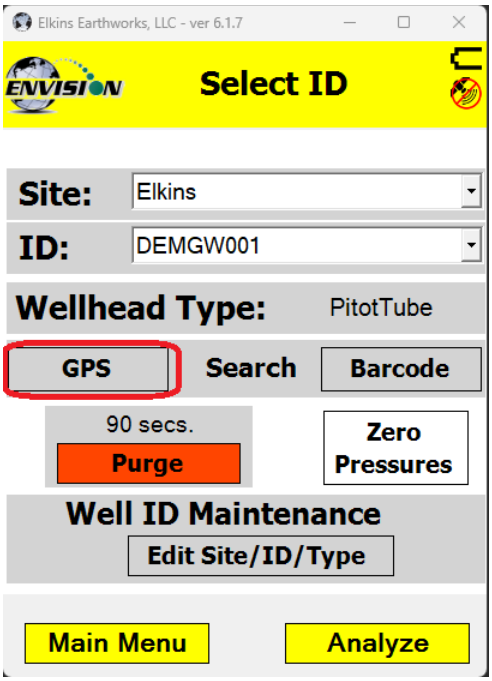


3) Once the purge is complete keep your sample trains disconnected and shielded from the wind then tap the "Zero Pressures" button. The user can also decide to skip the "Zero Pressures" feature and go directly to the Analyze screen by pressing the "Analyze" button in the lower right corner of the screen.

5.6.1.2 GPS Selection of ID

If the user desires to locate the monitoring point via GPS, then follow the instructions detailed below:

1) Stand at the location to be monitored – The first connection may take several minutes for the GPS to lock after the handheld computer is first turned on. Each location after this should be instantaneous.



2) Tap the GPS button on the handheld computer's touch screen.

3) Once the "GPS" button is pushed a status message will be displayed above the Site text box that will indicate "Reading GPS", then either "GPS not locked", "Site/ID selected by GPS", or "Failed to find GPS match".

4) The handheld computer will automatically populate the "Site" and "ID" text box with the nearest monitoring point.

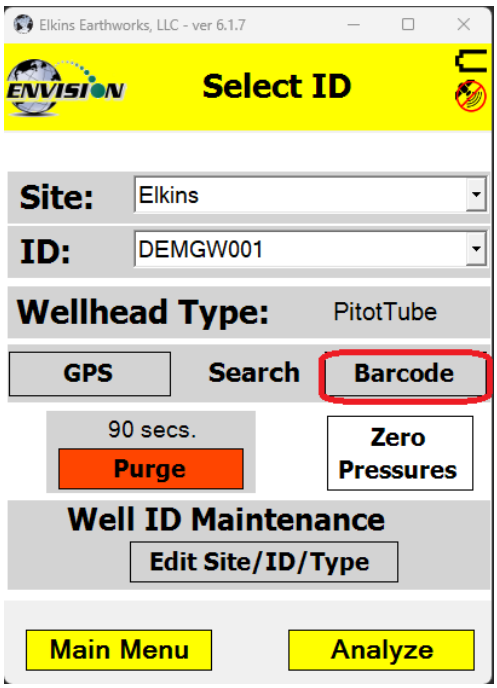
5) If the GPS does not find a monitoring point, then the status will change to "Failed to find GPS match". If the ID is known, the user can manually select the "Site" and "ID" then tap the "Well ID Maintenance" button to mark the GPS coordinates for that location. Instructions on how to use the "Well ID Maintenance" function can be found in section 5.9.1.

If sample points are located within 30 feet of each other, then the GPS function will select the closest point to your location.

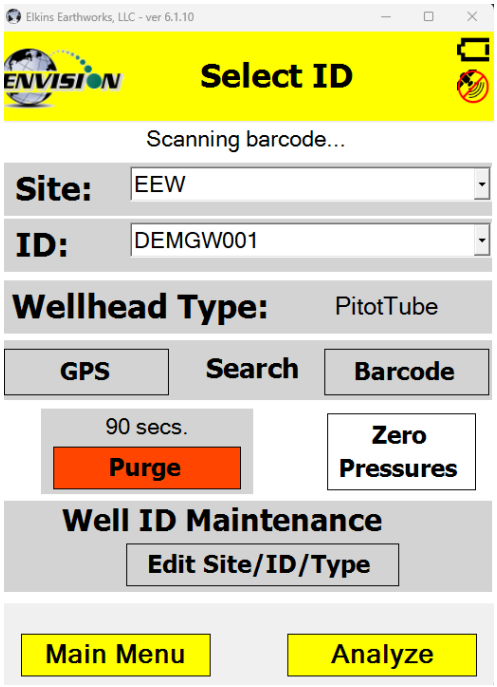
5.6.1.3 Barcode Selection of ID

If you desire to select the well to be measured by barcode, please follow the instructions below:

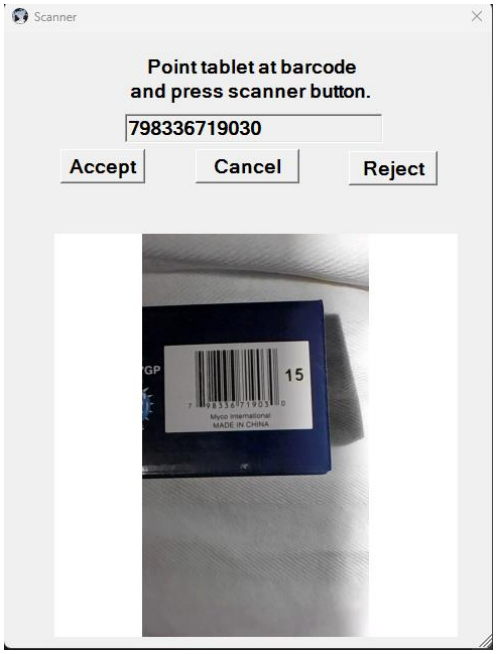
1) Walk up to the point to be monitored
2) Locate the barcode on the item to be monitored

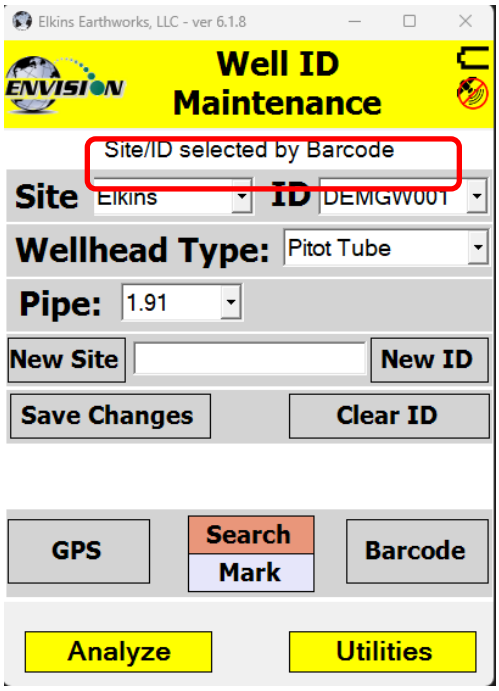


3) On the "Select ID" screen tap the "Barcode" button on the Tablet.



4) A status message will be displayed above the "Site" that will indicate "Scanning Barcode" and a window for the camera will appear.





5) Once the barcode has been verified the status will change to “Site/ID selected by Barcode”

6) The handheld computer will automatically populate the “Site” and “ID” text box with the correct monitoring point.

If the barcode does not find a monitoring point, then the status will change to “Failed to find Barcode match”. If the ID is known, the user can manually select the Site and ID then tap the “Well ID Maintenance” button to mark the barcode for that location. Instructions on how to Use the “Well ID Maintenance” function can be found in section 5.9.1.

5.6.2 Analyze

This feature allows the user to measure the gas qualities and pressures for a selected sample point. The "Analyze" screen is accessed by pressing the "Analyze" button in the lower right of the "Select ID" screen.

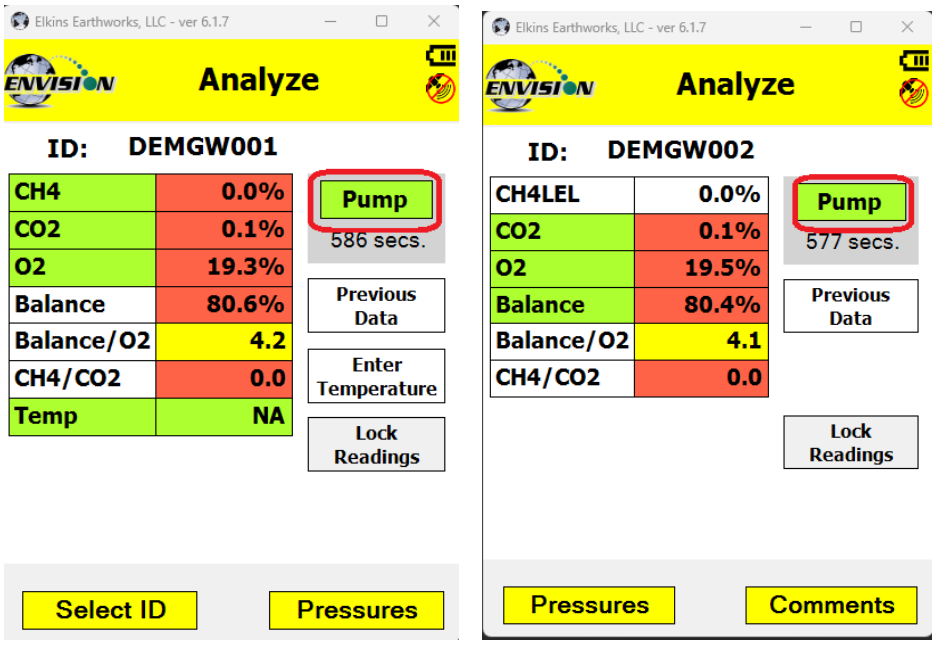
Note: The typical screen progression is from gas concentration analysis to pressure analysis. However, if the wellhead type is set to "Probe", the screen progression is reversed.

5.6.2.1 Analyze Screen (ENV100/200)

5.6.2.1.1 Pump

This button activates the sample pump located within the Envision® gas analyzer.

The left screen is for a typical well. The right screen is for a probe.

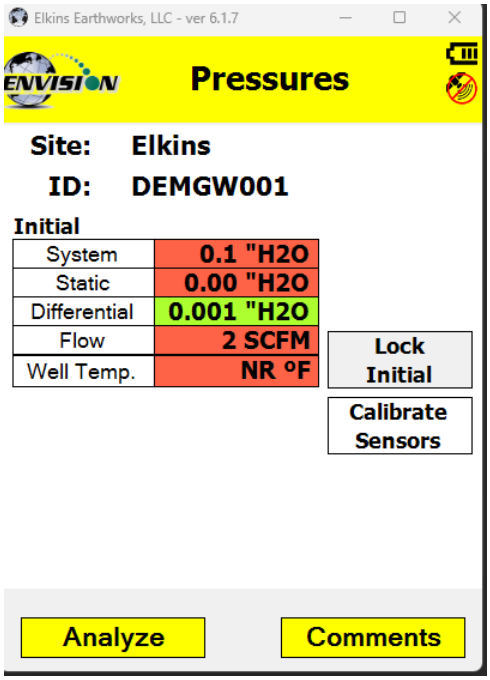


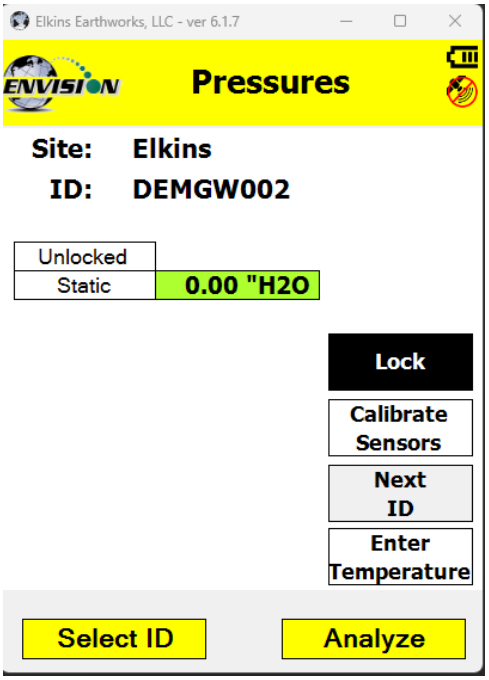
The button is red when the pump is off and green when activated. The default on time for the pump is 600 seconds. To activate the pump, tap the "Pump" button once. The sensor will then go through a 20 second warm-up before actual gas values will appear. The pump may be turned off by tapping the "Pump" button again. If the pump is turned off, then the gas values will return to the default "NA". To lock the gas values the user must tap the "Lock Readings" or "Read Pressures". The pump time can be changed within the Configuration Editor as described in section 0.

5.6.2.1.2 Read Pressures

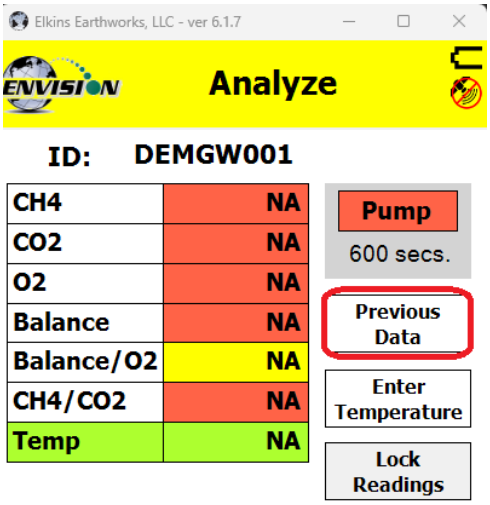
The Envision® unit measures Available, Applied, and Differential pressures. In order to view and record these pressures the user must go to the "Read Pressures" screen.

The left screen is for a typical well. The right screen comes up if the Wellhead Type is set to "Probe".

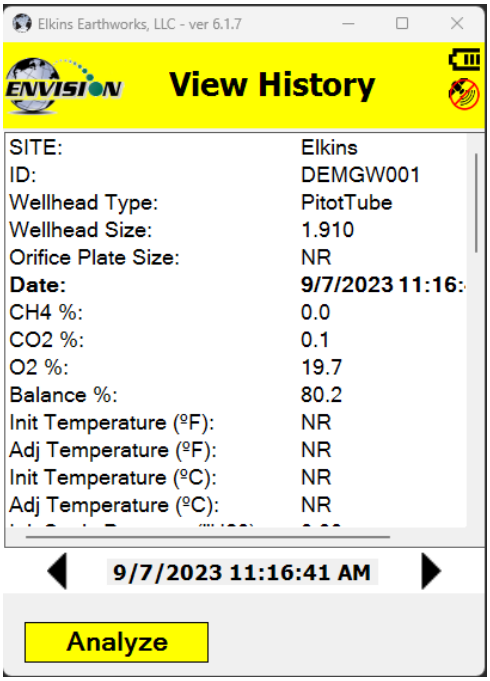




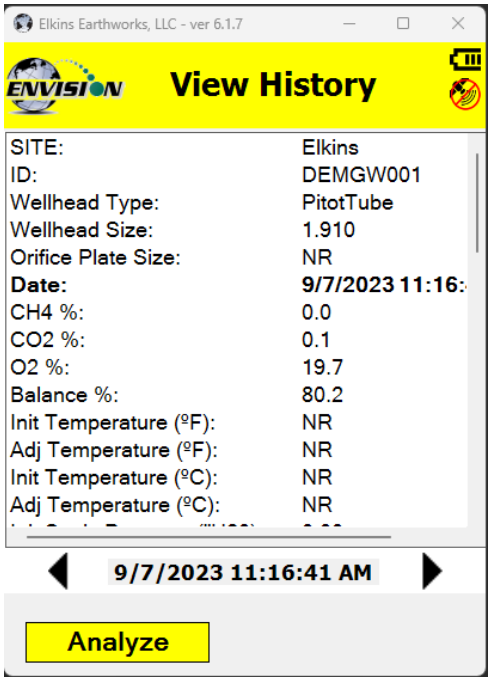
5.6.2.1.3 Previous Data



If the user desires to view data previously recorded on the handheld computer, then the Previous Data button should be tapped.

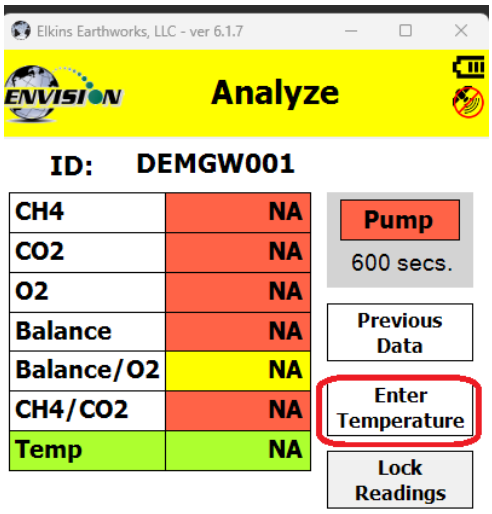


This button will take the handheld computer to the "View History" screen. The "View History" screen will display any historical well data for the selected ID located in the site's current month output file located on the handheld computer.

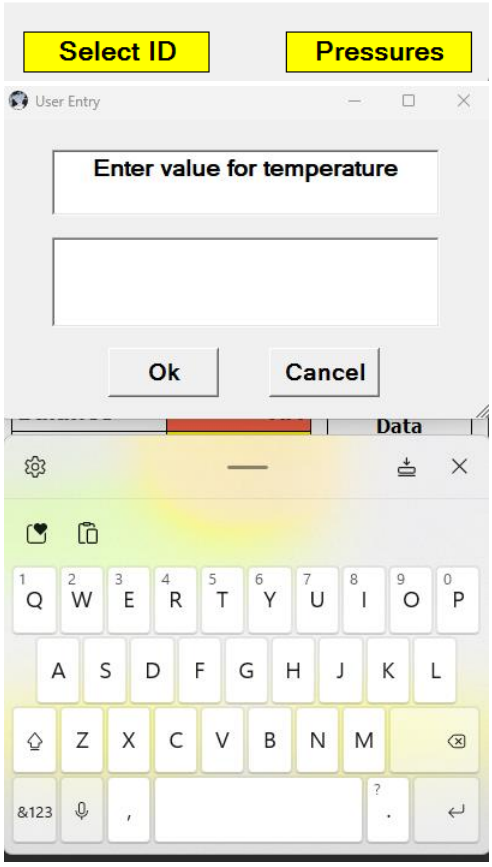


To return to the “Analyze” screen tap the Analyze button in the bottom left hand corner of the screen. Newer software versions have the ability to look back at all previous measurements (below).

5.6.2.1.4 Enter Temperature

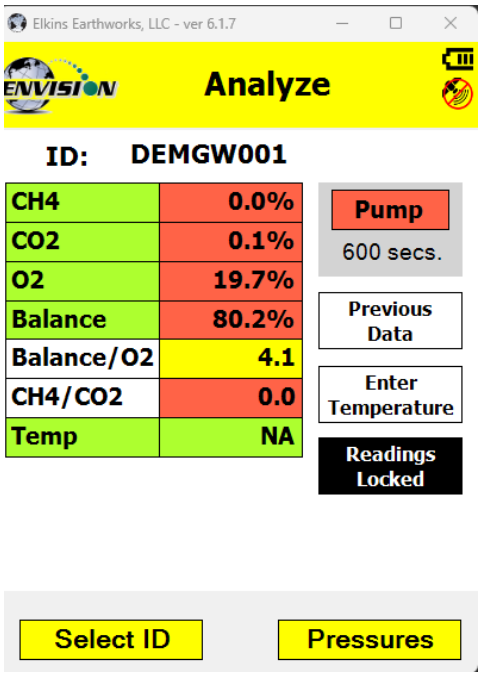


1) Press the "Enter Temperature" button to allow manual entry of well temperature. This will override any thermistor that happens to be attached to the Envision.



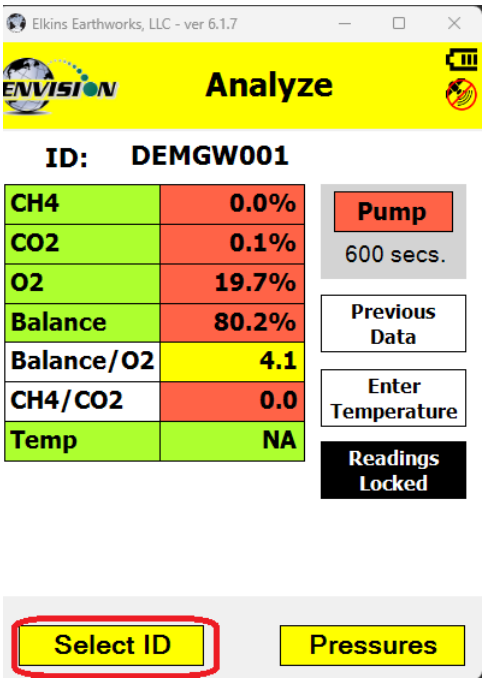
2) Use the hard or soft keypads to enter a temperature value, then hit Ok.

5.6.2.1.5 Lock Readings



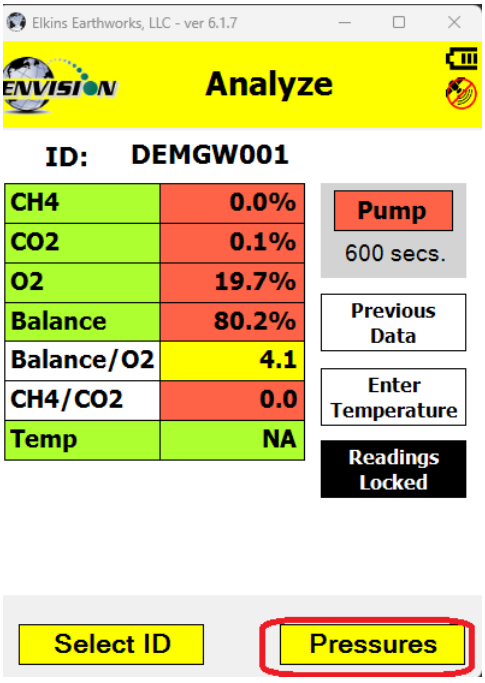
The “Lock Readings” button is designed to lock the gas values and to turn off the pump. This feature locks the readings so if you decide to come back to this screen your readings will not change. This feature does not actually “Store” the gas qualities into the .csv file.

5.6.2.1.6 Select ID



This button will return you to select ID screen so that another ID can be selected without having to proceed through the entire sample procedure. However, this will not store any of the data that you have gathered for the current ID.

5.6.2.1.7 Pressures

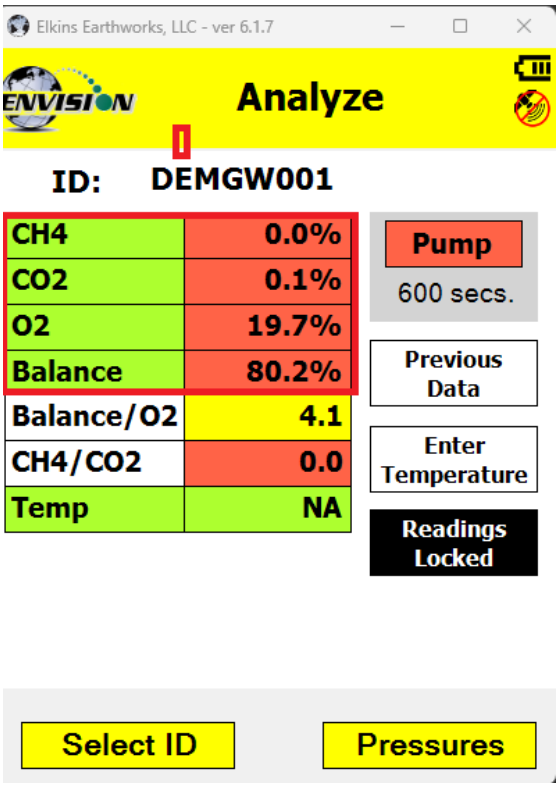


This button will exit the user from "Analyze" and take the user to the "Pressures"screen. However, this will not store any of the data that you have gathered for the current ID.

5.6.2.2 Gas Quality and Gas Quality Ratios

The Envision® gas analyzer measures concentrations of three gases: CH_4, CO_2 and O_2. The balance gas is calculated by subtracting the total of these three gas qualities from 100%.

5.6.2.2.1 Gas Qualities



<u>CH_4 - Methane</u>

- CH_4 is measured via an internal Infrared sensor. The measurement range of the sensor is 0-100% CH_4.

<u>CH_4 – LEL (Lower Explosive Limit)</u>

- By tapping the CH_4 box the handheld computer will display the CH_4 LEL%. The user can return to the standard CH_4% by tapping the CH_4 box again. Note: 100% LEL is equal to 5% CH_4.

<u>CO_2 – Carbon Dioxide</u>

- CO_2 is measured via an infrared sensor. The measurement range of the sensor is 0-100% CO_2.

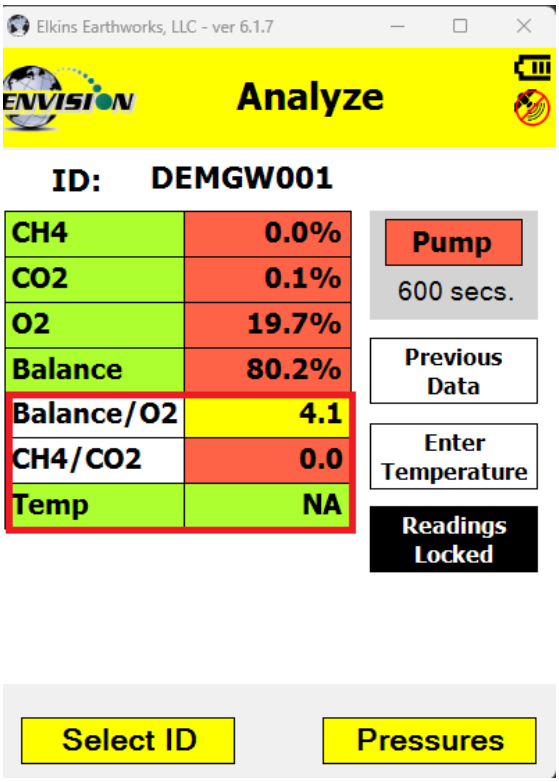
<u>O_2 - Oxygen</u>

- O_2 is measured via an electrochemical sensor. The measurement range of the sensor is 0 – 25% O_2.

<u>Balance Gas</u>

- Balance gas is a calculated value. It is calculated as follows:
- Balance gas = 100%- CH_4- CO_2- O_2

5.6.2.2.2 Gas Ratios



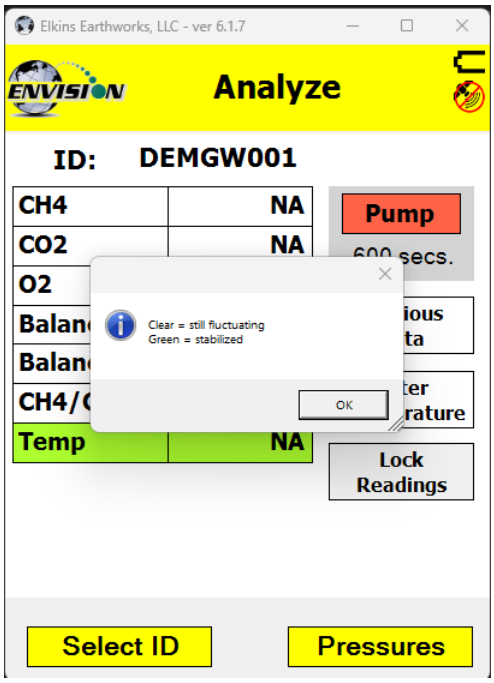
Balance/ O_2

- Results near "4" indicate a direct air leak into the sample train, sample fitting or wellhead.
- User should be familiar with interpreting the range of ratios for Balance/ O_2. Information is available within the SWANA Landfill Gas O&M Manual available at www.swana.org.

CH_4/ CO_2

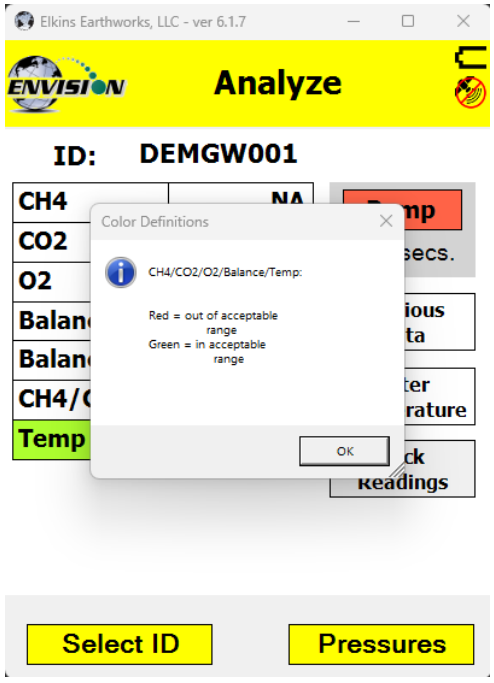
- Ratio lower than 1.1 may indicate potential for stressed conditions on a landfill gas well.
- The ratio may assist in drawing attention to different phases of landfill gas production.
- User should be familiar with interpreting the range of ratios for CH_4/ CO_2. Information is available within the SWANA Landfill Gas O&M Manual available at www.swana.org.

5.6.2.3 Color Definitions



The Elkins Gas Analyzer software has been programmed to help the user make tuning decisions by using acceptable ranges which have been set up using the Configuration Editor software. When the gas sensor is in the acceptable range the gas quality text box will turn from red to green. The color key can be displayed by touching the gas quality text box. Tap "OK" to close the color key.

These ranges are programmable for each well by utilizing the Configuration Editor software.



The software is also programmed to detect when the gas sensors have stabilized. When the gas sensor has stabilized the gas quality text box will turn from clear to green. The color key can be displayed by touching the sensor title. Tap "OK" to close the color key.

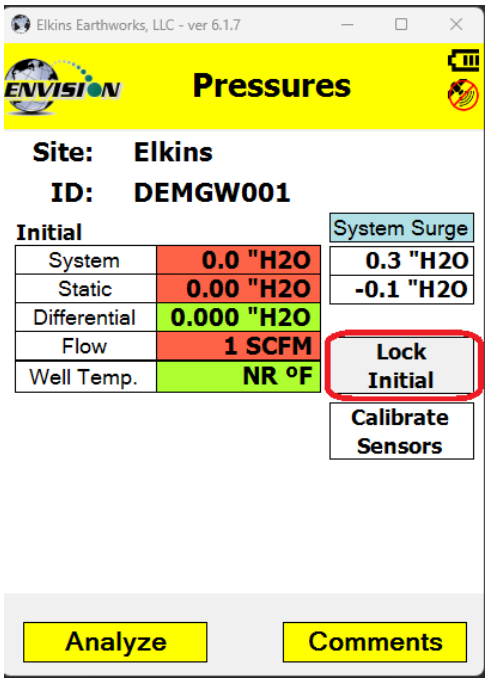
The user may progress to the next screen by pressing the Pressures" button. The user may also elect to go back to the Select ID screen by tapping the "Select ID" button.

5.6.3 Read Pressures (ENV100/200)

The Envision® gas analyzer is built with five internal pressure sensors. The software is programmed to use the sensor that is the most accurate for the range being measured. Listed below are the sensors and their ranges.

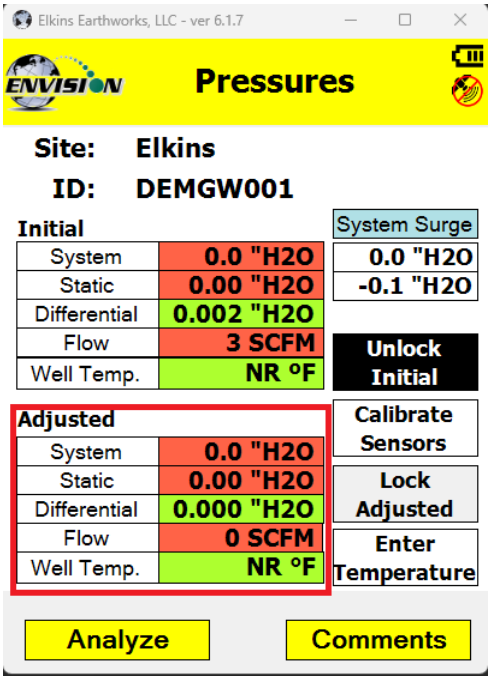
Pressure Sensor	Low Pressure ("H_2O)	High Pressure ("H_2O)
System	NA	-138 to +138
Static	-5 to +5	-138 to +138
Differential	-5 to +5	-30 to +30

5.6.3.1 Wellhead

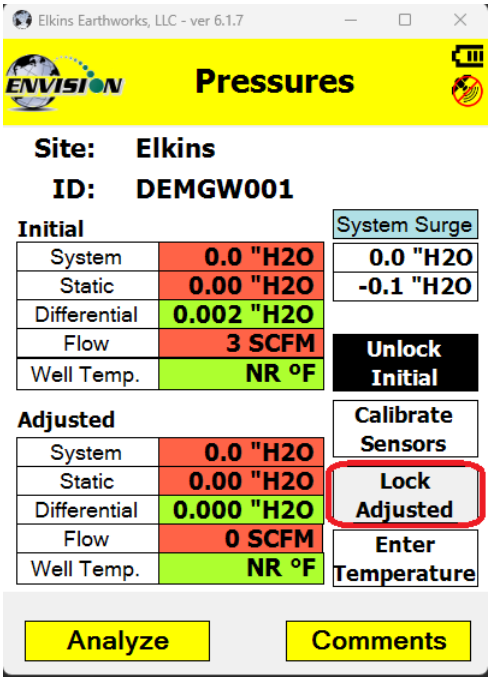


When the pressure sensors are in the acceptable programmed range, as programmed by the user in the Configuration Editor, the pressure text box will turn from red to green. The color key can be displayed by touching the gas quality text box. Tap "OK" to close the color key.

When the user is satisfied with the Initial pressures they may tap the Lock Initial button to lock in the initial pressures.



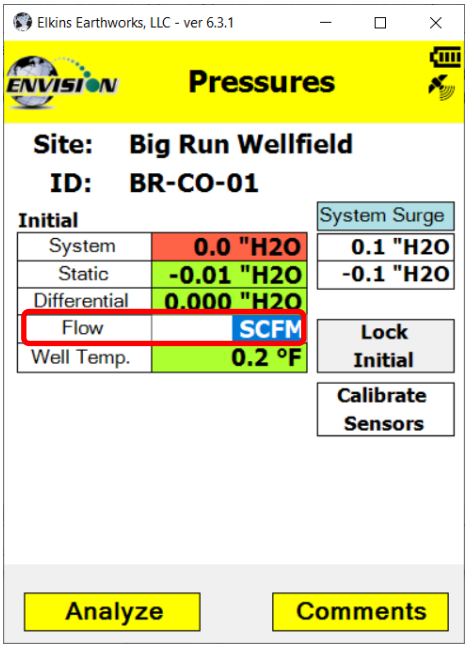
Once the lock initial pressure button is tapped the "Adjusted" pressures will appear and will start fluctuating.



Once the user makes an adjustment and the sensors have stabilized the user can tap the “Lock Adjusted” button. The button will then change to “Unlock Adjusted”. If the “Unlock Adjusted” button is pushed it will unlock the adjusted values allowing them to fluctuate. The user may now lock the value again. Failure to lock the values will result in the adjusted values not being stored in the output file.

The user may also access the pressure sensor calibrate (zero pressures) screen from these screens. Make sure that the hoses are disconnected and sheltered from the wind when calibrating the pressure sensors. Please refer here for calibration instructions.

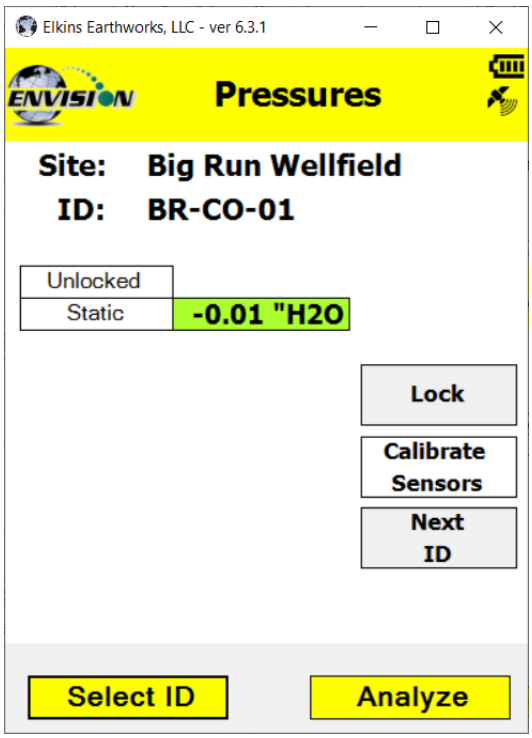
If the user has defined this monitoring point as “User Defined” then the user may type in a flow measurement for both the Initial and Adjusted flows.

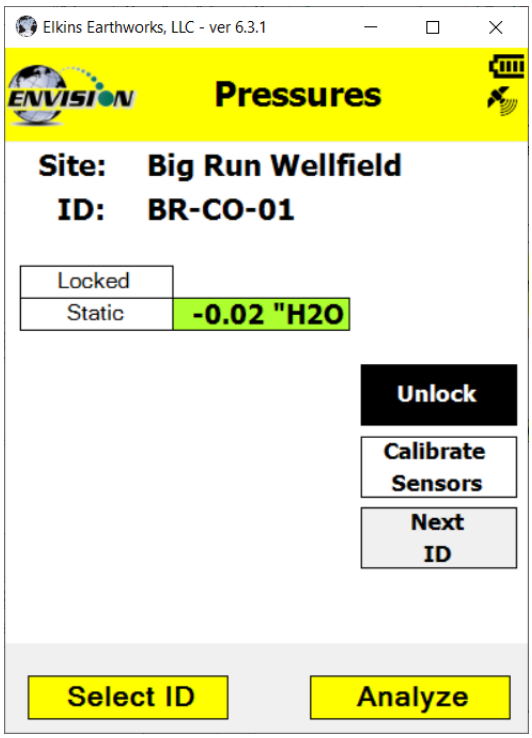


Use the “Comments” button to progress to the next screen or tap the “Analyze” button to go back to the “Analyze” screen.

5.6.3.2 Probe

If the Wellhead type is Probe, the screen progression begins with a pressures measurement and ends with gas concentration measurements. This screen is complete when the user presses the “Lock” button. Select the “Analyze” button to continue to the gas concentration measurement screens.

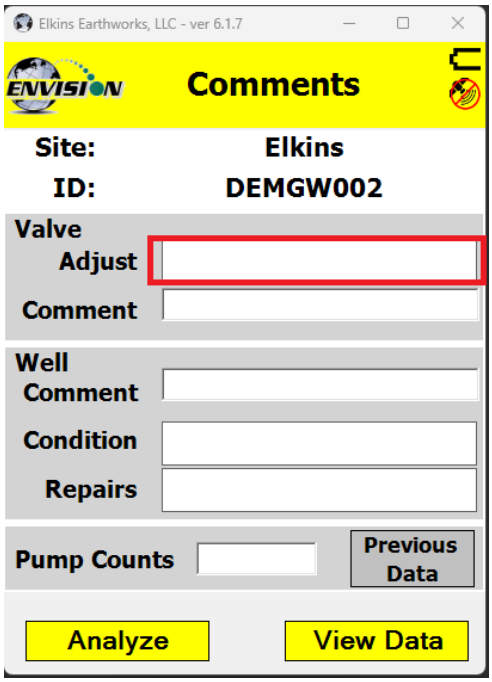


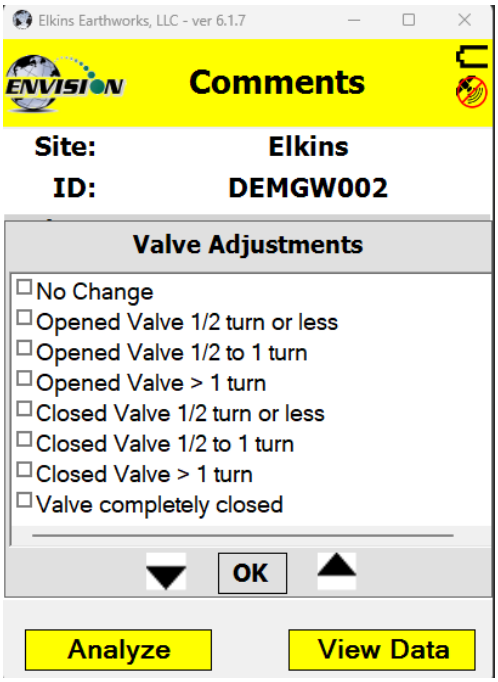


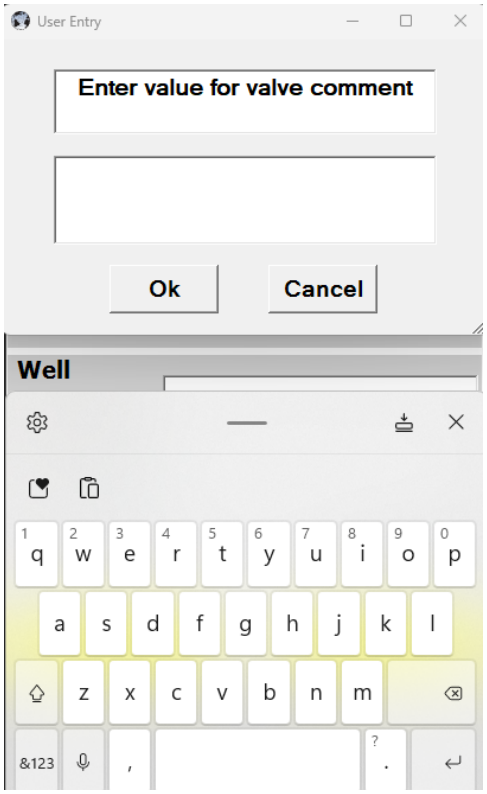
5.7 Comments

The comments screen is accessed from the “Pressures” screen (or from the “Analyze” screen for probes). The “Comments” screen is designed to give the user several opportunities to comment on the sample point.

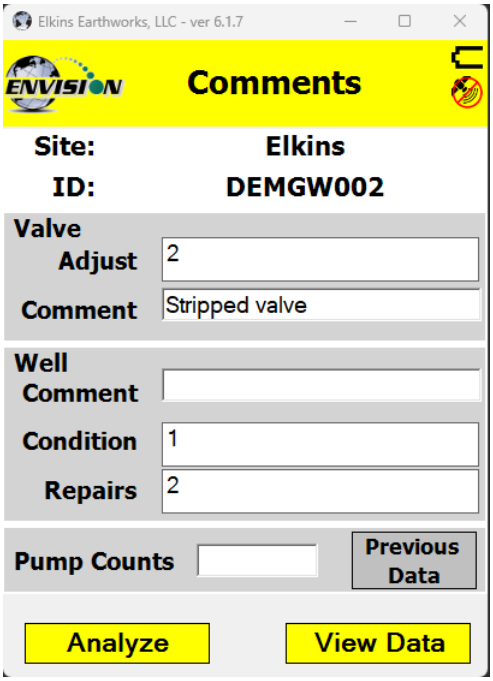
The user may check boxes from a group of populated comments. These comments are populated by using the Configuration Editor.





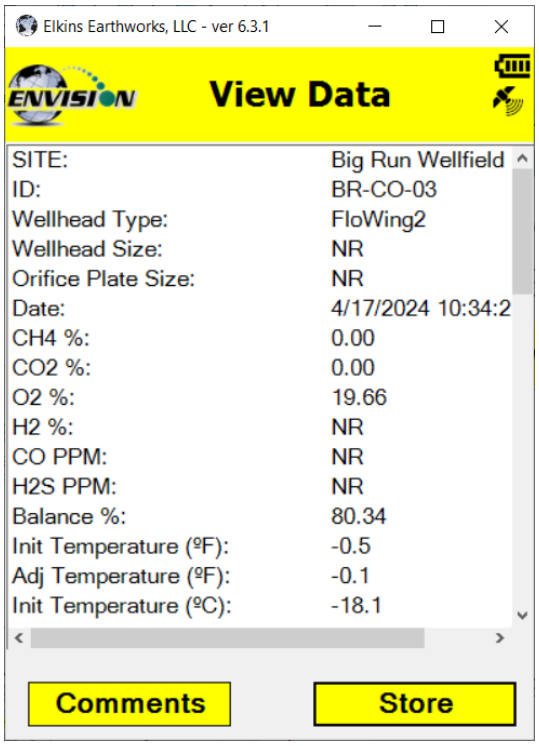


The open text boxes can be populated by tapping on the text box and tapping the keyboard symbol to open the touch screen keyboard. The user may then type in any comment that is needed.



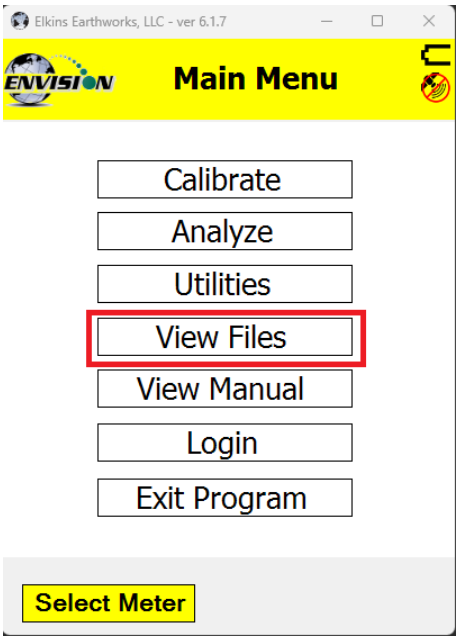
Once the user is done making comments they may progress to the next screen by tapping the “View Data” button. The user may also return to the Pressures Screen by tapping the “Pressures” button.

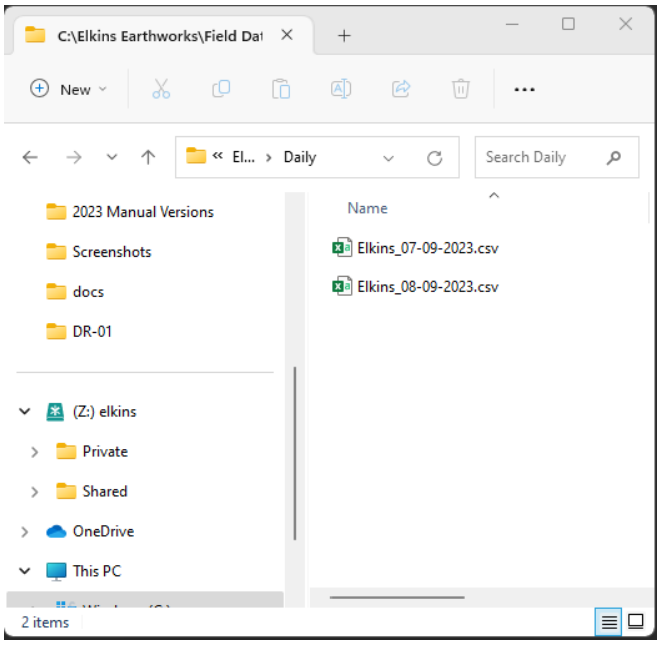
5.8 View and Store Data



The “View Data” screen is intended to let the user view all of the data collected for this ID. If the user is satisfied with the data viewed on this screen, then the user can tap the “Store” button to save the data in the .csv file. If the user is not satisfied with the results, then the user may tap the “Comments” button to go back and take the reading again.

Once the store button is tapped the data is stored in a .csv file on the handheld computer. The data may be accessed by pressing “View Files” on the Main Menu. The files are located in the directory as shown below.



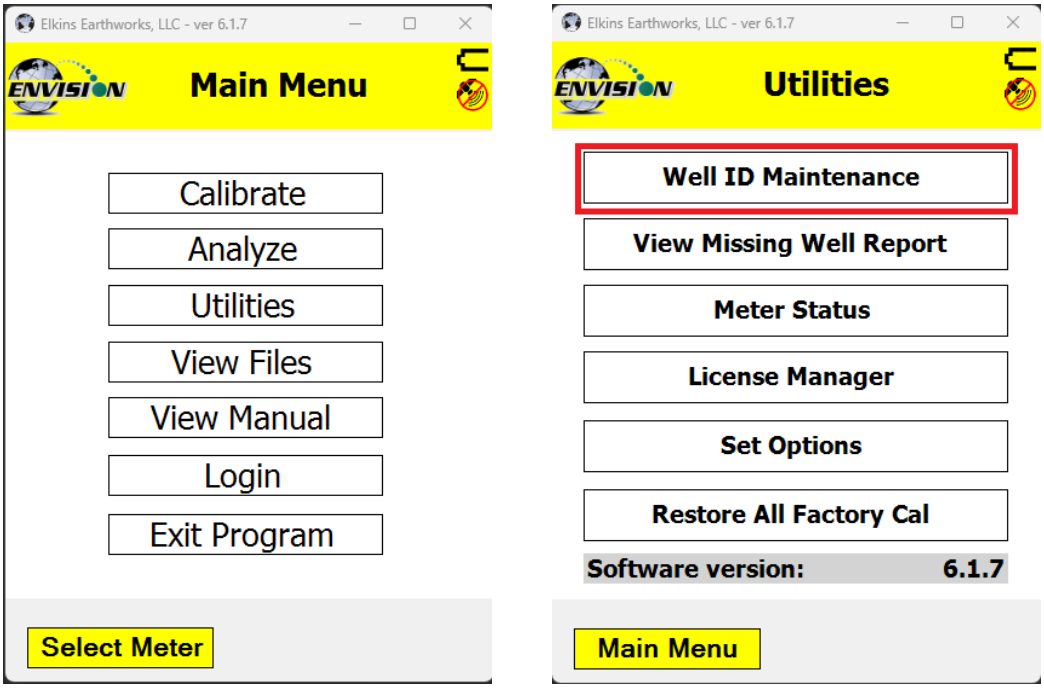


5.9 Utilities

The “Utilities” menu is accessible from the main menu. The “Utilities” menu contains the information needed to assist in keeping the user informed about the status of the Envision® gas analyzer.

5.9.1 Well ID Maintenance

The “Well ID Maintenance” feature of the utility menu is intended to allow the user to create or delete ID’s while in the field.

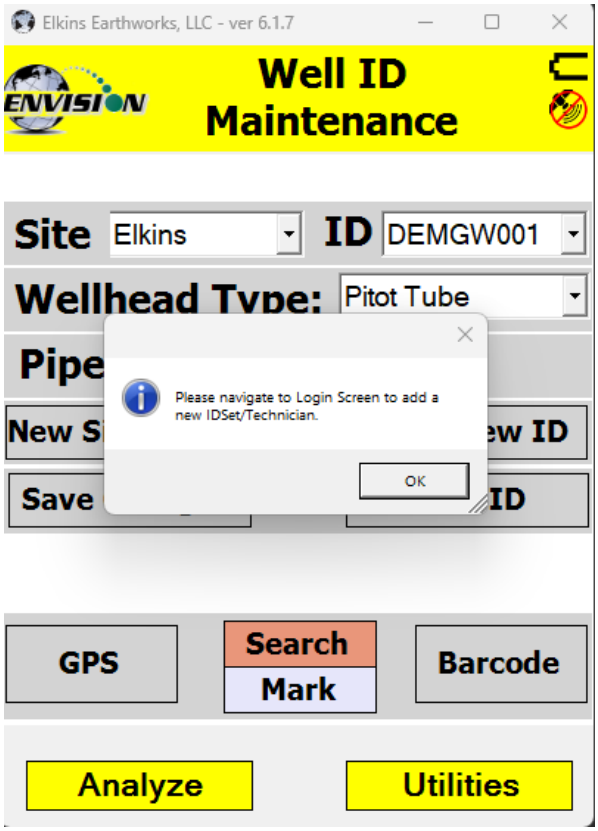


Tapping the “Well ID Maintenance” button will take the user to the “Well ID Maintenance Screen”.

5.9.1.2 Create New Site

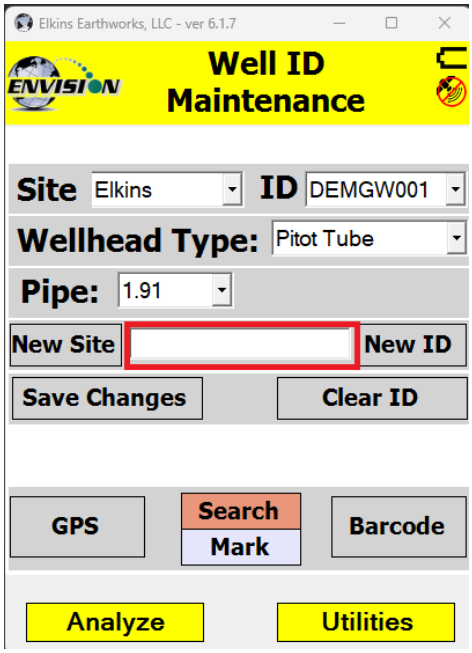
You must return to the login screen to make a new site for the existing ID set installed in the handheld computer.

Note: In later versions of the gas analyzer software, the "Clear Site" button has been removed to protect the user from inadvertently deleting all wells associated with a certain site. The site may still be cleared using the Configuration Editor software.

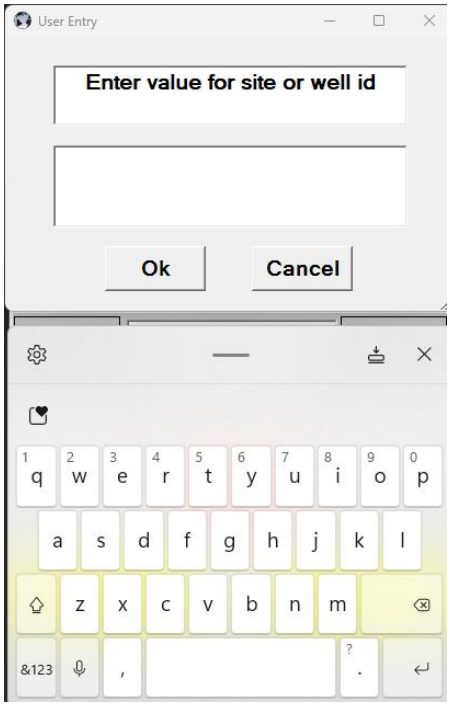


5.9.1.3 Create New ID

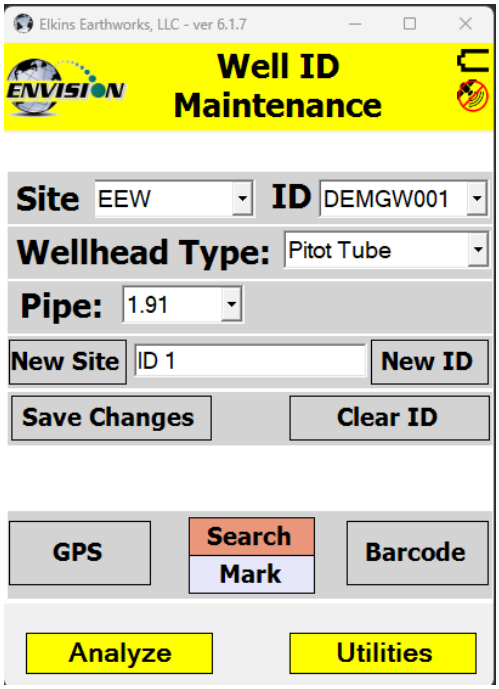
The Well ID maintenance screen will allow the user to make a new site for the existing ID set installed in the handheld computer.



1) Tap the text box between the “New Site” and “New ID”

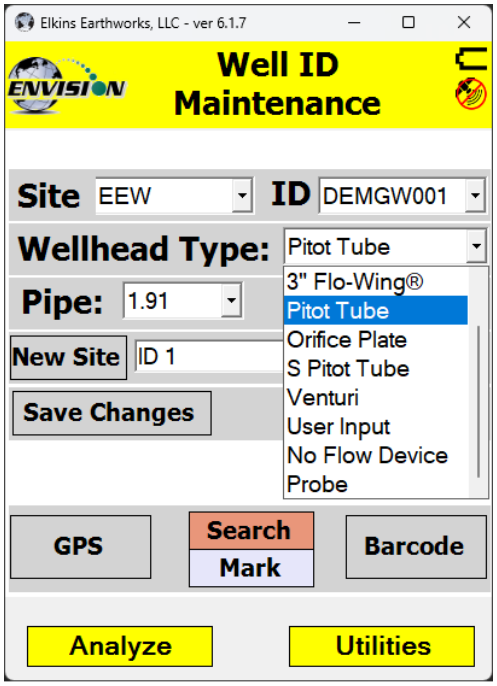


2) Open the touch screen keyboard by tapping the key board Icon at the bottom of the touch screen.

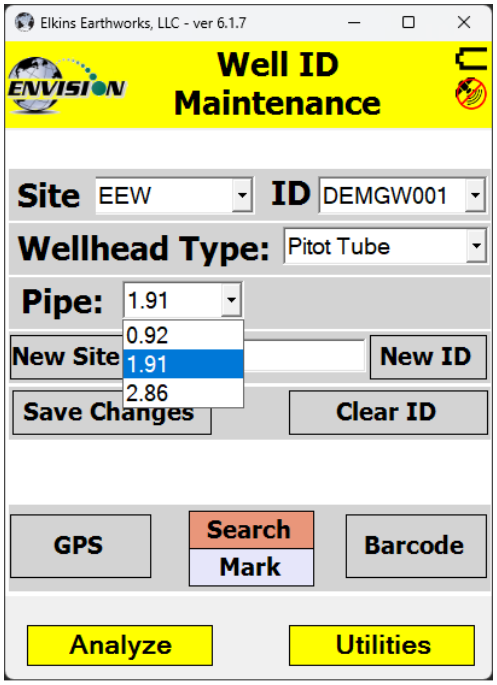


3) Type in the name of the new ID

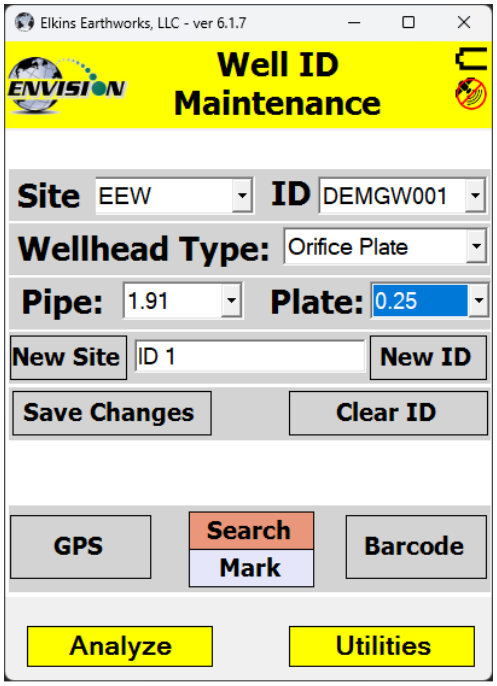
4) Drop down the keyboard by tapping the keyboard button



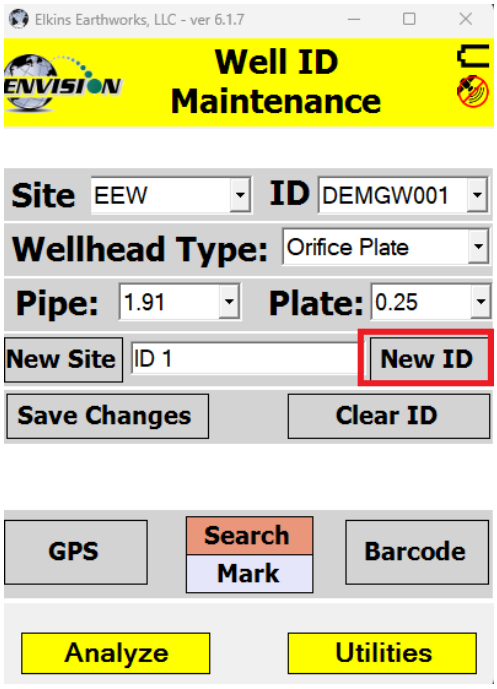
5) Select the Wellhead Type. If the user desires to manually type in a flow at the selected point each time, then the user may select user input.



6) Select the appropriate wellhead “Pipe” size (When applicable).



7) Select the appropriate “Plate” if using an orifice plate.

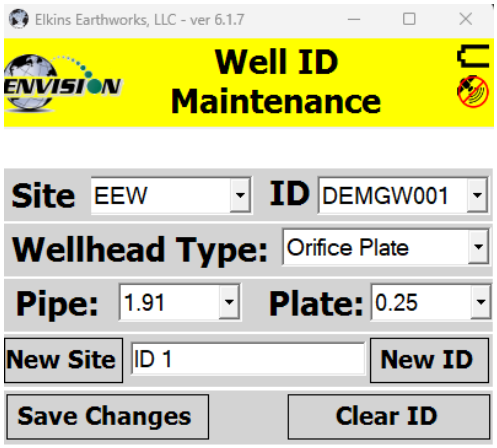


8) Once all of the parameters are correct tap the “New ID” button

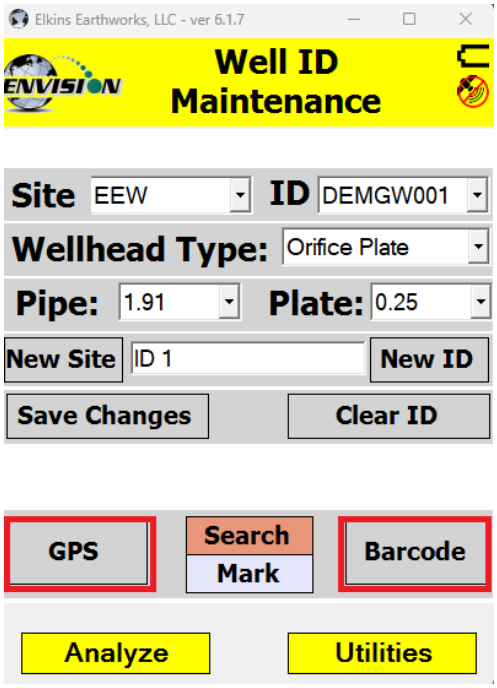
9) The new ID name will now appear in the “ID” text box.

10) The new ID is now located within the project ID set file on the tablet.

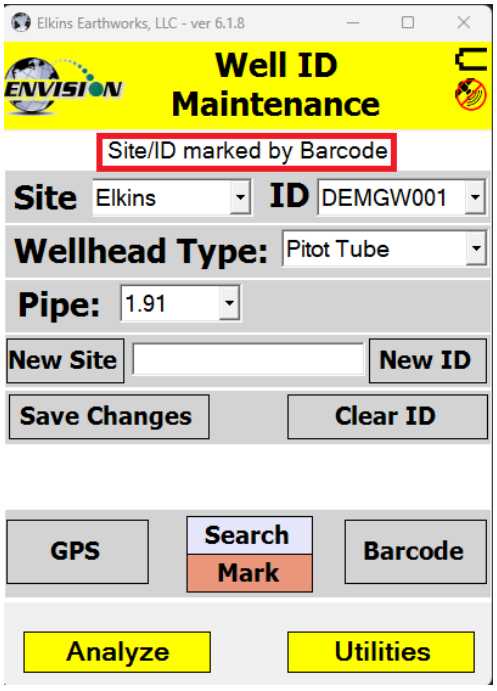
11) If the user is at the monitoring point, the GPS location or Well Barcode may now be recorded by using the mark feature.



12) Tap the “Mark” button so that it is highlighted in red



13) Tap the GPS button to mark the GPS coordinates or tap the Barcode button to mark the Barcode.



15) The new ID has now been updated.

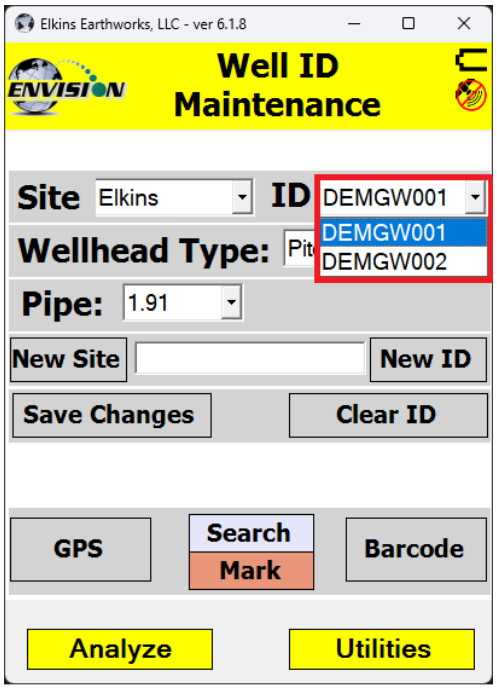
14) Once the GPS location or Barcode has been recorded then a comment will appear at the top of the screen “Site/ID marked by GPS” or “Site/ID marked by Barcode”. If the location failed to mark, then the message will read “GPS data not valid” or “Failed to find Barcode”.

5.9.1.4 Edit Well Information

The Wellhead Type, Pipe, and Plate sizes may also be changed for any existing ID. Simply select the ID and choose the corresponding parameters. Be sure to hit "Save Changes" when complete.

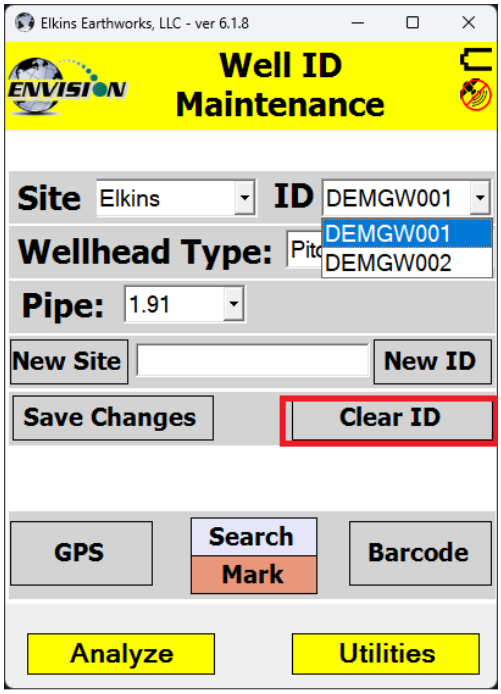
5.9.1.5 Delete Well ID

The software on the handheld computer will let the user delete an ID from the ID set loaded on the handheld computer. Deleting the ID will NOT delete any data stored in the .csv data files.

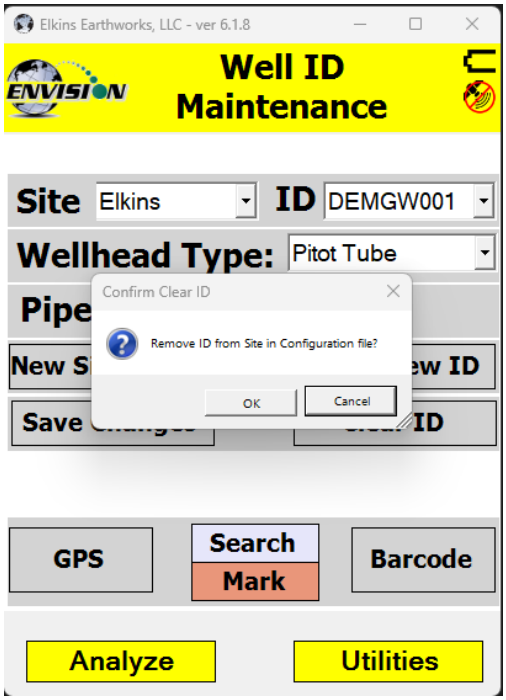


1) Open the "Well ID Maintenance Screen"

2) Select the ID that is to be deleted from the dropdown menu.



3) Tap the “Clear ID” button



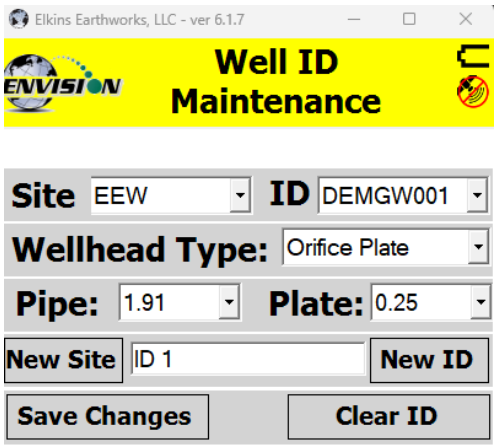
4) The “Remove ID from Site in Configuration file” message will appear. If the user is sure that they wish to delete that ID, then they can tap the “OK” button. If the user does not want to delete this ID, then tap “Cancel”.

5) The user may now return to the Analyze or Utilities menu by tapping the “Analyze” or “Utilities” button at the bottom of the touch screen.

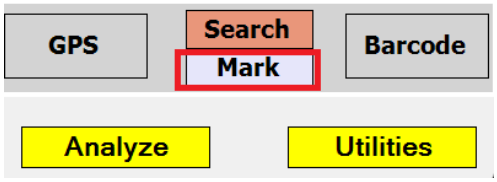
5.9.1.6 Mark Location

If the user is at the monitoring point, the GPS location or Well Barcode may now be recorded by using the mark feature. This feature is located in the "Well ID Maintenance" section of the program and may be accessed from the Utilities screen or the "Select ID" screen.

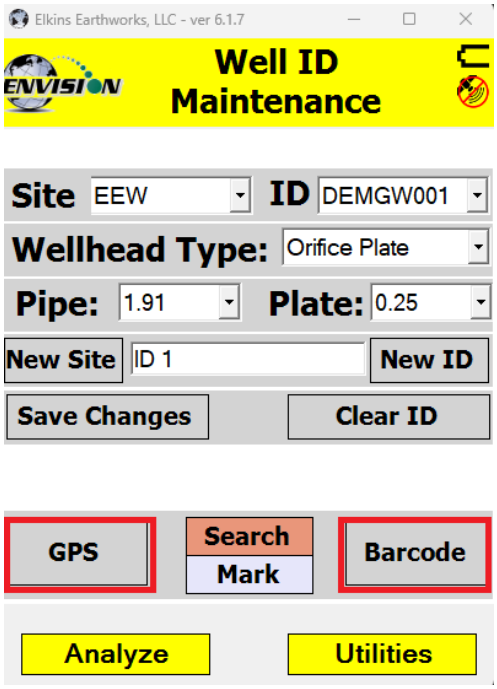
1) Using the dropdown menu for site and ID, select the ID that is to be marked.

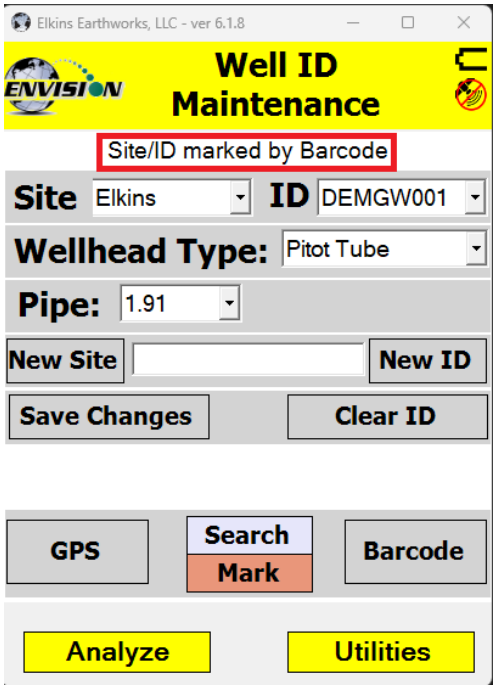


2) Tap the "Mark" button so that it is highlighted in red



3) Tap the GPS button to mark the GPS coordinates or tap the Barcode button to mark the Barcode





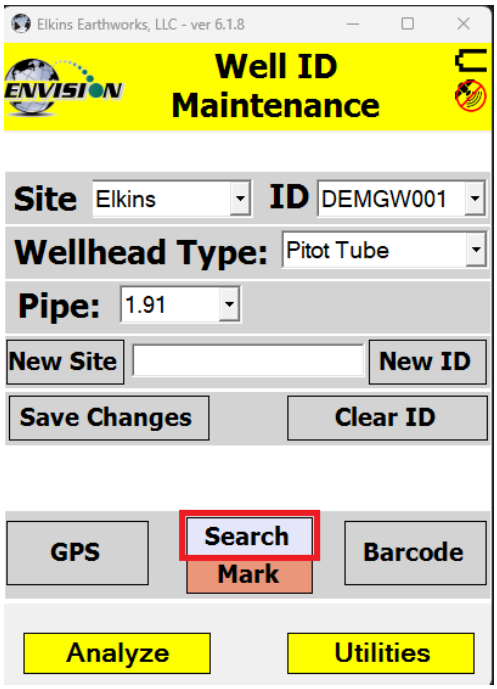
4) Once the GPS location or Barcode has been recorded then a comment will appear at the top of the screen "Sit/ID marked by GPS" or "Site/ID marked by Barcode". If the location failed to mark, then the message will read "GPS data not valid" or "Failed to find Barcode"

5) The ID is now updated and located on the handheld computer.

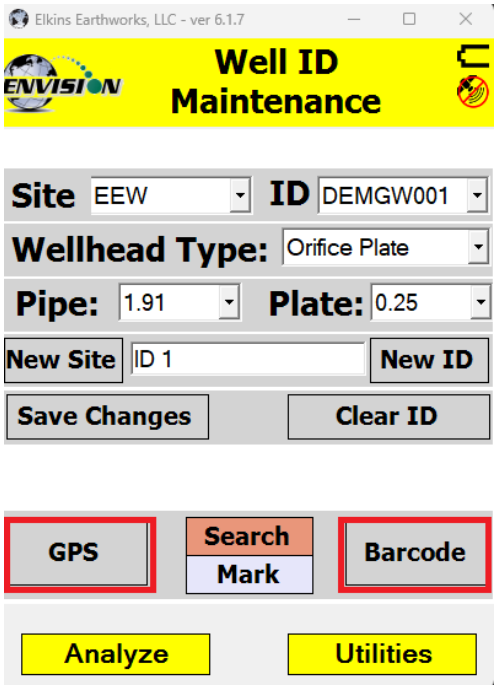
5.9.1.7 Search location

If the user is uncertain about the name of an ID that they want to modify then the user can use the search mode on the "Well ID Maintenance" screen.

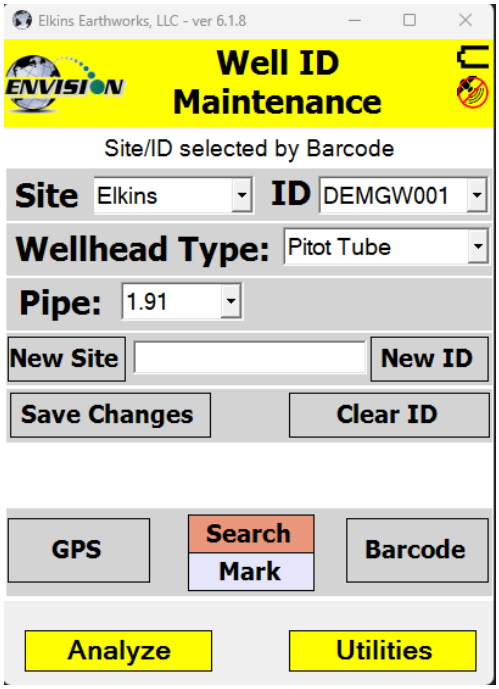
If the user's ID set contains stored GPS coordinates and/or Barcode information, then the user may use the search method to populate the Site and ID of their currently location.



1) While at the monitoring location the user must tap the "Search" button.



2) The user may then select if the search will be performed by the use of the GPS or the Barcode. The user must tap one of the options.

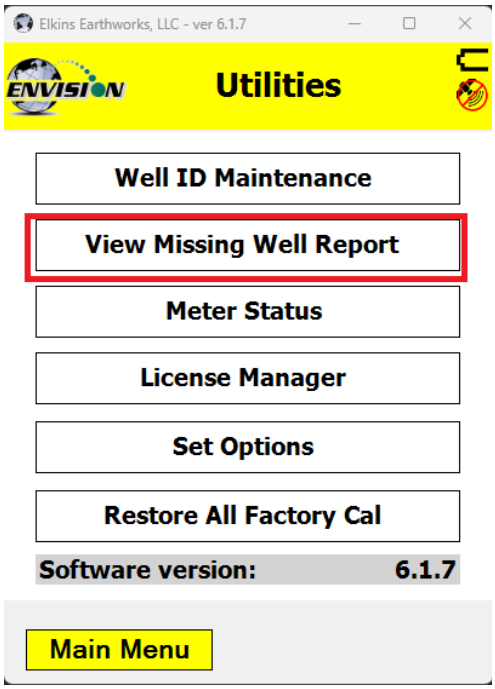


3) The software will then automatically populate the Site and ID with the correct information. The message "Site/ID selected by GPS" or "Site selected by Barcode" will appear. If there is no barcode or GPS location stored in the ID set, then the message will read "Failed to find GPS match" or "Failed to find Barcode match".

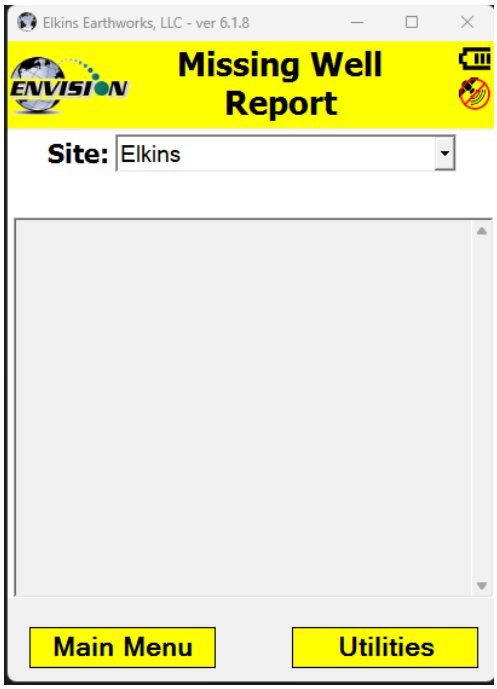
4) The user may now perform any ID maintenance desired.

5.9.2 View Missing Well Report

The View Missing Well Report was designed so that the user may determine if there are any monitoring points that have not been measured during the current month.



The software compares the site monitoring points stored in the configuration file to the data that has been stored in the current month's .csv file.

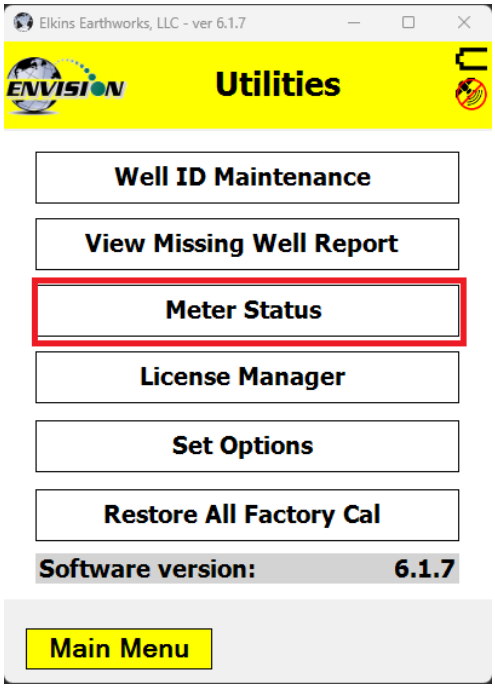


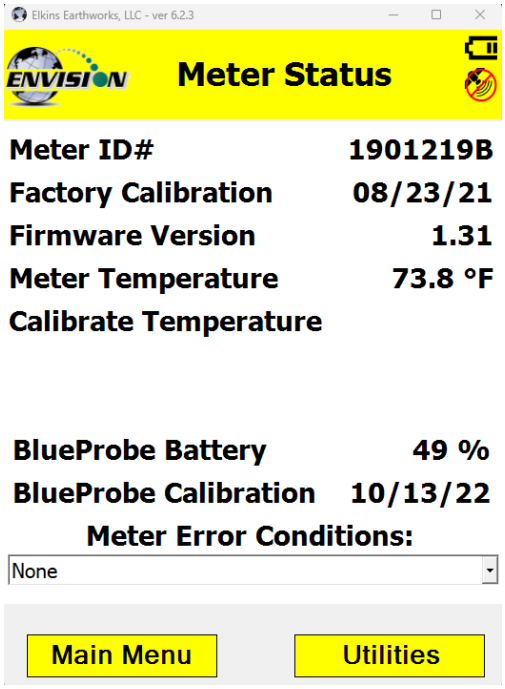
The user may return to the Main Menu or the Utilities screen by tapping one of the buttons at the bottom of the touch screen.

5.9.3 Meter Status

The meter status screen is accessible from the Utilities screen. This screen is intended to provide critical operational information to the user. This screen is accessible from the utilities screen.

The “Meter Status” screen gives the user useful information about the status of the Envision® meter.

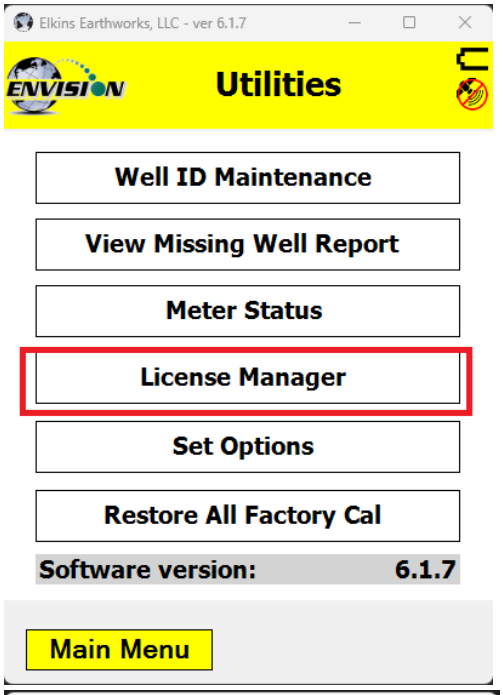




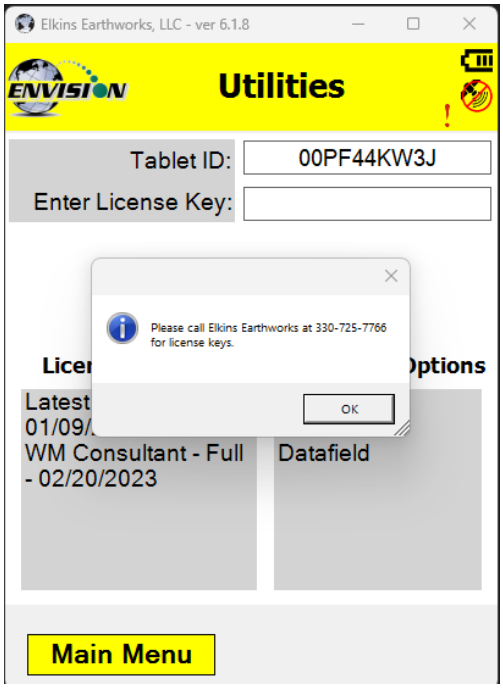
- Meter ID# - lists the ID number of the currently connected meter.
- Factory calibration – The date indicated is the last date the Envision® gas analyzer was last calibrated at the factory.
- Firmware version – Indicates the firmware version installed in the Envision® gas analyzer.
- Meter Temperature – This displays the internal temperature of the Envision® gas analyzer.
- Calibrate Temperature - Ambient Temperature of meter at last field cal
- BlueProbe Battery – Displays current battery level of connected BlueProbe
- BlueProbe Calibration - Lists the last date that a factory service on the probe has been completed.
- Meter Error Conditions – Will display the last 10 meter error conditions. This is useful when talking to tech support staff at Elkins Earthworks®.

5.9.3.1 License Manager

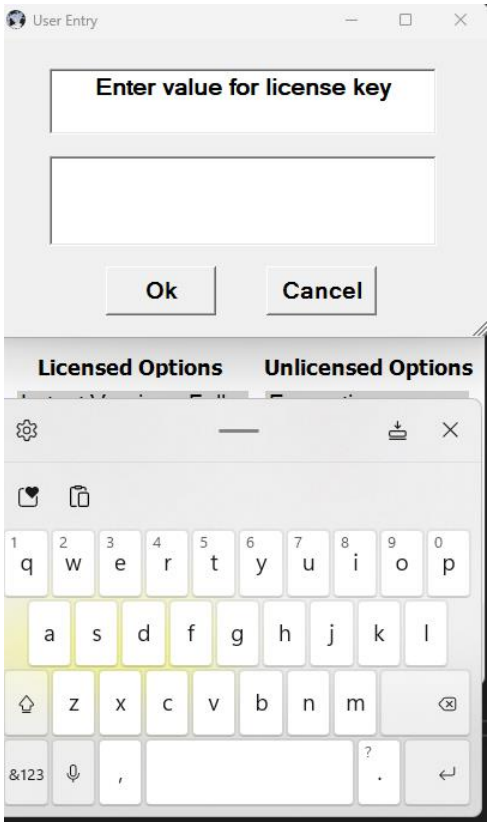
The Elkins Gas Analyzer software will not run unless a license is activated. Licenses not yet activated will appear as “Unlicensed Options”. Once activated, licenses will show as “Licensed Options”. To activate your Elkins Gas Analyzer package, complete the following steps.

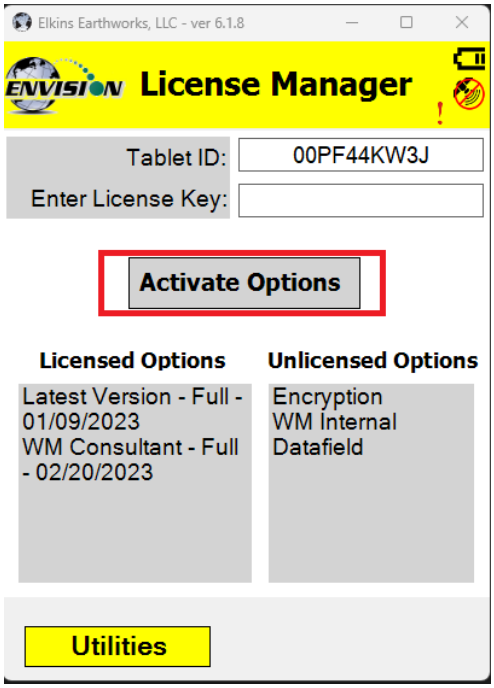


1) Select “License Manager” in the “Utilities” screen.



2) Enter your license key in the designated area. Call Elkins Earthworks (330-725-7766) to obtain license keys. Be prepared to provide the “Handheld ID: “ number shown on the screen.

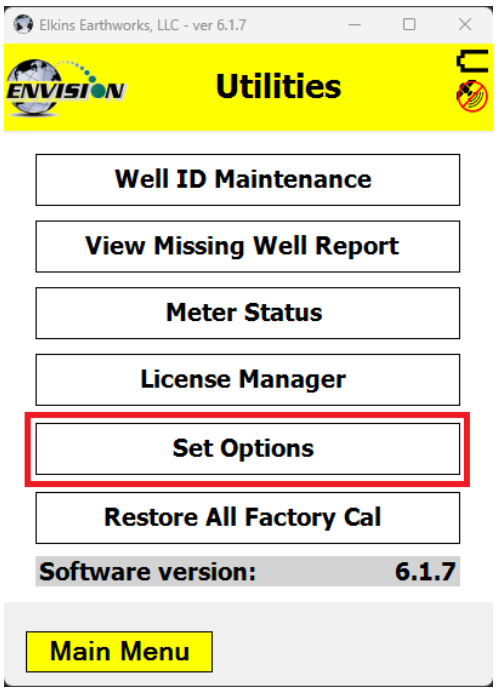




3) Once the license key is entered click “Activate Options”.

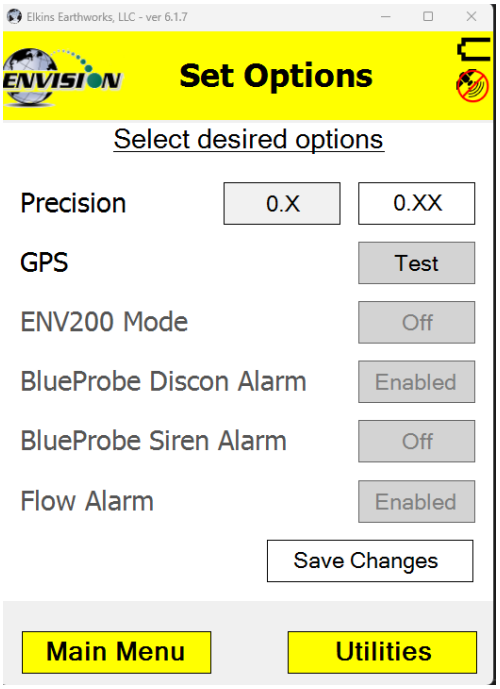
5.9.4 Set Options

The purpose of the set options screen is to allow the user to determine specific data reporting parameters.



1) Click “Set Options” on the “Utilities” page.

2) Below show all available options. See below for explanation of each option



Precision: Clicking 0.X will display and store measurements with one decimal place. Clicking 0.XX will display and store measurements with two decimal places

GPS: This allows the user to test the GPS (usually built-in to the tablet)

ENV200 Mode: This option is only enabled when connected to an ENVHCH model of theEnvision. When enabled this will make the ENVHCH measure and store only the gases of the ENV200.

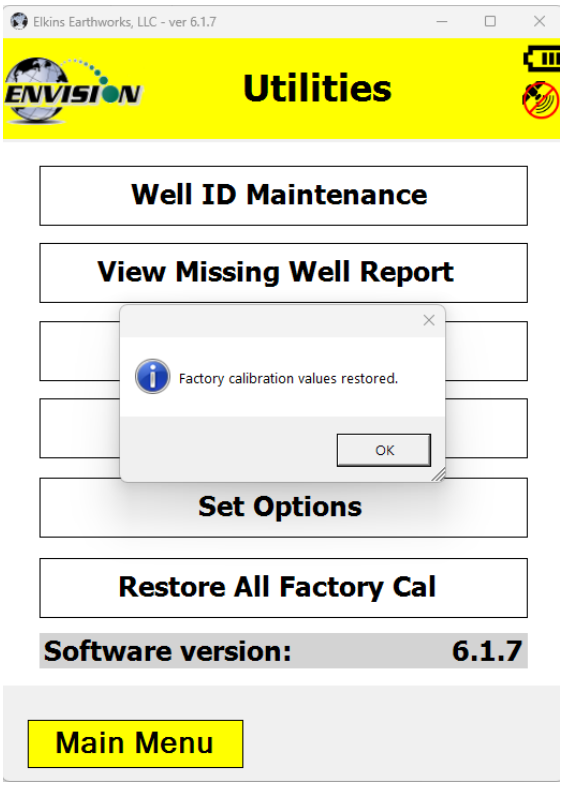
BlueProbe Disconnect Alarm: This option is only available when a BlueProbe Temperature Sensor is Connected to the tablet via Bluetooth. When enabled, if the Bluetooth connect between the table and the BlueProbe is lost, the BlueProbe will sound an alarm.

BlueProbe Siren Alarm: If the BlueProbe is ever misplaced, and still connected to the tablet via Bluetooth, enabling this feature sounds an alarm so it can be located.

Flow Alarm: This option enables and disables the alarm indicating low flow.

5.9.5 Restore All Factory Cal

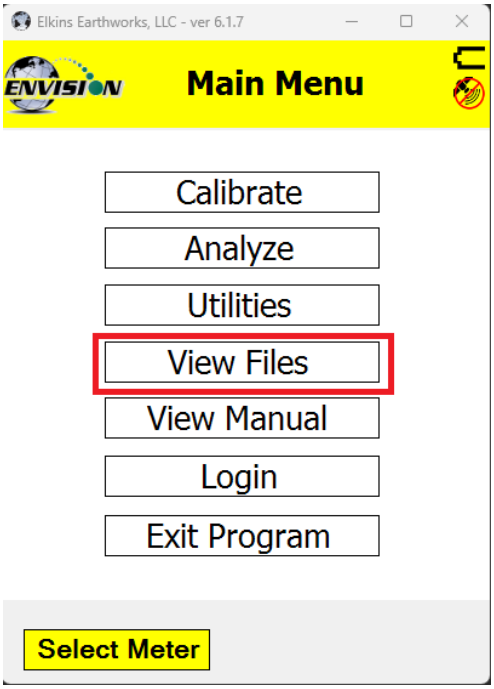
Tapping “Restore all Factory Cal” will set all field calibration offsets to zero and restore the calibration values from the last factory service.

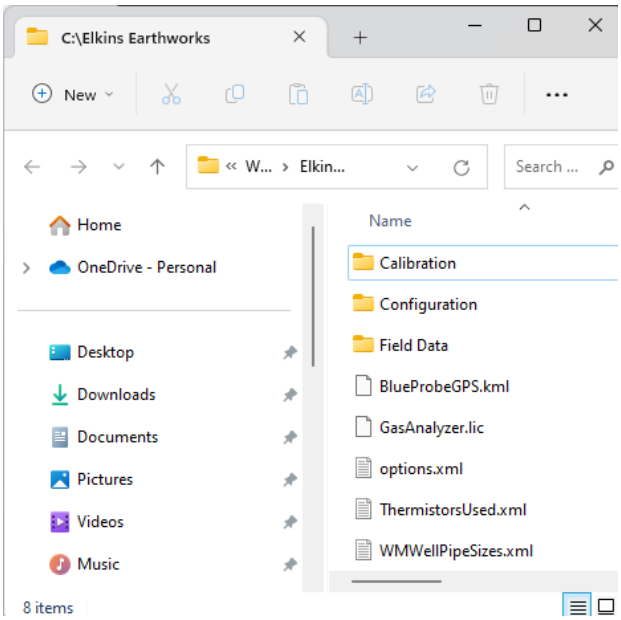


If a sensor has drifted significantly, a message indicating such may appear when the restore all factory cal button is pressed. If restoring factory calibration would adversely affect the ability of the user to calibrate the unit, the user will be notified and allowed to cancel the operation.

5.10 Stored Data

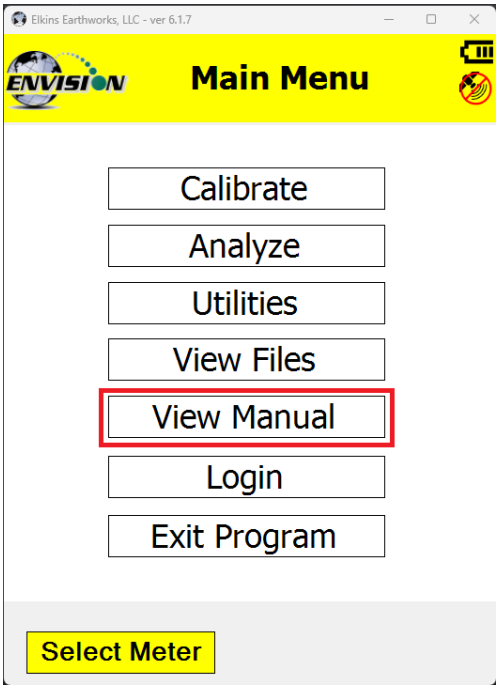
Return to the Elkins Gas Analyzer Main Menu and then click on “View Files”. A file explorer window will open to the directories used by the gas analyzer. The user can then locate the files that contain historical data from past monitoring events.

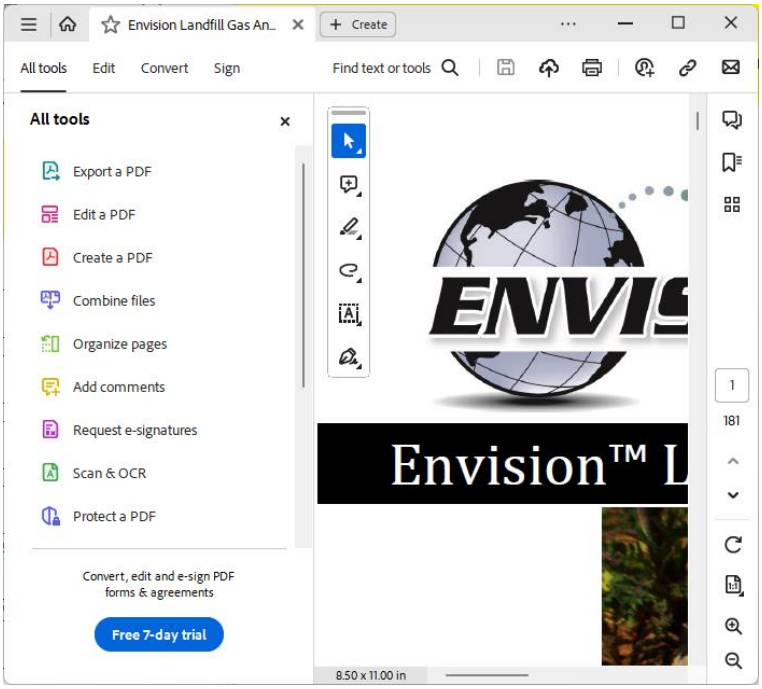




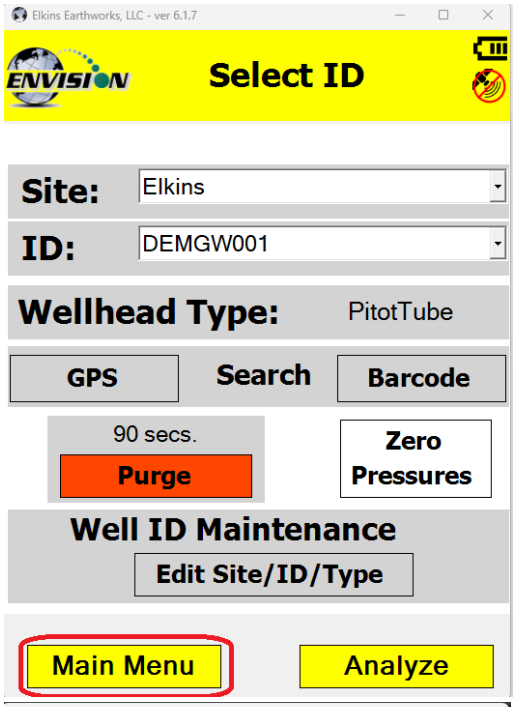
5.11 O&M Manual

Return again to the Main Menu, and then click on “View Manual”. The O&M manual button will take the user directly to an HTML or PDF version of the O&M manual. The blue texts are hyperlinks to the relevant sections of the manual. Tapping on the blue text will take the user directly to that section of the manual.

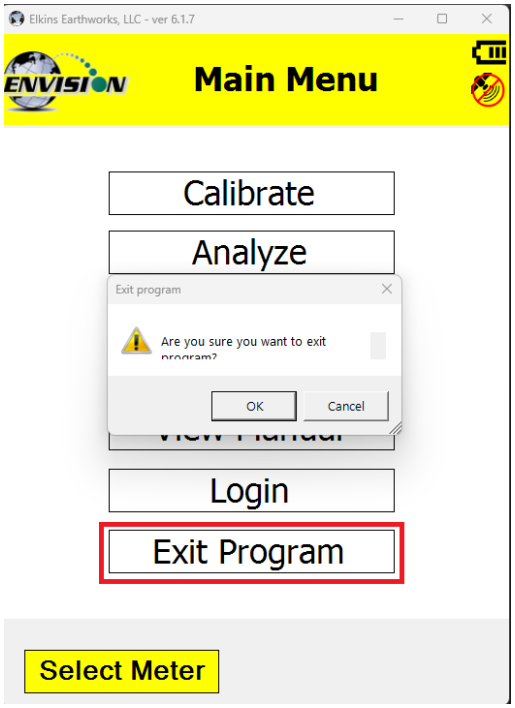




5.12 Exiting the Gas Analyzer Software

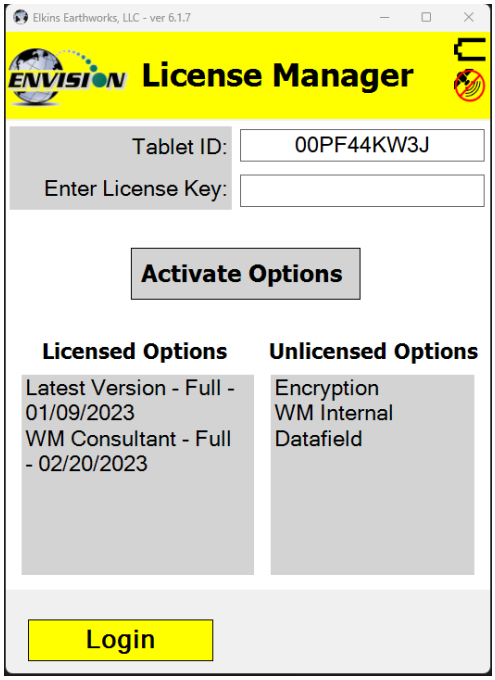


To exit the program, return to the Main Menu through the buttons on the bottom of the screen or click the "X" button in the top right hand corner of the screen.



You may then click "Exit Program", then "OK" to close the Elkins Gas Analyzer.

5.13 License Manager



The License Manager screen shows all of the software options available for purchase from Elkins Earthworks.

1. Base Package – This refers to the v3.03 software version. Envisions that have software versions less than v3.03 may be upgraded the newest version, but may require a new "Latest Version" license key. Please contact Elkins Earthworks for more information.
2. Latest Version – All new Envisions come standard with the latest version software.
3. Encryption – The encryption option provides features that ensure data integrity during and after monitoring operations.

a. GPS coordinates of user are logged and recorded when the reading was taken.
b. All field data is encrypted and unable to be modified by anyone other than the data processor. Free desktop software is provided with this option to allow for decryption and distance to well analysis utilizing Microsoft Excel.

4. WM Internal – When this option is enabled only Waste Management sites are displayed for selection. The gas analyzer operation is modified as follows:

a. ID sets and field data files are encrypted using a Waste Management proprietary algorithm and are used for downloading and uploading to the Waste Management database via Ecotec's LSGAM desktop software.
b. New prompts for well and site Questions which come from the Waste Management database.
c. Technician name selection is done via LSGAM.

d. Additions and changes to well configuration, location, and barcodes are not allowed.

5. WM Consultant – This option gives access to features from both item 2 (Latest Version) and item 4 (WM Internal). This allows the user to access both the traditional and the new Waste Management modes based on the type of ID set that is loaded.

   For further information regarding the Waste Management option, please refer to the following documents/files:

   1) ENV Quick Start Guide V4-Mesa2.pdf
   2) WM Envision ENV-Mesa2 Guide V2 – Calibration.pptx
   3) WM Envision ENV-Mesa2 Guide V2 - Well Read.pptx
   4) Envision Calibration.mp4
   5) Envision Well Read.mp4

6 The Envision® Gas Analyzer Configuration Editor Software

The handheld computer software can utilize an ID set created by the user on a Windows based **desktop or laptop computer**. This configuration editor software is provided by Elkins Earthworks® and is included on the flash drive with your original purchase. This software allows the user to create, modify and merge data sets.

The instructions below describe the process of generating a new ID set to import into the handheld computer.

It is important to use the proper configure configuration editor that corresponds to the models of Envision and handheld computer that you are using. These are shown below.

Hardware Configuration	**Name of Configuration Editor (shows in title bar)**
ENV100 & ENV200 – Handheld PC	Elkins Gas Analyzer Configuration Editor
ENV100 & ENV200 – Tablet PC	Elkins Gas Analyzer Configuration Editor Tablet
ENVAUS – Handheld PC	Elkins Gas Analyzer Configuration Editor BH (BH = borehole)

Most of the screen shots below will show the ENV100/200 handheld PC version of the configuration editor.

6.1 Loading the application

The flash drive delivered with the Envision® gas analyzer contains a file named “Configuration Editor”. Insert the flash drive into an unused USB port on the user’s computer.

6.2 Opening the Gas Analyzer Configuration Editor for the first time

When the Gas Analyzer Configuration Editor is selected for the first time it will indicate “No Configuration File found”. The software will create sample data when the user presses the “OK” button.
Newer versions of the ENV100/200 software will not automatically create a sample data file. They allow the user to create a new ID set using the “File -> New” menu. The user will then be asked whether the ID set should contain metric or English units. The sample file will then be created with the units specified.

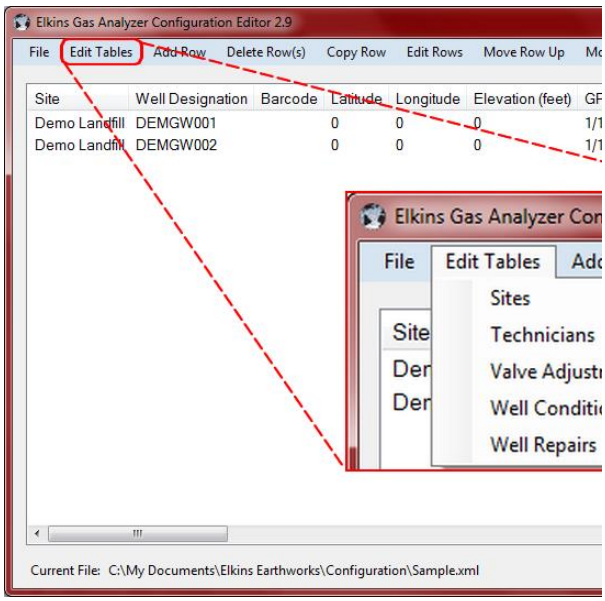
See table below for metric and English units used.

Property	Metric Units	English Units
Elevation	Meters (m)	Feet (ft)
Wellhead & Orifice Plate Size	Centimeters (cm)	Inches (in)
Pressure	Millibars (mB)	Inches of Water (“H_2O)
Flow	Standard Cubic Meters per Hour (scmh)	Standard Cubic Feet per Minute (scfm)
Temperature	Degrees Centigrade (°C)	Degrees Fahrenheit (°F)

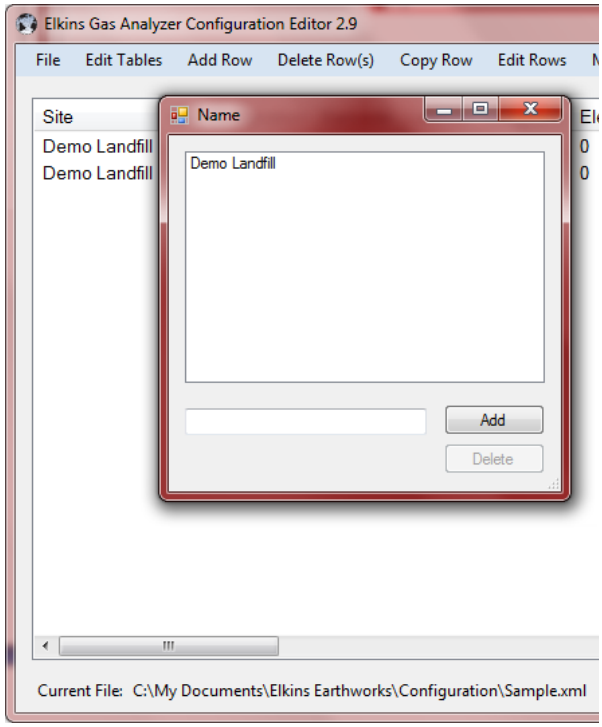
In addition to the metric units shown above, the ENVAUS version of the configuration editor also has the following differences from the ENV100/200 version.

Property	**ENV100/200**	**ENVAUS**
GPS Coordinates	Latitude and Longitude in decimal degrees	Latitude and Longitude in decimal degrees plus Easting and Northing in meters along with Zone
Gas Concentration Log Total Measurements	N/A	Number of total gas concentration measurements to accumulate in log file
Gas Concentration Log Interval	N/A	Time in seconds between gas concentration log measurements
Borehole Flow Log Total Measurements	N/A	Number of total borehole flow measurements to accumulate in log file
Borehole Flow Log Interval	N/A	Time in seconds between borehole flow log measurements

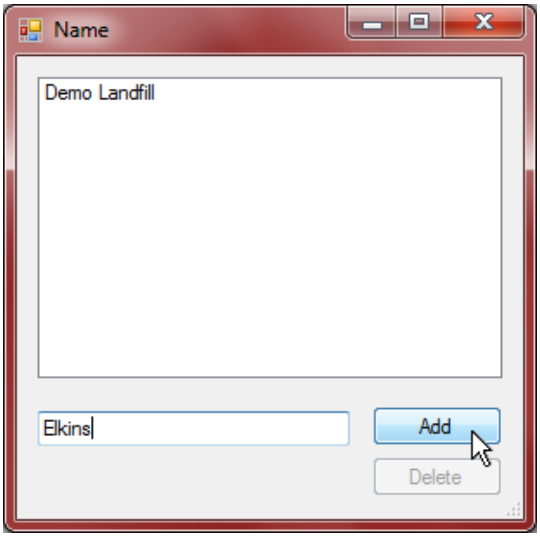
6.3 Add a Site, Technician, Valve Adjustment, Well Condition and/or Well Repair



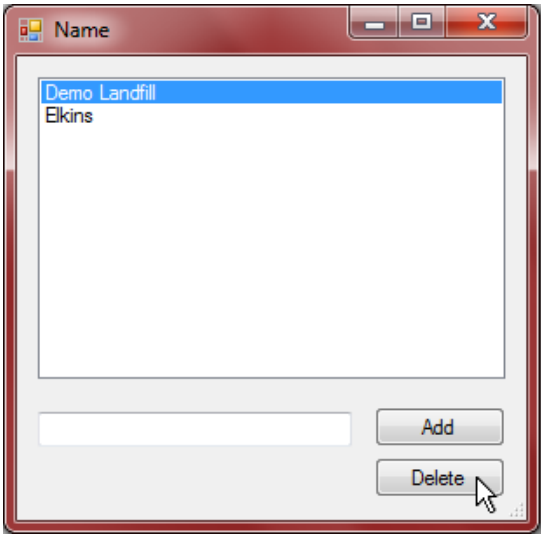
1) Click on the "Edit Tables" tab and select the desired category to add to.



2) A text box will open for the user to enter a new item within the selected category.



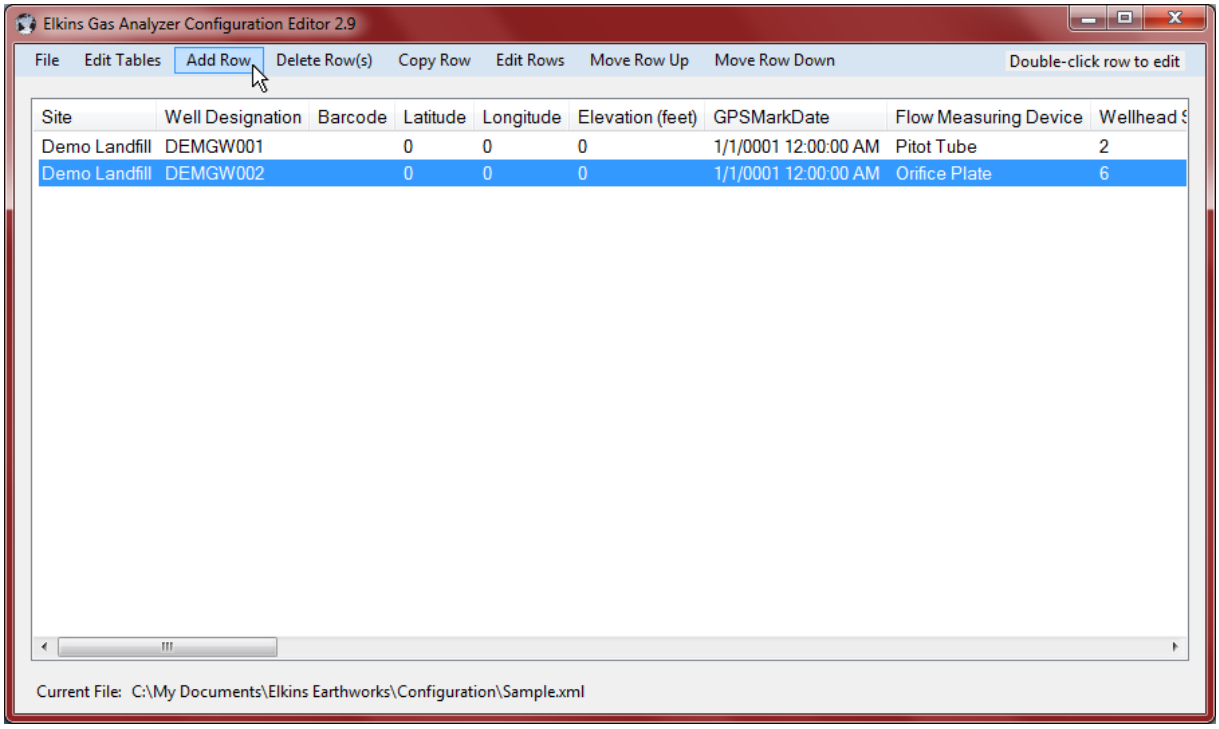
3) Click inside the text box, type in the new item, then tap the “Add” button.



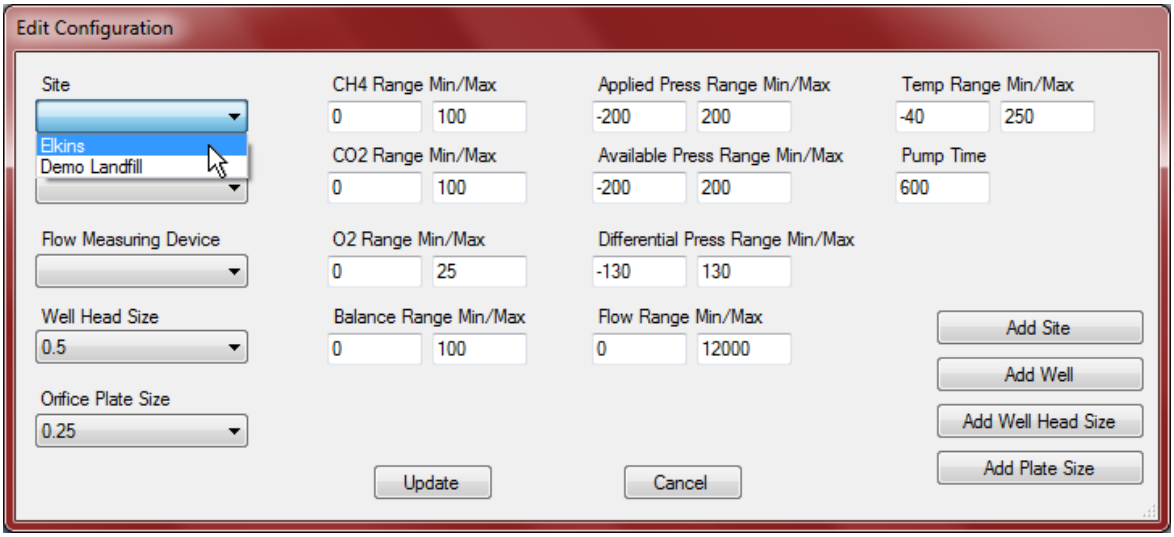
4) To delete an item, highlight the item and click on the “Delete” button.

6.4 Add a monitoring point

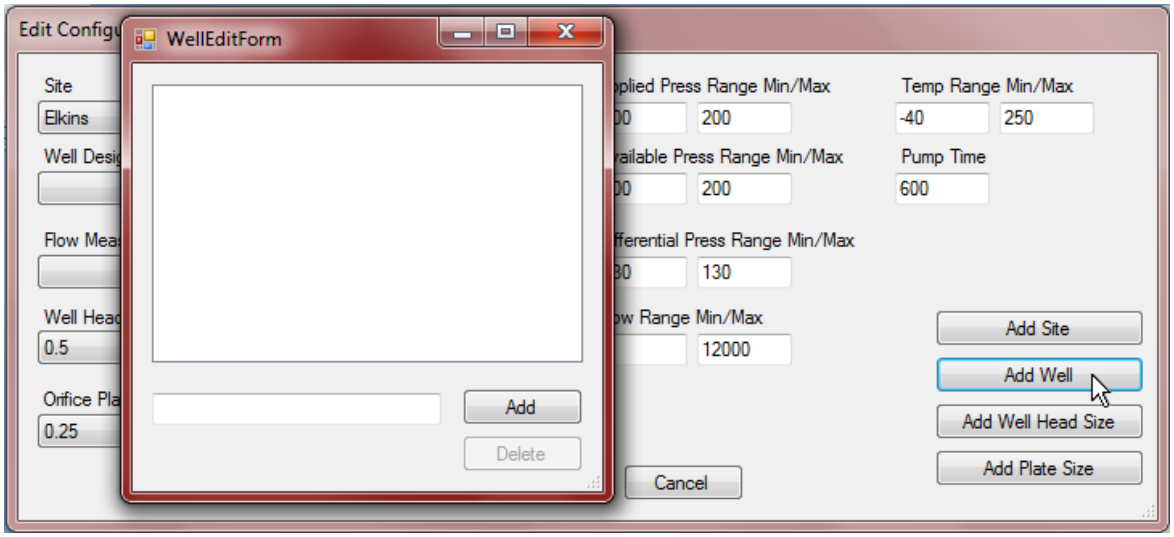
1) Click on the “Add Row” button on the upper left corner of the screen. A row must be selected where the new one is to appear.



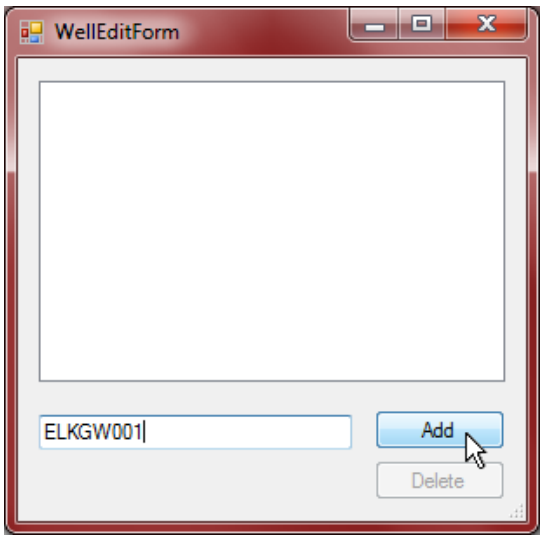
2) Select the “Site”. If the user needs to make a new site, then the “Add Site” button can be used to make a new site.



3) Next tap the “Add Well” button on the right side of the screen.

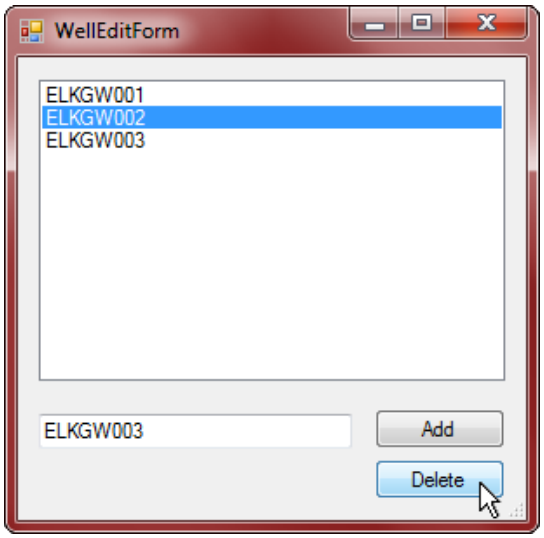


4) Click inside the text box and type in the name of the new well.

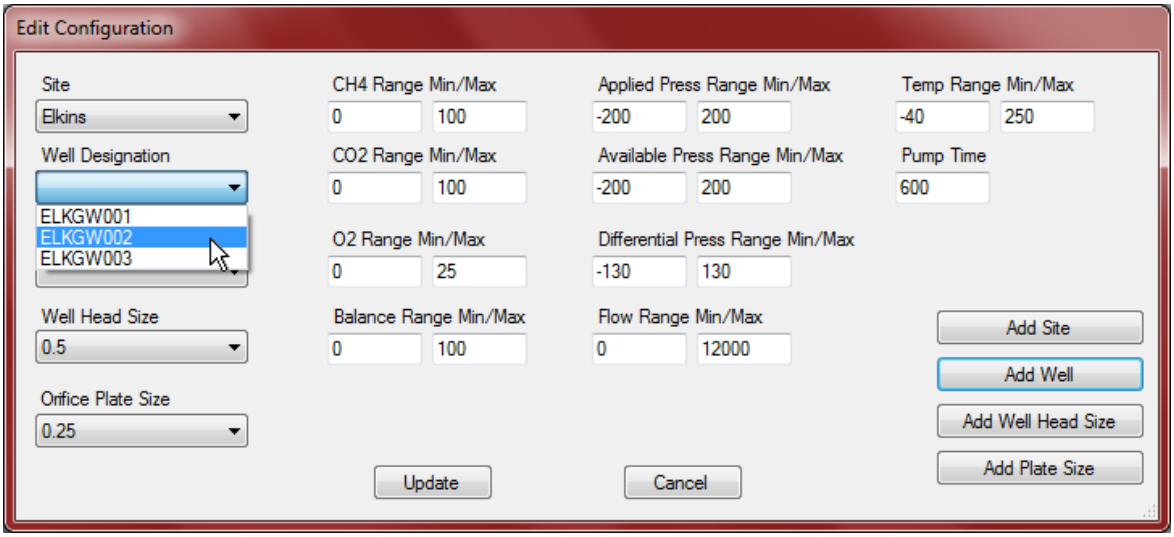


The text in the box that the user just entered will stay once the ID is added. This is done so that the user does not have to retype the common characters to each new well.

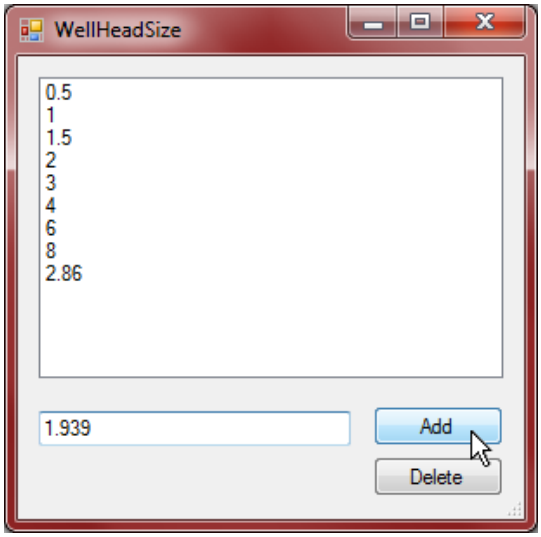
5) To delete a well, select the well and click the delete button.



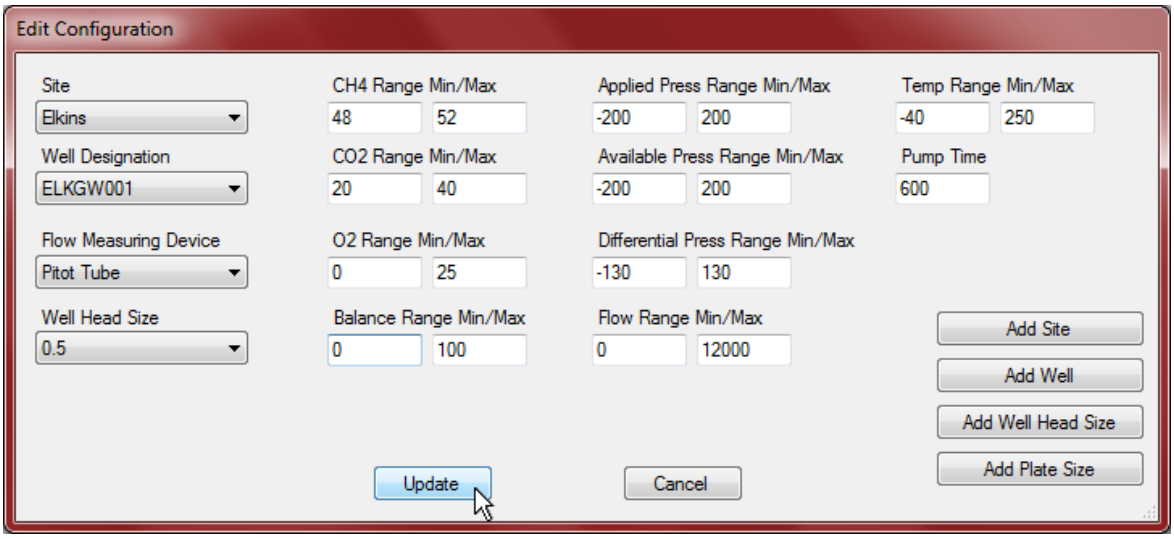
6) Once the well names have been added, the user may now configure each well. Click on the well that is to be configured.



7) The user may now select the wellhead type, wellhead size, and orifice plate size. If the user desires to type in the flow in the field they may use the "User defined" type under "Well Designation". If the default list of "Well Head Sizes" or "Orifice Plate Sizes" does not include the desired size, then the user may add a new size using the "Add Well Head Size" and "Add Plate Size" buttons.



8) The user may now set acceptable ranges for use with the handheld user interface. The user may do this by clicking in the appropriate box and typing in the desired values. When a measurement is within these ranges it will turn green on the Trimble handheld. Otherwise it will turn red.

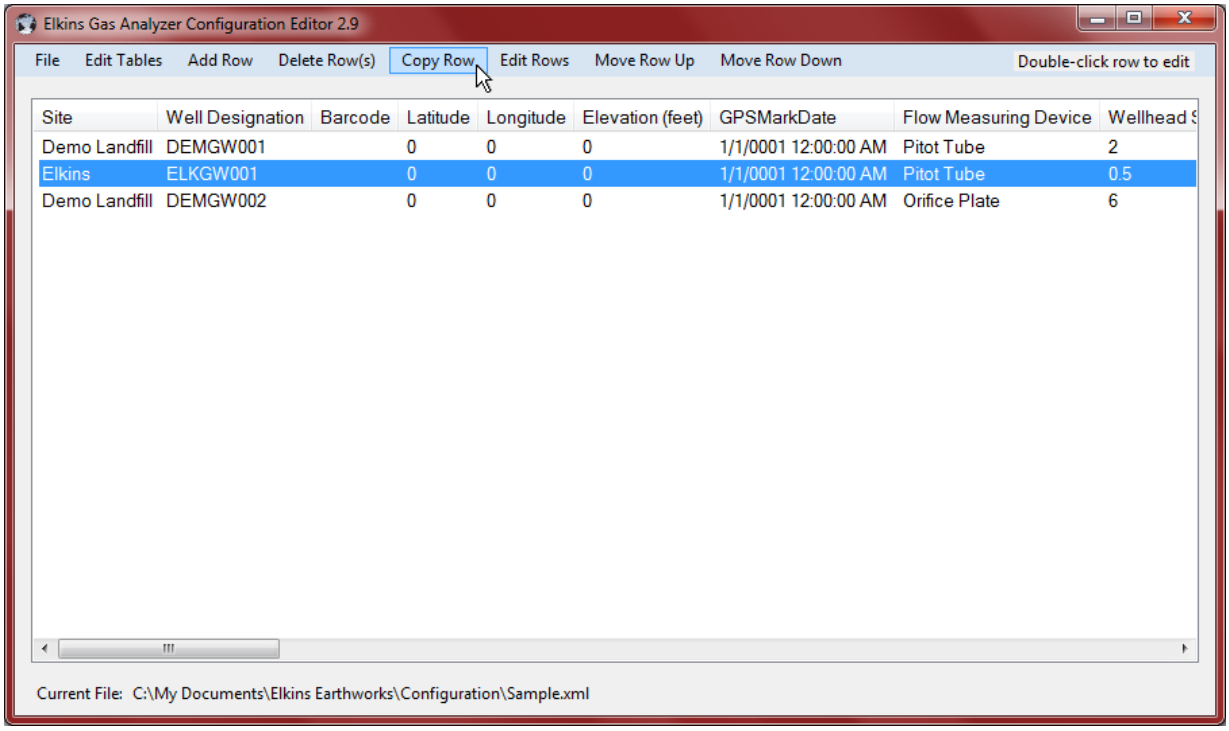


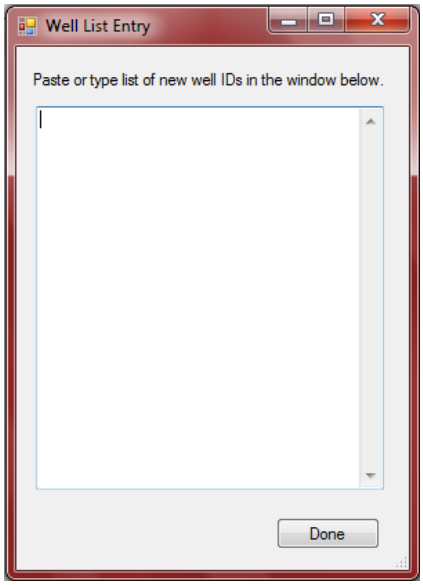
9) Once the well is configured the user should click on the “Update” button to save the changes and to return to the main screen.

6.5 Cloning wells

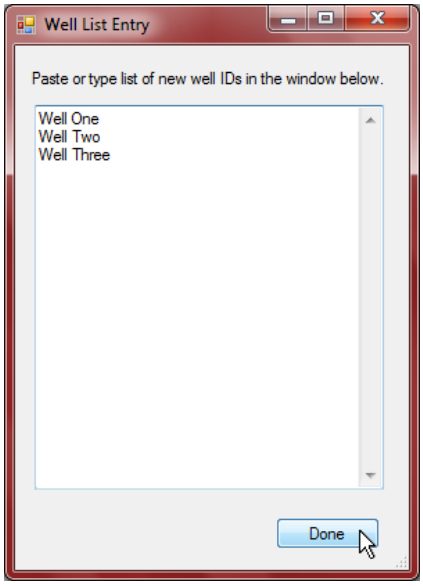
To make it easier for the user to enter multiple wells that have the same configuration, the software was designed with a copy feature.

1) Highlight the well to clone and tap the “Copy Row” button.

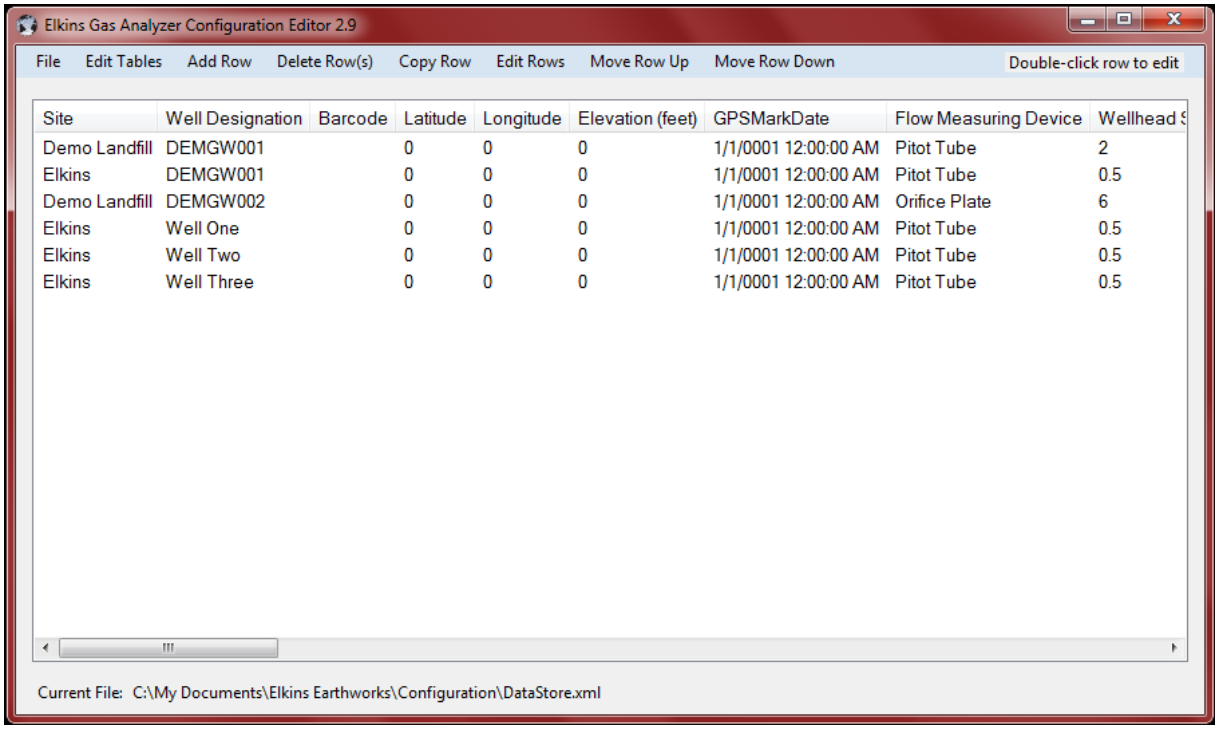




2) Once the “Copy Row” button from the top of the screen is selected the Well Entry list will open.

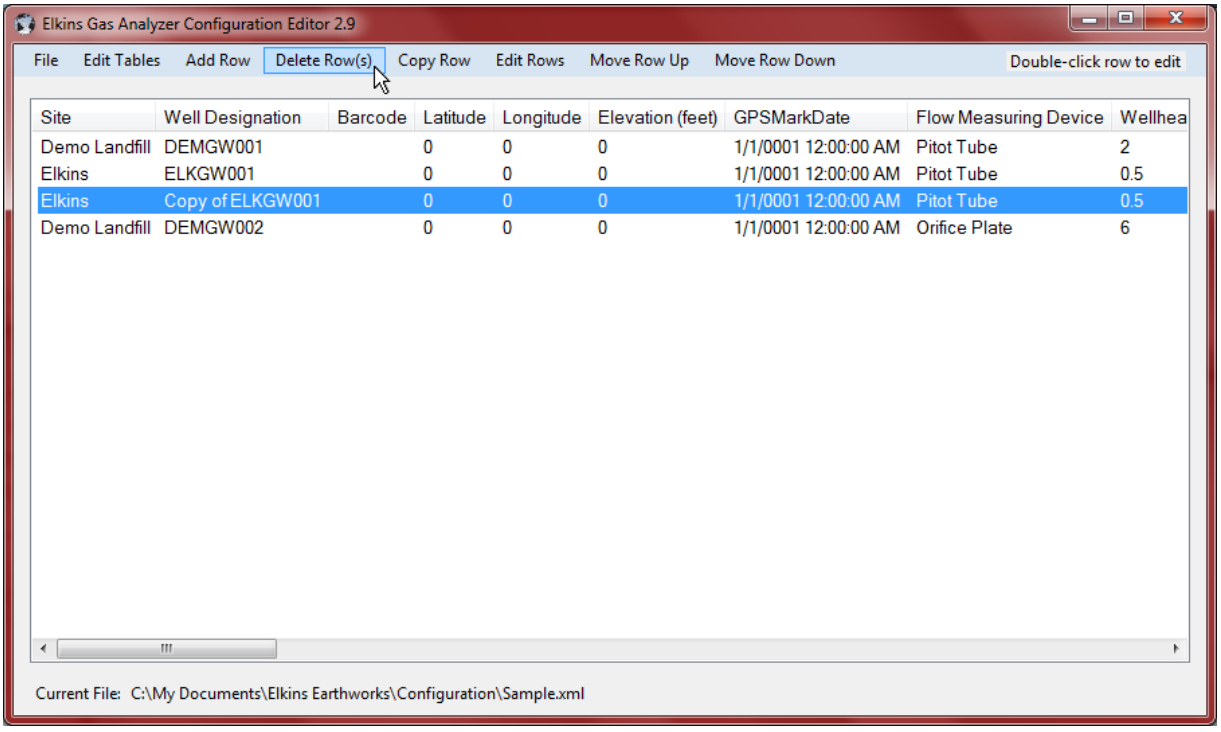


3) Type (or cut and paste) a list of desired names for the new wells to be added (there should be a carriage return after each name as shown below). Select done when finished and the new IDs will populate into the ID set with the same well configuration settings as the originally highlighted well.

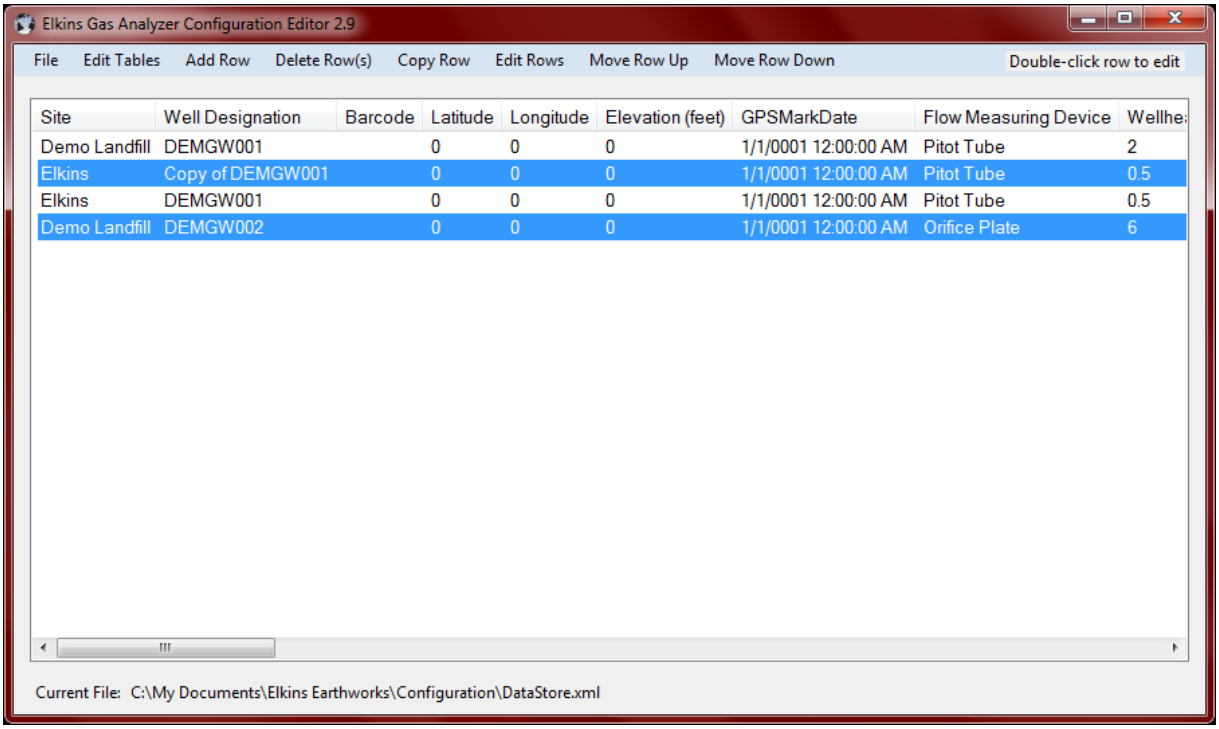

Elkins Gas Analyzer Configuration Editor 2.9
File
Edit Tables
Add Row
Delete Row(s)
Copy Row
Edit Rows
Move Row Up
Move Row Down
Double-click row to edit
Site
Well Designation
Barcode
Latitude
Longitude
Elevation (feet)
GPSMarkDate
Flow Measuring Device
Wellhead
Demo Landfill DEMGW001 0 0 0 1/1/0001 12:00:00 AM Pitot Tube 2
Elkins DEMGW001 0 0 0 1/1/0001 12:00:00 AM Pitot Tube 0.5
Demo Landfill DEMGW002 0 0 0 1/1/0001 12:00:00 AM Orifice Plate 6
Elkins Well One 0 0 0 1/1/0001 12:00:00 AM Pitot Tube 0.5
Elkins Well Two 0 0 0 1/1/0001 12:00:00 AM Pitot Tube 0.5
Elkins Well Three 0 0 0 1/1/0001 12:00:00 AM Pitot Tube 0.5
Current File: C:\My Documents\Elkins Earthworks\Configuration\DataStore.xml

6.6 Delete Wells

The user may delete a well from the ID set by highlighting the Well and clicking on the "Delete Row(s)" button.



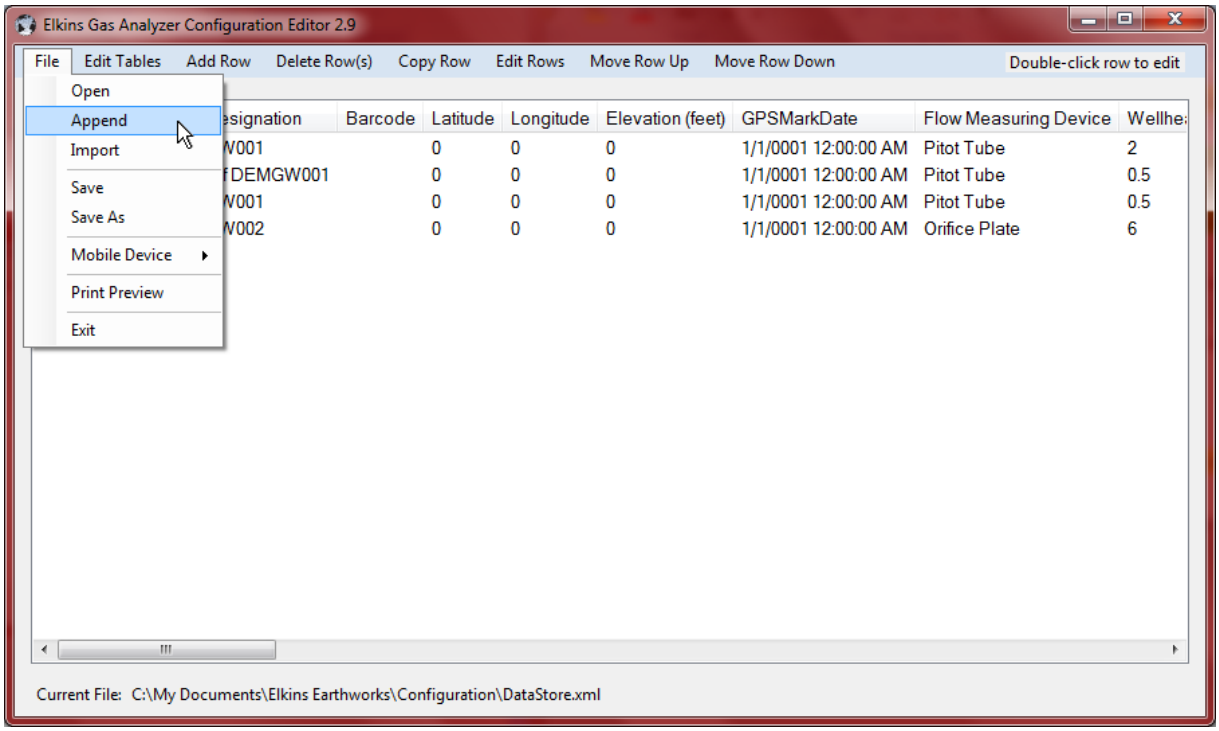
The user may also delete multiple rows at the same time by holding the CTRL key and clicking the desired rows.

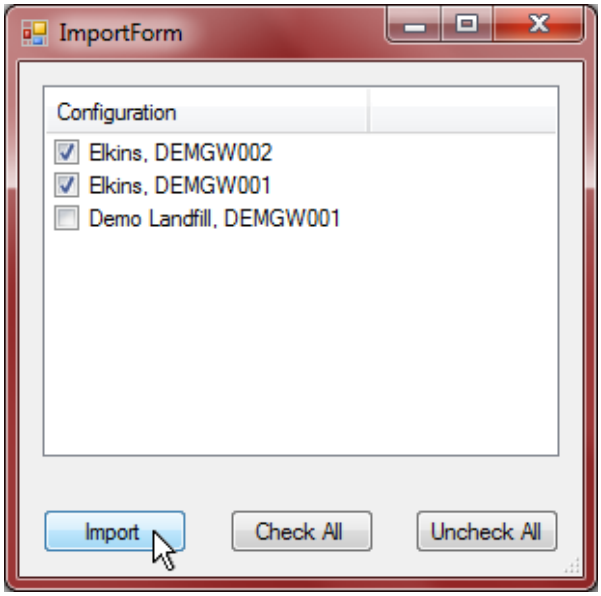


6.7 Combining wells from another ID set

The Gas Analyzer Configuration Editor will let the user find a second ID set and combine selected wells into the new ID set.

1) Click on the File tab, then the “Append” button.

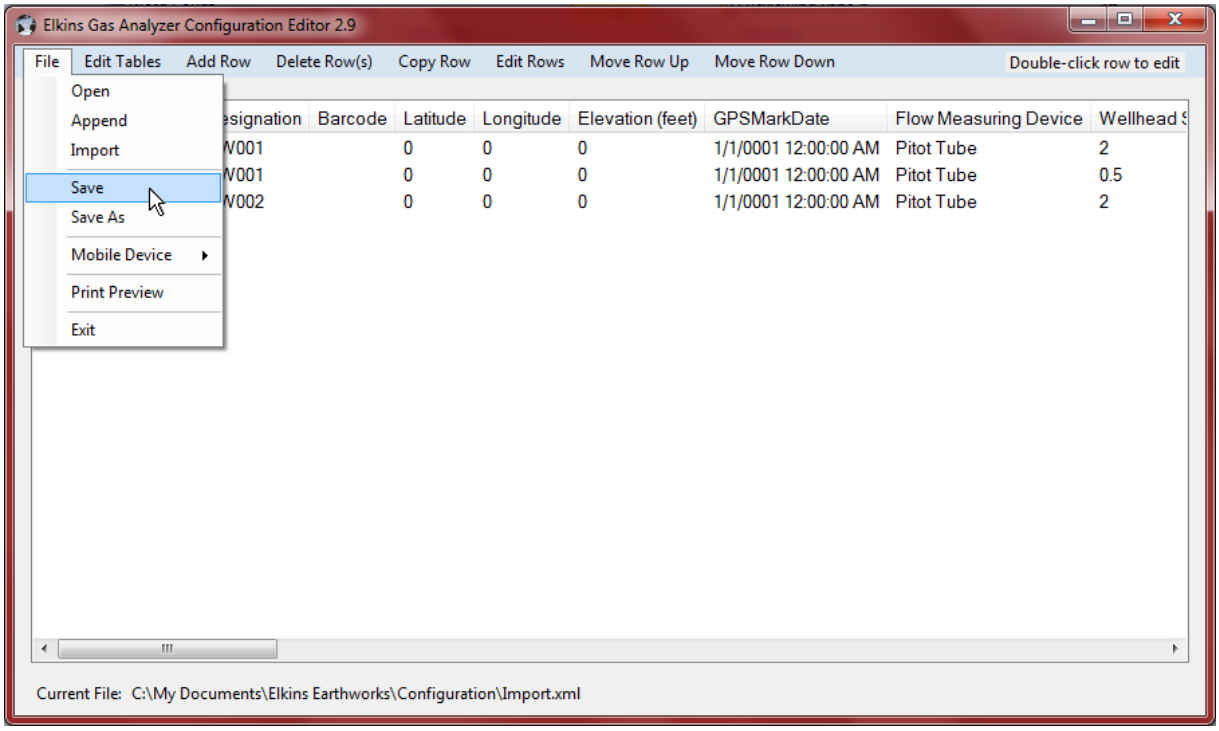




2) Browse for the second ID set which contains the well ID's that the user desires to add to the new ID set. Check the ID's that should be appended to the new ID set and then click the Import button.

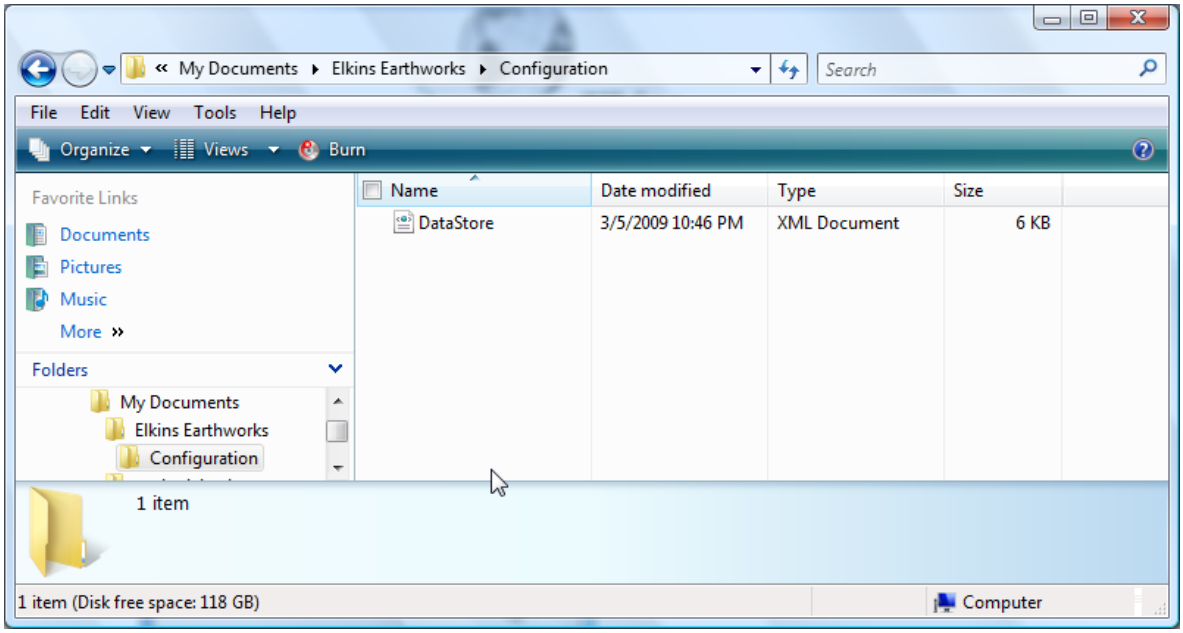
6.8 Save File

The user must click on the save button to save the changes that have been made to the ID set. The user may use the "Save As" button to specify a custom name for the file. The program ensures that the file name has the proper ".xml" extension.



6.9 ID set stored location on PC

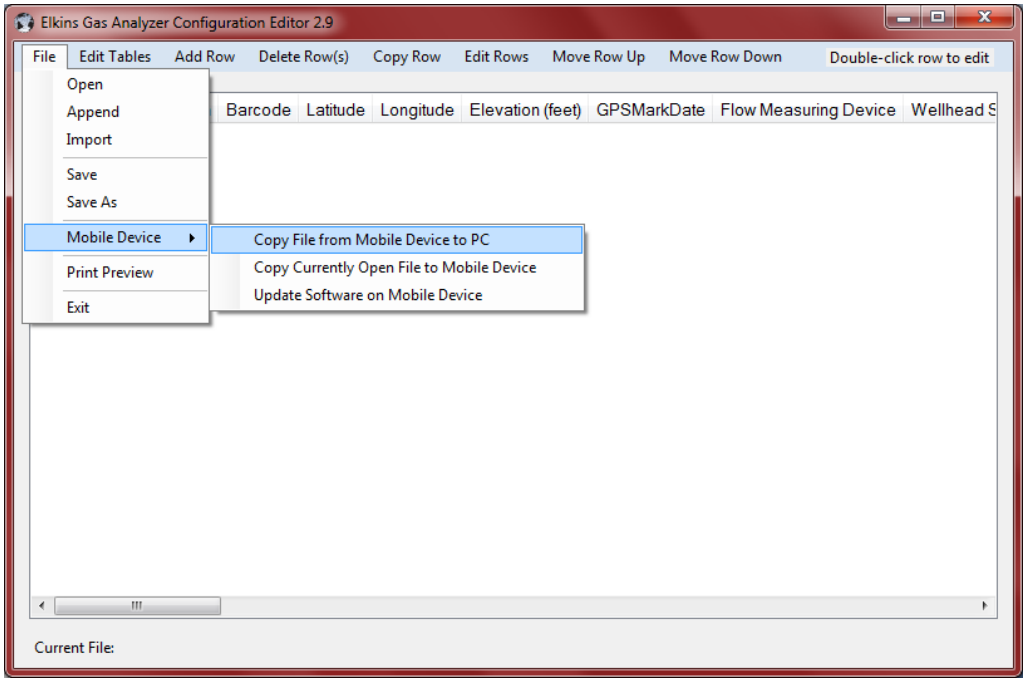
The ID set file is located in the c:/Elkins Earthworks/Configuration directory. The user may have multiple ID set files referencing multiple sites that the instrument is used on.



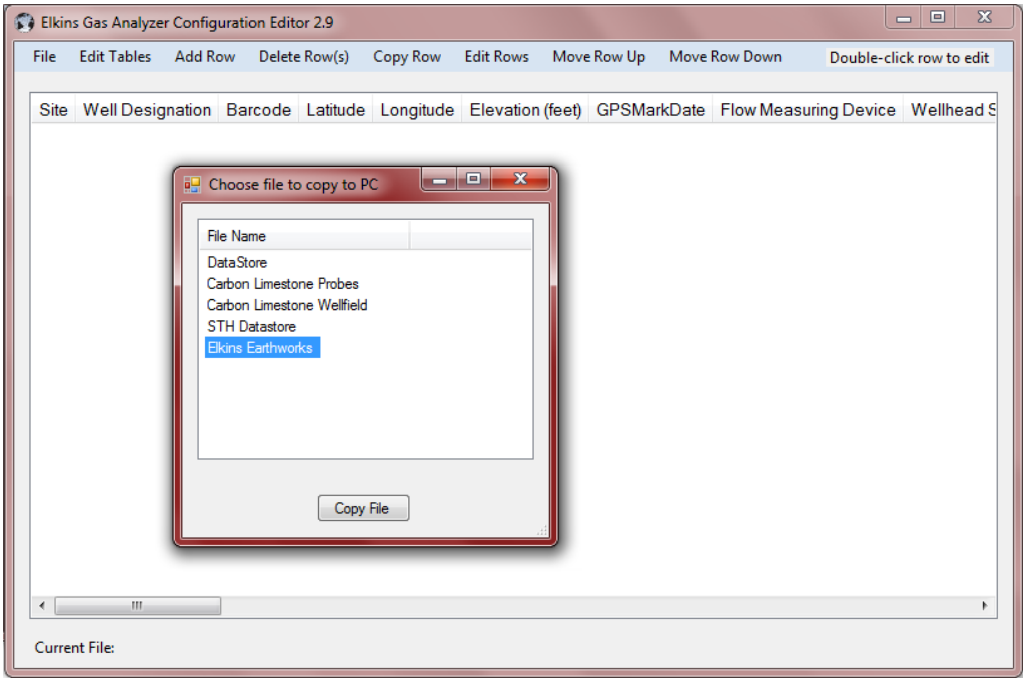
6.10 Transferring ID Sets between Windows Mobile device and desktop PC

Note: This method has been deprecated and is no longer supported. If you are still using a Windows Mobile device, the best way to transfer files is to use a USB flash drive.

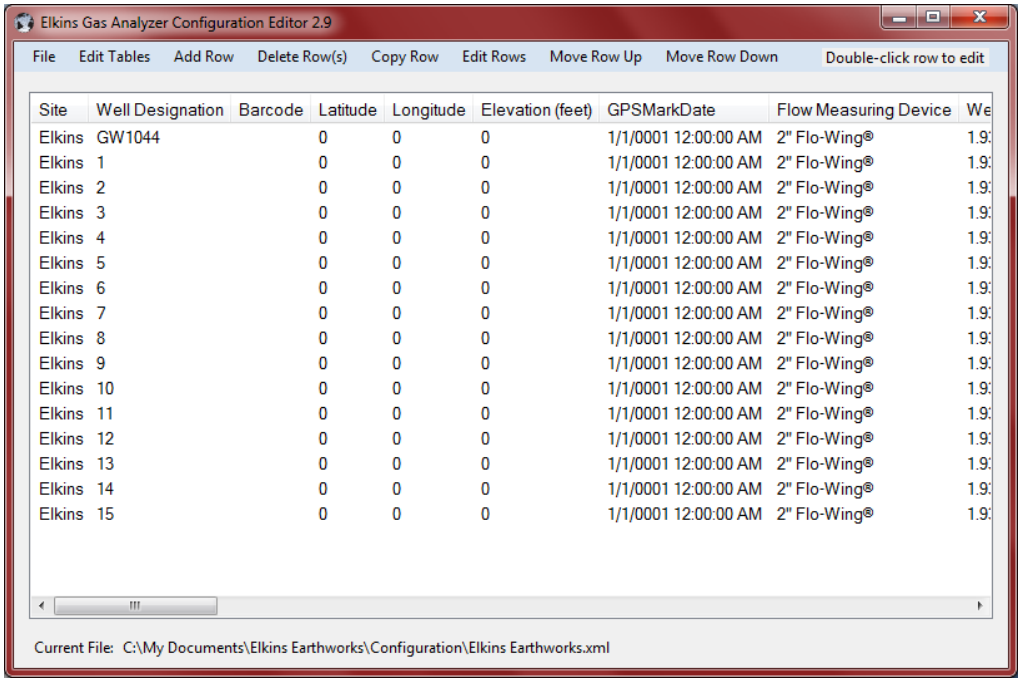
1) Attach the handheld to the PC and let the unit synchronize
2) Open the Configuration Editor program
3) Select “File” then “Mobile Device” and finally “Copy file from mobile device to PC”.



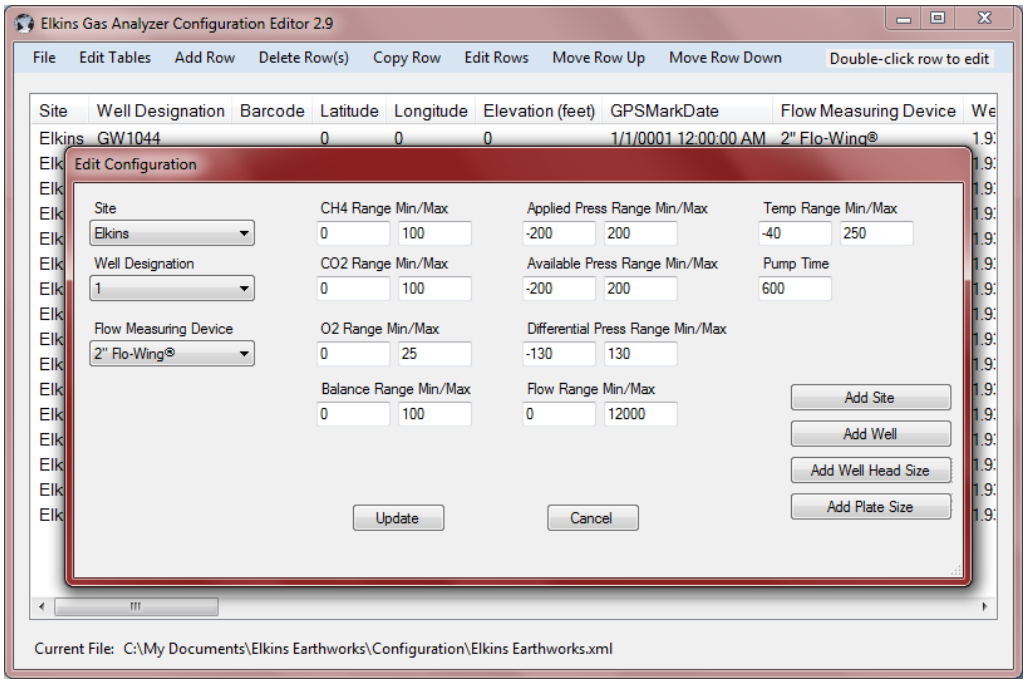
4) Select the file that contains the ID set that you want to manage and click on the “Copy File” button.



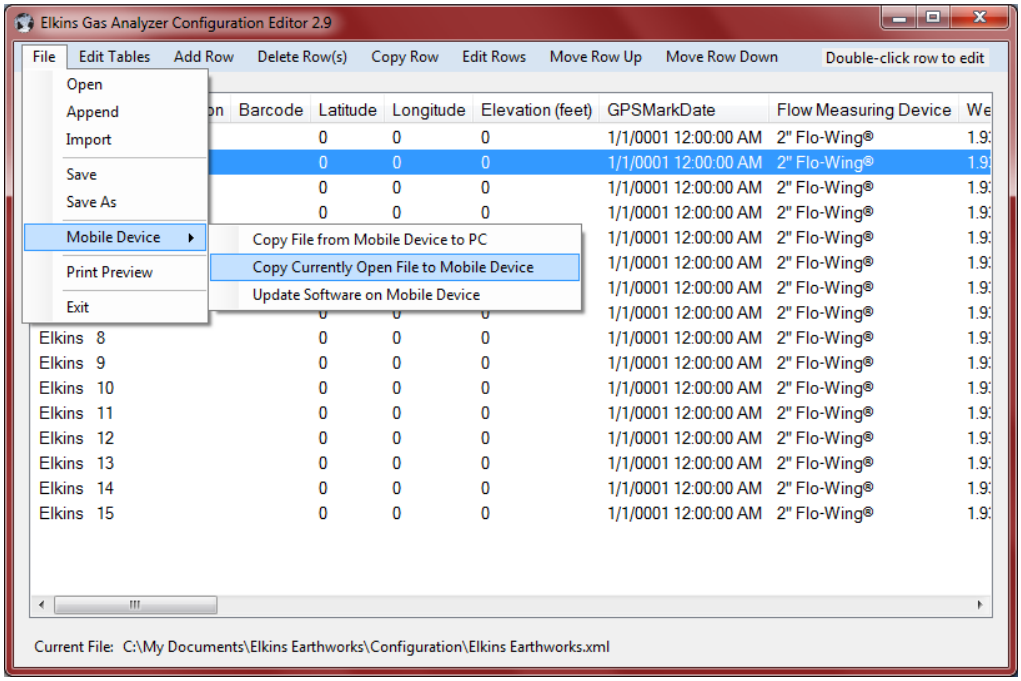
5) The selected ID set will then populate into the Configuration Editor.



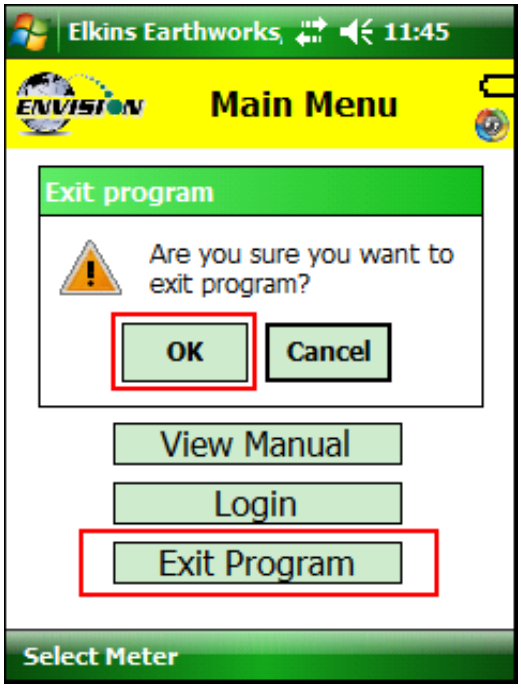
6) Make any desired changes to the selected ID set.



7) After all changes have been made the user should send updated ID set back to the handheld.

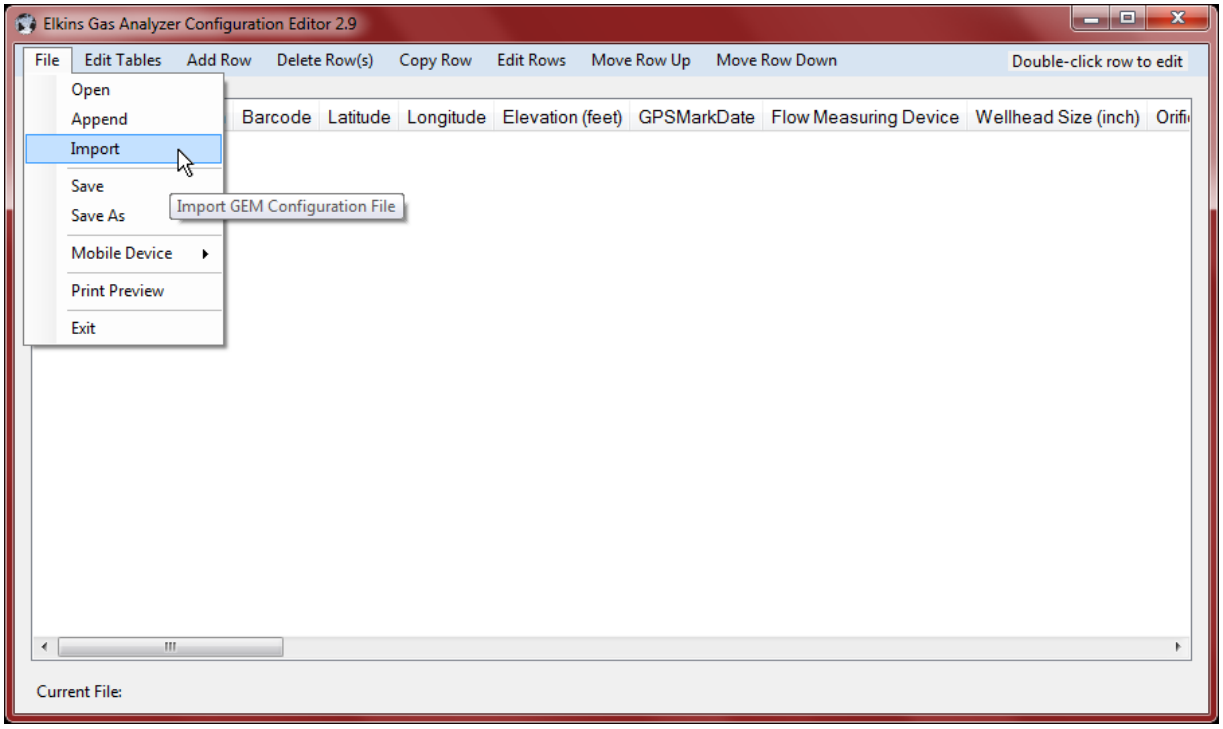


8) Updated ID set will be sent to mobile device and changes to the ID set will be viewable once Elkins Earthworks® Gas Analyzer program on the handheld has been exited and restarted.



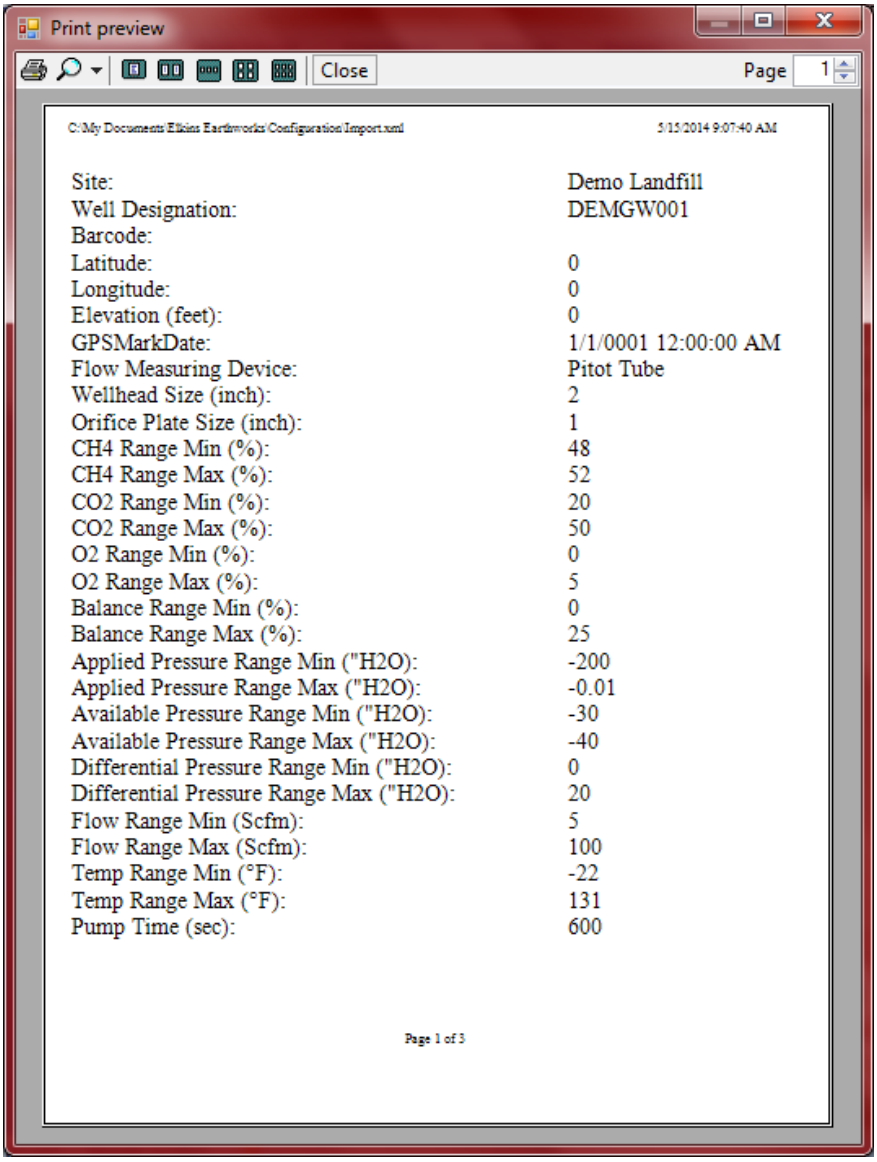
6.11 Importing GEM Configuration Files

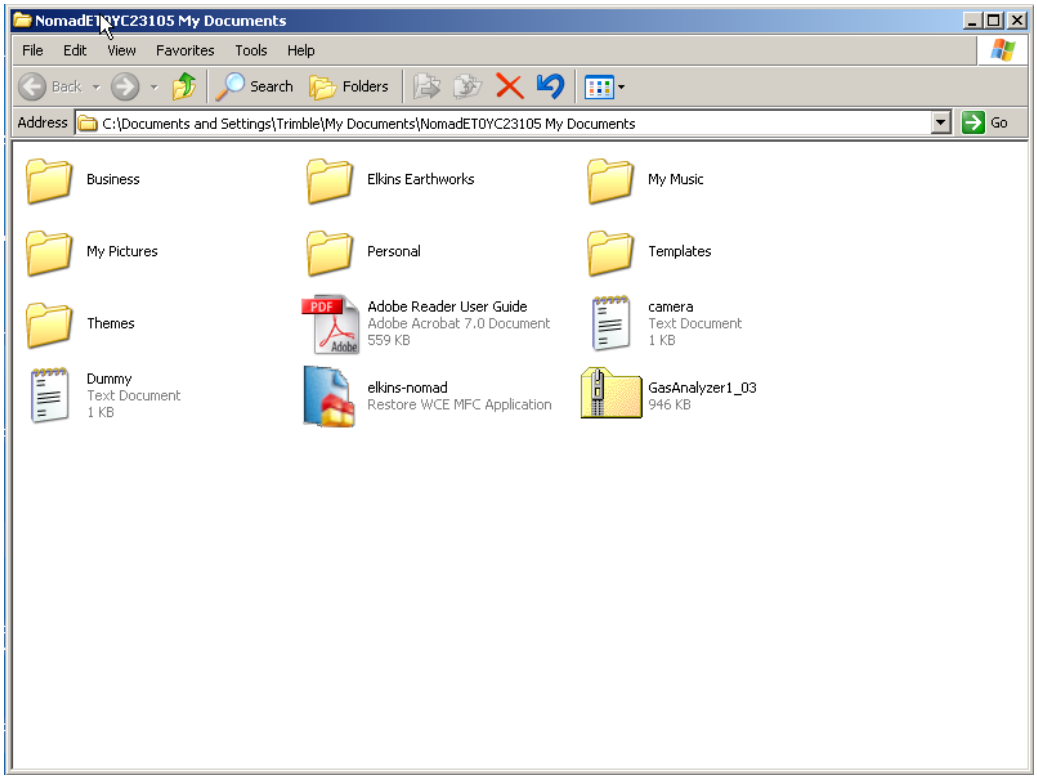
In order to import a GEM file, the user must find the location of an existing GEM .xml file on their hard drive. Press the import button and browse to the GEM file location. Note: Information imported into the Configuration Editor will be limited to well ID names and well configuration settings.



6.12 Print Preview

The “Print Preview” button allows the user to view the entire ID set and all of the configurations set for those wells. The user may print the ID set from this feature.



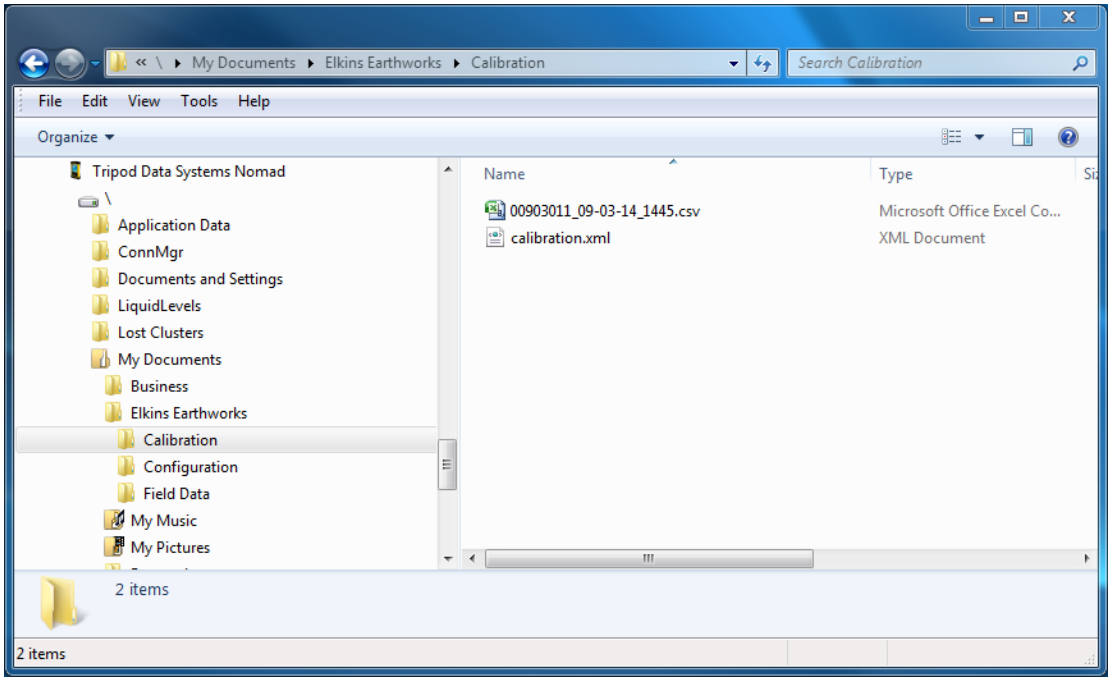


6.13 Transferring Files – Windows Mobile

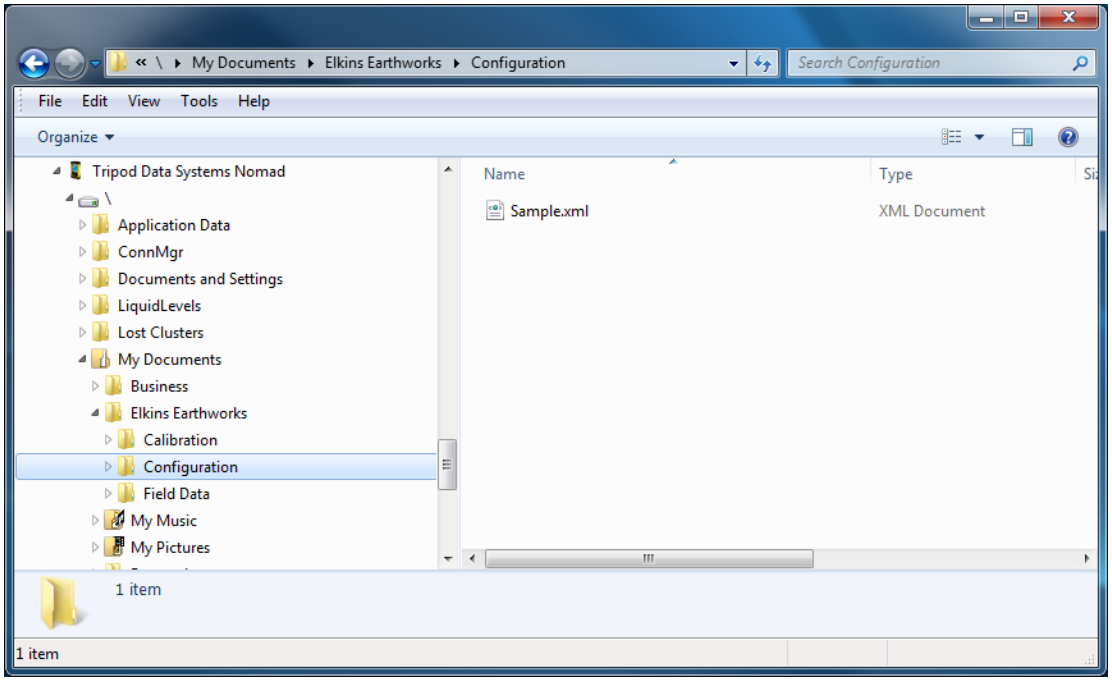
6.13.1 Directory Structure

The files associated with the gas analyzer program may be found on the handheld device at C:\My Documents\Elkins Earthworks. This directory contains the following 3 directories:

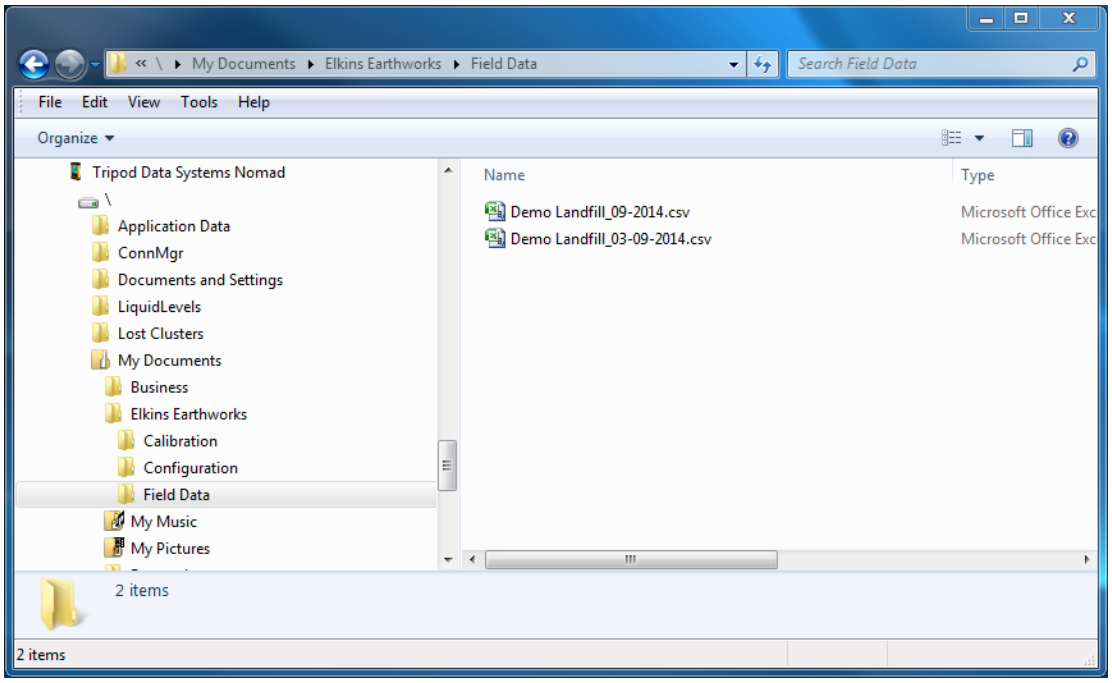
1) Calibration Directory – Where two types of calibration files are stored. A new .csv file is generated each time the user performs a field calibration. These files may be used to verify that a field calibration was performed on a certain date and time. The .xml file is used by the gas analyzer program. It contains information about the last field calibration for each Envision that has been calibrated with the handheld device.



2) Configuration Directory – This is where all the well ID sets are stored. The files are in .xml format and may be edited by the configuration editor. The file must be copied to the user's PC before editing.



3) Field Data Directory – This is where all the .csv field data files reside. A new file is generated each day and each month that a measurement is taken. These files may be opened with Excel. If the encryption option is enabled, encrypted (.enc) files are also present.



7 Errors and Troubleshooting

7.1 Envision® Error Conditions:

Error conditions from meter are presented by a blinking red "!" next to the connect icon in the header of each screen. The description of the error will appear in the "Meter Status" screen under error conditions. The following are error conditions that may be displayed:

1) **"Error 1-Battery Gauge"**
   a. *Explanation* - The battery gauge is displaying erroneous battery data, as a result of a charging chip failure. This will affect battery cut-offs and accurate monitoring.
   b. *Solution* – Call technical support at Elkins Earthworks® 330-725-7766.
2) **"Error 2-Charging**
   a. *Explanation*- The charging chip is not shutting off the charging process.
   b. *Solution* - Call technical support at Elkins Earthworks® 330-725-7766.
3) **"Error 3-Charging"**
   a. *Explanation* **-** The Envision® is charging too slowly.
   b. *Solution* - Call technical support at Elkins Earthworks® 330-725-7766.
4) **"Error 4-Sensor"**
   a. *Explanation*- The pump, manifold pressure sensor, or either of the two IR sensors have stopped operating correctly and are not drawing any current.
   b. *Solution* – Power down Envision® unit and reconnect to the tablet computer. If this does not correct the problem, call technical support at Elkins Earthworks® 330-725-7766.
5) **"Error 5-Over Current"**-
   a. *Explanation*- Excessive current draw. Any number of parts may have failed due to a short or component failure.
   b. *Solution* – Power down Envision® unit and reconnect to the tablet computer. If this does not correct the problem, call technical support at Elkins Earthworks® 330-725-7766.
6) **"Error 6-Pressure Sensor"**
   a. *Explanation*- One of the pressure sensors is reading out of spec, likely due to an overpressure situation (blown sensor)
   b. *Solution* – Try restoring the factory calibration on the pressure sensor calibration screen. If this does not solve the problem, then power down Envision® unit and reconnect to the tablet computer. If this does not correct the problem, call technical support at Elkins Earthworks® 330-725-7766.
7) **"Error 7-Low Flow"**
   a. *Explanation*- Low flow condition
   b. *Solution* – Check that the sample train hoses are not pinched. Check inline filters and make sure that they are clear and free from debris and liquids. If this does not correct the problem, call technical support at Elkins Earthworks® 330-725-7766.
8) **"Error 8-Oxygen Sensor"**
   a. *Explanation*- Oxygen sensor is out of spec. Potentially bad sensor.
   b. *Solution* – Restore factory calibration on O_2 sensor and recalibrate. If recalibration does not solve the error, then power down Envision® unit and reconnect to the tablet computer. If this does not correct the problem, call technical support at Elkins Earthworks® 330-725-7766.

9) **"Low pump voltage"**
   a. *Explanation*-Pump or supporting circuits is bad.
   b. *Solution* –Call technical support at Elkins Earthworks® 330-725-7766.
10) **"Low Flow Rate"**
   a. *Explanation*- Low Flow from clogged or pinched sample train.
   b. *Solution* – Check that the sample train hoses are not pinched. Check inline filters and make sure that they are clear and free from debris and liquids. If this does not correct the problem, call technical support at Elkins Earthworks® 330-725-7766.
11) **"Over Pressure"**
   a. *Explanation*- Pressure applied to pressure sensors are higher than sensors a specified for.
   b. *Solution* – Disconnect hoses from measurement location and recalibrate sensors. Verify that the pressure on the sample point is within the tolerance of the Envision® gas analyzer. If this does not correct the problem, call technical support at Elkins Earthworks® 330-725-7766.
12) **"Battery low. Plug in charger"**
   a. *Explanation*- Pressure Low battery on Envision unit.
   b. *Solution* – Plug meter in to charge. If this does not correct the problem, call technical support at Elkins Earthworks® 330-725-7766.
13) "Battery level is critically low"
   a. *Explanation*- Battery level is low.
   b. *Solution* – Charge Envision® gas analyzer. If the unit does not charge, then call technical support at Elkins Earthworks® 330-725-7766.
14) **"Over temperature. Cool unit"**
   a. *Explanation*- Measurement Unit over temperature.
   b. *Solution* – Move the Envision® unit into a cooler environment. If the error does not clear, then call technical support at Elkins Earthworks® 330-725-7766.

7.2 Other error codes

Listed below are additional error messages that may show up during operations:

1) "Unable to connect to selected meter"
    a. *Explanation*- Connection attempt failed during meter selection
    b. *Solution* – Make sure that the Envision® unit is on and the Bluetooth light is blinking before tapping search on the handheld computer. Also, verify that the handheld's Bluetooth is turned on. If this does not solve the problem then power down Envision® unit, close and restart the Elkins Gas Analyzer software and try again to connect to the Envision. If this does not correct the problem, call technical support at Elkins Earthworks® 330-725-7766.

2) "The Bluetooth connection to the meter has been lost"
    a. *Explanation*- Bluetooth connection has been disrupted either due to interference or user has walked out of range from the Envision® gas analyzer.
    b. *Solution* – Walk back within range of the Envision® gas meter and let the Bluetooth attempt to reconnect. If this does not solve the problem then power down Envision® unit, return the Elkins Gas Analyzer software to the "Select Meter" screen on the handheld. Reboot the Envision® unit and try to connect to the Envision® gas analyzer. If this does not correct the problem, call technical support at Elkins Earthworks® 330-725-7766.

3) "Unable to initialize scanner device"
    a. *Explanation*- The scanner function is not active on the handheld computer.
    b. *Solution* – Verify that the handheld unit has a barcode reader. If not the barcode feature will not be active. If the handheld has a barcode reader, then the user needs to verify that the correct driver is installed and the application is active. Call technical support at Elkins Earthworks® 330-725-7766 for help in verifying drivers.

4) "GPS data not valid"
    a. *Explanation*- the GPS has not yet connected with the satellites.
    b. *Solution* – Allow the handheld unit at least four minutes outside to connect to the satellites. If this does not correct the problem, call technical support at Elkins Earthworks® 330-725-7766 for help.

5) "Failed to find GPS/barcode match"
    a. *Explanation*- the GPS coordinates at the current location are not within 30 feet of the GPS coordinates of any well in the ID set.
    b. *Solution* – Wait one minute at the location and press the GPS button again. If this does not correct the problem, make sure that the current well has been previously marked by GPS. If it has not been marked, press the "Mark" and "GPS" buttons to mark the well. If this doesn't fix the problem, call technical support at Elkins Earthworks® 330-725-7766 for help.

8 Envision® Maintenance

8.1 Factory Maintenance

The Envision® gas analyzer should be returned to the factory at a minimum once per year for inspection and factory calibration.

8.2 Field Maintenance

The Envision® gas monitor has two internal filters. Over time these filters may clog or become fowled and may need to be changed. In order to change the filters, locate the aluminum door on the back of the Envision® gas analyzer under the protective black boot.

Remove the aluminum filter door by loosening the screws and lifting the door off of the enclosure.

Warning: do not remove the filter door in dusty or wet atmospheres as the internal components can get damaged.

The user may now remove and replace the filters by turning the Luer filter fittings. Make sure the seal is still in place and re-attach the filter door. Replacement Luer filters may be purchased from Elkins Earthworks®.

9 Envision Warranty

Elkins Earthworks®, LLC warrants its products to be free from defects in workmanship. This warranty shall be fulfilled by Elkins Earthworks® repairing or replacing its products, as necessary, to cure any such defect, which is reported to Elkins Earthworks® within 12 months of the ship date. All warranty work will be done at Elkins Earthworks® location.

(a) This warranty shall not apply to products which have been abused, altered, misused in application, improperly maintained or repaired.

(b) This warranty does not apply to components designed to be consumed or destroyed in normal operation.

(c) No product or part shall be returned to Elkins Earthworks without its prior consent. Any products which Elkins Earthworks consents to have returned shall be shipped to Elkins Earthworks factory with a completed RMA form at the customers expense. Elkins Earthworks shall only be responsible for payment of return ground shipment to customer location. Elkins Earthworks shall not be obligated to provide a “loaner” Envision gas analyzer while performing warranty repairs. A rental unit may be obtained during the repair period if one is available from the rental department.

(d) In the event the **BUYER** delays shipment, the warranty period commences on the date Elkins Earthworks® is prepared to make shipment.

(e) **BUYER** shall give Elkins Earthworks® written notice of the defect promptly after discovery.

(f) This warranty is exclusive and is expressly in lieu of any other express or implied warranties.

10 Specifications

10.1 ENV100 & ENV200 Specifications

Note: ENV200 does not have the low temperature heater option.

Envision™ Technical Specifications				
Operating Temperature Range				
Unit	Minimum	Maximum	Comments	
Envision	-4°F (-20°C)	122°F (50°C)	Heater option recommended below 14°F (-10°C)	
Gas Sensor Accuracy				
Sensor	Range	Linearity	Resolution	T90
CH_4	0 - 100%	± < 2.0% absolute	0.1%	<30s
CO_2	0 - 100%	± < 2.0% absolute	0.1%	<30s
O_2	0 – 2% 2 – 25%	± < 0.1% absolute ± < 5% relative	0.1%	<5s
Pressure Sensors				
Static	Range -5 to +5 (" H2O)	Range -130 to +130 ("H_2O)	Comments	
Accuracy	±0.14"H_2O	±2% of reading	According to sensor manufacture specs.	
Resolution	0.01"H_2O	0.01"H_2O		
T90	<1 ms	<10 ms		
Differential	Range -5 to +5 (" H2O)	Range -30 to +30 ("H_2O)		
Accuracy	±0.14"H_2O	±0.6"H_2O	According to sensor manufacture specs.	
Resolution	0.001"H_2O	0.01"H_2O		
T90	<1 ms	<10 ms		
Available		Range -130 to +130 ("H_2O)		
Accuracy	NA	±2% of reading	According to sensor manufacture specs.	
Resolution	NA	0.01"H_2O		
T90	NA	<10 ms		
Barometric (Absolute Pressure Only)		Range 22 to 31 ("Hg)		
Accuracy	NA	±0.24"Hg (±8 mBar)	According to sensor manufacture specs.	
Resolution	NA	0.1"Hg		
Wired Thermistor Accuracy	±1.8°F (±1.0°C)	Wired Thermistor Range	-22 to +212°F (-30 to +100°C)	
Battery Life (cycles)	up to 1000 full charge cycles		Temperature (°F)	Battery Life (hours)
Battery Construction	NiMH (no memory)		77	10.6
Charge Time	4 hours from complete discharge		50	10.1
Pump Inches H_2O	-138		32	8.1
Flow (cc/min)	260		14	5.1

10.2 ENVAUS Specifications

Gas concentration and battery life specifications are the same as those for ENV100/200 shown above.

Operating Range			
Unit	**Minimum**	**Maximum**	**Comments**
Envision	0° C	60° C	

Pressure			
	Range		
Static	**± 12 mBar**	**± 340 mBar**	**Comments**
Accuracy	± 0.4 mbar	± 2% of reading	According to sensor manufacture specs.
Resolution	0.1 mbar	0.1 mbar	
T90	<1 ms	<10 ms	
Differential	**± 12 mBar**	**± 75 mBar**	
Accuracy	± 0.4 mbar	± 2% of reading	According to sensor manufacture specs.
Resolution	0.1 mbar	0.1 mbar	
T90	<1 ms	<10 ms	
Barometric	**700 - 1100 mbar**		
Accuracy	NA	± 8 mbar	
Resolution	NA	0.1 mbar	

Borehole Flow & Temperature			
	Range	**Accuracy**	**Comments**
Borehole Flow	-14.0 to +15.0 lph	± 0.3 lph	
Temperature	5 to 95° C	± 0.5° C	

Pump Specifications	
Pressure (mB)	Flow (l/hr)
-344	15.6

11 Contact Information – Service and Sales

North America

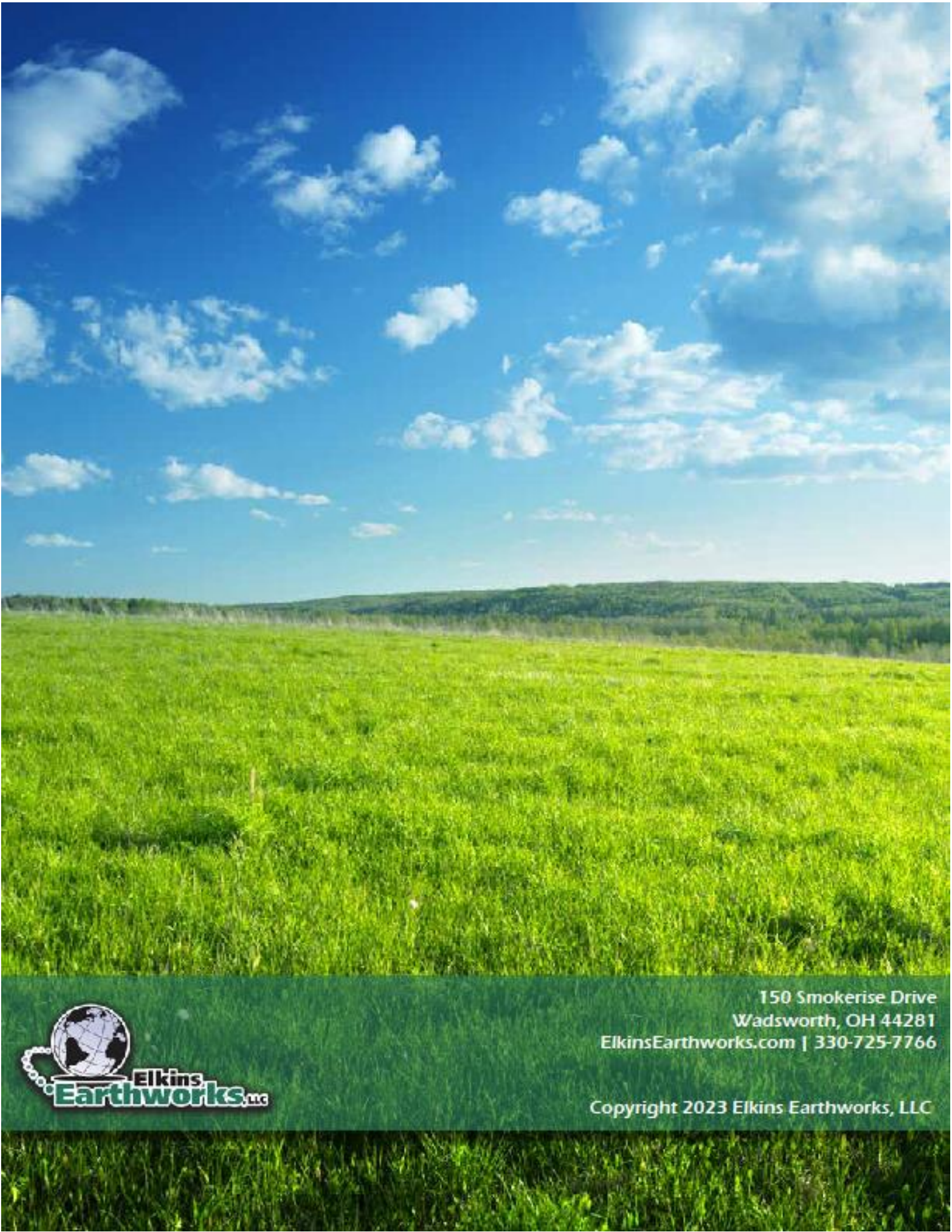
Elkins Earthworks, LLC

150 Smokerise Drive
Wadsworth, Ohio 44281
Phone: 330-725-7766
Email: sales@elkinsearthworks.com

Australia

airmet

Air-Met Scientific
7-11 Ceylon Street
Nunawading Victoria 3131
Phone: 03 8878 3300



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