DECLARATION OF CONFORMITY

Manufacturer:

CID Bio Science, Inc.
Felix Instruments – Applied Food Science
1554 NE 3rd Ave
Camas, WA 98607

Declares that the CE-marked Product:

Product Models (s):

Model F-950

Complies With:

89/336/EEC Electromagnetic Compatibility Directive
73/23/EEC Low Voltage Directive

Compliance Standards:

EN 55027	RF Emissions Information Technology Equipment
EN 50082-1	EMC Immunity Standard
EN 60950	Safety of Information Technology Equipment Including Electrical Business Equipment

October 23, 2014

Leonard Felix
President

Table of Contents

Introduction

Congratulations on the purchase of your new F-950 Three Gas Analyzer!

The new F-950 Three Gas Analyzer measures three critical gases: ethylene (C_2H_4), carbon dioxide (CO_2) and oxygen (O_2), to maintain optimum produce quality at every phase.

The F-950 is used to:

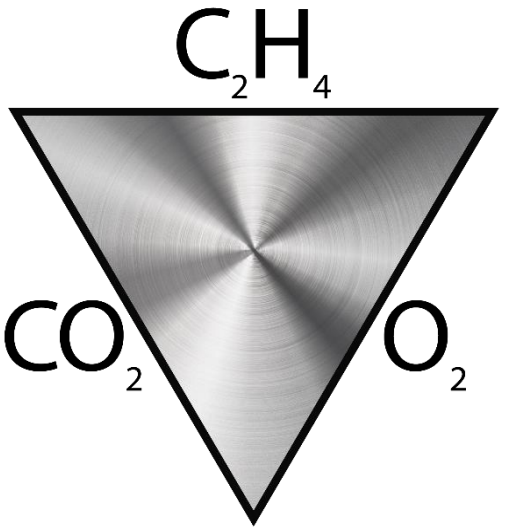
- Inspect storage and packing environments
- Verify ethylene mitigation efficacy
- Optimize ripening storage atmosphere conditions
- Quality assure MAP (Modified Atmosphere Packaging) for ethylene-sensitive products

Ethylene affects ripening, aging, and spoilage in produce. The F-950 measures levels of ethylene, CO_2 and O_2 in the atmosphere, and can be scaled to many environments, from cold storage to warehouse to transportation container.

Simple to operate and weighing less than a kilogram, the F-950 uses an electrochemical cell to measure ethylene between 0-200 ppm in air. It records date, time, relative humidity, temperature, and GPS location. The F-950 is ideal for measuring ethylene production across a wide range of fruit or floral types and is especially suitable for managing ethylene emissions from perishable cut produce products.

The F-950 is ideal for Modified Atmosphere Packaging (MAP) applications. Most MAP gas analyzers are only equipped to measure CO_2 and/or O_2 concentrations. Quality assurance for perishable cut produce demands a more comprehensive analysis. The F-950 makes it possible to respond to the change in ripening gases to ensure longer shelf-life and higher quality commodities.

We hope you enjoy using your F-950 Three Gas Analyzer.



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Features

- Portable, lightweight and easy to operate.
  Rapid response time, with data points saved every second.

- Repeatable, precise measurements.

- Two versatile modes of operation
  Measure in Continuous or Trigger mode depending on your application.

- True sunlight readable transflective display.
  The contrast of the display increases under brighter sunlight.

- Removable, re-chargeable standard sized batteries.
  Included stand-alone battery charger enables charging one battery set while using another. Two sets of batteries are included with the device. Additional button-top 19670 (or protected 18650) batteries can be purchased from your preferred battery vendor.

Specifications

F-950 Specifications	
Air Sampling Rate	70 mL/min
Measuring Rate	Automated; 1 sec intervals
Data Storage	Removable 16 GB SD card
Display	Sunlight visible transflective LCD
Operating environment	0°C - 50°C (15-90% humidity non-condensing)
Battery Capacity	8.5 hours
Dimensions	18 x 13.5 x 5.5 cm
Weight	1.0 Kg
Enclosure	Powder coated aluminum
Warm-up time	< 2 minutes
Sensors	
Ethylene Sensor	Electrochemical
Nominal Range	0 – 200 ppm
Lower Detection Limit	0.2 ppm
Resolution	0.1 ppm
Accuracy	± 5% relative; ±0.2 ppm absolute in Continuous mode ±5% relative; ±0.15ppm absolute in Trigger mode
Carbon Dioxide Sensor	Infrared Sensor, Pyroelectric detector
Nominal Range	0 – 100%
Full scale resolution	0.01%
Accuracy	± 3% relative; ±0.01% absolute in Continuous mode ±3% relative; ±0.50% absolute in Trigger mode
Oxygen Sensor	Electrochemical

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Nominal Range	0-100%
Resolution	0.1%
Accuracy	± 2% relative; ±0.10% absolute in Continuous mode ±2% relative; ±0.3% absolute in Trigger mode

Unpacking the F-950

The F-950 arrives with a hard-sided carrying case, two sets of batteries and a charger, a removable 16 GB SD card, and several accessory parts. The unit comes with an external conditioning chamber and potassium permanganate ($KMnO_4$), used to scrub the air entering the system. A sampling port with needle is included for sampling from packaging and an external PolarCept filter for reducing interfering gases. The sampling port is pictured below, connected to the intake.

Operating Instructions

WARNING: Do not store the F-950 without batteries! Charged batteries must be present in the instrument to maintain the accuracy of the sensors, even when the unit is powered off.

If the batteries of the F-950 discharge during storage, replace with charged batteries and allow the instrument to stabilize 48 hours before use. There is a small internal battery to maintain the bias voltage for the ethylene electrochemical sensor. This small internal battery will last for 1 day without the main batteries before sensor sensitivity is affected by losing its bias voltage. The calibration parameter data is intact with or without batteries.

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Fully charged main batteries allow for storage time of over 1 year. For long-term storage, consider attaching the potassium permanganate (KMnO4) external conditioning chamber to the inlet and outlet of the F-950 (see image below).

Aged batteries or batteries that started out with less charge will reduce the storage time available. The Li-ion batteries have little self-discharge and a life of about 3 years.

Loading the Battery

The F-950 uses 18650 Li-ion 3.7V 3100mAh rechargeable batteries. For longer lifespan, charge the batteries at 0.25A. For a faster charge, charge at 1A. The batteries must be removed from the F-950 to be charged.

To remove the batteries, twist the battery compartment cap, located on the bottom of the case. The cap can be twisted with fingers or a screw-driver to tighten or loosen. Take care when removing batteries, as the cap is spring loaded. Both batteries should be inserted into the unit positive (+) side first (towards intake or top). The battery compartment is pictured below.

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Basic Operation

To turn the instrument on, press the green power button. The Felix Instruments logo will flash, followed by the main menu. The top of the display reads Felix Instruments, and the current version of firmware the unit is running is displayed in the lower left hand corner. The battery meter is listed on the lower right hand side of the display.

For information on the latest firmware version, please visit the F-950 support webpage (www.felixinstruments.com/support/f-950-support).

The main menu displays the following options: Measure, Setup, and File. If the green power button is pressed, the display will prompt for confirmation before shutting off the F-950.

To scroll between menu items in the list, use the Up and Down arrows. To select an option from the menu list, use the Right arrow. To exit, use the Left arrow.

Measurement Modes

Two measurement modes are present on the F-950: Continuous mode and Trigger mode. To change measurement mode, go to Setup > Mode from the main menu.

Presence of volatile organic compounds (VOC's) other than ethylene in the sample environment can lead to falsely high ethylene readings with the F-950. VOC's are aromatic compounds like ethylene, esters and alcohols. Their production increase with produce aging and spoilage. The F-950 ethylene sensor cannot distinguish ethylene from many other VOC's. PolarCept was designed to optimize and improve the accuracy of ethylene measurements. PolarCept is an external water filter, which reduces the signal from interfering gases reaching the ethylene sensor. PolarCept is recommended in Trigger mode. PolarCept dramatically reduces the amount of interfering gases like alcohols and esters that are present in a sample, allowing ethylene to pass through to the sensors. For more information on Polarcept see page 12.

Continuous measurement mode measures the air entering through the input of the instrument. The controls default to Loop "open" and Pump "on". Continuous mode can be used **with or without the sample port** attached to the front of the instrument. The data is saved every one second in continuous mode.

Trigger measurement mode begins with the valve closed and the pump off. To start taking a measurement, press the square start button on the key-strip of the F-950 to initiate a new measurement. The pump will run and 30-40mL of gas will be drawn into the instrument for analysis. The final values of the analysis will be displayed on the screen and the measurement

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saved to the SD card. The pump will then turn off until the user initiates a new measurement.

Trigger mode can be used **with or without the sample port** attached to the front of the instrument. The instrument will detect and report total VOC's present in the sample.

Trigger mode should be used in place of continuous mode if expecting high ethylene concentrations. Trigger mode allows a purge of the internal volume of gas in the instrument between samples and will help protect the ethylene sensor from over-saturation.

Passcode Protection

Certain menu systems on the F-950 are protected by a passcode setting. These menu systems include Parameters, Set Zero, Calibration, and Factory Setup. The default code for entry is '1111'. The passcode only needs to be entered once for each reboot of the device. If the device is powered off, the passcode will need to be entered again for entry into the menu systems described above.

To set the passcode to a four-digit code other than the default setting, please follow the steps below.

1. Open SD card on PC
2. Click the 'View' tab in the taskbar
3. Click 'Options' in the far right of the toolbar
4. Open the 'View' tab
5. Scroll down and uncheck the box named 'Hide protected operating systems (Recommended)'
6. Check the box named 'Show hidden files, folders, and drives'

7. Click ‘Yes’
8. Click ‘Apply’ and then click ‘OK’
9. Open the Config.txt file that should now appear inside the SD card
10. Alter the ‘1111’ to four-digit numeric passcode desired
11. Save the changes
12. Insert SD card back into Gas Analyzer

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Interfering Gases

No analytical method is completely specific. Gases present in the environment, other than the "target" gas of a measurement, may affect instrument response. Interferences are not necessarily linear, and may also exhibit time dependent characteristics.

Ripening fruit emit a complex mixture of hydrocarbons, including ethylene. Oxidation of these other gases in the electrochemical sensor cannot be readily distinguished from ethylene. This causes the ethylene value to be falsely high in the presence of interfering gas.

Felix Instruments has tested a method to absorb some of the competing gases and provide better ethylene measurements. This method, PolarCept, uses distilled water in an external chamber and has been shown to filter out some polar hydrocarbons and alcohols to produce less interference.

PolarCept

It is recommended to use the external PolarCept filter when measuring a mixture of gas (such as when sampling fruit) or interfering gases may be reported by the instrument. The external filter can be used with either of the measurement modes, and is recommended for Trigger mode. PolarCept should only be used with **1.5 mL of distilled or deionized water.**

The PolarCept filter consists of a plastic molded part, hydrophobic filter and O-ring. It is also used with the sampling probe tubing and sample probe needle. A small plastic syringe is used to fill and empty PolarCept. Once the hydrophobic filter and O-ring are in place, it should be very difficult to remove it, creating a leak-proof seal. Additional hydrophobic filters are included as replacements, when the filter is soaked with water or damaged during removal.

Eventually the water in the PolarCept filter will become saturated with trapped interfering gases and should be replaced with fresh distilled water. Saturation rates will depend on the measurement mode and amount of interfering gases present in the sample environment. The table below shows example saturation times when measuring headspace of bananas (with a maturity index of 5) in Continuous mode. This sample contains

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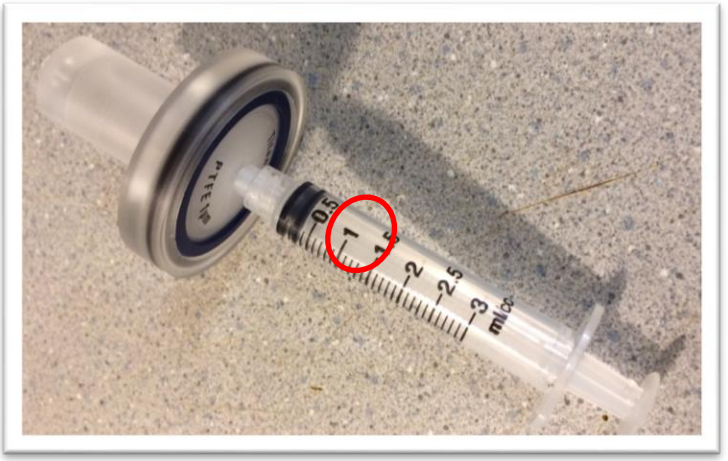
various mixed hydrocarbons, ethylene and VOCs. The total VOC in ppm listed is the signal reported by the C2H4 sensor in ppm.

VOC concentration	PolarCept saturation (min)
3 ppm	20
100 ppm	1

To fill the PolarCept filter, attach an empty syringe to the hydrophobic filter. The plunger of the syringe should be completely depressed. Lower PolarCept over a cup of distilled water and draw in **1.5 mL** with the syringe. Attach the sample needle and sample tubing to stop leaks. To empty PolarCept, re-attach the syringe and push the water out the sample needle end.



To properly use PolarCept, keep the sample needle pointed downwards while measuring, as seen in the example below on the left. The water in the filter should “bubble” as the gas sample is pulled through it, causing some of the interfering gases to be trapped.

See the following graph of measured ethylene concentration by the F-950 with and without using PolarCept, measuring the same headspace of bananas. After about 20 minutes, the water becomes saturated, and the signal beings to rise with PolarCept.

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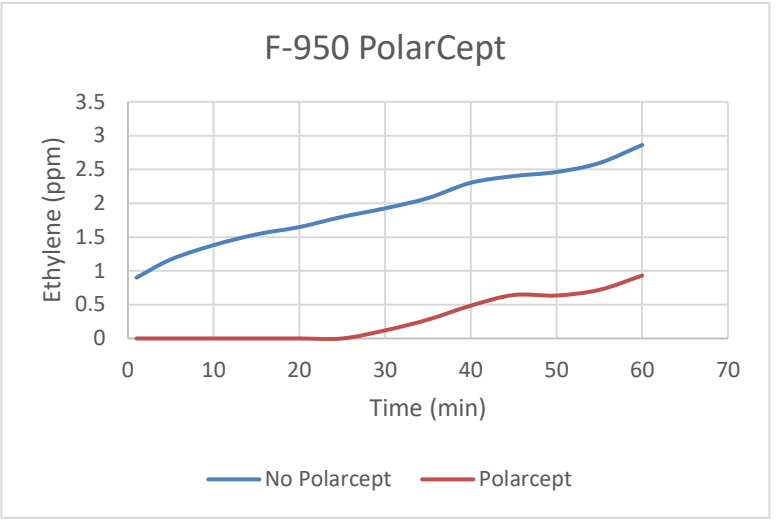
F-950 PolarCept
Ethylene (ppm)
3.5
3
2.5
2
1.5
1
0.5
0
0
10
20
30
40
50
60
70
Time (min)
No Polarcept
Polarcept

Measure

From the main menu, press the right arrow when the word Measure is highlighted, to enter the measurement display screen. All measurement variables are saved to the SD card every 1 second in Continuous mode. When the SD card is not present, the data will not be saved.

If sampling very high concentrations followed by very low concentrations, allow the instrument time to **purge** internal gas for the most accurate measurements.

Continuous Mode

When in Continuous mode, a graph of the concentration of each gas can be viewed over time. The default graph shown is the ethylene (C_2H_4) concentration in ppm. To view the graph of the other gases, simply use the up and down arrows to scroll through them. The current gas being graphed is shown on the top of the screen with the concentration in large font as shown below.

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The x-axis of the graph is time. The y-axis of the graph displays the range of the concentration (in ppm for ethylene and % for CO_2 and O_2), and the dynamic range is labeled at the top. The y-axis scale is set by the highest value shown in the buffer. This range will scale vertically, dependent on the highest concentration of gas measured. If the concentration is small, the dynamic range will reflect this.

The graph begins on the left side and moves towards the right as more data points are added. Once the line reaches the right side of the display, the data will begin moving towards the far left, keeping the current time at the far right. The total measurement time is displayed below the graph.

Current oxygen (% O_2) and carbon dioxide (% CO_2) concentrations are listed on the right side of the graph when ethylene is being graphed. This data changes slightly when displaying the graph of other gas concentrations. The flowrate (mL/m) is displayed at the bottom. If Relative Humidity (% RH) and Temperature (degrees Celsius) are not seen on the display, go to Setup>RH Conversion and enter the actual temperature of the measurement gas (see page Ref477940541 \h 28).

Trigger Mode

A measurement in trigger mode begins with the valves closed and the pump off. To begin, press the square start button as prompted, to measure. This will turn on the pump and the ethylene sensor will stabilize before drawing in sample gas. Trigger mode will take longer to stabilize if the concentration is in a different range from the last sample (30 sec-1.5 min).

The pump will draw in 30-40mL of the gas sample and then display the final values on the display screen. The results will be saved to the SD card.

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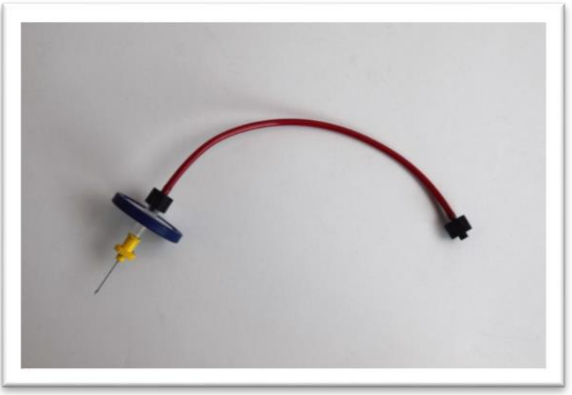
After the final values are displayed, the F-950 will read 'Purging' in the lower left-hand corner. During purging, the valves are closed and the instrument is running the gas sample through the internal potassium permanganate (KMnO4) chamber to purge the instrument of residual ethylene.

Once purging is complete, press the square start button to begin another measurement. Press the Left arrow to exit to the main menu.

Trigger mode can be used with or without the sample probe and needle attached. Assemble the probe by connecting the black tubing to the intake of the F-950. Next, twist on a hydrophobic filter to the end of the tubing. The filter will prevent any moisture or debris from being sucked into the instrument. Finally, attach a sterile needle to the filter. Depending on the application, needles can be re-used.



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Auto-Escape Feature

An upper limit auto-escape feature acts as a safety feature of the unit. This safety feature is always on. If the sensor detects **over 200 ppm** ethylene, the F-950 will auto-escape from monitor mode to prevent poisoning the electrode in the ethylene sensor. This will stop the measurement.

If the sensor becomes poisoned, it will continually auto-escape with the error message **"sensor out of bounds"**. If this message appears, connect the external conditioning tube filled completely with potassium permanganate ($KMnO_4$) to the inlet/outlet of the F-950. Allow time with the instrument powered on (Continuous Mode) to remove the high concentration of ethylene in the instrument.

Setup

Use the right arrow to enter the Setup Menu from the Main Menu screen.

The F-950 has a number of utility functions that allow the user to manage the instrument's capabilities. Eight setup functions are available: Mode, Set Zero, Calibration, Date & Time, RH Conversion, GPS, Language, and Factory Setup.

Setup Mode

Setup Mode allows the user to change the measurement mode of the instrument between Continuous and Trigger mode. To change the mode, highlight Measure and use the right arrow to highlight the mode. Then use the Up/Down arrows to cycle through the mode options. Use the left arrow to highlight Measure once the correct mode has been selected. Then press the left arrow again to exit to the main menu.

USB mode should be set to USB Storage. Bluetooth and USB Ctrl are the other available options to be used in conjunction with

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the F-950 Gas Analysis Software (G.A.S.). More information about these connection options can be found on page 39 of the manual.

0580 \h 39 of the manual.

Setup Set Zero

Setup Set Zero sets a new baseline, or zero, for the C_2H_4, CO_2, and O_2 sensors. All sensors should be zeroed **weekly**. While in the set zero menu, press the right arrow to set zero for your desired sensor. The set zero process can be completed for all sensors in the instrument without the use of standardized gases.

Ethylene Set Zero

The set zero process for the ethylene sensor utilizes a small chamber of $KMnO_4$ that is located inside the instrument. After initializing the set zero process, the display will read 'Use fresh air' and 'Please wait…'. A countdown to the completion of the set zero process can be viewed in the upper right corner. The offset value will be displayed on the screen as well.

Once the offset is completed the screen will flash 'OK' if the offset value was successfully reset by the set zero process. The display screen will automatically return you to the set zero menu.

CO_2 Set Zero

Pressing the right arrow while the CO_2 sensor is highlighted in the set zero main menu will cause the display to prompt you to hook up 100% N_2 gas or create a 0ppm environment for CO_2. To create the 0ppm environment, use the external conditioning chamber, provided with the unit, full of soda lime. Connect one end of the tubing to the intake on the instrument and the other end to the outtake. The soda lime will scrub the gas flow of CO_2, creating a 0ppm environment for a successful set zero.

Once the soda lime is hooked up with the instrument, press the right arrow to initiate the set zero process. Like the ethylene set zero, the display will show a countdown to completion and an offset value. 'OK' will flash when the set zero process has been completed.

O_2 Set Zero

Pressing the right arrow while the O_2 sensor is highlighted in the set zero menu will initiate the offset value for the O_2 sensor. Setting a true zero for the O_2 sensor requires the use of 100% N_2 gas. For the O2 sensor, an alternative calibration, O2 calibration in air, can be used instead of setting zero with 100% N2 gas. Please see the 'O2 Calibration in Air' section for more details on this process.

Setup Calibration

The calibration feature allows the user to set zero and set span without the use of a computer or G.A.S. (Gas Analysis Software). Unlike Setup > Set Zero in the previous section, a zero-standard gas is required as well as standard gases for the set span process.

The F-950 will prompt the user to set up a zero gas, which can be achieved by feeding 100% Nitrogen (N_2) gas to the intake.

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The unit will countdown to set zero. The following screen will prompt the user to setup a span gas, which is a known standard gas used for the span calibration process. Please refer to the table below for the appropriate standard gases to use for span calibrations.

	Set zero	Set span	Verification
Ethylene	Potassium permanganate ($KMnO_4$)	100ppm C_2H_4	75ppm C_2H_4
Carbon dioxide (CO_2)	Soda lime or 100% N_2	95% CO_2	16% CO_2
Oxygen (O_2)	Ambient air or 100% N_2	50% O_2	Ambient air

While the span calibration is running, the display will show what the instrument is currently measuring as the concentration of the standard gas. After giving the sensors 5-10 minutes to stabilize, use the up and down arrow keys to adjust the concentration to the actual concentration of the standard gas tank.

It is important to verify the calibration as successful after completion. Typically, it is best to run the verification process

the day after the calibration. To verify the calibration, connect your verification standard gas and take a measurement in Continuous mode. Give the sensors 2-3 minutes to stabilize and then ensure that the reported concentration is falling within the accuracy range of the device.

Setup > O2 Calibration in Air

Alternative to setting zero for the oxygen sensor weekly with 100% N2 gas, a user can use the O2 calibration in air menu option to calibrate the O2 sensor using ambient air.

Right arrow on this menu option to begin the calibration. The display will read, 'Use fresh air (20.9%) Please wait…'. The F-950 will beep upon completion of the O2 calibration in air.

Setup Date and Time

Use the Right and Left arrows to move between Month/Day/Year and Hour/Minute/Second and use the Up and Down arrows to change the values. To exit, use the left arrow to back out of the screen and return to the Setup menu.

Setup RH Conversion

The Setup RH Conversion menu is used to correct for the temperature sensor being inside F-950 housing. This causes the temperature sensor to reflect the temperature of the F-950 and not the ambient temperature. The temperature is usually several degrees above ambient. The Relative Humidity is calculated based on temperature.

Enter the correct ambient temperature in degrees Celsius, measured from an external temperature sensor, to have the F-950 use for calculating the relative humidity (RH %). To use the

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entered temperature for RH, “use sample T” should be set to “Yes.”

The current (internal RH) and corrected (sample RH) relative humidity are displayed at the bottom of this screen.

RH Conversion	
Enter Sample T(C)	20.0
Use Sample T (for measurements)	Yes
Internal RH (%)	43.6
Sample RH (%)	21.3

Setup GPS

The GPS sensor inside of the F-950 can be used to record latitude and longitude to within 10 meters. The instrument should be operated outside, without overhead obstruction for best GPS performance. It may be difficult to acquire a fix on GPS satellites indoors. The Setup>GPS menu turns on or off the GPS sensor and show the current GPS data. Data is also saved to the SDcard .csv file.

Setup GPS	
Enable GPS	Yes/No
Acquiring GPS data…..	
Longitude	122.558
Latitude	45.59

Setup Language

The F-950 Three Gas Analyzer now has options for Spanish and Portuguese languages for firmware 1.5.7.5 and above, to update your firmware refer to the Firmware Update portion of this manual.

Setup Factory Settings

The Setup > Factory Settings menu is used to back up or restore the factory defaults for the calibration parameters for all of the sensors (C_2H_4, CO_2 and O_2) on the device. The calibration parameters can also be modified using this menu. It is recommended to always back up the current parameters before making any modifications.

To modify calibration parameters:

1. Back up the current parameters (Setup>factory settings>back up)
2. Make the modification in the .cfg file
3. Import the .cfg file (Setup>factory settings>restore) to apply the changes

File

The File Menu is accessed by highlighting “File” on the Main Menu and pressing the right arrow key. Here, the user can manipulate files on the F-950. The F-950 remembers the last open file and will being saving data into it when it is powered back on.

In the main file menu, four options are available: Select, New, Delete and Review. All files created by the F-950 are .csv (comma separated value) files.

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To view data on a computer, simply insert the SD card into the computer's SD card reader. The computer should automatically detect the SD card as a new storage device and mount the drive so that measurement data will be accessible by any computer application. The mini-USB port can also be used to establish a USB connection with a computer to transfer data from the F-950.

File Select

File Select displays a list of .csv files that exist on the F-950 SD card. Use the Up and Down arrows to move between files, and the right arrow to select a file to which new data will be saved. If the unit is powered on and no file is selected, the data will be default saved to the file "data.csv". In the file, each data point is labeled with time and date for easy sorting.

File Create

Pressing the Right arrow when File Create is selected will create a new file according to the naming scheme programmed on the

instrument, XX_XX_XX_X or Year_Month_Date_Ordinal. For example, the first file created on September 8, 2014 will read 14_09_08_0 and subsequent files will increase the last placeholder numerically. After pressing the right arrow, go to File Select to see the list of files on the SD card. There will be a new file in the list with the current date.

File Delete

File Delete displays a list of files that exist on the F-950 SD card. Use the Up and Down arrows to scroll between files and use the right arrow to display the option to delete the selected file. A message will appear that reads “Delete File?” Press the Left arrow for no, leaving the file intact. Press the Right arrow for yes, deleting the file.

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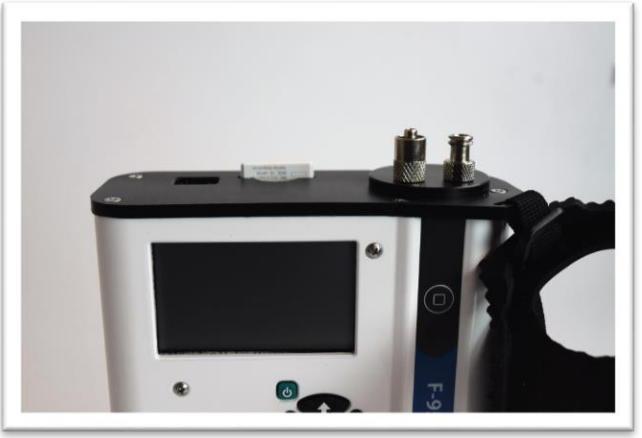
File Review

File Review displays a list of files that are on the SD card and allows you to view the data in the files. Use the Up and Down arrows to scroll between files and the right arrow to enter the selected file. The data.csv file is the default file, which data will be saved into if no other files are created.

After selecting a file name, the measurement mode with time of the measurement and ethylene concentration will appear for Trigger mode readings. Use the Up and Down arrows to highlight a measurement and the Right arrow to enter the measurement and see the more detailed data, including CO_2, O_2, Temperature, Relative Humidity and Flow Rate.

Data Files on the Computer

Open the data files saved on the SD card on the computer using Microsoft Excel or Notepad. Data files are saved as .csv (commas separated value). The following figure is an example data spreadsheet. Data values included are the date and time of the measurement, the measurement mode, the ethylene level in parts per million (ppm), the CO_2 concentration in percent, the O_2 concentration in percent, the temperature of the gas stream in degrees Celsius, the relative humidity (RH) of the gas stream in percent, and the flow rate of the gas stream in milliliters (mL) per minute.



REMEMBER: Always save the data files to the computer before making changes or starting analysis.

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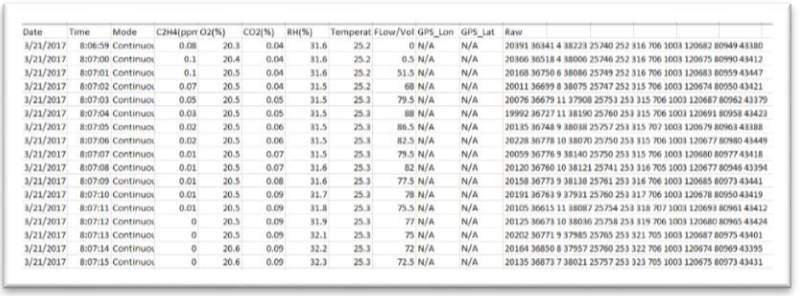

Date	Time	Mode	C2H4(ppm	O2(%)	CO2(%)	RH(%)	Temperat	FLow/Vol	GPS_Lon	GPS_Lat	Raw
3/21/2017	8:06:59	Continuou	0.08	20.3	0.04	31.6	25.2	0	N/A	N/A	20391 36841 4 38223 25740 252 316 706 1003 120682 80949 43380
3/21/2017	8:07:00	Continuou	0.1	20.4	0.04	31.6	25.2	0.5	N/A	N/A	20366 36518 4 38006 25746 252 316 706 1003 120675 80990 43412
3/21/2017	8:07:01	Continuou	0.1	20.5	0.04	31.6	25.2	51.5	N/A	N/A	20168 36750 6 38086 25749 252 316 706 1003 120683 80959 43447
3/21/2017	8:07:02	Continuou	0.07	20.5	0.04	31.5	25.2	68	N/A	N/A	20011 36699 8 38075 25747 252 315 706 1003 120674 80950 43421
3/21/2017	8:07:03	Continuou	0.05	20.5	0.05	31.5	25.3	79.5	N/A	N/A	20076 36679 11 37908 25753 253 315 706 1003 120687 80962 43379
3/21/2017	8:07:04	Continuou	0.03	20.5	0.05	31.5	25.3	88	N/A	N/A	19992 36727 11 38190 25760 253 315 706 1003 120691 80958 43423
3/21/2017	8:07:05	Continuou	0.02	20.5	0.06	31.5	25.3	86.5	N/A	N/A	20135 36748 9 38038 25757 253 315 707 1003 120679 80963 43388
3/21/2017	8:07:06	Continuou	0.02	20.5	0.06	31.5	25.3	82.5	N/A	N/A	20228 36778 10 38070 25750 253 315 706 1003 120677 80980 43449
3/21/2017	8:07:07	Continuou	0.01	20.5	0.07	31.5	25.3	79.5	N/A	N/A	20059 36776 9 38140 25750 253 315 706 1003 120680 80977 43418
3/21/2017	8:07:08	Continuou	0.01	20.5	0.07	31.6	25.3	82	N/A	N/A	20120 36760 10 38121 25741 253 316 705 1003 120677 80946 43394
3/21/2017	8:07:09	Continuou	0.01	20.5	0.08	31.6	25.3	77.5	N/A	N/A	20158 36773 9 38138 25761 253 316 706 1003 120685 80973 43441
3/21/2017	8:07:10	Continuou	0.01	20.5	0.09	31.7	25.3	78	N/A	N/A	20191 36763 9 37931 25760 253 317 706 1003 120678 80950 43419
3/21/2017	8:07:11	Continuou	0.01	20.5	0.09	31.8	25.3	75.5	N/A	N/A	20105 36615 11 38087 25754 253 318 707 1003 120693 80961 43412
3/21/2017	8:07:12	Continuou	0	20.5	0.09	31.9	25.3	77	N/A	N/A	20125 36673 10 38036 25758 253 319 706 1003 120680 80965 43424
3/21/2017	8:07:13	Continuou	0	20.5	0.09	32.1	25.3	75	N/A	N/A	20202 36771 9 37985 25765 253 321 705 1003 120687 80975 43401
3/21/2017	8:07:14	Continuou	0	20.6	0.09	32.2	25.3	72	N/A	N/A	20164 36850 8 37957 25760 253 322 706 1003 120674 80969 43395
3/21/2017	8:07:15	Continuou	0	20.6	0.09	32.3	25.3	72.3	N/A	N/A	20135 36873 7 38021 25757 253 323 705 1003 120675 80973 43431

Example spreadsheet data of an F-950 measurement.

Wireless SD Memory Card Operation

These instructions are meant to accompany the instructions supplied by the vendor for Toshiba FlashAir™ W-03 to use specifically with the F-950, which can be similarly applied to other Felix Instruments products.

1. Install FlashAir™ Wi-Fi card software appropriate to the SD card.
    a. Visit https://www.toshiba.co.jp/p-media/english/download/wl/software02.htm to download the software for configuring the Wi-Fi card and obtain vendor operation instructions.
2. Insert the Wi-Fi card onto a personal computer (PC).
3. Open the “FlashAirTool” on your PC to configure the SD card.
4. Follow the configuration instructions prompted by the “FlashAirTool”.
5. For additional guidelines, access the “Help” menu inside the “FlashAirTool” software.

6. The Wi-Fi card can be enabled in “internet pass thru mode”, outlined in the following documentation provided within the FlashAirTool software:
    - Go to Network Settings on the main menu
      Check Internet pass thru mode
      This function is available for FlashAir™ W-03 and FlashAir™ W-02 (Ver. F19BAW3AW2.00.02 or later) cards.

      When this function is enabled, the FlashAir™ card can be used like a router, by allowing another access point to be connected via the card.
      When an internet access point is connected, images stored on the FlashAir™ card can be viewed, and the internet can also be accessed. This is convenient when, for example, uploading image files downloaded form a FlashAir™ card onto social networking services, as there is no

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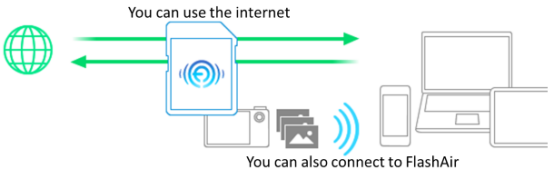
need to change the Wi-fi device network settings on your smartphone.



* CAUTION: If you want to connect to the internet without using the internet pass thru mode, the wireless LAN setting connection on

your smartphone or other device must be changed from the FlashAir™ card to the internet access point.

Check the “Enable internet pass thru mode” checkbox to enable “internet pass thru mode”.

- Access Point SSID
  Sets the SSID of the internet access point.
  Enter the SSID for the access point that you will use. An SSID of up to 32 alphanumeric characters can be entered.
- Access Point Password
  Set the internet access point password.
  Enter the password for the access point that you will use.
- In your browser, enter http://flashair to view or stream your files

For more information on the Toshiba FlashAir™ W-03 Wireless SD Memory Card, contact the application vendor at https://www.toshiba.co.jp/p-media/wwsite/contact.htm.

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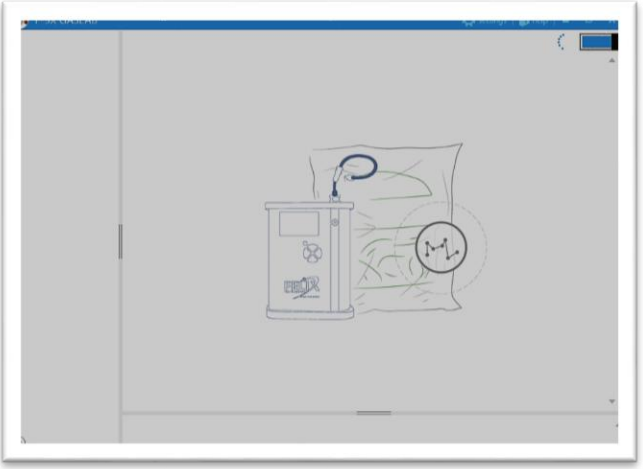
G.A.S. Gas Analysis Software

G.A.S. software enables the user to not only calibrate the F-950, but also view graph displays of measurements, download, edit and add notes to files, create upper and lower thresholds for quality monitoring, and remotely navigate through the F-950 menu system.

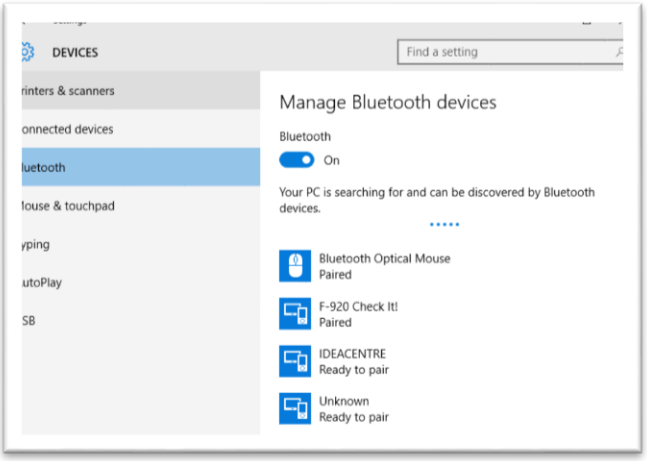
A. Download the F-9xx G.A.S. software from https://felixinstruments.com/support/F-950/software/
B. Install
C. Launch the downloaded G.A.S. program

There are two ways to connect the F-950 To the G.A.S. program: Bluetooth or USB cable connection.

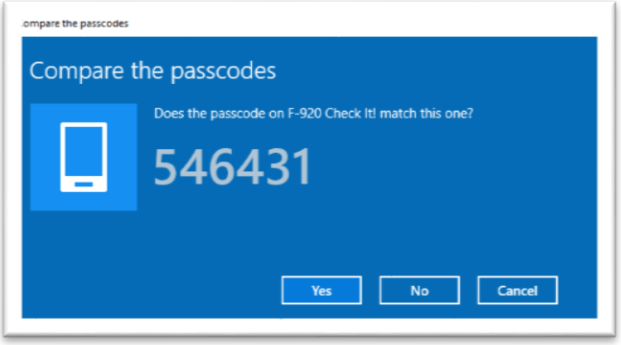


1. For USB cable connection, move ahead to step 4. For Bluetooth connection, on your F-950, navigate to Setup > Mode > Connection > Bluetooth. On your windows PC

navigate to Settings > Devices > Bluetooth and pair your computer to the F-950



2. Verify that the passcode matches between the F-950 and the computer, accept each.



3. Once verified, navigate back to G.A.S., the program will initiate a connection with the F-950

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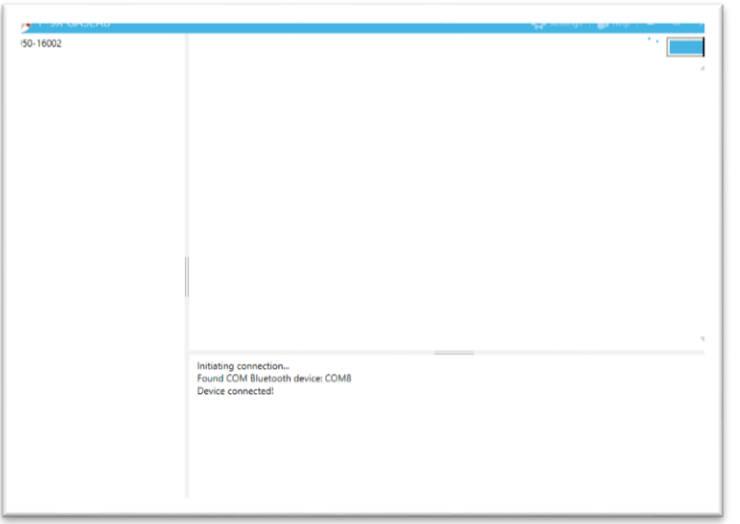
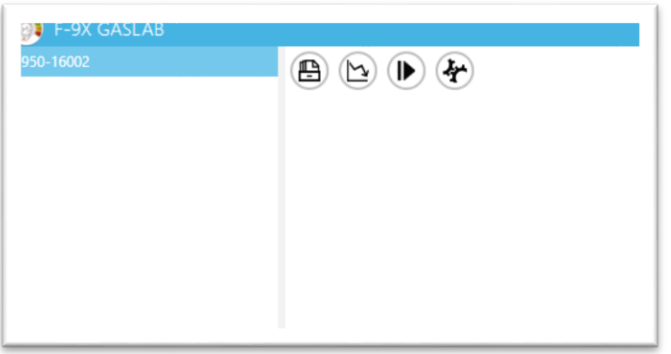


4. Once connected, your device serial number should appear in the upper left hand corner of the window, click on the serial number, you are now ready to interact with the F-950! Click on the grey and blue square in the upper right hand corner to dis-connect or re-connect.



Menu System

The following will describe the menu system functions and symbols:

The ‘Files’ menu allows viewing of all files saved to the F-950

The ‘Measurement Monitor’ menu displays measurements graphically in real time.

The ‘Control Panel’ menu displays toggle keys which allow the user remote control of the F-950

The ‘Calibration’ menu navigates the user through the calibration process for both set zero and set span.

Files 

The files menu will display all files saved to the SD card of the F-950.

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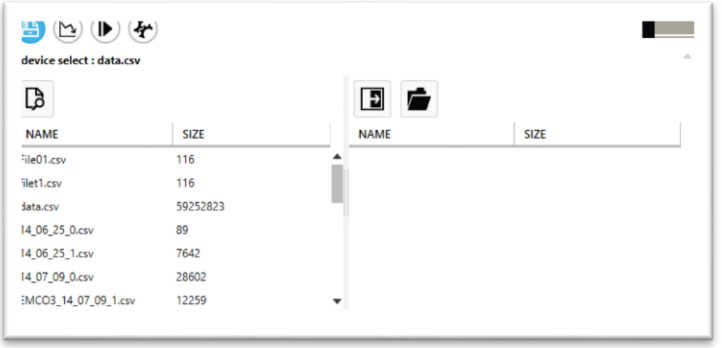
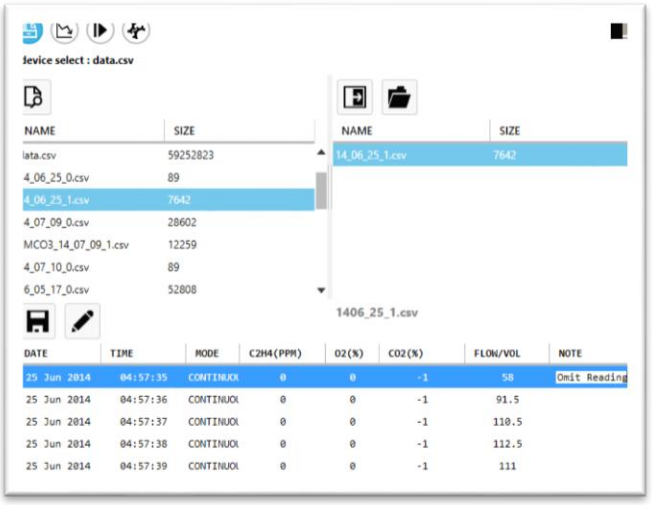


Just select the file of interest and choose whether to download the file from the device,

Or open a saved file from your PC.

When the document appears on the right-hand column, select it to view and make edits in the 'Note' section.



Once done reviewing and editing your data, select the save icon to save your changes. These changes will be saved to your pc.

Measurement Monitor 

The Measurement Monitor menu allows the user to view a graphical live feed of measurements taken on the F-950. This feature will display the measurement mode being used, the selected gas, temperature, flow, and RH with the option to toggle between CO_2, O_2 and C_2H_4. Zoom-in and zoom-out display can be adjusted as well as the time interval. Left click on the line to see information on the data point!

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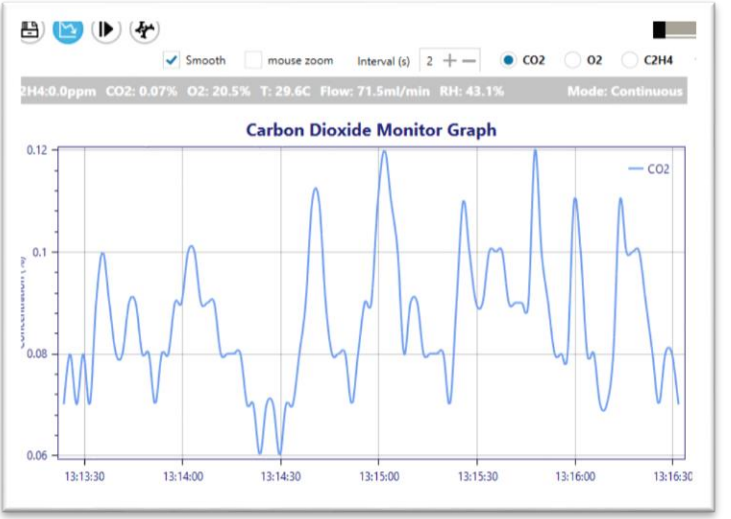
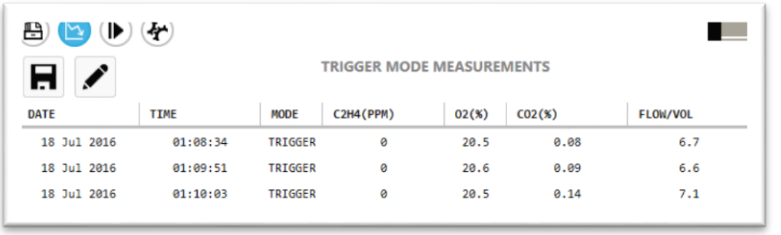


When Trigger mode is selected, the measurements will display upon completion in consecutive rows, where the user can again edit and add notes to the data.



DATE	TIME	MODE	C2H4(PPM)	O2(%)	CO2(%)	FLOW/VOL
18 Jul 2016	01:08:34	TRIGGER	0	20.5	0.08	6.7
18 Jul 2016	01:09:51	TRIGGER	0	20.6	0.09	6.6
18 Jul 2016	01:10:03	TRIGGER	0	20.5	0.14	7.1

Control Panel 

The Control Panel Menu allows the user to control the F-950 From a computer using a series of toggle keys seen below.

By pressing up or down, the user can navigate through the file menu to change settings on the unit and use the square button to take a measurement.

Calibration 

The Calibration menu enables a two-point calibration process for the F-950, including Zero Calibration and Span Calibration. The set zero process will require known standard gas of 100% Nitrogen (N_2) gas to set a zero baseline. Next the user will be prompted to connect a known standard gas to set the span for your sensors. For more information on the standard gases needed for calibration refer to page _Ref477940619 \h 26 of the user manual.

Each sensor will require its own standard gas for calibration. After the set span is complete it is best practice to verify your calibrations were successful by reading the standard gas to ensure accuracy.

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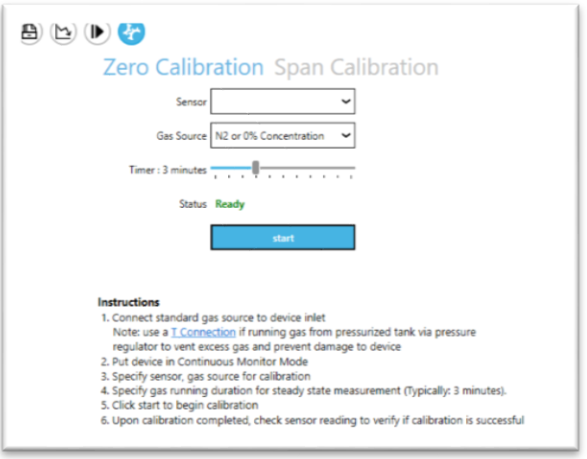
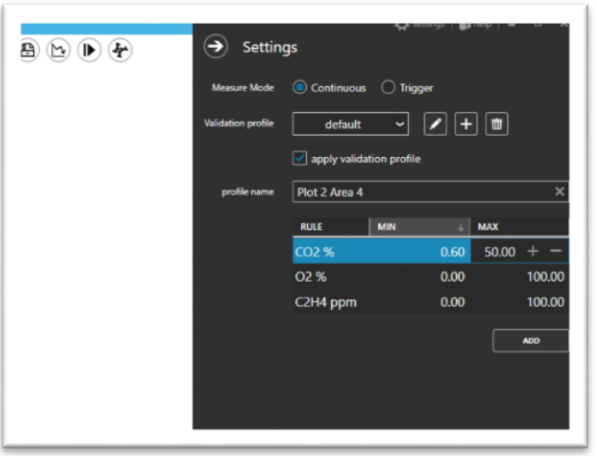


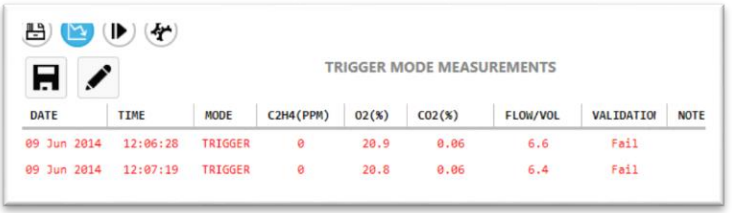
Settings

G.A.S. offers a settings menu allowing the user to switch between continuous and trigger modes, as well as setting thresholds for QA monitoring.

The user has the flexibility to create a customized validation profile, creating unique profile names and threshold values for each gas of interest, useful for quality monitoring!



Simply "apply validation profile" created after selecting your customized validation profile, and then proceed to see your results in the Measurement Monitor display.



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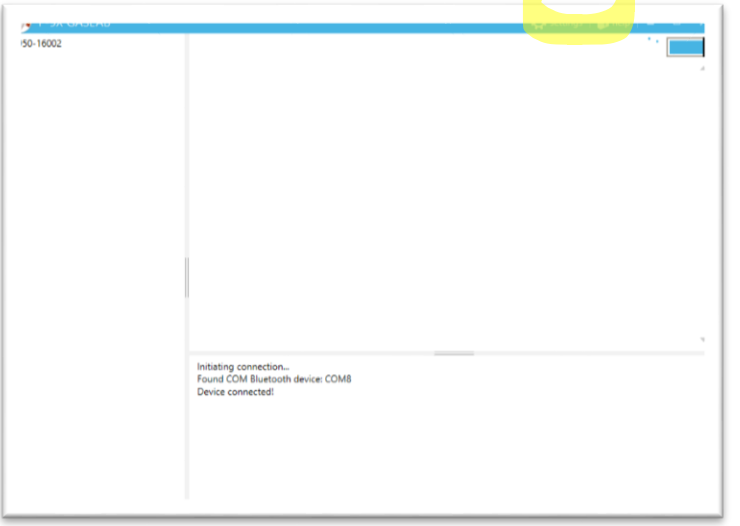
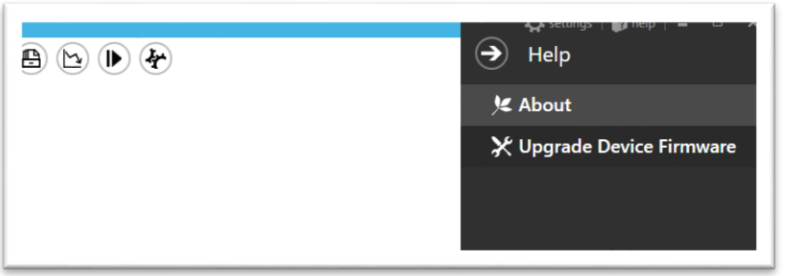
Firmware Update

To update the firmware on the F-950, you will need to download and install G.A.S. as outlined in the previous section. Launch the software, connect your device and select “Help”.



This will reveal a menu with the option to update your firmware.



Once “Upgrade Device Firmware” is selected, the software will

outline a series of steps for the upgrade.

Follow the instructions provided in steps 1 and 2, step 3 requires the selection of a .dfu file, which can be downloaded from: https://felixinstruments.com/support/F-950/software/

Once the file is downloaded to your computer and selected in step 3, click install as prompted in step 4.

You will be prompted to wait while the firmware upgrades.

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Followed by a confirmation that the firmware uploaded successfully. Press "OK" and proceed to power on the unit by pressing and holding the power button for 10 seconds. You're done!

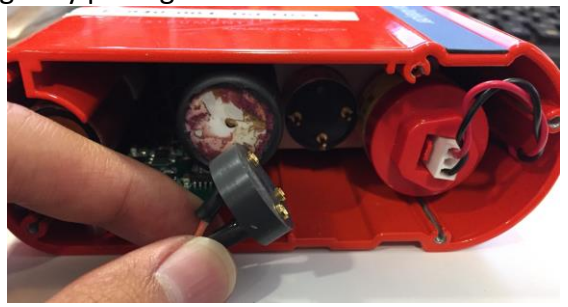
Maintenance of your F-950 Three Gas Analyzer

Long Term Storage of the F-950

WARNING: If you plan to store this device for longer than one month, follow the instructions below on how to disconnect the O_2 and C_2H_4 sensors from the board. This will prolong the life of the O_2 and C_2H_4 sensors.

1. Turn off the F-950 Three Gas Analyzer And remove the bottom rubber mat.
2. Remove the battery cap (it's spring loaded!) and unscrew the black bottom plate of the F-950.

3. Unplug the connector for the ethylene sensor by gently pulling it out.



4. Unplug the red and black cable connector by gently pulling the fastener out the end of the O_2 sensor.

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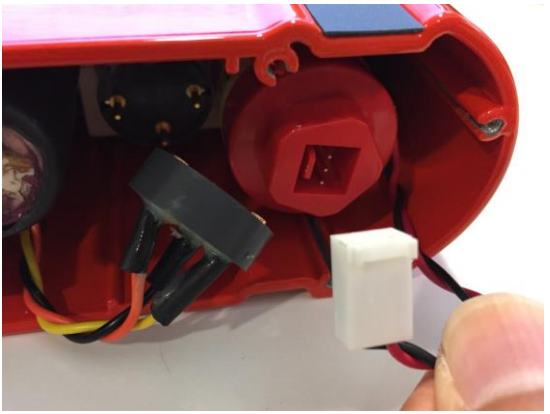


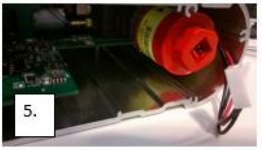
5. After reconnecting the sensors, insert fully charged batteries and allow 24 hours to stabilize the sensors.

Replacing the Oxygen (O_2) Sensor

The oxygen sensor has a life span of two (2) years, and the replacement of the sensor is simple and quick. To purchase the sensor from Felix Instruments contact sales@felixinstruments.com. To replace the sensor refer to images on following page:

6. Turn off the F-950 and remove the bottom rubber mat.
7. Remove the battery cap (it's spring loaded!) and unscrew the black bottom plate of the F-950.
8. Unplug the red and black cable connector by gently pulling the fastener out the end of the O_2 sensor.
9. Unscrew the O_2 sensor (counter-clockwise).
10. Screw in the new sensor (clockwise) until you feel a resistance—not too tight!
11. Plug in the cable connector by pressing the white fastener into the end of the new O2 sensor.

12. Screw the bottom plate into position, and fasten the battery cap.
13. Place the bottom rubber mat—and congratulations you've done it!
14. Photos of the process are below.



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Replacing the Potassium Permanganate Filter (KMnO4)

The Potassium Permanganate will expire after prolonged use and can be identified when the granules turn dark purple to brown. The small black jar is the KMnO4 filter, just unscrew the bottom plate of the F-950 unit after removing the battery cap, unscrew the filter, screw in the replacement and you're done! Screw back into place the bottom plate and finally the battery cap.

Appendix I: Sampling from a Jar

The following photos utilize a glass jar customized with the addition of a Vacutainer® septum.
The F-950 can draw and analyze a headspace gas sample from a rigid jar by incorporating an input probe and output flow into the septum to compensate for removed airspace, thus preventing a vacuum from occurring.

Instructions:

1. With the F-950 in Trigger mode, allow the instrument to purge and stabilize in ambient air before inserting the sampling probe into the sample jar septum.
2. Once stabilization is complete, insert the sample needle probe connected to the F-950 inlet into the jar septum.
3. To prevent a vacuum, insert another probe from the outtake of the F-950 into the septum. The loop back tube provided with the F-950 can be utilized for this purpose. There are now two needle probes inserted into the septum.

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4. Press the square button above the name of the instrument to initiate the Trigger mode measurement. The pump inside of the F-950 will activate and draw headspace gas into the unit.

*If you receive a *Clogged probe?* error, check that your needle is not bent and that the needle has penetrated through the septum and into the sampling space.
For larger sampling jars, consider incorporating an internal fan to improve circulation within the sample space. Carbon dioxide gas can sink to the bottom portion of the jar, rendering a non-representative reading to occur. Placing the jar on a long side helps to mitigate this from affecting the sample draw and more evenly distributes the internal gas.

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Appendix II: Guide for Purchasing Standardized Gases for Calibration

When deciding which standard gases to purchase for calibration, there are some important considerations that will help guide your purchase:

1) Determination of concentration of the gas to be purchased. The concentration of the standard gas is the first consideration. It needs to be at a concentration level that is appropriate for calibration of the instrument.

2) Determination of proper regulator for the standard gas tank. A regulator is needed to provide a consistent flow of gas to the instrument at a certain rate. At our facility, we use on-demand regulators that require the pumps within our instruments to pull the gas from the standardized tank. If this is not an option, other regulators are acceptable, just use a T-junction when connecting to the instrument to protect the instrument from damage.

3) Determination of the size of tank to order. Consider how many calibrations can be performed with the volume of gas purchased. Each calibration for the F-920, 940, and 960 will take around 0.3 liters of standard gas.

Below is an example of a standard order our company would make to Air Liquide for a 1.5ppm ethylene standardized gas tank for calibration of the F-950.

Air Liquide is a multi-national company that can deliver products to most business locations worldwide. You may look at www.airliquide.com for your local office.

Air Liquide America Specialty Gasses LLC

Telephone 425-931-8303 or 800-814-4642

A sample order for 34 Liter canister of appropriate calibration gas for an F-950 or F-950 would include the following (*Note, these are Air Liquide's unique product numbers)*:

CERTIFICATE OF ANALYSIS

Part number	**A0909352 Scotty 34**
Description:	Two component

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	mix: Balance air, gas 34, NR Ethylene 1.5ppm balanced with air
Phase	Cylinder gas
Measurement	Mole
Class	N/A
Size	34L

Your gas vendor will do their best to meet your specified concentration and will provide a certificate of analysis with your gas showing what they have delivered. Be certain to use the actual value on the certificate of analysis as it may differ from what you have ordered.

If you don't already own a regulator, you must buy one. The following is the ordering information for the on-demand style regulator that we typically use. (*Note, these are Air Liquide's unique product numbers)*

Part Number: A0315576

Description: Q114DRFRC10 – M14 Demand Regulator

0 – 3 LPM @ 3'

Warranty Information

Seller's Warranty and Liability:

Felix Instruments- Applied Food Science warrants new equipment of its own manufacturing against defective workmanship and materials for a period of one year from date of sale. The results of ordinary wear and tear, neglect, misuse, accident and excessive deterioration due to corrosion from any cause is not to be considered a defect. Felix Instruments' liability for repairing or replacing defective parts during the warranty period is contingent on examination by a Felix Instruments authorized representative. Felix Instruments liability will not extend beyond repairing or replacing parts from the factory where they were originally manufactured. Repair or alteration by an unauthorized technician voids warranty.
Material and equipment which is not manufactured by Felix Instruments is to be covered only by the warranty of its manufacturer. Felix Instruments will not be liable to the Buyer for loss, damage, or injury to persons or to property by the use of equipment manufactured by other companies.

Buyer accepts the terms of warranty through use of this instrument and any accessory equipment. There are no understandings, representations, or warranties of any kind, express, implied, statutory, or otherwise (including, but without limitation, the implied warranties of merchantability and fitness for a particular purpose), not expressly set forth herein.

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All instrument repairs or replacement covered under warranty require a Returned Material Authorization (RMA) number. Please contact Felix Instruments technical support department at support@felixinstruments.com to obtain an RMA number before shipping instrument to CID Bio-Science, Inc.

Buyer is responsible for shipping charges to Felix Instruments headquarters:

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Camas, WA 98607
USA

Felix Instruments is responsible for return shipping charges on repairs and/or replacement covered by warranty.

Warranty Registration Card

1554 NE 3rd Ave, Camas, WA 98607, USA
Phone: (360) 833-8835 Fax: (360) 833-1914 e-mail: sales@felixinstruments.com Web: www.felixinstruments.com

PRODUCT REGISTRATION CARD

Please complete and return this form to Felix Instruments within 30 days to validate your Warranty on Parts & Labor.

Registration Information:

Your Name:_____ Title:_____

Company/University:_____

Address:_____

City:_____ State:_____ Zip:_____

Country:_____Email_____

Phone:_____ Fax:_____

Felix Instruments Serial Number(s):_____

Purchase Date:_____Purchase Price:_____

FOLD ON DOTTED LINE

Your opinions will help improve our service. Please answer the following questions.

1. What was the basis of your product selection?

□ Representative Recommendation
□ Product Features
□ Technical Specifications
□ Warranty
□ Other _____
□ Price
□ Product Design
□ Brand Name
□ Service

2. What other competing brands did you consider? _____

3. Where did you first learn of this product?

□ Advertisement in _____
□ Friend/Colleague
□ Other _____
□ Representative
□ Exhibit

4. Who selected this product?

□ I did
□ University Department
□ Other _____
□ Research Group
□ Purchasing

5. Comments/Suggestions:

_____

_____

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