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Introduction

Congratulations on the purchase of your new F-940 Store It! Gas Analyzer.

The F-940 Store It! Gas Analyzer provides rapid and precise measurements of ethylene, CO2 and O2. The Store It! was designed for Quality Assurance staff to increase shelf-life and prevent spoilage of valuable produce by monitoring ripening gases throughout the storage process.

The Store It! features an intuitive user interface, making it simple to operate right out of the box. Its lightweight, handheld design enables users to rely on the Store It! at all stages of storage along the supply chain. A built-in data logger stores thousands of data points and conveniently transfers data through USB or Bluetooth onto a PC or tablet for later analysis. With its rapid response time and lightweight handheld profile, the F-940 provides a fast, portable verification process for atmosphere quality control. Easy to use straight out of the box with little or no training, the F-940 is ideal for verifying CO_2 and O_2 levels in Modified Atmosphere Packaging (MAP) applications, laboratories, distribution centers, retail centers, storage facilities, and shipping containers.

We hope you enjoy using your F-940 Store It! Gas Analyzer.

Features

- The F-940 features include:
- Measures C2H4, CO2 and O2
- Displays results in under 30 seconds
- Past records stored on the device
- Handheld and lightweight
- Internal data logging and storage
- (WiFi capable SD card)
- Bluetooth data transfer
- Battery lasts for 8+ hours
- Display easily viewed in dimly lit environments
  PolarCept!TM water filter for removing non-ethylene hydrocarbons

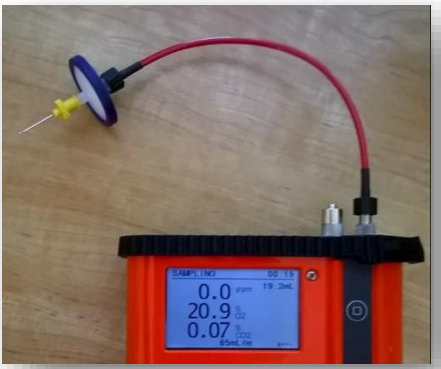
Specifications

F-940 Specifications	
Air Sampling Rate	70 mL/min
Measuring Rate	Automated, 1 second intervals to SD in Continuous Mode
Data Storage	Removable 16 GB SD and Bluetooth
Display	Sunlight visible transflective LCD
Operating environment	0°C - 50°C (15-90% relative humidity, non-condensing)
Power Source	Removable rechargeable lithium-ion battery
Dimensions	18cm x 13.5cm x 5.5cm
Weight	0.95kg
Enclosure	Powder coated aluminum
Warm Up Time	<3 minutes
Sensors	
Ethylene (C2H4) SENSOR	Electrochemical
Nominal Range	0-10 ppm
Full Scale Resolution	0.03 ppm
Accuracy Trigger Mode	±5% relative ±0.15 ppm absolute
Accuracy Continuous Mode	±5% relative ±0.030 ppm absolute
Lower Detection Limit	0.03 ppm
Sampling Time	30 seconds
Zero Interval	Weekly
Calibration Interval	3 months
Lifetime	2 years
Carbon Dioxide (CO_2) SENSOR	Infrared sensor, pyroelectric detector

Nominal Range	0-100%
Full Scale Resolution	0.01%
Accuracy – Trigger Mode	±.5% absolute and ±3% of measured value
Accuracy – Continuous Mode	±.01% absolute and ±3% of measured value
Lower Detection Limit	0.01%
Sampling Time	10 seconds
Zero Interval	Weekly
Calibration Interval	12 Months
Lifetime	5 years
Oxygen (O_2) Sensor	Electrochemical
Nominal Range	0-100%
Full Scale Resolution	0.1%
Accuracy – Trigger Mode	±0.3% absolute and ±2% of measured value
Accuracy – Continuous Mode	±0.1% absolute and ±2% of measured value
Lower Detection Limit	0.1%
Sampling Time	10 seconds
Zero Interval	Weekly
Calibration Interval	6 Months
Lifetime	2 Years

Unpacking the F-940 Store It!

The F-940 arrives with a hard-sided carrying case, two sets of batteries and a charger, a removable SD card, and several accessory parts. A sampling port with needle is included for taking non-destructive samples from packaging. The sampling port is pictured below, connected to the intake. There is also an extra Potassium Permanganate Filter (see *Maintenance of your F-940 Store It!: Replacing the Potassium Permanganate Filter*) and a Closed-Loop Probe used for sampling from Jars (see *Applications: Sampling with a Jar*).



Operating Instructions

WARNING: Do not store the F-940 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-940 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.

Loading the Battery

WARNING: Spring-loaded battery cartridge

The F-940 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-940 to be charged. If the batteries of the F-940 discharge during storage, replace with charged batteries. The Li-ion batteries have little self-discharge and a lifetime of ~ 3 years.

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 it. 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).

Additional button-top 19670 (or protected 18650) batteries can be purchased from your preferred battery vendor if replacements are needed.

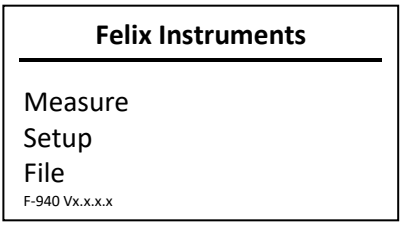
Basic Operation

To turn the instrument on, press the green power button. The current version of firmware the unit is running is displayed in the lower Left hand corner.

For information on the latest firmware version, please visit the F-940 support webpage: www.felixinstruments.com/support/F-940

The battery meter is listed on the lower right hand side of the display.

The main menu displays the following options: **Measure, Setup**, and **File**. If the power button is pressed, the display will prompt for confirmation before shutting down the F-940.



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 incorporated into the F-940 Store It!

- Continuous mode
- Trigger Mode

Continuous mode measures the air entering through the input of the instrument continuously without stopping. Continuous mode can be used **with or without the sample port** attached to the front of the instrument. Data is saved to a file every one second on the F-940.

Trigger mode measures the air entering through the input of the instrument, the pump will run and the sample will enter until a stable reading has been achieved. The final values will be displayed on screen and 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. See the specifications page for standard sample volume.

To change between modes, Navigate to Setup > Mode from the main menu.

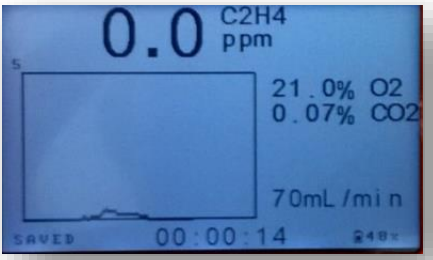
Measure

From the main menu, press the right arrow when the word 'Measure' is highlighted to enter the measurement display screen. All measurement parameters 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. The unit also comes equipped with Bluetooth technology, designed for wireless transfer of data (see *Transferring Files*).

If sampling very high concentrations followed by very low concentrations, allow the instrument 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 O_2 concentration in ppm. To view the C2H4 or CO_2 graph, simply use the up and down arrows to scroll through the graphs. The current gas being graphed is shown on the top of the screen with the concentration in large font as shown below.



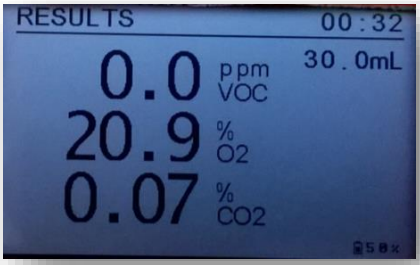
The x-axis of the graph represents time elapsed. The y-axis of the graph displays the range of the concentration in % for CO_2 and O_2, and the dynamic range is labeled at the top. The y-axis scale is set by the highest value shown in the active display.

The graph begins on the Left side and moves toward the right as more data accumulates. The total measurement time is displayed below the graph. The flowrate (mL/m) is displayed at the bottom.

Trigger Mode

A measurement in trigger mode will initiate a small volume sample taken over several seconds until the reading is stable. To begin, press the square start button as prompted to measure. This will turn on the pump before drawing in sample gas. Trigger

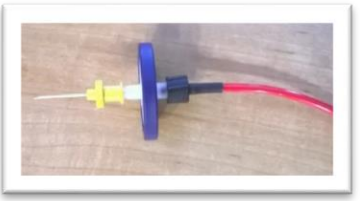
mode will take longer to stabilize if the concentration is in a different range from the last sample.



The results will be saved to the SD card. Press the square start button to begin another measurement. Press the Left arrow to exit to the main menu.

Taking a Measurement

Assemble the probe and connect the needle probe tubing to the intake of the F-940. Twist on a hydrophobic filter to the end of the tubing. The filter will prevent any moisture or debris from entering the instrument. [NOTE: Failure to use a hydrophobic filter risks drawing liquids into the instrument, which can potentially damage the instrument sensors.] Finally, attach a sterile needle to the filter. Depending on the application, needles can be re-used.



From the main screen, select ‘Measure’ and then the right arrow button. This will initiate a measurement in either mode. The F-940 will run either continuously (continuous mode) or until the minimum stable sample volume has been reached (trigger mode). Press the Left arrow button to return to the measurement screen.

Passcode Protection

Certain menu systems on the F-940 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

Setup Menu

Use the right arrow to enter the Setup Menu from the Main Menu screen. The following options are available:

Mode
Set Zero
Calibration
O2 Calibration in Air
Date & Time
RH Conversion
GPS
Language
Factory Setup

Setup > Mode

The Mode menu contains two options:

Measure: switches between Continuous and Trigger mode.

Connection: switches between USB Storage (default), Bluetooth (enabled in future versions), or USB Ctrl (enables communication to controller software).

To change, use the Up/Down arrows to cycle through the mode options. Press the Left arrow to exit to the main menu.

Mode	
Measure	Trigger
Connection	USB Storage

Setup > Set Zero

The set zero process sets a new baseline, or zero, for the sensors:

C2H4
CO2
O2

Set zero should take place weekly for all sensors. To set zero, first press the right arrow to select the sensor. Wait for a beep to verify the set zero process was completed. The set zero process requires the use of 100% nitrogen gas to set zero for O2, an internal Potassium Permanganate jar to set zero for C2H4, and an external conditioning chamber full of Soda Lime to set zero for CO2. Setting zero is important in establishing a zero baseline for the sensors.

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.

The following instructions can be followed to set zero for the CO2 sensor:

The F-940 is shipped with an external conditioning tube and a jar of Soda Lime. Fill the conditioning tube with the Soda Lime granules, keeping the ends packed with the cotton ball filters. Connect the external conditioning tube to the inlet and outlet of the F-940, seen below. Continue through the standard set zero process. The F-940 will prompt the user to use “0ppm/N2”. The Soda Lime external conditioning tube creates a 0 ppm CO2 environment, alternatively, the user can connect N2 gas, which provides a 0 ppm CO2 environment as well.

The Soda Lime external conditioning tube is used for the CO2 Set Zero process only.

Next, verify the set zero calibration for all sensors by measuring ambient air. Run the set zero calibration again if the verification is not successful.

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 next section, a zero standard gas is required as well as standard gases for the set span process.

The F-940 Store It! Will prompt the user to set up a zero gas, which can be achieved by feeding 100% Nitrogen (N2) gas to the intake. 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. For more information on standard gases used for calibrating the Store It! Refer to the calibration section in the 'Maintenance of your F-940 Store It!' section.

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-940 will beep upon completion of the O2 calibration in air.

Setup > Date and Time

To adjust the 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.

Date & Time	
MM/DD/YYYY	hh : mm : ss
04/21/2016	17 : 01 : 43

Setup > RH Conversion

The Setup RH Conversion menu is used to correct for the temperature sensor being inside F-940 housing. This causes the temperature sensor to reflect the temperature of the F-940 and not the ambient temperature, which is usually several degrees above ambient. The Relative Humidity is calculated based on the temperature value.

Enter the correct ambient temperature in degrees Celsius, measured from an external temperature sensor. To use the entered temperature for RH calculations, "use sample T" should be set to "Yes."

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

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

Setup > GPS

The GPS sensor inside of the F-940 Store It! can be used to record latitude and longitude +/- 10 meters. The instrument should be operated outside, without overhead obstruction for best GPS performance. The Setup > GPS menu turns on/off the GPS sensor and displays the current GPS data. Data is also saved to the SD card as a .csv file.

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

Setup > Language

The Language menu will display options for:

English
Spanish
Portuguese

Use the Up and Down arrows to select.

Setup > Factory Setup

The Factory Setup menu is used to:

Restore: Restores factory defaults
Backup: Backs up current parameters. “Backup device’s

configurations?”: NO or YES

File Menu

In the File Menu, the user can manipulate files on the F-940 Store It! The F-940 will by default save to the most recently used file on the instrument. The file menu contains:

Select
Create
Delete
Review

All files created by the F-940 are .csv (comma separated value) file extensions.

To view data on a computer, simply insert the SD card into a computer’s SD card reader **(always power off the F-940 before removing the SD card).** The computer should automatically detect the SD card as a new storage device enabling access to measurement data from any computer. The mini-USB port can also be used to establish a USB connection with a computer to transfer data from the F-940 Store It!

File > Select

File Select displays a list of .csv files that exist on the F-940 Store It! SD card. Use the Up/Down arrows to move between files, and right arrow to select a file to which new data will be saved.

Select
Data . csv
16_04_04_0 . csv

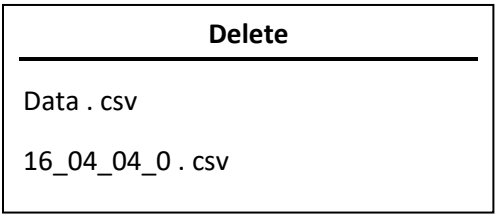
If the unit is powered on and no file is selected, the data will be default saved to the file *data.csv*. In the file, each data point is labeled with time and date for easy sorting.

File > Create

Pressing the Right arrow when '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. 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-940 Store It! SD card. Use the Up/Down arrows to scroll between files and



use the right arrow to delete the selected file. A message will appear: "Delete File?" Press the Left arrow for No, leaving the file intact. Press the Right arrow for Yes, deleting the file.

File > Review

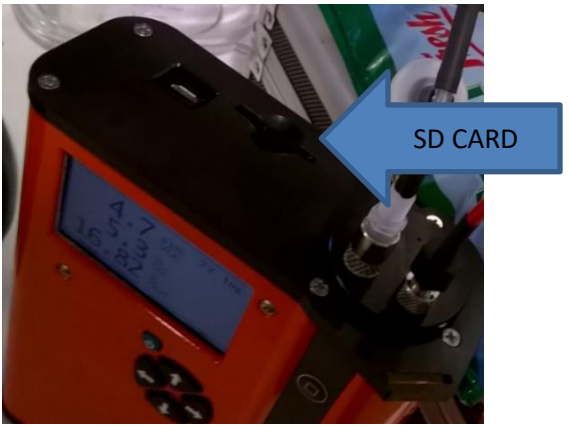
File Review displays a list of files on the SD card and allows you to view the data contained in the files. Use the Up/Down arrows to scroll between files and the right arrow to enter the selected

file. When reviewing trigger mode files, the software can support viewing up to 10 records at a time. The *data.csv* file is the F-940 default file used to store data when no other file is selected.

After selecting a file name, the measurement mode with time of the measurement and gas 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 Date, Time, O_2 and CO_2 concentrations, Mode and Sample Volume.

Transferring Files

Open the saved data files on the SD card using Microsoft Excel or Notepad. Data files are saved as .csv file extensions (comma separated values). The following figure is an example data spreadsheet. Data values included are the date and time of the measurement, the measurement mode, 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, the flow rate of the gas stream in milliliters (mL) per minute, and GPS data.



Example spreadsheet data from an F-940 Store It!

Date	Time	Mode	C2H4(ppm	O2(%)	CO2(%)	RH(%)	Temperat	FLow(ml)	GPS_Lon	GPS_Lat	Raw
4/18/2016	8:08:15	Continuou	N/A	50.2	0.04	32.1	25.6	0	N/A	N/A	0 41282 30719 92933 25833 256 321 744
4/18/2016	8:08:16	Continuou	N/A	50.2	0.04	32.1	25.6	35	N/A	N/A	0 41315 30717 92932 25817 256 321 742
4/18/2016	8:08:17	Continuou	N/A	50.2	0.04	32.1	25.6	73	N/A	N/A	0 41317 30762 92929 25814 256 321 744
4/18/2016	8:08:18	Continuou	N/A	50.2	0.04	32.2	25.6	84.5	N/A	N/A	0 41297 30813 92933 25822 256 322 743
4/18/2016	8:08:19	Continuou	N/A	50.2	0.04	32.2	25.6	89.5	N/A	N/A	0 41320 30813 92941 25832 256 322 744
4/18/2016	8:08:20	Continuou	N/A	50.2	0.04	32.3	25.6	89	N/A	N/A	0 41346 30795 92947 25826 256 323 742
4/18/2016	8:08:21	Continuou	N/A	50.2	0.04	32.3	25.6	89	N/A	N/A	0 41292 30810 92945 25813 256 323 742
4/18/2016	8:08:22	Continuou	N/A	50.2	0.04	32.3	25.6	89	N/A	N/A	0 41348 30850 92939 25817 256 323 744
4/18/2016	8:08:23	Continuou	N/A	50.1	0.04	32.3	25.6	86	N/A	N/A	0 41198 30846 92937 25814 256 323 742
4/18/2016	8:08:24	Continuou	N/A	50.1	0.04	32.3	25.6	84.5	N/A	N/A	0 41207 30818 92954 25837 256 323 744
4/18/2016	8:08:25	Continuou	N/A	50.3	0.04	32.3	25.6	80.5	N/A	N/A	0 41373 30807 92965 25815 256 323 743
4/18/2016	8:08:26	Continuou	N/A	50.3	0.04	32.2	25.6	81.5	N/A	N/A	0 41377 30777 92967 25826 256 322 744

REMEMBER: Always save the data files to the computer before making changes or starting analysis. **Raw output field designations: Raw C2H4, Raw O2, Raw CO2, CO2 Ref, Zero Baseline, Temp (10x), RH (10x), Battery Voltage, Pressure (mbar)*

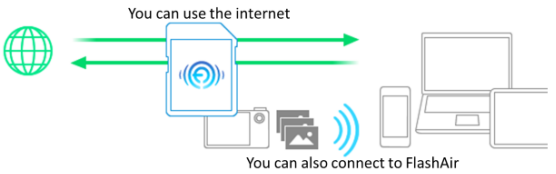
Wireless SD Memory Card Operation

These instructions are meant to accompany the instructions supplied by the vendor for Toshiba FlashAir™ W-03 to use specifically with the F-940 Store It! Gas Analyzer, 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 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.

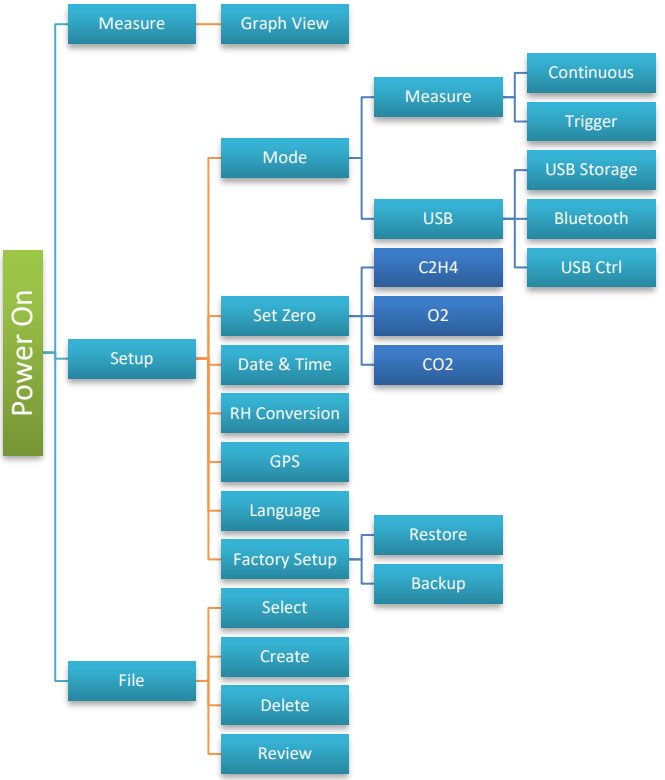
Check the “Enable internet pass thru mode” checkbox to enable “internet pass thru mode”.

- 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,

F-940 Store It! Menu Map

Below is a map of the F-940 Store It! Two Gas Analyzer menu system. Press the right arrow to enter a menu and the Left arrow to exit.

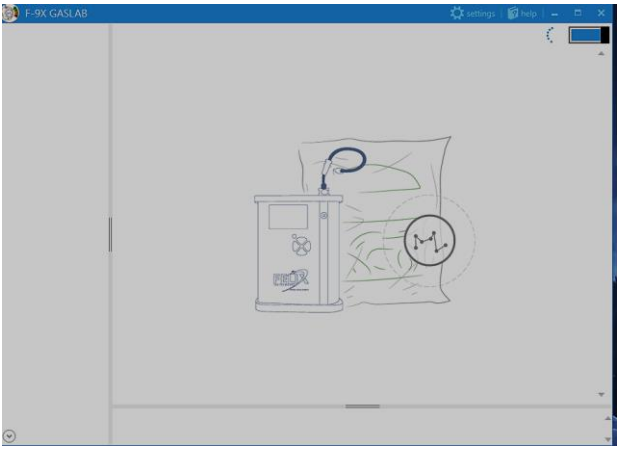


G.A.S. Gas Analysis Software

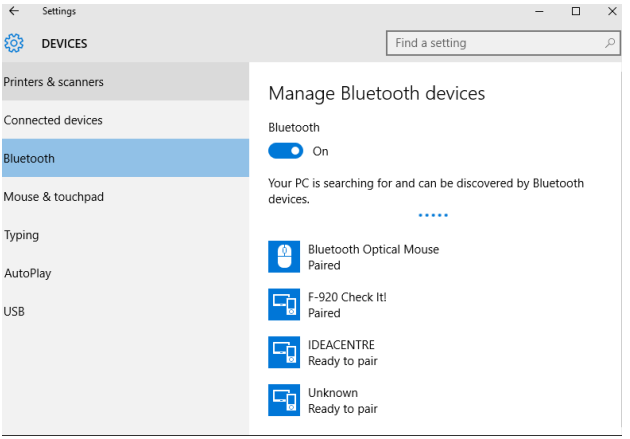
G.A.S. software enables the user to not only calibrate the F-940 Store It!, but also view graph displays of measurements, download, edit and add notes to files, create upper and lower thresholds for quality monitoring, and remotely navigate through the F-940 Store It! menu system.

A. Download the F-9x GAS_LAB_setup.exe from https://felixinstruments.com/support/F-940/software/
B. Install
C. Launch the downloaded G.A.S. program

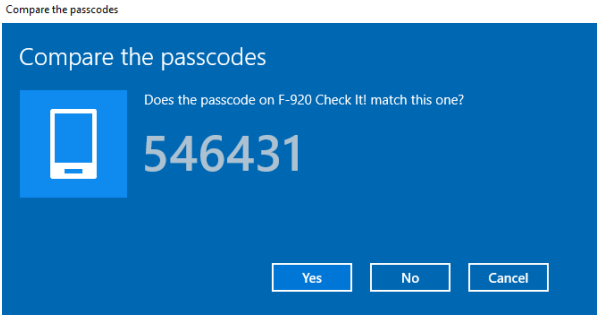
There are two ways to connect the F-940 Store It! To the G.A.S. program: Bluetooth or USB cable connection.



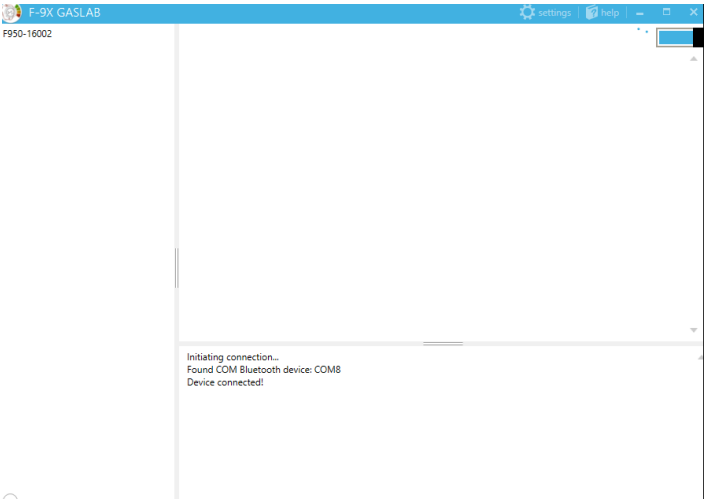
1. For USB cable connection, move ahead to step 4. For Bluetooth connection, on your F-940 Store It!, navigate to Setup > Mode > Connection > Bluetooth. On your windows pc navigate to Settings > Devices > Bluetooth and pair your computer to the F-940 Store It!



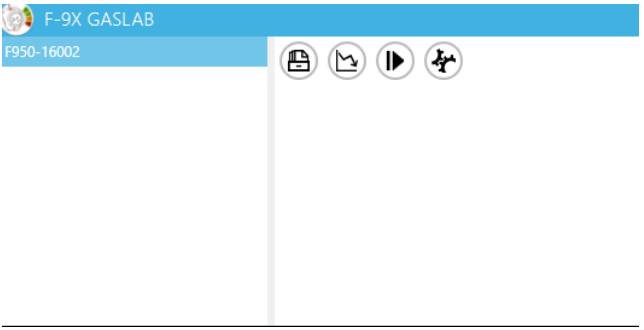
2. Verify that the passcode matches between the F-940 Store It! and the computer, accept each.



3. Once verified, navigate back to G.A.S., the program will initiate a connection with the F-940 Store It!



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-940 Store It! 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-940 Store It!

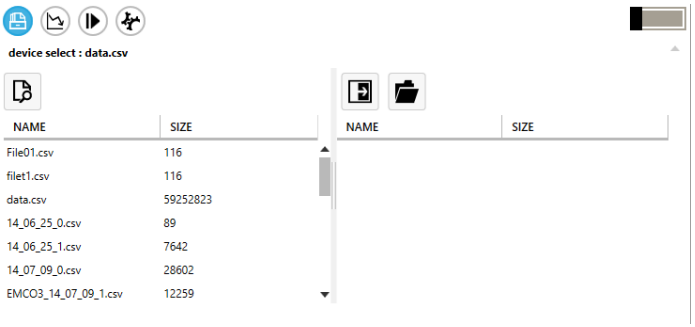
The ‘Measurement Monitor’ menu displays measurements graphically in real time.

The ‘Control Panel’ menu displays toggle keys which allow the user remote control of the F-940 Store It!

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

Files 

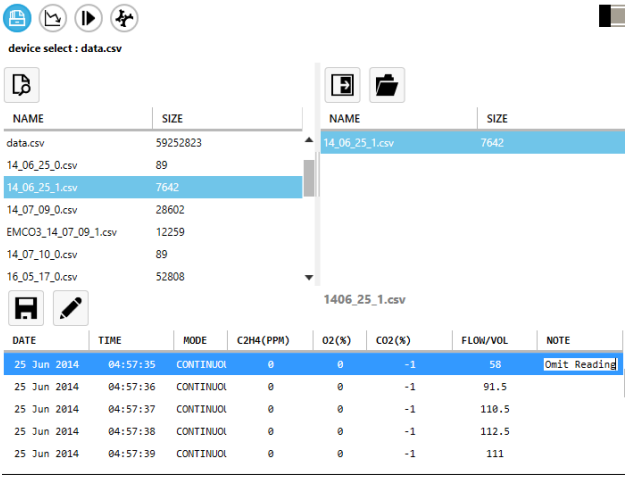
The files menu will display all files saved to the SD card of the F-940 Store It!



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

Or open a saved file from your pc.

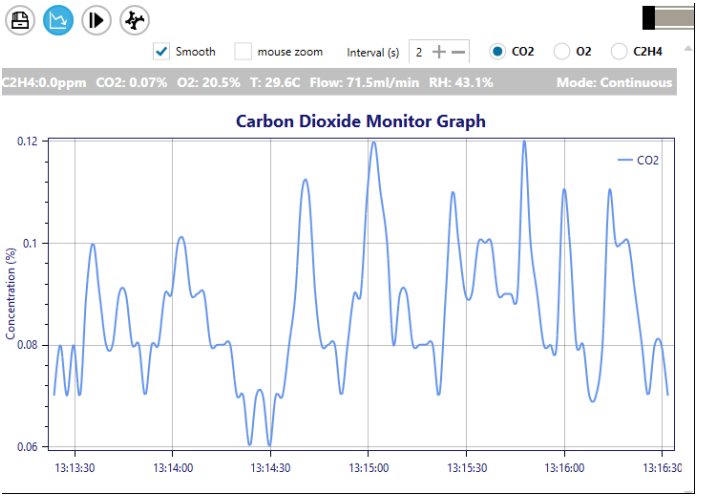
When the document appears on the right hand column, select it to view and make edits in the 'Note' section.



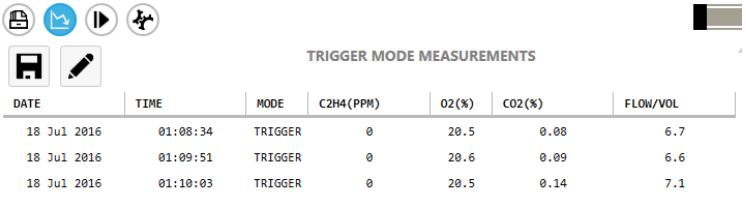
Once done reviewing and editing your data, select the save icon to save your changes. These changes will be saved to your pc.

Measurement Monitor 

The Measurement Monitor menu allows the user to view a graphical live feed of measurements taken on the F-940 Store It! This feature will display the measurement mode being used, the selected gas, temperature, flow, and RH with the option to toggle between CO2, O2 and C2H4. 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!



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.



TRIGGER MODE MEASUREMENTS

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-940 Store It! From a computer using a series of toggle keys seen below.

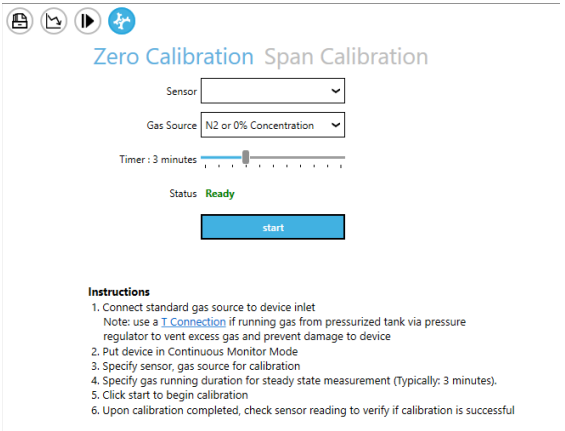
By pressing up or down, the user can navigate through the file menu to change settings on the unit and use the square button to take a measurement.

Calibration 

The Calibration menu enables a two-point calibration process for the F-940 Store It! Including Zero Calibration and Span Calibration. The set zero process will require known standard gas of 100% Nitrogen (N2) 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. We suggest the following:

C2H4 Set Span: 5 ppm C2H4 standard gas
CO2 Set Span: 95% CO2 standard gas
O2 Set Span: 50% O2 standard gas

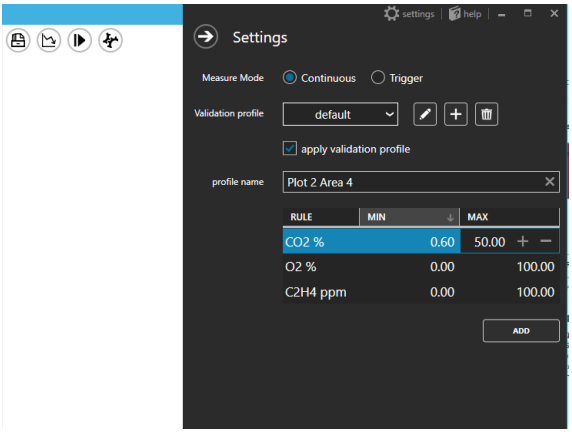
Each sensor will require its own standard gas for calibration. After the set span is complete it is best practice to verify your calibrations were successful by reading the standard gas to ensure accuracy.



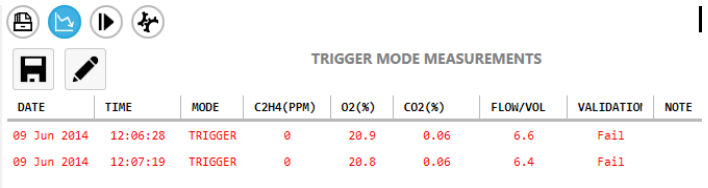
Settings

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!



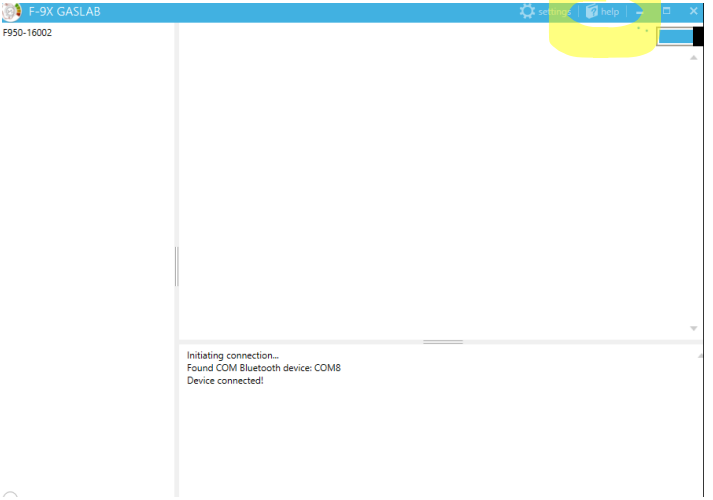
Simply "apply validation profile" created after selecting your customized validation profile, and then proceed to see your results in the Measurement Monitor display.



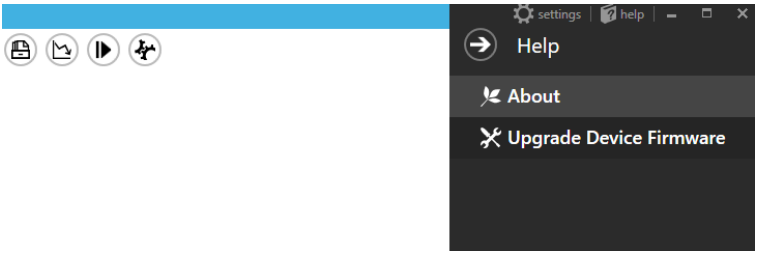
DATE	TIME	MODE	C2H4(PPM)	O2(%)	CO2(%)	FLOW/VOL	VALIDATIO	NOTE
09 Jun 2014	12:06:28	TRIGGER	0	20.9	0.06	6.6	Fail	
09 Jun 2014	12:07:19	TRIGGER	0	20.8	0.06	6.4	Fail	

Firmware Update

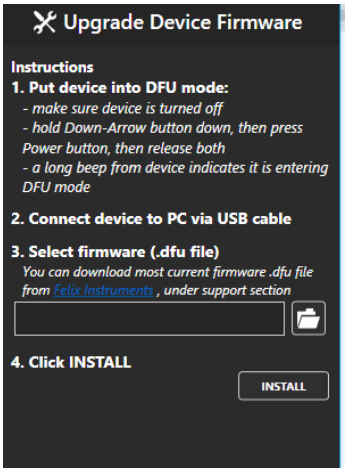
To update the firmware on the F-940 Store It!, you will need to download and install G.A.S. as outlined in the previous section. Launch the software, connect your device and select “Help”.



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



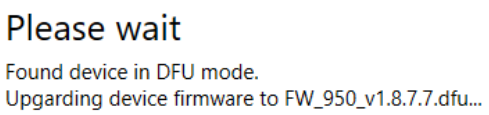
Once “Upgrade Device Firmware” is selected, the software will outline a series of steps for the upgrade.



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-940/software/

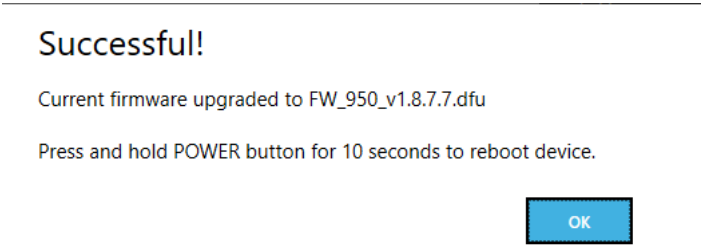
Once the file is downloaded to your computer and selected in step 3, click install as prompted in step 4.

You will be prompted to wait while the firmware upgrades.



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!



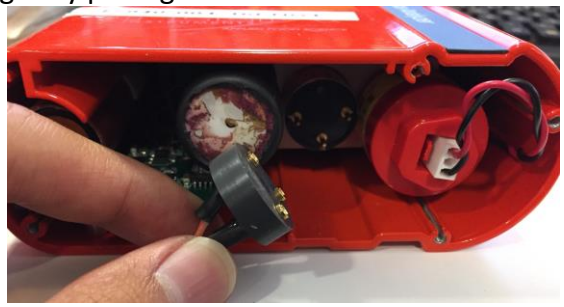
Maintenance of your F-940 Store It! Gas Analyzer

Long Term Storage of the F-940

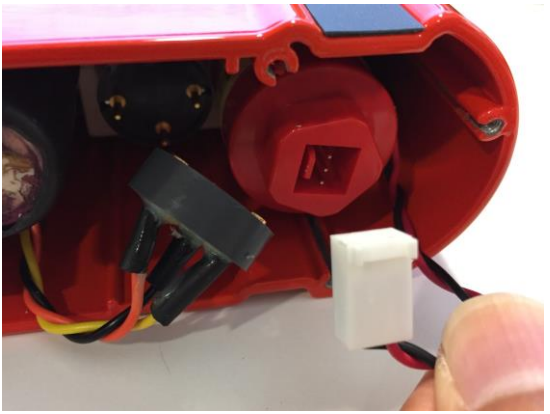
WARNING: If you plan to store this device for longer than one month, follow the instructions below on how to disconnect the O_2 and C_2H_4 sensors from the board. This will prolong the life of the O_2 and C_2H_4 sensors.

1. Turn off the F-940 Store It! And remove the bottom rubber mat.
2. Remove the battery cap (it's spring loaded!) and unscrew the black bottom plate of the F-940.

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.



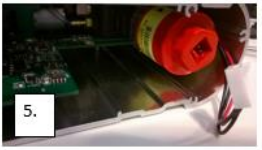
5. After reconnecting the sensors, insert fully charged batteries and allow 24 hours to stabilize the sensors.

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-940 Store It! and remove the bottom rubber mat.
7. Remove the battery cap (it's spring loaded!) and unscrew the black bottom plate of the F-940.
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.



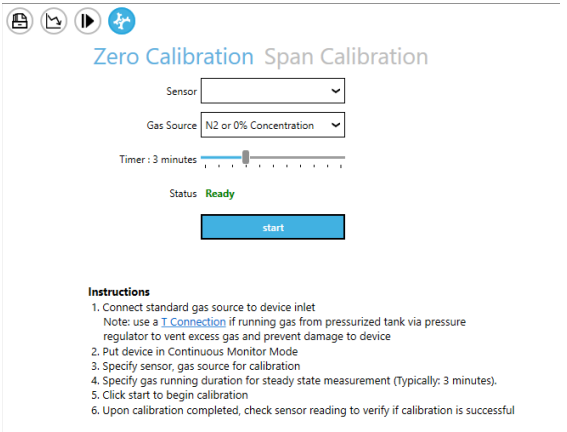
Replacing the Potassium Permanganate Filter (KMnO4)

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-940 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.

Calibration

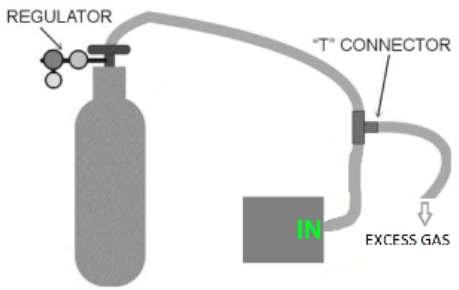
Full set span calibrations should take place every three months for the C2H4 sensor, annually for the CO_2 sensor and bi-annually for the O_2 sensor. Always set zero before setting span. If you have not already done so, download the G.A.S..exe package setup software from http://www.felixinstruments.com/support/F-940 and install it on your computer. See "G.A.S. Software" section. For C2H4 calibration standard gases, we suggest 5 ppm C2H4 and a verification gas of 2 ppm, for CO_2 calibration standard gases, we suggest 95% CO_2 for the set span procedure and a verification gas at a lower value, like 16%. For O_2 Calibration standard gases, we suggest 50% O_2 for the set span procedure and a verification using ambient air (20.9% O_2).

The F-940 allows the user flexibility with calibrating, there are two methods for calibrating: utilizing the computer-free calibration method through on-device adjustments under Setup > Calibration on the F-940, **OR** by using the computer software program: G.A.S. (Gas Analysis Software).
The G.A.S. Calibration menu also enables a two-point calibration process for the F-940 Store It! Including Zero Calibration and Span Calibration.

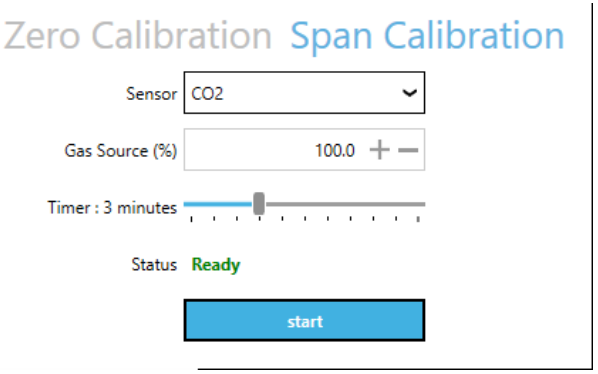


Set zero should take place weekly for all sensors to maintain maximum performance. The set zero process does not require G.A.S. and can be done following the processes outlined in the “Setup > Set Zero” section of the user manual. Set zero optionally CAN be done with G.A.S. utilizing 100% N2 gas (which represents a 0% CO2, C2H4 and O2 environment).

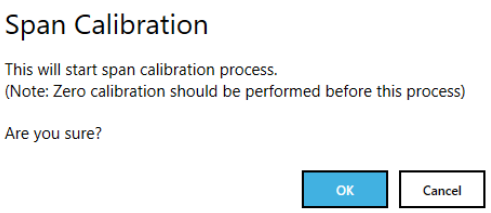
After setting zero, select "Span Calibration" and follow the instructions outlined in the software to complete the Span calibration process, a diagram outlining how to connect your standard gas will display.



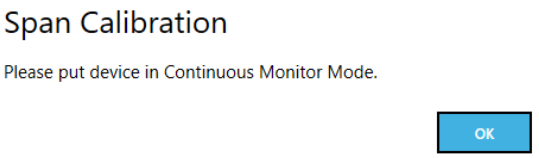
The timer is defaulted to 3 minutes, which is typically a sufficient stabilization period, if a longer stabilization period is needed, increase the timer to 5 minutes. Press start and wait for the calibration process to complete.



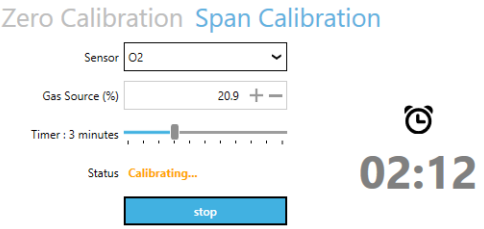
After pressing "Start", you will see the following prompt reminding the user of the set Zero process.



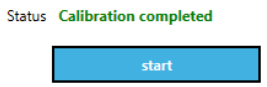
If you have already completed the set zero process, press "Ok". Another prompt will appear asking the user to put the device in Continuous Monitor mode (On the F-940 Store It!: Setup > Mode > Measure > Continuous). Then navigate to the main menu and begin measuring.



Press "Ok". The G.A.S. software will begin the calibration process and count down.



Once the calibration is completed, a green verification can be seen above the start button.



Following step 6 of the instructions listed, you should now verify the calibration was successful by taking a reading of the standard gas used in the process. The reading should fall within specifications outlined in the beginning of this manual.

Continuous Mode Verification *After Set Span

The following procedure is to check whether the sensors were calibrated to read within spec of the actual gas value. For C2H4, O2 and C2H4, refer to the specifications page.

It is highly recommended that this step be performed after one full day has passed since the calibration was performed. If this step is not performed, accuracy of the calibration cannot be verified.

Connect and read each gas and record the results here after three minutes (at least) of measure time. If any of the values are out of specification, check your procedure and recalibrate the sensor again.

Gas	Concentration	Pass/Fail
Air (Air is ~20.9% O2)	20.9% O2	□Yes □No
CO_2 Verification Gas		□Yes □No
O_2 Verification Gas	Can use Air	□Yes □No
C2H4 Verification Gas		□Yes □No

For information on sourcing known gases required for calibration, please refer to the following website to inquire about your region:

https://www.airliquide.com/group/where-we-operate

Applications

Sampling with a Jar

The F-940 comes with an extra accessory sample probe for creating a closed-loop system for sampling enclosed headspace in a sealed container. The example below displays a glass jar with a built-in septum for easy insertion of each sample probe. The standard sample probe is connected to the intake/inlet of the F-940 while the closed-loop sample probe is connected to the outlet. By creating a closed loop, the rigid jar will not pressurize by the displaced sample gas removed from the jar. The gas will be drawn into the F-940, analyzed by the sensor, and then re-circulated back into the jar through the closed-loop sample probe. For larger jars/containers, CO2 gas may settle to the bottom. This can be compensated by adding a small circulation fan inside the jar or by lying the jar on its side closer to the sample syringe.

PolarCept

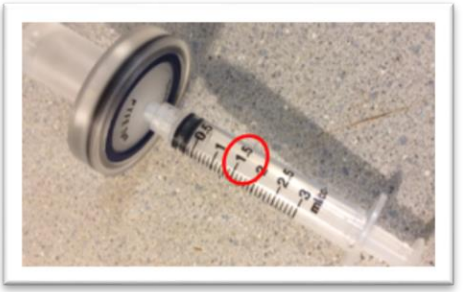
It is recommended to use the external PolarCept filter when measuring a mixture of gas (such as when sampling fruit) or interfering gases may be reported by the instrument. The PolarCept filter is recommended for Trigger Mode. PolarCept should only be used with **1.5 mL of distilled or deionized water.** The PolarCept filter consists of a plastic molded housing, hydrophobic filter and O-ring. It is attached to the sample probe in place of the hydrophobic filter and utilizes the same sample probe needle at the end. A small plastic syringe is used to fill and empty the PolarCept filter. Once the hydrophobic filter and O-ring are in place it should be very difficult to remove it and create a leak-proof seal. Additional hydrophobic filters are included as replacements, when the filter is soaked with water or damaged during removal, replace the filter.

After measuring, 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 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 various mixed hydrocarbons, ethylene and VOCs.

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 the PolarCept over a cup of distilled water and draw in **1.5 mL** with the syringe. Attach the sample needle and tubing. To empty the PolarCept, re-attach the syringe and push the water out of the PolarCept housing.

To properly use PolarCept, keep the sample needle pointed down while measuring. The water in the filter should "bubble" as the gas sample is pulled through, trapping interfering gases.



F-940 Production Test Check Sheet

SERIAL NUMBER:
Firmware Version:

NOTES:

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.

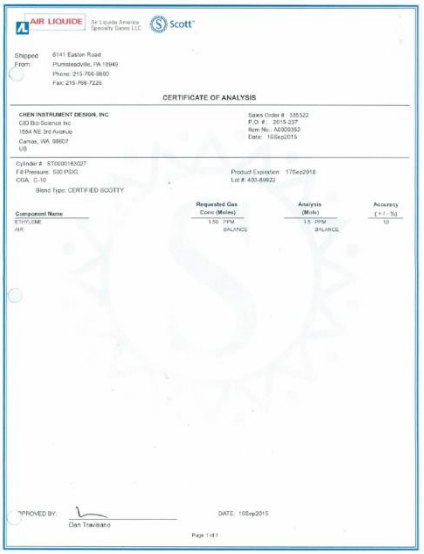
Below is an example of a standard order our company would make to Air Liquide for a 1.5ppm ethylene standardized gas tank for calibration of the F-940.

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-940 or F-940 would include the following (*Note, these are Air Liquide's unique product numbers)*:


AIR LIQUIDE
Scott
CERTIFICATE OF ANALYSIS
CHEN INSTRUMENT DESIGN, INC
Component Name
ETHYLENE
AIR
Requested Gas Conc (Moles)
1.50 PPM
BALANCE
Analysis (Mole)
1.5 PPM
BALANCE
Accuracy (+/- %)
10
APPROVED BY:
Dan Travisano
DATE: 16Sep2015
Page 1 of 1

Part Number:
A0909352
Scotty 34

Description: 2 Component Mix, Balance Air, Gas 34, NR

AIR
BAL

ETHYLENE 1.5 PPM

Phase: Cylinder Gas **Measurement**: Mole **Class**: N/A

Size: 34

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.

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:

1554 NE 3rd Ave.
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:

_____