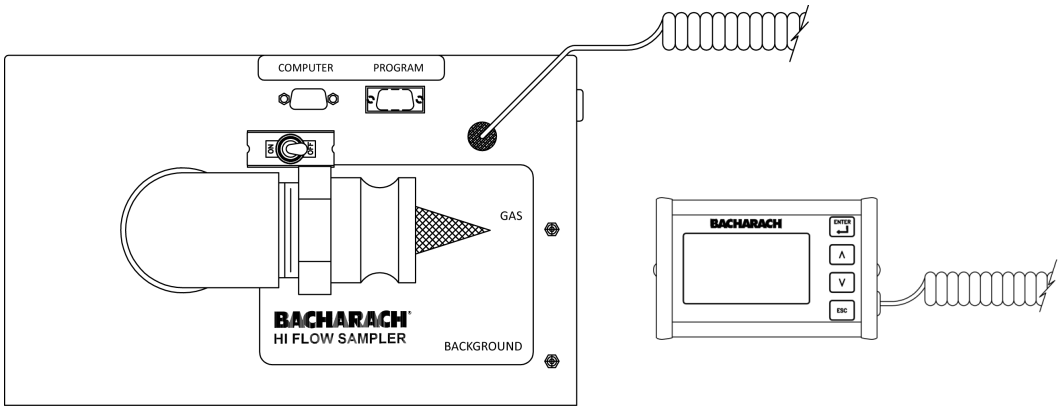
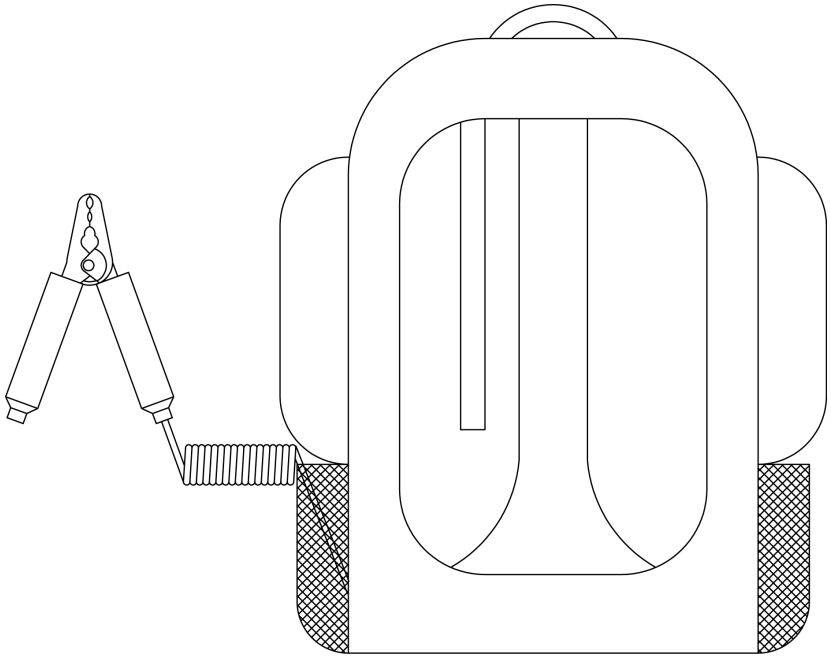
HI FLOW® Sampler

For Natural Gas
Leak Rate Measurement

Instruction 0055-9017
Operation and Maintenance

Rev. 7 – July 2015





Product Leadership • Training • Service • Reliability

WARRANTY

Bacharach, Inc. warrants to Buyer that at the time of delivery this Product will be free from defects in material and manufacture and will conform substantially to Bacharach Inc.'s applicable specifications. Bacharach's liability and Buyer's remedy under this warranty are limited to the repair or replacement, at Bacharach's option, of this Product or parts thereof returned to Seller at the factory of manufacture and shown to Bacharach Inc.'s reasonable satisfaction to have been defective; provided that written notice of the defect shall have been given by Buyer to Bacharach Inc. within one (1) year after the date of delivery of this Product by Bacharach, Inc.

Bacharach, Inc. warrants to Buyer that it will convey good title to this Product. Bacharach's liability and Buyer's remedy under this warranty of title are limited to the removal of any title defects or, at the election of Bacharach, to the replacement of this Product or parts thereof that are defective in title.

THE FOREGOING WARRANTIES ARE EXCLUSIVE AND ARE GIVEN AND ACCEPTED IN LIEU OF (I) ANY AND ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE: AND (II) ANY OBLIGATION, LIABILITY, RIGHT, CLAIM OR REMEDY IN CONTRACT OR TORT, WHETHER OR NOT ARISING FROM BACHARACH'S NEGLIGENCE, ACTUAL OR IMPLIED. The remedies of the Buyer shall be limited to those provided herein to the exclusion of any and all other remedies including, without limitation incidental or consequential damages. No agreement varying or extending the foregoing warranties, remedies or this limitation will be binding upon Bacharach, Inc. unless in writing, signed by a duly authorized officer of Bacharach.

Register Your Warranty by Visiting www.mybacharach.com

NOTICE

Product improvements and enhancements are continuous; therefore the specifications and information contained in this document may change without notice.

Bacharach, Inc. shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material.

No part of this document may be photocopied, reproduced, or translated to another language without the prior written consent of Bacharach, Inc.

Patent # 5,563,335 and 6,489,787.

Table of Contents

∇ ∇ ∇

1 Introduction

1.1 General Description and Use

WARNING: *The High Flow® Sampler is not to be used in any application that is beyond its intended purpose or beyond the scope of its specifications. Failure to follow this warning can result in personal injury or damage to the equipment. For details on appropriate use, refer to the general description, application, and operation discussions in this manual.*

WARNING: *The High Flow® Sampler is not to be used as a safety device for the personal protection of the user or others.*

The Hi Flow® Sampler is a portable, intrinsically safe, battery-powered instrument designed to determine the rate of gas leakage around various pipe fittings, valve packings, and compressor seals found in natural gas transmission, storage, and compressor facilities.

The Hi Flow® Sampler determines a component's leak rate by sampling at a high flow rate to capture all the gas leaking from the component along with a certain amount of surrounding air. By accurately measuring the flow rate of the sampling stream and the natural gas concentration within that stream, the gas leak rate can be calculated using Equation 1. The instrument automatically compensates for the different specific gravity values of air and natural gas, thus assuring accurate flow rate calculations.

$$Leak = Flow \times (Gas_{sample} - Gas_{background}) \times 10^{-2} \quad \textbf{Eq. 1}$$

where:

Leak	=	rate of gas leakage from source (cfm)
Flow	=	sample flow rate (cfm)
Gas_{sample}	=	concentration of gas from leak source (%)
$Gas_{background}$	=	background gas concentration (%)

To ensure that the instrument is capturing all the gas that is escaping from the component, two measurements are performed at two different flow rates. The first measurement is taken at the highest possible flow rate, followed by a second measurement at a flow rate that is approximately 70–80% of the first. If the two calculated leak rates are within 10% of each other, then it can be assumed that all gas has been captured during the test.

CAUTION: Additional precautions and considerations are required when using the instrument in natural gas streams of mixed composition. Refer to section 2.1 for guidelines.

The instrument is packaged inside a backpack, thus leaving the operator's hands free for climbing ladders or descending into a confined space.

The instrument is packaged inside a backpack, thus leaving the operator's hands free for climbing ladders or descending into tight spaces.

The instrument is controlled by a handheld Control Unit consisting of an LCD and a 4-key touch pad, which is attached to the main unit via a 6 foot coiled cord. The Control Unit comes with two magnets which can be easily attached to a steel pipe, regulator box or compressor for easy viewing. Alternately, the Control Unit can be used in conjunction with the neck strap accessory.

The gas sample is drawn into the unit through a flexible 1.5 inch I.D. hose. Various attachments connected to the end of the sampling hose provide the means of capturing all the gas that is leaking from the component under test.

The main unit consists of an intrinsically safe, high-flow blower that pulls air from around the component being tested through a flexible hose and into a gas manifold located inside the unit. The sample is first passed through an orifice restrictor where the measured pressure differential is used to calculate the sample's actual flow rate. Next, a portion of the sample is drawn from the manifold and directed to a combustibles sensor that measures the sample's CH_4 concentration in the range of 0.05 to 100% gas by volume. A second identical combustibles sensor channel measures the background CH_4 level within the vicinity of the leaking component. The final element in the sampling system is a blower that exhausts the gas sample back into the atmosphere away from the sampling area.

The measured flow rate and the measured CH_4 levels (both leak and background levels) are used to calculate the leak rate of the component being tested, with all measured and calculated values being displayed on the hand-held control unit.

1.2 Material Supplied

- High Flow Sampler Unit
- Backpack
- 6 Foot, 1.5 Inch Hose Assembly
- Battery Pack (Qty. 2)
- Battery Charger w/ Power Supply
- Control Unit with LCD and 4-button keypad
- Assortment of Attachments (for complete capture of the gas leak)
- Flange Strap 34", 80", and 137"
- Capture Bag 36" x 36"
- Beveled Nozzle 6.5" and 24"
- Bag Nozzle
- Bellows Tool
- Claw Tool

1.3 Control Unit Description

The control unit consists of an 8 line by 20 character LCD and the four pushbuttons.

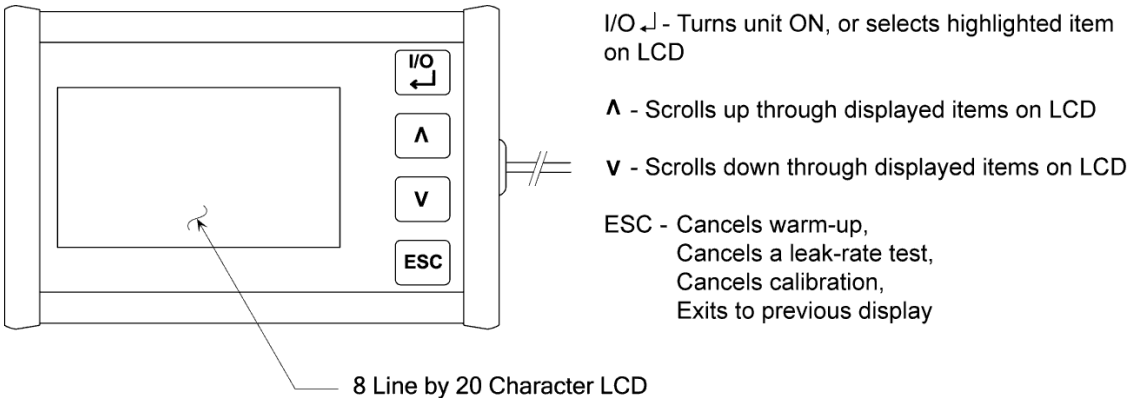


Figure 1-1. Control Unit

1.4 Top Panel Connections and Controls

The top panel contains the following items.

ON/OFF Switch	Turns unit ON and OFF.
Computer Port	RS232 communications port for downloading stored test data to an external computer.
Leak Gas Inlet	Main hose connection used to collect gas from leak source.
GAS Inlet	Calibration gas connection.
Background Inlet	Gas hose connection used to sample background levels of CH_4.

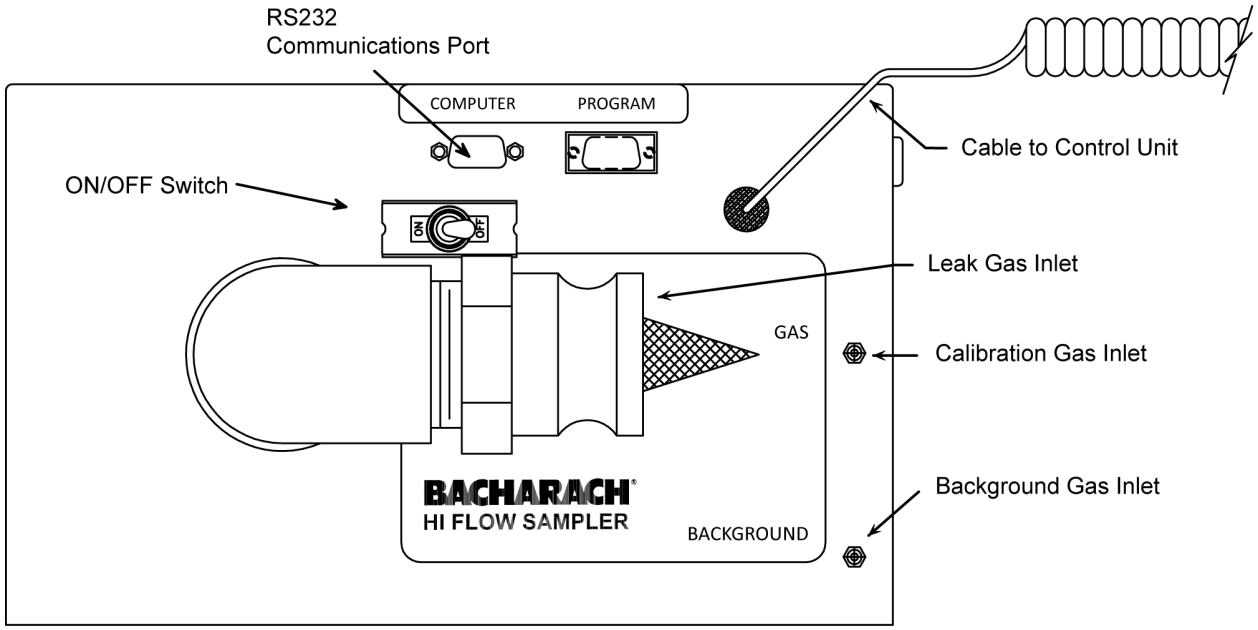


Figure 1-2. Top Panel Connections

1.5 Technical Data

TABLE 1-1. TECHNICAL SPECIFICATIONS

Specification	Description
Information Displayed	• Date and Time • Battery voltage • Leak rate in cfm • Sampling flow rate in cfm • Leak concentration in ppm or % by volume • Background gas concentration in ppm or % by volume • Percent difference between leak rate measurements #1 and #2
Display	8 line by 20 character LCD
Pushbutton Controls	**I/O** ↵ (Enter) ∨ (Down Arrow) ∧ (Up Arrow) **ESC** (Escape)
Communication	Three DB9 connectors providing serial data transfer at 115200 baud to a personal computer, or other peripheral device
Measured Values	• Sampling flow rate • Battery voltage • Sample gas concentration • Background gas concentration
Calculated Values	Leak concentration corrected for background gas level Leak rate Percent difference between leak rate measurements #1 and #2
Measurable Leak Rate	0.05 to 8.00 SCFM (1.42 to 226 LPM) 0.05 to 6.00 SCFM (1.42 to 170 LPM)
Accuracy	Calculated Leak Rate: ±10% of reading by volume methane
Temperature	Operating: 0 to 50 °C (32 to 122 °F) Storage: –40 to 60 °C (–40 to 140 °F)
Humidity	5 to 95% RH (non-condensing)
Sampling Flow Rate	Maximum ..... 10.5 SCFM (297 LPM) at full battery charge Operating Flow Points..... Initial flow ≈ 10 SCFM (283 LPM). Second flow ≈ 8 SCFM (226 LPM). (The second flow rate is approximately 75% of the initial flow) Measurement Method..... Differential pressure across restriction Accuracy..... ±5% of reading
Natural Gas Sensor	Detection Method..... Catalytic oxidation / Thermal conductivity Range: Catalytic oxidation..... 0 to 5% by volume methane Range: Thermal conductivity ..... 5 to 100% by volume methane Accuracy..... ±5% of reading or 0.02 % methane, whichever is greater
Battery	Voltage ..... 4.8 V, max. Type ..... Intrinsically Safe NiMH rechargeable pack Recharge Time ... 8 to 10 hrs Run Time ... >4.5 hours continuous operation @ 20 °C (68 °F)
Memory	Stores up to 1000 individual test parameters
Dimensions	18L x 12W x 7H inches (457 x 305 x178 mm)
Weight	20 lbs (0.9 kg)
Agency Approvals	Designed to be intrinsically safe for use in hazardous locations Class I, Division 1, Groups A, B, C & D in North America. CAN/CSA-C22.2 No. 157 – (June 1992). ANSI (June 27, 2002)/UL913-2002. Intrinsically Safe Apparatus and Associated Apparatus for use in Class I, Division 1, Hazardous (Classified) Locations. CE Mark – See section 8 for Declaration of Conformity statement.

∇ ∇ ∇

2 Operation

2.1 Operating Precautions

2.1.1 Limits of Use

The Hi Flow Sampler was developed for use on natural gas streams with high methane content. After introduction and industry acceptance, the instrument has been applied to additional areas in the natural gas industry, including upstream locations. These locations potentially contain less methane as a percentage of the overall mixture. As methane becomes less of the overall mixed gas stream, a response correction factor is recommended.

The response correction factor modifies Equation 1 as follows, and must be determined and applied by the user (to the measurements reported by the instrument):

$$Leak = (Flow \times (Gas_{sample} - Gas_{background}) \times 10^{-2}) \times k \qquad \textbf{Eq. 2}$$

where:

Leak	=	rate of gas leakage from source (cfm)
Flow	=	sample flow rate (cfm)
Gas_{sample}	=	concentration of gas from leak source (%)
$Gas_{background}$	=	background gas concentration (%)
k	=	response correction factor (user determined)

An alternative approach for use in mixed gas streams is to calibrate the instrument on the actual gas, in which case the response correction factor (k) is not required.

The Hi Flow instrument includes a temperature sensor and compensates for changes in density associated with temperature in the reported measurement. The Hi Flow does not however measure absolute pressure and as a result does not compensate for the effects of altitude.

2.1.2 Calibration

The instrument is calibrated to pure methane at the factory. Calibrate the instrument about every 30 days to assure its accuracy. More frequent calibrations may be required depending on how often the instrument is used and the amount of gas that was sampled. Create a maintenance log to keep track of when an instrument was calibrated, and then use this log to help develop a calibration schedule. In the case of mixed gas streams, it is recommended to calibrate prior to use each day.

2.1.3 Sensor Flooding and Poisoning

The Hi flow sensors operate in catalytic mode, from 0 up to 5% (by volume) methane concentration, and in thermal conductivity mode from 5% up to 100% methane by volume. The rapid introduction of high methane concentrations may inhibit the sensors operation in catalytic mode by starving the catalytic reaction of oxygen. Flooding the sensor in this way can result in erroneously low readings and prevent transition to thermal conductivity mode. In cases where very large leaks are suspected (approaching the limits of the instrument's measurement range, 8SCFM) the Hi Flow should be turned on sampling air adjacent to the leak and slowly moved toward the largest source of the leak. Please refer to section 2.3 for specific details on the attachments provided for leak capture.

IMPORTANT: *Avoid sampling leaded gasoline vapors, or gases or vapors that contain silicones or sulfur compounds. Tetraethyl lead, silicones, and sulfur compounds can form contaminating compounds on the sensor element (poison the sensor), with resulting loss in sensitivity.*

Always purge the instrument with clean air after testing. This removes combustibles from the sensor chambers and prolongs the life of the sensors.

2.2 Battery Connection

WARNING: *Explosion hazard! DO NOT connect or disconnect the battery in an unsafe atmosphere.*

The instrument's power cord is located inside the backpack's right-side pocket. Insert a battery pack into this pocket and connect it to the power cord.

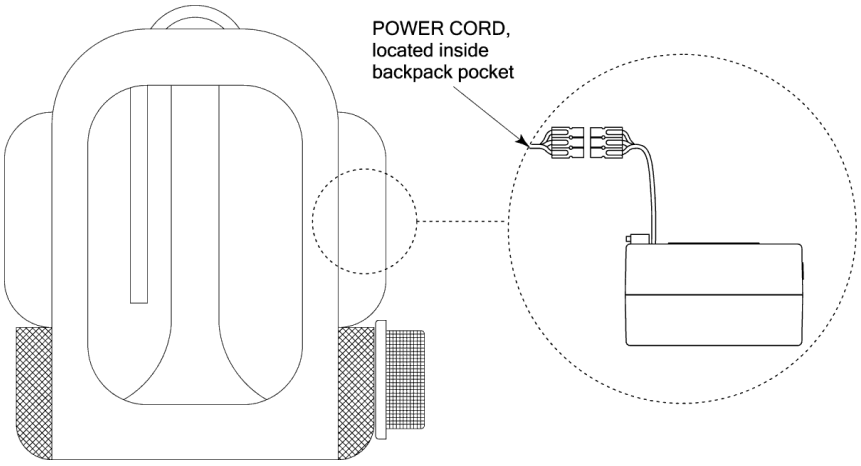


Figure 2-1. Battery Pack Connection

2.3 Sampling Hose and Attachment Connections

Connect the sampling hose to the instrument's leak-gas inlet by clamping the hose to the inlet as shown in Figure 2-2. Also connect the background gas sampling hose to the unit's BACKGROUND inlet.

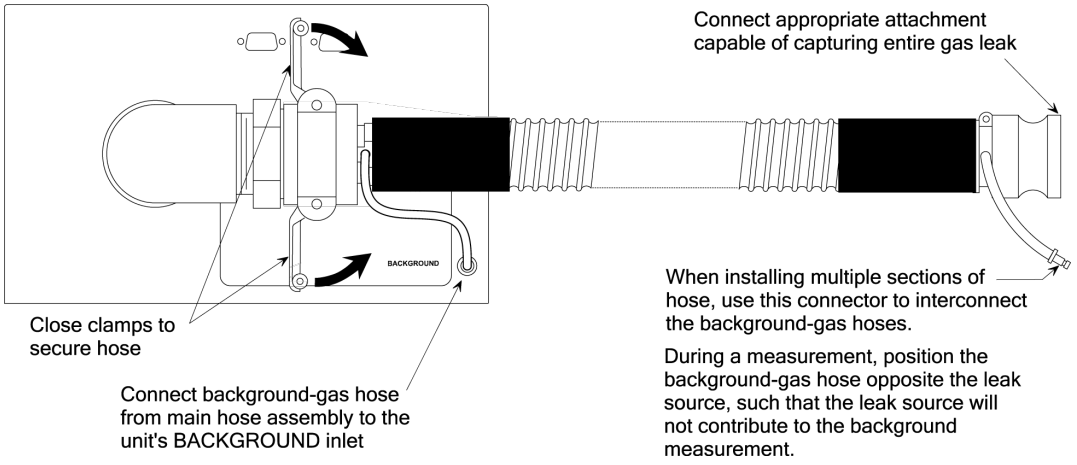


Figure 2-2. Hose and Attachment Connections

The standard sampling hose is 6 foot long. If a longer length is needed, the optional 12 foot hose (P/N 0055-0287) can be ordered, or additional sections of hose can be added by simply clamping them together along with connecting together the background-gas hose.

Choose an attachment (refer to Section *2.5 Attachments*) that will capture the entire leak and attach it to the end of the hose.

2.4 Grounding

WARNING: *To prevent the possibility of a static discharge, the Hi Flow® Sampler must be grounded while conducting a leak test.*

Attach the unit's grounding clamp to the nearest earth ground.

Tip: *When not in use, the grounding clamp can be stored by attaching it to one of the shoulder straps.*

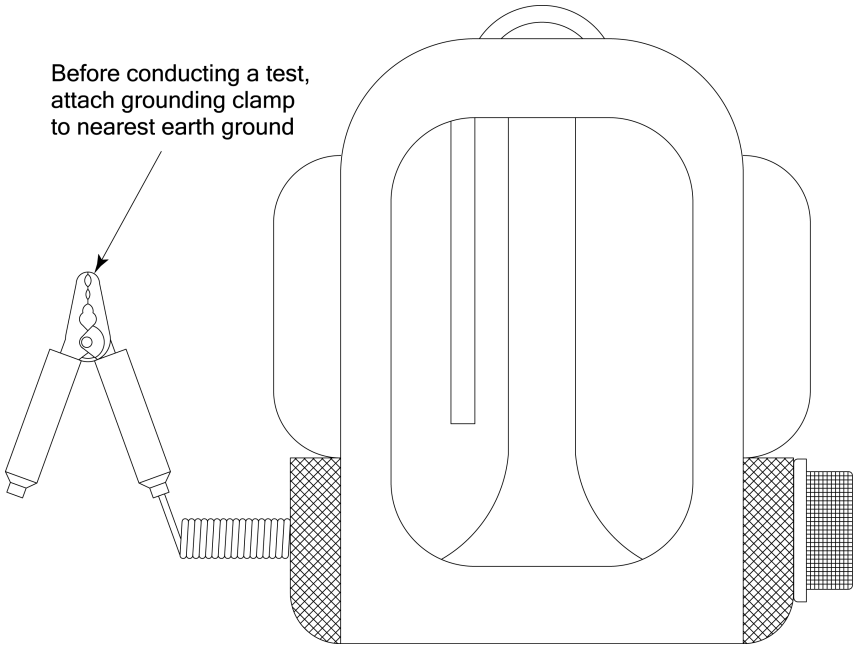


Figure 2-3. Grounding Clamp

2.5 Attachments

A variety of attachments are available for the Hi Flow® Sampler that simplifies the task of capturing the entire gas leak. Choose the appropriate attachment for the type of component being tested from the ones listed below, and then connect it to the end of the instrument's main sampling hose.

CAUTION: *Attachments can have the effect of concentrating the leak. Ensure that enough air is present when first sampling to support catalytic mode of the instrument. Flooding the sensor with high concentrations of methane at startup can result in erroneously low readings and prevent transition to thermal conductivity mode.*

2.5.1 Flange Strap (34", 80", and 137")

Flange leaks can be captured by wrapping this attachment around the edge of the flange, and securing in place using the two Velcro strips.

Attach the Hi Flow® Sampler's main sampling hose to the flange strap by simply pushing the end of the hose into the attachment's hose coupling. A click should be heard when the hose has been successfully connected. Release the hose by pushing in the coupling's release mechanism.

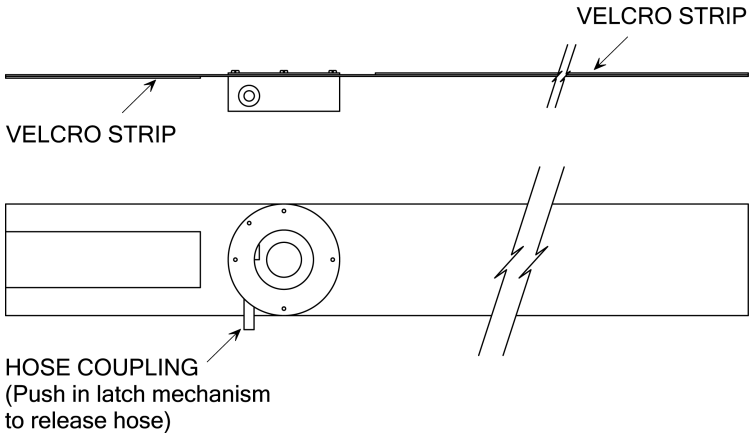


Figure 2-4. Flange Strap

2.5.2 Beveled Nozzle Tool (6.5" and 24")

For simple pin-hole type leaks, position this attachment directly over the leak source.

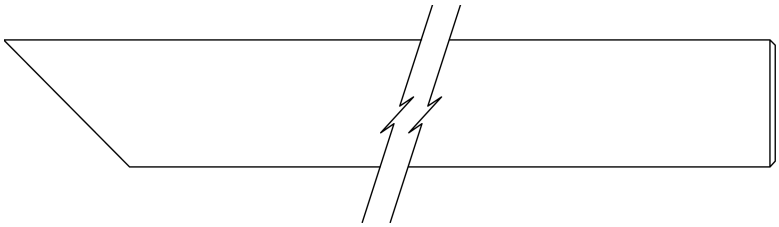


Figure 2-5. Beveled Nozzle Tool

2.5.3 Capture Bag

This reusable capture bag measures 36" x 36" and can be used to completely surround a component that may have multiple leak sources, or contains a leak source that is difficult to pinpoint or reach.

Attach the Hi Flow® Sampler's main sampling hose to the bag by simply pushing the end of the hose into the bag's hose coupling. A click should be heard when the hose has been successfully connected. Release the hose by pushing in the coupling's release mechanism.

Use the draw strings to close up the end of the bag. DO NOT, however, completely close off the bag – allow air to flow into the bag so as to replace the volume of gas and air being removed during the test.

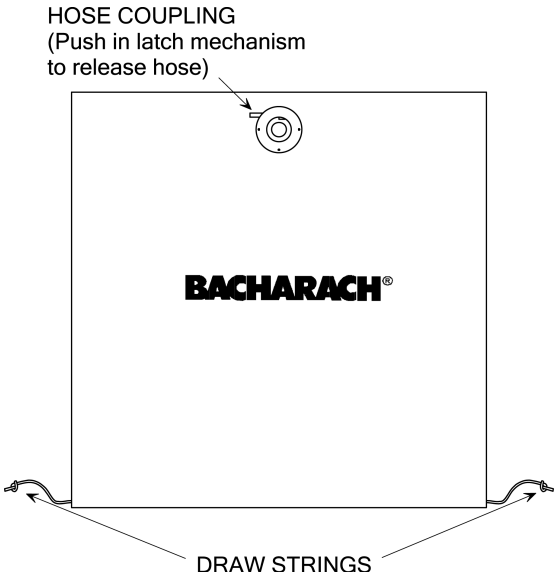


Figure 2-6. Capture Bag

2.5.4 Bellows Tool

This tool is useful in capturing leaks in valve stems and small fittings.

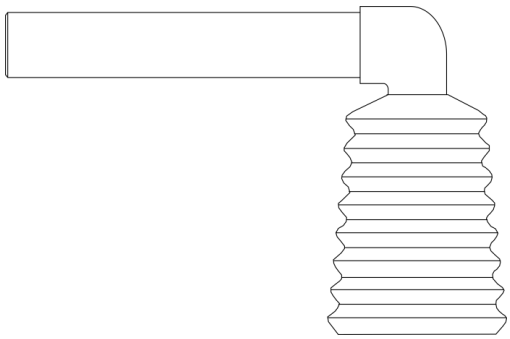


Figure 2-7. Bellows Tool

2.5.5 Aluminum Crevice Tool

Use this tool when the leak source is spread out over a narrow area, such as a crack in a pipe, square flanges, and cylinder heads.

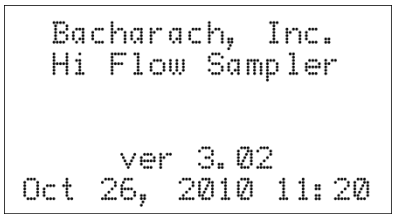
Figure 2-8. Aluminum Crevice Tool

2.6 Turning ON the Hi Flow® Sampler

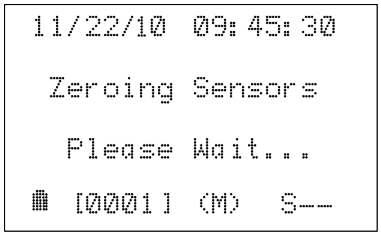
With the Hi Flow® Sampler located in an area containing clean air (no combustible gases or vapors), turn ON the instrument by flipping the ON/OFF switch to its ON position.

WARNING: *To ensure that the gas sensors are properly zeroed at startup, the Hi Flow® Sampler must be turned ON in clean air. Turning ON the instrument in air contaminated with combustible gas will cause false readings to occur. Use one of Bacharach's portable gas detection instruments to sample the surrounding area for levels of combustible gas before turning ON the instrument.*

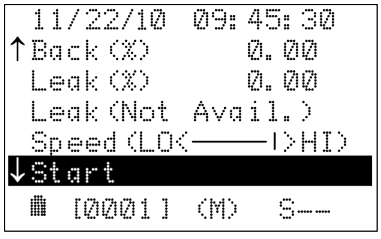
An initial banner screen is first displayed for 3 seconds that shows the instrument's name, software version, and the software's Month, Day, Year, and Time of creation.



After the banner screen is displayed, the sensors are automatically zeroed to ambient conditions. Zeroing time is dependent on the temperature of the sensors, and whether there is residual gas present inside the sensor chambers. If a sensor fails to zero, a message appears at the bottom of the LCD describing the cause of the failure. Refer to Section *6 Troubleshooting* for possible causes and remedies for this failure.



After the sensors are zeroed, either the instrument's Basic or Expanded Main Screen appears (refer to Section 2.8). The example below shows the Basic Main Screen.



The arrow symbols on the left indicate that there are more items to view above and/or below the current display.

Press the ∧ and ∨ keys to view additional items.

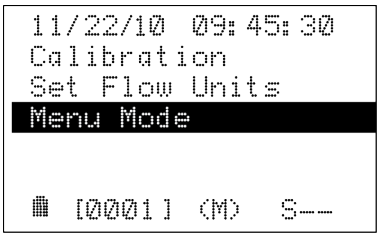
2.7 Turning OFF the Hi Flow® Sampler

Turn OFF the unit by flipping the ON/OFF switch to its OFF position.

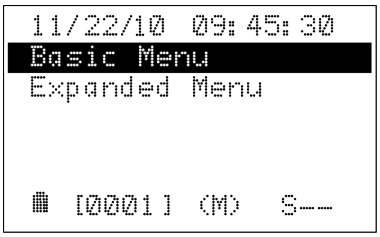
2.8 Selecting the Basic or Expanded Menu Mode

Select the Basic or Expanded Menu Mode as follows:

1. From either the Basic or Expanded Main Screen, select **Menu > Menu Mode**.



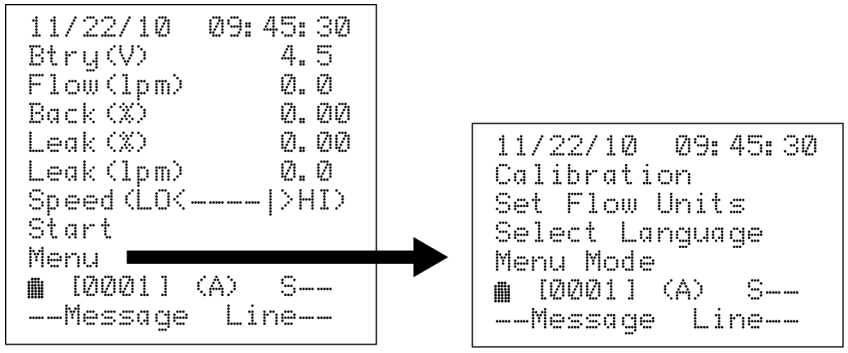
2. Highlight the desired menu mode, and then press the **I/O** ↵ key to select that mode.



3. Press **ESC** to return to the Main Screen.

Refer to Sections 2.8.1 and 2.8.2 for detailed descriptions of the information contained in the Basic and Expanded Main Screens.

2.8.1 Basic Main Mode



Date and Time: Date displayed as *mm/dd/yy*, while time is displayed in a 12-hour format. The date and time are set per Section 4.8.

Btry (V): Battery voltage

Flow (lpm): Sample flow rate in either liters/min or cu.ft./min.

Back (%): Measured background gas level in either percent-by-volume or ppm.

Leak (%): Measured natural gas leak concentration at the current sample flow rate in either percent-by-volume or ppm.

Leak (lpm): Calculated leak rate in either liters/min or cu.ft./min.*

Speed (LO<——|>HI): Blower speed indicator.

Start / Stop: Select to Start and Stop a test**

Menu: Select to display the first of several submenus (refer to Section 2.9)**

: Battery status icon (refer to Section 2.10)

[0001]: Current Test ID number

(A) or (M): Automatic or Manual mode (refer to Section 2.14)

S--: Standby
-1-: Measurement #1 (maximum flow rate)
--2: Measurement #2 (reduced flow rate)

Message Line: Various messages appear during operation describing the current function being performed, or errors that have occurred (refer to Section2.19: Message Line on page 38).

Calibration: Allows user to perform various calibration functions, including calibrate, verify, view calibration dates, view amplifier gain values, or erase calibration.

Set Flow Units: Select to set flow rate display to either lpm (liters per minute), or cfm (cubic feet per minute).

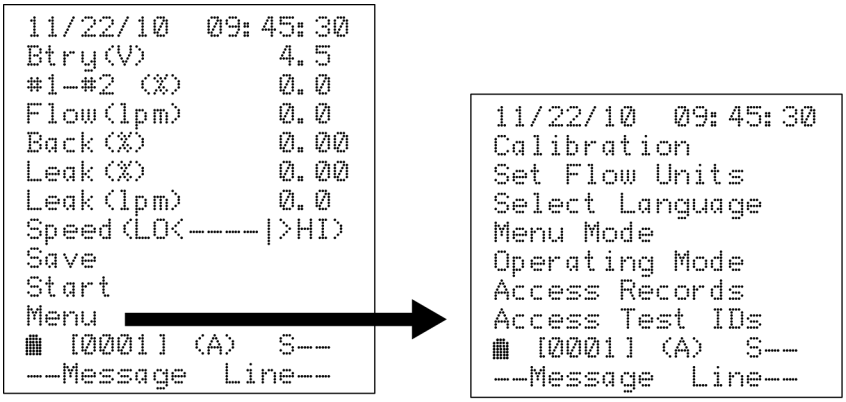
Select Language: Select to set menu language to English or Russian.

Menu Mode: Select to set menu to basic mode or expanded mode.

* "Not Avail." is displayed when a value cannot be calculated from available information.

** Selections are made by using the ∧∨ keys to highlight the desired function, and then pressing the **I/O** ↵ key to activate that function.

2.8.2 Expanded Main Mode



Date and Time: Date displayed as *mm/dd/yy*, while time is displayed in a 12-hour format. The date and time are set per Section 4.8.

Btry(V): Battery voltage

#1 – #2(%): Difference between test measurements #1 and #2 in percent*

Flow(lpm): Sample flow rate in either liters/min or cu.ft./min.

Back(%): Measured background gas level in either percent-by-volume or ppm

Leak(%): Measured natural gas leak concentration at the current sample flow rate in either percent-by-volume or ppm

Leak(lpm): Calculated leak rate in either liters/min or cu.ft./min.*

Speed (LO<——|>HI): Blower speed indicator.

Save: Select to save all current measurement parameters in memory**

Start / Stop: Select to Start and Stop a test**

Menu: Select to display the first of several submenus (refer to Section 2.9)**

: Battery status icon (refer to Section 2.10)

[0001]: Current Test ID number

(A) or (M): Automatic or Manual mode (refer to Section 2.14)

S--: Standby
-1-: Measurement #1 (maximum flow rate)
--2: Measurement #2 (reduced flow rate)

Message Line: Various messages appear during operation describing the current function being performed, or errors that have occurred (refer to Section2.19: Message Line on page 38).

Calibration: Allows user to perform various calibration functions, including calibrate, verify, view calibration dates, view amplifier gain values, or erase calibration.

Set Flow Units: Select to set flow rate display to either lpm (liters per minute), or cfm (cubic feet per minute).

Select Language: Select to set menu language to English or Russian.

Menu Mode: Select to set menu to basic mode or expanded mode.

Operating Mode: Select to set operating mode to automatic or manual mode.

Access Records: Select to send (to a PC), view (on LCD), or erase all saved records.

Access Test IDs: Create a new Test ID, edit an old one, send the Test IDs to a computer, or erase all existing Test IDs.

* "Not Avail." is displayed when a value cannot be calculated from available information.

** Selections are made by using the ∧∨ keys to highlight the desired function, and then pressing the **I/O** ↵ key to activate that function.

2.9 Menu System

Selecting **Menu** from either the Basic or Expanded Main Screen provides the user access to a system of submenus as shown in Figures 2-9 and 2-10.

The items that are listed in the submenus depend on whether the instrument is in its Basic or Expanded menu mode.

The functions listed are described in their associated sections of this manual.

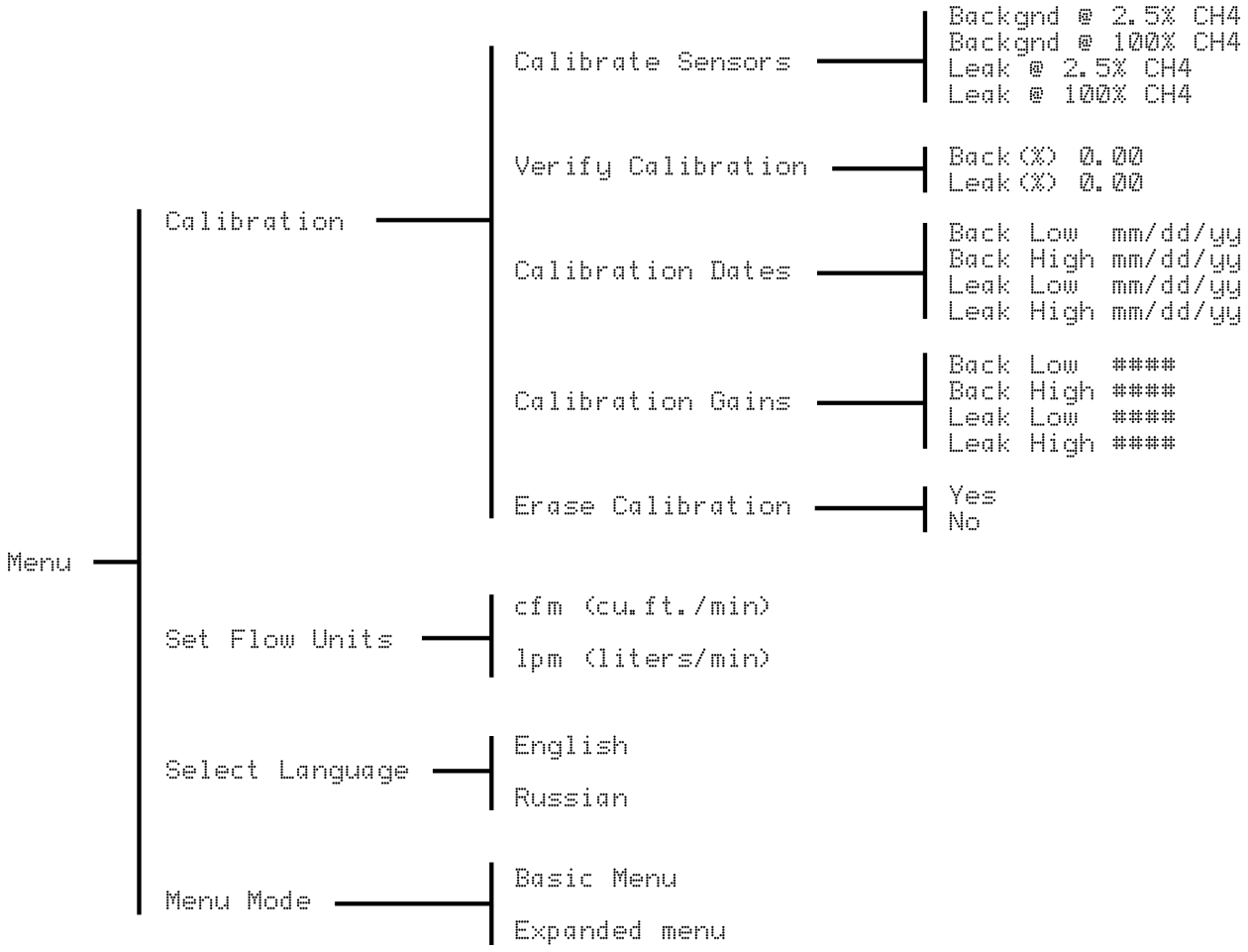


Figure 2-9. Basic Menu System

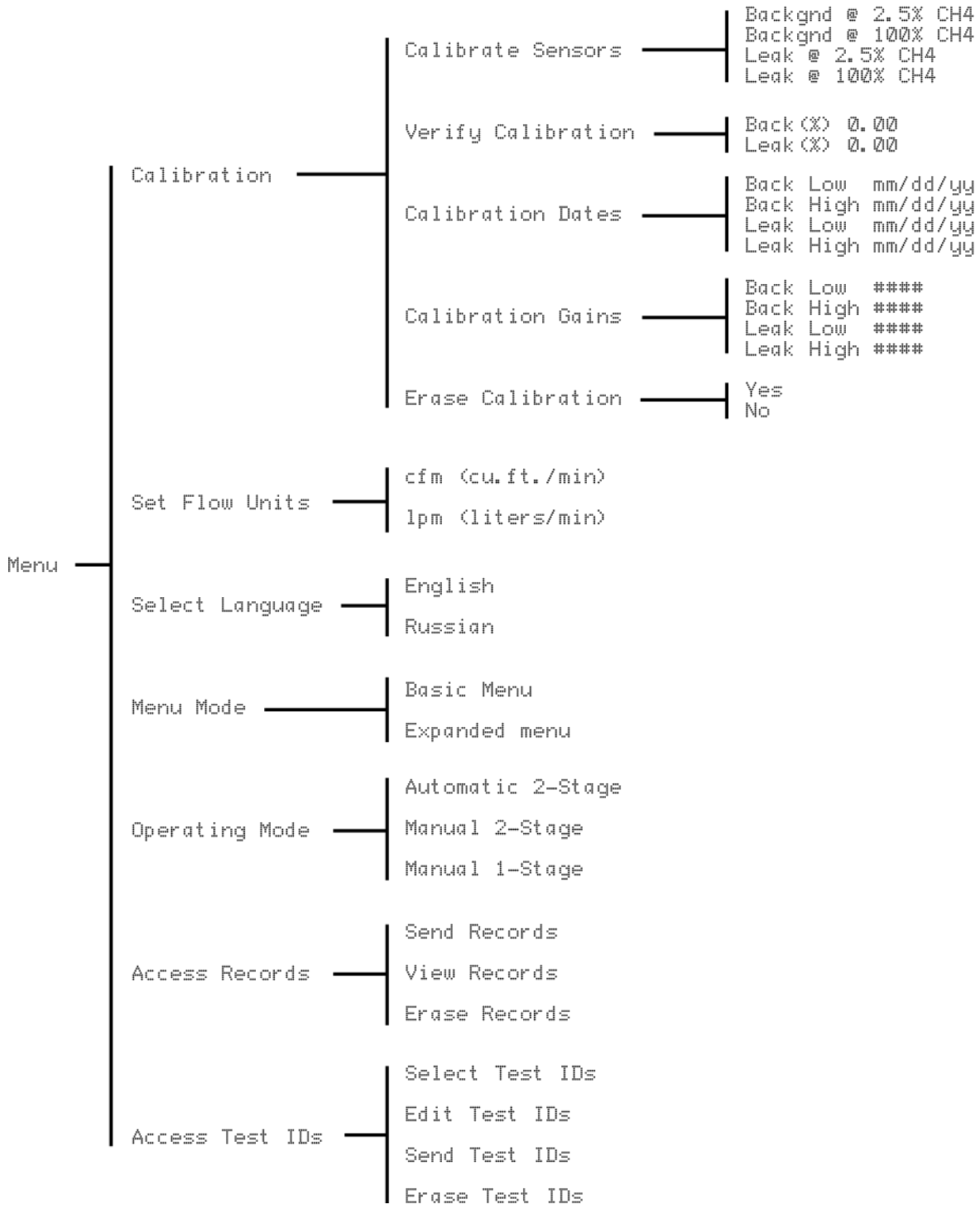


Figure 2-10. Expanded Menu System

2.10 Battery Status

Battery status is displayed as a single battery icon shown in the lower-left hand portion of the LCD. Since the voltage curve of the battery pack drops off rapidly towards the end of its charge, the Battery status icon is useful only in showing when the battery pack is nearing depletion. It does not show the pack's remaining percentage-of-charge. It does not show the pack's remaining percentage of charge.

- 4.0 volts and above
- Shutdown imminent, less than 5 minutes of operating time remain

2.11 Calibration Menu

Selecting **Calibration** from the Menu System allows the user to either:

1) calibrate the sensors
2) verify calibration
3) view dates on which calibrations were performed
4) view amplifier gain values (in hexadecimal) of each sensor circuit, or
5) erase calibration.

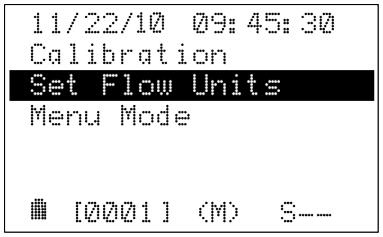
A detailed description of each calibration function is provided in Section *3 Calibration*.

2.12 Set Flow Units – LPM or CFM

Selecting **Set Flow Units** from the Menu System allows the user to select whether the flow rate is displayed in either lpm (liters per minute), or cfm (cubic feet per minute).

Select the desired flow rate unit of measure as follows.

1. From the Main Screen, select **Menu** > **Set Flow Units**.



2. Highlight the desired units of measure and then press the **I/O** ↵ key.

3. Press ESC to return to the Main Screen.

2.13 Menu Mode – Basic or Expanded

Selecting **Menu Mode** from the Menu System allows the user to select whether only the most basic amount of information is displayed on the Main Screen (Basic Menu mode), or if all available information is displayed (Expanded Menu mode).

Refer to Section *2.8 Selecting the Basic or Expanded Menu Mode* for detailed information on how to select the desired menu mode, and learn about what type of information is displayed in each mode.

2.14 Operating Mode – Automatic or Manual

Note: *The Operating Mode can only be selected if operating in the Expanded Menu Mode. Refer to Section 2.8.*

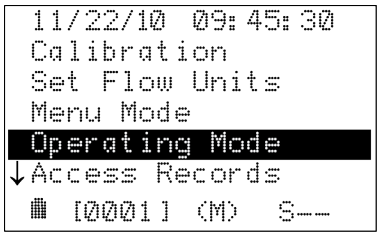
Selecting **Operating Mode** from the Expanded Menu System allows the user to set the instrument's operating mode to either Automatic or Manual.

2.14.1 Automatic 2-Stage Measurement Mode

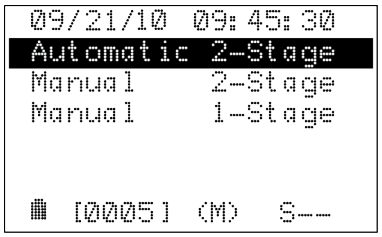
In the Automatic 2-Stage Mode the unit performs a leak rate measurement at first a high flow rate for 1 minute, and then automatically shifts to a lower flow rate and performs another measurement for another minute. The final measured and calculated values are automatically saved in memory. This mode is used to measure leaks that are easily identifiable and captured.

Select the automatic measurement mode as follows:

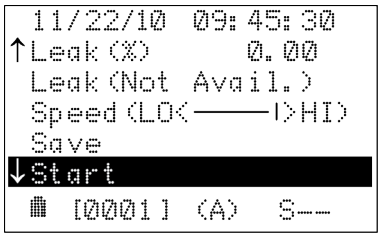
1. From the Expanded Main Screen, select **Menu** > **Operating Mode**.



2. Highlight **Automatic 2-Stage**, and then press the **I/O** ↵ key.



3. Press **ESC** to return to the Main Screen. Observe that (A) should appear at the bottom of the screen.

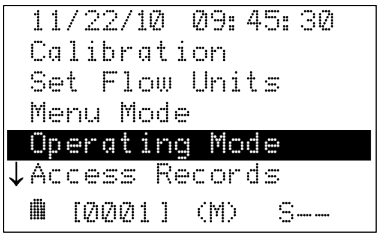


2.14.2 Manual Measurement Mode

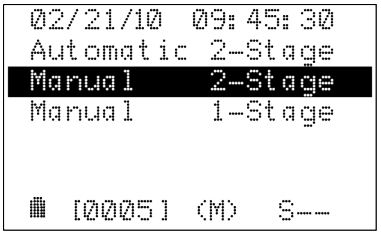
2.14.2.1 Manual 2-Stage Mode

In the Manual 2-Stage mode the user starts a measurement at a high flow rate, waits for a stable leak rate reading, and then *manually* saves the readings using the **Save** function. The unit then automatically lowers the flow rate, at which time the user makes a second leak rate measurement. After waiting for the leak rate reading to once again stabilize, the user then *manually* saves all final measured and calculated measurements in memory. This mode is used when more control of the leak rate measurement process is required. Select Manual 2-Stage operation as follows.

1. From the Expanded Main Screen, select **Menu** > **Operating Mode**.



2. Highlight **Manual 2-Stage**, and then press the **I/O** ↵ key.

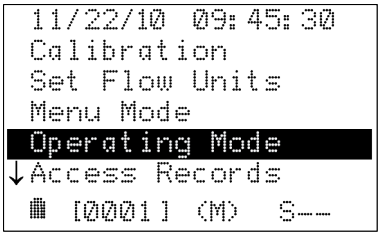


3. Press **ESC** to return to the Main Screen. Observe that (M) should appear at the bottom of the screen.

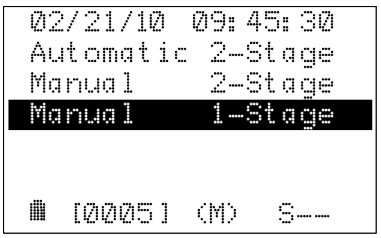
2.14.2.2 Manual 1-Stage Mode

In the Manual 1-Stage mode the user starts a measurement at a high flow rate and then waits for a stable leak rate reading to occur. During this time the flow rate can be changed using the **Speed** function on the Main Screen. After a stable leak rate reading is obtained, the user can *manually* save all final measured and calculated values in memory using the **Save** function on the Expanded Main Screen. This mode is used when more control of the leak rate measurement process is required. Select Manual 1-Stage operation as follows:

1. From the Expanded Main Screen, select **Menu** > **Operating Mode**.



2. Highlight **Manual 1-Stage**, and then press the **I/O ↵** key.



3. Press **ESC** to return to the Main Screen. Observe that (M) should appear at the bottom of the screen.

2.15 Access Records

Note: *Send Records can only be selected if operating in the Expanded Menu Mode. Refer to Section 2.8.*

Selecting **Access Records** from the Expanded Menu System allows a user to either:
1) send all saved records to a personal computer,
2) view the records on the unit's LCD screen, or
3) erase all saved records.

2.15.1 Send Records

All the measured and calculated values that were saved in memory can be downloaded to a personal computer as comma-delimited ASCII text, which can later be imported into most spreadsheet programs for analysis.

The following describes how to download saved records to a computer that is running Windows® HyperTerminal as the communications program. If a different operating system and/or communications program is being used, then please consult the appropriate instruction manuals for those products.

Note: *Send Records can only be selected if operating in the Expanded Menu Mode. Refer to Section 2.8.*

1. Install serial data cable P/N 104-4027 (straight through, 6 foot, DB9 male to DB9 female) between the computer's COM port and the COMPUTER connector of the Hi Flow®. (For computers having a 25-pin or USB COM port, the user must supply the appropriate adapter, or use a serial cable with appropriate connectors on each end.)

2. On the computer, start HyperTerminal by doing one of the following:

   - If HyperTerminal has already been set up to communicate with the Hi Flow® Sampler, then select **Start** > **Programs** > **Accessories** > **Communications** > **HyperTerminal**, and double-click the filename or icon that has been associated with the instrument.

   - If HyperTerminal has never been run in association with the Hi Flow® Sampler, then a new HyperTerminal connection needs to be made as follows:

     a. Select **Start** > **Run**. In the Run box type "hypertrm.exe" and click **OK.** The **New Connection** dialog box should appear.

     b. Type in a New Connection Name such as "HiFlow". Click **OK** to select the default icon (if desired, select a different icon before clicking OK). The **Connect To** dialog box should appear.

c. Click the **Connect using** drop-down menu and choose the **COM** port to which the Hi Flow® is connected. Then click **OK** to display the **COM Properties** dialog box for that COM port.

d. Set Port Settings to:
   - Bits per second: 115200
   - Data bits: 8
   - Parity: None
   - Stop bits: 1
   - Flow control: None

   Then click **OK** to display HyperTerminal's main window.

e. Click **File > Save**. This creates a file with an .ht extension using the name that was entered in Step b.

3. After HyperTerminal is running: click **Transfer** > **Capture Text** > **Start** to accept the default drive\directory\filename to which all received data will be stored as an ASCII text file.

Note: *The captured text file will be stored on the hard drive in the folder shown in the File dialog box. If desired, click **Browse** to select a different drive, directory and filename. The next time data is captured, it will be stored under the same location and filename.*

Tip: *Changing the filename extension to "CSV" (comma separated variable) will allow the file to be directly opened in the spreadsheet program. For example, double clicking the filename CAPTURE.CSV in Windows Explorer will automatically start Microsoft Excel and load the file.*

4. From the High Flow Sampler's Expanded Main Screen, start the download process by selecting **Menu** > **Access Records** > **Send Records**.

Observe that the Hi Flow® LCD displays the message "Sending record x of y @ 115.2kbps," where "x" is the current record being sent and "y" is the number of records in memory. Also observe that HyperTerminal displays the data as its being received.

5. After all data has been transmitted, stop HyperTerminal from capturing data by clicking **Transfer** > **Capture Text** > **Stop**.

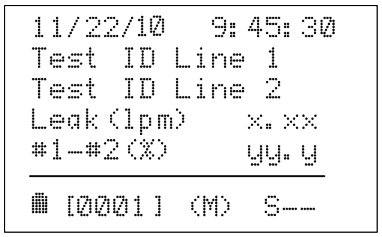
6. The saved data can now be viewed in a spreadsheet for analysis as described in Section *2.16 Importing Saved Data into a Spreadsheet*.

2.15.2 View Records

View the records stored in memory on the unit's LCD screen as follows:

1. Access the Review Record Screen from the Expanded Main Screen by selecting **Menu > Access Records > View Records**. This screen allows the user to view a short summary of each record stored in memory. If no records are in memory, then the message "No Records Saved" briefly appears in the message line.

   The first two lines in this screen contain the Test ID information as entered per Section *2.17 Access Test IDs*.



   Where: x.xx is the recorded leak rate in ether lpm or cfm
   yy.y is the percent difference between measurements #1 and #2

2. Use the ∧∨ keys to scroll through the saved records.

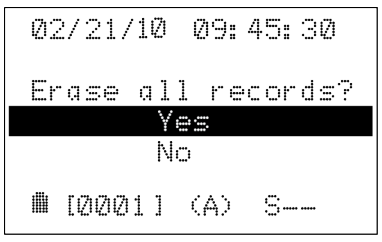
3. Press **ESC** three times to return to the Main Screen.

2.15.3 Erase Records

Erase all records from memory as follows:

1. From the Expanded Main Screen, select **Menu** > **Access Records** > **Erase Records**.

2. Confirm or cancel the erase process by selecting **Yes** or **No**.



3. Observe the message "Erasing all records" appears at the bottom of the display during the erase process.

2.16 Importing Saved Data into a Spreadsheet

Test records that were downloaded to a personal computer per Section 2.15.1 can be imported into spreadsheet programs that are capable of importing comma-delimited files. Note that each data record consists of 24 fields, some of which may be blank because of options not being installed.

TABLE 2-1. COMMA-DELIMITED FIELDS

Field	Label in Column Heading	Description
1	Record#	Test Record Number
2	Inst. Serial #	Instrument's Serial Number
3	Date#1(MM/DD/YY)	Date (Measurement #1)
4	Time#1(HH:MM:SS)	Time (Measurement #1)
5	Btry#1(V)	Battery Voltage (Measurement #1)
6	Flow#1(cfm)	Sample Flow Rate (Measurement #1) in cfm
7	Back#1(%)	Background Gas Level (Measurement #1) in %
8	Leak#1(%)	Sample Leak Rate (Measurement #1) in %
9	Leak#1(cfm)	Leak Rate of Component Under Test (Measurement #1) in cfm
10	Date#2(MM/DD/YY)	Date (Measurement #2)
11	Time #2(HH:MM:SS)	Time (Measurement #2)
12	Btry#2(V)	Battery Voltage (Measurement #2)
13	Flow#2(cfm)	Sample Flow Rate (Measurement #2) in cfm
14	Back#2(%)	Background Gas Level (Measurement #2) in %
15	Leak#2(%)	Sample Leak Rate (Measurement #2) in %
16	Leak#2(cfm)	Leak Rate of Component Under Test (Measurement #2) in cfm
17	Leak#1-#2(%)	Percent Difference Between Leak Measurements #1 and #2
18	Error Codes	Error Codes identifying problems that occurred during the test (refer to Section *5.3 Error Codes in Saved Test Records*)
24	Test Description	Test ID Information (refer to Section *3.15 Access Test IDs*)

TABLE 2-2. TYPICAL SPREADSHEET

RECORD #	INSTRUMENT SERIAL #	DATE #1 (MM/DD/YY)	TIME #1 (HH:MM:SS)	BTRY #1 (V)	FLOW #1 (CFM)	BACK #1 (%)	LEAK #1 (%)	LEAK #1 (CFM)
1	123456	01/20/09	10:15:05	4.9	9.9	0.0350	15.1500	1.49
2	123457	01/20/09	11:25:30	4.8	9.8	0.0155	21.3250	2.09

DATE #2 (MM/DD/YY)	TIME #2 (HH:MM:SS)	BTRY #2 (V)	FLOW #2 (CFM)	BACK #2 (%)	LEAK #2 (%)	LEAK #2 (CFM)	LEAK #1-#2 (%)	ERROR CODES
01/20/09	10:16:05	4.9	7.4	0.0375	21.2300	1.5	5.0	
01/20/09	11:27:45	4.8	7.3	0.0245	29.1800	2.1	1.8	

TEST DESCRIPTION
Test Location 1 Operator John Doe
Test Location 2 Operator John Doe

Row 1: Column Headings
Row 2: Record 1, Typical Test Automatic Mode
Row 3: Record 2

The following describes how to generate a spreadsheet from a comma-delimited text file using Microsoft® Excel 2000. If a different spreadsheet program is being used, then please refer to its instruction manual for information on how to import comma-delimited text files.

Tip: *If the text file was saved with the filename extension "CSV" as described in Section 2.15.1, a spreadsheet will automatically be created when that file is opened in Microsoft Excel.*

1. Start Microsoft Excel.
2. Click **File**, then click **Open** to display the **Open** dialog box.
3. Change the **Files of type:** to **Text Files**. Then navigate to the directory containing the text file to be imported.
4. Double-click the desired filename to display the *Text Import Wizard – Step 1 of 3* dialog box.
5. Select the **Delimited** radio button; then click **Next** to display the *Text Import Wizard – Step 2 of 3* dialog box.
6. Under **Delimiters**, select the **Comma** check box. Then click **Next** to display the *Text Import Wizard – Step 3 of 3* dialog box.
7. Click **Finish** to create the spreadsheet.

2.17 Access Test IDs

Note: *Access Test IDs can only be selected if operating in the Expanded Menu Mode. Refer to Section 2.8.*

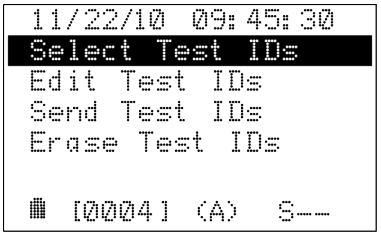
Saved test records can be identified (e.g., location of test, type of test, name of operator, etc.) by manually entering up to two lines of text, with each line containing a maximum of 20 alphanumerical characters. This information will be associated with all succeeding tests, and will appear when the test record is either viewed or printed. The chosen Test ID remains in effect until a new Test ID is selected.

Selecting **Access Test IDs** from the Expanded Menu System allows the user to select a previously entered Test ID, create a new Test ID or edit an old one, send the Test IDs to a computer, or erase all existing Test IDs.

2.17.1 Select Test IDs

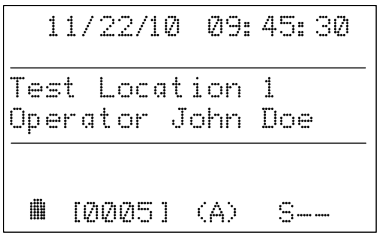
Select a Test ID as follows:

1. From the Expanded Main Screen, select **Menu** > **Access Test IDs** > **Select Test IDs**.

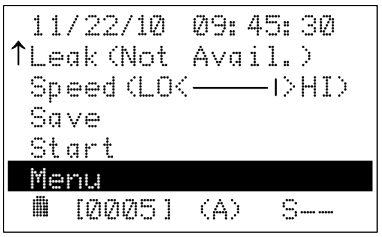


2. Use the ∧∨ keys to scroll through any previously stored Test IDs until the desired ID is displayed. In the example below, Test ID 0005 has been chosen.

   Tip: *To quickly scroll through the Test IDs, press and hold down the* ∧ or ∨ *key.*



3. Select the displayed Test ID by pressing the **I/O** ↵ key, and then return to the Main Screen by pressing **ESC** twice. Observe that [0005] is now displayed at the bottom of the screen.

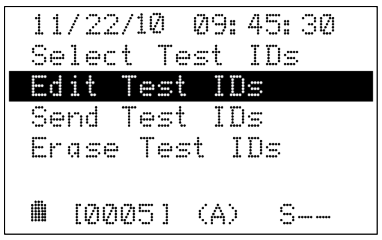


2.17.2 Edit Test IDs

Edit a previously entered Test ID or to create a new one as follows:

1. First select the Test ID to edit per Section *2.17.1 Select Test IDs*. To create a new Test ID, select the last Test ID number that can be displayed – the last Test ID number will always be blank.

2. From the Expanded Main Screen, select **Menu** > **Access Test IDs** > **Edit Test IDs**.

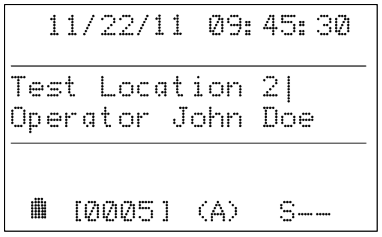


3. Use the following keys to select and then enter the desired character.
   - ∧∨ – displays desired alphanumerical character
   - **I/O** ↵ – selects displayed character and moves cursor one space to the right
   - **ESC** – moves cursor one space to the left

   Tip: *To quickly scroll through the characters, press and hold down the* ∧ or ∨ *key.*

   Tip: *The "space" character is between the number "9" and the capital "A".*

   In the example below, the Test Location has been changed from 1 to 2 with the cursor positioned to the immediate right of the number 2.



4. After all characters have been selected, press and hold down the **I/O** ↵ key to move the cursor to the end of the screen; after which, the screen shown in Step 2 should reappear.

5. Press the **ESC** key twice to return to the Main Screen.

2.17.3 Send Test IDs

The following describes how to download the current list of Test IDs to a computer that is running Windows® HyperTerminal as the communications program. If a different operating system and/or communications program is being used, then please consult the appropriate instruction manuals for those products.

1. Install serial data cable P/N 104-4027 (straight through, 6 foot, DB9 male to DB9 female) between the computer's COM port and the Hi Flow® COMPUTER connector. (For computers having a 25-pin or USB COM port, the user must supply the appropriate adapter, or use a serial cable with appropriate connectors on each end.)

2. On the computer, start HyperTerminal by doing one of the following:

   - If HyperTerminal has already been set up to communicate with the Hi Flow® Sampler, then select **Start** > **Programs** > **Accessories** > **Communications** > **HyperTerminal**, and double-click the filename or icon that has been associated with the instrument.

   - If HyperTerminal has never been run in association with the Hi Flow® Sampler, then a new HyperTerminal connection needs to be made as follows:

     a. Select **Start** > **Run**. In the Run box type "hypertrm.exe" and click **OK.** The **New Connection** dialog box should appear.

     b. Type in a New Connection Name such as "HiFlow". Click **OK** to select the default icon (if desired, select a different icon before clicking OK). The **Connect To** dialog box should appear.

     c. Click the **Connect using** drop-down menu and choose the **COM** port to which the Hi Flow® is connected. Then click **OK** to display the **COM Properties** dialog box for that COM port.

     d. Set Port Settings to:
        - Bits per second: 115200
        - Data bits: 8
        - Parity: None
        - Stop bits: 1
        - Flow control: None

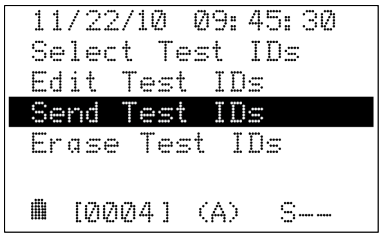
        Then click **OK** to display HyperTerminal's main window.

     e. Click **File > Save**. This creates a file with an .ht extension using the name that was entered in Step b.

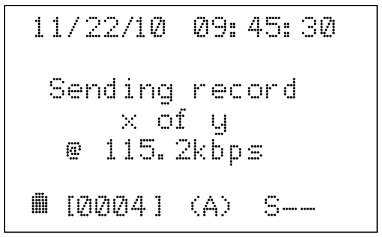
3. After HyperTerminal is running: click **Transfer** > **Capture Text** > **Start** to accept the default drive\directory\filename to which all received data will be stored as an ASCII text file.

Note: *The captured text file will be stored on the hard drive in the folder shown in the File dialog box. If desired, click **Browse** to select a different drive, directory and filename. The next time data is captured, it will be stored under the same location and filename.*

4. From the High Flow Sampler's Expanded Main Screen, start the download process by selecting **Menu** > **Access Test IDs** > **Send Test IDs**.



Observe that the Hi Flow® LCD displays the message "Sending record x of y @ 115.2kbps," where "x" is the current record being sent and "y" is the number of records in memory. Also observe that HyperTerminal displays the data as its being received.



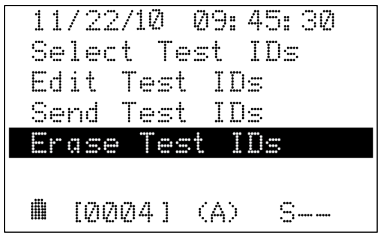
5. After all data has been transmitted, stop HyperTerminal from capturing data by clicking **Transfer** > **Capture Text** > **Stop**.

6. The saved data can now be viewed on the computer using any program capable of displaying "txt" files.

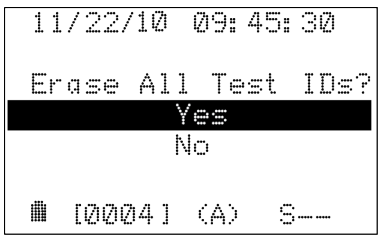
2.17.4 Erase Test IDs

Erase all Test ID information and reset the Test ID index back to 0001 as follows:

1. From the Expanded Main Screen, select **Menu** > **Access Test IDs** > **Erase Test IDs**.



2. Select **Yes** to erase all Test ID information, or select **No** to return to the previous screen.



3. Press **ESC** twice to return to the Main Screen.

2.18 Making a Leak Rate Measurement

Before making a leak rate measurement, the user must decide whether to use . . .

- the Basic or Expanded Menu Mode (Section 2.8)
- lpm or cfm for the flow rate (Section 2.12)
- the Automatic 2-Stage, Manual 2-Stage, or Manual 1-Stage method of making a measurement when operating in the Expanded Menu Mode (Section 2.14)
- a Test ID when operating in the Expanded Menu Mode (Section 2.17)

2.18.1 Leak Rate Measurement – Basic Menu Mode

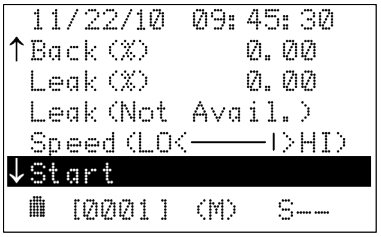
While operating in the Basic Menu Mode, the user starts a measurement at a high flow rate and then waits for a stable leak rate reading to occur. During this time the flow rate can be changed using the **Speed** function on the Main Screen. This mode is used when more control of the leak rate measurement process is required, and when saving data is not desired.

1. If not already done, place the instrument into its Basic Menu Mode per Section *2.8 Selecting the Basic or Expanded Menu Mode*.

2. Choose an attachment that will ensure the complete capture of the gas leak. Connect this attachment to the end of the Hi Flow® Sampler's main sampling hose and position the attachment's inlet over the leak source.

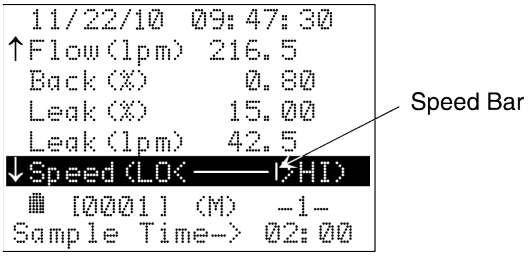
3. Position the inlet of the instrument's background gas sampling hose opposite the leak source, such that the leak source will not contribute to the background measurement.

4. Select **Start** from the Main Screen.

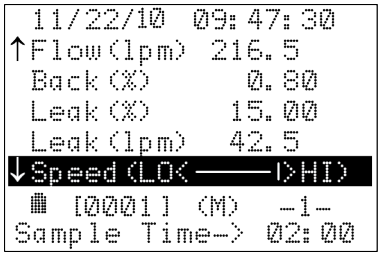


5. Begin measuring until a stable leak measurement is achieved—this may take several minutes.

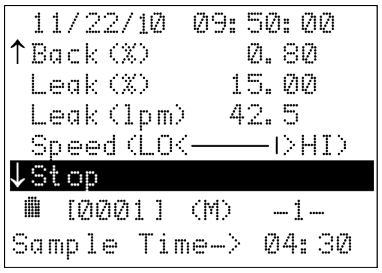
   If desired, the flow rate can be manually controlled by using the **Speed** function. Each press of the **I/O** ↵ key will lower the flow rate as indicated by the speed bar moving to the left.



6. In the example below, the current flow rate is 216.5 lpm, the background gas concentration is 0.8%, the leak concentration is 15% gas, and the calculated leak rate is 42.5 lpm.



7. The measurement process continues until **Stop** is selected.



2.18.2 Leak Rate Measurement – Automatic 2-Stage Mode

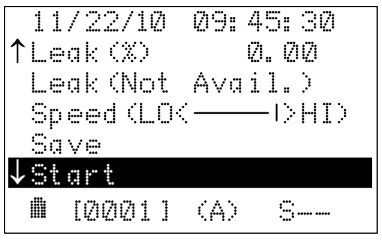
Note: *The Automatic 2-Stage Mode can only be selected if operating in the Expanded Menu Mode. Refer to Section 2.8.*

1. If not already done, place the instrument into its Automatic 2-Stage measurement mode (denoted by the letter (A) appearing at the bottom of the screen). Refer to Section *2.14.1 Automatic 2-Stage Measurement Mode.*

2. Choose an attachment that will ensure the complete capture of the gas leak. Connect this attachment to the end of the Hi Flow® Sampler's main sampling hose and position the attachment's inlet over the leak source.

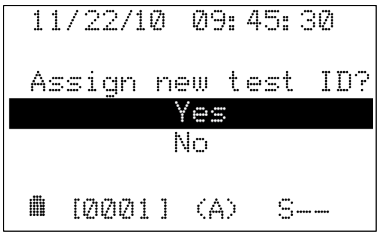
3. Position the inlet of the instrument's background gas sampling hose opposite the leak source, such that the leak source will not contribute to the background measurement.

4. Begin the measurement process by selecting **Start** from the Main Screen.

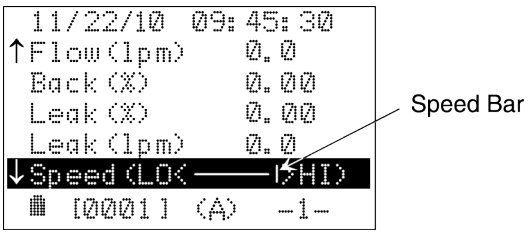


5. The user is now asked to choose a new or different Test ID.

   Selecting **Yes** causes the Access Records menu to appear (refer to Section 2.15). After selecting or creating a new Test ID, start the measurement by pressing **ESC** until the Main Screen appears. Selecting **No** returns the display to the Main Screen and starts the measurement using the current Test ID.



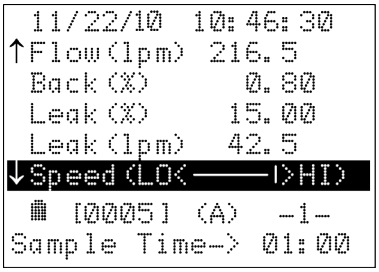
6. (Optional) The instrument normally controls the flow rate for measurements #1 and #2; however, the user can manually set the flow rate using the **Speed** function. Each press of the **I/O** ↵ key will lower the flow rate as indicated by the speed bar moving to the left.

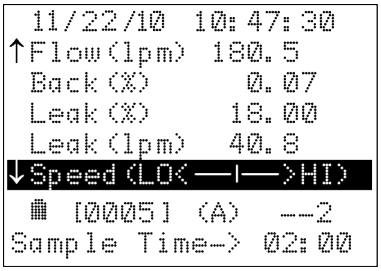


7. After both measurements are complete, the values in the Main Screen are put on hold (as indicated by "H--" appearing at the bottom of the screen), allowing the user to make note of these values before turning off the instrument or proceeding to the next measurement.

   In the examples below, the measured leak concentration was 15% gas during the first measurement and 18% gas in the second, while the calculated leak rates were 42.5 and 40.8 lpm, respectively. A difference of 4%.

IMPORTANT: *For a test to be considered valid, the percent difference between measurements #1 and #2 must be less than 10%. Scroll up to the **#1–#2** function on the Main Screen to see the percent difference between the last two measurements.*





8. When in the automatic mode, measurements are automatically saved. These saved measurements along with their associated Test IDs can be downloaded to a personal computer at a later time for analysis. Refer to Section *2.16 Importing Saved Data into a Spreadsheet*.

2.18.3 Leak Rate Measurement – Manual 2-Stage Mode

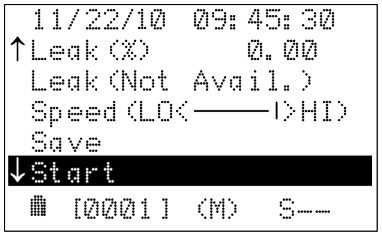
Note: *The Manual 2-Stage Mode can only be selected if operating in the Expanded Menu Mode. Refer to Section 2.8.*

1. If not already done, place the instrument into its Manual 2-Stage mode. Refer to Section *2.14.2.1 Manual 2-Stage Mode*.

2. Choose an attachment that will ensure the complete capture of the gas leak. Connect this attachment to the end of the Hi Flow® Sampler's main sampling hose and position the attachment's inlet over the leak source.

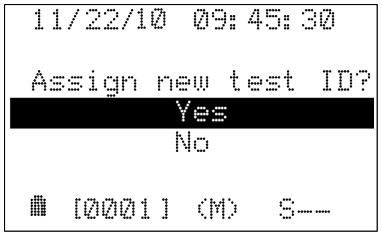
3. Position the inlet of the instrument's background gas sampling hose opposite the leak source, such that the leak source will not contribute to the background measurement.

4. Begin the measurement process by selecting **Start** from the Main Screen.



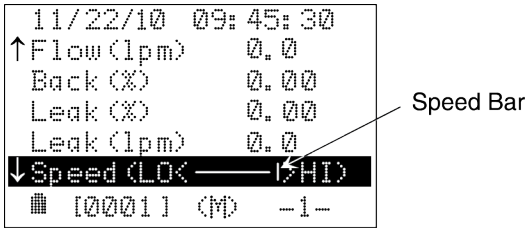
5. The user is now asked to choose a new or different Test ID.

   Selecting **Yes** causes the Access Records menu to appear (refer to Section 2.15). After selecting or creating a new Test ID, start the measurement by pressing **ESC** until the Main Screen appears. Selecting **No** returns the display to the Main Screen and starts the measurement using the current Test ID.



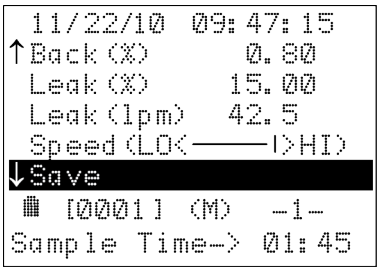
6. Begin measuring at the first flow rate until a stable leak measurement is achieved—this may take several minutes.

   If desired, the flow rate can be manually controlled by using the **Speed** function. Each press of the **I/O ↵** key will lower the flow rate as indicated by the speed bar moving to the left.



7. Once a stable leak measurement is obtained, highlight **Save** and press the **I/O** ↵ key. Observe that the measurement is saved in memory, and that the flow rate is automatically lowered.

   In the example below, the measured leak concentration for measurement #1 was 15% gas, and the calculated leak rate was 42.5 lpm.

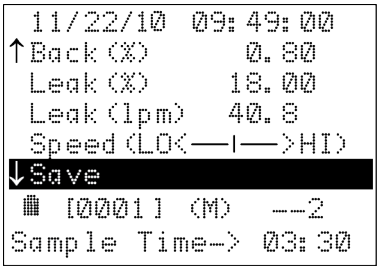


8. Continue sampling at the reduced flow rate until once again a stable leak measurement is achieved. If desired, the flow rate can again be manually controlled by using the **Speed** function.

   With **Save** highlighted, press the **I/O** ↵ key to save measurement #2 in memory. The blower then stops and the values in the Main Screen are put on hold (as indicated by "H——" appearing at the bottom of the screen), allowing the user to make note of these values before turning off the instrument or proceeding to the next measurement.

   In the example below, the leak concentration was 18% gas, the leak rate was 40.8 lpm, and the percent difference between measurements #1 and #2 was 4%.

⚠ **IMPORTANT:** *For a test to be considered valid, the percent difference between measurements #1 and #2 must be less than 10%. Scroll up to the **#1–#2** function on the Main Screen to see the percent difference between the last two measurements.*



9. Saved measurements can be downloaded to a personal computer at a later time for analysis. Refer to Section *2.16 Importing Saved Data into a Spreadsheet*.

2.18.4 Leak Rate Measurement – Manual 1-Stage Mode

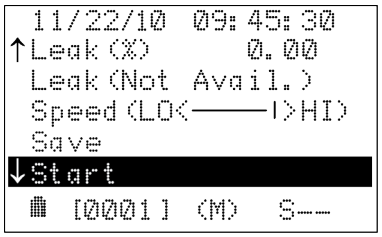
Note: *The Manual 1-Stage Mode can only be selected if operating in the Expanded Menu Mode. Refer to Section 2.8.*

1. If not already done, place the instrument into its Manual 1-Stage mode. Refer to Section 2.14.2.2**Error! Reference source not found.**.

2. Choose an attachment that will ensure the complete capture of the gas leak. Connect this attachment to the end of the Hi Flow® Sampler's main sampling hose and position the attachment's inlet over the leak source.

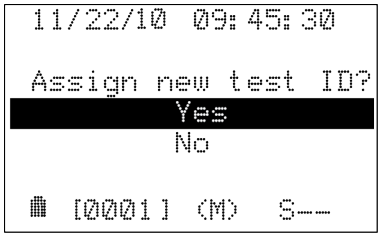
3. Position the inlet of the instrument's background gas sampling hose opposite the leak source, such that the leak source will not contribute to the background measurement.

4. Begin the measurement process by selecting **Start** from the Main Screen.



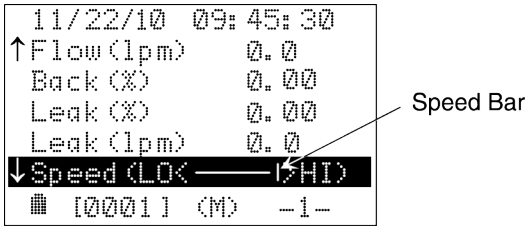
5. The user is now asked to choose a new or different Test ID.

   Selecting **Yes** causes the Access Records menu to appear (refer to Section 2.15). After selecting or creating a new Test ID, start the measurement by pressing **ESC** until the Main Screen appears. Selecting **No** returns the display to the Main Screen and starts the measurement using the current Test ID.



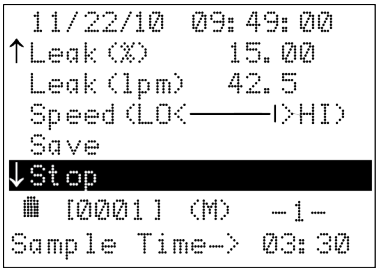
6. Begin measuring until a stable leak measurement is achieved—this may take several minutes.

   If desired, the flow rate can be manually controlled by using the **Speed** function. Each press of the **I/O** ↵ key will lower the flow rate as indicated by the speed bar moving to the left.

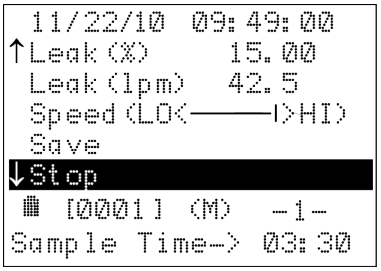


7. Once a stable leak measurement is obtained, all current readings can be saved in memory by highlighting **Save** and pressing the **I/O** ↵ key.

   In the example below, the current measured leak concentration is 15% gas, and the calculated leak rate is 42.5 lpm.



8. The measurement process continues until **Stop** is selected.



9. Measurements that were saved can be downloaded to a personal computer at a later time for analysis. Refer to Section *2.16 Importing Saved Data into a Spreadsheet*.

2.19 Message Line

Various messages will appear at the bottom of the LCD that describe what functions are currently being performed or errors that have been detected. The following list describes the meaning of these messages.

Note that detailed explanations of the error messages can be found in Section 5.2 *Troubleshooting Guide*.

TABLE 2-3. Message Line Explanations

Message	Explanation
Calibration Passed	Calibration procedure was successful.
Calibration Failed	Error – The calibration procedure was *not* successful. Refer to Section 5.2.
Saving Record	A test record is currently being saved to memory.
Memory Full	Error – The instrument tried to save a test record with 1000 records already stored in memory. Refer to Section 5.2.
No Records Saved	An attempt was made to send records to a computer with *no* test records stored in memory.
Flow Rate Lowered	The flow rate has just been lowered signaling the start of measurement #2 during an automatic or manual leak test. Refer to Section 2.14.
Erasing All Records	All test records are being erased after selecting “Erase records” per Section 2.15.3.
Check Background Pump	Error – The background-gas pump’s flow rate has been severely reduced. Refer to Section 5.2.
Check Leak Pump	Error–The leak-gas pump’s flow rate has been severely reduced. Refer to Section 5.2.

Message	Explanation
Check Background Calibration	Error – The background-gas sensor needs calibrated. Refer to Section 5.2.
Check Leak Calibration	Error – The leak-gas sensor needs calibrated. Refer to Section 5.2.
Check Background Offset	Error – The background-gas sensor did not properly zero during startup. Refer to Section 5.2.
Check Leak Offset	Error – The leak-gas sensor did not properly zero during startup. Refer to Section 5.2.
Check Zeroing Bypassed	Error – The ESC key was pressed during start up, thus bypassing the normal sensor-zeroing process. Refer to Section 5.2.
Check Leak Rate Difference	Error–The calculated leak rate difference between measurements #1 and #2 during an automatic or manual leak test was greater than 100%. Refer to Section 5.2.
Check Background Greater Than Leak	Error–The measured background gas level was greater than the measured leak gas concentration. Refer to Section 5.2.
Sample Time	The amount of time that a leak rate measurement has been in progress.
Purging Sensors	The instrument automatically turns on both sensor pumps to purge the background-gas and leak-gas sensor chambers. This action occurred because during an idle period (blower not running) or during shutdown the instrument has detected that more than 50 ppm of natural gas is present in the sensor chamber(s).
Low Battery	Error–Battery voltage has fallen below 4.0 volts. Refer to Section 5.2.

∇ ∇ ∇

3 Calibration

It is recommended that the Hi Flow® Sampler be calibrated by your nearest Bacharach Service Center every 30 days. Calibration, however, can be performed in the field if your facility has the necessary equipment and qualified personnel to perform the procedures described in the following sections.

The following procedures describe how to:

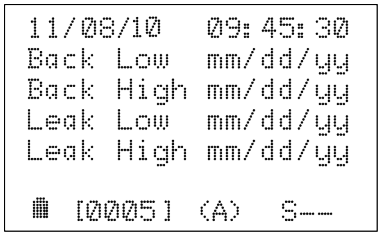
- View the dates on which calibrations were performed
- Verify calibration
- Calibrate the background and leak gas sensors
- Display the gain values of the calibration amplifier circuits
- Erase calibration

3.1 View Calibration Dates

Do the following to view the dates on which calibrations were performed on the background-gas and leak-gas sensors at both low (2.5% CH_4) and high (100% CH_4) calibration gas levels:

1. From the Main Screen select **Menu** > **Calibration** > **Calibration Dates**.

2. The following Calibration Dates Screen is displayed where mm/dd/yy is the month, day, and year calibration was performed:



3. Press the **ESC** key twice to return to the Main Screen.

3.2 Gas Calibration Equipment Setup

The following equipment is recommended to both check the calibration and perform a calibration procedure on the Hi Flow® Sampler:

- Calibration Kits
  - Hi Flow Cal Kit with Returnable or Disposable Cylinders. Contains 2.5% & 100% Methane, Case with 2 demand flow regulators, 2-way ball valve with demand regulator). P/N HPN 300060-0
  - Hi Flow Cal Kit with Refillable Cylinders. Contains 2.5% & 100% Methane, Pelican Style Case with two stage demand flow regulators, and transfillers for mother tanks. P/N HPN 300004-0
  - Available from Heath Consultants Inc. Ph.(713) 844-1300 or info@heathus.com
- Calibration Gas:

  2.5% CH_4 in air, P/N 0051-1121
  100% CH_4, P/N00 55-0060
  Zero Air, P/N 0051-7131 (optional)

Connect the components of the calibration kit, calibration gas cylinder, and Hi Flow® Sampler together as shown in Figure 3-1. DO NOT, however, attach the calibration equipment to the instrument until instructed to do so in the calibration procedure.

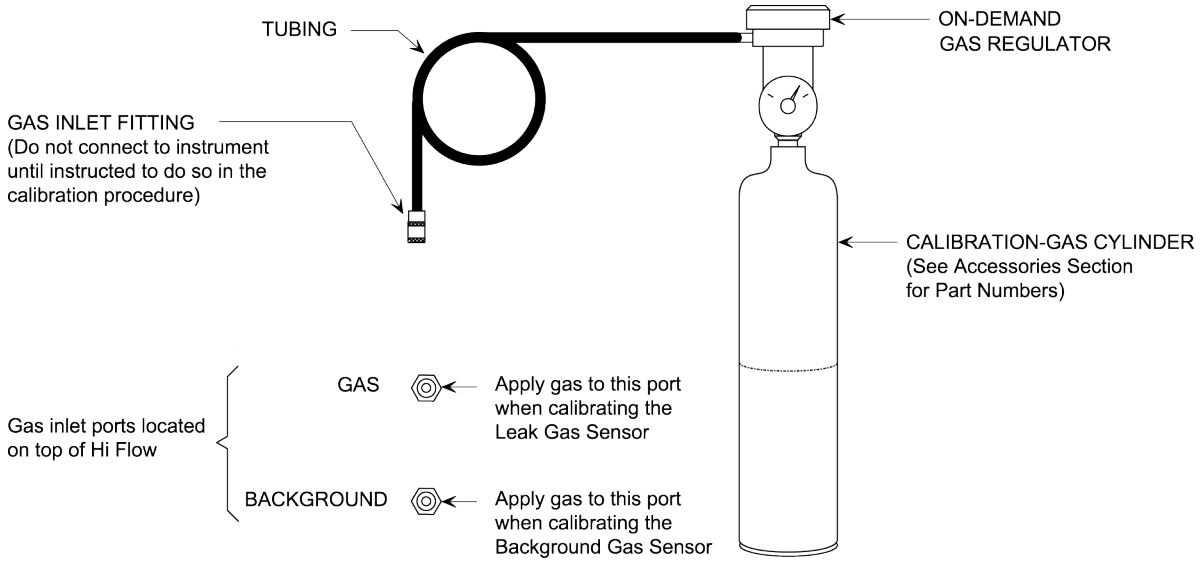


Figure 3-1. Calibration Equipment Setup

3.3 Check Calibration Procedure

This procedure checks the calibration of both the leak-gas sensor and the background-gas sensor using 2.5% CH4. After setting up the calibration equipment as described in Section 3.2, proceed to check the instrument's sensor calibration as follows.

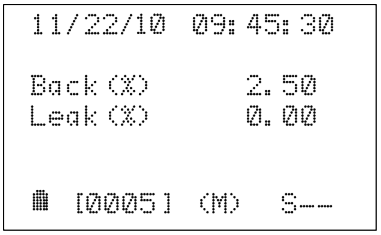
1. Before turning ON the instrument, be sure that the calibration equipment is *not* connected to the instrument's GAS or BACKGROUND inlet port, and that the instrument is in an area of clean air.

2. Turn ON the instrument and wait for its warm-up period to complete before proceeding with Step 3.

3. Apply 2.5% CH_4 from the calibration equipment to the instrument's BACKGROUND inlet port.

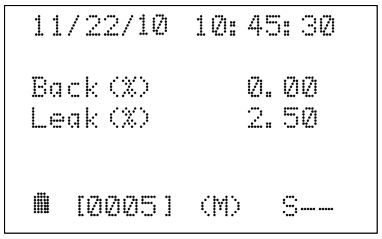
4. From the Main Screen select **Menu** > **Calibration** > **Verify Calibration** to begin the calibration verification process. Observe that the gas-sampling pump motors should start.

   Wait several minutes for the gas reading to stabilize. At this time the gas concentration shown on the display should match the concentration stamped on the calibration gas cylinder.



5. Disconnect the hose from the BACKGROUND inlet port and connect it to the GAS inlet port.

6. Again wait several minutes for the gas reading to stabilize. At this time the gas concentration shown on the display should match the concentration stamped on the calibration gas cylinder.



7. Disconnect the hose from the GAS port, and then allow the pumps to run until both the **Back** and **Leak** readings fall to zero percent.

8. Press the **ESC** key *three* times to return to the Main Screen.

Note: *If gas is still present in either sensor chamber when **ESC** is pressed, the instrument will automatically begin to purge the sensors until all gas is removed from the instrument.*

3.4 Gas Calibration Procedure

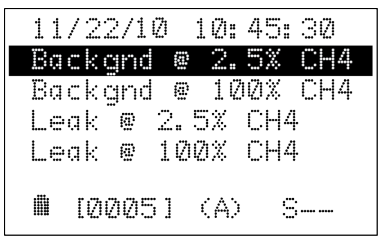
This procedure calibrates both the leak-gas sensor and the background-gas sensor at 2.5% and 100% CH_4. After setting up the calibration equipment as described in Section 3.2, proceed to calibrate the sensors as follows.

NOTE: The Hi Flow® Sampler can be calibrated on the low end with a mixture of methane between 0.75 - 2.75 for catalytic and 95-100% methane on the thermal conductivity side.

1. Before turning ON the instrument, be sure that the calibration equipment is *not* connected to the instrument's GAS or BACKGROUND inlet port, and that the instrument is in an area of clean air.

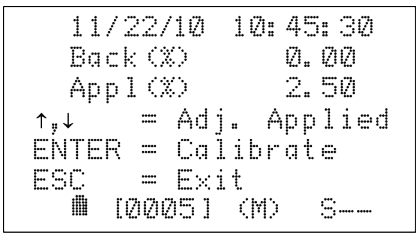
2. Turn ON the instrument and wait its warm-up period to complete before proceeding to Step 3.

3. From the Main Screen select **Menu** > **Calibration** > **Calibrate Sensors** to display the Sensor Calibration Screen.



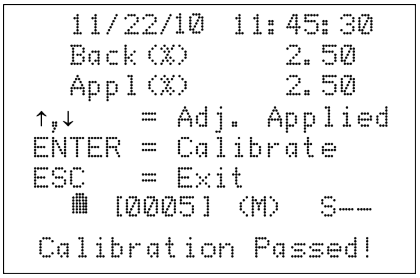
4. Using the ∧∨ keys, highlight the sensor to be calibrated along with its gas level. (In the example above, the background sensor will be calibrated using 2.5% CH_4.)

5. Apply the appropriate level of calibration gas from the calibration equipment to the instrument's GAS or BACKGROUND inlet port. (In the example above, apply 2.5% CH_4 to the BACKGROUND port.) Then press the **I/O** ↵ key to start the calibration process. Observe that the gas-sampling-pump motors start and the calibration screen appears.



6. If necessary, use the ∧∨ keys to adjust the Appl (%) reading to match the gas concentration stamped on the calibration gas cylinder.

7. Wait until the measured gas reading stabilizes, and then press the **I/O** ↵ key to calibrate the actual gas reading to that of the applied reading. The message "Calibration Passed!" will appear at the bottom of the screen if the calibration was successful. If, however, the calibration was not successful, the message "Calibration Failed!" will appear. Refer to Section 5 *Troubleshooting* for possible causes and remedies for this failure.



8. Disconnect the gas hose, and then wait until the measured gas reading falls to zero percent.

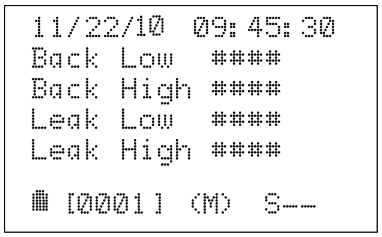
9. Press the **ESC** key to return to the Calibration Menu Screen.

10. Repeat this procedure as necessary to calibrate both sensors at 2.5% and 100% CH_4.

3.5 Calibration Amplifier Gain Check

Use this procedure to display the gain values of the calibration amplifier circuits in hexadecimal. This procedure is useful to service technicians for troubleshooting purposes.

1. From the Main Screen select **Menu** > **Calibration** > **Calibration Gains** to display the Calibration Gains Screen.



   Where: #### is the gain value in hexadecimal. Hexadecimal (or "hex") is like decimal, except:
   - hex uses the 16 hex digits 0-9 and A-F (vs. using only the 10 digits 0-9 in decimal notation), and
   - each position in a hex number is an exponent of 16 (16^0=1's place, 16^1=16's place, 16^2=256's place, etc.) rather than an exponent of 10 as in decimal (i.e., 10^0=1's place, 10^1=10's place, 10^2=100's place, etc.).

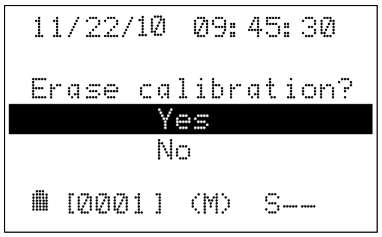
   For example, a gain value of 298 decimal (or base 10) equals 012A hex (or base 16).

2. Press **ESC** *three* times to return to the Main Screen.

3.6 Erase Calibration Procedure

The following procedure resets the gain of each calibration amplifier circuit to the factory default hexadecimal value of "FFFF".

1. From the Main Screen select **Menu** > **Calibration** > **Erase Calibration** to display the Erase Calibration Screen.



2. Select **Yes** to erase the calibration values. Observe that the message "Erasing Calibration" appears at the bottom of the screen. Select **No** to abort this procedure and return to the Calibration Menu Screen.

3. Press **ESC** *twice* to return to the Main Screen.

∇ ∇ ∇

4 Maintenance

Routine maintenance of the Hi Flow® Sampler consists of the following:

- Charging the battery pack
- Replacing the internal filters
- Replacing the gas sensors
- Verifying flow rate
- Setting the time and date
- Resetting the microprocessor

4.1 Electrostatic Discharge Precautions

CAUTION: *Electrostatic discharge (ESD) can destroy sensitive electronic components inside the Hi Flow® Sampler when its cover is removed.*

When performing any maintenance procedure that requires the Hi Flow® Sampler's cover to be removed, take the following precautions to prevent ESD from possibly destroying sensitive electronic components on the main circuit board:

- Make sure you have a reliable ground point available near the work site
- Connect your body to the ground point using a wrist strap
- Always stand on an approved conductive floor mat when touching or handling equipment
- Ground all equipment you are working on with ground straps
- Handle components only on a grounded anti-static work surface
- Do not wear clothing that generates static electric charges every time you move
- Do not handle static generating objects while working
- Maintain relative humidity in the work area between 40 and 50%

4.2 Charging the Battery Pack

WARNING: *Explosion hazard! DO NOT charge or disconnect the battery pack in an unsafe atmosphere.*

1. Unplug battery pack from the instrument's power cord; then remove battery pack from backpack.

2. Interconnect the supplied power supply, power cord, and charger as shown in Figure 4-1. Then plug the output of the charger into the battery pack's charger jack.

Note: *Connecting the charger to the Battery Pack disables the battery's output, making it impossible to both charge the battery and run the instrument.*

3. Allow a completely discharged battery pack to charge from 8 to 10 hours.

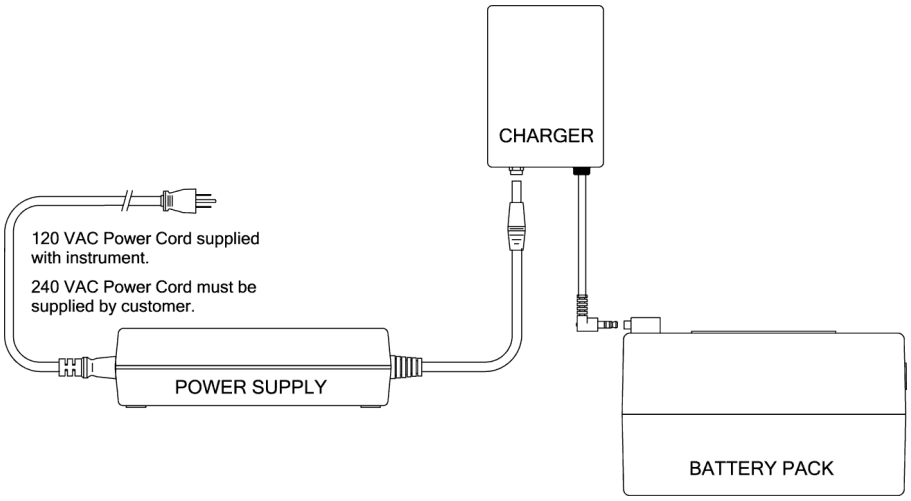


Figure 4-1. Charging the Battery Pack

4.3 Removing the Cover

When instructed to do internal maintenance, remove its protective cover as follows:

1. Do the following before removing the instrument from the backpack:
   - Disconnect battery pack
   - Unscrew metal-cage diffuser from the instrument's gas exhaust port
   - Disconnect ground clamp wire

2. Remove instrument from backpack.

3. Remove screws from cover as shown in Figure 4-2; then pull cover away from unit.

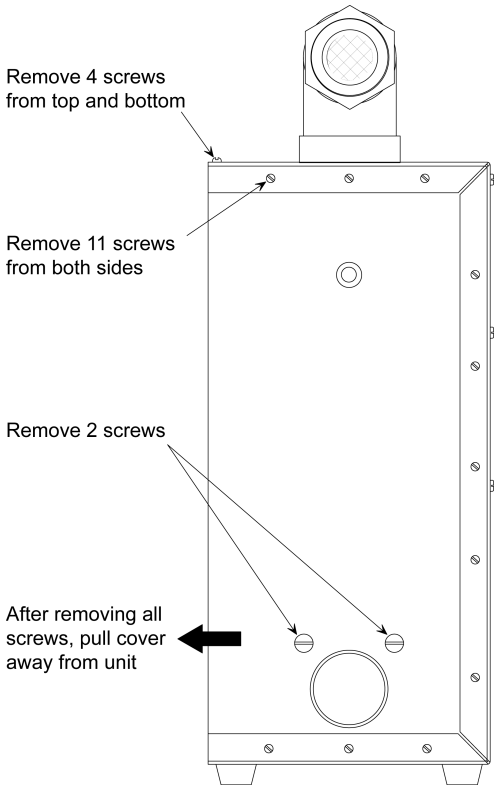


Figure 4-2. Removing the Cover

4.4 Replacing the Internal Filters

Three internal filters protect the instrument from being contaminated by dust and dirt. Replace these filters when they look contaminated. A good indication that a filter needs replaced is when the instrument's gas-response time increases.

4.4.1 Leak-Gas Filter

The leak-gas filter is located between the sampling port on the flow-measurement tube and its associated solenoid valve on the printed circuit board. See Figure 4-3.

Equipment Required:

- Medium Phillips Head Screwdriver
- Replacement Filter (P/N 07-1563)

Procedure:

1. Remove the cover per Section 4.3.
2. Remove tubing from old filter's inlet and outlet.
3. Install tubing on new filter, making sure that the filter's flow arrow points away from the flow-measurement tube.
4. Replace the cover that was removed in Step 1.

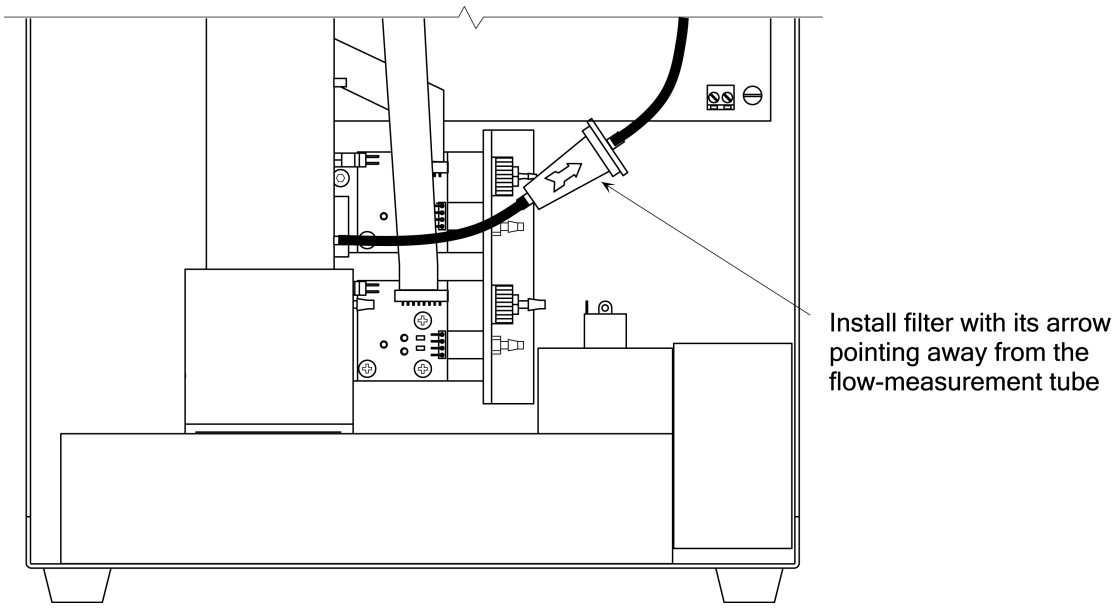


Figure 4-3. Leak-Gas Filter

4.4.2 Leak-Gas Sensor Filter

The leak-gas sensor filter is located inside the flow block of the leak-gas sensor assembly. See Figure 4-4.

Equipment Required:

- Medium Phillips Head Screwdriver
- Replacement Filter (P/N 0055-0045)

Procedure:

1. Remove the cover per Section 4.3.
2. Remove tubing from inlet of sensor assembly.
3. Unscrew the filter chamber's gas inlet fitting; then pull out old filter and discard.
4. Insert new filter; reinstall the inlet fitting; then reinstall tubing.
5. Replace the cover that was removed in Step 1.

4.4.3 Background-Gas Sensor Filter

The background-gas sensor filter is located inside the flow block of the background-gas sensor assembly. See Figure 4-4.

Replace filter as previously described for the leak-gas sensor filter.

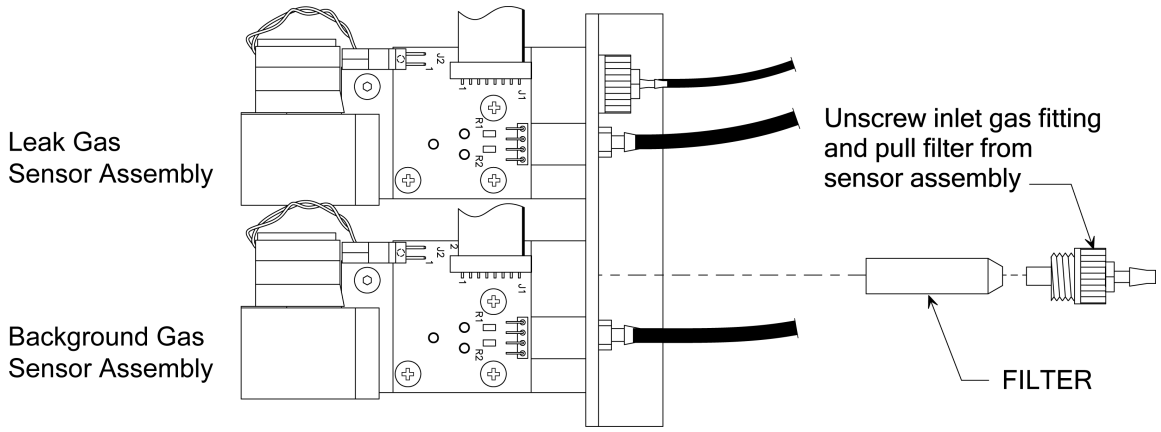


Figure 4-4. Leak Gas & Background Gas Sensor Filter Replacement

4.5 Gas Sensor Replacement

Replace a gas sensor when it fails to calibrate per Section 3 *Calibration*. The gas sensors are located inside their associated flow blocks of the leak-gas and background-gas sensor assemblies. See Figure 4-5.

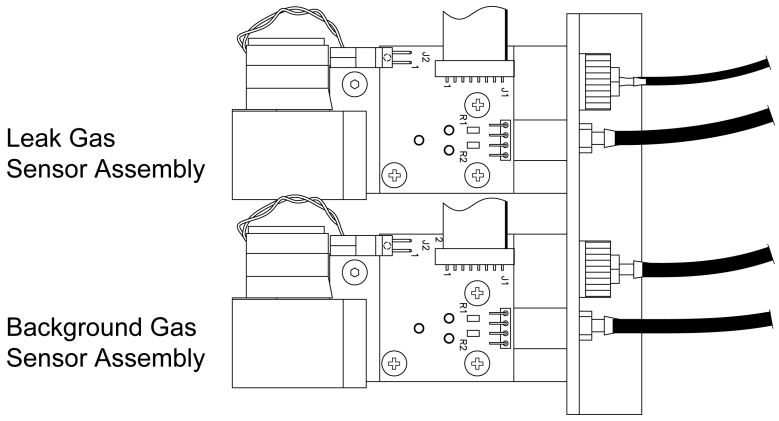


Figure 4-5. Leak Gas & Background Gas Sensor Assemblies

Equipment Required:

- Medium Phillips Head Screwdriver
- Replacement Sensor (P/N 0055-0040)

Procedure:

1. Remove cover per Section 4.3.

2. Remove the pump connector and multi-pin connector from printed circuit board, noting orientation of connectors. See Figure 4-6.

3. Remove three screws from printed circuit board; then *carefully* pry the board straight up from the flow block. The gas sensor is the silver cylindrical piece in the center of the circuit board.

4. Pull sensor from circuit board and replace with a new sensor, making sure that the new sensor is firmly seated into its receptacles and bottomed on circuit board.

5. Reinstall printed circuit board into flow block, taking care to properly position the board as shown in Figure 4-6.

6. Replace three screws and tighten to secure board. Reattach the pump and multi-pin connectors to the circuit board.

7. Replace cover that was removed in Step 1.

8. Calibrate the instrument per Section *3 Calibration*. Note that if a new sensor is installed without performing a calibration, either the message “Check Background Calibration” or “Check Leak Calibration” will appear at the bottom of the LCD when the instrument is turned ON.

4.6 Pump Replacement

The pump located in either the leak-gas or background-gas sensor assembly (see Figure 4-5) may become inoperative due to water or solid particles getting into the valves. This will require replacement of the pump to correct.

Equipment Required:

- $^{5}/_{64}$" Allen Wrench
- Replacement Pump Assembly (P/N 0055-0061)

Procedure:

1. Remove cover per Section 4.3.
2. Back off the pump-bracket screw using a $^{5}/_{64}$" Allen wrench; then rotate bracket arm to free pump. See Figure 4-6.
3. Unplug pump connector from printed circuit board and lift pump straight up.
4. Install the new pump by lining up the pump's inlet and outlet tubes with the two flow block holes and pushing into place. Swing bracket arm over pump and tighten—realigning pump as necessary to make a proper fit.
5. Replace cover that was removed in Step 1.

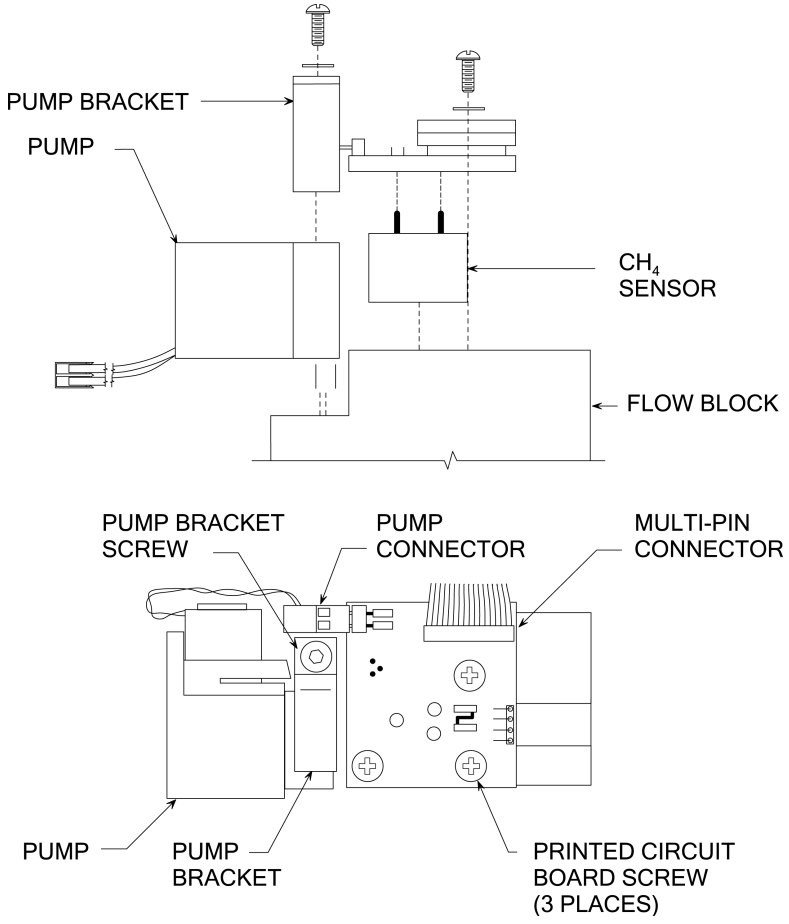


Figure 4-6. Sensor or Pump Replacement

4.7 Flow Rate Verification

This procedure verifies the Hi Flow® blower is operating at proper capacity and the flow rate measurement is accurate. Use a calibrated flow rate meter or anemometer with a minimum accuracy of +/-5%.

IMPORTANT: *To assure accurate flow readings, conduct the following procedure in clean air, free of any combustible gases.*

1. Install the flow meter onto the Hi Flow® Sampler's gas intake (see Figure 4-7).

2. Place the Hi Flow® Sampler into its Manual 1-Stage Mode per Section 2.14.2.2. Then start the blower by selecting **Start** from the Main Screen.

3. The Flow (cfm) value as displayed on the Hi Flow® Sampler's LCD should be within +/-5% of the measured cfm taking into account the flow meter's measurement error and any pressure or temperature corrections.

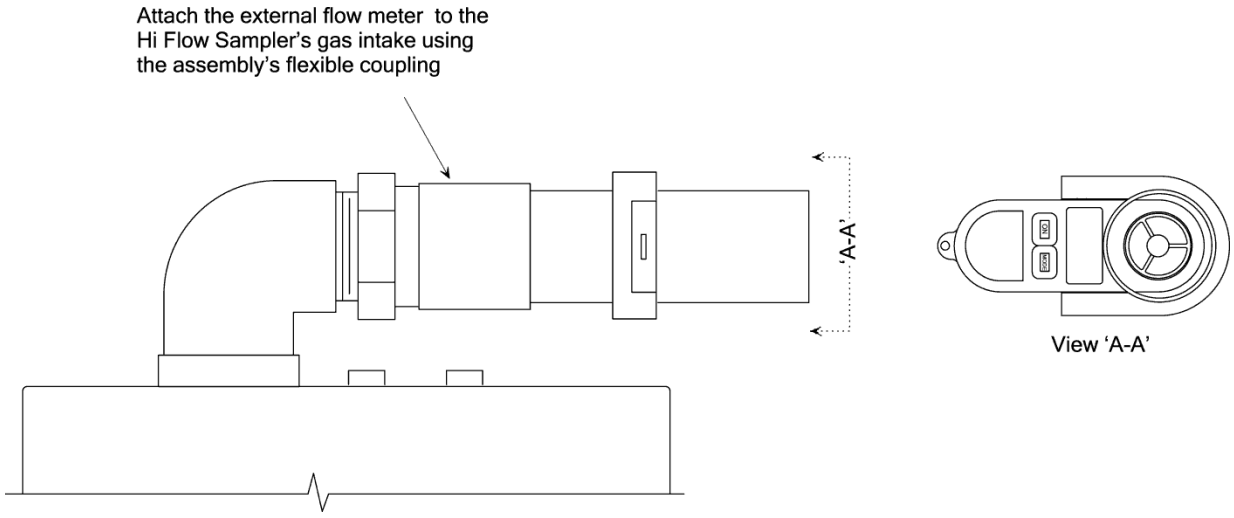


Figure 4-7. Flow Meter Installation

4. With a fully charged battery pack, the measured flow rate should be greater than 9 cfm. If not, perform the following (see Figures 4-8 and 4-9):

   - Clean the gas sample inlet screen.
   - Ensure that the exhaust port is not obstructed.
   - Remove the unit's cover and ensure that the high- and low-sampling point hoses are properly connected between the flow-measurement tube and their corresponding solenoid valves, and that these hoses are not pinched or kinked.
   - Ensure that no obstruction is present inside the flow-measurement tube.
   - If none of the above solves the problem, return the unit to your nearest Bacharach Service Center for evaluation.

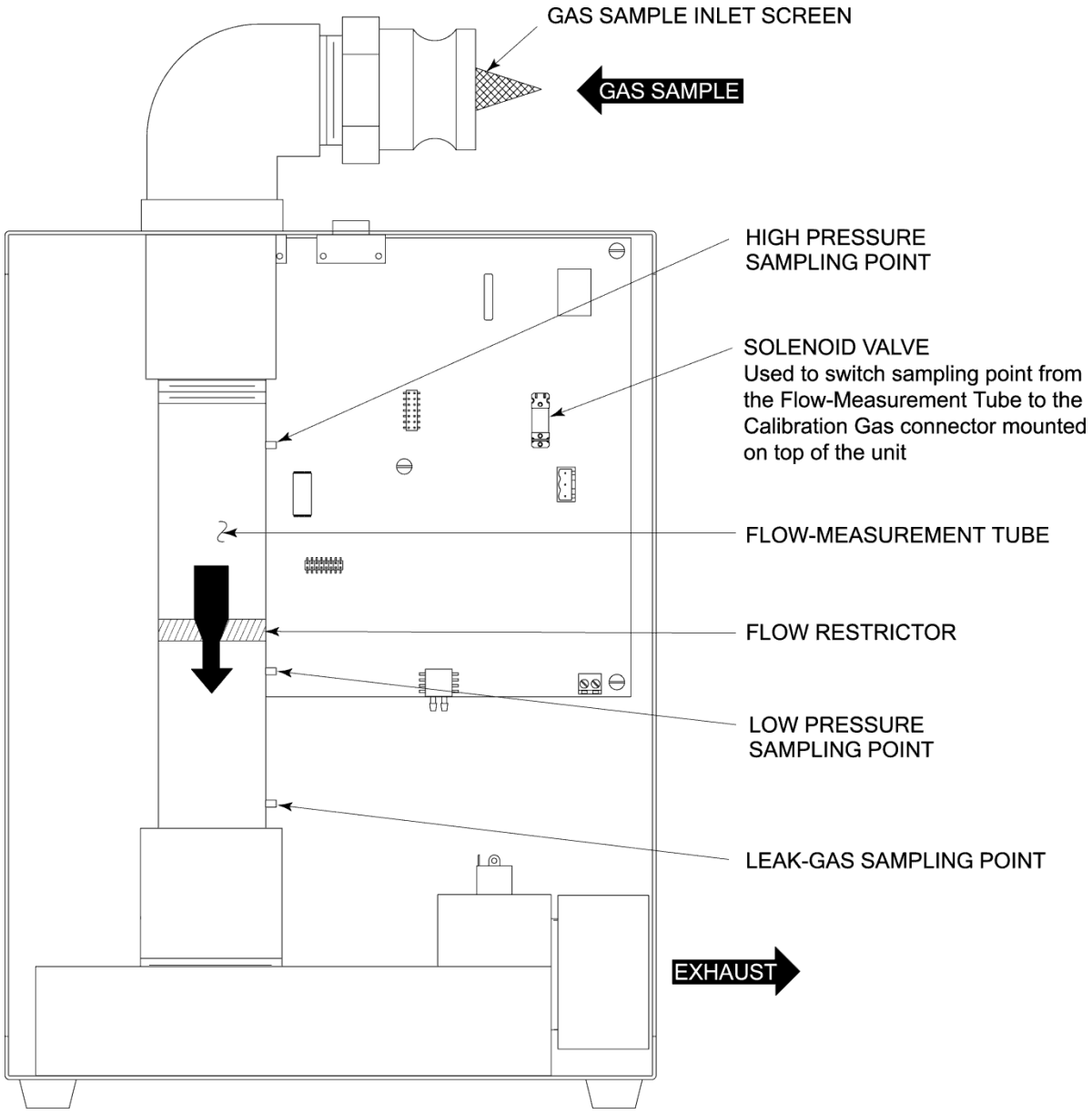


Figure 4-8. Gas Flow System

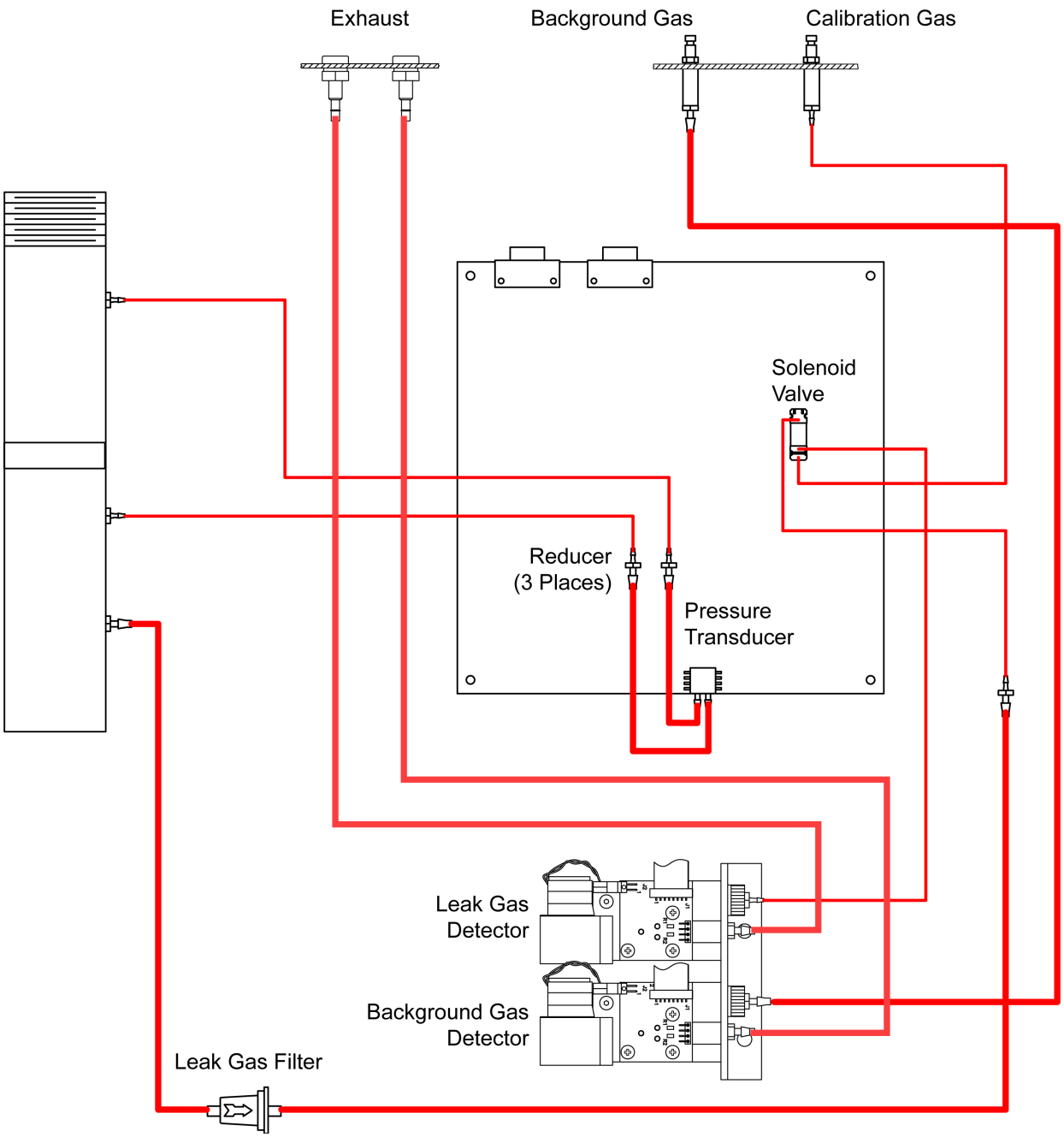


Figure 4-9. Plumbing Diagram

4.8 Setting Date and Time

The following describes how to set the date and time as displayed on the Hi Flow® Sampler's LCD using a personal computer that is running Windows® HyperTerminal as the communications program. If a different operating system and/or communications program is being used, then please consult the appropriate instruction manuals for those products.

1. Install serial data cable P/N 104-4027 (straight through, 6 foot, DB9 male to DB9 female) between the computer's COM port and the Hi Flow® Sampler's COMPUTER connector. (For computers having a 25-pin or USB COM port, the user must supply the appropriate adapter, or use a serial cable with appropriate connectors on each end.)

2. On the computer, start HyperTerminal by doing one of the following:

   - If HyperTerminal has already been set up to communicate with the Hi Flow® Sampler, then select **Start** > **Programs** > **Accessories** > **Communications** > **HyperTerminal**, and double-click the file name or icon that has been associated with the instrument.
   - If HyperTerminal has never been run in association with the Hi Flow® Sampler, then a new HyperTerminal connection needs to be made as follows:

     a. Select **Start** > **Run**. In the Run box type "hypertrm.exe" and click **OK.** The **New Connection** dialog box should appear.

     b. Type in a New Connection Name such as "HiFlow". Click **OK** to select the default icon (if desired, select a different icon before clicking OK). The **Connect To** dialog box should appear.

     c. Click the **Connect using** drop-down menu and choose the **COM** port to which the Hi Flow® Sampler is connected. Then click **OK** to display the **COM Properties** dialog box for that COM port.

     d. Set Port Settings to:
        - Bits per second: 115200
        - Data bits: 8
        - Parity: None
        - Stop bits: 1
        - Flow control: None

        Then click **OK** to display HyperTerminal's main window.

     e. Set up the terminal program to 'echo' typed characters by selecting **File > Properties > Settings > ASCII Setup** and placing a checkmarks in the "Send line ends with line feeds" box and the "Echo typed characters locally" box. Click **OK**.

        Tip: *If the typed characters do not echo on the screen, then your version of HyperTerminal needs to be upgraded. Download and install HyperTerminal Private Edition v4.0 or greater from Hilgraeve's website http://www.hilgraeve.com.*

     f. Select **File** > **Save**. This creates a file with an .ht extension using the name that was entered in Step b.

3. Set the date by typing “DATWmm/dd/yy” where mm/dd/yy is the current month, day and year (e.g., DATW02/24/09 for February 24, 2009). Press Enter on the computer’s keyboard to update the Hi Flow® Sampler’s date display.

4. Set the time in 24 hour format by typing “TIMWhh:mm:ss” where hh:mm:ss is the current hour, minute and second (e.g. TIMW18:00:00 for exactly 6 o'clock PM). Press Enter on the computer’s keyboard to update the Hi Flow® Sampler’s time display.

4.9 Resetting the Microprocessor

Should the instrument ‘lock up’ or fail to turn OFF, reset the microprocessor by disconnecting the battery pack for several seconds.

∇ ∇ ∇

5 Troubleshooting

5.1 Instrument Repair

It is recommended that field repair of the Hi Flow® Sampler be limited to:

- Cleaning gas-inlet screen
- Replacing internal filters
- Replacing sensors
- Replacing sensor assembly pump
- Simple checks of printed circuit board connectors

All other repairs should be performed by an authorized Bacharach Service Center. Any repairs performed by an *unauthorized* service organization will void the instrument's warranty and release Bacharach, Inc. of any implied or written product liability.

Before returning an instrument for repair, you may be able to determine and resolve a problem using the Troubleshooting Guide in Section 5.2.

5.2 Troubleshooting Guide

The following table lists the causes and remedies for most of the problems that may arise with the instrument.

If none of the suggested remedies resolves the problem, or for help with any problem that is not listed, contact one of Bacharach Service Centers listed in Section 6.3.

TABLE 5-1. TROUBLESHOOTING GUIDE

Symptom	Probable Cause and Remedy
Instrument completely nonfunctional; won't turn ON when the **I/O** ↵ key is pressed.	a. Battery pack is dead. Recharge battery pack per Section 4.2. b. Loosen battery connector. Remove the instrument's cover and ensure that all wires are attached to the battery connector, and that the connector is securely attached to the printed circuit board. c. Microprocessor needs to be reset. Disconnect battery pack for several seconds.
Display freezes during start up.	Battery pack voltage is low. Recharge battery pack per Section 4.2. For users in cold climates, take the instrument inside a room at 70 degrees F until the LCD becomes readable. After that, use in 15-20 minute intervals when in a 0 degree F environment and alternating in warm environment to keep LCD Fluid.
Instrument turned itself OFF during operation.	Battery pack is dead. Recharge battery pack per Section 4.2.
"**Low Battery**" message appears at bottom of display.	Battery voltage is below 4.0 volts. Recharge battery pack per Section 4.2.
Instrument won't respond when a control unit key is pressed.	Microprocessor needs to be reset. Disconnect battery pack for several seconds.

Symptom	Probable Cause and Remedy
Low flow rate reading with fully charged battery.	Flow path obstructed. Check flow path and verify flow rate per Section 4.7
Slow response time.	Internal filters are dirty. Replace filters per Section 4.4.
Battery power does not last at least 4.5 hours.	Battery pack defective. Replace.
Erratic gas readings.	a. The entire gas leak is not being captured. Use the proper attachment to capture leak. b. Faulty sensor(s). Calibrate both CH_4 sensors per Section 3. Replace any sensor that fails to calibrate. c. Flooding, poisoning or high VOC content results in erroneously low or unstable readings.
Sensor does not calibrate properly.	a. Wrong calibration gas or insufficient flow being applied to sensor. Ensure that the calibration setup is correct. b. Depleted sensor. Replace sensor and recalibrate.
"**Calibration Failed**" message appears at bottom of display.	Calibration parameters not within programmed limits due to either insufficient calibration gas flow, or new calibration value was greater than 50% of the old value. Check calibration setup and re-perform the calibration procedure. Replace sensor if necessary.
"**Memory Full**" message appears at bottom of display.	1000 test records have already been stored in memory. Save all test records per Section 2.15.1 and/or erase memory per Section 2.15.3.
"**No Records Saved**" message appears at bottom of display.	A send records command was given with no records stored in memory.
"**Check Background Pump**" message appears at bottom of display.	Flow to the background-gas pump has been severely reduced. Check that the background hose is not kinked or blocked, or the internal tubing has not become blocked (see Figure 4-10). Also check the condition of background-gas sensor filter, replace as necessary per Section 4.4.3.
"**Check Leak Pump**" message appears at bottom of display.	Flow to the leak-gas pump has been severely reduced. Check that the internal tubing has not become blocked (see Figure 4-10). Also check the condition of leak-gas sensor filter, replace as necessary per Section 4.4.2.
"**Check Background Calibration**" message appears at bottom of display.	The background-gas sensor needs to be calibrated per Section 3.
"**Check Leak Calibration**" message appears at bottom of display.	The leak-gas sensor needs to be calibrated per Section 3.
"**Check Background Offset**" message appears at bottom of display.	The background-gas sensor did not zero properly during start-up. Switch OFF instrument and restart in an area with clean air. Replace sensor if necessary.
"**Check Leak Offset**" message appears at bottom of display.	The leak-gas sensor did not zero properly during start-up. Switch OFF instrument and restart in an area with clean air. Replace sensor if necessary.

Symptom	Probable Cause and Remedy
"**Check Leak Rate Difference**" message appears at bottom of display.	The calculated difference between leak rates 1 and 2 was greater than 10%.
"**Check Zeroing Bypass**" message appears at bottom of display.	The **ESC** key was pressed during startup, thus bypassing the normal sensor zeroing process. Although the instrument will operate under this condition, no leak rate tests should be made because of the potential inaccuracy of the sensor channels.
"**Check Background Greater Than Leak**" message appears at bottom of display.	The measured background gas level is greater than the measured leak gas concentration. Make sure the background gas sample hose is not positioned too close the leak source.
"**Low Battery**" message appears at bottom of display.	Battery voltage is below 4.0 volts. Recharge battery pack per Section 4.2.

5.3 Error Codes in Saved Test Records

When saved test records are sent to a personal computer and later viewed in a spreadsheet program (refer to Section *2.16 Importing Saved Data into a Spreadsheet*), Field 18 "Error Codes" in the saved records contains letter-codes that identify problems that have occurred during that particular test. Refer to Table 5-2 for a listing and description of these codes.

TABLE 5-2. FIELD 18 ERROR CODES

Error Code	Description
A	Background gas sample pump blocked.
B	Leak gas sample pump blocked.
C	The background gas sensor needs calibrated at 2.5% and/or 100% CH_4.
D	The leak gas sensor needs calibrated at 2.5% and/or 100% CH_4.
E	The instrument failed to zero the background gas sensor during start up.
F	The instrument failed to zero the leak gas sensor during startup.
G	The user pressed the **ESC** key during start up before the sensors had a chance to completely zero.
H	The leak rate measurement #1 – #2 calculation failed.
I	The measured background gas level was greater than the measured leak source gas level. (This is an indication of improper equipment setup.)

∇ ∇ ∇

6 Parts & Service

6.1 Replacement Parts

Complete Hi Flow® Sampler Assembly 0055-8020
Standard Attachments:
- Bellows Tool 0055-0259
- Beveled Nozzle Tool:
  - 6.5" 0055-0213
  - 24" 0055-0247
- Capture Bag:
  - Reusable, nylon, 36" x 36" 0055-0250
- Aluminum Crevice Tool 0055-0258
- Disposable Bag Nozzle 0055-0214
- Flange Strap:
  - 34" 0055-0253
  - 80" 0055-0252
  - 137" 0055-0251

Backpack 0055-0286
Battery Pack 0055-0240
Battery Charger (requires power supply 24-0985) 0055-0241
Filters:
- Sample-Gas Intake, Wire Mesh 0055-0261
- Leak-Gas, Plastic Shell 0007-1563
- Sensor, Leak-Gas & Background-Gas, Fiber (package of 2) 0055-0045

Hose Assembly:
- 6 foot 0055-0215
- 12 foot 0055-0287

Power Supply, 100–240 VAC In, 12 VDC Out 0024-0985
- Line Cord, 120 VAC 4998-8986

Pump Assembly (for Leak-Gas and Background-Gas Sensor Assembly) 0055-0061
Serial Cable, 9 Pin DIN, Straight Through, 6 foot 0104-4027
Sensor, Combustible Gas 0055-0040
Tote Bag 0024-1204
Control Unit Assembly 0055-0262
Ground Clamp Assembly 0055-0265
Neck Strap, Control Unit 0051-1550

6.2 Optional Accessories

Calibration Kits:
- Complete Kit with Disposable Gas Cylinder ..... See Section 3.2 on page 41
- Complete Kit with Refillable Gas Cylinders ..... See Section 3.2 on page 41

Calibration Gases:
- 100% Methane, 58 L Tank 0055-0060
- 2.5% Methane, 103 L Tank 0051-1121
- Zero Air, 20.9% O_2, 103 L Tank 0051-4049

Combustible Gas Detectors:
- Informant® 2 0019-8041
- Leakator® Jr 0019-7075

6.3 Service Centers

United States

Bacharach Sales/Service Center
621 Hunt Valley Circle New Kensington, PA 15068
Phone: 724-334-5051
Fax: 724-334-5001
Email: help@mybacharach.com

Canada

Bacharach of Canada, Inc.
20 Amber St. Unit #7
Markham, Ontario L3R SP4
Canada
Phone: 905-470-8985
Fax: 905-470-8963
E-mail: support@bachcan.ca

∇ ∇ ∇

7 Declaration of Conformity

CE DECLARATION OF CONFORMITY

The manufacturer of the products covered by this declaration:	Bacharach, Inc. 621 Hunt Valley Circle New Kensington, PA 15068
Year conformity is declared:	2011
Product(s):	Natural Gas Leak Rate Measurement
Model(s):	High Flow Sampler

The undersigned hereby declares that the above referenced product is in conformity with the provisions of the following standard(s) and is in accordance with the following directives and standards.

Standard(s):

EN 50270-2006	Immunity	Product-specific standard
EN 55011-2009	Emissions	Product-specific standard

Directive(s):

2004/108/EC	In accordance with EMC Directive

Signature: _____

Name: Doug Keeports
Title: VP of Product Development
Date: 5 December 2011

The technical documentation file required by this directive is maintained at the corporate headquarters of Bacharach, Inc.

∇ ∇ ∇

Headquarters:
621 Hunt Valley Circle, New Kensington, PA 15068
Ph: 724-334-5000 • Fax: 724-334-5001 • Toll Free: 1-800-736-4666
Website: www.mybacharach.com • E-mail: help@mybacharach.com

Printed in U.S.A.