

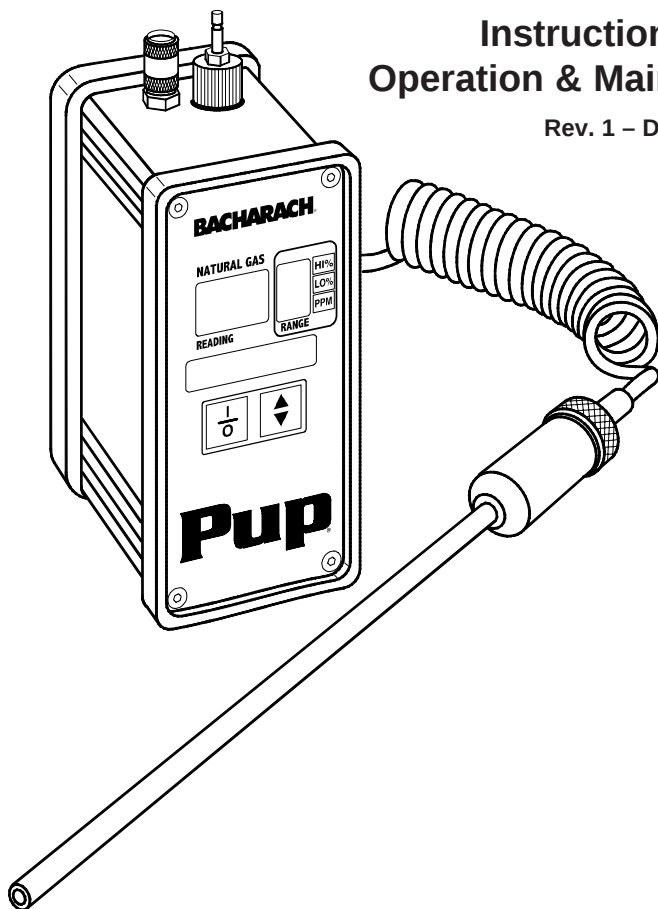


Gas Pup[®]

Natural Gas & Pressure Detection

Instruction 55-9002 Operation & Maintenance

Rev. 1 – December 2003



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Product name:	Gas Pup conforms to the following specifications: European Directive 89/336/EEC EN 50081-1: 1992 (Emissions) EN 50082-1: 1998 (Immunity) EN 61000-4-2: 1995 (Electromagnet) EN 61000-4-3: 1995 (Electromagnet)

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Safety

Safety is essential in the use and maintenance of Bacharach equipment. Therefore this manual and any marking on the instrument provide important safety information concerning the operation, care, and maintenance of this instrument.

All operating and maintenance personnel should *read* and *understand* the contents of this manual before operating or maintaining the instrument.

Observe all of the safety information provided.

Safety Alert Symbol

This symbol together with the word WARNING or CAUTION is used to call a user's attention to hazards or unsafe practices that could result in injury or property damage. The message that follows provides information for preventing or avoiding the hazard.



WARNING: *Informs the user of hazards or unsafe practices that if not avoided could result in severe personal injury or death.*



CAUTION: *Informs the user of hazards or unsafe practices that if not avoided could result in personal injury or property damage.*

Purpose of Manual

This instruction manual is intended to familiarize all personnel with the safe operation and maintenance procedures for the Bacharach Gas Pup.

Please retain this manual for future reference.

Notes:

Introduction

General Description

The Bacharach Gas Pup (Figure 1) is a natural gas detection instrument designed for general leak detection, barholing operations, regulator pressure checks, and line pressure integrity operations. It offers measurement of natural gas (as methane) in the following three ranges:

- **PPM (Low) Range:** Gas level displayed in 0 to 2500 ppm as a bar graph, allowing visual indication of the peak reading. Useful for locating leaks in piping.
- **LO% (Mid Percent) Range:** Measures natural gas in the range of 0.2–5.0% by volume, which corresponds to the lower explosive limit (LEL) of methane.
- **HI% (High Percent) Range:** 0–100% by volume is useful in “pin pointing” leaks in underground piping through barhole testing

The Gas Pup also features three pressure modes: High (0 to 99 psig); Low (–9.9 to 9.9 psig); and Delta (displays a pressure change in the range of ± 9.9 psig from any reference pressure between 0 and 90 psig).

Three ‘AA’ batteries power the instrument. Pressing the  key for at least 1 second turns the instrument ON; after which, the battery voltage is briefly displayed, followed by the gas and pressure sensors being zeroed, and then followed by the display of the detected gas level.

The Gas Pup’s gas display is auto ranging, automatically switching between its PPM, LO%, and HI% ranges as the detected gas level rises and falls. The Gas Pup’s pressure-operating mode is selected by pressing the  key while the word “GAS” is being displayed during the instrument’s warm-up period.

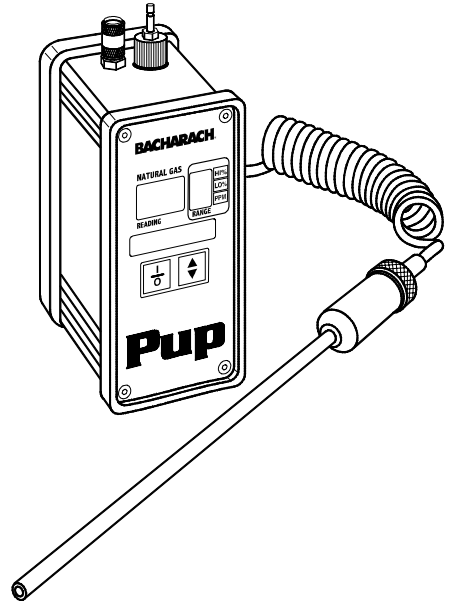


Figure 1. Gas Pup shown with Probe and Coiled Tubing

Components

Natural Gas Detection

The instrument's PPM and LO% ranges use a catalytic-bead detection circuit, which is the most widely accepted method of detecting combustible gases. The HI% range uses the thermal-conductivity method of detection, which is a reliable method for measuring the concentration of one gas in a second gas (methane in air).

Pressure Detection

The instrument contains a solid-state pressure sensor that supports the instrument's three pressure modes (High, Low & Delta). The optional Pressure Hose Kit accessory with fittings (P/N 55-0038) can be used to connect the instrument's quick-connect pressure fitting to the pressure source.

Sample Pump

An internal sample pump draws a gas sample into the instrument for analysis. This is a convenience in the LO% and HI% gas ranges, providing a more reliable and accurate test of gas levels. It is also important in the PPM range to achieve a stable gas reading at low gas concentrations.

The sample pump includes a flow-failure function. If the flow is blocked (e.g., clogged filter or crimped hose), the display will blink the letters "F P" in the READING window. When the pump returns to normal operation, the display stops blinking.

Batteries

Three 'AA' alkaline batteries supply power to the instrument. A fresh set of batteries will typically last 6–8 hours, depending on how the instrument is used. The batteries are housed in a battery block internal to the instrument, and are protected with a metal cover and retained by two thumbscrews. This design allows the batteries to be quickly replaced in an area known *not* to contain explosive gases.

Case

The instrument is housed in an anodized extruded aluminum case. The instrument is rugged, resistant to water and electromagnetic interference. Rubber-bumper guards provide impact protection on both ends of the instrument.

Control Panel Description

Two pushbutton controls and a large LCD are conveniently located at the top of the instrument. The backlit LCD provides highly readable indications of natural gas or pressure in any lighting condition ranging from direct sunlight to total darkness.

The control panel consists of the following three windows and two pushbutton keys:

- **READING Window:** A two-digit display that is used to primarily display the concentration of natural gas in the LO% and HI% gas ranges. The READING window also displays pressure readings when the instrument is operating in any one of its three pressure modes.

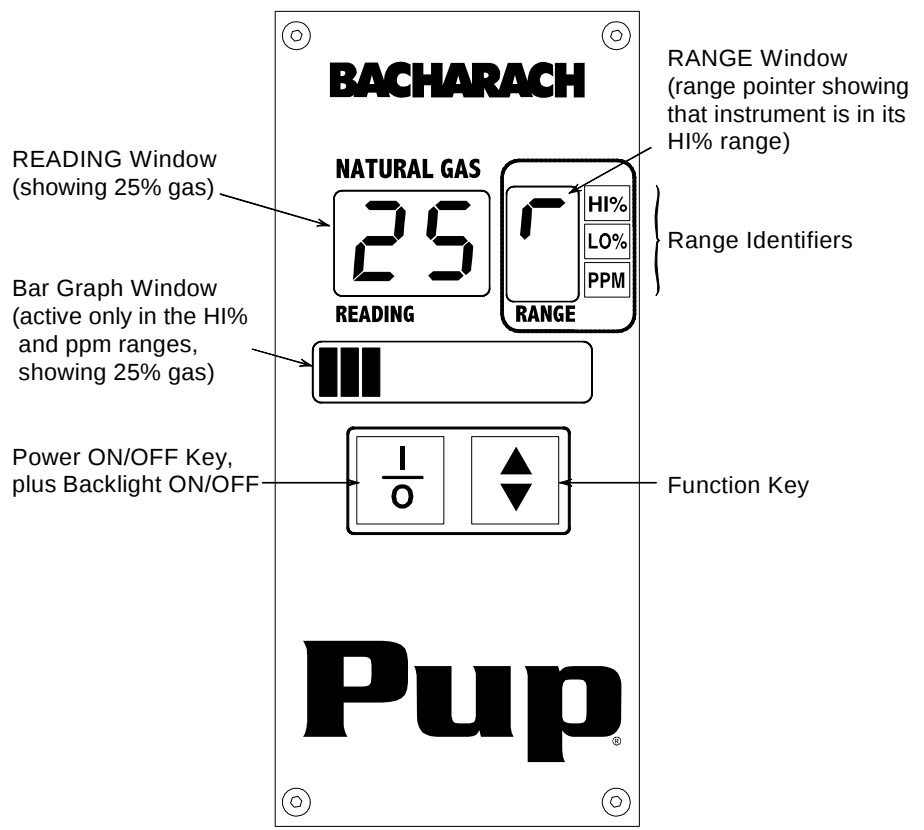


Figure 2. Controls and Indicators

- **Bar Graph Window:** Provides a real time moving display of the natural gas concentration to give a better 'feel' of when the gas level has reached a peak. The bar graph is active only in the PPM and HI% ranges.
- **RANGE Window:** Identifies the range in which the instrument is currently operating. This is accomplished by means of a pointer, which in conjunction with range-labels printed on the display overlay, define a range for the gas reading.
- **[ON/OFF] Key:** Turns the instrument, and also the backlight, ON and OFF.
- **[MODE] Key:** Changes the instrument's function as determined by its current operating mode, thus allowing a variety of functions to be selected with just one pushbutton. Refer to text in this manual's *Operating* section for details.

Gas and Pressure Fittings

Two quick-connect fittings (Figure 3) provide convenient connections to the gas probe and pressure hose assemblies.

The gas fitting mates with a quick-connect female plug, while the pressure fitting mates with a quick-connect male plug.

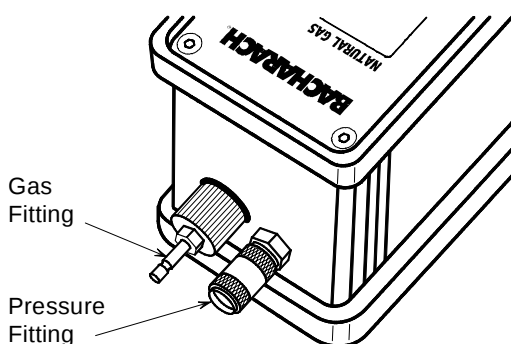


Figure 3. Gas and Pressure Fittings

Technical Characteristics

Measurement Ranges:

Natural Gas	PPM: 0 to 2500 ppm
	LO%: 0.2 to 5.0% volume gas
	HI%: 0 to 100% volume gas
Pressure:	
High	0 to 99 psig
Low	±9.9 psig referenced to atmospheric pressure
Delta	±9.9 psig from any reference pressure point between 0 and 90 psig

Accuracy:

Natural Gas	PPM: (not applicable)
	LO%: ±0.3% gas
	HI%: ±3% gas
Pressure:	±5% of Reading

Warm Up Time 1 minute

Response Time:

Gas	<20 seconds to 95% of final value
Pressure	<5 seconds to 95% of final value

Operating Environmental Conditions:

Temperature	−4 to 122 °F (−20 to 50 °C)
Humidity	10 to 95% R.H. (non-condensing)
Air Pressure	1 Standard Atmosphere, ±10%
Position	Any

Storage Environmental Conditions:

Temperature	−22 to 122 °F (−30 to 50 °C)
Humidity	10 to 95% R.H. (non-condensing)
Position	Any

Size 4.7 x 2.3 x 3.7 in. (11.9 x 5.8 x 9.4 cm)

Weight 25 oz (712 g)

Batteries Qty 3, ‘AA’ alkaline

Battery Life Typically 6–8 hours of continuous operation, and well over a week of operation when used from 50 to 60 minutes a day

Agency Approvals MET lab certified to UL913 and CSA C22.2-157, intrinsically safe for use in Class I, Division 1, Groups A, B, C & D hazardous areas

Operation

Operating Precautions (Please Read)

To ensure that the gas sensor is properly zeroed at startup, the Gas Pup must be turned on in fresh air (free of combustible gases or vapors).

Before using the Pup to detect gas, 'bump test' the instrument by applying a known concentration of gas to the instrument's gas inlet port, and then observing that the instrument responds to the applied gas in a positive manner. The optional Response Check Gas bottle (P/N 51-1816) is recommended for this purpose.

Calibrate the instrument about every 30 days to assure its accuracy. The frequency of calibration, however, may change 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. For example, an instrument that fails its calibration after only being calibrated a single time should be calibrated more often.

Avoid sampling leaded gasoline vapors, or gases or vapors containing 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 fresh air after completing a test. This removes combustibles from the sensor chamber and prolongs the life of the sensor.

Battery Installation



WARNING: *Explosion hazard:*

- *To reduce the risk of igniting a flammable atmosphere, batteries must only be changed in an area known to be non-flammable.*
- *To maintain agency approval, use only the following types of 'AA' alkaline batteries: Energizer E91; Duracell MN1500 or MX1500; Rayovac 815; and Panasonic AM-3PI.*

1. Loosen the two thumbscrews on battery cover and remove cover.
2. Insert three 'AA' batteries into the Pup, observing polarity as shown in Figure 4.
3. Reinstall battery cover and tighten its thumbscrews.

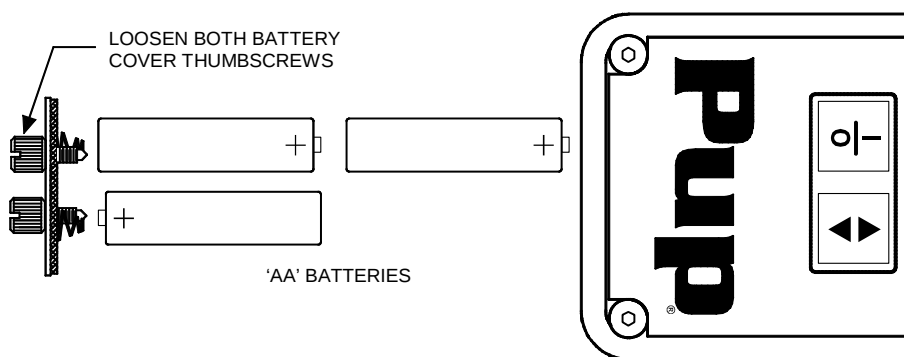


Figure 4. Battery Installation

Turning ON the Gas Pup

Important! *To assure that all detectors are properly zeroed, the Gas Pup must be turned on in a gas-free environment (no combustibles), and that no pressure is being applied to the instrument's pressure port.*

*It is also recommended that the probe and hose assembly be connected to the instrument **before** turning it on.*

Refer to Figure 5. The Gas Pup is turned ON by momentarily pressing the  key for 1 second. Listen for the pump to start and observe that all segments of the display are momentarily turned on. After all segments have been displayed the word "Uer" (Version) is displayed followed by the instrument's software version number. Next, the letter "b" appears in the RANGE window along with the battery voltage momentarily appearing in the READING window. The instrument will quickly move to display the word "GAS", indicating that the instrument is operating in its gas mode.

After several seconds, the READING window will display a flashing "AS" (Auto Start). This is the Auto Start portion of the instrument's operation, and is used to stabilize the gas sensor in order to establish 'zero' gas readings. Without additional operator intervention, the auto start portion of the start-up routine will finish, leaving the instrument in its PPM gas range.

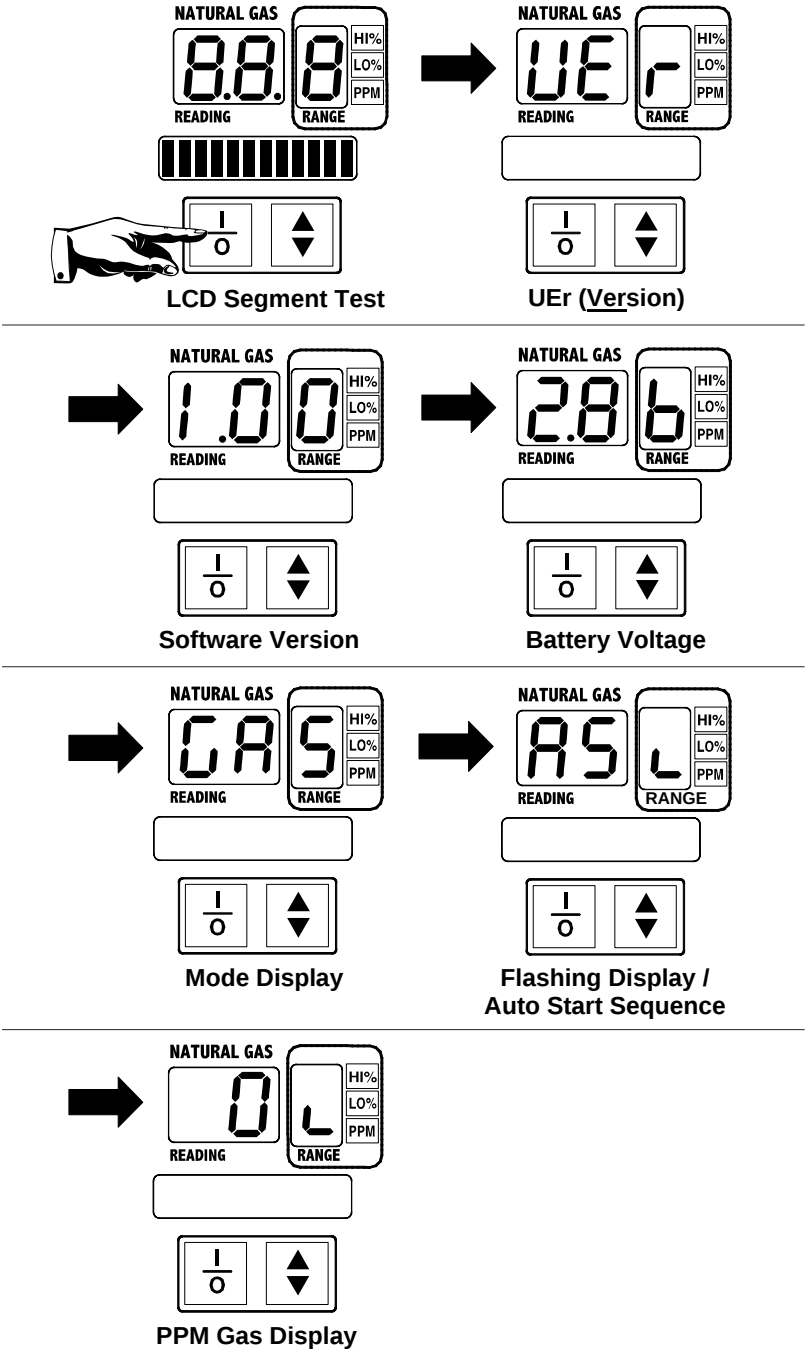


Figure 5. Turning ON the Gas Pup

Turning OFF the Gas Pup

Pushing and holding down the  key initiates the instrument's turn-off sequence.

At first the battery voltage is displayed, followed in about 1 second by the letters "OFF" scrolling across the screen. The screen will go blank shortly after all three letters are displayed.

Release the  key *as soon as* the display goes blank.

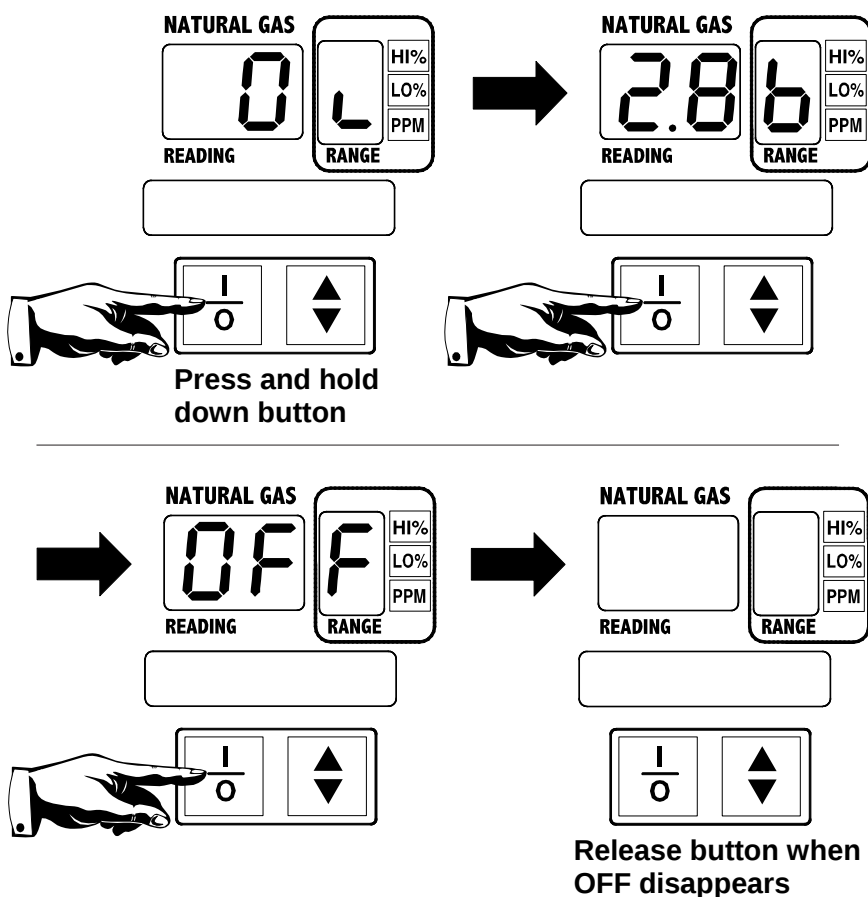


Figure 6. Turning OFF the Gas Pup

Backlighting

Backlighting of the LCD allows a user to see the display in darkened areas. Be aware that backlighting causes a higher battery drain and should only be used when needed. To conserve battery life, the backlight is automatically disabled when the battery voltage falls below 2.2 volts.

To activate the backlight, briefly press the  key. The backlight will turn ON along with the battery voltage being displayed for about one second. The backlight automatically turns OFF after 5 minutes, or it can be immediately turned off by again briefly pressing the  key.

Battery Voltage Check

Battery voltage can be displayed by briefly pressing the  key. Note that this action also turns on the backlight.

Battery voltage is displayed in terms of the voltage available at the printed circuit board from the battery source. The nominal voltage ranges from approximately 2.8 volts to a minimum of 1.9 volts. Although the Gas Pup will operate down to 1.9 volts, the last portion of the voltage curve is quite steep. It is recommended that, except for short tests, the batteries be replaced when the reading drops to less than 2.0 volts.

Gas Operating Mode

This is the default operating mode when no mode selection is made at startup.

With the probe and hose assembly connected to the Gas Pup's gas inlet fitting, begin checking for gas by placing the probe tip into the area to be tested. Wait approximately 15 seconds, and then observe the detected gas level on the instrument's LCD. The Gas Pup will display the detected gas level in one of three ranges: PPM (0–2500 ppm), LO% (0.2–5.0%), and HI% (0–100%).



WARNING: *Explosion hazard. Should the display indicate a gas reading near 5% (equivalent to 100% LEL), the instrument is sampling from an area with a potentially explosive concentration of gas. Take all necessary precautions to prevent ignition. Also, if the detected gas concentration is above 15%, which is normally considered too rich to be explosive, the concentration around the area sampled may be within the explosive range and should be considered dangerous.*

After checking for gas, allow the instrument to sample fresh air until the LCD shows a very low ppm reading. This will help prolong sensor life by purging the sensor chamber of combustible gas.

Auto-Ranging

The Gas Pup incorporates an auto-ranging function that automatically switches the display between ranges when a range limit is reached. This avoids manual switching, and assures, in conjunction with the range display, that accurate readings are provided at all times. The range selected by the instrument is indicated by a pointer that appears in the RANGE window (see Figure 7).

When a reading in the PPM range exceeds 2,500 ppm (equal to 0.25% by volume, bar graph at full scale), the display will automatically switch to the LO% range, covering from 0.2% to 5.0%. This change will be instantaneous. But if the reading is close to 2,500 ppm, observe that the display may flicker between ranges for a few seconds.

When the LO% reading exceeds 5.0%, the display automatically transfers to its HI% range. This transfer takes a few seconds to allow the detector to stabilize in the new range.

Auto-ranging from HI% to LO% occurs when the reading falls below 5.0% for more than 5 seconds. The 5-second delay is to prevent nuisance range transfers.

Fixed HI% Range

Manual selection of the HI% range may be made to avoid any delay caused by auto-ranging (for example in barhole testing), and to retain the highest reading shown on the bar graph. To lock the instrument in its HI% mode, momentarily press the  key. Once auto-ranging has been overridden, the instrument will remain in the HI% range until the  key is pushed again.

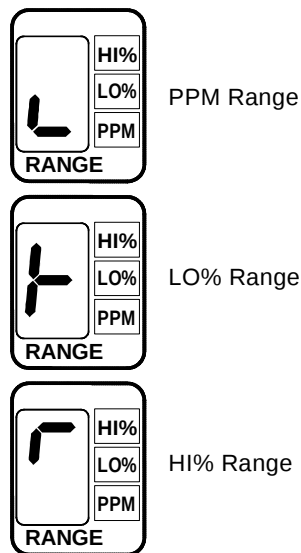


Figure 7.
Range Display

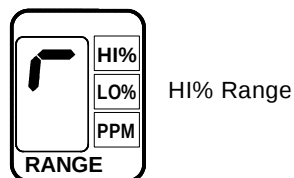


Figure 8.
Fixed High Range

PPM Range

After the Gas Pup has been turned on, it will default to its PPM range, showing nothing or some portion of a bar graph display. The range window will show a pointer to the “PPM” flag for range definition. Any low levels of gas will be shown by a moving bar graph, which is logarithmic providing a much higher response at the low end of the scale. No numerical display is provided in this range, as its primary purpose is to locate a small leak rather than to measure a gas concentration. Full scale on the PPM range is 2,500 PPM or 0.25% by volume. 500 PPM is about mid-scale, while 1,000 PPM is about $\frac{3}{4}$ scale.

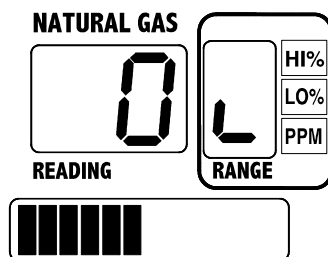


Figure 9.
Typical PPM Reading
Showing 500 PPM

LO% (Low Percent) Range

When the gas concentration increases beyond the upper limit of the PPM range, the display automatically switches (auto-ranges) to the LO% range, showing a two-digit value with one decimal place. This range of the instrument is used for detecting gas concentrations that may approach the explosive level. Natural gas may cause an explosion if the concentration is around 5% by volume in air. This is referred to as the Lower Explosive Limit (LEL) of gas, and represents an extreme hazard. The range indicator points to the “LO%” flag for range definition. The reading will track current concentration with a numerical-only display. This approach is used to provide a numerical readout where readings are significant and documentation of readings may be required. Auto switching from PPM to LO% is instantaneous. Switching from LO% to PPM, however, may be accompanied by the display momentarily flickering between the bar-graph-only display (PPM range), and the numerical-only display (LO% range). This flickering should be brief.

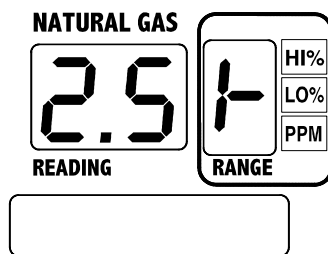


Figure 10.
Typical LO% Reading
Showing 2.5% Gas

HI% (High Percent) Range

If the gas concentration goes above the upper limit of the LO% range (greater than 5.0%), automatic changeover to the HI% range occurs. The instrument goes through a 5 second stabilization time period after this range change occurs, with the display flashing as an indication that the readings are inaccurate until stabilized.

In the HI% range, there is a two digit numerical display, with no decimal point, plus a bar graph that tracks the digital reading. The range indicator points to the “HI%” flag for range definition. The number displayed is the concentration of natural gas being sampled in steps of 1% by volume. Note that because there is only two digits, 100% gas is displayed as “— —”. The bar graph tracks the digital reading to give an enhanced visual picture of the changing gas concentration, but the highest bar ‘sticks’ at the maximum reading.

As noted above, a unique feature of the HI% range is that the bar graph ‘sticks’ at the maximum reading, a convenience in barhole testing where the peak value is desired. This peak value is retained until the instrument transfers (automatically or manually) to the LO% range.

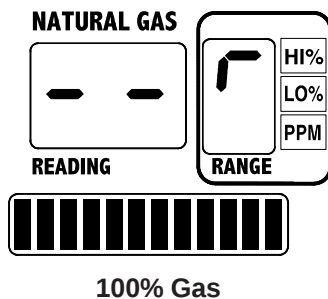
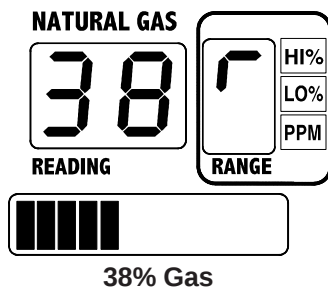


Figure 11.
Typical HI% Reading
Showing 38% Gas and
100% Gas

Pressure Operating Mode

Selecting the Pressure Mode

See Figure 12. The instrument is placed in its pressure mode by pressing the  key during startup while the word “GAS” is displayed. The display changes to “PrS” to indicate that the pressure mode has been selected. Then after the instrument warms up, the letter “P” appears in the RANGE window, indicating that the instrument is currently measuring pressure.

Important! Ensure that the instrument's pressure port is open to the atmosphere during startup, otherwise incorrect pressure readings may result.

Before making a pressure measurement, tubing must be connected between the gas source and the instrument's pressure port. Depending on the application, use the tubing and hardware supplied in either the optional Pressure Hose Kit (P/N 55-0038) or Service Line Pressure Testing Kit (P/N 55-0072) to make this connection. Refer to the *Accessories* section of this manual for a description of these options.

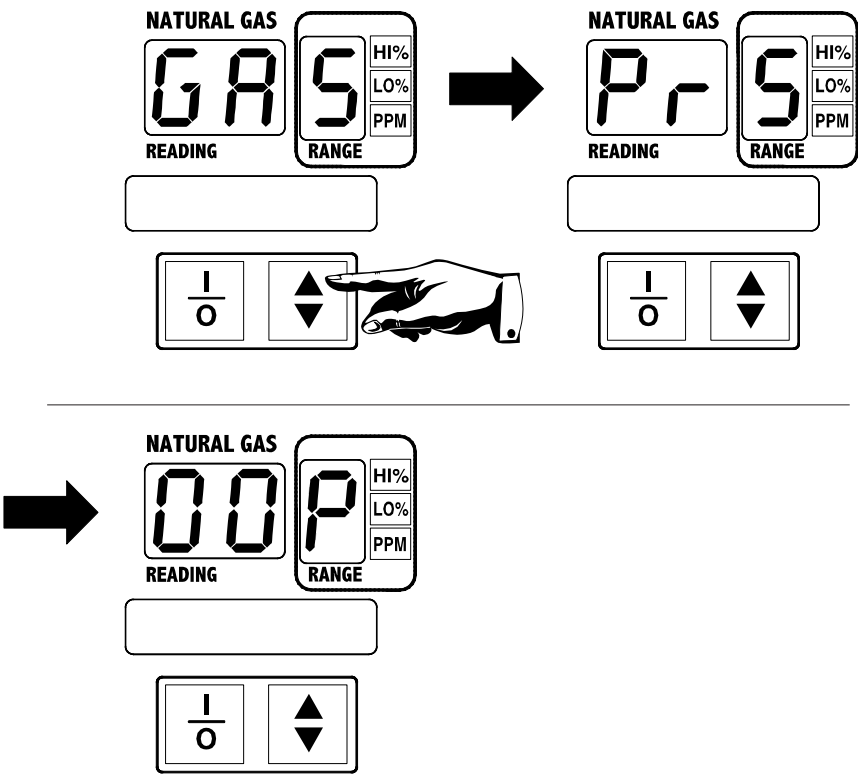


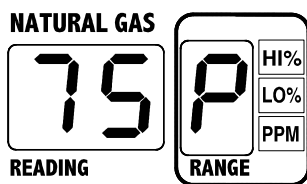
Figure 12. Selecting the Pressure Operating Mode During Startup

High Pressure Mode

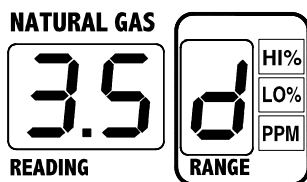


CAUTION: *Maximum over pressure without damage is 150 psig.*

The high-pressure mode measures pressure in the range of 0 to 99 psig. Enter this mode by first selecting the pressure mode during startup as previously described. The instrument will default to its high-pressure mode as signified by the letter “P” appearing in the RANGE window. The READING window will display the pressure applied to the instrument’s pressure port. Note that an out-of-range pressure condition is signaled by two dashes “-.-” appearing in the READING window.



Typical High-Pressure Reading



Typic Low-Pressure Reading

Figure 13. High & Low Pressure Modes

Low Pressure Mode

The low-pressure mode measures pressure in the range of 0 to 9.9 psig, and also negative pressures down to -9.9 psig. Enter this mode by first placing the instrument into it high-pressure mode as previously described. Then press the  key to switch to the low-pressure mode as indicated by the letter “d” appearing in the RANGE window. The READING window will display the pressure applied to the instrument’s pressure port. Positive pressure readings are indicated by a *steady* display, while negative pressures are indicated by a *flashing* display. Note that an out-of-range pressure condition is signaled by two dashes “-.-” appearing in the READING window.

Delta Pressure Mode

The delta pressure mode is used to measure the delta (difference) in pressure, and is useful when pressure proving new or repaired piping that has been pressurized with compressed air.

Do the following to pressure prove a piping system (see Figure 14):

1. Attach the components of the optional Service Line Pressure Testing Kit (P/N 55-0072) between the piping being tested and the instrument’s pressure port.
2. Set up the Pup to measure high pressure as previously described under the heading *High Pressure Mode*.

3. Attach a hand pump or air compressor to the tire-valve portion of the Testing Kit's Tee, and then pump up the system to the desired pressure (not to exceed 99 psig).
4. Press the  key until the letter "d" appears in the RANGE window, indicating that the Gas Pup is now operating in its delta pressure mode. The value "0.0" should now appear in the READING window, indicating that the pressure being measured equals the high-pressure reading just taken.

Note: The delta and low-pressure modes are activated in the same manner. The difference being that the low-pressure mode is entered while the instrument's pressure port is open to the atmosphere, while the delta mode is entered with pressure already applied to the instrument.

5. Monitor the value in the READING window. The value displayed indicates the difference in pressure (in the range of ± 9.9 psig) between the current reading and the initial pressure measurement. Positive pressure readings, probably due to a rise in temperature, are indicated by a *steady* display, while negative readings that are due to leaks are indicated by a *flashing* display. Note that an out-of-range pressure condition is identified by two dashes "--" appearing in the READING window.

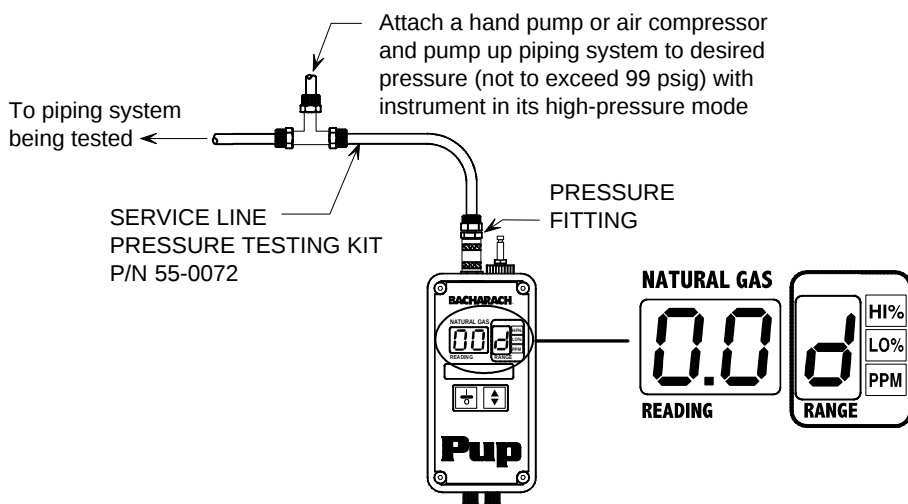


Figure 14. Pressure Proving a System using the Delta Pressure Mode

Using the Probe's Filter Chamber

The standard 10" probe supplied with the Gas Pup has a built-in filter chamber that can hold either a foam filter element, or a charcoal filter pack. Install and use these filters as follows:

Foam Filter Element – Particulate Filtration

When sampling, it is good practice to keep a foam filter installed inside the probe's filter chamber (see Figure 15). Although the instrument's gas inlet already has an internal particulate filter, the probe's foam filter will prevent dirt particles from building up inside the hose, which could eventually cause a flow restriction, and where the dirt particles would be difficult to remove for cleaning. Filters are packed ten to a box, and are available as P/N 5500-7100.

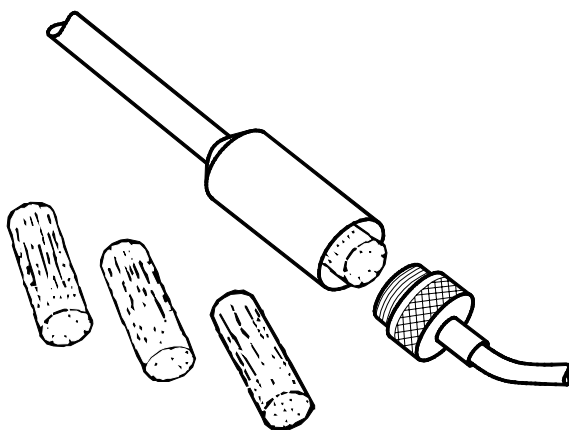


Figure 15. Foam Filter Element

Charcoal Filter – Petroleum Vapors vs. Combustible Gases

By using a disposable charcoal filter pack, it is a simple matter to distinguish between an indication caused by combustible gases (from a pipeline leak, for example) or an indication caused by a source of petroleum vapors (such as a nearby gasoline station). Activated charcoal will absorb a portion of the petroleum vapors in a gas sample; however, it will allow a dry combustible gas (such as natural gas or propane) to pass through. Filters are packed ten to a box, and are available as P/N 5500-7400.

The petroleum absorbing property of the activated charcoal filter is used to detect petroleum based gases and vapors in the following way:

1. With a standard foam filter installed in the probe's filter chamber, take a gas sample and note the display indication.
2. Remove the foam filter and install in its place one of the small activated charcoal filter packs. See Figure 16.

Note: *The charcoal pack will increase the response time of the instrument. Therefore, draw a sample of gas through the instrument for at least 60 seconds before taking a reading.*

3. Take a second gas sample from the same area, and note if the indication is less than it was in Step 1. If the indication has dropped, this means that the charcoal has probably absorbed petroleum vapors, and that one cause of the lower indication is likely to be petroleum vapors.



WARNING: *Following the use of a charcoal filter pack, the pack should be removed from the probe and discarded. Otherwise, the presence of combustible vapors may not be detected in subsequent testing.*

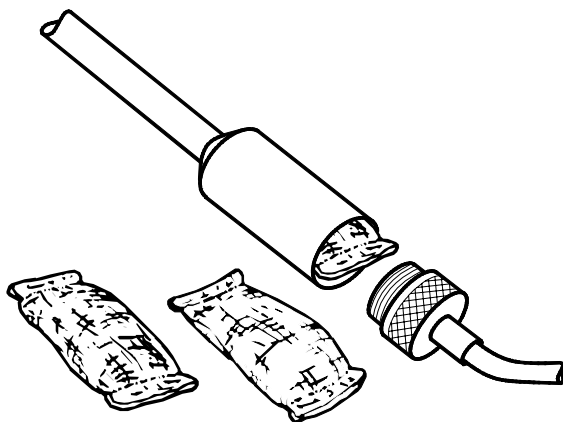


Figure 16. Charcoal Filter Pack

Water/Filter Trap

The optional water/filter trap accessory is recommended to be used in conjunction with the 30" barholing probe; thus preventing water from being drawn into the instrument when the probe is inserted into a hole filled with water. The water trap can also be used with the standard 10" probe when an operator is probing for a gas leak in an area that contains pools of water.

Install the water/filter trap directly on the instrument's gas inlet fitting; then connect the gas probe and hose assembly to the water trap as shown in Figure 17.

When using the water trap, observe that its bowl will begin to fill as water is drawn into the probe. It is good practice *not* to allow the water level to rise above the filter retainer. Empty the bowl by first turning OFF the Pup or removing the water/filter trap from the instrument, and then pushing up on the drain valve located at the bottom of the bowl.

The water trap also contains a particulate filter that should be changed when it becomes contaminated with dirt. Note that a dirty filter will slow down the flow of gas into the instrument and thus slow down the instrument's response time. Replace this filter by first unscrewing the bowl, and then unscrewing the filter retainer and discarding the old filter. Install a new filter and reattach the bowl.

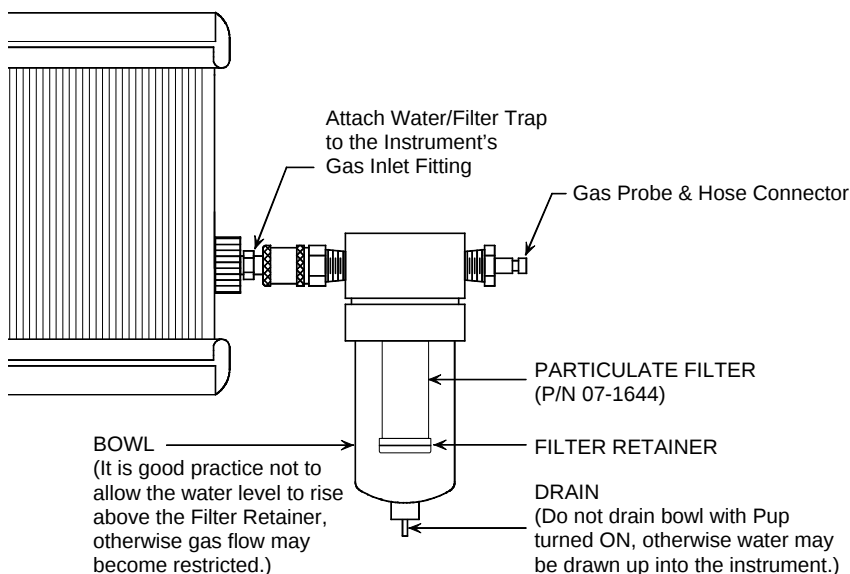


Figure 17. Water/Filter Trap

Error Messages

The following is a list of error messages that may appear when operating the Gas Pup. Note that numerical messages appear just prior to the instrument turning itself off. Contact your nearest Bacharach Service Center for assistance if the suggested remedies do not restore the instrument to normal operation.

Error Messages	Meaning	Remedies
2.3.0.	Stable level of calibration gas was not detected within 50 seconds during calibration.	Ensure that a sufficient amount of calibration gas is being applied.
2.3.1.	Calibration gas was <i>not</i> detected during calibration.	Apply calibration gas when required.
2.3.2.	Gain increase since last calibration was greater than 50%.	Replace combustibles sensor.
2.4.2.	Zero offset point for sensor is too low.	Replace combustibles sensor.
2.4.8.	Failure to write calibration value to EEPROM.	Return instrument to Bacharach for repair.
2.5.1.	Instrument failed to zero the combustibles sensor within 4 minutes.	Replace sensor.
2.5.2.	Low-battery condition.	Replace batteries.
F P	Pump not running at proper speed.	Blocked or insufficient gas flow through instrument due to a pinched hose or clogged inlet filter (see Fig. 23). Instrument may be too cold.
CAL	Instrument not calibrated.	Calibrate instrument.

Calibration

It is recommended that the Gas Pup be calibrated by your nearest Bacharach Service Center. 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.

Gas Calibration Equipment Setup

The following equipment is recommended to calibrate the Gas Pup (refer to the Accessories Section for part numbers):

- Calibration Kit (includes gas regulator, tubing, and instrument fitting)
- Calibration Gas:
 - Zero Air (20.9% Oxygen, balance Nitrogen) (optional)
 - 2.5 $\pm$ 0.05% methane
 - 100 $\pm$ 2% methane



WARNING: If you are not using Bacharach's calibration kit, be sure **not** to apply pressure to the gas inlet from your own calibration equipment. Use the excess flow calibration method, otherwise incorrect gas readings may occur.

Connect the components of the calibration kit, calibration gas cylinder, and Gas Pup together as shown in Figure 18. DO NOT connect the Gas Inlet Fitting to the Pup until instructed to do so in the calibration procedure.

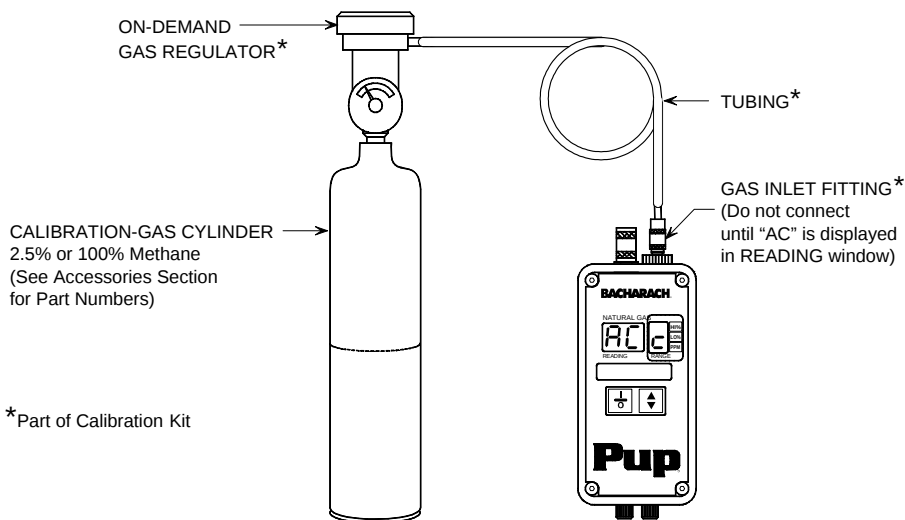


Figure 18. Calibration Equipment Setup

Gas Calibration Procedure

The Gas Pup has an auto-calibration feature that ensures proper calibration of the instrument. After setting up the calibration equipment as previously described, proceed with the calibration procedure as follows:

1. Before turning ON the instrument, be sure that the calibration equipment is *not* connected to the instrument, and that the instrument is in an area of fresh air.

Important! *Calibration should be performed in an area of fresh air. If the quality of the surrounding air is unknown, then zero air should be applied to the instrument's gas inlet port before the instrument is turned on and allowed to flow during the auto-start sequence (flashing "AS" in the READING window). This will require a second regulator to be connected to a zero-air cylinder.*

2. Press the  key to turn ON the Pup. Before proceeding to Step 3, wait until the instrument enters its auto-start period (flashing "AS" appears in the READING window).
3. See Figures 19 and 20. Auto calibration is started by pushing the  key at any time while "AS" is being displayed. Observe that the letter "C" appears in the RANGE window, indicating that the instrument is ready for calibration at the conclusion of the auto-start sequence. Calibration gas *must not* be supplied to the instrument before this time, or the sensor's zero setting will be in error.
4. Following the auto-start period, the instrument will display a steady "AC" for about 10 seconds and display "L" (for LO%) in the RANGE window. The default range is LO% (Figure 19), but if you are calibrating the HI% range (Figure 20), then press the  key until "h" is displayed.



WARNING: *In the following steps, be sure to apply the correct concentration of gas for the range being calibrated as listed below. Failure to apply the correct gas will cause inaccurate gas readings.*

- **LO%:** apply 2.5% gas while showing "L" in the RANGE window
- **HI%:** apply 100% gas while showing "h" in the RANGE window

Note: *If zero air is being applied at this time, remove it before proceeding to Step 5.*

5. While a steady “AC” is being displayed, apply calibration gas by simply connecting the tubing from the calibration equipment to the Pup’s gas-inlet fitting. The on-demand gas regulator will automatically begin to supply the correct amount of calibration gas to the instrument.
6. As the calibration gas is being applied, “AC” will begin flashing until a steady gas value is detected for a period of 5 seconds, after which the display will change to the calibration setting (2.5% for the LO% range, or 100% for the HI% range). At this time the calibration gas may be removed.

The instrument’s programming contains safeguards to prevent inaccurate calibration, or to limit the use of a sensor that may require replacement due to imminent failure.

Should calibration gas not be applied within the calibration period of 10 seconds, the instrument will drop out of the autocal mode and turn off (error code 2.3.1 is displayed just before the instrument turns off). The instrument is turned off to attract the users attention and make it evident that a proper calibration had not been achieved. The prior calibration values will be maintained to prevent an unintended change to these values.

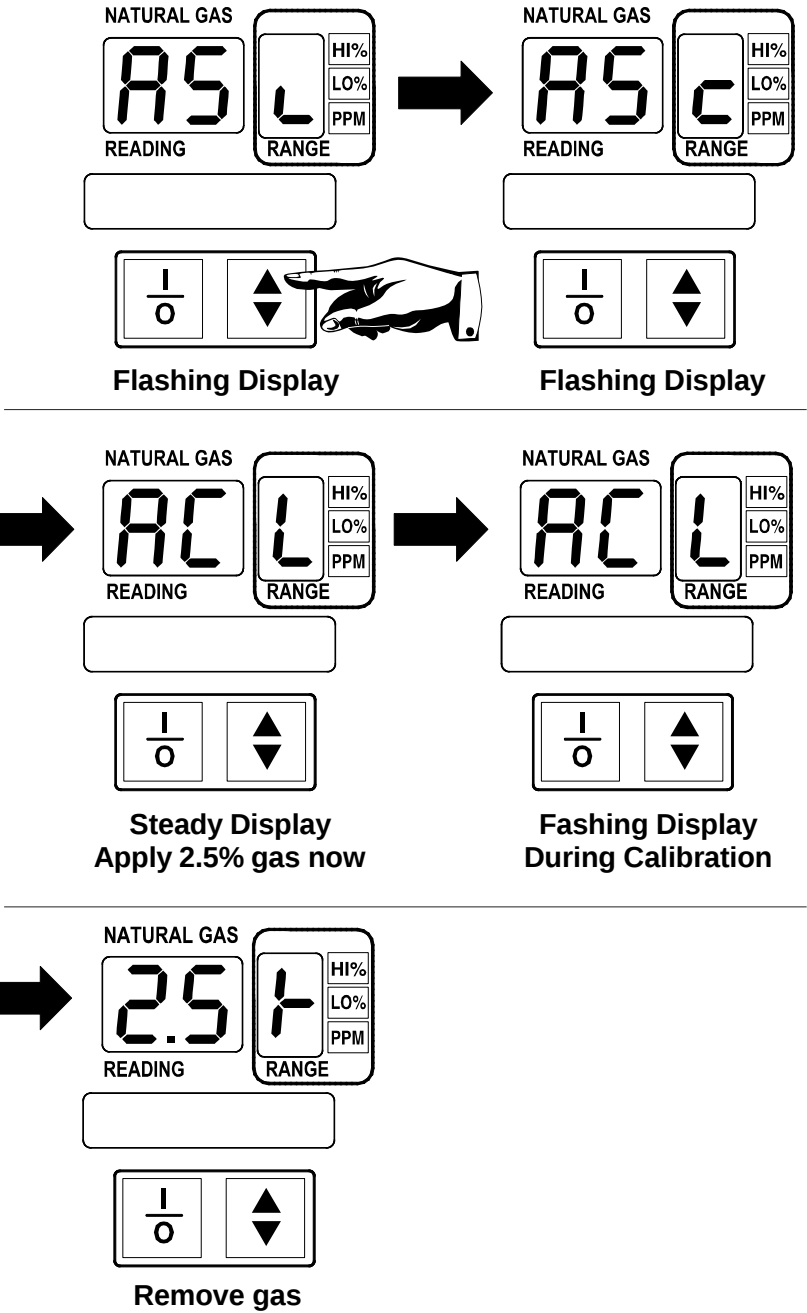


Figure 19. Performing a LO% Calibration

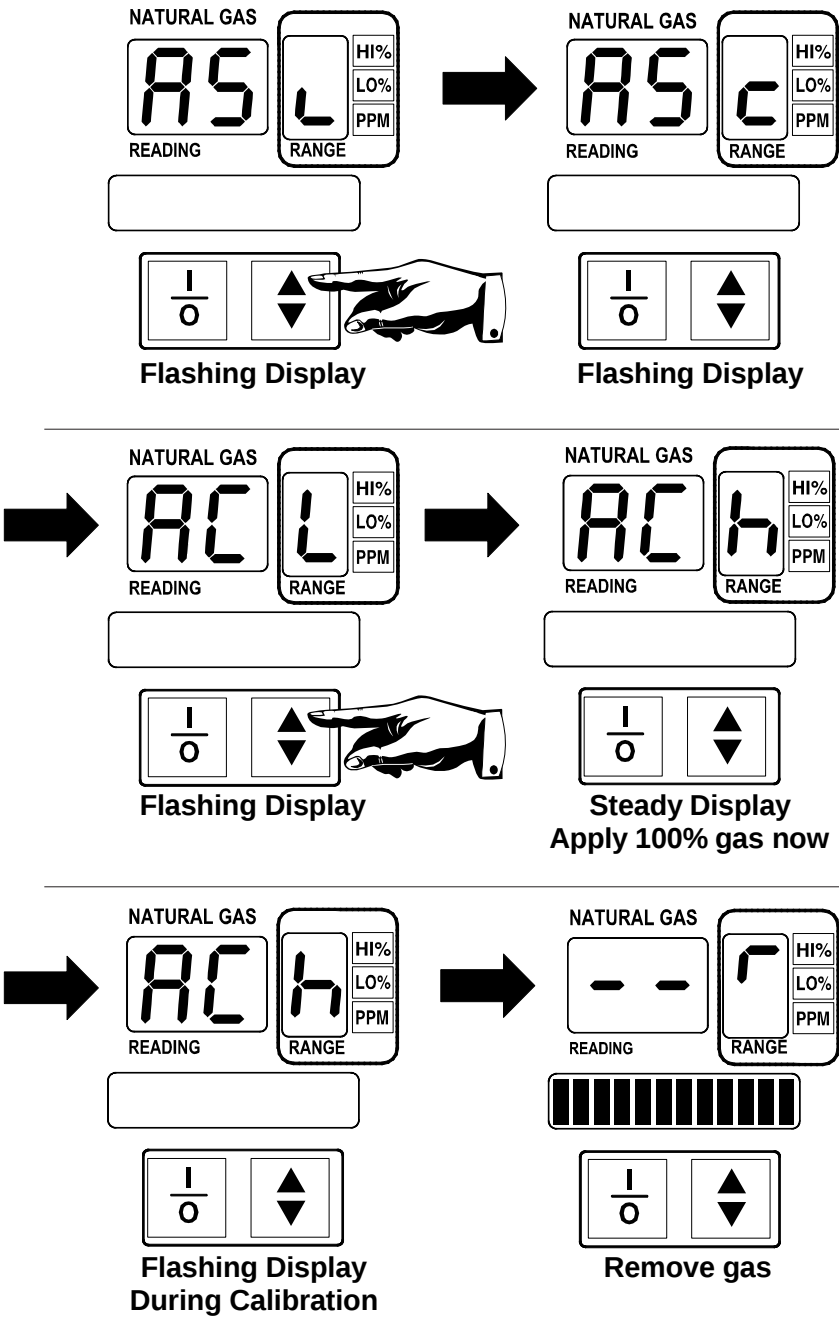


Figure 20. Performing a HI% Calibration

Pressure Sensor Check

The pressure sensor does not require calibration, but it is recommended that the sensor be checked for accuracy on a periodic basis and to assure that it is still operational.

To check the pressure sensor, the following equipment is recommended:

- Pressure source of at least 50 psig with an attached adjustable regulator (compressed-air cylinder, company gas, or shop air)
- Pressure measuring device (calibrated gauge, or digital manometer)
- Pressure Hose Kit (P/N 55-0038)
- Assortment of hardware: Tubing, Clamps, and Fittings

Check the pressure sensor as follows:

1. Connect the above equipment as shown in Figure 21.
2. Turn Pup ON and select its high-pressure mode as described under the previous heading *Pressure Operating Mode*.
3. Adjust regulator of pressure source for a pressure gauge reading of 50 psig. Observe that the pressure reading on the Pup should be within $\pm 5\%$ of the reading on the gauge.
4. Shut off regulator and disassemble test equipment.

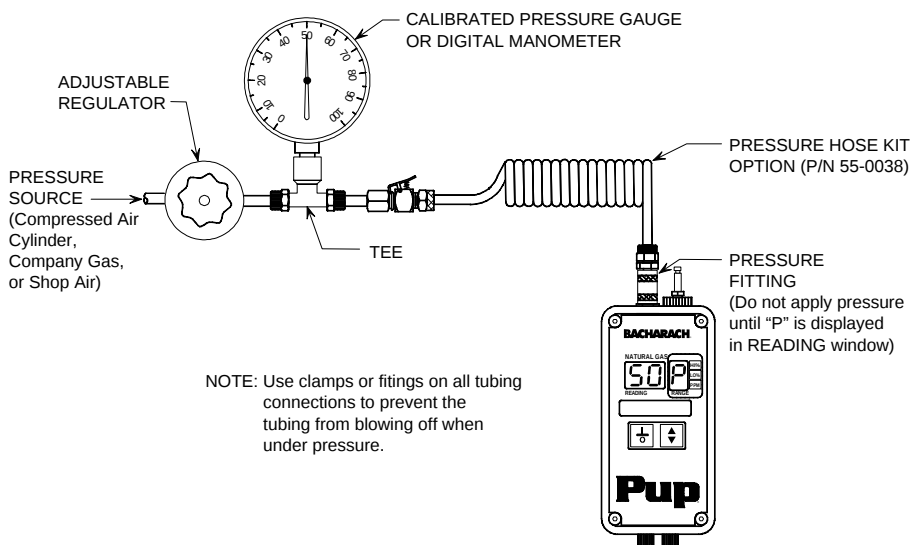


Figure 21. Pressure Testing the Sensor

Maintenance

Batteries

The battery voltage is monitored by the instrument's microprocessor, and can be checked by momentarily pressing the $\frac{b}{\text{b}}$ key. Refer back to the previous section *Battery Voltage Check*.

Battery replacement is recommended when the voltage at startup is less than 2 volts. The batteries must be replaced when the display starts blinking every five seconds while showing "b" in the RANGE window.

To replace the batteries, refer back to the previous section *Battery Installation*.

Sampling Probe

The sampling probe is the most likely candidate for maintenance as it is subject to damage in normal field operations. The probe tube may be made of either aluminum or clear polycarbonate.

Replacing either probe is a simple matter of unscrewing the damaged probe and installing a new one. Replace the O-ring if it looks deformed and can no longer provide an air-tight seal. See Figure 22.

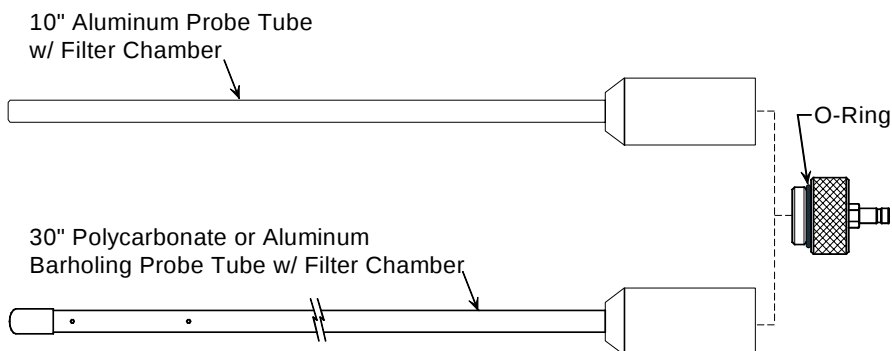


Figure 22. 10" Sampling and 30" Barholing Probes

Gas Inlet Filter Replacement

Periodically check the gas inlet filter, located directly behind the gas-inlet fitting, for signs of dirt. As necessary, replace this filter per Figure 23.

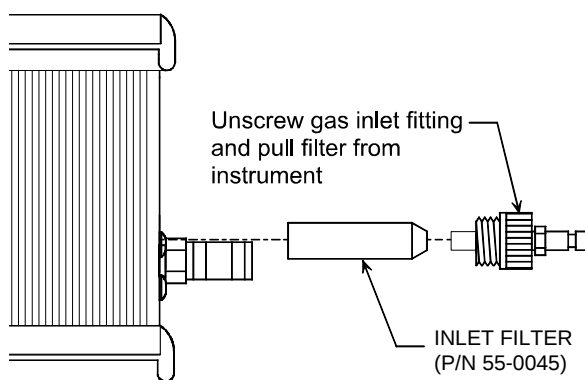


Figure 23. Gas Inlet Filter Replacement

Pump Replacement

The pump may become inoperative due to water or solid particles getting into the valves. This will require replacement of the pump to correct.

To replace the pump (see Figure 24):

1. Remove the instrument's bottom plate using a $\frac{5}{64}$ " Allen wrench to remove the plate's four corner screws. Then remove plate and rubber bumper to expose the instrument's interior.
2. Back off the pump bracket screw in the lower corner of the flow block and rotate bracket arm to free pump.
3. Unplug pump connector from printed circuit board and lift pump straight out of instrument.
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—aligning pump as necessary.
5. Leak test pump before use per section *Leak Check Basics*.

Combustibles Sensor Replacement

If the instrument cannot be calibrated in either range, the combustibles sensor must be replaced with a new unit.

To replace the sensor (see Figure 24):

1. Remove the instrument's bottom plate by using a $\frac{5}{64}$ " Allen wrench to remove the plate's four corner screws. Then remove the plate and rubber bumper to expose the instrument's interior.
2. Remove pump connector, pressure sensor connector, and multi-pin connector from printed circuit board, noting orientation of connectors.
3. Remove three screws from printed circuit board; then *carefully* pry the board straight up from flow block. The gas sensor is the silver cylindrical piece in the center of the circuit board.
4. *Gently* pull sensor from circuit board and replace with a new unit. Make sure that the sensor is firmly seated in 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 24.
6. Replace three screws and tighten to hold board. Reattach the pump, pressure sensor, and multi-pin connectors to the circuit board.
7. Leak check the assembly per the following section *Leak Check Basics*.
8. Calibrate the instrument per the previous section *Calibration*. Note that if a new sensor is installed without performing a calibration, the word "CAL" will appear when the instrument is turned on, alerting the operator that the instrument needs to be calibrated.

Leak Check Basics

The easiest method to perform a leak check is to close off the sample inlet, and then observe that a pump failure occurs. For example, to close off the standard 10" probe, either grip its end tightly with your hand, or cover with masking tape. Note that attempting to close off the fitting ends may be not be successful, as there are leak paths when the hose is not in place.

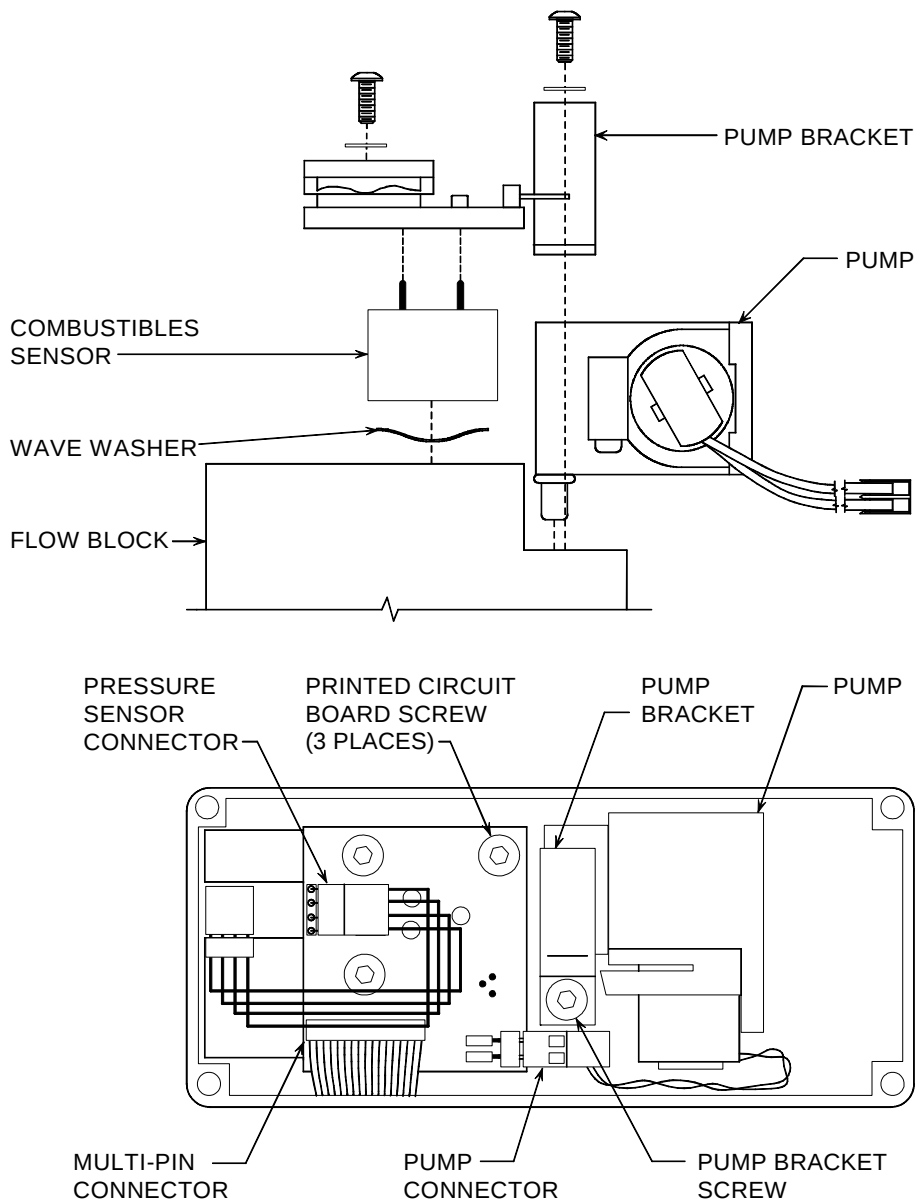


Figure 24. Pump or Sensor Replacement

Parts & Service

Replacement Parts

Gas Pup Instrument Kit: includes instrument, 10" gas probe, coiled gas tubing with quick-connect fittings, 2 inlet filters, 3 batteries, and a pocket size pressure & gas conversion card. 55-8000

Battery Cover Assembly	55-0013
Bottom Plate	55-0010
Bracket, Pump	55-0018
Bumper, Rubber	55-0011
Filter, Gas Inlet, 100 micron, (package of 2)	55-0045
Gas Hose Assembly	55-0043
Hose, Coiled	55-0032
Quick-Connect Fitting, Female	103-5402
Gas Probe Assembly	55-3000
Probe Tube w/ Filter Chamber, 10"	3474-1350
O-Ring, $^{11}/_{16}$ " ID x $^{13}/_{16}$ " OD	05-5116
Pump Assembly	55-0061
Quick Connect Fittings (on instrument):	
Pressure:	
Fitting, Quick Connect, Female	103-5408
Gas:	
Fitting, Inlet	55-0015
Fitting, Quick Connect, Male	103-5409
Washer, Rubber, $^{3}/_{8}$ " ID x 0.562 OD	05-5723
Screws:	
Button Head Socket, #6-32 x $^{1}/_{2}$ "	101-9805
Button Head Socket, #6-32 x $^{3}/_{8}$ "	101-9803
Pan Head #2-56 x $^{1}/_{4}$ "	01-6408
Sensor, Combustibles	55-0040
Washers:	
Lock, Internal Tooth, #6	102-5167
Rubber, $^{3}/_{8}$ " ID x 0.562 OD	05-5723
Wave, Sensor Hold Down	102-4663

Accessories

Barhole Probe Assemblies:

30" polycarbonate probe	55-3001
30" aluminum probe	3474-1210
Cap, Vinyl Tip (for polycarbonate probe tube)	05-4751

Calibration Kits:

Includes on-demand regulator, 3 feet of ¼" tubing, and a quick-connect female fitting	55-8002
On-demand regulator only	55-0064

Calibration Gas:

- Zero Air, 20.9% O ₂ in air, 103 L Tank	51-7131
- 2.5 ±0.03% Methane in air, 103 L Tank	51-1121
- 100 ±2% Methane, 58 L Tank	55-0060

Carrying Cases:

Hard Plastic Carrying Case: Provides storage space for the instrument, gas probe and hose, and other miscellaneous accessories	55-0039
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Soft Carrying Case: Holds the instrument and gas probe, supplied with a shoulder strap	55-0044
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Check Gas: 500 ppm Methane, 103 L Tank	51-1816
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Filters (fits inside filter chamber of gas probe):

Foam Filter Element (package of 10): Protects against dust and dirt from entering the instrument's gas tubing.	5500-7100
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Charcoal Filter Pack (package of 10): Provides the ability to detect the difference between petroleum vapors and natural gas.	5500-7400
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Pressure Hose Kit: Includes a 48" coiled polyurethane tube with a quick-connect female fitting on one end and a quick-connect insert plug on the other. Also includes a ⅛-NPT quick-connect socket. Use this kit to check regulator pressure and gas pressure in piping.	55-0038
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Service Line Pressure Testing Kit: Includes two 2-foot sections of ¼" tubing, tee with pressure valve, quick-connect male fittings on each end of tubing, plus an ⅛-NPT quick-connect socket. Use this kit to pressure prove new and repaired piping where the piping is pressurized with air and then monitored for leakage.	55-0072
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Socket, Quick-Connect, ¼-NPT (use on 55-0038 & 55-0072)	103-5386
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Socket, Quick-Connect, ⅛-NPT (part of 55-0038 & 55-0072)	103-5396
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Tubing Coupler: Provides the ability to couple together two sections of tubing that have quick-connect female fittings	55-0046
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Water Trap Assembly	55-0063
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Particulate Filter (package of 3)	07-1644
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Service Centers

Service and replacement parts can be obtained by contacting a Bacharach Service Center at the following locations:

United States

California

7281 Garden Grove Blvd.,
Suite H
Garden Grove, CA 92841
Phone: 714-895-0050
Fax: 714-895-7950
Email: calservice@bacharach-inc.com

Indiana

8618 Louisiana Place
Merrillville, IN 46410
Phone: 219-736-6178
Fax: 219-736-6269
Email: indservice@bacharach-inc.com

New Jersey

7300 Industrial Park
Rte. 130, Bldg. 22
Pennsauken, NJ 08110
Phone: 856-665-6176
Fax: 856-665-6661
Email: njservice@bacharach-inc.com

Pennsylvania

621 Hunt Valley Circle
New Kensington, PA 15068
Phone: 724-334-5051
Fax: 724-334-5723
Email: help@bacharach-inc.com

Texas

5151 Mitchelldale, B-4
Houston, TX 77092
Phone: 713-683-8141
Fax: 713-683-9437
Email: txservice@bacharach-inc.com

Canada

Bacharach of Canada, Inc.
250 Shields Court Unit #3
Markham, Ontario L3R 9W7
Canada
Phone: 905-470-8985
Fax: 905-470-8963
Email: bachcan@idirect.com

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