



**BASCOM-TURNER
INSTRUMENTS**

GAS-EXPLORER II™ DETECTORS

OPERATION MANUAL

**NATURAL GAS, CARBON MONOXIDE, OXYGEN,
HYDROGEN SULFIDE**

Part Number OM-0323

LIMITED WARRANTY

Bascom-Turner Instruments warrants Gas-Explorer Detectors to be free from defects in materials and workmanship for one year following the date of shipment. This limited warranty applies to the original purchaser of the Detector and is not transferable except by Bascom-Turner's authorized Distributors.

The instruments described in this manual are produced with standard commercial parts, any of which may fail under some circumstances. Although the probability of such failure is low, it is not zero. Accordingly, all personnel using such instruments must be trained to recognize instrument malfunctions and to have such instruments repaired promptly. Bascom-Turner offers no warranty that failures will not occur – only that when they occur, they will be promptly cured with the following procedure:

During the limited warranty period, we will repair or replace, at our option, any defective products or parts at no additional charge. A return merchandise authorization (RMA) number must be obtained prior to returning a detector to Bascom-Turner. A detector returned to Bascom-Turner with probe and water-block filter, shipping prepaid, will be repaired, calibrated and returned second day air. Warranty repairs do not include pump cleaning, filter replacement and calibration. All replaced parts and products become the property of Bascom-Turner Instruments.

This limited warranty does NOT extend to any Detectors which have been damaged as a result of accident, abuse, modification, misuse such as failure to follow the operating instructions provided by Bascom-Turner Instruments, or other contingencies beyond our control. No other warranty is expressed or implied. Bascom-Turner is not liable for consequential damages.

CAUTION

Personnel who operate, calibrate, or repair this instrument must first read and fully understand this manual in its entirety.

For use in Class I, Division 1, Group D atmospheres (Propane and Methane).

These products have not been tested for intrinsic safety in oxygen enriched atmospheres.

Change batteries, service, and use the USB interface only in areas known to have non-hazardous atmospheres.

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FEATURES

The Gas-Explorer II™ portable methane, and combined methane, carbon monoxide and oxygen detectors are intrinsically safe, microprocessor based instruments designed to test ambient air and flue gas over a wide temperature range.

These detectors have many features for easy and reliable operation:

- **Absolute Compliance (Optional)**
The instrument automatically calls for and requires calibration at the end of a pre-determined interval.
- **Automatic Data Storage and Reports**
Automatic storage of time and mode-stamped readings. Automatic storage of the last 24 calibrations. Automatic generation of reports.
- **Automatic Calibration**
Calibration is performed automatically using Bascom-Turner's calibration gas.
- **One-Gas Calibration (Optional)**
Calibration of the thermal conductivity sensor (vs methane) is automatically carried out with the One-Gas routine. Alternatively, the sensor can be calibrated with System Gas.
- **Measurements Over the Full Range of Gas**
The instruments detect methane over the full range of methane concentrations up to 100% GAS. Peak and current readings are displayed simultaneously.
- **Track Gas**
A sensitive, calibrated scale with 20ppm resolution and quick response makes it easy to find gas leaks.
- **Bar Holing**
Peak and sustained bar-hole readings are automatically displayed after gas is pumped for a precise, fixed time.
- **Purge**
Measures the concentration of natural gas with resolution of 0.1% by volume as sensed by the thermal conductivity sensor.
- **Automatic Sampling**
An intrinsically safe pump automatically samples ambient air, flue gas, or bar hole gas.
- **Automatic Self-Tests**
Automatic checks of battery, sensors, and pump. Tests for blockage and for tight connection of probe to instrument.
- **Audible and Visual Alarms**
Audible and visual alarms individually set. Continuous monitoring of natural gas, and (optionally) CO and O₂.
- **Easy-to-Use**
Simple operation without complicated or confusing displays. A short “help” manual is stored onboard.

SPECIFICATIONS

Gases Detected	Natural Gas (Methane) Carbon Monoxide (CO) [Optional] Oxygen (O ₂) [Optional] Hydrogen Sulfide (H ₂ S) [Optional]
Sensors	Dual Catalytic Combustion (CH ₄) Thermal Conductivity (CH ₄) Electrochemical (CO, H ₂ S, O ₂)
Ranges	
GAS	0 to 10,000 ppm CH ₄ by volume 0 to 100% CH ₄ by volume
PPM CO	0 to 2000 ppm carbon monoxide
% O₂	0 to 40% by volume
PPM H₂S	0 to 100 ppm by volume
Data Storage And Reports	24 Calibrations 6+ months readings (typical) Exposure and Bar-Hole Measurements, Calibration History, Sensor Sensitivity, Operational Periods by User and Unit ID, Office Reports
Calibrated Accuracy (5° to 35°C)	2% of reading ±20 ppm CH₄: ±0.1% to 5%; ±2.0% from 5% to 100 vol % CO: ±5% of reading ±10 ppm O₂: ±0.2% vol % H₂S: ±5% of reading ±1 ppm

Resolution	
GAS	20 ppm from 0 to 10,000 ppm 0.05 vol % from 0 to 5 vol % 1.0 vol % from 5 to 100 vol %
CO	1 ppm
O₂	0.1 vol %
H₂S	1 ppm
Warm-Up Time	60 seconds
Response Time:	CH₄: 0.6 seconds (Track Gas) 2.0 seconds (Monitor) H₂S/CO: 45 seconds O₂: 60 seconds
Operating Temp.	-20°C to 40°C (0°F to 105°F)
Storage Temperature	-40°C to 60°C (-40°F to 140°F)
Humidity	0 to 95% RH (non-condensing)
Power Supply	Two C-size Alkaline or Two C-size Rechargeable NiMH
Continuous Operating Time per Battery Set	10 hours typical (25°C)
Weight	24 oz. (680 g)

PART I. OPERATION

1. THE GAS-EXPLORER DETECTORS

This manual describes the operation of the family of Gas-Explorer detectors for natural gas, carbon monoxide and oxygen:

- Model EGI -201 - Detects natural gas and displays it as PPM, % LEL or % GAS
- Model EGI -211 - Detects natural gas and displays it as PPM and % GAS
- Model EGC-301 - Detects natural gas and carbon monoxide and displays it as PPM, and -311 % LEL(301) or % GAS(311), and PPM CO (parts per million of CO)
- Model EGO-321 - Detects natural gas and oxygen and displays PPM, % LEL or % GAS, and % Oxygen
- Model EGO-322 - Detects natural gas and oxygen and displays PPM or % GAS and % Oxygen
- Model EGA-411 - Detects natural gas, CO, and oxygen and displays PPM, or % LEL(411) or and -412 % GAS(412), PPM CO and % Oxygen
- Model EGA-611 - Detects natural gas, CO, and oxygen and displays PPM or % LEL(611) or and -612 % GAS(612), PPM CO, PPM H₂S and % Oxygen

All models display gas in ppm in the Track Gas mode.

All models may be used to test ambient air and bar hole to locate natural gas leaking from pipes and other conduits. All models which detect carbon monoxide (CO) may be used to test for CO in ambient air, flue gas, and gases given off by appliances.

A detector alerts the user acoustically and visually, by “flashing” the symbol(s), for detected gas(es), whose concentration exceeds preset limits. Visual alarms are displayed in-between readings. For example, the display will flash “CO”, approximately every two seconds, in-between normal Monitor mode displays. If the concentration of natural gas also rises above its alarm limit, the display will flash “GAS”, then a normal Monitor mode display, then “CO”, and so on. Simultaneously, the sound alarm will be on.

Visual alarm symbols are “GAS” for natural gas, “CO” for carbon monoxide, “HS” for H₂S, “Low Oxygen” for low oxygen, and “High Oxygen” for high oxygen.

Factory set alarm limits are 1.0% methane, 35 ppm CO, 9ppm H₂S and 19.5% for low and 23.0% for high oxygen.

No alarms are given in the Bar Hole mode. The low battery warning is given in all modes.

<p>WARNING: Each detector responds to the gases for which it was designed. Other toxic or dangerous gases may not be detected.</p>

OPTIONS

All units may have (optionally) Bluetooth and/or GPS. The former may be used for transmitting stored calibrations, while the latter assigns coordinates to all measurements (gas readings) obtained by an instrument. GPS coordinates are automatically stored together with corresponding readings of all sensors on-board.

2. ESSENTIAL OPERATING PRACTICE

Gas-Explorer detectors are easy to use. A detector is turned on by pressing the left button; its operation is controlled by three “*Soft*” buttons whose function is shown on the display. The middle button generally toggles “*Mute*” on and off in Track Gas mode (see later). Double-clicking the middle button turns the backlight continuously ON or OFF depending on its previous state. Once the appropriate display is selected, operation is automatic. However, a few general rules must be followed to insure reliability.

Pump. Gas-Explorer detectors have a built-in pump and depend on this pump for their operation. If the pump is not functioning normally, the instrument will not function properly. It is therefore essential to check the pump each time the instrument is turned on.

Pump Test: Connect the probe you plan to use and turn the instrument on. After the display shows “*Block Intake*”, block the probe at its intake to show “*Pump OK*”.

If “*Pump OK*” does not appear, tighten all connections and repeat the test. If a block condition is still not observed, remove the probe and block directly the inlet. If “*Pump OK*” still does not appear, return the instrument for repair.

A pump test can be carried out as above at any time during normal operation of the instrument. **If there is any indication that the pump is not operating normally, the instrument should not be used until repaired.**

Filters. Dust and water-block filters protect the sensors and the pump from dust and accidental intake of liquid water. Just as a car would not be operated without air and fuel filters, do not operate a detector without a filter on the probe. **Operation without this filter will eventually degrade the sensors and the pump. It also voids the limited warranty.**

It is essential that the filter be replaced monthly or sooner if it turns brown. Operation without a filter will degrade the natural gas sensor and will void the warranty. Filters are available from Bascom-Turner in packages of five, Part No. WF-505.

Models VGA-611 and VGA-612 require special filters available from Bascom-Turner in packages of five, Part No. WF-705.

Zero Check. All sensors drift to some extent over time. Sensor drift is corrected by zeroing if the drift is within 0.1% vol. GAS (and 10ppm CO if the unit is equipped with a CO sensor). If the drift is outside these limits, “*NO GO*” is displayed and the user is asked to autozero the unit in “clean” outdoor air. The user can override this limit and re-zero the instrument unless the zero has drifted over 1.0% vol. GAS (or 20ppm CO if the unit is equipped with a CO sensor), in which case the instrument must be checked by a trained professional (the sensor may need replacement). It is important that the zero adjustment be done in clean air, for example, outdoors. If the sampled gas is not clean, a systematic error may be introduced in subsequent measurements.

WARNING: On a call, turn the instrument on outdoors, not indoors.
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Test and Calibration. Gas-Explorer detectors must be checked and calibrated periodically with gas of known composition. The catalytic combustion, carbon monoxide, and hydrogen sulfide sensors depend on catalysts which may lose activity or get poisoned during use. When this happens, there will be diminished response.

The necessary frequency of calibration depends on actual use and on the concentration of catalyst poisons in the sampled gas. This concentration is, of course, not generally known.

A detector can be tested with methane bump gas. Such tests merely verify that the gas sensor(s) are in operating condition. To verify and adjust, if necessary, their sensitivity they must be calibrated.

A detector can be automatically calibrated in approximately one minute using Bascom-Turner's calibration gas (2.5% CH₄ and 100 ppm CO in air). Given the ease and speed of automatic calibration, it pays to calibrate as frequently as possible, and certainly, no less than monthly.

Accuracy. A properly operating and calibrated detector will respond with the specified accuracy. If combustible gases other than the gas used for calibration are likely or suspected, the instrument **cannot** be relied upon to give a proper indication of their concentration and hence of how close to their combustible limits they may be. For example, the detector responds quite differently to gasoline, to methane, and to propane. Accordingly, readings of % LEL (or its equivalent in percent gas) refer only to the calibration gas and can be relied upon only in this respect in assessing an atmosphere sampled by the detector. Furthermore, concentrations displayed by the detector refer to a local sample at the tip of the instrument probe. Low gas concentrations at one spot do not necessarily mean that the gas concentration is low throughout a wider area.

WARNING: Each detector responds to the gases for which it was designed. Other toxic or dangerous gases may not be detected.

Safety. These instruments measure the concentration of natural gas in air and give, more generally, an indication of the presence of other combustible gases. When used by trained personnel, they constitute one element for assessing the safety, or lack thereof, of a particular atmosphere. **However, they must not be relied upon by themselves for judging safety; all other significant factors must be taken into account.** The measured concentration refers only to the immediate vicinity of the probe – concentrations in a wider area may be significantly different. A trained technician should consider possible interferences, physical or chemical, and be aware that calibrated values are only valid in air. If other gases, including inert gases such as carbon dioxide are present, the measurements may not be reliable. Finally, although there are built-in safeguards, a specific instrument may malfunction. It is therefore imperative that other indicators, including, for example, odorant levels, must be taken into account.

WARNING: Catalytic combustion sensors do not respond in inert or reducing atmospheres. They should not be used for detecting combustible dusts or mists.

3. OPERATIONAL DESCRIPTION

To conserve the batteries, turn the instrument OFF when not in use.

The instrument is controlled by three push button switches whose function changes with each particular display (see Appendix 1). The function of each push button is shown on the display in each case. In Track Gas mode, the middle button silences the beeper (“mutes” the instrument).

Startup Sequence. To turn the instrument on, press the left switch. A series of screens is automatically displayed preparatory to entering the first operational mode, viz. “*Monitor*”. Along the way, a number of specialized screens can be used to access specialized functions.

The first screen shows the Model Number and the second displays gases detected by the instrument and provides access to the USB interface (see Part 3) or to a display of the serial number. The next screen shows the date and time. To edit the date or time, press the right “Edit” button. The first digit of the hour will begin flashing and can be changed from 0 to 1 or 1 to 0 by pressing the right “Update” button. Pressing the “Next” button advances the flashing digit which can then be edited (or not) by pressing the right (or left) button, and so on. The same screen provides access to a short manual by pressing the left “Help” button.

Following the Edit/Help screen, the pump is tested (“Block Pump” screen). If no block is detected in 40 seconds, “*Check Probe*” is displayed, followed by “*Remove Probe and Block Intake*” and finally “*Repair Pump*” followed by an automatic turning off of power.

The next display suggests a “*Calibrate by* [a date thirty days from the date of the last calibration]” and an opportunity to calibrate (see Part 2, Calibration). If calibration is not chosen, the instrument proceeds to enter the operational mode of “Monitor” (see below).

The period of thirty days between calibrations is only a default value. The instrument should be calibrated as often as possible, ideally every day. In any case, if poisoning of the natural gas sensor or some other problem is suspected, the instrument should be promptly checked by calibration with CAL Gas (see Part 2, Calibration).

Backlight. Pressing any button backlights the display for 20 seconds. To backlight any display, press the middle button twice (if in Track Gas mode, this sequence leaves the instrument in its original state – mute or not mute). The backlight remains on until a new display is entered or the middle button is double-clicked again. An exception to this procedure is during bar holing (middle button initiates sampling). Pressing the middle “Go” button automatically backlights the display long enough (60 seconds) to read the results.

Turning the Instrument Off. The instrument can be turned off from most displays. Such places are obvious when a particular button is marked “Off.”

When a direct “Off” button is not available, you may follow the procedures suggested below:

1. At the USB access display, press the left “USB” button and then after the new screen, the right “Off” button.

Operational Modes. The instrument operates in four distinct modes: “Monitor”, “Track Gas”, “Bar Hole” and “Purge”. A mode may be entered from the Mode Menu screen which can be accessed by pressing the “Mode” button from most screens. In the Mode Menu, pressing the “Yes” button will enter the mode pointed to by the arrow. Pressing the “No” button will move the arrow down the list to the next mode. The instrument enters Monitor mode at startup by default.

Monitor: The detector shows the concentration of natural gas (methane) in air in steps of 0.05% GAS (1% LEL) up to 5% GAS (100% LEL) and then in steps of 1% GAS up to 100% GAS. The concentrations of CO, H₂S (HS), and O₂ are also shown if the unit is equipped with the corresponding sensors (see below).

The peak reading for GAS is retained and displayed along with the current readings until another mode of operation (Track Gas or Bar Hole) is chosen, or a new zero is obtained, or the unit is turned off.

Models EGI-201, EGC-301, EGO-321, EGA-411, and EGA-611 display concentrations in increments of 1% LEL up to 100% LEL and then in increments of 1% vol. from 5% to 100% GAS. All other models display % vol. gas in increments of 0.05% up to 5% and then in increments of 1% to 100% GAS.

Track Gas: Connect an appropriate probe (see Section 7) and select “TRACK”. The display shows “*Track Gas*” for a few seconds. After warm-up, the display shows the concentration of gas in air in parts per million by volume (ppm). Advance a probe along the pipe or other conduit suspected of having a gas leak. The beeper will sound if the ambient concentration of gas rises above 20ppm. The number of beeps will increase as the concentration of gas increases according to the chart below.

2 Beeps:	20 ppm – 100 ppm
3 Beeps:	100 ppm – 250 ppm
4 Beeps:	250 ppm – 500 ppm
5 Beeps:	500 ppm – 1,000 ppm
6 Beeps:	1,000 ppm – 5,000 ppm

Since methane is lighter than air, track a conduit from above whenever possible. Sometimes it is desirable to silence the beeper during a leak survey. To silence the beeper, press the middle switch. “*Mute*” will appear on the display and the beeper will be silent. If the gas concentration goes over 10,000 ppm, (1% Gas) the unit automatically enters the Monitor Mode.

As in the Monitor Mode, the peak reading for Gas is retained and displayed until another mode of operation is chosen, or a new zero is obtained, or the unit is turned off.

Bar Holing: The detector may be used to measure gas levels in sampling holes used for locating underground natural gas resulting from seepage or leaks in a conduit. Gas concentrations in a bar hole near a significant leak will exceed several percent. Therefore an alarm for gas is likely, but since it is not relevant to the ambient atmosphere above ground, it is automatically suppressed. During bar-holing, the alarms for all gases are automatically turned OFF.

To bar hole, select an appropriate probe (see Part 1, Section 7) and set the front panel to Bar Hole (BH). The instrument automatically clears any residual gas and checks for clean air. The pump is then turned off and the instrument is ready for bar holing. After inserting the probe into the bar hole, press the “Go” button (the middle switch). The pump is turned on and the instrument samples gas for a fixed time (**factory set time is 15 seconds**). Readings during sampling are shown on the display. At the end of the fixed time for sampling, the instrument turns

off the pump, and displays the peak and sustained readings. Both values are in % GAS.

If in the course of bar holing, water is encountered, press the left “Stop” button to stop the pump. Use of a water-stopper (see Figure 2 in Section 8) will prevent water from entering the instrument.

<p>WARNING: If a check is to be made for trace amounts of gas, for example around the foundation of a structure, the Monitor or the Track Gas – not the Bar Hole - mode should be selected.</p>
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Purge: The purge mode measures the concentration of natural gas in nitrogen with a resolution of 0.1% by volume from 0.0% to 100.0% as sensed by the thermal conductivity sensor. Purging air-filled lines into service requires lowering the oxygen content to less than 9.7% (or natural gas concentration over 70%).

To Detect Carbon Monoxide

Carbon Monoxide in Ambient Air

Connect an appropriate probe with a water-block filter and select the Monitor mode. After warm-up, the display shows the concentration of CO in parts per million (ppm). If the air is clean (contains no carbon monoxide), the display should read zero. If it does not, use the right “Zero/Off” button to obtain a new zero in clean air.

Carbon Monoxide in Flue Gas

Connect the flue gas probe, with an attached flue gas filter, to the water-block filter on the hose and select the Monitor mode. After warm-up, insert the probe into the flue and read the concentration of CO in parts per million. A flue gas check of CO should take one minute or less. For every minute of flue gas sampling allow the detector a minute of room air sampling to dry the filters.

CAUTION: The filter provided with the flue probe **must** be used to avoid interference by nitrogen oxides in combusted gas. Filters should be replaced approximately monthly or if they become clogged or flooded (see "Accessories and Spare Parts", Flue Gas Filter, Part No. FF-005).

Note: The standard flue gas probe and filter are suitable for spot checks lasting a minute or two. For measurements of CO in flue gas over longer periods use an Extended Duty Flue Gas Probe and Filter (Part No. FP-012).

WARNING: Do not touch the flue probe immediately after a measurement. Wait until it cools. Running the instrument in air helps cool the probe.

“Air-Free” CO Flue Measurements.

The EGA-411/412 and 611/612 detectors can display measurements of CO on an “air-free” basis if this feature is selected (see Part 2). When this selection is made, the measured CO concentration is referred to air-free flue gas according to:

$$\text{"Air - Free"PPM CO} = \frac{20.9}{(20.9 - \text{measured \% O}_2)} (\text{measured ppmCO})$$

The instrument displays CO concentrations on an air free basis using the above relation. The CO reading on the display is labeled by ppm AFCO, i.e. air-free CO. This calculation is used up to 16% Oxygen. Beyond this, CO concentrations are displayed without conversion, i.e. the “air-free” formula is **not** used.

4. INSTRUMENT CHECKS

Automatic Sensor Check

If a gas sensor fails (opens up), the display shows “*Replace Methane Sensor*”.

Automatic Pump Check

If the intake is blocked, the display shows “*Flow Blocked*” and the detector beeps until the problem is cleared. This check is carried out whether or not a probe is being used. During the power on sequence, if a blocked flow is not detected within 40 seconds (from manually blocking the intake to the pump), the detector displays “*No Block Check Probe*” then “*Remove Probe and Block Intake*”, and finally “*Repair Pump*”.

Check for Tight Connections

To check for tight connections, block the probe inlet to observe “*Flow Blocked*” on the display. If “*Flow Blocked*” fails to appear, there may be a leak.

WARNING: The instrument will not operate when first turned on if it fails to block when the air intake is blocked. Subsequently, however, connections can only be checked by blocking the probe inlet and observing “*Flow Blocked*” on the display. If “*Flow Blocked*” fails to appear, the probe and/or inlet must be checked for leaks.

Automatic Zero

The zero is adjusted automatically when “Zero” is chosen from an appropriate display.

CAUTION: Zero adjustment **must** be carried out in clean air; otherwise, a systematic error will be introduced in subsequent measurements. The instrument will auto zero in concentrations of methane below 0.10% GAS and concentrations of CO below 10 ppm.

5. INTERFERENCE FROM OTHER GASES, LIQUIDS, OR RFI

The methane detectors use two sensors:

- i) A catalytic combustion filament calibrated with methane. It is used up to about the lower flammable limit (5.0% by volume) of methane.
- ii) A thermal conductivity sensor calibrated with methane. It is used from the lower flammable limit (5.0 vol %) to 100 vol % of methane.

Models EGC-301 and EGC-311 (methane and carbon monoxide detectors) use the sensors listed above and:

- iii) A three-electrode, electrochemical cell for carbon monoxide.

Models EGO-321 and EGO-322 (methane and oxygen detectors) use the methane sensors listed above and:

- iv) A two-electrode, electrochemical cell for oxygen.

Models EGA-411/412 use all four sensors.

Models EGA-611/612 use the four sensors listed above and an electrochemical H₂S sensor.

Gases, or liquids with appreciable vapor pressure, which may interfere with the detection of methane include substances which can be combusted on the catalytic combustion filament (examples are ethane, propane, ethylene, propylene, octane, and the like) and substances which differ in thermal conductivity from air (examples are hydrogen, helium, carbon dioxide, other hydrocarbons).

Gases or vapors which may interfere with carbon monoxide detection include substances which can be electrochemically oxidized or reduced on the working electrode of the electrochemical sensor. Examples are hydrogen, hydrogen sulfide, oxides of nitrogen, alcohols, and unsaturated hydrocarbons.

Many of the substances that interfere with CO are removed by the flue gas filter (Part No. FF-005). This filter can be used for both flue gas measurements and for ambient air measurements of CO whenever the ambient concentration of other oxidizable substances is significant. This filter should **not** be used in ambient air with EGA-611/612.

WARNING: The methane and CO sensors use catalytically active surfaces which may be poisoned by air contaminants. These sensors should not be exposed to atmospheres that contain silicones, halogens and halides, such as chlorides, and volatile compounds containing lead or antimony. If exposure to atmospheres that adversely affect the sensors is suspected, the detector should be recalibrated promptly.

Radio Frequency Interference

The Gas-Explorer detectors have an interior coating on their cases to suppress radio frequency interference (RFI).

6. CHANGE OF BATTERIES

Gas-Explorer detectors may be powered by two (2) alkaline (non-rechargeable) C-size batteries (1.5V, Type AM-3) or by two rechargeable nickel metal hydride (NiMH) batteries sold by Bascom-Turner. The batteries are good for at least eight, and typically ten, hours of continuous operation. When the batteries are drained to about one hour of remaining continuous use, the unit alarms and the display flashes “*Low Batteries*” between readings. If battery life is over, the unit displays “*Low Batteries*” and powers down. The batteries must be changed to make the instrument operational again.

WARNING: The batteries must be changed in an atmosphere known to be non-hazardous.

To change batteries:

1. Turn instrument OFF.
2. Remove spent batteries.
 - a) Unscrew the battery cap and slide out two C-cells.
 - b) Discard two alkaline C-cells or recharge the NiMH cells.
3. Insert two, fresh C-size alkaline batteries or two charged NiMH C-sized cells.
4. Replace the battery cap and give it one quarter turn (battery cap bar vertical).

Note that the batteries are inserted with the positive terminal first.

If the instrument does not operate after battery replacement, there is a high probability that a battery has been inserted with the wrong polarity. Re-insert the batteries taking extra care to insert each battery correctly.

Note: Always replace a set of batteries with a new set. When operating in cold weather (below -10°C) use a fresh set of batteries, if possible. **Alkaline batteries have shortened life in cold weather; NiMH batteries are recommended.**

WARNING: Do not attempt to charge the alkaline (non-rechargeable) batteries because they may leak or vent.

WARNING: Use only alkaline batteries or rechargeable batteries sold by Bascom-Turner in a Gas-Explorer.

WARNING: To reduce the risk of a battery venting, do not mix old batteries with new batteries, or mix batteries from different manufacturers.

WARNING: Do not attempt to service the instrument in a hazardous atmosphere.

7. PROBES

Metal Gooseneck Probe

The metal gooseneck probe (Part No. GP-514) is a 14 inch long flexible probe which connects to the dust and water-block filter and has a quick connect fitting.

Standard Probe

The standard probe (Part No. SP-306), a rigid tube, connects to the dust and water-block filter. If extra length is desired, an extension (7", SP-308) is screwed finger-tight onto the end of the probe. A rubber gas collector (Part No. RT-107) is useful for finding leaks under windy conditions.

CAUTION: Do not use this probe for flue gas measurements. The plastic probe may become soft, deform or decompose.

Flue Gas Probe

The flue gas probe (Part No. FP-110) is a telescoping metal probe screwed finger-tight into the flue gas filter. The other end of the filter attaches to the dust and water-block filter. This probe, together with its filter, may also be used for CO measurements in ambient air.

CAUTION: Never attach the flue gas filter cartridge directly to the sample hose - always use a dust and water-block filter.

WARNING: Hold the probe without touching metal while it is in the flue and immediately afterwards. Running the instrument in air after a measurement will help cool the probe quickly and dry the filters.

Bar Hole Probes

There are five optional probes suitable for bar holing:

Bar Hole/Ceiling Probe (Part No. BP-034) 34" long, clear, one hole at end.

Bar Hole Probe (Part No. BP-134) 34" long, clear, side holes.

Bar Hole Probe (Part No. BP-136) 36" long, fiberglass, one hole at end.

Bar Hole Probe (Part No. BP-236) 36" long, fiberglass, side holes

Bar Hole Probe (Part No. BP-536) 36" long, steel, side holes.

The bar hole/ceiling probe has a single inlet on the end and comes with a rubber gas collector (Part No. RT-030) useful for finding leaks in overhead pipes. The stainless steel probe has an electrically insulated handle. Bar hole probes are designed to be attached to the water block filter on the hose. A convenient way to release water from a bar hole probe is with a water-stopper (Part No. WS-001) described in Section 8.

WARNING: Hold the steel bar hole probe only by the insulated handle to avoid electrical shock from buried power lines.

8. ROUTINE MAINTENANCE

Dust and Water-block Filter

A filter, housed in a knurled nut, removes particles of dust and dirt and blocks water. Do not insert objects into the water block filter as they may puncture the filter. The filter should be replaced monthly. Replacement dust and water-block filters are available as Part No. WF-705 (package of 5 filters).



Figure 1. WF-705.

CAUTION: Do not use a Gas-Explorer without a dust and water-block filter.

Inlet Dust Filter (IF-705)

Removal of the intake connector (used to attach the sampling system of choice) of the detector exposes a metal filter pressfit onto the intake. These filters are not a substitute for dust and water-block filters as they will not block water or remove very fine dust and dirt. If this filter gets blocked, it may be cleaned with compressed air or replaced.

Water-stopper (WS-001)

The water-stopper (Figure 2) provides a quick way to continue bar holing if water is encountered in a bar-hole. The water-stopper is inserted between the dust and water-block filter and the bar hole probe. A float inside the water-stopper is connected to a plunger which blocks flow whenever the float is lifted by water. Water is released and the plunger returned to its normal position by depressing a release push-button.

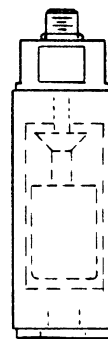


Figure 2. Water-stopper

Dust-Stopper (DS-001)

The dust-stopper is a filter with a large surface area on which dust can collect without slowing the sampling rate of the Gas-Explorer. The filter element is easily cleaned or replaced by removing the threaded cap and either blowing off the filter element or pulling it off and replacing. Replacement dust filter cartridges are available as Part No. DF-105. The dust-stopper should be used between the dust and water-block filter and the probe or water-stopper.

Flue Gas Filter

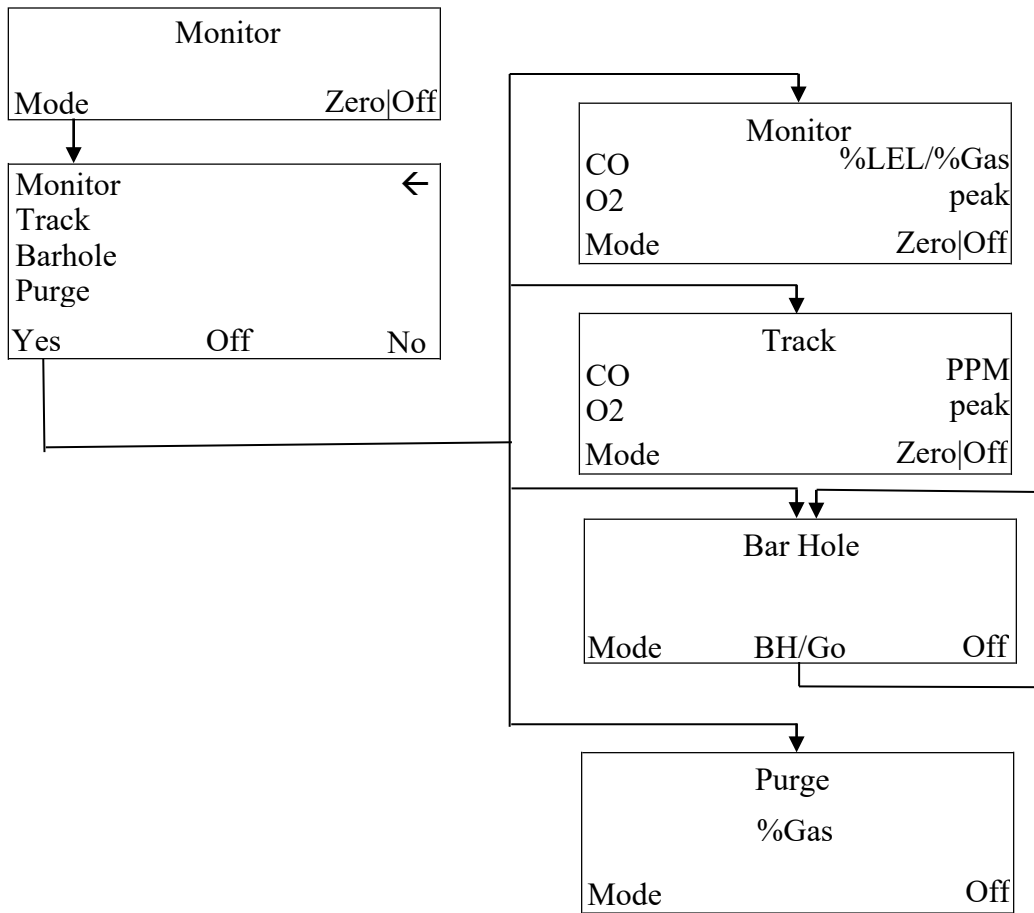
This filter is screwed, finger-tight, between the telescoping metal probe and the dust and water-block filter. It must be used for CO measurements in flue gas and may also be used for CO measurements in ambient air. The filter should be replaced periodically or when it becomes blocked by soot or water. Replacement flue gas filters are available as Part No. FF-005 (package of 5 filters).

Heavy Hydrocarbon Filter

A heavy hydrocarbon filter, filled with activated carbon, can be used with the standard probe or the bar hole probe on a one-time-only basis. Activated carbon adsorbs gasoline and other heavy hydrocarbons (for example, propane or butane) which interfere with methane detection. In order to keep the filter material from adsorbing hydrocarbons prior to use, the filter is fitted with plastic end caps which must be removed just before use. Heavy hydrocarbon filters are available as Part No. HF-005 (package of 5 filters).

APPENDIX 1

MAIN SEQUENCES FOR OPERATION MODES



PART 2. SETUP, CALIBRATION AND ALARM LEVEL SELECTION

1. SETUP PARAMETERS

To change setup parameters, power on the Gas-Explorer and while the unit displays “*Bascom-Turner Gas-Explorer II*” press the right button once. A menu will be displayed with a pointer:

Alarm Limits ←
Bar Hole Time
Air Free CO
Power Off

The left “Yes” button selects the parameter indicated by the pointer while the right “No” button advances the pointer to the next parameter.

Once a parameter is selected the current setting can be saved unchanged by pressing the left “Save” button or can be changed by pressing the right “Edit” button. If editing is selected, the Edit screen flashes the parameter or portion of the parameter which can be toggled or incremented with the right “Update” button. When a (flashing) parameter is OK, press the left “Next” button to either advance to the next digit or to leave the Edit screen and display the edited parameter.

Alarm Limits. Alarm level displays which allow limits to be saved or edited are:

%LEL	Alarm Limit: 1 to 20%	Factory Setting: 20%
%GAS	Alarm Limit: 0.1 to 1%	Factory Setting: 1%
PPM CO	Alarm Limit: 1 to 200ppm	Factory Setting: 35ppm
PPM H ₂ S	Alarm Limit: 1 to 10ppm	Factory Setting: 9ppm

The low and high percent oxygen alarm limits (19.5% and 23%) can not be changed.

Bar-Hole Time. The bar-hole time is the time, in seconds, during which gas is sampled from a bar-hole. The bar-hole time can be set from 5 to 60 seconds. The factory setting is 15 seconds.

Air-Free CO. Detectors with both CO and Oxygen sensors may be setup to display CO on an “air-free” basis. This choice may be appropriate when sampling flue Gas which may contain varying amounts of “excess” air. When this feature is enabled, the instrument automatically calculates the concentration of CO in ppm in a gas free of Oxygen and displays it in the Monitor mode labeled as AFCO. Whenever the amount of Oxygen in the sampled gas exceeds 16%, CO is automatically reported without the excess air correction, i.e. as measured, on the assumption that the medium is in fact air and not flue gas. This feature is set at the factory to OFF, i.e. disabled.

2. FURTHER SETUP PARAMETERS

Power on the Gas-Explorer and while the detector displays “*Bascom-Turner Gas-Explorer IP*”, press the right button once and the center button once. A menu of four choices will be displayed:

Cal Due Time	←
Pump Current	
New Sensor	
Power Off	

The left “Yes” button selects the option indicated by the pointer and the right “No” button advances the pointer to the next line.

Cal-Due Time. The Gas-Explorer should be calibrated regularly and this parameter specifies the desired calibration period in days. When the detector is turned on, the Gas- Explorer notifies the operator when calibration is due. The factory setting for the calibration period is 30 days; this parameter may be set from 1 to 91 days.

Pump Current. The test starts with the pump off, indicated by 0, and a current that should be a small number, less than 5, possibly negative. The left “Up” key turns the pump on. The nominal current is 50 ma, range 40-60 ma. When the detector intake is blocked, the pump current should increase significantly, nominally to 220 ma. Typically, the pump current rises by about 15 ma when a hose and probe are attached.

The Pump Noise test follows when the “Exit” key is pressed. Pump Noise is meaningful only under load, i.e. when hose, probe, and filters are connected to the detector’s intake nozzle. The detector should not be handled or moved when the pump noise test is running.

Pump Noise (Typical)	
Off	On
3.5	7.4

The pump is cycled through Off and On, in round robin fashion, while the overall sensor noise is measured. Because of thermal drift, this test must be run for about 3 minutes before meaningful noise numbers are displayed.

The noise shown in the “Off” column is independent of the pump. When new, the methane sensor noise should be less than 10. As the sensor ages, the noise may increase somewhat, but should remain less than 15. The noise with the pump on should be less than 20. The noise numbers change as the test runs and typical numbers should be used for interpretation; an occasional high number is not significant and may be ignored.

New Sensor. This screen **must** be run after a new sensor is installed and before the sensor is first calibrated. To start the new sensor process, press the left “Run” button. After a “*Please Ensure Clean Air*” screen, the instrument reverts to a normal start up screen and proceeds through the various screens to a mandatory calibration, either One-Gas or Two-Gas.

3. CALIBRATION

Calibration must be carried out on a new sensor the next time the instrument is turned on; with an already installed sensor, the calibration should be carried out at specified intervals. The A-CAL firmware calibrates the Gas-Explorer using calibration gas available from Bascom-Turner containing $2.5 \pm 0.05\%$ methane and $100 \text{ ppm} \pm 2 \text{ ppm}$ CO in air. Calibration gas is provided in a disposable tank containing either 105 liters of gas (Part No. MC-105) or 620 liters (part No. MC- 620). The thermal conductivity sensor is automatically calibrated for 100% methane during the autozero routine preceding calibration with the One-Gas calibration algorithm. It can be also calibrated with pure methane or system gas by using the Two-Gas calibration. The oxygen sensor is calibrated with ambient air during power-up.

The calibration gas must be delivered at or near atmospheric pressure to ensure accurate calibration. For the 105 liter gas tanks, Bascom-Turner recommends using a constant flow regulator (Part No. FR-001) set to the sampling rate of the Gas-Explorer. For the 620 liter gas tanks, Bascom-Turner recommends using an on-demand regulator (Part No. FR-401), which automatically adjusts its flow to the pumping rate of the Gas-Explorer.

A-CAL Calibration. The A-CAL procedure guides the user through the calibration procedure and instructs when to supply the required gases. After the Autozero is successful, the user can select a One-Gas calibration which only uses the 2.5% Methane with 100 ppm CO or the Two-Gas calibration which uses both the 2.5% Methane with 100 ppm CO and Pure Methane or System Gas. The Two-Gas procedure should be utilized when it is necessary for the System Gas to report as 100% Gas such as when purging pipes.

When the gases have been connected, the screen displays “*Calibrating*” for about a minute and then changes to “*Calibration OK*” with a display of readings taken while sampling calibration gas or “*Does Not Calibrate*” if calibration was unsuccessful. Three tries are allowed before the screen displays “*Please Service*” for 15 seconds and then the instrument turns OFF.

Following calibration, an intermediate screen displays the sensitivity in $\mu\text{w/ppm}$ and $\text{mw}/1\%$. The first quantity ($\mu\text{w/ppm}$) refers to the Track Gas mode, the second ($\text{mw}/1\%$) to the Monitor mode. If the sensitivity of the Track Gas mode falls below $0.5 \mu\text{w/ppm}$, the gas sensor should be changed. Similarly if the sensitivity in the Monitor mode falls below $8 \text{ mw}/1\%$, the gas sensor should be changed. In both cases, the display reads “*Please Change Methane Sensor*” and the instrument is not operable until a new sensor is installed.

Calibration of the H₂S sensor. Proceed as above for pure methane, but use the H₂S calibration gas (10ppm H₂S in methane). The instrument will automatically calibrate the thermal conductivity sensor as well as the H₂S sensor.

CAUTION: Automatic calibration presupposes and depends on using Bascom-Turner’s calibration gas (Part No. MC-105 or MC-620). Do not use a gas of a different composition for automatic calibration.

PART 3. THE USB INTERFACE

The USB interface is used for docking calibration, for data transfer to a computer and for setting operating parameters. The cable required for the connection is a six-foot-long, 4-pin, mini BM plug to standard AM plug and is available from Bascom-Turner (Part No. UC-001).

Docking calibration is described in a separate manual and by prompts on the dock. Data transfer is described below.

DataLink4Access™. DataLink4Access™ is a software package available from Bascom-Turner (Part No. DL-001) for downloading and archiving data, viewing and optionally printing reports of data logged by Gas-Explorers, and for maintaining the detectors by uploading setup parameters. DataLink4Access™ can be installed on PC's with Windows 10 or Windows 7 operating systems and equipped with a USB port. See the DataLink4Access™ User Manual for a detailed description of the software's operation.

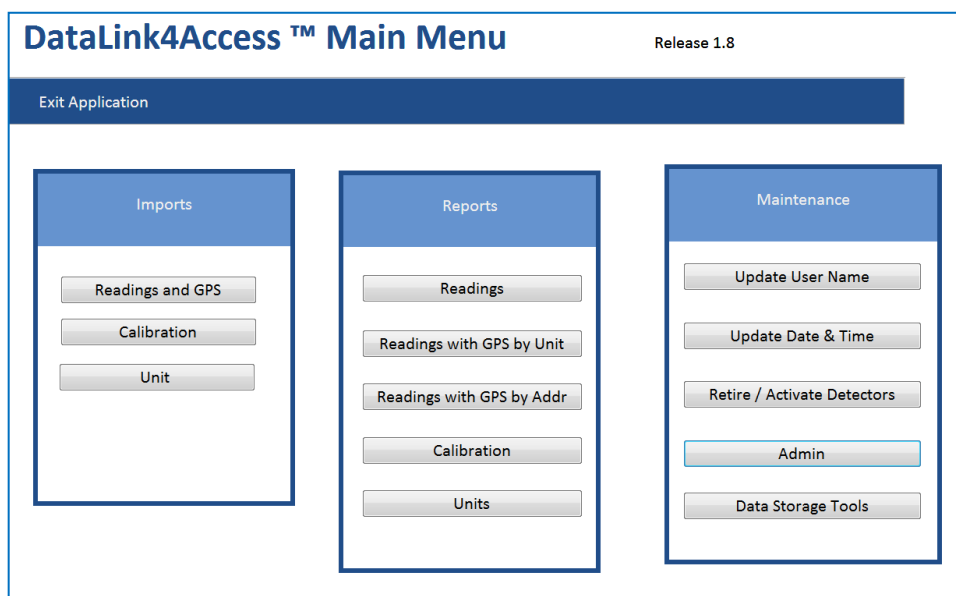


Figure 3. Main Menu, the initial DataLink4Access™ screen

1. DOWNLOADS

The main menu is structured into three blocks: Imports, Reports and Maintenance. The Imports block allows selection of three different downloads from the detector to the PC: Readings and GPS data, Calibration data, and Unit data. Five report menus can be selected: Readings, Readings with GPS by Unit, Readings with GPS by Address, Calibration and Units reports. Three Maintenance menus allow assigning a user name, resetting date and time and retiring or activating detectors. The Admin button controls functionality of the datalink program itself. The data storage tools enables centralized data back-up and restoration using a network drive.

Readings. Readings are time and date-stamped gas concentration measurements (e.g. %LEL, %GAS, %Oxygen, and ppm CO) recorded by the detector along with identifying information such as the detector's serial number, user's name, the operational mode used to acquire the readings, and the state of the pump when the readings were taken. When the memory is filled, the oldest data is automatically overwritten by the new data.

The following gas concentration readings are recorded with a full suite of sensors:

Percent LEL	0 – 100%	Percent O ₂	0 – 40% vol.
Percent GAS	0 – 100% vol.	PPM CO	0 – 2000 ppm
PPM GAS (Track Gas Mode)		PPM CH ₄	0 - 10,000 ppm

Note: % LEL readings are only recorded in detector models ending in 201, 301, 321 and 411.
Standard: 100% LEL = 5% GAS; Optional: 100% LEL = 4% GAS.

The data also includes alarm flags set under the following conditions:

Start of any alarm condition	Start of a low/high O ₂ alarm
Start of LEL alarm	Start of a high CO alarm

Calibration Data. Data from the last 24 calibrations are stored in the gas detector. The following data are stored for each calibration:

1. Key data that makes each calibration unique:

- Unit Serial Number
- Date Calibrated
- Hour and Minute Calibrated
- Calibration Sequence

2. Before calibration readings on calibration gas
3. After calibration readings on calibration gas
4. Sensor sensitivities
5. Operational information:

- Pump working OK (Y/N)
- Days since last calibration
- Calibration check OK (Y/N)
- Minutes operated since last calibration
- Number of times the unit was powered on since last calibration
- Methane sensor cleaned during calibration (Y/N)

Unit Data. The Unit data is stored in the detector as a single record and includes:

- User Name
- Day Limit Between Calibrations
- Sensor Serial Numbers
- Unit Settings

Required Unit Data. Unit ID Number is an integer assigned to the unit when it is entered into the unit database for the first time. Unit Serial Number is the multi-digit hyphenated number on the case of the unit and permanently stored in the unit's memory (i.e. XXXX-XXXXXX). Unit Model Number is the alpha-hyphen-numeric which appears on the label of the unit (i.e. VGC-301). Date Originally Invoiced is the date of Bascom-Turner Instrument's invoice when the unit was originally shipped. It serves as the start of all warranty periods and mean times between failure periods.

Optional Unit Data. "Assigned to Office" is the name or number of the location where the detector will be stationed. User's name is the name or number of the person using the detector, or when the unit is retired and the reason why it is retired (i.e. Lost). Last assigned date and time is changed each time a new user's name is entered.

Setup Data. There is a factory installed setup file in every detector which contains operational parameters such as alarm levels for each gas detected, features enabled (Y/N), e.g. air-free CO, and settings such as Bar Hole time.

Downloading Data. Before downloading any data the operator is asked to verify that the unit is connected to the PC by USB. If the unit is not connected or becomes disconnected, the download program times-out and you must try again. Data is not erased in the unit after downloading so it can be downloaded multiple times. Only one copy of the data is archived in the PC no matter how many times it is downloaded from the unit to the PC.

Downloading Readings Data. It can take 5 minutes to download all the readings data from a unit to a PC. In order to save time a data summary can be downloaded, sorted, and only the desired readings can then be downloaded. The Readings and Alarm Events tables can be sorted by unit serial number, date, time, and the operational mode the unit was in when the readings were acquired in order to select the desired readings.

Downloading all readings in a time period bounded by two dates can also be done by first entering the date range and then selecting "Download Readings by Date Range".

2. REPORTS

Readings, Readings with GPS by Unit, Readings with GPS by Address). Depending on whether the unit is equipped with a GPS receiver different readings reports are available. In any case, all data is available using the readings button.

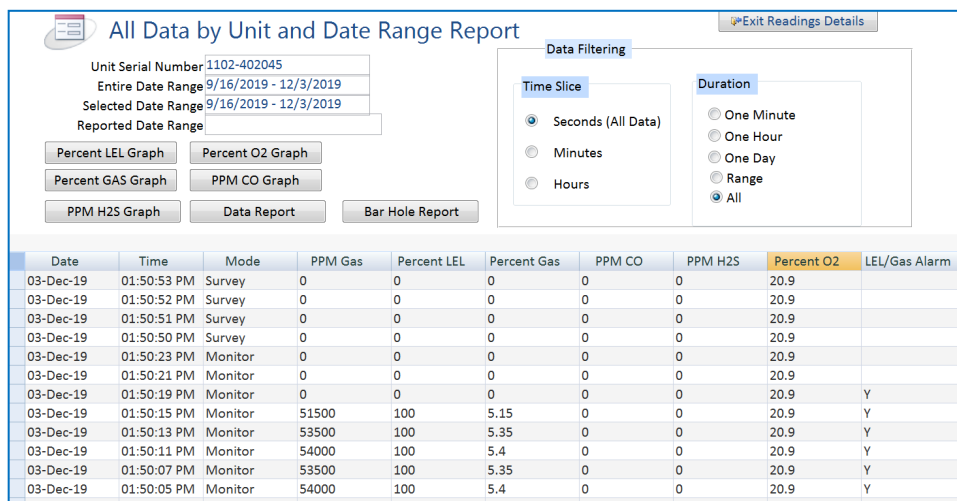


Figure 4. Display Readings Reports for a Selected Unit screen

Readings Reports. There are different readings history reports. One is tabular, and the other is a screen consisting of concentration versus time plots. In order to view or print these reports, the unit ID of the detector which acquired the data must be entered along with a date and time range. Once the report is displayed there is a print button for obtaining a hardcopy.

Readings with GPS Reports. When the unit has a GPS Receiver the Readings with GPS menu allows selection of Survey, Monitor or Bar-Hole data as those modes are stored with the readings. Selecting one of the choices will filter the data accordingly. This new form shows the filtered data and allows plotting the selected data directly in Google Earth. A detailed view of the readings and the ability to export the data to different file formats is also available.

Max Date	Unit ID	Serial Number	User	Model Number	Min Date
12/3/2019	1	1102-402045		VGA-411	9/16/2019

Figure 5. Readings with GPS by Unit screen

Serial Number	User	Date	Start Time	Duration(hh:mm)	MaxPPM	MinHDOP	MaxHDOP	Seq
1102-402045		12/3/2019	1:35:16 PM	0:19	7980	0.8	1.8	1
1102-402045		11/27/2019	2:36:40 PM	0:17	151	0.8	2.6	1
1102-402045		11/26/2019	2:40:31 PM	0:41	8273	0.8	3.1	1
1102-402045		10/1/2019	9:17:58 AM	0:13	1948	0.8	2.6	1
1102-402045		9/17/2019	7:00:05 AM	0:03	559	1.1	1.8	1
1102-402045		9/16/2019	11:17:35 AM	0:00	0	1.1	1.1	1

Figure 6. Survey Data by Unit and Date Range Report screen

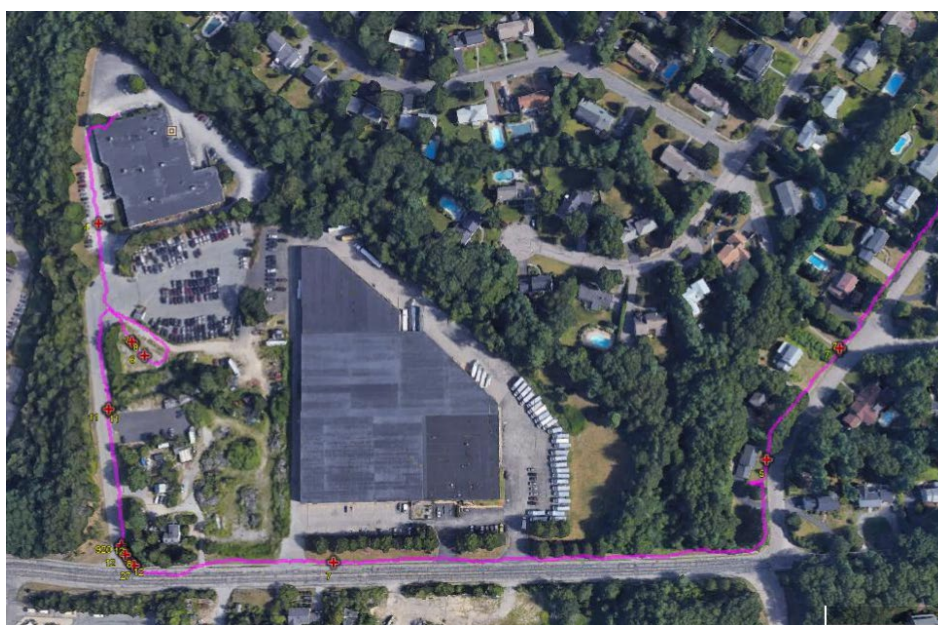


Figure 7. Survey Data plotted in Google Earth Pro

Bar-Hole Report. The bar-hole report is viewed or printed by entering the unit ID of the detector along with a date and time range. A print button is used to obtain a hardcopy.

Calibration Reports. The Calibration Reports screen can be viewed by selecting Calibration in the Reports block of the Main Menu. This submenu has a table listing units by unit ID. To select the unit of interest simply click into the corresponding row in the table.

Sensor Sensitivity History by Unit ID is a report of the date and time of each calibration and the sensitivity of each sensor with the last calibration data listed first. This report can be used to forecast sensor performance and replace sensors before they reach the lower sensitivity limit.

Calibration History by Unit ID is a report of the date and time of each calibration with before and after calibration readings of each sensor. Since the pump must work in order to calibrate a detector, this is checked first and is indicated in the "Pump OK" column in the report.

Last Calibration Data by Unit ID is a complete report of the last recorded calibration. The right hand column summarizes the date, time, pump, and sensor checks.

Units Overdue for Calibration is a report of all units not calibrated within their calibration period.

Look Back Period in Months. This will limit the search results for the calibration history and other calibration reports to entries within the specified time period.

Unit ID	Serial Number	User	Model Number	Last Calibration	
1	1102-402045		VGA-411	9/16/2019	

Figure 8. Calibration Reports screen

Unit Reports. The Unit Reports screen can be viewed by selecting Units in the Reports block of the Main Menu. This submenu has a table listing units by unit ID. To select the unit of interest simply click into the corresponding row in the table.

Unit ID	Serial Number	User	Model Number	Active(Y/N)	
1	1102-402045		VGA-411	Y	

Figure 9. Units Reports screen

Active Unit Report is a listing of all detectors in the UNITLOG database indicated as non-retired. The report is entitled "Active Unit Data". Fields, which are columns in the tabular report, include:

Unit ID	Invoice Date
Serial No.	Assigned to Office
Model No.	Assigned to User

Retired Unit Report is a listing of all detectors in the UNITLOG database indicated as retired. The report is entitled "Retired Unit Data". Fields which are columns in the tabular report are identical to the Active Unit Report.

Active Unit Settings Report gives a listing for the Model number, Calibration due time frame, Unit and Alarm settings.

3. MAINTENANCE

Update User Name. This will store the user name to the instrument.

Update Date And Time. This will update the date and time of the instrument to match the computer's time.

Retire/Activate Detectors. This allows the instrument to be set as Active or Retired in the database. Retired units will not show up on the Detectors overdue report.

Admin. This menu changes the location of the database and contains additional special functions.

Data Storage Tools. This menu provides a network path for centralized data collection and the ability to push files from the PC to the network location.

PART 4. MAINTENANCE

1. SENSOR AND PUMP INSTALLATION

To install a new sensor or pump follow these steps while referring to Figure 10:

1. Power OFF the instrument, remove the batteries, and with a box wrench unscrew the inlet port and filter assembly.
2. Remove the six recessed Phillips screws from the back of the instrument case and lift the top cover off the case. Do **not** remove the two large Phillips screws flush with the back of the case, unless installing a new pump.
3. Place the instrument on a flat surface and remove the two Phillips screws located near the end of the handle. Carefully lift the circuit board out of the case.
4. If the **methane sensor** is to be replaced, remove the two Phillips screws holding the old sensor and unplug the 10 pin connector on the end of the sensor cable. Replace the old sensor with the new and connect and secure as before.
5. The **oxygen and CO sensors** are replaced by unplugging the old sensor from the circuit board, recovering the black gasket on the end of the sensor and replacing it in the sensor well, and inserting the new sensor into the sockets on the circuit board.
6. The **pump** is replaced by removing the two large Phillips screws flush with the back of the case (see Step 2 above), removing the manifold from the bottom of the case, and unscrewing the four screws which secure the pump gasket, pump plate, diaphragm, and piston to the manifold. Usually replacing the pump plate is sufficient to restore operation. Reverse the process for reinstallation.
7. The **pump motor** can be replaced by following the procedure in Step 6 and then removing the four Phillips screws which secure the pump motor to the mounting bracket. Reverse the process with the new motor.
8. Verify that the manifold, methane sensor, pump, and pump motor are securely mounted to the bottom of the case and the sensors appropriate to the instrument are plugged into the circuit board.
9. Align the cables to avoid the pump and guide the battery board into the two grooves on the left and right side of the handle. Lower the main circuit board until it rests on all the bosses.

<p>CAUTION: Crossed wires trapped between the main circuit board and the intake manifold will prevent the board from seating properly and may lead to intermittent contact of sensors with their sockets on the circuit board.</p>

10. Secure the two Phillips screws on the right and left side of the circuit board toward the end of the handle.
11. Replace the top cover of the case and secure it with the six Phillips screws.
12. Replace the inlet port and filter assembly with a box wrench and replace the batteries.

CAUTION: After replacing a methane or a CO sensor, perform the New Sensor procedure (described under Part 2, Setup and Calibration) and then completely calibrate the instrument (both with 2.5% and 100% gas).

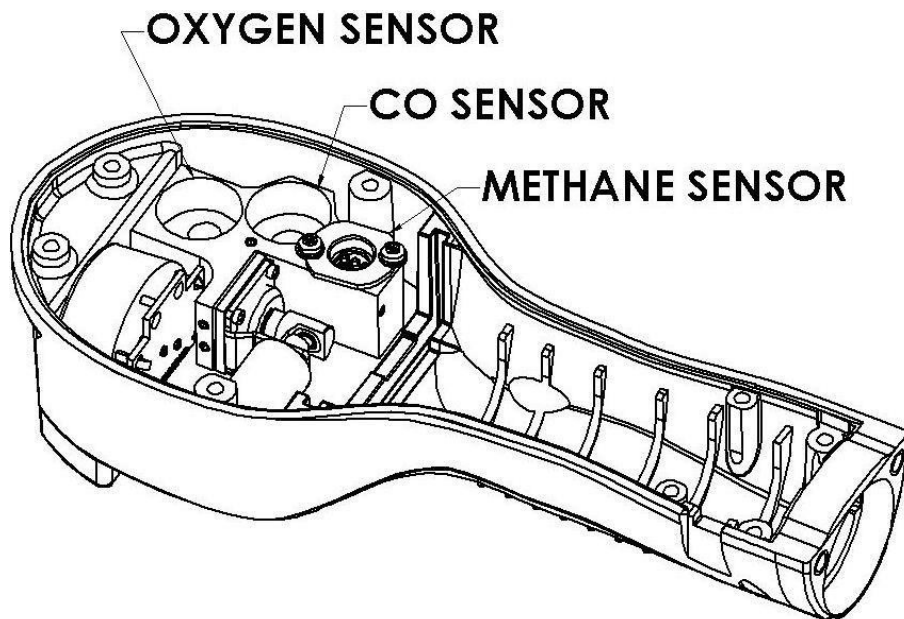


Figure 10. Gas-Explorer with top of case and main circuit board removed.

ACCESSORIES AND SPARE PARTS

Description	Part Number
1. Probes and Hoses	
Gooseneck Probe with Quick Connect and Filter (14 inch long)	GP - 514
Surface Probe (with Quick Connect and Cone)	SP - 636
Ceiling/Bar Hole Probe & Rubber Tip (34 inch long, clear)	BP - 034
Clear Bar Hole Probe (34 inch long, clear, side holes)	BP - 134
Fiberglass Bar Hole Probe (36 inch long, no side holes)	BP - 136
Two-Piece Bar Hole Probe (24 inch long when put together)	BP - 224
Fiberglass Bar Hole Probe (36 inch long, side holes)	BP - 236
Metal Bar Hole Probe (36 inch long, side holes)	BP - 536
Standard Flue Gas Probe & Filter (10 inch long)	FP - 110
Heavy Duty Flue Gas Probe & Filter	FP - 112
Straight Hose with Quick Connect Fitting (42 in. long)	QH - 042
Straight Hose with Quick Connect Fitting (5 ft. long)	QH - 060
2. Filters	
Dust & Water-block Filter (5/pkg)	WF - 705
Water-stopper (with push-button release)	WS - 001
Dust Stopper (with replaceable filter)	DS - 001
Replacement Dust Filters (5/pkg)	DF - 105
Flue Gas Filter (5/pkg)	FF - 005
Extended Duty Flue Gas Filter (5/pkg)	FF - 105
Heavy Hydrocarbon Filter (5/pkg)	HF - 005
Inlet Filter & Quick Connect Air Intake (5/pkg)	IF - 705
3. Sensors	
Methane Sensor (in flame arrestor)	MS - 711
CO Sensor	CO - 302
Oxygen Sensor (K Series)	OS - 502
Combination CO/H ₂ S Sensor	CS - 601
4. Replacement Parts, and Manual	
Pump Motor	PM - 501
Pump Head, Diaphragm/Plunger Assembly (5 sets/pkg)	PD - 505
Intake Manifold with Pump	RM - 501
Battery Compartment Cap	BC - 501
Operating Manual	OM - 0323
5. Instrument Case	
Instrument Case w/Ethafoam Insert	IC - 501
6. Accessories for Calibration & Maintenance	
Manual Calibration Apparatus (with MC-620 & FR-401)	PCA - 302
Methane & CO Calibration Gas (2.5% methane & 100 ppm CO, 620L)	MC - 620
On-demand Regulator for MC-620	FR - 401
Rechargeable C-Sized Batteries (NiMH, 4/pkg)	NM - 524
Rapid Charger for 2 to 4 C-Sized Batteries	RC - 502

Prices and Terms

Prices and specifications are subject to change without notice. Prices are U.S. dollars. Orders are subject to acceptance and are FOB Norwood, Massachusetts. Payment terms are Net 30 days. Minimum order is \$50.



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