BASCOM-TURNER
INSTRUMENTS

CATALYTIC COMBUSTION DETECTORS (CCD)

OPERATION MANUAL

Part Number OM-0123

LIMITED WARRANTY

Bascom-Turner Instruments warrants Catalytic Combustion 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.

Intrinsically safe, ia, for use in explosive atmospheres Class 1, Div 1, Groups C&D, T4.

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.

TABLE OF CONTENTS

FEATURES

Catalytic Combustion Detectors (CCDs) are intrinsically safe, microprocessor based instruments designed to test ambient air for combustible gases over a wide temperature range.

These detectors have many features for easy and reliable operation:

- **PPM Measurement of Combustible Gas with Catalytic Sensors**
  A calibrated ppm ranges up to 40,000 ppm of combustible gas.
- **Easy-to-Use**
  Simple operation without complicated or confusing displays.
- **A Tough Package and a Light Weight**
  Housed in a high impact case, the instruments weigh only 24 ounces.
- **Automatic Sampling**
  An intrinsically safe, built-in pump samples ambient air.
- **Automatic Calibration**
  Calibration is performed automatically using Bascom-Turner's calibration gas.
- **Automatic Self-Tests**
  Automatic checks of battery, sensors, and pump. Tests for blockage and for tight connection of probe to instrument.
- **Automatic Data Storage**
  Automatic storage of time, mode-stamped data readings, and GPS coordinates.
- **Audible and Visual Alarms**
  Audible and visual alarms individually set.

SPECIFICATIONS

Gases Detected	Combustible gases in air
Sensors	Catalytic Combustion Thermal Conductivity
Range	0 to 40,000 ppm by volume
Calibrated Accuracy (5º to 35ºC)	2% of reading ±20 ppm
Resolution	1 ppm from 0 to 40,000 ppm
Warm-Up Time	60 seconds
GPS	72 Channel U-blox M8 engine Horizontal position accuracy 2.5m Time to first fix 29 seconds
Blue Tooth	Certified BlueTooth Version 4.2, Class 2, 10 meter range, 10kbps FCC ID A8TB1478ABCDEFGH

Flow Rate	0.5L/min
Response Time	0.75 seconds
Operating Temp.	-20ºC to 40ºC (0ºF to 105ºF)
Storage Temperature	-40ºC to 60ºC (-40ºF to 140ºF)
Humidity	0 to 95% RH (non-condensing)
Power Supply	Two C-size Rechargeable NiMH
Continuous Operating Time per Battery Set	10 hours typical (25ºC)
Data Storage And Reports	24 Calibrations, 2 to 3 months readings Calibration History, Sensor Sensitivity, Operational Periods by User and Unit ID, Office Reports
Weight	24 oz. (680 g)

RESPONSE FACTORS

CCD sensor responds to a wide range of combustible gases but cannot distinguish between them. However, response of the sensor varies for different combustible gases. If the sensor is calibrated using Methane, then the reading of the sensor needs to be multiplied with appropriate response factor, R_f, to get the correct concentration of the target gas. To obtain the response factor the instrument is first calibrated using methane, then a known concentration of the target gas is measured. The response factor, R_f, is then given by:

$$R_f = \frac{Known\ Gas\ Concentration}{Instrument\ Reading}$$

If the measured gas is known, then the device should be calibrated using the target gas, The readings of the instrument will then match the actual concentration of the measured gas. Usually larger the molecule, lower is the value of R_f. Table below provides the measured values of response factor, R_f, for different types of gases.

Chemical	**LEL (%)**	**MW**	**Rf**
Hydrogen	4	1	**0.83**
methane	5	16	**1.00**
Acetylene	2.5	26	*1.27*
Ethylene	2.7	28.1	*0.75*
Ethane	3	30.1	**0.80**
Methanol	6	32	*1.59*
Propene	2.4	42.1	*0.65*
propane	2.1	44.1	**0.73**
iso-butylene	1.8	56.1	*0.64*
n-Butane	1.6	58.1	**0.70**
n-propanol	2.2	60.1	*0.78*
iso-propanol	2	60.1	**0.81**
Ethylene Glycol	3.2	62.1	*1.33*
i-pentane	1.4	72.2	*0.64*
Neo-pentane	1.4	72.2	*0.64*
n-pentane	1.5	72.2	**0.67**
n-hexane	1.1	86.2	**0.69**
Toluene	1.1	92.1	*0.69*
n-heptane	1.05	100	*0.66*
Xylene	1	106	*0.74*
n-Octane	1	114	*0.69*
n-nonane	0.8	128	*0.68*

Bold: Measured *Italics: Predicted*

PART I. OPERATION

1. CATALYTIC COMBUSTION DETECTORS

This manual describes the operation of Catalytic Combustion detectors (CCDs) for combustible fugitive emissions. These instruments may be used to test ambient air for VOC and thereby identify leaks in process equipment.

The CCD displays combustible gas in parts per million. Above a certain concentration (user selectable), it also notifies the user acoustically of the presence of combustible gas. The factory set acoustic threshold is ten parts per million (10 ppm).

The CCD as configured by Bascom Turner is essentially a twin microcalorimeter adapted to the particular conditions of its application. Major differences from traditional microcalorimeters include an open system for exchanging reactants and products with a flowing stream, and dynamic rather than static conditions. These differences and portability impose restrictions on how the microcalorimeter is constructed and operated so as to minimize noise and achieve the required precision and accuracy.

In its present configuration, the Bascom Turner CCD measures combustion heats of gaseous reactants, usually organic, at elevated temperatures, typically 300° to 600°C, at the microwatt (one quarter of a microcalorie) level.

Safety. These intrinsically safe instruments measure the concentration of combustible gases in air and give, more generally, an indication of the presence of 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 <u>not</u> 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, 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 safety indicators be taken into account.

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

2. ESSENTIAL OPERATING PRACTICE

CCD detectors are easy to use. A detector is turned on by pressing the left button; its operation is controlled by three buttons whose function is shown on the display. The middle button generally toggles "*Mute*" on and off. Double-clicking the middle button turns the backlight continuously ON or OFF, depending on its previous state.

Pump. CCD 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 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.**

The filter should be replaced monthly or sooner if needed (See "Routine Maintenance"). Filters are available from Bascom-Turner.

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. If the drift is outside this limit, "*NO GO*" is displayed and the user is asked to autozero the unit in "clean" air. The unit will re-zero unless the zero has drifted over 1% vol. GAS, in which case the instrument must be checked by a trained professional (the sensor may need replacement).

Test and Calibration. Detectors must be calibrated periodically with gas of known composition. The sensors depend on catalysts which may lose activity during use. The necessary frequency of calibration depends on actual use and on the concentration of catalyst poisons, if any, in the sampled gas. This concentration is, of course, not generally known.

When CCDs are used to test for fugitive emissions they should be calibrated with an appropriate standard prior to use. For example, they should be zeroed prior to use with "zero air" and calibrated with 500 ppm or 10,000 ppm methane depending on the definition of what constitutes a "leak".

A detector can be automatically calibrated in approximately one minute using Bascom-Turner's calibration gas (either 500 ppm or 10,000 ppm methane).

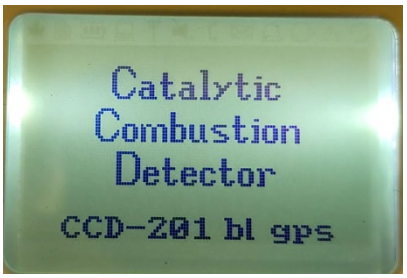
3. OPERATIONAL DESCRIPTION

The instrument is controlled by three push button switches whose function changes with each particular display. The function of each push button is shown on the display in each case. In general, the middle button silences the beeper ("mutes" the instrument).

Startup Sequence. Press the left switch to turn the instrument on. A series of screens is automatically displayed preparatory to entering an operational mode, viz. "*Survey*".

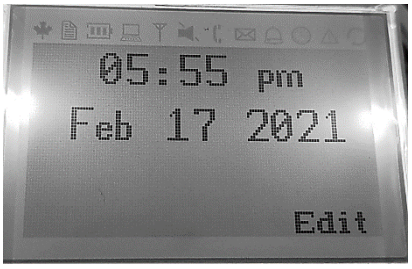
The sequence of screens and operation that appear at the startup are as follows:

1. The first screen shows the **Model Number**.

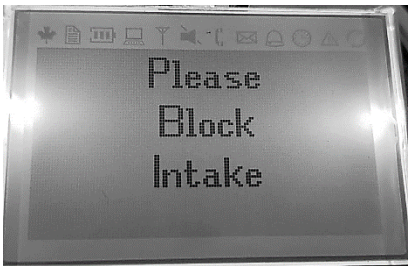


2. The second screen provides access to the **USB interface** (see Part III).

3. The third 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. **If date and time do not require updating, then no button needs to be pressed.**

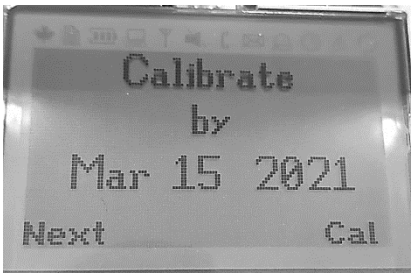


4. Following the date and time screen, the **pump operation** is tested. "*Please Block Intake*" is displayed on the screen. If no block is detected in 40 seconds, "*Check Probe*" is displayed, followed by "*Remove Probe and Block Intake*" and finally "*Repair Pump*" followed by an automatic turning off of power.



5. After successful detection of pump blockage, the screen displays: "*Pump OK*". The display then shows: "*Please Ensure Clean Air*". Please ensure clean air (generally air that does not have a high concentration of target gas, like an outdoor environment)

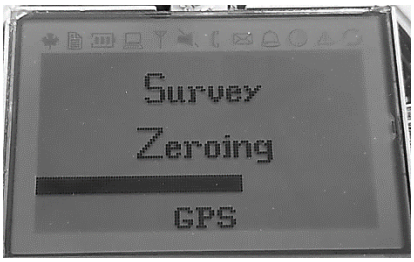
6. The next display suggests a "*Calibrate by* [a date that is typically thirty days from the date of the last calibration]" and an opportunity to calibrate. There are two options displayed on the screen "*Next"* and "*Cal"*. If calibration is needed or wanted, then press "*Cal*" (See Calibration). By pressing "***Next***" the instrument enters the **survey mode** (see later).



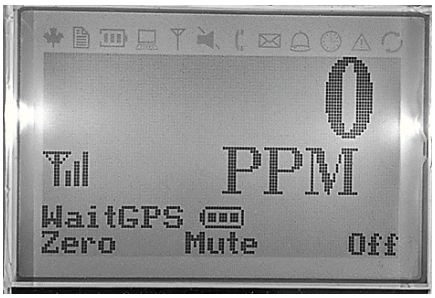
Backlight. Pressing any button backlights the display for 20 seconds. To backlight any display, press the middle button twice (double click). The backlight will remain on until a new display is entered, or the middle button is double-clicked again.

Survey Mode: After the instrument enters the Survey mode (pressing "*Next"* in step 6 above), the following screens are displayed:

1. In the next screen "*Survey Zeroing*" is displayed on the screen. Please ensure that you are in a clean air environment during this step. A progress bar shows the progress of the "*Survey Zeroing*".



2. After zeroing the instrument displays the concentration of combustible gas in air in parts per million by volume (ppm). The beeper will sound if the ambient concentration of gas rises above a user selected value (see Part II, Section 1). The factory set value is 10ppm. To silence the beeper during a survey, the middle switch mutes the instrument ("*Mute*" appears on the display).



The Symbol. The symbol depicted here is used to indicate sensitivity at any particular instant. In general, sensitivity is an inverse function of background noise – the lower the noise, the greater the sensitivity.

Under most circumstances, all three vertical bars should be present. If the background noise increases, one or more bars will be missing and in extreme circumstances, the whole symbol may disappear. If the noise level rises so that more than two vertical bars are missing, the instrument should be allowed to return to its normal state by holding it steady for a few seconds.

CAUTION:	If two or more bars are consistently absent, replace the gas sensor or return the instrument for repair.

4. INSTRUMENT CHECKS

Sensor Check

If the gas sensor fails, 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.

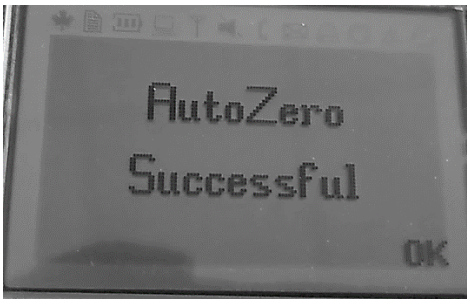
WARNING: The instrument will not operate when first turned on if it fails to block when the air intake is blocked. Subsequently, however, connections can only be checked by blocking the probe inlet and observing "*Flow Blocked*" on the display. If "*Flow Blocked*" fails to appear, the probe and/or inlet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

5. CALIBRATION

In the start-up sequence when the user is at step 6 (see above) and the display says calibrate by [date] press the right button, labeled "CAL", this will the start the calibration process. The calibration process goes through the following steps:

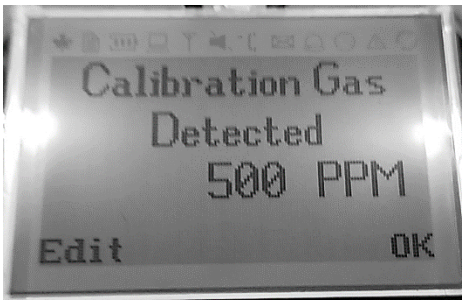
1. Pressing the right "*Cal*" button once, starts the calibration process. Connect "Zero Gas" to the probe input when the display shows, "*Connect Zero Air*". "Zero Gas" is air with less than 10 parts per million by volume (ppmv) of the gas used for calibration. In this case, Methane (CH_4).

2. After connecting "*Zero Air*" press "*Yes*". Display will then show, "*Running Auto Zero in Zero Air*". After successful auto zeroing, the display screen will show, "*AutoZero Successful*". Press "*OK*".

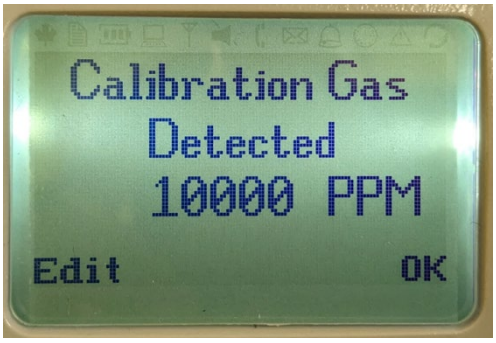


3. Connect Bascom Turner's calibration gas to the probe input and then press, "Yes".

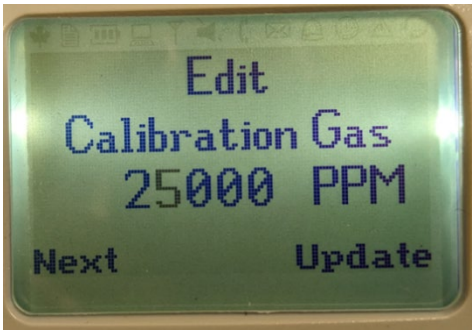
4. The instrument will perform "Auto Calibration" with 500ppm or 10000 ppm of methane gas. If 500 ppm of methane is used for calibration, the device will detect the gas and display, "Calibration Gas Detected 500 PPM"



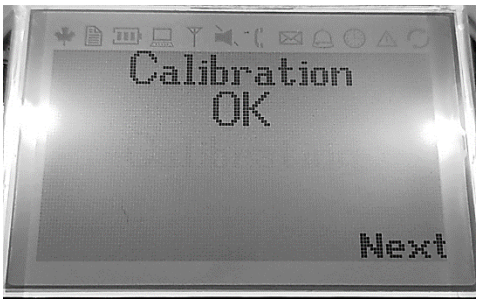
If 10000ppm of methane is used for calibration the device will display, “Calibration Gas Detected 10000 PPM”



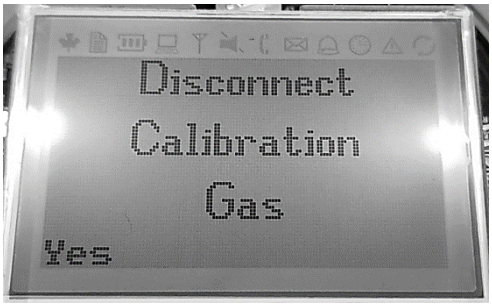
Press “*OK*” to complete calibration. If a concentration other than 10000 ppm or 500 ppm is used, the user can manually change the concentration of the calibration gas by pressing “*Edit*”. This will display the “Edit Calibration Screen” which flashes each digit to be adjusted. Press “*Update”* to change the digit to the desired value. When the desired digit is shown, press “Next” to advance to the next digit or to exit the edit screen.



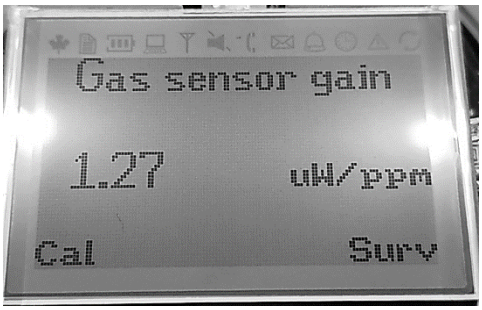
5. With successful calibration the screen will then display “*Calibration OK*”. If the calibration was unsuccessful, the screen will display “*Does Not Calibrate*”. Pressing the left “Re-Try” button returns to the Calibration screen. If three tries at calibration are unsuccessful, the screen displays “*Please Service*” for 15 seconds and then the instrument turns OFF.



6. After the screen displays "*Calibration OK*", press "Next". Disconnect the calibration gas when prompted and then press "*Yes*".



7. "*Gas sensor Gain*" are displayed on the screen next. The information displayed are for informational purpose only. The displayed sensitivities are in µw/ppm. If the sensitivity falls below 0.5 µw/ppm, the natural gas sensor should be changed. In this case the display reads *"Please Change Methane Sensor"* and the instrument is placed in Off condition until a new sensor is installed. If re-calibration is not desired, then press "*Surv*" and enter the survey mode, otherwise, press "*Cal*" and follow the previous steps.



6. CHANGE OF BATTERIES

Catalytic Combustion 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 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:

a. Turn the instrument OFF.

b. Remove spent batteries.

i. Unscrew the battery cap and slide out two C-cells.

ii. Discard two alkaline C-cells or recharge the NiMH cells.

c. Insert two, fresh C-size alkaline batteries or two charged NiMH C-sized cells.

d. Replace the battery cap and give it one quarter turn (battery cap bar vertical).

Note that both 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^{o}C) use a fresh set of batteries, if possible. Alkaline batteries have shortened life in cold weather; NiMH are recommended.

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

WARNING: Use only rechargeable batteries from Bascom-Turner.

WARNING: 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

Flex Probe with Stainless tip FP-821

The flex probe is a 14” long flexible probe with a 1/4” O.D. by 3” long stainless-steel tip. The probe connects to a dust and water-block filter and a quick connect fitting.

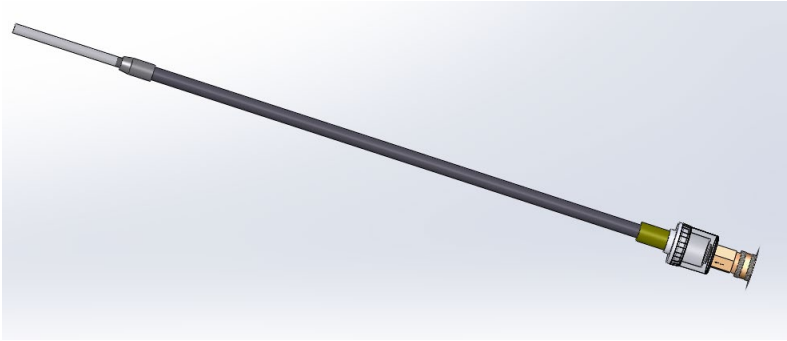


Figure 1

Stainless Steel Probe SSP-821

The SSP-821 Probe has a 3/16” O.D. by 6” long stainless-steel tip inserted into a plastic handle with a rubber grip. This probe can be attached to a dust and water-block filter.

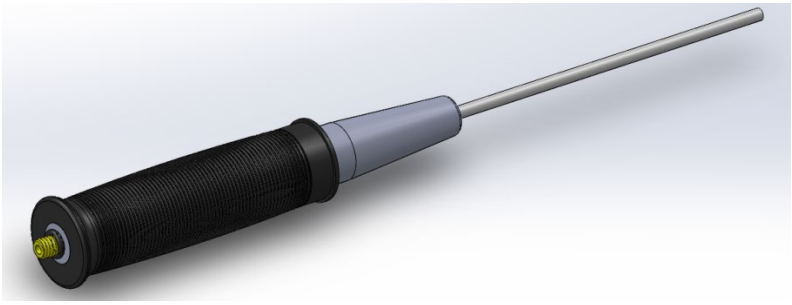


Figure 2

DP-821 Dilution probe (includes hose, dilution chamber, filter, and SSP-821)

The Dilution probe injects clean air to a sample drawn through its tip in a ratio of 10:1 (within 5%)

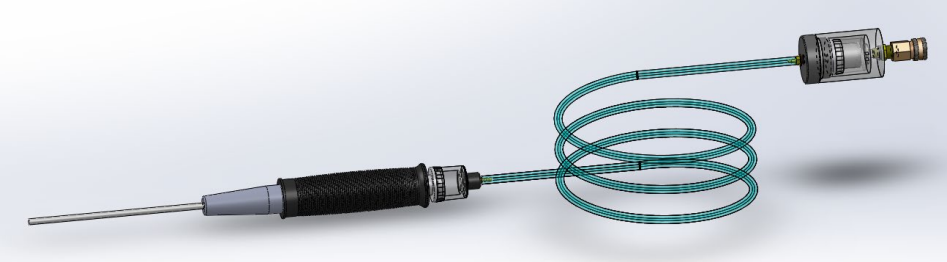


Figure 3

8. ROUTINE MAINTENANCE

Dust and Water-block Filter WF-905

A filter, in a clear body, 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 needs to be replaced monthly or sooner if it accumulates dust. Replacement water-block filters are available as part No. WF-905 (Package of 5 filters)

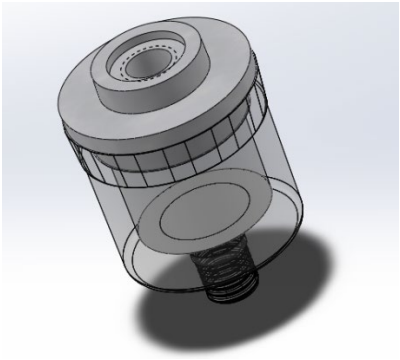


Figure 4

Replacement Carbon Filters for Dilution system DF-821

Carbon Filters should be replaced once a month. Simply unscrew the dilution system cap, remove the carbon filter and replace with a new one.

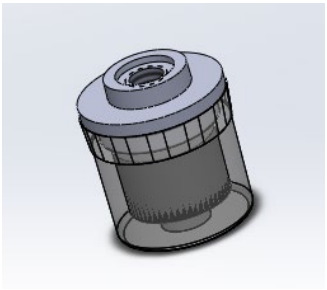


Figure 5

PART II: SETUP

1. SETUP

Time and Date. To Change the time and/or date, power the unit with the left "Power-On" button and when the unit displays time and date, press the right "Edit" button once. The first digit of the hour will begin to flash. The right "Update" button will increment the flashing digit and the left "Next" button will advance it. When "Next" is pressed at the last flashing digit, the Edit screen will be restored and the power-on sequence will resume with the edited time and date.

Alarm Setting. To review or change alarm settings, power on the unit and while it displays "Catalytic Combustion Detector" press the right button once. Two parameters will be displayed with the pointer to the first one.

Alarm Limits	←	Factory Setting: 10 ppm
BlueTooth		
Power Off		

The left "Yes" button selects the parameter indicated by the pointer while the right "No" button advances the pointer. Once a parameter is selected, the "Edit" button increments the flashing digit while the "Save" button advances the flashing digit. When a desirable value is displayed press the "Save" button to return to the original menu.

BlueTooth. The "BlueTooth" selection, displays the condition of the "BT Data Stream" feature, either "disabled" or "enabled". The detector incorporates a fully certified, BlueTooth version 4.2 wireless module, a class 2 device with a range of 10 meters and through put up to 10kbps. Enabling BlueTooth allows direct input of acquired data to a paired device, e.g., a laptop, as data acquired.

2. FURTHER SETUP AND TEST PARAMETERS

Power on the detector with the left "Power On" button and while the detector displays "Catalytic Combustion Detector", press the right button once and the center button once (in this sequence). A menu will be displayed:

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.

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
5.0	7.0

The pump is cycled through Off and On, in round robin fashion, while the overall sensor noise is measured. This test must be run for at least 3 minutes before meaningful noise numbers are displayed.

The noise shown in the "Off" column is independent of the pump. When new, the sensor noise should be less than 5.0. As the sensor ages, the noise may increase somewhat, but should remain less than 8.0. The noise with the pump on should be less than 12.0. 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 "*No*" till the arrow appears next to the "*New Sensor*" option. Press "*Yes*" to select "*New Sensor*". On the next screen, "*New Sensor Requires Calibration*" is displayed. Press "*Yes*" to progress to next screen. If "*New Sensor*" routine was started by error or the user does not want to continue running the "*New Sensor*" process, this screen allows the user to abort by pressing the "*Off*" button. After pressing "*Yes*", the screen displays "*New Sensor*". Press the left "*Run*" button. Next screen displays "Kelvin Current". Press "Continue". Next screen displays, "Please Wait" as the unit is running through its new sensor routine. Next screen displays, three resistance values, T_c, and the two catalytic beads in Ohms at a preselected temperature. This is for informational purpose only. Press "Continue" to finish the "New Sensor" process.

PART III: THE USB INTERFACE

Readings and calibration records are automatically stored in the detector's memory. To access this data, Bascom-Turner supplies an Access based software platform (DATA-LINK™) that extracts the data from a unit via either a usb cable or Bluetooth, processes the data into an easy to navigate Access database and allows for filtering to specific dates, times and modes for viewing, printing and saving reports in a PDF format for emailing.

To install this free software package, go to www.bascomturner.com and create an account in our online store. Once completed, you can download the DATA-LINK installation package complete with a Microsoft runtime version of Access if needed.

Typically, corporate security will not allow random downloads to occur, so it is advisable to contact your IT for guidance prior to attempting the download.

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 enable centralized data back-up and restoration using a network drive. The main functioning of the DATA-LINK platform are described briefly here. For more information please contact Bascom Turner.

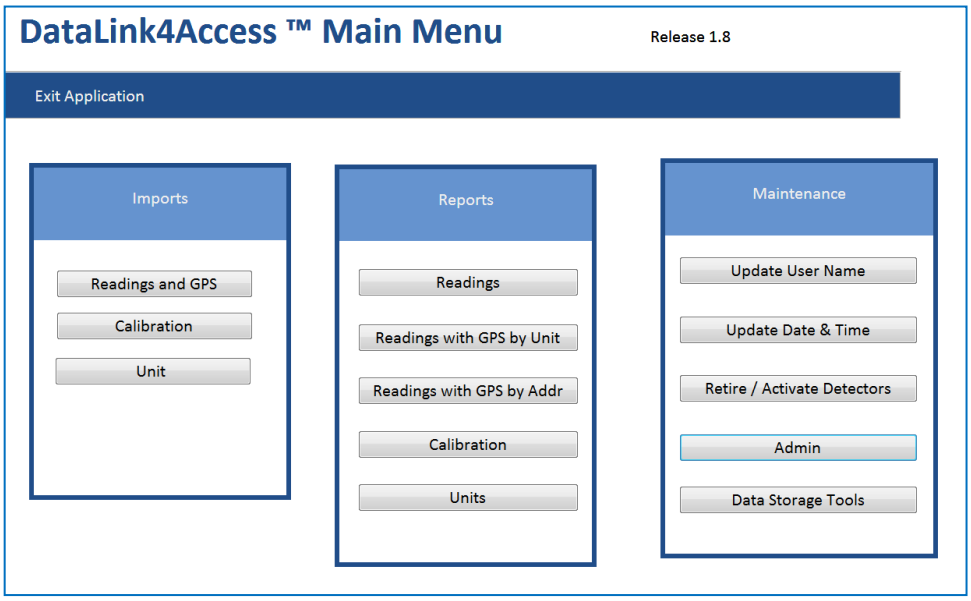


Figure 6: Main Menu, the initial DataLink4Access™ screen

1. DOWNLOADS

The imports block of functions is used to download data from the device to the PC. The various functions are described below:

Readings and GPS: Pressing this button will download time and date-stamped gas concentration measurements 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 new data**.**

The following gas concentration readings are recorded (For CCD only relevant field is PPM GAS):

Percent LEL0 – 100% Percent O2 0 – 40% vol.

Percent GAS 0 – 100% vol. PPM CO 0 – 2000 ppm

PPM GAS (Survey Mode) PPM CH4 0 - 40,000 ppm

The data also includes alarm flags set under the following conditions (Only Relevant is

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. This button will download calibration data from the last 24 calibrations. The following data are downloaded 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)

   Day(s) since last calibration

   Calibration check OK (Y/N)

   Minutes operated since last calibration

   Number of times the unit was powered on since last calibration

Unit Data. This button downloads Unit data as a single record and include:

User Name

Day Limit Between Calibrations

Sensor Serial Numbers

Unit Settings

Required Unit Data. The 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. 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, features enabled (Y/N), and other settings.

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.

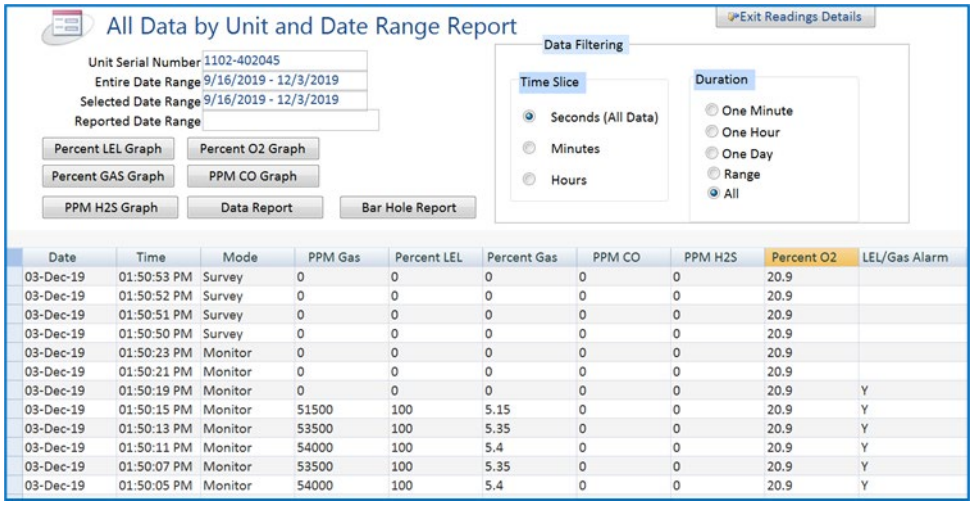


Figure 7: Display Readings Reports for a Selected Unit screen

Readings Reports. There are two readings history reports. One is tabular, and the other is a screen consisting of concentration versus time plots. 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 data stored with the readings. A detailed view of the readings and the ability to export the data to different file formats is also available.

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 the 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.

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 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.

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.

Exposure Reports. There are two exposure history reports: one is tabular and the other is a screen consisting of two STEL and two TWA versus time plots. 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.

Calibration Reports. Calibration Reports are selected from the "Calibration Reports" submenu. This submenu has two tables listing units by unit ID with each table providing different information about the units. The tables can be scrolled independently of each other by left-clicking with the mouse highlighting a field, then scrolling with either the up and down arrow keys or the Page Up and Page Down keys. The tables can be searched jointly by unit ID, serial number, assigned office and user to limit the unit information displayed in the tables. The complete data can be redisplayed in both tables by selecting any of the four searches and pressing the enter key without entering any search criteria.

There are two types of calibration reports, one type is a summary of data acquired during calibration limited to a specific unit and the second type is a general report of all units.

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.

Operation Check Report by Unit ID is a report of the methane operation check which can be optionally displayed and printed from Calibration History by Unit ID.

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.

Calibration and Usage first asks for "Prior Monthly Period Selection" with a default value of 1 month. If the averages over the last month are to be reported then select "OK", otherwise enter the desired number of months over which to average and then select "OK". The report lists units

by unit ID number and has five averages for each unit:

Time/Use is total minutes unit was on divided by number of times it was turned on. Use/Day is total minutes unit was on divided by number of days in use.

Uses/Day is number of times unit was turned on divided by number of days in use. CAL. Period is the number of days in use divided by the number of times unit was automatically calibrated (either docked or non-docked).

User, Unit, and Office Reports. User, unit and office reports are selected from the "User, Unit, and Office Reports" submenu. This submenu has two tables listing units by unit ID with each table providing different information about the units. The tables can be scrolled independently of each other by first left-clicking with the mouse highlighting a field, then scrolling with either the up and down arrow keys or the Page Up and Page Down keys. The tables can be searched jointly by unit ID, serial number, assigned office and user to limit the unit information displayed in the tables. The full data can be redisplayed in both tables by selecting any of the four searches and pressing the enter key without entering any search criteria.

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.

Unit Assignment History by Unit ID is a list of each time when a unit's assigned user is changed. Whenever the Unit Edit button is used to change a unit’s assignment, there is a date and time stamped record created which provides an assignment audit trail of who began using the unit. The Unit Assignment History by Unit ID report summarizes this audit trail with a chronological list of users and the date and time when they were assigned the unit.

Unit Assignment History by User is a list of each time when a user is assigned a new unit. The Unit Assignment History by User report summarizes the assignment audit trail with a chronological list of units used by a user and the data and time when they were assigned the unit.

Office Report is a list of offices which have assigned units. The office name, office supervisor and their email address or FAX number are listed in the report.

3. MAINTENANCE

Update User Name. Store the user name to the instrument.

Update Date And Time. 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.

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 a unit.

Uploading Location. From the main menu of DATA-LINK™ under Maintenance, click on the "Location" button. On the Maintain Location Data screen select a record with the desired location using the select buttons along the bottom of the table. Or add a record, if none exists for the location you are uploading. With just the desired record selected, click on the "Upload One Selected Location Record" button.

Uploading Username. From the main menu of DATA-LINK™ under Maintenance, click on the "User, Unit, Office & Pin" button. On the Maintain User, Unit, Office & Pin screen, select a record with the username you wish to upload using the select buttons along the bottom of the table. Or add a record, if none exists for the unit you are setting up, or edit an existing record for the unit with the username you would like to upload. With just the desired record selected and displayed in the table, click on the "Upload One Selected User Record" button.

PART IV: MAINTENANCE

1. SENSOR AND PUMP INSTALLATION

To install a new sensor or pump follow these steps while referring to figure 2:

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 **sensor** is to be replaced, remove the two Phillips screws holding the old sensor and unplug the 8 pin connector on the end of the sensor cable. Replace the old sensor with the new and connect and secure as before.

5. 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.

6. 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.

7. Verify that the manifold, 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.

8. 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.

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.

9. Secure the two Phillips screws on the right and left side of the circuit board toward the end of the handle.

10. Replace the top cover of the case and secure it with the six Phillips screws.

11. Replace the inlet port and filter assembly with a box wrench and replace the batteries.

CAUTION: After replacing a sensor, perform the New Sensor Routine and then calibrate the instrument

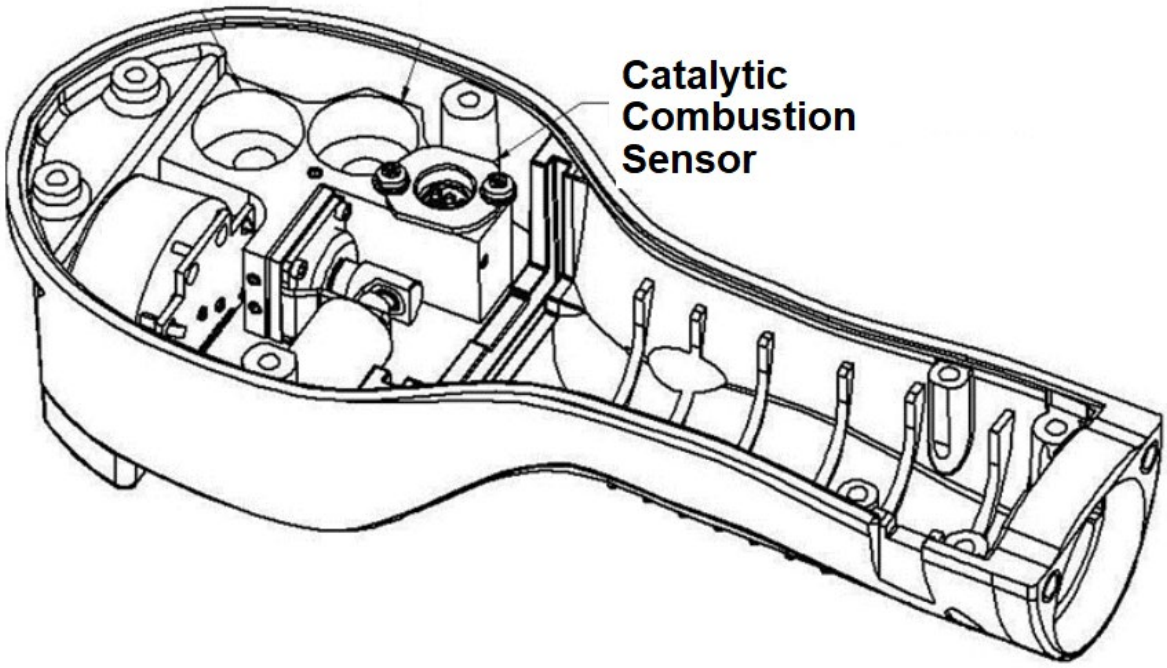


Figure 2. CCD with top of case and main circuit board removed.

ACCESSORIES AND SPARE PARTS

Description	Part Number
1. Probes and Hoses	
Flex Probe with Stainless tip (3" long tip)	**FP - 821**
Stainless Steel Probe with Rubber Insulated Handle (6" long tip).	**SSP - 821**
Dilution Probe (includes hose and dilution chamber)	**DP - 821**
Straight Hose with Quick Connect Fitting (3.5 ft. long)	**QH - 042**
Straight Hose with Quick Connect Fitting (5 ft. long)	**QH - 060**
2. Filters	
Dust & Water-Block Filter for CCD-201	**WF - 905**
Replacement Carbon Filter for Dilution System	**DF - 821**
Inlet Filter & Quick Connect Air Intake (5/pkg)	**IF - 705**
3. Sensors	
Replacement Sensor for CCD Detector	**PS - 611**
4. Replacement Parts, and Manual	
Pump Motor	**PM - 501**
Pump Assembly	**PA 501**
Pump Head, Diaphragm/Plunger Assembly (5 sets/pkg)	**PD - 505**
Intake Manifold with Pump	**RM - 501**
Battery Compartment Cap	**BC - 501**
Rubber Boot for CCD Detector	**RB 501**
Shoulder Strap for CCD Detector	**SS 501**
Operating Manual	**OM 0717**
Rechargeable C-Sized Batteries (NiMH, 4/pkg)	**NM 524**
Rapid Charger for 2 C-Sized Batteries	**RC - 502**
5. Instrument Case	
Instrument Case w/Ethafoam Insert	**IC - 501**
6. Accessories for Calibration & Maintenance	
103 Liter Tank of 500 ppm Methane Calibration Gas	**M21 - 500**
103 Liter Tank of 10,000 ppm Methane Calibration Gas	**M21 - 10K**
Low Flow Regulator for 103 Liter Tank	**FR - 001**
Calibration Gas Case	**GC 001**
Calibration Hose with Quick Connect	**QC - 512**

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. OM-2017

Bascom-Turner Instruments
111 Downey Street, Norwood, MA USA 02062
781-769-9660 800-225-3298
Fax 781-769-2099
bascomturner.com