

CAL 2000 LT

GAS GENERATOR

RELEASE 1



Advanced Calibration Designs, Inc.

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Revision - 040525

INSTRUCTION MANUAL

www.goacd.com

VIII. SPECIFICATIONS

Chlorine (Cl ₂).....	1 - 25 ppm
Hydrogen (H ₂).....	1 - 25 ppm
Hydrogen Cyanide (HCN).....	1 - 25 ppm
Hydrogen Sulfide (H ₂ S).....	1 - 25 ppm
(ppm concentration must be specified when ordering cell)	
Air Flow Rate.....	0.5 or 1.0 LPM
(flowrate must be specified when ordering CAL 2000 LT)	
Warm-up time (to 90%).....	Approximately 5 minutes
L x W x H.....	8.5 x 4.25 x 3.0" (21.6 x 10.8 x 7.6 cm)
Weight.....	3 lbs. (1360 g)
Operating Temperature.....	0° C to 50° C
Relative Humidity (intermittent use).....	0 -100%
Accuracy.....	±10%
Repeatability.....	±5%
Battery Power.....	4 alkaline "C"
Battery Life.....	10 hours

CSA Certified Intrinsically Safe

Class I, Division 1, Groups A, B, C & D
European Standards approval for Zone 0

Instruction Manual

CAL 2000 LT GAS GENERATOR

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Manufactured by:

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WARNING:

This instrument generates calibration gas for toxic gas detectors. The instruction manual should be read and understood prior to operation of the instrument. Failure to operate the instrument correctly can lead to improper calibrations.

This instrument conforms to the protection requirements of the **EC DIRECTIVE 89/336/EEC** on Electromagnetic Compatibility (EMC), in accordance with the provisions of Statutory Instrument 2372.

The following standards have been applied:

EN 50081-1
Emissions Standard (Residential Commercial and Light Industry)

EN 50082-1
Immunity Standard (Residential Commercial and Light Industry)

700-0600-03	Pump, Low Flow Rotary Vane, 6 VDC
715-0403-0X	3 Foot Hose w/connector, low flow, 1/4" OD
715-0405-0X	5 Foot Hose w/connector, low flow, 1/4" OD
730-0615-00	Hard-body, Water Resistant, Padded Carrying Case
910-0603-LT	Instruction Manual

VII. Accessory Items / Parts List

The following items are available as accessories for the CAL 2000 LT:

P/N	Description
113-0402-00	Male Hose Barb Quick Connector, 1/8" OD hose
150-4121-00	Charcoal Filter Element, one each
150-4131-00	Charcoal Filter Element, package of 12
362-0600-00	AC Adaptor, 115 VAC, US style plug 7.5VDC, 300 mA
400-0600-LT	Main Circuit Board Assembly
400-0703-00	Power Circuit Board Assembly
510-2000-LT	Chlorine Cell
510-2050-LT	Hydrogen Sulfide Cell
510-2070-LT	Hydrogen Cyanide Cell
510-2090-LT	Hydrogen Cell

I. GENERAL DESCRIPTION

The Cal 2000 LT is a battery-powered, portable electrochemical gas generator designed to calibrate toxic gas sensors. Fast warm-up time allows the instrument to be turned off between remotely located sensors saving battery life and avoiding generation of unwanted gas. A built-in mass flow sensor provides accurate flow control to insure proper calibration gas concentrations. The Cal 2000 LT uses the following components to produce the calibration gas/air mixture:

Internal Micro Pump

A small, rotary vane, micro air pump draws in ambient air to blend with the generated gas.

Electrochemical Generating Cell

The electrochemical generating cell contains an electrolyte solution and either inert or consumable electrodes, depending upon the gas being generated. A precise concentration of gas is produced when a known amount of current and a known amount of air is supplied continuously to the cell. Each cell has a built-in memory chip that tells the Cal 2000 LT instrument what type and concentration of gas is to be generated and how much cell life is remaining. The electronics board mounted to the cell should never be removed from the cell. Removal of this board will void warranty and destroy the cell. Due to the design characterization of the cell, the unit must be oriented flat (on the units feet) for correct concentration output.



Cell Installation and Removal

There are no tools required by the end user for service of the instrument. The electrochemical cells are shipped separate of the unit and should be installed on receipt. To install the cell, remove the bottom cover of the instrument. This is done by pulling each of the 'plunger feet' on the bottom of the instrument. Once all of the plungers have been pulled out, the bottom cover is simply removed from the instrument.



The cell is keyed to ensure proper alignment into the instrument. When installed, the circuit board of the cell should be flat with the bottom of the instrument. Push up on the clear window at the back of the instrument to eject the cell.



warranty of fitness for a particular purpose. In no event shall Advanced Calibration Designs, Inc. be liable for direct, incidental or consequential loss or damage of any kind connected with the use of its products or failure of its products to function or operate properly.

The following is a listing of the available electrochemical Cal 2000 LT cells and their standard warranty when installed in equipment manufactured and supplied by Advanced Calibration Designs, Inc.

10 Hour Generating Cells

1. Chlorine - One year or 10 hours of use.
2. Hydrogen Sulfide - One year or 10 hours of use.
3. Hydrogen Cyanide - One year or 10 hours of use .
4. Hydrogen - One year or 10 hours of use .

25 Hour Generating Cells

1. Chlorine - One year or 25 hours of use.
2. Hydrogen Sulfide - One year or 25 hours of use.
3. Hydrogen Cyanide - One year or 25 hours of use .
4. Hydrogen - One year or 25 hours of use .

VI. Standard Warranty

We warrant gas calibration equipment manufactured and sold by us to be free from defects in materials, workmanship and performance for a period of one year from date of shipment. Any parts found defective within that period will be repaired or replaced, at our option, free of charge, F.O.B. factory. This warranty does not apply to those items which by their nature are subject to deterioration or consumption in normal service, and which must be cleaned, repaired, or replaced on a routine basis.

Such items may include, but are not limited to:

- a. Electrochemical type generating cells
- b. Electrolyte
- c. Batteries

Warranty is voided by abuse including rough handling, mechanical damage, alteration, or repair procedures not in accordance with the instruction manual. This warranty indicates the full extent of our liability, and we are not responsible for removal or replacement cost, local repair costs, transportation costs or contingent expenses incurred without our prior approval.

Advanced Calibration Designs, Inc.'s obligation under this warranty shall be limited to repairing or replacing, and returning any product which shall be returned to Advanced Calibration Designs, Inc. at its manufacturing facilities, with transportation charges prepaid, and which Advanced Calibration Designs, Inc.'s Material Review Board examination shall disclose to its satisfaction to have been defective.

This warranty is expressed in lieu of any and all other warranties and representations, expressed or implied, and all other obligations or liabilities on the part of Advanced Calibration Designs, Inc. including, but not limited to, the

Alkaline "C" Batteries

A set of four fully charged, **heavy duty alkaline "C"** batteries provides approximately 10 hours of operation. **Note: Re-chargeable or light duty batteries can be used, but they give significantly less operating time. Using re-chargeable batteries will also void the CSA safety certification during the time of their use.**

Microprocessor-Based Circuitry

The Cal 2000 LT has microprocessor based circuitry that performs several different operations and offers the user many different features. The microprocessor tracks cell and battery usage, monitors the air flow rate and controls the cell and pump to give the correct ppm and flow rate. In addition to English, every Cal 2000 LT is capable of providing menu displays in French, German and Spanish. See section III. Menu Options for instructions on how to change the menu language.

Digital Display

The Cal 2000 LT has a liquid crystal display (LCD) located on the front of the instrument. This display is protected by a thin, clear plastic cover that is part of the front label and may be replaced if it becomes scratched or unclear.

POWER and SELECT

The POWER and SELECT switches are momentary push button type switches activated through the front membrane panel. They are physical switches mounted directly on the circuit board.

Delivery Hose

The instrument comes standard with a three (3) foot long, ¼ inch diameter noprrene hose for delivering the gas to the sensor or calibration adapter. The hose has a male quick connect adapter for easy attachment to the instrument.

Nylon Carrying Case

The Cal 2000 LT comes with a convenient, durable, nylon carrying case. It is adjustable to be worn as a hip pack, or the belt strap can be reattached to be worn around the neck or over the shoulder. The top of the carrying case is clear plastic, allowing the unit to be operated while within the case, and there is a convenient front pocket for storage of additional cells or the delivery hose.

Mass Flow Sensor

The Cal 2000 LT has a built-in mass flow sensor that measures the flow rate of the instrument. This information is used to control the pump to provide the desired flow-rate. The flow meter should be calibrated against a primary mass flow standard every 12 to 24 months.

Internal Charcoal Filter

An internal charcoal filter is provided to scrub contaminated air and provide a clean baseline for the calibration gas generated. This filter should be replaced on a yearly basis and is removed by pulling out the grey plunger at the top of the unit. Spare filter elements can be purchased through ACD. Note: The charcoal filter must be fully installed into the instrument for correct operation.



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"Cell Failure!" *accompanied by an audible beep.*

There are two possible causes for a cell failure. One cause is that the instrument has not detected a cell. The other is that a high voltage has been detected across the cell.

If the cell is not initially detected by the processor, the unit will display cell failure and immediately shut down (without entering 'purge mode'). This failure can happen either because a cell is not inserted, connection to the cell is not made, or due to a failure of the circuit board on the generating cell.

The cell failure alarm will also engage if the microprocessor detects an abnormally high cell voltage condition. One possibility for this high voltage is that one of the pins may be making a faulty electrical connection. Another possibility is that the electrolyte level is too low. For instructions on how to replenish the electrolyte refer to

Section V: Maintenance.

If this message continues after the cell has been plugged in correctly and the electrolyte level has been confirmed to be sufficient, contact the factory and/or replace the cell.

"Cell is used up! " *accompanied by an audible beep.*

The cell life has expired and the display will show no time remaining on the cell.

V. Troubleshooting

No Power To Instrument

There are two common causes for the unit to not power up when the POWER switch is pressed for three seconds.

The most common is that the batteries are dead. Try replacing the batteries with new alkaline batteries or try powering the unit from the AC power adapter.

The second most frequent cause for no power to the instrument is a blown protective fuse. **This fuse can be shorted out if the batteries have been removed from the instrument with a metallic object such as a screwdriver.** If the protective fuse has been blown contact the factory.

"Battery is low!" *accompanied by an audible beep.*

If battery power drops below 5% capacity, the screen will flash "Battery is low!". Replace the batteries or switch to AC power.

"Flow too low" / "Flow too high" *accompanied by an audible beep.*

Accurate air flow is critical to an accurate gas mixture. The microprocessor and built-in precision mass flow sensor continuously monitor the air flow. If, however, a flow problem develops (e.g. air blockage or kinked tubing) which cannot be corrected within ten seconds, the unit will display "Flow too low." If the problem cannot be cleared after an additional minute, the instrument will enter the purge mode and then power down.

Optional items available for the Cal 2000 LT include:

AC Adapter

The Cal 2000 LT may also be operated from an AC adapter. The AC adapter converts the AC voltage supplied from the main power lines to 6 VDC which is used in lieu of the batteries. The adapter plugs into the instrument from the underside of the case directly into the power board and is independent of polarity. If needed, contact the factory for exact specifications of the AC adapter.

Hard Body Instrument Case

A water resistant, padded instrument case is available for storage and shipping of the Cal 2000 LT. The case is made out of rugged, high impact resistant plastic and will help protect the instrument in harsh environments. The foam insert may be customized to hold additional items like spare batteries and cells.

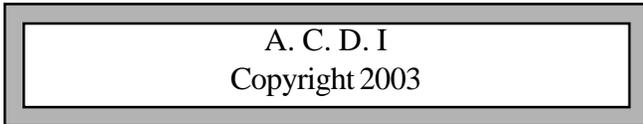
Extension Hoses

Longer sample hoses may be purchased for use with the Cal 2000 LT in lengths up to 20 feet. Note: the internal pump may not be capable of overcoming flow restrictions associated with extreme hose lengths when operating at 1.0 LPM.

II. Normal Operation

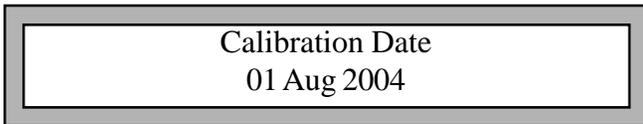
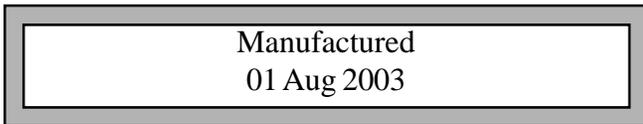
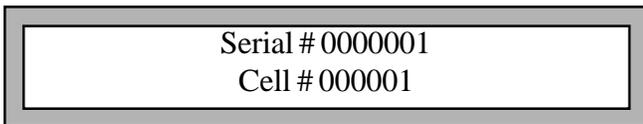
To start the generator, **press and hold** the POWER switch, located in the middle left front of the instrument, until the display reads A. C. D., approximately **three (3) seconds**. Release the switch immediately thereafter.

The instrument will sequence through several screens as follows:



Please Note: If you would like to change the language of the menus, see section III. Menu Options: Foreign Language Option, for instructions.

The instrument will display the Serial Number and Cell Number, followed by the manufactured date.



IV. Maintenance

The electrochemical cells of the CAL 2000 LT require periodic maintenance to provide optimum performance. It is recommended that the electrolyte solution be replaced on an annual basis.

If the instrument is returned with the cell on an annual basis to maintain NIST certification, the electrolyte will be replaced by the factory.

The following steps should be taken to replace electrolyte.

- a. Remove cell as described in section I. General Description: Cell Installation and Removal.
- b. Unscrew solid fill plugs on reservoir and remove liquid.
- c. Use syringe (provided with electrolyte) to add liquid to within 1/8 inch from the bottom of fill hole.

Warning: Do not over-fill reservoir. Trapped air must be allowed to escape through vent plug as fill screw is replaced. Contact the factory for more information.

- d. Replace fill plugs.

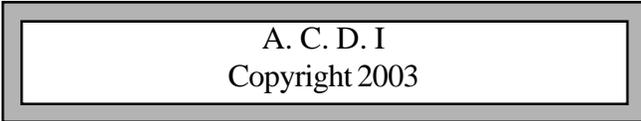
The electrolyte in the electrochemical cells can also dehydrate over time in dryer climates. A low electrolyte level will ultimately result in a "Cell Failure" warning. Since only water is evaporated, and the electrolyte salts are remaining in solution, it is only necessary to replenish the electrolyte with distilled or de-ionized water. Ordinary tap water (as well as many bottled waters) should not be used as it contains chemicals and minerals that could contaminate the cell.

Replenishing the cell with water is similar in procedure to replacing the electrolyte shown above, but the remaining electrolyte is not removed before the replenishment water is added.

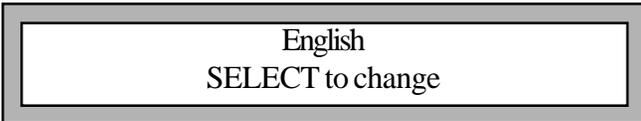
III. Menu Options

Foreign Language Option

The menu options can be adjusted to read in German, French, or Spanish. To change the language, start the unit as you normally would. When the ACD screen appears,



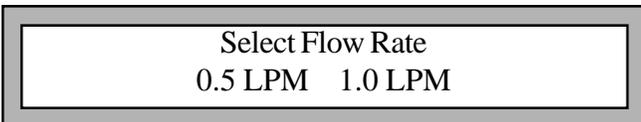
press the SELECT button. This will bring up the following screen:



Press the SELECT button to choose the preferred language. When the language is displayed, press the POWER button to continue with the start up sequence.

Flow-Rate Select Option

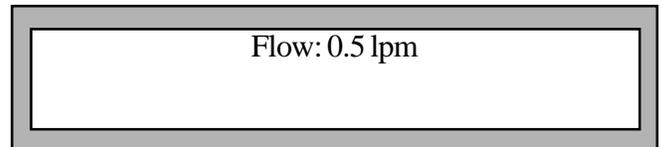
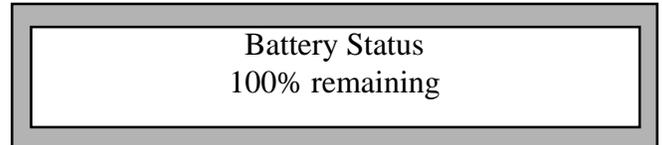
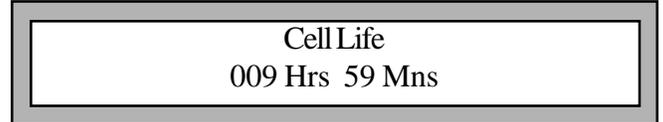
The CAL 2000 LT is shipped from the factory set at either 0.5 LPM or 1.0 LPM depending on what was specified when the unit was ordered. To change this in the field the following screen can be used.



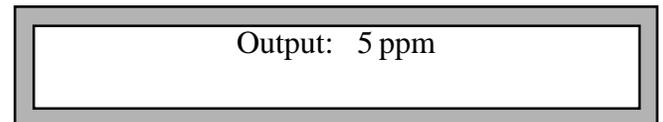
Note that the CAL 2000 LT cells read this setting on the instrument and will work correctly at either flow-rate.

The Calibration Date refers to when the instrument itself was last calibrated at the Factory. It does not refer to the calibration date of the generating cells, which are field replaceable.

The following status screens indicate the remaining cell life, battery status and flow-rate.



Immediately after the flow rate screen appears, the ppm screen appears.



Once the flow and concentration have been displayed, the instrument will enter the stabilization period and the display will alternate between the following three screens:

Stabilizing ...
Standby: 146 sec

5 ppm CL2
Standby: 145 sec

Flow: 0.5 lpm
Standby: 144 sec

When the instrument has finished counting down to zero (0) seconds, it has reached 90% of its final output and will enter the gas generating mode. In this mode, the instrument will display the gas being generated, the flow rate, the ppm setting and the time while running at these settings as follows:

CL2 @ 0.5 lpm
5 ppm 00:00:07

When you are finished generating gas and wish to turn off the instrument, **press and hold** the POWER switch until the purge screen is displayed.

Purging ...
Standby: 300 sec

The instrument will purge itself of gas for 300 seconds and then automatically shut off. At any time during this period, you may turn the instrument back on by pressing the SELECT switch and entering the status screens as described above. You must change either the flow rate or the ppm setting and then the instrument will immediately go to the stabilization screen and continue to run at the new settings. The amount of stabilization time will depend upon how long the instrument was in the purge mode.