

MiniCal Gas Generator

Release II

Advanced Calibration Designs, Inc.

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INSTRUCTION MANUAL

Instruction Manual

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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)

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 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 MiniCal cells and their standard warranty when installed in equipment manufactured and supplied by Advanced Calibration Designs, Inc.

Chlorine, Hydrogen, Hydrogen Sulfide, and Hydrogen Cyanide

- 10 Hour Cell - One year or 10 hours of use
- 5 Hour Cell - One year or 5 hours of use
- 2 Hour Cell - One year or 2 hours of use

IX. 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:

- a. Electrochemical type generating cells
- b. 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.

I. GENERAL DESCRIPTION



The MiniCal is a small, 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. The MiniCal uses the following components to produce the calibration gas/air mixture:

Internal Micro Pump

A small air pump draws in ambient air to blend with the electrochemically 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 the MiniCal supplies a known amount of current and a known amount of air continuously to the cell.

Alkaline "AA" Batteries

A set of two fully charged alkaline "AA" batteries provides 10-12 hours of operation. To replace the batteries, open the battery cover on the back of the unit with either a fingernail or small flat object. It is important that when changing the batteries in the instrument, to not use a metal object, such as a screw driver. Using a metal object to remove the batteries will frequently blow the pico fuse in the unit, preventing the unit from powering up.

NOTE: Rechargeable batteries will provide substantially fewer hours of operation and will self discharge while the instrument is in storage. Users should also be aware that use of rechargeable batteries will void the CSA approval of the MiniCal for intrinsic safety.

Microprocessor-Based Circuitry

When powered-up, the microprocessor provides remaining cell life in hours. It also monitors battery life and indicates when either a low battery or exhausted cell condition occurs. (See section IV Non-Normal Operation.) The circuit board is attached directly to the bottom case via solder joints to the battery terminals. If damaged or inoperable, it should be replaced as part of the case rather than removed from these terminals.

VIII.

Accessory Items / Parts List

The following items and spare parts are available for the MiniCal:

P/N	Description
113-0400-00	Quick connect outlet fitting, body, panel mount
113-0402-00	Quick connect hose fitting, insert, 1/16 " barb
115-0400-00	Screw cap, with hose fitting, MiniGen
250-0401-00	Battery cover, MiniGen
375-0400-00	Mini pump, rotary vane, 6.0 VDC
400-0450-00	Circuit board for MiniCal, release II
510-0400-0X	Chlorine generation cell, 10 hour, specify ppm
510-0405-0X	Chlorine generation cell, 5 hour, specify ppm
510-0401-0X	Chlorine generation cell, 2 hour, specify ppm
510-0450-0X	Hydrogen sulfide generation cell, 10 hour, specify ppm
510-0455-0X	Hydrogen sulfide generation cell, 5 hour, specify ppm
510-0451-0X	Hydrogen sulfide generation cell, 2 hour, specify ppm
510-0470-0X	Hydrogen cyanide generation cell, 10 hour, specify ppm
510-0475-0X	Hydrogen cyanide generation cell, 5 hour, specify ppm
510-0471-0X	Hydrogen cyanide generation cell, 2 hour, specify ppm
510-0490-0X	Hydrogen generation cell, 10 hour, specify ppm
510-0495-0X	Hydrogen generation cell, 5 hour, specify ppm
510-0491-0X	Hydrogen generation cell, 2 hour, specify ppm
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
730-0400-00	Nylon carrying case
730-0415-00	Hard-body, water proof, padded accessory case
910-0450-00	Instruction manual, MiniCal

VII.

Maintenance

ON/OFF Switch

The ON/OFF Switch is identified by the universal symbols of 1 and 0 and is activated through the front membrane panel. It is a physical switch mounted on the circuit board. If the membrane area gets damaged, it is replaced as part of the entire front label. If the switch becomes nonfunctional, it must be repaired or replaced as part of the circuit board.

Caution

Both the electrochemical cell and the alkaline batteries used in the MiniCal instrument contain corrosive chemicals. While it is not expected that the chemicals in the cell or alkaline batteries will leak during normal operation, it is recommended that both the cell and the batteries be removed from the instrument if it is being stored for periods longer than one week between use.

ON/OFF Switch

The ON/OFF Switch is identified by the universal symbols of 1 and 0 and is activated through the front membrane panel.

Delivery Hose

The instrument comes standard with a three foot long, 1/4 inch outside diameter noprrene hose for delivering the gas to the sensor calibration adapter. The air flow of the instrument is affected by the hose length (and subsequent pressure drops through the hose) and must be readjusted if alternative delivery hoses are used.

II.

Start-Up

To start the generator, **press and hold** the ON/OFF Switch, located in the middle front of the instrument, until the GREEN and/or RED LEDs turn on, approximately **three (3) seconds**. Release the switch immediately thereafter.

The GREEN LED will flash rapidly from one to ten times, twice in succession, indicating the number of hours remaining in the electrochemical generating cell. If only one rapid flash is observed, the generating cell is near depletion.

After the cell life indication, the GREEN LED will begin to flash slowly during the warm-up period. During this period, the generating cell is coming to equilibrium. To speed up equilibrium, the air pump is not turned on for the first 60 seconds of operation. This helps to saturate the generating cell with gas. After 60 seconds, the pump will start to pump air through the instrument and the GREEN LED will continue to flash for another 45 seconds.

When the GREEN LED stops flashing and remains lit, the instrument has reached at least 80% of its final output. Complete equilibrium may take an additional two to five minutes, depending upon the type and amount of gas being generated and the operating conditions of the instrument.

Example:

An instrument set for 10 ppm is used to calibrate a sensor at 3200 feet with a temperature of 29 °C. The corrected output is:

$$10 \text{ ppm} \times 1.116 \times 1.034 = 11.5 \text{ ppm}$$

VI. Corrections to Gas Output

Changes in altitude and temperature can cause changes in air density, thus affecting the output of the MiniCal. The output of the MiniCal was calibrated to STP (standard temperature and pressure) of sea level and 20 °C. To compensate for differences in altitude or temperature from STP, the following tables should be utilized:

Note: Altitude and Temperature are cumulative, i.e., you must correct for both factors to obtain the most accurate calibration.

Altitude Correction Table		Temperature Correction Table	
Altitude (in feet)	Corrected Output (multiply by)	Temperature (°C)	Corrected Output (multiply by)
0	1.000	-30	0.829
1000	1.038	-20	0.863
2000	1.076	-10	0.898
3000	1.116	0	0.932
4000	1.158	10	0.966
5000	1.202	20	1.000
6000	1.248	30	1.034
		40	1.068
		50	1.102

If the RED LED begins flashing or remains lit continuously it indicates the instrument is in either low battery condition or cell failure mode. Please refer to the section on Non-Normal Operation.

At any time the instrument may be shut off by pressing and holding the ON/OFF Switch for a few seconds. The GREEN and RED LED will begin to flash indicating that the instrument has entered a purge mode. The instrument will purge itself of gas for approximately 2 minutes and then shut down.

At any time during the purge mode, the instrument may be restarted by pressing and holding the ON/OFF Switch as above. The instrument will immediately go back into the warm-up mode at the moment that the pump normally turns on, with approximately 60 seconds left in the warm-up cycle. It will not give a cell life indication, which only happens during the first power up.

III.

Normal Operation

After the desired equilibrium has been achieved, the instrument may be used to perform gas calibration. The GREEN LED will remain on during this period and the pump will continue to operate. While in normal operating mode, the MiniCal will run continuously and generate gas until either the battery becomes discharged or the cell is consumed. If either condition occurs, a RED LED will light, indicating a non-normal condition, refer to the Non-Normal Operation section that follows.

Note: Changes in air pressure or temperature will affect the output of the MiniCal instrument. Before beginning any calibration please refer to section VI Corrections to Gas Output for important adjustments needed to obtain accurate calibration gas.

The calibration gas is delivered through the three foot long calibration hose attached to the MiniCal via a quick connect coupling. A calibration adapter, or cup, which is provided by the manufacturer of your gas detector, is usually attached to the end of the delivery hose. This adapter or cup is then placed over the gas sensor. Be sure not to restrict or block the delivery hose while the pump is running. This method is used for calibrating diffusion type sensors.

up the electrode pins with the corresponding sockets. Do not force the cell into the cell chamber if it is not properly aligned, otherwise the pins may become damaged rendering the cell and/or instrument useless.

Note: The generating cells contain very small amounts of acidic solution and should be disposed of as per local regulations. For more information, please contact the factory.

V.

Cell Life

The generating cell is consumed during the operation of the unit. Cells can be purchased for two hours, five hours, or ten hours of generation time. Once a cell has been depleted, it may be replaced with a new cell to provide additional calibration time. Replacement cells may be stored in their containers in a cool, humid area for several years under most conditions.

Different types of generating cells can be used with each instrument, both in the type of gas and in the concentration of the gas being generated. Please note that the flow rate designated on the cell must correspond to the flow rate of the instrument to ensure accurate gas generation. The microprocessor reads the type of gas and the ppm output of the cell from a memory chip embedded in the cell body. It then adjusts the current for the proper gas output. For a complete list of correct cell part numbers, please refer to the parts list at the end of this manual.

To replace the generating cell in the instrument, first remove the instrument cap located on the top of the instrument. The generating cell pulls directly up out of the cell chamber. Do not twist or rotate the generating cell while removing it from the cell chamber or damage may occur to either the cell pins or the cell chamber sockets. The replacement cell is replaced in reverse fashion. Care must be taken when replacing the cell to correctly line

Alternatively, the output gas may be collected into a gas collection bag for calibrating sample draw instruments. If this method is used, it is recommended that the instrument is allowed to flow into and out of the bag via a "Y" connector. First, partially fill the bag with generated gas. Second, attach the sample draw unit to the third side of the "Y" connector. The sample draw instrument will draw from both the generator and/or the bag depending upon the flow rate of the generator. Be sure to disconnect the sample draw unit before the bag is completely emptied of gas.

An alternative method is to use the "Y" adapter directly to the instrument with no bag attached. This should only be used if the flow rate of the MiniCal is greater than that of the sample draw instrument, otherwise dilution gas will also be drawn into the instrument reducing the calibration gas concentration.

NOTE: Never attach a sample draw instrument directly to the end of the MiniCal delivery hose without a "Y" connector in between the two instruments. This may cause damage to one or both of the air pumps in the MiniCal and/or sample draw instrument.

IV.

Non-Normal Operation

If either the batteries or the generating cell become depleted, or the generating cell is removed from the MiniCal, the instrument enters a non-normal operating condition and the RED LED will turn on.

Under a low battery condition, the RED LED will begin to flash. If the low battery condition occurs during power up, the RED LED will flash for approximately 30 seconds and then the instrument will power down. If the low battery condition occurs after start up, the RED LED will begin flashing and the instrument will continue to run for approximately five minutes before power down. This allows the completion of any ongoing calibration that may be in process. It is recommended to replace depleted batteries with two "AA" heavy duty Alkaline batteries for maximum operating life.

If the cell becomes depleted or is removed, the RED LED will light continuously. If the depleted cell condition occurs during power up, the RED LED will flash for approximately 30 seconds and then the instrument will power down. If the low battery condition occurs after start up, the RED LED will light and the instrument will continue to run for approximately five minutes before power down. This allows the completion of any ongoing calibration that may be in process.

If the cell has been depleted, it should be removed and replaced with a new generating cell. Please refer to the section on cell life for proper instructions on replacing the generating cells. If the cell has not been depleted, there may be a faulty electrical connection between the cell and the instrument. Remove the cell and inspect the pins protruding from the cell and the sockets in the cell chamber. Remove any debris and or corrosion that may be present and retest the cell. If either the pins or sockets become damaged or non-repairable, both the cell chamber and/or the cell should be replaced.