

# ECO SENSORS, INC.

## VOC GAS SENSOR Model C-21

### INSTRUCTIONS FOR USE

#### GENERAL

The model C-21 is a solid-state gas monitor capable of sensing a variety of gases and vapors. The ones it is generally sensitive to are called VOCs (volatile organic compounds), and the most common application of the C-21 is for solvent vapors. Common examples are paint thinners, dry cleaning fluids, cleaning solvents, and gasoline vapors. The instrument does not respond to carbon dioxide or radon, and has only a weak response to carbon monoxide. The C-21 is self-contained except for its AC adapter power module. The instrument also has an audio alarm and has outputs to external alarms, data loggers, calibration equipment, etc.

#### OPERATION

Plug the AC adapter into AC power and plug the adapter's output plug into the power jack on the instrument. After a few seconds, most or all of the display will light up; it will stay high for 1-2 minutes; and then it will go down to as low as one green bar. The C-21 will require at least 3 minutes to warm-up, and 5 or more minutes is recommended.

The alarm will go on while the instrument's display is in the red including during warm-up. If this is too objectionable, you may put a muffling cloth such as a towel over the instrument during warm-up, or you may switch the alarm off through a hole in the back cover (see illustration to the top right).

One green bar lit indicates the instrument is receiving correct power. Illumination to the first yellow bar indicates a cautionary situation for most VOCs, and reaching the first red bar often indicates a hazardous condition such as reaching the OSHA TLV.

Test the instrument's response by holding a fresh felt marker pen a few millimeters from the sensor grill for a few seconds. The display should light up to red. Check the C-21's response to gases and solvents of interest by exposing the instrument to these VOC's and noting its response. The C-21's response to common VOC's is shown on the reverse side of this instruction sheet.

It is best for your protection and for the instrument itself to leave it on 24 hours a day.

#### INSTALLATION

The instrument may be hung on hooks, screws, etc. using the outer two top holes on the back, or it may be stuck to machinery cabinets, etc. using its magnetic backing. Avoid areas that have a lot of vibration, dust, or dripping or sprayed water. The instrument is not designed for outdoor use. For dusty or wet areas, the C-21 should be mounted in the Eco Sensors EE-1 Environmental Enclosure which protects it from these hazards.

#### CALIBRATION

The instrument indicates red at high levels of VOC gases and vapors. The C-21 is broadly sensitive to most VOCs, but its response is different for each one. To calibrate for a specific gas, a chemical laboratory is required. The procedure detailed in our Tech Note C-100. The perchloroethylene calibration ("perc" or dry cleaning fluid) is shown on the reverse side of this instruction sheet.

#### BATTERY OPERATION

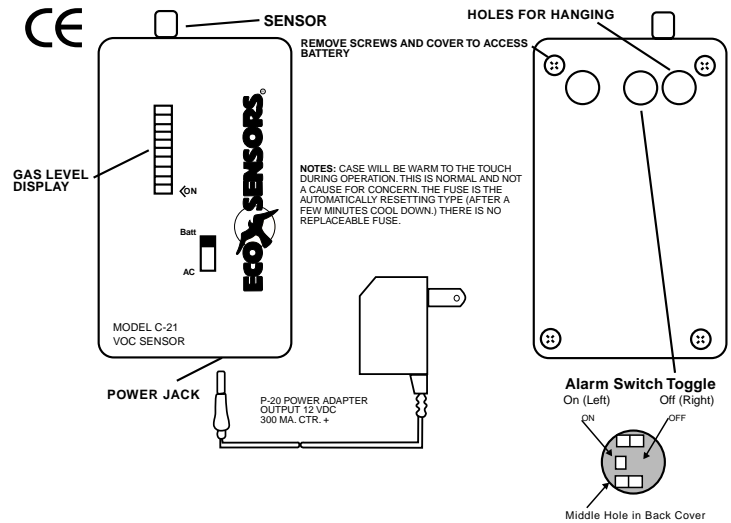
To investigate a VOC leak, or to do field research, the instrument may be unplugged from the AC adapter and operated from its internal rechargeable battery for about 2 hours (This will not work on initial operation. The battery will require about 10 hours of charging which happens automatically whenever the instrument is being powered by the AC adapter).

#### ALARM

The audible alarm (buzzer) is normally triggered when the first red segment of the LED is lit. During warm-up of the instrument the sensor will read high for 1-2 minutes and the alarm will actuate unless it has been turned off.

The alarm set-point, which is the same set-point as for the internal relay contacts, can be changed through resetting the 8 toggle DIP switch found on the circuit board. This switch allows reconnecting the set-point across any of the top 8 bars of the LED display. Switch number 1 connects to the top red bar, all the way down to switch 8 controlling through the third green bar from the bottom of the display. Please note that no more *than one* switch should be *down* (on) at a time. If no switch is on, the alarm and internal relay will not work.

Normally, the third switch, corresponding to the first red bar, is on. This switch can be shut off using a pen or screwdriver actuating it through the upper middle hole in the back plate. When this is done, neither the alarm nor the internal relay contacts will function.



#### OUTPUTS TO EXTERNAL EQUIPMENT

The C-21 has two output circuits for external measurements and controls via the accessory plug. They are (refer to drawing on the reverse side of this instruction sheet):

Low powered (transistor) relay that will switch up to 30 volts at 130 mA directly, or it can drive an external power-handling relay that has its own coil power supply. This relay closes when the buzzer actuates because it is programmed by the same DIP switch that controls the buzzer.

0-2 volts DC output that increases as the VOC level increases. The first red bar on the LED bargraph corresponds to an output of one volt. The output is not linear, however. It is logarithmic (See output table, reverse side of this sheet). This DC output can be used to drive data loggers such as the Eco Sensors model DL-2 for PCs, a digital voltmeter for remote readout, or the Eco Sensors RAP-7800 Remote Access Panel. The RAP Panel has a 90 db alarm, a pulsating red strobe alarm light, and a 4-20 mA output loop to connect to a building control system (BCS). For RAP systems be sure to order the C21 with an interface terminal block.

#### USE IN VEHICLES

The C-21 may also be used in cars and trucks, or wherever there is 12 volts DC available. A cigarette lighter adapter should be purchased for this purpose from an electronics store. Make sure the plug selected fits our jack (2.5 mm) and that it is configured for center pin = +. Radio Shack has several models that work such as their part number 270-029. For vehicular use, the instrument's panel switch should be in the AC position.

Vehicular use includes charging the battery in the C-21, checking for leaks in solvent containers, inspection of gasoline station and vehicle maintenance areas, and environmental checking of roadside hazards and spills.

#### SERVICE AND MAINTENANCE

The battery and the sensor are the only user serviceable parts of the instrument. While they should last 3-5 years, it is good practice to replace them annually.

**Battery** The nickel cadmium (NiCad) battery (9 volt snap-on connector) generally does not fail suddenly. After about a year, its performance will gradually decline. The battery replacement is Eco Sensors part number XB-C2. NiCad batteries are also available in local electronics stores such as Radio Shack (part number 23-526). Both NiCad and NiMH batteries will work, and both 7.2 volt (6 cell) and 8.4 volt (7 cell) models will work. The higher voltage version has a somewhat longer discharge life, but the lower voltage version will charge more efficiently. If the AC adapter is only putting out 12-13 volts (most "12 volt" AC adapters, like our model P-20, put out about 15 volts under load). *Do NOT attempt to use alkaline or other non-rechargeable batteries. The non-rechargeable batteries will overheat and destroy the instrument, voiding the warranty.*

The battery may be replaced by disconnecting the AC adapter and removing the back of the instrument. Exchange the batteries being careful to put the new battery in exactly where the old one was and to replace the protective felt material surrounding it.

**Sensor** If the instrument no longer responds to gases and vapors, the likely cause is sensor failure. The replacement sensor is the Eco Sensors part number SE-4.

**AC Adapter** For use in North America and other areas with the "American System" of 120 V 60 HZ, the Eco Sensors P-20 adapter should be used. For other areas adapters should be purchased locally that fit local wall sockets and conform to local codes. The output should be 12 volts DC unregulated, 300-500 mA. The plug on our instrument should fit a 5.5/2.5 mm socket with the center pin +. For further details see our Tech Note P-101.

## SPECIFICATIONS

*Sensor:* Heated metal oxide semiconductor.

*Sensitivity:* First responds at a few ppm for many VOC gases and vapors. Alarm typically sounds at about 50 ppm.

*Response time:* Within one minute of when gas reaches the sensor.

*Audio alarm level:* Approximately 80 db.

*Temperature and humidity range:* 0-40 deg C and 0-80% relative humidity.

*Supply voltage required:* 12 volts DC, 200 mA.

*Battery life:* Over 2 hours per charge.

*Size of instrument:* 85 X 35 X 60 mm (3 1/4" X 1 3/8" X 2 3/8").

*Weight of instrument:* 140 grams (5 oz.).

*Shipping weight of instrument and adapter:* about 2/3 kg. (1 1/2 lbs.)

## SAFETY FEATURES

*Enclosure:* Self-extinguishing ABS plastic.

*Sensor:* Heated element is flame arrestor protected.

*Electrical:* (a) Circuits operate at 24 volts, 250 mA, or less with no high capacity inductors or capacitors. (b) Self-resetting fuse to protect against excess input current flow. (d) Overvoltage protection diode barrier to protect against supply voltage surges, spikes, overvoltage, and reverse polarities.

## PRECAUTIONS

- Allow at least 5 minutes warm-up.
- Read all instructions in this manual.
- Keep instrument dry. Never let water or other liquids into the sensor.
- Do not drop the instrument or subject it to continuous vibration.
- Do not store in high levels of dust.
- Do not clean the instrument with cleaning chemicals or solvents. Clean it with a damp cloth.
- Do not operate near heavy aerosols (spray) usage or where oxygen is being administered.
- Call a qualified electrician if you have any doubts about voltages, currents, electrical practice, etc.

## WARRANTY

This product is warranted against defects in materials and workmanship for one year following the date of purchase by the original owner. This warranty does not include damage to the product as a result of misuse, accident, damage, modifications or alterations, and it does not apply if the instructions in this manual are not followed.

If a defect develops during the warranty period, Eco Sensors at its election will repair the instrument or replace it with a new or reconditioned model of equivalent quality. In the event of replacement with a new or reconditioned instrument, the replacement unit will continue the warranty of the original unit.

To return the instrument contact your distributor, or call Eco Sensors at (800) 472-6626 or e-mail at sales@ecosensors.com to receive return instructions and a Return Goods Authorization (RGA) number.

Except as provided herein, Eco Sensors makes no warranties express or implied, including warranties of merchantability and fitness for a particular purpose. Eco Sensors shall not be liable for loss of use of the instrument or other incidental or consequential damages, expenses or economic loss, or claims for such damage or economic loss.

This warranty gives you specific legal rights and you may also have other rights which vary from state to state.

RECORD YOUR SERIAL NUMBER HERE \_\_\_\_\_

KEEP THIS MANUAL AND WARRANTY FOR YOUR RECORDS.

Eco Sensors is a registered trademark of Eco, Sensors, Inc.

© Eco Sensors, Inc. 1999 Revision 2 for C-21 REV 1.

For brochures, application and tech notes, and other useful information, visit our extensive website at [www.ecosensors.com](http://www.ecosensors.com). E-mail us at sales@ecosensors.com.

**Response Data and Wiring Diagram on the next page.**

## Eco Sensors Model C-21

### RESPONSE RANGES FOR SOME COMMON VOCs

	<u>First detects</u>	<u>Alarm</u> (First red bar)	<u>TLV*</u>
	ppm	ppm	ppm
Acetone	4-5	20-25	750
Benzene	5-10	25-50	10
Diacetone alcohol	5-10	25-50	50
Formaldehyde	1-5	15-25	0.1
Methylene chloride	8-10	40-50	50
Methyl ethyl ketone	3-5	15-20	200
Perchloroethylene	5	50	50
Toluene	3-5	15-25	50
Trichloroethylene	10-20	50-100	50

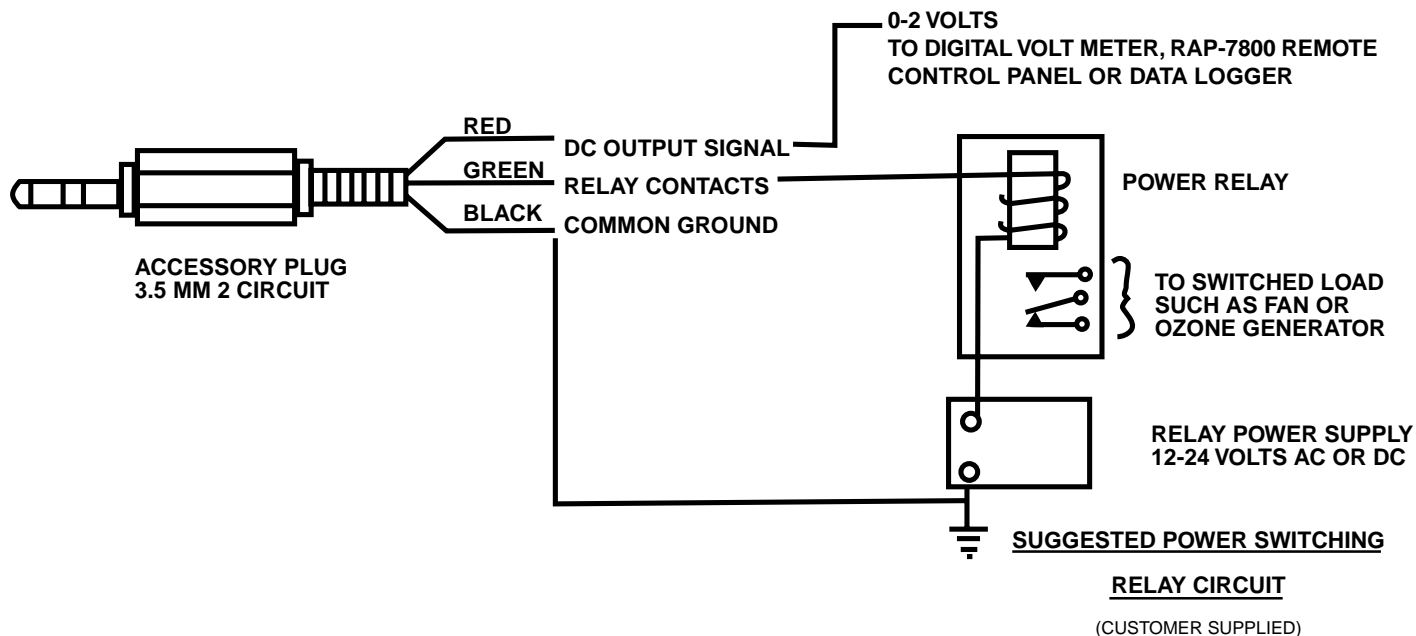
\*Threshold Limit Value. Average estimate of government industrial hygienists for repeated worker exposure.

### DISPLAY CALIBRATION FOR "PERC"

(Partial calibration for perchloroethylene, the common dry cleaning fluid.)

<u>LED Display</u>	<u>Concentration</u>
	ppm
All green	20
All yellow	40
One red	50
Two red	100
All red	140

## C-21 OUTPUT CIRCUITS



The C-21 internal relay is a "dry contact" FET device. It will handle up to 30 volts AC or DC at up to 130 ma so it will switch low voltage alarms directly. For switching power loads an intermediate relay and power supply should be used such as shown above.

## RECOMMENDED ACCESSORIES

**EE-1 Environmental Enclosure** For dust and water protection in industrial and agricultural environments and where the public may be near the instrument. 120 x 180 x 90 mm (5"x 7"x 3") with a clear polycarbonate gasket front cover.

**DL Series Data Loggers** Tiny battery-operated data loggers record data for later analysis in PCs.

**RAP-7800 Remote Alarm Panel** In rugged PVC enclosure. Feature 90 dB audio alarm, red alarm strobe light, 4- 20 mA analog signal loop (for building control systems), and optional digital readout.