



## Limited Warranty

**1. Limited Warranty.** Manning Systems, Inc. ("Manning") warrants to the original purchaser and/or ultimate customer ("Purchaser") of Manning's Products ("Product") that if any part thereof proves to be defective in material or workmanship within eighteen (18) months of the date of shipment by Manning or twelve (12) months from the date of first use by the purchaser, whichever comes first, such defective part will be repaired or replaced, free of charge, at Manning's discretion if shipped prepaid to Manning at 11511 W. 83rd Terrace, Lenexa, Kansas 66214, in a package equal to or in the original container. The Product will be returned freight prepaid and repaired or replaced if it is determined by Manning that the part failed due to defective materials or workmanship. The repair or replacement of any such defective part shall be Manning's sole and exclusive responsibility and liability under this limited warranty.

**2. Exclusions.**

A. If gas sensors are part of the Product, the gas sensor is covered by a twelve (12) month limited warranty of the manufacturer.

B. If gas sensors are covered by this limited warranty, the gas sensor is subject to inspection by Manning for extended exposure to excessive gas concentrations if a claim by the Purchaser is made under this limited warranty. Should such inspection indicate that the gas sensor has been expended rather than failed prematurely, this limited warranty shall not apply to the Product.

C. This limited warranty does not cover consumable items, such as batteries, or items subject to wear or periodic replacement, including lamps, fuses, valves, vanes, sensor elements, cartridges, or filter elements.

**3. Warranty Limitation and Exclusion.** Manning will have no further obligation

under this limited warranty. All warranty obligations of Manning are extinguishable if the Product has been subject to abuse, misuse, negligence, or accident or if the Purchaser fails to perform any of the duties set forth in this limited warranty or if the Product has not been operated in accordance with instructions, or if the Product serial number has been removed or altered.

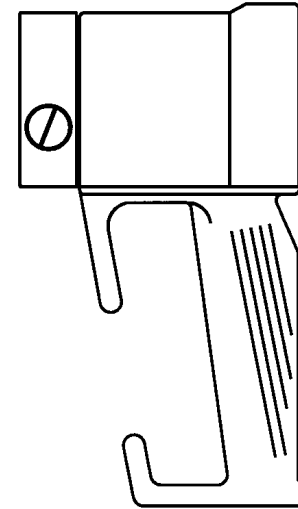
**4. Disclaimer of Unstated Warranties.** THE WARRANTY PRINTED ABOVE IS THE ONLY WARRANTY APPLICABLE TO THIS PURCHASE. ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED.

**5. Limitation of Liability.** IT IS UNDERSTOOD AND AGREED THAT MANNING'S LIABILITY, WHETHER IN CONTRACT, IN TORT, UNDER ANY WARRANTY, IN NEGLIGENCE OR OTHERWISE SHALL NOT EXCEED THE AMOUNT OF THE PURCHASE PRICE PAID BY THE PURCHASER FOR THE PRODUCT AND UNDER NO CIRCUMSTANCES SHALL MANNING BE LIABLE FOR SPECIAL, INDIRECT, OR CONSEQUENTIAL DAMAGES. THE PRICE STATED FOR THE PRODUCT IS A CONSIDERATION LIMITING MANNING'S LIABILITY. NO ACTION, REGARDLESS OF FORM, ARISING OUT OF THE TRANSACTIONS UNDER THIS WARRANTY MAY BE BROUGHT BY THE PURCHASER MORE THAN ONE YEAR AFTER THE CAUSE OF ACTION HAS OCCURRED.



# INSTRUCTION AND OPERATION MANUAL

## PORTABLE CARBON MONOXIDE DETECTOR



Model EC-P1-CO



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## 1 SENSOR DESCRIPTION



### A Introduction

This manual has been prepared to help in the use of the Manning Systems portable Model EC-P1-CO (Electrochemical-Carbon Monoxide) Sensor.

**This manual must be carefully followed by all individuals who have or will have the responsibility for using or servicing the sensor.** If in doubt about a procedure, please contact Manning Systems, Inc. before proceeding.

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### B System Description

The Model EC-P1 is a portable, battery operated instrument for the measurement of gas concentrations in ambient air. The standard range for carbon monoxide is 0-200 ppm with 1 ppm resolution. Figure 1 shows the

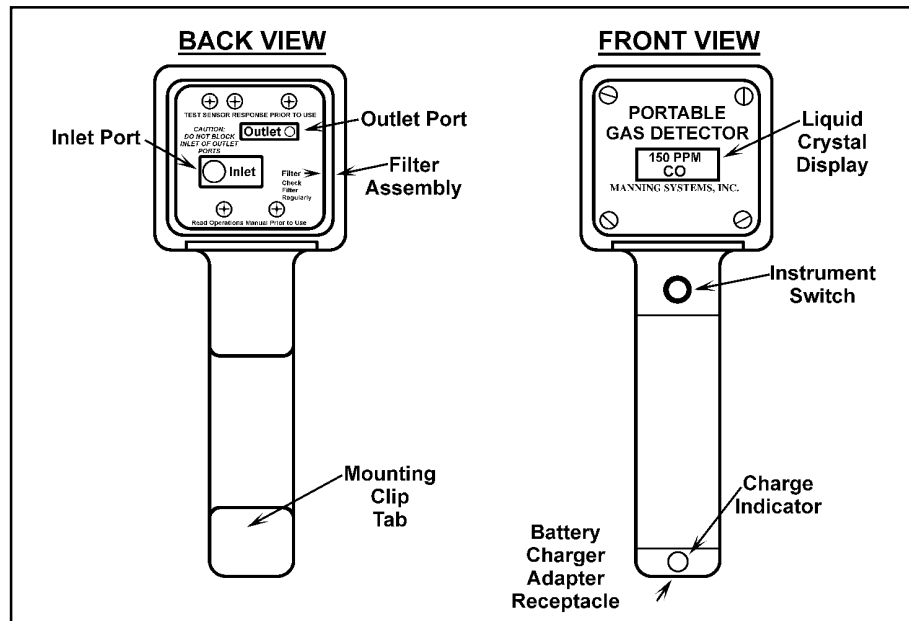


Figure 1: Operating controls and features of the Model EC-P1

some power. If the battery is run down, charge the unit for 16 hours before use. It will take up to six hours of charging for a run-down unit to turn on.

- Detector does not respond to carbon monoxide: Verify the proper flowrate using the supplied flowmeter. Perform calibration. If sensor won't calibrate, the cell may be depleted. Contact Manning Systems for service.
- *PUMPOUT* alarm: This condition is usually caused by a motor failure. Plug the charger into the unit and see if the motor starts. If not, contact Manning Systems for service.
- High reading, won't clear: When the sensor is exposed to very high gas concentrations, it takes a relatively long time for the

sensor to clear. Leave the unit running in a clean environment for a few hours to clear the sensor. If it doesn't clear after six hours, the sensor may have been damaged. Contact Manning Systems for service.

- No flow: If pump is running, check the filter assembly and replace the filter if clogged. This condition can also be caused by drawing water through the wand directly into the pump. Allow the unit to run continuously in a dry environment for one hour.

### Gases/Ranges Available in the EC-P1

Gas	Standard Range	Resolution	Alternate Range
Ammonia	0-500 ppm	1 ppm	0-200 ppm
Arsine	0-1000 ppb	1 ppb	0-10 ppm
Bromine	0-2 ppm	0.01 ppm	0-100 ppm
Carbon Monoxide	0-200 ppm	1 ppm	0-1000 ppm
Chlorine	0-10 ppm	0.1 ppm	0-100 ppm
Chlorine Dioxide	0-2 ppm	0.01 ppm	0-100 ppm
Diborane	0-1000 ppb	1 ppb	0-10 ppm
Fluorine	0-2 ppm	0.01 ppm	0-100 ppm
Germane	0-1000 ppb	1 ppb	0-10 ppm
Hydrogen	0-2000 ppm	10 ppm	0-4 %
Hydrogen Chloride	0-20 ppm	0.1 ppm	0-100 ppm
Hydrogen Cyanide	0-20 ppm	0.1 ppm	0-100 ppm
Hydrogen Fluoride	0-20 ppm	0.1 ppm	0-100 ppm
Hydrogen Selenide	0-1000 ppb	1 ppb	0-10 ppm
Hydrogen Sulfide	0-50 ppm	1 ppm	0-500 ppm
Nitric Oxide	0-200 ppm	1 ppm	0-500 ppm
Nitrogen Dioxide	0-20 ppm	0.1 ppm	0-500 ppm
Oxygen	0-25 %	0.1 %	0-5 %
Ozone	0-2 ppm	0.01 ppm	0-100 ppm
Phosgene	0-2 ppm	0.01 ppm	0-100 ppm
Phosphine	0-1000 ppb	1 ppb	0-10 ppm
Silane	0-10 ppm	0.1 ppm	0-100 ppm
Sulfur Dioxide	0-20 ppm	0.1 ppm	0-200 ppm

ppm = parts per million, ppb = parts per billion

## 2 OPERATION (CONT'D)



the walls of the tubing can affect the reading. To dry, allow the unit to pump dry, ambient air for 15 minutes.

### D Response and Recovery Time

Under normal conditions, the instrument will reach 90% of final value within two minutes. This is dependent on concentration and temperature.

Recovery time for the sensor depends on duration and concentration of exposure. Short exposures of less than 100 ppm result in rapid recovery. Long exposures to levels above 100 ppm or short exposures to levels above 500 ppm can extend recovery times to hours. Repeated exposures above 200 ppm will reduce sensor life and should be avoided.

### E Interferences

The EC-P1-CO is specific to carbon monoxide, but some other gases can affect the reading. Hydrogen and nitrogen dioxide can give a slight upscale indication.

### F Alarm Functions

The EC-P1 provides both visible and audible gas concentration alarms. Two levels are provided, with adjustable set points for each alarm.

When the gas concentration exceeds the warning set point, the LCD display will flash "WARNING" and the audible beeper

will sound intermittently. If the alarm set point is exceeded, the display will flash "ALARM" and the audible beeper will sound continuously.

#### Set Point Adjustment

The Warning and Alarm set points are adjusted using potentiometers inside the instrument. Remove the front panel to gain access. Figure 2 shows the location of these pots. The following steps detail the adjustment of set points:

1. With the unit turned off, **press and hold** the instrument switch for 10 seconds. When the LCD reads *CAL/MODE*, release the switch. The display will read *XXX PPM/WARN SP*. XXX indicates the current Warning set point.
2. Use the potentiometer marked *WARNING* to adjust to the desired value. To disable the alarm, turn down the pot until the display reads "OFF."
3. Press and release the instrument switch and the display will read *XXX PPM/ALARM SP*. This is the set point for the alarm function.
4. Use the potentiometer marked *ALARM* to adjust to the desired value. Turn down to "OFF" to disable the alarm.
5. Press and release the instrument switch and the display will read *XXX/CAL*. Press and hold the switch until the display reads *DONE*, then release the switch for normal operating mode.

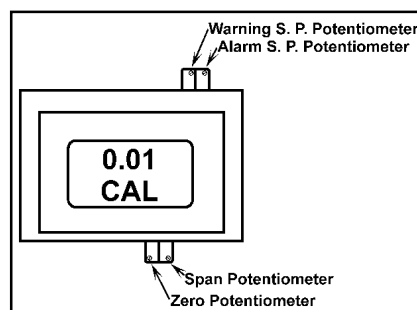


Figure 2: Potentiometers

### Pump Out Alarm

A pump continuously delivers an air sample to the gas sensor at approximately 0.8 LPM. Should the pump fail, the LCD will read *PUMP OUT* and the audible horn will sound intermittently.

A flowmeter is included to allow quick verification of proper flow. To check flow, turn the instrument on and connect the sampling wand. Place the tip of the wand into the tubing adapter attached to the flowmeter. Hold the flowmeter vertically and verify that the flow is above the red mark on the flowmeter. Proper flow should always be verified before use.

### Low Battery Alarm

The instrument is powered by a rechargeable NiCad battery contained in the handle. This battery is shipped fully charged. However, the EC-P1 unit uses a small amount of power to maintain proper sensor bias, even when the power is off. This keeps the instrument ready for use, but will discharge the battery after about four weeks without charging. **The instrument should be charging at all times when not in use.**

Should the battery condition become weak during operation, the LCD display will indicate *LOW BATT* and the beeper will sound intermittently, leaving about one hour of operation. After a low battery condition, place the unit on charge for 16 hours before using again.

### G Calibration

Calibration is recommended every six months in normal use. Span gas must be at least 50 ppm CO and must be balanced in air, not nitrogen.

The *ZERO* and *SPAN* potentiometers used during calibration are located inside the detector behind the front panel (see Figure 2). Remove the four screws in the corners of the front panel and remove the panel.

The calibration procedure requires the use of a bypass tee to allow a span gas to be drawn into the flow cell, and to allow span gas to flow past the sample inlet without creating variable pressure or dilution problems. **Calibration gas cannot be fed into the flow cell under pressure from any outside source.**

#### Zero Calibration

Be sure the unit is in clean air. With the unit off, press and hold the switch until the display reads *CAL/MODE*. Then release the switch. The display will change to *XXX PPM/WARN SP*. Press and release the switch twice more. The display should now read  $\pm XXX/CAL$ .

After two minutes use a small screw driver to adjust the *ZERO* potentiometer until the display reads 0.

If you do not intend to span the unit, press and hold the switch until the display reads *DONE*. Release the switch and the unit will revert to the normal operating mode.

#### Span Calibration

**Do not attempt to span the instrument without certified calibration gas.**

Perform a *Zero Adjustment* prior to making any span adjustments.

Using the bypass tee as shown in figure 3, apply span gas.

After two minutes adjust the *SPAN* potentiometer until the display reads the value of the span gas.

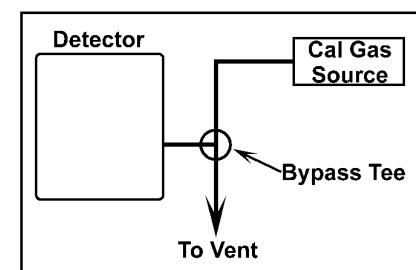


Figure 3: Zero and calibration flow schematic.

## 2 OPERATION (CONT'D)



Press and hold the instrument switch until the display reads *DONE*. Then release and the unit will switch to the normal operating mode.

Manning Systems provides a rapid turnaround factory calibration service. Contact Manning Systems for details.

### H Mounting

A stationary mounting clip is provided for conveniently hanging the detector while not in use. See Figure 4.

Mount the unit in an air conditioned office and always keep it plugged into the charger when not in use.

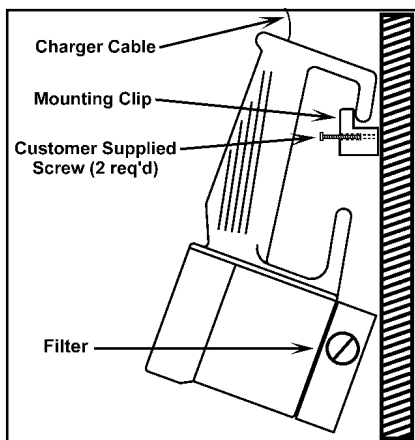


Figure 4: Wall mounting

## 3 MAINTENANCE



### A Maintenance

It is essential that the test and calibration schedule be adhered to. Manning Systems recommends the following maintenance schedule:

- Response test prior to each use. Expose sensor to CO calibration gas to verify proper sensor response and alarm functions.
- Calibration should be performed with certified calibration gas every six months, and all tests must be logged.
- Check filter material every six months. Replace if dirty or moist. See Figure 4.

**Sensor Life:** The electrochemical cell is extremely reliable, but the following can cause the cell chemicals to become depleted:

- a period of time
- exposure to high temperatures
- exposure to varying concentrations of the target gas
- exposure to high moisture

When the cell becomes depleted, the unit will give no indication of failure other than that the sensor will not respond. For this reason it is absolutely essential that these units be exercised with a gas sample on a regular basis.

Typical sensor life under normal use is three years or more. Exposure to high levels of carbon monoxide or storage at high temperatures will shorten this time. When the cell becomes depleted return to Manning Systems for repair.

### B Trouble Shooting

- The detector does not start: If the unit has not been stored with the battery being charged, the battery will run down in a few weeks because the cell continuously uses

operating controls and features of the Model EC-P1.

#### Specifications:

**Electrical Power:** Rechargeable NiCad battery - at least 8 hours of operation on a full charge.

**Charger:** Standard 120 VAC (220 VAC or auto battery adapter optional).

**Display:** Backlit LCD, two line by eight character alphanumeric.

**Pump:** Miniature rotary vane type, 800 cc/minute nominal

**Electronics:** Designed to intrinsic safety standards.

**Alarms:** Two concentration alarms, one pump out alarm, one low battery alarm.

**Standard Accessories:** Storage case, 10" extension wand, battery charger, mount-

ing hook, flow meter, and bag of filter material.

Optional Accessories:

- Calibration Tee
- Auto Charger

**Sensor Type:** Carbon Monoxide selective electrochemical cell

**Ranges Available:**

0-200 ppm standard

0-1000 ppm optional

**Accuracy:** +/- 3% of full scale

**Resolution:** 1 ppm

**Linearity:** +/- 2%

**Operating Ambient Temperature range:** 0° F to 120° F

**Storage Temperature:** -40° F to 140° F, recommend cool environment (50-75° F).

**Weight:** 2 pounds

**Dimensions:** Approx 3" x 4" x 8"

## 2 OPERATION



### A Operating the Sensor

The EC-P1 is shipped ready for use. To power up the instrument, press and release the switch on the handle.

When power is first applied, the LCD display will scroll through three screens. The first indicates the range of the unit, the second indicates the current value of the warning set point, and the third indicates the value of the alarm set point. After the third screen, the LCD display will indicate the current gas value.

The EC-P1 is designed to avoid accidental shut-off of the power. **In order to turn the unit off, the switch must be held down for approximately three seconds.** Release the button after the "Power Down" message appears.

**Note:** Always keep it in an air conditioned office and plugged into the charger when not in use. The battery will run down in three to four weeks if not kept in the charger and keeping it in an air conditioned office will extend sensor life.

An LED indicator near the bottom of the detector handle provides a visual confirmation that the unit is charging.

### B Response Test

Prior to use, the unit should first be tested for proper response. With the detector operating, place the inlet near the mouth of a bottle of carbon monoxide calibration gas. The display should show increasing gas concentration. If not, do not use it for field measurements.

### C Sample Inlet Port

The Model EC-P1 is shipped with a short inlet fitting connected to the sample inlet port. A flexible extension wand is supplied in the kit.

**When using the extension wand, the internal walls must be kept dry.** Water on