

ENMET Corporation
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C-2000

Manual

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NOTE: [important information about use of instrument – if not followed may have to redo some steps.]

CAUTION: [affects equipment – if not followed may cause damage to instrument, sensor etc...]

WARNING: [affects personnel safety – if not followed may cause bodily injury or death.]

1.0 Introduction

The **C-2000** is a small, pocket-size personal gas detector for monitoring carbon dioxide. This lightweight hand-held instrument is an effective warning device for staff working in areas that may contain elevated levels of carbon dioxide(CO₂). The **C-2000** may be used by personnel performing indoor air quality measurements, or by personnel entering rooms where CO₂ contamination is common, such as greenhouses, wineries or breweries. The instrument has a digital display of the gas concentration and audio/visual alarms that are activated at a programmable alarm level.

NOTE: *All specifications stated in this manual may change without notice.*

1.1 Unpack

Unpack the **C-2000** and examine it for shipping damage. If such damage is observed, notify both **ENMET** customer service personnel and the commercial carrier involved immediately.

Regarding Damaged Shipments

NOTE: It is your responsibility to follow these instructions. If they are not followed, the carrier will not honor any claims for damage.

- This shipment was carefully inspected, verified and properly packaged at our company and delivered to the carrier in good condition.
- When it was picked up by the carrier at **ENMET**, it legally became your company's property.
- If your shipment arrives damaged:
 - Keep the items, packing material, and carton "As Is." Within 5 days of receipt, notify the carrier's local office and request immediate inspection of the carton and the contents.
 - After the inspection and after you have received written acknowledgment of the damage from the carrier, contact **ENMET** Customer Service for return authorization and further instructions. Have your Purchase Order and Sales Order numbers available.
- ENMET** either repairs or replaces damaged equipment and invoices the carrier to the extent of the liability coverage, usually \$100.00. Repair or replacement charges above that value are your company's responsibility.
- The shipping company may offer optional insurance coverage. **ENMET** only insures shipments with the shipping company when asked to do so in writing by our customer. If you need your shipments insured, please forward a written request to **ENMET** Customer Service.

Regarding Shortages

If there are any shortages or questions regarding this shipment, please notify **ENMET** Customer Service within 5 days of receipt at the following address:

ENMET Corporation
680 Fairfield Court
Ann Arbor, MI 48108
734-761-1270 734-761-3220 Fax

1.2 Check Order





Check the contents of the shipment against the purchase order. Verify that the **C-2000** is received as ordered. If there are accessories on the order, ascertain that they are present. Check the contents of calibration kits. Notify **ENMET** customer service personnel of any discrepancy immediately.

1.3 Serial Numbers

Each **C-2000** is serialized. These numbers are on tags on the equipment and are on record in an **ENMET** database.

2.0 Features of the C-2000

See figure 1 for location of features on the C-2000.

Feature	Description
<p>Display</p> 	<p>The Liquid Crystal Display(LCD) allows messages to be read clearly:</p> <ul style="list-style-type: none"> • 4 larger digits for displaying the measurement May display 3 digits in normal operation • 3 smaller digits for displaying symbols such as: MIN, MAX, DEG, CO2, OFF... • 3 arrowhead symbols to indicate the parameter scrolling menu is used • Up, Down and Negative indicators • 4 pictograms supplementing the audio and visual alarms relating to the exceeding of thresholds, battery faults, maintenance mode • Equipped with backlight by Light-Emitting Diodes(LED)
<p>ENTER Switch</p> 	<p>Red oval pushbutton switch on the front of the C-2000, below the display.</p> <ul style="list-style-type: none"> • Switching the instrument on or off • Enter, confirmation
<p>BACKLIGHT / Minus Switch</p> 	<p>Round w/down pointing triangle pushbutton switch on the front of the C-2000.</p> <ul style="list-style-type: none"> • Backlighting the display • Scrolling the parameters and menus • “Minus ” switch • "yes" or "no" for confirmation
<p>ALARM / Plus Switch</p> 	<p>Round w/up pointing triangle pushbutton switch on the front of the C-2000.</p> <ul style="list-style-type: none"> • Clears the gas alarms • “Plus” switch
<p>Visual Alarm</p>	<p>Located at the top of the C-2000.</p> <ul style="list-style-type: none"> • Red indicator clearly visible on 3 sides
<p>Audio Alarm</p>	<p>Located on the front panel of the instrument.</p> <ul style="list-style-type: none"> • Loud buzzer
<p>Sensor</p>	<p>Located under the sensor cover on the top of the C-2000.</p> <ul style="list-style-type: none"> • Infra-red CO₂ sensor
<p>Belt Clip</p>	<p>Located on the back of the C-2000.</p> <ul style="list-style-type: none"> • Clip to outside of clothing for hands-free operation
<p>Programming / Charge Port</p>	<p>Located at the left side of the C-2000 under an attached cover.</p> <ul style="list-style-type: none"> • To plug-in battery charger • To plug-in programming plug
<p>Programming Plug</p>	<p>Used to access the Programming and Calibration Menus for Maintenance</p>

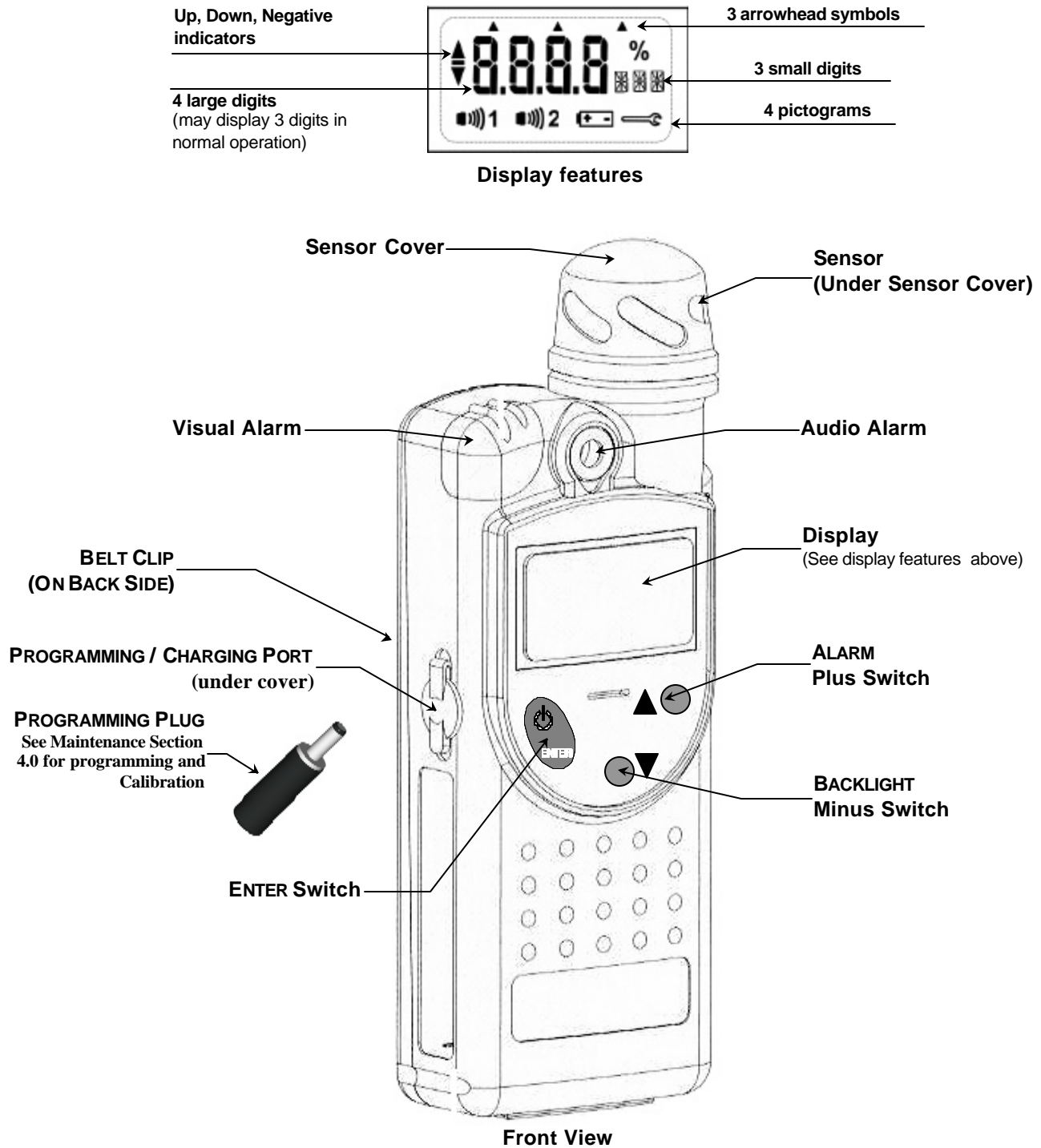


Figure 1: C-2000 Features

3.0 Operation

Refer to Figure 1 for location of the **C-2000** switches, alarms and display. While in operation the **C-2000** will regularly sound a chirp or “beep” to indicate the instrument is turned on and in normal operation with no faults detected. This confidence chirp is set at the factory and can not be altered or turned off.

The ENTER switch is used for both start-up and shutdown of the **C-2000**. See section 3.1 for start-up & operation and section 3.2 for shutdown of the **C-2000** instrument.

3.1 Starting up the C-2000



To start-up the **C-2000** press and release the ENTER switch. The audio alarm will sound and display the software version, run a self test and count down typical time for sensor stabilization before displaying the CO₂ measurement.

Example of display at start-up:

	Audio and Visual alarms are active during this sequence: <ol style="list-style-type: none"> 1. Whole display is flashed. (4 large digits will flash, 3 large digits will display in normal operation) 2. Software version is displayed.
	<ol style="list-style-type: none"> 3. Self-test is indicated. 4. Countdown of sensor stabilization time is displayed.
	<ol style="list-style-type: none"> 5. Operational measurement displayed. And Audio & Visual Alarms go to the normal state.

3.1.1 Alarms

Audio and visual alarms will activate in pulsed or continuous, to indicate the type of alarm being triggered. The display will indicate the threshold or code of the alarm. To clear a threshold alarm *after leaving the dangerous area*, press and release the ALARM switch. ▲

NOTE: If the alarm threshold is still exceeded: The visual alarm will continue to flash and the threshold pictogram will remain indicated.


Fault alarms are not able to be cleared, see fault alarms table for possible remedies.

Threshold Alarms: Pulsed audio alarm can be cleared by pressing the ALARM switch ▲



Alarm Type	Alarm Indication	Parameters
Threshold 1	Display: 1 XXX% Audio : 1 beep every 2 seconds	Adjustable from 0 – 5% CO ₂ , instantaneous alarm By default equal to .5% CO ₂ (depending on the standard in force)
Threshold 2	Display: 2 XXX% Audio: 1 beep per second	Fixed at 0.5% CO ₂ (TWA*/CO ₂) Averaged alarm (TWA/8h)
Over-range	SUP; continuous audio alarm	See fault alarms table

*TWA = Time Weighted Average

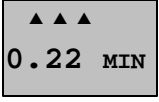
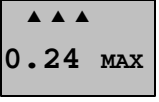
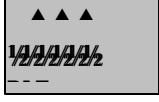
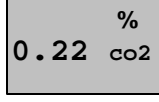
Fault Alarms: Continuous audio alarm can not be cleared

Display	Possible Cause	Possible Remedy
Display: BAT 	Batteries discharged: The instrument can no longer operate	Recharge the batteries
Display: SUP	Measurement range is exceeded	Leave contaminated area and allow sensor to stabilize in clean air.
1DEF	The cell zero has drifted out of spec	Calibrate
2DEF	The cell is too sensitive	Calibrate
4DEF (on small digits)	Expired Cell (sensitivity too low)	Replace cell and calibrate
8DEF	The EEPROM of the instrument is not initialized	Return to ENMET for initialization
512DEF	Problem in the calculations, capacity exceeded	Return to ENMET
16DEF	Measurement to negative	Calibrate May need to replace cell and calibrate
256DEF	The instrument temperature sensor is defective	Return to ENMET
64DEF	If $T^{\circ} \geq 45^{\circ}\text{C}$ (113°F) temperature range exceeded	Clears when instrument is returned to within temperature range
128DEF	If $T^{\circ} \leq -15^{\circ}\text{C}$ (5°F) temperature range exceeded	Clears when instrument is returned to within temperature range
Er45 or Er49	Communication error between the microprocessor and the cell EEPROM	<ul style="list-style-type: none"> • Disconnect the cell and check the connection. • Replace cell if message persists • Return to ENMET


3.1.2 Scrolling of Parameters

To view the present status of MIN, MAX and battery level press the BACKLIGHT switch twice.  

Example of parameter sequence:

	<p>Audio and Visual alarms are active during this sequence: 3 arrowhead symbols indicate instrument is not in measurement display mode.</p> <ol style="list-style-type: none"> 1. The Minimum (lowest) measurement detected since the C-2000 was started-up or reinitialized (see section 3.1.4) 2. Press the BACKLIGHT switch again.
	<ol style="list-style-type: none"> 3. The Maximum (highest) measurement detected since the C-2000 was started-up or reinitialized (see section 3.1.4) 4. Press the BACKLIGHT switch again.
	<ol style="list-style-type: none"> 5. Battery status is indicated with a series of bars. The number of bars indicating the battery life remaining. 6. Press the BACKLIGHT switch again.
	<ol style="list-style-type: none"> 7. Return to Operational measurement display. And Audio & Visual Alarms go to the normal mode.

3.1.3 Backlight



To backlight the **C-2000** display for viewing in a low light location, press and release the BACKLIGHT switch. 

The two red LEDs on either side of the display will stay lit for 20 seconds.

3.1.4 Reinitialize Min & Max

The Minimum and Maximum readings are held in memory since the instrument was turned on. They are reset each time the instrument is turned on. These measurements can be reinitialized (restarted) manually (without restarting the instrument).

To reinitialize the **C-2000** press and *hold* the BACKLIGHT and ALARM switches at the same time:

1. The **C-2000** will beep to indicate the min & max value reset is complete.  

2. Release the switches.

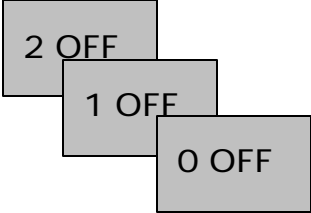

3. The new MIN and MAX readings now equal the current value.

3.2 Shutting down the C-2000

To turn off the **C-2000** press and *hold* the ENTER switch.



Example of display at shut down:

	<p>The display indicates count down of shut down:</p> <ol style="list-style-type: none">1. Hold down ENTER switch while instrument counts down internal shut down sequence.
	<ol style="list-style-type: none">2. Audio alarm beeps once to indicate the instrument is off.3. Release the ENTER switch.

3.3 Charging the C2000

The **C-2000** is powered by a rechargeable NiCd battery pack, 3.6V – 0.8 Ah.

The battery pack is connected directly to the main PCB

The expected operating battery charge is 16 hours under normal use. It is recommended that the batteries be completely discharged at least once a month, and then fully recharged to maximize the life of the cadmium-nickel batteries.

Too completely, discharge the **C-2000** operate until it automatically shuts down.

To charge the **C-2000** battery, plug the charger into the Program/Charge Port on the left side of the instrument. Maximum recharge time is 16 hours.

4.0 Maintenance

The **C-2000** is a safety instrument so needs to be calibrated regularly to insure accuracy.

CAUTION: The procedures and adjustments described in the following sections must be performed by authorized personal. Failure to follow instructions may jeopardize accurate measurements.

To enter the maintenance menus:

1. Insert the programming plug into the programming/charge port on the side of the instrument, see Figure 1.
2. Press the BACKLIGHT and ALARM switches at the same time.
 - A flashing pictogram of the maintenance wrench will appear, to indicate the **C-2000** is in maintenance mode.
 - The audio and visual alarms are disabled while the instrument is in maintenance mode.
 - Press the BACKLIGHT switch to toggle between the programming and calibration menus.

4.1 Programming the C2000

The programming menu is used to manually program the adjustable alarm threshold: Threshold 1

1. Enter the programming menu by inserting the programming plug into the programming port and pressing the ALARM & BACKLIGHT switches simultaneously. The pictogram of the maintenance wrench will appear and PrOG will appear on the display, to indicate the **C-2000** is in maintenance mode and ready for programming.
2. While PrOG is displayed press the ENTER switch to enter the programming menu.
 - The current alarm threshold will be displayed.
3. Modify the alarm threshold:
 - Press the BACKLIGHT switch to decrease the threshold value
 - Press the ALARM switch to increase the threshold value.
4. Press the ENTER switch to enter the new threshold value.
 - A confirmation request for the new alarm threshold will appear on the display.
5. Press the BACKLIGHT switch to toggle between NON (no) and OUI (yes).
6. Press the ENTER switch to confirm or reject the new threshold.

The instrument will return to the Operational Mode

Remove the programming plug.

4.2 Calibrating the C-2000

The **C-2000** calibration menu is used to check and adjust the zero in nitrogen or in ambient air, and the sensitivity to the standard gas (CO₂). See section 5.0 for **ENMET** part number of gas cylinder.

In order to guarantee optimum performance of the instrument, the zero calibration should be verified periodically, preferably in nitrogen.

The sensitivity of the infrared technology is sufficiently stable so that the standard gas verification does not need to be carried out as frequently as the zero verification.

NOTE: The test with standard gas cannot be made until after doing a zero calibration in nitrogen.

To enter the Calibration Menu:

1. Enter the Calibration menu by inserting the programming plug into the programming/charge port and pressing the ALARM & BACKLIGHT switches simultaneously.
2. While CAL is displayed press the ENTER switch to enter the calibration menu.

The Calibration Sub-menu will be displayed:

3. Press the BACKLIGHT switch to scroll through the Calibration Sub-menus:
 - Adjust in ambient air menu (r G-O AIR), see section 4.2.1
 - Adjust in nitrogen menu (r G-O N2), see section 4.2.2
 - Adjust sensitivity to CO₂ in standard gas menu (r G-S CO2), see section 4.2.3
4. Press the ENTER switch while the desired menu is displayed.

4.2.1 Adjust Zero in Ambient Air

This adjustment must be done in a well ventilated area. The zero calibration in ambient air enables a coarse zero adjustment without a gas cylinder. Ambient air normally contains about .033% CO₂.

1. Press the ENTER switch while [r G-O AIR] is displayed to zero adjust in ambient air
2. The current measurement is displayed, Make sure the current measurement
3. Press the ENTER switch to request confirmation, COnF is displayed
4. Press the ENTER switch to accept conformation
5. Press the BACKLIGHT switch to toggle between the no [COnF non] and yes [COnF oui] display
6. Press the ENTER switch while yes is displayed the zero setting is made automatically and saved.

Press the ENTER switch while no is displayed the zero setting is not made and the old setting is kept.

7. The **C-2000** returns to the normal mode
8. Remove the programming plug.

4.2.2 Adjust Zero in Nitrogen

To make this adjustment attach the calibration adapter to the cylinder of nitrogen.

1. Press the ENTER switch while [r G-O N2] is displayed to zero adjust in ambient air
2. The current measurement is displayed
3. Attach the calibration adapter and flow nitrogen over cell
4. Wait until the signal stabilized, at least 8 seconds
5. Press the ENTER switch to request confirmation, [COnF] is displayed
6. Press the ENTER switch to accept conformation
7. Press the BACKLIGHT switch to toggle between the no [COnF non] and yes [COnF oui] display
8. Press the ENTER switch while yes is displayed the zero setting is made automatically and saved.
Press the ENTER switch while no is displayed the zero setting is not made and the old setting is kept.
9. The **C-2000** returns to the normal mode
10. Remove the calibration adapter and cylinder of nitrogen.
11. Remove the programming plug.

4.2.3 Adjust Sensitivity in CO₂ Gas

To calibrate the **C-2000** with CO₂, make a zero adjustment in nitrogen, then apply the standard gas with a known content of at least between 0.5% and 1.5% CO₂. There is no need to modify the adjustment of the observed measurement if the error is not more than 5% of the standard value.

Adjust zero in nitrogen (see section 4.2.2) through step 8.

1. Press the ENTER switch while [r G-S CO2] is displayed to zero adjust in ambient air
2. Adjust the display to the value of the standard gas that is being used. [1.50 G-E]
Press the ALARM switch to increase value
Press the BACKLIGHT switch to decrease value
3. Press the ENTER switch to accept setting.
4. Attach the calibration adapter and flow the standard gas over cell
5. Wait until the signal stabilized. Press the ENTER switch to request confirmation, [CO_nF] is displayed
The setting is automatically updated regardless of the value displayed.
6. Press the ENTER switch to accept conformation
7. Press the BACKLIGHT switch to toggle between the no [CO_nF non] and yes [CO_nF oui] display
8. Press the ENTER switch while yes is displayed the zero setting is made automatically and saved.
Press the ENTER switch while no is displayed the zero setting is not made and the old setting is kept.
9. The **C-2000** returns to the normal mode
10. Remove the calibration adapter and cylinder of nitrogen.
11. Remove the programming plug.

4.3 Replacing the Sensor

The **C-2000** is equipped with an infrared sensor with a microprocessor source. This CO₂ sensor resists the presence of hydrogen sulfide, ammonia, other gases and moisture.

The sensor is protected by a water repellent dust-resistant filter attached around the sensor. See figure 2.

To replace the sensor and filter:

- Remove sensor cover by unscrewing the sensor cover from the instrument.
- Note the placement of the cover seal, filter and sensor seal.
- Unplug sensor and remove.
- Plug-in the new sensor.
- Replace sensor seal, filter and cover seal
- Replace sensor cover and screw into instrument.

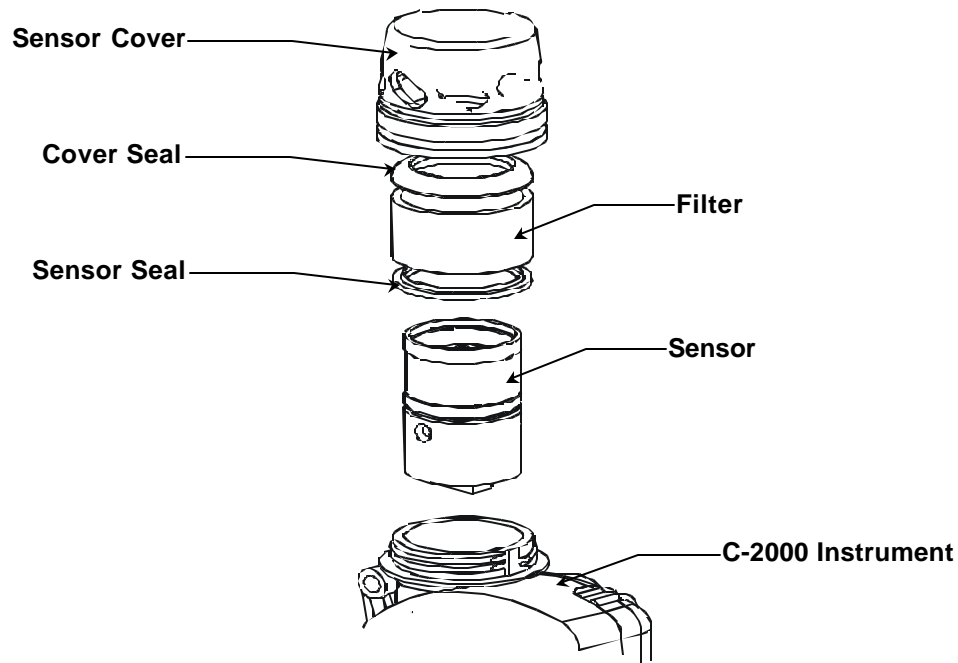


Figure 2: Sensor located under the sensor cover

5.0 Replacement Part Numbers

ENMET replacement part numbers:

Description	Part Number
Programming Plug	02552-005
Calibration cup	02552-013
Sensor	02552-015
Battery pack	02552-012
Charger, 110Vac	67051-050
Charger, 220Vac	67051-051

6.0 WARRANTY

ENMET warrants new instruments to be free from defects in workmanship and material under normal use for a period of one year from date of shipment from **ENMET**. The warranty covers both parts and labor excluding instrument calibration and expendable parts such as calibration gas, filters, batteries, etc... Equipment believed to be defective should be returned to **ENMET** within the warranty period (transportation prepaid) for inspection. If the evaluation by **ENMET** confirms that the product is defective, it will be repaired or replaced at no charge, within the stated limitations, and returned prepaid to any location in the United States by the most economical means, e.g. Surface UPS/RPS. If an expedient means of transportation is requested during the warranty period, the customer is responsible for the difference between the most economical means and the expedient mode. **ENMET** shall not be liable for any loss or damage caused by the improper use of the product. The purchaser indemnifies and saves harmless the company with respect to any loss or damages that may arise through the use by the purchaser or others of this equipment.

This warranty is expressly given in lieu of all other warranties, either expressed or implied, including that of merchantability, and all other obligations or liabilities of **ENMET** which may arise in connection with this equipment. **ENMET** neither assumes nor authorizes any representative or other person to assume for it any obligation or liability other than that which is set forth herein.

NOTE: When returning an instrument to the factory for service:

- Be sure to include paperwork.
- A purchase order, return address and telephone number will assist in the expedient repair and return of your unit.
- Include any specific instructions.
- For warranty service, include date of purchase
- If you require an estimate, please contact **ENMET** Corporation.

There are Return for Repair Instructions and Form on the last pages of this manual. This form can be copied or used as needed.