

# Operate the Mutli-Gas Monitor PID

## Multi-Gas Monitor



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# Operate the Mutli-Gas Monitor PID

## Learning Objective

- **TASK:** Operate the Multi-Gas Monitor
- **CONDITION:** In a classroom environment, given a fully charged Multi-gas Monitor with the manufacturer operator's manual, all monitor components/accessories, containers of multiple and single sensor standard reference gases, a clean air environment, flat-tip screw-driver, VOC simulant, a small piece of lint free cloth, a cotton swab, GC Grade methanol, a small container capable of holding enough GC Grade methanol to dip the PID sensor, and a Student Handout of the Lesson Plan.
- **STANDARD:** Operate the Multi-gas Monitor by performing start-up, calibration, bump test, and shut-down procedures; entering and exiting the monitor's programming function; recharging the battery pack; replacing a sensor; cleaning the Photo-Ionization Detector (PID) module/Ultra Violet (UV) lamp.



# Operate the Mutli-Gas Monitor PID

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## Lesson Administrative Data

- Safety Requirements: None
- Risk Assessment: Low
- Environmental Considerations: None
- Evaluation: Practical Exercise.



# Operate the Mutli-Gas Monitor PID

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## Enabling Learning Objective A

- **TASK:** Perform Basic Monitor Functions.
- **CONDITION:** In a classroom environment, given a fully charged Multi-gas Monitor with the manufacturer operator's manual, all monitor components/accessories, containers of multiple and single sensor standard reference gases, a clean air environment and a Student Handout of the Lesson Plan.
- **STANDARD:** Perform basic monitor functions by performing start-up, calibration, bump test, and shut-down procedures.



# Operate the Mutli-Gas Monitor PID

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## Introduction to the Multi-Gas Monitor

- 29 CFR 1910.120 Requires:
  - Monitoring the air with appropriate direct reading test equipment for IDLH and other conditions that may cause death or serious harm, including **combustible or explosive atmospheres, oxygen deficiency, or toxic substances.**



# Operate the Mutli-Gas Monitor PID

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## Introduction to the Multi-Gas Monitor

- The Multi-Gas Monitor is programmable and designed to provide continuous exposure monitoring of **toxic gases**, **oxygen levels**, and **combustible gases** in the environment.



# Operate the Mutli-Gas Monitor PID

## Multi-Gas Monitor Characteristics

- Extremely rugged for extensive field use
- Weather Proof Case/Rubber Boot
- Operating temperature range of -4° to 113° F
- Power sources: Rechargeable Li-ion or Ni-Cd Battery Pack, 4 AA Alkaline battery adapter
- 10 – 14 hours optimum run time
- Intrinsically safe
- Integrated sampling pump
- Lightweight (16oz)



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# Operate the Mutli-Gas Monitor PID

## Multi-Gas Monitor Characteristics

- Internal Sampling Pump:
  - High and Low pump settings
  - Tube extension for stand off sampling
  - Liquid water trap for added protection
  - Pump stall feature
  - Capable of drawing a sample up to 100 feet

How much does the monitor weigh?

**16 oz**



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# Operate the Mutli-Gas Monitor PID

## Multi-Gas Monitor Capabilities

- Volatile Organic Compounds
- Lower Explosive Limits (LEL)
- Oxygen Levels
- Specific Toxic Industrial Compounds
- Short Term Exposure Limits (STEL)
- Time Weighted Averages (TWA)



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## Multi-Gas Monitor Capabilities

- Sensors:
  - **PID** monitors VOCs: 0.1 - 2000 ppm
  - **Catalytic Bead Sensor/Combustible Gas Indicator** for combustible gases: 0-100% of LEL calibrated to Methane.
  - **Electrochemical Sensor** for Oxygen Deficiency:
    - 0-30%
  - **Electrochemical Sensors** for Inorganic Toxic Industrial Compounds (measured in ppm)
    - Two chemical specific sensors can be installed.
    - Examples include: **CO**, **H<sub>2</sub>S**, **Cl<sub>2</sub>**, **NH<sub>3</sub>**, **HCN**, **PH<sub>3</sub>**

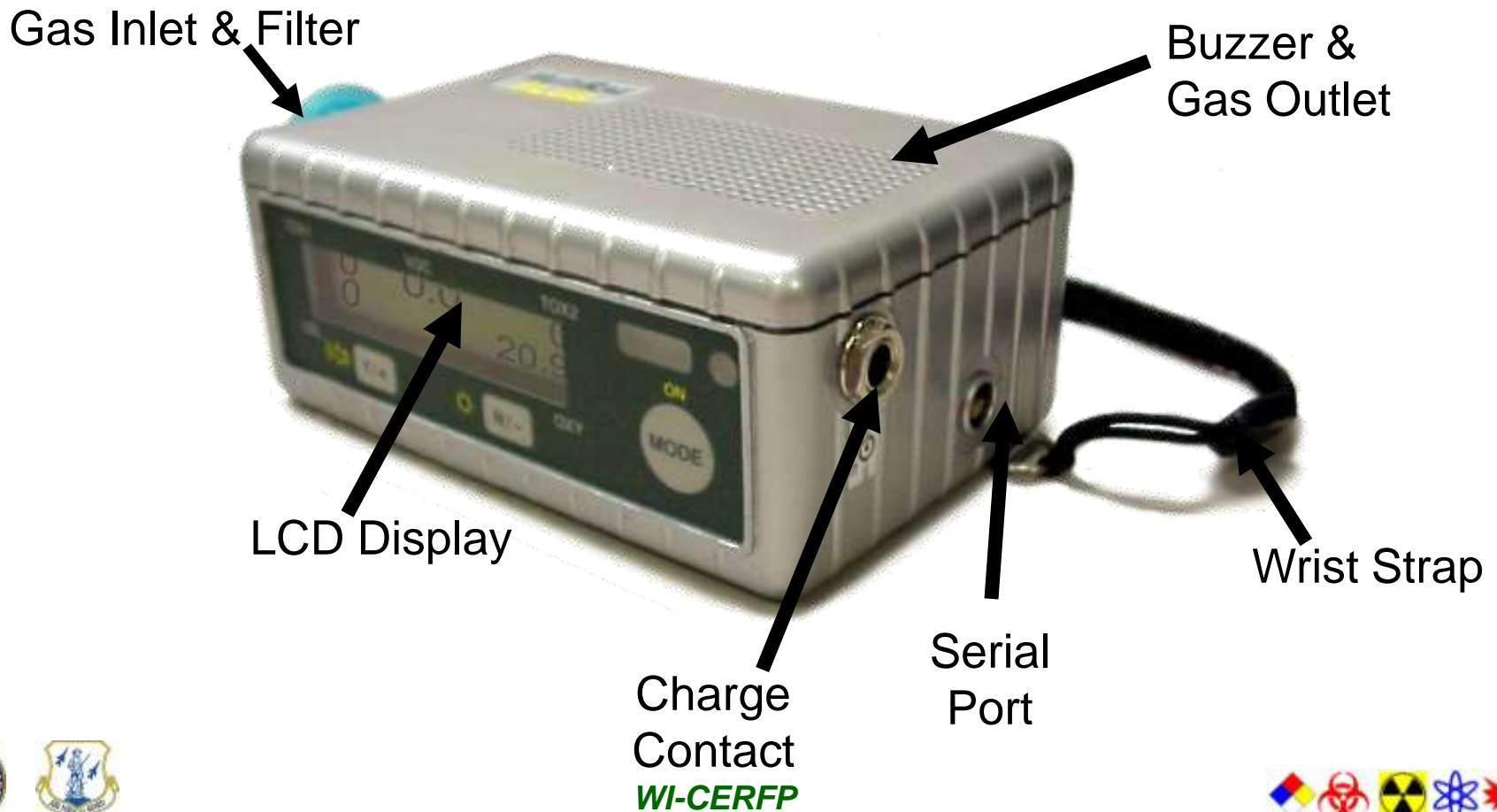
What type of sensor does the monitor use to monitor combustible gas LEL?

**Catalytic Bead Sensor/CGI/Combustible Gas Indicator**



# Operate the Mutli-Gas Monitor PID

## Monitor Features



# Operate the Mutli-Gas Monitor PID

## Monitor Features

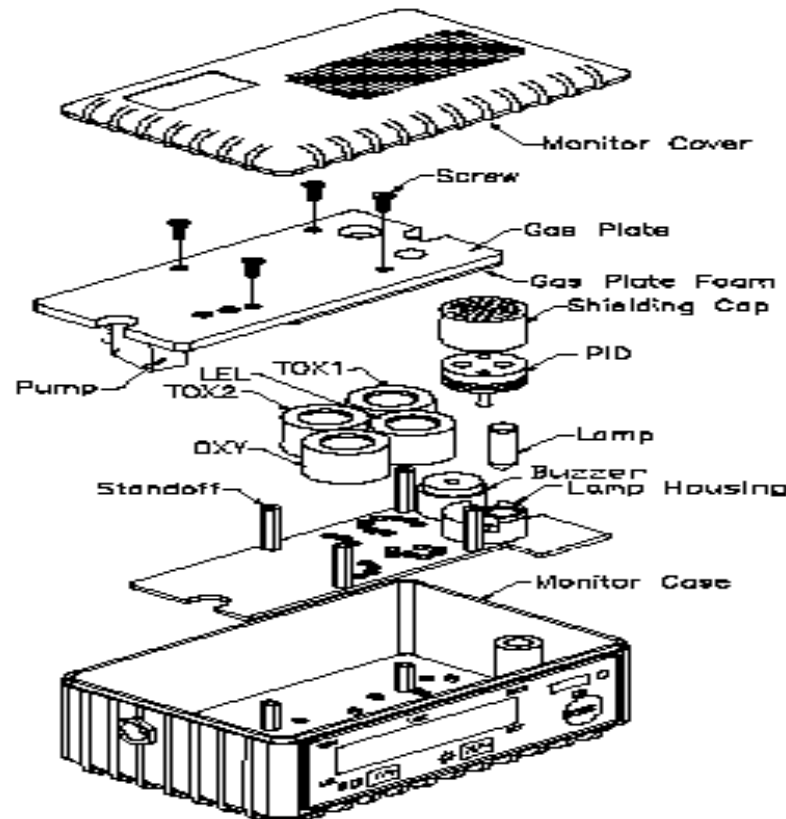


- Three buttons on a sealed membrane faceplate:
  - **Y/+:** Alarm test and acknowledgement; increases the numerical value or answers a question.
  - **N/-:** Decreases numerical value, denies a question, and manually turns on backlight.
  - **MODE:** Scrolls display menu items, exits the programming mode, turns on/off power.



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## Monitor Features



Name Five features of the monitor?

**LCD, Light sensor, Mode key, Y and N buttons, Air exhaust port, RS-232 port, AC Adapter, PID, O<sub>2</sub>, LEL, CO, H<sub>2</sub>S Sensors, Buzzer, Pump, Gas Plate**



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## Monitor Accessories



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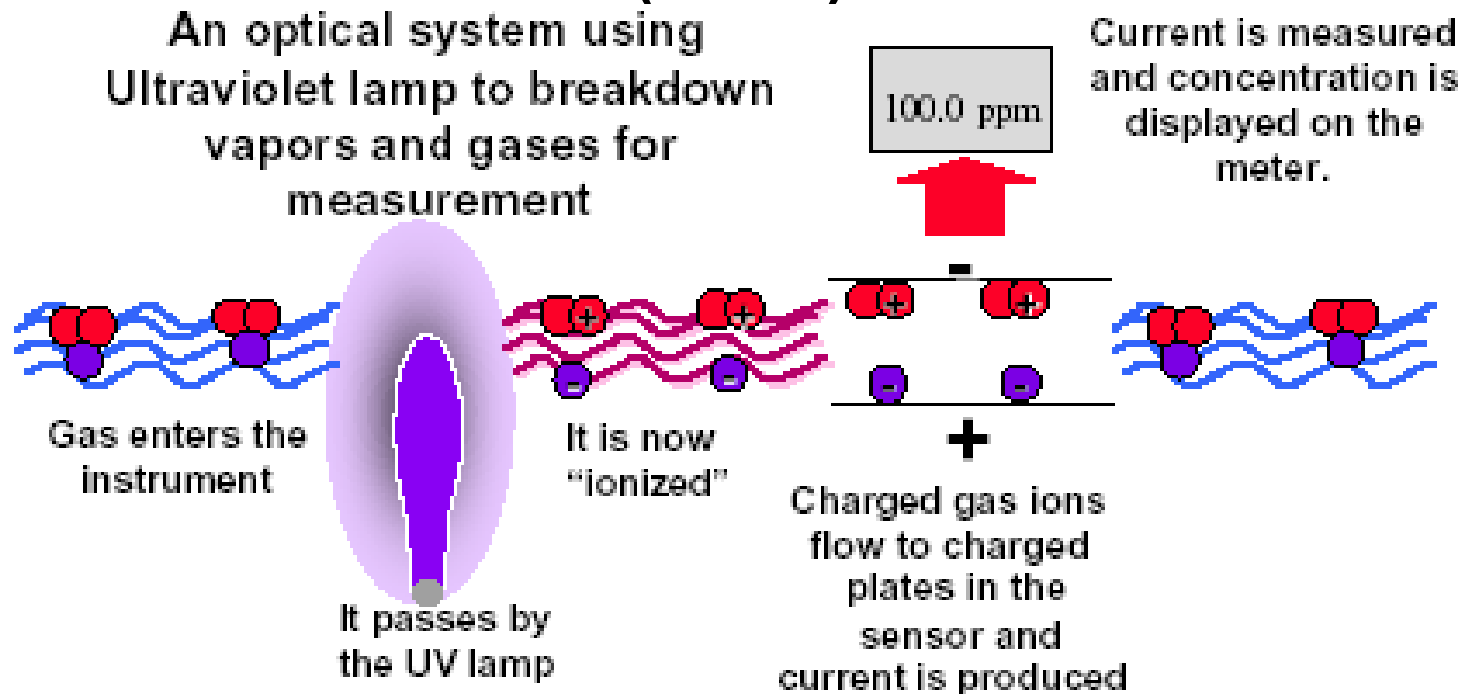
## Photo Ionization Detector (PID)

- Utilized for VOC monitoring and some Inorganics.
- Uses ultraviolet (UV) light to ionize a gas sample.
- Molecules absorb the high energy UV light and become excited, temporarily losing their negative charge.
- They become positively charged and give off an electric current that is measured in electron volts (eV) and converted to ppm.



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## Photo Ionization Detector (PID)





# Operate the Mutli-Gas Monitor PID

## Operational Concepts

- Volatile Organic Compounds (VOC)
- Lower Explosive Limit (LEL)
- Time Weighted Average (TWA)
- Short Term Exposure Limit (STEL)
- Ionization Potential



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## Operational Concepts

- The MultiRAE and Decision Making:
  - PPE Assessment
  - Hazard Zone/Perimeter establishment and Maintenance
  - Leak Detection
  - Decontamination
  - Remediation



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## Operational Concepts

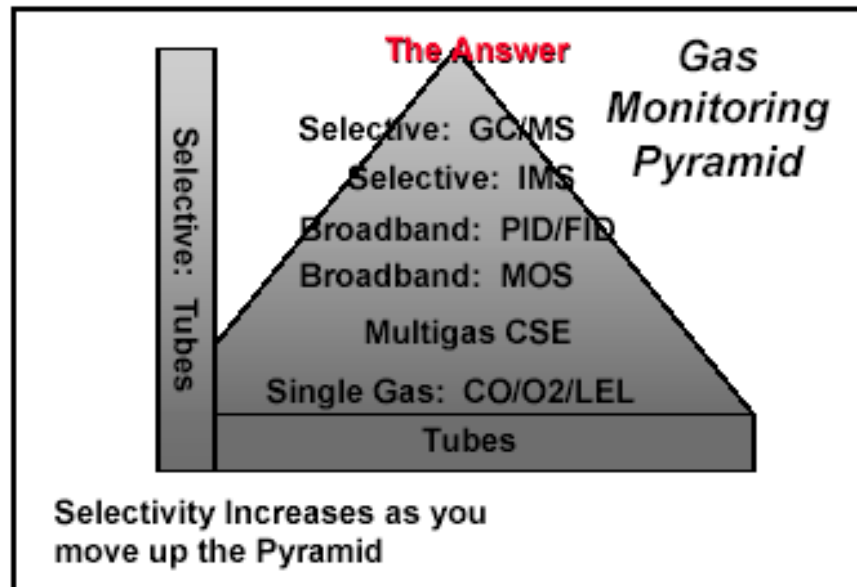
- The is the cornerstone for safety and survey.
- The monitor is a sensitive and accurate instrument that can provide continuous monitoring.
- The monitor PID is not a Selective Monitor.
- The utilization of Recognition and Identification clues is essential.
- Toxic Sensors provide accurate and specific measurement.



# Operate the Mutli-Gas Monitor PID

## Gas Monitoring Program

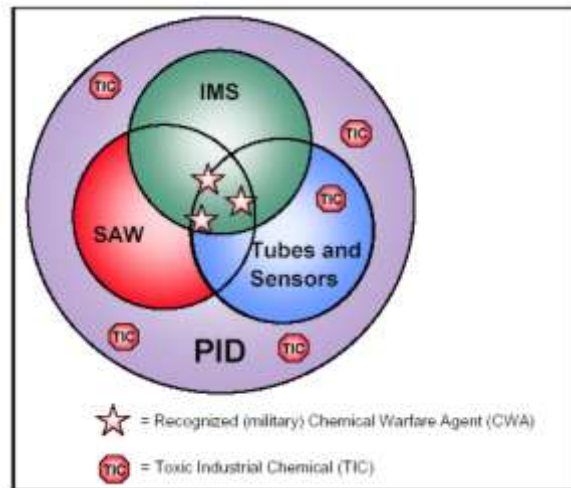
- The monitor is a “tool” in the CST inventory.
- The “tip of the spear” for survey.



# Operate the Mutli-Gas Monitor PID

## Gas Monitoring Program

- The monitor's role in survey:



- The Role of a PID in Screening for the Broadest Range of Hazards

What are the 3 hazard control zones?

**Hot, Warm, Cold**



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# Operate the Mutli-Gas Monitor PID

## Monitor Start-Up

- Unplug monitor from charger
- Hold “MODE” Key to turn on
- Alarm will beep once
- Watch display screen for messages that include:
  - Sensors installed & their warranty expiration
  - Alarm limits
  - Last calibration date
  - User/Alarm/Datalog modes
- Warm-up will take approximately 90 seconds



# Operate the Mutli-Gas Monitor PID

## Monitor Start-Up

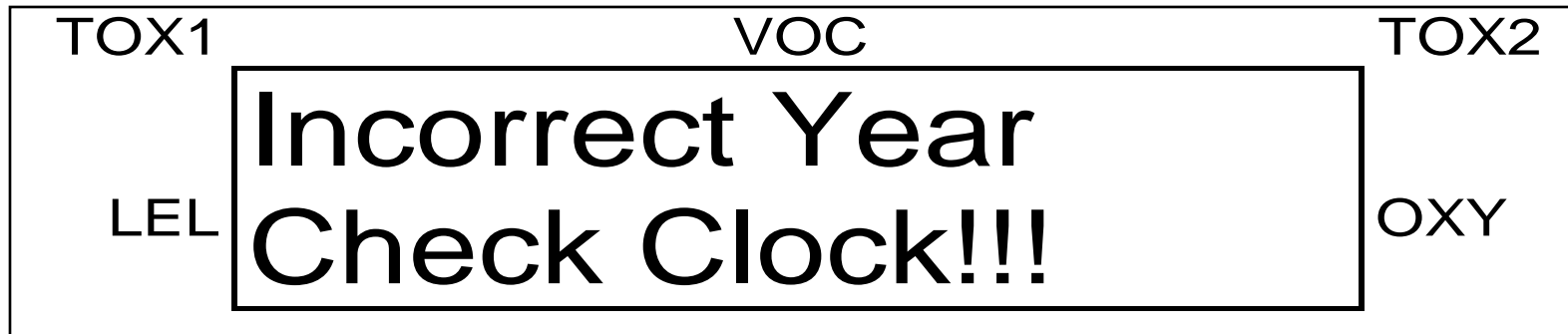
TOX1		VOC		TOX2
	0	0.0	0	
LEL	0		20.9	OXY

- After the 90 second warm-up, the monitor should display the above readings.
- If there are no alarms and the sensor readings are in the ranges shown above, the monitor is ready for use.



# Operate the Mutli-Gas Monitor PID

## Monitor Start-Up



- If this screen appears during the start-up just acknowledge it with the “Y” key and follow the procedure for setting the clock.
- The battery has gone dead and the monitor has detected a mismatch between the date code on the sensors and its internal clock.





# Operate the Mutli-Gas Monitor PID

## Monitor Start-Up



- Continued use is acceptable if proper calibration is achieved.
- Acknowledge by pressing the “Y” key to continue warm-up.
- For maximum performance, monitor recommends replacing sensors at the end of their warranty period.



# Operate the Mutli-Gas Monitor PID

## Monitor Start-Up

TOX1		VOC		TOX2
	0	0.0	0	
LEL	0	Lamp	20.9	OXY

- “Lamp” display along with audible alarm indicates the PID lamp has failed to light.
- Press “Y/+” key to clear alarm, if it clears, the monitor is ready for use.
- If alarm does not clear, wait a few minutes and check again.

How long does warm-up take?

Approximately 90 seconds



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# Operate the Mutli-Gas Monitor PID

## Monitor Start-Up

Lamp Alarm

TOX1		VOC		TOX2
	0	0.0	0	
LEL	0	Lamp	20.9	OXY

- “Lamp” display along with audible alarm indicates the PID lamp has failed to light.
- Press “Y/+” key to clear alarm, if it clears, the monitor is ready for use.
- If alarm does not clear, wait a few minutes and check again.
- How long does warm-up take? **Approximately 90 seconds**



# Operate the Mutli-Gas Monitor PID

## Modes of Operation

- **Text Mode** – displays readings, sensor names and battery voltage and allows calibration.
- **Display Mode** – displays text mode info plus peak, minimum, STEL, TWA, run time, temperature, datalog, LEL and VOC CF's and allows calibration.
- **Programming Mode** (Default Mode) – displays the text and display mode information and allows the operator to adjust the operating parameters.

Can you get into calibration menu while in display mode?

**NO**



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# Operate the Mutli-Gas Monitor PID

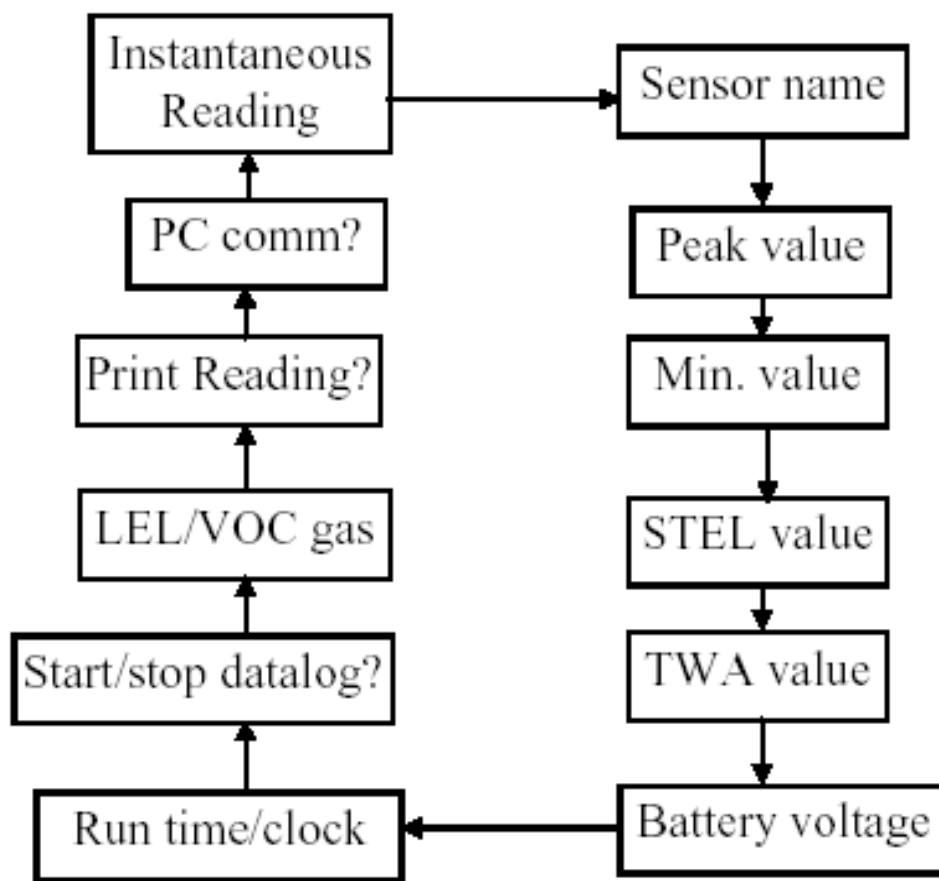
## Program Mode Displays

- Instantaneous Reading
- Sensor Names
- Peak Reading
- Minimum Reading
- STEL
- TWA
- Battery Voltage
- Run Time/Clock
- Start/Stop Datalog
- LEL/VOC Gas
- Print
- PC communication



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- Access various displays by pressing the MODE key:



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## Instantaneous Reading

TOX1		VOC		TOX2
	0	0.0	0	
LEL	0		20.9	OXY

- Monitor will return to this screen in 60 seconds if left in any subsequent screen.
- Alternates between the instantaneous reading and the sensor name approximately every 3 seconds.



# Operate the Mutli-Gas Monitor PID

## Sensor Names

TOX1	VOC			TOX2
LEL	CO	VOC	H <sub>2</sub> S	OXY
	LEL		OXY	

- Five Installed Sensors:
  - **CO**: Carbon Monoxide Sensor
  - **VOC**: Photo Ionization Detector (PID)
  - **H<sub>2</sub>S**: Hydrogen Sulfide Sensor
  - **LEL**: Combustible Gas Sensor
  - **OXY**: Oxygen Sensor





# Operate the Mutli-Gas Monitor PID

## Peak Reading Display

TOX1	VOC	TOX2
34	584	11
LEL	PEAK	OXY
6	20.9	

- The Highest reading of each gas concentration since the monitor was turned on.
- Updated once per second.



# Operate the Mutli-Gas Monitor PID

## Minimum Reading Display

TOX1		VOC		TOX2
	0	0.0	0	
LEL	0	MIN	13.5	OXY

- The lowest reading of each gas concentration since the monitor was turned on.
- Updated once per second.



# Operate the Mutli-Gas Monitor PID

## STEL Display

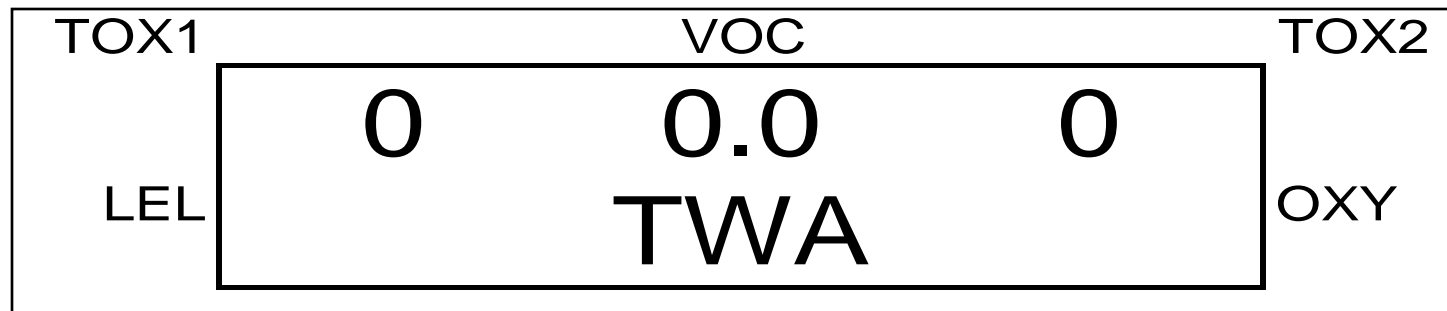
TOX1	VOC	TOX2
0	0.0	0
LEL	STEL	OXY

- Short Term Exposure Limit (average for the past 15 minutes).
- Displays “\*\*\*\*\*” until monitor has been on for 15 minutes.
- STEL is only calculated for VOCs and TICs.



# Operate the Mutli-Gas Monitor PID

## TWA Display



- Time Weighted Average is the accumulated reading of gas concentration divided by 8 hours since the monitor was turned on.
- TWA is only calculated for VOCs and TICs.



# Operate the Mutli-Gas Monitor PID

## Battery Voltage Display

TOX1

VOC

TOX2

**Battery = 4.8 V**

**Shut down at 4.2 V**

LEL

OXY

- Monitor shuts down when battery voltage drops below 4.2 volts.
- Normal Full Charge is 4.8 volts.



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# Operate the Mutli-Gas Monitor PID

## Low Battery Voltage

TOX1		VOC		TOX2
	0	0.0	0	
LEL	0	Bat	20.9	OXY

- A flashing “Bat” display along with a 1 beep alarm every 10 seconds indicates that the battery voltage has dropped below 4.4 volts.
- Automatic shutdown will occur in 20 - 30 minutes.



# Operate the Mutli-Gas Monitor PID

## Run Time Clock

TOX1	VOC	TOX2
LEL	07/01/98	12:00
	ON=01:22	25°C
		OXY

- Date
- Time
- Accumulated time in hours and minutes since the Monitor was turned on.
- Temperature in Fahrenheit or Celsius (operating range from -20°C to 45°C/ -4 to 113°F).



# Operate the Mutli-Gas Monitor PID

## Datalog Mode Display

TOX1		VOC		TOX2
	0	0.0		0
LEL	0	L		OXY
			20.9	

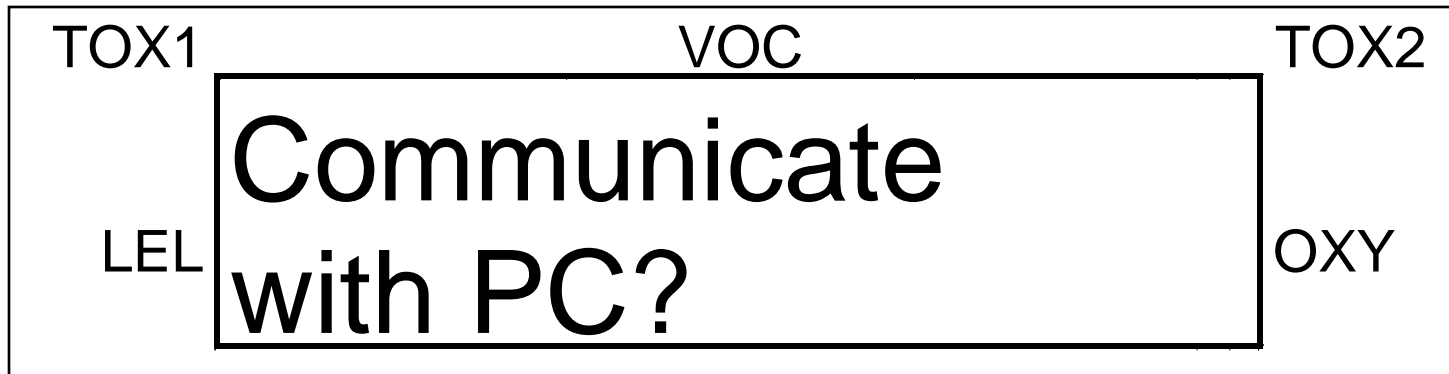
- A small “L” displayed in the left center of the LCD indicates datalogging.





# Operate the Mutli-Gas Monitor PID

## Communicate with PC Display



The STEL and TWA displays apply to what type of gases?

**VOC & Toxic Gases**



# Operate the Mutli-Gas Monitor PID

## Alarm Signals

- High Alarm
- Low Alarm
- STEL
- TWA
- Negative Drift (NEG) or Over Range (OVR)
- Pump
- OFF
- Lamp
- Bat
- Mem

Which alarm limits are factory set?

**STEL TWA**



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# Operate the Mutli-Gas Monitor PID

## Calibrate the Monitor

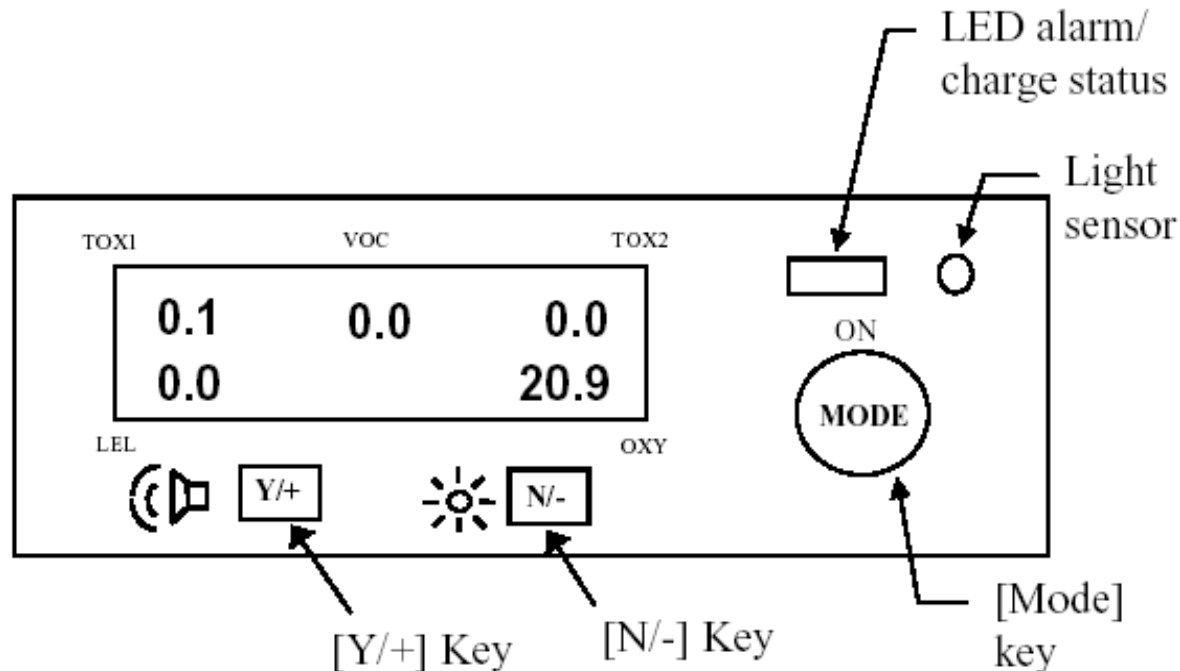
- Calibration should be performed prior to each use and be incorporated into each unit's maintenance program.
- If time does not permit full calibration, perform a fresh air calibration and “Bump” test.
- The Calibration process includes:
  - Fresh Air Calibration
  - Multiple Sensor Calibration
  - Single Sensor Calibration



# Operate the Mutli-Gas Monitor PID

## Calibrate the Monitor

- To access the calibration menu, simultaneously press and hold the MODE and N/- keys for 3 seconds.



# Operate the Mutli-Gas Monitor PID

## Calibrate the Monitor

### Calibration Sub-Menu

Fresh Air Calibration?

Multiple Sensor Calibration?

Single Sensor Calibration?

Modify Span Gas Value?

Change LEL/VOC Span Gas?

- ***Fresh Air Calibration?*** Will appear when accessed.
- Press Y/+ to perform calibration.



# Operate the Mutli-Gas Monitor PID

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## Fresh Air Calibration

- Apply VOC free Oxygen or calibrate in a clean atmosphere
- Utilize the charcoal filter if the O<sub>2</sub> content is unknown.
- Once “Zero Cal Done” is displayed, proceed to “Multiple Sensor Calibration.”



# Operate the Mutli-Gas Monitor PID

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## Bump Test

**Prior to using the monitor at an incident site, a bump test should be conducted to verify that the sensor's are within tolerance.**

**Why should you do a bump test prior to using the monitor at an incident?**

**To Verify that the sensor's are within tolerance**



# Operate the Mutli-Gas Monitor PID

## Monitor Shutdown Procedure

- Press and hold MODE Key for 5 seconds.
- Audible alarm will beep and display will read “Power-down in ...5 seconds.”
- Following shut-down, Datalogged information will be preserved.
- Place the monitor on charger when not in use.

How long do you hold the mode key?

**5 seconds**



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# Operate the Mutli-Gas Monitor PID

## Enabling Learning Objective B

- **TASK:** Maintain the Multi-Gas Monitor.
- **CONDITION:** In a classroom environment, given a fully charged Multi-gas Monitor with the manufacturer operator's manual, all monitor components/accessories, a flat-tip screwdriver, a small piece of lint free cloth, a cotton swab, GC Grade methanol, a small container capable of holding enough GC Grade methanol to dip the PID sensor, and a Student Handout of the Lesson Plan.
- **STANDARD:** Maintain the Multi-Gas Monitor by: recharging the battery pack; replacing a sensor; cleaning the Photo-Ionization Detector (PID) module/Ultra Violet (UV) lamp.



# Operate the Mutli-Gas Monitor PID

## Monitor Maintenance

- Inventory
- Serviceability
- Warranty expiration or Error Messages

How often should maintenance be performed on the Multigas Monitor?

**Before and after every use**



# Operate the Mutli-Gas Monitor PID

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## Operator Level Maintenance

- Battery Replacement
- Sensor Replacement

When should you clean the PID sensors module and lamp?

**Only when malfunction is detected**



# Operate the Mutli-Gas Monitor PID

## Monitor Decontamination

- As a “front line” survey instrument, the monitor will likely become contaminated in the Hot Zone.
- The protective rubber boot allows the monitor to be subjected to decontamination.



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# Operate the Mutli-Gas Monitor PID

## Short Term Decontamination Procedures

- Upon completing down-range operations, exit the Hot Zone.
- Place the monitor in the equipment drop and allow it to run for 15 minutes.
- Turn the unit off.
- Remove the Rubber Boot and soak in decon solution.
- Remove any inlet filters (water trap), soak in decon solution, and discard as hazardous waste.



# Operate the Mutli-Gas Monitor PID

## Short Term Decontamination Procedures

- Wipe the outside of the instrument with a moist cloth containing the selected decon solution.
- After the appropriate reaction time, wipe the monitor with clean water and allow it to air dry.
- If the remote probe was used, it may be decontaminated by running decon solution through it and the Teflon tubing; or discarded as hazardous waste.
- Check for residual Contamination.



# Operate the Mutli-Gas Monitor PID

## Summary

