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HAZARDOUS MATERIALS FIELD SCREENING EQUIPMENT MANUAL
Instrumentation for Emergency, Investigatory, and Remedial Response

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PREFACE

The California CUPA Forum (CCF) is an organization consisting of representatives from Certified Unified Program Agencies (CUPAs) and Participating Agencies (PAs) for promoting consistent implementation of hazardous materials/waste regulatory programs. The CCF works cooperatively with Federal, State and local agencies, industry and members of the public to promote a single, united voice statewide for the handling, storage, and disposal of hazardous materials and waste. These local unified program agencies are mostly fire and environmental health organizations with a primary responsibility to inspect regulated facilities and enforce applicable laws and regulations. Hazardous materials emergency response is a component of this responsibility, especially in the more urban areas of the State. The need to have portable and reliable monitoring equipment is necessary for site characterization, initial identification of hazards present, and to ensure public safety during a hazardous materials incident.

Appropriate use of field screening equipment and environmental protection can aid personnel involved with a hazardous materials situation in determining potential or actual effects on public safety, the environment, immediate and long term risks to public health, actions to mitigate the hazards, and appropriate personnel protection equipment to be used.

This manual was compiled to provide a single source of hazardous materials field detection equipment useful for hazardous waste sites and incident response. This document is intended as a quick reference of equipment and specifications for use. The instructions contained within should not replace the manufacturers operating instructions for the device or equipment. Use of any device for hazard assessment and or identification requires a full understanding of the equipment's responses, limitations, and mode of operation. This document is also not intended to be a training tool for response personnel, but a quick reminder for someone who has received full and appropriate training to include operations, limitations, and interpretations of results.

The instruments described in this manual represent the current models that are marketed by a variety of equipment manufacturers; and models that have been updated or discontinued but are still used by many Fire and Health HazMat agencies. The manual does not include those outdated and relatively unused equipment and also recognizes that new technology and instrumentation is a constantly evolving trend.

Funding for this Instrument Manual was provided through the CUPA Forum Environmental Protection Trust Fund, established to manage and disburse funds from enforcement case settlements. The document was compiled by Jeff Benedict, former City of Long Beach Hazardous Waste Operations Officer through document research; and consultation with local CUPA and fire department hazmat agencies, and equipment vendors. The project manager for the CCF was Division Chief Bill Jones, Los Angeles County Fire Department. Comments and suggestions may be directed to Chief Jones at **Bill.Jones@fire.lacounty.gov** or the CCF Manager Sheryl Baldwin at **Sheryl@calcupa.org.**

INTRODUCTION

Need and technology has produced an array of instruments to comply with OSHAs standards to identify and evaluate unseen hazards at locations requiring an evaluation due to the presence or potential presence of hazardous substances. The instruments and tools in use are designed to indicate specific types of hazards or characteristics of the materials being evaluated within a designated operating or indication range. Trained professionals, such as Environmental or Hazardous Material Specialists, Industrial Hygienists, Safety Officers, or emergency responders can use hazardous materials field screening equipment for a variety of purposes, not the least of which includes protection of the public and response personnel during an emergency situation or disaster involving unknown or known hazardous materials.

With the large array of field screening tools available, the CCF set out to address two concerns in compiling this manual. First, there are agencies that have many of the instruments and tools described in this manual and need a "quick and dirty" resource to refresh staff on the screening tool and its use. This manual, with the links to manufacturers' manuals gives the information to the user quickly and conveniently. Second, in some jurisdictions, multiple agencies often have varying tools and this manual will allow users to quickly learn what the tool can do and any concerns regarding its use.

These hazardous materials field screening tools analyze various media (gas, liquids or solids) for a wide variety of parameters and assists responders and other personnel responsible to evaluate site conditions to gauge risk, develop mitigation strategies and options for reducing or eliminating hazardous conditions. This assessment also assists in identifying needed personal protection equipment and actions necessary to keep workers safe during mitigation activities.

This manual has been compiled using instructions and information provided by the manufacturer of the specific instrument or equipment. Users must read the manufacturer's instructions completely for a full understanding of the equipment. Summary information and specifications are provided with references to website links for more detailed instrument use, calibrations, and maintenance instructions.

Most importantly, this guide does not describe or intend to assist in the interpretation of the results and findings using the field screening tools described herein. Only properly trained professionals, knowledgeable in the many variables that could affect result interpretations should be making decisions or giving directions based on the field results.

INSTRUMENT	HAZARD MONITORED	APPICATION
Combustible Gas Indicator (CGI)	Fire or Explosion Hazard	Measures the concentration of combustible gas or vapor in air
Oxygen Meter (O_2)	Oxygen Concentration	Determines % O_2 in air and fire hazard
Multi Gas Detector	Inorganic and Organic Gases and Vapors	Identifies Hazardous conditions
Color Metric Tube	Specific Gases and Vapors	Measure concentration of specific gases and vapor
Chemical Specific Instruments	Toxicity	Establish exposure levels
Radiation Meters	Radiation	Identify presence of a radiation source
Photoionization Detectors (PID)	Organic and Inorganic Gases and Vapors	Measure total organic vapors
Flame Ionization Detector (FID)	Organic Gases and Vapors	Measure total organic vapors
Infrared	Hazardous Substance	Compound identification
Laser	Hazardous Substance	Compound identification

Combustible Gases

< 10%	LEL	Continue monitoring
< 5%*	LEL	Continue with caution
10 – 25%	LEL	Continue monitoring with Extreme Caution
> 25%	LEL	Explosion Hazard
>5%*	LEL	withdraw from area Immediately

*Confined Space

Oxygen Concentrations

< 19.5%	Must wear SCBA
19.9 – 25%	Continue monitoring with caution SCBA not needed based on O_2
> 25%	Discontinue monitoring Fire, Consult Fire

Toxic Gases and Vapors

> IDLH SCBA required

Instrument Manual Mailing List

RAE Systems, Inc.
3775 North First Street
San Jose, CA 95134 USA
Phone: 408.952.8200
Fax: 408.952.8480

GfG Instrumentation Inc.
1194 Oak Valley Drive, Suite 20
Ann Arbor, Michigan 48108
Western Region: GfG Instrumentation, Inc. (800) 959-0329 Mike Calvo (Irvine)

MSA Manufacturer, (800) 672-2222 /800-672-2222 Lauren – customer service
Pine Environmental Services,
2350 Reynolds, Suite #117
Irvine, CA
(949) 955-3930

RKI Instruments, Inc.
33248 Central Ave.
Union City, CA 94587
RKI Tech Support 800-754-5165 (Mike Jeter)/Shirley Trejis) photos

Rhett Squires Retail Representative (Ventura) 805-218-8853

Smiths Detection Inc.
2202 Lakeside Boulevard
Edgewood, MD 21040
410-844-5186
fax 1 410-510-9496
usa@smithsdetection.com

Don Wolf & Associates, Inc.
21955 Plummer Street
Chatsworth, CA 91311
818-885-5800
800-266-2046

Honeywell Analytics

651 South Main Street
Middletown, CT 06457
800 711-6776 860 344-1079
Fax 860 344 – 1068

MULTIPLE-GAS METERS

Multiple-Gas handheld meters are used to detect multiple gases simultaneously. Gases are detected using sensors to include: catalytic, electrochemical, photoionization (PID) infrared (IR) and thermo-conductivity. The 'Four (4)-gas' meter is the most common instrument used and is designed to detect the confined space gases: CO, H2S, O2 and combustible gases (LEL). Five (5)' and 'Six (6)' gas meters are also available to increase the monitoring capabilities. Sensors can be interchangeable and replaced by sending to the manufacturer or by trained staff.

Glossary of Specifications

Sensors

Photoionization Detection (PID)	Use of a high energy ultraviolet (UV) light source to ionize chemicals in an airstream, The charged molecules are collected on a charged surface, which generates a current that is directly proportional to the concentration of the chemical in the air being sampled for the measurement of volatile organic compounds and other gases. PIDs are broadband detectors with a sensitivity that differs for each VOC.
Infrared (IR)	Useful for measuring a broad range of inorganic and organic chemicals in the air IR analyzers operate by passing Infrared radiation generated from a heated metal source through a gas sample. The IR radiation is absorbed by the chemical in the sample. The IR analyzer is preloaded with library of known chemicals for identification and concentration of chemicals in the air. It measures a variety of gases to include CO2, CO, CH4, NO and SO2.
Electrochemical Sensors	Measures the concentration of a target gas by oxidizing or reducing the gas at an electrode and measuring the resultant current commonly used for CO and H2S.
Catalytic Combustible Sensors	Catalytic bead sensors are used primarily for the detection of combustible gases Based on the premises that all electrically conducted materials change their conductivity as temperature changes. There is a *coefficient of temperature resistance* (ct) for each combustible gas mixture.
Oxygen Sensors	Based on electrochemical (galvanic) cells. The generated current in the sensor, which is produced from an oxidation reaction, is directly proportional to the rate of oxygen diffusion into the cell. Meters are generally calibrated oxygen concentrations between 0 -25%. Normal oxygen is 20.9%. Meter alarms are set at concentrations lower than 19.5% or above 23.5%.
Explosivity Sensors	For combustible gases use of an oxidizing agent such as platinum or palladium combustible gas meters measure flammable gas concentration as a percentage of the LEL of

the calibrated gas.

Toxic Gas Sensors   Use of electrochemical technology (NH3, HCN, PH3, SO2.)

Detection Method
Diffusion   Passive monitoring installed in a port on the meter.

Pump   Internal or external pump to actively collect gases/vapor. Can be used with attached tubing for more specific or remote gathering points.

Aspirator   External handheld pump (bulb) with tubing

Meter Display
LED   Liquid Emitting Diode

LCD   Liquid Crystal Display

Note: *Both LED and LCD are considered 'state of the art' displays and the differences for use in portable meters are arguably negligible*

Power Sources

Alkaline Batteries   AAA, AA, C, D size and 9 volt snap on. These batteries are generally single use/disposable. Rechargeable alkaline batteries are available but seldom used. Interchangeable with lithium and nickel rechargeable batteries.

Lithium Ion   (Li-Ion) most commonly used rechargeable battery.

Nickel Metal Hydride   (NiMH) Rechargeable battery, common use for AA penlight size

Nickel Cadmium   (NiCD) Small rechargeable battery

Direct Current   (DC Power) can be used to recharge batteries and may be plugged into vehicle 'cigarette lighters' for long-term monitoring.

Alternating Current   Power generated for plug-in to utility supplied systems

Miscellaneous
STEL/TWA   Short Term: X Exposure Limit value above which exposure to a chemical substance should not occur. Usually relates to a 15 minute reference period.
Time Weighted Average: The exposure to a chemical can be used when both the chemical concentration and time for exposure varies over time. It is used as the average exposure to a contaminant to which workers may be exposed without adverse effect over a period such as an 8 hour day or 40 hour week.

Data Logging	Turn on/off, gas readings, battery condition, and calibration data. Software is available for transfer of information to a PC for data storage and remote monitoring.
Alarms	Instruments are equipped with audio, visual and or vibrating alarms that may be set at threshold limits for gas or conditions of concern.
Calibration	Test/Auto-calibration checks Fresh air/zero calibration. Use of manufacturers supplied known gas exposure for appropriate readings.
	Stand Alone Docking Stations. Available to cradle calibration gas and expedite the process/provide additional data storage capabilities.
	Full Calibration Outsourced to manufacture/representative or performed in-house by trained technicians to certify calibration of meter accuracy.
Modes of Operation	Normal Mode: Confined space or area monitoring
	Bar Hole Mode: Underground gas leaks/only combustible or O2.
	Leak Check Mode: Location of leaks in valves and piping.

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RKI Multiple Gas Meters

Models: RKI Eagle 2
                RKI GX-2012
                RKI GX-2009

RKI Eagle 2

Use of Instrument: Handheld meter capable of monitoring up to six different gases simultaneously. For use in confined spaces, 'Bar Hole' (underground leaks) and hazardous environments. The meter has interchangeable sensors for detection of different gases.

Specifications

Measurements of Gases and Detectable Ranges

Combustibles (CH4)	0—100% LEL
Oxygen (O2)	0—40% VOL
Carbon Monoxide (CO)	0—500 PPM
Hydrogen Sulfide (H2S)	0—100 PPM
Ammonia (NH3)	0—75 PPM
Arsine (ASH3)	0—1 PPM
Phosphine (PH3)	0—1 PPM
Sulfur Dioxide (SO2)	0—10,000 PPM
Carbon Dioxide (CO2)	0—10,000 PPM
Methane (CH4)	0—100%LEL
Methane (CH4)	0—100% VOL
Hydrocarbons	0—100% LEL
Hydrocarbons	0—30% VOL
VOC	0—2,000PPM
VOC	0—50PPM
Hydrogen	0—100% VOL
Hydrogen	0—10% VOL

<u>Sensors</u>	Electrochemical, catalytic combustion, galvanic cell, toxic, thermal Conductivity, PID, IR
<u>Detection Method</u>	Internal pump (draw up to 125 feet)
<u>Power Source</u>	MIMH (rechargeable) or Alkaline size C batteries
<u>Alarms</u>	TWA/STEL; Audio/Visual/Vibrating
<u>Display</u>	LCD
<u>Data Logging</u>	Equipped with <u>Eagle 2</u> <u>Data Logger Management Program</u>. Data is logged to internal memory and can be downloaded to computer infrared capabilities. Data includes gas readings, alarm and calibration information.
<u>Calibration</u>	Bump test and auto-calibration using manufacturer issued kit. Stand Alone: <u>RKI Gas Monitor Calibration Station SDM E-2 </u>for enhanced calibration and record keeping.

<u>RKI Eagle 2</u>

Start Up (Normal Operation):

1. Determine if a sample hose will be needed and configure the instrument based upon the intended tasked and objectives. Connect the sample hose and or probe.

2. Press and hold briefly the **POWER ENTER RESET** button until you hear a beep.

   The machine will cycle through the start- up sequence and enter the monitoring mode. If needed, perform a calibration. To skip calibration, press and release the **DISPLAY ADJUST NO** button.

3. In an environment free of toxic or combustible gases and normal oxygen, perform a demand zero (fresh air set) by pressing and holding the **AIR ▲YES** button until the unit prompts you to release.

   The unit is now ready to monitor. Proceed to the monitoring area then allow 10 – 15 seconds for response (response increases with length of hose).

   A rapid increase in combustible gas readings followed by a declining or erratic reading may indicate a gas concentration above the LEL which may be hazardous.

   To monitor for combustible gases in the ppm range allow the instrument to run for 3 – 5 minutes after the start-up sequence is complete. This stabilization period is not needed for monitoring in the % LEL or % volume range.

Resetting and Silencing Alarms

If the instrument goes into alarm press and release any button to silence. The concentration must fall below the alarm setting before you can reset the alarm.

If the instrument will not silence, the machine is set to alarm silence off and self-resetting.

Once the condition passes, press and release the **POWER ENTER RESET** button.

Powering Down the Unit:

Press and hold the **POWER ENTER RESET** button. Release the button when "Good Bye" and the RKI logo appear.

Calibration Station SDM E-2

Eagle 2 Operator's Manual: www.rkiinstruments.com/pdf/71-0154RK.pdf

RKI Tech Support (800) 754-5165
Rhett Squires Retail Representative (Ventura) (805) 218-8853

RKI GX-2012

Use of Instrument: Small handheld meter. Monitors up to five different gases simultaneously; for use in confined space entry, 'Bar Hole' monitoring (underground gas leaks and other hazardous environments. (Replaces RKI GX 2003)

Measurements and Detectable Ranges

Combustible Gases (CH4)	0 – 100% LEL
Oxygen (O2)	0 – 40% VOL
Hydrogen Sulfide (H2S)	0 – 100 PPM
Carbon Dioxide (C02)	0 – 500 PPM
Combustible Gases (CH4)	0 – 100% VOL

Sensors   Catalytic combustion, thermal conductivity, galvanic and electrochemical cells

Detection Method   Internal pump (draw up to 50 feet)

Power Source   Lithium Ion (rechargeable) or Alkaline size AA batteries

Alarms   STEL/TWA; Audio/Visual/Vibrating

Display   LCD

Data Logging   Equipped with GX 2012 Logger Management Program software. Data is logged to internal memory and can be downloaded to a computer through infrared capabilities to log gas readings, alarm and calibrated information.

Calibration   Bump testing/auto or single calibration uses manufacturer's calibration kit. Stand Alone Docking Station: RKI SDM 2012 Calibration Station for enhanced calibration and data retrieval.

RKI SDM 2012 Calibration Station

RKI GX – 2012

Start Up (Normal Operation) Only:

1. Determine if a sample hose will be needed and configure the instrument based upon the intended tasked and objectives. Connect the sample hose and or nozzle.

2. Press and hold briefly the **POWER ENTER** button until you hear a beep. The machine will cycle through the start- up sequence until it reaches the calibration mode.

3. Calibrate using Auto Cal or One Cal.

4. In an environment free of toxic or combustible gases and normal oxygen, perform fresh air adjustments by pressing and holding the **AIR ▲** button until the unit prompts you to release.

   The unit is now ready to monitor. Proceed to the monitoring area then allow 10 – 15 seconds for response (response increases with length of hose). If beep set is turned on, the unit will beep once every 5 minutes to confirm that it's operating.

Note: A heart symbol flashes in the display while the instrument is functioning properly and, a fan symbol spins while the pump is operating.

In a low light environment press and release any button to turn on display backlight.

Resetting and Silencing Alarms

If the instrument goes into alarm press and release the **RESET SILENCE** button to silence, LEDS will continue to flash. The concentration must fall below the alarm setting before you can reset the alarm.

If the instrument will not silence, the machine is set to alarm silence off. Once the condition passes, press and release the **RESET SILENCE** button.

Powering Down the Unit:

Press and hold the **POWER ENTER** button. The buzzer will pulse and "Turn off" will appear in the display. Release the **POWER ENTER** button when "Turn off" disappears.

Operator's Manual – RKI Instruments
http://www.rkiinstruments.com/pdf/71-0239RK.pdf

RKI GX-2009

Use of Instrument: Small portable gas meter. Monitors up to four different gases simultaneously. For use in confined spaces and hazardous environments. (Replaces RKI GX 2001)

Specifications:

Measurements – Gases and Ranges

Combustible Gases (CH4)	0 – 100% LEL
Oxygen (O2)	0 – 40 PPM
Hydrogen Sulfide (H2S)	0 – 100 PPM
Carbon Dioxide (C02)	0 – 500 PPM

Sensors   Catalytic combustion, electrochemical and galvanic cells

Detection Method   Diffusion/attached powered pump/hand aspirated sample draw with hose and probe

Power Source   NiMH batteries

Display   LCD

Alarms   STEL/TWA; Audio/Visual/Vibrating

Data logging   Equipped with GX 2009 Data Logger Management Program software. Data is logged to internal memory and can be downloaded to a computer through infrared capabilities. Data includes gas readings, alarm and calibration information.

Calibration   Bump test and auto-calibration using manufacturers issued kit. Stand Alone Docking: RKI Cal 2000 Docking Station for enhanced calibration and data retrieval.

RKI Cal 2000 Docking Station

RKI GX – 2009

Start Up:

1. In a known fresh air environment press and briefly hold down the **POWER MODE** button. Release when you hear a beep. The start-up sequence will begin (alarm LEDs and buzzer will pulse several times).

   The machine will cycle through the start- up sequence until it reaches the calibration and bump test mode.

2. Press the **POWER MODE** button to confirm calibration limits and bump test.

3. The unit will perform an automatic fresh air adjustment and proceed into the monitoring mode and is ready for use.

4. Prior to entering the impacted area, with the unit operating in the monitoring mode perform a fresh air adjustment by pressing and holding the **AIR** button until the unit prompts you to release.

5. Proceed to the monitoring area.

Resetting Alarms

　　　　To reset the alarm, the gas reading that caused the alarm must decrease below the alarm set point. Press and release the **POWER MODE** button.

Powering Down the Unit:

Press and hold the **POWER MODE** button for about 3 seconds to turn off the unit. Release button when the LCD is blank.

Operator's Manual – RKI Instruments
http://www.rkiinstruments.com/pdf/71-0158RK.pdf

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MSA Multiple Gas Meters

Models: MSA Sirius Multi-gas Detector
            MSA Altair 5X
            MSA Altair 4X
            MSA Altair Pro Single Gas Detector

MSA Sirius Multi-Gas Detector

Use of Instrument: Handheld multi-gas meter will simultaneously monitor up to four gases with a PID sensor for monitoring of low vapor VOCs. PID capabilities have a library of the detection of up to 100 gases. For confined space entry and other hazardous environments.

Specifications:

Measurements and Detectable Ranges

Combustible Gases	0 - 50% LEL
Oxygen (O2	0 - 25% VOL
Carbon Monoxide (CO)	0 - 500 PPM
Hydrogen Sulfide (H2S)	0 - 200 PPM
VOCs	0 - 2,000 PPM

Sensors   Catalytic, electrochemical, PID sensors
                    PID Sensor measures VOCs with isobutylene as the reference gas.

Detection Method   Internal pump

Power Source   Lithium Ion (rechargeable) or Alkaline batteries

Display   LED

Alarms   STEL/TWA; Visual/Audio

Data Logging   MSA Link software works with IR reader USB port plugged into a computer
                    for retrieval and storage of events.

Calibration   Bump test and auto-calibration using manufactures kit.
                    Stand Alone: MSA Galaxy Automated Calibration System and for enhanced
                    calibration and data retrieval.

MSA Galaxy Automated Calibration System

Operating Manual (turn on Ch. 3.3 page 19)
Reference Link: http://www.livoniafirefighters.com/docs/MSA Sirius Manual.pdf

MSA Manufacturer (800) 672-2222

Sirus MultiGas Detector

Start Up:

1. Determine if a Fresh Air Set-up (FAS) should be used. In a fresh air environment press
   the **POWER ON** button to begin the start-up cycle and self-check.

2. Perform the FAS or skip the FAS

   a. To perform the FAS press **ON/OFF** button while zero is flashing

   b. To skip FAS, press the **RESET/▼** button.

3. The unit is in the measuring mode and ready for monitoring when the measure gas page

appears.

4. Verify pump operation by plugging the free end of the pump inlet or probe. Alarm must activate (pump should be checked before each use).

   Press the **RESET/▼** button to reset the alarm and restart the pump.

5. Ensure PID bulb corresponds to PID bulb setting on instrument display.

   Note: Default bulb is 10.6

   Organic silicones, silicates, lead containing compounds, hydrogen sulfide exposures over 200 ppm or exposures over 55 ppm for one minuet may desensitize the combustible gas sensor and/or voc sensor reducing its readings.

   (Check each sensors calibration prior to field use.)

Silencing Alarms

   Alarms can be silenced by pressing the **RESET/▼** button.

   Combustible gas alarm cannot be reset with the reset button if the indication reaches 100% LEL or 5% CH_4. . Proceed to a fresh air area and power down then restart the meter to reset.

Powering Down the Unit:

Press and hold the **ON/OFF/ACCEPT** button for 3 seconds. Four beeps will be heard during the turn off sequence.

MSA ALTAIR 5X Multi-gas Detector

Use of Instrument: Handheld multi-gas meter will simultaneously monitor up to five different gases. For confined space and other hazardous environments.

Specifications:

Measurements and Detectable Ranges

Combustible	0 - 100% LEL
Oxygen (O2)	0 - 30% VOL
Carbon monoxide (CO)	0 - 2,000 PPM
Hydrogen Sulfide (H2S)	0 - 200 PPM
Sulfur Dioxide (SO2)	0 - 20 PPM
Chlorine (CL)	0 - 10 PPM
Ammonia (NH3)	0 - 100 PPM
Nitrogen Dioxide (NO2)	0 - 20 PPM
Hydrogen Cyanide (HCN)	0 - 30 PPM
Phosphine (PH3)	0 - 5 PPM
Carbon Dioxide (CO2)	0 - 10% VOL
Butane (C4H10)	0 - 25% VOL
Methane (CH4)	0 - 100% VOL
Propane (C3H8)	0 - 100% VOL

Sensors   IR (Infrared) sensor and interchangeable sensors (X Cell) sensors for the detection of a variety of gas types

Detection Method   Internal Pump

Power Source   Lithium Ion (rechargeable) or Alkaline AA size batteries

<u>Display</u>	LED (monochrome or color)
<u>Alarms</u>	STEL/TWA; Audio/Visual/Vibrating
<u>Data Logging</u>	MSA Link Software The data link communication port on the meter is aligned to PC IR interface
<u>Calibration</u>	Bump test and auto-calibration using manufacturer's kit. Stand Alone: <u>MSA Galaxy Calibration System</u> for enhanced calibration and data retrieval.

Altair 5x Multi Gas Detector

Start Up:

1. Determine if a Fresh Air Set-up (FAS) should be used.

2. In a fresh air environment press the **ON/OFF** button to begin the start-up cycle, self-check and sensor warm up period.

3. Verify pump operation by blocking the end of the pump inlet or probe when the alarm sounds within 30 seconds. Watch for a pass or error message.

 If the pump passes:

> Press the **RESET/▲** button to reset the alarm and restart the pump.

If an error occurs check for an leak in the sampling system and retest.

4. Perform the FAS or skip the FAS

    a. To perform the FAS press **ON/OFF** button while zero is flashing

    b. To skip FAS, press the **RESET/ ▼** button.

5. The unit is in the measuring mode and ready for monitoring when the measure gas page appears.

Silencing Alarms

> Alarms can be silenced by pressing the **RESET/ ▼** button.

> Combustible gas alarm cannot be reset with the reset button if the indication reaches 100% LEL or 5% CH_4. Proceed to a fresh air area and power down then restart the meter to reset.

Powering Down the Unit: Press and hold the **ON/OFF** button for 3 seconds.

MSA ALTAIR 4X Multi-gas Detector

Use of Instrument: Handheld multi-gas meter monitors up to four different gases simultaneously. For use in confined space entry and other hazardous environments.

Fluorescent Model

Specifications:

Measurements and Detection Ranges

Combustible Gases	0 - 100% LEL
Oxygen (O2)	0 - 30% VOL
Carbon Monoxide (CO)	0 - 1,999 PPM
Hydrogen Sulfide (H2S)	0 - 200 PPM
Nitrogen Oxide (NO2)	0 - 50 PPM
Sulfur Dioxide (SO2)	0 - 20 PPM

Sensors   Dual Tox Sensor (CO/H2S), X Cell (trademark) Sensors

Display   LCD

Power Source   Rechargeable Lithium-polymer

Detection   Diffusion (Accessories – Universal Pump Probe)

Alarms   STEL/WTA; Audio/Visual/Vibrating

Data Logging   MSA Link Software Data link communication to IR interface with PC

Calibration   Bump test and auto-calibration using manufacturer supplied kit.
                 Stand Alone: MSA Galaxy Calibration System for enhanced calibration and
                 data retrieval.

MSA Manufacturer (800) 672-2222
Pine Environmental Services, 2350 Reynolds, Irvine, Suite #117 (949) 955-3930

Altair 4x Multi Gas Detector

Start Up:

1. Determine if a Fresh Air Set-up (FAS) should be used.

2. In a fresh air environment press the **ON/OFF** button to begin the start-up cycle, self-check.

3. Verify that LCD and audible alarm sounds briefly.

4. Perform the FAS or skip the FAS

   a. To perform the FAS press **ON/OFF** button within 10 seconds

   b. To skip FAS, press the ▲ button.

5. The unit goes into the measuring mode and ready for use

   A ♥ in the display indicates the sensor has reached or near the end of life.

   Activate backlight by pressing any button

Silencing Alarms

   Alarms can be silenced by pressing the ▲ button. If alarm condition continues to exist, the ▲ will only silence for 5 seconds.

   False O2 alarms can occur due to changes in barometric pressure or extreme changes in ambient temperature.

   Lock alarm state ("xxx" appears in display) can only be reset by turning the unit off and on in a fresh air environment.

Powering Down the Unit:

Press and hold the **ON/OFF** button

MSA Altair Pro Single Gas Detector

Use of Instrument: Handheld one gas meter for Oxygen, Hydrogen, Sulfide and Carbon Monoxide using interchangeable electrochemical sensors for specific gas to be monitored. For measurement of known chemical in potentially hazardous environments.

Specifications:

Measurements and Detectable Ranges

Oxygen (O2)	0 - 25% VOL
Carbon Monoxide (CO)	0 -500 PPM
Hydrogen Sulfide (H2S)	0 - 100 PPM

Sensors   Electrochemical Sensors (O2, CO, H2S)

Detection Method   Diffusion

Power Source   Lithium (rechargeable) batteries

Alarms   STELTWA; Audio/Visual/Vibrating

Display   LCD

Data Logging   Capacity to record events and transfer data to a PC receiving device with MSA Five Star Link Software

Calibration   Bump test and auto-calibration using manufacturers supplied kit.
Stand Alone: MSA Galaxy Calibration System for enhanced calibration and data retrieval.

Operating Manual
MSA ALTAIR SINGLE GAS DETECTOR

Altair Single Gas Detector

Start Up:

1. Press and hold the TEST button until "ON" and "?" appear. Release the button and press again to activate the unit. A 99 second activations cycle begins.

2. After activating, press the TEST button to perform an alarm test. If the alarm LED and sounds do not activate do not proceed with the unit.

    Once activated the unit remains activate until low battery error occurs.

    Vibrating alarm may cease to operate if temperature is below 0°C.

    A confidence indicator flashes every 60 seconds to indicate that the unit is on and operating normally.

    Do not block the sensor.

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GfG Instrumentation

Models: GfG Multi-gas Detector
             GfG Multi-gas Detector

GfG Instrumentation 450 Multi-Gas Detector

Use of Instrument: Handheld 1 - 4 sensor meter for the monitoring of up to four gases simultaneously
Used for confined space and hazardous environments.

Specifications:

Measurements and Detection Ranges

Combustible Gases	0 – 100% LEL
Carbon Monoxide (CO)	0 – 500 PPM
Hydrogen Sulfide (H2S)	0 – 100 PPM
Oxygen (O2)	0 – 25% VOL

Sensors   Four "G45" sensors

Detection Method   Diffusion mode or attachable motorized pump

Power Source   NiMH (rechargeable) or alkaline AA size batteries

Alarms   STEL/TWA; Audio/Visual/Vibrating

Display   LCD

Data logging   GfG 450 Simulator Software Program Records gas concentrations and alarms. Events can be downloaded to a PC for viewing, storage and evaluation.

Calibration   Bump test and auto-calibration using manufacturers calibration kit. Docking Station: OEM GfG DS404

Docking Station: OEM GfG DS404

Operators Manual
G450 MULTI-GAS DETECTOR

GfG Instrumentation, Inc. (800) 959-0329

G450

Start Up (Normal Operation):

1. Press button 3 to activate the unit. Allow the instrument to stabilize then completely warm up (approximately 5 min.).

2. If fresh air adjustment is needed attach the calibration adapter. Push the "AIR" button to initiate fresh air adjustment. Remove adapter once completed, the unit is ready for normal use.

   Reset alarms by pushing the RESET key (button 2). Press yes when prompted to resume detection.
   > Green back light, No alarms
   > Orange backlight, 1 alarm
   > Red backlight, 2 or 3 alarms

Alarms in fresh air, perform an auto zero

   ↑↑↑ Indicates detection range of LEL sensor has been exceeded.

Shut down unit by pressing and holding button 3 for 5 seconds.

G460 Multi-gas Detector

Instrument Use: Handheld 1 – 6 channels for simultaneous monitoring of a variety of gases. Features include PID, IR, capability and a wide range of sensors. Use in hazmat response and confined spaces.

Specifications:

Measurements of Gases and Detectable Ranges

Combustibles	0 – 100% LEL
Oxygen (O2)	0– 25% VOL
Carbon monoxide (CO)	0 – 300 PPM
Hydrogen sulfide (H2S)	0 – 100 PPM
Ammonia (NH4)	0 – 200 PPM
Carbon dioxide (CO2)	0 – 10 PPM
Chlorine (CL2)	0 – 2 PPM
Ethylene oxide (C2H4O)	0 - 20 PPM
Hydrogen (H2)	0 – 2,000 PPM
Hydrogen chloride (HCL)	0 - 30 PPM
Hydrogen cyanide (HCN)	0 - 50 PPM
Hydrogen fluoride (HF)	0 - 10 PPM
Nitric oxide (NO2)	0 - 100 PPM
Nitrogen dioxide (NO2)	0 – 50 PPM
Ozone (O3)	0 - 1 PPM
Phosgene (CL2)	0 - 10 PPM
Phosphine (PH2)	0 – 10 PPM
PID (VOC)	0 - 2,000 PPM
Silane (SiH4)	0 - 40 PPM
Sulfur dioxide (SO2)	0 - 10 PPM

Sensors	PID sensors for direct reading of VOCs; IR; and smart (electrochemical and catalytic sensors) for detection of a variety of gases
Detection Method	Diffusion mode or attachable motorized pump
Power Source	NIMH (rechargeable) or alkaline AA size batteries
Alarms	STEL/TWA; Audio/Visual/Vibrating
Display	LED
Data Logging	GfG Simulator Software Program records gas concentration and alarms. Events can be downloaded to a PC for viewing, storage and evaluation
Calibration	Bump test and auto-calibration using manufacturer supplied calibration kit. Docking Station: OEM GfG DS404

Field Operations Manual
G460 MULTI-GAS DETECTOR

G460

Start Up (Normal Operation):

1. Press button 3 to activate the unit.

2. Allow the instrument to stabilize then complexly warm up (approximately 5 min.).

3. If fresh air adjustment is needed attach the calibration adapter.

4. Push the "AIR" button to initiate fresh air adjustment.

5. Remove adapter once completed, the unit is ready for normal use.

   Reset alarms by pushing the RESET key (button 2). Press yes when prompted to resume detection.

   Green back light, No alarms

   Orange backlight, 1 alarm

   Red backlight, 2 or 3 alarms

Alarms in fresh air, perform an auto zero

Shut down unit by pressing and holding button 3 for 5 seconds.

RAE Systems Multi Gas Meters

Models: QRAE II Gas Detector
QRAE 3 Wireless 4-Gas Monitor
MultiRAE Multigas Detection Monitors
ppbRAE3000/MiniRAE3000
ToxiRAE Single Gas Monitors
AreaRAE Steel Multi-Gas Monitoring System

QRAE II GAS Detector

Use of Instrument: Handheld 1 - 4 gas monitor for the simultaneous detection of combustibles, O2, H2S, or CO. For confined space entry and other hazardous environments.

Specifications:

Measurement and Detection Ranges

Combustible	0 – 100% LEL
Oxygen (O2)	0 – 30% VOL
Carbon Monoxide(CO)	0 – 1,000 PPM
Hydrogen Sulfide (H2S)	0 – 100 PPM

Sensors   2 electrochemical (CO/H2S); 1 solid electrolyte (O2); 1 catalytic (combustible)

Detection Method   Diffusion or pump (depending on the QRAE II model) option – hand pump (squeeze bulb)

Power Source   Lithium Ion (rechargeable) and alkaline size AA batteries

Alarms   STEL/TWA; Audio/Visual/Vibrating

Display   LCD

Data logging   ProRAE Studio Software Download data to PC capabilities

Calibration   Bump test and auto-calibration using manufacturer's test kit.
                   Stand Alone: Auto RAE Lite Docking Station for enhanced calibration and data
                   retrieval.

Auto RAE Lite Docking Station for QRAE II

User's Guide
QRAE II GAS DETECTOR

RAE Systems (San Jose) (408) 952-8200 / (877) 723-2878

QRAE 3 Wireless 4-Gas Monitor

Instrument Use: Handheld meter with 1-4 gas capabilities for simultaneously monitoring with wireless real-time readings and alarm status. For confined space and other hazardous environments.

Specifications:

Measurements and Detection Ranges

Oxygen (O2)	0 - 30% VOL
Combustible	0 - 100% LEL
Carbon Monoxide (CO)	0 - 500 PPM
Hydrogen Sulfide (H2S)	0 – 100 PPM
Sulfur Dioxide (SO2)	0 – 20 PPM
Hydrogen Cyanide (HS)	0 – 50 PPM

Sensors   Up to 4 replaceable sensors: Electrochemical (H2S, CO,SO2,HCN), electrolyte Oxygen (O2), catalytic (combustible)

Detection Method   Built-in pump or diffusion

Alarms   STEL/WTA; Audio/Visual/Vibrating

Data Logging   Data download and instrument setup on PCC via Travel Charger Wireless data and status transmission via built in RF modem. ProRAE Guardian Software

Calibration   Bump test and auto-calibration using manufacturer supplied test kit. Stand Alone: AutoRAE Lite Docking Station; AutoRAE 2 Station

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User's Guide
QRAE 3 WIRELESS 4-GAS MONITOR

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MultiRAE Multigas Detection Monitors

Models: MultiRAE Pro, MultiRAE Standard, MultiRAE Lite

Instrument Use: Portable handheld 1 – 5 gas meter that will simultaneously monitor a variety of gases using interchangeable electrochemical sensors and PID capabilities. Used in confined space entry and other hazardous environments. Three MultiRAE models: MultiRAE Pro is the top of the line of the models with 10.6eV PID capability and sensor capability to measure gamma radiation; MultiRAE Standard monitors up to 6 contaminants; MultiRAE Lite best suited for confined space gases. (Replaces MultiRAE Plus).

<table>
<tr><td>PRO</td><td>STANDARD</td><td>LITE</td></tr>
</table>

Specifications:

Measurements and Detection Ranges

Standard

Oxygen (O2)	0 – 30 ppm
Combustible Gas	0 – 100% LEL
VOCs	0 – 200 ppm
Carbon Monoxide (CO)	0 – 500 ppm
Hydrogen Sulfide H2S)	0 – 100 ppm
Sulfur Dioxide (SO2)	0 - 20 ppm
VOCs	0 – 5000 ppm

Sensors   Interchangeable sensors for radiation (gamma), PID and electrochemical for toxics, oxygen and combustible LEL

Detection Method   Diffusion or internal pump (15 foot sampling wand)

Power Source   NiCd (rechargeable) and alkaline AA size batteries

Alarms   STWL/TWA; Audio/Visual/Vibrating

Data Logging   ProRAE Suite Software This meter can store gas concentrations and other
                         data for data downloading into a PC. Wireless data and status can be
                         transmitted via built-in RF modem.

Calibration   Bump and auto-calibration manually by use of manufacturer supplied gases.
                         Docking Station: AutoRAE2 Test and Calibration Station.

AutoRAE2 Test and Calibration Station

User's Guide
MULTIRAE MULTIGAS DETECTION GAS MONITORS

ppbRAE3000/MiniRAE 3000

Use of Instrument: Portable handheld meter – single use (display) for VOCs. This instrument has broadband VOC gas monitoring using PID detection capabilities. The ppbRae 3000 detects at 1 ppb – 10,000 ppm; the mini RAE detects at 0 – 15,000 ppm.
This meter features PID capabilities for measuring VOC's of over 200 different gases. For use in HazMat and environmental hazard areas.

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Specifications:

Measurements and Detection Ranges

ppbRAE	3000 – VOCs	1 ppb – 10000 ppm
miniRAE	3000 – VOCs	0 – 15000 ppm

Gases are organized into four lists:

1. My List – Customized list that can be created. First gas is always isobutylene
2. Last Ten – List of last ten gases used by the instruments
3. Gas Library – List of all gases found in RAE Systems library
4. Custom Gases – Gases with user modified parameters

Sensors   PID sensor

Power Source   Lithium Ion (rechargeable) or Alkaline battery pack

Detection Method   Internal pump (Up to 100 feet of tubing)

Alarms   STEL/TWA; Audio/Visual/Vibrating

Display   LED Backlit

Data Logging   ProRAE Guardian Software An RF modem allows for real time transmissions.
                            A PC can be used as a base station for remote viewing.

Calibration   Calibration regulator and flow controller/isobutylene calibration gas used. (ppb
                            manually only) Stand Alone: AutoRAE Calibration Station (MiniRAE only).

User's Guide
 ppbRAE3000/MiniRAE 3000

ToxiRAE Pro Single Gas Monitor

Instrument use: Small, portable single gas monitor for detection of a variety of different gases by use of field interchangeable sensors. Product range has three models all using the single interchangeable sensors. For measurement of a known chemical in potentially hazardous environments.

Models: ToxiRAE Pro, ToxiRAE II, ToxiRAE III

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Specifications:

Measurements and Detection Ranges

Model ToxiRAE Pro

Combustible Gases	0 – 100 LEL
Oxygen (O2)	0 – 30% Vol
Carbon Monoxide (CO)	0 – 2,000 ppm
Hydrogen Sulfide (H2S)	0 – 100 ppm
Ammonia (NH3)	0 – 100 ppm
Chlorine (CL2)	0 – 50 ppm
Chlorine Dioxide (CLO2)	0 – 1 ppm
Ethylene Oxide (EtO-B)	0 – 10 ppm
Hydrogen (H2)	0 – 1,000 ppm
Hydrogen Chloride (HCL)	0 – 15 ppm
Hydrogen Cyanide (HCN)	0 – 50 ppm
Hydrogen Flouride (HF)	0 – 10 ppm
Methyl Mercaptan (CH3-SH)	0 – 10 ppm
Nitric Oxide (NO)	0 – 250 ppm
Nitrogen Dioxide (NO2)	0 – 20 ppm
Phosgene (COCL2)	0 – 1 ppm
Phosphine (PH3)	0 – 20 ppm
Sulfur Dioxide (SO2)	0 – 20 ppm

Note: Model ToxiRAE II NH3, CO, H2S and O2
             Model ToxiRAE 3 CO and H2S

Sensors   20 field interchangeable replaceable electrochemical sensors

<u>Power Source</u>	Lithium Batteries (rechargeable)
<u>Display</u>	LCD
<u>Detection Method</u>	Diffusion (wireless range 300 feet)
<u>Alarms</u>	STEL/TWA; Visual/Audio/Vibrating
<u>Data Logging</u>	Wireless downloads to PC via built-in RF modem for Area RAE. Short range radio. <u>Pro Guardian Software</u>.
Calibration	Manual bump and auto-calibration using manufacturer's supplied gases. Alone: Docking Station: <u>AutoRAE2 Test and</u> <u>Calibration. Station</u> for enhanced calibration and data retrieval.

User's Guide
http://www.enviroequipment.com/rentals/PDF/toxirae-pro-manual.pdf

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<u>ToxiRAE Pro</u>

Start Up (Normal Operation):

1. Press and hold [mode] for 3 seconds to activate the unit. A self-test begins.

2. Sensors warm up. Visual count down will appear.

3. Unit is ready for use.

   Reset alarm by pressing [Y/+]

Alarms in fresh air, perform an auto zero

↑↑↑ Indicates detection range of LEL sensor has been exceeded.

Shut down unit by pressing and holding [mode]. Continue holding until you see "Unit Off".

AreaRAE Steel Multi-Gas Monitoring System

Instrument Use: Portable 1 – 5 gas multi-gas detector with a wireless radio frequency (RF) modem which allows communication and data retrieval (real-time) at remote location(s). AreaRAE detectors can be placed at outlying locations for the establishment and monitoring of an emergency perimeter.

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Specifications:

Measurements and Ranges

Oxygen (O2)	0 – 30%
Combustible	1 – 100% LEL
VOCs	0 – 200 ppm
Carbon Monoxide (CO)	0 – 500 ppm
Hydrogen Sulfide (H2S)	0 – 100 ppm
Sulfur Dioxide (SO2)	0 – 20 ppm
Nitric Oxide (NO)	0 – 250 ppm
Nitrogen Dioxide (NO2)	0 – 20 ppm
Chlorine (Cl2)	0 – 10 ppm
Ammonia (NH3)	0 – 50 ppm
Phosphine	0 – 5 ppm

Sensors   Up to 5 sensors with catalytic, electrochemical and PID capabilities

Detection Method   Internal pump with attached probe

Power Source   Lithium-ion or Alkaline size C batteries

Display   LCD

Alarms	STEL/TWA; Visual/Vibrating
Data Logging	Download to PC software: Remote Basic Host or ProRAE Suite Package. Real time wireless transmission with built in RF modem (2 miles)
Calibration	Field calibration with Manufacturer's supplied calibration gas kit.

Website:
AreaRAE Steel Multi-Gas Monitoring System

INDUSTRIAL SCIENTIFIC Multi Gas Detectors

Models: IBRID MX6 Multigas Detector, Ventis MX4 Multigas Detector

(Note: Scientific iTX Gas Monitor – discontinued)

IBRID MX6 Multigas Detector

Use of Instrument: Portable handheld meter capable of simultaneously monitoring from 1 – 6 gases. Detects a variety of gases with electrochemical, catalytic PID and IR sensors. For confined space entry and other environmental environments.

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Specifications:

Measurements and Detection Ranges

Combustible Gases	0 - 1-100% LEL
Carbon Monoxide (CO)	0 – 1,500 ppm
Hydrogen Sulfide (H2S)	0 – 500 ppm
Oxygen (O2)	0 – 30% Vol
Hydrogen (H2)	0 – 2,000 ppm
Nitric Oxide (HO)	0 – 1,000 ppm
Chlorine (CL2)	0 – 100 ppm
Nitrogen Dioxide (NO2)	0 – 150 ppm
Sulfur Dioxide (SO2)	0 – 150 ppm
Hydrogen Cyanide (HN)	0 – 30 ppm
Hydrogen Chloride (HCL)	0 – 30 ppm
Ammonia (NH3)	0 – 500 ppm

Chlorine Dioxide (CLO2)	0 – 1 ppm
Phosphine (PH3)	0 – 10 ppm
Carbon Dioxide (CO2)	0 – 5 ppm
VOCs (general) PID	0 – 2,000 ppm

Sensors   25 interchangeable field replaceable PID, IR, catalytic bead and electrochemical sensors.

Display   LCD

Power Source   Lithium Ion (replaceable) or Alkaline size AA batteries.

Detection Method   Diffusion or integrated sampling pump

Alarms   STEL/TWA; Audio/Visual/Vibrating

Data logging   Internal memory provides real time and historical memory for incident review.

Calibration   Auto-calibration or bump test using manufacturers supplied test kit. Stand Alone: DS2 Docking Station for enhanced automatic calibration and record keeping.

DS2 Docking Station

Instruction Manual
IBRID MX6 MULTIGAS DETECTOR
Industrial Scientific Corp (800) 338-3287

MX6 iBrid

Start Up (Normal mode):

1. Press and hold the center navigation button for 3 seconds to activate the unit. A self-test process begins.

2. Unit is ready for use.

   A blinking red "**OR**" is displayed when conditions exceed the range.

   Blinking black text indicates an alarm condition.

   Solid red numbers indicate an alarm condition.

Bump test should be performed before each use.

   Full instrument calibration should be performed monthly to ensure accuracy

Shut down unit by pressing and holding the center navigation button for more than 2 seconds.

Ventis MX4 Multi-gas Detector

Use of Instrument: Handheld meter for the simultaneous detection of 1 – 4 gases. Used for confined space entry and in other hazardous environments and for personal monitoring.

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Specifications:

Measurements and Detection Ranges

Combustible Gases	0 – 100% LEL
Oxygen (O2)	0 – 30% Vol
Carbon Monoxide (CO)	0 – 1,000 ppm
Hydrogen Sulfide (H2S)	0 - 500 ppm
Nitrogen Dioxide (NO2)	0 – 150 ppm
Sulfur Dioxide (SO2)	0 – 150 ppm

Sensors   Changeable sensors (4) electrochemical/catalytic

Detection Method   Diffusion/ modified pump (draw up to 100 feet)

Power Source   Lithium Ion (rechargeable) or Alkaline size AAA batteries

Display   LCD

Alarms   STEL/TWA Alarms; Audio/Visual/Vibrating

Data logging   Meter performs continuous data logging. Date and time stamped events records and stores data.

| Calibration | Manufacturer supplied calibration kit for bump testing and calibration. Stand Alone: DS2 Docking Station provides automatic calibration and record keeping. |

Product Manual
http://www.indsci.com/WorkArea/DownloadAsset.aspx?id=9399

(412) 788-4353 located in PA

Ventis MX 4

Start Up (Normal Operation):

1. Determine sampling mode. Ensure that the appropriate battery pack is installed.

2. Press and hold ON/OFF/MODE for 3 to 5 seconds to activate the unit. An internal test and initialization phase begins.

3. Select gas monitoring mode. If aspirated: determine the sampling time.

    Minimum time required to draw air and read concentrations is 2 minutes plus 2 seconds for every 12 inches of tubing

4. Ensure portals are exposed to the air. No part of the monitor should be covered by any garment or part of a garment.

5. Unit is ready for use.

    High frequency tone indicates pump or sensor failure

Beeping patterns indicate service needs

Shut down unit by pressing and holding ON/OFF/MODE for a full 5 seconds.

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SPERIAN BIOSYSTEMS Multi Gas Detectors

Models: Sperian PHD6 Multi-gas Detector, Sperian MultiPro Multi-gas Detector

<u>Sperian PHD6 Multi-gas Detector</u>

Use of Equipment: Handheld meter for the measurement of 1 – 6 gases simultaneously. For use in confined space entry and other hazmat response areas.

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Specifications:

Measurements and Detection Ranges

Combustible Gas	0 – 100 % LEL
Oxygen (O2)	0 – 30% Vol.
Carbon Monoxide (CO)	0 – 1,000 ppm
Hydrogen Sulfide (H2S)	0 - 200 ppm
Sulfur Dioxide (SO2)	0 – 25 ppm
Nitric Oxide (NO)	0 – 350 ppm
Nitrogen Dioxide (NO2)	0 – 50 ppm
Hydrogen Cyanide (HCN)	0 – 100 ppm
Phosphine (PH3)	0 – 20 ppm
Chlorine (CL)	0 – 50 ppm
Chlorine Dioxide (CLO2)	0 – 5 ppm
Ammonia (NH3)	0 – 100 ppm
VOCs	0 – 2,000 ppm

Sensors	19 sensor options interchangeable into 5 sensor ports Include PID, IR, electrochemical sensors.

Power Source	Lithium ion (rechargeable) or Alkaline size AA batteries.

Detection Method	Internal motorized draw pump (option – manual sample draw kit with squeeze bulb with 10 foot tubing)

Display	LCD

Alarms	STEL/TWA; Visual/Audible

Data logging	Built in IRDA port for configuration with a PC. Allows data to be downloaded in the field to retrieve information on calibration and recorded events.

Calibration	Bump test/auto-calibration with manufacturer's test kit at turn-on. Stand Alone: Biosystems IQ6 Express Docking Station for enhanced calibration and record keeping.

Biosystems IQ6 Express Dock

Reference Manual
Sperian PHD6 Multi-gas Detector

Sperian Instruments Conn (800) 711-6776

SPERIAN MULTIPRO MULTI-GAS DETECTOR

Use of Instrument: Handheld meter capable of monitoring 4 gases simultaneously. Used for confined space entry and other hazmat response areas.

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Specifications:

Measurements and Detections Ranges

Combustible Gases	0 – 100% LEL
Oxygen (O2)	0 – 30% Vol.
Carbon Monoxide (CO)	0 – 1,000 ppm
Hydrogen Sulfide (H2S)	0 – 200 ppm

Sensors   3 sensor capability electrochemical and catalytic bead

Detection Method   Diffusion or sample draw mode (hand aspirated sample draw kit or with motorized sample draw pump)

Power Source   Lithium ion (rechargeable) or Alkaline size AA batteries

Display   LCD

Alarms   STEL/TWA; Audio/Visual

Data logging   Automatic event logging stores information to include gas readings, turn on times, battery conditions and calibration data. Built-in IRDA transceiver with capabilities for transfer to a PC.

Calibration   Manufacturer's MultiPro Kits can be used at start-up. Stand Alone: <u>IQ</u>
                       <u>Express Docking Station</u> for enhanced automated bump test, calibration and
                       record keeping.

Reference Manual <u>Sperian MultiPro Detector</u>
Sperian Bio systems (800) 711-6776

HONEYWELL MULTI GAS MONITORS

Models: Lumidor MicroMax Pro Multi-gas Monitor
          Honeywell Lumidor Impact Pro Multi-gas Monitor
          BW Gas Alert5 by Honeywell

HONEYWELL LUMIDOR MICROMAX PRO

Use of Instrument: Handheld meter for simultaneously monitoring 1 – 5 gases. Used for confined space entry and other hazardous environments.

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Specifications:

Measurements and Detection Ranges

Combustible Gases	0 – 100% LEL
Oxygen (O2)	0 – 40% Vol.
Carbon Monoxide (CO)	0 – 999 ppm
Hydrogen Sulfide (H2S)	0 – 500 ppm
Ammonia (NH3)	0 – 200 ppm
Chlorine (CL2)	0 – 20 ppm
Chlorine Dioxide (CLO2)	0 – 10 ppm
Sulfur Dioxide (SO2)	0 – 20 ppm
Phosphine (PH3)	0 – 20 ppm
Nitrogen Dioxide (NO2)	0 – 50 ppm
Hydrogen Cyanide (HCN)	0 – 200 ppm
Combustible Gases (CH4)	0 – 100% Vol.

Sensors   25 interchangeable electrochemical sensors

<u>Detection Method</u>	Diffusion and built-in internal sampling pump (10 foot sampling hose)
<u>Power Source</u>	NiMH (rechargeable) or Alkaline size AAA batteries
<u>Alarms</u>	STEL/TWA; Audio/Visual/Vibrating
<u>Data logging</u>	Built in data logging memory for recording events. <u>Biosystems IQ Management System</u> software is available for data retrieval and record keeping.
<u>Calibration</u>	Bump test and auto-calibration using manufacturer's supplied kits. Stand Alone: <u>Honeywell Biosystems IQ Dock</u> Station has fully automated bump test, calibration, meter diagnostics and data download.

User and Maintenance Manual
https://www.instrumart.com/assets/MicroMAXpro_manual.pdf

(847) 955-8200 Honeywell Analytics (Illinois) Or Honeywell Analytics (800) 538-0363

HONEYWELL LUMIDOR IMPACT 4X

Use of Instrument: Handheld meter capable of monitoring 4 gases simultaneously. Two configurations are available - Impact (diffusion) and Impact Pro (sample pump). For use in confined space entry and other hazardous environments.

Specifications:

   Measurements and Detection Ranges

Combustible gases	0 – 100% LEL
Oxygen (O2)	0 – 25% Vol.
Carbon Monoxide (CO)	0 – 500 ppm
Hydrogen Sulfide (H2S)	0 – 50 ppm
Sulfur Dioxide (S02)	0 – 20 ppm
Chlorine (CL2)	0 – 10 ppm
Chlorine Dioxide (CL02)	0 – 5 ppm
Nitrogen Dioxide (NO2)	0 – 20 ppm
Ammonia (NH3)	0 – 100 ppm
Carbon Dioxide (C02)	0.2 – 2.2% v/v

Sensors   Installed interchangeable catalytic, electrochemical and IR sensors

Detection Method   Diffusion mode or built-in pump (standard on Impact Pro). Hand aspirator capabilities (option)

Power Source   Alkaline dry cell batteries

Display   LED

Alarms   STEL/TWA; Audio/Visual/Vibrating

Data Logging   Event information is accessed by down loading to a PC using   software supplied in manufacturer's Datalogging Kit

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Calibration   Bump test or auto-calibration using manufacturer's target test gases. <u>Honeywell Enforcer Automatic Calibrator</u> can be used to enhance calibration data retrieval.

<u>Honeywell Enforcer Automatic Calibrator</u>

Impact Pro Manual
http://www.buygasmonitors.com/content/10722_Imp-ImpPro_DS0280_V5_09-07_EMEA.pdf

GAS ALERT MICRO5

Use of Instrument: Handheld meter for the simultaneous measurement of 1 to 5 gases. This instrument has two models for IR and PID sensor capabilities. For use in confined spaces or other hazardous environments.

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Specifications:

Measurements and Detection Ranges

Combustible Gases	0 – 100% LEL
Oxygen (O2)	0 – 30% Vol.
Carbon Monoxide (CO)	0 – 999 ppm
Hydrogen Sulfide (H2S)	0– 500 ppm
Phosphine (PH3)	0 – 5 ppm
Sulfur Dioxide (SO2)	0 – 150 ppm
Chlorine Dioxide (CL2)	0 – 50 ppm
Ammonia (NH3)	0 – 100 ppm
Nitrogen Dioxide (NO2)	0 – 99 ppm
Chlorine Dioxide (CLO2)	0 – 1ppm

Sensors   12 interchangeable electrochemical, catalytic bead and PID sensors

Detection Method   Diffusion or attached external pump

Power Source   NiMH (rechargeable) or alkaline size AA batteries

Display   LCD

Alarms   STEL/TWA; Audio/Visual/Vibrating

Data logging   Continuous data logging while instrument is operating. Data is saved on a
                           multi-media card (mmc) or secure digital (sd) card and can be downloaded
                           onto a PC for review and record keeping.

Calibration   Bump test and auto-calibration using manufacturer's calibration kit. Stand
                           Alone: MicroDock II Automatic Test and Calibration Station is available for
                           enhanced calibration and record keeping.

MicroDock II Automatic Test and Calibration Station

User Manual
Gas Alert Micro 5/PID/IR

ChemPro100i

Use of Instrument:

The ChemPro100i weights 2 lbs and is small enough to be used as a monitor to survey the scene after an event and as a personal detector. It uses an open loop Ion Mobility Spectrometer technology (IMS) and orthogonal sensors. Its Ion Mobility Cell is designed to detect chemical warfare agents (CWAs) and toxic industrial compounds/Materials (TICs/TIMs).

Specifications

Sensors	Orthogonal detection using and open loop IMS cell, temperature, humidity, pressure and mass flow sensors, 6 semiconductor sensors.
Detection Libraries	Chemical Warfare Agent/CWA std, First Responders (optional), Toxic Industrial Chemical (optional), CWA precursor (optional), Volatile Organic Compounds (optional)
Battery	Li-ion rechargeable and alkaline packs included
Operating Hours	8 hours continuous use of Li-Ion, 5 hours continuous on alkaline batteries, 12 hour continuous on Li-Ion AA batteries
Battery Recharge Time	5 hours using the standard power supplies, unit will run and charge simultaneously
Power	110-250 VAC, 50-60Hz Mains Power Supply
User Interface	Graphical LCD display with blue backlight and 3 operation keys
Sampling	1.3 LPM internal pump with continuous airflow
Calibration	No calibration is required, but a simple confidence check is recommended before use
Alarm Modes	Audible 85 db and visual alarm, optional earphone alarm available
Temperature	-22° to 131°F
Humidity	0-95% non-condensing
Dust & Water	IP67: dust tight (resists blowing sand MIL-STD-810F) and protected against water immersion when inlet is closed

Shock & Vibration Resistance	Highly resistant to electromagnetic & radio interference and does not generate electromagnetic interference
Use in Potentially Flammable Environments	Will not ignite in a n-Hexane atmosphere (Mil-STD-810°F)
Size	9" L x 4" W x 2" H
Weight	31 ounces with battery pack

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Website: ChemPro100i Operator's Manual – Environics ChemPro 100 Quick Reference Link: http://www.environics.fi/us/product/chempro100i/ quick reference.pdf

Contact: Tech support Christopher Wrenn, Environics USA (610)659-4507
          Don wolf & Associates, Inc., Retail representative (800)266-2046

Normal Operation of ChemPro100i

Start Up:

1. Startup procedures last 1-3 minutes depending on ambient temperature

2. Make sure that the ChemPro is turned on in a clean environment.

3. Open the storage cap at the top of the instrument by turning it counter-clockwise.

4. In a fresh air environment press the **ON/OFF** button to right, just below the display screen, to begin the start-up cycle. Built-in test checks RAM and Flash memory, IMCell channels, bias voltage and flow measurements.

Selecting menus

1. Press Menu button in main display

2. Select target menu by pressing the right button several times until the right menu appear.

3. Press the main menu button to select the appropriate menu.

Sensor Test

Sensor test should be performed and passed before every usage to assure the operation of all sensors.

1. Select the sensor test menu

2. Warm the test tube if necessary before the test. (Test tube contains a mixture of Propanol and Di-isopropyl Methyl Phosphonate (DIMP))

3. Open the Test Tube holder cap until the hole is fully visible.

4. With the field monitoring cap attached, insert to probe into the opening.

5. Keep the test tube in place until the display shows the condition of the sensors. (Test passed, or Test failed)

6. Close the Test Tube

7. Exit the sensor test mode (after 30 seconds)

Trend Function

1. Press the left button in the main menu display. Enable user to switch between gas libraries)

2. Press the right button to select "Gas library"

3. Select the required "Gas library" by using the down arrow button

4. Press the Main-menu button to select or confirm the library selection.

5. Exit back to the Trend screen by pressing the left-button

Shutting Down ChemPro100i

The shutdown process uses a two button process to avoid unwanted shutdown.

1. Press the right button (shut' down) for about three seconds until the shutdown screen appear

2. Press Menu-button (ok) to accept the shutdown.

3. Change the field monitoring cap to storage cap after shutdown.

Note: Run the ChemPro100i for a least 30 minutes after a significant chemical exposure to keep chemical contamination from permanently damaging sensors.

Gas Measurement Instruments (GMI)

Models: GMI VISA 5 Gas Detector
          GMI P200 Series Multi-Gas Detector
          GMI PT Series
          GMI PSI Single Gas Detector

VISA 5 GAS DETECTOR

Use of Instrument: Handheld meter for detection of up to 5 gases with catalytic sensors, PID and IR capabilities. For use in confined spaces and other hazardous environments. (This model is upgrade from Visa 4 Gas Detector).

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Specifications:

Measurements and Detection Ranges

Combustible Gases	0 – 100% LEL
Oxygen (O2)	0 – 25% Vol.
Carbon Monoxide (CO)	0 – 1,000 ppm
Hydrogen Sulfide (H2S)	0 – 100 ppm
Sulfur Dioxide (SO2)	0 – 30 ppm
Chlorine (CL2)	0 – 10 ppm
Ammonia (NH3)	0 – 100 ppm
Nitric Oxide (NO)	0 – 300 ppm
Nitrogen Dioxide (NO2)	0 – 20 ppm
Carbon Dioxide (CO2)	0 – 5% Vol.
Phosphine (PH3)	0 – 100 ppm

Sensors   14 interchangeable 'plug-in' catalytic, electrochemical, IR and PID sensors

<u>Power Source</u>	NIMH (rechargeable) or alkaline size AA batteries
<u>Detection Method</u>	Diffusion or electric pump (10 foot sample line)
<u>Display</u>	LCD
<u>Alarms</u>	STEL/TWA; Audio/Visual
	Data Logging: Built-in data retrieval which allows the storage of data; to include events and turn-off/on times.
<u>Calibration</u>	Manufacturer's <u>Visa Calibration Kit</u> can be used for bump test and auto-calibration.

<u>Visa Calibration Kit</u>

Handbook: http://www.gmiuk.com/product/visa/

Detcon (713) 559-9290 or GMI Instruments (716) 609-3053 or GMI main office 877-421-5315

GMI PS200 SERIES MULTI-GAS DETECTORS

Use of Instrument: Handheld meter simultaneously measures up to 4 gases (combustible, O2, CO and H2S). For use in confined spaces and other hazardous environments.

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Specifications:

Measurements and Detections Ranges

Combustible Gases	0 – 100% LEL
Oxygen (O2)	0 – 25% Vol.
Carbon Monoxide (CO)	0 – 1,000 ppm
Hydrogen Sulfide (H2S)	0 - 100 ppm

Sensors   5 Interchangeable sensors (4) LEL, O2, H2S, CO electrochemical and (1) dual toxic H2S/CO sensor

Methods of Detection   Diffusion or sampling pump (10 foot line). Optional hand aspirator (ten feet of tubing)

Power Source   Lithium Ion (rechargeable)

Alarm   STEL/TWA;Audio/Visual/Vibrating

Display   LED

Data Logging   Capabilities for event recording and calibration tests for automatic storage and later downloading into a PC via a USB connection

Calibration   Bump/auto-calibration testing using manufacturers supplied test gases. Stand Alone: PS200 Auto Bump/Calibration Station enhances calibration and data storage.

PS200 Auto Bump/Calibration Station

User Handbook
http://www.sedasl.es/resources/64171a_01+PS200+User+Handbook.pdf

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PS200

Start Up (Normal Operation):

1. Press and hold the right hand button to   (⏻)   activate the unit. A 30 second warm up begins.

2. Check battery status.

3. Attach accessories if needed.

4. Perform a leak test.

5. Unit is ready for use.

   Display changes from **green** to **red** when an alarm condition exists.

   Clear or acknowledge an alarm press the right hand button   (⏻)

Turn the unit off by pressing the left hand button.

GMI GT SERIES

Use of Instrument: Handheld meter with seven (7) application modes. Designed for use by gas technician in the gas industry. Can be used in confined space entry and hazardous environments for monitoring methane gas. Seven application modes:

1. Confined Space Mode measures up to 4 gases simultaneously (O2,LeL, CO, H2S)
2. Leak Test Mode measures methane in 3 ranges (ppm, LEL, % Vol.)
3. Barhole Mode for testing underground leaks
4. Carbon Monoxide Mode measures CO directly in ppm
5. Project Mode measuring methane 0 – 100 ppm
6. Sniffer Mode enables rapid leak detection by measuring methane 0 – 1,000 ppm
7. Pressure Mode measures from 0 – 60 inches of water column via a pressure sensor on the back of the instrument. For tightness tests on gas systems up to 2 psi.

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Specifications:

Measurements and Detection Ranges

Combustible Gases	0 – 100% LEL
Oxygen (O2)	0 – 25% Vol.
Carbon Monoxide (CO)	0 – 2,000 ppm
Hydrogen Sulfide	0 – 100 ppm

Sensors   7 interchangeable electrochemical, semiconductor, catalytic bead and thermal conductivity sensors

Detection Method   Integral pump

Display	LED
Power Source	Alkaline size C batteries
Alarms	STEL/TWA; Audio/Visual
Data Logging	Automatic data logging
Calibration	Alone GT Series Bump Test & Calibration Station Stores calibration test results

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User Handbook
GMI GT SERIES

GT series

Start Up (Normal Operation):

1. Tightly screw in 'clear bulb'.

2. Switch on unit by pressing and holding the right hand ⏻ button for 1 second to initiate the warm up sequence. When warm up is complete, screen light switches off.

3. Attach accessories if needed. Unit is ready to operate in the configured option.

   Power on LEDs will be illuminated (LEDS on the left bottom)

After use allow the unit to run 1 – 2 minutes in fresh air prior to switching off. Switch the unit off by pressing and holding both the left hand and (((right hand ⏻ buttons. Hold the buttons throughout the countdown.

GMI PS1 SINGLE GAS DETECTOR

Use of Instrument: Handheld single gas detection meter with interchangeable sensors to monitor O2, H2S, CO, and SO2. Used for monitoring of single known gases.

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Specifications

Measurements and Detection Ranges

Oxygen (O2)	0 – 25% Vol.
Hydrogen Sulfide	0 – 100 ppm
Carbon Monoxide (CO)	0 – 500 ppm
Sulfur Dioxide (SO2)	0 – 20 ppm

Sensors   Interchangeable electrochemical sensors (O2, H2S, CO, SO2)

Display   LCD

Power Source   Lithium heavy duty 3.6V battery

Alarms   STEL/TWA; Audio/Visual/Vibrating

Data Logging   Internal data logging for bump/calibration results

Calibration   Manual testing can be performed by using manufacturer's supplied calibration gas kit. Stand Alone: PSI Auto Bump/Calibration Station with data record keeping capabilities.

User Handbook
http://www.gmiuk.com/images/library/manuals/63183_07.pdf

PSI Auto Bump/Calibration Station

DRAGER GAS MONITORS

Models: Drager x-am 7000
                   Drager x-am 5600
                   Drager x-am 2500
                   Drager Pac 3500/5500

DRAGER X-AM 7000

<u>Use Instrument:</u> Handheld meter with simultaneous and continuous detection of up to five gases simultaneously. For use in confined space and other hazardous environments.

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Specifications

<u>Measurements and Detection Ranges</u>

Combustible Gas	0 – 100% LEL
Oxygen (O2)	0 – 25% Vol.
Carbon Monoxide (CO)	0 – 2,000 ppm
Hydrogen Sulfide (H2S)	0 – 100 ppm
Carbon Dioxide (CO2)	0 – 5% Vol.
Sulfur Dioxide (SO2)	0 – 100 ppm
Nitrogen Dioxide (NO2)	0 – 50 ppm
COCL2	0 – 3 ppm
Ammonia (NH3)	0 – 50 ppm
Hydrogen Cyanide (HCN)	0 – 50 ppm
Chlorine (CL2)	0 – 20 ppm
Hydrides	0 – 20 ppm
Hydrogen (H2)	0 – 2,000
PID Sensor	0 – 2,000

<u>Sensors</u>   Over 25 interchangeable catalytic bead, electrochemical, PID and IR sensors
                      enables the detection of over 100 gases and vapors.

<u>Detection Method</u>   Diffusion or pump mode; built in pump (up to 150 foot draw)

Power Source   NIMH or alkaline size C batteries

Alarms   STEL/TWA Alarms; Audio/Visual

Display   LCD

Data Logging   Use of a data logger to record monitoring information. The data   can be
                      transferred to a PC using an infrared interface together with the Drager
                      GasVision software package.

Calibration   Stand Alone: Drager X-am 7000 Bump Test Station with calibration adapter
                      for test gas cylinder auto-calibration.

Drager X-am 7000 Bump Test Station

| Handbook:: http://draeger-mo.com/files/x-am_7000_instructions.pdf |
| Contact – Drager (800) 752-8472 |

X-am 7000

Start Up (diffusion mode):

1. Press and hold **OK** key for 3 seconds. A green operating LED will illuminate and
    countdown sequence will begin, release **OK** when countdown reaches 0.

    The self-test and warm up period automatically initiates. When the warm up is complete
    the unit is in the measuring mode and ready for use.

    Acknowledge an alarm condition by pressing the **OK** key

    ↑↑↑ indicates the measuring range has been exceeded.

    - - - - ambient concentration lower than minimum value.

Power down the unit by pressing and holding both the ▲ and ▼ keys for more than 3 seconds
   to initiate the shutdown sequence. Continue holding the keys throughout the count down.
   Releasing the buttons before reaching zero will return the unit to the measuring mode

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DRAGER X-AM 5600

Use of Instrument: Handheld meter for the monitoring of up to 6 gases simultaneously. Used for confined spaces and other hazardous environments.

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Specifications:

Measurements and Detections Ranges

Combustible Gases	0 – 100 LEL
Oxygen (O2)	0 – 100% Vol.
Carbon Monoxide(CO)	0 – 2,000 ppm
Hydrogen Sulfide (H2S)	0 – 200 ppm
Carbon Dioxide (CO2)	0 – 5% Vol.
Nitric Oxide (NO)	0 – 200 ppm
Nitrogen Dioxide (NO	0 – 50 ppm
Sulfur Dioxide (SO2)	0 – 100 ppm
Phosphine (PH3)	0 – 20 ppm
Hydrogen Cyanide (HCN)	0 – 50 ppm
Ammonia (NH3)	0 – 300 ppm
Chlorine (CL2)	0 – 20 ppm
Hydrogen (H2)	0 – 2,000 ppm

Sensors   Interchangeable IR(3) and electrochemical (24) sensors

Power Source   NiMH (rechargeable) or Alkaline batteries

Detection Methods Diffusion or external pump (hoses draw up to 100 feet). Option: hand pump adapter

Display   LCD

Alarms   STEL/TWA; Visual/Audio/Vibrating

Data logging   PC Software <u>Drager CC-Vision Software</u> record and storage of events

Calibration   Manual bump testing/auto-calibration using manufacturer's gas supply Stand Alone: <u>Drager Bump Test and Calibration Station</u>

<u>Drager Bump Test and Calibration Station</u>

Manual:
http://www.draeger.net/media/10/08/02/10080210/9046571_DraegerSensor_Handbook_en.pdf

DRAGER X-AM 2500   (Replaces Drager am-x 2000)

Use of Instrument: Handheld meter for the simultaneous monitoring of 1 – 4 gases. For use in confined space and other hazardous environments.

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Specifications:

Measurements and Detection Ranges

Combustible Gases	0 – 100% LEL
Oxygen (O2)	0 – 25% Vol.
Hydrogen Sulfide (H2S)	0 – 100ppm
Sulfur Dioxide (SO2)	0 – 100 ppm
Nitrogen Dioxide (NO2)	0 – 50 ppm

Sensors   5 interchangeable catalytic and electrochemical sensors

Power Source   NiMH (rechargeable) or Alkaline batteries

Detection Methods Diffusion or external pump (100 foot draw)

Display   LCD

Alarms   STEL/TWA; Audio/Visual/Vibrating

Data Logging   Data retrievable to PC with Drager CC-Gas Vision software with IR adaptor to USB cable

Calibration   Stand Alone: Drager Bump Test and Calibration Station. Bump test using manufacturer's gas cylinder mix.

X-am 2500

Start Up:

1. Press and hold **OK** key for 3 seconds.

    The self-test and warm up period automatically initiates. When the warm up is complete the unit is in the measuring mode and ready for use.

2. Check that the inlet opening is not covered.

    Acknowledge an alarm condition by pressing the **OK** key

Power down the unit by pressing and holding both the **OK** and **+** keys for more than 3 seconds to initiate the shutdown sequence. Continue holding the keys throughout the count down. Releasing the buttons before reaching zero will return the unit to the measuring mode.

DRAGER PAC 3500/5500

Instrument Use: Handheld <u>single</u> detection meter for carbon monoxide, hydrogen sulfide or oxygen. 'For measurement of a known chemical in potentially hazardous environments.'

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Specifications:

<u>Measurements and Detection Ranges</u>

Oxygen (O2)	0 – 25% Vol.
Hydrogen Sulfide (H2S)	0 – 100 ppm
Carbon Monoxide (CO)	0 – 500 ppm

<u>Sensors</u>   Electrochemical sensors for each gas (CO, H2S, and o2)

<u>Power Source</u>   Lithium battery (rechargeable)

<u>Detection Method</u> Diffusion

<u>Alarms</u>   STEL/TWA; Visual/Audio

<u>Display</u>   LCD

<u>Data Logging</u>   Stores monitoring data/can be linked to a PC via a connecting cable.

<u>Calibration</u>   Bump tests and auto-calibration Stand Alone: Drager <u>Bump Test Station Drager Pac 3500</u>

Drager Bump Test Station Drager Pac 3500

Reference Link:
http://www.draeger.net/media/10/08/02/10080210/9046571_DraegerSensor_Handbook_en.pdf

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SCOTT BACHARACH Multi Gas Detectors

Models: Scott Protégé Multi-gas Monitor
                   Scott Scout Multi-Gas Detector

SCOTT PROTÉGÉ MULTI-GAS MONITOR

Use of Instrument: Handheld 4 gas meter with the capability for simultaneous readings.   Used in confined spaces and other hazardous environments. (Replaces Scott Scout Multi-Gas Meter)

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Specifications:

Measurements and Detection Ranges

Combustible Gas	0 – 80% LEL
Carbon Monoxide (CO)	0 – 999 ppm
Hydrogen Sulfide (H2S)	0 – 500 ppm
Oxygen (O2)	0 – 25% Vol.

Sensors   5 electrochemical interchangeable sensor combinations for use in this 4 gas continuous display meter

Detection Methods   Diffusion mode with optional pump and 12 inch tubing

Power Source   Lithium Ion battery

Display   LCD

Alarms   STEL/TWA; Audio/Visual/Vibrating

Data Logging   Data download capabilities with logging to PC

Calibration   Automatic zero calibration and bump test using manufacturer's supply kit. Stand Alone: Protégé Masterdock Automated Bump Test and Calibration Station for enhanced calibration and data retrieval.

Protégé Masterdock Automated Bump Test and Calibration Station

Instruction Manual
https://www.scottsafety.com/en/anzp/DocumentandMedia1/Protege Manual_REVL.pdf

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Protege

Start Up:

1. Press and hold down either the right or left operation button until the LCD displays release. The self-test sequence initiates. When the sequence is complete the unit is in the monitoring mode and ready for use.

   Blinking heart ♥ on the display indicates the device is in the monitoring mode

   If the gas type label blinks with no audible, sensor is detecting a negative drift. Perform a zero calibration.

   +++ indicates concentration exceeds sensor range

   > If an over range condition is encountered, bump test the unit. If it fails the bump test, perform a full calibration.

Power down the unit by pressing both the left and right operation buttons until the countdown and LCD shuts off.

SCOTT SCOUT MULTI-GAS DETECTOR

(This monitor was discontinued by Scott Safety; Effective 12/31/2011)

Use of Instrument: Multi-gas monitor can detect up to 5 gases simultaneously, with up to 9 sensors capable of measuring a variety of gases. For use in confined spaces, site remediation and other hazardous environments.

Specifications:

Measurements and Detection Ranges

Combustible Gases	0 – 100% LEL
Oxygen (O2)	0 – 30%
Carbon Monoxide (CO)	0 – 999 ppm
Hydrogen Sulfide (H2S)	0 – 500%

Sensors — 9 electrochemical sensors for CO, O2, H2S and combustible LEL and a variety of chemicals PID sensors can detect HCN, NO2, and SO2.

Detection Methods — Diffusion mode and internal pump/option – hand drawn aspirator.

Power Source — Lithium Ion or Alkaline size C batteries

Alarms   STEL/TWA– Audio/Visual

Data Logging   Event log menu with events and dates transfer to PC

Calibration   Automatic zero calibration/bump test to known gas concentration

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Users Guide: http://www.enviroequipment.com/rentals/PDF/Scott-Scout-Manual.pdf

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(800) 247-7259 (Monroe NC)

SCOUT

Start Up:
  1. Press and hold any of the four function buttons.

      After the initialization process, the unit goes right into monitoring mode and is ready for use

      Flashing +++ indicates over range conditions

      Interfering gases can potentially cause a negative reading or zero drift
Power down the unit by pressing both the lower left and right operation buttons simultaneously for 3 seconds. Press the upper left button to complete the shutdown sequence.

THERMO SCIENTIFIC FIELD ANALYZER

Model: TVA2020 Toxic Vapor Analyzer

Instrument Use: Portable analyzer configured as a Flame Ionization Detector (FID) or dual detection technology (FID/PID-photo ionization detector). TVA2020 detects organic and inorganic compounds in applications such as Method 21 monitoring and site remediation that are intrinsically safe.

Specifications:

Accuracy	FID Instrument–±10% of reading or ±1.0 ppm, whichever is greater, from 1.0 to 10,000 ppm PID Instrument–±20 % of reading or ±0.5 ppm, whichever is greater, from 0.5 to 500 ppm
Components Measured	Most organic and inorganic compounds
Concentration Measurement Range	FID: 0-30,000 ppm (methane) PID: 0-2,000 ppm (isobutylene)
Outputs	BluetoothTM, USB
Serial Interface	USB
Voltage	100-230 V
Weight (English)	FID only—9.2 pounds Dual—9.4 pounds
Width (English)	9 in
Battery Type	Lithium ion
Detector Type	FID or PID/FID
Portable Operation Time	Minimum 10 hours

Operating Manual
http://www.geotechenv.com/Manuals/Thermo_Scientific_Manuals/Thermo_Scientific_
TVA2020_Instruction_Manual.pdf

Start Up (Normal Operation):

ON   The ON key enables power from the battery to the instrument.

OFF   The OFF key disables power from the battery to the instrument.
                            CONTROL
                            The CONTROL key is multi-function and is used to turn the pump,
                            PID, and FID, Bluetooth and GPS on or off, and to ignite the FID.
                            Note: Value displayed is opposite of existing status. If pump
                            displays "OFF", you would press the 1 key to turn it off.

EXIT   The EXIT key clears any entry made in error or bypasses
                            information that you do not want to change, and clears error or
                            warning screens.

ENTER   The ENTER key has three functions:
                              1. Press ENTER if you have typed one or more characters
                                 and wish to keep that information.

                              2. Press ENTER to respond to a menu question.

                              3. Press ENTER instead of entering the logging mode from
                                 the enhanced probe to initiate logging.

Left/Right Arrows   The left and right arrow keys move character entry positions.

Up/Down Arrows   The up and down arrow keys make page selections or scroll
                            through options in SETUP entry screens and info screen.

Alphanumeric   The alphanumeric keys enable you to type letters or numbers into
                            various menus. If a display asks for a number only, simply press
                            the desired key. Two steps are required to type an alphanumeric
                            character. First, press the key with the desired letter or number.
                            The screen then displays a selection prompt at the bottom in
                            which 1 = first letter, 2 = second letter, 3 = third letter, and 0 =
                            number. Press the appropriate key to execute the selection. Three
                            uses:
  • Select menu options
  • Enter numbers, 0-9, using single keystroke
  • Enter alphanumeric data, A-Z, 0-9, SPACE, using 2 keystrokes per character

LANDTEC GEM5000

Instrument Use: Portable gas analyzer designed specifically to monitor landfill gas (LFG) extration systems, flares, and migration control systems. Additional uses include monitoring subsurface migration probes, and measuring gas composition, pressure and flow of gas extraction systems.

Model: Gem5000

Specifications:

Measurements and Detection Ranges

Combustible Gases (CH4)	0 – 100% VOL
Carbon Dioxide (CO2)	0 – 100% VOL
Oxygen (02)	0 – 25% VOL
Carbon Monoxide (CO)	0 – 2000 PPM
Hydrogen Sulfide (H2S)	0 – 500 PPM

Sensors   Dual-wave length infrared cell

Display   LCD

Power Source   Nickel metal hydride

Alarms   Automatic detection and structured organization of transferred data

Calibration   ISO/IEC 17025 calibrated at time of manufacture

Field Operations Manual
http://www.geotechenv.com/Manuals/CES-Landtec_Manuals/GEM5000_Manual.pdf

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Gem5000

Start Up:

Steady yellow   Unit turning on. This will extinguish when software has loaded correctly.

Flashing (rapid)   Unit is powering off.

Flashing (slow)   Power off is being delayed for purge/shutdown handling.

Flashing yellow   Unit is turning off due to power button being pressed.

Flashing red   Unit is turning off due to critically low battery.

Date/Time Settings

Click on the Set to System Date/Time button.

Answer Ok and the instrument's date/time will set to that of the computer.

Date: Use the calendar options to select the desired date.

Time: Use the up and down controls to select the desired hour and minutes.

Set Date/Time in the instrument: Click the Set Date/Time button to apply the settings to the instrument.

HAZARDOUS MATERIALS FIELD GAS ANALYZERS

Field Gas Analyzers

Using spectrometry for the measurement of hundreds of different compounds, the field gas analyzer can be used as a survey tool, specific gas monitor or for Chemical Warfare Agents (CWCs). This is not a monitor to be used for confined space entry. Software allows the use of a library of compounds that can be identified in the field. Gases are drawn into a portable monitor for spectral analysis; with information then transferred to a PC for data retrieval, further analysis and record keeping. Both identification of a specific gas and concentration can be obtained.

Materials Solids and liquid Field Analyzers

Using spectrometry for the identification of unknown materials (solids/liquids). Software allows the use of a library of compounds that can be identified in the field. Solid and liquid chemical samples are placed on a portable monitor for spectral analysis; with information then transferred to a PC for data retrieval, further analysis and record keeping.

Mercury Vapor Analyzers

Using atomic spectroscopy, mercury vapors can be identified by use of portable mercury vapor analyzers. Used for environmental spills, contaminated sites and cleanup analysis. Monitors have capabilities for data retrieval, logging and storage.

Glossary of Specifications

Infrared Spectroscopy	Chemicals will absorb infrared light. The absorption pattern is unique to specific chemicals which is called a spectrum. The infrared spectrum is recorded by passing an infrared beam through a sample and light energy absorbed reveals specificities at each frequency or wavelength. The spectrum of the sample can be matched to a library sample for identification and quantification of a chemical.
Ramon Spectroscopy	An analytical technique using laser technology.
Ion Mobility Spectrometry	Use analytical technique to identify ionized molecules in gas phase. Use for mercury vapor detection.
Atomic Spectroscopy	Use of electromagnetic radiation absorbed and emitted by atoms Used in mercury vapor detection
Teguchi Gas Sensors	Gas detectors that measure the concentration by oxidizing the target gas at an electrode and measuring the resulting current. Also known as an electrochemical gas sensor.
Fournier Transform Infrared	A measurement technique for recording infrared spectra. (FTIR) Spectroscopy
Toxic Industrial Chemicals	NATO's International Task Force established a list of 25 Toxic Industrial Chemicals (TIC's) that could cause harm in military

operations. The TICs are considered easier to use than conventional chemical and biological weapons and are more readily available.

Chemical Warfare Agents   Manufactured as weapons to be used in warfare and must be toxic enough to cause instant harm when inhaled or in contact with skin.

Library   Single gas calibrations are established in a standard library and through the use of a PC matched for selection of a compound from the infrared spectrum.

THERMO MIRAN SAPPHLRE PORTABLE INFRARED AMBIENT AIR (GAS) ANALYZER

Use of Equipment:

Portable infrared ambient air analyzer different from other gas monitors with the ability to measure over 100 different compounds. Can be used as a survey tool or gas monitor by emergency responders in hazardous environments. Not a tool for confined space entry.

Specifications:

Measurement and Detection
Analysis of up to 120 compounds with results displayed in ppm, ppb, percent (%) or Absorbance Units (AU) with detection range charts for each compound provided by the manufacturer

Infrared Spectroscopy	ThermoMatch software/match with manufacturers' library of over 120 compounds
Detection Method	Pump with 4 foot tubing and attached wand.
Power Source	NiCD (rechargeable) battery. Connector available for auto cigarette lighter socket, with AC and DC capabilities
Display	LCD
Alarms	STEL; Visual/Audio
Data Logging	ThermoConnect software for downloading, analyzing and storing data
Calibration	"Zero Score" automatic auto-calibration using a known substance injected into the monitor. Information saved on PC.

Reference Link: https://www.thermo.com/eThermo/CMA/PDFs/Various/File_27169.pdf

Contact (866) 282-0430 (MA)

SapphIRe

Start Up:

1. Connect the wand to the analyzer Press the ON/OFF key. Allow 20- 30 minutes for warm up

2. Select gas. Zero the analyzer (install chemical filter). The unit is ready for use.

3. Replace chemical filter with particulate filter, and press enter to draw sample.

4. Press and hold any of the four function buttons.

    After the initialization process, the unit goes right into monitoring mode and is ready for use

    Flashing +++ indicates over range conditions

    Interfering gases can potentially cause a negative reading or zero drift

Power down the unit by pressing the control key. Then use the arrow keys to select the desired function and press Select or Enter.

GASMET DX 4040 PORTABLE FTIR GAS ANALYZER

Instrument Use: Portable FTIR gas analyzer for measuring multiple gases (both organic and inorganic) at low concentrations in real-time. For use at chemical spills and other hazardous environments. Not used for confined space entry.

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Specifications:

Measurement and Detection Ranges

In standard configuration mode can measure 25 gases simultaneously. A large manufacturer supplied chemical library provided in instrument software provides capability for the measurement of numerous compounds.

Infrared Spectroscopy	Fourier Transform Infrared (FTIR) Spectroscopy
Detection Method	Internal pump with attached tubing (wand)
Power Source	Battery or AC power supply
Data Logging	Using Calcmet Lite Software: the analyzer is connected to a PDA with Bluetooth for analysis results.
Display	LCD
Calibration	Zero calibration with clean air or nitrogen

Reference Link: **GASMET DX 4040 FTIR Gas Analyzer**
Gasmet Technologies (866) 685-0050

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Gasmet™DX4040

Instrument use: Portable ambient gas analyzer that traces greenhouse gas emissions from the soil and air.

Measurement and Detection Ranges:

Can detect up to 25 gases simultaneously providing validated results in 25 seconds. With Calcmet Software, it allows users to have access to a library with over 250 gases and 50 gas measFTIR stands for Fourier Transform Infrared Spectroscopy. An FTIR gas analyzer detects gaseous compounds by their absorbance of infrared radiation. Because each molecular structure has a unique combination of atoms, each produces a unique infrared spectrum. From this, identification (Qualitative analysis) and analysis (Quantitative measurement) of the gaseous compounds is possible. An FTIR analyzer simultaneously measures multiple analytes in a complex gas matrix, detecting virtually all gas-phase species (both organic and inorganic).

Gasmet™ FTIR gas analyzer collects a complete infrared spectrum (a measurement of the infrared light absorbed by molecules inside the sample gas cell) 10 times per second. Multiple spectra are co-added together according to selected measurement time (improving signal-to-noise ratio). The actual concentrations of gases are calculated from the resulting sample spectrum using patented modified Classical Least Squares analysis algorithm.

Calcmet DX4040 Standard	Calcmet DX4040 Pro
• Gasmet Reference Library (250 gases) • Possibility to identify unknown compouds • Reconfiguration of PDA analysis settings for 25 gases	• Possibility to measure 50 gases simultaneosly with PC via RS-232 port • Gasmet Extended Reference Library including over 5,000 gases • Identification of gas components using library search routine • Possibility to use NIST library • Single user license protected with HASP USB key

Infrared Spectroscopy: Fourier transform infrared, FTIR
Detection Method: Internal Pump with attached tubing (wand)

Power Source: Battery can be charged both inside the analyzer and via charger.
Roughly, 2.5 hours operation time with bluetooth on.
115/230 VAC

Data Logging: Calcmet Software with DX4040 Pro key. Laptop PC+Windows7(32-bit)
required.

Calibration: Zero Calibration with clean air or nitrogen once a day.

Reference Link: Technical Data

SMITHS DETECTION HGVI HAZARDOUS GAS AND VAPOR IDENTIFIER

Instrument Use: Handheld multi-sensor for the detection of Toxic Industrial Chemicals (TIC) and Chemical Warfare Agents (CWA) used for first responders for unknowns at hazard incidents. Instrument can be operated while wearing Level 'A' gear.

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Specifications:

Measurements and Detection Ranges
- Chemical Warfare Agents- nerve, blister, blood and choking agents
- Toxic Industrial Chemicals – high and medium hazard materials from the International Terror Force 25 List (ITF)
- Gamma Radiation

Sensors	Ion Mobility Spectrometry (IMS); Photoionization; Taguchi Gas Sensors (TGS)
Power Source	Lithium Ion (rechargeable battery; 'cigarette' lighter power adapter
Display	LCD
Alarms	Audio/Visual/Vibrating
Data Logging	Data retrieved using H-Fusion Enhancement Software; HGVI LINK Wireless Communcations Kit with RF Modem on linx enables transfer of reading to remote locations.

Website: HGVI Hazardous Gas and Vapor Identifier

Federal Resources (800) 892-1099

SMITHS DETECTION APD 2000

Instrument Use: Hand-held monitor and detector designed for emergency first responders to hazardous chemical releases and Chemical Warfare Agents (CWA). Simultaneously detects nerve and blister agents, and recognizes pepper spray and mace. Sensors options can monitor radiation (gamma, x-ray) and hazardous compounds.

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Specifications:

Measurements and Detection Ranges
        Chemical Warfare Agents (CWA) and hazardous chemicals can be identified to include relative concentrations

ID System   Ion Mobility Spectrometry (IMS)

Power Source   Alkaline size C batteries

Alarms   Audio/Visual

Data Logging   Communication cable links monitor with PC. Used with APD Datalogger Software

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User's Manual
http://www.livoniafirefighters.com/docs/APD2000 TM 2.0.pdf

Contact Smiths Detection (410) 510-9141

APD 2000

Start Up (Detect Mode):

1. Install the batteries.

2. Remove the protective cap and attach the nozzle

3. Press and hold power button until APD appears

4. Wait 3 minutes for self-test to complete

   When display shows Ready CW or CWVX it is ready for use.

   Do not touch the nozzle or filter nozzle standoff

   Interfering gases can potentially cause a negative reading or zero drift

To shut down, in a clean environment press and hold the power button for 1 second. Remove the nozzle standoff and treat as hazardous waste if CW has been detected. Cover nozzle with protective cap and remove batteries from handle.

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Thermo Scientific Field Analyzers

THERMO SCIENTIFIC FIRST RESPONDER/TRUDEFENDER FIELD ANALYZERS

Instrument Use: Portable analyzers for the field identification of unknown chemicals (solid/liquid/headspace gas), to include toxic industrial chemicals, explosives, narcotics, chemical warfare agents, powders (anthrax) and other common chemicals. Based on Raman Spectroscopy. Not used for confined space entry.

Models: First Defender RMX (solid/liquid identification)
TruDefender FTG (headspace gas detection)
TruDefender FT (solid/liquid identification)

First Defender RMX and TruDefender FTi
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Specifications:

Measurements   Measures explosives, narcotics, toxic industrial chemicals (TICs), chemical warfare agents (CWAs), powders (anthrax) and other common chemicals.

ID System   Fournier Transform Infrared Raman Spectroscopy (FTIR) with manufacturers supplied library for detection of hundreds of chemicals.

Detection Method   TruDefender FTG – internal pump First Responder RMX/TruDefender FT – manual solid material or liquid sampling

Power Source   Lithium Ion (rechargeable) battery/DC wall adaptor

Data Logging   Can be transmitted to PC for remote monitoring, data retrieval and storage

Calibration   Poly-styrene (known sample) system readout

Notes: Thermo Scientific – Thermo Innova Model has been discontinued

Thermo Scientific – formally AHURA Scientific

Reference Link: http://www.ahurascientific.com/chemical-explosives-id

(978) 657-5555

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FirstDefender

Start Up:

1. Press the power key. Enter the password

2. Position the instrument or insert vial. Press the scan key

   Hold the instrument still during the scan

To power down, press and hold the power button for several seconds.

TruDefender

Start Up:
1. Press the power key.

2. Clean the tip

3. Press Go to perform a background check

4. Position the unit

5. Press the scan key

   Hold the instrument still during the scan
To power down, press and hold the power button for several seconds.

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SMITHS DETECTION HAZMATID RANGER

Use of Instrument: Portable analyzer used for the identification of unknown materials (solids/liquids) including chemical warfare agents (CWAs), common chemicals, explosives toxic industrial chemicals (TICs) and narcotics. Over 30,000 liquid/solids can be identified using a manufacturer's supplied chemical library. Not used for confined space entry.

Specifications:

Measurements

Detection of over 30,000 chemicals (solid/liquid). Explosives, common chemicals, narcotics, organic (petroleum products, pesticides, fertilizers; in-organics (mineral acids, inorganic oxides, nitrates, chlorates and phosphateS); and unknown powders (anthrax).

ID System   Fournier Transform Infrared – FT-IR/Raman Spectroscopy with manufacturer's chemical library for detection of over 30,000 chemicals

Display   LCD

Power Source   Lithium Ion (rechargeable) or AC Power

Data Logging   Spectra can be transmitted to wireless to a PC for remote monitoring and retrieval/storage of information

Calibration   Effective cleaning of Diamond Internal Reflection Element is auto-displayed on spectrum readout.

Reference Link:
http://www.smithsdetection.com/index.php/products-solutions/chemical-identification.html

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X-MET800 Series

Models: X-MET800 Smart, X-MET8000 Optimum, X-MET8000 Expert

Instrument Use: Portable handheld XRF analyzers monitor a variety of metal alloys using a combination of a high performance X-ray tube and Oxfords Instruments' large area silicon-drift detector (SDD). Three X-MET800 series: X-MET8000 Smart rapidly sorts common alloys; X-MET8000 Optimum is optimized for the high speed sorting and analysis of alloys, from aluminums to bronzes to stainless steels etc. Lastly, X-MET8000 Expert provides the ultimate performance for the testing of the widest variety of alloys; with superior light elements (Mg, Al, Si, P and S), tramps and penalty analysis. All designed for the toughest environments with "point and shoot" simplicity. Exhibiting a large 4.3" color touchscreen for excellent results and easy operation with gloves on.

SMART	**OPTIMUM**	**EXPERT**

Specifications:

Measurement and Detection Ranges

	X-MET8000 SMART	X-MET8000 OPTIMUM	X-MET8000 EXPERT
X-ray tube	40K	50kV for enhanced heavy elements analysis (e.g. Sn, Ag, Cd)	
X-ray tube filters	Single filter	6 position filter wheel for optimized analysis of all elements from Mg to U	
Detector	Large area SSD	Large area SSD	Large area SSD
Element Range	K-U	Mg-U	
Max. Sample Temperature	400^0C	100^0C 400^0C with HERO™ (heat resistant) window (optional)	
Calibrations	Standard less	Standard less (includes light element analysis	Standard less + automatic selection of empirical calibrations (traceable to certified reference materials) for superior precision and accuracy

<u>Sensors</u>   X-ray tube
<u>Detection Method</u>   Oxfords Instruments' large area silicon-drift detector (SDD)
<u>Power Source</u>   10-12 hours battery life
<u>Display</u>   4.3" color touchscreen

Calibration	X-MET8000 provides a robust fundamental parameters (FP) method and empirical calibrations that are traceable to certified reference materials.
Data Logging	Store up to 100,000 results including spectra and sample image (if camera is fitted)
	Download results and reports directly to a USB memory stick, to a PC or a network share using Wi-Fi or Bluetooth, using a CSV format or tamper-proof PDF for ultimate data integrity, create customized, professional looking reports using the X-MET report generator (no software installation needed): include company logo, sample image, results, spectra, additional sample information (e.g. description, location, batch number) etc.
	Use real-time averaging for effortless batch evaluation

Website: www.oxford-instruments.com/X-MET8000

Jerome Mercury Vapor Analyzers (Arizona Instruments)

JEROME 411/431 MERCURY VAPOR ANALYZERS

Use of Instrument: Portable meters (Models 411 and 431) designed to detect mercury vapors in hazardous areas for the location and concentrations of mercury from spills and other environmental contamination.

| **Model 411** | **Model 431** |

Specifications:

Measurements and Detection Ranges

Mercury (Hg) vapors	Ranges:
Model 411	0 – 1.999 mg/m3Hg
Model 431	0.001 – 0.999 mg/m3Hg

Sensor	A thin gold film in the meter will undergo an increase in electrical resistance proportional to the mass of mercury in a sample.
Power Source	NiCd rechargeable batteries or AC power generator
Display	LCD
Detection Method	Internal intake pump with probe attachment
Data Logging	Model 431 Jerome Communications Interface Software for retrieval and storage of data on a PC
Calibration	The gold film sensor does not require frequent calibration and manufacturer's recommendation is annual factory servicing. The manufacturer's Functional Test Kit AZIP/N-0902 is used in between annual servicing to determine if the instrument is within calibration tolerances.

Manual Model 411: <u>JEROME MERCURY VAPOR ANALYZER</u>

<u>411</u>

Start Up (Detect Mode):

1. Ensure the zero air filter is installed in the instruments intake. Press the power button.

2. Attach line cord and plug into an outlet

3. Perform a film heat (15 minuet cycle)

4. Wait 30 minutes before continuing to use the instrument

5. Press sensor status if within the range, the unit is ready for use.

    411 is intended for vapor use only

    Sensor Status must be between 01 and 99 to operate, occasionally check status.

    Sampling period is a 10 second cycle

    Once initiated, do not interrupt the film heat cycle.

    A probe may be used to locate mercury in hard to reach places. Plug probe directly into intake.

To shut down, press the power off button. Plug the zero air filter into the intake during storage.

Manual Model 431: <u>JEROME MERCURY VAPOR ANALYZER</u>

AZI Instruments (800) 528-7411

<u>431-X</u>

Start Up (Sample Mode):

1. Ensure the zero air filter is installed in the instruments intake.

2. Attach line cord and plug into an outlet.

3. Press the power button.

4. Sample continuously (12 sec cycle) until readings stabilize.

5. Perform sensor regeneration (10 minuet cycle). **0.0.0** is displayed when complete.

6. Remove power cord, unit is ready for use after zeroing.

7. Wait 30 minutes before zeroing the instrument for maximum accuracy. Unit can be re-zeroed immediately after sensor regeneration if immediate use is needed.

> Press and hold sample button to enter survey mode. Take several samples for approximately 1 minuet to zero. (Instrument will sample for 12 seconds then go into 3 second sampling cycles). Release sample button to exit survey mode.

431-x is intended for vapor use only. Do not allow probe or instruments intake to be exposed to any liquid, dust, or other foreign matter

8.8.8. indicates sensor is saturated

Approximately 65 samples at .1mg/m^3 may be taken before regeneration is required.

Use survey mode to locate mercury spills or assess areas of potentially high mercury concentrations

Once initiated, do not interrupt the sensor regeneration cycle. AC power is required to thermally regenerate the sensor. When in storage, at a minimum, regenerate every 30 days.

A probe may be used to locate mercury in hard to reach places. Plug probe directly into intake.

To shut down, press the power off button. Perform the sensor regeneration prior to storing the instrument and ensure the zero air filter remains plugged in during storage

JEROME J405 MERCURY VAPOR ANALYZER

Use of Instrument: Portable mercury vapor analyzer for low level mercury detection for spills and other environmental contamination and cleanup analysis. The J405 in the Jerome 400 series models (preceded by the 411/413) and has lower detection capabilities.

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J405 Mercury Vapor Analyzer

Specifications:

Measurement and Detection Ranges

Mercury (Hg) Vapors	Range:	0.5 – 999 ug/m3Hg (0.0001 – 0.999 mg/m3Hg)

Sensor	A thin gold film in the meter will undergo an increase in electrical resistance proportional to the mass of mercury in a sample.
Power Source	NiMH rechargeable batteries or 24V DC power adapter/AC power supply/charger
Detection Method	Internal intake pump with probe attachment
Display	LCD
Data logging	USB communications to a PC for data retrieval, storage and reporting
Calibration	The gold film sensor does not require frequent calibration and manufacturer's recommendation is annual factory servicing. The manufacturer's Functional Test Kit AZIP/N-0902 is used between annual servicing to determine if the instrument is within calibration tolerances.

Manual: JEROME J405 MERCURY VAPOR ANALYZER

J405

Start Up:

1. Ensure the zero air filter is installed in the instruments intake. Attach power cord and plug into an outlet. Press the **I/O** button.

2. Initiate automatic 5 min warm-up by pressing warm-up from Regen Menu

3. Perform sensor regeneration (45minuet cycle).

4. Remove power cord, and power on for 5 minutes prior to sampling

5. Sample every 15 seconds with the zero air filter attached until readings are zero.

6. Remove zero air filter, unit is ready for use. Wait 15 seconds between samples to allow sensor to stabilize. Sampling cycle is 16 seconds.

   J405 is intended for vapor use only. Do not allow probe or instruments intake to be exposed to any liquid, dust, or other foreign matter

   Approximately 65 samples at .1mg/m^3 may be taken before regeneration is required.

   Use survey mode to locate mercury spills or assess areas of potentially high mercury concentrations

   Once initiated, do not interrupt the sensor regeneration cycle. AC power is required to thermally regenerate the sensor. When in storage, at a minimum, regenerate every 30 days.

To shut down, press the power off button. Perform the sensor regeneration prior to storing the instrument and ensure the zero air filter remains plugged in during storage.

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Mercury Instruments

Mercury Tracker 3000 IP Portable Mercury Vapor Analyzer

Use of Instrument: Detection of mercury vapors for environmental monitoring of spills, investigation of contaminated sites and cleanup analysis.

Mercury Tracker 3000 IP Portable Mercury Vapor Analyzer

Specifications:

Measurement and Detection Ranges

Mercury (Hg) vapors
Ranges: Three (3) ranges
0 – 100 ug/m3Hg
0 – 1000 ug/m3Hg
0 – 2000 ug/m3Hg

Sensor   Cold vapor atomic spectrometry (UV absorption)

Power Source   NiMH rechargeable batteries/external DC 'cigarette lighter' adapter or AC power 240/110V (50/60 HZ) with power supply connection capabilities

Display   LCD

Alarms   3 levels programmable (cell soiled, battery state, UV status)

Data Logging   Data logger system integrated with data transfer to PC.

Calibration   Factory calibration – long lasting. For quality control a test screen is used to check calibration

Website: Mercury Tracker 3000 IP Portable Mercury Vapor Analyzer for Air and Other Gases.
Reference Link: http://www.mercuryinstrumentsusa.com/Brochures/MI Tracker 3000-IP Brochure.pdf
Contact: (303) 972-3740

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LUMEX MERCURY VAPOR ANALYZERS

LUMEX RA 915 MERCURY VAPOR ANALYZER

Instrument Use: Handheld meter for the detection of mercury vapor in the environment from spills, contaminated sites or cleanup analysis.

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Specifications:

Measurements and Detections

Mercury (Hg) vapors
Range:
0.1 – 200 ug/m3Hg

Sensor   Zeeman atomic absorption spectrometry using high frequency modulation of light polarization

Detection Method   Internal pump with attached probe

Power Source   Rechargeable batteries/12 V DC and 240/110V AC (50/60 HZ)

Data Logging   Data logging integrated into meter with USB transfer to PC

Calibration   Serviceability test done prior to and after each sampling period to verify proper functions using manufacturer's quality assurance procedures.

Manual: http://www.cihequipment.com/sites/default/files/manual_RA_915.pdf

RA 915+

Operating:

1. Select the operating mode. Select the power mode.

2. Set the handle of test cell into off position and optical bridge handle to position III.

3. Switch the analyzer on.

4. Press the Ent button.

5. Press and hold the lamp ignition button. The * sign will go out when the lamp turns on.

6. Let the analyzer warm up at least 20 minutes.

7. Device is ready for measurements.

GENESIS LABORATORY SYSTEMS MERCURY VAPOR ANALYZERS

HG 253 PORTABLE MERCURY VAPOR ANALYZER

Instrument Use: Portable monitor used for the detection of mercury vapor in industry and the environment.

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Specifications:

Measurement and Detections Ranges

Mercury (Hg) vapors
Ranges:
0.001 mg/m3Hg – 10.000 mg/m3Hg

Sensor   Atomic absorption spectrometry

Power Source   Lithium-Ion rechargeable batteries

Detection Method   Internal pump with attached probe

Alarm   Alarm capabilities (programmable)

Calibration   Annual factory calibration Monitoring for status of batteries, detectors and calibration.

User Manual: http://www.genlabsystems.com/mercury/hg253man.pdf

Genesis Laboratory Systems (970) 241-0889 or (888) 270-0465

Hg 253

Operating:
1. Power on the unit.

2. To operate simply press the touch screen where a visual interface button appears.

3. Press the sample button to enter the sample mode.

   A sample will take about 3 minutes.

   Press cancel to abort a sample and return to the main screen.

COLORIMETRIC GAS INDICATORS

Detector tubes can be used for spot measurements of over 200 organic and inorganic gases and vapors in the air. These tubes are most useful for screening purposes to determine, if warranted a need for further analysis. Sealed glass tubes are filled with a granular reagent that is coated with an appropriate indicator chemical that will react with a specific gas or vapor to provide a color change. A pump is used to draw a known volume of gas inside the tube to measure the concentration of the substance. Pumps can be hand or battery operated. A number of commercially manufactured hand pump colorimetric gas indicators are available; in addition, a battery pumped Dragger Chip Measurement System (CMS) uses a colorimetric 10 capillary chip for multiple gas detection.
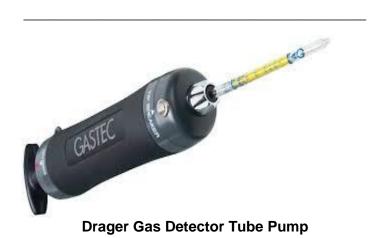
COLORIMETRIC GAS INDICATOR TUBES

Models:
Drager
Ion Science – Uniphos ASP-40
Drager Accuro (bellows pump)
MSA RAE LP – 1200
MSA Kwik Draw Deluxe (bellows pump)
Sensidyne

Instrument Use:

Basic use and detection are similar for each model. Colorimetric indicating tubes are used to monitor a variety of chemicals. The indicating tube contains a reagent that responds to specific chemicals in the environment resulting in a color change in the tube. The length of the stain is proportional to the concentration of the chemical in the atmosphere.

Sensors (tubes)   Glass tubes with specific reagents for colorimetric evaluation. Colorimetric tubes are available for over 200 inorganic or organic chemicals. The accuracy of a detector tube, established by the National Institute of Occupational Safety & Health (NIOSH) and the American Industrial Hygiene Association (AIHA) is +/- 25% of a reading.

Detection Method   The glass ends of a detection tube are broken and inserted into a pump. Pump strokes are performed per the manufacturer's information type use of instrument. A color change in the reagent is analyzed by either the length of stain generated inside the tube or the degree of color. The color change is compared to a scale printed on the tube or to a manufacturer's reference chart to determine concentration.

Calibration   Detection tubes are calibrated prior to leaving the factory. Field calibration is not necessary.

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Drager Gas Detector Tube Pump

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Drager Accuro (bellows pump)

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Draeger Safety (800) 482-5536
Reference Link: http://www.draegersafetyonline.com/index.php

Ion Science – Uniphos ASP-40

Ion Science Uniphos precision Air Sampling Pump Model ASP-40
http://www.ionscienceusa.com/wp-content/uploads/2013/11/ASP-40-V1.pdf

Contact: (877) 864-7710

ASP 40

Operating:

1. Insert a new detector tube without breaking its ends into the rubber tube connector.

2. Align red dots and pull the pump handle a full stroke.

3. Wait 3 minutes, and release the pump handle by turning 90 degrees left or right.

4. Ensure piston returns to its original position.

5. Cut both ends of the detector tube using the tip cutter.

6. Insert into the rubber tube connector. Ensure the arrow on tube points toward the pump.

7. Align the red dots.

8. Pull pump handle to 50 or 100 cc. Complete the desired number of strokes keeping the tube in the sample source.

    Keep the detector tube in the gas source for 1 – 3 minutes.

    Empty broken tips by pulling off rubber cap opposite the tip cutter.

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MSA RAE LP - 1200

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RAE Colorimetric Gas Detection Gas Detection Tubes and Pump
http://www.raesystems.com/products

Contact: (408) 952-8200

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MSA Kwik-Draw Pump

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Manual: MSA Kwik-Draw Pump

Contact:

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Sensidine/Kitagawa Detector Tubes
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Website: www.sensidyne.com
http://www.sensidyne.com/colorimetric-gas-detector-tubes/detector-tubes/
Contact: (800) 451-9444

DRAEGER CHIP MEASUREMENT SYSTEMS (CMS)

Instrument Use: Handheld meter for spot gas measuring of types and concentrations of chemicals by use of a replaceable chip containing colorimetric tubes. A chip containing up to 10 glass tubes is inserted into the meter. Once the chemical type and concentration is read on the meter LCD display screen, the chip is automatically ejected from the instrument and the analyzer shuts down.

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Specifications:

Measurements   Glass tubes with reagents for over fifty gases and vapors.

Sensors (tubes)   Draeger CMS Chip with 10 capillary glass tubes containing reagents with substance-specific granules.

Power Source   Alkaline size AA batteries

Data Logging   Integrated data recorder will store events which may be recalled and retrieved upon demand.

Calibration   Chips are calibrated before leaving the factory. No field calibration checks are necessary. After an automatic system self-test, the meter is ready for operation.

Manual: Draeger CMS Operator Guide
Website: Draeger Chip Measurement System
Contact: (412) 787-8383

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RADIATION DETECTION METERS

Radiation detection meters, both survey and dosimeters are used to locate and quantify sources of ionizing radiation. Survey meters are used for radiation detection to check personnel, equipment and facilities for radioactive contamination; or to evaluate radiation fields (contaminated environments) for direct exposure hazards. Radiation dosimeters are used to measure the dose of individual exposure to radiation energy. Meters are designed to measure Alpha/Beta/Gamma and X-Ray radiation.

<u>Glossary</u>

Ionizing Radiation	Ionizing radiation alters the structure and, by association the electric charge of individual atoms by a process known as ionization. The substances that produce ionizing radiation are said to be radioactive. There are four types of ionizing radiation – Alpha, Beta, Gamma and Neutron. X-Rays are also electromagnetic radiation as light and radio waves, but are also ionizing.
Non-Ionizing Radiation	Electromagnetic radiation that does not carry enough energy per quantum to ionize atoms or molecules Non-ionizing radiation is located at the low end of the electromagnetic spectrum and sources include power lines, microwaves, radio waves, visible light and lasers. Radiation survey meters are not used for the detection of non-ionizing radiation.
Survey Meter	Portable radiation detectors and measurement instruments Used to check personnel, equipment and facilities for radioactive contamination. Radiation survey meters are used to locate and quantify sources of ionizing radiation or to quantify the exposure rare from sources of ionizing radiation. To assess the quantity of radioactive materials present, survey meters for Alpha and Beta are typically calibrated to measure counts per minute (cpm). To measure the exposure rate from gamma or X-Ray sources, survey meters are calibrated to measure roentgens per hour (R/h).
	Commonly used hand-held survey meters:
	Scintillation Counter – Used in measurement of Alpha, Beta and Neutron particles.
	Geiger Counter - Commonly used for measurement of Alpha, Beta and Gamma levels.
	Ion Chamber – Used for Beta, Gamma and X-Ray measurements.
Dosimeter	Used to measure and record individual and exposure to radiation energy.
Alpha Particles	With 2 protons and no electrons positively charged. Paper, clothing or a few inches of air space can effectively shield Alpha particles. Particles can be hazardous if ingested or inhaled. Generally read in cpm.

Beta Particles	Electrons have a negative charge and may travel 6 – 10 feet through the air. Heavy clothing, thick cardboard or one-inch thick wood will provide protection from Beta particles. Generally read in cpm.
Gamma Particles	These particles have no charge, with a short wavelength and high energy. Gamma is the most penetrating form of the Alpha/Beta/Gamma radiation particles and can travel in the air up to 1,500 feet. Lead or concrete barriers are necessary to shield from Gamma particles. Generally read in R/h.
X-Ray	X-Rays are electromagnetic radiation of the same nature as light and radio waves, but they are also ionizing. Similar characteristics to Gamma particles. Generally read in R/h.
Neutron Radiation	Neutron radiation is a form of ionizing radiation most often found in nuclear reactors and nuclear bombs. Neutrons are found in all elemental nuclei except for hydrogen. Neutron radiation is considered the fourth major type radiation after Alpha/Beta particles and Gamma rays. Ionizing radiation consists of free neutrons through splitting or nuclear fusion. It consists of the use of free neutrons from atoms and these free neutrons react with nuclei of other atoms to form new isotopes creating radiation (example - radioactive isotope uranium/plutonium). Neutron radiation is not directly measured by use of survey meters, but a Gamma component in association with neutron particles can be detected and measured.

Radioactive Material Measurements:

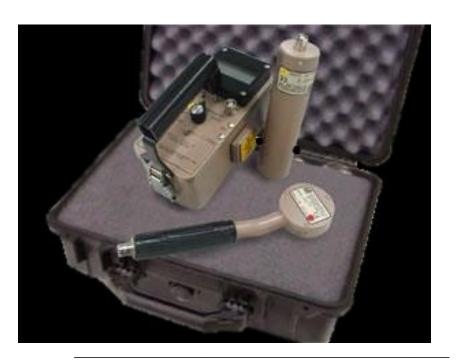|	
Curie (Ci)	Measures amount of ionizing radiation released by a material (point of origin). Expressed in terms of "radioactivity" which represents how many atoms in the material decay in a given time period
Counts Per Minute (cpm)	Measures quantity of radioactive materials present (monitoring location). Generally associated with Alpha and Beta particles.
Roetgen	Measures exposure or the amount of radiation. Radiation meters often measure exposure in roentgens per hour (R/h).
RAD	Measures the amount of radiation absorbed by an object or person.
REM/Sievert (Sr)	Dose equivalent (effective dose) combining the amount of radiation absorbed and the medical effects of the radiation type. Exposure to different types of radiation expressed as RAD do not produce equal biological effects. For example, one RAD of Alpha will have a greater effect than one RAD of Beta. Thus radiation effects are expressed in radiation as an effective dose or Roetgen Equivalent Man (REM). REM is also measured in Sieverts (Sv).

100 REM = 1 Sv

Survey Meters

LUDLUM RADIATION METER MODEL 2241-3RK

Equipment Use: This meter is a pancake for detection of beta and gamma radiation. Used for personnel testing, objects and environmental detection.

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Detection – Beta and gamma radiation

Website: Ludlum Model 2241 3RK Response Kit July 3013
Website: Product Manuals – Ludlum Measurements, Inc
http://www.ludlums.com/multisites/medphys/images/stories/product_manuals/M2241-3RK.pdf

Contact: 888-62401

<u>Ludlum 2241</u>

Operating:
1. Connect a detector by firmly pushing the connectors together while twisting clockwise until the connector latches.

2. Place SCA/RATE switch in the Rate position.

3. Check for background readings.

4. Switch the AUD ON/OFF switch to the on position.

When surveying for alpha particles ensure the F/S switch is in the F position.

Instrument response time varies from 2 to 50 seconds.

To survey for beta particle use no shielding.

The tip is the most sensitive. Point the detector towards the radiation being measured.

LUDLUM GM PANCAKE MODEL 44-9

Equipment Use: pancake probe for radiation detection of personnel, objects and hazardous environments.
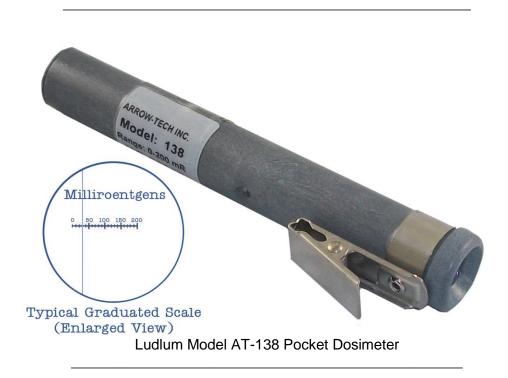
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Ludlum GM Pancake Model 44-9

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Detection – Alpha, beta, gamma radiation

LUDLUM MODEL AT-138 POCKET DOSIMETER

Equipment Use: Direct read pocket dosimeter for documentation of exposure to workers and visitors in restricted areas. Has an eye-piece lens.

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Ludlum Model AT-138 Pocket Dosimeter

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Detection: Gamma and x-ray radiation

LUDLUM MODEL 25 PERSONAL RADIATION DETECTION METER

Equipment Use: Pocket sized handheld meter for radiation detection in hazardous environments.

Ludlum Model 25 Personal Radiation Detection Meter

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Detection: Gamma and X-Ray radiation

FLUKE RADIATION DETECTION METERS

Survey Meters

FLUKE ASM 990 ADVANCED SURVEY METER

Equipment Use: Portable handheld meter with probe which can be used by emergency responders at HazMat incidents. (Model 993 has built-in pancake probe)

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Fluke ASM 990 Advanced Survey Meter

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Detection: Alpha, beta, gamma (above 60 KeV) and x-ray radiation

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Website: Fluke Biomedical ASM 990 Series Operators Manual
http://fieldenvironmental.com/assets/files/Manuals/Victoreen 990 ASM Manual.pdf
Contact: (800) 850-4608

ASM 990

Actuating:

1. Press the ON/OFF key to power on the unit.

2. Select the probe to be used.

3. Unit is ready for normal operation.

To turn off, press the ON/OFF button.

Dosimeters

FLUKE DIRECT READING POCKET DOSIMETER

Equipment Use: Direct read pocket dosimeter for measuring accumulated gamma and x-ray radiation. The dosimeter is read through an eye-piece.
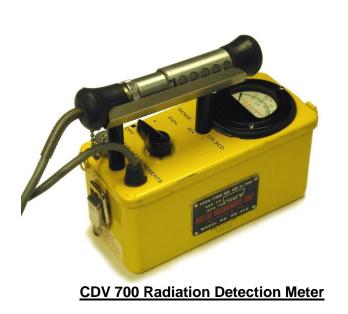
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Detection – Gamma and x-ray radiation

Website: Fluke Biomedical Nuclear Direct Reading Pocket Dosimeters
Operating Manual: FLUKE DIRECT READING POCKET DOSIMETER

CDV 700 RADIATION DETECTION METER

Equipment Use: Radiation survey meter for low-range measurement of gamma and detection of beta radiation. Used for the monitoring of personnel, food and water in shielded areas with low radiation backgrounds.

CDV 700 Radiation Detection Meter

Detection: 0 – 50 mr/hr/hr for Gamma dose and detects presence of beta radiation. (When the probe on the instrument is closed, beta is stopped and only gamma is detected and measured. When the shield is opened, both beta and gamma can be detected.

Website: CDV -700 Gamma Survey Meter Page
http://www.civildefensemuseum.com/cdmuseum2/radkits/cdv700.html
Contact: (619) 708-8114

CDV 715 RADIATION DETECTION METER

Equipment Use: This meter detects gamma radiation by design for use only for the period immediately following a nuclear weapon attack.

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CDV 715 Radiation Detection Meter

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Detection – Gamma only

Instruction and Maintenance Manual
http://www.orau.org/ptp/Library/cdv/victor715-1a.pdf

CD V 715

Start Up:
1. Turn the instrument on by switching the range switch from "Off" to "Zero" .

2. Allow 1 minute to warm up.

3. Adjust the needle to zero.

4. Perform a circuit check.

5. Select the appropriate range.

   Meter reading observed must be multiplied by the factor indicated by the position of the range switch. To power down, switch the range switch to the off position.

Victoreen 450-B Ion Chamber Survey Meter

Equipment Use:

This handheld meter monitors for low level alpha, beta and gamma radiation.

Victoreen 450-B Ion Chamber Survey Meter
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Detection: Alpha above r MeV, beta above 100keV, gamma, x-ray radiation. The model responds to but is not calibrated for alpha, beta radiation with the slide open.

Reference link: Victoreen 450-B Ion Chamber Survey Meter

Victoreen 450

Actuating:

1. Press the ON/OFF button. A self-test will initiate.

2. If the unit passes the self-test it will go into the normal operation mode.

To turn off, press the ON/OFF button.

MIRION RADIATION DETECTION METERS

Survey Meters

Mirion DX-1 Radiation Monitor

Equipment Use: Handheld pocket radiation detector.

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Mirion DX-1 Radiation Monitor

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Detection: Beta, Gamma and X-Ray radiation.

Website: Mirion DX-1 Instruction Manual
Reference link: http://www.filterwater.com/docs/sensafe/dx1-dx2_instruction_manual.pdf
Contact: Mmaddox@Mirion.com (770) 432-2744 X156

DX-1

Actuating:

1. Hold the unit in your right hand with your thumb over the push button.

2. Press and hold the button for operation.

    LED above the push button indicates the unit is on.

To power down, release the push button.

Mirion RDS 31 Survey Meter

Equipment Use: Handheld dose rate radiation detector for survey in field applications and monitoring of field personnel.

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Mirion RDS 31 Survey Meter

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Detection: Alpha, Beta, Gamma, X-Ray

Website: RDS-31 | Modular Radiation Survey Meter
Reference Link: Mirion RDS 31 Survey Meter

Dosimeters

Mirion DMC 3000 Personal Electronic Dosimeter

Equipment Use: Personal dosimeter for gamma and x-ray radiation.

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Mirion DMC 3000 Personal Electronic Dosimeter
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Website: Mirion DMC 3000 | Electronic Radiation Dosimeter
DMC 3000 Quick User's Guide: DMC 3000 Electronic Dosimeter
Reference Link: https://www.mirion.com/products/dmc-3000-electronic-radiation-dosimeter/

Detection: Gamma and x-ray radiation

Survey Meter

W.B. Johnson Instruments DSM-500 Digital Radiation Survey Meter

Equipment Use: Handheld meter for the measurement and monitoring of radiation in contaminated environments.

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Detection: Alpha, Beta, Gamma

Website: B Johnson Instruments DSM Digital Radiation Survey Meter Reference Link: http:www.jradmeters.com/device.php?device=2
Contact: W.B. Johnson Instruments 208-557-6945 or 208-557-6945 Idaho

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Survey Meter

Model PM 1405 Survey Radiation Monitoring Meter

Equipment Use: This is a survey radiation meter for detection of gamma and x-ray radiation sources. A special screen-filter allows choosing beta radiation flux density measurement mode.

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Model PM 1405 Survey Radiation Monitoring Meter
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Detection: Beta, Gamma and X-Ray radiation (opening special screen filter and choosing beta radiation flux density measurement mode – can detect beta nuclear radiation sources)

Website: Polimaster Survey Meter 1405 Reference Link: Model PM 1405 Survey Radiation Monitoring Meter
Contact: (703) 525-5075

PM 1405

Actuating:

1. Hold the lower button till the backlight comes on

2. After an internal test and calibration the instrument is ready for use.

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RADEX RADIATION DETECTION METER

RADEX RD 1706 Radiation Detector

Equipment Use: Handheld Geiger counter for detection of beta, gamma and x-ray radiation.

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Detection: Beta, Gamma and X-Ray radiation

Website: Radiation Monitor Radex RDI 1706 – Quarta Reference Link: http://www.quarta-rad.ru/en/manuals/RD1706.pdf
Contact: (201) 877-2002

RD 1706

Actuating:
1. Switch on device by pressing the off button. Examination of radioactive environments starts.

2. After 13 seconds, the results of a short cycle are displayed. First reliable results are displayed after 26 seconds.

   To find a source of radiation, turn off the threshold signal. Switch on audio signal and pay attention to sound frequency.
   Do not use in areas of high humidity.
   Keep device away from which generate strong magnetic fields.
   Extract batteries if the device is not being used for a long time, keep unit in cool dry conditions.
   Check working capacity of unit before using after being in storage for long periods of time.

To turn off, press off button and hold till disappearance of messages.

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Survey Meter

PRM-9000 Geiger Counter – Nuclear Radiation Detector and Monitor

Equipment Use: Handheld pancake Geiger detector tube for surveying radiation levels.

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PRM-9000 Geiger Counter – Nuclear Radiation Detector and Monitor

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Detection: Alpha, Beta, Gamma and X-Ray radiation

Website: Mazur Instruments PRM 8000/9000 Nuclear Radiation Monitor User's Guide Reference Link: http://www.mazurinstruments.com/PRM-8000-9000_UG_R2_EN.pdf
Contact:

PRM 8000/9000

Actuating:
1. Press and hold the power button. After 3 seconds the unit will default to the home screen and begin displaying measurements.
   Changes in the rate of beeps will be the first indication of a radiation object or area.
   If display is off, press any key to wake unit up (the 8000/9000 is designed to be always on. Internal battery life in sleep mode can be up to 60,000 hours).

The unit can be powered down for long time storage by pressing and holding the power key.

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Survey Meters

Radiation Alert Radiation Monitors

Models: Digital - Inspector USB; Inspector EXP (pancake external probe); Analog – Monitor 4EC

Equipment Use: Handheld radiation meters

Detection: Alpha, Beta, Gamma

Radiation Alert Reference Link: http://seintl.com/support/manuals/

Inspector USB

Inspector

Actuating:

1. Set the mode switch to the desired mode.

2. Set the bottom switch to On or Audio. After a short system check, the radiation level is displayed. After 30 seconds a beep indicates enough information has been collected to ensure statistical validity.

    Be sure there is no obstruction between the detection window and source being monitored.

    Data is updated every 3 seconds unless you're using the timer mode.

    Remove batteries when storing for long periods of time

Power down the unit by switching the bottom switch to OFF.

Inspector EXP (pancake external probe)   **Analog – Monitor 4EC**

Inspector EXP

Actuating:
1. Connect external probe.

2. Install standard 9 volt alkaline battery

3. Set the mode switch to the desired mode.

4. Set the bottom switch to On or Audio. After a short system check, the radiation level is displayed. After 30 seconds a beep indicates enough information has been collected to ensure statistical validity.

   Be sure there is no obstruction between the detection window and source being monitored.

   Data is updated every 3 seconds unless your using the timer mode.

   Remove batteries when storing for long periods of time

Power down the unit by switching the bottom switch to OFF.

SMITHS DETECTION RADIOISOTOPE IDENTIFIER

Smiths Detection RadSeeker Handheld Radioisotope Identifier

Equipment Use: Handheld meter with two types of sensors for both gamma and neutron detection provides for assessment of radiation threat for HazMat emergency or WMD response. Spectrum processing and identification algorithms provide state of the art identification accuracy.

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Detection: Gamma and Neutron

Website: Smiths Detection Radseeker Handheld Radioisotope Identifier
Reference Link: RadSeeker Handheld Radioisotope Identifier

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Gamma RAE II R Radiation Detector

Equipment Use: This a handheld radiation meter with dual capabilities of a general environmental response detector and dose measurement (dosimeter).

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Detection: Gamma Radiation
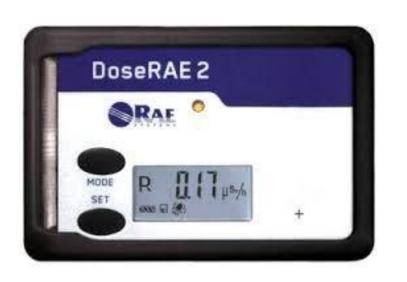
RAE Systems Gamma RAE II R Radiation Detector and Dosimeter
User's Guide: Gamma RAE II R Radiation Detector

Contact (877) 723-2828

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DoseRAE 2 – Electronic Dosimeter

Equipment Use: Electronic direct reading personal detector to detect gamma and x-ray radiation. Provides real-time monitoring of personal dose and dose rate.

Specifications: Detection – Gamma and x-ray radiation
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Detection: Gamma and X-Ray radiation

RAE Systems DoseRae Pro Electronic Dosimeter
User's Guide: DoseRAE 2 Electronic Dosimeter

Contact (877) 723-2878

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HAZCAT KITS

HAZTECH SYSTEMS, INC

HazCat kits can be used to categorize unknown solids and liquid chemicals in the field. These kits are used for screening purposes and not intended to replace analysis using calibrated field monitors or licensed laboratories. **HazCat 2.0 Identification System** is designed for substance identification in the field. Extensive training is provided for emergency responders and a kit is issued with appropriate supplies for use in the detection of unknown chemicals.

MICROCAT/WMD KIT

Equipment Use:

This kit is for screening white powder unknowns for potential hazards of nuclear, biological and chemical WMD warfare agents. This kit can enable First Responders to quickly assess the nature of suspicious powder threats in the field. It is designed to augment WMD field response protocol and features an assessment algorithm to categorize a suspect powder as either harmless or a potential WMD threat. Used for screening purposes and not intended to replace sophisticated analysis of licensed laboratories or federal authorities. The kit can reduce the number of samples that must be sent to a laboratory and save time to reduce severe economic impacts downtime at critical facilities.

MICROCAT/WMD KIT
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Kit Supplies	-Clinical microscope, phase optics (10x, 40x, 100x)
	-Digital camera microscope attachment
	-Forensic collection kit
	-HazCat kit with an assessment algorithm to sort between WMD threats and non-threats
	-Training materials
	-Travel cases

Operation A minimum of 40 hours of hands-on training is required to operate this kit. A variety of flow charts are used for screening radiological, biological and chemical WMDs. Chemical weapon screening involves substantial skills in basic chemical hazcatting. Radiological screening requires operating a radiation detection meter. Biological screening requires skills in operating a compound microscope and conducting a variety of organic chemical and immune-assay tests. Other required skills is wearing a Level A chemical encapsulation suit while using this kit.

Sensitivity Range Varies from test to test

Deficiencies Expensive, fragile and bulky components
Vehicles lack space for routine transport
Difficult to use while wearing personal protection equipment
Some test reactions are difficult to interpret, even under ideal conditions
False positives/negatives are likely due to operator's level of experience and familiarity of equipment.
Regular use and practice is needed to maintain necessary skill sets

Calibration Basic calibration is needed before every microscope use and is part of the 40 hour training exercise. Radiation meter may need annual test for simple qualitative radiation detection.

Website: Haztech Systems, Inc
Reference: http://www.hazcat.com/Products.html
Contact: HazTech Systems, Inc (800) 543-5487

HAZCAT KIT

QUICK TEST KIT

1) BORAX BEAD TEST

- Place ½ inch of Sodium Borate in a test tube
- Unknown chemical. Add 2-3 granules of solid or ¼ inch liquid
- Heat until the borax forms a glassy bead
- Allow to cool and observe color

OBSERVATIONS		
OXIDIZED	**ELEMENT**	**REDUCED**
Deep Blue	COBALT	Deep Blue
Aquamarine	COPPER	Red Opaque Grey (usually with specks of free copper metal)
Green to Lime Green	CHROMIUM	Green to Lime Green
Yellow	IRON	Green to Lime Green
Deep Purple/Brownish Red	MANGANESE	Colorless/Clear
Clear	MOLYBDENUM	Chocolate Brown
Colorless (Yellow when hot)	TITANIUM	Powder Blue (Yellow when hot)
Colorless	TUNGSTEN	Yellow
Yellow	URANIUM	Green
Colorless	VANDIUM	Green

2) HAIRPIN TEST

The Hairpin Test is a test for explosives.

- Unknown chemical. Place a grain size solid or drop of liquid on a watch dish.
- Take a hairpin and heat one end in the flame of a torch until cherry red.
- Take the heated end of the hairpin and touch it to the unknown solid or liquid.

OBSERVATIONS

The heated end of the hairpin when in contact with the unknown material will create a volatile explosive "puff"

3) CHAR TEST

The Char Test is to determine if unknown is organic or inorganic.
Always do a Hairpin Test before conducting a Char Test

- Unknown chemical. Add two peas-size amounts or ½ inch of the liquid to a test tube.
- Heat until no further reaction takes place or the test tube is melting.

<u>**OBSERVATIONS**</u>

ORGANIC: Ignition of head space vapors or smoke.
                  Exception: halogenated hydrocarbons, which sink in water, will not ignite.

INORGANIC: No ignition of head space vapors or smoke

4) CHLORINE HOT WIRE TEST

The Chlorine Hot Wire Test is used to test an unknown chemical for determination of chlorine, an amine, a nitrate or ammonium salt.

- Unknown chemical. Place liquid into a test tube.
- Heat the Chlorine Hot Wire (copper wire) to with a torch flame, until there is not a green flame and then allow the wire to cool. (If the green flame persists, or if the wire is black or discolored, cleaning of the wire will be necessary).

Note: To clean the Chlorine Hot Wire

- Heat the Chlorine Hot Wire in a torch flame until heated through
- Place the heated wire into a small jar labeled "Chlorine Hot Wire Cleaner Methanol", stir for a few seconds and remove.
- The wire is clean if a bright copper color is observed when the wire is removed from the methanol. BE CAREFUL, the methanol can ignite if the wire is very hot.
- Repeat as necessary to obtain a bright copper color.
- Place the cleaned wire into the test tube containing the unknown chemical; then reheat the wire using a torch flame.

<u>**OBSERVATIONS**</u>

A green flame indicates chlorine, an amine, a nitrate, or an ammonium salt.

5) CHROMIUM TEST

- Unknown chemical. Place ½ inch of substance into a test tube.
- Adjust the pH to less than 3 by adding a drop of Sulfuric Acid.
- Add 10 drops of Diphenylcarbazide.

<u>**OBSERVATIONS**</u>

A deep color purple indicates a chromate

6) COMBUSTIBILITY TEST

- Unknown chemical. Add the chemical to a watch dish to form a pool the size of a quarter.
- Try to ignite with a lit match.

OBSERVATIONS

EXTREMELY FLAMMABLE: Flame jumps from match to liquid
FLAMMABLE: Stays ignited after removing the match
COMBUSTIBLE: Requires match as a wick
NON-FLAMMABLE: Will not ignite

7) CYANIDE TEST

- Unknown chemical. Dilute unknown in water.
- Add a drop of Sodium Hydroxide to obtain a pH of 11.
- Add 3 – 4 drops of p-Dimethylaminobenzal rhodanine.
- Add a drop of Silver Nitrate.

OBSERVATIONS

Positive for Cyanide if NO COLOR CHANGE is observed

8) ORGANOPHOSPHATE TEST

- Unknown chemical. Dilute unknown in water (Observe an emulsion)
- Add 2 – 3 drops of Silver Nitrate to the emulsified solution

OBSERVATIONS

A lemon yellow color indicates the presence of an organophosphate

Note: Pesticides have a strong odor.

9) OXIDIZER TEST

- Acidify a Potassium Iodide Starch Paper with a drop of Hydrochloric Acid.
- Touch the unknown with the paper.

OBSERVATIONS

Blue or Black or Purple color indicates an oxidizer

10) pH TEST

- Wet pH Test Paper with water
- Dip the pH Test Paper into the unknown solution

OBSERVATIONS

Compare the colors with those on the container of the PH Test Paper
pH greater than 2 or less than 12. Not hazardous (CCR Title 22)
pH greater that 12.5 is corrosive
pH less than or equal to 2 is acidic

11) SULFIDE TEST

- Wet Lead Acetate Test Paper with a drop of water.
- Touch the paper to the unknown on a watch dish.

OBSERVATIONS

A Color change to Brown indicates a Sulfide

12) WATER REACTIVE TEST

- Place a pea-size amount of the solid unknown or form a dime size pool of the liquid unknown on a watch glass.
- Place a drop of Hydrochloric Acid on Potassium Iodide Starch Paper

OBSERVATIONS

Positive if occurrence of a Reaction (Ignore color of Potassium Iodide Starch Test Paper)

13) WATER SOLUBILITY TEST

- Add a pea-size amount of the unknown to a ½ inch of water in a test tube.
- If the unknown is not effervescing, stopper the test tube and shale it vigorously.

OBSERVATIONS

Allow time for reactions to occur and observe the results of unknown solubility

14) WATER TEST

- Add a pea-size amount of the unknown to a ½ inch of water in a test tube.

OBSERVATIONS

Effervescence indicates the presence of greater than 1% water in the solution.

Further detailed instruction regarding tests can be found in the Ascot Chemical Identification Manual by Torrington.

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TELEMETRY

Used to record readings from detection meters at multiple locations to establish perimeter and area data from a contamination source. Specific analyzers (gas/radiation) are placed in strategic areas to provide immediate (real-time) detection of contaminants to communicate the readings to a remote location.

Safe Environment Engineering – Lifeline Wireless Monitoring System

Equipment Use:

This system relays live readings by the use of a Lifeline Interoperable Network Communicator (LINC) which connects to a variety of instruments to create a wireless connection through a Lifeline Gateway WiFi to a remote computer system. Each detection meter is connected to a LINC for transmission to the remote PC which can be located in a safe location away from the potential hazard. Event data can be shared with real-time information between departments and across jurisdictions.

LINC   **Lifeline Gateway WiFi**

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Power Source: Lithium Ion batteries (rechargeable)

Website: LINC – Safe Environment Engineering   Contact: (661) 295-5500
Reference Link: http://www.safeenv.com/lifeline-training-video-lifeline-operation/

FLIR INFRARED GAS CAMERA

Instrument use: The camera is a preventative maintenance solution to spot leaks in piping, flanges and connections in petrochemical operations. The infrared camera can rapidly scan large areas and pinpoint leaks in real time. It is ideal for monitoring plants that are difficult to reach with contact measurement tools. It embeds GPS data into the image to pinpoint the location of the leak or hot spot.

Model: FLIR GF300/320 Infrared Camera

Imaging Specifications	320 × 240
Resolution	76,800
Total Pixels	-20°C to 350°C (-40°F to 662°F)
Temperature Range	1 – 8× continuous digital
Zoom	Auto & Manual
Focus	4.3"; 800 × 480 Pixels
Color LCD	3.2 MP
Total Pixels	Yes
Temperature Range	HDMI
Zoom	1 – 8× continuous digital
Focus	Auto & Manual
Color LCD	4.3"; 800 × 480 Pixels
Video Camera w/Lamp	3.2 MP
Laser Spot	Yes
Video Out	HDMI
Analysis	
Spotmeters	10*
Annotation	
GPS	Yes

<u>FLIR GF300/320</u>

Start Up:

Start the Flir camera:

Push and release the on button, when you turn on the camera, a mechanical cooler will begin cooling down the infrared detector. The cooler has a sound that resembles a subdued motor. This sound is normal. The cooling procedure will typically take 7 minutes for Flir GF300, and Flir320. In high ambient temperatures the cooling times may increase 30% or more.

Adjusting the viewing angle of the viewfinder:

Tilt the viewfinder up or down for your eyesight.

To adjust the viewfinder's dioptric correction:

Look at the displayed text or graphics on the screen and rotate the   adjustment knob counter-clockwise for best sharpness.

Adjusting the viewing angle of the display:

To make your working position as comfortable as possible, you can adjust the viewing angle of the display.

Installing an infrared lens:

Do not touch the lens when you install an infrared lens if this happens, clean the lens.

1. Align the index mark on the lens with the index mark on the bayonet ring.
2. Carefully push the infrared lens into the bayonet ring.
3. Rotate the infrared lens 30° clockwise (looking at the front of the lens).

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