

ToxiRAE II

PGM-1100 Series
Personal Toxic Gas Monitor




User Manual


045-4003-000, Revision B, March 2005

- READ BEFORE OPERATING -

This manual must be carefully read by all individuals who have or will have the responsibility of using, maintaining, or servicing this product. The product will perform as designed only if it is used, maintained, and serviced in accordance with the manufacturer's instructions.


CAUTION!

 To reduce the risk of electric shock, turn off power before removing the monitor cover. Disconnect the battery before removing sensor module for service. Never operate this monitor while the cover is removed. Remove monitor cover and sensor module only in an area known to be non-hazardous.

 Sensors are not interchangeable; use only RAE Systems sensors, and use only the sensor type specified for your ToxiRAE II monitor. Use only RAE Systems batteries. Use of non-RAE Systems components will void the warranty and can compromise the safe performance of this product.

 Calibrate before use.


 Make sure gas inlet is free of dirt and debris.

 Properly recycle Lithium batteries when disposing.

US & Canadian Intrinsic Safety

UL/cUL Class I, Groups A, B, C, D, T5

European Intrinsic Safety

CE 0575  II 1G EEx ia IIB T5 / 2G EEx ia IIC T5

DEMKO 02 ATEX 0233306X

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Table of Contents

US & Canadian Intrinsic Safety • ii

European Intrinsic Safety • ii

Standard Contents • iv

Calibration Kit • iv

General Information • 1

Physical Description • 2

Display Features • 3

Operating the ToxiRAE II • 4

Turning the Monitor ON • 4

Using the ToxiRAE II • 4

Time Weighted Average (TWA) • 5

Peak Reading (PEAK) • 5

Turning the Monitor OFF • 5

Program Mode • 6

Calibration • 7

Changing Preset Limits or Span Gas Values • 10

Maintenance • 11

Replacing the Lithium Battery • 11

Replacing the Sensor • 12

Specifications • 15

Table A: Sensor Configuration • 16

Table B: Alarm Signals (H₂S) • 17

Standard Contents

ToxiRAE II monitor with sensor as specified

Lithium battery installed

Spare Lithium battery

Gas adapter

Alligator clip

Stainless steel belt clip / hardhat adapter

Operation instructions

Calibration Kit

Test gas (for sensor as specified)

Gas regulator with flow controller

Hard transport case

General Information

The ToxiRAE II single gas monitor continuously displays toxic gas concentrations and costs just a little more than disposable detectors. Unlike typical disposables that only display remaining life, the ToxiRAE II is full-featured gas monitor providing continuous, digital display of the selected toxic gas concentration, STEL, TWA and Peak values as well as high, low, TWA and STEL alarms.

A simple to use one-button product, the ToxiRAE II is easy to calibrate. Use the pre-set alarms, or modify the alarms to meet your specific requirements. In contrast to disposables that are turned on once and remain on until their batteries expire, you decide when and where to use your ToxiRAE II and you turn it on and off accordingly.

The ToxiRAE II does not have a preprogrammed expiration date so you get the full life out of the battery and sensor. Sensors and battery are easily replaced in the field, too. And, because the cost of the ToxiRAE II is about the same as many reduced-feature disposables, you have the choice of renewing it, or disposing of it and starting out with a fresh, new monitor.

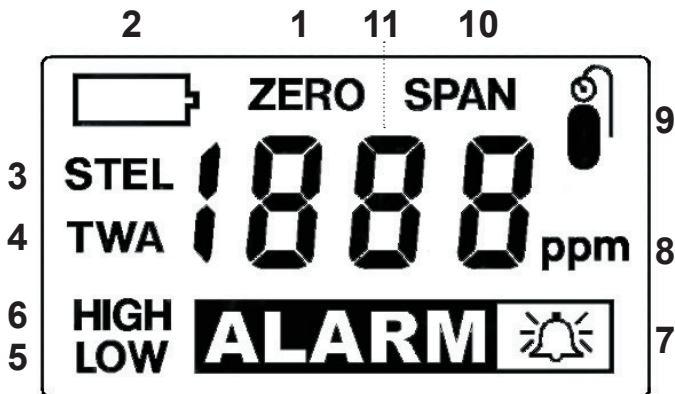
Physical Description

- 1 Bright red LED Alarm
- 2 Display
- 3 Audio Alarm
- 4 Gas Inlet
- 5 Button
- 6 Alligator Clip




Display Features

- 1 Zero Calibration
- 2 Low Battery Indicator
- 3 Short Term Exposure Limit (STEL)
- 4 Time Weighted Average (TWA)
- 5 Low Alarm
- 6,7 High Alarm
- 8 Parts Per Million (ppm)
- 9,10 Span Calibration
- 11 Gas Concentration

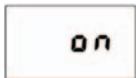


Operating the ToxiRAE II

Turning the Monitor ON

 The sensor is zeroed at power on. Always turn the monitor on in clean ambient air.

Make sure the Lithium battery is installed.



Hold the button down and release when it beeps. The monitor is now on.



The monitor will perform a self-test preceding the warm-up and zero calibration.



The user will see the firmware version displayed briefly (e.g. "F10" means firmware version 1.0). Then the current gas concentration reading is displayed.

Using the ToxiRAE II

After the monitor is turned on and completes its warmup, it is in Monitor Mode. The display shows the current concentration of the specified gas in ppm ("Current ppm").

The user can also view the exposure analysis - the STEL, TWA, and PEAK - in Monitor Mode.

From the Current ppm display, press the button to cycle through each exposure analysis reading. If left idle for one minute, the monitor will automatically return to the Current ppm display from any of the analysis displays. After the monitor is turned on and completes its warmup, it is in Monitor Mode. The display shows the current concentration of the specified gas in ppm.

Short Term Exposure Limit (STEL)

The STEL is the average reading of the gas concentration for the last 15 minutes.

NOTE: The STEL reading does not appear until 15 minutes have elapsed.



Time Weighted Average (TWA)

The TWA is the accumulated reading of the gas concentration, divided by 8 hours, since the monitor was turned on.



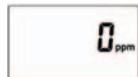
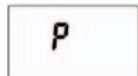
Peak Reading (PEAK)

The peak reading is the highest reading since the monitor was turned on.

NOTE: The display switches back and forth between "P" and the actual peak reading.

If the pre-set alarm limits are exceeded, the monitor will go into alarm, and the user should leave the contaminated area immediately.

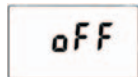
See Table A for the preset limits.



Turning the Monitor OFF

Hold the button down, through the "5...4... 3... 2... 1... OFF" sequence.

The monitor is off when the display is blank.



Program Mode

Use the Program Mode to perform any of the following actions (listed in order of appearance):

Calibrate the Monitor

Changing Preset Limits or Span Gas Values



To enter the Program Mode, press and release when “Pro” appears in the display.



To exit the Program Mode at this point, do not press the button, and the monitor will automatically return to the reading display.

Press and hold the button again. Release when “go” starts flashing on the screen.

Calibration

While all instruments are calibrated prior to leaving the factory, temperature extremes and/or shocks during shipment can cause sensor drift. Therefore, the accuracy of any newly purchased RAE Systems monitor should be tested by exposing the sensor to a known concentration calibration gas before the monitor is used or put into service.

How often should you calibrate the monitor?

The monitor should be calibrated no less than every 30 days, or if it does not pass a fresh air reading, or if it does not pass a field calibration. The sensors are calibrated in a two-step process using fresh air and span gas (a span gas contains a known concentration of a given gas).

Field Calibration

For maximum safety, the accuracy of the monitor should be checked by field calibration: expose the sensor to known concentration calibration gas before each day's use.

To do this, attach the calibration adapter to the unit. (See *picture on page 9.*) Connect the tubing to a cylinder of span gas. With the unit in Monitor Mode, turn the gas on and allow the measurement to reach a steady state. If the measurement displayed is +/-10% of the span gas concentration as noted on the cylinder, the unit is ready for use. (See *page 6, "How often should you calibrate the monitor?"*)

Calibrate Monitor



Span Gas Calibration

Put the unit into Program Mode. "CAL" (calibration) and "go" messages switch back and forth in the display. Press and hold the button until "go" displays continuously without flashing on and off.



The "gAS" and span gas preset value will switch back and forth on the screen. During these 10 seconds, connect the span gas to the monitor. (See picture on page 9.) When calibrating, use tygon tubing for all sensors except Cl_2 , ClO_2 , and HCN.



When the monitor detects a change in gas concentration or after 10 seconds of idle time, or when the key is pressed, the countdown timer will begin. **NOTE:** Sensors vary in the amount of time it takes to calibrate.

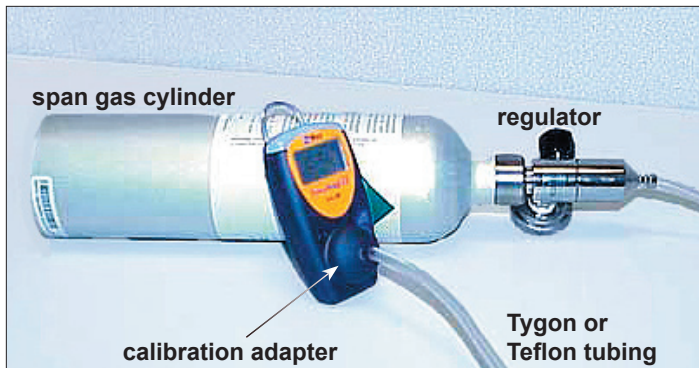


Span calibration fails when the monitor does not detect any change in gas concentration. In the latter case, the "Err" (error) message appears on the screen, the monitor beeps and the LED lights up. In either case, begin span calibration again.



When span calibration is complete, "dn" (done) and the real time reading briefly appear on the screen before advancing to the next submenu.

To interrupt and exit span calibration during the 90-second countdown, press the button and “no” appears on the screen. Press the button again to confirm and advance to the next submenu.



Changing Preset Limits or Span Gas Values

High Alarm



Low Alarm



STEL



TWA



SPAN



Example:

Changing the High Alarm preset



Cycle through the submenus by pressing the button once after each; stop at appropriate screen. (The monitor returns to the Monitor Mode after the span gas value.)

The user will see “SEt” and “go” switch back and forth on the screen, prompting the user to change the preset limit or value.

To change the preset, press and hold the button. Release when “go” stops flashing.

The current preset will appear on the screen. The blinking digit is the one that will change.

To change the digit, press the button and it will increase by one increment; the digits cycle from 0 through 9.

To move to the next digit, hold the button down and release when the next digit starts blinking.

To save the new limit, hold the button and release when “dn” appears on the screen. The monitor will advance to the next submenu.

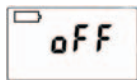
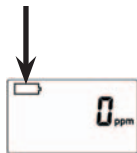
Maintenance

Replacing the Lithium Battery

The ToxiRAE II is shipped with the Lithium battery installed.

Change the battery when the low battery symbol appears. The alarm will beep and flash once a minute until a fresh battery is installed.

Just before the battery dies, “oFF” will appear instead of the reading. The alarm will continue to beep, flash and vibrate for a minute until the battery is dead.



CAUTION!!

Change battery only in an area known to be non-hazardous.

Step 1. Remove the battery compartment cover on the back of the detector.



Step 1



Step 1



Step 2



Step 3

Step 2. Lift the ribbon out.

Step 3. Using the ribbon, pull the battery out.

Step 4. Replace the old battery using the orientation markers inside the battery compartment.



Step 4

⚠ Warning!!

Use only the following models of batteries:

Tadiran TL 5955

EVE ER14335

Replacing the Sensor


 **New sensors need to warm-up before first calibration and use.**
(See **Table A** for required warm-up times.)

To replace the sensor, using the calibration adapter, remove the sensor cap.




Then carefully remove the sensor by pulling straight out. Also remove the filter that is held in place with an o-ring, located in the ToxiRAE II housing above the sensor.

Replace with a new sensor and filter. Replace the filter (P/N: 045-2045-000) when it appears dirty or when the sensor is replaced. (See **Table A** for sensor part numbers.)

 **Sensors are not interchangeable; use only RAE Systems sensors, and use only the sensor type specified for your ToxiRAE II monitor. Use of non-RAE Systems components will void the warranty and can compromise the safe performance of this product.**

Make sure the pins are not bent or corroded. Align the pins to the corresponding holes and push straight in. The sensor should fit flush against the PCB.

Specifications

Size	3.6" (9.3 cm) x 1.9" (4.9 cm) x 0.9" (2.2 cm)
Weight	3.6 oz (102 gm) with clip
Battery	User replaceable 2/3 AA high capacitance Lithium battery
Operating Period	2 years typical battery life when use 8 hours/day with less than 5 minutes of alarms per day. 2 years typical sensor life for CO/H ₂ S sensors, all other sensors typical 1 year life
Display	Easy-to-read LCD for continuous display of concentration in ppm and text messages
Keypad	One button operation
Direct Readout	<ul style="list-style-type: none"> • Instantaneous display of toxic gas concentration in ppm (or oxygen in %) • STEL & TWA values • Peak hold
Alarms	<ul style="list-style-type: none"> • Audible: 90 dB at 10 cm • Visual: Bright Red/Green LED bar visible from top, front, and sides • Sensory: Built-in vibration alarm • High: Displays "High" emits 3 beeps and flashes per second • Low: Displays "Low" 2 beeps and flashes per second • STEL: Displays "STEL" 1 beep and flash per second • TWA: Displays "TWA" 1 beep and flash per second
Calibration	Two point field calibration; Auto-zero at startup, user initiated span/standard reference gas.
EMI/RFI	Highly resistant to EMI / RFI. Compliant with EMC Directive 89/336/EEC
IP Rating	rating: protected against dust, protected against low pressure jets of water from all directions
Hazardous Area Approval	<ul style="list-style-type: none"> • UL/cUL Classified as Intrinsically Safe for use in Class I, Division 1 Groups A, B, C, D, Hazardous Locations T5 rating • ATEX II 1G, EEx ia IIB T5 II 2G, EEx ia IIC T5 •  European Conformity (Conformite Europeene)
Temperature	<ul style="list-style-type: none"> • Continuous: -4 to 114 °F (-20 to 45 °C) • Intermittent: -40 to 131 °F (- 40 to 55 °C)
Humidity	95% relative humidity (non-condensing)
Attachments	Wrist strap, stainless steel alligator clip (installed), stainless steel belt clip/hardhat adapter
Warranty	2-year warranty for instrument and CO/H ₂ S sensors (all other sensors have 1 year warranty)

**On going projects to enhance our products means that these specifications are subject to changes.*

Table A: Sensor Configuration



Sensors are not interchangeable; use only RAE Systems sensors, and use only the sensor type specified for your ToxiRAE II monitor. Use only RAE Systems batteries. Use of non-RAE Systems components will void the warranty and can compromise the safe performance of this product.

Sensor and Part Number	Range (ppm)	Resolution (ppm)	Span Gas (ppm)	Low (ppm)	High (ppm)	STEL (ppm)	TWA (ppm)	Sensor Warm-Up Time**
NH₃ 045-0518-000	0-50	1	50	25	50	35	25	4 hours
CO 045-0512-000	0-500	1	100	35	200	100	35	20 min
CO* 045-0512-200	0-1999	10	100	35	200	100	3	20 min
Cl₂* 045-0516-000	0-10	0.1	10	0.5	5	1	0.5	20 min
ClO₂* 045-0523-000	0-1	0.01	0.5	0.2	0.5	0.3	0.1	20 min
HCN* 045-0517-000	0-100	1	10	4.7	50	4.7	4.7	20 min
H₂S 045-0511-000	0-100	1	25	10	20	15	10	20 min
NO* 045-0514-000	0-250	1	25	25	50	25	25	4 hours
NO₂* 045-0515-000	0-20	0.1	5	1	10	1	1	20 min
O₂* 045-0006-000	0-30	0.1	20.9% (air)	19.5	23.5	-	-	20 min
PH₃* 045-0519-000	0-5	0.01	5	1	2	1	0.3	20 min
SO₂* 045-0513-000	0-20	0.1	5	2	10	5	2	20 min

* Call for availability

** Applies to newly installed sensor only.

Table B: Alarm Signals (H₂S)

Alarm Type	Display	Cause	Buzzer & LED	Vibration Alarm
Over Range		Reading > maximum range	3 beeps/sec	once every second
High		Reading > High Alarm Limit	3 beeps/sec	once every second
Low		Reading > Low Alarm Limit	2 beeps/sec	once every second
TWA		TWA reading > TWA Limit	1 beep/sec	once every second
STEL		STEL Reading > STEL Limit	1 beep/sec	once every second
Negative		Reading < 0 ppm	1 beep/sec	once every second
Battery Low		Battery < 3.2V	1 beep/min	None
Battery Dead		Battery < 3.1V	1 beep/sec	once every second



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SPECIAL NOTE: If the monitor needs to be serviced, contact either:

the **RAE Systems distributor** where the unit was purchased; they will return the monitor on the user's behalf,

or the **RAE Systems Technical Service department**. Before returning the unit for service or repair, obtain a Returned Material Authorization (RMA) number for proper tracking of your equipment. This number needs to be on all documentation and posted on the outside of the box in which the monitor is returned for service or upgrade. ***Packages without RMA Numbers will be refused at the factory.***

ToxiRAE II

Addendum To User Manual



Rev B 04.2006

Physical Description

- 1 Bright red LED Alarm
- 2 Display
- 3 Audio Alarm
- 4 Gas Inlet
- 5 Button
- 6 Alligator Clip
- 7 Removable sensor cover (China and E.U. only)



Operating the ToxiRAE II

Turning the Monitor ON (Firmware 1.4)



Make sure the Lithium battery is installed.



Hold the button down until you see the word "on" displayed, and then release it.

You see the firmware version displayed briefly (for example, "F15" means firmware version 1.5).



The monitor performs a self-test preceding the warm-up and zero calibration.

Then the current gas concentration reading is displayed. The ToxiRAE II is now operational.

Turning the Monitor ON (Firmware 1.5)

NOTE: Firmware version 1.5 is used on ToxiRAE II models equipped with sensors for CO, H₂S, and O₂.

Make sure the Lithium battery is installed.



Hold the button down until you see the word "on" displayed, and then release it.



You see the firmware version displayed briefly (for example, "F15" means firmware version 1.5).

The monitor performs a self-test preceding the warm-up. It counts down from 10 to 1, beeps, and vibrates.



Then the current gas concentration reading is displayed. The ToxiRAE II is now operational.

Program Mode (v.1.5 only)

Use the Program Mode to perform any of the following actions (listed in order of appearance):

Calibrate the Monitor

Change Alarm Limits



Pro



CAL



Go

To enter Program Mode, the instrument must first be turned off. Press the blue button rapidly, 3 times in succession. “Pro” appears in the display. Immediately hold the button down again until the display reads “on.” The display counts down and the buzzer, lights, and vibration alarms are tested.

To exit Program Mode, press the button until “Pro” and “End” appear. Hold the button down for 5 seconds and release. The unit is now in Monitor Mode.

Replacing the Sensor (China & E.U. Only)

ToxiRAE II models with a removable sensor cover allow you to change the sensor. **Note:** Removable sensor-cover versions are not available in the U.S.

New sensors need to warm up before first calibration and use.
(See **Table A** or **Table B** for required warm-up times.)

To replace the sensor, use the calibration adapter to turn the sensor cap one quarter-turn counterclockwise. Next pull off the sensor cap.



Then carefully remove the sensor by pulling it straight out. Also remove the filter that is held in place with an o-ring, located in the ToxiRAE II housing above the sensor.

Replace these with a new sensor and filter. Replace the filter (P/N: 045-2045-000) when it appears dirty or when the sensor is replaced. (See **Table A** or **Table B** for sensor part numbers.)

Sensors are not interchangeable. Use only RAE Systems sensors, and use only the sensor type specified for your ToxiRAE II monitor. Use of non-RAE Systems components will void the warranty and can compromise the safe performance of this product.

Make sure the pins are not bent or corroded. Align the pins to the corresponding holes and push the sensor straight in. The sensor should fit flush against the printed circuit board.

Table A: Sensor Configuration (U.S. Only)



Sensors are not interchangeable; use only RAE Systems sensors, and use only the sensor type specified for your ToxiRAE II monitor. Use only RAE Systems batteries. Use of non-RAE Systems components will void the warranty and can compromise the safe performance of this product.

ToxiRAE II Model and Part Number	Range (ppm)	Resolution (ppm)	Span Gas (ppm)	Low (ppm)	High (ppm)	STEL (ppm)	TWA (ppm)	Sensor Warm-Up Time**
NH₃ 045-0518-000	0-50	1	50	25	50	35	25	4 hours
CO 045-0512-000	0-500	1	100	35	200	100	35	20 min
CO* 045-0512-200	0-1999	10	100	35	200	100	35	20 min
Cl₂* 045-0516-000	0-10	0.1	10	0.5	5	1	0.5	20 min
ClO₂* 045-0523-000	0-1	0.01	0.5	0.2	0.5	0.3	0.1	20 min
HCN* 045-0517-000	0-100	1	10	4.7	50	4.7	4.7	20 min
H₂S 045-0511-000	0-100	1	25	10	20	15	10	20 min
NO* 045-0514-000	0-250	1	25	25	50	25	25	4 hours
NO₂* 045-0515-000	0-20	0.1	5	1	10	1	1	20 min
O₂* 045-0006-000	0-30	0.1	20.9% (air)	19.5	23.5	-	-	20 min
PH₃* 045-0519-000	0-5	0.01	5	1	2	1	0.3	20 min
SO₂* 045-0513-000	0-20	0.1	5	2	10	5	2	20 min

* Call for availability.

** Applies to newly installed sensor only.

Table B: Sensor Configuration (China & E.U.)



Sensors are not interchangeable; use only RAE Systems sensors, and use only the sensor type specified for your ToxiRAE II monitor. Use only RAE Systems batteries. Use of non-RAE Systems components will void the warranty and can compromise the safe performance of this product.

ToxiRAE II Model and Part Number	Range (ppm)	Resolution (ppm)	Span Gas (ppm)	Low (ppm)	High (ppm)	STEL (ppm)	TWA (ppm)	Sensor Warm-Up Time**
NH₃ 045-0518-x00***	0-50	1	50	25	50	35	25	4 hours
CO 045-0512-x00***	0-500	1	100	35	200	100	35	20 min
CO* 045-0512-X20***	0-1999	10	100	35	200	100	35	20 min
Cl₂* 045-0516-x00***	0-10	0.1	10	0.5	5	1	0.5	20 min
ClO₂* 045-0523-x00***	0-1	0.01	0.5	0.2	0.5	0.3	0.1	20 min
HCN* 045-0517-x00***	0-100	1	10	4.7	50	4.7	4.7	20 min
H₂S 045-0511-x00***	0-100	1	25	10	20	15	10	20 min
NO* 045-0514-x00***	0-250	1	25	25	50	25	25	4 hours
NO₂* 045-0515-x00***	0-20	0.1	5	1	10	1	1	20 min
O₂* 045-0006-x00***	0-30	0.1	20.9% (air)	19.5	23.5	-	-	20 min
PH₃* 045-0519-x00***	0-5	0.01	5	1	2	1	0.3	20 min
SO₂* 045-0513-x00***	0-20	0.1	5	2	10	5	2	20 min

* Call for availability.

** Applies to newly installed sensor only.

***Use "C" for China and "E" for E.U.



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SPECIAL NOTE: If the monitor needs to be serviced, contact either:

the **RAE Systems distributor** where the unit was purchased; they will return the monitor on the user's behalf,

or

the **RAE Systems Technical Service department**. Before returning the unit for service or repair, obtain a Returned Material Authorization (RMA) number for proper tracking of your equipment. This number needs to be on all documentation and posted on the outside of the box in which the monitor is returned for service or upgrade. ***Packages without RMA Numbers will be refused at the factory.***