SENSOR TECHNOLOGY ENGINEERING, INC.

5553 Hollister Ave. #1, Santa Barbara, CA 93117 (805) 964-9507 Fax (805) 964-2772

RADIATION PAGER®

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DESCRIPTION

The Radiation Pager is a small, self contained gamma-ray radiation detector for use in the interdiction and location of nuclear materials. It was specifically designed to be easily used by government agencies and emergency responders. The Radiation Pager is hundreds of times more sensitive than commercially available Geiger-Muller (GM) tube type detectors in this size range. This increase in sensitivity is made possible by the use of a miniature photomultiplier tube and solid state scintillation detector. The Radiation Pager is approximately the size of a message pager, and is intended to be worn on the belt or carried in a pocket. When x-rays or gamma rays are detected at levels significantly above the natural background, the unit quickly alerts the operator by flashing a high intensity light and either sounding an audio alarm or triggering a vibrator. The operator can quickly localize the source of the alarm with a single digit LED display, a flashing LED, or an audio tone if selected. The pager can operate continuously for one year on a pair of commonly available AA alkaline batteries.

SPECIFICATIONS

Detector Type: Cesium Iodide Scintillator

Detector Size: 0.5 inch diameter (1.3 cm)
1.5 inches long (3.8 cm)

Unit Size: 4.1 inches long (10.2 cm)
2.4 inches wide (6.1 cm)
0.9 inches thick (2.3 cm)

Unit Weight: 6 oz. (170 g) with batteries

Batteries: 2 alkaline AA cells

Battery Lifetime: Greater than 1 year of continuous operation

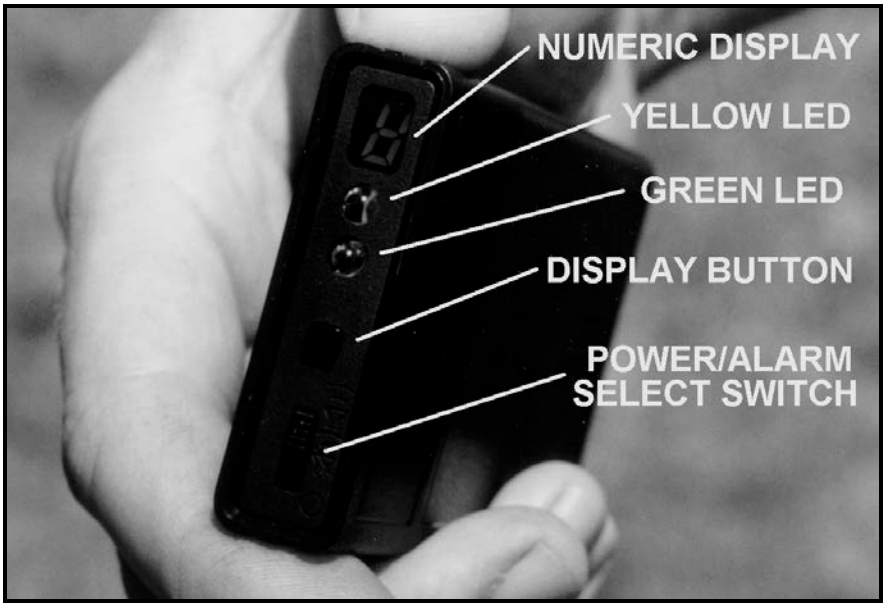
Operating Temperature Range: 5-122 degrees F (-15 to 50 degrees C)

Alarm type: flashing yellow LED (high intensity daylight visible),Audio tone, Vibrator

Low Energy Cutoff: approximately 45 KeV

Integration Time (Response time): less than one second

Search capability: A seven segment LED display indicating radiation intensity, a repetition modulated audio tone, and a repetition modulated high intensity daylight visible LED.



OPERATION

The Radiation Pager is activated by the three-position Power/Alarm Select switch. The outside position powers the instrument OFF, the middle position powers the instrument ON and enables the vibrator alarm (disables audio), and the inner position powers the instrument ON and enables the audio alarm (disables vibrator).

The two high intensity Light Emitting Diodes (LEDs) on the Radiation Pager are used to indicate the status of the instrument and the intensity of the detected radioactivity.

When the instrument is first powered up, the yellow LED flashes while a self test is conducted. At the successful conclusion of the test the green LED illuminates for one second and then both LEDs are extinguished. The Pager is now measuring the ambient radioactivity and will alarm if the detected radiation exceeds a preset value (for more on setting the alarm trip level, see the Alarm Threshold section of this manual).

When the Radiation Pager alarms, it flashes the yellow LED and either vibrates or sounds an audio tone, depending on the setting of the Power/Alarm Select switch. The Radiation Pager will alarm for 14 seconds unless the DISPLAY button (the square black push-button on the control panel) is pressed to terminate the alarm. Alarms remain disabled while the DISPLAY button is pressed. Future alarms will not occur until the DISPLAY button is released and the radiation levels fall below the preset alarm threshold level.

At any time the instrument may be used to search for radioactive material (or to confirm the operating status of the unit) by pressing the DISPLAY button. Pressing the DISPLAY button causes the LEDs to flash in proportion to the number of gamma or X-rays detected, and activates the numeric display. At low radiation levels the green LED will flash after every 16

radiation counts. If the radioactivity is increased to the point that the alarm threshold is exceeded, the green LED will be extinguished and the yellow LED will flash after every 16 radiation counts. If the Power/Alarm Select switch is set to enable audio, a short tone will be emitted each time the green or yellow LED flashes. At higher radiation levels the yellow LED will appear to stay on continuously.

The numeric display provides an indication of the intensity of the detected radiation by a number between 0 and 9. Each number indicates a radiation intensity of twice the previous value (i.e. a level 4 is twice the radiation intensity of a level 3). A level 8 on the display occurs at a radiation exposure of about 2 mR/Hr.

Table 1 shows the display values and their corresponding exposure rates. The instrument can withstand considerably higher exposure rates than shown in Table 1 without paralyzing, and will display a 9.

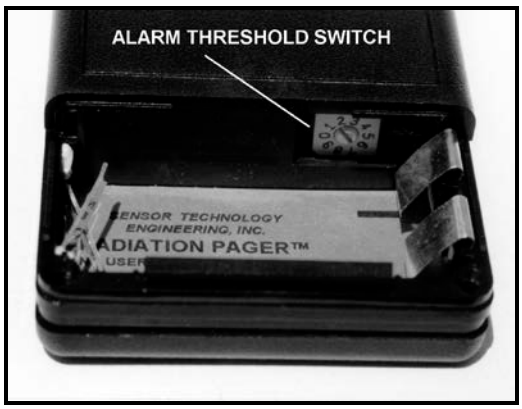
Display	micro R/Hr*
0	7
1	15
2	30
3	60
4	120
5	240
6	480
7	960
8	1900
9	>3800

Table 1 - Display Level vs. Exposure Rate

* Measured at 662 KeV (137 Cs)

ALARM THRESHOLD

The threshold at which an alarm occurs is adjustable by a ten position ALARM THRESHOLD switch accessible through the battery compartment.



Ordinarily the ALARM THRESHOLD switch needs to be set only once for use in a particular location to account for the natural background radiation. Factors that influence the natural background radiation include altitude and the radioactive constituents of the soil and nearby building materials.

At sea level, on land, an ALARM THRESHOLD switch setting of 3 is typical, and the Radiation Pager is shipped with the switch in this position. Testing of the Alarm Threshold using a Cesium-137 source produced the results shown in Table 2. If the ALARM THRESHOLD switch needs to be changed, it is accessible in the battery compartment after the batteries have been removed, and is rotated using a small slotted screwdriver until the pointer on the switch is aligned with the desired number. **NOTE: There are high voltages inside the electronics compartment. Do not insert anything beyond the ALARM THRESHOLD switch**.

When the ALARM THRESHOLD switch is properly set, the occurrence of false alarms will be very rare (less than one per week). Higher settings can reduce the false alarm rate even more, however the alarming sensitivity of the instrument will be adversely affected (a smaller separation distance is necessary to detect a radioactive source). In general, the lowest ALARM THRESHOLD switch setting possible without undue false alarms is the most desirable switch setting.

Switch setting	micro R/Hr*
0	11
1	15
2	23
3	30
4	45
5	60
6	90
7	120
8	180
9	360

Table 2 - Alarm Threshold Switch

* Measured at 662 KeV (137 Cs)

BATTERIES

The Radiation Pager uses two AA size alkaline batteries. In routine operation with few alarms, a pair of batteries will power the unit continuously for over one year.

A low battery condition is indicated when the green and yellow LEDs flash together. This can be observed any time the green LED would normally be illuminated alone, including during power up or when the DISPLAY button is pressed at low or background radiation levels. In addition, the instrument will produce a short audio "chirp" every fifteen seconds when a low battery condition occurs.

To change the batteries, remove the two screws on the lower back of the case and slide the battery door down. The old batteries can now be removed and replaced with fresh ones. Only alkaline AA batteries should be used, with care being given to insert the new batteries in the correct orientation.

If the batteries are inserted with incorrect polarity they will be discharged after several hours by the power protection circuitry of the Radiation Pager. Incorrect battery polarity causes illumination of a red LED visible inside the battery compartment, indicating that the batteries should be removed and replaced in the correct orientation.

WARNING - HIGH VOLTAGE : Do not open the electronics compartment - there are no user serviceable parts inside.

Install the battery door and the two screws holding it in place. Press the case halves firmly together while installing the two screws.

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MAINTENANCE AND CALIBRATION

If on power up the yellow LED continually flashes, or the yellow LED stays on in a steady state, the instrument is malfunctioning, and needs to be sent back to Sensor Technology Engineering, Inc. for maintenance.

It is a good practice to periodically check the operation of the Radiation Pager against a small, low energy gamma-ray source. The preferred source is 1 microCi 241Am such as found in a typical battery powered smoke detector. This source will be detectable at 3-4 inches from the sensor. The alarm level will be in the range of 3-6 when the instrument is placed in contact with the smoke detector.

If the instrument should get immersed in fresh water, remove the battery cover and batteries, and let it air dry. If the instrument should get immersed in salt water, remove the battery cover and batteries, flush with fresh water and let it air dry. Never place the instrument in a microwave oven.

STATEMENT OF WARRANTY (the fine print)

Sensor Technology Engineering, Inc. warrants this product to be free of defects due to workmanship, material, and design for a period of twelve months from the date of delivery. The performance of this product is warranted to be within its specified accuracy limits at the time of shipment. In the event of instrument failure, notify Sensor Technology Engineering, Inc. to determine if repair, or replacement is required.

This warranty excludes the replacement of photomultiplier tubes and scintillation crystals which are broken due to excessive physical abuse or used for purposes other than intended.

There are no warranties, expressed or implied, including without limitation any implied warranty of merchantability or fitness, which extend beyond the description. If the product does not perform as warranted herein, the purchaser's sole remedy shall be repair or replacement, at the option of Sensor Technology Engineering, Inc.. In no event will Sensor Technology Engineering, Inc. be liable for damages, lost revenue, lost wages, or any other incidental or consequential damages arising from the purchase, use or inability to use this product.

Note: all specifications subject to change without notice