RADIATION ALERT™

Ranger

OPERATION MANUAL

SE INTERNATIONAL

RADIATION® A•L•E•R•T

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Chapter 1: Introduction

The unit is a health and safety instrument that is optimized to detect low levels of radiation. It measures alpha, beta, gamma, and x-ray radiation (ionizing radiation only).
Its applications include:

- Detecting and measuring surface contamination
- Monitoring possible radiation exposure while working with radionuclides
- Screening for environmental contamination
- Detecting noble gases and other low energy radionuclides

How The unit Detects Radiation

The unit uses a Geiger-Mueller tube to detect radiation. The Geiger tube generates a pulse of electrical current each time radiation passes through the halogen quenched tube. Each pulse is electronically detected and registers as a count. The unit displays the counts in the mode you choose.

The number of counts detected by The unit varies from moment to moment due to the random nature of radioactivity. A reading is expressed more accurately as an average over time, and the average is more accurate over a longer time period. *For details, see Operating in Count Mode in Chapter 3.*

Precautions

To keep The unit in good condition, handle it with care, and observe the following precautions:

- CAUTION: Never touch The unit to a surface that may be contaminated. You may contaminate the instrument.
- Do not leave The unit in temperatures over 100° F (38° C) or in direct sunlight for extended periods of time.
- Do not get The unit wet. Water can damage the circuitry and the mica surface of the Geiger tube.
- Do not put The unit in a microwave oven. It cannot measure microwaves, and you may damage it or the oven.
- This instrument may be sensitive to and may not operate properly in radio frequency, microwave, electrostatic, and electromagnetic fields.
- If you do not expect to use The unit for longer than one month, remove the batteries to avoid damage from battery corrosion. A battery indicator appears on the display to show remaining power.
- CAUTION: The tube window can sometimes rupture at altitudes higher than 8000 feet (2438.4 meters).
- The mica surface of the Geiger tube window is fragile. Be careful not to let anything penetrate the screen.
- This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy, and if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:
  - Reorient or relocate the receiving antenna
  - Increase the separation between the equipment and receiver
  - Connect the equipment into an outlet on a circuit different from that to which the receiver is connected
  - Consult the dealer or an experienced radio/TV technician for help

Chapter 2: Features

The unit measures alpha, beta, gamma, and x-ray radiation. It is optimized to detect small changes in radiation levels and to have high sensitivity to many common radionuclides. This chapter briefly describes The unit's features. *For more information on how to use The unit, see Chapter 3: Operation.* The unit counts ionizing events and displays the results on the liquid crystal display (LCD). You control which unit of measurement, located to the lower right below the numerical value of the radiation exposure level, is selected by using the mode switch. Whenever The unit is operating, the red LED indicator flashes each time a count (an ionizing event) is detected *Figure 2 (2)*.

The LCD Display *Figure 2 (1)*

The LCD *(liquid crystal display. Figure 2(1))* shows various indicators according to the mode setting, function(s) being performed, and battery condition as shown below.

Indicators

Figure 2(1)

BATTERY ICON - Indicates that the unit is powered by the AA batteries and shows the remaining battery life. The battery icon (not shown) will not appear if the unit is plugged into USB power.

USB ICON - Indicates that the unit is plugged into the USB jack and is running on USB Power. The USB icon will not appear if the unit is running on battery.

ALARM ICON - Indicates that the alarm has been set and is active.

HOURGLASS ICON - The hourglass icon indicates that a timed count is being taken.

RADIATION ICON - The flashing radiation icon indicates that an alarm has been triggered and will remain until the radiation levels drop below the set alarm threshold. The radiation icon will continue to flash at the top of the display if an alarm has been muted.

BACKLIGHT ICON - The backlight icon indicates that the backlight has been turned on.

AUDIO ICON - The audio icon indicates that the audio clicks will sound with each count collected.

MUTE ICON - The mute icon indicates audio has been turned off and the unit is operating in silent mode. It will mute the audio clicks with each count detected (see AUDIO ICON), will mute the beeps with button pushes, counts, etc., but it will not mute the alarm.

RECORD ICON - The record icon indicates that the readings are being recorded into the internal memory, which can be downloaded with the Free Observer USB Software.

\+ The crosshairs, located at the bottom center of the display, marks the center of the GM tube.

The Buttons

The unit has a circular membrane button on the face of the unit, which consists of: Power (Enter), Alarm, Count, Audio (Minus), Menu, Backlight (Plus), and Mode.

Power (Enter) Button

The power (enter) button is located in the center of the membrane switch. It's function is to turn on and off the unit and act as the "Enter" button when in the utility menu. To turn the unit on, press the power button. To turn the unit off, press and hold the power button for 3 seconds.

Alarm Button

The alarm button is used to active the alarm after setting the desired alarm levels.

Count Button

The default count time is 10 Minutes.

Figure 2(2)

The count button is used to take a timed count. To enter the time set screen, press the count button.

Audio (Minus) Button

When not in the menu, the Audio Button will function to silence the audio clicks and switch between silent and audio operation. To switch between audio clicks and no audio clicks with each count collected, press the Audio Button. To switch between silent and audio operation, which mutes everything except the ALARM, press and hold the Audio Button for 3 seconds

When in the menu, the Audio Button will function as the "scroll down," or "Minus Button," for numbers and settings in the utility menu.

Menu Button

Pressing the MENU button will enter into the menu. *See Utility Menu in Chapter 3 for more information on using the utility menu.*

Backlight (Plus) Button

The LCD has a backlight that can be activated for the default 10 seconds by pressing the backlight button. Pressing and holding the backlight button for 3 seconds will turn the backlight on permenantly. Once the backlight has been permenatly activated, pressing and holding the backlight button for 3 seconds will turn off the backlight.

Mode Button *Figure 2 (2)*

The MODE BUTTON is used to select from the available units of measurment.

- *mR/hr (MilliRoentgen)* - displays the radiation level from .001 to 100.
- *µR/hr (MicroRoentgen)* - displays the radiation level from 1 to 9999. Once the levels exceed 9999 µR/hr, the unit of measure will change to mR/hr. Once the radiation levels go below 9999 µR/hr, the unit of measurement will revert back to µR/hr.
- *µSv/hr (MicroSeivert)* - displays the radiation level from .01 to 1000.
- *CPM (Counts Per Minute)* - displays the radiation level from 0 to 350,000
- CPS *(Counts Per Second)* - displays the radiation level from 0 to 5000
- *Count* - displays the accumulated total of counts from 1 to 9,999.
- NOTE: In *CPM and Count* modes, when numeric values exceed 9999, the unit of measurement will change from COUNTS to kCOUNTS (1000 Counts)

The Detector

CAUTION: The mica surface of the Geiger tube is fragile. Be careful not to let anything penetrate the screen.

The unit uses a two-inch, thin window Geiger tube, commonly called a "pancake tube." The screen on the back of The unit is called the window (*Figure 2 (3)*). It allows alpha and low-energy beta and gamma radiation, which cannot get through the plastic case, to penetrate the mica surface of the tube. The small radiation symbol on the end panel of the detector and the small crosshairs shown on the display indicate the center of the Geiger tube.

Figure 2(3)

The USB Port *Figure 2 (2)*

The USB Port allows you to interface the unit USB to a PC for use with the Observer USB Software. *For details, see Chapter 7 Observer USB Software*.

Lanyard Loop

The lanyard loop is located on the botton of the unit and serves as a means to connect a lanyard and also serves as the clip to lock the unit into the stand.

Xtreme Boot

The Xtreme Boot is great for protecting against drops and scratches.You will need to remove the boot to change the batteries and use the Wipe Test Plate option.

Be sure to remove the detector cover or any exposure or rate filters you might have attached to the back of the unit before removing the protective boot.

CAUTION: Be sure you do not damage the mica end window on the back of the detector when removing the protective boot from the unit.

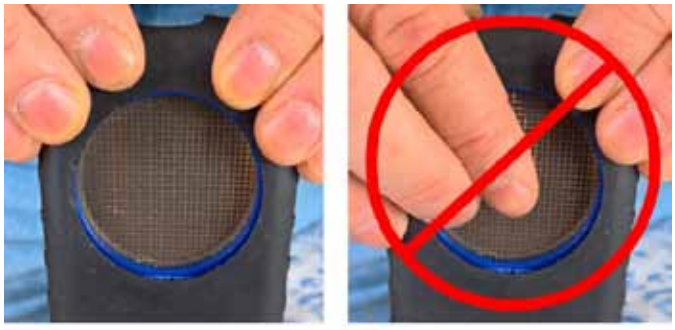


Figure 2(4)

Chapter 3: Operation

Starting The unit

Before starting the unit, install 2 AA alkaline batteries in the battery compartment located in the lower rear of the enclosure. You will need to remove the protective boot to gain access. *CAUTION: Be sure not to press on the 2 inch window of the GM tube while removing the boot.*

To start the unit, press the power button, located in the center of the circular buttons on the front of the unit. The unit then begins a system check, displaying the serial number of the unit, firmware version, and the last calibration date on the start up screen. After the system check, the radiation level is displayed in the previously selected mode. Approximately 30 seconds after you start the unit, a short beep indicates that enough information has been collected to ensure statistical accuracy.

Units of Measurement

The unit is designed for the use of conventional measurement units; counts per minute *(CPM)*, milliroentgens per hour *(mR/hr),* microroentgens per hour *(µR/hr),* counts per second *(CPS)*, microsieverts per hour *(µSv/hr),* and counts, which are used when taking a timed count. To switch between units, press the mode button.

Display Update

In the dose, rate, and count modes, the numeric display is updated every second.

Maximum level

When the maximum level for the current mode is reached, The unit beeps for 3 seconds, pauses for 3 seconds, and repeats that pattern. Also, the numerical values displayed will show OVER instead of the specific rate. The beeping pattern and the flashing display continue until the level decreases or the unit is turned off.

Response Time (Autoaveraging)

When the radiation level is less than 6,000 CPM, the reading in any of the dose rate modes is based on the radiation detected in the previous 30 seconds. In order to give a quicker response to changes, when the radiation level exceeds 6,000 CPM in any 30 second period, the reading is based on the previous 6 seconds. When the radiation level exceeds 12,000 CPM in any 30-second period, the reading is based on the previous 3 seconds. Note: Though Auto-Averaging is on by default, you can choose the fast response mode at any radiation level in the menu.

After 30 second start-up if instrument is detecting	**The reading will be based on an average of the previous**
(<100 CPS) <6000 CPM or <1.75 mR/hr	30 seconds
(100 -200 CPS) 6000-12,000 CPM or 1.75-3.6 mR/hr	6 seconds
(>200 CPS) >12.000 CPM > 3,6 mR/hr	3 seconds

Autoranging

When radiation levels increase in some modes over certain preset levels, The unit uses autoranging, automatically changing from CPM to KCPM or from µR/hr to mR/hr.

Operating in Dose/Rate Modes

Caution: Be sure there is no obstruction between the detector window and the source being monitored/ surveyed. Avoid making measurements with the GM window facing the sun, as it could affect your readings.

At low count rates, significant changes in the radiation level displayed can take up to 30 seconds to stabilize when set to auto-ranging. *For details see Autoranging in this chapter.*

CPM, CPS, and Total counts are the most direct methods of measurement.

µR/hr, mR/hr and µSv/hr are calculated using a conversion factor optimized for Cesium-137. This mode is less accurate for radionuclides other than Cs-137, unless you have calibrated the unit for the specific radionuclide you are surveying.

The most immediate indicators of the radiation level are the audio indicator and count light.

Using The Alarm

The Alarm can be set in dose or rate modes using the currently selected unit of measurement. Once the alarm threshold is reached, the beeper will sound and the alert icon (radiation symbol) will flash until the alarm is deactivated, or the radiation level drops below the set alarm threshold.

1. To set the Alarm, press the alarm button. The set alarm screen will be displayed.
2. Use the + or - buttons to increase or decrease the desired alarm level.
3. Once you have set the alarm to the desired level, press the enter button to retain the setting into memory and activate the alarm. The alarm icon (bell icon) is now displayed to indicate the alarm is active.
4. Once alarm is triggered, press the alarm button to mute the alarm. The alert icon (radiation symbol) will remain flashing until the radiation level fall below the set alarm level.
5. To deactivate the alarm mode, press alarm button, then enter. The alarm icon is no longer shown at the top of the display.

Using the Data Logging Feature

We recommend the clock be set prior to collecting data to ensure a correct time and date in your collected data. The internal clock of the unit can be set to the time on a PC running the Observer USB Software by clicking Functions > Synchronize Ranger to PC Clock. The unit will beep twice once synchronization has completed.

Once the time has been set, you can activate the datalogging via the Observer USB Software or via the menu button on the unit. To activate it on the unit, simply press Menu > Data Logging, then enter and follow the onscreen prompts. The default data logging frequency is 10 minutes. You can change the value in the Cal Panel window of the Observer USB Software. *For more information , see Chapter 7: Observer USB Software.*

Operating in Count Mode

A timed count is useful for determining the average counts per minute over a longer period of time. The number of counts detected by the unit varies from minute to minute due to the random nature of radioactivity. When a count is taken over a longer period, the average count per minute is more accurate.

Taking an average allows you to detect low-level contamination or differences in background radiation due to altitude or soil mineral content. For example, if one 10-minute average is 1 count per minute higher than another 10-minute average, the increase is likely due to normal variation. But over 12 hours, a 1 count per minute increase over the 12 hour background average may be statistically significant.

How to Take a Timed Count

1. Press the count button
2. Using the menu button to switch between seconds, minutes, and hours, est the time using the + and - buttons, to increase and decrease the time.
3. Once you set the count time, press the enter button to begin the timed count.
4. On the count screen, once the count has begun, a flashing hourglass will appear at the top of the display and a star will appear next to the count down until it is completed.
5. From the count screen, press the mode button to cycle through the various units of measure. If you want to see the remaining time in the count, continue cycling through the units of measure until you return to the count screen. If you have pressed the count button accidentally and do not wish to start a new timed count, press the count button again to exit the set count time screen and return to the units of measure.
6. To stop the current count, press the count button, and press enter.

Using Dose/Rate Modes While Timer is On

Dose/rate modes can be used while the timer is on. In any dose/rate mode, the hour glass indicator will continue to flash during a timed count. At the end of the timed period, the hour glass will remain solid, and the unit will beep 3 times.

The Menu

The Menu allows the user to change default settings for several operating parameters. Once a setting is changed, it remains in effect unless they are changed through the Utility Menu, The USB Observer Software, or restoring the unit to its default settings.

1. To activate the Menu, press the menu button. The display will show the menu options.
2. Scroll through the menu by pushing the + or - buttons.
3. To select an option, push the enter Button.
4. Use the + or - buttons to toggle between choices and press the enter button to select the new value. To adjust another menu option, repeat the above steps.
5. To exit the Utility Menu at any time, press the menu button again. The unit will continue with normal operation.

Menu Options

Auto Averaging - Turn on and off auto averaging. On by default.
Data Logging - Turn on and off the internal memory to record readings. Off by default.
Pick Efficiency - Select the efficiency to apply to the reading. Ranger only.
Set To Defaults - Reset to the default factory settings. Doing this will not change the deadtime and sensitivity or the time and date.

Setting the Internal Clock

It is not necessary to set the internal clock to start collecting data to memory, but it is recommended to properly time stamp the data collection on your device to ensure a correct time and date in your collected readings. You will need a copy of the Observer USB Software to set the internal clock. The latest version is available at seintl.com/software. *For details, see Chapter 7: Observer USB Software.*

Interfacing with an External Device

The USB jack on the left side of The unit provides an interface for use with the USB Observer Software. You can use it to record the counts on a computer, download the recorded data, and calibrate the instrument. *For details, see Chapter 7 Observer Software*. The USB will not charge the batteries.

Chapter 4: Common Procedures

The following sections give instructions for several commonly-used procedures. With any procedure, the user must determine the suitability of the instrument or procedure for that application.

Establishing the Background Count

Normal background radiation levels vary at different locations, different times, even in different areas of the same room. To accurately interpret the readings you get on the unit, it is good to establish the normal background radiation count rate for each area you plan to monitor. You can do this by taking a timed count. *For more information on using the timer, see How To Take A Timed Count in Chapter 3*.

A 10-minute average is moderately accurate. You can repeat it several times and compare the results to establish accuracy. To establish a more accurate average, take a 1 hour timed count. If you need to determine whether there is prior contamination, take averages in several locations, and compare the averages.

Environmental Area Monitoring

You can keep The unit in dose/rate mode whenever you want to monitor the ambient radiation, and look at it from time to time to check for elevated readings.

If you suspect an increase in ambient radiation, use the count mode and take a 5 or 10 minute count, and compare the average to your average background count. If you suspect an increase that is too small to detect with a short timed reading, you can take a longer count (for example 6, 12, or 24 hours).

Checking for Surface Contamination

To check a surface, hold the detector window close to the surface, and read the count rate (wait 30 seconds or until the reading has stabilized). If you want to find out if a surface is slightly radioactive, take a timed count or a longer accumulated count.

Chapter 5: Maintenance

The unit requires regular calibration and careful handling to assure good measurements. Use the following guidelines to maintain the instrument properly.

Calibration

We recommend that the unit be calibrated annually, or as often as your regulations require. The best way to calibrate is using a calibrated source at a calibration lab. However, if no source is available, it is possible to calibrate electronically using the calibration software. S*ee Chapter 8 for more information*.

The standard by which The unit is calibrated is Cesium-137. A certified calibration source should be used. To calibrate The unit for another radionuclide, use a calibrated source for that radionuclide or the appropriate conversion factor referenced to Cs-137. CAUTION: Errors can occur when using low level sources or background for calibrating. In the Calibration mode, the smallest increment which can be adjusted is .010.

If you would like more information about source calibrations, please contact us at 1.800.293.5759 or go to seintl.com/services.

General Maintenance Tips

1. Do not get the instrument wet.
2. Be sure to store the meter in a location without direct sunlight, as sunlight can damage the end window of the detector over time.
3. Be sure to store the unit inside the carrying case when not in use.
4. If you are planning to store the unit for a long time, remove the batteries to avoid battery corrosion inside the battery compartment.
5. Do not place the unit inside a microwave oven as it can damage the unit and/or the microwave. This instrument is for detecting ionizing radiation such as alpha, beta, gamma, and x-rays. It will not detect non-ionizing radiation such as microwave and radio emissions.
6. Do not place any objects that may puncture the mica end window of the detector near the detector.

Chapter 6: Basics of Radiation and Its Measurement

Ionizing Radiation

Ionizing radiation changes the structure of individual atoms by ionizing them. The ions produced in turn ionize more atoms. Substances that produce ionizing radiation are called radioactive. Radioactivity is a natural phenomenon. Nuclear reactions take place continuously on the sun and all other stars. The emitted radiation travels through space and a small fraction reaches the Earth. Natural sources of ionizing radiation also exist in people and in the ground. The most common sources of ground radiation are uranium and its decay products

Types of Ionizing Radiation

X-Rays

X-rays are man made radiation produced by bombarding a metallic target with electrons at a high speed in a vacuum. X-rays are electromagnetic radiation of the same nature as light waves and radio waves, but at extremely short wavelength, less than 0.1 billionth of a centimeter. They are also called photons. The energy of X-rays are millions of times greater than that of light and radio waves. Because of this high energy level, X-rays penetrate a variety of materials, including body tissue.

Electromagnetic radiation (photons) of higher frequency and energy than visible and ultraviolet light. X-rays are photons emitted by interactions involving orbital electrons rather than atomic nuclei. X-rays and gamma rays have the same basic characteristics. The only difference between them is their source of origin.

Gamma Rays

Gamma rays are almost identical to X-rays. Gamma rays generally have a shorter wavelength than X-rays. Gamma rays are very penetrating and thick lead shielding is generally required to stop them.

Short wavelength electromagnetic radiation higher in frequency and energy than visible and ultraviolet light. Gamma rays are emitted from the nucleus of an atom. These high energy photons are much more penetrating than alpha and beta particles.

Beta Radiation

Beta radiation A beta particle consists of a negatively charged electron emitted from an atom. It has more mass and less energy than a gamma ray, so it doesn't penetrate matter as deeply as gamma and X-rays.

Beta particles have a mass and charge equal to that of an electron. They are very light particles (about 2,000 times less mass than a proton) and have a charge of -1. A few millimeters of aluminum will stop most beta particles.

Alpha Particles

Alpha radiation is a particle that consists of two protons and two neutrons, the same as the nucleus of a helium atom.

Positively charged particles emitted from the nucleus. Alpha particles are relatively large, and very heavy. Due to this strong positive charge and large mass, an alpha particle cannot penetrate far into any material. It generally can travel no more than 1 to 3 inches in air before stopping, and can be stopped by a piece of paper.

Chapter 7: Observer USB Software

The Observer USB reads in Total Counts, CPM, CPS, µR/hr, mR/hr, µSv/hr and has the ability to collect, log the data received, calibrate the unit, and echo the readings collected on a PC. The data is displayed on a graph, as well as a digital on-screen meter. Data can be saved or printed in various ways, including a spreadsheet format. The dwell/count time can be adjusted for each point on the graph. You can also set the length of time for the count. The on-screen display in the software has adjustable settings as well as a settable alarm.

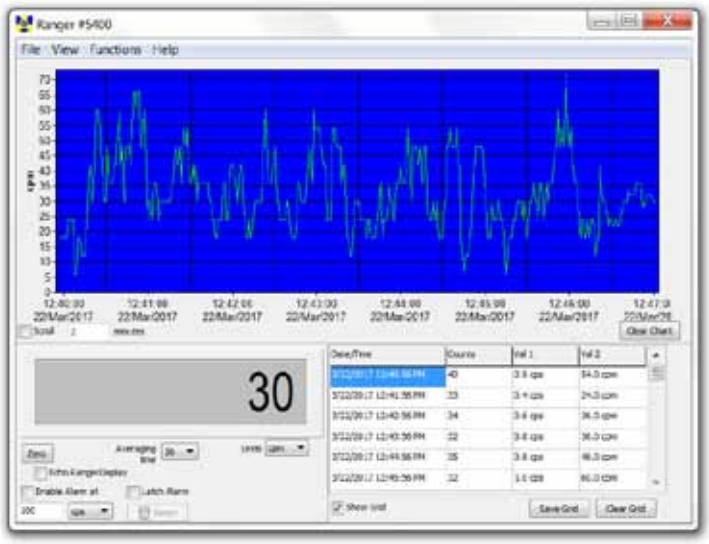
Installing the Observer USB Software

To use the Observer USB Software with your unit, you will first need to install the software prior to connecting your instrument to the computer. You can download a copy at seintl.com/software. After the software has completed downloading, double click on the installer and follow the on-screen prompts. Once the software is installed and started, the detector will be automatically detected and identified once the unit is connected via USB.

Connect to The unit

Ensure that you have installed the Observer USB Software before connecting The unit. The USB port is a microUSB type jack located on the side of the unit above the Output *Figure 2 (9)*. To connect the unit, power on your detector, plug the cable into the USB jack, and connect the other end to the USB port on your computer.

Once the unit is connected, the Observer Software will launch and open a window for the instrument with a serial number displayed in the upper left corner of the title bar. A new window will open for each detector connected.



Preferences

The alarm settings, auto-save chart feature, and the grid settings for datalogging frequency and units of measurement can be adjusted in View > Preferences menu.

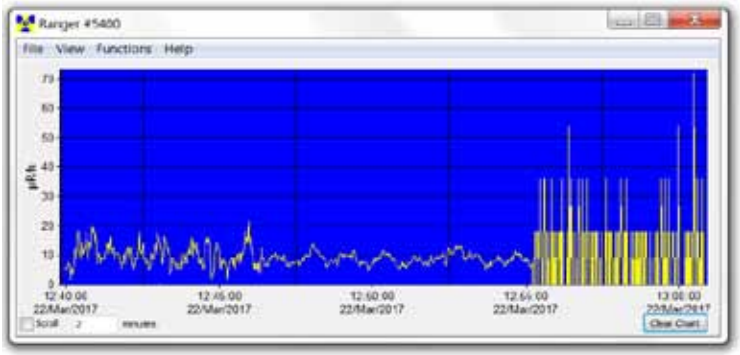
Using the Data Logging Feature

You should set the time and date on the unit prior to collecting data. We recommend the clock be set prior to collecting data to ensure a correct time and date in your collected data. The internal clock of the unit can be set to the time on the PC you are using by clicking Functions > Synchronize The Ranger to PC Clock. The unit will beep twice once synchronization has completed. The update will be recorded in the on board memory if the recording feature is on. *See Chapter 3: Operation, Menu for information on activating the recording feature.*

If the recording feature on the unit is activated and the internal clock is set, then the collected data can be retrieved from the unit's internal memory by selecting Functions > Retrieve Memory. Data is stored in a text delimited file, which can be opened in your preferred spreadsheet software. The default data logging frequency is 10 minutes. You can change the value in the Calibration Panel window of the Observer USB Software.

Show Grid

The Show Grid check box displays the data collected in the grid. The grid displays an ongoing collection of data based on the user selectable settings in the View > Preferences > Grid Settings dialog box. For example, if the grid setting is 60 seconds, a new data point will appear on the grid every minute.



Observer USB Chart Screen

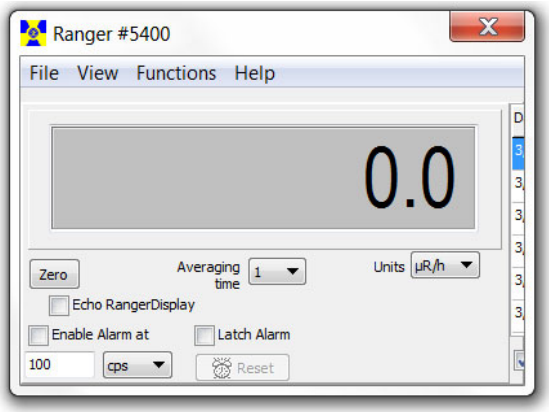
The Observer USB Chart Screen displays a chart of the data currently collected by the attached instrument.

The X Axis

The X axis consists of the time and date stamp of the reading collected and will adjust automatically to display all of the data collected unless the Scroll check box is selected. If the Scroll check box is selected, the X axis will display the latest readings collected in the minute(s) time frame selected next to the Scroll check box. For example, if 2 minutes is selected in the Scroll time, then the chart will display the latest 2 minutes of data collected. The most recent data collected will be shown on the right side of the graph.

The Y Axis

The Y axis displays the unit of measurement for the reading displayed and will automatically adjust to display the highest reading collected.



Observer USB Meter Screen

The Observer USB Meter Screen simulates a digital meter to display the readings collected by the detector.

Enable Alarm

This will enable the alarm that is built into the software. Once the radiation levels go back below the set level of the alarm, the alarm will stop unless you have checked Latch Alarm. When the Latch Alarm is checked, the alarm will continue to go off until the reset button is pressed. This is a USB Observer Software alarm only, not the alarm on the unit itself.

Zero

When the Zero is clicked, the averaging of the collected counts starts over.

Units/Echo Display

When Echo Display is checked, the meter screen will mirror the display of your Ranger and the units dropdown box selects the unit of measurement displayed on the y axis of the chart screen. When Echo Display is not checked, the meter screen will not mirror the display of your Ranger. You can select your own averaging time and the units dropdown box selects the unit of measurement displayed on both the y axis of the chart screen and the meter screen.

Averaging Time

The Averaging Time selects the amount of time in which the previous readings are averaged for a more accurate display of the collected counts. The longer the averaging time, the more accurate your reading. Shorter averaging times allow significant changes to be seen more quickly.

Cal Panel (Calibration Panel)

Located under View > Cal Panel, the Cal Panel window can be used to change a number of settings on your unit. The unit should be in the mode or count screen when Updating the Settings, as some changes to the menu items via the Cal Panel will not refresh on the unit if the unit is displaying a menu screen.

Cal Panel (Calibration Panel)

Calibration Information

Calibrations, such as an NIST Source Calibration, include information such as the Serial Number, Calibration Date, Deadtime (sec), and Sensitivity (cpm per mR/hr).

CAUTION: Please note that changes to the Serial Number, Calibration Date, Deadtime (sec), and Sensitivity (cpm per mR/hr) may void any calibration of the unit on record.

Applied Isotope

See Chapter 8: Built in Isotope Efficiencies.

Alarm Settings

The Alarm cpm and Alarm Enabled fields set the alarm. To activate the alarm, enter the desired alarm threshold in the Alarm cpm field and check Alarm Enabled. To disable the alarm, uncheck Alarm Enabled.

Preset Counting Time (sec)

This will set the default time for taking a count on your unit.

Data Logging Settings

Use Datalogging, Datalogging Interval (min), Circular Buffer, and Clear Memory handle the data logging settings in the Cal Panel.

Use Datalogging - Check the box to enable writing the collected data to the internal memory.
Datalogging Interval (min) - How often you want the data to be logged.
Circular Buffer - When this box is checked, the oldest collected data will be overwritten with the most recent data collected.
Clear Memory - Clears the data stored in the internal memory of the unit.

Backlight On Time

This will determine how many seconds the backlight will be on when pressing the backlight button on the unit.

Auto-Averaging

This activates the auto-averaging feature of the unit. When unchecked, the unit is in fast response mode.

Audio Settings

Clicks Enabled - enable/disable the clicks only with the Clicks Enabled checkbox.
Quite Mode - enable/disable all sounds on the unit.

Chapter 8: Built in Isotope Efficiencies

Built in Isotope Efficiencies

The unit has a number of built in efficiencies for specific isotopes. If you know the isotope being surveyed, then you can select one of the pre-programmed isotope efficiencies to calculate the activity of your known source.

The activity *(DPM and Becquerel (Bq))* is different from the rates of exposure *(mR/hr, µSv/hr, CPM, and CPS).* Activity is the number of disintegrations of a radioactive substance in a given unit of time, which is specific to the isotope being detected. The efficiencies programmed into the unit are based on the geometry of our wipe test plate, which places samples 1cm from the end window of the detector. *Caution: Do not use the built in efficiencies unless you are surveying a known isotope, as doing so will give you inaccurate results.*

Decay

When an atom emits an alpha or beta particle or a gamma ray, it becomes a different type of atom. Radioactive substances may go through several stages of decay before they change into a stable, or non-ionizing, form. An element may have several forms or isotopes. A radioactive isotope of an element may be called a radioisotope. However, the more correct term is radionuclide.

Selecting a Built-In Isotope Efficiency

Press the menu button, scroll to Pick Efficiency, and press the enter button. Use the + and _ buttons to scroll to the desired isotope and press enter to select the isotope efficiency you want to use for your survey. Press menu again to exit the menu. Use the mode button to scroll to the DPM and Bq screens to display the activity.

You can select from any of the following isotope efficiencies built into The unit: ^{14}Carbon (C-14), ^{32}Phosphorus (P-32), ^{35}Sulfur (S-35), ^{90}Strontium (Sr/y-90), ^{131}Iodine (I-131), ^{137}Cesium (Cs-137), ^{60}Cobalt (Co-60), and Alpha.

Additionally, when using the Observer USB Software, users can add a custom isotope efficiency to meet their application. For more information on how to calculate the efficiency of a known isotope, see the support section of our website at seintl.com/support.

Adding a Custom Isotope Efficiency

Select the Cal Panel from the View Menu on the main Observer USB Software screen. You can select any of the preprogrammed isotopes from this screen in addition to adding your own custom efficiency.

1) Check the box under Named Isotope, located in the lower left portion of the Cal Panel Screen.

2) Then use the name field to the right of the check box to name your isotope. You can use up to 7 characters and this will be displayed under Menu > Pick Efficiency on the unit as well.

3) Then enter the value of the efficiency in the efficiency field to the right of the name field.

4) Click Update Settings and you will hear the unit beep four times, indicating the settings have been updated.

Chapter 9: Observer USB Calibration Software

General Discussion of Calibration

In order to have confidence in the measurements taken with a radiation detection instrument, a calibration must be performed. The calibration compares the response of the instrument to known values and the instrument is adjusted (if needed) to bring all indications within the range of the instrument to within ±10% of the true values. Generally, radiation detection instruments should be calibrated annually.

CAUTION: Errors can occur when using low level sources or background for calibrating. In the Calibration mode, the smallest increment which can be adjusted is .010.

Pulse Based Pre-Calibration

Since GM-based instruments are essentially pulse counters, it must be verified that the number of counts reported equals the number of counts input. This should be demonstrated for both count rates and total counts. The issue is confused somewhat with the addition of dead-time compensation where the number of counts in any given second is adjusted upward to account for pulses “lost” during the time the detector is busy recharging from a pulse.

All calibration factors must be entered using the Observer USB software.

Requirements

You will need a PC running Observer USB and a Pulse generator

Procedure

1. With the instrument powered off, remove the back of the unit and attach a pulse generator to the unlabeled test point immediately to the left of U2. Pulses must be positive with a duration of approximately +3.3 to 5V peak to peak square wave. No high voltage is connected to this test point.
2. Power on the instrument.
3. Connect the instrument to the PC running Observer USB using the USB cable. An application window for the attached instrument should open within a few seconds.
4. Go to *View > Cal Panel* menu of The Observer USB Software to access the Calibration Screen.
5. Record the currently displayed dead time. *(Default is 1.8E-4 seconds.)*
6. Change the dead time to 0 and click the Update Settings button. After a second or two the instrument should beep to acknowledge that the new setting has been received, stored, and applied. Setting the dead time to 0 seconds causes the device to not apply any dead-time correction at all, so the display should report the true input pulse rate.
7. Run the pulse generator at several different rates to span the range of the instrument. For The unit, the maximum working input pulse rate should be about 367,000 CPM (6.123 Hz). Verify that the value reported by the instrument is within ±10% of the input value in all cases.
8. Change the dead time back to the setting recorded in Step 5.

Efficiency Calibration

The unit can be used beyond simple detection of contamination and can also be used to determine the activity of any beta- or alpha-emitting isotopes present.

Efficiency is the ratio of events detected by the instrument to the number of decays of the particular isotope. The units are therefore counts per disintegration or, c/d. Since efficiencies are generally somewhat less than one, they are often multiplied by 100 and expressed as a percentage. However, the Observer USB software requires that values not be entered as percentages. Since efficiency varies based on the energy and abundance of the particular isotope being measured, it is best to determine efficiency for the specific isotope(s) for which the activity is to be determined.

The efficiency is also affected by the size of the source and the source to detector distance. To achieve consistency, efficiencies should be determined using a point source (which means a source with an area significantly smaller than the detector entrance window) at a fixed distance from the detector face (which must be specified, but 1 cm will be assumed to be the standard).

Requirements

You will need a PC running Observer USB, Calibration sources, a Ranger Wipe Test Plate (or other constant-geometry source holder to maintain sources 1 cm from the detector entrance window)

Procedure *(American Units)*

1. Attach the Wipe Test Plate to the unit. Ensure the unit is in the count mode, displaying COUNTS.
2. Place the unit in the location where the efficiency calibration will be performed and take a count of at least 10 minutes. Divide the total number counts by the acquisition time (in minutes) to calculate the background counting rate (RB) in CPM. Record this value.
3. Center the first source to be used into the Wipe Test Plate and take a count of at least 1 minute. Divide the total number of counts by the counting time (in minutes) to calculate the gross count rate (gcpm or RG).
4. Calculate the efficiency using the following equation:

$$Eff = \frac{(R_G - R_B)}{A}$$

Where
Eff is instrument efficiency in counts per disintegration
RG is the gross count rate in counts per minute (cpm)
RB is the background count rate in cpm
A is the activity of the source in disintegrations per minute (dpm)

5. Repeat Steps 3 and 4 for additional radionuclides.
6. If you would like to record efficiency values in the unit's memory for any of the supported radionuclides (S-35, Sr/Y-90, Cs-137, P-32, C-14, I-131, Co-60, ALPHA), continue with the following steps.
7. Connect the unit to the PC running Observer USB using the USB cable. An application window for the unit should open within a few seconds.
8. Display the control panel by clicking View > Cal Panel.
9. Enter the updated efficiencies in the appropriate fields.
10. If you would like the unit to display in activity units (i.e., DPM) for a specific source instead of the count rate (CPM), select it from the Applied Isotope dropdown box. Otherwise, leave as None (cpm/cps).
11. When all relevant values have been updated, click the Update Settings button. After a second or two the unit should beep twice to acknowledge receiving the updated settings.

Procedure (Metric Units)

1. Attach the Wipe Test Plate and power on the unit. Make sure The unit is in count mode displaying COUNTS.
2. Place the unit in the location where the efficiency calibration will be performed and take a count of at least 10 minutes. Multiply the acquisition time by 60 to convert it from minutes to seconds. Divide the total number counts by the acquisition time (in seconds) to calculate the background counting rate (RB) in cps. Record this value.
3. Center the first source to be used into the Wipe Test Plate and take a count of at least 1 minute. Divide the total number of counts by the counting time (in seconds) to calculate the gross count rate (gcps or RG).
4. Calculate the efficiency using the following equation:

$$Eff = \frac{(R_G - R_B)}{A}$$

Where
Eff is instrument efficiency in counts per disintegration
RG is the gross count rate in counts per second (cps)
RB is the background count rate in cps
A is the activity of the source in disintegrations per second (dps) or becquerels (Bq)

5. Repeat Steps 3 and 4 for additional radionuclides.
6. If you would like to record efficiency values in the unit's memory for any of the supported radionuclides (S-35, Sr/Y-90, Cs-137, P-32, C-14, I-131, Co-60, ALPHA), continue with the following steps.
7. Connect the unit to the PC running Observer USB using the USB cable. An application window for the unit should open within a few seconds.
8. Display the control panel by clicking View > Cal Panel.
9. Enter the updated efficiencies in the appropriate fields.
10. If you would like the unit to display in activity units (i.e., DPM) for a specific source instead of the count rate (CPM), select it from the Applied Isotope dropdown box. Otherwise, leave as None (cpm/cps).
11. When all relevant values have been updated, click the Update Settings button. After a second or two The unit should beep to acknowledge receiving the updated settings.

Exposure Rate Calibration

An exposure rate calibration correlates the number of counts in a given time to the exposure rate present in that field. This is in many ways similar to efficiency but we refer to it in this case as gamma sensitivity. Although it is possible to express this value in several different units, The unit uses a formula of CPM/mR/hr (counts per minute per milliroentgen per hour).

The instrument is placed in gamma radiation fields of different (but known) intensities that span the working range of the instrument, and the settings are adjusted (if needed) such that all measurements are within ±10% of the true value. The relevant settings include both the sensitivity and the dead time.

The gamma field is usually generated by a relatively strong Cs-137 source. Exposure rates are calculated to the center of the detector's volume.

Requirements

You will need a PC running Observer USB and a Gamma calibration range

Procedure

1. Power on the instrument.
2. Connect the instrument to the PC running Observer USB using the USB cable. An application window for the attached instrument should open within a few seconds.
3. Display the calibration panel by clicking View > Cal Panel.
4. Record the displayed values for Dead Time and Sensitivity.
5. Begin checking the instrument's Sensitivity. Place the instrument in a relatively low field, approximately 5 mR/hr, and allow it 30 seconds or so to stabilize.
6. If the indicated response is off by more than 3% at this level, adjust the Sensitivity to a lower value if the instrument is reading too low, or to a higher value if the instrument is reading too high. After changing the value on the Calibration Panel, click the Update Settings button. After a second or two the instrument will beep to indicate that the new value has been received.
7. Repeat Step 5 as needed to bring the instrument indication as close as possible to the true value.
8. Next, expose the instrument to a field near the top of its range of 100 mR/hr. Allow the reading to stabilize for at least 30 seconds. In the preferences tab, you can adjust the time in the gird to show a selected average count.
9. If the indicated response is off by more than 10%, adjust the Dead Time to a lower value if the instrument reading is too low, or to a higher value if the instrument reading is too high. After changing the value on the Calibration Panel, click the Update Settings button. After a second or two the instrument will beep twice to indicate that the new value has been received.
10. Repeat step 9 as needed to bring the instrument's indication within ±10% of the true value.
11. Once the values for Sensitivity and Dead Time have been verified to be correct, expose the instrument to a series of values spanning the range of the instrument. All indications should be within ±10% of the true value.

Chapter 10: Troubleshooting

The unit is a highly reliable instrument. If it does not seem to be working properly, look through the following chart to see if you can identify the problem.

Problem	Possible Cause	Action
Display works, but no counts are registered	defective Geiger tube or bad cable	look through the window to check the mica surface of the tube; if it is wrinkled or a break is visible, replace it
Reading is high, but another instrument has a normal reading in the same location	possible contamination	scan The unit with another instrument. You may need to replace the rubber strips on back of The unit
Instrument has false high reading	moisture	circuit board may be wet; dry the instrument in a warm dry place; if it still has a problem, it requires service
Instrument has false high reading or OVERRANGE	photosensitivity	remove from direct sunlight and ultraviolet sources; if the high count drops, the mica window coating may have washed off the Geiger tube due to getting wet; the tube will need to be replaced
	continuous discharge	replace the Geiger tube
	electromagnetic field	move the instrument away from possible sources of electromagnetic or radio frequency radiation
Display is blank	no battery, dead battery, poor battery connection defective LCD	install a new AA batteries *(if count light and audio work, the LCD may need to be replaced)*

Chapter 11: Basics of Taking Measurements

The unit will not detect neutron, microwave, RF (radio frequency), laser, infrared, or ultraviolet radiation. All of our instruments are most accurate for Cesium-137 and isotopes of similar energies. Some isotopes detected relatively well by most Geiger counters are Cobalt-60, Technicium-99M, Phosphorous-32, Strontium-90, and many forms of Radium, Plutonium, Uranium, and Thorium.

Some forms of radiation are very difficult or impossible for a Geiger tube to detect. Tritium, for example, is a by-product of a nuclear reactor and is used in research. The beta emissions from Tritium are so weak that there are very few instruments that are capable of detecting it. More sophisticated equipment is needed for the measurement of environmental samples, such as radioactivity in milk, produce, soil, etc., unless you are looking for gross contamination.

The radiation from some isotopes can cause a Geiger tube to overexcite and indicate a higher level of radiation than is actually present. Americium 241 is an example of this phenomenon. Americium 241 is used in some smoke detectors and many different types of industrial density and flow meters.

Unless you know exactly what you are measuring and understand the limitations of detection instruments, it is possible to draw misleading conclusions from your readings. We design our instruments to detect the broadest range of ionizing radiation possible and still be affordable. The full spectrum of ionizing radiation cannot be measured by one single instrument. Everyone agrees that radioactive materials can be dangerous. We encourage you to seek out other sources of information.

How to Detect Background Radiation

To see what the background radiation is in your area, simply turn the instrument on and, after the 30 second start up beep, the general background radiation will be displayed.

How To Survey a Surface

When surveying a surface, such as a counter top, you will need to hold The unit about 1-2 centimeters from the surface while moving the unit horizontally across the survey area at a rate of 2 inches per second.

How to Perform a General Survey

A general survey would be used to find a potential source. For example, if you are looking for a potential source in a pile of scrap, The unit will typically detect about 2 feet into a pile. It is easier to find a source when The unit is set to Fast Response mode. However, even if the unit is in Auto-Averaging mode, the audio clicks that indicate a count should be a sufficient indicator if a potential source is present. To find the source, slowly move the unit in the direction of the higher readings or clicks until the potential source is found.

Geiger counters can detect the four main types of ionizing radiation: alpha, beta, gamma, and x-rays. Some detect only gamma and x-rays. Our instruments are calibrated to Cesium 137, but also serve as excellent indicators for many other sources of ionizing radiation. Gamma and x-rays are measured in milliroentgens per hour (mR/hr), microsieverts (µSv/hr), or millisieverts (mSv/hr). Alpha and beta are measured in counts per minute (CPM) or counts per second (CPS).

The window of the GM tube is very thin mica. This mica window is protected by a screen. Some levels of alpha, low energy beta, gamma, and x-rays that cannot penetrate the plastic case or the side of the tube can be sensed through the window.

Try not to touch the instrument to any suspected radioactive substance.

Although some beta and most gamma radiation can go through protective gear, try to avoid skin contamination and ingestion. When you leave a radioactive area, remove any protective outerwear and dispose of it properly. If you think you have been contaminated, as an additional precaution, shower and consult a physician.

How to Determine Alpha, Beta, or Gamma source.

To determine whether the radiation detected is alpha, beta, or gamma, hold the instrument toward the source.

Alpha: If there is no indication through the back of the case (the side of the tube), position the window close to but not touching the source. If there is an indication, it is alpha, beta, or low energy gamma. If a sheet of paper placed between the window and the source stops the indication, it is most likely alpha. To avoid particles falling into the instrument, do not hold the source above the window.

Beta: Place a piece of aluminum about 1/8 inch (3 mm) thick between the instrument and the source. If the indication stops, decreases, or changes, it is most likely beta radiation. Most common isotopes emit both beta and gamma radiation. This is why the indication would decrease or change but not stop.

The non-occupational dose limits set by the government is 100 mR above background annually.

It is up to the individual to decide what a safe radiation level is. It will be different depending on the individual and their knowledge of radiation and its affects. Radiation levels will vary according to location and circumstances. As an example; if your background level is 25 CPM (counts per minute) where you live, when you fly in an airplane at 30,000 feet your rate meter may measure 200 CPM (.2 mR) for 2 to 5 hours. That is 8 times your normal background radiation on the ground, but it is only for a limited amount of time.

When measuring radiation in an emergency response situation, it is good to have something to compare your readings to. Taking a background radiation level reading in your area before a radiation event will help you determine if you have an elevated level of radiation and whether or not to stay in that location. Background radiation is naturally occurring radiation that is always present. It includes high energy gamma rays from the sun and outer space and alpha, beta, gamma radiation emitted from elements in the earth. Using a rate meter, you can determine your normal background radiation levels.

Gamma and X-Rays: If there is an indication of radioactivity, it is most likely gamma or high energy beta. Low energy gamma and x-rays (10-40 keV) cannot penetrate the side of the GM tube, but may be detected through the window.

If you perform the alpha/beta test above and there is no change or only a very slight change in the indication, the source is emitting primarily gamma radiation.

Radiation Measurement Units

Several different units are used to measure radiation, exposure and dosage.

Roentgen is the amount of X-radiation or gamma radiation that produces one electrostatic unit of charge in one cc of dry air at 0° C and 760 mm of mercury atmospheric pressure. One thousand milliroentgen (1,000 mR)= 1R. The unit displays in milliroentgens per hour (mR/hr).

Rad is the unit of exposure to ionizing radiation equal to an energy of 100 ergs per gram of irradiated material. This is approximately equal to 1.07 roentgen.

Rem is the dosage received from exposure to a rad. It is the number of rads multiplied by the quality factor of the particular source of radiation. The rem and millirem are the most commonly-used measurement units of radiation dose in the U.S. 1 rem= 1 rad.

Sievert is the standard international measurement of dose. One sievert is equivalent to one hundred rems. A microsievert (µSv) is one millionth of a sievert. A unit of dose equivalent. 1 Sv= 100 roentgens, 10 µSv/hr = 1 milliroentgen/hr.

Curie is the amount of radioactive material that decays at the rate of 37 billion disintegrations per second, approximately the decay rate of one gram of radium. Microcuries (millionths of a curie) and picocuries (trillionths of a curie) are also often used as units of measurement.

Becquerel (Bq) is defined as the activity of a quantity of radioactive material in which one nucleus decays per second. 1 dps (one disintegration per second).

Converting CPM to mR/hr

$$\text{mR/hr} = \frac{\text{cpm}}{\text{sensitivity}}$$

Sensitivity is expressed in cpm per mR/hr (Counts Per Minute for every milliroentgen the GM tube can detect) referenced to Cs-137. Mathematically the cpm units cancel each other out leaving mR/hr, as shown below.

$$\frac{\text{cpm}}{\frac{\text{cpm}}{\text{mR/hr}}} = \frac{\text{cpm}}{1} \times \frac{\text{mR/hr}}{\text{cpm}} = \text{mR/hr}$$

For example, if you have collected 200 CPM with the Radiation Alert Ranger, which has a typical gamma sensitivity of 3340 cpm per mR/hr, you would divide the 200 cpm by the 3340 cpm per mR/hr sensitivity. The cpm cancels out and you are left with 200/3340 mR/hr = 0.057 mR/hr

$$\frac{200\ \text{cpm}}{3340\ \frac{\text{cpm}}{\text{mR/hr}}} = 0.057\ \text{mR/hr}$$

Chapter 12: Glossary of Common Terms

Background Radiation

Naturally occurring radiation is always present, it includes high energy gamma rays and particles from the sun and outer space and alpha, beta, and gamma radiation emitted from elements in the earth.

CPM (counts per minute)

The unit of measurement usually used to measure alpha and beta radiation.

Ion

An atomic particle, atom, or molecule that has acquired an electrical charge, either positive or negative, by gaining or losing electrons.

Ionization

The process by which neutral atoms of molecules are divided into pairs of oppositely charged particles known as ions.

Ionizing Radiation

Radiation capable of producing ionization by breaking up atoms or molecules into charged particles called ions.

Radiation

The emission and propagation of energy through space or through matter in the form of particles or waves.

Radionuclide

The naturally occurring or artificially produced radioactive form of an element.

Decay

When an atom emits an alpha or beta particle or a gamma ray, it becomes a different type of atom. Radioactive substances may go through several stages of decay before they change into a stable, or non-ionizing, form. For example; U-238 has 14 different stages of decay before it stabilizes. An element may have several forms, or isotopes. A radioactive isotope of an element may be called a radioisotope. However, the more correct term is radionuclide.

Half-life

Each radionuclide has a characteristic half-life, which is the time required for half of a quantity of the material to decay.

Chapter 13: Accessories

Xtreme Boot (Included)

The Xtreme boot offers maximum performance in a lightweight rugged solution for using Radiation Alert® products in the field. The Xtreme boot is designed specifically for individuals operating in tough environments, such as 1st Responders, Mining and HAZMAT crews. Made of a RoHS compliant TPE rubber, the case also offers superior grip and drop protection. When using the pancake detector, a protective cap opens on the back of the case exposing the end window of the GM for alpha detection.

Detector Cover (Included)

The detector cover will help protect the mica window of the GM detector. You will need to remove the protective cover to detect alpha radiation.

Wipe Test Plate (Optional)

The stainless steel WipeTest Plate slides easily onto the unit positioning the depression and wipe directly in front of the GM tube window at a fixed distance of 1 centimeter. The WipeTest plate is removable for general surveying. Many of the customers using the Wipe Test Plate also use it as a Beta Shield for the 2-inch GM detector.

Stand (Included)

Whether you need to perform area monitoring or scan your hands and items for contamination, the STAND offers a convenient way for the instrument to STAND vertically while leaving your hands free for other tasks.

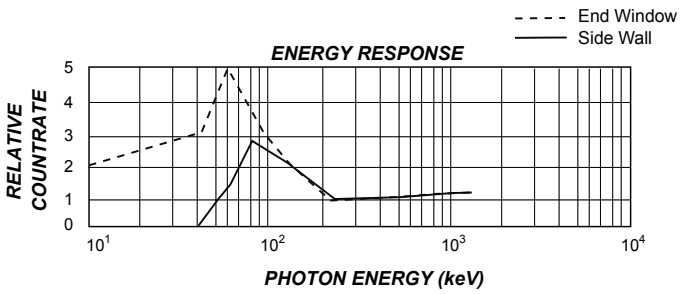
Lanyard (Included)

The loop on the bottom of the enclosure can accommodate the included lanyard to help protect the unit from drops.

Appendix A: Technical Specifications

Detector
Internal Halogen-quenched, uncompensated GM tube with thin mica window, 1.4-2.0 mg/cm2 areal density. Effective diameter of window is 45 mm (1.77 in.).

Operating Range
mR/hr - .001 (1µR) to 100
CPM - 0 to 350,000
µSv/hr - .01 to 1000
CPS - 0 to 5000
Total Counts- 1 to 9,999,000 counts



Accuracy (Referenced to Cs137)
Typically ±15% from factory, ±10% with NIST Source Calibration

Energy Sensitivity
Detects Alpha down to 2 MeV. Detects Beta down to .16 MeV; typical detection efficiency at 1 MeV is approx. 25%. Detects Gamma down to 10 KeV through the detector window. 3340 CPM/mR/hr (137Cs). Smallest detectable level for 125I is .02 µCi at contact.

Built-In Efficiencies
Sulfur (35S), Strontium (90Sr/y), Cesium (137Cs), Phosphorus (32P), Carbon (14C), Iodine (131I), Cobalt (60Co), and Alpha

Selectable Alert Set Range
mR/hr .001 - 100 and CPM 1 - 350,000. Pulsating beeper sounds the alert. Adjustable alert levels are used for mR/hr / CPM, and µSv/hr / CPS. 70db @ 1m. Alarm will sound when in Timer Mode when set alarm threshold is reached.

Anti-Saturation
Meter will hold at OVER RANGE in fields as high as 100 times the maximum reading.

Averaging Periods
Display updates every 3 seconds. At low background levels, the update is the average for the past 30-second time period. The timed period for the average decreases as the radiation level increases.

Display
Graphic Display with Backlight

Count Light
Red LED flashes with each radiation event

Audio Indicator
Internally mounted beeper (can be switched off for silent operation)

Outputs
USB for use with Free Observer USB Software for PCs

Power Requirements
Two AA alkaline batteries (included)

Size
140 X 68 X 33 mm (5.5 X 2.7 X 1.3 in.)

Includes
Carrying Case, Xtreme Boot, Stand, Lanyard, Detector Cover, Mini-USB Cable, Observer USB Software Download , Certificate of Conformance

Options
Wipe Test Plate, Swipes, NIST Calibration

Limited Warranty
1 year limited warranty

Appendix B: Limited Warranty

WARRANTOR: S.E. International, Inc., P.O. Box 39, 436 Farm Road, Summertown, TN 38483-0039, USA, (931) 964-3561

ELEMENTS OF WARRANTY: S.E. International, Inc., warrants for one year all materials and craftsmanship in this product to be free from all defects with only the limitations set out below.

WARRANTY DURATION: The warranty shall terminate and be of no further effect one year after the original date of purchase of the product or at the time the product is: a) damaged or not maintained as is reasonable or necessary, b) modified, c) repaired by someone other than the warrantor for a defect or malfunction covered by this Warranty, d) contaminated with radioactive materials, or e) used in a manner or purpose for which the instrument was not intended or contrary to S.E. International, Inc.'s written instructions. This warranty does not apply to any product subjected to corrosive elements, misuse, abuse, or neglect.

STATEMENT OF REMEDY: In the event that the product does not conform to the warranty at any time while this warranty is effective, the Warrantor will repair the defect and return the instrument to you prepaid, without charge for parts or labor.

NOTE: While the product will be remedied under this warranty without charge, this warranty does not cover or provide for the reimbursement or payment of incidental or consequential damages arising from the use of or the inability to use this product. The liability of the company arising out of the supplying of this instrument, or its use, whether on warranties or otherwise, shall not in any case exceed the cost of correcting defects in the instrument, and after the said one year period all such liability shall terminate. Any implied warranty is limited to the duration of the written warranty.

PROCEDURE FOR OBTAINING PERFORMANCE OF WARRANTY: In the event that the product does not conform to this warranty, please write or call to the address above. S.E. International, Inc. will not accept contaminated instruments for calibration or repair under warranty or otherwise.

NOTE: Before using this instrument, the user must determine the suitability of the product for his or her intended use.

Calibration Database Application

Please fill out this form and send it back to us if you would like to be notified of the NIST calibration renewal for your instrument to:

S.E. International, Inc.
P.O. Box 39, 436 Farm Rd. Summertown, TN 38483
1.800.293.5759 | 931.964.3561 | Fax: 1.931.964.3564
www.seintl.com | radiationinfo@seintl.com

NAME	MODEL NAME
COMPANY	SERIAL NUMBER
ADDRESS	DATE PLACED IN SERVICE
CITY	EMAIL
STATE, ZIP, & COUNTRY	PHONE NUMBER

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