



RADIATION[®]
A • L • E • R • T

RADIATION ALERT™ *Ranger EXP*

OPERATION MANUAL

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Chapter 1: Introduction

The Ranger EXP 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 Ranger EXP Detects Radiation

The Ranger EXP 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 count is displayed in the mode you choose.

The number of counts detected by the Ranger EXP 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. *See Chapter 3: Operating in Count Mode.*

Precautions

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

- CAUTION: Never touch the Ranger EXP to a surface that may be contaminated. You may contaminate it.
- Do not leave the Ranger EXP in temperatures over 100° F (38° C) or in direct sunlight for extended periods of time.
- Do not get the Ranger EXP wet. Water can damage the circuitry and the mica surface of the Geiger tube.
- Do not put the Ranger EXP in a microwave oven. It cannot measure microwaves, and you may damage it or the oven.
- The Ranger EXP may be sensitive to and may not operate properly in radio frequency, microwave, electrostatic, and electromagnetic fields.
- The software may disconnect in high static conditions and may need to be restarted by the user.
- If you do not expect to use the Ranger EXP 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.
- 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:
 1. Reorient or relocate the receiving antenna
 2. Increase the separation between the equipment and receiver
 3. Connect the equipment into an outlet on a circuit different from that to which the receiver is connected
 4. Consult the dealer or an experienced radio/TV technician for help


Chapter 2: Features


The Ranger EXP 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 Ranger EXP's features. The Ranger EXP counts ionizing events and displays the results on the liquid crystal display (LCD). The unit of measurement is located on the lower right, below the numerical value. The unit of measurement is selected by using the mode switch. Whenever the Ranger EXP is operating, the red LED indicator flashes each time a count (an ionizing event) is detected *Figure 2(2)*.


The LCD Display

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


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

 USB ICON - Indicates that the Ranger EXP is plugged into the USB jack and is running on USB power. The USB icon will not appear if it is running on battery power.


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


 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 - Indicates that the backlight has been turned on.

 AUDIO ICON - Indicates that the audio clicks will sound with each count collected.

 MUTE ICON - Indicates the audio has been turned off and the Ranger EXP is operating in silent mode. While in silent mode, you will not hear the beeps that indicate turning on or off the alarm, turning on or off the timer or making changes in the menu. You can still activate the clicks by pressing the Audio button. The Mute function does not turn off the beeps from the Alarm or the Over Range feature. If you turn the unit off, you will have to turn the Mute feature back on if you wish to use it.

 RECORD ICON - Indicates that the readings are being recorded into the internal memory, which can be downloaded with the free Observer USB Software. The record icon will flash when the on-board memory is full.

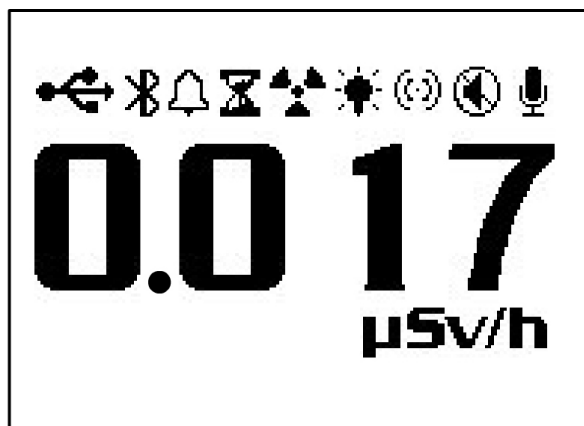


Figure 2(1)

The Buttons

The Ranger EXP has a circular membrane button on the face of the instrument, 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 turns the Ranger EXP on and off and acts as the “Enter” button when in the utility menu. To turn the Ranger EXP on, hold down the power button until you hear a beep. To turn it off, press and hold the power button until prompted to release.

Alarm Button

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

Count Button

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

The default count time is 10 Minutes. *See Chapter 3: How To Take A Timed Count.*

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 and OVER RANGE, press and hold the Audio Button for 3 seconds

NOTE: 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 Chapter 3: Utility Menu.*

Backlight (Plus) Button

The LCD has a backlight that can be activated for the default 7 seconds by pressing the backlight button. Pressing and holding the backlight button for 3 seconds will turn the backlight on permanently. Once the backlight has been permanently activated, pressing and holding the backlight button for 3 seconds will turn off the backlight.

NOTE: When in the menu, the Audio Button will function as the “scroll up,” or “Plus Button,” for numbers and settings in the utility menu.



Figure 2(2)

Mode Button

The MODE BUTTON (*Figure 2 (2)*) is used to select from the available units of measurement.

- *mR/hr (MilliRoentgen)* - displays the radiation level from .001 to 100.
- *CPS (Counts Per Second)* - displays the radiation level from 0 to 5000.
- *μSv/hr (MicroSievert)* - displays the radiation level from .01 to 1000.
- *Counts* - displays the accumulated total of counts from 1 to 9,999 kcounts (9,999,000).
- *CPM (Counts Per Minute)* - displays the radiation level from 0 to 350,000.
- *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.
- 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: Be sure the Ranger EXP is turned off when you connect or disconnect the EXP probe from the device. The mica surface of the Geiger tube is fragile. Be careful not to let anything penetrate the screen.

The Ranger EXP uses a two-inch, thin window Geiger tube, commonly called a “pancake tube,” that connects to the base unit via BNC with the included cable. The screen on the face of the probe 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 back of the detector indicates the approximate center of the Geiger tube.

The USB Port

The USB Port (*Figure 2 (2)*) allows you to interface the Ranger EXP via USB to a PC for use with the Observer USB Software. See *Chapter 6: Observer USB Software*.

Lanyard Loop and Stand

The lanyard loop is located on the bottom of the Ranger EXP and serves as a means to connect a lanyard to the base. It also serves as the clip to lock the Ranger EXP into the stand. When using the stand with the Ranger EXP, it is recommended that you secure the stand to a surface via the screw holes, located in opposing corners of the stand’s base.

Xtreme Boot

The Xtreme Boot is great for protecting against drops and scratches. You will need to remove the boot to change the batteries. Be sure the Ranger EXP is turned off, and disconnect the EXP probe from the device before removing the boot to prevent potential stress on the connectors.



Figure 2(3)

Chapter 3: Operation

Starting the Ranger EXP

Before starting the Ranger EXP, 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.

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

If you plan on using the datalogging feature, please be sure to set the correct local time and date with the Observer USB Software prior to activating the datalogging. *See Chapter 6: Observer USB Software.*

Units of Measurement

The Ranger EXP is designed for the use of conventional measurement units; counts per minute (CPM), microroentgens per hour ($\mu R/hr$), milliroentgens per hour (mR/hr), counts per second (CPS), microsieverts per hour ($\mu Sv/hr$), 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 Ranger EXP beeps for 3 seconds, pauses for 3 seconds, and repeats. 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 instrument 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 Ranger EXP uses autoranging, automatically changing from CPM to KCPM or from $\mu\text{R/hr}$ 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. *See Autoaveraging.*

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

$\mu\text{R/hr}$, mR/hr and $\mu\text{Sv/hr}$ 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 Ranger EXP 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 the alarm is triggered, press the alarm button to mute the alarm. The alert icon (radiation symbol) will remain flashing until the radiation levels fall below the set alarm level.
5. To deactivate the alarm mode, press alarm button, then the enter button. The alarm icon is no longer shown at the top of the display.

Using the Data Logging Feature

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 the 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. *See Chapter 6: Observer USB Software.* The internal clock of the Ranger EXP can be set to the date and time on a PC running the Observer USB Software by clicking *Functions > Synchronize Ranger to PC Clock*. The Ranger EXP 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 Ranger EXP. To activate it on the Ranger EXP, press Menu > Data Logging, then enter and follow the on screen prompts. The default data logging frequency is 1 minute. You can change the frequency in the Cal Panel window of the Observer USB Software. There is enough on-board memory for a data logging frequency of 1 minute to record for 90 hours. A data logging frequency of 10 minutes can record for 888 hours. *See Chapter 6: 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 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, set the time using the + and - buttons, to increase and decrease the time.
3. Once you set the count time, press the enter button (Figure 2(2)) 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 the count is completed. Once the count is completed the hour glass and star will disappear.
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 The 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 Ranger EXP will beep 3 times.

Menu

The Menu allows the user to change the default settings for several operating parameters. Once a setting is changed, it remains in effect unless it is changed through the Utility Menu, the USB Observer Software, or by restoring the 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. Normal operation will continue.

Menu Items

Auto Averaging

Turns auto averaging on or off. On by default.

Data Logging

Turns the internal memory on or off to record readings. Off by default.

Pick Efficiency

Selects the efficiency to apply to the reading.

Set To Defaults

Resets the Ranger EXP to the default factory settings. Doing this will not change the deadtime and sensitivity, the time and date, or the data collection frequency.

Bluetooth LE

Turns the Bluetooth on or off. Off by default.

Ranger EXP Factory Defaults

The factory default setting are:

Auto Average - On

Clicks - On

Audio Button silent mode - Off

Count Time - 10 minutes (600 seconds)

Alarm - Off - Default level - 3340 CPM (1.0 mR/hr, 1000 μ R/hr, 10 μ Sv/hr, 55 CPS)

Data Logging Interval - 1 minute

When you access **Set to Defaults** in the **Menu** on the instrument, all of the above settings will be returned to the factory defaults, except **Data Logging**. The **Data Logging** Interval can only be changed through the software.

When you turn off the Ranger EXP, any settings you have made will come back to their last state except the **Audio Button** silent function. To switch between silent and audio operation, which mutes everything except the ALARM and OVER RANGE, press and hold the Audio Button for 3 seconds.

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 the 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. See *Chapter 6: Observer USB Software*.

Interfacing with an External Device

The USB jack on the right side provides an interface for use with the USB Observer Software. See *Chapter 6 Observer Software*. The USB connection 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, 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. *See Chapter 3: How To Take A Timed Count.*

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 Ranger EXP 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). Do not touch the unit to whatever you are checking to avoid contaminating the unit.

Chapter 5: Maintenance

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

Calibration

We recommend that the Ranger EXP be calibrated annually, or as often as your regulations require. The best way to calibrate is using a calibrated source at a calibration lab.

The standard by which The Ranger EXP is calibrated is Cesium-137. A certified calibration source should be used. To calibrate The Ranger EXP 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 Ranger EXP wet.
2. Be sure to store the Ranger EXP in a location without direct sunlight, as sunlight can damage the end window of the detector over time.
3. Be sure to store the Ranger EXP inside the carrying case when not in use.
4. If you are planning to store the Ranger EXP for a longer than one month, remove the batteries to avoid battery corrosion inside the battery compartment.
5. Do not place the Ranger EXP inside a microwave oven as it can damage the instrument and/or the microwave. This Ranger EXP 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 window of the detector near the detector screen.

Chapter 6: Observer USB Software

The Observer USB reads in Total Counts, CPM, $\mu\text{R/hr}$, mR/hr , CPS, $\mu\text{Sv/hr}$, and has the ability to collect, log the data received, set the calibration date and settings, 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 set the length of time for the count. The software display has adjustable settings as well as a settable alarm.

Installing the Observer USB Software

The New Observer USB is a free version of the Observer software that runs on Windows®. You can download a copy the Observer USB Software at seintl.com/software. Install the software prior to connecting your Ranger EXP to the computer. After the software has completed downloading, double click on the installer, and follow the on-screen prompts.

Connect to the Ranger EXP

Once the software is installed and started, it will run as a service in the background identified by the icon in the system tray. The instrument will be automatically detected and identified when the Ranger EXP is connected via USB. The USB port is a micro USB jack located on the side of the Ranger EXP *Figure 2(2)*. To connect, turn the instrument on, plug the cable into the USB jack, and connect the other end to the USB port on your computer.

Once the Ranger EXP is connected, the Observer Software will launch and open a window for the instrument with the serial number displayed in the upper left corner of the title bar (*Figure 6(1)*). A new window will open for each detector connected.

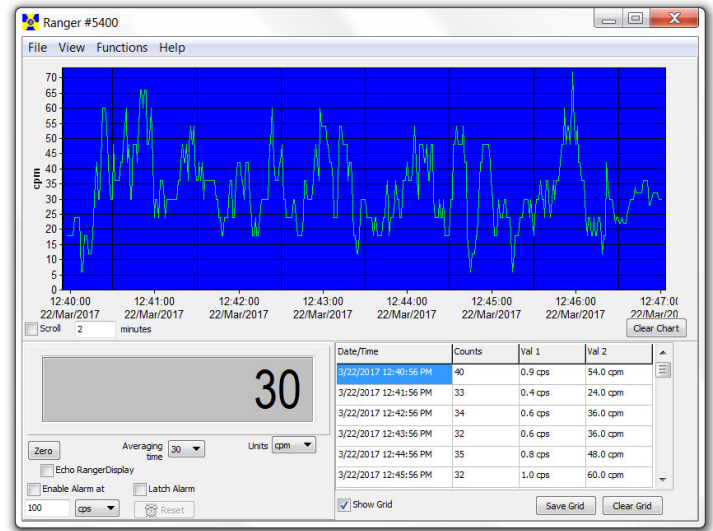


Figure 6(1)

Observer USB Chart Screen

The Observer USB Chart Screen (*Figure 6(2)*) 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.

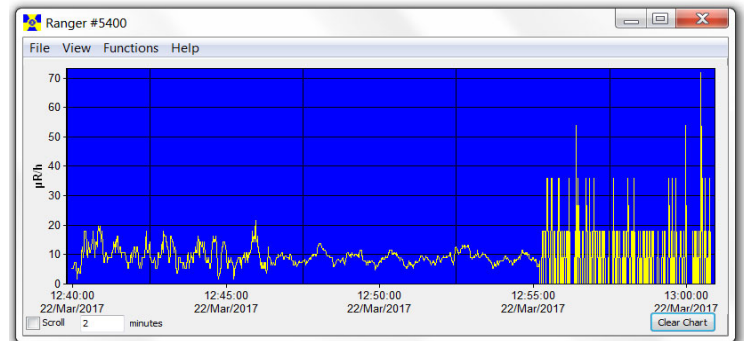


Figure 6(2)

Observer USB Meter Screen

The Observer USB Meter Screen (*Figure 6(3)*) simulates a digital meter to display the readings collected by the detector.

Zero

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

Averaging Time

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

Units

To switch between units of measurement, use the **Units** drop down menu. The **Units** drop down box selects the unit of measurement displayed on the y axis of the chart screen. You can select **Averaging Time** and the **Units** of measurement of the chart screen and the meter screen.

Echo Ranger EXP Display

When Echo Ranger Display is checked, only the meter screen will mirror the display of the Ranger EXP.

Enable Alarm at and Latch Alarm

You must first check **Use Audible Alarm** in *View > Preferences* to enable the alarm on your computer's sound system. The **Enable Alarm at** box will activate 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 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 Ranger EXP.

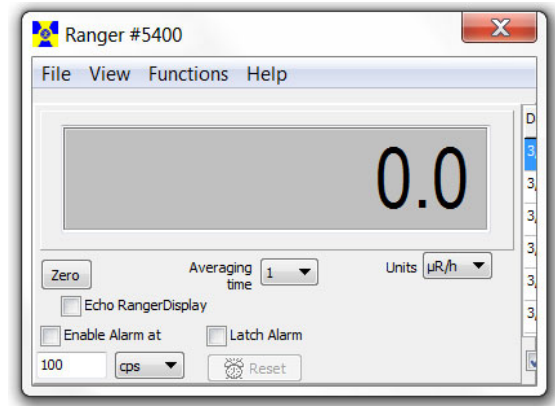


Figure 6(3)

Show Grid

Show Grid displays an ongoing collection of data based on the user selectable settings in the *View > Preferences > Grid Settings* dialog box (*Figure 6(4)*).

Save Grid and Clear Grid

You can save or clear the Grid at any time by clicking on the **Save Grid** or **Clear Grid** boxes.

File

Save Chart

A text file of the Chart data is saved.

Save Grid

A text file of the Grid data is saved.

Exit

Closes the program.

Date/Time	Counts	Val 1	Val 2
8/15/2017 10:04:02 AM	7	0.2 cps	10.0 cpm
8/15/2017 10:05:02 AM	18	0.2 cps	14.0 cpm
8/15/2017 10:06:02 AM	6	0.1 cps	8.0 cpm
8/15/2017 10:07:02 AM	10	0.2 cps	12.0 cpm
8/15/2017 10:08:02 AM	10	0.2 cps	12.0 cpm

Show Grid Save Grid Clear Grid

Figure 6(4)

View

Preferences

Use *View > Preferences* menu to adjust the settings in the Observer USB Preferences (Figure 6(5)).

Chart Settings

Autosave and Clear Chart Every

Will automatically save and clear the chart at the number of minutes selected. Auto Save files are saved to the Observer USB Data folder located in the Documents Library.

Use Audible Alarm

Will sound an alarm on the computer's sound system.

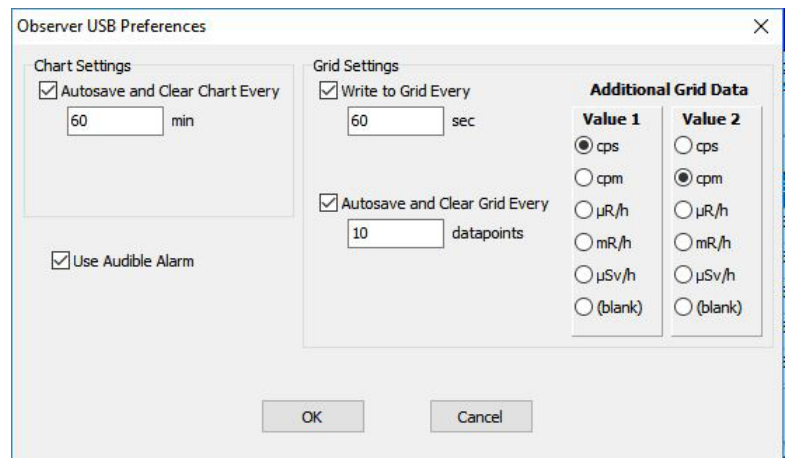


Figure 6(5)

Grid Settings

Write to Grid Every

Will set how often a new data point will appear on the grid.

Autosave and Clear Grid Every

Will automatically save and clear the grid at the number of data points selected.

Additional Grid Data

Allows the setting of the units of measurement shown in the grid for **Value 1** and **Value 2**.

Cal Panel (Calibration Panel)

Located under *View > Cal Panel*, the Calibration Panel Window (Figure 6(6)) displays the **Serial Number** and **Calibration Values**. You can use the **Calibration Panel** to change a number of settings on the instrument. The Ranger EXP should be in a mode screen or count screen when choosing to **Update Settings**, as some changes to the menu items via the Cal Panel will not refresh if the instrument is displaying a menu screen. **Note: Update Settings must be chosen before any changes made in the Calibration Panel will be applied to the Ranger EXP.**

Calibration Information

Calibrations, such as an NIST Source Calibration, contain information including 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 instrument on record.

Applied Isotope

See Chapter 7: Built in Isotope Efficiencies.

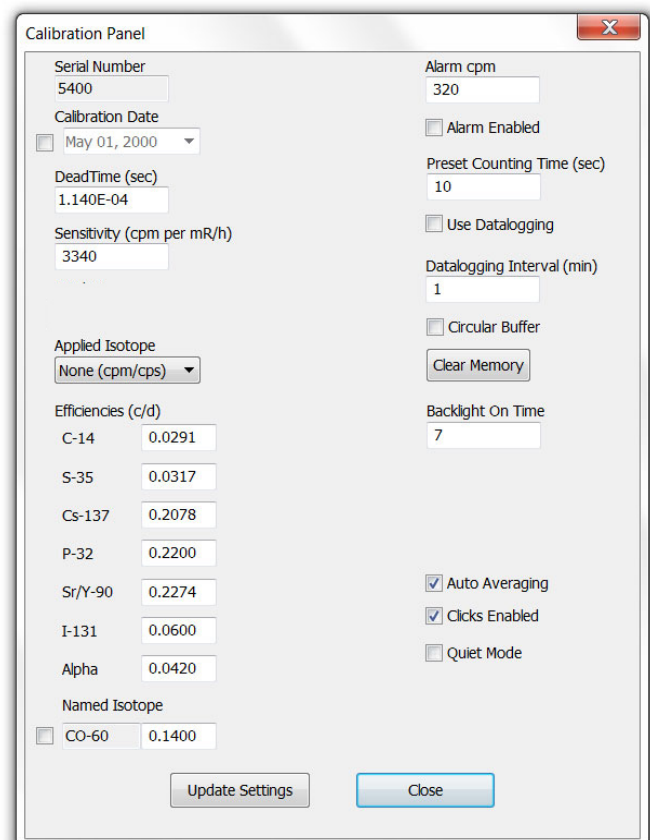


Figure 6(6)

Alarm cpm and Alarm Enabled

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**. If the alarm has been activated and **Alarm Enabled** is then unchecked, the alarm will continue to sound until **Update Settings** has been selected.

Preset Counting Time (sec)

Enter the number of seconds to set the default time for taking a timed count. The default is 600 seconds

Use Data logging

Enables writing the collected data to the internal memory. When the memory is full (**Memory Full**) will appear below **Use Datalogging**. *Note: Set the time and date on the Monitor 200 before activating the data logging feature. The internal clock of the Monitor 200 can be set to the time on a PC running the Observer USB Software by clicking Functions > Synchronize Monitor 200 to PC Clock. The Monitor 200 will beep twice when synchronization has completed unless **Quiet Mode** is on.*

Datalogging Interval (min)

Sets the interval for data logging. The default is 1 minute. This can only be changed through the software.

Circular Buffer

Allows the oldest collected data to be overwritten with the most recent data when the memory is full.

Clear Memory

Clears the data stored in the internal memory of the instrument.

Backlight On Time

Sets how many seconds the backlight will be on when pressing the backlight button.

Display Mode

Use to select from the available units of measurement

Contrast

Sets the contrast of the LCD display numbers and icons.

Auto-Averaging

This activates the auto-averaging feature. When unchecked, the Ranger EXP is in fast response mode. Fast response mode is only recommended for use in high radiation fields.

Clicks Enabled

Enable or disable the clicks only.

Quiet Mode

Enable or disable all sounds on the Ranger except the ALARM and OVER RANGE. You can still enable clicks in **Quiet Mode**.

Functions

Retrieve Memory

If the recording feature is activated and the internal clock is set, then the collected data can be retrieved from the internal memory by selecting *Functions > Retrieve Memory*. Data is stored in a delimited text file, which can be opened in your preferred spreadsheet software. The default data logging frequency is 1 minute. You can change the value in the Calibration Panel window of the Observer USB Software.

Synchronize Ranger EXP to PC Clock

Sets the date and time on a PC running the Observer USB. The instrument will beep twice when synchronization has completed.

Chapter 7: Radiation Alert Observer Bluetooth BLE

To connect via Bluetooth

1. Download the **Radiation Alert Observer BLE** app from the Google App Store onto your phone or tablet.
2. Turn on your detector and activate the Bluetooth by pressing the menu button and using the up and down arrows to scroll to **Bluetooth LE**.
3. Press **Enter** and **Use BluetoothLE?** will appear. Press the + button to activate it or press the - button to turn it off.
4. The device will remain discoverable for 1 minute.
5. Make sure your phone or tablet's Bluetooth is turned on.
6. Launch the **Radiation Alert Observer BLE**.
7. Select Scan to begin searching for your detector.
8. The Model and Serial Number will appear in the list of available devices. Select your detector and you will be prompted to connect.
9. Select **Yes** and you will be taken to the **Readings** screen of the Observer BLE app.

Android device settings for Bluetooth can often be found by swiping down from the top of the screen to display a menu containing an icon for Bluetooth. Alternately, you can go to Home > Settings > Connections > Bluetooth. Once you are on the Bluetooth screen, be sure to turn on the Bluetooth radio and your phone or tablet will be ready for the Observer BLE App to search for available devices within range. If your device keeps losing the Bluetooth connection, restart your device and reconnect.

Readings Screen

1. The **Readings** screen displays the readings from your detector at the top of the screen. The unit of measure shown will reflect whichever unit of measure is selected on the detector.
2. Below the readings are two text fields. The top one is the title of your **Sample name**. The lower text box is for notes and descriptions, as well as any GPS data you want to append to your survey.
3. Users can add any GPS data collected by their mobile device to the notes section of their survey by tapping the GPS button.
4. Note: If the GPS data is not available, the GPS data will be displayed as **NO FIX**. Depending on the settings of your device, you may need to allow the app to access the GPS data, as some settings will restrict the access to that data.
5. To quickly clear any of the text fields, select the **X** to the right of the corresponding text fields.
6. To save a survey, select **Save**. Users can append the current data to the existing text file on their device or to create a new one. Files will be saved to the ObserverBLE directory on their device.
7. To send your saved survey file, select the Send button. Users will then be prompted for the email address to which they want to send the survey data. The data will include a time and date stamp, the reading, the unit of measure used in the survey, the title of the survey, the notes from the survey and any appended GPS data.
8. ex: "05/01/2018","14:12:35","307150","8","uR/h","Title of Survey","Notes about the survey Lat = 35:28.62857 Lon = -87:19.84835"

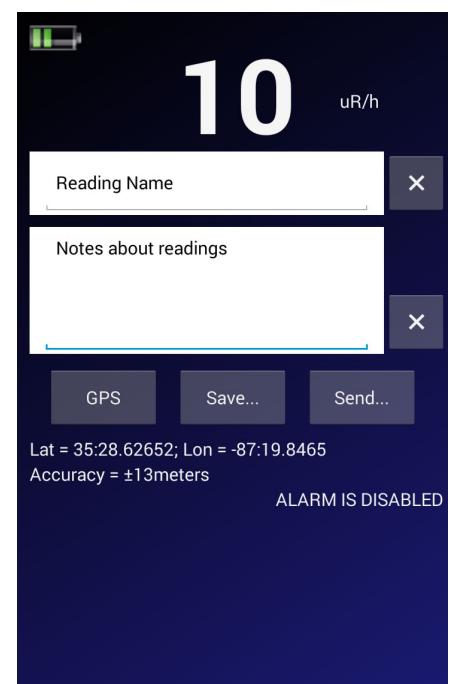


Figure 7(1)

Timed Count Screen

The **Timed Count Screen** enables users to automate the process of collecting, saving, and sharing your collected **Timed Counts**. The units of measure displayed are raw counts.

1. **Count Time (sec)** - Select the time (in seconds) for your count.
2. **Start** – Your pad device will stay awake during the count. Total counts are the top of our screen.
3. To start a new count select **Clear**, set your time, and **Start**.
4. The top text field is the title of your timed count. The lower text box is for notes and descriptions, as well as any GPS data you want to append to your count.

Users can add any GPS data collected by their mobile device to the notes section of their count by selecting the **GPS** button.

Note: If the GPS data is not available, the GPS data will be displayed as **NO FIX**. Depending on the settings of your device, you may need to allow the app to access the GPS data, as some settings will restrict the access to that data.

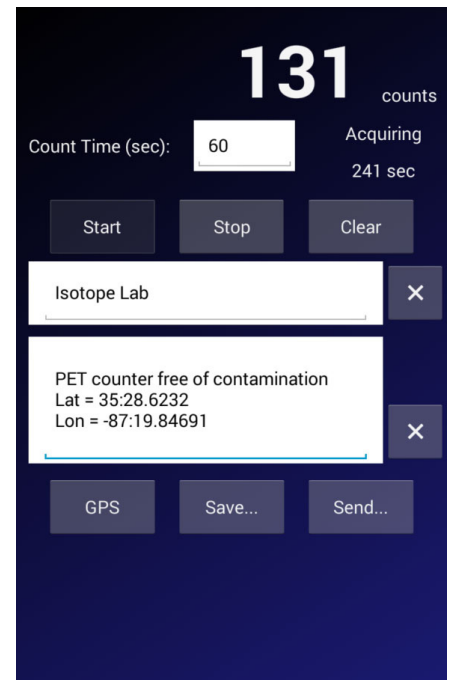


Figure 7(2)

To clear any of the text fields, select the **X** to the right of the corresponding text fields.

To Save a Timed Count, select **Save....** Users will be given the option to append the current timed count data to the existing file on their device or to create a new one. Files will be saved to the ObserverBLE directory on their device.

To send your saved Timed Count file, select the **Send...** button. Users will then be prompted for the email address to which they want to send the Count Data file. The data will include a time and date stamp, the counts collected, the time of the count, the title of the Timed Count, the notes from the Timed Count, and any appended GPS data.

ex. "05/01/2018","14:39:51","307150","42","60 sec","Timed Count Title","Timed Count Notes Lat = 35:28.62716 Lon = -87:19.84849"

Graphic Screen

The graphic screen is a graphical representation of the radiation levels detected.

1. The set up for the graphical screen is on the Settings screen.
2. Warnings are indicated by a change in the color wheel.
 - Green – Okay
 - Yellow warning icon - Activates at 80% of the alarm level
 - Red – Alarm Level Reached

For example, if the alarm on your detector is set to 10 mR/hr, the warning will appear at 8 mR/hr. The warning alarm will remain active until the radiation level falls below the warning threshold or increases enough to trigger the alarm.

Once the alarm level is reached, the warning icon will change to a radiation symbol and the portion of the color wheel below the alarm set point will change to red. The alarm will remain active until the radiation level falls below the set alarm threshold on your detector.

Settings Screen

The Alarm level is set on the instrument or through the Observer Software.

The Settings Screen enables users to set the scale of the Graphic Screen and to add a phone number to send text alerts in the event that an alarm is triggered.

To set the scale of the Graphic Screen

1. Tap the three dots on the top right.
2. Select **Settings...**
3. Select the units of measurement at the top by tapping the box next to **Select Units**.
4. Select the scale maximum in the selected units of measurement by tapping the box next to **Scale Max**. The **Scale Max** is the unit of measurement that will determine the top end of the color wheel on the **Graphic** screen. For example, if the **Scale Max** is set to 10 mR/hr, then the color wheel will show a graphic representation of the readings collected up to 10 mR/hr. Users should be sure that the **Scale Max** is set to a value higher than the average background to see the full range available on the display. Additionally, the **Scale Max** should also be set equal to or higher than the alarm set on the detector.
5. To send text alerts when an alarm condition is triggered, tap the three dots, enter the phone number, and check the **Send Text on Alarm box**.

Rad Responder Screen

1. Tap the three menu dots on the top right.
2. Select **Rad Responder...**
3. To use this feature, you will need to sign up for a free Rad Responder account at radresponder.net.
4. Instructions for using the RadResponder App are on the website.

The RadResponder Network is the national standard and Whole Community solution for the management of radiological data. It is a product of collaboration between Federal Emergency Management Agency (FEMA), Department of Energy (DOE) / National Nuclear Security Administration (NNSA), and the Environmental Protection Agency (EPA), and is provided free of charge to all Federal, state, local, tribal, and territorial response organizations.

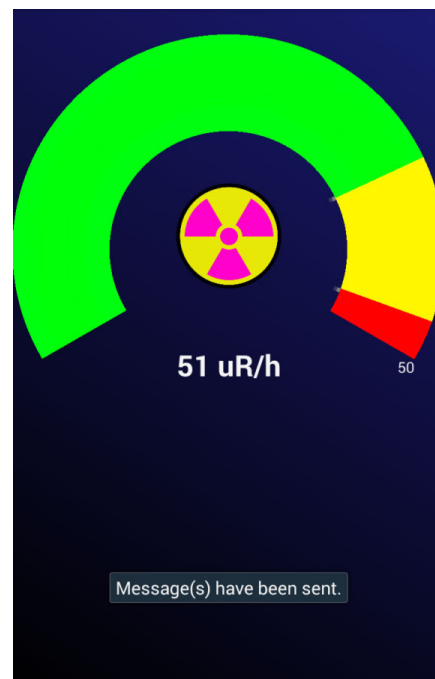


Figure 7(3)

Chapter 8: Built in Isotope Efficiencies

Built in Isotope Efficiencies

The Ranger EXP has a number of built in efficiencies for common isotopes (Figure 7(1)). 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, μ Sv/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 Ranger EXP are based on the geometry of placing samples 1cm from the detector window. *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 Ranger EXP: ¹⁴Carbon (C-14), ³²Phosphorus (P-32), ³⁵Sulfur (S-35), ⁹⁰Strontium (Sr/y-90), ¹³¹Iodine (I-131), ¹³⁷Cesium (Cs-137), ⁶⁰Cobalt (Co-60), and Alpha. Once you have selected an isotope efficiency, the name of the isotope will be displayed in the lower right on the display when selecting DPM or Bq modes.

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 web site 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 pre-programmed isotopes from this screen in addition to adding your own custom efficiency.

1. Check the Named Isotope box, located on the lower left of the Cal Panel.
2. Then use the isotope name field to name your isotope. You can use up to 7 characters and this will be displayed under Menu > Pick Efficiency on the Ranger EXP 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 Ranger EXP beep four times, indicating the settings have been updated.

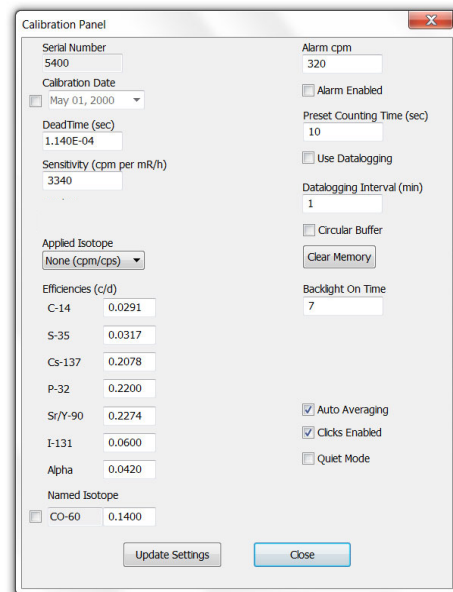


Figure 7(1)

Chapter 9: Troubleshooting

The Ranger EXP 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	Look through the window to check the mica surface of the tube. If it is wrinkled or a break is visible, replace it.
	possible bad cable	replace cable
Reading is high, but another instrument has a normal reading in the same location	possible contamination	Scan the Ranger EXP with another instrument.
Instrument has false high reading	moisture	The circuit board may be wet. Dry the instrument in a warm, dry place. If it still has a problem, it may require service.
Instrument has false high reading or OVER RANGE	photosensitivity	Remove the Ranger EXP 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 new AA batteries. If the count light and audio work, it requires service.

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.

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 a hand free for other tasks. Unlike the Ranger and Monitor 200, the Ranger EXP has an external probe and cable. When using the stand, it is recommended that you secure the stand to a surface via the screw holes, located in opposing corners of the stand's base.



Lanyard (Included)

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

Free Observer USB Software (Download)

The New Observer USB is a free version of the Observer software that runs on Windows®. It can be used with The USB versions of the Radiation Alert® Radiation Detector Family. The Observer USB reads in Counts, CPM, and CPS, as well as $\mu\text{R/hr}$, mR/hr , and $\mu\text{Sv/hr}$ and has the ability to collect, log, and perform statistical analysis on the data received. You can download a copy at seintl.com/software.

No Mac or WinRT versions are available.

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

Alarm can be set in any mode. Pulsating beeper sounds the alert. Alarm will sound when in Count 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 second. 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 and Bluetooth BLE (4.1) for use with Free Observer Family Software for PCs and Android OS.

Power Requirements

Two AA alkaline batteries (included). Approx. 800 hrs @ background.

Size

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

Weight

567 g (20 oz)

Includes

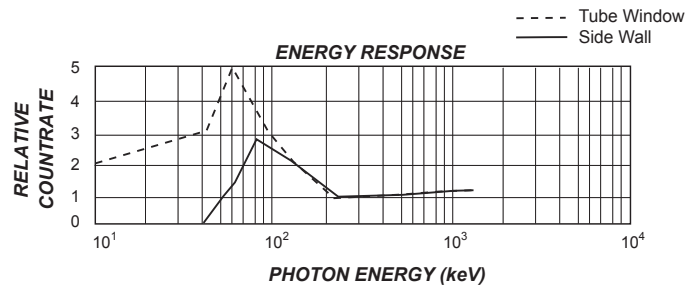
Carrying Case, Xtreme Boot, Stand, Lanyard, Detector Cover, Mini-USB Cable, AA Batteries, Observer USB Software Download, Certificate of Conformance

Options

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 | 1 931.964.3561 | 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

Or fill out the form online at
<http://seintl.com/calibrations/>

