

Chapter 3 Basic Operation

WARNING!

The primary purpose of the RadSeeker™ DL is to detect and identify radioactive material. This is a detection instrument that is designed to recognize and identify small signals from the energy profiles of isotopes. This is not a safety device or a personal safety monitor.

3.1 Pre-Check

- The detector needs to be above -4°F (-15°C) for the unit to start-up. The normal operating temperature is -25°F (-32°C) to 122°F (50°C).
For extreme conditions allow extra time for the detector to acclimatize.
- Before setting off for the inspection site, you should collect the accessories you need. The detector should always be transported in its carrying case. Refer to "Transporting the RadSeeker™ DL" on page 3-38.
- Dirt can make the detector's screen difficult to read, or make it slippery to handle. It is best to begin any assignment with clean equipment. Refer to "Cleaning the RadSeeker™ DL" on page 3-37.
- For most applications, you will use the batteries to power the detector. You need to take enough charged batteries to complete the job.

3.2 Startup

To start the RadSeeker™ DL:

1. Press and hold the Power key for 3 - 5 seconds.

Look for the green and red LED's. Release the Power key as soon as they light up.

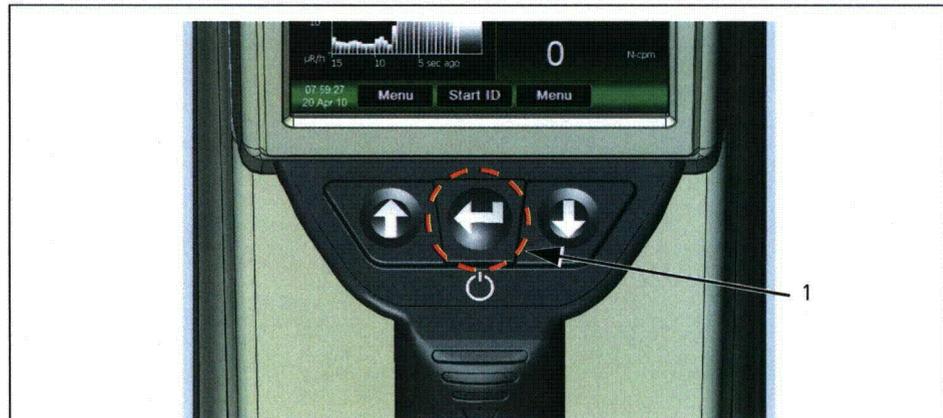


Figure 3-1 RadSeeker DL Unit

1. "Select" key

The startup splash screen opens.

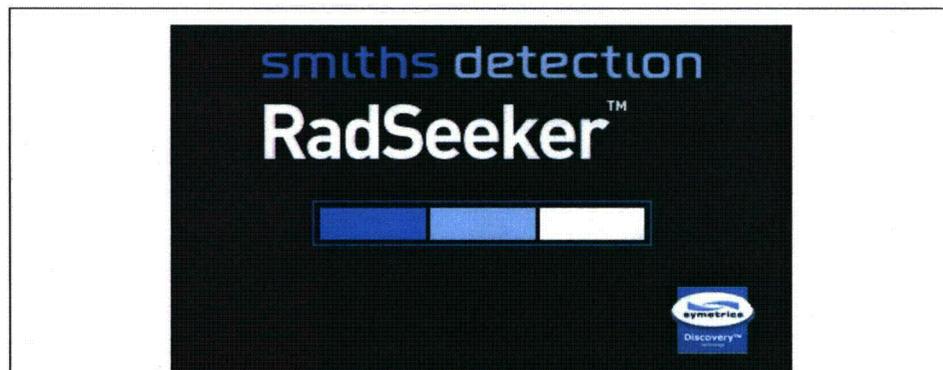


Figure 3-2 Startup Splash Screen

2. After the operating system has loaded, the application starts and the unit automatically runs through a self-test cycle.

NOTE: The self-test includes operating the LEDs, the beeper, and the vibrator.

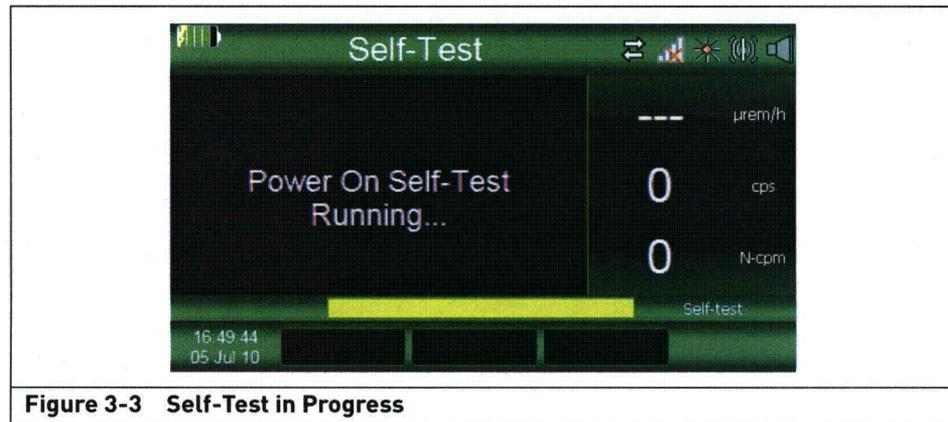


Figure 3-3 Self-Test in Progress

3. The RadSeeker DL starts its self-calibration process during the self-tests.
NOTE: The unit can take up to two minutes to become fully operational.
4. After the self-tests complete successfully, a (Pass/Fail) message is displayed on the screen, and written to the system log. If a component fails, the warning message will scroll across the bottom of the screen.

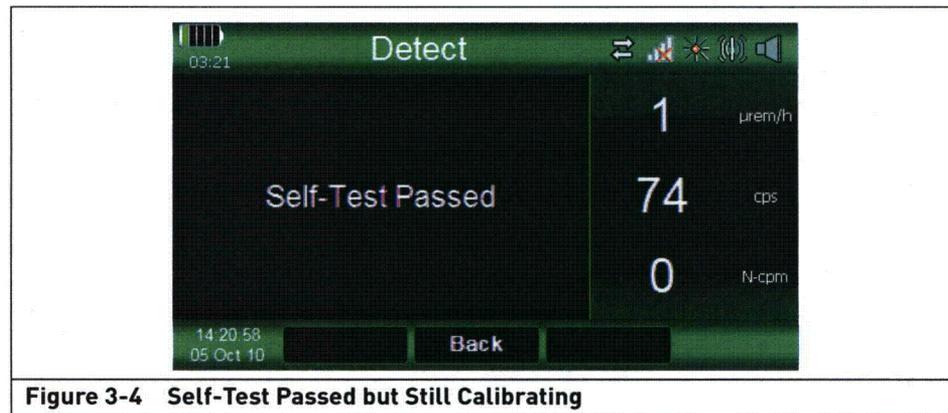


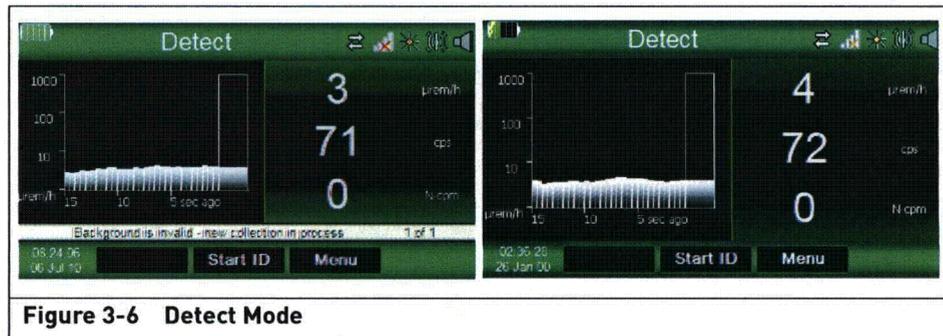
Figure 3-4 Self-Test Passed but Still Calibrating

NOTE: If the unit reports a "Low Battery" condition, replace the battery. Attach the detector to external power before swapping the batteries.

After completion of the Self-Test the unit begins stabilizing. The status area displays "Stabilizing" until the completion of the self-calibration process (approximately 30 seconds).



5. Upon completion of the self-test and system stabilization, the display switches to the "Detect" and continues to collect a new background. After completion the invalid background message is turned Off.



6. If any of the self-tests fail, the system generates an alarm and displays an appropriate message.

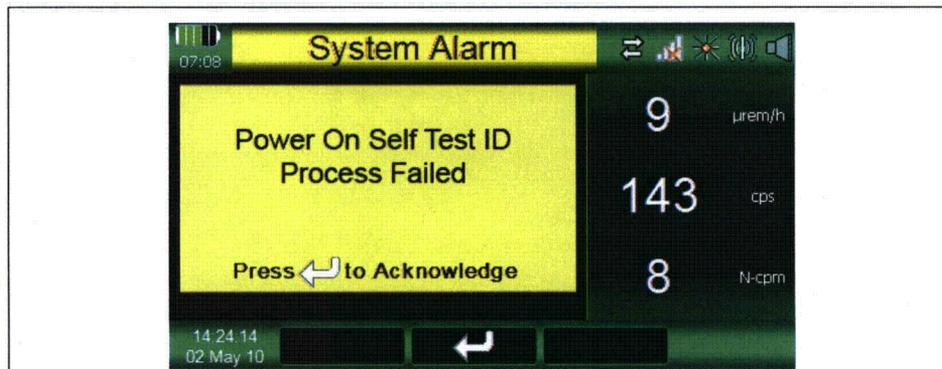


Figure 3-7 Self-Test Failure

7. Acknowledge the alarm by pressing the "Select" key. Follow any instructions provided in the error message.

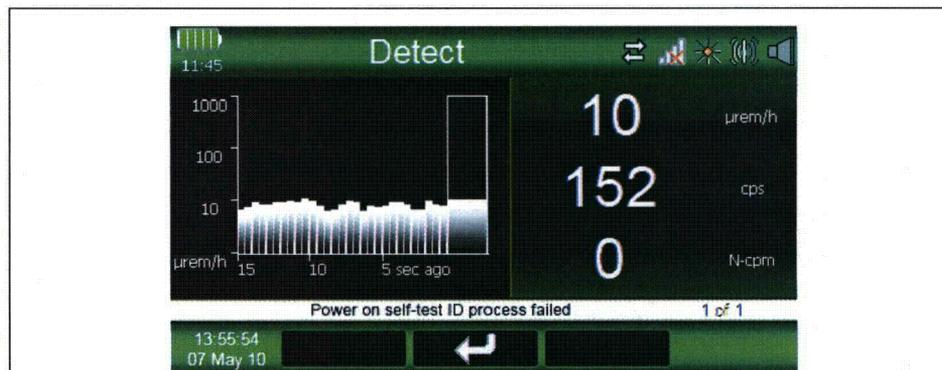


Figure 3-8 Self-Test Failure - System Message

- NOTE:** The results (Pass/Fail) are displayed on the screen and written to the system log. Failure messages scroll across the bottom until the system has determined the problem no longer exists.
- NOTE:** If the unit reports a Low Battery error, replace the battery. Refer to ["Removal and Replacement of the Battery"](#) on page 3-30.
8. If errors prevent the use of the unit, report it to the service department.

3.3 Manual Shutdown

To shutdown the RadSeeker™ DL:

CAUTION!

Never remove the battery, or pull the plug to shutdown the unit. This may cause loss of data or corruption of the software.

1. Press and hold the Power key for 5 seconds. The display shows the shutdown message.

NOTE: In the event the application is not running correctly (for example, the display or key pad is unresponsive), press and hold the "Select" key for 15 seconds to force the RadSeeker DL to shutdown.

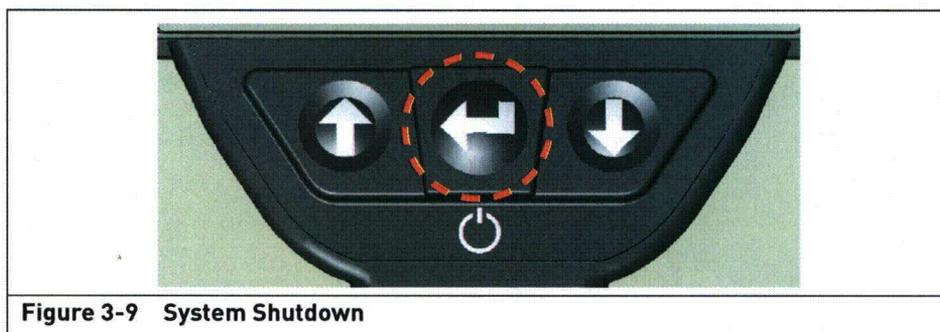


Figure 3-9 System Shutdown

3.4 Auto Shutdown

This occurs when connected to the power supply, and the unit is idle for 5 min.

- a. The software recognizes that the unit is plugged in, and may have been left On unintentionally. It gives a 30 second count-down and then shuts down.
or
- b. If the unit is connected to the USB, instead of a full shutdown, it only shuts Off the gamma and neutron detectors. Press "Select" (the middle key) to reactivate the detectors.

3.5 Detection

The system displays the real-time count rate from the detector subsystem for both neutron and gamma radiation with no input necessary from the user. In Detect mode, the unit shows the count data and dose rate values on the right hand side of the display and the time plot on the left hand side.

The display provides a historical graph of the intensity of the source. To localize the radiation source(s), use the graph to determine if the source is getting closer or further away.

3.5.1 Identification

To perform an identification:

1. Press the Start ID key on the Detect screen to start the identification process.

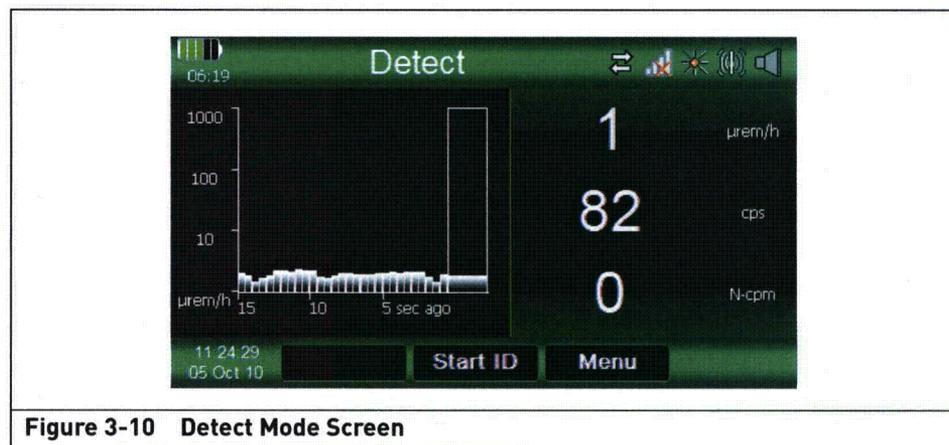
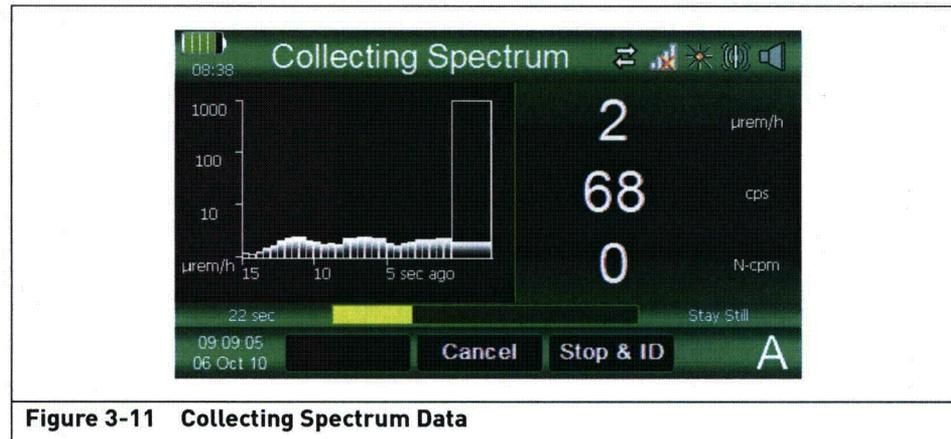


Figure 3-10 Detect Mode Screen

2. Inspect the target by moving the detector slowly across the surfaces of interest in a methodical way.
It is best to cover the full width and height of a container, where this is possible.
3. Keep the detector close to the item of interest for best results. Try to stay close, but avoid bumping or banging into the target.
The detector is multi-directional for gamma radiation. You do not need to “point” the front of the detector. The neutron detector may provide more sensitivity when vertical or sideways-on, because of the long and narrow tube that runs the length of the handle.
4. The detector subsystem collects spectrum data for the default period of 30 seconds.
5. The system collects spectrum data and completes the identification process unless the user cancels the process or forces an early identification.
 - A progress bar provides a visual indication of the data collection time
 - The value to the left of the progress bar is the time of data collection remaining

6. Manually stop the spectrum data collection at any time by doing one of the following:
 - Press Stop & ID to directly identify the isotopes
 - Press Cancel to stop the data collection and return to the Detect mode



7. After the data collection is completed, the system runs through the identification process (5 to 10 seconds) and presents the results.

3.5.2 Adding Time

To add time following an identification:

1. Select Add Time from the Identification screen.
The Additional Collection Time menu is displayed.
2. Highlight the desired option using Down arrow.
3. Press the "Select" key.
4. The unit begins collecting spectrum data for the additional time selected in Step 2, adding to the original spectrum.

5. Press Back to exit the Additional Collection Time menu without making any changes.

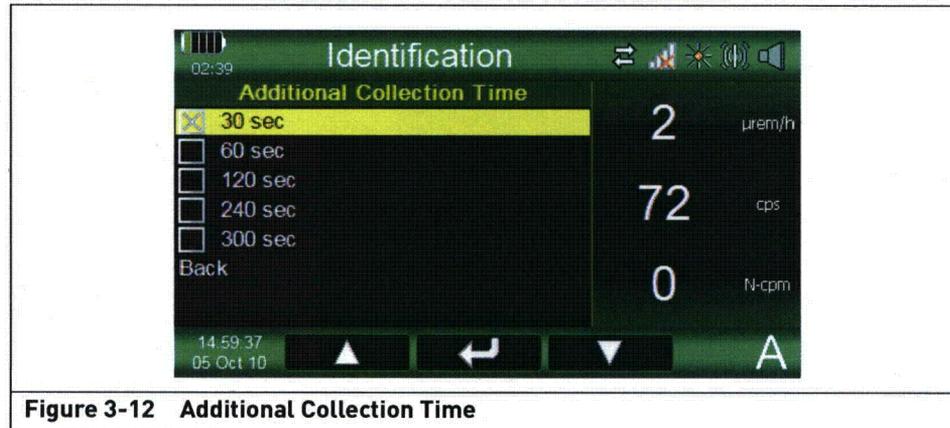


Figure 3-12 Additional Collection Time

NOTE: The operator may choose to add time following an identification in order to collect a second spectrum of data for a longer period, and report back to a group of specialists who will analyze that data.

3.5.3 ID Alarms

If an identification is made, the unit generates an alarm (Innocent or Threat).

The title bar [Figure 3-13](#), indicates that this is considered to be an “Innocent” alarm. Innocent versus threat is a determination that is based on the specific isotope that is recognized.

1. Press the “Select” key to acknowledge. Refer to [Figure 3-13](#) and [Figure 3-14](#) for alarms generated.

NOTE: To continue, all alarms must be Acknowledged by pressing the “Select” key.



Figure 3-13 Identification Result Display (Innocent Source)

2. A threat alarm is displayed when one or more of the recognized isotopes is listed in the threat category. Refer to "Radionuclides" on page A-1. Each individual radionuclide is assigned as either innocent or a threat.



Figure 3-14 Identification Result Display (Threat Source)

3. With the alarm acknowledged, the display shows the identification results, as in [Figure 3-15](#) and [Figure 3-16](#), along with the event number of the data file created.

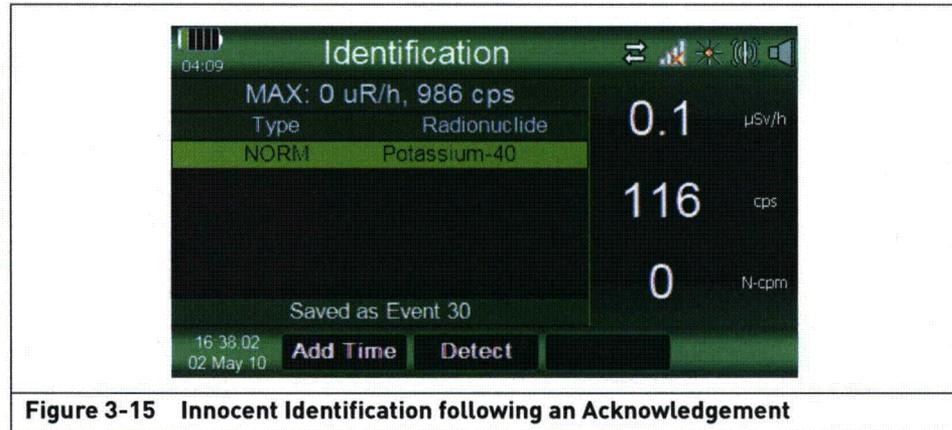


Figure 3-15 Innocent Identification following an Acknowledgement

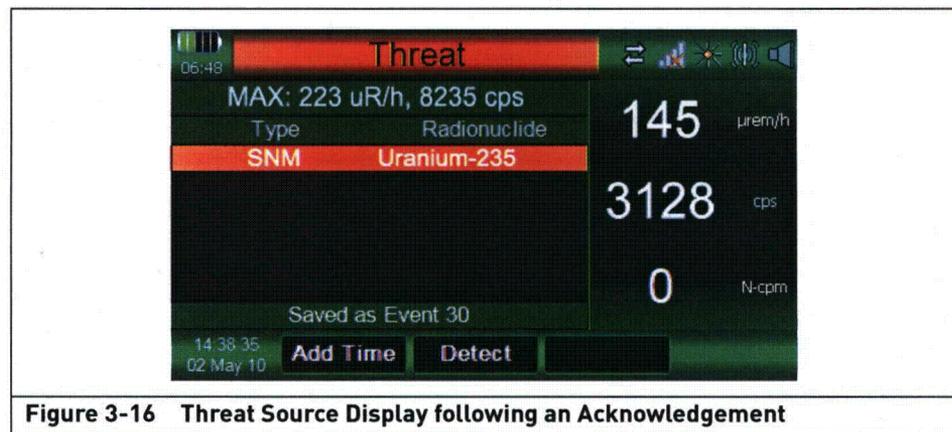


Figure 3-16 Threat Source Display following an Acknowledgement

NOTE: If required, select Add Time. Refer to [“Adding Time”](#) on page 3-8.

3.5.4 Multiple ID Alarms

In the case where multiple radionuclides are identified, they are listed by priority (threat/innocent). Refer to [“Radionuclides”](#) on page A-1.

1. If the unit identifies more radionuclides than can fit on a single screen, use the scroll bar to view the entire list.
2. If the results contain a combination of threat and non-threat isotopes, the screen presents the threats first.

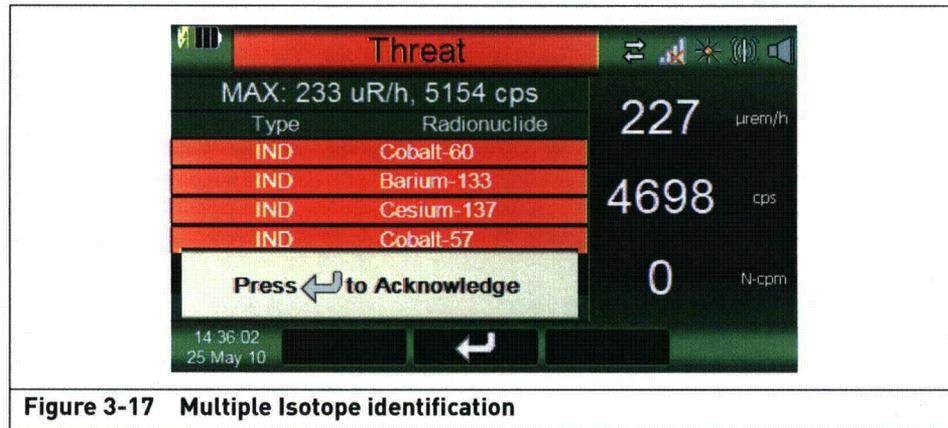


Figure 3-17 Multiple Isotope identification

3. Press the "Select" key to acknowledge the alarm before proceeding.
4. With the alarm acknowledged, options are to add more collection time (refer to "Adding Time" on page 3-8), return to Detect mode, or scroll down to the next screen.

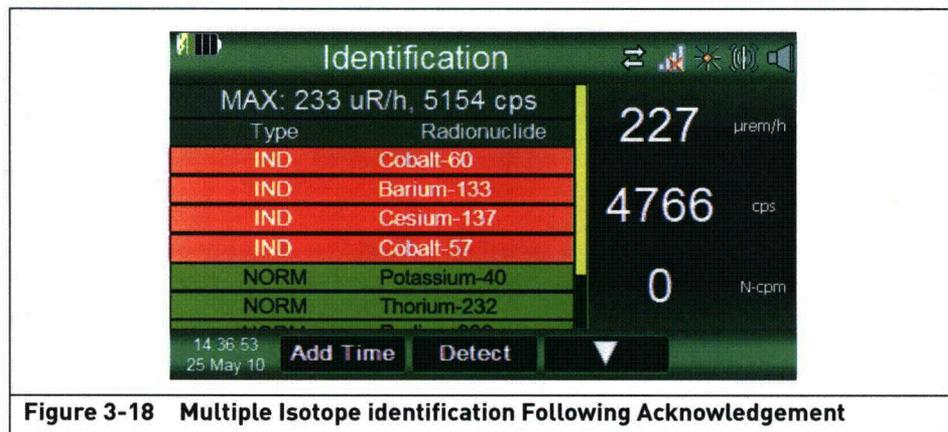


Figure 3-18 Multiple Isotope identification Following Acknowledgement

5. From the second screen, the user can:
 - Make note of the event number of the data file created
 - Scroll up to the previous screen
 - Return to Detect mode

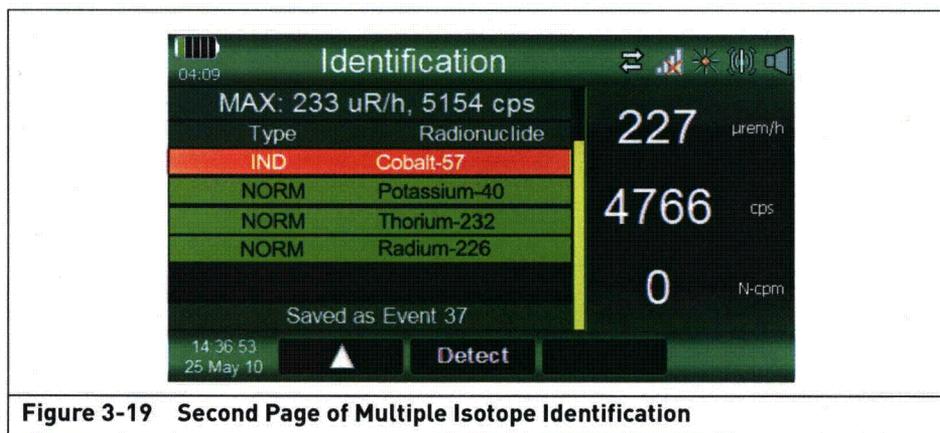


Figure 3-19 Second Page of Multiple Isotope Identification

6. If no radionuclides are found, this is identified on-screen along with the event number of the data file created.
This means that no traces of isotopes were identified in the spectrum. Continue with operations

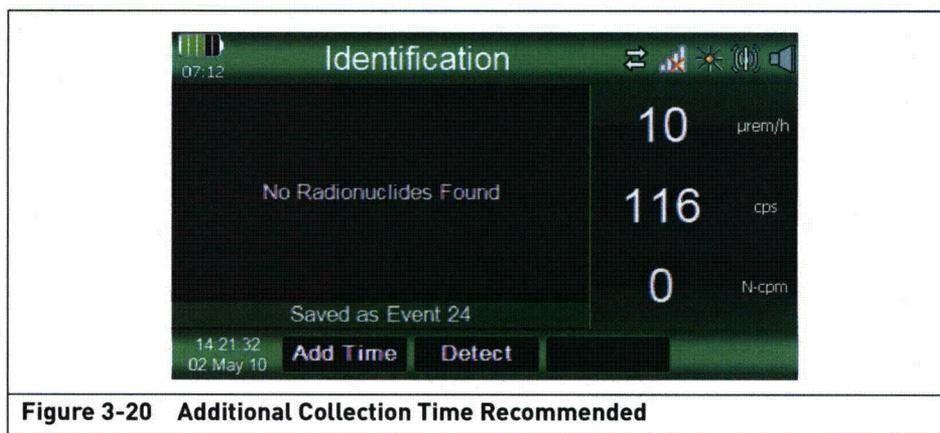


Figure 3-20 Additional Collection Time Recommended

The Identification screen provides the maximum dose rate and gamma cps that were seen during the collection period. Since this is not an alarm, no alert is shown or sounded.

The event number can be used for reference after the data is off-loaded to a PC. A record in the system log is also recorded.

The identification is saved as an event in the data files of the detector. The spectrum data is recorded with the analysis results for every event, regardless of the outcome.

3.6 Normal Mode Settings

Perform basic settings changes from the Normal Mode menu. To access the Normal Mode Functions from the Detect screen:

Press the Menu key.

NOTE: Any changes made to Normal Mode configurations are temporary and are erased when the unit is powered Off.

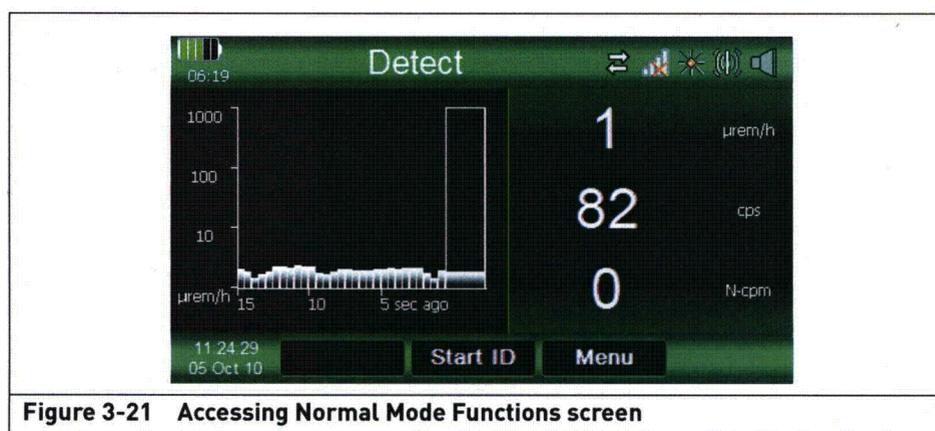


Figure 3-21 Accessing Normal Mode Functions screen

3.6.1 Adjust Brightness

Adjust the display brightness as follows:

1. From the Detect screen, press the Menu key.
2. From the Normal Mode Functions screen, use the Down arrow to highlight "Adjust Brightness." Press the "Select" key.

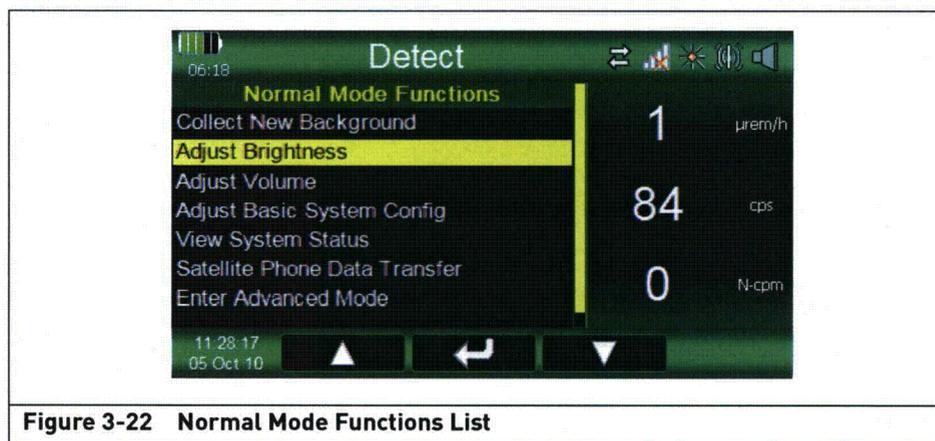


Figure 3-22 Normal Mode Functions List

3. Use the Down arrow to highlight the required display brightness.
4. Press the "Select" key. See [Figure 3-23](#).

NOTE: The default factory setting is Auto.

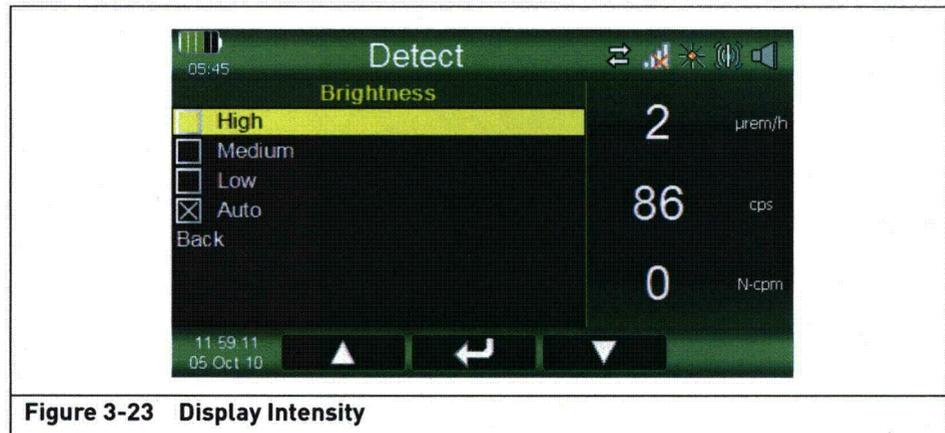


Figure 3-23 Display Intensity

5. Press the Back key to exit and save any changes.

NOTE: In auto mode, the display intensity is software controlled according to the light level detected by the light sensor.

3.6.2 Adjust Volume

To set the volume level of the beeper and audio port to Low, Medium or High.

1. From the Detect screen, press the Menu key.
2. From the Normal Mode Functions screen, use the Down arrow to highlight "Adjust Volume." See [Figure 3-24](#). Press the "Select" key.

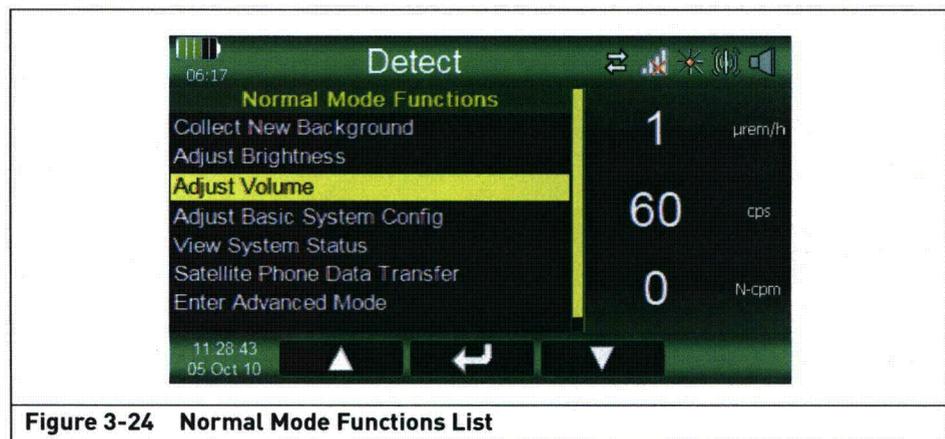


Figure 3-24 Normal Mode Functions List

NOTE: Choose Back to exit without making any changes.

3. Use the Down arrow to highlight the required volume.
4. Press the "Select" key. Refer to [Figure 3-25](#).

NOTE: The default factory setting is High.

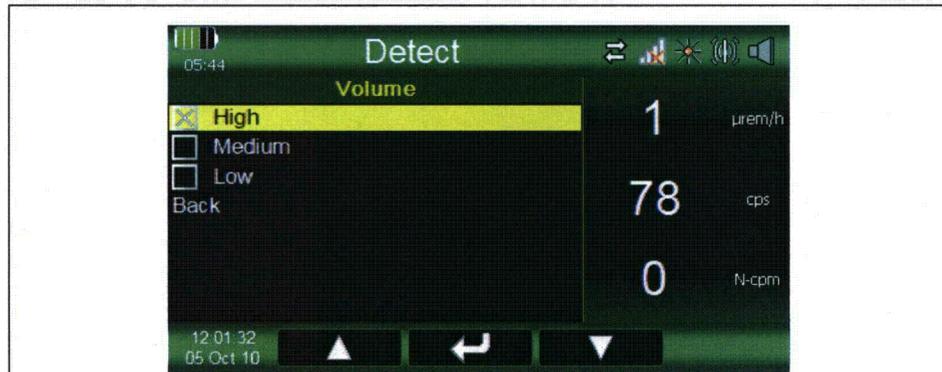


Figure 3-25 Volume Setting

5. Press the Back key to exit and save any changes.

NOTE: To disable the sound, use the Adjust Basic System Configuration menu.

3.6.3 Basic System Configuration

The Basic System Configuration screen allows adjustment of the following:

- Enabling or disabling the LEDs, the beeper, the vibration, and the Wi-Fi (802.11g)
- Setting Battery Format to either Time remaining or Percentage

To change the basic system configurations:

1. From the Normal Mode Functions menu, choose "Adjust Basic System Config."

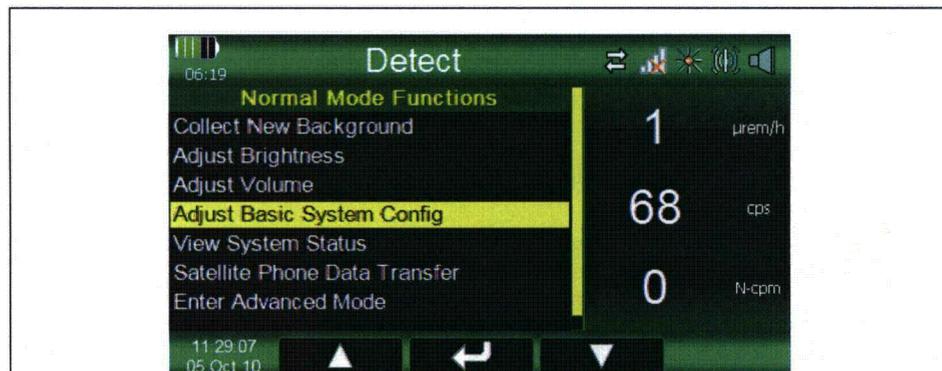


Figure 3-26 Adjust Basic System Config

2. Use the Down arrow to select the option to be changed. See [Figure 3-27](#).
3. Press the "Select" key to toggle the state of the option (such as Enabled to Disabled).

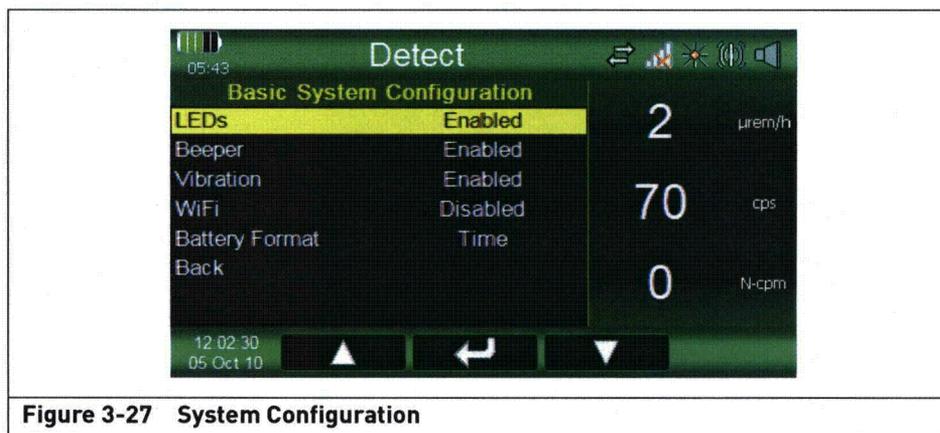


Figure 3-27 System Configuration

4. Select Back to set new configuration.
5. When disabling the LED indicator ([Figure 3-28](#)), the unit displays a message to confirm this setting. Select Yes or No.



Figure 3-28 LEDs Disable Confirmation

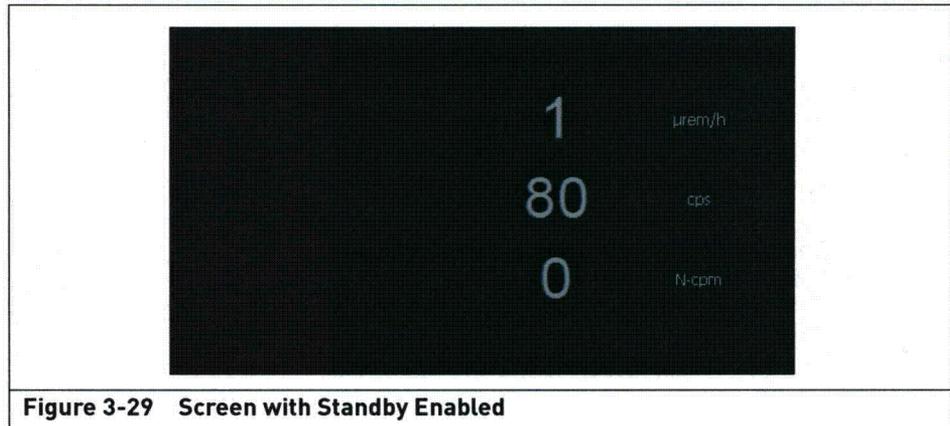
3.6.4 Standby Power Mode

The display automatically switches to the state shown in [Figure 3-29](#) when Standby Power Mode is enabled. While in standby power mode the count numbers will scroll from left to right and back again.

NOTE: The screen saver appears after 60 second of inactivity with the detector, this is the default setting. The range of the standby power mode idle time is configurable from 15 to 300 seconds. Refer to [“Advanced System Configuration”](#) on page 6-7.

To return the unit to full power mode, press any key.

NOTE: An alert / alarm condition also returns the unit to the full battery power state.



When Standby is disabled, the screen automatically dims as shown in [Figure 3-30](#).



3.7 Data Transfer Using Detector Controller

3.7.1 Connecting the RadSeeker™ DL to a PC

To connect and disconnect the RadSeeker DL to the Detector Controller application:

NOTE: These instructions assume the user has access to a Windows PC with Smiths Detection's Detector Controller and Connection Manager software and drivers already installed. Refer to the Detector Controller manual for further instructions.

1. Remove the dust plug.
2. Using the USB cable, connect the RadSeeker DL to a computer running Connection Manager applications.

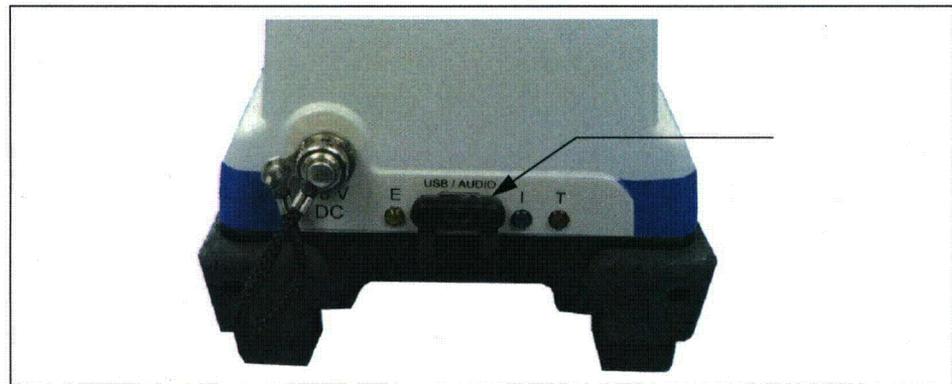


Figure 3-31 Connection Port

3. Connection Manager detects the RadSeeker DL connected to the PC USB port and starts the Detector Controller application (Figure 3-32).

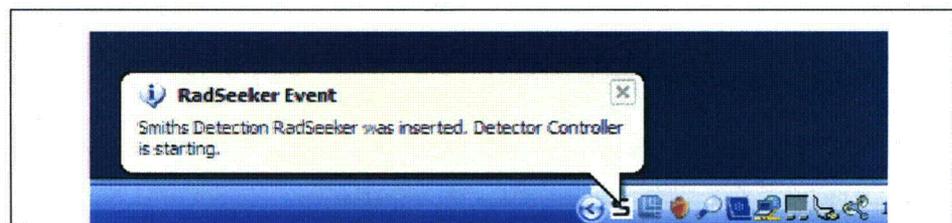


Figure 3-32 RadSeeker DL Connection Notification in System Tray

4. The Detector Controller application opens to the Offload Data tab which list all the current data files available for download (Figure 3-33).

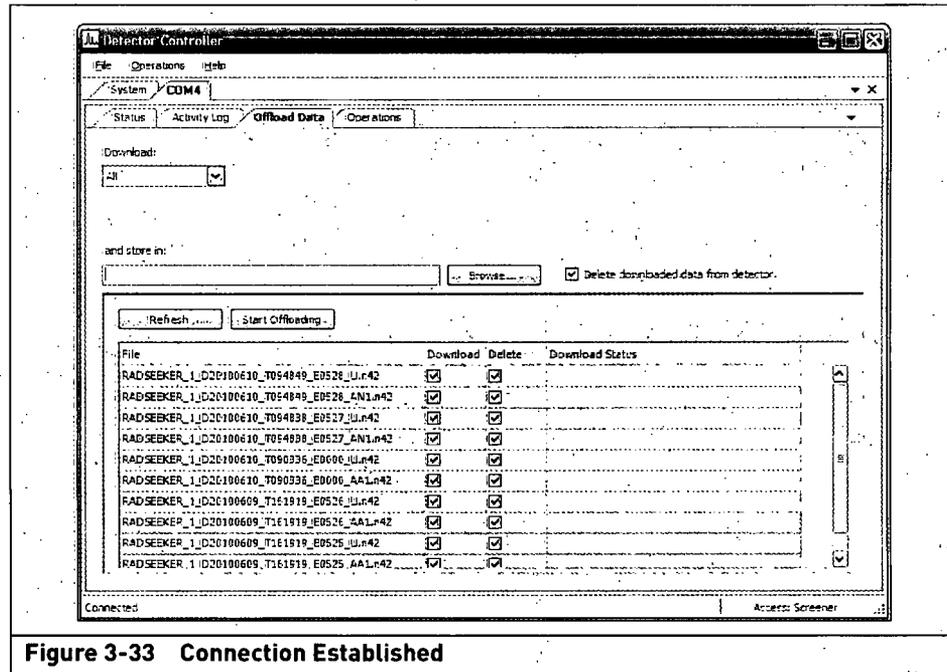


Figure 3-33 Connection Established

3.7.2 Connection Check

During the connection process, the Detector Controller will check the validity of the connection. Any errors encountered will be displayed in an error dialog box. Refer to Figure 3-34, which indicates the connection medium between the PC and RadSeeker DL has been timed out.

The possible cause for an error:

- The connector is removed
- The wire is damaged or frayed

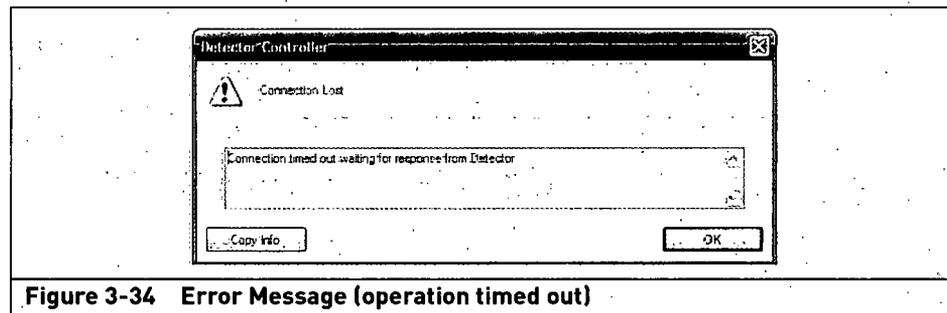


Figure 3-34 Error Message (operation timed out)

3.7.3 Offload Data

The Detector Controller software allows the operator to offload radiation data files from the RadSeeker DL to a storage directory.

1. Select the Offload Data tab.
2. Open the Download drop down menu.

There are three methods of extracting data files from the RadSeeker DL.

All	Selects all radiation data files for offloading
Most Recent	Selects the last two entries for offloading
Date range	A date range may be selected for offloading

3. Select the file extraction method.
4. Press the Browse button. Select the directory to store the files.

NOTE: By default "Delete downloaded data from the detector" is checked. All downloaded files will be deleted from the RadSeeker DL, or uncheck the box to keep the files on the RadSeeker DL memory card.

5. All files that are checked by default; the operator can uncheck any file(s) not required.

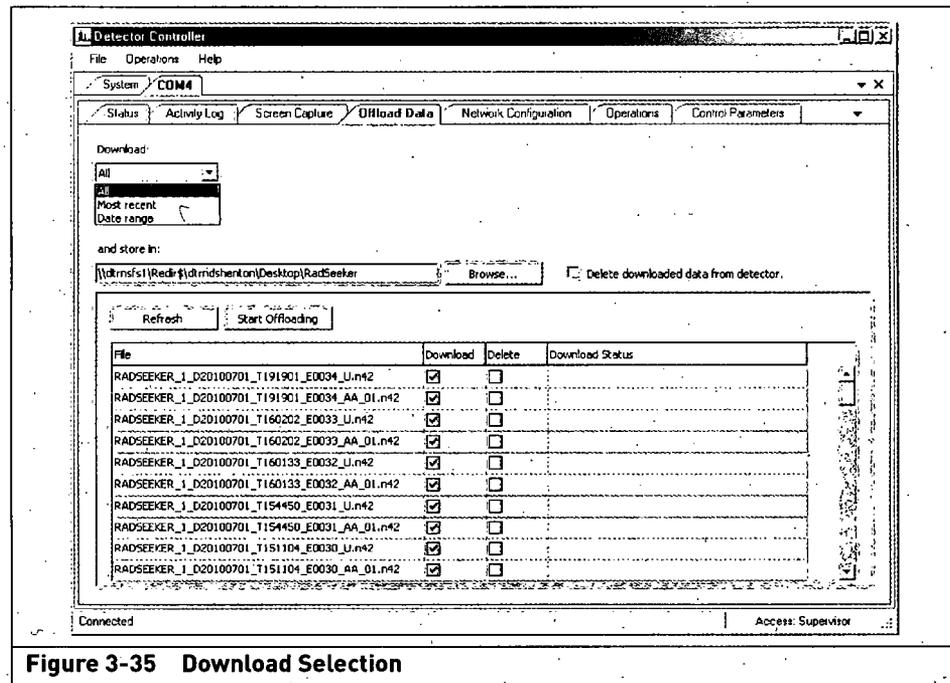


Figure 3-35 Download Selection

6. To check the status of the ICD files on the detector, select Refresh. The on-screen inventory show the files that remain on the detector, and their offloading status.
7. Press Start Offloading. A progress bar displays until the download to the storage directory is complete.

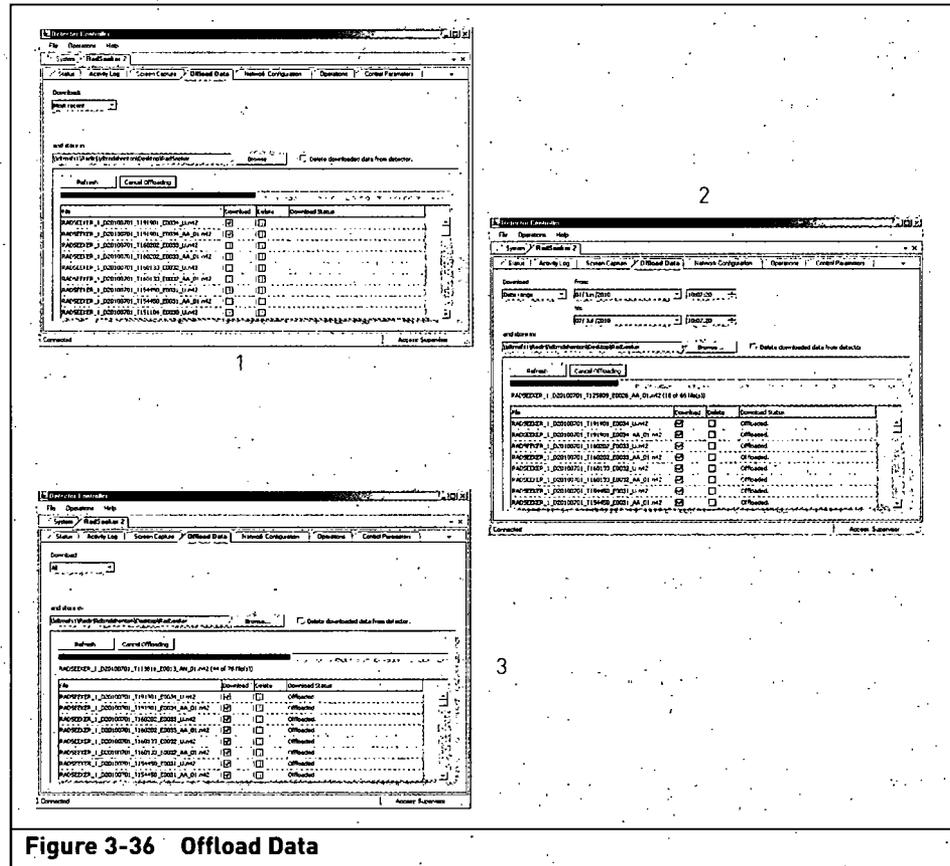


Figure 3-36 Offload Data

3.7.4 Changing the Tab Description Name

When Connection Manager detects the RadSeeker™ DL it automatically starts the Detector Controller application and opens to the Offload page. The name of the COM Port used in the connection process is used for the tab name. If required the tab name can be changed.

To change the tab name:

1. From the menu bar select "Connect" from the file drop down menu.

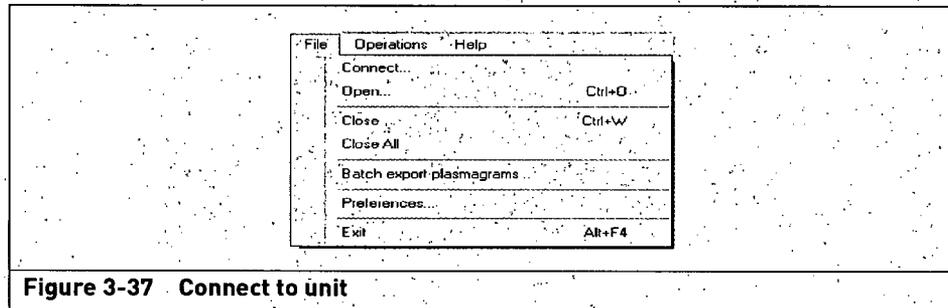


Figure 3-37 Connect to unit

2. The Detector Connection List displays the RadSeeker DL currently connected. Click in the blank field for "Description" to activate the Delete and Modify buttons.

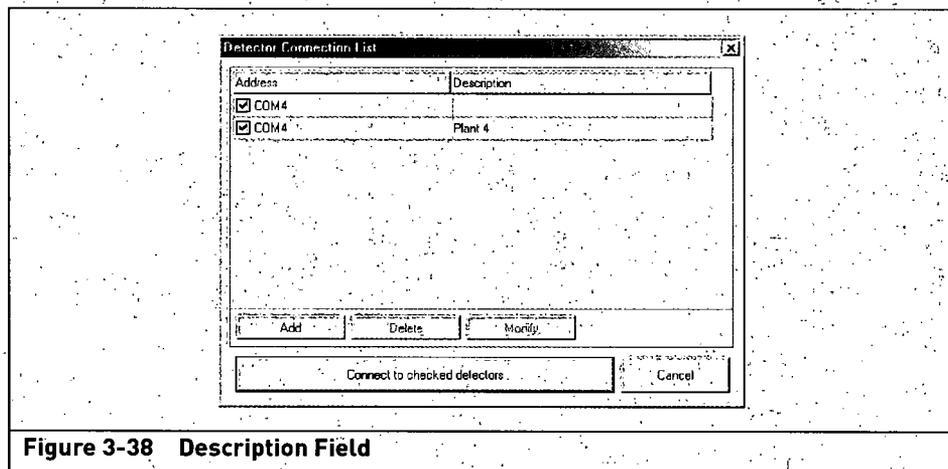
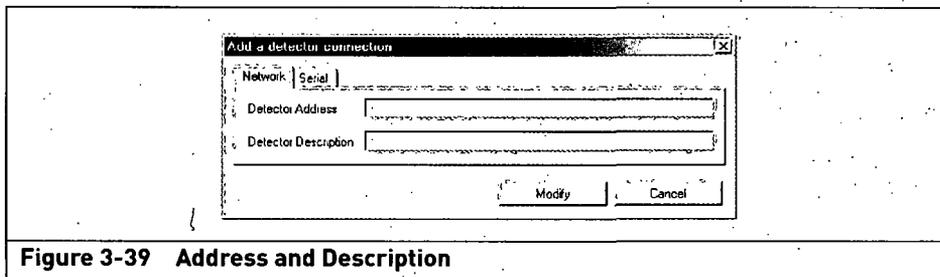


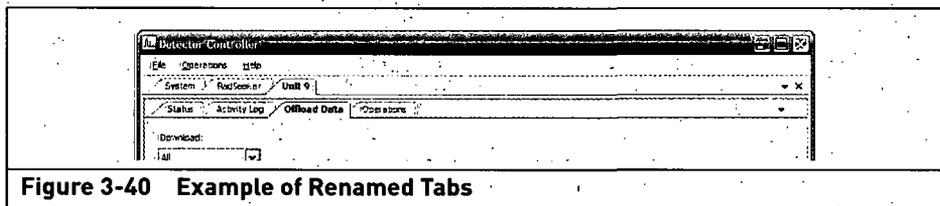
Figure 3-38 Description Field

3. Click Modify. Select the Network tab and enter the Detector Address (found on the Network Status screen).

4. Enter a suitable Detector Description.



5. The detector description displays on the tab.



3.7.5 Ending Connection

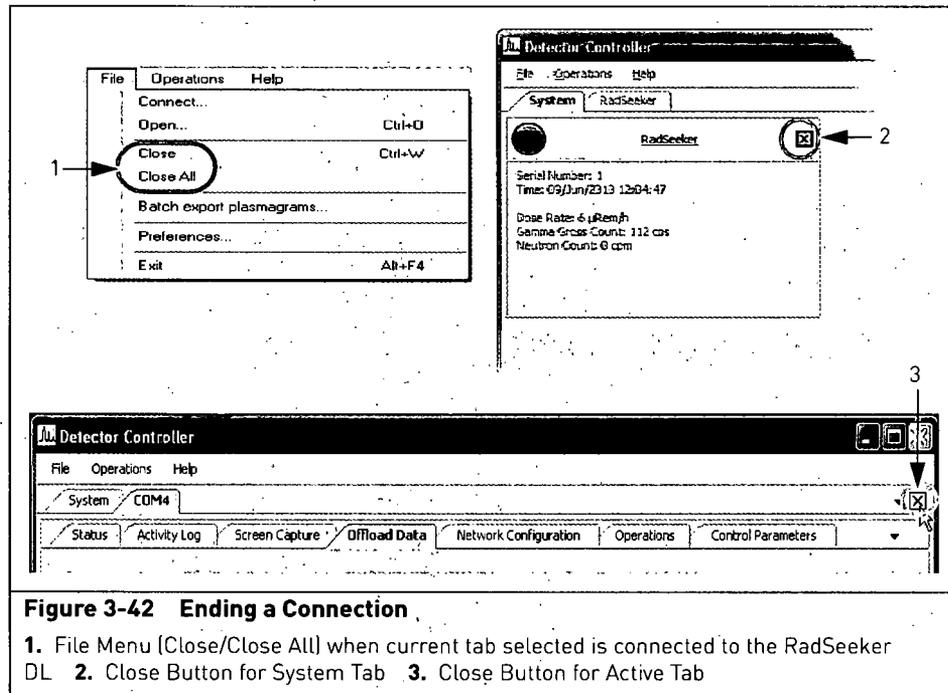
Do one of the following to end the communication (Figure 3-42) between the operator's PC and the RadSeeker™ DL:

1. Remove the USB cable from the rear of the unit and replace the dust cover. The connection will automatically close. The Detector Controller application will remain active.



Figure 3-41 USB Portal and Dust Cover

1. USB Dust Cover
2. On the main menu bar, select File; scroll down the drop-down menu and select either:
 - "Close" to end the communication from a single unit (item 1).
 - "Close All" to end connections with multiple units (item 1).
3. Click the Close button (item 2) within the connection summary item in the system tab.
4. Click the Close button for the active tab (item 3).



3.7.6 Connecting Additional Units

To connect additional units to the Detector Controller:

1. Select the **Connect** option from the **File** menu to add a communication channel to the RadSeeker DL.

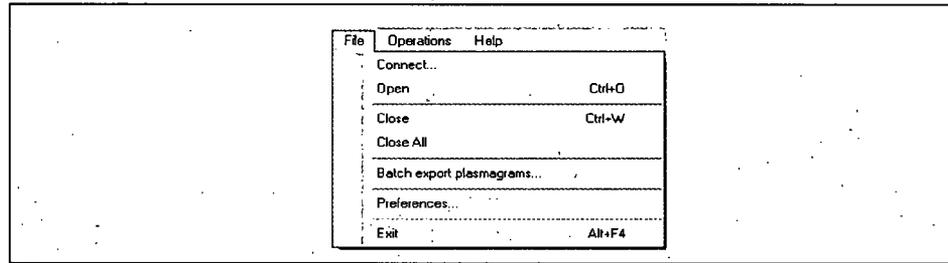


Figure 3-43 System File Menu

2. The Detector Connection List displays.

NOTE: The Detector Controller application also allows the operator to make additional connections to RadSeeker DL units.

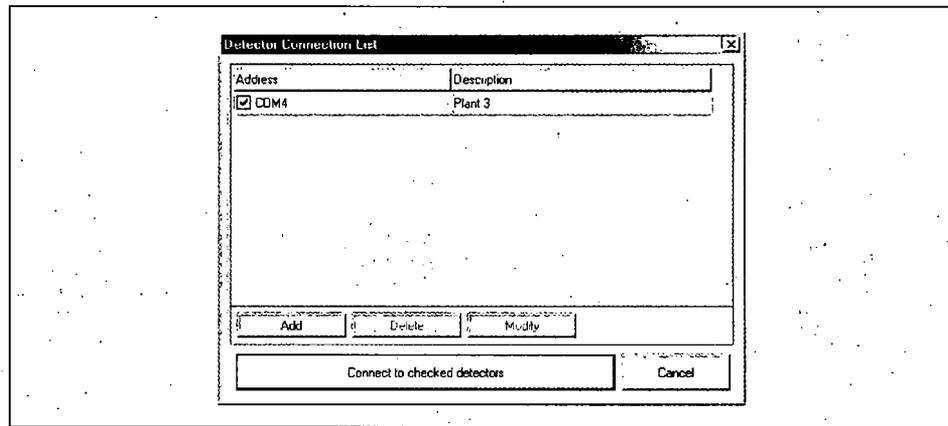


Figure 3-44 Detector Connection List

3. If a new connection is required. Press the Add button.
4. The connection dialog displays, select the Serial tab.

5. Click on the drop-down list for the Serial Port.
6. Select COM4 - Smiths Detection RadSeeker DL Serial.
7. Enter a Detector Description. Press Add.

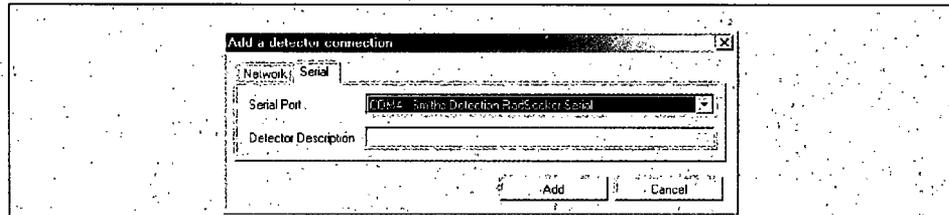


Figure 3-45 Serial Port

The new Address and Description are now displayed.

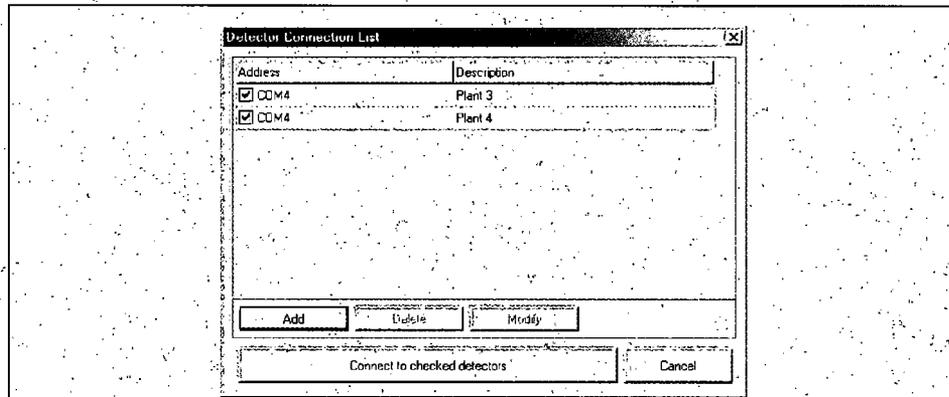


Figure 3-46 New Connection

8. If not already applied, select the new connection by clicking on the box.
9. Press "Connect to checked detectors." The Offload Data screen displays showing the connection is established.

3.8 Connecting RadSeeker™ DL to AC Power

Connecting the RadSeeker™ DL to the AC power supply recharges the battery without having to power down the unit or remove the battery from its compartment.

1. Remove the external power port cover by grasping it firmly and pulling straight back.

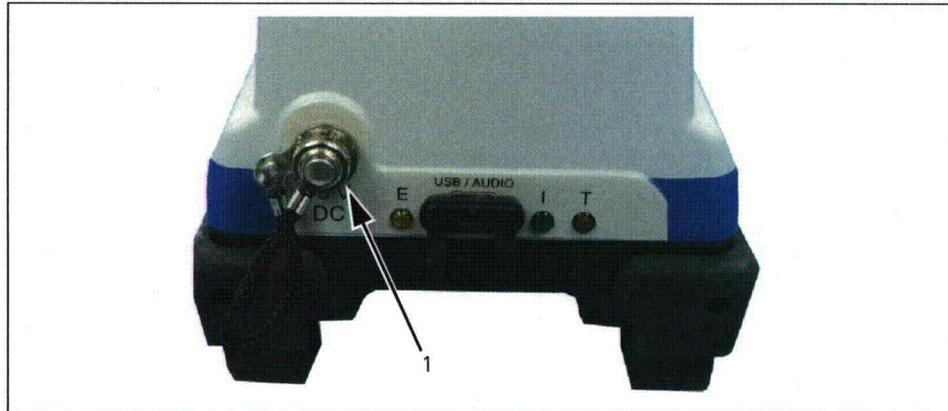


Figure 3-47 AC Power Port

1. External power port cover

2. Insert the AC adaptor plug into the external power port on the RadSeeker DL, making sure to align the plug correctly (red orientation mark pointing down).
3. Plug the AC power supply into a suitable outlet.

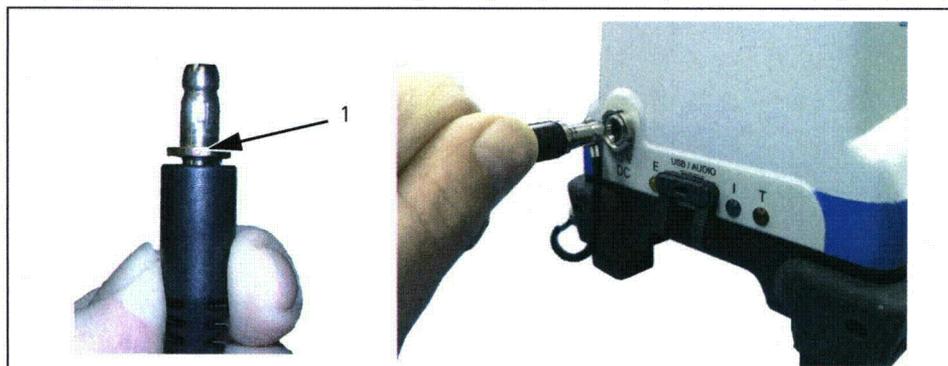


Figure 3-48 Plugging in the AC power adaptor

1. Red orientation mark

4. After the battery is fully charged, remove the adaptor plug by grasping it firmly and pulling straight back.
5. Replace the power port cover.

3.9 Removal and Replacement of the Battery

If possible, connect the RadSeeker™ DL unit to an AC power adapter before removing the battery.

CAUTION!

If the RadSeeker™ DL is not connected to AC power, turn it OFF before removing the battery. Failure to do so could result in loss of data.

To remove the battery:

1. Push the retaining clip off the battery cover; lift up the lid to expose the battery.



Figure 3-49 Open Battery Cover

2. Remove the battery by pulling on the tab.

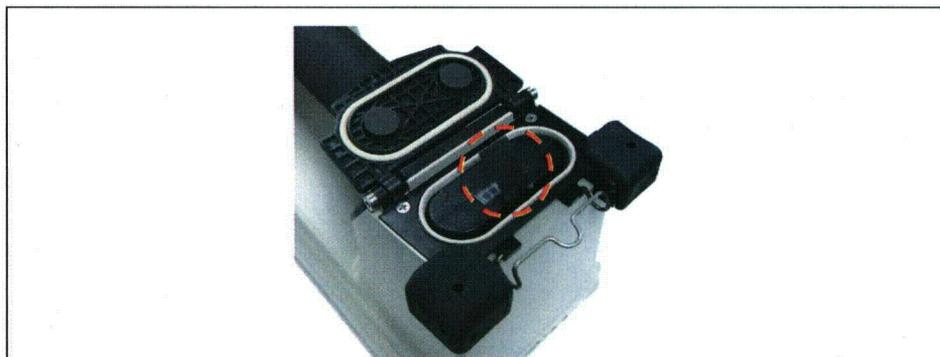


Figure 3-50 Remove Battery

To replace the battery:

1. Check the contact points inside the RadSeeker DL and on the base of the battery for correct alignment. The battery tab and contact points should face the rear of the unit.

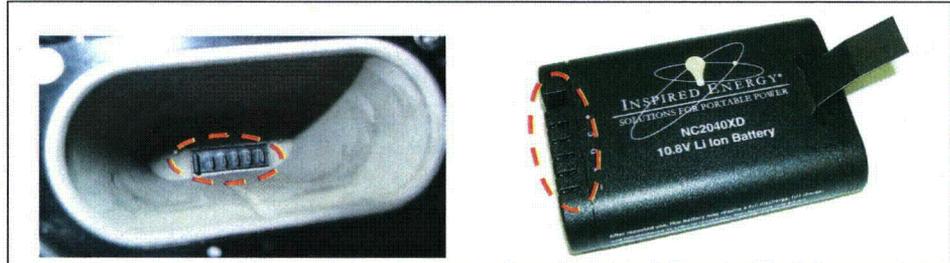


Figure 3-51 Battery Contact Points

2. Insert the battery into the housing.
3. Close the battery cover and slide the clip back into position to lock the cover.

NOTE: The on-screen battery indicator shows when the RadSeeker DL has recognized the battery, and also when external power is attached.

3.9.1 Battery LCD Display

The battery can directly display the capacity information. Each LCD segment represents 20 percent of the full charge capacity. The LCD pattern definition is given in the table below. If the battery voltage is below 2.4V/parallel-cell-group, there will be no LCD indication.

Capacity	LCD Segments				
	1	2	3	4	5
Below 1%					
1% - 20%	█				
21 - 40%	█	█			
41 - 60%	█	█	█		
61 - 80%	█	█	█	█	
81 - 100%	█	█	█	█	█

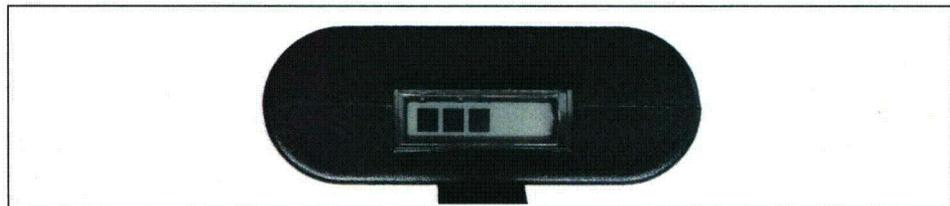


Figure 3-52 Battery LCD Segments

NOTE: If the battery is left in the unit when it is not being used it will discharge completely. Remove the battery from the RadSeeker DL to prolong the charge life.

3.10 Charging the Battery

The external charger requires approximately 2.5 hours to fully charge each battery. To connect the power adapter to the charger:

1. Plug the AC connector into the rear of the charger.



Figure 3-53 AC Connection

2. Check the power contact on the battery is in alignment with the contact point on the charger.

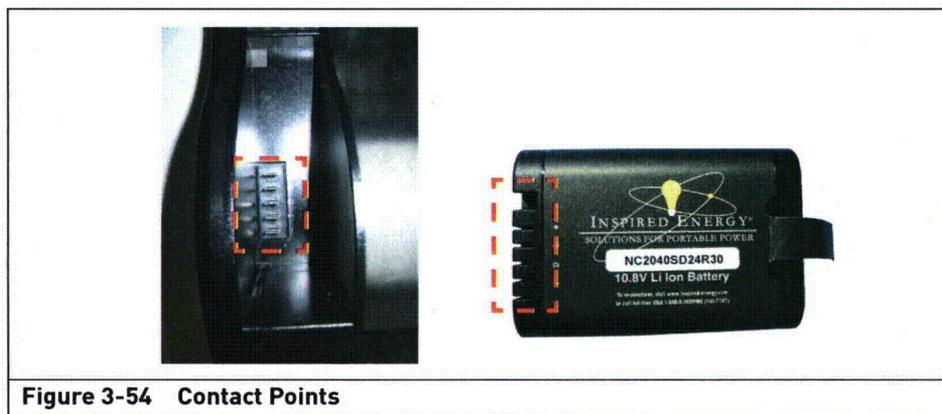


Figure 3-54 Contact Points

3. Gently push down on the battery to complete installation. Refer to [Figure 3-53](#). The battery charging automatically starts.

3.10.1 Battery Charger LED Display

LEDs on the front of the charger indicate the condition of the battery. The LEDs will flash for one second on power up, for each of the two terminals.

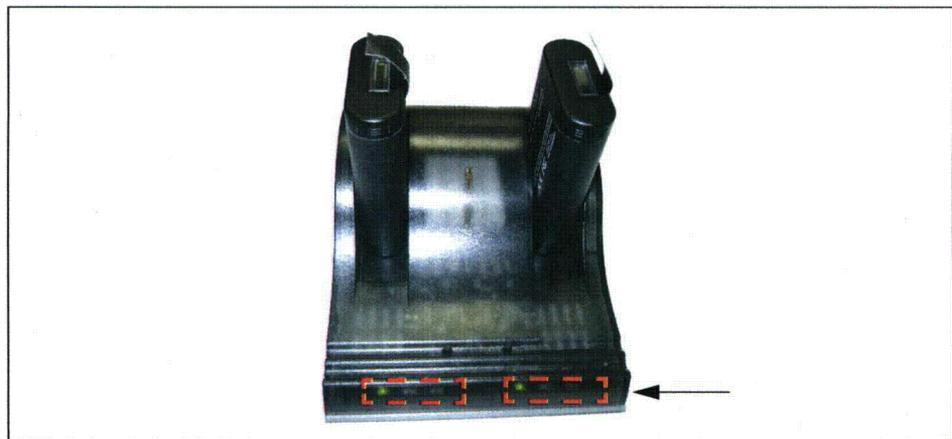


Figure 3-55 Battery Charger LEDs

LED Indicator	Battery Status
Green Flashing	Battery charging
Green Solid	Battery fully charged
Red	Error: <ul style="list-style-type: none">• Unsuccessful charger communications within 210 second timeout• No Battery communications within 210 section timeout

3.11 Changing the Bumpers

The RadSeeker™ DL ships with standard Mini bumpers. For applications where the unit is subject to greater shocks, optional Larger bumpers are available. The process for removing and installing either bumper types is the same.

In both configurations, the bumpers are formed to fit tightly to all of the corners of the enclosure. Each bumper location is numbered (on both the top and bottom enclosure) and each matching bumper has the same number.

The top rear (left and right) locations the bumpers are not numbered. These components fit onto the battery back plate which is then secured to the top rear enclosure.

3.11.1 Removing / Replacing Top Front Bumpers

To remove and/or replace the Top Front Bumpers:

1. Using the screwdriver provided in the carrying case, remove the two screws from both sides of the mini bumpers.

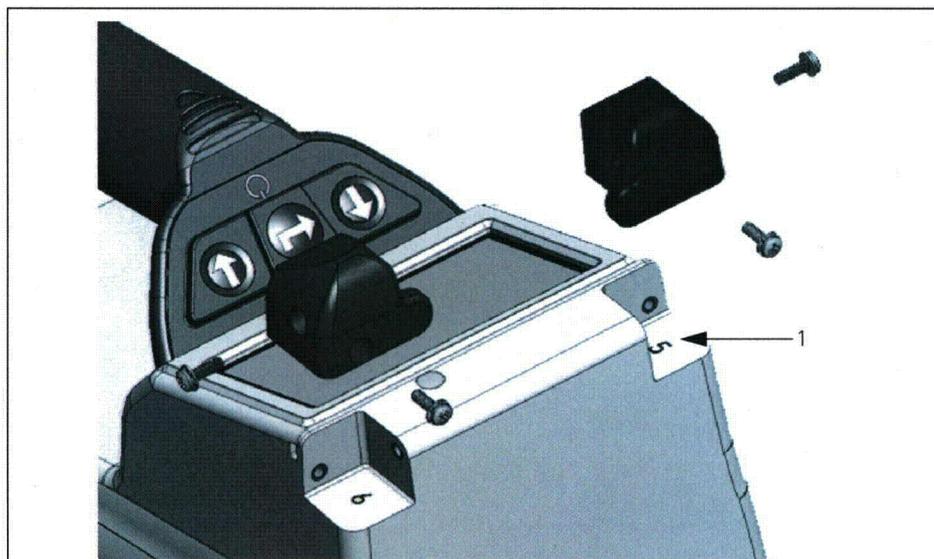


Figure 3-56 Removing the front left and right bumpers

1. Location Number

2. If necessary, use a blunt 1/16" diameter tool (or equivalent), to push out the screw and lock washer. Place the screws and lock washers in a clean container to be re-used when installing.
3. Install bumpers as indicated by the location number (Figure 3-56) on the unit and bumper. Install the screws with lock washers.

4. Use a Phillips #1 screwdriver and tighten each screw until screw cap becomes tight and add an extra quarter-turn.

3.11.2 Removing / Replacing Top Rear Bumpers

To remove or replace the Top Rear Bumpers:

1. Flip down the wire latch securing the battery cover and, using the Phillips # 1 screwdriver provided in the carrying case, remove the two screws from both sides of each bumper and the one from underneath the bumper back plate.

Place the screws in a clean container to be re-used when installing.



Figure 3-57 Removing top rear left and right bumpers

2. Replace the bumpers and as indicated by their numbered location.
3. Replace the screws and hand-tighten until snug and then add an extra quarter turn.

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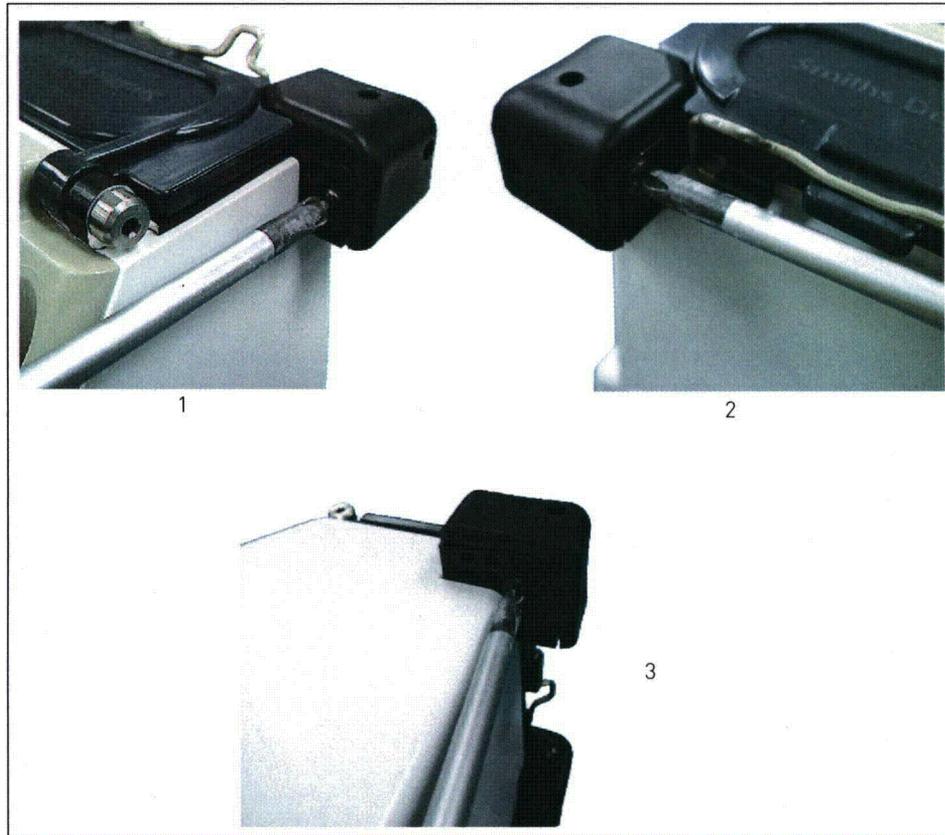


Figure 3-58 Screw Locations

1. Outside 2. Inside 3. Bottom

3.11.3 Removing / Replacing Bottom Bumpers

To remove or replace the bumpers:

1. Using the Phillips # 1 screwdriver provided in the carrying case, remove the two screws from both sides of the bumpers.

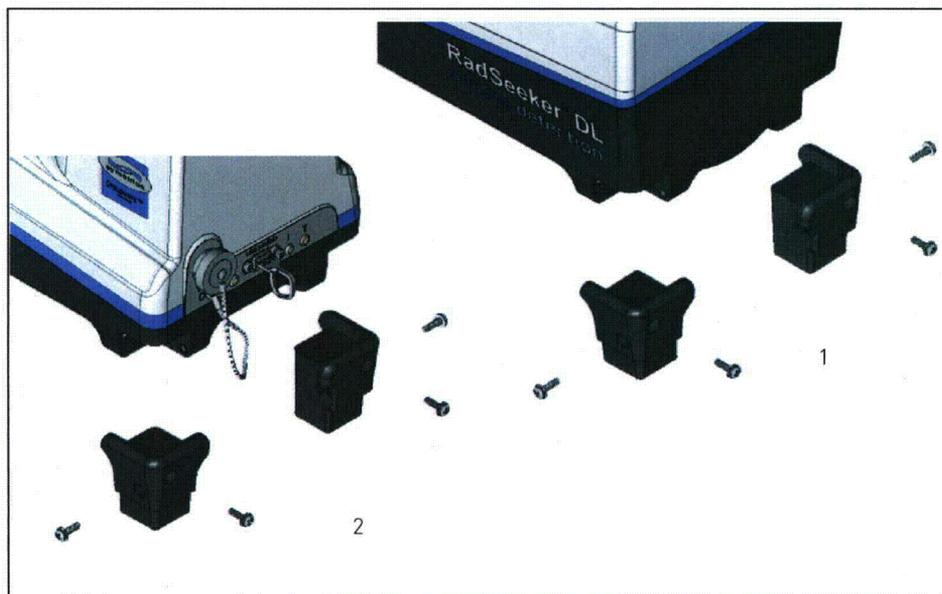


Figure 3-59 Removing Bottom Bumpers

1. Front Bumpers 2. Rear Bumpers

2. If necessary, use a blunt 1/16" diameter tool (or equivalent), to push out the screw and lock washer, from the bumpers.
Place the screws in a clean container to be re-used when installing.
3. Replace the bumpers and as indicated by their numbered location.
4. Replace the screws and hand-tighten until snug and then add an extra quarter turn.

3.12 Cleaning the RadSeeker™ DL

To clean the RadSeeker™ DL unit:

1. Use a mild soap solution and a soft cloth on the case, handle, and bumpers. Avoid using caustic chemical cleaners.
2. Wipe the OLED display with a lint-free cloth moistened with isopropyl alcohol. Avoid spraying cleaning solution directly on the display.

3.13 Transporting the RadSeeker™ DL

Place the RadSeeker™ DL in its protective carrying case whenever transporting the unit to a different location. The case is designed to hold the RadSeeker DL and its accessories, including spare batteries, the battery charger, the AC adapter, USB cables, and spare bumpers. See [Table 3-1 on page 3-39](#) for a typical list of accessories.

NOTE: Content of case may vary depending on options purchased with RadSeeker DL unit.

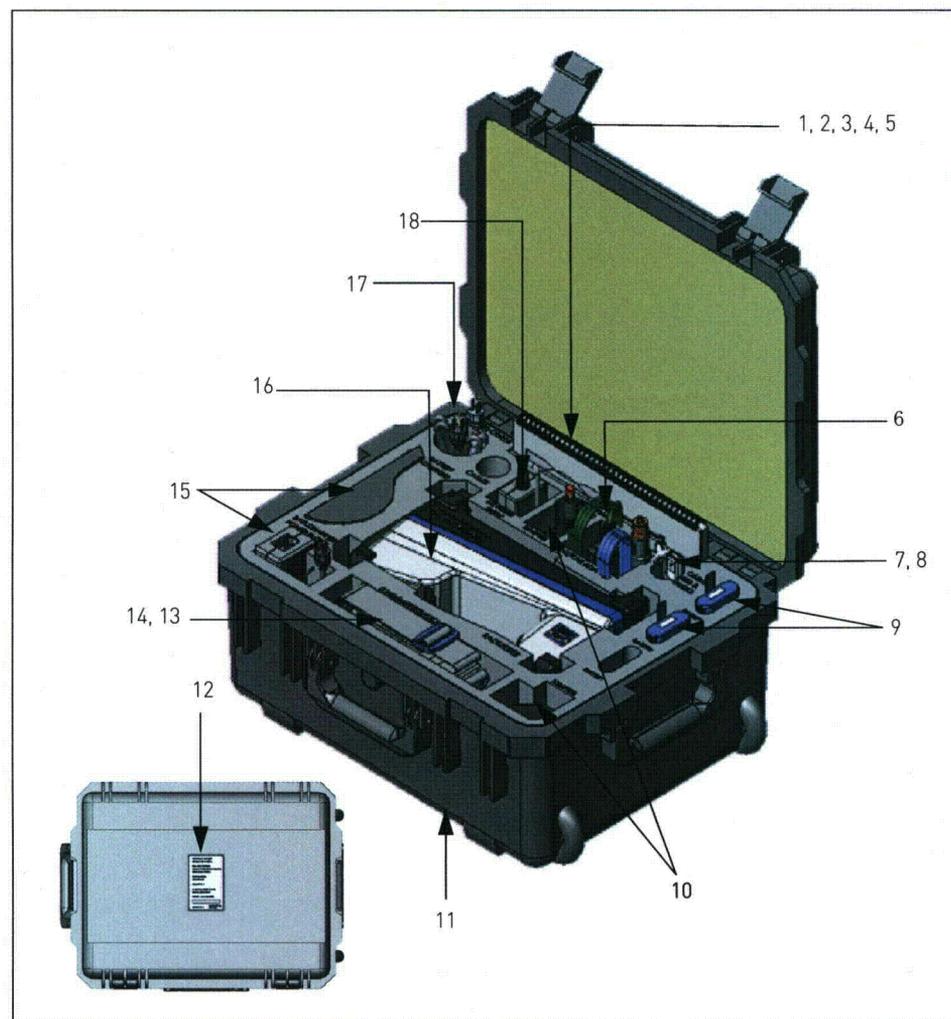


Figure 3-1 RadSeeker DL Carrying Case with Accessories

Table 3-1 Carrying Case Components

Item	Description
1	Instrument Password Sheet
2	Detector Controller Software
3	Reference Guide, RadSeeker DL
4	Operator Manual, RadSeeker DL
5	Detector Controller Manual, RadSeeker DL
6	DC/Car Adapter
7	USB A Male To Mini B Male Convertor Cable
8	Cable Assembly, Audio Adapter
9	Lithium ION Battery, [x 2]
10	Large Bumper, Kit
11	Transportation Case
12	Shipping Label
13	Phillips #1, Screwdriver
14	Sling
15	Two Bay Smart Battery Charger (with Power Supply and Cable)
16	Human Portable Radiation Detection System (RadSeeker DL)
17	Power Cord
18	AC Adapter, 15VDC

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smiths detection

RadSeeker™ DL

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Chapter 4 Normal Mode

4.1 System Power States

The system has two power states: battery power and external power. In each of these power states there are two power modes:

- For Battery Power: "Standby Enabled" and "Standby Disabled" (refer to "Standby Power Mode" on page 3-18).
- For External Power: "Auto Off Enabled" and "Auto Off Disabled" (refer to "External Power" on page 4-1).

To configure the Standby Power Mode and the Auto Off Power Mode, refer to "Advanced System Configuration" on page 6-7 for further instructions.

4.1.1 External Power

In the External Power state, the RadSeeker DL either has Auto Off Enabled or Disabled.

If enabled:

- The unit will turn itself Off following a period of inactivity. The user is alerted 30 seconds prior to shutdown and shown the progress of the timer to shutoff. Refer to Figure 4-1.

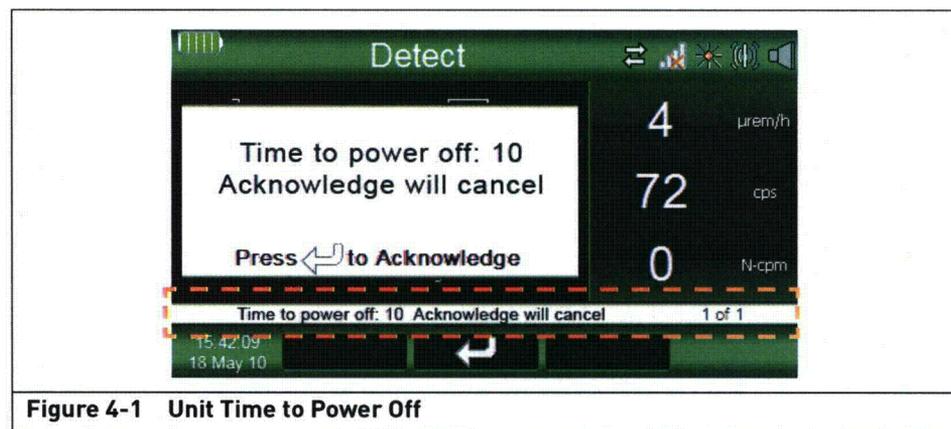
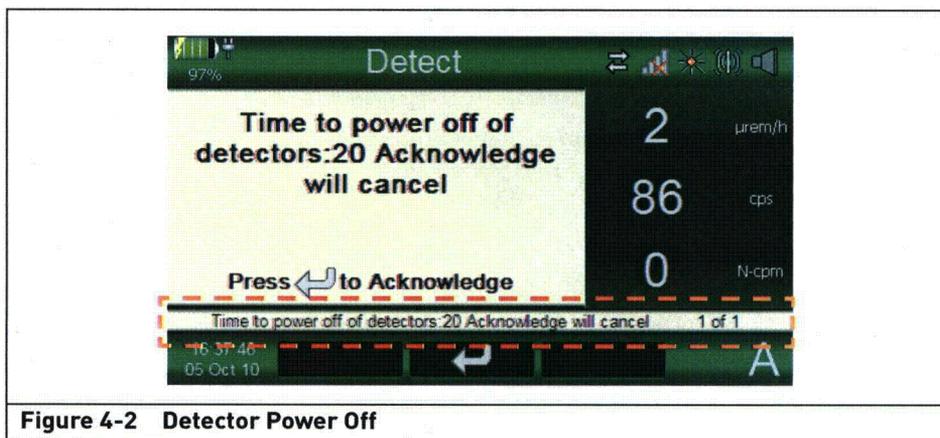
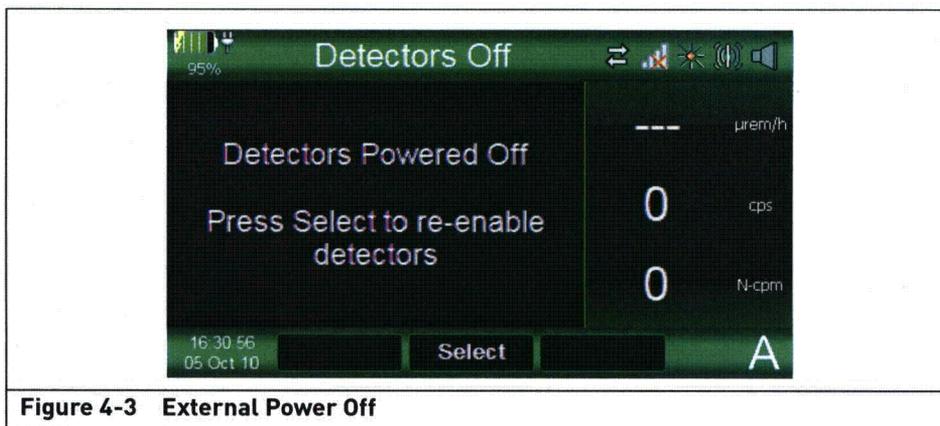


Figure 4-1 Unit Time to Power Off

- If the RadSeeker DL is connected and communicating to a PC via a USB cable, only the detectors, rather than the entire unit, will power Off. Refer to [Figure 4-2](#) and [Figure 4-3](#).



The following screen displays with a message to Press “Select” to Re-Enable Detectors.



4.2 Levels of Functionality

There are 3 levels of functionality:

- “Normal Mode” on page 4-3
- “Advanced Mode” on page 6-1. While the user is in this mode of operation, the letter A appears in the bottom right corner
- For Service Mode, refer to the Technical Manual

4.2.1 Normal Mode

The normal mode main menu is reached from the detect screen by pressing the key with the Menu label above it. The following sections describe the menu options available in Normal mode.

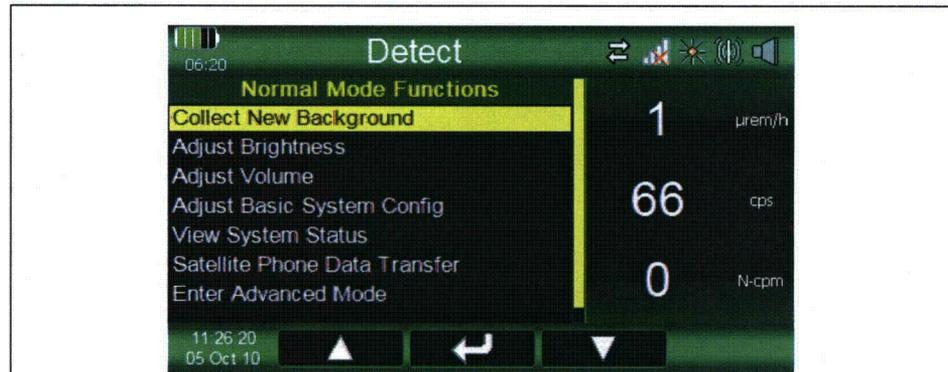


Figure 4-4 Menu List

NOTE: Any changes made to the Normal mode configuration are reset back to the factory default settings upon power cycling the unit (powering it Off and back On)

4.2.2 Collect New Background

To properly interpret the radiation from targets, the detector needs an accurate picture of what is normal. The natural resources and the environment affect background levels, as we move from location to location.

Examples of NORM sources: Radon gas, presence of radium and thorium, plant life and other natural radiation emitting sources create an energy signature that is "normal" for a particular place.

As the detector is used in different locations, it is important that the measured background is tailored to the inspection location.

The detector assesses the background every 30 seconds, and when the background spectrum needs to be replaced because it is different than the current background, a default setting of 300 seconds (5 minutes) is used for the new spectrum.

The value of the background is that it provides a graph of the levels of gamma radiation that can be used as a baseline for measuring differences. This clarifies the radiation contribution of a target that should be compared to the characteristics of known sources.

To collect a new background:

1. Select Menu from the Detect screen.

CAUTION!

Do not move while the background collection is in process.

2. Select "Collect New Background" from the Normal Mode Functions screen.

The unit displays the screen shown in [Figure 4-5](#). Pressing the Cancel button stops the new background collection.

NOTE: Cancelling the new background collection causes the unit to return to using the background that was in use prior to the start of this collection.

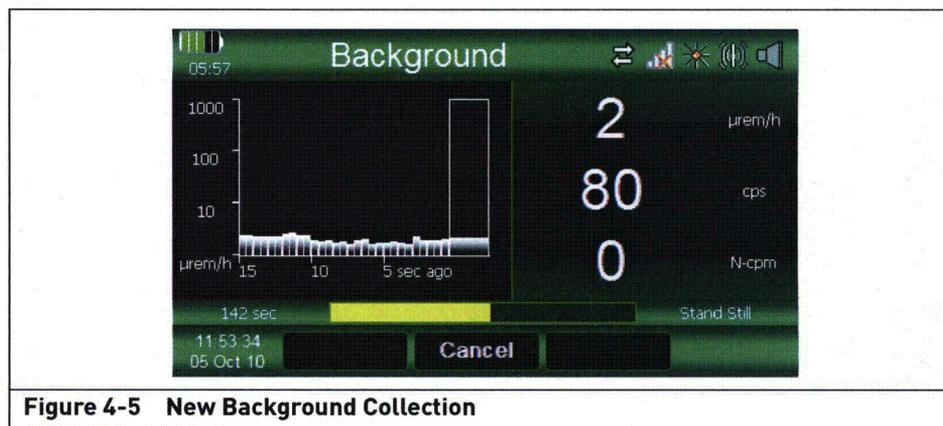


Figure 4-5 New Background Collection

3. The system informs the operator when background collection is complete, refer to [Figure 4-6](#).



Figure 4-6 Manual Background Complete

- Press the "Select" key to acknowledge and return to Detect mode.

NOTE: If Active Background collection is enabled (refer to "Active Background" on page 4-5), when a manual background collection is initiated, the Active Background is temporarily suspended during the manual collection time. After the manual background collection is complete and the user chooses Yes/No, the Active Background mode then resumes. This may take up to 5 minutes depending on background.

While Active Background is Enabled, then any time the current background appears to be significantly different from the manually collected background, the system will inform the user that it is implementing a new background and that the manually collected background is no longer in use (see Figure 4-7). Refer to "Active Background" on page 4-5.

4.2.2.1 Active Background

The system can be configured to actively collect background without operator initiation.

During an Analysis	Operation
The system determines a new background is needed	The operator is notified for a short period of time (10 seconds). This display situation will appear at any time, similar to an alert or alarm condition.
The operator is running through a manual self-test	The active background process will wait until the operator has completed the self-test before displaying the new background status.
The operator is in the process of conducting an identification	The background process is temporarily halted.

- Figure 4-7 indicates New Background has been implemented.

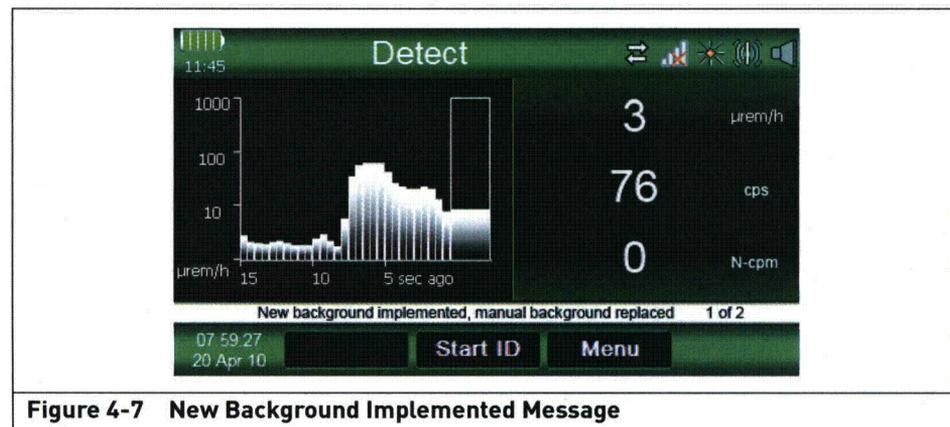


Figure 4-7 New Background Implemented Message

- NOTE:** If a manual background collection has been performed and the Active Background mode is enabled, the user is notified explicitly when the Active Background overwrites the manually-collected background.
2. A popup displays "New background Implemented Manual Background Replaced." Press the "Select" key to acknowledge the message (see [Figure 4-8](#)).

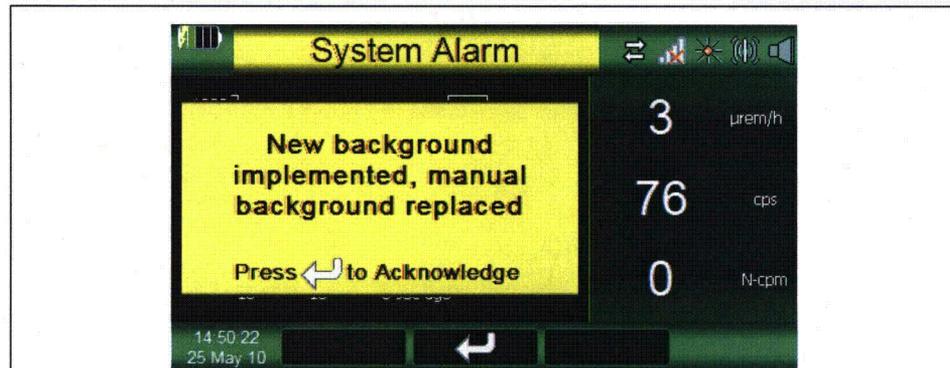


Figure 4-8 New Background Implemented System Alarm

This yellow color distinguishes the alarm as a non-threat alarm. The details of this alarm are written to the system log for later review.

4.2.2.2 Active Background Updates

When the system is powered On with Active Background 'enabled', or whenever Active Background is switched from 'disabled' to 'enabled', it evaluates the background environment to determine whether it is effectively the same as that which it was last using.

The message always occurs on power-up when Active Background is enabled, or anytime the system moves from an area of higher to lower background and needs to reevaluate.

During this evaluation time, which can take anywhere from 30 seconds to a few minutes, a notification is shown in the message bar: "Evaluating Background - Background subtraction not being used". Refer to [Figure 4-9](#).

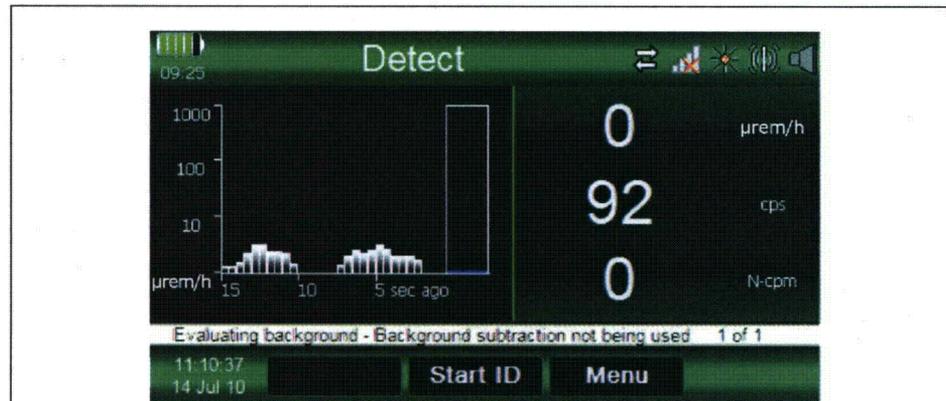


Figure 4-9 Evaluating Background Indication

- The notification will disappear after analysis indicates that the current background is equivalent to the stored background.
- After a certain time (defined by *Active Interval*; refer to "[Background Settings](#)" on page 6-6), if the backgrounds do not prove to be similar, the stored background is replaced with the background collected during this time period. The "Evaluating Background" notification disappears at that time.

NOTE: Background subtraction is disabled whenever the message "Evaluating Background - Background subtraction not being used" is displayed. While it is possible to perform identifications during this time, for most accurate identification results it is recommended that the operator wait until background evaluation is complete prior to performing identifications. Identifications performed without background subtraction may in some cases include indications of non-present radionuclides. ICD files saved during this condition may not have a background spectrum included, and will have a `<BackgroundState Invalid="true">` tag present in the ICD1 file to indicate this condition.

4.2.3 Adjust Brightness

Refer to "[Adjust Brightness](#)" on page 3-14 for additional instructions.

4.2.4 Adjust Volume

Refer to "[Adjust Volume](#)" on page 3-15 for additional instructions.

4.2.5 Basic System Configuration

Refer to “Basic System Configuration” on page 3-16 for further instructions.

Note that the following are the factory default settings:

- LEDS, Beeper, Vibration: Enabled
- Wi-Fi (802.11g) Interface: Disabled
- Battery format: Time remaining

4.2.6 View System Status

The system status menu provides access to general system information and system health monitoring.

1. From the Normal Mode Menu, select View System Status.
2. The System Status menu allows the user to access the following screens:
 - System Information
 - System Health
 - Battery Information
 - System Log
 - Network Info
 - Self-test

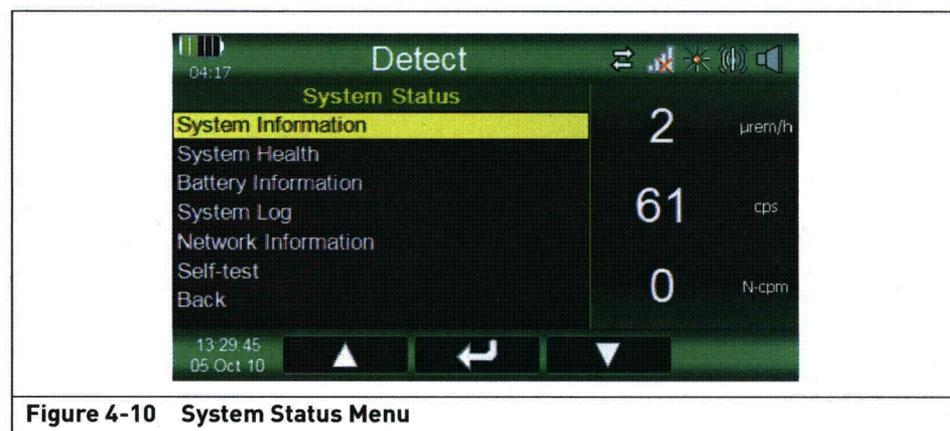


Figure 4-10 System Status Menu

4.2.6.1 System Information

Selecting this option enables the user to view the system information.

1. The System Information screen displays the following:

System Information	Description
Model	Device Model name
Serial	Device Serial Number
Instrument Version	Overall hardware/software configuration identifier
Software	Software version
Main Board Bootloader	Main Board boot loader version
Display Board Bootloader	Display Board boot loader version
Isotope Library	Isotope library version
Algorithm	Algorithm version
DSP	Digital Signal Processor software version
Neutron	Firmware version
OS	Operating System version
Last Calibration	Date of last unit calibration
Storage	Data storage space Used and Available for ICD file pairs
Operating Hours	Lists hours of operation of System and Gamma Detector
Last Data Offload	Date/Time of last data transfer to PC
Detector Setup Used	Type of detector (LaBr or NaI)

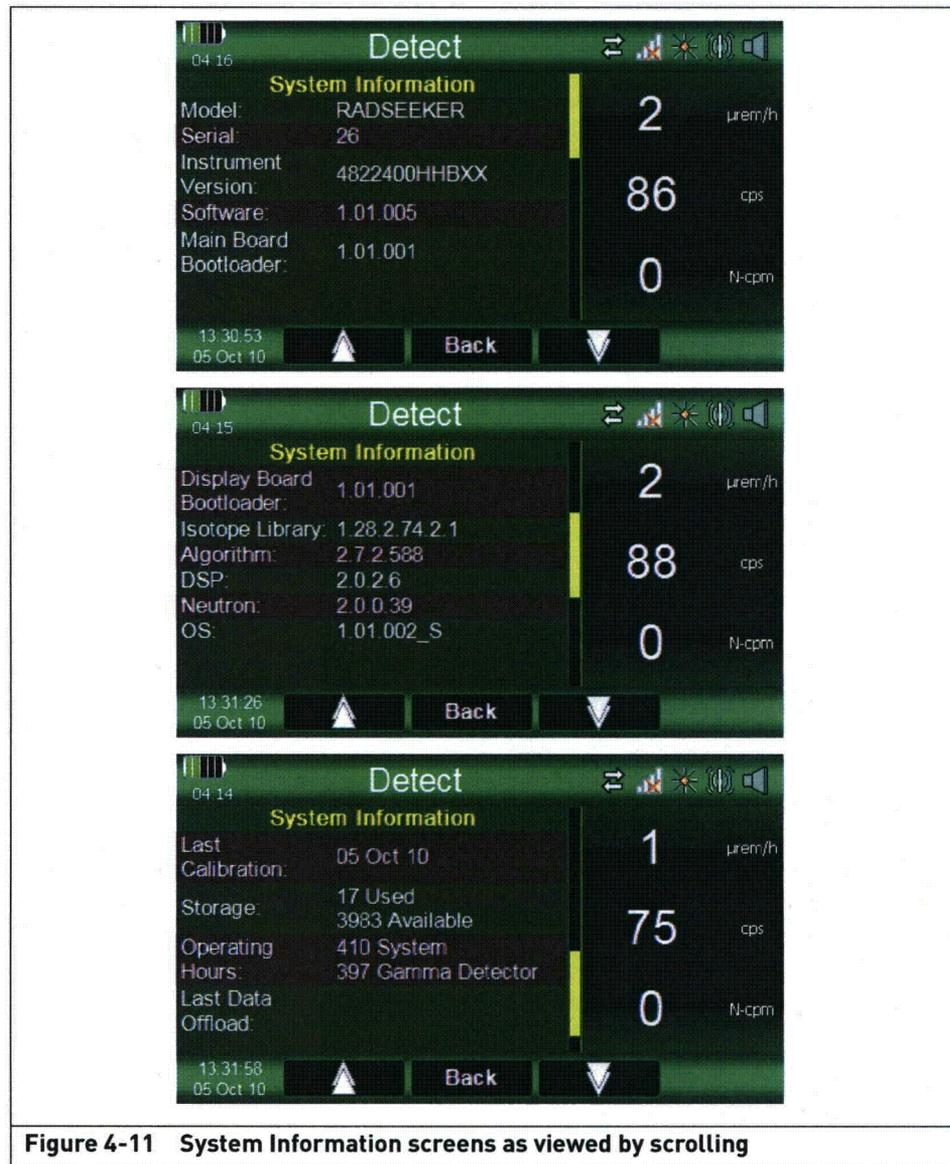


Figure 4-11 System Information screens as viewed by scrolling

2. Select Back to return to the System Status menu.

Further information on embedded firmware and API versions is available on the Diagnostics screen in Service Mode.

4.2.6.2 System Health

Selecting this option enables the user to view the system health information.

1. Select System Health. The system health screen displays the following values:

System Information	Description
DSP Temperature	Normal range between -13°F and 167°F (-25°C and 75°C)
Gamma Temperature	Normal range between -8°F and 122°F (-22°C and 50°C)
Unit Temperature	Normal range between -13°F and 167°F (-25°C and 75°C)
Display Temperature	Normal range between -26°F and 158°F (-32°C and 70°C)
Gamma Bias Voltage	Normal range between 500 V and 1200 V
Neutron Bias Voltage	Normal range between 800 V and 1800 V

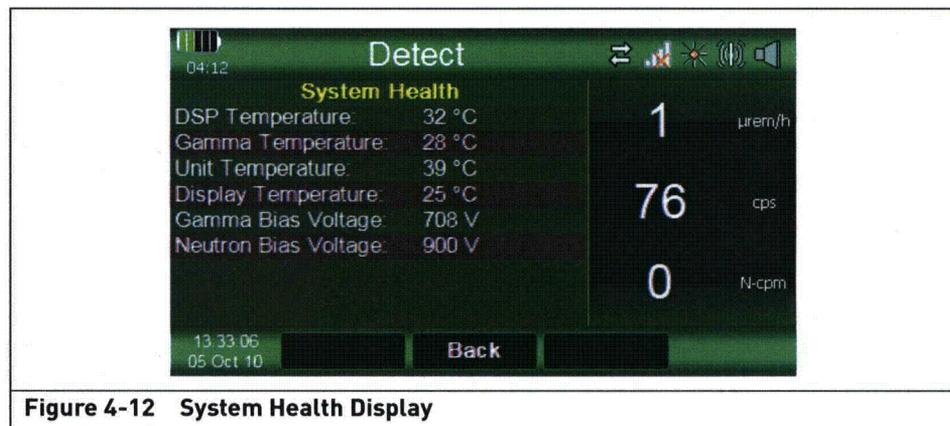


Figure 4-12 System Health Display

2. Select Back to return to the System Status menu.

4.2.6.3 Battery Information

It is important for both users and maintenance personnel to monitor the life of the batteries. The battery health screen provides this information.

1. From the System Status menu, select Battery Information.

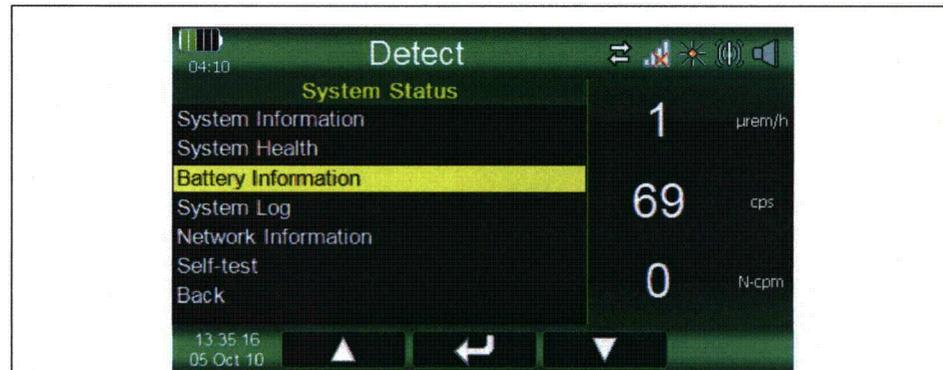


Figure 4-13 System Status Menu

The Battery Information screen displays as shown in [Figure 4-14](#) and [Figure 4-15](#). Use the Down key to scroll through the battery information.

Battery Information	Definition
Temperature	Actual battery temperature: <ul style="list-style-type: none"> • Max: 127°F charging, 163°F discharging • Max: 53°C charging, 73°C discharging
Voltage	Actual battery voltage
Current	Actual battery current in amps (A)
Avg. Discharge Current	Battery drain current averaged over last 15 seconds; shows as N/A when charging
Time to Full / Empty ¹	Remaining time before battery recharged / drained
Remaining Capacity	Remaining battery capacity as a percentage and in mAh
Capacity	Total battery capacity in mAh
Charging Voltage	Required charging voltage (V)
Charging Current	Required charging amps (A)
Input Current	Current from AC adaptor to unit
Cycle Count	Number of times the battery has been charged
Serial Number	Serial number of the battery
Device Name	Name of the battery

1. Displays Time to Full when plugged into AC and Time to Empty when running on battery power.

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Figure 4-14 Battery Information screens while on battery power

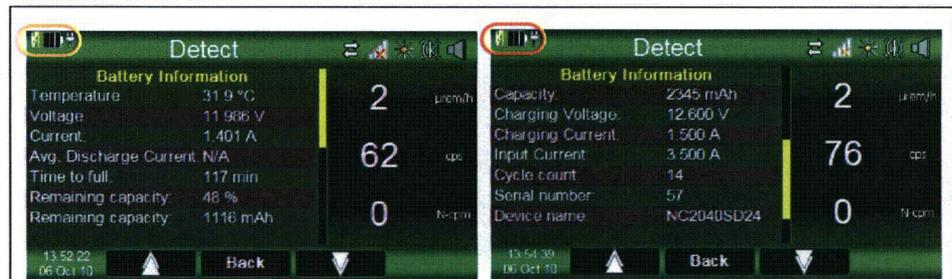


Figure 4-15 Battery Information screens with AC power connected

2. Select Back to return to the System Status menu.

4.2.6.4 System Log

The system log is written by the system at startup, and continually during operation. It contains a record of all system messages, any alerts or alarms, self-test results, and configuration changes.

1. From the System Status menu, select System Log.

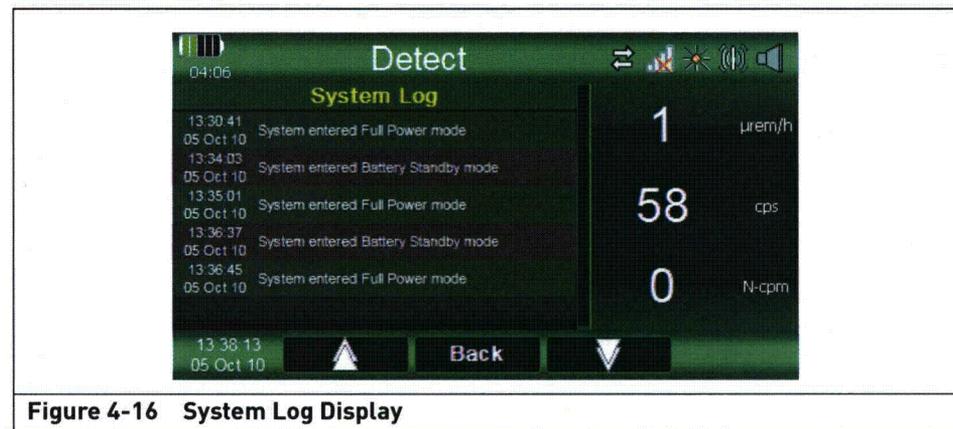


Figure 4-16 System Log Display

2. Select Back to return to the System Status menu.

4.2.6.5 Network Information

The network information screen shows:

- The unit's IP address for the USB interface when connected via a cable to a PC
NOTE: By default, the USB mode is set to "Serial" by service-mode options. When this is the case, no IP address is displayed.

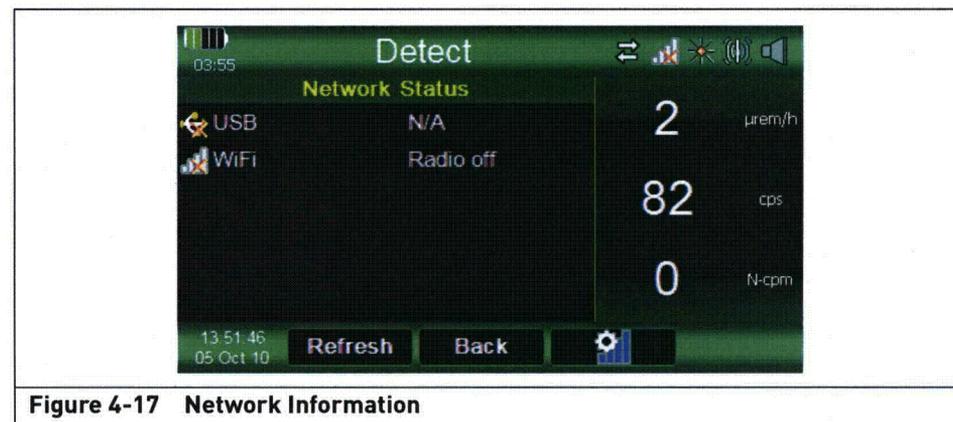


Figure 4-17 Network Information

4.2.6.6 System Self-Test

A system self-test can help in diagnosing system problems. To execute a system self-test:

1. From the System Status menu, select Self-Test.

The self-test runs automatically. After each interface tests, the user must indicate if the test was successful or not.

NOTE: System Self-Tests takes up to 15 minutes to complete.

2. **Beeper Test:** The beeper is turned On in a threat alarm condition. A confirmation is required on the working condition of the beeper. Select Yes or No.



Figure 4-18 Beeper Test

3. **Vibration Test:** A confirmation is required on the working condition of the vibration in the handle. Select Yes or No.



Figure 4-19 Vibration Test

4. **LED Test:** Each LED is turned On in sequence and the user is asked to confirm one at a time that the LED worked correctly.

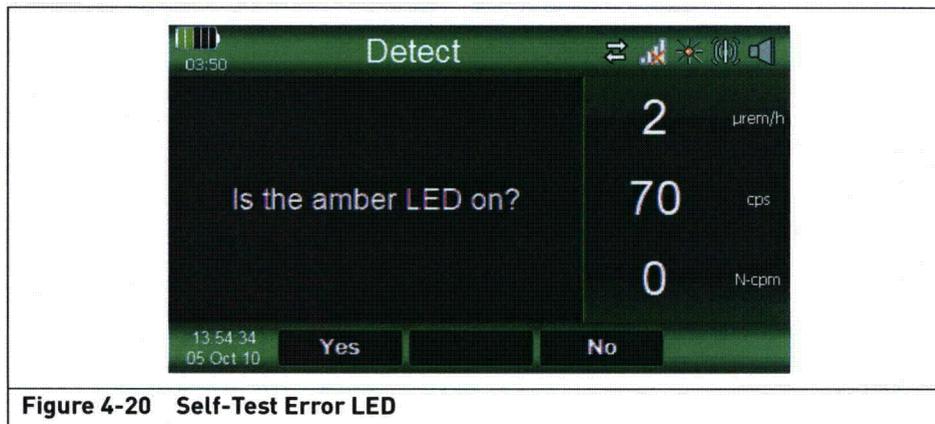


Figure 4-20 Self-Test Error LED



Figure 4-21 Self-Test Innocent Alarm LED



Figure 4-22 Self-Test Threat Alarm LED

A progress bar displays, showing the time remaining in the test.

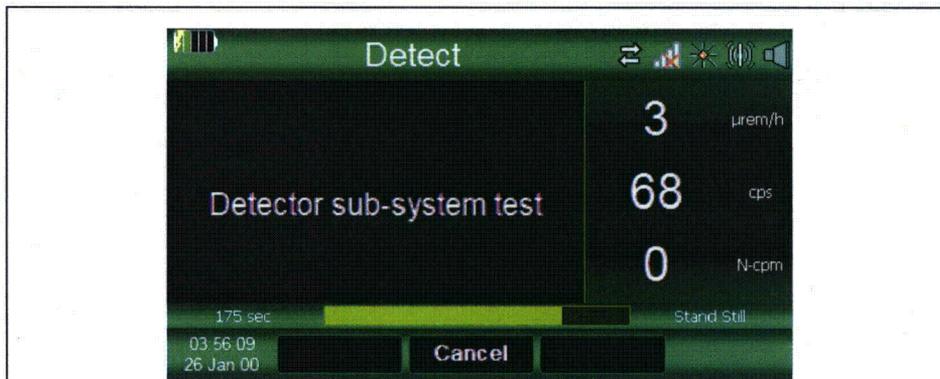


Figure 4-23 Self-Test Progress Bar

Upon completion of a successful self-test, the system displays a "Passed" message.

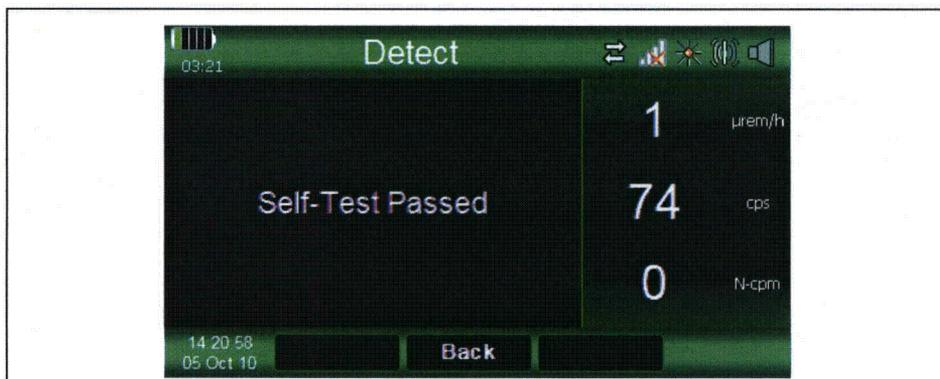
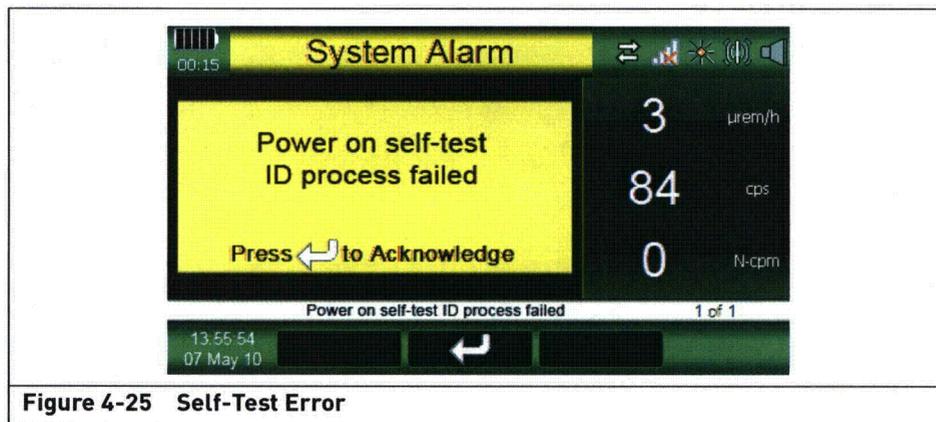
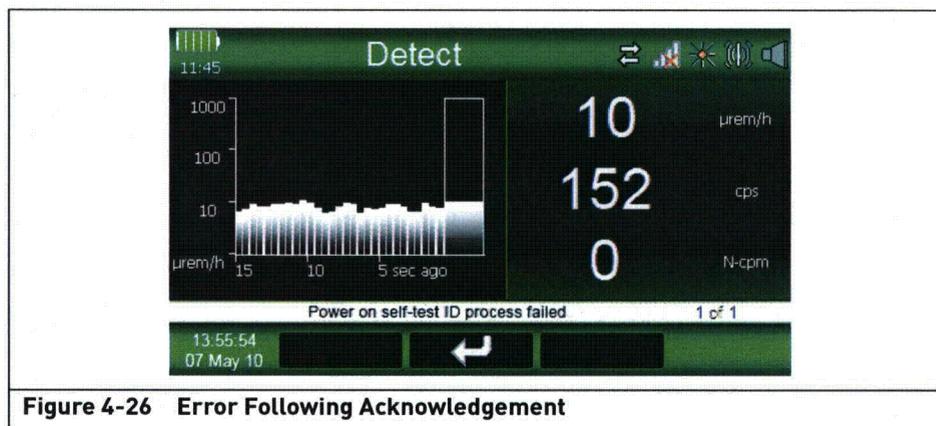


Figure 4-24 Self-Test Pass

5. If the self-test fails at any point, the test will halt. The fault condition is displayed in the form of a system alarm containing an error message. Press the "Select" key to acknowledge the message and proceed with the self-test.



Following completion, the Pass/Fail status of the self-test is displayed in the message area of the display. See "Alerts and Alarms" on page 5-1 for complete error-handling conditions.



NOTE: Contact Smiths Detection's Service department for support in the event the unit fails to complete the self-test.

4.2.7 Satellite Phone Data Transfer

4.2.7.1 Introduction

The Satellite Phone Communications feature allows the user to transfer events recorded on the RadSeeker DL to a computer located at another location.

Refer also to "Satellite Phone Configuration" on page 6-10.

The system consists of:

- RadSeeker DL
- USB to serial adapter and cable
- Activated satellite phone (The satellite phone is part of the Handheld Communications Package)
- A phone number associated with a modem that is connected to a computer at the receiving end completes the system.

NOTE: For operational instructions on the satellite phone, refer to the user instructions supplied each system.

4.2.7.2 Satellite Phone Connection

Connecting the satellite phone:

- Do not attempt to use this phone indoors.
 - You must be outside away from large structures and trees.
 - You must have a minimum 80% view of the sky when using this phone.
 - If you are on a ship you must be on the upper deck away from antennas and radar domes.
1. Check the coverage status on the phone. The more bars indicated the greater the coverage.
 2. Connect the phone to the unit using the USB to serial cable and adaptors.
 3. If the RadSeeker is already On perform a power cycle. Example; turn the unit Off then back On.
 4. Use the Up and Down arrows and highlight "Satellite Phone Data Transfer." Press the "Select" key.

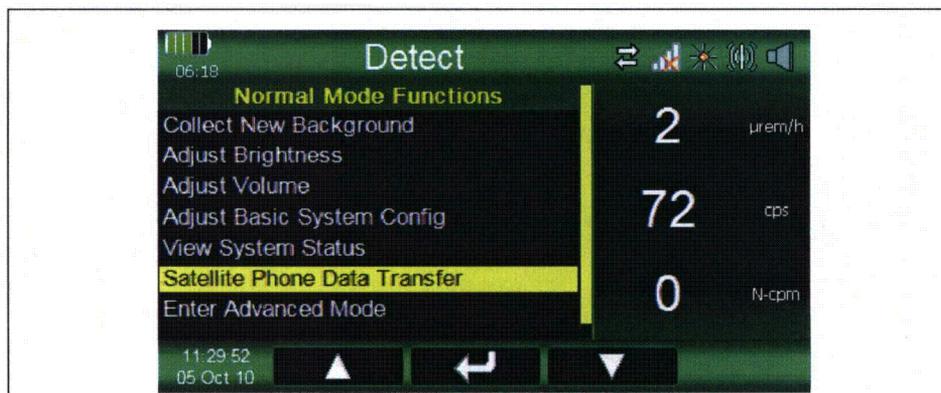


Figure 4-27 Normal Mode Menu Functions

5. The Satellite Phone Data Transfer screen opens. Use the Up and Down arrows to highlight the event type that is to be used for data transferred.

Options listed:

- Most Recent Event - the last logged event
- All Events - all events logged on the RadSeeker DL
- Event Number Range - range of events
- Back - return to the satellite phone menu screen

NOTE: Event: Any alarm or identification spectrum that is numbered and logged by the RadSeeker DL.

6. Use the Up and Down arrows and highlight the type of event desired.
7. Press the ""Select" key" to begin the transfer process.

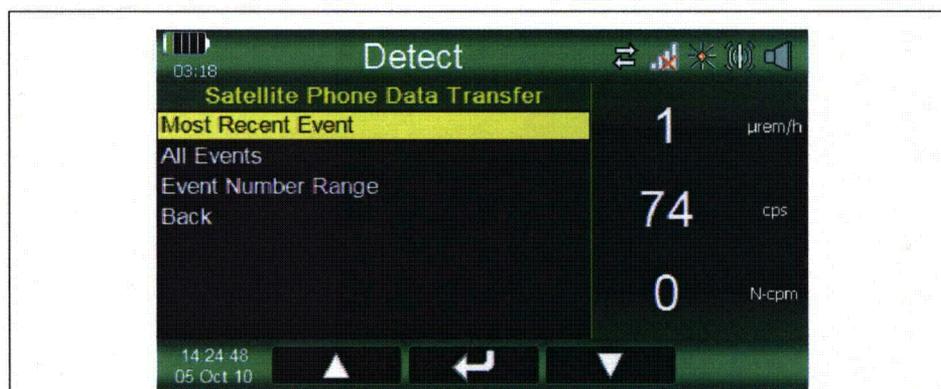


Figure 4-28 Satellite Phone Data Transfer Menu

4.2.7.3 Most Recent Event

Selecting this option allows the user to transfer the most recent event only.

1. Select "Most Recent Event."

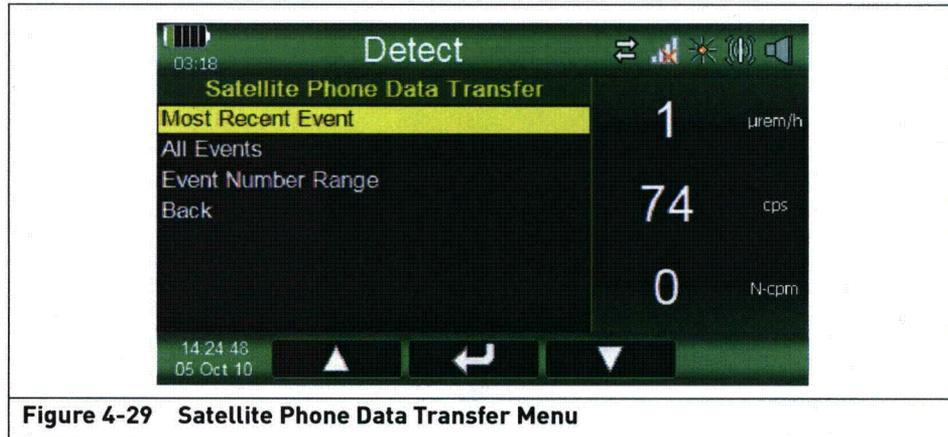


Figure 4-29 Satellite Phone Data Transfer Menu

2. Press the "Select" key, a message screen displays indicating that the RadSeeker DL is "Connecting to the Satellite phone..." Followed by a Dialing screen.



Figure 4-30 Satellite Connecting

- a. If the connection is cancelled by pressing "Stop" a message indicates that the "Transfer Failed To Start."
- b. Press the "Back" button to return to the satellite phone menu screen. Repeat the connection process if required.

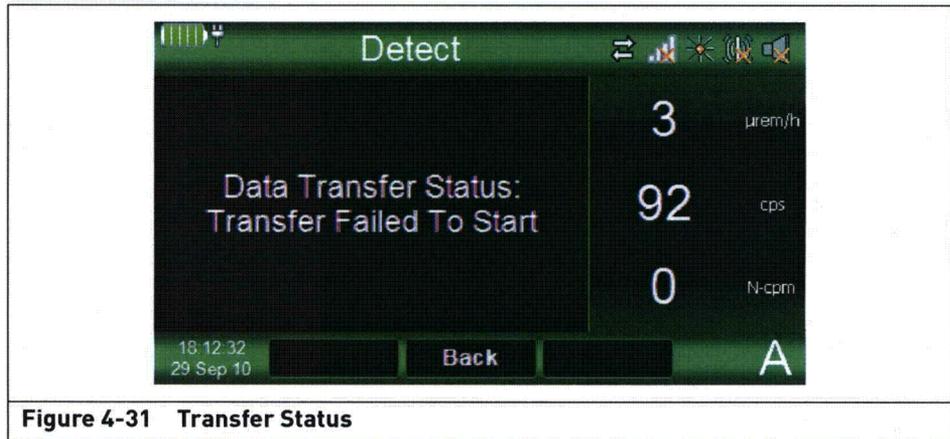


Figure 4-31 Transfer Status

3. After a successful connection is made the progress screen opens indicating the:
 - Status of the file in transfer
 - Event number as it is being transferred
 - Remaining files to be transferred
 - Total number of files already transferred
 - File name being transferred

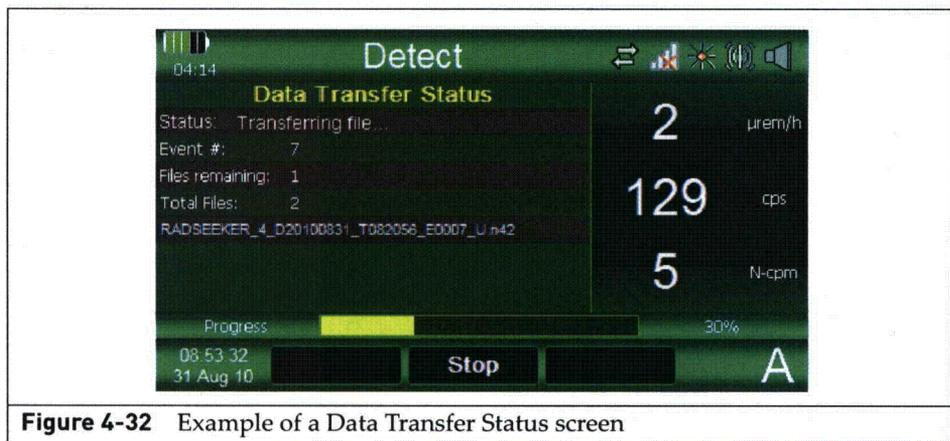
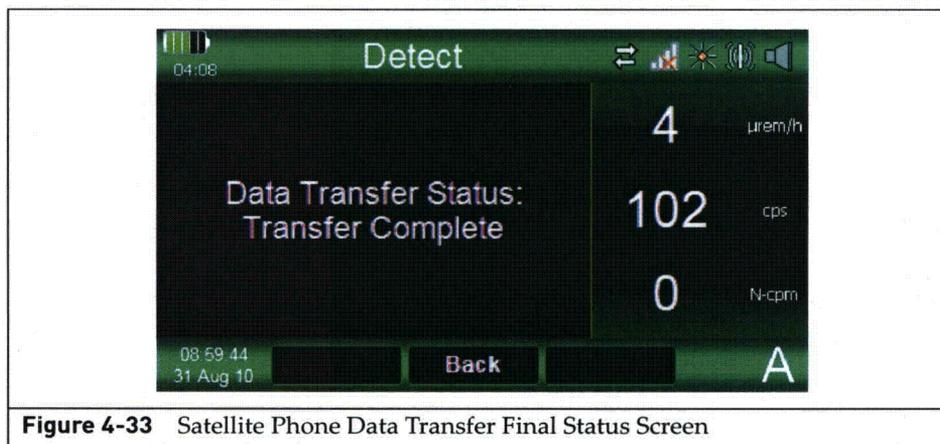


Figure 4-32 Example of a Data Transfer Status screen

NOTE: 2 files are sent for each event.

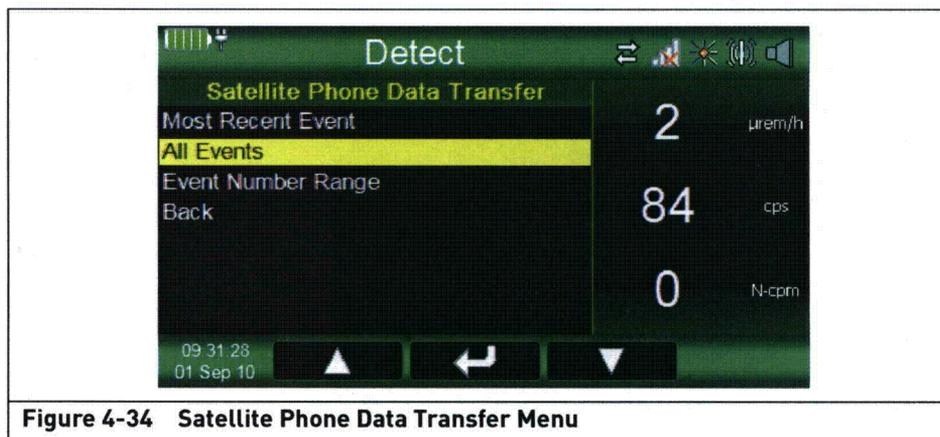
4. On completion of the event transfer, the final status is displayed. Press the "Back" button to return to the satellite phone menu screen.



4.2.7.4 All Events

This option allows the user to transfer all events logged on the RadSeeker DL.

1. Select "All Events."



2. Press the "Select" key, a message screen displays indicating that the RadSeeker DL is "Connecting to the Satellite phone..." Followed by a Dialing screen.



Figure 4-35 Satellite Connecting

- a. If the connection is cancelled by pressing "Stop" a message indicates that the "Transfer Failed To Start."
- b. Press the "Back" button to return to the satellite phone menu screen. Repeat the connection process if required.

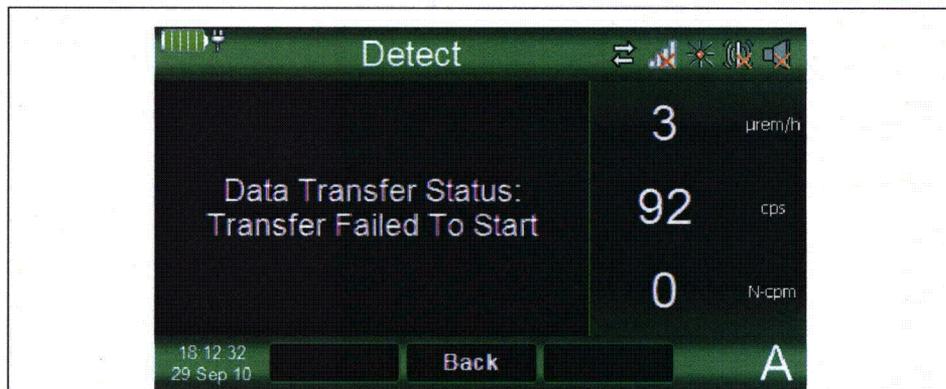


Figure 4-36 Transfer Status

3. After a successful connection is made the progress screen opens indicating the:
 - Status of the file in transfer
 - Event number as it is being transferred
 - Remaining files to be transferred
 - Total number of files already transferred
 - File name being transferred

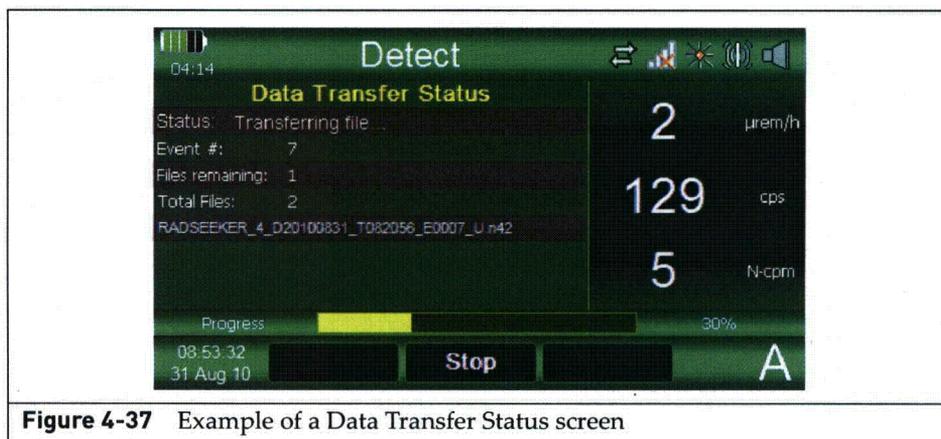


Figure 4-37 Example of a Data Transfer Status screen

NOTE: 2 files are sent for each event.

4. On completion of the event transfer, the final status is displayed. Press the "Back" button to return to the satellite phone menu screen.

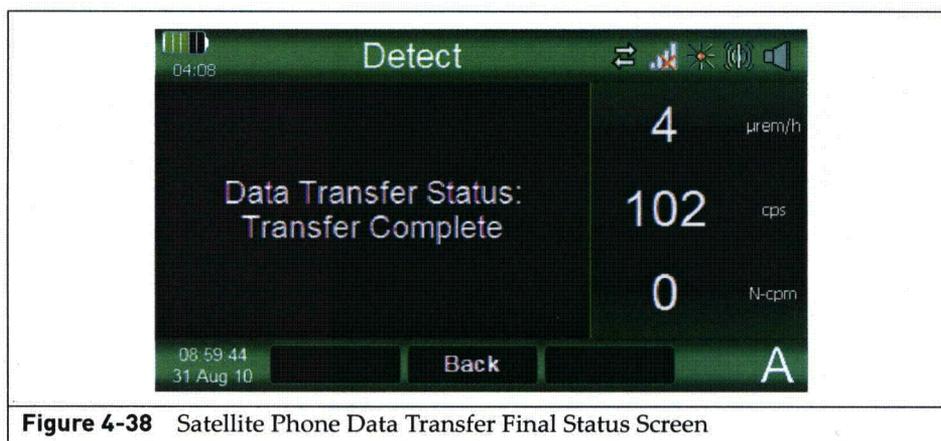


Figure 4-38 Satellite Phone Data Transfer Final Status Screen

4.2.7.5 Event Number Range

This option allows the user to select a range of events to send. The user enters the "Starting" event number and the "End" number, for the range of data that is to be transferred. The default "End" range is the full range of events.

1. Select "Event Number Range."

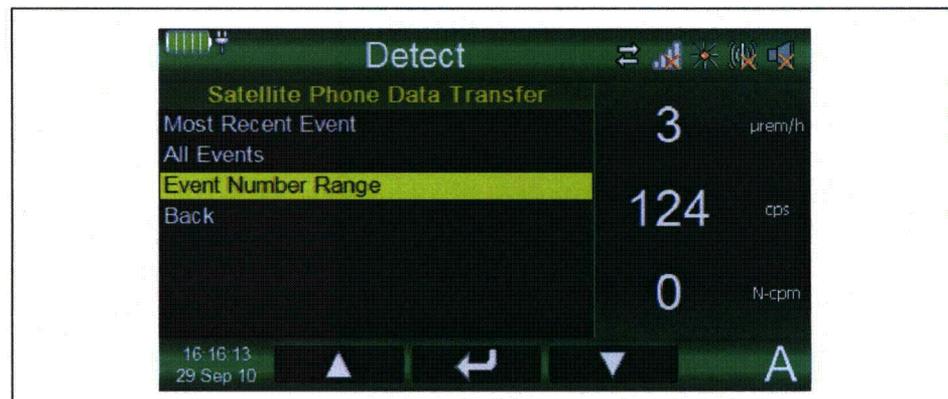


Figure 4-39 Satellite Phone Data Transfer Menu

2. The Event Range Selection screen opens.

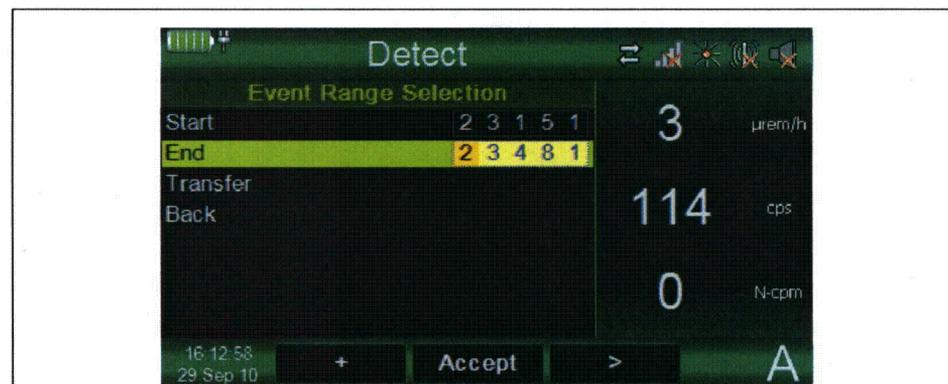


Figure 4-40 Editing the event range to be transferred

3. To edit the event number. Use the Up and Down arrows to highlight the Start or End of an event number.
4. Press the "Select" key, the cursor falls on the first digit and the arrows are replaced with the "+" and ">" symbols.
 - a. The currently selected digit turns orange. Press "+" to increment the value of the selected digit.
 - b. Press ">" to toggle to the other digit.
 - c. Press "Accept" after setting the required value.

- d. If "Back" is selected the user is returned to the previous screen.
- 5. Select "Transfer." Press the "Select" key, a message screen displays indicating that the RadSeeker DL is "Connecting to the Satellite phone..."



Figure 4-41 Satellite Connecting

- a. If the connection is cancelled by pressing "Stop" a message indicates that the "Transfer Failed To Start."
- b. Press the "Back" button to return to the satellite phone menu screen. Repeat the connection process if required.

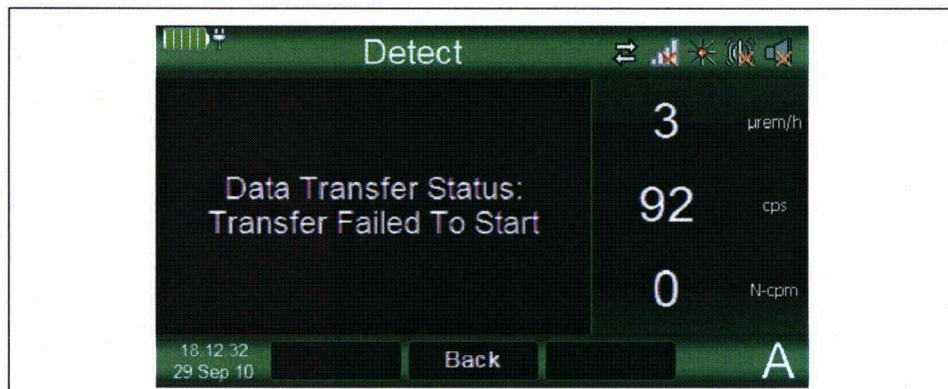


Figure 4-42 Transfer Status

6. After a successful connection is made the progress screen opens indicating the:
 - Status of the file in transfer
 - Event number as it is being transferred
 - Remaining files to be transferred
 - Total number of files already transferred
 - File name being transferred

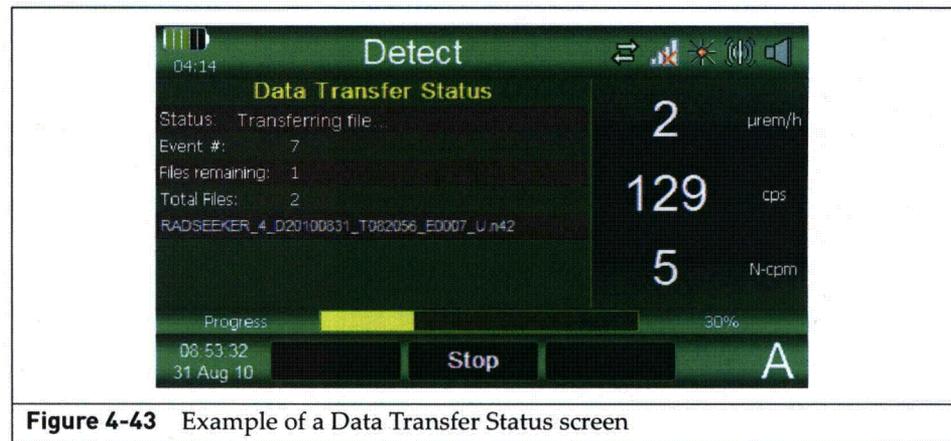


Figure 4-43 Example of a Data Transfer Status screen

NOTE: 2 files are sent for each event.

7. On completion of the event transfer, the final status is displayed. Press the "Back" button to return to the satellite phone menu screen.

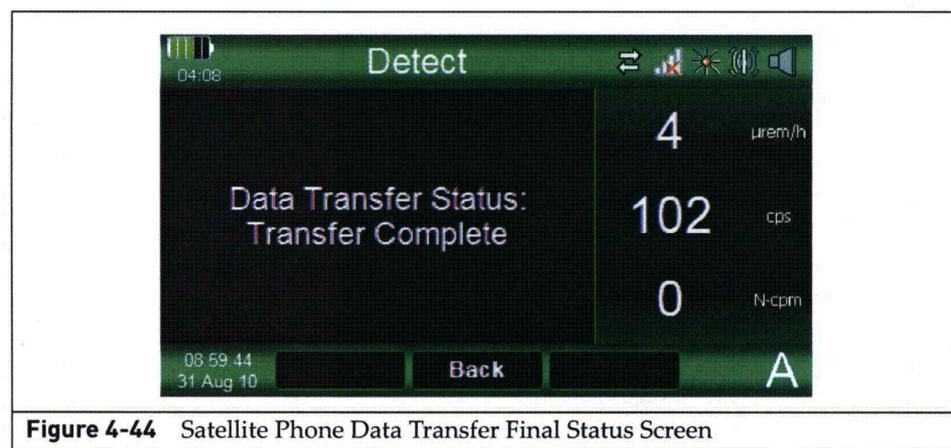


Figure 4-44 Satellite Phone Data Transfer Final Status Screen

4.2.7.6 Back

Selecting this option returns the user to the Normal Mode menu.

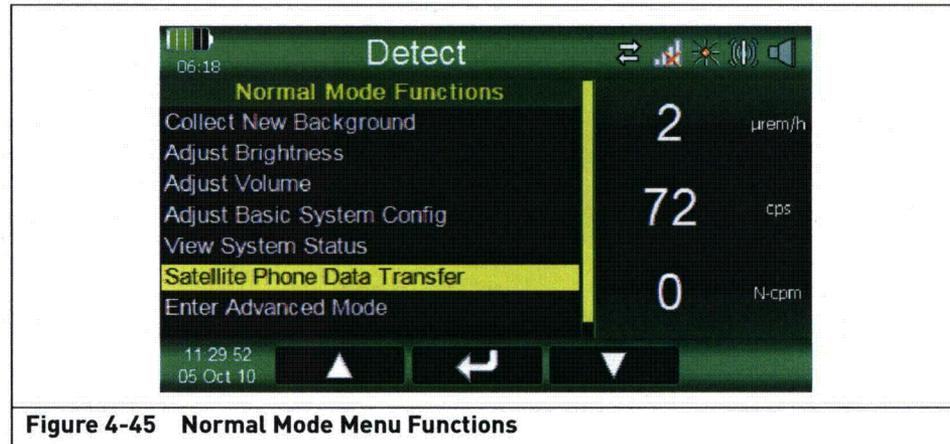


Figure 4-45 Normal Mode Menu Functions

4.2.7.7 Receiving End Notification

Occasionally data transmissions will fail during the transfer due to poor or intermittent satellite coverage. This requires manual intervention by the operator at the receiving end (LSS) of the transmission.

The issue occurs when the status window shows connection Time-out in both the "Status box" and "Last Message Received Box".

At the receiving end of the satellite phone data transmission, the operator must close the zmodem status window whenever the status and last status received lines read "Connection Timed Out".

This will allow the data transmission to continue the transmission when connection is re-established.

4.3 Detection

Refer to "Detection" on page 3-7 for further instructions.

Figure 4-46 and Figure 4-47 display optional measurements of Rem and Sieverts. These units are configurable from the Advanced Mode Configuration screen. Refer to "Advanced System Configuration" on page 6-7.

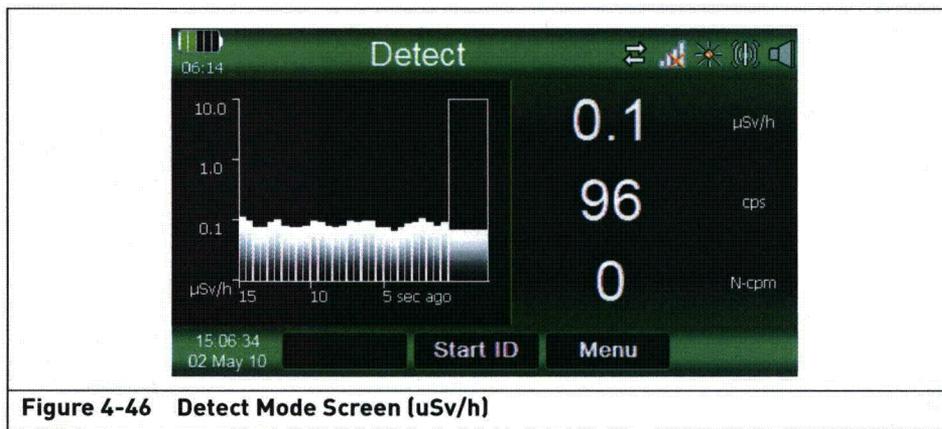


Figure 4-46 Detect Mode Screen (uSv/h)

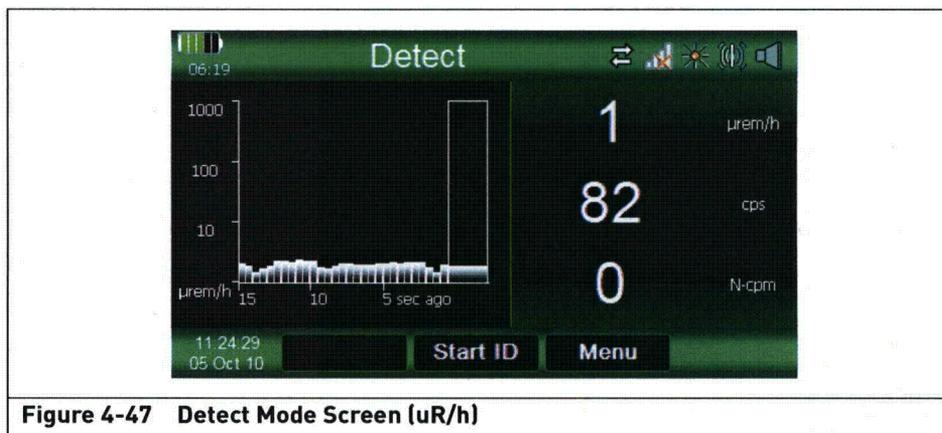


Figure 4-47 Detect Mode Screen (uR/h)

4.3.1 Identification

To perform an identification:

1. Press the "Select" key on the Detect screen to initiate the identification process. The detector subsystem collects spectrum data for the default value period (30 seconds). The default value is adjusted via the Advanced System Configuration screen. Refer to "[Advanced System Configuration](#)" on page 6-7. The system proceeds through the source identification process and reports the result on a new screen.

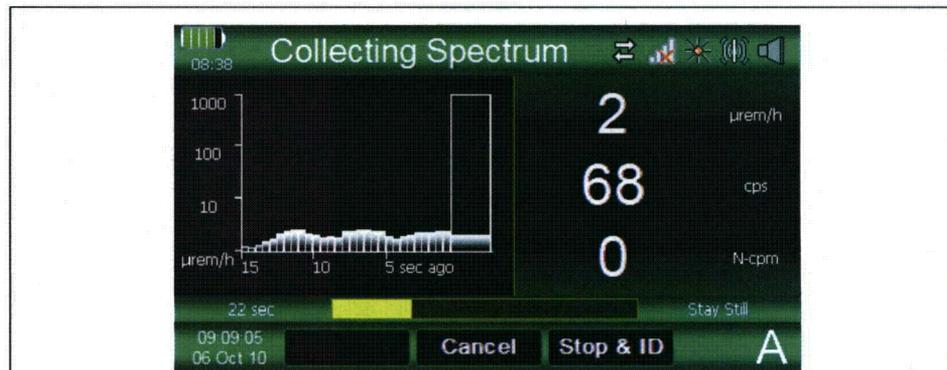


Figure 4-48 Collecting Spectrum Data

- The system collects spectrum data and completes the identification process unless the user cancels the process or forces an early identification.
 - A progress bar provides the user with a visual indication of the data collection time.
 - The value to the left of the progress bar is the time of data collection remaining.
 - The user may cancel the identification process any time during the collection, by pressing "Cancel". The RadSeeker returns to the Detect screen.
 - The user may cut the collection time short and attempt to identify based on the shorter spectral collection, by pressing "Stop & ID". Results may be less reliable when this is done.
- After the data collection is completed, the system runs through the analysis process and presents the results. The analysis process typically takes 5-10 seconds; during this time, the word "Identifying" appears to the right of the completed progress bar. This process cannot be cancelled.
- If any radionuclides are identified, an alarm is generated (innocent or threat). Press Acknowledge to proceed. Refer to [Figure 4-49](#) and [Figure 4-50](#) for alarms generated.



Figure 4-49 Identification Result Display (Innocent Source)

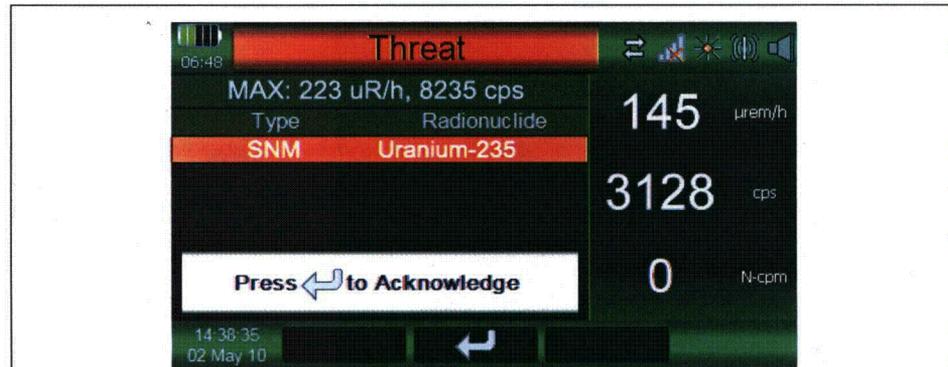


Figure 4-50 Identification Result Display (Threat Source)

5. Figure 4-51 shows the display after the user has acknowledged the identification result.



Figure 4-51 Innocent Identification following an Acknowledgement

6. In the case where multiple radionuclides are identified, they are listed by priority; threat radionuclides are listed before innocent radionuclides. Refer to "Radionuclides" on page A-1.
7. Use the scroll bar to view the entire list when more radionuclides are identified than can fit on a single screen.

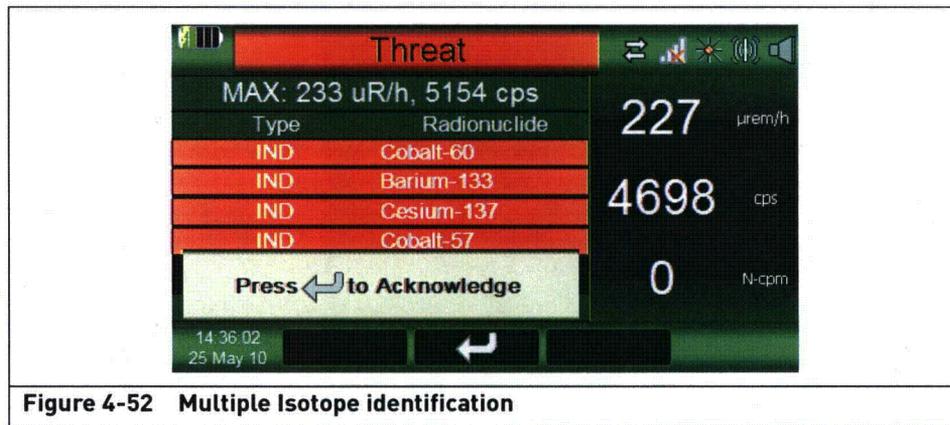


Figure 4-52 Multiple Isotope identification

8. The user must acknowledge the alarm before proceeding.
9. After the alarm is acknowledged, the user can add more collection time or scroll down to the next screen.

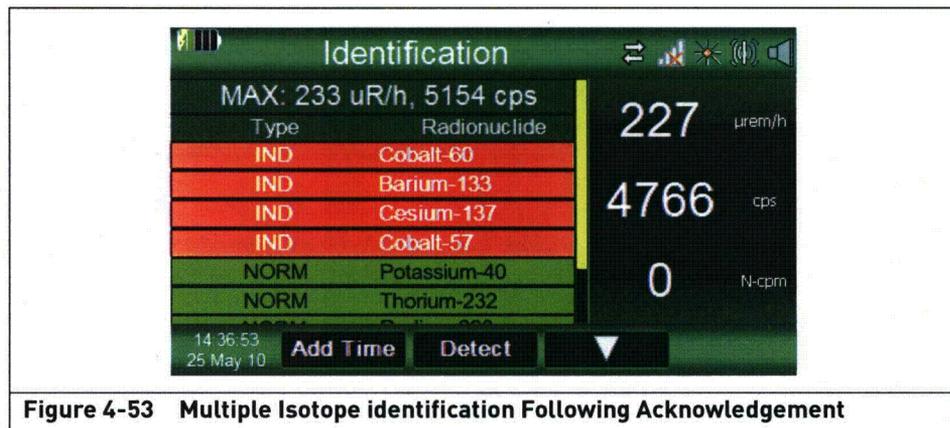


Figure 4-53 Multiple Isotope identification Following Acknowledgement

10. From the second screen, the user can:
 - Scroll up to the previous screen
 - Return to Detect mode

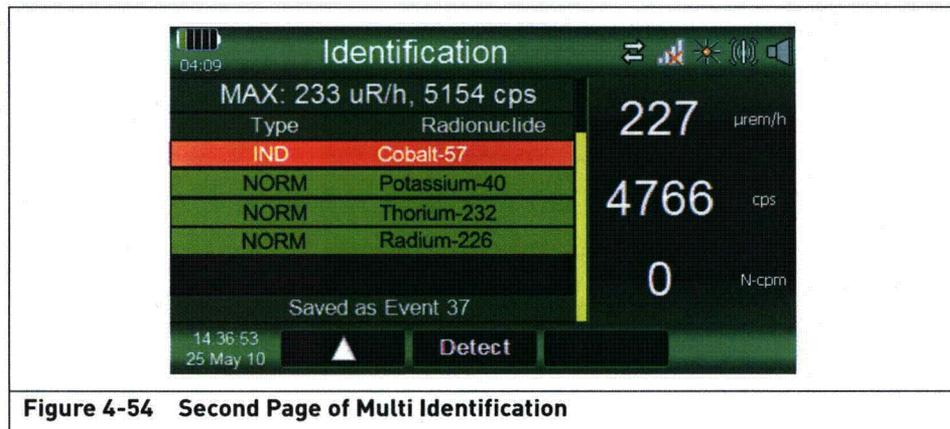


Figure 4-54 Second Page of Multi Identification

11. If no radionuclides are found, this is indicated on-screen along with the event number of the data files created.

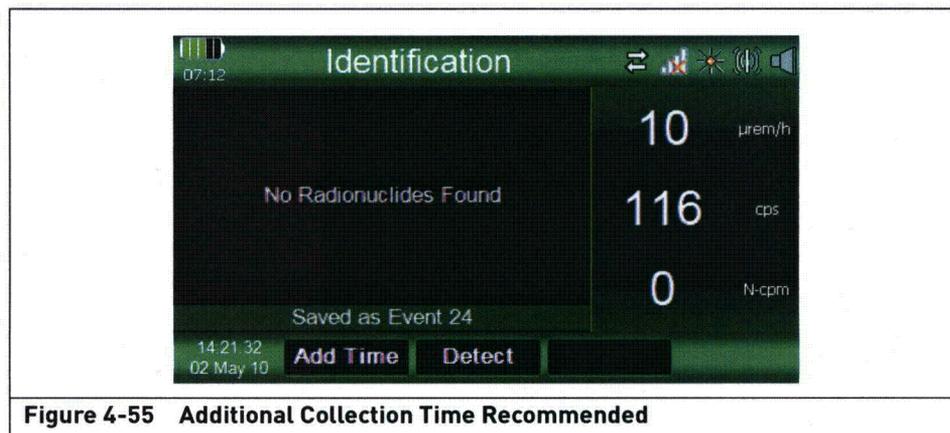


Figure 4-55 Additional Collection Time Recommended

12. If the user selects the option to Add Time following an identification, the Additional Collection Time menu is displayed. Refer also to ["Advanced System Configuration"](#) on page 6-7.
13. The user:
 - a. Highlights the desired option using the Up or Down arrows.

- b. Press the "Select" key to continue.
- c. The unit automatically begins collecting spectrum for the additional time selected. This spectrum is added to the one already collected, to create one long spectrum, which then undergoes the isotope identification analysis.

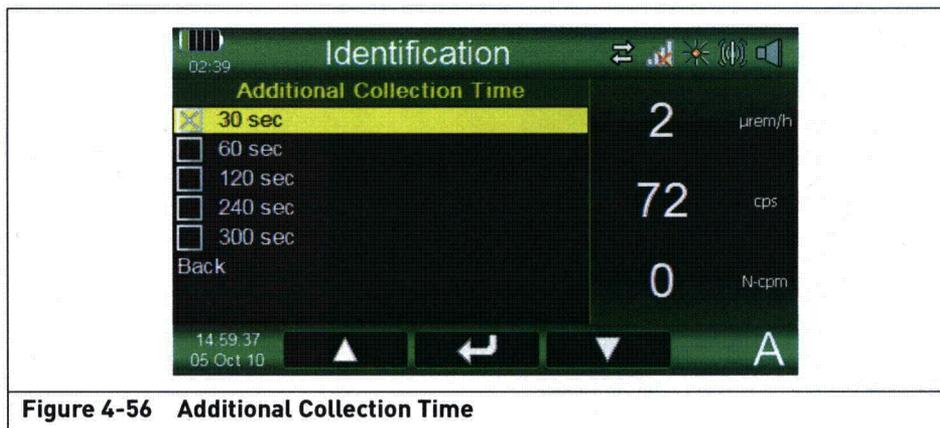


Figure 4-56 Additional Collection Time

NOTE: The operator choose to add time following an identification in order to collect a second spectrum of data for a longer period and report back to a group of specialists who will analyze that data.

4.4 Exiting Menus and Function Screens

The system always takes the user back to the function or menu the user was previously viewing. For example:

- Pressing "Back" from the System Information screen returns the system to the System Status Menu.
- Pressing "Back" from the System Status menu returns the system to the Normal Mode main menu.
- Pressing "Back" from the Normal Mode menu takes the user back to Detect mode.

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smiths detection

RadSeeker™ DL

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Chapter 5 Alerts and Alarms

5.1 Types of Alerts and Alarms

The RadSeeker DL notifies the operator when Alerts or Alarms happen. An alert is information that may be useful to an operator; an alarm is generally something of more importance that an operator is required to act on.

There are three categories of Alerts and Alarms:

- **Threshold Alerts/Alarms** - inform the operator when some measure of radiation has reached a threshold. These can occur at any time during operation.
- **Identification Alarms** - inform the operator that radionuclides have been identified as a result of an identification operation.
- **System Alarms** - can happen at any time and provide the operator with critical information about the functioning of the system, such as low battery conditions or system failures.

5.1.1 Hysteresis for Threshold Alerts / Alarms

When radiation levels hover near a threshold value, repeated alarms could become a nuisance for an operator. For instance, after acknowledging an alarm, if the radiation level dipped below the threshold and then rose again, the operator could be presented with another alarm immediately.

To prevent alarms from recurring in rapid succession, a recovery period or "hysteresis" is applied to some threshold-type alarms.

Once the threshold is exceeded, the alarm persists for a configurable time period after the underlying condition goes away.

The default hysteresis period is 10 seconds; this means that once an alarm occurs, it cannot re-occur for 10 seconds after the underlying radiation condition subsides.

If the levels go below, then back above the threshold within this time period, it is considered to be a continuation of the previous alarm, rather than a new alarm.

The specific alerts/alarms that use this hysteresis mechanism are:

- Gamma Detection Alert
- High Gamma Dose Rate Alarm
- Neutron Detection Alarm.

5.2 Gamma Detection Alert

The gamma detection alert is disabled by default in the RadSeeker DL. This section describes how this feature works when enabled. It may be enabled using Advanced mode.

The unit displays an alert when gamma radiation rises over the background by an amount determined by the configurable threshold value. This alert can happen at any time during operation.

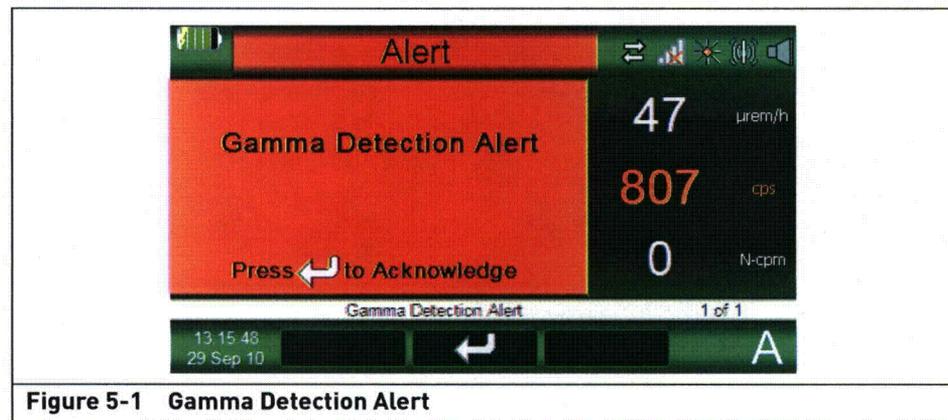


Figure 5-1 Gamma Detection Alert

1. The unit displays the alert until the user acknowledges it, at which point the unit returns to displaying the Detect screen or whichever screen the unit was operating prior to the alert.

- The gamma count rate is highlighted in red for as long as the threshold is exceeded. The times during which the threshold is exceeded is also shown in the histogram, indicated by yellow-colored bars where the gamma count is above threshold.



Figure 5-2 Gamma Detection Alert in Detect Mode

The alert messages remain on the screen as long as the gamma gross count remains above the threshold value. The threshold has a hysteresis feature to prevent the system from repeatedly alerting when the count rate near the threshold value.

Once the alert occurs, the count rate must return below threshold level and remain there consistently for the "hysteresis" time in order for the system to alert again. The hysteresis time is configurable in Advanced Mode and defaults to 10 seconds.

5.3 High Gamma Dose Rate Alarm

The High Gamma Dose Rate alarm “Refer to [Figure 5-3](#)” is a personal hazard alarm which triggers when the gamma dose rate exceeds the Advanced Mode configurable threshold value.

By default, this threshold is set to a dose rate of 20 mRem/hr. It is adjustable from 1 to 20 mRem/hr from the Advanced Menu. Refer to “[Adjust Alarm Thresholds](#)” on [page 6-4](#).

The dose rate is calibrated for Cs-137; dose rates from gamma signals of different energies may be reported with less accuracy. For examples, see “[Dose Rate Range](#)” on [page 2-12](#).

1. Press the “Select” key to acknowledge the alarm.

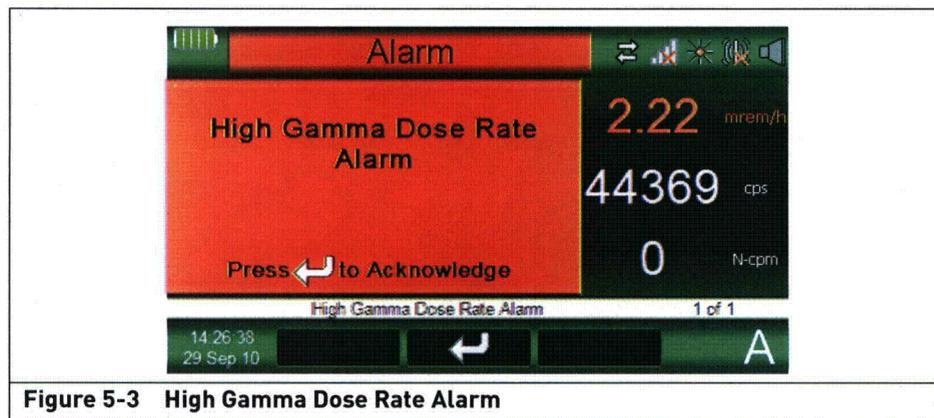


Figure 5-3 High Gamma Dose Rate Alarm

At this point the unit displays the alarm status message at the bottom of the Detect screen. This message remains on the screen as long as the high gamma dose rate condition exists.

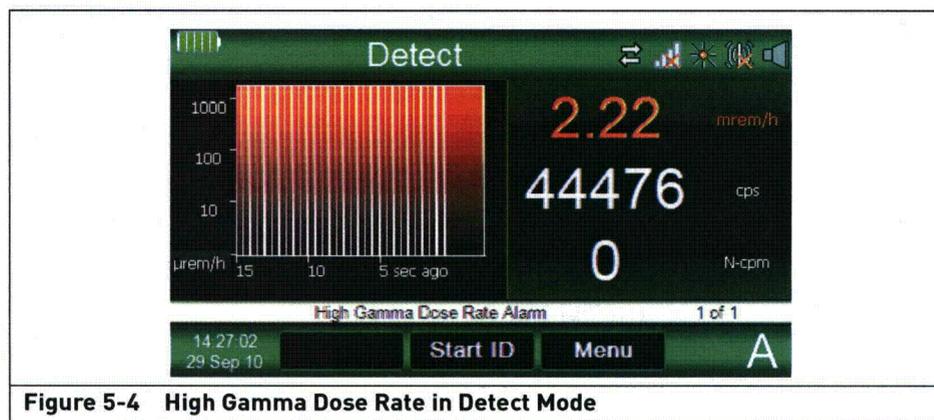
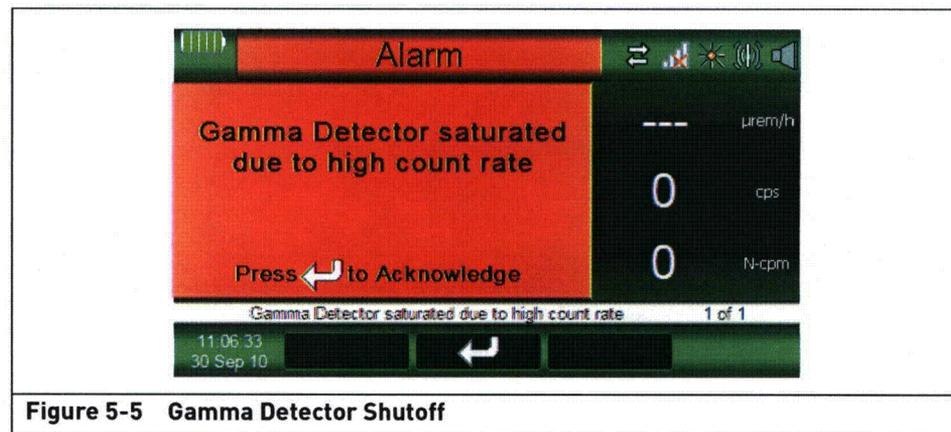


Figure 5-4 High Gamma Dose Rate in Detect Mode

2. Follow your local Standard Operating Procedure in response to an alarm indicating that the programmed dose rate threshold has been exceeded.

5.4 Gamma Saturation Alarm

At any time during operation, if the gamma count rate exceeds the fixed threshold of 500,000 counts per second, the system will issue a Gamma Saturation Alarm. Refer to Figure 5-5.



At high count rates, the gamma detector could be damaged. In response to this alarm, the system powered down the detectors to prevent possible damage.

1. Press "Select" to acknowledge the Gamma Saturation Alarm.
2. The system indicates that the detectors have been powered down, and advises the operator to re-enable the detectors once the unit has been moved to an area of lesser radiation that is safe for the detector to operate in.



CAUTION!

Move a safe distance from the source. Follow the appropriate SOPs for this type of situation.

3. Press "Select" to restart the detectors.

NOTE: During the time the detectors are powered off, there is no radiation data presented, and no further radiation-based alarms are possible.

5.5 Neutron Detection Alarm

The Neutron Detection Alarm is triggered by a neutron count exceeding an adjustable threshold over background, as shown in Figure 5-7. The user can configure this threshold value in Advanced mode. Refer to "Adjust Alarm Thresholds" on page 6-4.

When, the neutron count rate exceeds the threshold over background, the N-cpm number turns red, and the histogram bars are colored red. Periods below the threshold are shown in the histogram as white.

You should follow your SOPs in the handling of neutron alarms. Performing an identification can provide more information on neutron presence. If found, neutrons are listed in the isotopes list.

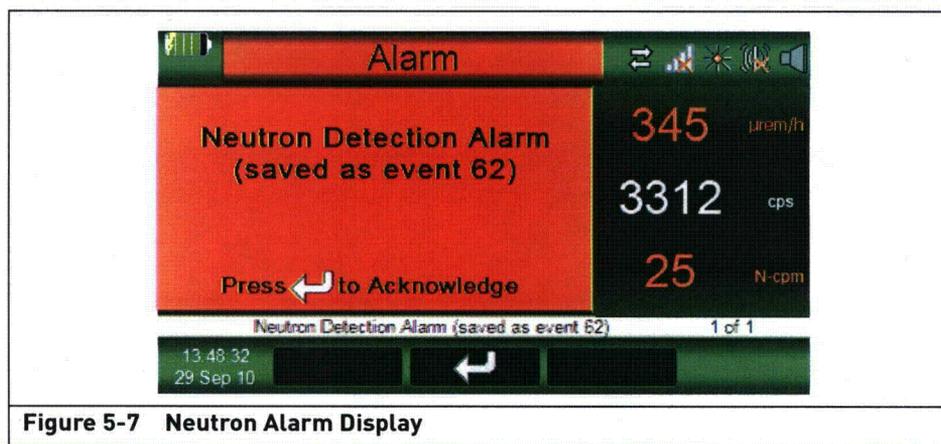


Figure 5-7 Neutron Alarm Display

This event also causes the unit to create ICD1/ICD2 files, which captures the event, however the data in these files may not be useful for analysis, as only an instantaneous snapshot of count and dose rates are presented. The intent is only to capture the occurrence of the event and mark the date/time.

1. Press enter to acknowledge the alarm. The system returns to the screen which was in operation when the neutron alarm occurred, which may be the Detect screen (see Figure 5-8) or menu screens.

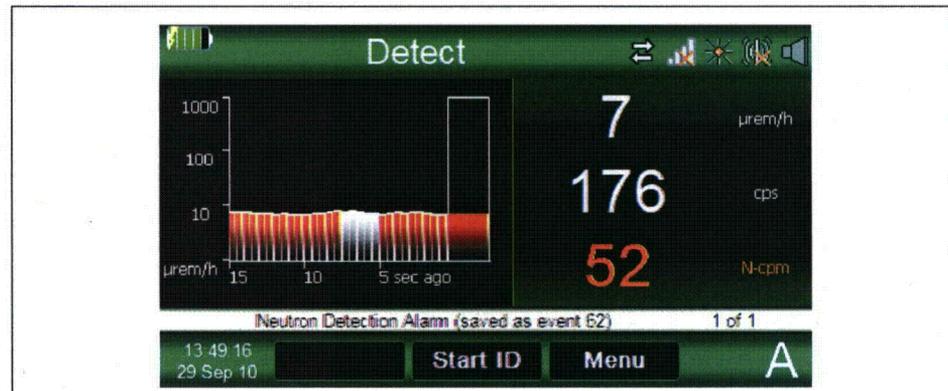


Figure 5-8 Neutron Alarm after Acknowledgement

2. The display continues to show the alarm until the condition is no longer present for the amount of time defined by the Hysteresis setting.

5.5.1 Neutron Saturation Alarm

A Neutron Saturation Alarm is generated by the unit when the neutron detector reaches saturation and the neutron count rate is at the maximum value it can accurately report. The detector can report up to 1.8M cpm, but not above.

The neutron detector is not shut off by saturation. After moving away from the source, the count will reduce below the threshold level. Refer to [“Dose Rate Range” on page 2-12](#) for the neutron gross count.



Figure 5-9 Neutron Saturation Alarm

1. Press enter to acknowledge the alarm.
With the alarm acknowledged, the unit returns to the Detect screen. The alarm continues to display at the bottom of the screen until the neutron count falls below the detect threshold level.

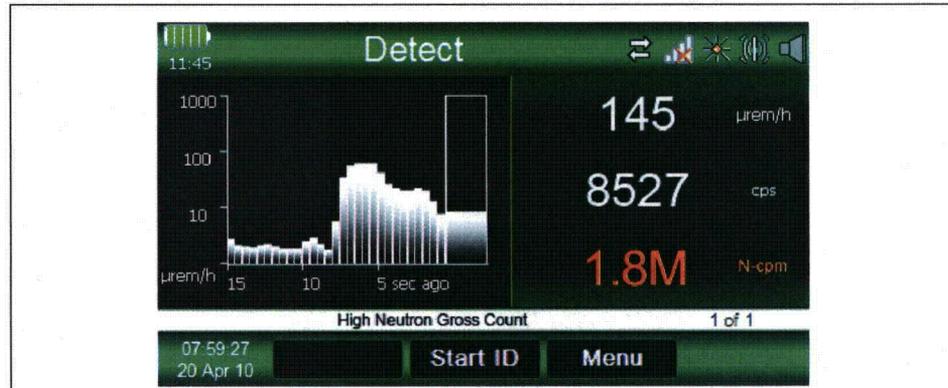


Figure 5-10 Acknowledged Neutron Saturation Alarm

5.6 Simultaneous Alarms

If multiple alarms occur simultaneously, each alarm is acknowledged separately by the user. The highest priority alarm according to Table 5-1 is acknowledged first, followed by the others.

Table 5-1 Alert - Alarm Priority

Alert / Alarm Condition	Alarm Priority Level
High Neutron Count (Saturation)	1
High Gamma Dose Rate	2
Threat Radionuclide Identification	3
Neutron Detect	4
Gamma Detection Alert	5
Innocent Radionuclide Identification	6
System Alarm	7

The priority scheme determines which alarm is presented for acknowledgement to the operator when more than one unacknowledged alarms exist. Once the user acknowledges the alarm shown, they are then presented with the next alarm to acknowledge in priority order.

Figure 5-11 and Figure 5-12 give examples of both the Neutron Detect Alarm and High Gamma Dose Rate alarms occurring simultaneously. The display will indicate both conditions as shown.

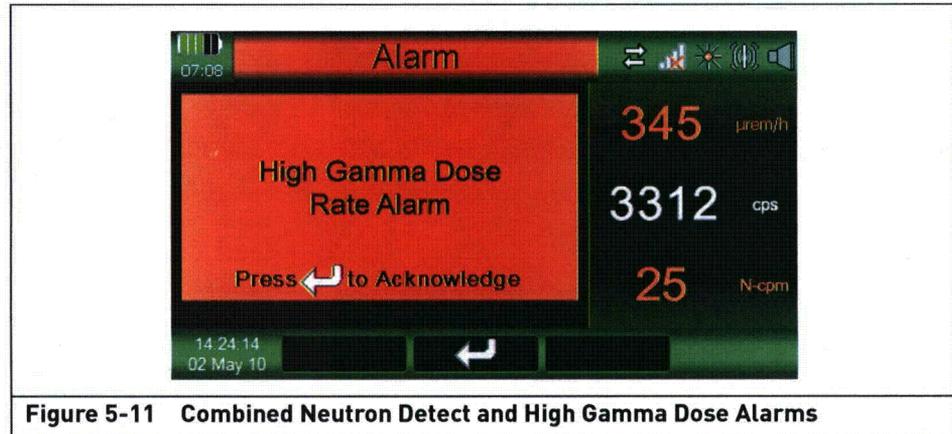


Figure 5-11 Combined Neutron Detect and High Gamma Dose Alarms

1. The RadSeeker displays a High Gamma Dose Rate Alarm.
2. After pressing "Select" to acknowledge the High Gamma Dose Rate alarm, the unit displays the Neutron Detection Alarm.

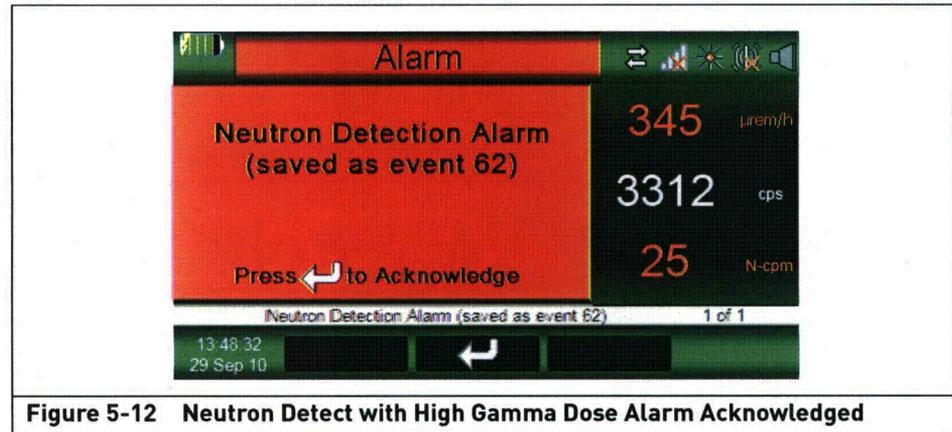


Figure 5-12 Neutron Detect with High Gamma Dose Alarm Acknowledged

3. Once all alarms are acknowledged, the unit is at the Detect screen, in the example shown in Figure 5-13. As long as the alarm conditions are still present, they are indicated alternately on the message bar.

NOTE: Due to the detection of neutrons in this scenario, the system generates ICD1/ICD2 files.

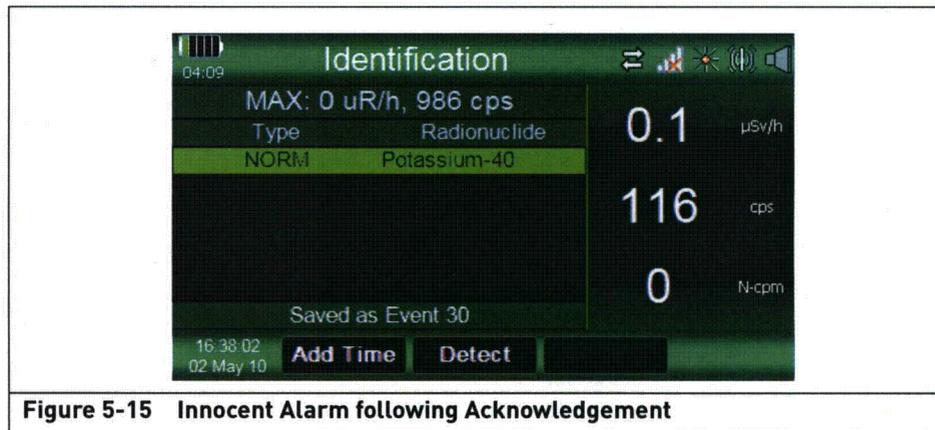
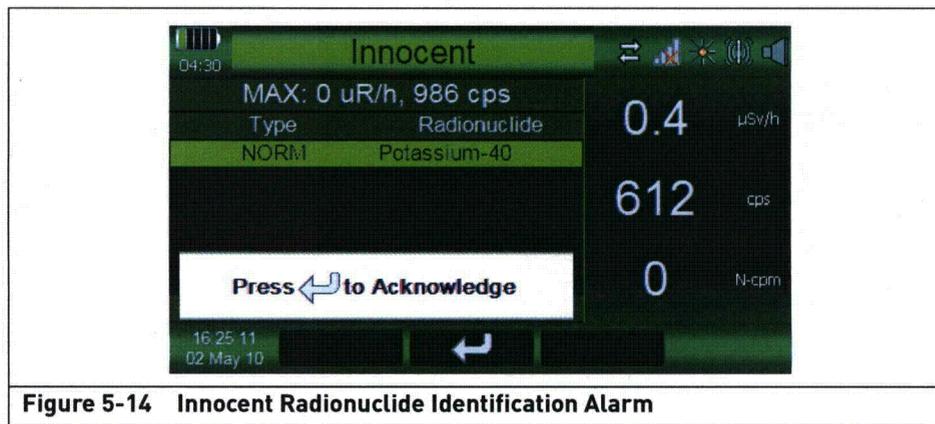
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Figure 5-13 Acknowledged Multiple Alarm Condition

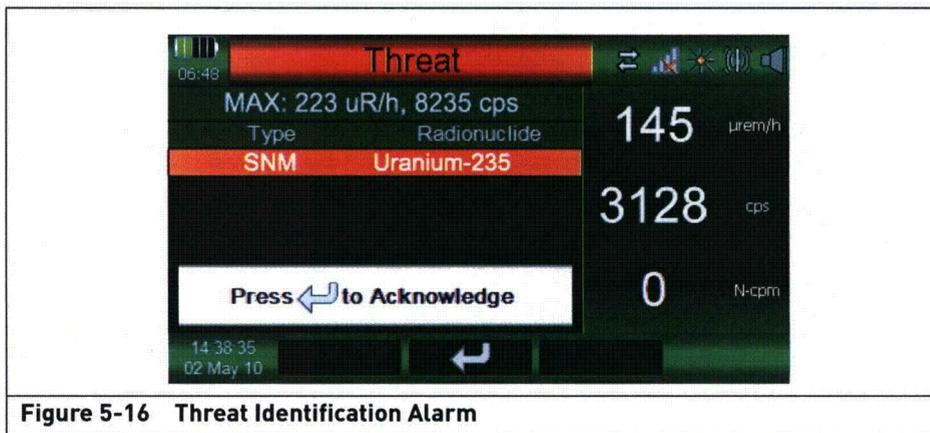
5.7 Innocent Radionuclide Identification Alarm

Each identification of a radionuclide, either innocent or threat, generates an alarm. When multiple radionuclides are identified, they are displayed in order of priority. Refer to "Radionuclides" on page A-1.

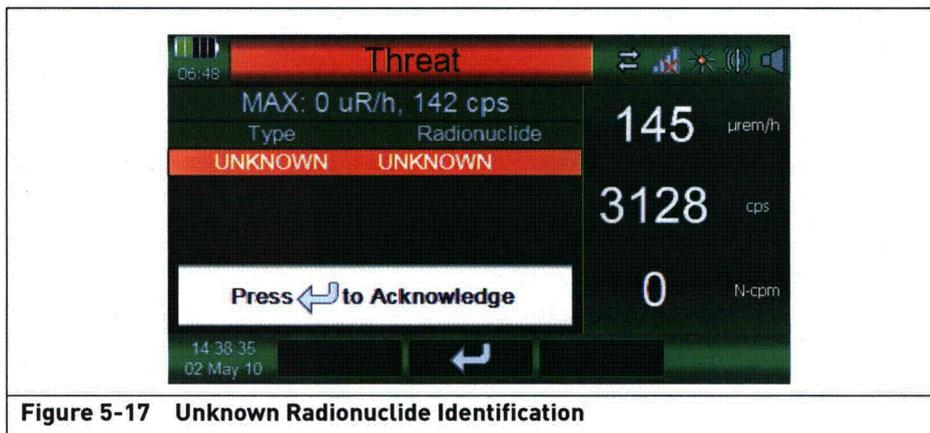


5.8 Threat Radionuclide Identification Alarm

The threat alarm is similar to the innocent alarm with the difference being that the status area background changes to red.



1. Figure 5-16 shows an identified Threat alarm.
2. Press the "Select" key to acknowledge the alarm and switch to the Identification screen.



3. Figure 5-17 shows a Threat Identification alarm where the system has detected radiation above background but is unable to identify the source. An "UNKNOWN" identification is considered a threat.

5.9 Degraded Identification Performance for SNM

The system is capable of determining certain circumstances where identification performance for Special Nuclear Materials (SNM) may be degraded; this is accomplished by monitoring the background in specific energy regions of interest.

If the system detects SNM at any time during the collection of a spectrum for identification, the RadSeeker DL will inform the operator of this condition on the identification results screen.

Figure 5-18 shows the banner "Degraded SNM ID performance due to increased gamma signal", which indicates the collected spectrum may cause a reduced ability to identify SNM materials present.

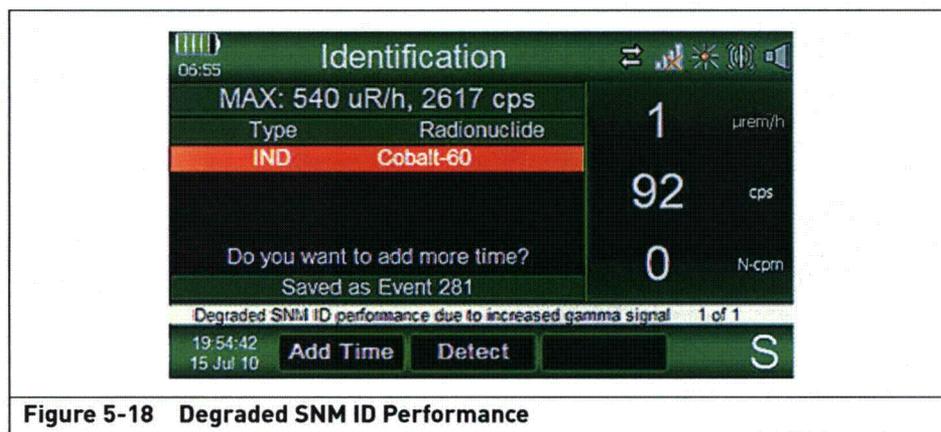


Figure 5-18 Degraded SNM ID Performance

The ICD file saved as a result of such a collection will contain an indication that the unit was operating in a background that may cause degraded identification performance for SNM.

5.10 Identification of Low-Level Gamma Signals

When analyzing a spectrum for identification, the system will evaluate the gamma spectrum for relative strength over the current background.

If the system determines that the signal strength could be marginal for performing identification, the user is notified as shown in [Figure 5-19](#).



Figure 5-19 Signal Weak

This notification will occur along with any radionuclides that have been identified. It is an indication that for at least one of the identifications, the signal was considered marginal for making that detection. The user may wish to get closer to the signal source and/or add more time in order to obtain a stronger spectrum for analysis.

5.11 System Alarms

All other alarms fall under the system alarm category. These are alarms generated whenever a fault or error condition exists within the device itself.

These alarms range from low memory and low battery charge to failure of either detector or other hardware.

Figure 5-20 gives an example of a critically low Battery System Alarm when the remaining battery charge falls below the critically low battery threshold. The RadSeeker DL allows the user to set "low" and "critically low" thresholds for remaining battery and memory, using the Advanced Mode configuration menu.

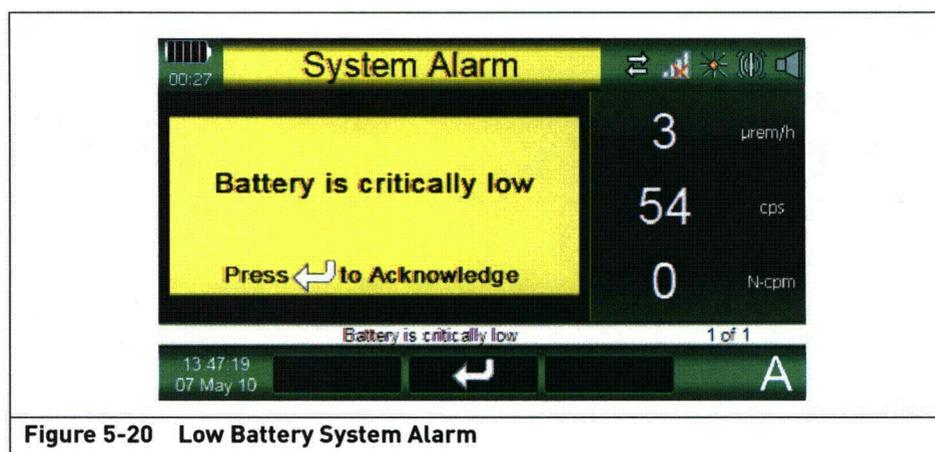


Figure 5-20 Low Battery System Alarm

Figure 5-21 shows the battery capacity alarm following acknowledgement. The system will return to the operation it was performing prior to the alarm.

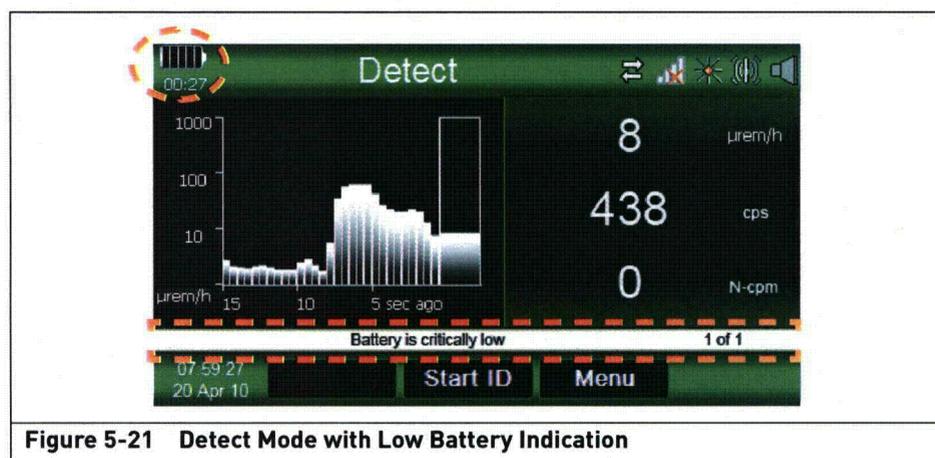


Figure 5-21 Detect Mode with Low Battery Indication

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smiths detection

RadSeeker™ DL

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Chapter 6 Advanced Mode

The Advanced Mode menu allows the user to access Advanced functions.

While the user is in the Advanced Mode of operation, the letter A appears in the bottom right corner of the display.

All units are programmed with a unique password, which is supplied with the documentation shipped with each unit.

6.1 Configure Operation Settings

In Advanced Mode the user can:

- Set Detection Alert & Alarm Threshold Levels
- Set Background Collection Parameters
- Set Advanced System Configuration Parameters - Configure Satellite Phone options
- Reset to Factory defaults
- Enter Manual ID mode in order to view the spectrum

6.1.1 Advanced Mode Menu Tree

After entering Advanced Mode, the user remains in this mode until selecting the "Exit Advanced Mode" menu option. In Advanced Mode, the display shows an "A" in the lower right corner, and the Advanced Mode menu is available without the need for re-entering the password.

Main Menu
Adjust Thresholds
Background Options
Advanced System Configuration
Satellite Phone Configuration
Manual Identification
Update Software
Factory Reset
Enter Service Mode (see Note)
Exit Advanced Mode
Back

Note: The "Enter Service Mode" menu is only visible if the user enters the Service Mode password when prompted on the "Enter Advanced Mode" login screen.

Menu Options	
Adjust Thresholds	High Gamma Dose Rate
	Gamma Alert Level
	Neutron Alarm Level
	Hysteresis Time
	Back

Background Options	Manual Collection Time
	Active Interval
	Background Subtraction
	Active Background
	View Background Spectrum
	Back

Advanced System Configuration	Brightness Low
	Brightness Medium
	Brightness High
	Audio Low
	Audio Medium
	Audio High
	Beeper Low
	Beeper Medium
	Beeper High
	Battery Low Threshold
	Battery Critical Threshold
	Storage Low Threshold
	Storage Critical Threshold
	Default Data Collection Time
	Standby Power Mode
	Standby Idle Time
	Auto Off Power Mode
	Auto Off Idle Time
	Gamma Dose Rate Units
	Back

Satellite Phone Configuration	Phone Number
	Number of Tries
	Back

Manual ID	Refer to "Manual ID" on page 6-14
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6.2 Advanced Mode Login

To enter Advanced Mode:

1. From the Normal mode menu, select the Advanced Mode option.

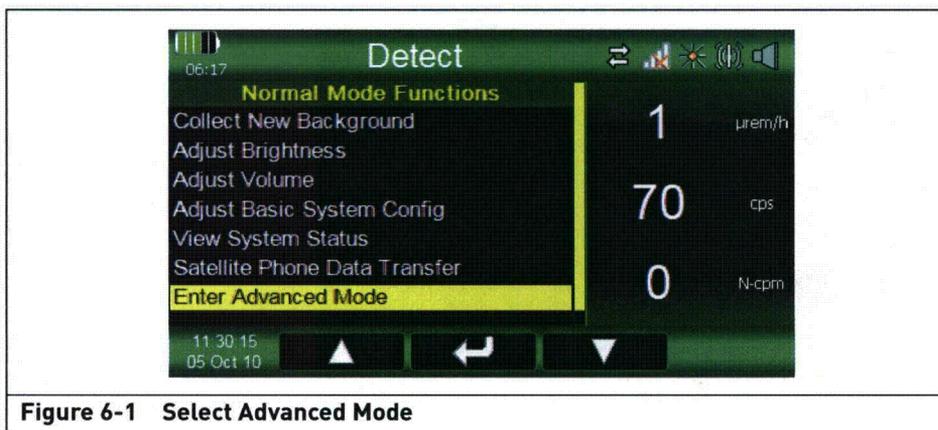


Figure 6-1 Select Advanced Mode

2. Enter the Advanced Mode password. Press the "Select" key to login.

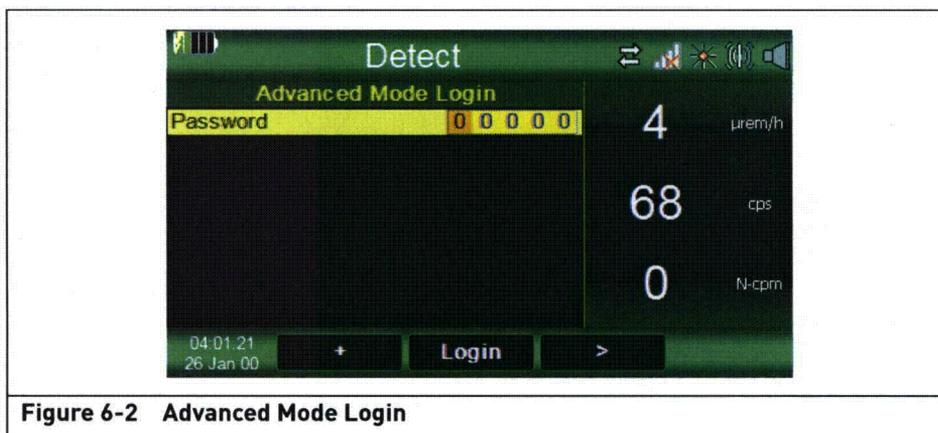


Figure 6-2 Advanced Mode Login

3. The Advanced mode menu displays. Exiting any menu or option returns the user to the previous menu or function.

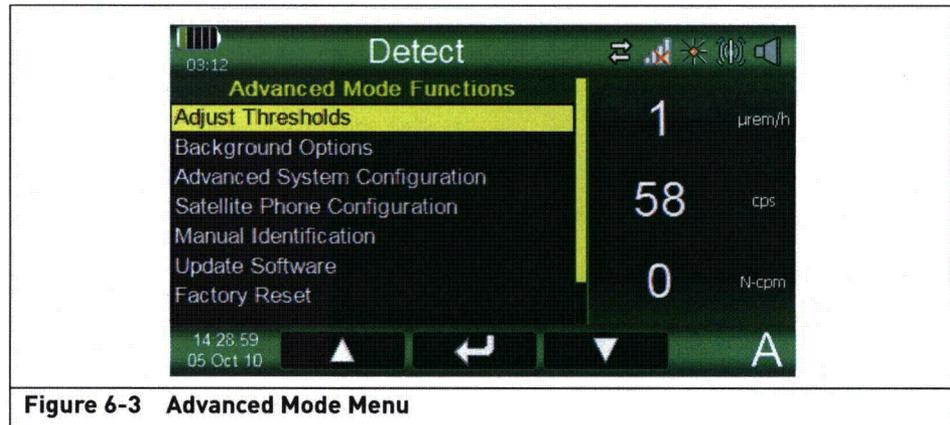


Figure 6-3 Advanced Mode Menu

6.3 Adjust Alarm Thresholds

In Advanced mode the user is able to configure detection-related threshold values, as shown in Figure 6-4:

- High Gamma Dose Rate Alarm threshold
- Gamma Gross Count above background Alert threshold
- Neutron Count above background threshold
- Hysteresis Time

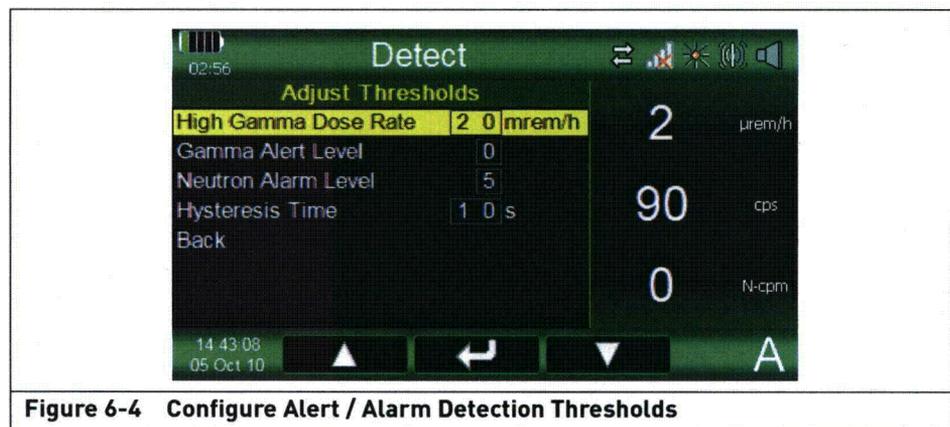


Figure 6-4 Configure Alert / Alarm Detection Thresholds

1. Use the arrow key to scroll down the list.
2. Press the "Select" key to choose the highlighted parameter.

3. Move between the digits to select and modify each setting.
 - a. The currently selected digit turns orange. Press "+" to increment the value of the selected digit.
 - b. Press ">" to toggle to the other digit.
 - c. Press "Accept" after setting the required value.



Figure 6-5 Configure Alert / Alarm Detection Thresholds

4. Follow the instructions in Step 3 to set other thresholds.
5. On completion, select "Back" to return to the Advanced Mode Functions menu.

Gamma Alert Level: Alert Threshold Level is 0 (x1000) cpm, which disables the alert function. The working range is from 0 to 9. A value of 0 disables the alert (it is disabled by default). Values 1-9 represent varying levels of sensitivity, 1 being the most sensitive and 9 being the least. When enabling the alert, level 5 is recommended as a starting point; this represents roughly 4-sigma over background as a threshold.

The factory default setting is 0.

Neutron Alarm Level: The Neutron Alarm cannot be disabled. The working range is from 1 to 9; these values represent sensitivity levels, 1 being the most sensitive and 9 being the least. The factory default setting is 5.

Hysteresis Time: The Hysteresis Time parameter can be between 0 and 99 seconds. The factory default is 10 seconds.

The hysteresis setting (in seconds) determines the amount of time that an alarm/alert condition must remain below its corresponding threshold before a subsequent alarm/alert of that type can be raised again.

For example, with a hysteresis of 10 seconds, after a gamma detection alert occurs, the system must see 10 seconds of continuous data below the detect alert threshold before it will recognize another gamma detection alert condition.

6.3.1 Background Settings

Use the Background Settings menu to configure various parameters.

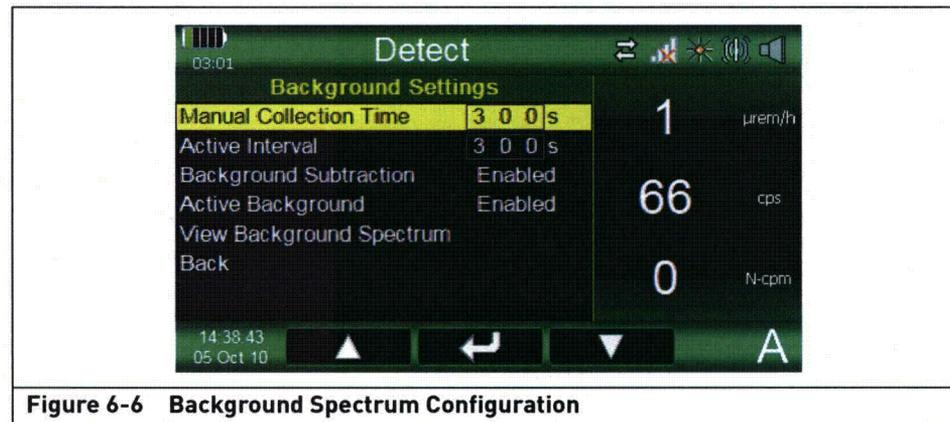


Figure 6-6 Background Spectrum Configuration

1. Use the Down keys to move to the required parameter.
2. Press the "Select" key to highlight the parameter.
3. Move between the digits to select and modify each setting.
 - a. The currently selected digit turns orange. Press "+" to increment the value of the selected digit.
 - b. Press ">" to toggle to the other digit.
 - c. Press the "Select" key to set the value.
4. Follow the instructions in Step 3 to set other thresholds.
5. After completion, scroll down and select "Back" to return to the Advanced Mode Functions menu.

Manual Collection Time: Determines how long spectrum data will be collected when a manual background collection is initiated.

Active Interval: The number of seconds of spectrum collection used by Active Background when replacing a stored background. The factory setting is 300 (or 5 minutes) and it is recommended that this not be changed.

Background Subtraction: Can be enabled or disabled; when enabled, the current background spectrum will be scaled and subtracted from a spectrum collected for identification before being analyzed.

Active Background: Can be enabled or disabled; when enabled, the system will continuously evaluate the current gamma environment, determine if the background has changed, and collect a new background as needed. This is all automatic and without user intervention; the user is notified whenever the background has been changed.

NOTE: The factory default setting for background collection time is 300 seconds. Background subtraction and Active Background features are both enabled as factory defaults.

6.4 Advanced System Configuration

From the system configuration settings the advanced user is able to configure a number of system parameters. The factory default settings are as shown in the following screens.

1. Use the Down key to move between the parameter options.

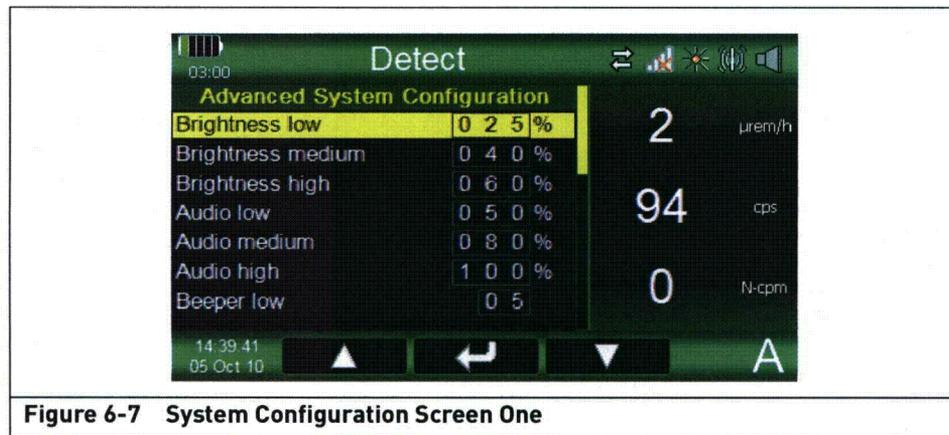


Figure 6-7 System Configuration Screen One

2. Press the "Select" key, the cursor falls on the first digit and the arrows are replaced with the "+" and ">" symbols.
 - a. The currently selected digit turns orange. Press "+" to increment the value of the selected digit.
 - b. Press ">" to toggle to the other digit.
 - c. Press "Accept" after setting the required value.
3. Refer to Figure 6-8. The counter being modified is highlighted orange while the others remain yellow.

To accept the new setting. Press the "Select" key to return to the parameters list.

NOTE: Changes made are automatically saved.

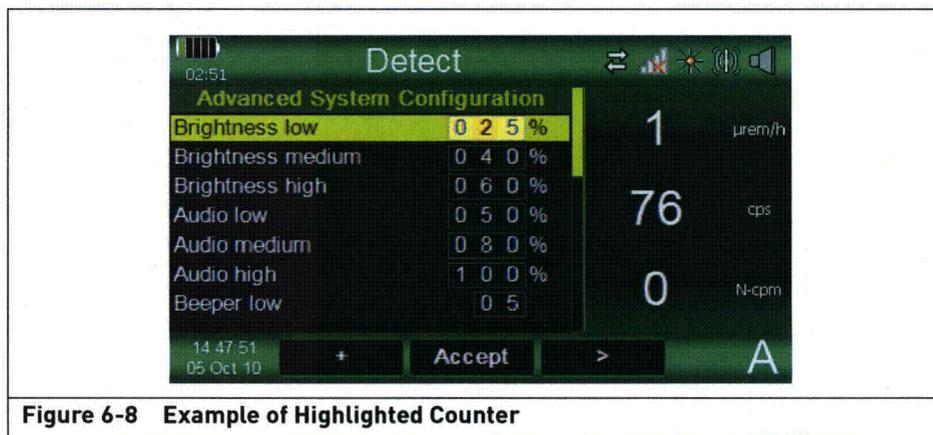


Figure 6-8 Example of Highlighted Counter

4. To reset all parameters to the factory default values, scroll down to the Factory Reset and press the "Select" key to accept.

Unlike Normal Mode configuration parameters, any changes to Advanced Mode configuration parameters remain through a power Off/On cycle. The user is able to reset all parameters back to the factory default values using the Factory Reset menu option.

Setting	
Audio/Display	The Low, Medium and High settings are percentage levels from 1 to 100%. The system will prevent a low setting from being set higher than a medium or high setting (likewise for the medium settings).
Beeper	The Low, Medium and High settings are levels from 1 to 10. The system will prevent a low setting from being set higher than a medium or high setting (likewise for the medium settings).
Battery	The battery low and critical low values are percentages of total battery capacity remaining.
Storage	The remaining memory storage values are numbers of ICD1&2 pairs which can be stored before the memory is exhausted.
Standby Power Mode	When Standby Power Mode is enabled, the display will switch to a screen saver after a duration of inactivity determined by the Standby Idle Time parameter. The screen saver shows live radiation count/dose rate data, and the system remains responsive to all alert/alarm conditions. Press any key to restore the normal screens.
Factory Reset	Reset all parameters back to the factory default values.

Setting	
Auto Off Power Mode & Auto Off Idle Time	When enabled, the Auto Off Power Mode causes the system to automatically power down after a duration of inactivity, defined by Auto Off Idle Time, when operating from external power. This is to reduce operating hours when the unit has been plugged in to charge the batteries. If the unit is connected to a PC via USB when auto shut down occurs, the unit will remain powered on but will instead power off the detectors only.
Gamma Dose Rate	defines the units (Rem or Sieverts) for displaying dose rate data.

The factory default settings are as shown in the following screens.

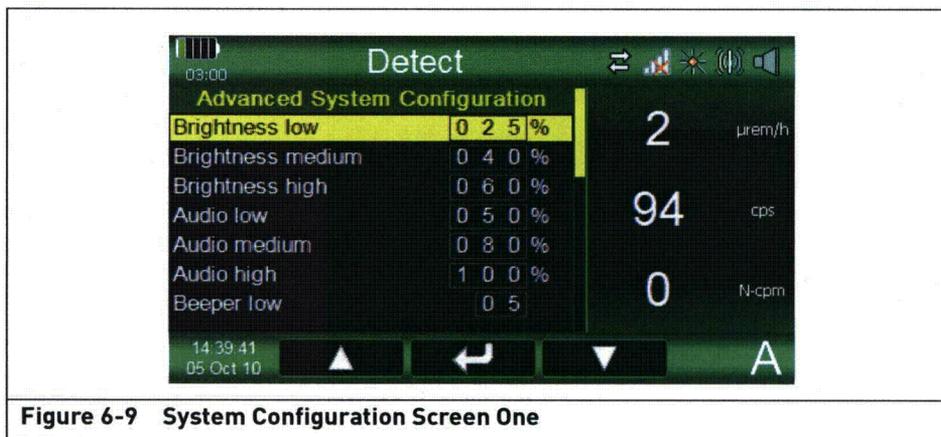


Figure 6-9 System Configuration Screen One

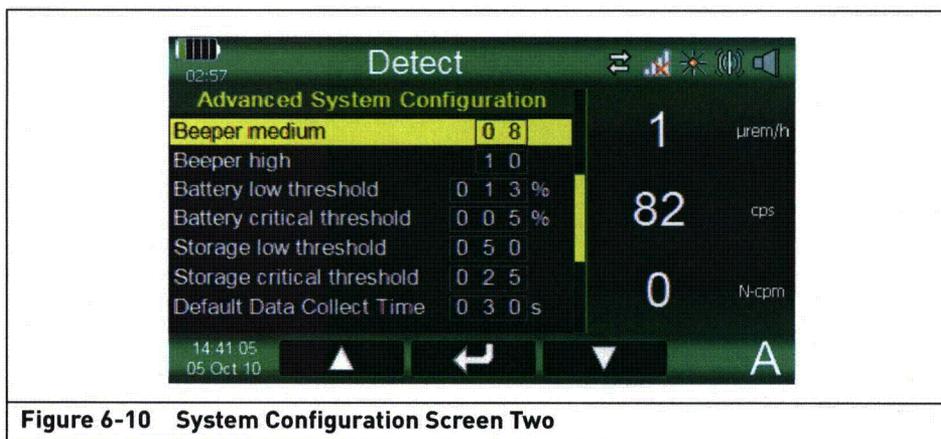
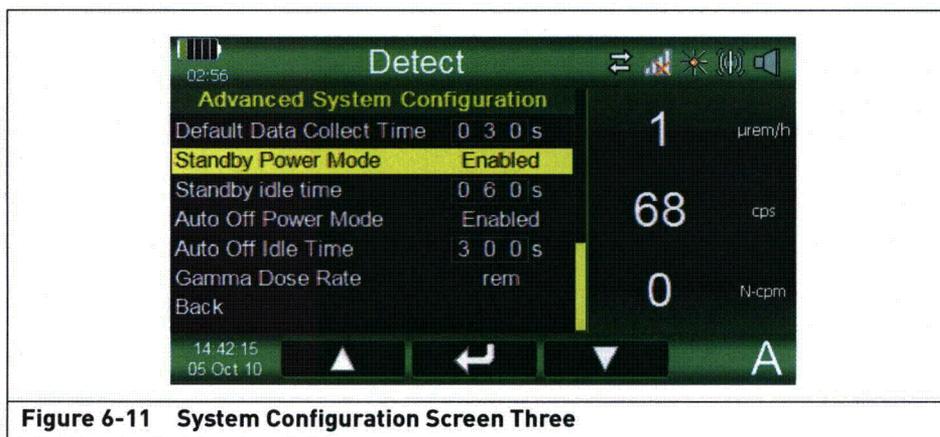


Figure 6-10 System Configuration Screen Two



6.5 Satellite Phone Configuration

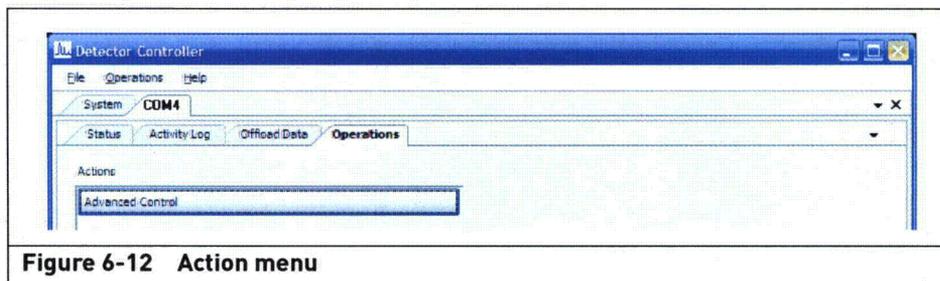
The configuration process allows the user to change the phone number and the specific parameters, such as, the number of re-tries before failing the connection. The Satellite Phone configuration can be setup using two methods:

- Detector Controller
- RadSeeker

6.5.1 Detector Controller Software

To edit the Satellite Phone settings:

1. After the connection has been established, click on the link to the unit. Select the Operations tab.
2. From the Actions menu select Advanced Control. The login window displays.



3. Enter the unique RadSeeker password for this unit. A unique password is supplied with each unit, press Login.

4. Select the Control Parameters tab.
5. Click in the Number of Retries field and enter the amount of retries that the phone will make to acquire a connection.
6. Click in the Phone Number and enter the new number.

NOTE: North America the phone code begins with "001."

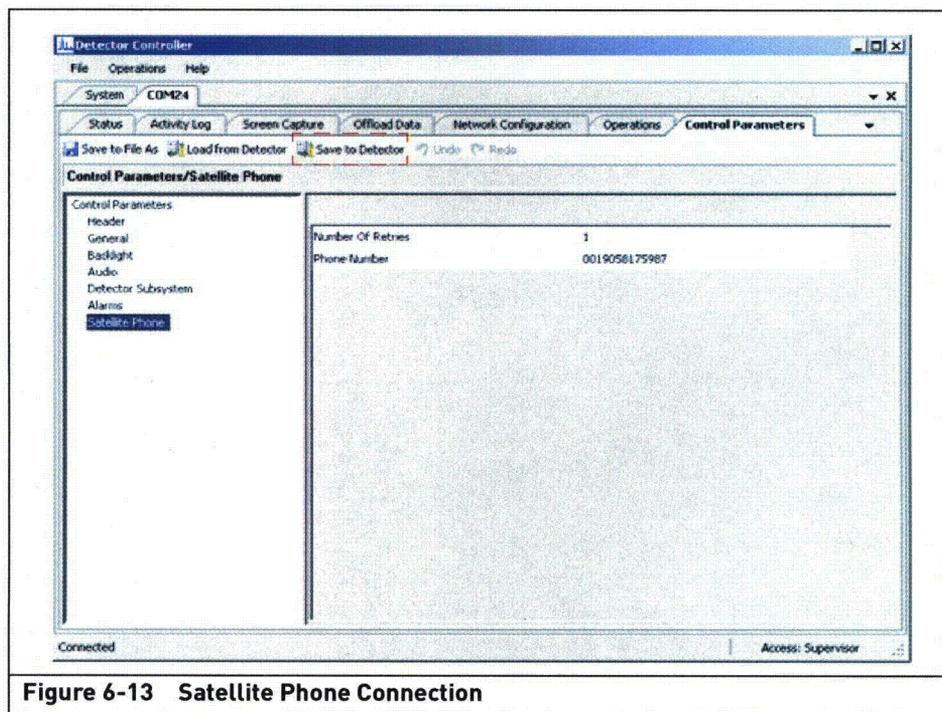


Figure 6-13 Satellite Phone Connection

7. To save the new settings, select "Save to Detector."

6.5.2 Configuring the Satellite Phone on RadSeeker

1. Use the Up and Down arrows and highlight "Satellite Phone Configuration." Press the "Select" key."

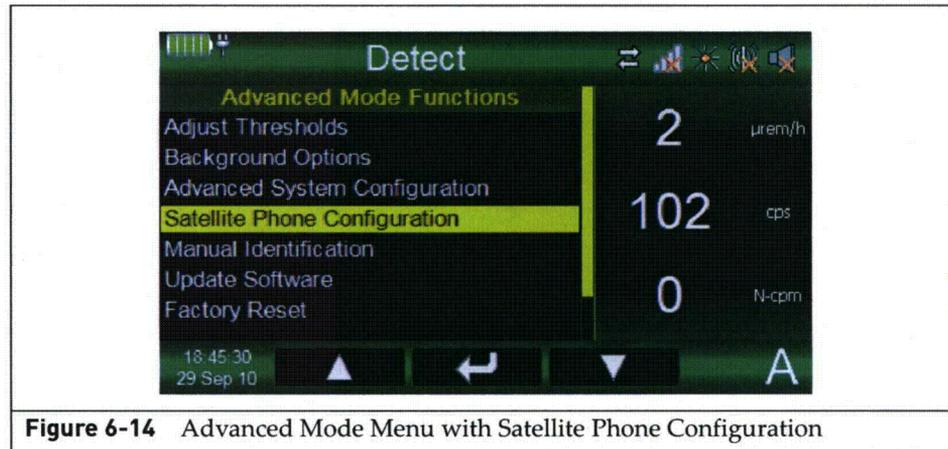


Figure 6-14 Advanced Mode Menu with Satellite Phone Configuration

2. The "Satellite Phone Configuration" screen opens. Use the Up and Down arrows to highlight the "Phone Number."
- NOTE:** All new systems are delivered with a Smiths default number. This should be changed at first configuration of the Satellite Phone.
3. Press the "Select" key to edit the phone number.

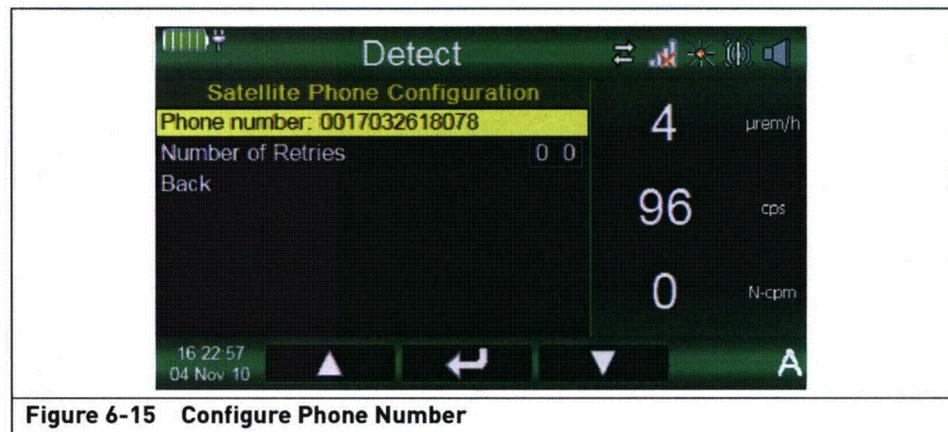


Figure 6-15 Configure Phone Number

4. The phone number screen opens.
 - a. Use the arrows to move between each keyboard item.
 - b. Use either "Back Space" or "Clear" to edit the phone number.

5. Use the keyboard to enter a new phone number. Highlight a number and press the "Select" key. Repeat for the remaining numbers.

NOTE: North American numbers start with "001."



Figure 6-16 Accept Number

6. Highlight "Accept" and press the "Select" key on completion, the "Satellite Phone Configuration" screen opens.
7. Use the Up and Down arrows to highlight the "Number of Retries."

This feature allows the user to configure the number of retries the satellite phone will make to connect to the modem at the opposite end. This re-try number is also the number of times the system will attempt to re-send on transmission errors.

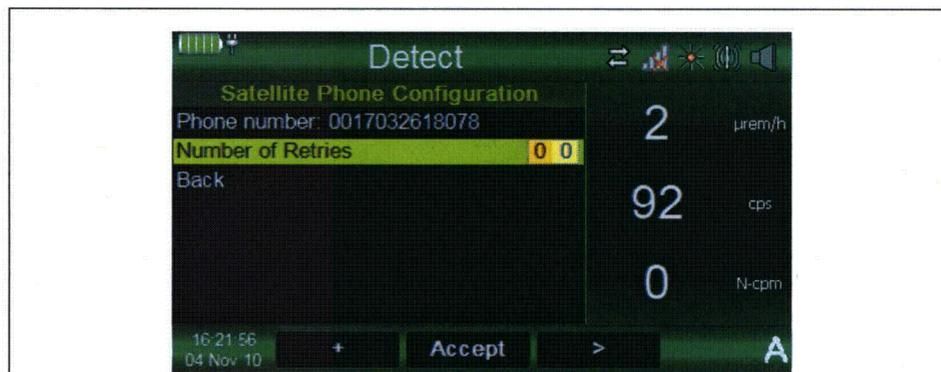


Figure 6-17 Satellite Phone Configuration

8. Press the "Select" key, the cursor falls on the first digit and the arrows are replaced with the "+" and ">" symbols.
 - a. The currently selected digit turns orange. Press "+" to increment the value of the selected digit.
 - b. Press ">" to toggle to the other digit.
 - c. Press "Accept" after setting the required value.

6.6 Manual ID

In Manual ID mode, the user is able to view the live spectrum, start and stop spectrum data collection as desired, and perform an identification at any time.

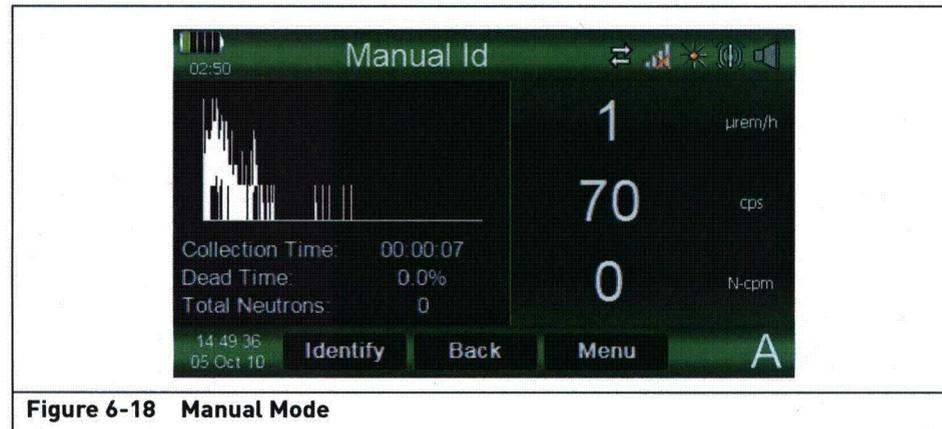


Figure 6-18 Manual Mode

Data collection starts as soon as the user enters this function. The user can also stop the data collection at any time.

1. Press Menu. Use the arrow key to scroll Up or Down the list.
 - a. Highlight "Restart" and press the enter key to start a new Identification.
 - b. Highlight "Pause" and press the enter key to pause the current Identification.
 - c. Highlight "Continue" and press the enter key to continue with the current Identification.
2. Press the Back key to stop the Identification and exit the Manual ID mode.

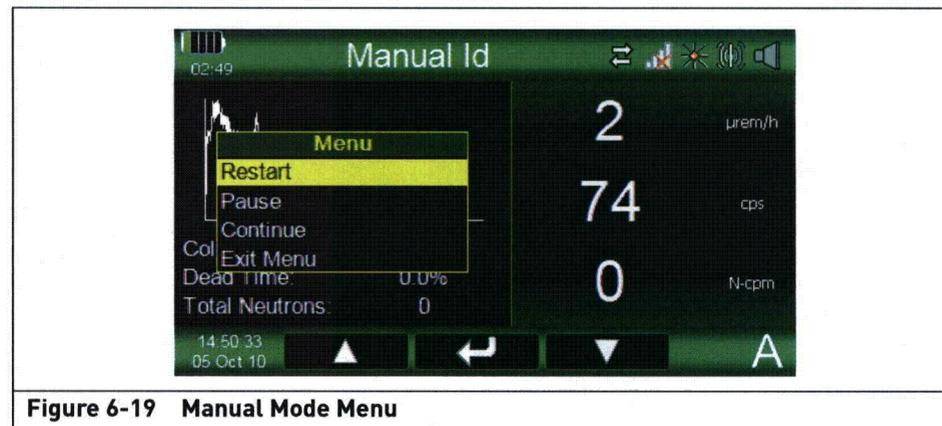


Figure 6-19 Manual Mode Menu

The identification screen is identical to the Normal mode identification screen with the exception that the user returns to Manual mode upon acknowledging any identification screens.

Chapter 7 Troubleshooting

7.1 System Alarms or Errors

An Error Alarm is triggered by the identification of conditions that may compromise RadSeeker DL source detection or identification. Refer to Figure 7-1. Several conditions could trigger these alarms.

System Alarms: failure or degraded conditions, such as full memory, failed sensors or processors, low battery, etc., that require some intervention either by the officer or maintenance personnel.

The yellow LED will become illuminated, the status background will change from green to yellow, and the RadSeeker DL will inform the operator of the system error with a description of the fault, an error code plus a recommended action for the operator.

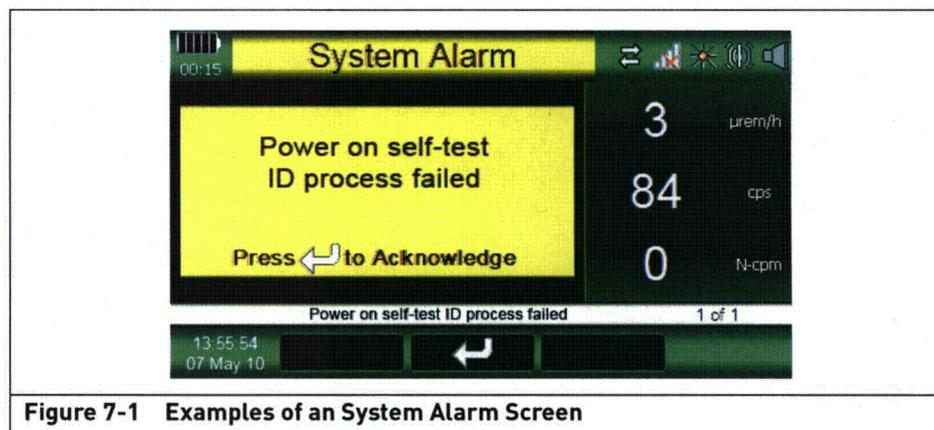


Figure 7-1 Examples of an System Alarm Screen

An Error Alarm is indicated by an auditory and/or vibration alert (depending on the alarm configuration) and a flashing amber LED.

If an Error Condition is detected during the same scan in which radiation is found, both the error and the highest-priority radiation alerts are shown or sounded.

NOTE: Because system errors can affect the accuracy of radiation detect, the user should be trained to understand that radiation alarms might not be reliable under certain degraded system conditions.

7.2 System Notification Messages

This table describes notification messages that may be displayed in a System Alarm message, along with a brief explanation and some possible actions to take.

Table 7-1 Notification Messages

Code	Description	Type	Level	Reason	Resolution
1	Internal software error	Error	8	Pointer are set to NULL. Please see Service Activity Logs to get further details about the fault	Contact service
2	Dss failed to initialize (error code %s)	Error	8	Indicates the DSS initialization failed %s= numerical code, example:802	Restart unit. Contact service if problem persists
9	Software version mismatch	Warning	8	The software versions do not match	Contact service
10	Display board communication failure	Error	8	Cannot establish I2C communication to the display board	Restart unit. Contact service if problem persists
11	Main board communication failure	Error	8	Cannot establish I2C communication to the display board	Restart unit. Contact service if problem persists
12	Light sensor communication failure	Error	8	Cannot establish I2C communication to the light sensor	Restart unit. Contact service if problem persists
13	Real-time clock read/write failure	Error	8	Cannot read or set the real time clock	Restart unit. Contact service if problem persists
14	Process %s stopped unexpectedly.	Error	8	A process failed to launch (%s= name of one of the system processes. example GUI.exe, Comm.exe)	Restart unit. Contact service if problem persists
15	'%s' value was not in range	Warning	8	A value entered by the user is out of range. %s= the name of the field in the GUI that was out of range example: "Gamma Alert Level". Any of the values that can be set on the system settings screens can generate this message.	Enter value within range
16	Beeper self-test failed	Error	8	Self-test beeper failed	Restart unit. Contact service if problem persists

Table 7-1 Notification Messages

Code	Description	Type	Level	Reason	Resolution
17	Handle vibrator self-test failed	Error	8	Self-test vibrator failed	Restart unit. Contact service if problem persists
18	Amber LED self-test failed	Error	8	Self-test amber LED failed	Restart unit. Contact service if problem persists
19	Green LED self-test failed	Error	8	Self-test green LED failed	Restart unit. Contact service if problem persists
20	Red LED self-test failed	Error	8	Self-test red LED failed	Restart unit. Contact service if problem persists
21	DSP device error	Error	8	DSP device error	Restart unit. Contact service if problem persists
22	Audio/USB device error	Error	8	Audio/USB device error	Restart unit. Contact service if problem persists
23	Battery charger device error	Error	8	Battery charger device error	Restart unit. Contact service if problem persists
24	CPLD device error	Error	8	CPLD device error	Restart unit. Contact service if problem persists
25	Neutron device error	Error	8	Neutron device error	Restart unit. Contact service if problem persists
26	Gamma device error	Error	8	Gamma device error	Restart unit. Contact service if problem persists
27	Display thermometer device error	Error	8	Display thermometer error	Restart unit. Contact service if problem persists
28	Internal thermometer device error	Error	8	Internal thermometer error	Restart unit. Contact service if problem persists
29	DSP thermometer device error	Error	8	DSP thermometer error	Restart unit. Contact service if problem persists
30	Gamma thermometer device error	Error	8	Gamma thermometer error	Restart unit. Contact service if problem persists
31	Display thermometer range exceeded	Warning	8	Display thermometer range exceeded	Contact service if problem persists

Table 7-1 Notification Messages

Code	Description	Type	Level	Reason	Resolution
32	Internal thermometer range exceeded	Warning	8	Internal thermometer range exceeded	Contact service if problem persists
33	DSP thermometer range exceeded - DSP powered off	Warning	8	DSP temperature range exceeded	Contact service if problem persists
34	Gamma thermometer range exceeded	Warning	8	Gamma temperature range exceeded	Contact service if problem persists
35	Battery is low	Warning	8	The battery time remaining is low	Recharge the battery at earliest convenience
36	Battery is critically low	Warning	8	The battery time remaining is critically low	Recharge the battery at earliest convenience
37	Invalid battery installed - will not charge	Error	8	Invalid battery installed - will not charge	Contact service
38	Battery charging failure - replace battery	Error	8	Battery charging failure - replace battery	Contact service if problem persists
39	Battery communication failure	Error	8	Battery communication failure - remove & replace battery	Contact service if problem persists
40	Charger communication failure	Error	8	Charger communication failure - remove battery & AC power, then replace	Contact service if problem persists
41	Storage card space is low	Warning	8	The storage space is low	Offload data files
42	Storage card space is critically low	Warning	8	Storage card space is critically low	Offload data files
43	Storage card is missing or invalid	Error	8	The storage card is missing or invalid.	Contact service
44	Battery cycle count exceeded	Warning	8	The battery cycle count has been exceeded	Information only
45	Battery time remaining not reliable at this temperature	Warning	8	Battery time remaining not reliable at this temperature	Information only
46	Battery temperature range exceeded	Warning	8	The battery temperature range exceeded	Contact service if problem persists
47	Battery voltage range exceeded	Warning	8	The battery voltage range exceeded	Contact service if problem persists
51	Failed to load serialization file	Error	8	The PSS serialization file is missing or invalid.	Contact service
54	Detector history file missing; the operating hours have been reset	Error	8	The detector history file was not loaded, operating hours will be reset	Contact service
55	The detector operating hours have been reset	Information	9	The detector operating hours have been reset	

Table 7-1 Notification Messages

Code	Description	Type	Level	Reason	Resolution
57	Failed to load service control parameters	Error	8	The service control parameters could not load	Restart unit. Contact service if problem persists
58	Failed to load current control parameters	Error	8	The current control parameters could not load	Restart unit. Contact service if problem persists
58	Failed to load network configuration	Error	8	The network configuration could not load	Restart unit. Contact service if problem persists
61	Gamma uptime error	Error	8	Gamma uptime error	Restart unit. Contact service if problem persists
62	Gamma detector count rate out of expected range	Error	8	Gamma count rate error	Restart unit. Contact service if problem persists
63	No gammas detected within threshold period	Error	8	Time since last gamma error	Restart unit. Contact service if problem persists
64	Gamma detector resolution out of expected range	Error	8	Gamma resolution error	Restart unit. Contact service if problem persists
65	Gamma detector high voltage out of expected range	Error	8	Gamma high voltage error	Restart unit. Contact service if problem persists
66	Gamma detector dose rate out of expected range	Error	8	Gamma dose rate error.	Restart unit. Contact service if problem persists
67	Gamma detector communications error	Error	8	Gamma communications error.	Restart unit. Contact service if problem persists
68	Neutron detector high voltage out of expected range	Error	8	Neutron high voltage error.	Restart unit. Contact service if problem persists
69	Neutron detector count rate out of expected range	Error	8	Neutron count rate error.	Restart unit. Contact service if problem persists
70	No neutrons detected within threshold period	Error	8	No neutrons detected within threshold period	Restart unit. Contact service if problem persists
71	Neutron update error	Error	8	Uptime of the neutron detector error	Restart unit. Contact service if problem persists
72	Neutron detector saturated due to high count rate	Error	8	Neutron saturated error	Information only. Recommend exiting area

Table 7-1 Notification Messages

Code	Description	Type	Level	Reason	Resolution
73	Neutron detector communications error	Error	8	Neutron communications error.	Restart unit. Contact service if problem persists
74	Stabilization count rate out of expected range	Error	8	Stabilization count rate error.	Contact service if problem persists
75	Stabilization beta counts out of expected range	Error	8	Stabilization beta counts error.	Contact service if problem persists
76	Stabilization bias voltage out of expected range	Error	8	Stabilization bias voltage error.	Contact service if problem persists
77	Stabilization intensity out of expected range (511keV)	Error	8	Stabilization 511 intensity error.	Contact service if problem persists
78	Gamma detector resolution out of expected range (511keV)	Error	8	Stabilization 511 FWHM error.	Contact service if problem persists
79	Stabilization channel error (511keV)	Error	8	Stabilization 511 channel error	Contact service if problem persists
80	Stabilization intensity out of expected range (1274keV)	Error	8	Stabilization 1274 intensity error	Contact service if problem persists
81	Gamma detector resolution out of expected range (1274keV)	Error	8	Stabilization 1274 FWHM error	Contact service if problem persists
82	Stabilization channel error (1274keV)	Error	8	Stabilization 1274 channel error	Contact service if problem persists
83	Stabilization count rate out of expected range	Error	8	Stabilization tagged count rate error.	Contact service if problem persists
84	DSP power on self test failed	Error	8	Data analysis POST failed	Restart unit. Contact service if problem persists
85	DSP model CRC error	Error	8	Data analysis model CRC error	Restart unit. Contact service if problem persists
88	The power on self test failed to complete	Error	8	The POST failed to complete	Restart unit. Contact service if problem persists
89	Failed to load factory control parameters	Error	8	The factory control parameters could not load	Contact service
91	System restarted due to communication failure	Error	8	The main board firmware rebooted the SOM when the SOM stopped communicating	Restart unit. Contact service if problem persists

Table 7-1 Notification Messages

Code	Description	Type	Level	Reason	Resolution
92	System restarted due to firmware failure	Error	8	The main board firmware stopped responding and was restarted	Restart unit. Contact service if problem persists
93	Communication lost with detector subsystem	Error	8	Communication was lost with DSS	Restart unit. Contact service if problem persists
94	Failed to start the gamma module (code %s)	Error	8	DSS API function DssGammaStart failed = CODES 91 - 119 %s= numerical code :example 800	Restart unit. Contact service if problem persists
95	Failed to set the ICD information (code %s)	Error	8	DSS API function DssICDInfoSet failed	Restart unit. Contact service if problem persists
96	Failed to stop an acquisition (code %s)	Error	8	DSS API function DssAcquisitionStop failed	Restart unit. Contact service if problem persists
97	Failed to start an acquisition (code %s)	Error	8	DSS API function DssAcquisitionStart failed	Restart unit. Contact service if problem persists
98	Failed to pause an acquisition (code %s)	Error	8	DSS API function DssAcquisitionPause failed	Restart unit. Contact service if problem persists
99	Failed to resume an acquisition (code %s)	Error	8	DSS API function DssAcquisitionResume failed	Restart unit. Contact service if problem persists
100	Failed to get the detector status (code %s)	Error	8	DSS API function DssStatGet failed	Restart unit. Contact service if problem persists
101	Failed to get the detector fast data (code %s)	Error	8	DSS API function DssFastdataGet failed	Restart unit. Contact service if problem persists
102	Calibration could not start (code %s)	Error	8	DSS API function DssCalibrateStart failed	Restart unit. Contact service if problem persists
103	Calibration could not be stopped (code %s)	Error	8	DSS API function DssCalibrateExit failed	Restart unit. Contact service if problem persists
104	Failed to get calibration status (code %s)	Error	8	DSS API function DssCalStatusGet failed	Restart unit. Contact service if problem persists
105	Failed to get last calibration date (code %s)	Error	8	DSS API function DssCalibrateGetDateLast failed	Restart unit. Contact service if problem persists

Table 7-1 Notification Messages

Code	Description	Type	Level	Reason	Resolution
106	Failed to get next calibration date (code %s)	Error	8	DSS API function DssCalibrateGetDateNext failed	Restart unit. Contact service if problem persists
107	Failed to start an auto sample (code %s)	Error	8	DSS API function DssAutoSampleStart failed	Restart unit. Contact service if problem persists
108	Failed to stop an auto sample (code %s)	Error	8	DSS API function DssAcquisitionStop failed	Restart unit. Contact service if problem persists
109	Failed to get sample results (code %s)	Error	8	DSS API DssEventSummary indicates sample failed	Restart unit. Contact service if problem persists
110	Background collection could not start (code %s)	Error	8	DSS API function DssBackgroundAcqStart failed	Restart unit. Contact service if problem persists
111	Background collection could not be stopped (code %s)	Error	8	DSS API function DssBackgroundAcqStop failed	Restart unit. Contact service if problem persists
112	Background status could not be determined (code %s)	Error	8	DSS API function DssBackgroundGet failed	Restart unit. Contact service if problem persists
113	Failed to update collected background (code %s)	Error	8	DSS API function DssBackgroundAcceptID failed	Restart unit. Contact service if problem persists
114	Failed to set background collection type (code %s)	Error	8	DSS API function DssBackgroundTypeSet failed	Restart unit. Contact service if problem persists
115	Failed to shutdown the detector sub-system (code %s)	Error	8	DSS API function DssShutdown failed	Restart unit. Contact service if problem persists
116	Failed to start identification (code %s)	Error	8	DSS API function DssIDStart failed	Restart unit. Contact service if problem persists
117	Failed to start Batch Mode (code %s)	Error	8	DSS API function DssBatchStart failed	Restart unit. Contact service if problem persists
118	Failed to stop Batch Mode (code %s)	Error	8	DSS API function DssBatchStop failed	Restart unit. Contact service if problem persists
119	Failed to get alarm thresholds (code %s)	Error	8	DSS API function DssPersonalHazardGet failed	Restart unit. Contact service if problem persists
120	Failed to set alarm thresholds (code %s)	Error	8	DSS API function DssAlarmThresholdsSet or DssPersonalHazardSet failed	Restart unit. Contact service if problem persists

Table 7-1 Notification Messages

Code	Description	Type	Level	Reason	Resolution
121	Failed to start the detector self test (code %s)	Error	8	DSS API function DssUistBegin failed	Restart unit. Contact service if problem persists
122	Failed to get the detector type (Nal or LaBr) (code %s)	Error	8	DSS API function DssGetDetectorType failed	Restart unit. Contact service if problem persists
124	New background implemented, manual background replaced	Warning	8	The active background replaced the last manual background	Information only
125	ICD File storage failed	Error	8	ICD File storage failed	Restart unit. Contact service if problem persists
126	Could not load DetectorID; InstrumentVersion in ICD file will be blank	Error	8	The detector ID file was not loaded. Part number on ICD file will be blank	Contact service
131	Stabilization failed; recalibration recommended	Error	8	Device can not stabilize	Restart unit. Contact service if problem persists
132	Detector self-test %s failed	Error	8	The DSS BIT failed %s = The name of the test that failed, example: Detector Sub-System Tests	Restart unit. Contact service if problem persists
133	Error during detector self-test %s	Error	8	The DSS BIT had an error %s = The name of the test similar to previous row	Restart unit. Contact service if problem persists
134	Failed to set the background subtraction mode (code %s)	Error	8	DSS API function DssBackgroundSubtractionSet failed %s= numerical code, example:800	Restart unit. Contact service if problem persists
135	SD Card self-test failed	Error	8	The SD Card BIT has failed. Inspect the SD Card	Restart unit. Contact service if problem persists

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RadSeeker™ DL

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Appendix A Radionuclides

Table A-1 RadSeeker DL List of Radionuclides

Radionuclide	Display Name	Alarm	Radionuclide Type
Am-241 ¹	Americium-241	Threat	Weapons Indicating
Ba-133	Barium-133	Threat	Industrial
Cs-131	Cesium-131	Threat	Medical
Cs-137	Cesium-137	Threat	Industrial
Cr-51	Chromium-51	Threat	Medical
Co-57 ¹	Cobalt-57	Threat	Medical
Co-60	Cobalt-60	Threat	Industrial
Eu-152	Europium-152	Threat	Medical
F-18	Fluorine-18	Threat	Medical
Ga-67 ¹	Gallium-67	Threat	Medical
In-111	Indium-111	Threat	Medical
I-123	Iodine-123	Threat	Medical
I-125	Iodine-125	Threat	Medical
I-131	Iodine-131	Threat	Medical
Ir-192 ¹	Iridium-192	Threat	Industrial
Mn-54	Manganese-54	Threat	Industrial
Mo-99 ¹	Molybdenum-99	Threat	Medical
Np-237 ¹	Neptunium-237	Threat	SNM
Pd-103	Palladium-103	Threat	Medical
Pu-238 ¹	Plutonium-238	Threat	SNM
Pu-239	Plutonium-239	Threat	SNM
Pu-241	Plutonium-241	Threat	SNM
Sm-153	Samarium-153	Threat	Medical
Se-75	Selenium-75	Threat	Medical
Na-22	Sodium-22	Threat	Medical
Sr-89	Strontium-89	Threat	Medical
Sr-90 / Y-90	Beta Emitter	Threat	Industrial

Table A-1 RadSeeker DL List of Radionuclides

Radionuclide	Display Name	Alarm	Radionuclide Type
Tc-99m	Technetium-99m	Threat	Medical
Tl-201 ¹	Thallium-201	Threat	Medical
Tl-204	Thallium-204	Threat	Industrial
U-232	Uranium-232	Threat	Weapons Indicating
U-233	Uranium-233	Threat	SNM
U-235	Uranium-235	Threat	SNM
U-238	Uranium-238	Threat	Weapons Indicating
Xe-133	Xenon-133	Threat	Medical
Y-88	Yttrium-88	Threat	Industrial
La-138	Lanthanum-138	Innocent	NORM
K-40	Potassium-40	Innocent	NORM
Ra-226 ¹	Radium-226	Innocent	NORM
Th-228	Thorium + Daughters	Innocent	NORM
Th-232	Thorium-232	Innocent	NORM

NOTE:

1. This isotope has special considerations in the library to account for shielded cases. In the ICD2 file, the isotope may appear as shown in the Radionuclide column, or a capital 'S' may be added to indicate that the shielded entry in the library created this match.

The following table lists identification results that are not radionuclides, but may appear along with or instead of radionuclides on the Identification result screen:

Table A-2 Non-radionuclide Identification Results

Radionuclide	Display Name	Alarm	Radionuclide Type
UNKNOWN ¹	UNKNOWN	Threat	UNKNOWN
NEUTRONS ²	NEUTRONS	Threat	Weapons Indicating
Hac-1 ³	Hydrogen Activation	Threat	Indicating

NOTES:

1. UNKNOWN ID is displayed as an identification result when excess radiation is detected above background, but an associated radionuclide can not be identified.
2. "NEUTRONS" is used to indicate that a neutron count significantly above background has been seen during the collection time.
3. "Hydrogen Activation" is used to indicates the presence of gamma energy at 2223keV which may be caused by neutrons interacting with nearby hydrogenous material.

Appendix B RadSeeker™ DL Terminology

B.1 Glossary

This table contains terms used in operating the RadSeeker™ DL. It is provided as a quick-reference dictionary.

This is not a language dictionary. Words that have a common meaning and normal usage are not included here. This glossary includes only RadSeeker DL special terms.

Description	Definition
Definition Contents	Each term is introduced with its context. This may often be a sufficient reminder of what a word means. The context outlines the main subject and topic in which the term is most normally used. When a term is also used as an acronym, the acronym form is listed. A separate alphabetized Acronyms List is also provided.
Organization	The terms are listed in alphabetic order. The synonyms are listed with references to the preferred term in this Glossary. Acronyms are listed for those terms that may be used in mnemonic form. If a term has been included for clarification, but is not the recommended term for an idea, its entry begins with "See: [term]", to provide a reference to the proper term. References to closely related terms are provided by "See also: [term]".
Style	All Glossary definitions contain a strict definition of the term, along with contextual and usage explanations that help to understand its meaning and value. All texts begin in the style of a proper definition. This is the completion of a sentence: A <u>[term]</u> is a ... Definitions have a style that begins by stating what a term is, and then later describes what it is related to or is used for.
Active Background	Context: Configurable items See also: Background A configuration option that permits the RadSeeker DL to actively collect backgrounds without operator initiation. While Active Background is enabled, whenever the new background appears to be significantly different from that which it is currently using, the system will collect a new background, inform the user that it is implementing a new background and that the old background is no longer in use.

Description	Definition
Activity	<p>Context: Radiation</p> <p>A property of a radioactive source; specifically it is the rate of disintegration of the source.</p> <p>A common measurement unit for activity is: 1Bq = 1 disintegration per second</p> <p>Note: The activity of a radioactive source will change over its life.</p> <p>1 Becquerel (Bq) = 1 event of radiation emission per second.</p> <p>Also measured in Curie (Ci) – 1Ci = 37,000MBq</p>
Activity Log	<p>Context: Operational history</p> <p>aka: System Log</p> <p>A collection of records that define the specifics of every significant event that has occurred in operation of the equipment.</p> <p>It contains a record of all system messages, any alarms, self-test results, and configuration changes. There is a limit of up to 4000 entries, at which point, earliest entries are overwritten by later ones.</p> <p>The activity log can be viewed from the RadSeeker DL display or downloaded using Detector Controller.</p>
Advanced Mode	<p>Context: User mode</p> <p>A password-restricted collection of functions and menu items that provide system administration capabilities. The Advanced Mode menu allows the user to access Advanced functions.</p> <p>While the user is in the Advanced Mode of operation, the letter A appears in the bottom right corner of the display.</p> <p>All units are programmed with a unique password for access to the Advanced mode. This password can not be changed by users. It is supplied with the documentation shipped with each unit.</p>
Alarm, Innocent	<p>Context: Alarm type</p> <p>An alarm type that notifies the operator that a radioactive source has been identified and categorized as a non-threat. The green LED will become illuminated, the status background will remain green, and the RadSeeker DL will inform the operator of the detection by listing the alarm type and radionuclide(s). If enabled, the handle will vibrate and an audio alarm will sound to notify the operator of the alarm.</p>
Alarm, Threat	<p>Context: Alarm type</p> <p>An alarm type that notifies the operator that a radioactive source has been identified and categorized as a potential threat. The red LED will become illuminated, the status background will change from green to red, and the RadSeeker DL will inform the operator of the detection by listing the alarm type and radionuclide(s). If enabled, the handle will vibrate and an audio alarm will sound to notify the operator of the alarm.</p>
Alarm, System	<p>Context: Alarm type</p> <p>An alarm type that notifies the operator that the RadSeeker DL is in a fault state. The yellow LED will become illuminated, the status background will change from green to yellow, and the RadSeeker DL will inform the operator of the system error with a description of the fault, an error code plus a recommended action for the operator.</p> <p>Examples of recommended actions include: Reboot, and/or Contact Service.</p>

Description	Definition
Alpha Particle	Symbol: α , α^{2+} , He^{2+} Context: Radiation See also: Alpha Radiation A positively charged subatomic particle emitted from an atom during radioactive decay. The alpha particle consists of two protons and two neutrons, and is identical to a helium nucleus.
Alpha Radiation	Context: Radiation See also: Alpha Particle Radiation that consists of a positively charged particle (alpha particle) emitted from the nucleus of an atom during radioactive decay. Alpha radiation has low penetrating effect and a short range. It can be stopped by a sheet of paper and cannot penetrate human skin. Harmful effects may occur if ingested, inhaled or absorbed through broken skin.
ANSI N42.34	Context: National standards A listing of performance criteria for hand-held instruments for the detection and identification of radionuclides. This standard addresses instruments that can be used for homeland security applications to detect and identify radionuclides, for gamma dose-rate measurement, and for indications of neutron radiation.
Background	Context: Operation principles A spectrum of the radiation levels presumed to reflect the current radiation environment without sources. The RadSeeker DL maintains an internal view of the background, which is checked/updated at startup or when changes are detected. A background spectrum is used to establish a baseline for determining the presence of radionuclides. If the RadSeeker DL detects radiation above what is defined in the background spectrum, a gamma detection alert is triggered, if enabled.
Background Subtraction	Context: Configurable items See also: Background The process by which the current background spectrum is scaled and subtracted from a separate spectrum that was collected for identification. Prior to analysis the non-significant components of the spectrum are removed with the intent to emphasize radiation above background levels.
Beta Particle	Symbol: β , β^+ , β^- , e^+ , e^- Context: Radiation See also: Beta Radiation A subatomic particle emitted from an atom during radioactive decay. A negatively charged particle is called an electron. A positively charged particle is called a positron.

Description	Definition
Beta Radiation	<p>Context: Radiation See also: Beta Particle</p> <p>Radiation that consists of beta particles emitted from the nucleus of an atom during radioactive decay. Beta radiation is more penetrating than alpha particles but less than gamma rays or x-rays. Large amounts of beta radiation may cause skin burns, and beta emitters are harmful if they enter the body. Beta radiation may be stopped by thin sheets of metal or plastic.</p>
Bumper	<p>Context: External components</p> <p>A rubber shock absorber whose presence mitigates damage to the internal components in the event that a RadSeeker DL receives a blow or is dropped. The RadSeeker DL ships with standard mini bumpers but, for applications where the unit is subject to greater shocks, optional larger bumpers are available.</p>
Count Rate	<p>Context: Operation principles See also: CPS, Activity</p> <p>The number of detector outputs per unit time. Note that this is different from activity. Count rate is applicable to both gamma and neutron detection. The RadSeeker DL displays the real-time count rate for both neutron and gamma radiation. In Detect mode, the unit shows the count data on the right hand side of the display.</p>
Decay	<p>Context: Radiation</p> <p>The spontaneous disintegration of the unstable nucleus of a radioactive isotope. The process emits radiation and transforms the radioactive isotope into a new isotope or element. Several different particles can be emitted by decay, including alpha particles, beta particles, gamma rays and neutrons.</p>
Detect Mode	<p>Context: Operating modes</p> <p>The RadSeeker's continuous analysis of the environment to detect radioactivity. The system displays the real-time count rate on the right hand side of the display and the dose rate time-plot on the left hand side. To localize the radiation source(s), an operator would use the real-time count rate and graph to localize the radioactive source and then initiate Identification [Start ID] to collect a spectrum.</p>
Detector Controller	<p>Context: Software</p> <p>A software application that is designed for use with the RadSeeker DL. The software permits an operator to monitor the state of the RadSeeker DL, configure control parameters and download data files. A communication link is established using a USB cable between the RadSeeker DL and local PC. This application runs using Windows XP, Windows Vista, or Windows 7.</p>

Description	Definition
Dose Rate	<p>Context: Radiation</p> <p>The rate at which a gamma radiation energy is absorbed (note for the RadSeeker DL, the dose rate measured is gamma only; neutrons are not included in dose calculation). It is a measure of radiation exposure that accounts for the energy of the photons (as opposed to count rate, which considers each photon as a single count). Gamma dose rate is displayed in base units of rem per hour, or Sieverts per hour.</p> <p>Dose rate is shown by the histogram on the RadSeeker DL display.</p>
Electron Volt	<p>Acronym: eV</p> <p>Context: Radiation</p> <p>A measure of the energy of a gamma photon. Each radionuclide gives off gamma photons with specific energy (energies) characteristic of that isotope; for instance, Cs-137 emits gamma photons with energy of about 662keV.</p> <p>One electron volt is an extremely small amount of energy. Commonly used multiple units are kiloelectron-volt (keV) and megaelectron-volt (MeV).</p>
Event	<p>Context: Operating principles</p> <p>Is any alarm or identification spectrum that is numbered and logged by the RadSeeker DL. A history of events can be viewed via the Activity Log (System Log).</p>
Function keys	<p>Context: External components</p> <p>aka: Keypad, function buttons</p> <p>A three button user interface associated with menu options displayed on the screen. The function keys permit the operator to power on/off, select menu options, scroll up or down, enter parameter values, and acknowledge alarms.</p>
Full Width Half Max	<p>Acronym: FWHM</p> <p>Context: Data Analysis</p> <p>The width of a peak at half the maximum intensity (half its height). Expressed as a percentage of the energy of at the peak's center, it's a measure of the resolution of the detector. It is used to describe the shape of a peak as a small FWHM suggests a narrow peak.</p>
Gamma Radiation	<p>Symbol: γ</p> <p>Context: Radiation</p> <p>High energy radiation that consists of photons emitted from the nucleus of an atom during radioactive decay. Gamma radiation is more penetrating than alpha or beta particles. A large amount of gamma radiation is lethal to most living beings. Gamma rays may be stopped by an adequate thickness of lead, tungsten or similar heavy metals.</p>

Description	Definition
Gamma Detection Alert	Context: Alert An optional alert that notifies the operator that a radiation source has been detected and has exceeded the threshold level over background defined in the advanced menu. No LED will illuminate, but the status background will change from green to red. A beeper alert will sound and the alert messages remain on the screen as long as the gamma gross count remains above the threshold value.
Half-life	Context: Radiation The time it takes for half of the atoms in a radioactive sample to undergo decay. Each radionuclide has a unique half-life. The length of a half-life for different radionuclides varies from a fraction of a second to millions of years.
He-3 Detector	Context: Internal components aka: Neutron detector A proportional counter filled with Helium-3 gas and surrounded by a sheath of High-density polyethylene. The detector emits an electric pulse each time a neutron interacts with the gas. The electrical pulse is proportional to the number of neutrons detected. The sheath slows incoming neutrons allowing for a greater chance of neutron detection.
High Gamma Dose Rate	Context: Alarm type A personal hazard alarm which triggers when the gamma dose rate exceeds the advanced mode configurable threshold value. All three LED's will begin to flash and the status background will change from green to red, and the RadSeeker DL will inform the operator with a warning. If enabled, the handle will vibrate and an audio alarm will sound to notify the operator of the alarm.
Histogram	Context: Display A bar chart representing the observed dose rate. Each bar represents a 0.5 second interval and the height of the bar is equal to the dose rate (top number on right-hand side of the display). The fat bar on the far right is representative of the present dose-rate and refreshes once per second.
Humidity, non-condensing	Context: Operating principles An environmental condition where the ever-present humidity in the air will not condense to form dew on or within the detector. Since dew typically has lots of atmospheric "dirt" in it, it's quite conductive – which can damage sensitive internal components. One can avoid condensation in various ways. The simplest is keeping the temperature of the components the same or a little warmer than ambient conditions.

Description	Definition
Hysteresis Time	<p>Context: Operating principles</p> <p>The delay between an action and reaction of any measuring device. With respect to the RadSeeker DL it is the recovery time following an alarm. This variable defines the length of time that must pass with detection levels below alarm thresholds before a new alarm is considered a new event.</p> <p>The hysteresis time in the RadSeeker DL is used to ensure that an alarm lasts for at least the specified length of time, rather than generating multiple alarms. Once a threshold is reached, the alarm is raised, and remains raised for n seconds after the underlying condition disappears</p>
Identification	<p>Context: Operating principles aka: ID (menu option "Start ID")</p> <p>The process by which the RadSeeker DL collects a spectrum to recognize and classify a detected radioactive source. An operator will typically operate in the Detect mode and monitor the dose rate and counts displayed on the right-hand side of the display. When a signal is localized, the operator selects Start ID and the RadSeeker DL analyzes the signals. The result of an Identification is either an innocent or threat alarm, or "No Radionuclides Found".</p>
Interface Control Document	<p>Context: Data files aka: ICD1 and ICD2</p> <p>A file generated by the RadSeeker DL for each event (threat identification alarm, innocent identification alarm, or neutron alarm). ICD1/2 formats are based on the ANSI N42.42 standard; ICD1 files contain raw data (e.g. instrument information, collected spectrum). ICD2 files contain "processed" data (e.g. identification results).</p>
Isotope	<p>Context: Radiation</p> <p>An element that can have several forms. All forms have the same chemical properties but a different number of neutrons, atomic mass and nuclear properties. There are two forms of notation: the elemental symbol preceded by the atomic mass superscripted or the elemental symbol followed by a dash and the atomic mass - e.g. ²²Na or Na-22.</p>
LED Indicators	<p>Context: Status indicators</p> <p>A set of three Light Emitting Diodes (LED's) located at the back of the RadSeeker DL that are used to indicate alarm states. Since operators may hold the RadSeeker DL in various ways causing them to be in positions where the screen is not visible, the LEDs communicate alarms in real time.</p>
Laboratories and Scientific Services	<p>Acronym: LSS</p> <p>Context: Data analysis and technical services</p> <p>A group of scientists working for Customs and Border Protection (CBP) whose primary role is to use the latest scientific tools to appraise imported commodities and assist with anti-terrorism efforts.</p>

Description	Definition
Manual ID	<p>Context: Operating principles</p> <p>A menu option that permits an operator to view the live spectrum and perform identification at any time. Data collection begins as soon as the user enters this function. The user can then stop the data collection at any time. Once stopped, the user has the choice of re-starting the data collection, performing identification or exiting Manual ID mode.</p>
Multi Channel Analyzer	<p>Context: Internal components</p> <p>A counting system where every incoming pulse from the gamma detector is sorted into defined channels. When the measurement is completed, the sums of all the counts are electronically sorted to produce a spectrum. The main objective is to determine the energy distribution of the radiation that is reported from the detector. The multi-channel analyzer is the key to identifying the spectrum of energy that is being received. With proper interpretation, bars of higher intensity identify the materials that are nearby.</p>
Moderator Tube	<p>Context: Internal components</p> <p>See also: He-3 Detector aka: Sheath</p> <p>The high-density polyethylene material surrounding the neutron detector located in the RadSeeker DL handle. The sheath slows incoming neutrons allowing for a greater chance of neutron detection.</p>
Neutron	<p>Symbol: n, n⁰, N⁰</p> <p>Context: Radiation</p> <p>See also: Neutron Radiation</p> <p>A subatomic particle emitted from an atom during radioactive decay. The neutron has no electric charge and a mass similar to that of a proton.</p>
Neutron Radiation	<p>Context: Radiation</p> <p>See also: Neutron</p> <p>Radiation that consists of neutrons emitted from the nucleus of an atom during radioactive decay. Neutron radiation is difficult to stop because it has high penetrating power. Due to the high kinetic energy of neutrons, this radiation is considered to be the most dangerous radiation type.</p>
Normal Mode	<p>Context: User mode</p> <p>A collection of functions and menu items that provide basic operation capabilities. The Normal Mode menu allows the user to access user interface settings, view system status and perform all normal screening activities. Normal mode is the default operating mode and no password is needed to access the menus. Any changes made to the Normal mode configuration are reset back to the factory default settings upon power cycling the unit.</p>

Description	Definition
Photon	Context: Electromagnetic radiation A discrete quantity of electromagnetic energy that is the basic unit for all forms of electromagnetic radiation. It has no mass and no electric charge. It is the energy of the photon that determines the nature of the radiation. Gamma radiation consists of high energy photons.
Photo Multiplier Tube	Acronym: PMT Context: Internal components aka: Amplifier An extremely sensitivity light detector that amplifies the signal emitted from the scintillator and directs an output current to the multi-channel analyzer. The photo multiplier tube increases the strength of the signal without changing the other characteristics.
Radioisotope	Context: Radiation See also: Isotope, Radionuclide An isotope of the same chemical element that undergoes radioactive decay.
Radiological Dispersal Device	Acronym: RDD Context: Threats A device that involves radioactive materials and some method to spread them over a wide area. The dispersal device can be any size, but the purpose is to cause contamination, panic, fear, economic loss and possibly physical harm. A commonly used term is "dirty bomb." A dirty bomb uses conventional explosives to scatter radioactive material.
Radionuclide	Context: Radiation See also: Radioisotope Any atom with an unstable nucleus that undergoes radioactive decay.
Reach-back	Context: Data analysis and technical services See also: Laboratories and Scientific Services A program that allows screeners to obtain immediate technical expertise in analyzing and evaluating threats. This service is used by screeners when data files from the RadSeeker DL require further interpretation and when guidance is needed.
Satellite Phone	Context: Accessories A telecommunications method that uses satellites instead of terrestrial cellular base stations. Such systems permit communication to remote areas.

Description	Definition
Saturation Alarm	<p>Context: Operating principles</p> <p>The state where the gamma or neutron detectors have reached their maximum detection threshold. If the gamma dose rate reaches or exceeds the detector saturation level, the unit shuts off the gamma detector to protect it from damage. Recycling power restarts the gamma detector. The second type of saturation alarm is generated when the neutron count rate is at the maximum value it can accurately report. With the alarm acknowledged, the unit returns to the Detect screen. The alarm continues to display at the bottom of the screen until the neutron count falls below the threshold level. Both the gamma and the neutron detectors have fixed saturation alarm thresholds.</p>
Scintillation	<p>Context: Operating principles</p> <p>The flashes of light emitted by the transparent crystal inside of the gamma detector (LaBr or NaI). The sparkles of light are caused by an ionization event as gamma photons interact with the crystal.</p>
Screening	<p>Context: Operational practice</p> <p>The active testing and evaluation of objects or persons by authorized personnel in order to determine if a concealed threat is present. The RadSeeker DL is intended to be used as a screening device to identify unauthorized nuclear materials. Effective screening requires the operator to get as close as they can to the target. Distances should be measured in inches.</p>
Self-Test	<p>Context: Operational practice</p> <p>An operator interactive test that can help in diagnosing system problems and provide assurance that the RadSeeker DL is working correctly. To initiate a system self test, select Self-Test from the System Status menu. The first part of the self-test requires the operator to acknowledge light and sound functions. The second part tests the detector sub-system and a progress bar is displayed across the bottom of the screen. In the event the self-test fails, an alarm appears on the screen. The self-test requires 15-20 minutes.</p>
Service Mode	<p>Context: User mode</p> <p>A password-restricted menu that provides advanced system configuration and system diagnostic capabilities. While the user is in the Service Mode, the letter S appears in the bottom right corner of the display.</p> <p>All units are programmed with a unique password for access to the Service mode. It is not supplied with the documentation shipped with each unit as this mode is only intended for service and repair technicians.</p>
Shielding	<p>Context: Radiation</p> <p>A general term used to include all methods and materials that reduce or eliminate the transfer of radiation from a radioactive source to the surrounding area.</p>

Description	Definition
Special Nuclear Material	Context: Radiation A short list of materials that are important in the fabrication of weapons grade materials and are therefore under strict licensing and handling controls. The list included plutonium, uranium-233, uranium-235 and nuptuniu-237.
Spectrum	Context: Operating principles A visual representation that shows the ordered array of signals from the gamma detector. With proper interpretation, areas of higher intensity can be used to identify radioactive materials that are nearby.
Stabilization	Context: Operating principles An automated process where the equipment establishes a baseline for interpreting detected energy levels. Temperature and other factors can occasionally cause the detector to lose track of the correct energy scale. The RadSeeker DL continuously monitors the reference source, and continually adjusts to lock the reference peaks in place. The RadSeeker DL contains an extremely weak radioactive source of 22Na. Only when there is a stable reference reading does the equipment agree that it has stabilized enough to begin detection.
Standby Power Mode	Context: Power conservation A power conservation strategy where the display automatically switches dims. While in standby power mode the count rate and dose rate numbers will scroll from left to right across the screen. By default the standby power mode feature is enabled. The range of the standby power mode idle time is 15 to 300 seconds. To return the unit to full power mode, press any key.
Storage Low Threshold	Context: Warning The number of remaining sampled defined in the Advanced System configuration menu that triggers a warning to the operator. It is best to download data before new samples overwrite older samples.
System Health	Context: Operating principles A menu available through the System status screen. The system health screen provides information on the real-time temperature and operating voltage of the gamma and neutron detectors. More information regarding valid operating ranges can be found in the operator's manual.
System Log	See: Activity log

Description	Definition
Tactile Indicator	Context: Internal components An alarm indicator that can be perceived by touch. The RadSeeker DL handle is equipped with a mechanical device that vibrates upon alarm and remains on until the alarm is acknowledged. The feature can be disabled through normal mode menu options.
User Mode	Context: Operating principles A distinct functionality level within the RadSeeker DL that permits access to menus where basic settings can be changed or system information can be viewed. A password is required to enter Advanced mode. There are three levels of functionality: Normal, Advanced and Service.

B.2 Acronyms

This reference table provides a list of the acronyms for the RadSeeker™ DL. The acronyms are presented along with their full names.

Use the Glossary in combination with this list to obtain the definitions of the terms.

Acronym	Description
CONOPS	Operational practice: Concept Of Operations
cps	Radiation: Cycles per second
DIS	Digital Signal Processing
DL	Product name: DNDO + Lanthanum Bromide
Dose Rate	For people - The total amount of radiation absorbed by the body per unit of time.
Gamma Dose Rate	The total amount of gamma radiation absorbed by material or tissues over a period of time.
Neutron Dose Rate	The total amount of neutron radiation absorbed by material or tissues over a period of time.
E	Error (alarm)
FWHM	Data analysis: Full Width at Half Max
Hazmat	Hazardous Material
HPRD	Human Portable Radiation Detector
I	Innocent (alert)
IND	Radionuclide type: Industrial
IP65	International standards: Ingress Protection or International Protection Rating
IPA	Cleaning agents: Isopropyl Alcohol
OLED	Organic Light Emitting Diode
LED	Hardware (rear indicator lights): Light Emitting Diode
LS	Long Sample
LSS	Data analysis and technical services: Laboratories and Scientific Services
MED	Radionuclide type: Medical

Acronym	Description
NORM	Radionuclide type: Naturally Occurring Radioactive Material
N-cpm	Neutron count rate in counts per minute
OLED	Hardware (display): Organic Light Emitting Diode
RDD	Radiation Dispersal Device
rem	Is a basic unit used to measure the amount of biological damage caused by various types of ionizing radiation, equal to the dose that produces the same amount of damage in human tissue as one roentgen of X-rays or gamma rays (0.01 sievert)
RSO	Local authorities: Radiation Safety Officer
RSSI	Radio Signal Strength Indicator
S	Suspect (alarm)
SNM	Radionuclide type: Special Nuclear Materials
SOP	Standard Operating Procedure
SSI	Signal Strength Indicator
T	Threat (alarm)
µrem	µrem is 0.000001 rem
µrem/h	µrem/h is the amount of micro rem in one hour
µSv/h	micro Sieverts per hour (dose)
WI	Radionuclide type: Weapons Indicating
USB	Data Transfer: Universal System Bus

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smiths detection

RadSeeker™ DL

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Appendix D User Feedback

Smiths Detection

Technical Documentation Department
7030 Century Avenue
Mississauga, Ontario
Canada, L5N 2V8
Fax: 905-817-5992

Product	RadSeeker™ DL
Version	Draft Document, Revision A3, November 2010
Customer	
Product Serial Number	

To help us continually improve the quality of this manual, we appreciate your input. Please answer the following questions, and fax or mail the completed questionnaire back to the address above.

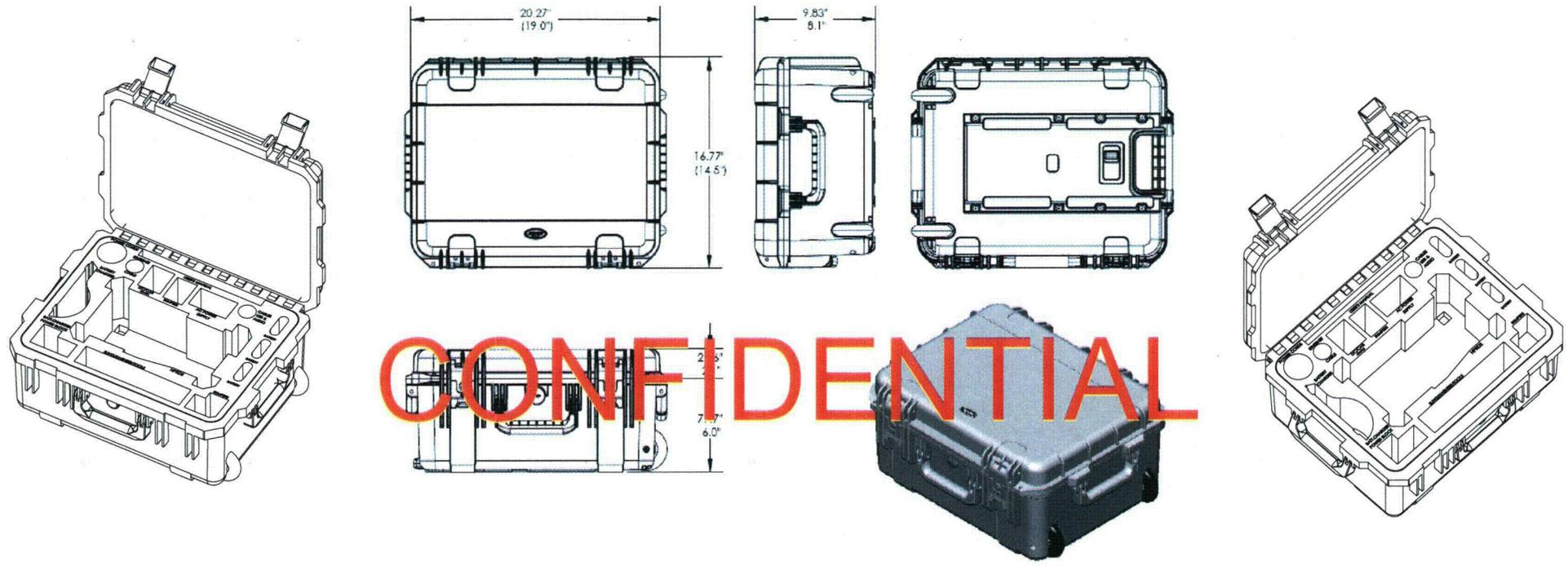
1. Is this manual easy to use?
2. Is the information presented in a clear and logical way?
3. Is the information accurate?
4. Would you like to see instructions for any additional procedures? Please list them in the space below.
5. Is there something you do not like about this manual?

Please use the space on the back of this page to add any additional comments you may have about this manual.

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REV	DESCRIPTION	DATE	Drawn	Checked	Auth
01	PRODUCTION	4 DEC 2009	BL	CL	AW
02	PRODUCTION	11 FEB 2010	BL	CL	AW
03	PRODUCTION	28 FEB 2010	BL	CL	AW
04	PRODUCTION	4 MAR 2010	BL	CL	AW



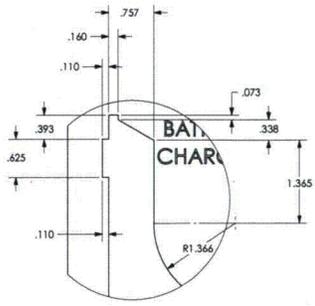
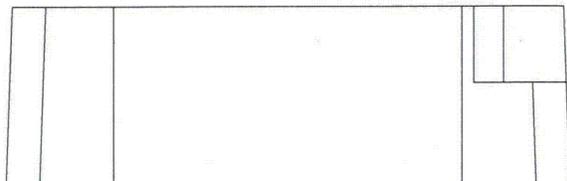
NOTE:
1. VENDOR: PRODUCTION CASE COMPANY, OTTAWA, ONTARIO, CANADA.

Case Series	Mil-Standard	Dimensions (for reference only)			
		Length	Width	Overall	Base / Lid
Case part #	31-1914-48-C	left to right	front to back	height	height
Weight	13.6 lb.	Exterior: 20.27"	16.77"	9.83"	7.47" / 2.36"
		Interior: 19.0"	14.5"	8.1"	6.0" / 2.1"

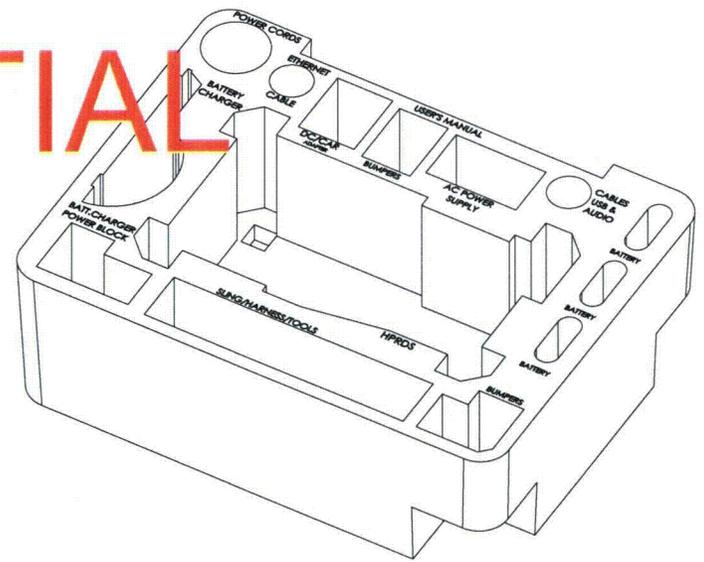
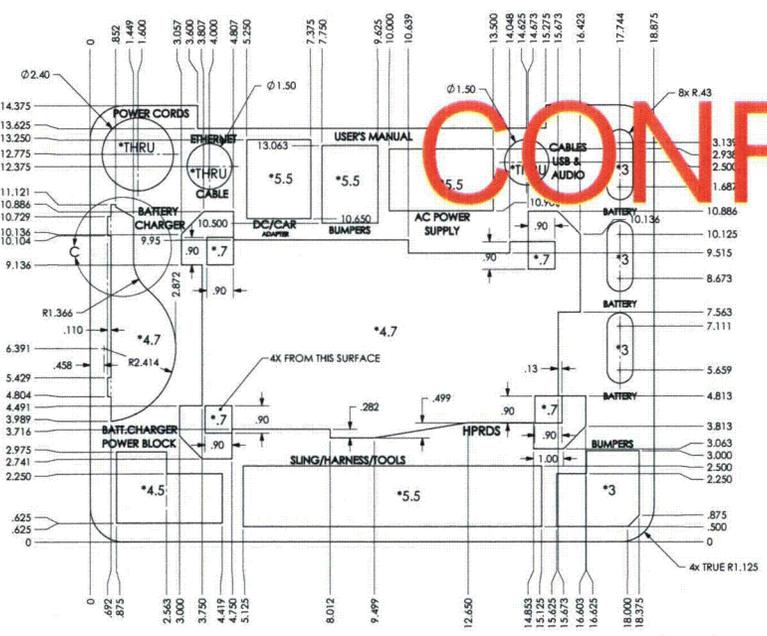
- BOTTOM CASING FOAM TO BE CUT PER SHEET 2 AND SHEET 3 OF THIS DRAWING. MATERIAL: PLASTAZOTE KPLD35
- TOP COVER FOAM. MATERIAL: ESTER FOAM, CONVOLUTED, 1.5" THICK, OPEN CELL TYPE DENSITY: 2 LB./CU.FT.

DIMENSIONS AND TOLERANCES: THIS DRAWING IS TO BE USED FOR PRODUCTION ONLY.
 X = 0.02" ± 1" MATERIAL: SEE BOM
 XXX = 0.02" ± 1/32" FINISH: SEE BOM
 SCALE: 1:2
 TITLE: TRANSPORTATION CASE HPRDS
 DATE: 4 NOV 2009
 DATE: 16 FEB 2010
 DRAWN: BL
 CHECK: CL
 APP'D: -
 DATE: -
 CAGE CODE: 35471
 THIRD ANGLE PROJECTION
 smiths detection A
 bringing technology to the
 OTTAWA, CANADA
 Dwg No: 4822406 Rev: 04 Sheet 1 of 3

REV	DESCRIPTION	REVISION	DATE	CHKD	APP'D
1	See Sheet				



DETAIL C
SCALE 1:1

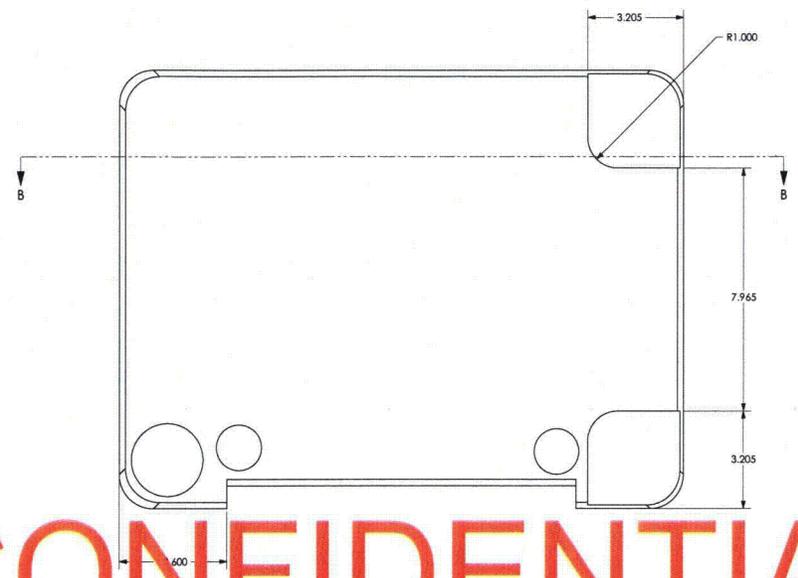
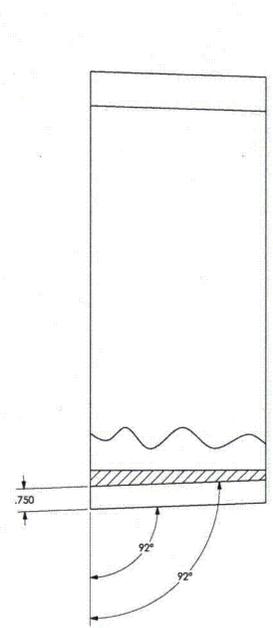


CONFIDENTIAL

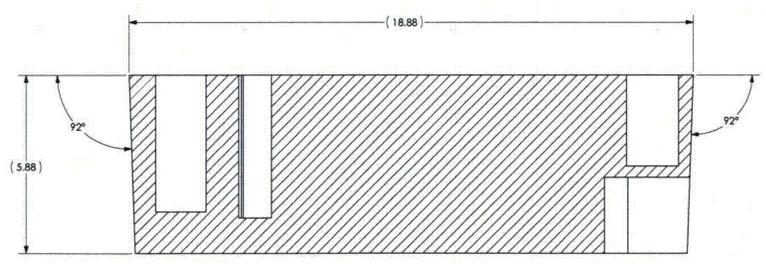
***XX SIGNIFIES THE DEPTH OF HOLES AND POCKETS**
THE LABELING IS FOR REFERENCE ONLY, IT SHOULD NOT BE PART OF THE FOAM.

DESIGNED AND DRAWN BY JESSE BROWN	DO NOT SCALE THIS DRAWING	CAGE CODE: 35471	THIRD ANGLE PROJECTION	 <small>bringing technology to life</small>
DATE: 16 FEB 2010	SCALE: 1/2	DATE: 4 NOV 2009	DATE: 16 FEB 2010	
THIS DOCUMENT INCLUDES PROPRIETARY INFORMATION WHICH MAY BE USED FOR THE BENEFIT OF OTHERS WITHOUT WRITTEN CONSENT	DATE: 16 FEB 2010	DATE: 4 NOV 2009	DATE: 16 FEB 2010	TITLE: FOAM INSERT - TRNS-CASE HPRDS Dwg No: 4822406 REV: 04 SHEET 2 of 3

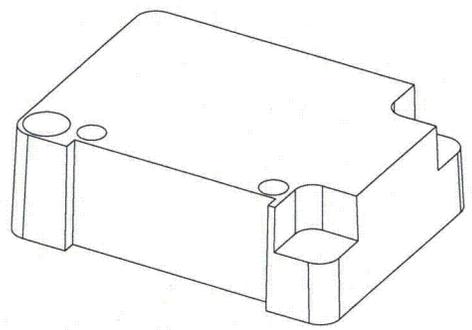
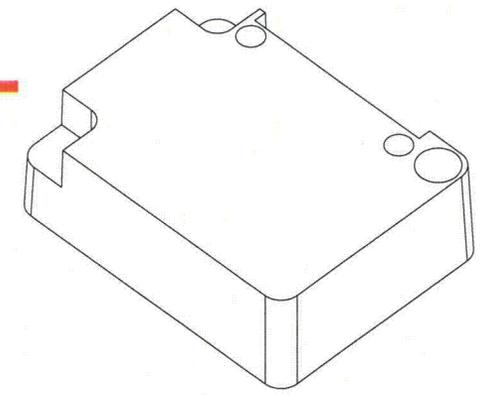
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-	See sheet	-	-	-



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SECTION B-B



DIMENSIONS AND TOLERANCES PER ISO UNLESS OTHERWISE SPECIFIED X = 0.02 X + 1 XXX + 0.02 X + 1/32 FEMSE XXX + 0.02 X + 1/32 FEMSE	DO NOT SCALE THIS DRAWING SEE NOTES	CAGE CODE: 35471 THIRD ANGLE PROJECTION SCALE: 1:2	smths detection bringing technology to life OSHAWA, CANADA
THIS DOCUMENT INCLUDES PROPRIETARY INFORMATION OF THE INVENTOR WHICH MAY NOT BE USED FOR THE BENEFIT OF OTHERS WITHOUT WRITTEN CONSENT	DRAWN: BL DATE: 4 NOV 2009 CHECKED: CIL DATE: 16 FEB 2010 APP'D: - DATE: -	TITLE: FOAM INSERT - TRNS-CASE HPRDS D W/D NO: 4822406 REV: 04 SHEET: 3 OF 3	

PROCESS INSTRUCTION

DESCRIPTION: RadSeeker Packing Procedure

INSTRUMENT:		Date:	Jun 22, 2010
RadSeeker		Part Name:	HPRDS HHB LaBr, HPRDS COM NaI
		Smiths P/N:	4822400HHB, 4822500COM
Revision:	A	Author(s):	Cosmin Borcea
Revision Date:	Jun 22, 2010	Authorization:	Ronda MacArthur
Qualification:	HPRDS Technician		
Safety:			
Equipment:			
		<p>WARNING: THIS DOCUMENT CONTAINS SENSITIVE INFORMATION PROPRIETARY TO SMITHS DETECTION. NO PART OF THIS DOCUMENT MAY BE RELEASED WITHOUT THE WRITTEN PERMISSION. UNAUTHORIZED RELEASE MAY RESULT IN CIVIL PENALTY OR OTHER ACTION. ANY DISCLOSURE OR ANY REPRODUCTION OF THIS DOCUMENT, OR ANY PART THEREOF, IS EXPRESSLY PROHIBITED, EXCEPT AS SMITHS DETECTION MAY OTHERWISE AGREE TO IN WRITING.</p>	
		<p>smiths detection bringing technology to life</p> <p>Smiths Detection - Toronto, Ltd. 7030 Century Avenue Mississauga, ON L5N 2V8</p>	

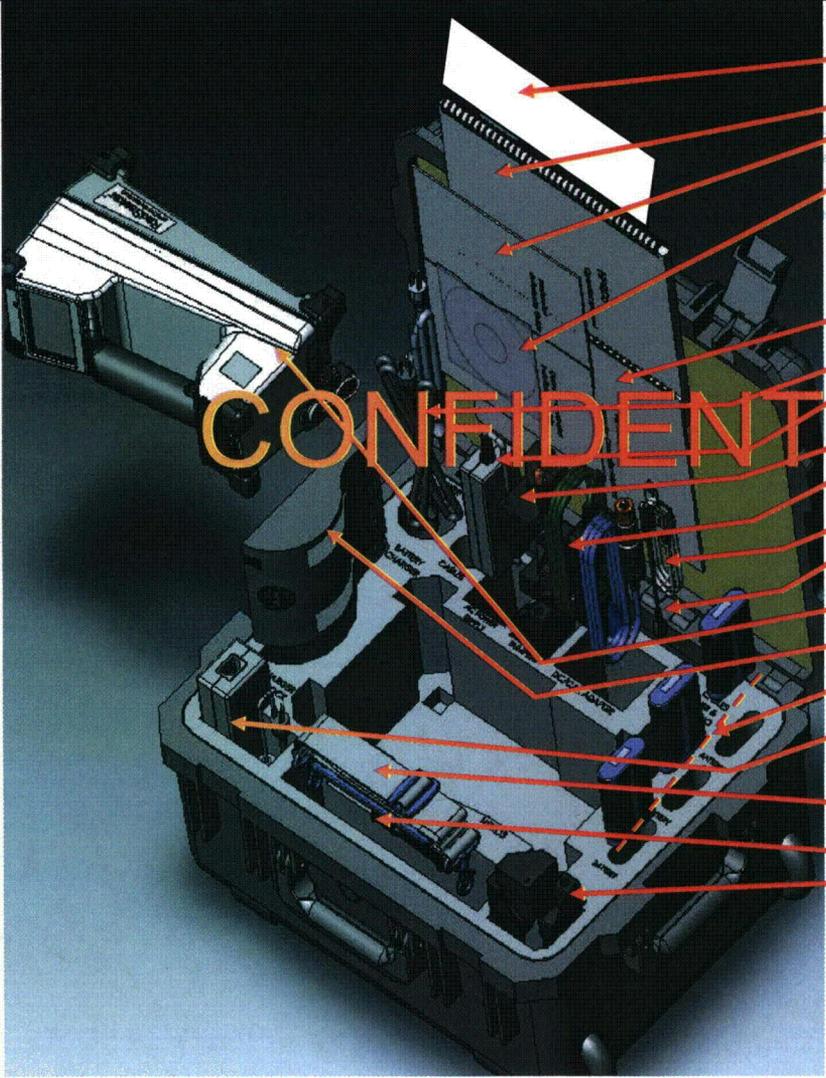
Revision Table

ECN	DATE	REV	DWN	PROD. CHK	MFG. CHK
	Jun 22, 2010	A			CB

Where electronic components and devices are handled, follow the PS100143 - Electrostatic Discharge (ESD) Work Instruction

PROCESS:

This Process uses 6922405 Bill of Materials.

PHOTO	STEPS	CHK
	<ol style="list-style-type: none"> 1. Instr. Password 2. Op. Manual 3. Reference Guide 4. Software package: <ul style="list-style-type: none"> - Det. Ctrl. CD - Install. Guide 5. Det. Ctrl. Manual 6. Power Cables (x 2) 7. AC Adaptor 8. Large Bumpers (x4) 9. DC Car Adaptor 10. USB Cable 11. Audio Cable 12. Instrument 13. Batt. Charger 14. Batteries(x 2 + Opt.) 15. Charger P. Supply & Cable 16. Sling 17. Screwdriver 18. Large Bumpers (x4) 	

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