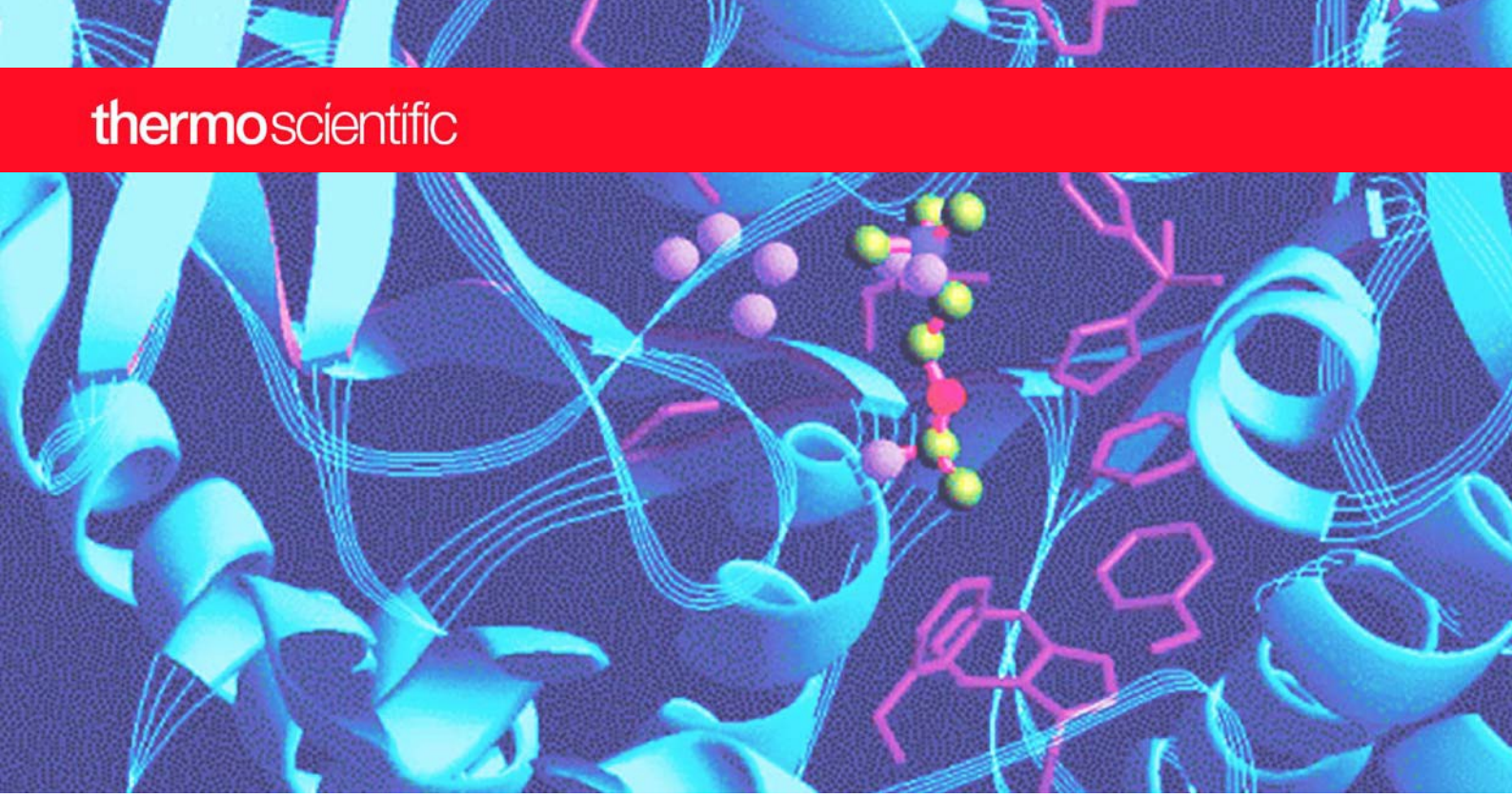

thermo scientific

Handheld Radio-Isotope Identification Device

Model RIIDEye X-G, -H, -GN, -HN

Operator and Technical Manual

DB-099 E

Revision I December 2016

Rev.	Rev. State	Dept. Resp	Name	Rev. page	Cat.*	Explanation
A	10/28/2013	PGT/RM&SI -E	Tr			
B	04/23/2014	RM&SI	Mas/Tr	Complete	A	Complete revision V 3.9.6
C	04/28/2014	RM&SI	JW/LD Gr/Tr	xv	A	Revision contact information
D	06/13/2014	RM&SI	SM/LD	22-25,46,67,70	A	Corrections
E	08/05/2014	RM&SI	Tr	76, 78	I	Spec Correction: “R” to “rem”, QCC
F	09/12/2014	RM&SI-E	Tr	78	A	Radiation Measurements Specifications added
G	08/28/2015	RM&SI-E ECN 80160	Tr	19, 20 75, 76 complete	A C, I	New Battery compartment Recall of factory settings Small corrections in whole document
H	06/24/2016	RM&SI-EH	Winter	3	A	ECN 80844
I	12/22/2016	RM&Si-EH	Winter	17, 18	A	ECN 80755

Category C: editorial correction
I: clearing improvement
A: substantial amendment

Explanations must be given, at least with Category A.

Regulatory Compliance

Thermo Fisher Scientific performs complete testing and evaluation of its products to ensure full compliance with applicable domestic and international regulations. When the system is delivered to you, it meets all pertinent electromagnetic compatibility (EMC) and safety standards as described in the next section or sections by product name.

Changes that you make to your system may void compliance with one or more of these EMC and safety standards. Changes to your system include replacing a part or adding components, options, or peripherals not specifically authorized and qualified by Thermo Fisher Scientific. To ensure continued compliance with EMC and safety standards, replacement parts and additional components, options, and peripherals must be ordered from Thermo Fisher Scientific or one of its authorized representatives.

EMC Directive 2004/108/EC

This device complies with EMC directive 2004/108/EC and harmonized standard IEC EN 61326-1:2006 Class A.

Low Voltage Safety Compliance

This device complies with Low Voltage Directive 2006/95/EC and harmonized standard EN 61010-1:2001.

FCC Compliance Statement

THIS DEVICE COMPLIES WITH PART 15 OF THE FCC RULES. OPERATION IS SUBJECT TO THE FOLLOWING TWO CONDITIONS: (1) THIS DEVICE MAY NOT CAUSE HARMFUL INTERFERENCE, AND (2) THIS DEVICE MUST ACCEPT ANY INTERFERENCE RECEIVED, INCLUDING INTERFERENCE THAT MAY CAUSE UNDESIRED OPERATION.

CAUTION
Read and understand the various precautionary notes, signs, and symbols contained inside this manual pertaining to the safe use and operation of this product before using the device.

WEEE Compliance

This product is required to comply with the European Union's Waste Electrical & Electronic Equipment (WEEE) Directive 2002/96/EC. It is marked with the following symbol:

Thermo Fisher Scientific has contracted with one or more recycling or disposal companies in each European Union (EU) Member State, and these companies should dispose of or recycle this product. See www.thermoscientific.com/rohsweee for further information on Thermo Fisher Scientific's compliance with these Directives and the recyclers in your country.

WEEE Konformität

Dieses Produkt muss die EU Waste Electrical & Electronic Equipment (WEEE) Richtlinie 2002/96/EC erfüllen. Das Produkt ist durch folgendes Symbol gekennzeichnet:

Thermo Fisher Scientific hat Vereinbarungen mit Verwertungs-/Entsorgungsfirmen in allen EU-Mitgliedsstaaten getroffen, damit dieses Produkt durch diese Firmen wiederverwertet oder entsorgt werden kann. Mehr Information über die Einhaltung dieser Anweisungen durch Thermo Fisher Scientific, über die Verwerter, und weitere Hinweise, die nützlich sind, um die Produkte zu identifizieren, die unter diese RoHS Anweisung fallen, finden sie unter www.thermoscientific.com/rohsweee.

Conformité DEEE

Ce produit doit être conforme à la directive européenne (2002/96/EC) des Déchets d'Equipements Electriques et Electroniques (DEEE). Il est marqué par le symbole suivant:

Thermo Fisher Scientific s'est associé avec une ou plusieurs compagnies de recyclage dans chaque état membre de l'union européenne et ce produit devrait être collecté ou recyclé par celles-ci. Davantage d'informations sur la conformité de Thermo Fisher Scientific à ces directives, les recycleurs dans votre pays et les informations sur les produits Thermo Fisher Scientific qui peuvent aider la détection des substances sujettes à la directive RoHS sont disponibles sur www.thermoscientific.com/rohsweee.

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Preface

The RIIDEye™ is a portable Radio-Isotope Identification Device (RIID) that detects and identifies multiple nuclides, providing quantified results using time-slice analysis.

This manual describes the functionality and operation of the RIIDEye.

Manual Conventions

This manual uses the following typographic conventions:

Identify, User	Soft key names are shown in bold mixed case.
New background is recommended	Messages and on-screen prompts are shown in italics.
ENTER, MENU, UP	Keypad key names are shown in small capital letters.

Related Documentation

In addition to this guide, Thermo Fisher Scientific provides the following documents for RIIDEye:

- RIIDEye Quick Start Guide (COMD000687)

Safety and Special Notices

Make sure you follow the precautionary statements presented in this guide. The safety and other special notices appear in boxes.

Safety and special notices include the following:

CAUTION Highlights hazards to humans, property, or the environment. Each CAUTION notice is accompanied by an appropriate CAUTION symbol.

IMPORTANT Highlights information necessary to prevent damage to software, loss of data, or invalid test results; or might contain information that is critical for optimal performance of the system.

Note Highlights information of general interest.

Tip Highlights helpful information that can make a task easier.

Safety Instructions

CAUTION Use RIIDEye instruments only within their specified measurement range and operational limits. Using an instrument in exceeding conditions may cause malfunction of the device.

CAUTION Do not use the instrument in an explosive atmosphere.

CAUTION Do not use the instrument if a critical error message appears on the screen.

CAUTION Maintain the mechanical integrity of a RIIDEye instrument at all times with the exception of the connections described below for external devices such as the DC power supply and data exchange interfaces.

CAUTION Only charge the RIIDEye's battery pack inside the RIIDEye device with the supplied battery charging equipment and only if the pack contains rechargeable batteries.

CAUTION You can operate the RIIDEye using non-rechargeable alkaline batteries but you must not charge the device when these batteries are installed.

CAUTION Radioactive objects found or identified with RIIDEye instruments may emit hazardous levels of radiation. Never use the displayed dose rate value to estimate hazards to exposed persons.

Note Thermo Fisher Scientific shall not be taken accountable for any displayed data such as nuclide identification information. This applies also for actions taken as consequence of the displayed information.

Contacting Us

There are several ways to contact Thermo Fisher Scientific for the information you need.

- **To contact Technical Support for North and south America and Canada**

Phone	800-274-4212
International	508-553-1700 (International, +1)
Support Fax	508-520-2815
E-mail	techsupport.rmsi@thermofisher.com
Web	www.thermo.com
Address	Thermo Fisher Scientific RM & SI One Thermo Fisher Way Oakwood Village, OH 44146 USA

- **To contact Technical Support for customers outside of North and South America and Canada**

Phone	+49 9131 998 290
Support Fax	+49 9131 998 475
E-mail	techsupport.epd.erlangen@thermofisher.com
RGA process	www.thermoscientific.com/servicerepair
Web	www.thermofisher.com
Address	Thermo Fisher Scientific Messtechnik GmbH Frauenauracher Straße 96 D-91056 Erlangen, Germany
Post Address	P.O Box 16 60 D-91051 Erlangen, Germany

Introduction

The RIIDEye can be operated either in a very simple mode requiring no previous experience (see Quick Reference Guide starting on page 3) or in a more advanced operating mode that takes advantage of the comprehensive set of advanced features.

Contents

The RIIDEye offers two modes of operation: User and Administrator. User functions allow first line responders to perform all the tasks needed in the line of duty without a logon. Administrator functions require a logon and password; they allow a Health Physicist or other expert to set up the device for specific applications and to perform additional detection and maintenance functions. This manual will cover aspects of both, but places an emphasis on User functions. These are discussed in detail in General Operation on page 27 and Calibration on page 45.

The device powers up in an initial search mode. Several different views of this mode are available, but all are based on data collected in real time. In addition to the search modes, you can also access the setup, alarm review, and calibration functions through the menu system. These are discussed in General Operation on page 27.

The instrument has a simple user interface (described in Description of Keypad on page 9) and a wide range of setup functions and utilities (described in System Menus on page 51. Depending on the mode, RIIDEye uses 256 or 512 channel Quadratic Compression Conversion (QCC), including the saving of spectra. Measurement data is stored on a Compact Flash (CF) card and formatted in ANSI standard (N42.42-2006) format for processing on external devices.

About Your RIIDEye

Congratulations on purchasing your new RIIDEye. RIIDEye represents the latest in portable gamma spectroscopy. Your RIIDEye is designed to detect and identify a

wide range of gamma radiation (20 keV to 3 MeV). Its reliable design provides virtually maintenance free operation for five years and a long service life.

RIIDEye units consist of:

- Spectrometer electronics
- Gamma ray detector (underneath the display)
- Optional neutron detector (in the handle)
- Battery pack (installed in the rear end of the instrument)
- AC power adapter
- CF-card USB reader

RIIDEye X-G, order No 42508/80, is the standard instrument using a 2x2" NaI(Tl) gamma detector with a typical resolution of 7.5% (@662 keV). Its large detector is excellent for searching for and locating gamma radiation sources. The position of the gamma detector is marked with a red colored spot at the front of the housing.
RIIDEye X-GN, order No.: 42508/85 offers an internal neutron detector in the handle of the instrument in addition to the gamma detector. The position of the internal neutron detector is marked with a blue dot.

RIIDEye X-H, order No. 42508/82, uses a 1.5" Lanthanum Bromide detector and with its typical 3.0% (@662 keV) energy resolution is especially suitable to identify multiple nuclides in difficult identification scenarios.
RIIDEye X-HN, order No.: 42508/86, offers an internal neutron detector in the handle of the instrument in addition to the Lanthanum Bromide detector. The position of the internal neutron detector is marked with a blue dot.

Figure 1. RIIDEye X

What's in the Box

Your RIIDEye X comes with a suite of accessories to meet your mission. Below is a list of components that ship with RIIDEye X:

1. Hard sided case that stores all components for RIIDEye – Case is suitable for transportation and adds further shock protection to the RIIDEye.

2. RIIDView SW – Software that allows offline viewing and reporting of spectrum
3. RIIDEye Reachback cable – Cable that facilitates Reachback through USB and Satellite phone (optional)
4. RIIDEye PC Interface cable – Cable that facilitates data push from RIIDEye to PC
(optional)
5. Battery charging cable and AC/DC power converter
6. USB memory reader for Compact Flash cards
7. Shoulder Strap
8. Quick Start Guide (COMD000687)
9. RIIDEye Operator manual (DB-099E)

Quick Reference Guide

Getting Ready

Before using the RIIDEye for the first time, we highly recommend that you backup the contents of the CF card completely, charge the battery to 100%, and setup an Administrator password.

Backing up the CF Card

To backup the CF card, do the following:

1. Locate the access panel at the back of the unit (see Figure 16 on page 16). Turn the thumb screw lock on the access panel a quarter turn counter clockwise to unlock. Remove the access panel.
2. With the unit turned off, remove the CF card and backup the contents completely using the supplied USB adapter, a PC, and Windows™ Explorer; store the files in a safe place.
3. Re-insert the CF card (see Figure 2 for correct orientation).
4. Replace and lock the access panel by turning the thumb screw a quarter turn clockwise.

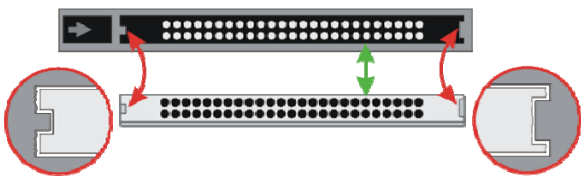


Figure 2. CF card orientation

For additional information, see Compact Flash Card on page 19.

Loading and Charging the Batteries

You can charge the rechargeable battery pack inside the RIIDEye unit using the AC adapter supplied with the instrument. Although you can operate the RIIDEye while the batteries are charging, the necessary charging time will be longer.

1. Connect the AC charger (see Figure 16 on page 16) and plug the charger into a wall outlet.
2. To confirm that the unit is fully charged, power-up the device (see Starting-up below) and watch for the battery charging bars to change to the AC mains symbol (), which indicates a full charge.

For additional information, see Connecting AC Power on page 16.

Starting-up

To turn on the RIIDEye, press and hold down the BACK/POWER key ⏻ for at least one second. Release when the Status screen displays (Figure 3). You will hear the "welcome" sound during this start-up phase.

Note New units come with no password, which must be entered by an administrator or expert user. With no password, the unit automatically boots up in Administrator mode (see User or Administrator Operation on page 14. With a password, the system automatically boots up in User mode. In either case, the unit displays the Dial search screen (Figure 3).

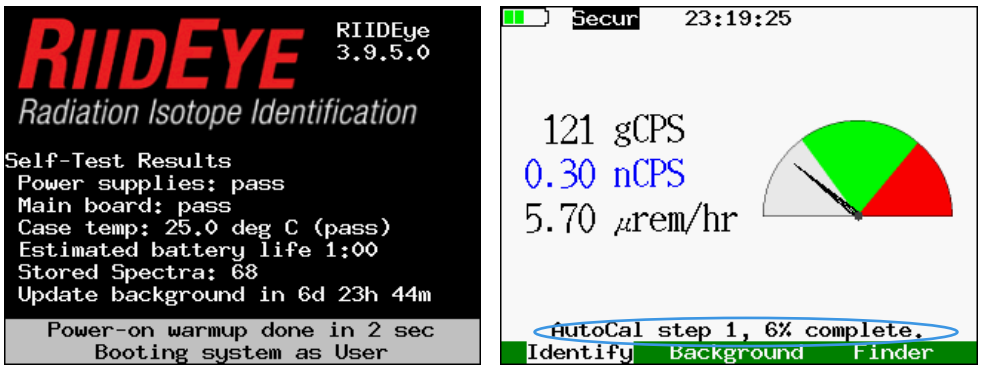


Figure 3: Status screen followed by Dial screen

The User-mode Dial search screen displays the AutoCal progress. This may take 1-3 minutes and up to four passes to resolve in high background areas.

CAUTION Wait until AutoCal is 100% complete before taking a new background.

If the text message “New background is recommended” appears on the screen during or after the auto calibration process, then initiate a background procedure by using the Background soft key function (see Figure 4). Use the keypad to highlight Background and then press the BACK/POWER key ⏻. Always collect a new background before you start scanning.

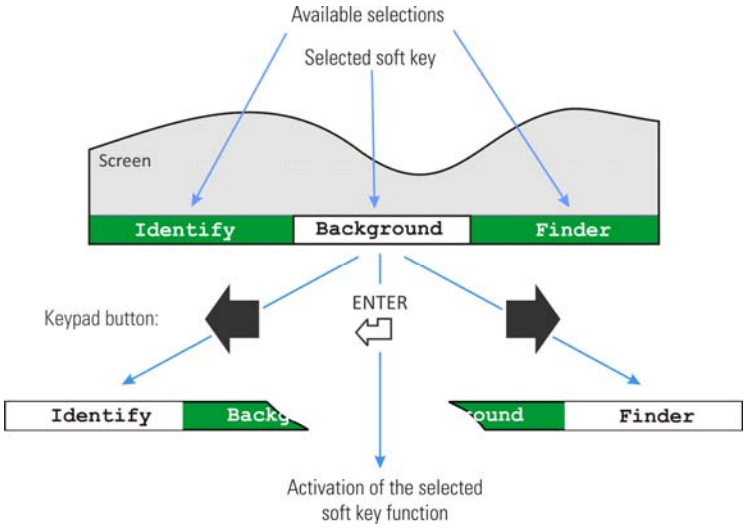


Figure 4. Soft key control showing **Background**, **Identify**, and **Finder**

Basic Operation

The right-most soft key “Finder/Bars/Spectrum/Dial” lets you select between the available search modes. Figure 5 shows the order in which each screen displays. Pressing the BACK/POWER key ⏻ key selects the highlighted soft key. Pressing BACK/POWER repeatedly will scroll through the search screens.

Note The “Bars” and “Spectrum” modes are not available in the User mode according to the factory setting. They must be enabled by an administrator to be accessible by a user.

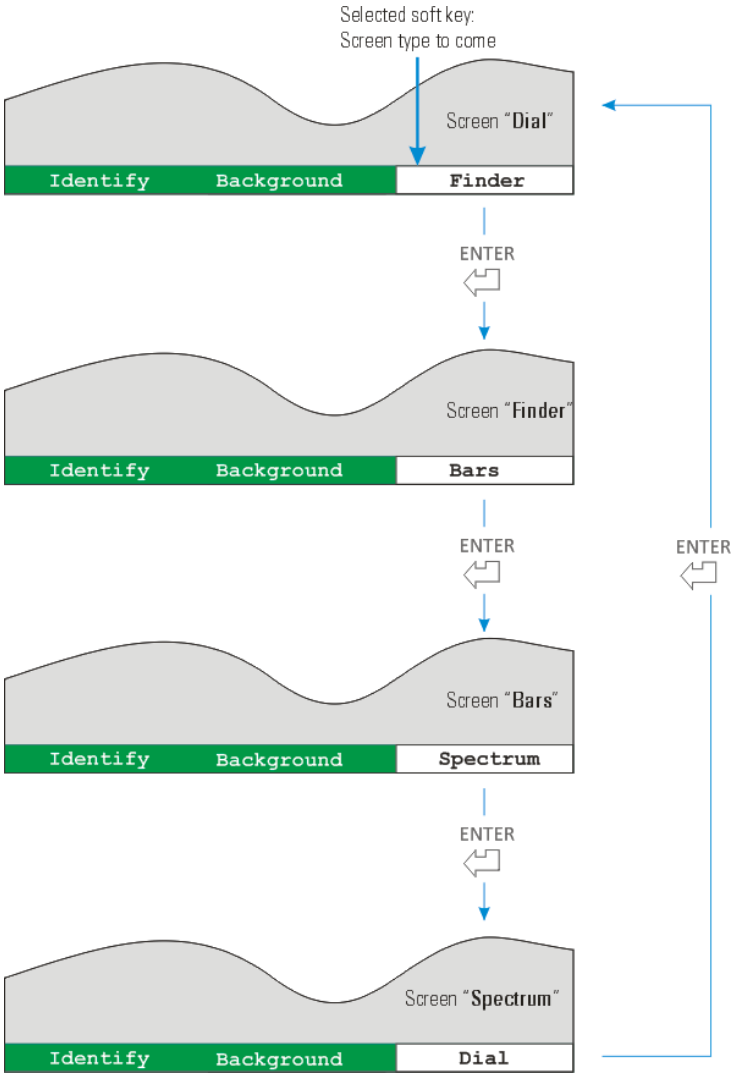


Figure 5: Available search modes

Dial Mode

The Dial provides count rate information in the form of a speedometer. When radioactive material gives an indication in the green region, the intensity of the source is sufficient to allow identification with gamma and neutron count rates (with optional neutron counter). The other colored regions indicate that the source is either too far (gray) or too close (red).

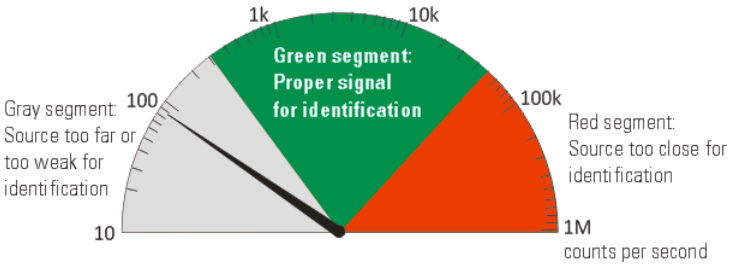


Figure 6: Dial mode, signal strength

Finder Mode

The Finder mode allows location of the source by displaying intensity vertically and time horizontally. The mid scale “ID” shows the proper intensity for identification; the solid color under the graph indicates that the signal strength is sufficient for identification. In addition, an audio signal can aid in finding the source.

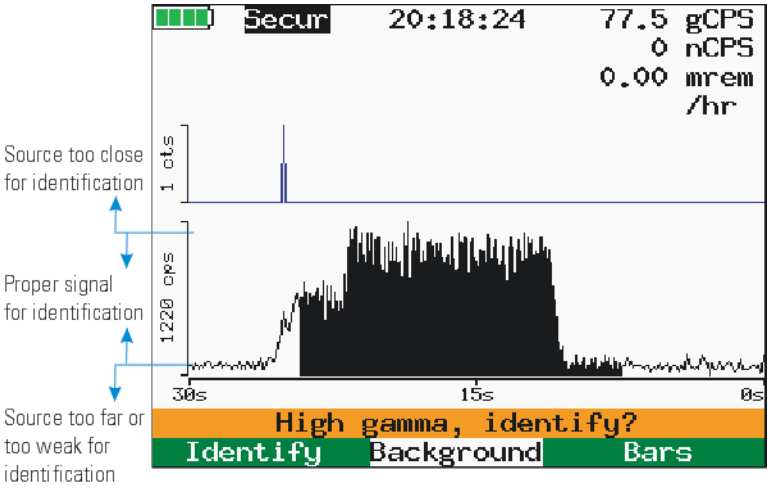


Figure 7: Finder mode, signal strength

Bars Mode

The Bars mode is more advanced and must be enabled in the Administrator menu. This screen displays isotopes in the form of vertical “Bars” where the isotope is identified or its presence seen in real time. This mode also gives isotope category and dose rate in real time. See the Bars Search Screen on page 32 for more details. By default, this mode is not available in the User mode but can be enabled for Users in the Administrator menu.

Spectrum Mode

The Spectrum mode is more advanced (not available to Users according to factory settings) but can be enabled in the Administrator menu. The screen provides a live spectrum and will automatically start to acquire and build time-based spectra when the RIIDEye encounters enough counts to make an ID. This is typically 300 cps or more. See Basic Operation on page 5 for more details.

Identification (ID)

You can identify a detected nuclide from any of the four search modes by highlighting the Identify soft key and pressing ENTER. Make sure that the received radiation signal is in the range for proper identification. If you are too close to the source (high counts) or too far away (low counts), RIIDEye will automatically prompt you to move closer or further away, as required. During the entire acquisition, RIIDEye evaluates the count rate every second and prompts you to adjust your distance if the count rate is too high or low.

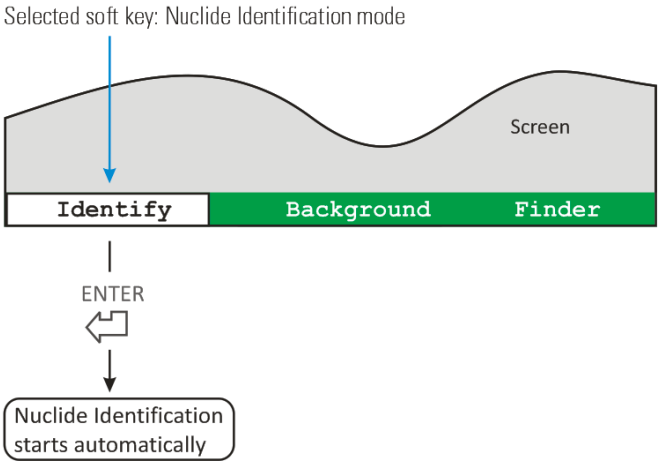


Figure 8: Soft key **Identify** starts nuclide ID

A report displays after the acquisition period. Any isotopes that were identified are shown with a statistical confidence number ranging up to 100%. The RIIDEye bases this confidence number on source strength, length of acquisition, number of energy lines, and statistical factors. The factory default spectrum acquisition time is one minute.

You can adjust this time in the green "Field Settings" menu described on page 57. To increase or decrease the acquisition time, highlight either the + 30 s or – 30 s soft key and then press ENTER. To change the length of time rapidly, press and hold ENTER. To return to the search modes after an ID is made, press the BACK key. To cancel an acquisition in process and return to the last search screen, press **Cancel**. Press **Erase** to clear the spectrum in process and restart the acquisition over again; this also resets the acquisition time to the time prescribed in the Field Settings menu.

SNM Assist

The Real Time Spectral Build during acquisition gives users of RIIDEye a visual indication of the progress the RIIDEye is making to identify radiation.

However, just having the visual progress of the spectral acquisition is not enough to determine if some difficult to detect Special Nuclear Material (SNM) is present. Gamma spectroscopy is a statistical analysis and each identification routine always has a confidence level associated with it, so it is valuable to have a tool that can help you find and identify high risk isotopes.

'SNM Assist' automatically calculates and displays the required scan time (T1 in Figure 9) to positively include or exclude high value, but difficult to detect isotopes Pu, U, and Np. The horizontal line represents a completely accurate identification result. The sinusoidal wave pattern represents the acquired statistics RIIDEye uses to make the identification. As the acquisition time increases, the accuracy of the result increases due to the additional statistics. This is represented by the wave pattern losing amplitude and approaching the ideal accurate identification result. T1 is represented by dose rates of Plutonium (Pu), Uranium (U), and Neptunium (Np).

The factory default is to enable SNM Assist when acquiring a spectrum where the foreground is five times higher than the background. When SNM Assist is enabled, an Administrator can adjust it using the Admin menu (see page 63).

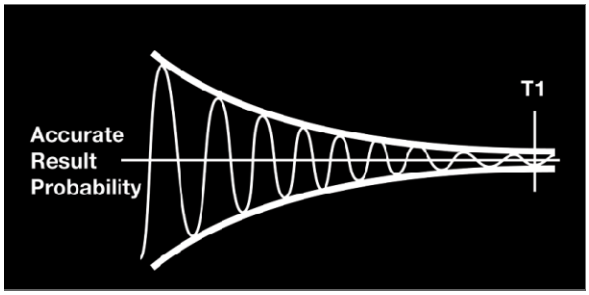


Figure 9: SNM Assist

Menus

You can access the menu from any one of the search modes. Once there, you can access, review, and Reachback stored spectra, instrument settings, parameters, and many other features from the User or Administrator (password-protected) menu. For a detailed description of all menus and menu items, see System Menus on page 51.

Turn Off RIIDEye

Hold down the BACK/POWER key for the countdown of three seconds to turn off the instrument. While the instrument is powering down, the display will show a gray bar with the time remaining to hold down the BACK/POWER key.

Description of Keypad

Figure 10 shows a rendering of the RIIDEye keypad. The keypad is designed to allow operation with the thumb of the same hand holding the instrument and is accessible to people wearing protective gear, such as a level 1 suit and heavy gloves, as well as to both left- and right-handed users.

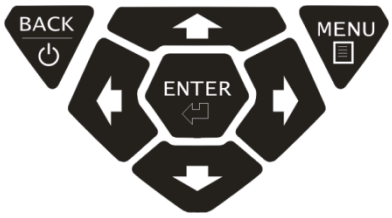


Figure 10: RIIDEye keypad

The following is a brief description of the seven keys and how they are used.

BACK/POWER (⏻) Return to previous screen; exit from menu or report. Use this key to turn system power on and off.

MENU Enter the menu system from any search screen.

ENTER	Select currently highlighted option, such as a soft key or a menu item; also continue to the next step of a multi-step process.
⬅ and ➡	These are the LEFT and RIGHT keys. Use them to select among the soft key options or menu tabs; to move backward and forward in a string entry process; to select among items in a menu choice process; and for various other applications that will be described later in the document.
⬆ and ⬇	These are the UP and DOWN keys. Use them to scroll among menu items; to scroll through reports; to change the current letter when entering a string such as a password; and for various other applications that will be described later in the document.

Description of the Soft Keys

Soft keys, represented by a set of words in a green bar shown at the bottom of the screen, are used to perform many common RIIDEye operations. Figure 11 shows the normal soft keys seen in the Dial search screen with Background currently selected. Press LEFT or RIGHT to move the highlighting to the other soft keys, Identify and Finder. Press ENTER to perform the action specified by the highlighted soft key. In this example, pressing ENTER will start the background process to learn the current radiation background.

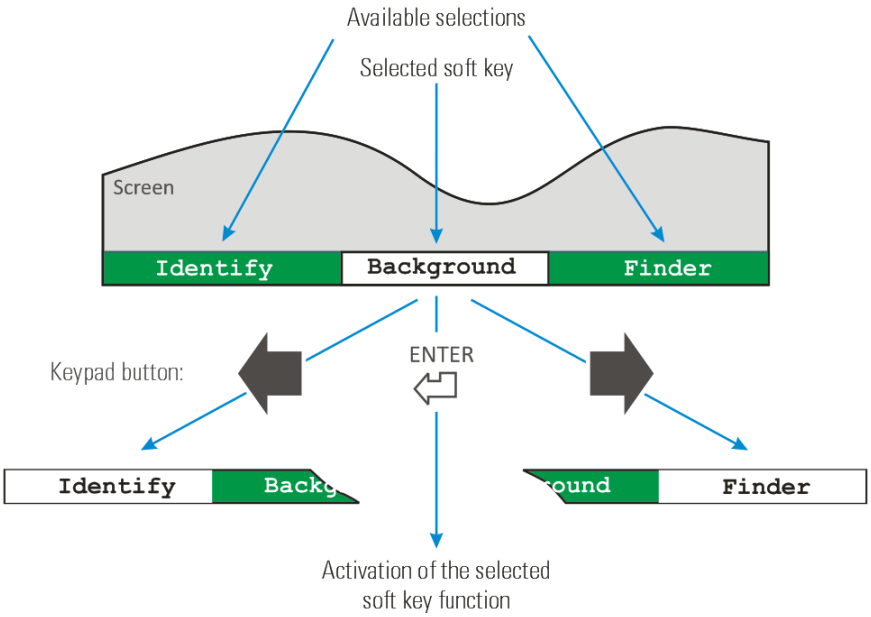


Figure 11: Soft keys

Display Conventions

To make the RIIDEye easier to use, several color and layout conventions are defined for the user interface.

Color Meanings

Table 1: Color meanings

Color	Meaning	Examples
red	Bad condition	Dangerous dose rate, detector failure
orange	Alarm condition	Radiation alarm threshold exceeded (gamma, neutron, dose rate)
yellow	Concern	Calibration incomplete; detector background is lower than stored background
green	Normal	Calibration done, OK to ID

Exception: See Nuclide Classes below.

Count Rate Information

Gamma and neutron radiation are distinguished by color in numbers, dials, and graphs. Gamma elements are black and neutron elements are blue:

Table 2: Count Rate information

Example rate	Description
756 gCPS	Gamma counts per second (g = Gamma)
0.02 nCPS	Neutron counts per second (n=neutrons)

Nuclide Classes

Various nuclide “classes” are defined by their colors, which appear as labels and as filled-in areas in spectra.

Table 3: Nuclide classes color codes

Code	Nuclide Classes
IND	Industrial
SNM	Special Nuclear Materials
MED	Medical
NRM	Naturally occurring radioactive materials (NORM)
UNC	Uncertain*
UNK	Unknown**
C/B	Compton/Scatter/Bremsstrahlung***

* Insufficient data to be sure that peak is present

** Something definitely present but not matched to any currently enabled nuclide

*** Scattered radiation or Bremsstrahlung that results

Soft Keys

Soft keys always display at the very bottom of the screen. A selected function is in black text on a white background. Other available functions are in white text on a green background. Please see also Description of the Soft Keys on page 10 for additional details.

Menus

In most cases, where possible, small arrows are shown on the currently selected item to indicate possible choices of direction. In the example below, on the selected menu tab, you can go LEFT or RIGHT through the menu choices or DOWN into the selected menu's items. For some menu items, you can use LEFT and RIGHT to change the value.

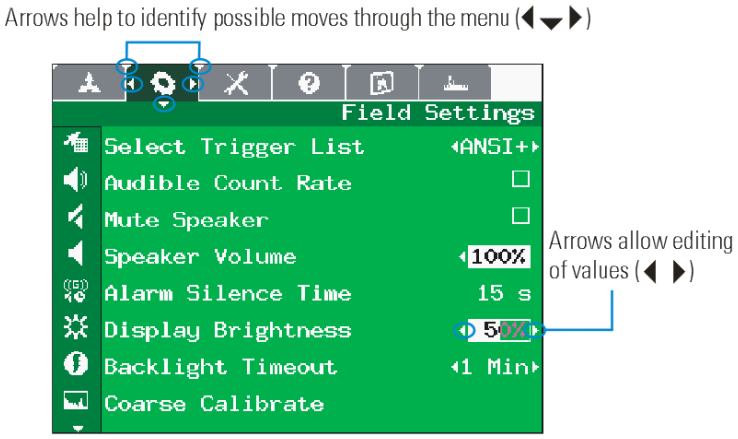


Figure 12: Navigation through the menu

Selected items are indicated by increased contrast versus the individual color of each main menu. The BACK key takes you back to the higher level menu.

Self Test and Status Screen

When the RIIDEye is first powered on, you will see a screen that shows the results of an initial Power-On Self-Test (POST). A properly functioning unit will have a display similar to that shown in Figure 13, although the internal case temperature may vary.

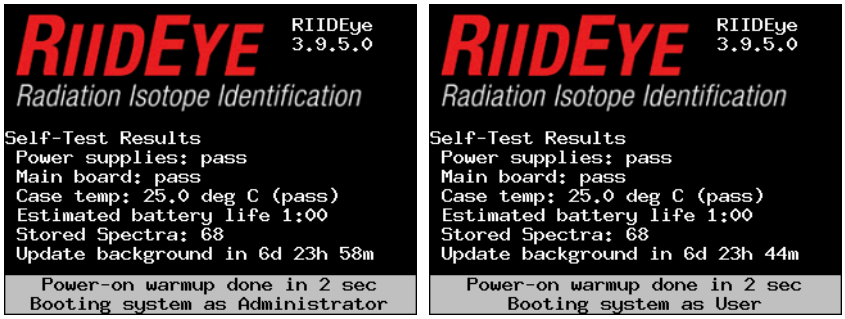


Figure 13: Successful POST screen

The self test reports the following information:

1. Internal firmware version in the upper right corner
2. Power supply test results
3. Main board test results
4. Internal RIIDEye temperature
5. Expected battery life remaining (if not connected to AC power)

6. Number of spectra stored on the instrument
7. Remaining time before a new background is required (configuration item in Configuration on page 59. If a new background is required, a message will display “New background required”. Default is one week.

Note If there are any failures during the self test, they will be reported in red on the screen shown in Figure 13.

As the system warms up, it displays the mode it will boot into once warm-up is completed. If no administrator password has been set, the system will automatically boot into the Administrator mode. If a password has been set, the system will boot into User mode. To Set an Administrator password, see User or Administrator Operation on page 14; to switch between User/Administrator, see Field Settings on page 57.

Entering a Password

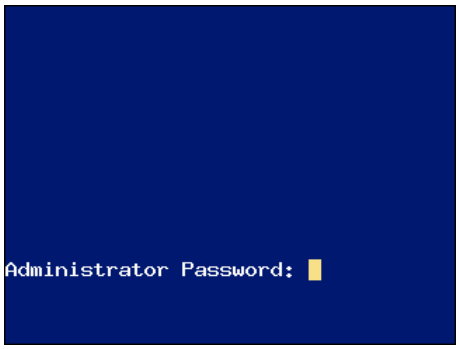


Figure 14: Login screen

Use the UP and DOWN arrows to change the letter at the cursor position when entering the Administrator password. Hold down the UP or DOWN arrow to rapidly scan through the alphabet. Use the LEFT and RIGHT arrows to move within the word. Press ENTER to confirm the entry either while the cursor is at the last correctly entered character of the password or press RIGHT after the password is entered and then press ENTER. As shipped from the factory, no password is active.

Secrecy of the Password

The password letters are displayed on screen because letter selection is made through a series of arrow presses and no QWERTY keyboard is present to definitively identify the letters. To ensure secrecy, enter the password while no one else can see the screen.

Note If the password is lost or forgotten, contact Thermo Fisher Service for instructions on resetting.

User or Administrator Operation

Immediately after the self-test screen, if a password is present in the RIIDEye, the system will boot up in User mode and display the “Dial” search screen. If no password is present, the unit will boot up in Administrator mode.

Note No Login screen will appear *unless* you set a password and switch from User to Admin.

Once a password is set, the RIIDEye will never boot into Administrator mode on startup unless the password is removed.

Table 4: User overview

Login	Target user group	Setup of the device	Password
User	First Line Responder	Perform all the tasks needed in the line of duty	No password
Administrator	Health Physicist / Expert	Set up device for specific applications; additional maintenance functions[1]	Password protected

[1] These modes are designed to comply with ANSI N42.34 *Routine* and *Restricted* modes and IAEA Pub 1240 *Easy* and *Expert* modes.

Connections

The RIIDEye has external connectors for power, communications, and headphones. Some of these are located on the left part of the instrument. Others are hidden behind the battery compartment cover as shown in Figure 16.

Contents

RIIDEye Assembly

A RIIDEye device is comprised of four major components as shown below.

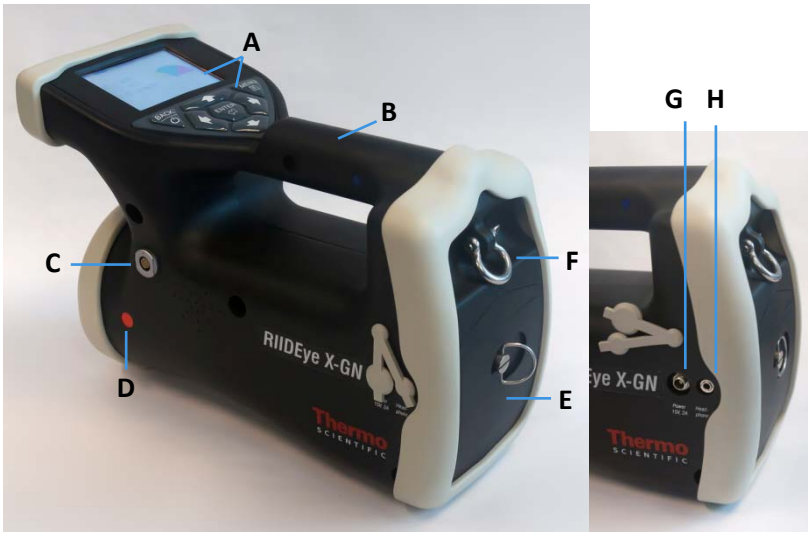


Figure 15: Main components

Legend:	
A	Electronics with display and keypad
B	Optional neutron detector in the handle
C	Reachback port
D	Gamma detector in lower part of housing
E	Battery compartment with battery pack
F	Carabineer (front and back) for shoulder strap and to strap instrument down
G	Power jack
H	3.5 mm headphone jack

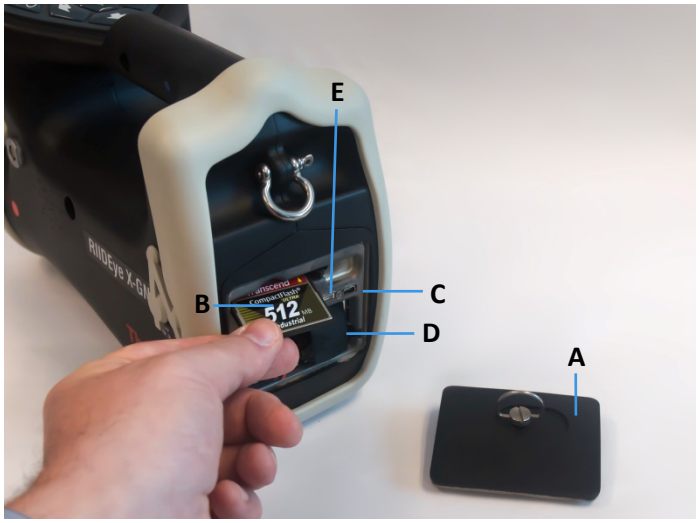


Figure 16: Lower front face of RIIDEye

Legend:			
A	Battery compartment cover	**D**	Battery
B	CF slot (hidden behind CF card)	**E**	Neutron detector calibration and diagnosis connector (Thermo Scientific staff only)
C	USB-connector		

Connecting AC Power

A universal (110-240 V, 50/60 Hz) AC power supply is available for your RIIDEye unit that connects directly to the power connector. This adapter provides power to charge the internal rechargeable batteries while the RIIDEye is turned off or operating. The rolling battery icon keeps you aware of the external power source and the charging progress of the batteries.

Figure 17: Charging the internal batteries with the AC adapter

CAUTION Do not connect the RIIDEye unit to an AC power adapter when non-factory supplied batteries (and especially non-rechargeable alkaline

batteries) are installed in the RIIDEye's battery compartment.

Note For charging in a 12 V DC application (vehicle or boat), you will need to use the 12 V DC charger (P/N 42508/8535) or a small inverter (175 W or larger) with the 15 V DC power supply.

Batteries

Your RIIDEye comes with 2 battery holder and one set storage batteries (8x AA) (Figure 18 below and „D" in Figure 16). Put them into the holder. Look about the polarizations!

Figure 18: Battery holder with assembled batteries

To maintain a long service interval between battery charges, RIIDEye's rechargeable battery pack may require replacement every two years or as needed. Always store RIIDEye with the battery pack fully charged to extend the battery life.

Depending on usage, the RIIDEye will generally run 8 hours on a single charge in ambient conditions between 15 and 25 °C, when the delivered removable battery pack is used.

To open the battery compartment cover, turn the thumb screw a quarter turn counter clockwise.

To remove the battery pack the interlock must be released by pressing the two knobs as shown.

RIIDEye also supports "hot swapping" of the batteries. If you have two sets of rechargeable batteries, you can switch them without losing power to the RIIDEye. To do so, connect RIIDEye to AC power, open the battery cover and change the battery pack as described above. Once complete, remove the RIIDEye from AC power and continue the mission.

CAUTION Be sure to insert the battery pack in the right orientation.

The notch of the battery front plate must be on the low side.

Note Always store RIIDEye's batteries fully charged to maintain the full power capacity of the NiMH batteries.

Spare Battery Holder

Spare Battery Holder can be ordered under P/N 42508/8538

CAUTION Do not attempt to use the RIIDEye charger if alkaline batteries are in the instrument. Damage to RIIDEye may occur.

Optimizing Battery Life

There are several things you can do to improve your battery life:

- Reduce the display brightness as low as possible without affecting your ability to read the display. If operating out-of-doors, you may find that the reflected sunlight is sufficient to read the display even with the brightness at its minimum setting (see Field Settings on page 57).
- Turn off the *Audible Count Rate* and/or *Mute* the speaker (see Field Settings on page 57).
- Shorten the *Backlight Timeout* so that the display darkens when you are not using the system (see Field Settings on page 57).
- Use AC power when connecting to a PC or doing other stationary operations in the office. The unit will automatically run from AC power if it is available (see Connecting AC Power on page 16).

Data Storage and Reachback Options

All RIIDEye X and M models save spectra and background files in ANSI N42.42-2006 format. In addition, RIIDEye contains logging modes for mapping and locating radiological material that can be exported to be read in programs such as Microsoft™ Excel. These files remain in RIIDEye's memory storage until they are manually removed by the administrator.

It is often very important to post process the data and archive it outside of the RIIDEye. In addition, these methods are required to remove data from RIIDEye in order to free up space on the internal memory.

This section will detail three ways this can be accomplished.

- Compact Flash card
- Satellite telephone using RIIDEye Reachback cable
- USB-to-PC using RIIDEye PC Interface cable

Compact Flash Card

Your RIIDEye unit comes with a CF card that serves the following purposes:

- Storage for 4000 spectra in ANSI standard (N42.42) format
- Storage of specific system configuration information
- Easily upgradeable system firmware

Figure 19: CF card with label

CAUTION Do not remove the CF card while the system is running. Removal while system is running may result in loss of data.

Note Do not interchange cards between RIIDEye units; unit-specific calibration data is stored on the card that is necessary for proper operation. See Compact Flash card label.

Turn the unit off if you need to remove the card. Return the card to its slot *before* you turn the unit on again. *This card is specific to your unit and detector.* In fact, the serial number of the electronics is printed right on your particular CF card. Because each unit is factory-calibrated for optimal performance, and this calibration is stored on the CF card, you should never interchange the cards between different units. The

spectral contents of the card should not be erased when transferring from Windows; this should be done within the RIIDEye itself. However, if mass deletion is desired, be sure to only delete files in the “SPECTRA” folder.

RIIDEye has storage for about 4000 spectra files. RIIDEye reports the number of spectra on the CF in its state of health screen on start-up as well as when *Run Self Check* from the green *Field Settings* menu is selected. In addition, RIIDEye warns you when the memory on the CF is 95% full and continues to warn on start-up. If the CF card becomes full, spectra files can no longer be saved. We recommend removing spectra files from RIIDEye as soon as possible to allow for proper backup to a PC.

If you wish to read the saved spectral information on the card using your PC, insert the card into the appropriate slot on your PC or use the supplied USB adapter. See Spectral Data on page 55).

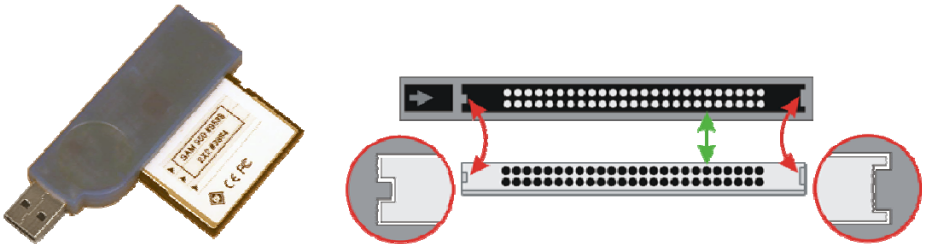


Figure 20: USB Compact Flash card adapter to USB with CF card connector details

Note The CF card has a narrow groove on one side and a slightly wider groove on the other. The opening of the USB adapter has matching guides, a thinner and a thicker one. Ensure that the CF card is pushed gently into the adapter according to this groove/guides arrangement.

The ANSI (N42.42-2006) format-compliant spectra data is stored in the CF’s folder “Spectra”. You can review this data with appropriate software, such as PeakEasy, which is optimized for use with RIIDEye spectra, as well as with the included RIIDView software. Other software capable of reading ANSI N42.42-2006 files can also be used to read RIIDEye spectra.

Satellite Telephone using Reachback Cable

By connecting a RIIDEye Reachback cable (P/N COMA001548) to RIIDEye and a satellite telephone, Reachback will be enabled, allowing spectral files to be sent through a satellite phone.

Compliant Phones and Accessories

- Iridium 9505a (need to purchase data kit from Iridium)
- Iridium 9555 (comes with USB cable)
- Thermo Scientific RIIDEye Reachback cable P/N COMA001548

Note The RIIDEye Reachback cable has a white label with a round serial connector on one end and a female USB connector for the satellite phone on the other.

Figure 21: RIIDEye Reachback cable and serial port

Setup Procedure

1. From the *Admin* menu, select *Serial Mode/Speed* > *Reachback* (see Figure 22).

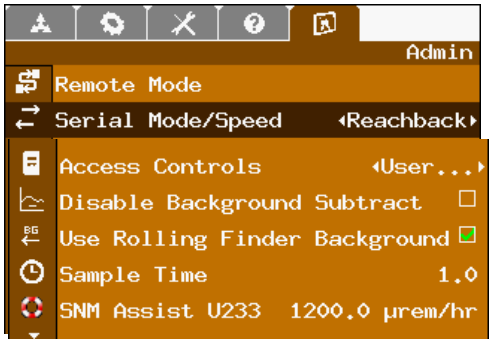


Figure 22: Selecting Reachback in Admin menu

2. The *Reachback Phone#* option displays. From the *Admin* menu, select *Reachback Phone#* (see Figure 23).

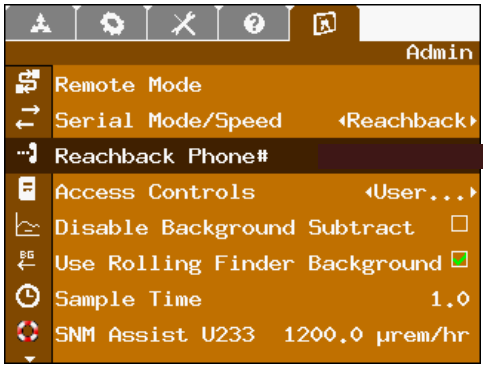


Figure 23: Reachback Phone # in Admin menu

3. Enter the Reachback phone number using the keypad. See your system administrator for the correct number.

CAUTION Reachback phone number can contain numbers, *, #, and commas. Do not enter alphanumeric characters “A-Z” or “a-z”. If you do, the software may freeze and require rebooting of the instrument.

Connecting to a Satellite Phone

1. Connect the RIIDEye Reachback cable, with its white label and female USB connector, to the serial connection on RIIDEye (see Figure 21).
   a. Match the red dot on the cable to the red dot on the round serial connector.
   b. Push the cable connector straight into the RIIDEye connector – do not twist.
2. Connect the USB connector on the Reachback cable to the Iridium phone as follows:
   a. For 9555:
      i. Connect the phone directly to the Reachback cable’s USB connector.
   b. For 9505a:
      i. Connect the phone’s interface cable (supplied with phone) to the Reachback cable’s USB connector.

ii. Connect the interface cable to the RS232 port on 9505a.

3. Make sure that the satellite phone has a clear view of the sky.

4. Press the MENU key to display the *Spectral Data* menu.

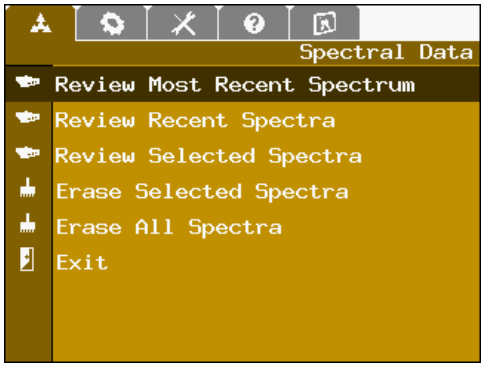


Figure 24: Spectral Data menu

5. Select the desired option and then select Report. The following screen displays.

Figure 25: Satellite connection verification

6. Wait while the connection is verified. When the following screen displays, press ENTER to send the report or BACK to view the report without sending.

Note It may take several seconds (<5) after pressing ENTER before the RIIDEye displays the next screen. During this time, communications are being established between the RIIDEye and the Reachback cable.

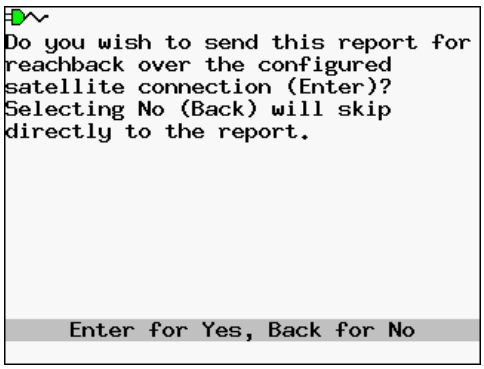


Figure 26: Send or view report

USB to PC using PC Interface Cable

The USB connection port (see Figure 27) is used for service and diagnostic purposes only. However, RIIDEye is able to connect to a USB port of a PC using the RIIDEye PC Interface cable (COMA001568). The cable, with its black label, has a male USB connector for connecting to a PC. This establishes a “push” data connection where RIIDEye can push files to a PC; however, no files can be uploaded to RIIDEye in this configuration.

To upload data, simply connect the cable to a PC USB port and your RIIDEye. From RIIDEye, review the spectra and when prompted, Reachback the data. Allow up to 30 seconds for the RIIDEye to recognize the cable.

Note Reachback does not remove spectral files from RIIDEye. To delete these files from RIIDEye directly, use the Erase command. Otherwise, remove the CF and then use Windows Explorer to select and delete them.

Figure 27: RIIDEye PC Interface cable and serial port

Note The RIIDEye PC Interface cable has a black label with a round serial connector on one end and a USB connector for the PC on the other.

Setup Procedure

1. From the *Admin* menu, select *Serial Mode/Speed* > *Reachback* (see Figure 28). Ignore the Reachback Phone# selection when it appears.

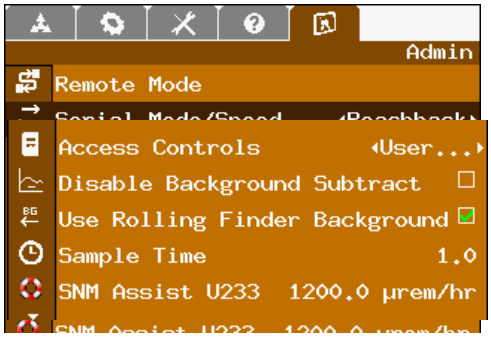


Figure 28: Selecting Reachback in Admin menu

Connecting a RIIDEye USB port to a PC

1. Connect the RIIDEye PC Interface cable, with its black label and male USB connector, to the round serial connection on RIIDEye (see Figure 27 above).
    a. Match the red dot on the cable to the red dot on the serial connector.
    b. Push the cable connector straight into RIIDEye connector – do not twist.
2. Connect the USB connector on the PC Interface cable to the USB port on the PC.
3. Press the MENU key to display the *Spectral Data* menu.

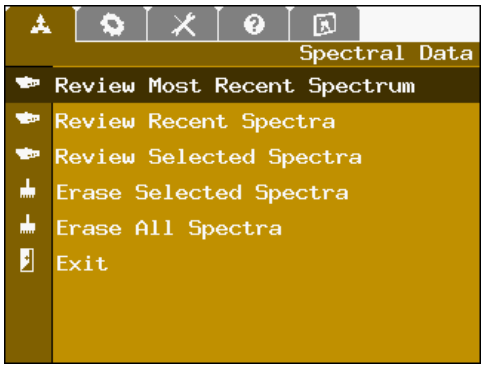


Figure 29: Spectral Data menu

4. Select the desired option and then select Report. Wait while the connection is verified. When the following screen displays, press ENTER to send the report or BACK to view the report without sending.

Note It may take several seconds (<5) after pressing ENTER before the RIIDEye displays the next screen. During this time, communications are being established between the RIIDEye and the PC Interface cable.

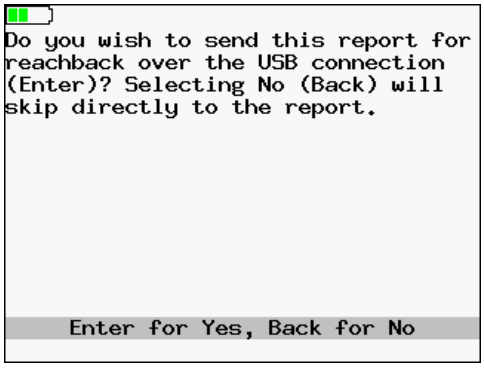


Figure 30: Send or view report

Connecting a RIIDEye X to a GPS device

To connect an ecternal GPS to RIIDEye X, you will an interface cable and a compatible GPS device. Both is included in the RIIDEYE X EXTERNAL GPS-KIT (42508/8536).

1. Connect the cable to the RIIDEye X and the GPS device.

2. From the Admin menu, select *Serial Mode/Speed > GPS NMEA*.

For more information, see the RIIDEYE X EXTERNAL GPS-KIT manual.

Data from the GPS will be sent to RIIDEye X for inclusion into the logging file (see on page 68). It is also recorded in the N42 files.

Note: A Thermo Fisher GPS license is required to make the GPS NMEA option available. For help with setting up for GPS communication, contact Thermo Fisher Customer Service (see page xiv). You will need your RIIDEye's serial number. If the GPS offers multiple output formats, use the GPS user manual to configure it for 4800 bps NMEA.

General Operation

The following sections describe the standard operating procedures for the system including the different operating modes.

Contents

Connecting the Shoulder Strap

RIIDEye X are equipped with carabineer hooks to accommodate the included shoulder strap. Connect the shoulder strap to the front and back carabineers and wear the RIIDEye on your shoulder to facilitate hands free carrying. Alternatively, you can remove the shoulder strap and use the carabineers to secure RIIDEye to a backpack or case for added security during missions such as ascending/descending ladders or on extended horizontal-based missions.

Turning the Power On and Off

Turn on the RIIDEye by holding down the BACK/POWER (⏻) key for at least one second. The instrument will automatically begin a self-test and indicate the status on the screen. In the following example, taking a new background is recommended.

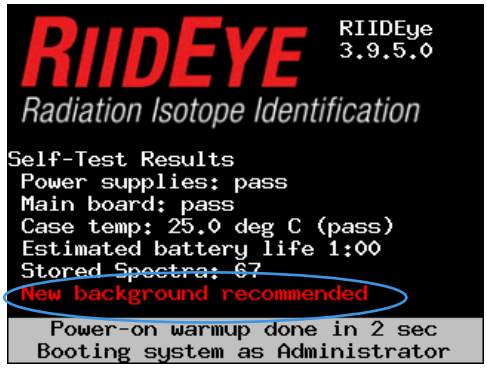


Figure 31: Status screen

Turn the RIIDEye off by pressing and holding the BACK/POWER (⏻) key. After one second, a message displays and counts down three seconds before the system turns off. Release the key.

Enforced Power Down

In the rare event of a system lock-up, hold the BACK/POWER (⏻) key down for a longer period of time (approximately 10 seconds) to engage the fail-safe power-down mechanism and to force a power down.

Safety of Data and Date/Time Information

Whenever the RIIDEye is turned off, all information is saved on the CF card, allowing you to restart the instrument without losing calibrations or other information. The real-time clock has a separate internal lithium battery that keeps it running even when there is no other power source.

Detector Stabilization Period

Sodium iodide detectors normally stabilize about 10 minutes after the power is turned on, assuming a stable temperature environment. However, the RIIDEye has a built-in stabilization feature that will generally complete operating point stabilization within two minutes. During this time, the device will display an informational message at the bottom of the screen indicating that a calibration is in progress (see Figure 32).

Note In a high radiation background area, AutoCal may take up to four steps to fully calibrate. If AutoCal fails to calibrate, move to a lower background area and restart RIIDEye. If AutoCal still fails to calibrate, consider performing a Coarse Calibration with either Cs-137 or Lu-176 as defined in Coarse Calibration (Gain, Offset) on page 47 or contact Thermo Fisher Scientific customer service (see Contacting Us on page xiv.

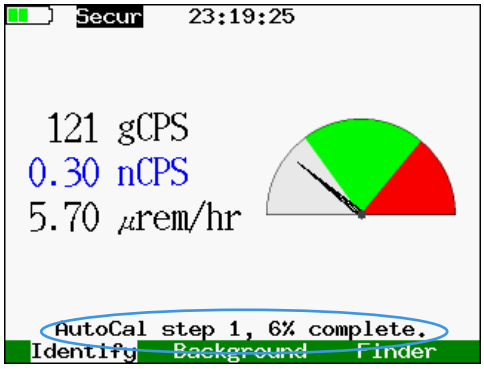


Figure 32: AutoCal information text

Although in an emergency, data can still be collected while the unit is stabilizing, the built-in analytical software may not make correct identifications during this time. When the informational message at the bottom of the screen goes away, the system is ready to use.

When the AutoCal step progress meter completes, RIIDEye displays *AutoCal Complete!* in green. It displays this message for about 10 seconds before disappearing. The process from start up to completion of the initial AutoCal process takes about one and a half minutes (1:30) in a stable low background (fewer than 200 cps). Above 200 cps, additional AutoCal steps may be required and the process will take about two minutes to complete.

CAUTION Do not attempt to take a new Background *until AutoCal completes*. Taking background before AutoCal completes could adversely affect the identification performance of RIIDEye.

Search Screens

The “search” screens are the modes normally used to detect the presence of radioactivity and to determine its location. They respond quickly and make it easy to tell if something has changed but give less detailed analytical results. In these modes, the instrument continuously takes readings, searches for isotopes, and analyzes them for dose rate and other measurements.

There are four search modes available: *Dial*, *Finder*, *Bars*, and *Spectrum*. Only *Dial* and *Finder* are enabled by default when logged in as User. However, the Administrator can change which screens are enabled, so that it is easier to quickly access the most important information for your particular response plan. To learn more about enabling and disabling features, see Admin on page 63.

There are a number of common elements that appear on all of the search mode screens.

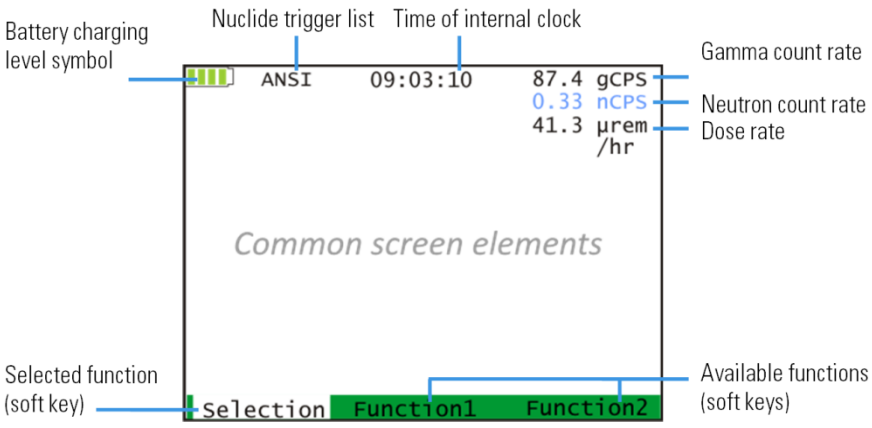


Figure 33: Common screen elements on search screens

Press the ENTER key to execute the selected function.

Note It is important to have the time of the internal clock set correctly, including your time zone, so that the stored spectra will have the correct time recorded.

Dial Search Screen

The *Dial* screen provides a quick visual indication, similar to that given by a handheld dose meter or Geiger counter, showing the intensity of radiation being measured. For more information, see General Concept of Use on page 42. The position of the dial's pointer refers to the displayed count rate.

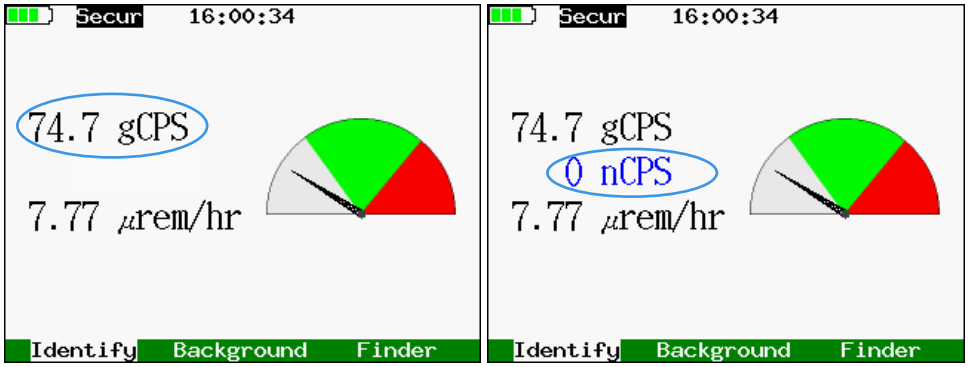


Figure 34: Dial search screens – gamma only on left, gamma and neutron on right

At the bottom of the screen you will see three soft keys: Identify, Background and one additional choice[2] that will move you to the next search display screen. In this example, it is Finder.

[2] On systems where only one search screen is allowed by the administrator, only the first two keys will be shown.

Gamma Dial

The signal from the radiation present may not be sufficient for the identification of nuclides when the dial pointer is in the gray area. For example, this could occur if the RIIDEye is used to scan an area where the current radiation level is caused by normal background radiation only.

The contribution of a source is sufficient for an identification process if the pointer of the large gamma dial moves up into the green area. When the pointer is in the green area, an Identify operation (described in Identifying Sources of Radiation on page 34) should be started. Finally, if the pointer moves into the red area, the activity is too high for a correct identification. If you can, move back from the source before you try to identify it.

CAUTION A source that reads in the red area may be hazardous. *Move back* from the radioactive source, if at all possible, before attempting to identify it.

Gamma Reading

The gamma reading is shown in “gCPS” and indicates a digital reading of the gamma dial. It reports the gamma counts every second; it is normal for the reading to be ± 50 cps.

Neutron Reading

The Neutron reading only appears on RIIDEye variants with a built-in neutron detection extension. It displays in blue text below the Gamma indication (see Figure 34).

Dose Rate

Below the gamma and neutron readings, RIIDEye displays a dose rate. The dose rate is an instantaneous representation of the current radiation dose. The units of measure are configured in the blue *Configuration menu*, *Dose Rate Scale* (see Configuration on page 59).

Finder Search Screen

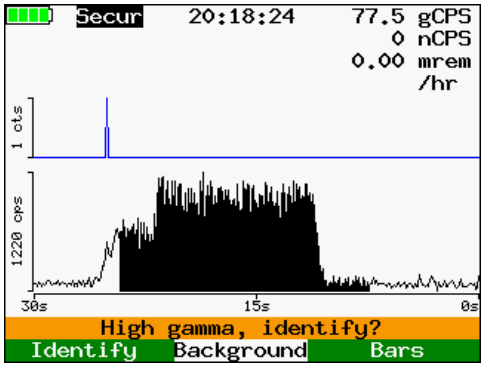


Figure 35: Finder search screen

Once you have located the source, tap the Identify soft key to begin the ID process, just as you would with the Dial screen.

Like the Dial screen, the Finder screen shows all count rate-based information and dose rate in the upper right corner. The time plot has time in seconds on the X-axis and an auto scaling counts per second (cps) on the Y-axis. There are two plots, one for gamma and one for neutron cps (if equipped with a neutron detector).

When the gamma count rate is high enough to make an ID, the area under the line plot is colored black (see Figure 35). When paired with audible clicks, locating a source can be done very easily. As you approach a source, the count rate rises. The higher the cps (peak in the Y-axis) the closer to the source the RIIDEye is. As RIIDEye moves away from the source, the counts fall (see Figure 35).

You can adjust the recorded line graph by tapping the UP or DOWN arrows on the keypad to display from a minimum of 0-15 seconds to a maximum of 0-2 minutes.

You can use this mode to find a good position to perform an Identify operation. The "low" area shown on the screen corresponds to the gray area on the Dial screen; the "ID" area matches the green portion; and the "high" area matches the red portion. Identify is most effective when the top of the rolling chart falls in the ID area (see also General Concept of Use on page 42).

Bars Search Screen

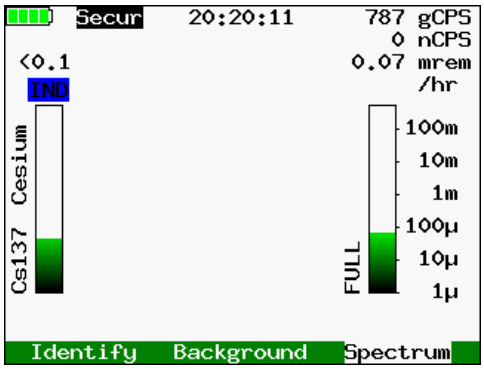


Figure 36: Bars search screen

The *Bars* screen provides a different view of the information. In a normal background, the *Bars* screen displays a "FULL" bar on the right side of the screen. The green fill in the bar is similar to a thermometer, but which indicates the current dose rate. When radiation is present it will immediately attempt to identify it and quantify it by placing additional bars for any isotopes identified on the screen (Figure 36). As the dose rate increases, the bar will fill in, providing an indication of what radiation is present and which isotopes are contributing to the overall dose rate.

The symbol and name of the isotope are listed to its left. Above each bar is a "class" indication (see Nuclide Classes on page 11).

Search Screen Spectrum

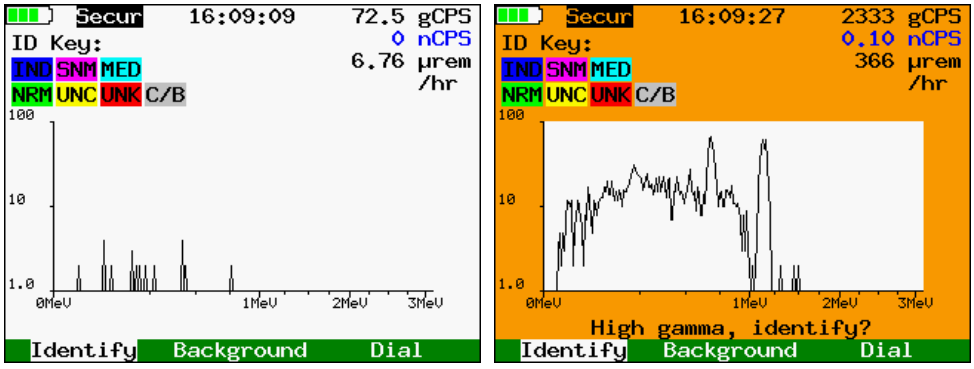


Figure 37: Search screen spectrum – no radiation on left, radiation present on right

The *Spectrum* screen is designed for users with a Health Physics background[3] to see the data collection and statistics in real time. This screen provides a dynamic display for this particular set of users.

This screen provides a live spectrum and will automatically start to acquire and build time-based spectra when the RIIDEye encounters enough counts to make an ID. This is typically 300 cps or more.

This screen is useful only if you want to monitor spectral building from one screen. Disabling this screen will not reduce functionality of RIIDEye because field data can be acquired through:

- Location of radiation: Dial or Finder
- ID: Tap Identify to ID the radiation source

Audible Search Setting

Using the audible output can increase awareness of the location of high radioactivity. The *Audible Count Rate* setting in the *Field Settings* menu (see Field Settings on page 57 for details) turns on a click that increases in frequency along with the input count rate. This sound continues as long as the instrument is collecting data and also gives feedback when you are in menus and other screens that do not show count rate information. For best results in the field, use headphones to hear the audible clicks distinctly.

Note	Enabling the *Audible Count Rate* may noticeably reduce your battery life.

Radiation Alarms

RIIDEye contains four configurable radiation alarms which are all detailed in Configuration on page 59:

[3] Certain changes in the spectrum shape, such as that produced by beta particle interactions, can be interpreted by the trained eye, even when it cannot be identified by the automated algorithms.

- Dose Rate Alarm Level -- System alarms when a Dose rate threshold is exceeded
- Dose Rate unsafe Level -- System sends an additional warning to move away due to dangerous dose rate levels
- Gamma Rate Alarm -- Alarms when the gamma CPS exceeds a threshold
- Neutron Rate Alarm -- Alarms when the neutron CPS exceeds a threshold

When an alarm is triggered, the screen turns orange and prompts the user to perform an ID. The type of alarm that was triggered is noted at the bottom of the screen (see Figure 38). At the same time, RIIDEye sounds an audible tone and triggers the vibration motor in the handle.

To silence the alarm, (vibration and audible) press any key. You can configure the time that the unit stay silenced in the green *Field Settings* menu under *Alarm silence time*. The default is 10 seconds. The screen will continue to be in an alarm state until the source has been removed or the source has been rolled into the background (if *Rolling Finder Background* mode is turned on).

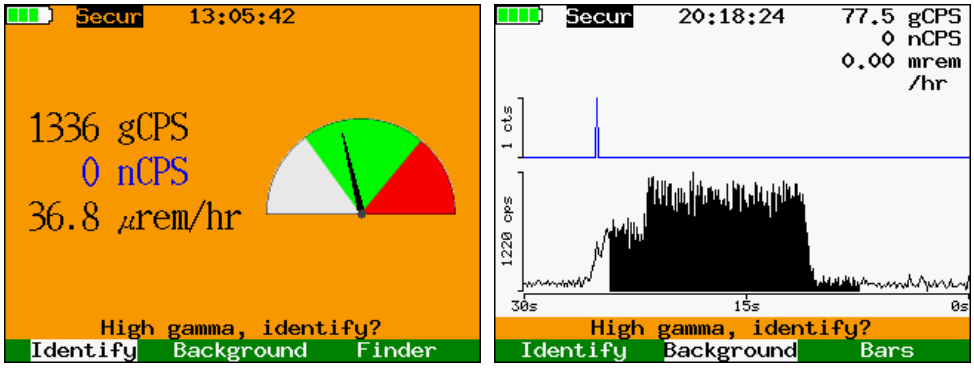


Figure 38: Alarm on Dial screen and on Finder screen

Identifying Sources of Radiation

The RIIDEye can analyze radioactive material that was located by previous actions.

Trigger list

The system has an internal library of over 46 nuclides. However, at any given time, only the subset defined by the current *Trigger List* is enabled. You can change to different trigger lists by using the *Select Trigger List* item in the *Field Settings* menu. This is described in more detail in Field Settings on page 57.

There are five standard trigger lists included inside RIIDEye:

- ANSI - contains all isotopes required for ANSI N42.34-2006 compliance
- ANSI+ - includes ANSI trigger list plus seven other industrial and SNM isotopes
- Medical - contains isotopes used in medical treatments
- Industrial - contains isotopes found in industry and nuclear power

- Security - contains all of the isotopes in RIIDEye library

At times a custom trigger list may be desired. Contact Thermo Fisher Customer Service for support in generating new trigger lists (see Contacting Us on page xiv).

Starting the Nuclide ID

To collect data for identification (ID), simply select the Identify soft key on the search mode screen. The system will immediately begin to collect data for identification. RIIDEye will move into one of two screens, depending on the configuration: (1) a standard live spectrum building with SNM Assist or (2): Simple. You can access this configuration item from the *Admin* menu > *Access Controls* menu (see Admin on page 63).

Example of each are displayed in Figure 39. During spectra acquisition, RIIDEye monitors the count rate every second. If the count rate becomes too low (gray area of the dial) for a reliable ID, the screen will flash “MOVE CLOSER” (see top half of Figure 39). If the count rate becomes too high (red area of the dial), the screen will flash “MOVE BACK” (see bottom half of Figure 39.

Figure 39: Spectra acquisition – Standard on left, Simple on right

Colored Areas in the Spectra

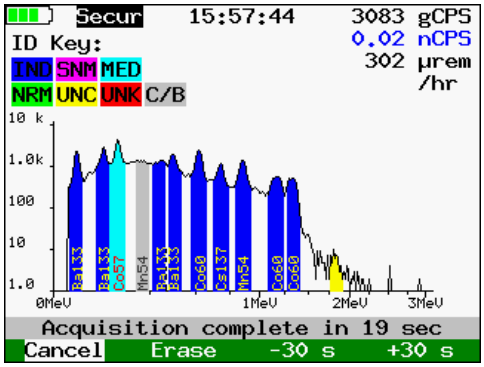


Figure 40: Screen ID of isotopes – Ba-133, Co-57, Co-60, and Mn-54

Figure 40 shows an example of a multiple isotope spectral acquisition, including Ba-133, Co-57, Co-60 and Mn-54. As soon as the system has identified the nuclides present, it colors the peaks with their appropriate class color (see also Nuclide Classes on page 11).

In this example, peaks identified as Ba-133, Co-60, and Mn-54 are colored blue (IND=industrial) and labeled with the name of the nuclide found. There is one peak colored gray that was originated by backscatter effects of Mn-54; it is labeled Mn-54. In addition, there is one light blue peak for Co-57 (MED = Medical). Lastly, there is one remaining peak colored yellow for UNC (uncertain).

Yellow Peaks (UNC)

Do not be concerned if some parts of the display are marked in yellow – this is an indication that the system is uncertain whether there is an actual signal or "peak" present in the spectrum. If you wish to eliminate these uncertainties, you can extend the collection time by using the +30 s soft key until the uncertainty has been resolved.

The value in RIIDEye's real time spectra build is the ability to customize the scan time to each scenario to which RIIDEye is exposed. One way to monitor the spectrum acquisition is to watch for the presence of yellow UNC peaks. Depending on the source, location, and background, the yellow peaks can be resolved by adding between 30 and 120 seconds. When paired with SNM Assist (see SNM Assist on page 8), you can be highly confident in the accuracy of the results.

Red Peaks (UNK)

If there is a definite peak that does not match any nuclide on the current trigger list, it will be labeled in red for unknown (UNK). If this occurs, you may achieve more conclusive results by re-analyzing the data with a different trigger list to see if can match the relevant nuclide (see Trigger list on page 34).

To reanalyze with another trigger list, simply change the trigger list in the green Field Settings menu. Once the trigger list has been changed, review the spectra using the Spectral Data menu. The results of the scan will automatically be reanalyzed with

the newly selected trigger list and the revised results will display in the report and in the graph.

Analysis Report

When identification is complete, RIIDEye presents an analysis report. If the report is longer than the available text lines per one screen page, then a scroll bar will appear on the right. The analysis report gives the results of a detailed analysis of the collected data. An example of this is shown in Figure 41.

This report provides all of the needed details for a Reachback voice call, because it details:

1. Nuclide ID, class, and confidence
   Nuclides are listed in order of importance by class:
   a. Special Nuclear Material (SNM)
   b. Industrial (IND)
   c. Medical (MED)
   d. NORM
2. Acquisition time
3. Total Dose Rate
4. Gamma and neutron total counts for the acquisition
5. Gamma energy lines associated with each ID and their associated sigma confidence

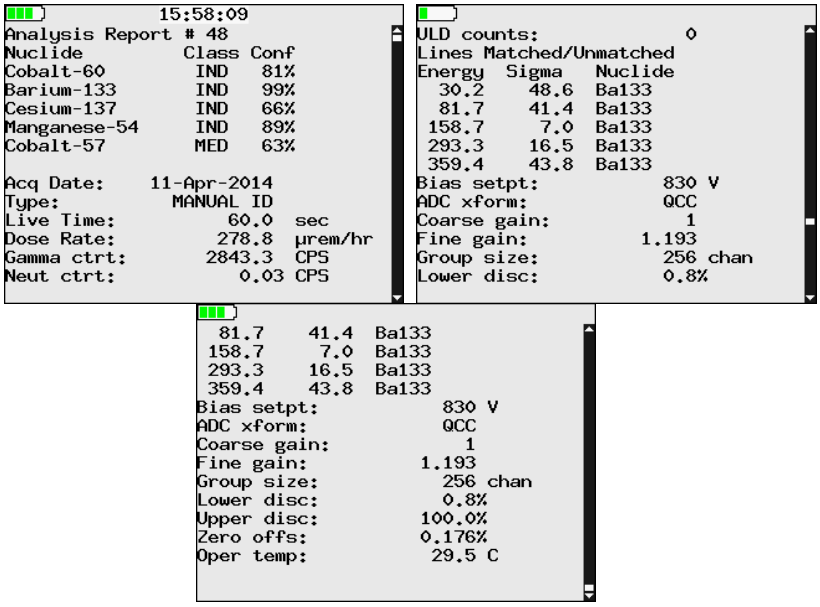


Figure 41: Report screen (top section on left, scroll down center and right)

Table 5. Legend of report's line items

Line item	Description
Analysis Report #	Running number
Nuclide / Class	Identified nuclide class (e.g., IND = industrial)
Nuclide / Conf	Level of confidence that the identification result is true
Acq Date:	Date when the identification was performed
Type:	Type of measurement
Live Time:	Duration of the identification process
Dose Rate:	Measured dose rate during the identification
Gamma ctrt:	Count rate of the received Gamma signal
Neutron ctrt	Count rate of the received Neutron signal
ULD Counts:	Upper Limit of Detection: Counts above 3 MeV
Lines Matched/Unmatched	Found/not found in nuclides/peaks table
Energy:	Gamma energy of the listed nuclide/peak
Sigma:	A higher number indicates higher statistical significance
Nuclide:	Name of the identified nuclide
Bias Setpt:	High voltage of the detector
ADC xform:	Analogue/Digital Converter - Always QCC
Coarse or Fine gain:	This number is what AutoCal Adjusts
Group size:	for NaI its 256 and LaBr its 512
Lower disc:	% of full spectrum below which spectral information is not captured
Upper disc:	% of full spectrum above which spectral information is not captured
Zero offs:	% of the spectrum by which the zero point of the spectrum is offset
Oper temp:	Internal operating temperature of the instrument

Note Portions of this screen can be hidden or shown by checking or unchecking the appropriate boxes in the *Access Control* menu within the *Admin* menu (see page 63).

Storing, Reviewing, and Erasing Spectra

Spectra are automatically saved whenever an Identify process is completed. Spectra are also saved for each background taken and for certain other operations such as fine energy calibration.

The RIIDEye can store nearly 4000 spectra in its “catalog.” Each stored alarm consists of a spectrum and all the information necessary to analyze it. They are stored in a standard format designed to comply with ANSI N42.42-2006.

These files, saved in RIIDEye with extension *.n42 can be read after exporting to a PC with the included RIIDView SW package or other PC-based spectral viewing and manipulating tool such as PeakEasy (see Figure 42).

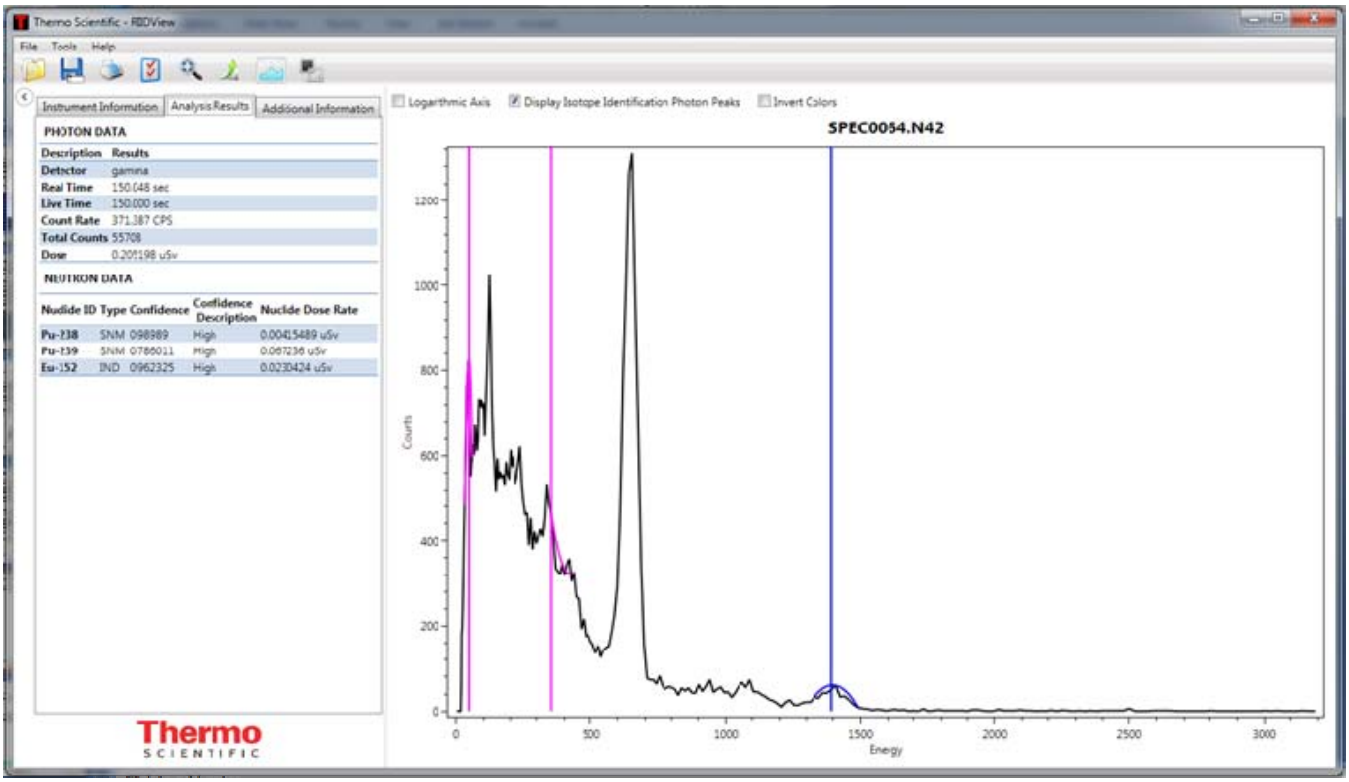


Figure 42: RIIDView screen

After viewing the spectra in RIIDView, you may wish to generate a PDF report. RIIDView has ready-made data entry fields, lets you add a photograph, and prints conveniently on one page.

You can review and (when desired) erase these spectra using the Spectral Data menu, described in detail in Spectral Data on page 55. By default, both User and Administrator can erase spectra. To prevent users from deleting spectra data, disable this feature in the *User Access Controls* menu under the *Admin* menu (page 63).

Taking a Background

In an environment with known sources that should not be detected, it may be desirable to acquire a background spectrum before taking additional measurements. In environments without peaks except for the K-40 peak, taking a background spectrum is not required and does not improve identification capability.

However, backgrounds should be taken regularly to ensure that the background being subtracted is of the same quality as the spectrum being acquired. As gamma

scintillation detectors age, resolution Full Width Half Max (FWHM) increases. For RIIDEye to maintain its class-leading identification capability, regular backgrounds need to be taken so that the FWHM of the spectrum matches the background that is being subtracted during the ID process. Your natural background and operational procedures will dictate the frequency of background acquisitions. RIIDEye factory default is one background per week.

The ambient background spectrum is stored and then subtracted from all other collected spectra on a channel-by-channel basis before they are analyzed. The spectrum shown during spectrum acquisition is always without background subtraction; however, the identification of peaks during acquisition and in the report is based on the spectrum with background subtracted. Background subtraction can be disabled in the menu (see Admin on page 63).

Before beginning, insure that AutoCal has completed (either by viewing the green *AutoCal Complete!* note (see Figure 43) or confirming that there is no *AutoCal Step...* displayed.

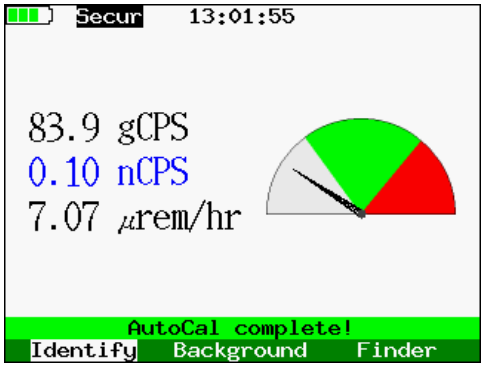


Figure 43: AutoCal complete message

It is easy to take a new background on the RIIDEye. If background subtraction is not disabled, select the Background soft key and press ENTER three times in response to the questions that will follow. First, the system will remind you to ensure that any known sources of radioactivity are properly stored or shielded (see Figure 44). When you are ready, select Background. If you need more time, you can use the soft keys to Wait or even Cancel if necessary. If the countdown completes, the system will continue for you.

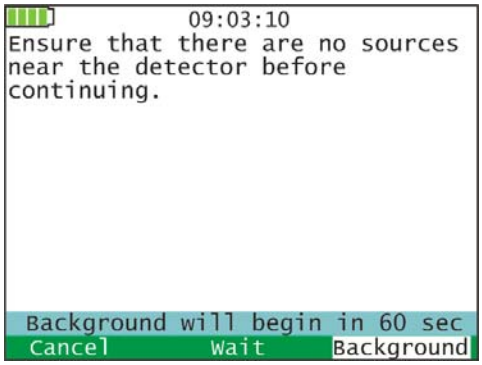


Figure 44: Collecting background - instructions to remove sources

Once you continue, you will see a display like that shown in Figure 45. Initially, the graph will be fuzzy (due to lack of statistics), but it should smooth as time goes on. If you wish to collect a longer background, you can increase beyond the default time by selecting +30 s; hold down the ENTER key to rapidly increase the collection time. You also have the option to shorten the collection time (-30 s), to Cancel at any time, or to Erase (for example, if you believe that you have forgotten to shield all sources in the vicinity). When this new countdown completes, the system will be ready for operation. Factory default background acquisition time is one minute.

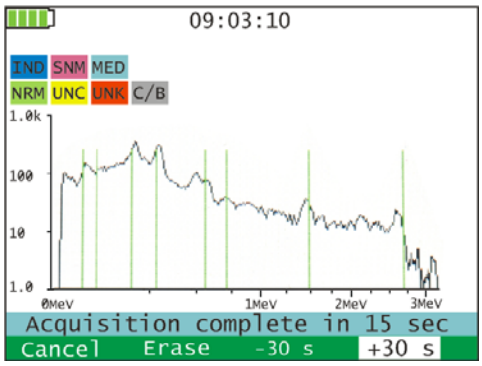


Figure 45: Collecting background – typical spectrum

Note Because the counting statistics in the background spectrum directly affect the uncertainty in the analyzed spectra, the background should be counted for as long as or longer than the acquisition time for IDs. Adding additional time will refine the statistics and discount any stray counts that may cause a “false peak” in the spectrum. Reducing the time will increase the exposure to stray counts and potential for “false peaks” in the spectrum.

Normal readings will have significant variations based on location and detector size. As you use RIIDEye in your environment, you will gain experience in understanding your background, especially what a normal gamma CPS range is.

The most likely causes for high background readings are:

- Presence of radioactive materials near the system in the form of samples or standards
- High concentrations of natural radioactive material such as K-40 in the building materials

Less likely causes include:

- High radon levels

Background subtraction can be enabled or disabled in the Admin menu (see Figure 64 on page 63). Enabling background subtraction will cause RIIDEye to only identify and post statistics for isotopes not present in the background. By disabling background subtraction, all isotopes detected will be displayed, including the intrinsic K-40 source as well as any isotope regularly present in the background (building materials and so forth).

Note Enabling or disabling Background Subtraction will not affect RIIDEye's ability to detect or identify any radiation isotopes normally in the background. Enabling

Background Subtraction will prevent the isotopes from being reported in the spectral analysis report if they do not contribute at least three times the count rate to the background. We highly recommend enabling *Background Subtraction* for –H and –HN units because of intrinsic background in the LaBr detector.

General Concept of Use

The RIIDEye is typically used to support a three-step process for the identification of radiation threats.

Table 6. Three-steps concept

Step	Search screens				ID screen
	Dial	Finder	Bars*	Spectrum *	Identify
1. Survey	++	+	+		
2. Location	+	++			
3. Identify			+	+	++

++ Excellent
\+ Good
* Not available in User level according to factory settings

❖ **Step 1: Survey**

Surveys can be conducted using either the Finder or Dial screens. For convenience, instrument starts in the Dial screen with each power cycle. Determine the area you will be surveying. Walk the area, taking time to fully cover the area, looking for radiation alarms. Be vigilant to get as close to objects requiring scanning as possible. Sometimes this step is performed by larger “portal monitors” such as Thermo Scientific ASM IV and V, LFM3, and SGS series.

The result of this process is either a radiation alarm or the knowledge that a certain area or objects that are or had been in a surveyed location are clean (not contaminated with radiation).

Note Small but nevertheless significant radiation contributions from hidden sources of radiation may not move the pointer into the green area of elevated radiation, but you can use the count rate information to guide you in the direction of a potential threat. It is important to set a sensitive alarm set point in reference to the current background when surveying and to use a sensitive setting of the gamma count rate alarm.

CAUTION An increase of the neutron signal within an area must be always taken as a serious indication of an artificial source of radiation because the presence of neutrons in nature is very rare.

- **Step 2: Location**

  If there was an alarm during Step 1: Survey, the next step is to locate the source of the radiation. Using the *Finder* screen as well as turning on the audible count rate will allow RIIDEye to quickly find the source. Scan the area where the survey alarm happened. As the line graph displays increasing counts and the audible count rate increases, you will be approaching the source. Pay attention to the dose rate and the Finder line graph. RIIDEye will track your dose rate and alarm if the dose rate exceeds a user-settable threshold. Once the area under the line graph is filled in black, continue to Step 3. Alternatively, you can also use the *Dial* screen. When the dial moves to the green area on the display, move to Step 3.

- **Step 3: ID**

  To perform an ID, tap the Identify soft key. RIIDEye will immediately display the building spectrum if in Standard interface mode or an acquisition countdown if in Simple mode. Once the acquisition completes, RIIDEye will automatically generate a report suitable for telephone Reachback detailing the isotopes found and associated information. To Reachback using USB or Satellite, follow the instructions in

Data Storage and Reachback Options on page 19.

Calibration

The RIIDEye implements three methods to ensure the accurate determination of the energy of a peak. The identification capability of every radioisotope identifier device relies on the accuracy of peak energy determination.

Contents

The following table gives an overview of these methods. Details are described in the following sections.

Table 7. Calibration methods

	Nuclide	HV	Gain	Offset	Poly-nom	Comment
Coarse Calibration (Menu activated)	Cs-137 or Lu-176	X	X	X		Requires unshielded Cs-137 source
Fine Energy Calibration (Factory only)	Eu-152 Co-57/ Cs-137/Co-60				X	Uses a number of peaks to linearize energy calibration
AutoCal at start-up and continuous while RIIDEye is powered on	K-40 X-G & X-GN La-138 X-H & X-HN		X			Gain adjustment so that K-40 peak is at 1461 keV or La-138 peak is at 1436 keV

AutoCal

The built in auto calibration routine using the embedded K-40 source is capable of stabilizing RIIDEye's energy calibration across all temperature variations. During

start-up, the AutoCal routine calibrates the RIIDEye by placing the K-40 energy peak for NaI detectors and the La-138 peak in LaBr units at the correct energy and applying the gain corrections across the entire energy spectrum.

Depending on the radiological background, AutoCal may take up to four steps to completely calibrate.

Note Attempting to make a gamma identification before AutoCal completes for the first time may yield inaccurate results. In addition, upon completing or cancelling the identification, the initial AutoCal process will start over.

Normally, the built-in AutoCal mechanism using the K-40 source is capable of stabilizing the instrument's energy calibration.

You can confirm proper operation of the AutoCal process by checking for the K-40 peak position (background subtraction disabled). The RIIDEye performs an AutoCal at each start-up and continually during operation as long as no other sources near the K-40 peak are detected (see Figure 46). To optimize peak identification, leave the instrument powered on for at least ten minutes at a stable background location. The K-40 peak should then be within a ±0.25% range (1457 keV … 1465 keV) of true position.

Note The *AutoCal complete!* message displays both after startup completes and any time RIIDEye recovers from an *AutoCal paused* status.

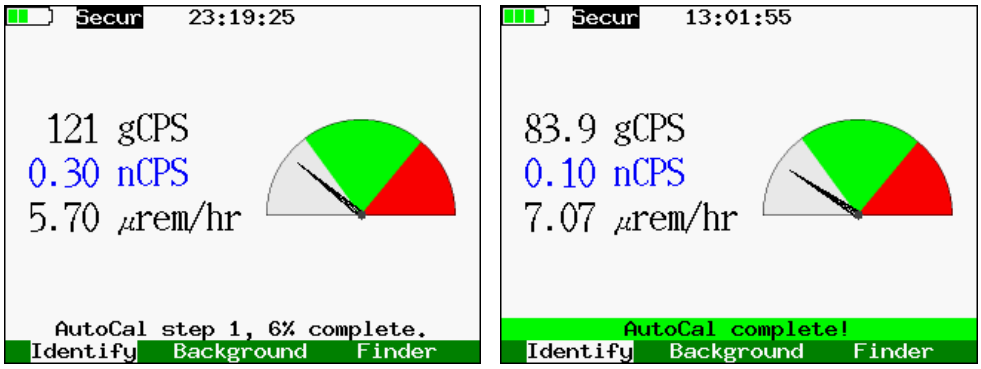


Figure 46: AutoCal screens – startup on left, complete on right

We recommend performing a *Coarse Calibrate with Cs-137 or Lu-176* and a background procedure in the following circumstances:

- The position of the K-40 peak is no longer found (background subtraction disabled) within a ±1% range of the nominal position (1446 keV … 1476 keV)
- The device fails to ID a check source that is included in the trigger list
- Upon start-up, AutoCal fails to complete after four steps

During normal use, users may see *AutoCal paused, consult Help Menu* (see Figure 47). This alert is to make users aware that AutoCal has paused due to the presence of high radiation, specifically count rates above 6000 cps or 60 cps for energy levels above 1000 keV.

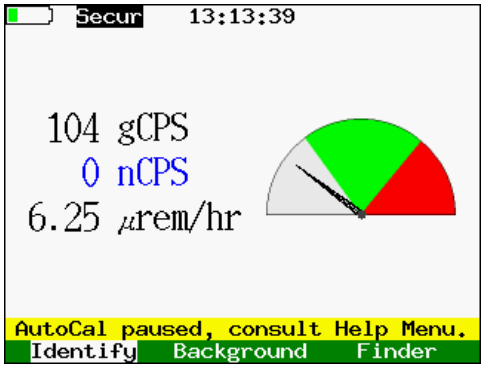


Figure 47: AutoCal paused

Note If you see the *AutoCal paused* message immediately after starting up the RIIDEye, perform a coarse calibration according to the next section.

AutoCal automatically resumes once count rates fall below "Pause" rates. It could take up to three minutes to clear, depending on how long RIIDEye was exposed to high count rates.

Unit functions normally even with AutoCal paused as long as the external temperature remains within ±10 °C.

Coarse Calibration (Gain, Offset)

The recalibration procedure described in this section automatically adjusts hardware parameters (high voltage, amplifier gain, and offset) to obtain an accurate system energy calibration.

Only perform this function if the AutoCal process continually does not succeed in pulling the K-40 peak near 1461 keV (range 1446 keV … 1476 keV). It requires one radioactive source, Cs-137 with the 32 keV not shielded of approximately 0.25 to 5 µCi (9 to 185 kBq) or Lu-176 (Part Number 42549/48).

Note The higher the strength of the source is, the shorter time a coarse calibration will take to complete.

To begin the process, press the MENU button to enter the menu system. You should immediately see a *Field Settings* menu that looks similar to the figure on the left in Figure 48. Press the UP or DOWN arrow keys to move the selection so that *Coarse Calibrate* is selected and press ENTER. On the next screen (see Figure 48 on the right), select the desired source (Cs-137 or Lu-176). After choosing the source, press ENTER to begin the calibration.

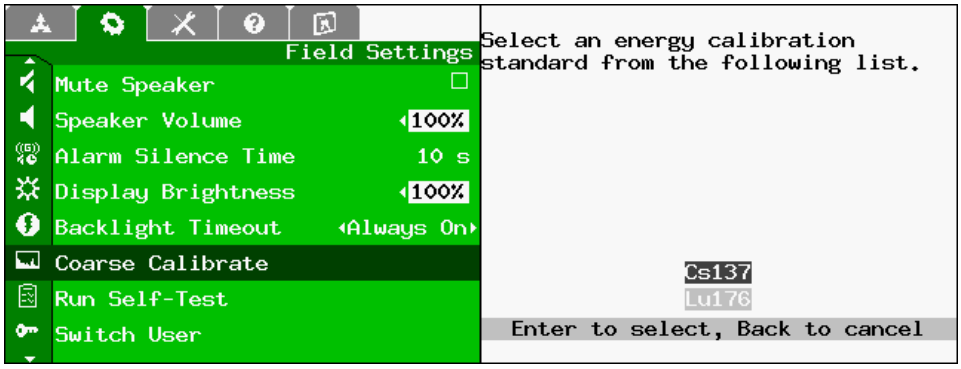


Figure 48: Field Settings menu and Coarse Calibrate selection screen

When prompted (see Figure 49), place the source near or on the red dot on RIIDEye. If you do not have the source close at hand, you can ask the system to Wait (which will give you an extra minute) or Cancel (to stop the process if you made a mistake).

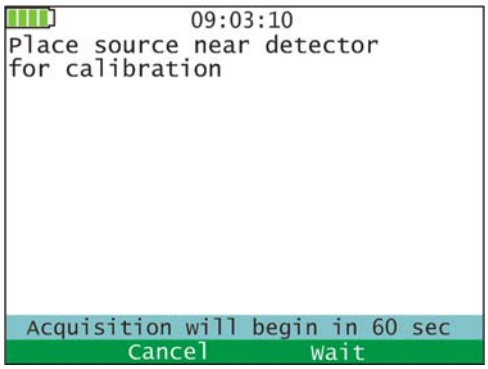


Figure 49: Coarse Calibrate source placement dialog

When the countdown completes, you will see a screen that looks similar to the one shown in Figure 50. This process may repeat several times as the system updates different parameters to ensure that your calibration is as close as possible to the target calibration. The target calibration is shown by the two blue/gray lines near the centers of the peaks. Do not be concerned if the parameters shown in the message area above the soft keys are different – they are unique to each detector type and detector.

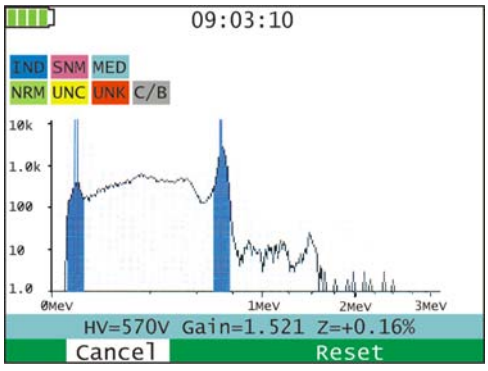


Figure 50: Coarse Calibrate collecting data

The soft keys (Cancel) and (Reset) are defined as follows:

- Cancel: Cancels coarse calibration process
- Reset: Restores the RIIDEye's HV and Gain to near factory defaults

Selecting reset should be used as a last resort, only if the coarse calibration process fails to restore RIIDEye's HV and Gain to levels where accurate IDs can be made. When the process is complete, the system will beep three times (unless you have the sound turned off) and return to the *Field Settings* menu.

Fine Energy Calibration (Linearity)

The RIIDEye provides a method to guarantee optimal energy linearization to ensure the exact determination of peak energies throughout the whole energy range. The process is only required when a new detector is attached to the instrument and is hidden in the *Factory Settings* menu.

The process requires sources with a couple of peaks with energies distributed across the whole energy range. Factory calibration uses the following: Co-57, Cs-137 and Co-60 (32 keV, 124 keV, 662 keV, 1173 keV, 1333 keV, 2506 keV). Alternatively, Eu-152 and Lu-176/Th-232 are also supported for fine energy calibration.

Dose Rate Calibration

A dose rate calibration corrects for individual variations in the detector efficiency. This calibration is performed in the factory with traceable sources and is intended to be done once for the lifetime of your instrument.

While not a dose of record device, such as an electronic dosimeter, the dose rate of your RIIDEye is intended to be reasonably accurate across the full energy spectrum. The RIIDEye is calibrated to within 30% of a dose measured at 661 keV.

System Menus

The following sections describe how to use the menu system and show the different settings that can be adjusted from each menu. See Appendix 1 – Menu Structure Summary on page 85 for a summary of all menus and menu items and their availability for the User and Administrator levels.

Note All menus and functions shown in this chapter relate to the Administrator level. See Appendix 1 – Menu Structure Summary on page 85 for the availability of User level menus and functions.

Contents

Using the Menus

Before describing each of the different menus in detail, this section shows and explains how to choose the menu, how to choose an item within the menu, and how each of several standard menu editing operations work.

Entering the Menu

Press the MENU key from one of the search mode screens to enter the menu system.

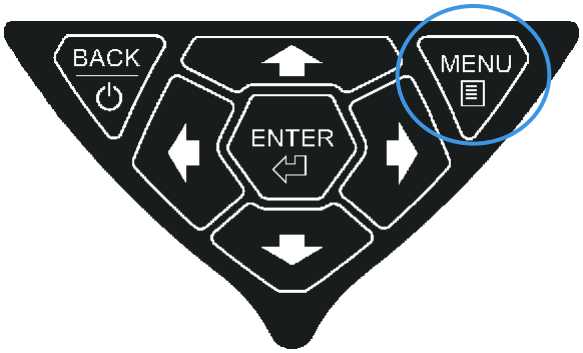


Figure 51: Keypad and location of the MENU button

Moving Through the Menu Headers and Entering a Menu

Three little white arrows show the possible movements from the initially highlighted menu header icon at the far left tab. The name of the active menu displays in the

top right area. All other available menu header icons are shown as tabs with a blue background.

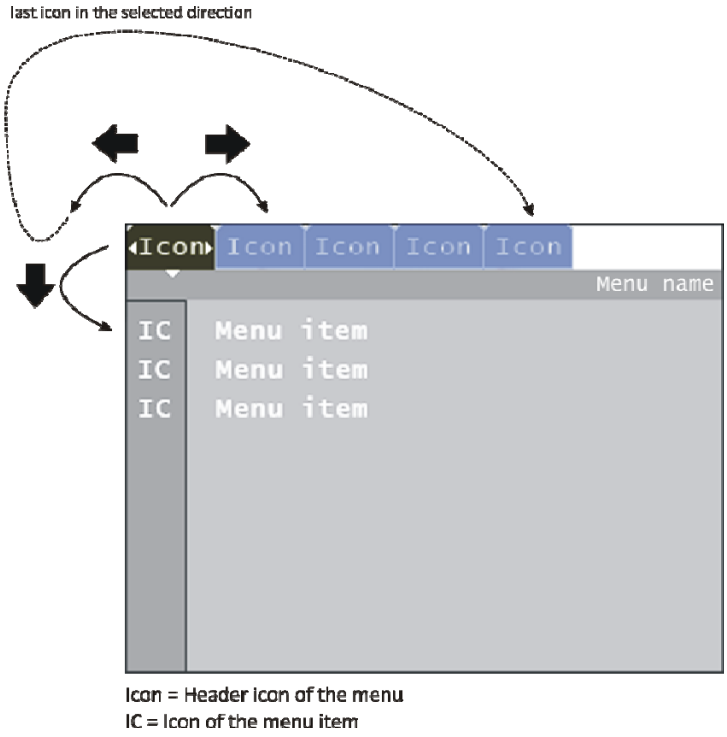


Figure 52: Moving through the menu headers

Table 8. Moving through the menu headers

Keypad button	Action
⬅	Moves to the next menu left. If the far left position is reached, the last menu on the right is selected.
➡	Moves to the next menu right. If the far right position is reached, the first menu on the left is selected.
⬇	Enters the menu by selection of the top item.

Moving in the Menu and Changing Values

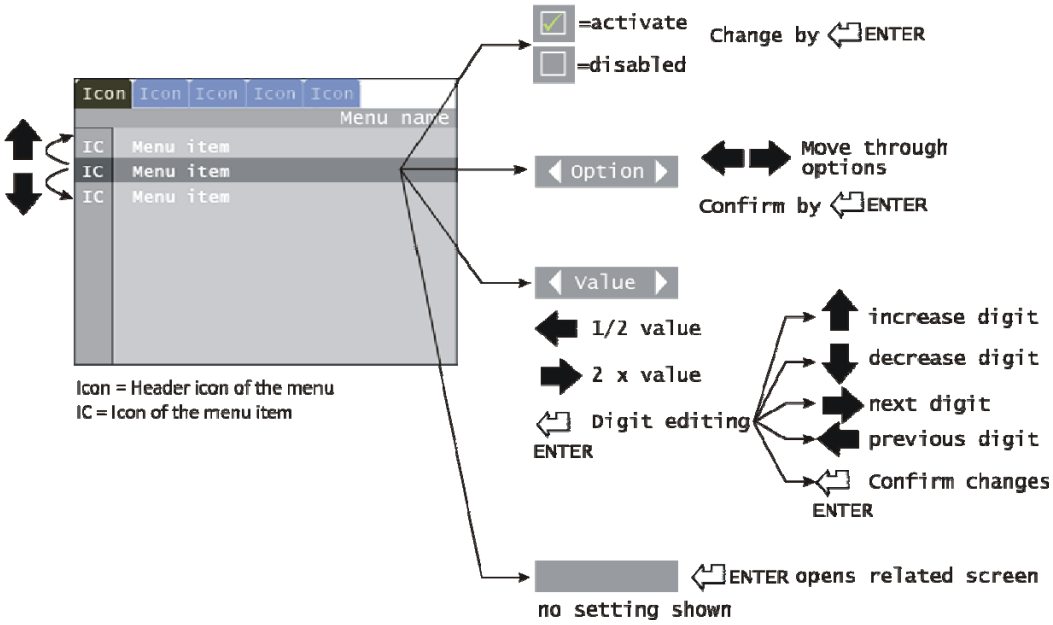


Figure 53: Moving through the menu and values

To quickly return to the tabs from somewhere in the middle of a menu, press the MENU key. To select an item from the menu, press the UP or DOWN arrow key. Press the DOWN arrow when on the tab to move to the first item on the menu. As a shortcut, press the UP arrow when on the tab to move to the *last* menu item. To return from the menu system to the search mode, use the BACK key (unless you are running a procedure or editing a specific item) or select the *Exit* item at the bottom of each menu.

Run a Procedure/Display Information/Open Submenu

Perhaps the simplest type of menu item is one that runs a procedure, displays information (such as a Help file), or opens a sub-menu. These all look the same on the screen, except for the name of the menu item. To perform a task, simply move the highlighted area (darker background) onto this menu item, and press ENTER. For a procedure, the first step of the procedure displays; for a Help menu item, the associated help text displays.

Check Option On or Off

A check-box allows you to change whether the option is enabled or not. Highlight the menu item and either press ENTER or use the LEFT and RIGHT arrows to toggle the check mark.

Selection among Options / Adjust a Slider

A few features, particularly *Speaker Volume* and *Display Brightness*, are set using sliding adjustments. To change the value, highlight the item and press the LEFT arrow to reduce the value or the RIGHT arrow to increase it. The value is shown both as a percent and as a bar that goes from empty (0%) to full (100%). The small arrows

shown on the screen are a reminder that LEFT and RIGHT are the keys you use to make a change.

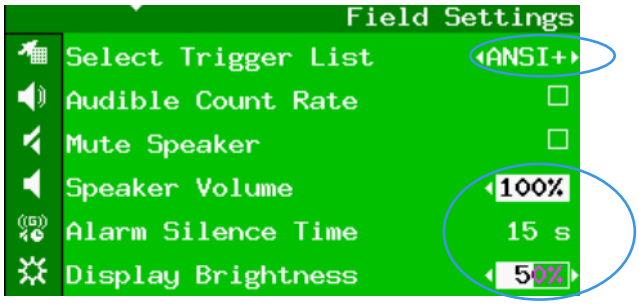


Figure 54: Slider adjustments and static options

Some items give you a choice among different static options. Press the LEFT or RIGHT arrow to change to the previous/next item in the list. The small arrows shown on the screen are a reminder that LEFT and RIGHT are the keys you use to make a change. In cases where there is no particular order to the list, you can continue flipping through items until you come back around to where you started. For other items, like time intervals, there may be a minimum and maximum value. When the minimum is reached, the left arrow disappears from the screen and LEFT will no longer make a change; the same is true for RIGHT when the maximum is reached.

Edit Numeric Value or Date

There are two mechanisms for changing these values. When the menu item is first highlighted, press the LEFT key to reduce the value to a smaller value – sometimes half, sometimes another convenient interval – until it reaches a minimum setting. Press the RIGHT key to increase the value up to a maximum.

If the existing steps are not satisfactory, you can change the value one digit at a time by entering the "free edit" mode. Press ENTER while the menu item is highlighted. Once in this mode, LEFT and RIGHT move to different digits and UP and DOWN to change the currently highlighted digit. To accept your changes or to use UP and DOWN to move to the next menu item, press ENTER. This will save the current value and put you back in the normal menu-browsing mode.

When choosing a date, the menu item works in a way similar to the *Edit Numeric Value* function. In some menu functions, *Any* date is preset. To set a date, you must edit the value. Press an arrow key to change the date to today's date; press an arrow key again to change it back to *Any*. To edit the date, press ENTER. While in this mode, you can change each portion of the date using the UP and DOWN arrow keys. (Note that the actual format of the date may vary depending on your *Language* choice.) Pressing UP or DOWN on a U.S. date format will change the month to the previous or the next month. Press the LEFT or RIGHT key to change to another field. When you have the date you want, press ENTER to return to the normal mode.

Note If you press the LEFT and RIGHT arrow keys again, the date will change back to *Any*. However, the system will remember the date you entered and if you press the arrow key once more, your edited date will display.

User Menus

Five menus are available: *Spectral Data, Field Settings, Configuration, Administrator,* and *Help.* See Appendix 1 – Menu Structure Summary on page 85 for details about menus and functions related to User or Administrator level. This section of the manual describes the Administrator level.

Spectral Data

Figure 55 depicts the fully accessible *Spectral Data* menu, including the ability to erase spectra. Erasing of spectra can be controlled in the *Access Controls* menu under the *Admin* menu. When *Erase* is disabled, those menu items are hidden. The items on this menu allow you to navigate through the stored spectra, search for particular spectra, review, and delete those spectra.

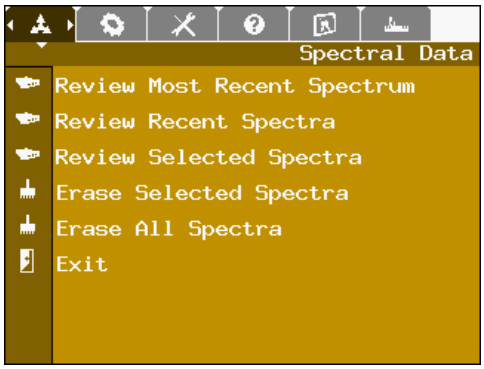


Figure 55: Spectral Data menu

❖ **Review Most Recent Spectrum**

Opens the last taken spectrum, shows the spectrum as diagram, and provides the soft keys to go to the *Report* screen or to *Erase* this data. Press the BACK key to return to the menu.

❖ **Review Recent Spectra**

Opens the last taken spectrum and shows the spectrum as diagram. It provides the soft keys to go to the *Previous* spectrum, the *Report* screen, or to *Erase* this data. If the previous spectrum is opened, then the additional soft key *Next* toggles between the stored spectra. Press the BACK key to return to the menu.

When either the *Review Stored Spectra* or the *Clear Stored Spectra* operation is chosen, the next screen brought up is a sub-menu for searching the catalog of stored spectra (Figure 56). The gray color of this menu indicates that it is a sub-menu of another menu operation.

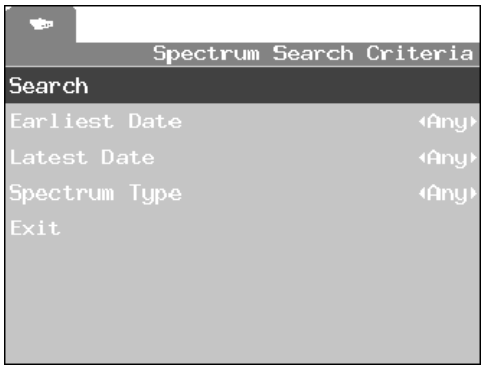


Figure 56: Spectrum Search Criteria submenu

In this menu, you can set the *Earliest Date* and *Latest Date* for the search, to specify the set of spectra to be considered. See Moving in the Menu and Changing Values on page 53 for details about date entry. You can also restrict the search to a single *Spectrum Type*, such as “captured alarm” or “background”, or leave it open to any type. The default settings shown above will include every spectrum in the catalog. Once you have set any search limits you want, highlight the *Search* item as shown in Figure 56 and press ENTER to continue to the next step, the selection of individual spectra.

The next sub-menu is shown in Figure 57. This menu gives you the opportunity to accept or reject individual spectra. This step may be less important when displaying spectra, especially if your filter is very narrow. However, when clearing spectra, you must individually go through and check each spectrum that you wish to clear, as a confirmation that you really wish to permanently delete that spectrum. Also, you can never check the currently used background spectrum, as indicated by a red X in the check box.

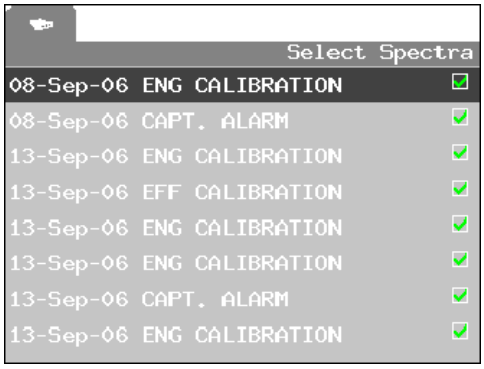


Figure 57: Select Spectra submenu

Once you have checked all the spectra, select the *Display* or *Erase* item at the very end of the menu. To quickly access this item, you can go to the top of the menu (by pressing MENU if needed) and press the UP arrow once to take the shortcut to the last item.

If you are clearing spectra, the process will complete and return you to the *Spectral Data* menu. However, if you are reviewing spectra, the screen defaults to displaying the spectra with a purple border (see Figure 58).

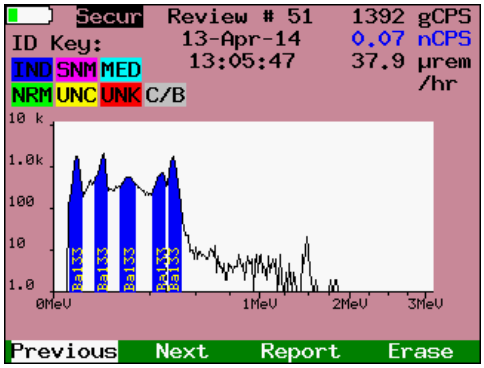


Figure 58: Review mode of spectra

If you are viewing the spectra from *Review Recent Spectra* or *Review Selected Spectra*, the soft key menu will look like Figure 58. If you entered from *Review Most Recent Spectra*, the Previous and Next soft keys will not be visible.

- Previous cycles to the previous spectra in the RIIDEye
- Next cycles to the next spectra within RIIDEye.
- Report opens the *Report* screen (see page 37), which allows details of the spectra and ability to perform "Voice Only" Reachback by reading details of the analysis report over a telephone.
- Erase will erase the spectra. Note that Erase is only available when the Administrator has granted that approval; otherwise, it is disabled.

Field Settings

Figure 59 shows the User *Field Settings* menu. This menu is intended to put all the most frequently used items at the user's fingertips.

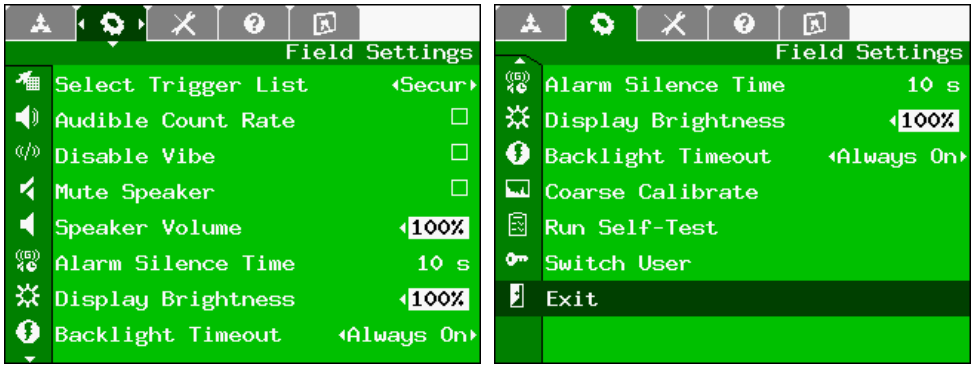


Figure 59: User's Field Settings menu

❖ **Select Trigger List**

The "Trigger List" is the list of all of the nuclides that are currently enabled for detection and analysis. Knowing the kind of nuclides you normally search for will help reduce false identifications. There are four standard lists included, although your Administrator may choose to have different options available. These options include:

ANSI: Standard nuclides from ANSI N42.34

ANSI+: ANSI plus; additionally, several frequently occurring nuclides

MED: Medical isotopes, mostly a subset of ANSI+

IND: Industrial isotopes, mostly a subset of ANSI+ list

SECUR: Contains all isotopes in RIIDEye library

In addition to using LEFT and RIGHT to change lists, you can display the contents of the currently selected list by pressing ENTER to. Press ENTER again to return to the menu. The active trigger list is indicated on the main screen next to the battery symbol.

- **Audible Count Rate**

  This option turns on and off the audible clicks that indicate the count rate. It is important to note that if the speaker is muted (see next item), you will not hear these clicks unless you are using headphones. Generally, you should hear the clicks as soon as you check the check-box.

- **Disable Vibe**

  When checked, the vibe motor, located in the handle of RIIDEye X series, will engage and vibrate when an alarm is generated. The tactile alert has the same vibe pattern for all alarms.

- **Mute Speaker**

  This option turns on and off the internal RIIDEye speaker – when the box is *checked*, the speaker is *off*. No matter how this option is set, the headphone will continue to operate, allowing inconspicuous audio monitoring.

- **Speaker Volume**

  This option adjusts the speaker volume from 0 to 85 dB.

- **Alarm Silence Time**

  This setting is for the time the audible alarm is silenced when pressing any button on the keypad. When silenced, RIIDEye remains in an alarm state visually. After the silence time expires, RIIDEye will sound audible alarms if alarm thresholds are still exceeded. This tool is especially useful when localizing a radiation source. Default Silence time is 10 seconds.

- **Display Brightness**

  This setting increases or decreases the brightness of the display “backlight.” Because the display backlight is one of the largest consumers of battery power, changes to this setting can significantly impact your battery life. It is recommended that this be set to the lowest setting that still gives a comfortably readable display. For operations in bright sunlight, RIIDEye's high contrast screen can usually be set to 70% and still completely viewable.

❖ **Backlight Timeout**

You can set the timeout for the display backlight. The backlight will turn off if there is no activity for this amount of time. To turn the backlight on again, press any key. Because backlight use increases the battery discharge rate, small timeout settings will lengthen useful battery life.

Note While any button will engage the backlight, we recommend pressing the BACK button to prevent accidental commanding of the RIIDEye (because the buttons do not know that the backlight is off, the button behaves as if backlight were on).

❖ **Coarse Calibrate**

This operation performs a manual calibration, as described in Coarse Calibration (Gain, Offset) on page 47.

❖ **Run Self-Test**

Self-test checks all of the hardware and detectors to verify that they are operating within the factory designated range; it repeats the same tests conducted at startup. Checks are performed on all PC Boards, detectors and case temperature. In addition, it lists the number of spectra stored on the device and the number of alarms the RIIDEye has seen since startup. When complete, RIIDEye displays the test results (see Figure 60).

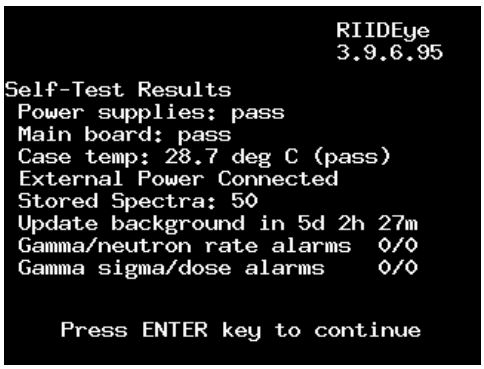


Figure 60: Self Test report

❖ **Switch User**

Tap this menu switch to toggle between User and Administrator modes. If a password is required to enter Administrator, RIIDEye will prompt for the password before switching from User (see Entering a Password on page 13).

❖ **Exit**

Leave current menu and returns to last real-time radiation screen, *Dial*, *Finder*, *Bars* or *Spectrum*.

Configuration

The Administrator *Configuration* menu is shown in Figure 61.

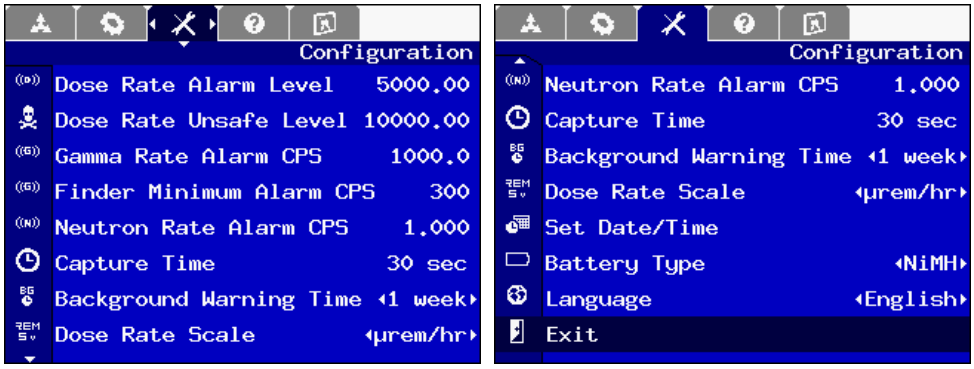


Figure 61: Administrator Configuration menu

- **Dose Rate Alarm Level**

  This setting determines the dose rate required to set off the dose rate warning alarm. This is specified in the units given by the *Dose Rate Scale* further down in the menu. The system will flash the screen, sound an audio alarm, and engage the vibrating motor for tactile feedback when the threshold for the alarm is reached.

- **Dose Rate Unsafe Level**

  This setting determines the dose rate that will set off the personnel protection or "turnback" alarm. This is specified in the units given by the *Dose Rate Scale* further down in the menu. The system will flash the screen red and sound a distinctive audio alert when this level is reached. In addition, the vibe motor (if enabled) will vibrate to give a tactile alert.

- **Gamma Rate Alarm Level CPS**

  This setting determines the gross gamma count rate in CPS (includes background counts) that will set off the gamma warning alarm. Although this has some functional overlap with the dose rate alarm, there may be cases where a low energy source with a high count rate would set off this alarm but not the dose rate alarm. The system will flash the screen and sound an audio alert when this level is reached. See also General Concept of Use on page 42 about an alarm threshold concept for survey tasks.

- **Finder Minimum Alarm CPS**

  This setting indicates the minimum gamma CPS change to sound an alarm when using the rolling finder background.

- **Neutron Rate Alarm Level CPS**

  This setting determines the neutron count rate (in CPS) that will set off the neutron warning alarm. This is generally set much lower than the *Gamma Rate Alarm Level,* because true background neutron events are quite rare. However, setting the value too low (< .8 cps) will increase the alarm rate as background or stray neutrons will cause the RIIDEye to alarm frequently. The system will flash the screen and sound an audio alert when this level is reached.

❖ **Capture Time**

The capture time setting determines the default for run time for the Identify operation. You can either change the default time here, or increase or decrease the time from the Identify screen itself by using the +30 s or -30 s feature for the Standard *Identify* screen. For the Simple *Identify* screen, only adding time in 30-second increments is possible.

❖ **Background Warning Time**

Taking regular backgrounds is important in getting accurate and reliable spectral data and radiation identifications. *Background Warning Time* warns users at prescribed time intervals to acquire a new background for radiation identifications. Default warning time is one week.

❖ **Dose Rate Scale**

This setting changes the preference for the display of dose rates. There are four options: µREM/hour, mREM/hour, nSieverts/hour, and µSieverts/hour; these are abbreviated on-screen. All dose rates are stored internally in the same units, so this has no effect on stored data, only on the way it appears on the display. When viewing the full Administrator menu, you will see that the dose level settings also change to match the currently selected unit value.

❖ **Set Date/Time**

Both User and Administrator can set date and time. Date and time are very important because every spectrum and background file include the time/date stamp. RIIDEye records the date and time in Universal Coordinated Time (UTC); it must not only know the date and time but also the current time zone. All of these are set from this menu item, which opens the dialog shown in Figure 62.

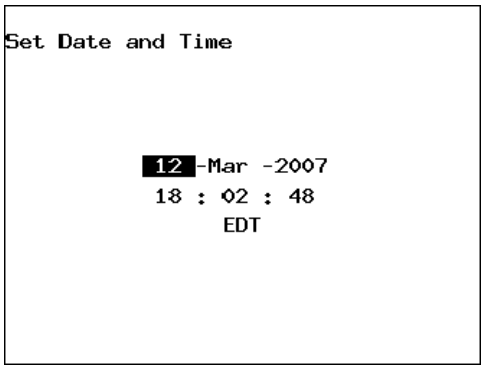


Figure 62: Setting date and time

To change from one field to the next, use the LEFT and RIGHT arrows. To increase or decrease the value of a particular field, use the UP or DOWN arrow, respectively. If you need to change the time zone, we recommend that you do this first, because the hour (and possibly minute) will automatically be updated when you make this change. Finally, press ENTER to accept the currently shown date and time.

❖ **Battery Type**

This allows you to indicate to the system the type of battery currently in use (NiMH or Alkaline). To get the most accurate estimate of battery life and to prevent the system from shutting down earlier than necessary, this should be set if the battery type is changed.

CAUTION This setting will NOT prevent the hardware charging circuitry from operating with Alkaline or non-factory-supplied NiMH batteries in place, which can lead to overheating or leakage and damage to the batteries or the system.

❖ **Language**

Select one of the nine languages available:

English, German, Spanish, Brazilian Portuguese, Italian, French, Chinese, Korean and Russian

Help Menu

The *Help* menu provides in-system help for many of the features described in this manual. Each item in the menu is a separate help topic that can be read using a scrolling help viewer. A typical *Help* menu is shown in Figure 63.

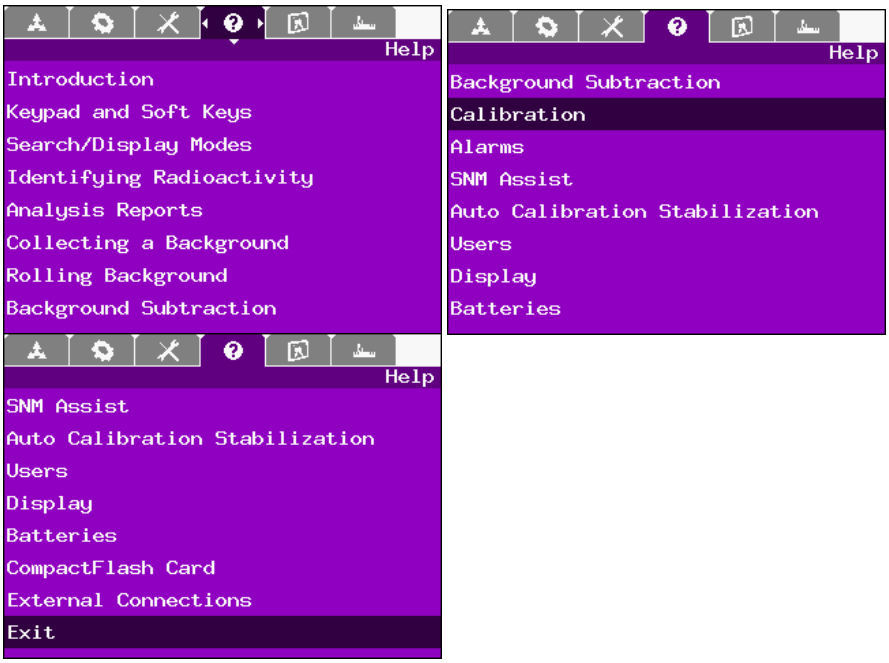


Figure 63: Help menu

To access any help item, highlight that item and press ENTER. If a scroll-bar is shown on the right, you can scroll through the text using the UP and DOWN arrow keys. When you are done reading the help item, press ENTER again to return to the menu.

Admin

The *Admin* menu is shown in Figure 64. This menu contains utilities for setting up the instrument and changing the protections of the various modes.

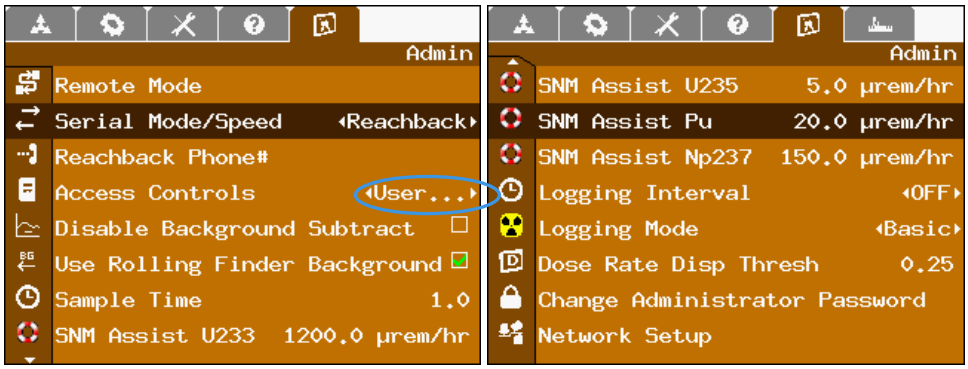


Figure 64: Admin menu

❖ Remote Mode

This operation puts the unit into a remote communications mode.

❖ Serial Mode/Speed

The default setting is Comm 115k. Alternative communication speeds and modes can be set based on your individual needs.

❖ Access Controls

This item brings up a sub-menu (Figure 65) for the currently selected login, either *User* (as shown above) or *Admin*. Select the login using the LEFT or RIGHT arrow keys.

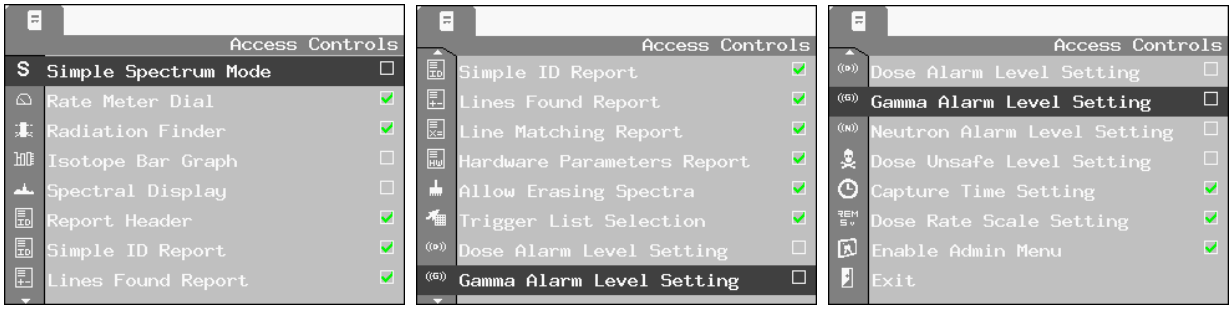


Figure 65: Access Controls submenu

Both User and Admin have separate Access Controls menus. They are the exact same menu structure, with one difference in #16.

1. *Simple Spectrum Mode*: When checked, RIIDEye will hide *Real Time Spectra Build* and *SNM Assist* during spectra acquisition. Default is unchecked.

2. *Rate Meter Dial*, *Radiation Finder*, *Isotope Bar Graph*, *Spectral Display*: Checking these will allow either User or Admin (depending on which access controls are active) to view these screens during use. Unchecked will hide the screens and make them unavailable until rechecked.

3. *Report Header*: In the spectra report, checking this box will display the report header. Default is checked.

4. *Simple ID Report*: In the spectra report, checking this box will display the isotope and atomic number with confidence level. Unchecking the box will hide the results. Default is checked.

5. *Lines Found Report*: In the spectra report, checking this box will display the matched energy lines with sigma value. Default is checked.

6. *Line Matching Report*: In the spectra report, checking this box will link the matched lines with the isotope called in the simple report. Default is checked.

7. *Hardware Parameters Report*: In the spectra report, checking this box will display the Hardware parameters, including the temperature, HV, gain, ADC. Default is checked.

8. *Allow Erasing Spectra*: Checking this box allows the User or Admin (depending on which access controls are active) the ability to erase spectra.

9. *Trigger List Selection*: Checking this box allows the User or Admin (depending on which access controls are active) to change the trigger list selection from the green *Field Settings* menu.

10. *Dose Alarm Setting*: Checking this box allows the User or Admin (depending on which access controls are active) to change the dose rate alarm settings. Unchecking the box hides the menu item in the blue Configuration menu.

11. *Gamma Alarm Level Setting*: Checking this box allows the User or Admin (depending on which access controls are active) to change the gamma alarm settings. Unchecking the box hides the menu item in the blue Configuration menu.

12. *Neutron Alarm Level Setting*: Checking this box allows the User or Admin (depending on which access controls are active) to change the neutron rate alarm setting. Unchecking the box hides the menu item in the blue *Configuration* menu.

13. *Dose Rate Unsafe Level Setting*: Checking this box allows the User or Admin (depending on which access controls are active) to change the dose rate unsafe alarm setting. Unchecking the box hides the menu item in the blue *Configuration* menu.

14. *Capture Time Setting*: Checking this box allows the User or Admin (depending on which access controls are active) to change the default Spectrum Acquisition time. Unchecking the box hides the menu item in the blue *Configuration* menu.

15. *Dose Rate Scaling Setting*: Checking this box allows the User or Admin (depending on which access controls are active) to change the dose rate scaling. Unchecking the box hides the menu item in the blue *Configuration* menu.

16. *Enable Admin Menu*: In the *User Access Control* menu, Administrators can grant Users access to the *Admin* menu. This option is not visible in the Admin *Access Control* menu.

- **Disable Background Subtract**

  Disabling the background subtraction will cause RIIDEye to identify all isotopes contained in the sample, including those rolled into the background (such as the K-40 calibration ring of X-GN and the La-138 in the X-HN).

- **Calibrate Food Measurement**

  Food Measurement capability must be enabled in the configuration of the instrument. If you require this feature, please contact Thermo Fisher Customer Service for instructions on implementing it (see Contacting Us on page xiv).

  Once implemented, food measurement measures Bq/kg in samples for Cs-137, Cs-134, and Ba-133. In order to properly list the intensity in Bq/kg, sample mass in kg must be input into RIIDEye. If needed, other isotopes can be added to this feature. Please contact Thermo Fisher Customer Service for details.

- **Use Rolling Finder Background**

  When checked, Rolling Finder Background is enabled. RIIDEye will compare the background (average 30 seconds) with the immediately acquired foreground. This ability makes RIIDEye especially sensitive when searching for radiation.

  In addition, if you linger too long in a high radiation background, RIIDEye may discontinue alarming on gamma or neutron count rate alarms as the high radiation will have been integrated into the background. The dose rate alarms; however, it will still alarm if a threshold is exceeded.

- **Sample Time**

  The RIIDEye collects and analyzes spectra in real time. The *Sample Time* is the spectrum acquisition time, sometimes called the time slice. The recommended minimum sample acquisition time is one second; however, a 3 to 5 second setting is recommended for dose rate monitoring. Select a short sample if a quick response is required. Select a longer time if more averaging is desired or to reduce stray bars displayed in the *Bars* mode.

- **SNM Assists**

  SNM Assist default dose rate values engage *SNM Assist* when foreground values exceed background by five times for the channels associated with the isotopes displayed on screen: Pu, Np237, U238, U235.

  Lowering dose rates will increase *SNM Assist* sensitivity and raising them will decrease the sensitivity. If dose rates are set high enough, *SNM Assist* may be effectively turned off. See SNM Assist on page 8 for more information.

- **Logging Interval**

  The logging interval is the interval in which RIIDEye gathers data in *Logging* mode (see below). The duration can be as short as one second to as long as one minute. Care should be taken in that enabling logging will affect system performance and more rapidly deplete storage capacity. The shorter the interval time, the faster RIIDEye's memory storage will fill.

- **Logging Mode**

  Logging mode allows the system to be used to record measurements in real time, including positional tagging with GPS location if equipped to do so. *Logging* supports three different modes, *Basic*, *Isotopes*, and *Spectrum*, as well as a range of logging intervals from as short as one second to as long as one minute. Each time the logging mode is changed or the instrument is powered off and on, a new log file is started. Logs are kept on the CF card in the "logfiles" directory; within this directory, a new directory is created for each date and sequential logfiles on that day are created with the time as the file name and the extension ".log". The stored files are in CSV format and can be read into Microsoft Excel or other tools that support CSV.

  The *Basic* mode includes just the date, time, gross gamma counts per second, and GPS location. Basic mode is most appropriate for general surveys of brownfields looking for hot spots that might need additional analysis.

  The *Isotopes* mode extends the *Basic* mode with a count rate for each isotope in the currently enabled trigger list; the count rates are derived from the primary intensity peak of the isotope in the system library. The *Isotopes* mode gives a simple way of analyzing what is found at each location if only a few readily distinguishable species are of interest, but it does not give useful results in environments with many distinct species present, as there are too many possible confounds measuring just a single line.

  The *Spectrum* mode extends the *Basic* mode with the counts in each channel of the spectrum in a separate column. The *Spectrum* mode can be used in the same cases as the *Isotopes* mode; however, it requires post-hoc analysis or expert inspection of the spectral data.

  Care should be taken in that enabling logging will affect system performance and more rapidly deplete battery life and memory storage capacity. The shorter the interval time, the faster RIIDEye's memory storage will fill and the more quickly RIIDEye will consume battery power.

- **Dose Rate Disp Thresh**

  Dose Rate Display Threshold applies only to the *Bars* mode. It determines the minimum per-isotope dose rate that is required before a bar will display. Once the dose rate reaches this level for one *Sample Time* period, the bar will appear. (It will then remain on the screen for up to 30 seconds, even if the level falls below the threshold again, to make the display easier to follow visually.)

- **Change Administrator Password**

  The password used for the Administrator login (see User or Administrator Operation on page 14) can be changed by the Administrator. To do this, enter the old password first and then enter the new password, as shown in Figure 66.

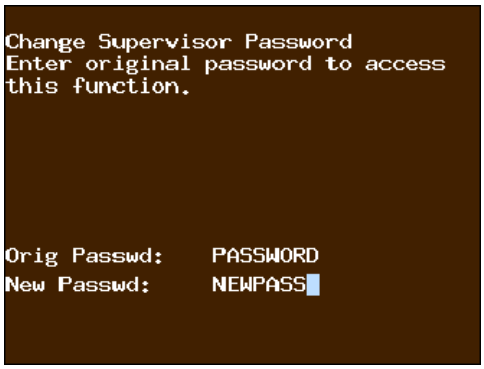


Figure 66: Changing password

❖ **Network Setup**

This feature is only used during initial factory construction. No external connections on RIIDEye allow direct network connections.

RIIDEye X supports communications when using its Reachback Smart cable. Connections can be made using a satellite phone (see Satellite Telephone using Reachback Cable on page 20) or through a USB port on a personal computer (see USB to PC using PC Interface Cable on page 24.

Factory Settings

There is an additional *Factory Settings* menu that is normally only used at the factory. Under special circumstances, including at Beta test sites, this menu may be enabled, but the details of how to use this menu are beyond the scope of this document.

Help & Troubleshooting

Contents

RIIDEye Does Not Power-up

White Screen Flash Only

If the RIIDEye does not power-up and only a white screen flashes at the moment when POWER/BACK key (⏻) is pressed, then check the presence and the correct positioning of the Compact Flash card. Re-seat the card and insure that it is fully engaged in the card slot. If it is fully engaged, check the contents of the CF. It may be necessary to replace the contents with an archived image of the CF if the image is damaged or missing (see Backing up the CF Card on page 3 for making a backup image of RIIDEye CF).

No Reaction at All

If there is no reaction to the POWER/BACK key (⏻) at all, then check the battery's capacity with a suitable voltage-meter. If the battery pack is not functioning, you can use the spare battery holder with eight AA batteries or the AC charging adapter to supply DC power to the unit. Be sure to note the type of battery installed and adjust the green *Field Settings* menu accordingly as either rechargeable (NiMH) or alkaline (alkaline).

Zero Count Rate

There are two ways RIIDEye X will return a zero count rate:

1. In an extremely high dose rate field, RIIDEye will report "OVERLOAD" in the gamma or neutron count rate due to the large amount of pulses being too close together to definitively count. Once out of the high dose rate field, the PMT will return to normal. It could take up to 30 minutes to fully recover.
2. If for any other reason RIIDEye X returns a zero count rate, please contact Thermo Fisher Customer Service for repair (see Contacting Us on page xiv).

If You Drop RIIDEye

RIIDEye X has been designed to survive drops onto concrete from 1 meter from any face according to the MIL-STD 810G requirement described in Section 516.6. Performing an identification immediately after a drop may give inaccurate results. RIIDEye X may require time to adjust the fine gain of the instrument to properly identify isotopes.

There are three ways that RIIDEye X can recover:

1. Allow RIIDEye X to recover on its own with no user interaction required through the AutoCal process (3-5 min).
2. Manually shut down RIIDEye X and restart. This restarts the AutoCal process and locates the K-40 peak (< 2 min).
3. Manually perform a Coarse Calibration on RIIDEye X with Cs-137 or Lu-176 (< 1 min).

RIIDEye Does Not Switch Off

In the rare event of a system lock-up, you may need to hold down the POWER/BACK key
(⏻) for a longer period of time (10 seconds) in order to engage the fail-safe power-down mechanism.

Coarse Calibration Cs-137 Fails

Be sure the source is not steel/brass encapsulated so that the 32.9 keV is shielded. This peak is required for offset adjustment.

Optimize the distance of the source to the front end of the detector. A 10kBq source should be placed directly to the surface of the detector. Stronger sources should be placed in a distance that the needle of the dial is rather in the middle of the green range. If the count rate is too high, then the calibration ends most properly with the generic timeout window (see Figure 67).

If for some reason your system is having trouble seeing the peaks – for instance, if the peaks are already far to the right of where they should be - then you can select

the Reset soft key to initialize all the parameters to defaults. Please be aware that resetting all the parameters will make the calibration take a much longer time than normal. If the unit still fails to calibrate, then please contact the Thermo Scientific Customer Service (see Contacting Us on page xiv). You can always select Cancel and go back to the previously stored calibration.

Generic Timeout

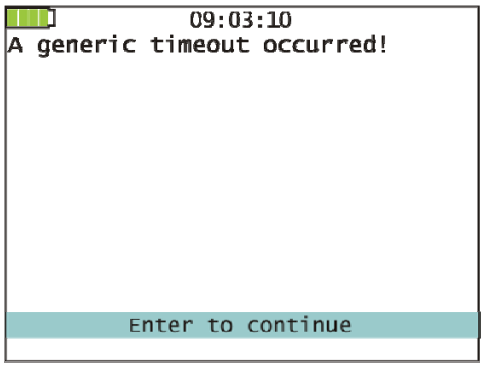


Figure 67: Generic timeout screen

Press ENTER to return to be previous screen or menu. Please note the circumstances of the appearance should you want to contact the Thermo Scientific Technical Support team.

Note If the generic timeout window turned up as result of a manual calibration, then see Coarse Calibration Cs-137 Fails on page 70.

Unable to Write to File

This error will display if the CF card is full or damaged. Erase spectra to clear space on the CF. In addition, it may be necessary to repair the CF from within Windows using the following command at the “RUN” prompt in Windows, assuming the CF is set as drive e: chkdsk e: /f. Once complete, replace the CF in the RIIDEye.

Low ID Counts

If the emitted radiation of a source to be identified is lower than the stored background on the RIIDEye, the yellow caution *Low ID counts, take new background?* displays. We recommend taking a new background before attempting an ID (see Taking a Background on page 39).

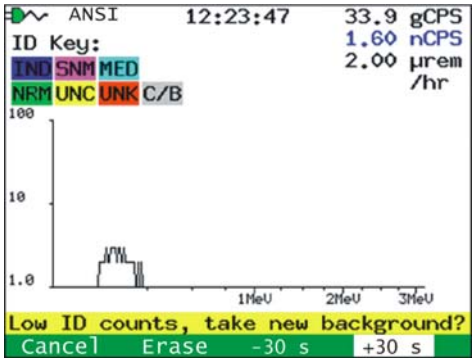


Figure 68: Low ID counts text

If the background measurement data is reasonable, then try to optimize the distance between the source to be identified and the RIIDEye unit while keeping an eye on the dose rate information for personal protection measures.

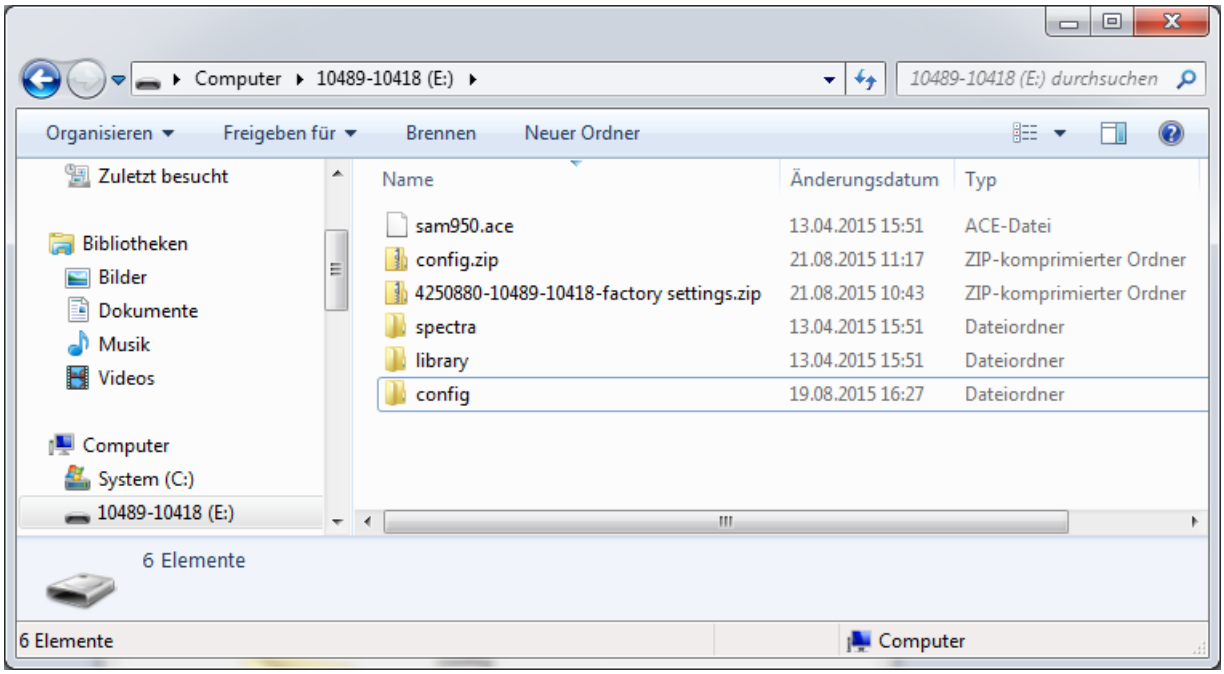
Recall Factory Settings and Calibration

With some instrument failures it can be useful to restore factory settings and factory calibration.

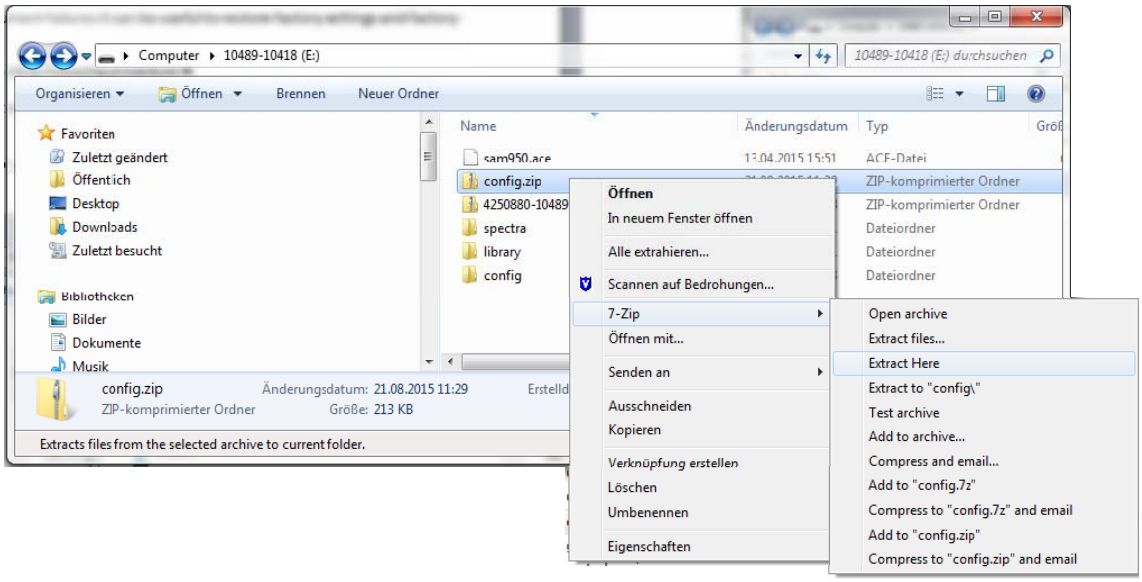
This is done according following procedure:

- Pull the CF-memory card out of the instrument as described in chapter Compact Flash Card on page 19.
- Put the CF into the USB adapter and put the adapter into an USB slot of a PC.

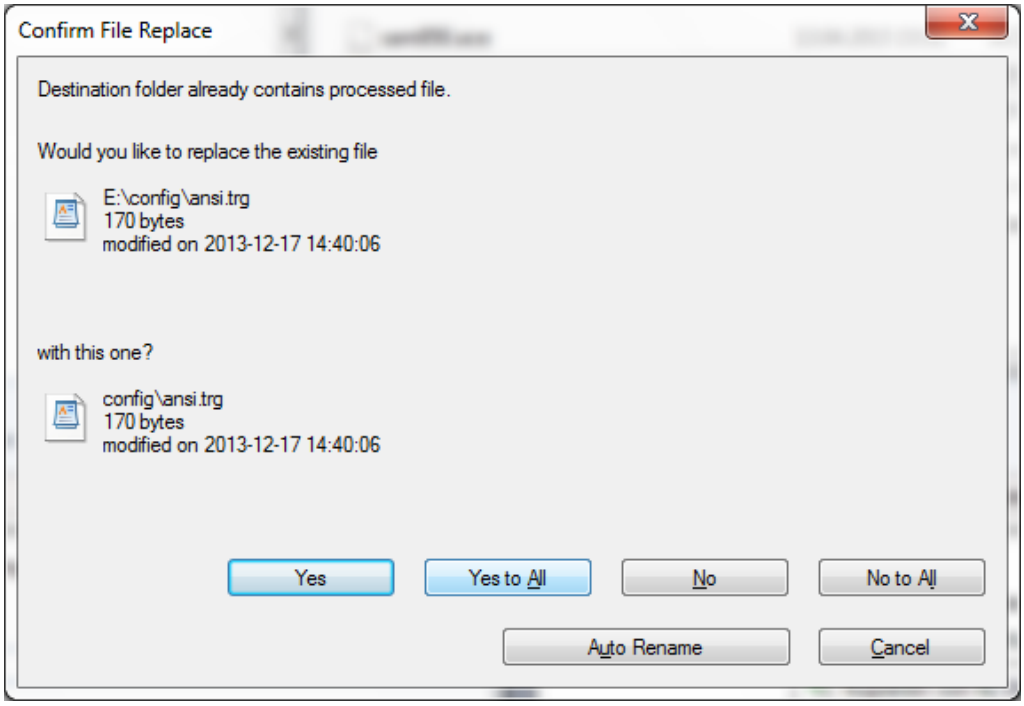
- Open the Explorer:



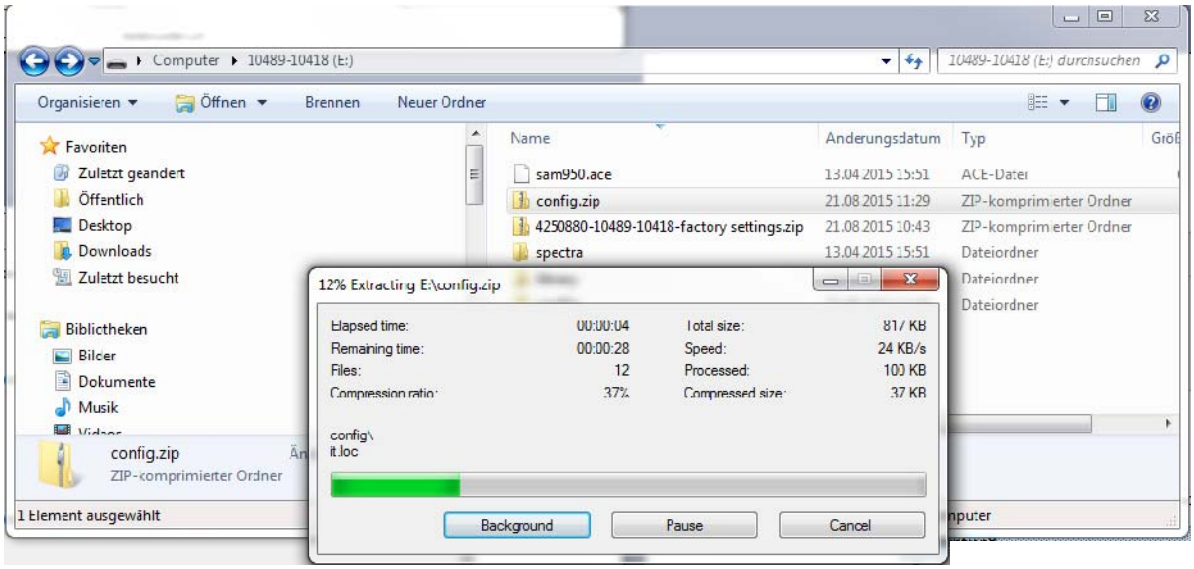
- Extract the content of config.zip :
  right mouse click on config.zip, then left mouse button: 7-Zip/extract Here:



- Confirm replacement of files “Yes to all”:



The extraction will be performed and all files in the config folder will be replaced with the data present at instrument shipment.



- Remove the compact flash from the PC and put it into the instrument.
- After power on the instrument will start with the original factory settings and calibration

Maintenance & Service

Contents

Spare Parts

There are very few user serviceable spare parts. Spare parts include:

Description	Part Number
Rechargeable battery pack and holder	42508/8540
AA battery holder	42508/8509
Rubber bumper Kit (includes 1 of each of the three bumpers)	42508/8550
Rubber power/headphone port cover	42508/8500-19
Firmware with calibration Data	FIRMWARE-RIIDEYE-X
Compact Flash Card reader	PG-111978
Battery/CF access door with ¼ turn latch and spring	42508/8552
AC charging cable/kit (Netzteil kpl.)	42550/5026
Vehicle 12-V supply adapter	42508/8535
Shoulder Strap incl. In the front and back	42508/8551
RIIDEye Reachback Cable	COMA001548
RIIDEye PC Interface Cable	COMA001568
Replacement Storage Case/with Foam	42508/8551

If your RIIDEye requires additional parts to repair, call Thermo Fisher Customer Service to schedule depot repair service. Contact your Thermo Fisher Customer Service or your local dealer for information if you require spare parts. The RIIDEye X does not contain parts that are considered as consumables.

Cleaning the Instrument

RIIDEye X is rated as IP65, meaning that it is dust proof and resistant to spraying water. To effectively clean RIIDEye without damage, use a water moistened cloth or a cloth with mild soap (dish wash liquid soap) and water is recommended. Avoid spraying water and immersing the RIIDEye in water.

CAUTION Do not use solvents or harsh cleaners because they can weaken the mechanical integrity or damage the appearance of the plastic housing.

Regular Maintenance

The RIIDEye is nearly maintenance free. Regularly clean the instrument under normal use and clean immediately after exposure to heavy radiation contamination.

Your rechargeable battery pack may require replacement every 24 months if you notice reduced operating times between charges.

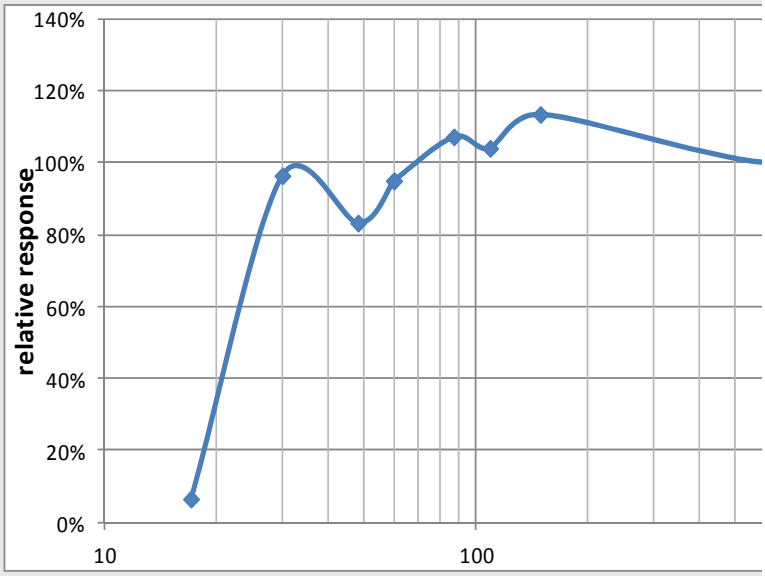
Follow the recommendations of RIIDEye to acquire and maintain updated backgrounds. Regular background updates (see Taking a Background on page 39) are required to insure the high identification accuracy performance.

RIIDEye also offers field calibration capability if needed (Coarse Calibration (Gain, Offset) on page 47).

Thermo Fisher offers extended warranties and maintenance plans to suit your needs. Coverage would include complete fine calibration of the instrument to the current detector resolution, estimated remaining useful life before a detector requires replacement, instrument operating software upgrade and any other instrument repairs required.

Specifications

Contents



General Specifications

Size	5.3” x 11.2” x 8.4” (135 mm x 285 mm x 215 mm)
Weight	X-GN: 6.3 lbs (2.86 kg) X-HN: 5.5 lbs (2.5 kg)
Temperature range for operation	-20 °C to +50 °C
Relative humidity	10% - 85%, 35 °C
Operating voltage AC adapter	100 V – 240 V
Power consumption AC adapter	50 W (max, charging)

Battery service life	8 hours nominal with rechargeable 2400 mAh battery pack Up to 12 hrs with 8 AA Alkaline batteries
Headphone compatibility	3.5 mm standard stereo headphone jack
EMC	IEC61000-6-2 Immunity, industrial IEC61000-6-3 Emissions, domestic (IEC 61326, Industrial Immunity/domestic emissions)
Charging time	4 hours
Degree of protection	IP 65
Standards Compliance:	CE, designed to meet ANSI N42.34-2006 performance

Radiation Measurement Specifications

Radiation Type	RIIDEye X-G, X-H: Gamma radiation RIIDEye X-GN, X-HN: Gamma and Neutron
Measured variables	Gross count rate [cps] Ambient equivalent dose rate [Sv/h or rem/h]
Measuring range:	Dose Rate: 10 mrem/h (100 µSv/h) Neutron: 0 – 2000 cps Identification: 100 – 40,000 cps
Overload display:	Lesser of 10 mrem/h (100 µSv/h) or 100,000 cps
Sensitivity (RIIDEye X-G, 2” x 2” NaI crystal):	14 cps/µrem/h, Cs-137 (1400 cps/µSv/h)
Sensitivity (RIIDEye X-H, 1.5” x 1.5” LaBr crystal):	10 cps/µrem/h, Cs-137 (1000 cps/µSv/h)
Gamma Energy Range	<25 keV - 3 MeV

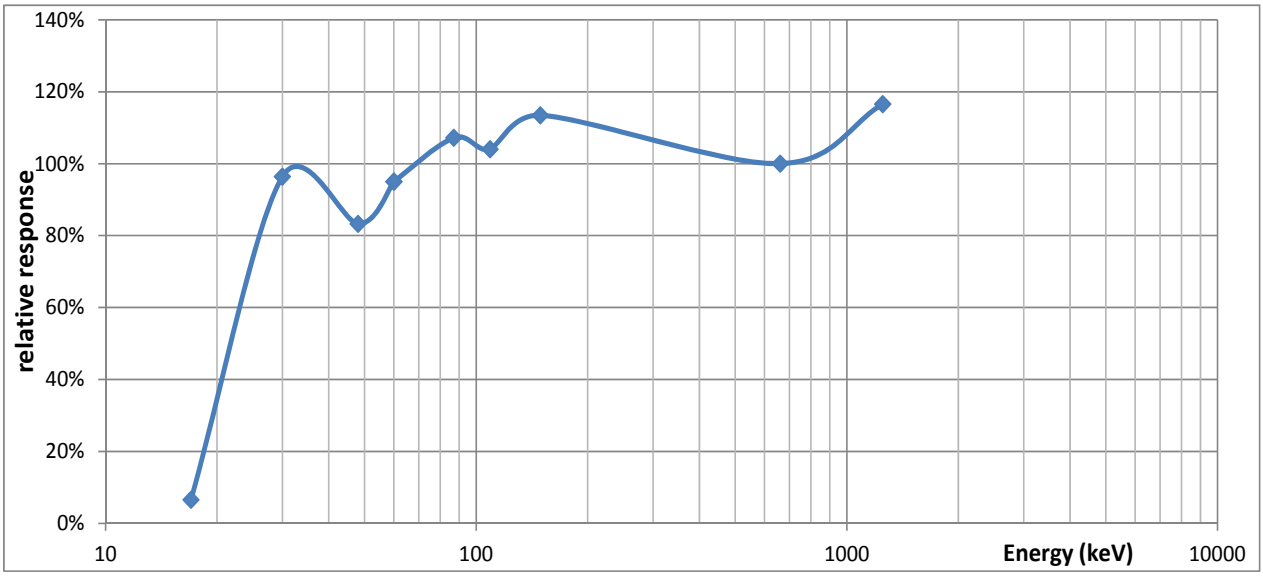


Figure 69: Relative response of gamma dose rate, ambient equivalent, H*(10), RIIDEye X-G and -X-GN

Nuclide Identification Specifications

Available libraries	Standard ANSI, ANSI+, medical, industrial, security, or user-defined; editable library with >40 nuclides listed
Gain stabilization process	Continuous
Gain stabilization method	K-40 embedded included with each detector X-G and X-GN: K-40 contained in housing X-H and X-HN: no additional source; uses La-138 intrinsic to detector
Isotope ID algorithm	Patented QCC algorithm for fastest isotope ID
Peak recognition	Color coded peak ID to specific triggers

Peak Efficiency for NaI Specifications

Source	Energy (keV)	Intrinsic Efficiency
^{57}Co	122	63.95
^{133}Ba	356	39.65
^{137}Cs	662	26.5
^{60}Co	1173	14.35

^{60}Co	1332	13.1

Peak Efficiency for LaBr Specifications

Source	Energy (keV)	Intrinsic Efficiency
^{57}Co	122	63.8
^{133}Ba	356	40.9
^{137}Cs	662	27.1
^{60}Co	1173	14.6
^{60}Co	1332	13.0

Specifications of Components

Preamplifier

Type:	Charge Sensitive
Input:	Negative Current (anode)

ADC

Type:	14-bit pipelined
Speed:	50 MHz

Pulse Processing

Type:	Digital, Trapezoidal Shaping
Peaking times:	40 ns to 5.1 µs, factory set to 1.28 µs
Gain:	Digital, 0.25x to 16x
LLD:	0 to 100% of full scale digitally adjustable in .006% intervals
ULD:	0 to 100% of full scale digitally adjustable in .006% intervals
Zero:	-5% to +5% of full scale, digitally adjustable

Spectrum Conversion

Collection Mode:	Linear – 16384 Channels
Conversion Modes:	Linear – 256, 512, Channels QCC – 256 (G, GN, G3), 512 (H, HN) Channels (U.S. Patent 5,608,222)

System Controller

Processor:	PPC405 CPU at 50 MHz
Display:	3.5”, 320x240 high contrast 32000 color display with LED backlight viewable in all light conditions and with polarized lenses
Controls:	7-key custom keypad
I/O:	Connection via RS232 or via Smart cable for USB, Wireless, and Satellite telephone
Clock:	Battery-backed-up clock/calendar

Power

Batteries:	Packaged 8 AA size, 2400 mAH rechargeable batteries Additional battery adapter allows provisions for AA alkaline batteries or additional rechargeable batteries.
AC:	30 W, 15 V Universal AC adapter
Vehicle:	Connect AC plug through any commercially available 75 W or larger inverter or through 12-V Vehicle adapter, 50 W, 12 V

Gamma Detector RIIDEye X-G and GN

Crystal:	2" x 2" NaI(Tl)
Bias:	Integral HV supply from 0 – 1200 V Actual operating voltage calibrated to each detector

Gamma High Resolution RIIDEye X-H, RIIDEye X-HN

Crystal:	LaBr – crystal, 1.5" x 1.5"

Neutron Detector RIIDEye X-GN, RIIDEye X-HN

Crystal:	CLYC: 12.5 x 12.5 x 31 mm^3 crystal, internal, separate from gamma detector
Moderator:	None – CLYC module is in handle; uses hand as moderator
Discriminator:	Analog pulse shaping and amplitude discrimination
Count Rate Range	0 to 2000 cps

Appendix 1 – Menu Structure Summary

	Level: User	Administrator
Spectral Data		
Review Most Recent Spectrum	✓	✓
Review Recent Spectra	✓	✓
Review Selected Spectra	✓	✓
Erase Selected Spectra	●	✓
Erase All Spectra	●	✓
Exit	✓	✓
Field Settings		
Select Trigger List	●	✓
Audible Count Rate	✓	✓
Disable Vibe	✓	✓
Mute Speaker	✓	✓
Speaker Volume	✓	✓
Alarm Silence time	✓	✓
Display Brightness	✓	✓
Backlight Timeout	✓	✓
Coarse Calibrate	✓	✓
Run Self-Test	✓	✓
Switch User	✓	✓
Exit	✓	✓
Configuration		
Dose Rate Alarm Level	●	✓
Dose Rate Unsafe Level	●	✓
Gamma Rate Alarm LevelCPS	●	✓
Finder Minimum Alarm level CPS	●	✓
Neutron Rate Alarm Level CPS	●	✓
Capture Time	●	✓
Background Warning Time	●	✓
Dose Rate Scale	●	✓
Set Date/Time	✓	✓
Battery Type	✓	✓
Language	✓	✓
Exit	✓	✓

Help		
Introduction	✓	✓
Keypad and Soft Keys	✓	✓
Search/Display Modes	✓	✓
Identifying Radioactivity	✓	✓
Analysis Reports	✓	✓
Collecting a Background	✓	✓
Rolling Background	✓	✓
Background Subtraction	✓	✓
Calibration	✓	✓
Alarms	✓	✓
SNM Assist	✓	✓
Auto Calibration (Stabilization)	✓	✓
Users	✓	✓
Display	✓	✓
Batteries	✓	✓
CompactFlash Card	✓	✓
External Connections	✓	✓
Exit	✓	✓
Admin		
Remote Mode	○	✓
Serial Mode/Speed	○	✓
Reachback Phone#	○	✓
Access Controls	○	✓
Disable Background Subtract	○	✓
Use Rolling Finder Background	○	✓
Sample Time	○	✓
SNM Assist U233	○	✓
SNM Assist U235	○	✓
SNM Assist Pu	○	✓
Logging Interval	○	✓
Logging Mode	○	✓
Dose Rate Disp Thresh	○	✓
Change Administrator Password	○	✓
Network Setup	○	✓

Menu
Function

✓ Permanently present
○ Available if menu **Admin** is activated by the administrator
● Available if function is activated by the administrator