InSpector™ 1000
Digital Hand-Held MCA

User's Manual

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ISO 9001
SYSTEM
CERTIFIED

CE

Body: 9236119C

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The information in this document describes the product as accurately as possible, but is subject to change without notice.

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NOTICE

Before you can use the InSpector™ 1000

- for the first time, or
- with a new probe,

you must calibrate the system.

Perform an Auto Recalibration (page 66), using a mono line source (10 to 20 nCi) such as Canberra's:

- Model CSRCCS-1 for the IPRON-1 probe.
- Model CSRCCS-2 for the IPRON-2 probe.
- Model CSRCCS-3 for the IPRON-3 probe.

For the greatest calibration accuracy, follow this with a Full energy calibration (page 71), using a multipeak gamma source, such as Canberra's:

- Model MGS-3 Calibration Standard.

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Preface

The InSpector™ 1000 is an easy-to-use digital handheld multichannel analyzer, ideally suited for:

- Homeland Security and First Responder Applications (fire fighters, law enforcement, Coast Guard, hospital emergency personnel).
- Customs and Border Controls.
- Waste (scrap) Applications.
- Health Physics Applications which need isotope specific results.
- *In Situ* Environmental Screening.
- Treaty and Non-proliferation Compliance.
- Monitoring of Nuclear Transportation.

The InSpector 1000 and Attached Probe

The InSpector 1000 can be used for any field measurement application requiring dose and count rate measurements, locating sources, nuclide identification with activity measurements, and spectrum acquisition and analysis. All these modes of operations are easily selectable with one touch.

The InSpector 1000 gives results not just data! It continuously updates information about radiation hazards: identified nuclides, nuclide activities or dose rate.

The InSpector 1000 provides a flexible application-specific response by accommodating different detector/probe sizes and technologies. The high voltage power supply and preamplifier are built into each probe.

The instrument automatically recognizes each of these intelligent probes and it selects the associated calibrations and other parameters.

The crisp color display and well-organized six hard buttons allow the user quick access to all modes and to switch from one mode to another with one push of a button! Even with gloved

hands, the user can also use the touch screen instead of these hard keys. The intuitive user interface provides the ultimate flexibility in field operations.

InSpector 1000 is readily usable without the need of extensive training and also offers high-level spectrometry analysis capabilities for expert use.

One-click simplicity masks the powerful spectral processing built within this instrument. This instrument provides a level of performance previously available only in sophisticated computer-based laboratory systems. It offers the full power of Canberra's time-tested spectrum processing algorithms – minimizing false positive identifications while improving sensitivity for low level shielded and mixed sources, or sources "hidden" by natural or legitimate radioactive materials.

Moreover, the use of Digital Signal Processing technology improves the overall signal acquisition performance; this results in increased stability, accuracy, consistency and reproducibility in a Smart probe instrument.

Notes

1. Introduction

The InSpector™ 1000's software runs under the Windows® CE operating system. Though it may seem that other Windows CE applications could be run on the InSpector, doing so will cause undesirable results and may void your warranty.

CAUTION
- Do not use the InSpector as a PDA.
- Do not use the InSpector to run other Windows CE applications.

Doing so will cause the InSpector to malfunction and may cause data to be corrupted or irretrievably lost.

About This Manual

The *InSpector 1000 User's Manual* is designed for users of all levels of sophistication. Each chapter is a tutorial, addresses an operating mode or explains how to set up the instrument for daily operation.

Chapter 2, **Quick Start**, uses the Dose Mode as a brief introduction to working with the InSpector's Dose, Locator and Nuclide ID operating modes.

Chapter 4, **Dose Mode**, presents a quick view of both the Instantaneous Dose Rate and the Cumulative Dose in one of several different display modes in your choice of sievert, roentgen or rem units.

Chapter 5, **Locator Mode**, charts the moment by moment radiation intensity seen by the InSpector, helping you locate lost, hidden or contraband sources of radiation.

Chapter 6, **Nuclide ID Mode**, provides continuous real-time identification of individual isotopes with their activity calculation, in either Bq or µCi.

Chapter 7, **Spectroscopy Tutorials**, is based on Genie 2000's gamma analysis functions. This chapter explains how the InSpector implements those functions.

Chapter 8, **Spectroscopy Mode**, lets you collect and analyze radionuclide spectra with the spectroscopy tools normally found only in a high-end MCA.

Chapter 9, **Setup Mode**, lets you set the system-wide parameters and the parameters for each of the four data modes.

2. Quick Start

The Quick Start chapter uses the Dose Mode as a brief introduction to working with the InSpector's Dose, Locator and Nuclide ID operating modes. The Spectroscopy mode has its own tutorial, starting on page 29.

Preparing the InSpector

If you haven't already connected the probe(s) to your InSpector, refer to "Connecting the InSpector's Cables" on page 132 for instructions.

Turning on the InSpector™

To turn on the InSpector, select the **Power** key (Figure 1).

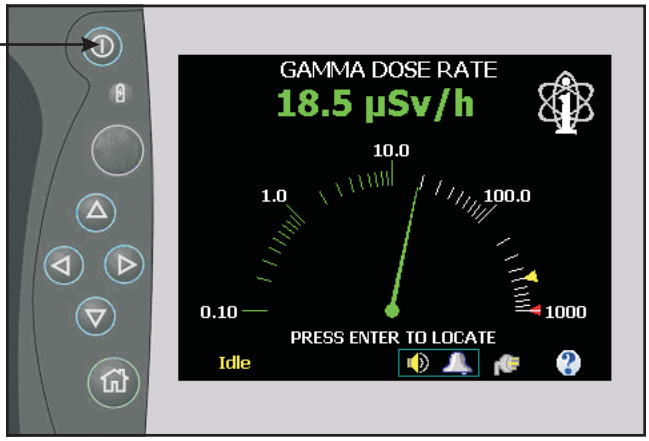


Figure 1 The InSpector's Front Panel

The Dose Mode

The Dose Mode, which is always running in the background, measures and displays both the instantaneous Dose Rate, the amount of radiation being measured at this moment, and the Cumulative Dose.

Displaying the Dose Mode's Data

There are several ways of displaying the Dose Mode's data. As an example, the Simple Dose Rate display in Figure 2 shows:

- The current Dose Rate as a value and unit, 1.8 mR/h (milliRoentgens per hour) as a histogram bar.
- The bar's highlighted length is the proportion of the value, 1.8, to the full scale, 10.0.
- The histogram's first (yellow) vertical bar indicates the Dose Rate warning level and the second (red) bar indicates the Dose Rate alarm level.

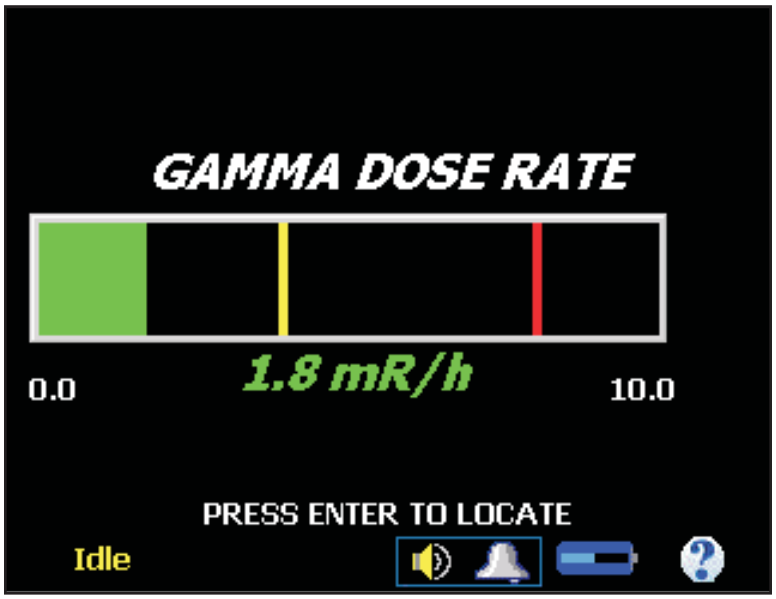


Figure 2 The Simple Dose Display

The Status Line

The Status Line at the bottom of the screen (Figure 3) displays several status indicators:

Figure 3 The Status Bar

- The current instrument status: Idle, Acquiring, High Field, Stabilized, Hold, No Probe or ERROR.
- The current analysis status: Analyzing or ERROR.
- The audio icons disable/enable an active Annunciator or Alarm/Warning audio output.
  - The Annunciator output is active only if the Annunciator (page 19) has been enabled. Selecting the audio icons will turn the Annunciator audio off and put a red **X** through the Annunciator icon.

- If any enabled Warning or Alarm threshold is exceeded (page 91), its audio alert will be heard.

Turning Off the Audio Alerts

- Selecting the audio icons a second time will turn the Alarms audio off and put a red **X** through the Alarms icon. 

- Select the icons again to re-enable the first audio output, and a second time to re-enable the second audio output.

- If the Annunciator has not been enabled, its icon will always be disabled. In this case, only the Alarms icon can be toggled between on and off.

- There are two power icons: One  shows that the InSpector is using an external power source; the other shows that the internal battery  is powering the unit, and shows the battery charge remaining.

- A Help icon.  Select this button to display the help screen for the current Mode or dialog screen.

Error Messages

If a red **NO PROBE** appears in the status line, you must connect a probe to the InSpector before you can acquire data in the NID or Spec Modes.

If a red **ERROR** appears in the status line, there is an acquisition or analysis fault. Select the word “error” to open a text window describing the error (Figure 4).

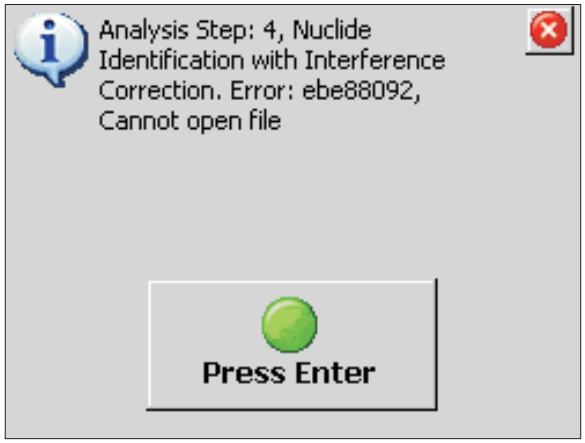


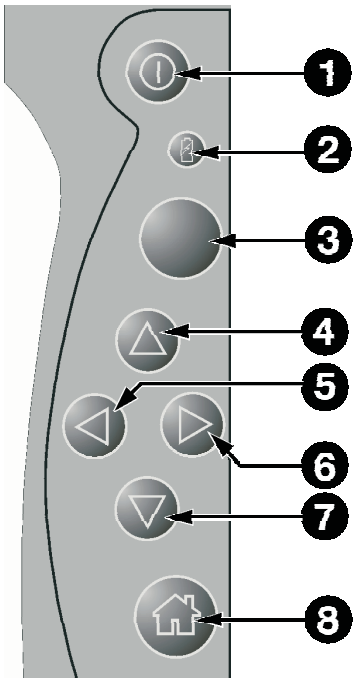
Figure 4 An Example of an Error Message

Navigating the InSpector's Menus

There are two ways to navigate around the InSpector 1000's menus and functions: by the hard keys to the left of the display or by the soft buttons on the display.

Hard Keys

These are general descriptions of the hard keys' functions. The function of most keys depends on which mode is active.



1. **Power:** Cycles the InSpector On/Off.

2. **Charge:** Light whenever the battery is being charged.

3. **Enter:** Function varies, depending on the active mode.

4. **Up**: Enters the main menu; in the menu, changes the displayed mode.

5. **Left:** In the menu, moves to the left.

6. **Right:** In the menu, moves to the right.

7. **Down:** Exits the menu and returns to the current display.

8. **Home:** Changes the display to the **Home Mode** selected in Instrument Setup (page 98).

Soft Buttons

The touchscreen allows both coarse control and fine control.

- Touch a soft button on the screen to select that button's function.
- For fine control, use a stylus or your fingernail.

The Home Mode

You can always select the **Home** button to go back to the default operating mode, as defined in Instrument Setup (page 98).

Accessing the Menus

You can move through the menus by:

- Selecting the menu's soft buttons,
- Using the arrow hardkeys.

For example, selecting the Up Arrow key shows you the first level menu with a soft button for each of the InSpector's operating modes (Figure 5).

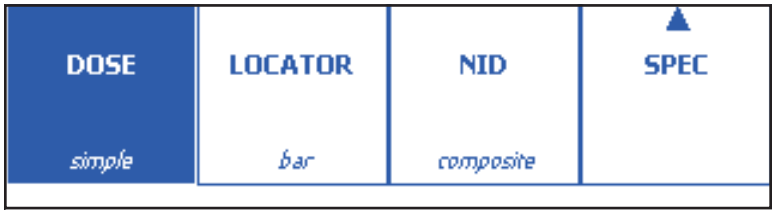


Figure 5 The First Level Menu

- Three of the menu buttons show a legend in italics. Each time you select a button like this, the button's legend and the function's display will change.
- For example, each time you select the **DOSE** button, the Dose Mode's display will change, displaying the data in a different way. The button's legend will also change, describing that display.
- The upward pointing triangle Δ on the **SPEC** soft button indicates that there's another menu level associated with that button.

- If you select the **SPEC** button, you'll see the next level of the Spectroscopy menu (Figure 6).

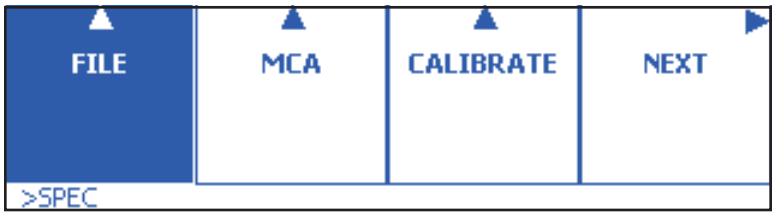


Figure 6 The Spectroscopy Menu

- The area just below the menu displays the path you've followed to get to this point. In this example, you can see that you have gotten here by having selected SPEC.

- Three of this level's buttons show the upward-pointing Δ triangle, indicating that each has another menu level associated with it.

- The fourth button, **NEXT**, shows a right-pointing ▷ triangle. Select this button to see more menu items at the same level.

The Backlight

The InSpector's display backlight will illuminate the LCD display in low light or no light conditions but its use will reduce the operating time of the instrument. The backlight can be configured to always be On, always Off, or to automatically turn off a specified number of seconds after the unit becomes inactive (see "Instrument Setup" on page 98).

3. Easy Mode of Operation

The InSpector is normally set for this mode of operation. If your unit is set to the Standard Mode, you'll find the information you need in the chapters on Dose Mode, Locator Mode, NID Mode and Spectroscopy Mode.

There are two main functions in the Easy Mode:

- The Locator (LOC) function, which lets you locate the source of radioactivity, making it easy to locate lost, hidden or contraband sources (this page).
- The Nuclide Identifier (NID) function, which identifies individual isotopes and their activity (page 11).

Locator Mode

As soon as the Locator Mode is selected, it begins operating, displaying a histogram. The Dose Rate is continuously evaluated and the warning and alarm levels are constantly tracked by the InSpector.

As you scan an area with the InSpector's probe, the change in intensity lets you locate the source of the radioactivity, making it easy to precisely locate lost, hidden or contraband sources.

When you select the Locator Mode, you'll see a bar chart (Figure 7) showing the instantaneous radiation intensity.

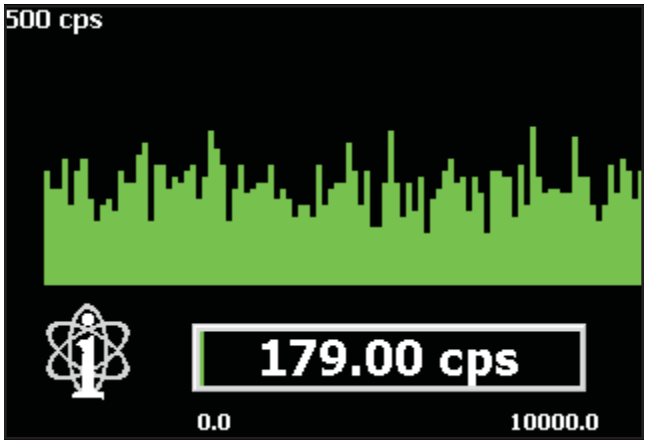
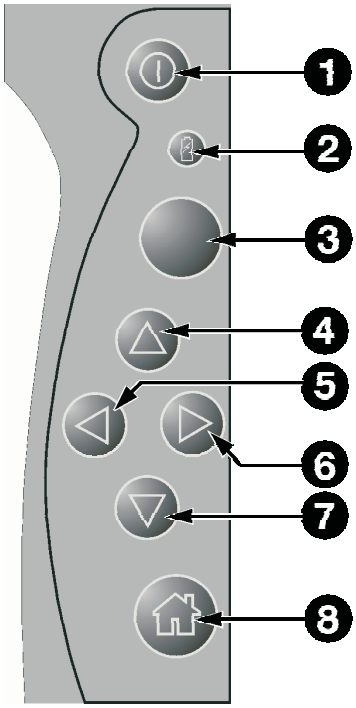


Figure 7 Locator Mode, in Counts per Second

- The most current data (i.e., time now) is the right end of the display. As time advances, data will move to the left.
- In Figure 7, the display's x-axis is calibrated in counts. The width of the graph, in time, is the figure below the right end of the graph.
- The y-axis is calibrated in CPS or Dose Rate units (selected in Monitor, page 95); its range can be changed and Autoscale can be enabled (both selected in Locator, page 94).
- When configured for Dose Rate operation, the dose results are updated once a second.

Hard Key Functions



1. **Power** – Turns the InSpector On/Off.
2. **Charge** – Light whenever the battery is being charged.
3. **Enter** – Starts/stops data acquisition.
4. **Up** – No function in this mode.
5. **Left** – Halves the width of the dwell window (and changes the dwell time).
6. **Right** – Doubles the width of the dwell window (and changes the dwell time).
7. **Down** – No function in this mode.
8. **Home** – Changes the display back and forth between the LOCate and NID modes.

Changing to the NID Mode

To change the display to the NID Mode (page 11), select the isotope icon or the keypad's **Home** key.

The Locate Mode Bargraph

The bargraph at the bottom of the screen can be made to read CPS (counts per second) or Dose Rate (page 95). As Dose Rate, the bargraph shows the same data as the Simple dose display. As CPS, the bargraph shows the same data (ICR) as the Composite dose display.

Overflow Indicator

If the bargraph's data is beyond the selected scale, a right-pointing triangle appears at the right end of the bargraph (circled in Figure 8).

Figure 8 CPS Overflow Indication

Alerts

The InSpector can be set to alert you if the detected radiation exceeds the low level Warning or high level Alarm threshold.*

Warning Indicators

If a Warning Level is exceeded, the color of the bar will change to yellow.

If enabled, an audio alert will sound and the display's background will alternate between black and gold.

Alarm Indicators

If an Alarm Level is exceeded, the color of the bar will change to red.

If enabled, an audio alert will sound and the display's background will alternate between black and maroon.

Turning Off the Audio Alerts

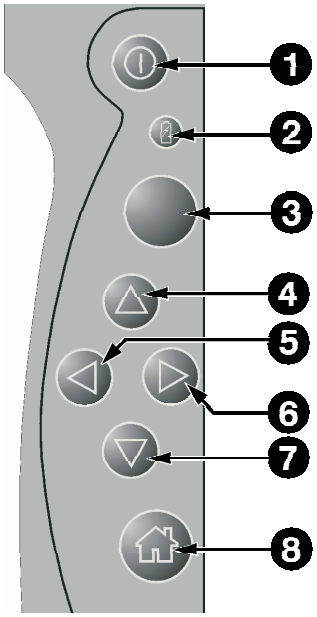
See "Turning off the Audio Alerts" on page 4.

*The InSpector can alert you to any or all of excessive Dose Rate, Cumulative Dose or Neutron Count Rate. Their thresholds are defined in the Setup Mode. In addition, an alert for specific isotopes can be programmed.

Nuclide ID Mode

When data has been acquired and analyzed, NID (nuclide identification) provides continuous real-time identification of individual isotopes with their activity calculation. The results for all identified isotopes are displayed as a chart. In addition, the InSpector™ can monitor specific isotopes and notify you when the alert levels you specify are exceeded (page 27).

Hard Key Functions



1. **Power** – Turns the InSpector On/Off.
2. **Charge** – Light whenever the battery is being charged.
3. **Enter** – Starts/stops data acquisition.
4. **Up** – No function in this mode.
5. **Left** – Displays the previous page of NID results.
6. **Right** – Displays the next page of NID results.
7. **Down** – No function in this mode.
8. **Home** – Changes the display between the NID and LOCate modes.

The NID Display

The Easy Mode display (Figure 9) lists the identified nuclides, their isotope type (fission, activation, etc.), and either dose rate or activity.

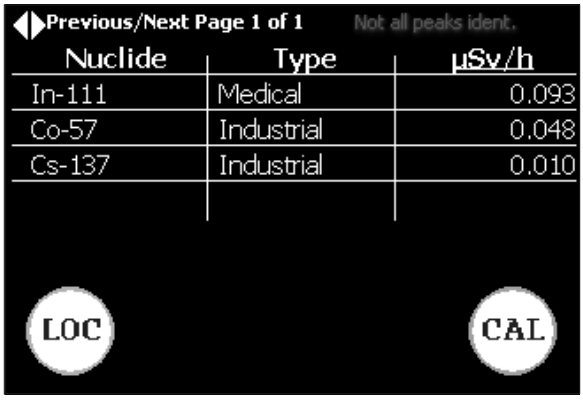


Figure 9 The Nuclide ID Display

Changing to the Locator Mode

To change the display to the Locator Mode (page 8), select the onscreen Locate button  or the keypad's **Home** key.

Calibrating the InSpector

Select the onscreen Calibrate button  to access the InSpector's standard Auto Recal function, which is covered in detail starting on page 66.

Note: The CAL button will be not be seen when data acquisition is in process.

Starting Data Acquisition

To acquire nuclide data, select the **Enter** key.

- If there already is a list of nuclide data, you'll be asked if you want to start a New acquisition or Resume the old one.
- When data acquisition terminates, the identified nuclides will be listed in the nuclide table.
- If more nuclides have been found than can be listed on the page, use the right/left arrow keys to move between pages.

Selecting Which NID Data to Display

- Selecting the first column's heading orders the column by atomic mass.
- Selecting the last column's heading toggles the data between activity and dose rate.

Saving the Data

When acquisition is off, select the keyboard's **Enter** key to start a New data acquisition, with or without Saving the current data (Figure 10).

Note: Data cannot be saved when data acquisition is in process.

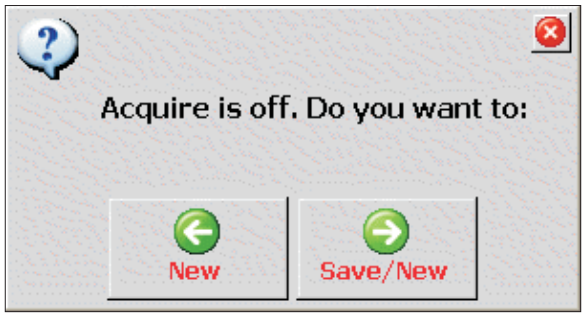


Figure 10 Saving the Data

- **New** clears the data and starts a new acquisition.
- **Save/New** saves the current data before starting a new acquisition.

Isotope-Specific Alerts

The InSpector can announce warnings and alerts for specific nuclides. This feature is set up in the Standard Operating Mode (page 27).

If the Nuclide's Warning Level is Exceeded

- The General Alert Warning Indicator (described below) is triggered.
- The nuclide's line will blink yellow.

If the Nuclide's Alarm Level is Exceeded

- The General Alert Alarm Indicator (described below) is triggered.
- The nuclide's line will blink red.

General Alerts

The InSpector can be set to alert you if the detected radiation exceeds the low level Warning or high level Alarm threshold.*

Warning Indicators

If a Warning Level is exceeded, the color of the bar will change to yellow.

If enabled, an audio alert will sound and the display's background will alternate between black and gold.

*In addition to the alert for specific isotopes, the InSpector can alert you to any or all of excessive Dose Rate, Cumulative Dose or Neutron Count Rate. Their Warning and Alarm thresholds are defined in the Setup Mode.

Alarm Indicators

If an Alarm Level is exceeded, the color of the bar will change to red.

If enabled, an audio alert will sound and the display's background will alternate between black and maroon.

Turning Off the Audio Alerts

See “Turning off the Audio Alerts” on page 4.

Using a Stabilized Probe

The Stabilized Probe is very easy to use. When the InSpector finds a Stabilized Probe connected to its DET connector, it will display a message for about 30 seconds, advising you that the probe is stabilizing (Figure 11).

Figure 11 The Probe is Stabilizing

- The blue LED on the probe will blink while stabilization is in process. When stabilization is complete, the LED will glow steadily.
- If stabilization is lost, perhaps due to moving the unit from a warm environment to a cold one (indoors to outdoors), data acquisition will stop and the instrument will restabilize itself (the blue LED will start blinking). When the LED glows steadily, stabilization is complete and acquisition can be restarted.

- If you enter a high radiation area, High Field will be displayed at the bottom of the screen, data acquisition will stop, the probe's high voltage and its blue LED will be turned off. When you leave the High Field area, the high voltage will be turned on again and the LED will start blinking as the probe begins stabilizing. When the LED glows steadily, stabilization is complete and acquisition can be restarted.

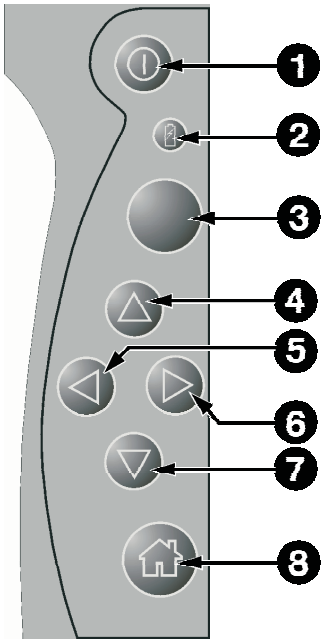
4. Dose Mode

The Dose Mode, which is always running in the background, measures and displays the instantaneous Dose Rate, the amount of radiation being measured at this moment. You can choose any of several displays, each providing different data.

Dose Rate Equivalent

The InSpector 1000 reports the dose rate equivalent on 10 mm of human tissue [H*(10)]. It does not report surface tissue dose. Therefore, the values reported by the InSpector will not be the same as those reported by instruments using surface methods.

Hard Key Functions



1. **Power** – Turns the InSpector™ On/Off.

2. **Charge** – Light whenever the battery is being charged.

3. **Enter** – Change to the Locator Mode.

4. **Up** – Enters the main menu; in the menu, changes the displayed mode.

5. **Left** – In the menu, moves to the left.

6. **Right** – In the menu, moves to the right.

7. **Down** – Exits the menu and returns to the Dose display.

8. **Home** – Changes the display to the **Home Mode** selected in Instrument Setup (page 98).

How Dose Information is Displayed

All Dose Mode displays include a digital readout and visual indicators for both the warning threshold and the alarm threshold. The thresholds and the display units are selected in “Dose Setup” (page 91).

NaI Probe Displays

If a Gamma (NaI) Probe is connected to the InSpector, you can choose:

- Simple – Displays the current Gamma Dose Rate as a bargraph (Figure 12).
- Composite – Displays the Gamma Dose Rate, the Cumulative Gamma Dose and the Gamma Count Rate as bargraphs (Figure 13).
- Ebar – Displays the Gamma Dose Rate, the Cumulative Gamma Dose and the Average Spectrum Energy as bargraphs (Figure 14).
- Log Dial – Displays the current Gamma Dose Rate on a logarithmic analog scale (Figure 15).
- Linear Dial – Displays the current Gamma Dose Rate on a linear analog scale (similar to Figure 15).

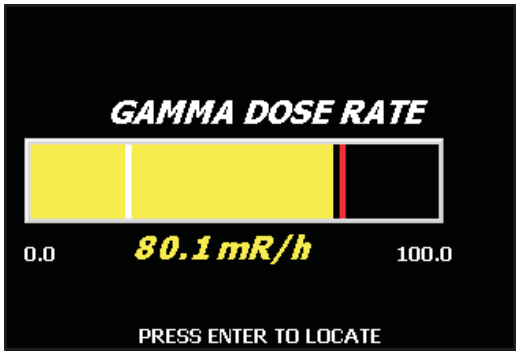


Figure 12 Simple Dose Display

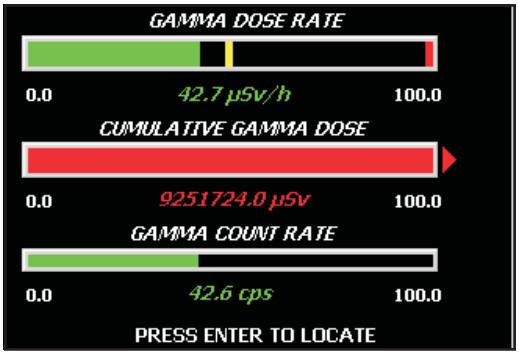


Figure 13 Composite Dose Display

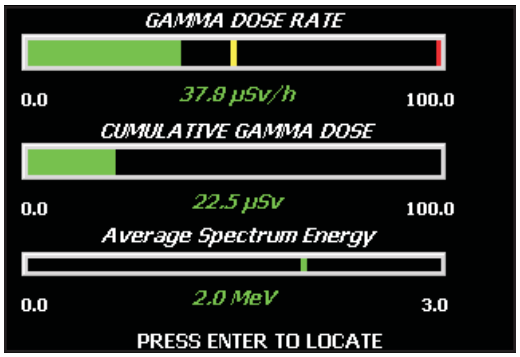


Figure 14 Ebar Dose Display

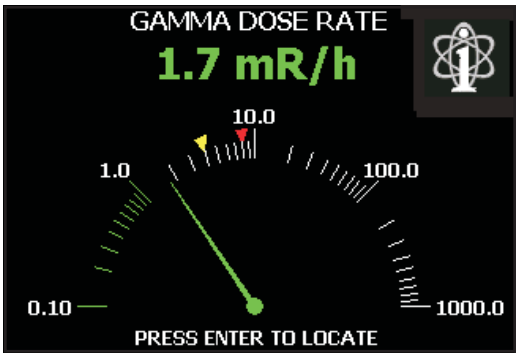


Figure 15 Log Dial Dose Display

Neutron Probe Displays

If a Neutron Probe is connected to the InSpector, two more displays are available.

- Dose Neutron – Displays the current Gamma Dose Rate and the Neutron Count Rate as bargraphs (Figure 16).
- Composite Neutron – Displays the current Gamma Dose Rate, the Cumulative Gamma Dose and the Neutron Count Rate as bargraphs (Figure 17).

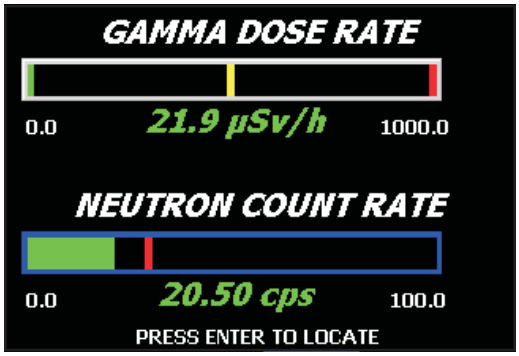


Figure 16 Dose Neutron Display

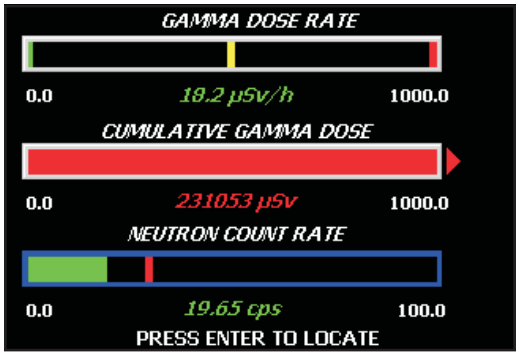


Figure 17 Composite Neutron Display

Dose Alerts

If the low-level warning and/or high-level alarm thresholds for Dose Rate, Cumulative Dose and/or Neutron Count Rate (page 91) are exceeded, you will be alerted to the condition in several ways.

Warning Indicators

If the Warning threshold is exceeded, the color of the bar will change to yellow.

If the Enable parameter for either of these warnings is set to On, the audio alert for that warning will sound and the display's background will alternate between black and gold.

Alarm Indicators

If the Alarm threshold is exceeded, the color of the bar will change to red.

If the Enable parameter for either of these alarms is set to On, the audio alert for that alarm will sound and the display's background will alternate between black and maroon.

Turning Off the Audio Alerts

See “Turning off the Audio Alerts” on page 4.

Overflow Indicator

If the bargraph’s data is beyond the selected scale, a right-pointing triangle appears at the right end of the bargraph (circled in Figure 18).

Figure 18 Dose Rate Overflow Indication

Neutron Count Rate Alert

If the Neutron Count Rate exceeds the Neutron Count Rate Alarm setting (page 94), a blinking **Neutron** will overwrite the current mode’s display (Figure 19) and the display's background will alternate between black and maroon.

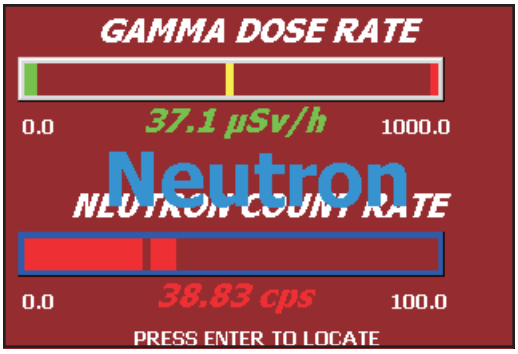


Figure 19 Dose Neutron Alarm Indicator

The Annunciator

If the Annunciator is enabled (page 93), the InSpector can be used to locate an isolated source. When the InSpector detects radioactivity, an audio alert will sound. As the unit approaches the source, the radiation intensity (incoming count rate) increases, causing the audio output’s rate or pitch to change with the rate of detected radiation changes.

Clearing the Cumulative Dose

The Cumulative Dose is the total radiation dose received by the unit since the InSpector was turned on or since the dose memory was cleared using the Setup Mode's Clear Cumulative Dose command (page 100).

Changing to the NID Mode

If NID results are available (page 24), you'll see an isotope icon  in the upper right corner of the Dial displays. You can change from a Dial display to the NID Mode display by selecting this icon.

The Isotope Icon

If isotope-specific alerts have been enabled in the NID Mode (page 27), the isotope icon will change to yellow if any specified isotope's warning threshold has been exceeded or red if its alarm threshold has been exceeded.

5. Locator Mode

As soon as the Locator Mode is selected, it begins operating, displaying a histogram. The Dose Rate is continuously evaluated and the warning and alarm levels are constantly tracked by the InSpector™.

As you scan an area with the InSpector's probe, the change in intensity lets you locate the source of the radioactivity, making it easy to find lost, hidden or contraband sources.

When you select the Locator Mode, you can choose to display either a bar chart (Figure 20) or a line chart showing the instantaneous radiation intensity.

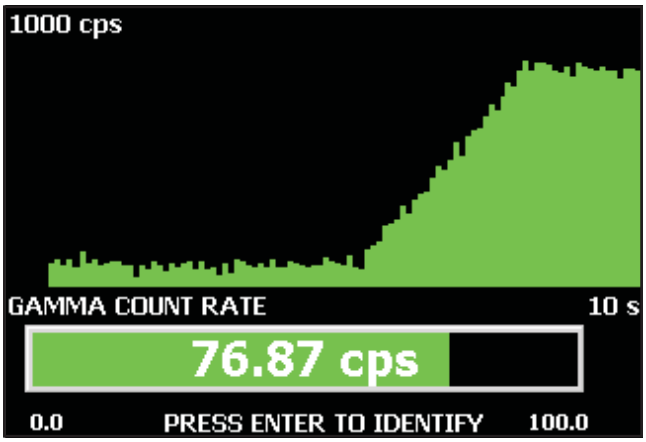
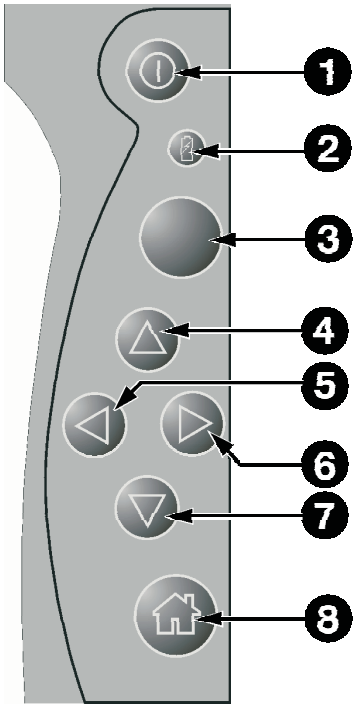


Figure 20 Locator Mode with the Dose Rate Bar

- The most current data (i.e., time now) is the right end of the display. As time advances, data will move to the left.
- The display's horizontal axis is calibrated in time. The width of the graph, in time, is the figure below the right end of the graph (10 seconds in Figure 20).
- The vertical axis is calibrated in CPS or Dose units (selected in Monitor Setup). Its range can be changed or Autoscale can be enabled (in Locator Setup). The vertical axis scale's maximum value is shown in the upper left corner (1000 cps in the figure).

- The bar graph's scale is shown below the bar (0.0 and 100.0 in the figure).
- The number shown on the bar (76.87 cps in the figure) is the current count rate.
- If nuclides have been identified, you can move from the Locator Mode to the Nuclide ID (NID) Mode by selecting the **Enter** key.
- When configured for Dose Rate operation, the dose results are updated once a second.
- The operation is limited to gamma fields within the usable range of the attached gamma probe.

Hard Key Functions



1. **Power** – Turns the InSpector On/Off.
2. **Charge** – Light whenever the battery is being charged.
3. **Enter** – Change to the Nuclide ID Mode.
4. **Up** – Enters the main menu; in the menu, changes the displayed mode.
5. **Left** – In the menu, moves to the left through the menu; in the Locator Mode, halves the width of the dwell window (and changes the dwell time).
6. **Right** – In the menu, moves to the right through the menu; in the Locator Mode, doubles the width of the dwell window (and changes the dwell time).
7. **Down** – Exits the menu and returns to the Locator display.
8. **Home** – Changes the display to the Home Mode selected in Instrument Setup (page 98).

The Locate Mode Bargraph

The bargraph at the bottom of the screen can be made to read CPS (counts per second) or Dose Rate ("Monitor", on page 95). As Dose Rate, the bargraph shows the same data as the Simple dose display. As CPS, the bargraph shows the same data (ICR) as the Composite dose display.

Overflow Indicator

If the bargraph's data is beyond the selected scale, a right-pointing triangle appears at the right end of the bargraph (circled in Figure 8).

Figure 21 CPS Overflow Indication

Alerts

If the low-level warning and/or high-level alarm thresholds for Dose Rate, Cumulative Dose and/or Neutron Count Rate (page 91) are exceeded, you will be alerted to the condition in several ways.

Warning Indicators

If the low-level Warning threshold is exceeded, the color of the bar will change to yellow.

If the Enable parameter for either of these warnings is set to On, the audio alert for that warning will sound and the display's background will alternate between black and gold.

Alarm Indicators

If the high-level Alarm threshold is exceeded, the color of the bar will change to red.

If the Enable parameter for either of these alarms is set to On, the audio alert for that alarm will sound and the display's background will alternate between black and maroon.

Turning Off the Audio Alerts

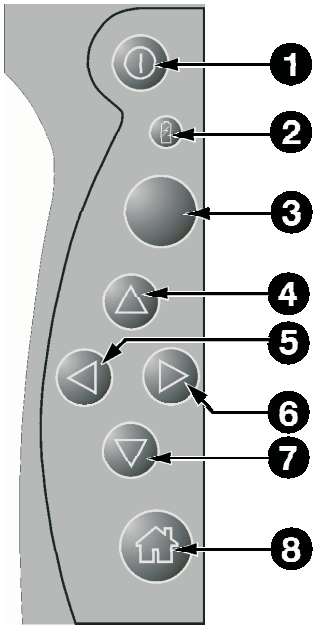
See "Turning off the Audio Alerts" on page 4.

6. Nuclide ID Mode

When data has been acquired and analyzed, The NID (nuclide identification) Mode provides continuous real-time identification of individual isotopes with their activity calculation. The results for all identified isotopes are displayed as a chart. In the Composite display, a Dose Rate bargraph is added.

In addition, the InSpector™ can monitor specific isotopes and notify you when the alert levels you specify are exceeded (page 27).

Hard Key Functions



1. **Power** – Turns the InSpector On/Off.

2. **Charge** – Light whenever the battery is being charged.

3. **Enter** – The Enter key has several easily understood context-sensitive functions.

4. **Up** – Enters the main menu; in the menu, changes the displayed mode.

5. **Left** – In the menu, moves to the left through the menu; in the NID mode, displays the previous page of NID results.

6. **Right** – In the menu, moves to the right through the menu; in the NID mode, displays the next page of NID results.

7. **Down** – Exits the menu and returns to the NID display.

8. **Home** – Changes the display to the **Home Mode** selected in Instrument Setup (page 98).

How Nuclide Information is Displayed

The InSpector has three NID displays, Simple, Composite and Neutron. The Dose (units/h) column will display zeros if a Dose by Isotope step (page 165) is not included in the current analysis file.

- The **Simple** display (Figure 22) shows a table listing the nuclide, the isotope type (fission, activation, etc.), and either its dose rate or its activity.
- The table in the two **Composite** displays (Figures 23 and 24) list the Nuclide, its dose rate (if enabled), its activity, and either its activity % Error or its Confidence, and a Gamma Dose Rate bargraph.
- The **Neutron** display (Figure 24), which will be seen only if a Neutron Probe is attached to the InSpector, adds a Neutron Count Rate bargraph.

Simple NID Display

Selecting the first column's heading orders the column by atomic mass.

Selecting the last column's heading toggles the data between activity and dose rate.

The header of the column that has been sorted will be underlined.

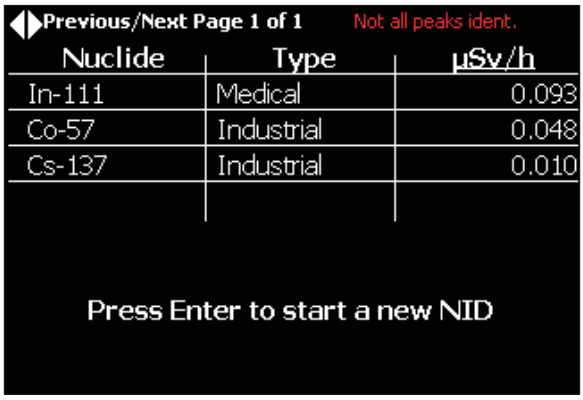


Figure 22 Simple Nuclide ID

Composite NID Displays

Selecting a column's heading sorts its data. See "Sorting the NID Data" on page 26.

The header of the sorted column will be underlined.

Percent Error, if displayed, indicates the 1 sigma uncertainty of the activity.

Confidence, if displayed, indicates the percent confidence that the nuclide identification is correct.

A '*' displayed before the activity value at the head of its column indicates that the default efficiency was used for analysis.

The Dose Neutron Nuclide ID screen (Figure 24) will be seen only if a Neutron Probe is attached to the InSpector.

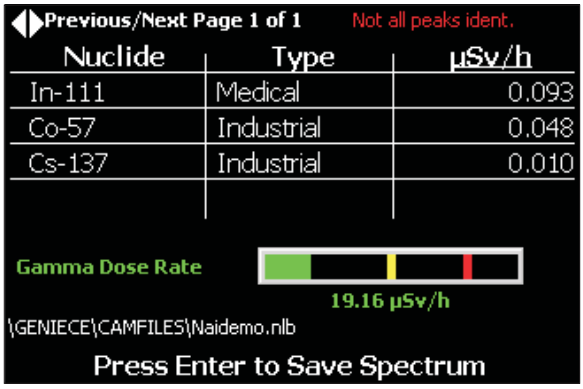


Figure 23 Composite Nuclide ID

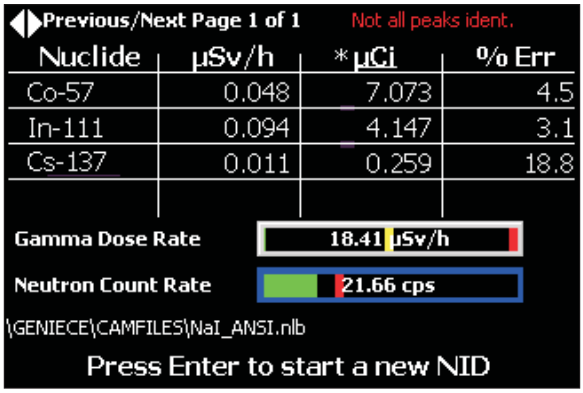


Figure 24 Neutron Nuclide ID

When two or more nuclides, such as ^{85}Kr and ^{85}Sr, produce their single peak at the same energy level, the InSpector is not able to determine which nuclide to assign to that peak. If this happens, the InSpector will display a '?' before the nuclide name.

Pressing Enter

- If data acquisition is not in progress, "Press Enter to start a new NID" (Figure 22).
- If data acquisition *is* in progress, "Press Enter to Save the Spectrum", then select "NEW" to acquire a new spectrum or "RESUME" to continue the current acquisition (Figure 25).

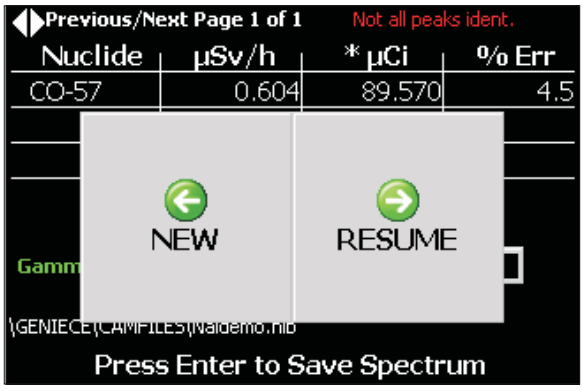


Figure 25 New or Resumed Spectrum

Gamma Dose Rate Bargraph

The Gamma Dose Rate bargraph below the Composite Display's nuclide table shows the same data as the Simple Dose Mode display (page 17). Click on the Gamma Dose Rate bar to change to the last selected Dose Mode display.

Library Used

The name of the nuclide library used for nuclide analysis will be shown below the bargraph only if there is an NID step in the analysis file and a library has been defined.

Sorting the NID Data

You can sort the Composite display's data by selecting any of its columns.

- Click on **Nuclide** to sort the rows in increasing order of atomic mass.
- Click on the **unit/h** (Dose Rate, if enabled), **unit** (activity) or **Conf(%)** (if enabled) column title to sort the rows in decreasing order.
- Click on **% Err**, if enabled, to sort the rows in increasing order.
- The title of the column that has been used for sorting will be underlined.

Isotope-Specific Alerts

Genie 2000's Nuclide Library Editor, described in its own chapter in the *Genie 2000 Operations Manual*, is used to set isotope-specific alerts (Action Levels) for specific nuclides in a nuclide library (NLB) file.

- Set Action Level 1 for a nuclide to enable its warning level.
- Set Action Level 2 for a nuclide to enable its alarm level.

After modifying the nuclide library…

- Use the Maintenance Utility's Send function (page 108) to transfer the library to the InSpector.
- Then load it in the NID Analysis Setup (page 97).
- This library will be used for the NID Analysis step of the currently loaded analysis sequence file.
- How to Analyze a Spectrum on page 47 tells you how to Load and Start an analysis sequence.

After each execution of the analysis sequence, the InSpector evaluates the NID results data, comparing the mean activity for each nuclide to the Action Level 1 and Action Level 2 settings for that nuclide.

If the Nuclide's Warning Level is Exceeded

- The nuclide activity Warning Indicator (described in General Alerts, below) is triggered.
- Its line will blink yellow.
- The isotope icon  in the upper right corner the Dose Mode's Linear Dial or Log Dial display (page 17) will change to yellow.

If the Nuclide's Alarm Level is Exceeded

- The nuclide activity Alarm Indicator (described in General Alerts, below) is triggered.
- Its line will blink red.
- The isotope icon  in the upper right corner the Dose Mode's Linear Dial or Log Dial display (page 17) will change to red.

General Alerts

If, in addition to the Isotope-Specific Alerts, the low-level warning and/or high-level alarm thresholds for Dose Rate, Cumulative Dose and/or Neutron Count Rate (page 91) are exceeded, you will be alerted to the condition in several ways.

Warning Indicators

If the low-level Warning threshold is exceeded, the color of the bar will change to yellow.

If the Enable parameter for either of these warnings is set to On, the audio alert for that warning will sound and the display's background will alternate between black and gold.

Alarm Indicators

If the high-level Alarm threshold is exceeded, the color of the bar will change to red.

If the Enable parameter for either of these alarms is set to On, the audio alert for that alarm will sound and the display's background will alternate between black and maroon.

Turning Off the Audio Alerts

See “Turning off the Audio Alerts” on page 4.

7. Spectroscopy Tutorials

This chapter describes the Spectroscopy Mode display and is a quick overview of some of the Mode's functions. See Chapter 8, *Spectroscopy Mode*, for more information.

Relationship of the InSpector™ to Genie 2000

The Spectroscopy Mode's functions parallel the same functions in the Genie 2000 Spectroscopy Software. For detailed information, please refer to the *Genie 2000 Operations Manual* and the *Genie 2000 Customization Tools Manual*. Both are included as PDF files on your Genie 2000 CD-ROM.

Spectral Data Conventions

Canberra's MCAs manage two types of spectra: data currently being acquired (a "live" spectrum) and data loaded from a file (a saved spectrum acquired at an earlier time). Any spectroscopy function affecting the data of one type will not affect the data of the other type.

Memory Resident Files

Several of the Spectroscopy Mode's functions require choosing a file resident in the InSpector's memory as the current file, the one to be used for that function. The Maintenance Utility's Send command (page 105) transfers files from your PC to the InSpector.

Screen Layout

There are several parts to the Spectroscopy display: the Data Line, the Spectral Display Area, the Information Pages and the Status Line (Figure 26).

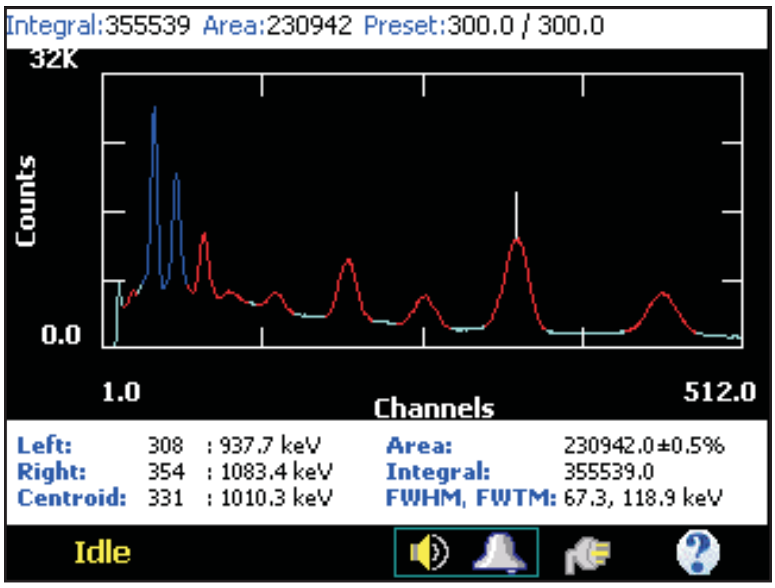


Figure 26 The InSpector's Screen

The Data Line

The Data Line, at the top of the screen, has two display modes. If there are ROIs in the spectrum *and* the cursor is in an ROI, you'll be able to toggle between either of the two modes.

Cursor Mode

If the cursor is not in an ROI, or there are no ROIs in the spectrum, the Data Line will display only:

- The number of the current Channel, the one the cursor is in, in terms of both its channel number and its energy in keV.
- The Counts at that position.
- The Preset values for the preset's setting and the elapsed preset time.

ROI Mode (Shown in Figure 26)

If the cursor is in an ROI, select the Down Arrow key to see:

- The Integral and Area of the current ROI, the one the cursor is in.
- The Preset values for the preset's setting and the actual elapsed preset.

Selecting the Down Arrow key again will change back to the Cursor Mode.

Indexing the ROIs

When the Data Line is in the ROI Mode, you can Index (jump) from one ROI to another:

- Select the Right Arrow key to move to the next ROI to the right.
- Select the Left Arrow key to move to the next ROI to the left.

The Spectral Display

This area, in the middle of the display, shows the spectral data. Optional display configurations are covered in Settings (page 81).

Frequently, there are ROIs (regions of interest) in a spectrum, as seen in Figure 26. ROIs that have been associated with a nuclide are blue; ROIs that contain an unidentified peak are red.

The Information Pages

User selectable data about the current spectrum can be displayed below the spectrum in an information page (page 77).

The Status Line

The Status Line at the bottom of the screen (Figure 27) displays several status indicators:

Figure 27 The Status Bar

- The current instrument status: Idle, Acquiring, High Field, Stabilized, Hold, No Probe or ERROR.

- The current analysis status: Analyzing or ERROR.
- The audio icons disable/enable an active Annunciator or Alarm/Warning audio output.
  - ▶ The Annunciator output is active only if the Annunciator (page 19) has been enabled. Selecting the audio icons  will turn the Annunciator audio off and put a red **X** through the Annunciator icon. 
  - ▶ If any enabled Warning or Alarm threshold is exceeded (page 91), its programmed sound (page 99) will be heard.

Turning Off the Audio Alerts

- ▶ Selecting the audio icons a second time will turn the Alarms audio off and put a red **X** through the Alarms icon. 
- ▶ Select the icons again to re-enable the first audio output, and a second time to re-enable the second audio output.
- ▶ If the Annunciator has not been enabled, its icon will always be disabled. Only the Alarms icon can be toggled between on and off.

- There are two power icons: One  shows that the InSpector is using an external power source; the other shows that the internal battery  is powering the unit, and shows the battery charge remaining.
- A Help icon.  Select this button to display the help screen for the current Mode or dialog screen.

Error Messages

If a red **NO PROBE** appears in the status line, you must connect a probe to the InSpector before you can acquire data in the NID or Spec Modes.

If a red **ERROR** appears in the status line, there is an acquisition or analysis fault. Select the word “error” to open a text window describing the error (Figure 28)

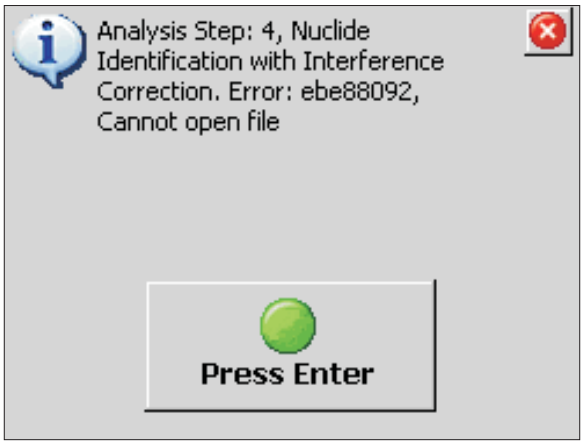
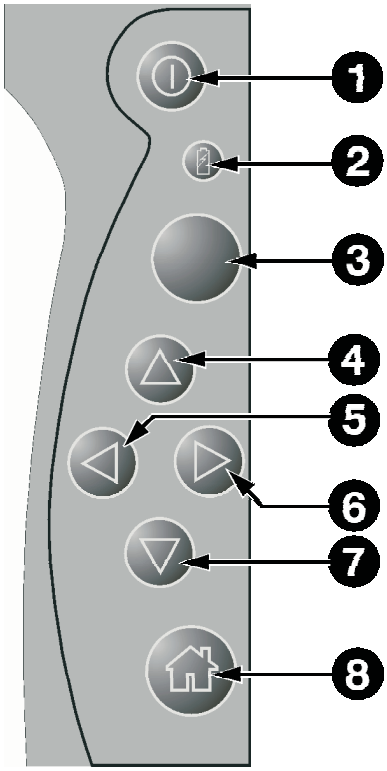


Figure 28 An Example of an Error Message

Navigation

There are two ways to navigate around the InSpector 1000's menus and functions: by the hard keys to the left of the display or by the soft buttons on the display.

Hard Keys



1. **Power** – Turns the InSpector On/Off.

2. **Charge** – Light whenever the battery is being charged.

3. **Enter**: – In a menu, executes the current soft key's function; when not in a menu, Starts or Stops data acquisition.

4. **Up** – Enters the main menu; in the menu, goes to the next submenu.

5. **Left** – In the menu, moves left through the menu; in the Cursor Mode (page 30), moves the plot cursor left; in the ROI Mode, jumps one ROI to the left.

6. **Right** – In the menu, moves right through the menu; in the Cursor Mode, moves the plot cursor right; in the ROI Mode, jumps one ROI to the right.

7. **Down** – In the menu, goes to the previous menu level; if no previous level, exits the menu. In the spectrum, toggles the data line between Cursor Mode and ROI Mode.

8. **Home** – In the menu, exits the menu; otherwise, changes the display to the "Home Mode" selected in Instrument Setup (page 98).

Soft Buttons

The touchscreen allows both coarse control and fine control.

- Touch a soft button on the screen to select that button's function.
- Touch the screen to position the cursor approximately in the spectrum.
- For fine control, use a stylus or your fingernail.

Moving the Spectrum's Cursor

Touching the screen will move the Spec Mode's spectrum cursor to an approximate location. Then it can be moved more precisely with the front panel Left Arrow and Right Arrow keys.

Accessing the Menus

You can move through the menus by:

- Selecting the screen soft buttons,
- Using the arrow hardkeys.

For example, selecting the Up Arrow shows you the first level menu with its four soft buttons (Figure 29).

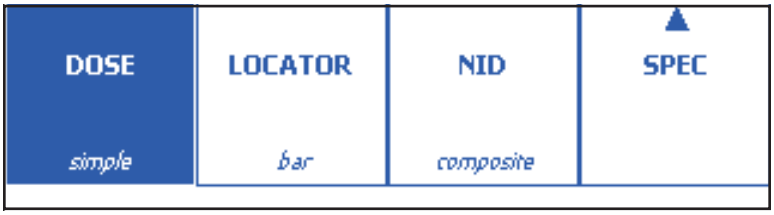


Figure 29 The First Level Menu

- The upward-pointing Δ triangle on the **SPEC** soft button indicates that there is an another menu level associated with the button.

- Select the **SPEC** button to see its next menu level. Figure 31 shows that each of the first three menu buttons has another menu level.

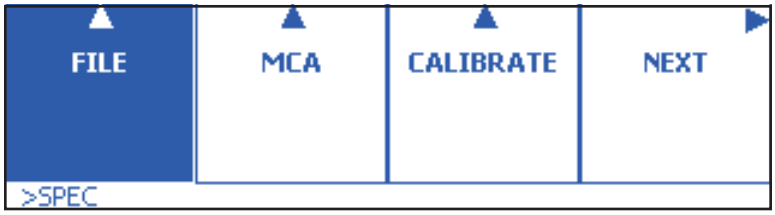


Figure 31 The Spectroscopy Menu

- The last button has a right-pointing ▷ arrow, showing that there is at least one more set of buttons at this level.

- The area just below the menu displays the path you've followed to get to this point. In this example, you can see that you have gotten here by having selected **SPEC**.

- If you want to set the MCA's preset parameters, select the **MCA** button in the first spectroscopy menu level (Figure 30.)

Figure 30 The MCA Menu

- In the next menu level, select Preset Time (Figure 33).

Figure 33 Preset Time Menu

- This will open the MCA Presets dialog (Figure 35).

How to Acquire Data

To start acquiring data, select the **Enter** key.

Note: If the File | Open menu selection has been used to open a Spectrum (CNF) file, data acquisition will be disabled.

Starting Acquisition

When you select the **Enter** key with acquisition off, you'll see Figure 32.

- You can start a **New** acquisition.
- Or **Save** existing data and start a new acquisition.

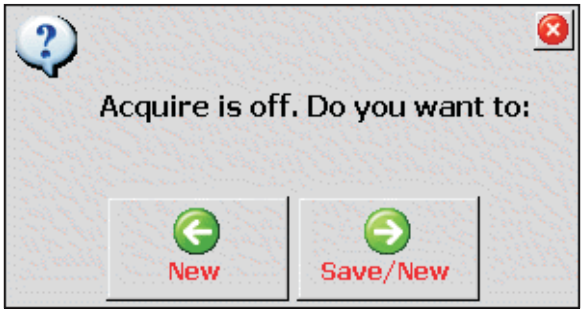


Figure 32 Starting Data Aquisition

Stopping Acquisition

When you select the **Enter** key with acquisition on, you'll see Figure 34.

- You can stop acquisition and **Clear** data.
- You can **Stop** acquisition without clearing data.

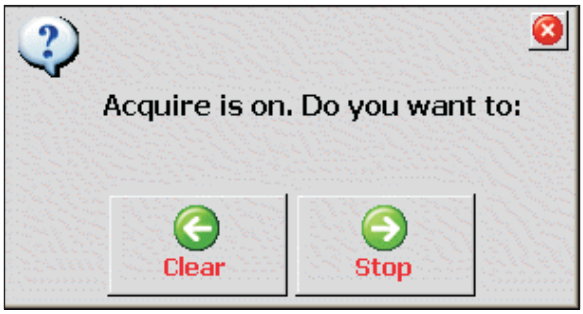


Figure 34 Stopping Data Acquisition

How to Navigate a Parameters Dialog

To navigate a Parameters Dialog, such as MCA Presets (Figure 35):

- Select the **Enter** key to move the highlight to the first text box, Time.
- Each time you select the key, the highlight will move down one text box at a time, then to the soft buttons, then back to the top of the dialog.
- To cancel a dialog box without savings any changes, select the **Home** key, the Cancel button, or the red in the upper right corner of the dialog.

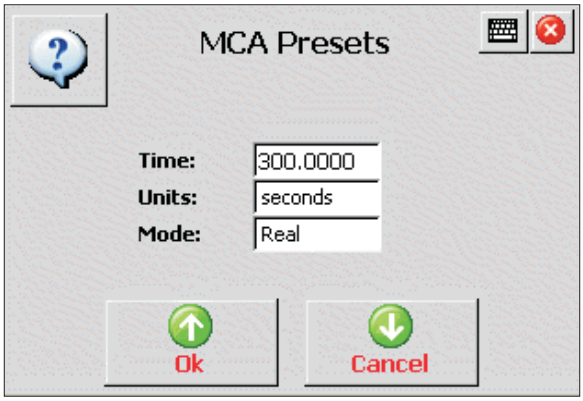


Figure 35 A Typical Parameters Dialog

Changing a Numeric Parameter

- Move the highlight to a numeric text box (for instance, Time). Only the first digit is highlighted, showing that this is a numeric parameter.
- Use the Up/Down Arrow keys to increase/decrease the value of the highlighted digit.

- Use the Left/Right Arrow keys to move forward/back through the digits.
- Repeatedly select the **Enter** key until the Ok and Cancel buttons are highlighted, then select the Up Arrow (Ok) to apply the change.

Note: If you enter an invalid value, the system will change it to the closest valid value when you select Enter.

The Virtual Keyboard

Numeric parameters can also be changed by selecting the virtual keyboard icon  in the upper right corner of the screen. Using a stylus (or a fingernail):

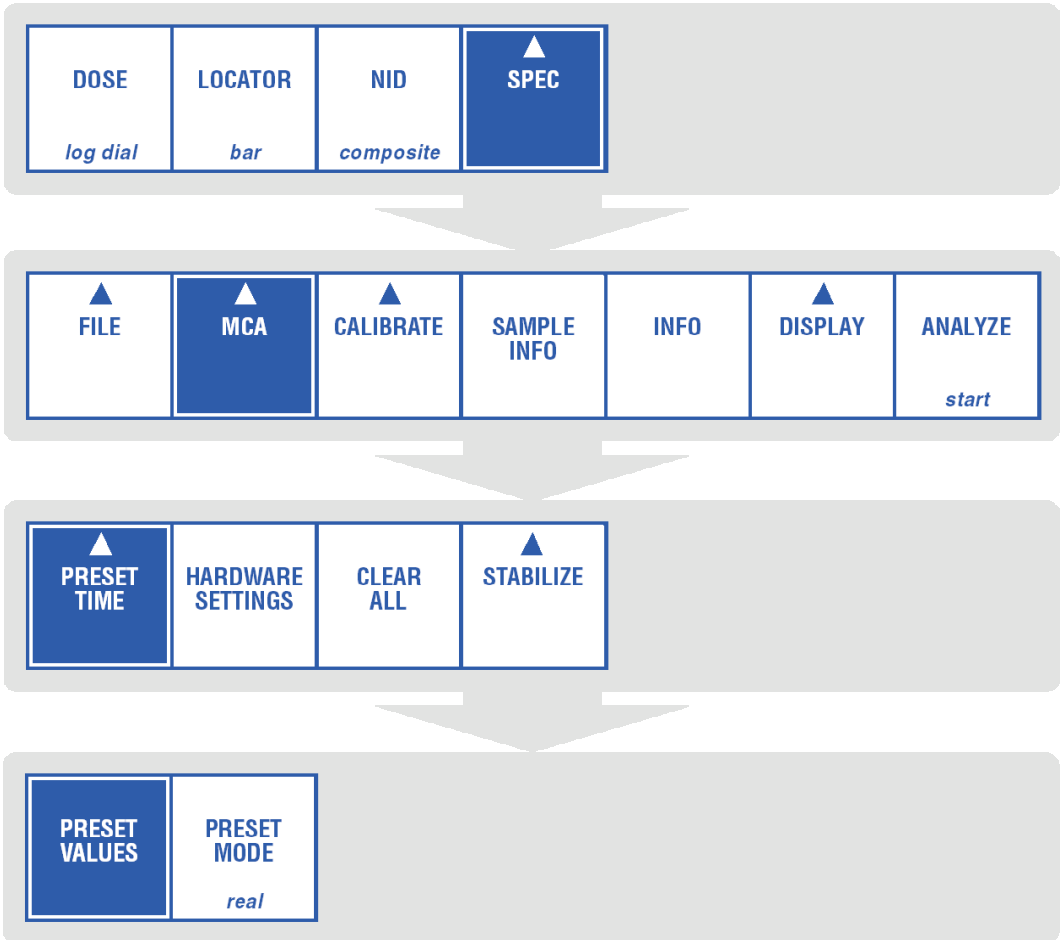
- Select the left or right arrow key in the lower right corner of the keyboard to position the highlight.
- Select a digit, 0–9, to change the digit's value.
- Select an arrow key to move to the next position to be changed.
- To correct an error, use the backspace key to delete the character to the left of the cursor.
- When done, select the keyboard icon to close the keyboard.

Changing a List Parameter

- Move the highlight to a serial selection text box, such as Mode. The entire parameter is highlighted, showing that this is a list parameter.
- Select the Up or Down Arrow key to move through the parameter list. For Mode, for instance, the selections are Real, Live and Continuous.
- When the parameter has been selected, repeatedly select the **Enter** key until the Ok and Cancel buttons are highlighted, then select the Up Arrow (Ok) to apply the change.

How to Verify Spectroscopy Parameters

Before you start acquiring data, you might want to check the Preset Time parameter. Select the Up Arrow, then select:



Note: To show you all items at the same menu level, the “Next” and “Previous” buttons are omitted from these illustrations, a convention used throughout this manual.

Preset Values

When you select the Preset Values button, the MCA Presets dialog (Figure 36), which lets you verify or modify the preset time parameters, will be seen.

- Time – The amount of time in the selected Units to pass before acquisition ends.
- Units – The preset's time units.
- Mode – Live time, Real time or Continuous acquisition.

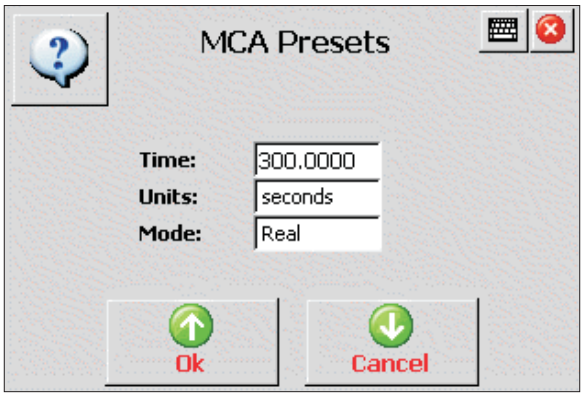


Figure 36 Preset Values

How to Collect a Spectrum

- To acquire a spectrum, you must first attach a probe to the InSpector.
- Then select the **ENTER** key. Data acquisition will start, using the parameters entered via the Spectroscopy Menu.

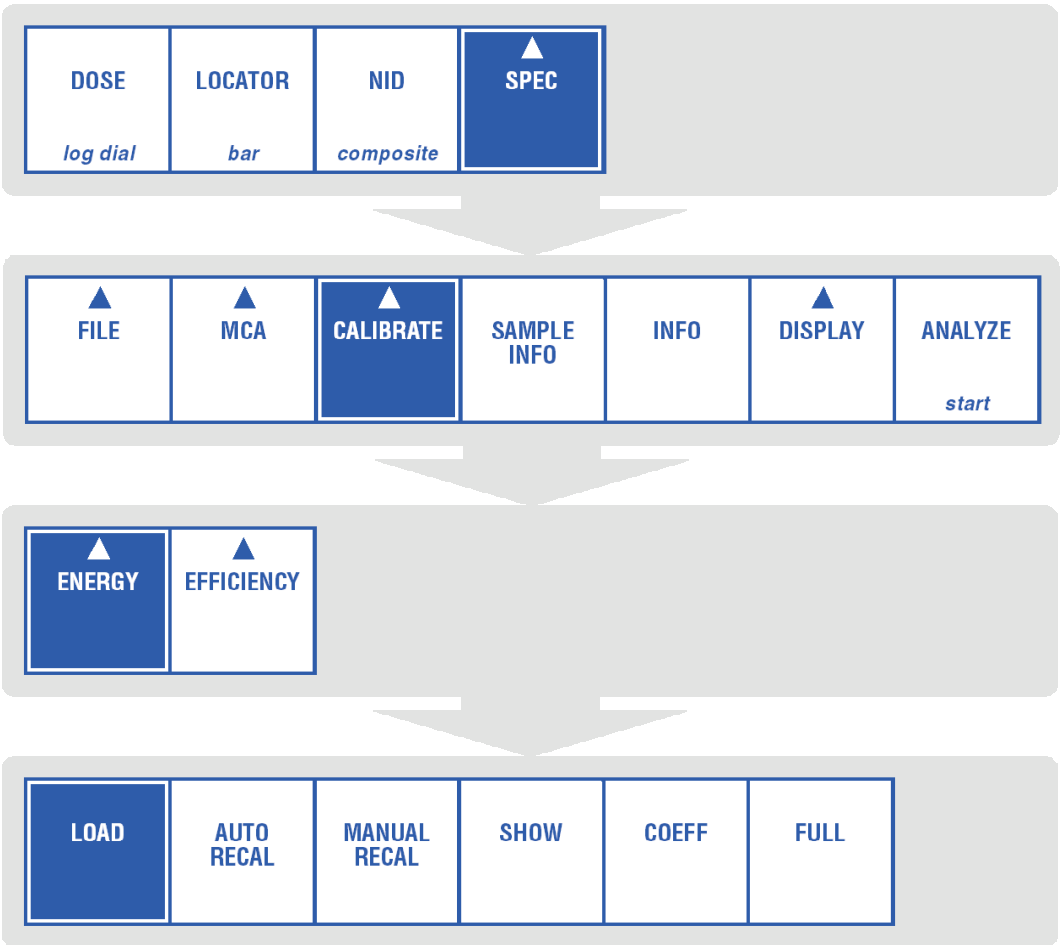
How to Load a Calibration File

The InSpector lets you Load a memory-resident (already downloaded) Energy or Efficiency Calibration file for current use.

Since the InSpector can have several calibration (CAL) files resident in memory, you need to specify which one is to be used, using the Load command.

To illustrate, we'll load an Energy Calibration file. Loading an Efficiency Calibration file is a similar process.

To load an Energy Calibration file, select the Up Arrow, then select:



The InSpector will show you a list of files to choose from. To illustrate a typical file list, Figure 37 shows the energy calibration files for each probe type. You don't need to select one of these files; the InSpector automatically uses the correct one.

- Use the Up/Down Arrow keys to move the highlight bar through the list.
- Use the Left/Right Arrow keys to move to the previous/next page of files.
- Select the **Enter** key to load the highlighted file.
- Select the **Ok** button to confirm your choice.
- At any time, select **Home** to close the file box without selecting a file.

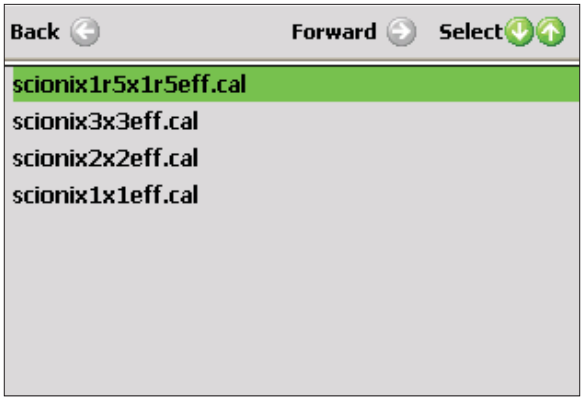


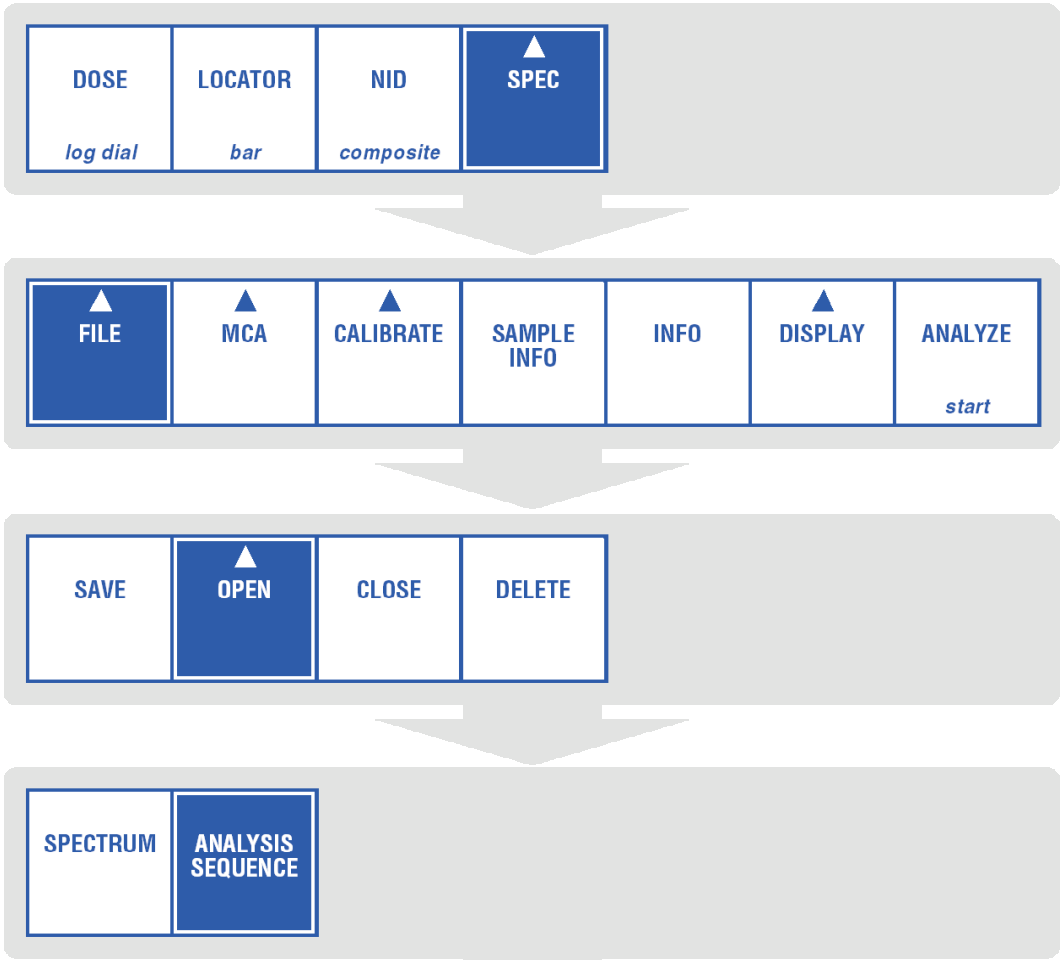
Figure 37 Illustration of a File List

Working With ROIs

An ROI is a region of interest, usually marking a photopeak. There are two ways to enter ROIs in your spectrum: you can run an analysis (ASF) routine containing Peak Locate and Peak Analysis algorithms or you can load an existing ROI file.

Creating ROIs With an Analysis Routine

To create ROIs in the current spectrum via an analysis sequence (ASF) file. To open an analysis sequence file, select the Up Arrow, then select:



The InSpector will show you a list of files to choose from (Figure 38).

- Use the Up/Down Arrow keys to move the highlight bar through the list.
- Use the Left/Right Arrow keys to move to the previous/next page of files.
- Select the **Enter** key to load the highlighted file.
- Select the **Ok** button to confirm your choice.
- At any time, select **Home** to close the file box without selecting a file.

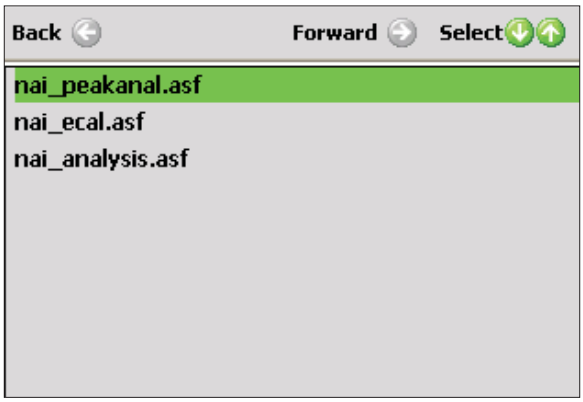
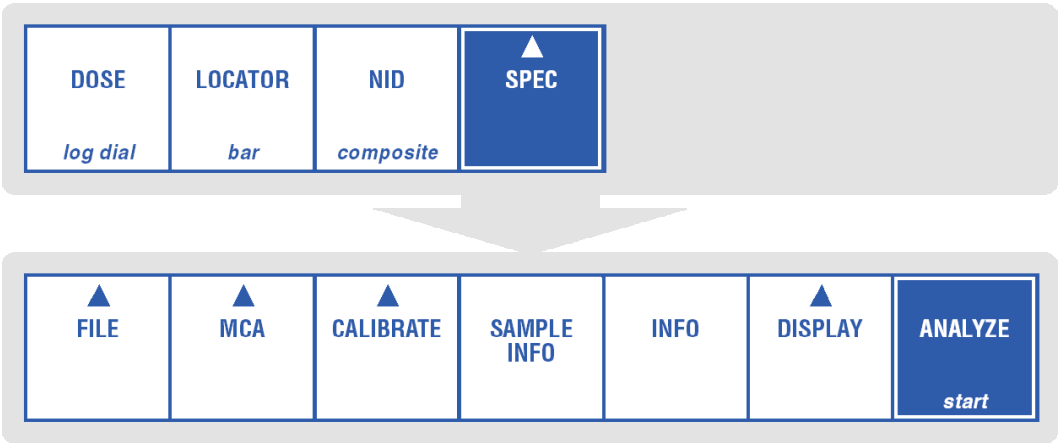


Figure 38 An ASF File List

Starting the Analysis Sequence

Now select the Up Arrow again and select:



The analysis sequence file you loaded will be executed and all found peaks will have ROIs entered around them.

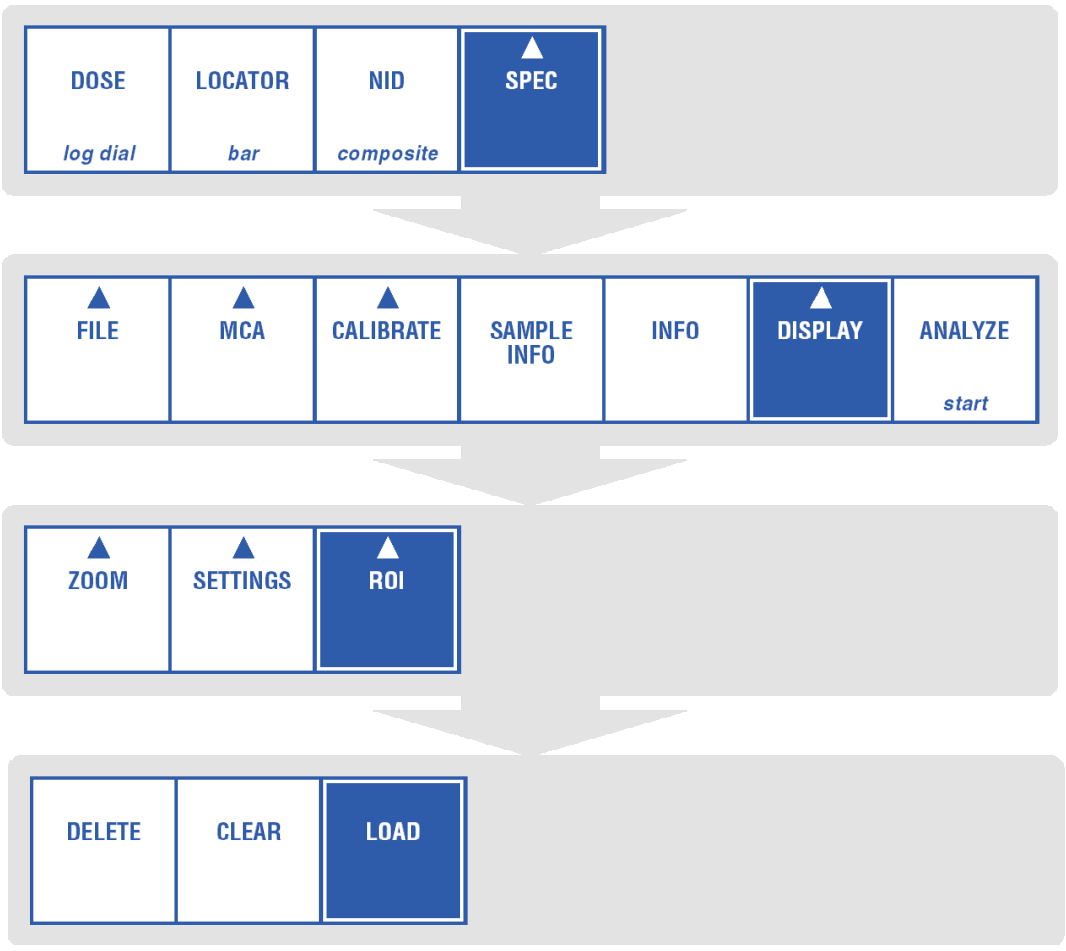
Note: The analysis may take some time to complete, depending on the number and complexity of its steps.

Color of the ROIs

The analysis routine will mark each found peak with an ROI (region of interest). Peaks associated with an identified nuclide will be marked with a **blue ROI**. Peaks that cannot be identified will be marked with a **red ROI**.

Loading ROIs From an ROI File

ROIs can be added to a spectrum by loading an ROI (region of interest) file. To load the ROIs, select the Up Arrow, then select:



The InSpector will show you a list of files to choose from (Figure 39).

- Use the Up/Down Arrow keys to move the highlight through the list.
- Use the Left/Right Arrow keys to move to the previous/next page of files.
- Select the **Enter** key to load the highlighted file.
- Select the **Ok** button to confirm your choice.
- At any time, select **Home** to close the file box without selecting a file.

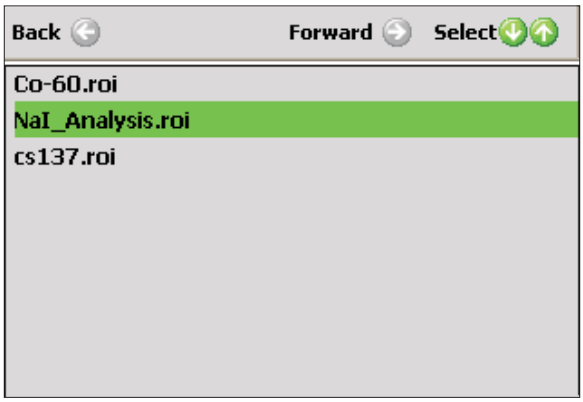


Figure 39 An ROI File List

Note: If ROIs loaded from a file are present in a spectrum, they will prevent the display of ROIs generated from an analysis routine. Clearing the loaded ROIs will allow the generated ROIs to be displayed.

Deleting One ROI

Select **Delete** to remove the current ROI, the one with the cursor in it, from the display. The ROI's data will not be changed.

Clearing All ROIs

Select **Clear** to remove all ROIs from the spectrum. The ROIs' data will not be changed.

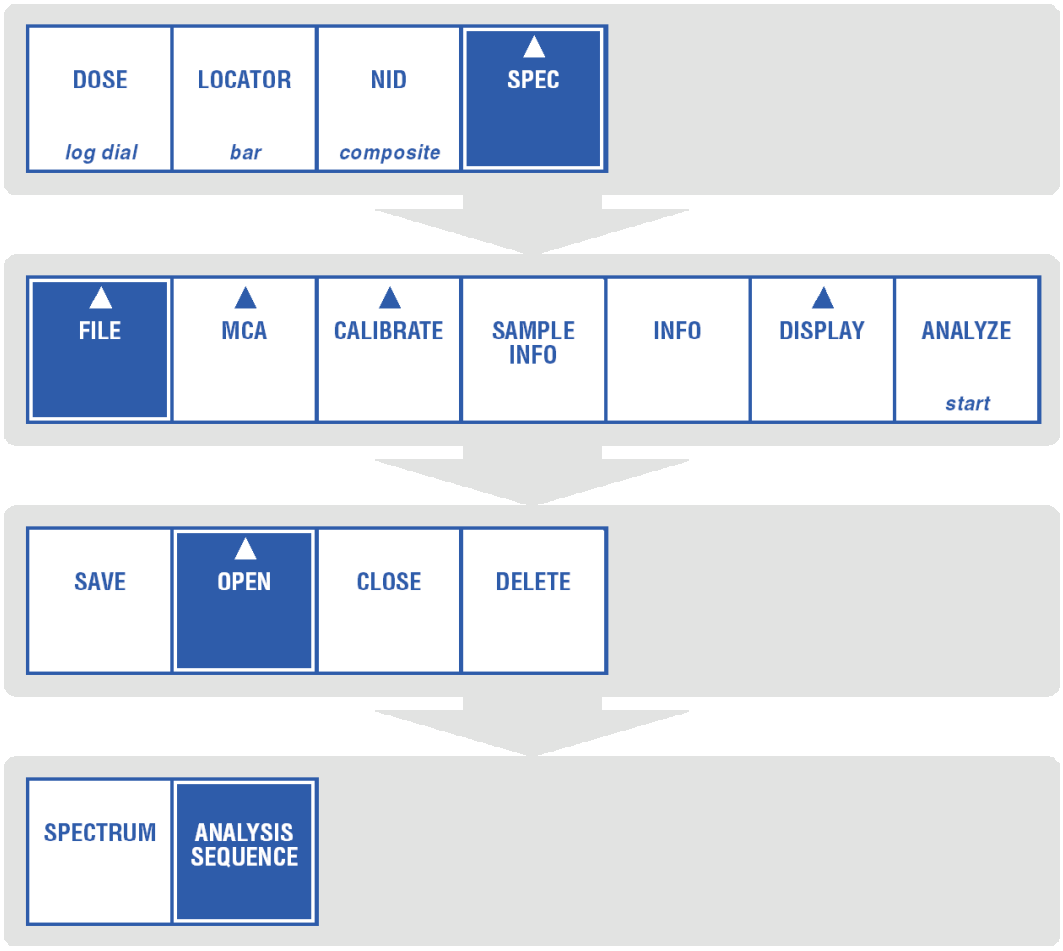
How to Analyze a Spectrum

Spectrum analysis is performed by an analysis sequence file (ASF). The InSpector always has at least one ASF loaded

How to Select a Different Sequence File

Since the InSpector can include several ASF files, there may be a time when you need to change the one being used.

To load another ASF, select the **Up Arrow**, then select:



The InSpector will show you a list of files to choose from (Figure 40).

- Use the Up/Down Arrow keys to move the highlight bar through the list.
- Use the Left/Right Arrow keys to move to the previous/next page of files.
- Select the **Enter** key to load the highlighted file.
- Select the **Ok** button to confirm your choice.
- At any time, select **Home** to close the file box without selecting a file.

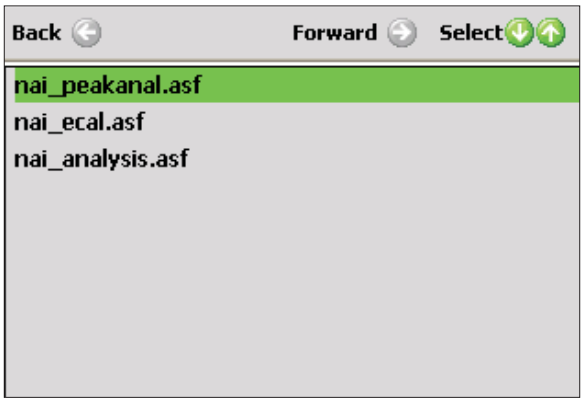
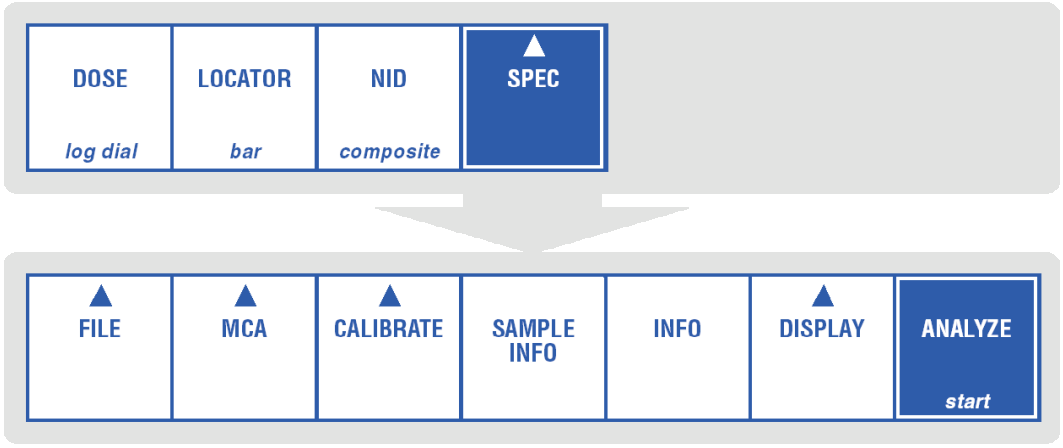


Figure 40 A Typical ASF File List

How to Start the Analysis

With a spectrum present on the screen, select the Up Arrow, then select:

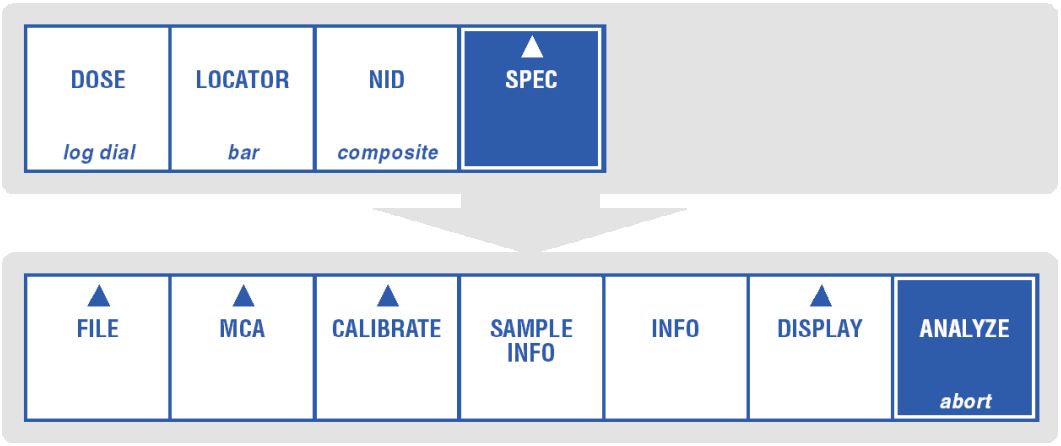


The spectrum will be analyzed according to the instructions in the currently selected ASF.

During an acquisition and analysis, you can switch to NID mode in order to view the existing NID results which are updated as soon as the latest analysis sequence has finished execution.

How to Stop the Analysis

When the Analyze button is selected, its legend changes from *start* to *abort*. So to stop an executing analysis, all you have to do is select the Analyze button again. The analysis will stop.

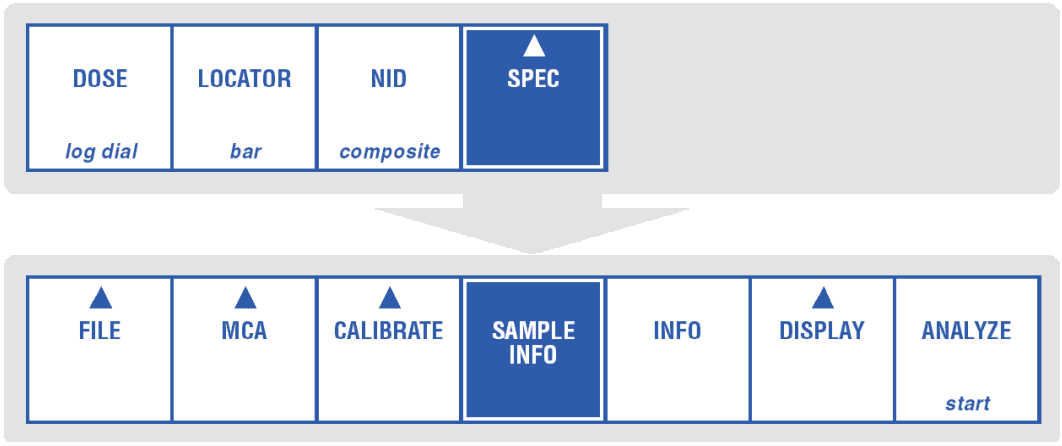


How to Use Sample Info

The Sample Information dialog lets you add identifying data for the current sample for inclusion in reports.

Entering Sample Information

To enter sample information for the current spectrum, select:



The Sample Info dialog (Figure 41) will open, allowing you to type in the sample information. The data you enter will remain in memory until the InSpector is switched off and will be included each time you Save a spectrum (page 57).

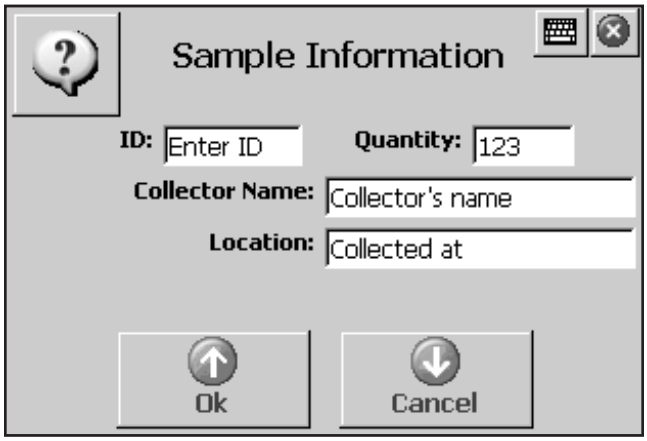


Figure 41 Example Sample Information

- ID is a sample identification of your choice.
- Quantity lets you enter the sample's quantity. Calculated activities are divided by this value, so that if the quantity is set to 1 (the default), total activity is reported. If any other value is entered, concentration is reported.
- Collector Name lets you enter the name of the person who collected the sample.
- Location is a description of the place where the sample was collected.

Transferring the Spectrum

Use the Maintenance Utility's Get function (page 107) to copy the current spectrum to the In1k*name* folder on your PC*, where *name* is the Instrument ID assigned on the General page of the Configuration Editor (page 117) or during a software update.

The file's name will be *filename*.cnf, where *filename* is the date and time of the file's creation: YYYYMMDDHHMMSS.cnf (Year, Month, Day, Hour, Minute, Second).

Creating the Report in Genie 2000

To create the Example Report shown on page 53 from the transferred spectrum file:

- In Genie 2000, select File | Open, then select *filename*.cnf to open the file you transferred.
- Select Analyze | Report | Standard (Figure 42) to open the Standard Report Setup dialog and select the parameters for generating the report.

Template Name

Scroll down the Template Name list to find and select the 1page.tpl report template.

Section Name

Scroll down the Section Name list to find and select the 1page report section.

The Activity Units

- Activity is reported in microcuries by default. (The Activity Units field is uCi and the Multiplier is 1).
- If you want to use another Activity Unit, you'll have to supply a Multiplier to convert the activity from microcuries to your unit.

*The standard path for this folder is in C:\Genie2k\Camfiles. If you didn't select the Standard installation for Genie 2000, your path will be different.

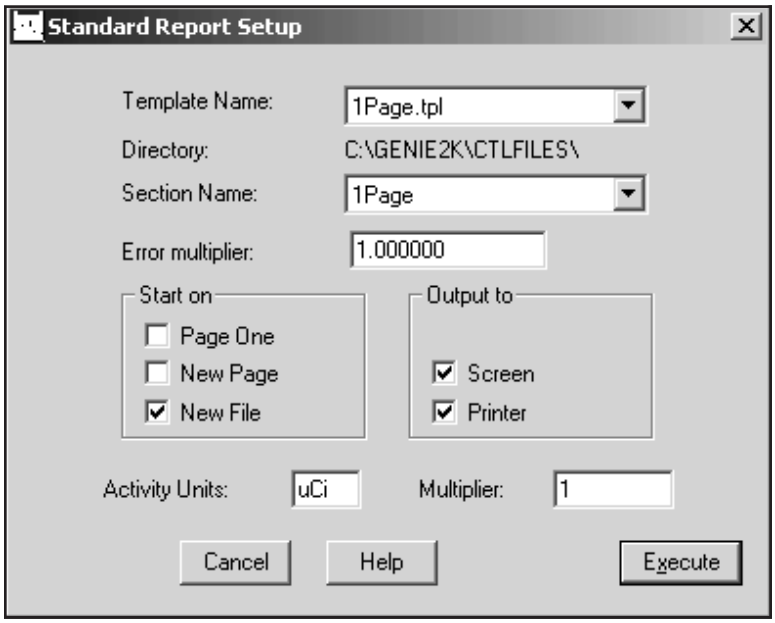


Figure 42 Selecting the Report's Parameters

- For instance, if you want the activity to be reported in bequerels:
  - Type Bq in the Activity Units field.
  - Type 37000 in the Multiplier field.

The "Output to" Checkboxes

Genie 2000 provides two outputs for a report. You can select either or both of their checkboxes.

- Check **Screen** to display the report in Genie 2000's Report window *and* file it as C:\Genie2k\Repfiles\filename.rpt, where filename is the name of the currently opened spectrum file.
- Check **Printer** to send the report to your computer's default printer.

Create the Report

Click the **Execute** button to generate the report. An example of a report created by the 1page.tpl Template you chose in Figure 42 is shown on page 53.

Example Report

```
Interference Corrected Activity Report    3/09/2004  11:46:04      Page  1

************************************************************************
*****   N U C L I D E   I D E N T I F I C A T I O N   R E P O R T   *****
************************************************************************

Filename: C:\GENIE2K\CAMFILES\02047924\20040903114041.cnf

Sample Title                    : InSpector 1000 spectrum
Sample Identification           : Enter ID
Sample Size                     :  1.2300E+02
Operator Name                   : Collector's name
Location                        : Collected at

Acquisition Started, detector   : 3/09/2004  10:53:50   ,   Scionix2x2
Live Time, Dead time            :      192.5 seconds,    0.41 %

Analysis Sequence Title         : NaI Analysis
Identification Energy Tolerance :    0.250 FWHM
Env. Background File            :     <not performed>
Nuclide ID Library Used         : \GENIECE\CAMFILES\NaI_ANSI_4.NLB
Efficiency ID                   : POINT_@1M_1G/CC

************************************************************************
*****   I N T E R F E R E N C E   C O R R E C T E D   R E P O R T   *****
************************************************************************

                Nuclide       Wt mean         Wt mean       Wt mean
      Nuclide     Id          Activity        Activity      Activity
      Name     Confidence    (Bq  /S. Size)   Uncertainty   Uncertainty%

      K-40       0.982        2.206E+04       2.933E+03       13.30
      Cs-137     0.990        2.442E+05       7.025E+03        2.88

      ? = nuclide is part of an undetermined solution
      X = nuclide rejected by the interference analysis
      @ = nuclide contains energy lines not used in Weighted Mean Activity

      Uncertainty quoted at  1.000 sigma

   **********   U N I D E N T I F I E D   P E A K S   **********

       Peak   Energy           Peak Size in        Peak CPS
        No.   (keV)          Counts per Second   % Uncertainty

     F   1    73.97             3.692E+00            16.28
     F   2   435.76             1.128E+01             5.36

       M = First peak in a multiplet region
       m = Other peak in a multiplet region
       F = Fitted singlet
```

CAM Parameters

For reporting purposes, these CAM variables are used:

Inspector Data Field	CAM Parameter
ID:	CAM_T_SIDENT
Quantity:	CAM_F_SQUANT
Collector Name:	CAM_T_SCOLLNAME
Location:	CAM_T_SLOCTN

8. Spectroscopy Mode

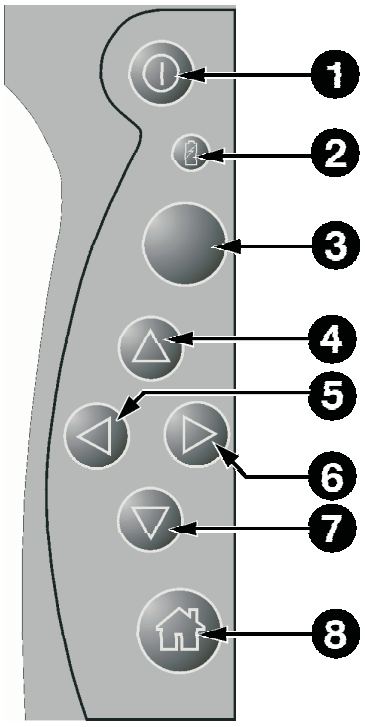
The Spectroscopy Mode lets you acquire and display data and analyze either the current spectrum or a spectrum file.

The Spectroscopy Mode functions of the InSpector™ parallel the same functions in the Genie 2000 Spectroscopy Software. For detailed information, please refer to the *Genie 2000 Operations Manual* and the *Genie 2000 Customization Tools Manual*. Both are included as PDF files on your Genie 2000 CD-ROM.

Memory Resident Files

Several of the InSpector's functions require choosing a file resident in the InSpector's memory as the current file, the one to be used for that function. The Maintenance Utility's Send command (page 105) transfers files from your PC to the InSpector's memory.

Hard Key Functions



1. Power: Turns the InSpector On/Off.

2. Charge: Light whenever the battery is being charged.

3. Enter: Starts or Stops an acquisition.

4. Up: Enters the main menu; in the menu, goes to the next submenu.

5. Left: In the menu, moves left through the menu; in the Cursor Mode (page 30), moves the plot cursor left; in the ROI Mode, jumps one ROI to the left.

6. Right: In the menu, moves right through the menu; in the Cursor Mode, moves the plot cursor right; in the ROI Mode, jumps one ROI to the right.

7. Down: In the menu, goes to the previous menu level; if no previous level, exits the menu. In the spectrum, toggles the data line between Cursor Mode and the ROI Mode.

8. Home: In the menu, exits the menu; otherwise, changes the display to the "Home Mode" selected in Instrument Setup (page 98).

Alarms

If the warning and/or alarm thresholds for Dose Rate, Cumulative Dose and/or Neutron Count Rate (page 91) are exceeded, you will be alerted to the condition in several ways.

Warning Indicator

If the low-level Warning threshold is exceeded,the spectral display's background will alternate between black and gold.

Alarm Indicator

If the high-level Alarm threshold is exceeded, the spectral display's background will alternate between black and maroon.

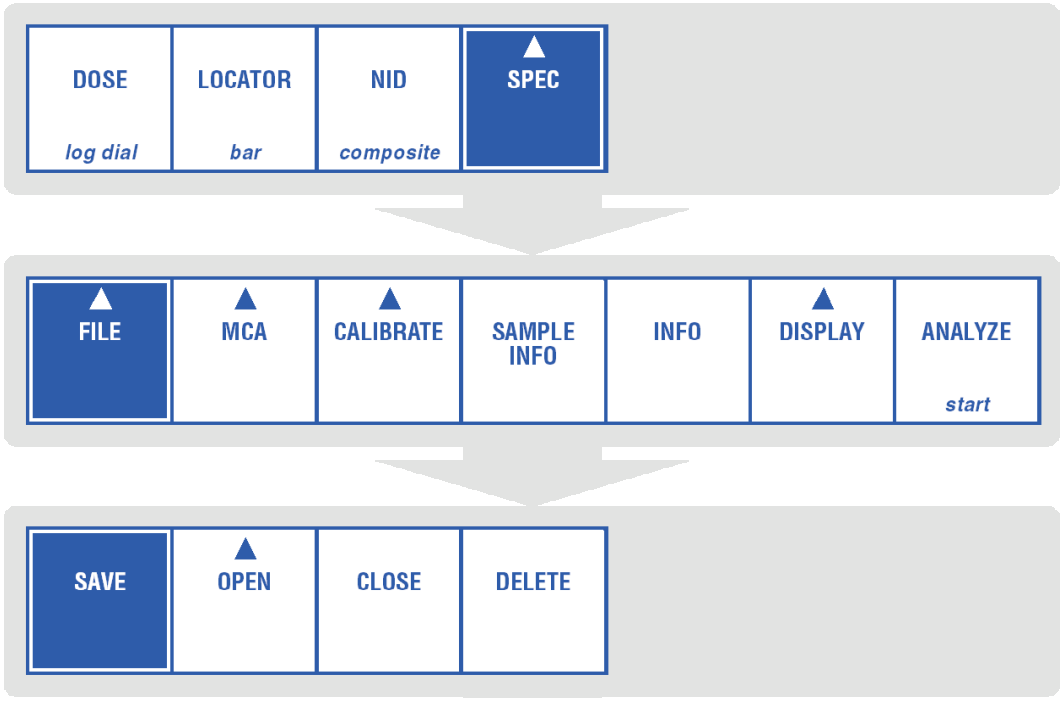
The Spectroscopy Mode Menus

Each of the remaining sections in this chapter describes the Spectroscopy Mode's menus and the use of their selections.

- File
- MCA
- Calibrate
- Sample Info
- Info (display pages)
- Display
- Analyze

File

The File menu is used to Open or Close a file, Save the current file, or Delete it from memory.



Save

Select Save to save the current spectrum to Genie 2000's C:\Genie2K\Camfiles directory.

Note: This is the directory created by a Standard Genie 2000 installation. If you chose Custom installation, your path for storing spectrum files may be different.

Spectrum File Name

The file name is created from the file's date/time stamp: YYYYMMDDHHMMSS.cnf (Year, Month, Day, Hour, Minute, Second).

The file will contain the spectrum's raw data, the results, all the current context parameters, based on the current Analysis file, any parameters changed in Setup | Spec Setup (page 96), and the data entered in Sample Info (page 76).

Open

Select the **Open** button to open a Spectrum (CNF) file or a Sequence (ASF) file already resident in the InSpector's memory.

The Open Spectrum button will not be available if data acquisition is in progress or if a CNF file is already open.

Spectrum / Analysis Sequence

Whether you choose the Spectrum button or the Analysis Sequence button, the InSpector will show you a list of files to choose from.

- Use the Up/Down Arrow keys to move the highlight bar through the list.
- Use the Left/Right Arrow keys to move to the previous/next page of files.
- Select the **Enter** key to load the highlighted file.
- Select the **Ok** button to confirm your choice.
- At any time, select **Home** to close the file box without selecting a file.

The file will be opened and displayed. The Status Line (Figure 43) displays the word File to remind you that this is a file, not a live spectrum. When a change has been made to the file, the File indicator's color will change from cyan to gold, indicating the file's changed status.

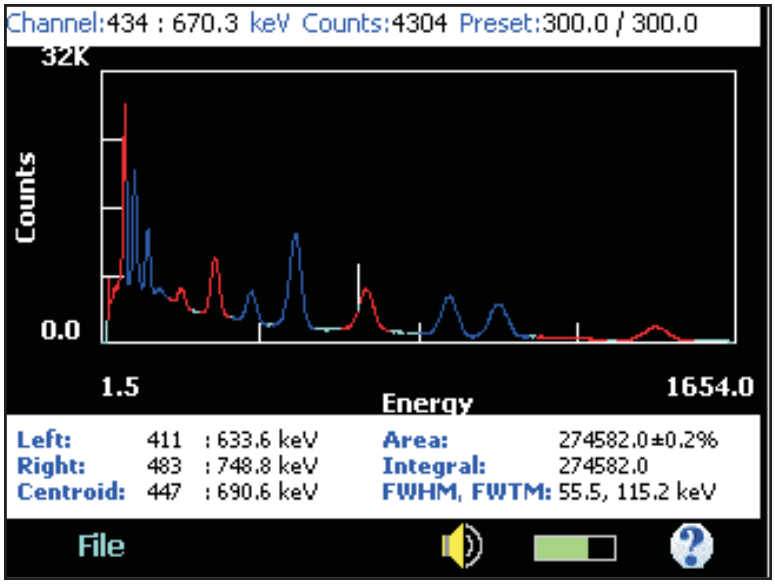


Figure 43 Opened Spectrum File

Close

Select **Close** to close the spectrum most recently opened from a file. This command is available only if a file has been opened.

Note: An acquired spectrum cannot be closed; you can only Save it.

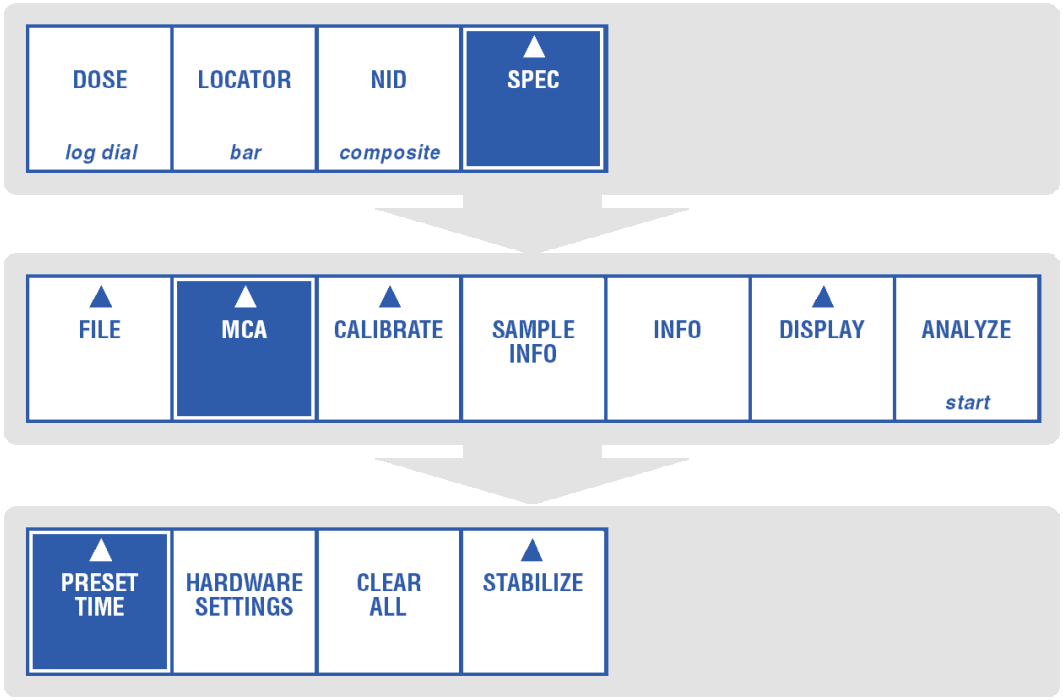
Delete

When you choose to **Delete** a file, the InSpector will show you a list of spectrum files to choose from.

- Use the Up/Down Arrow keys to move the highlight bar through the list.
- Use the Left/Right Arrow keys to move to the previous/next page of files.
- Select the **Enter** key to delete the highlighted file.
- Select the **Ok** button to confirm your choice.
- At any time, select **Home** to close the file box without deleting a file.

MCA

The MCA Menu lets you select the Preset Time, change some of the InSpector's settings, clear the display, and use the instrument's Stabilizer.



Preset Time

The **Preset Time** command lets you define the period of time allowed for data collection.

Preset Values

The **Preset Values** command defines the absolute time, the time units and the preset mode.

If you enter the preset using units other than seconds, the time will be converted to and stored as the equivalent number of seconds when you select Ok.

- **Time** – Selects the value of preset time. The combination of Time and Units determines how long data acquisition will continue.
- **Units** – Selects the preset's units of time.
- **Mode** – Selects the mode of operation:
  - Real – Counts to the specified elapsed real time.
  - Live – Counts to the specified elapsed live time.
  - Continuous – Counts until the Enter key is pressed to stop acquisition. When this Mode is selected, the values for Time and Units are ignored.

Preset Mode

This button gives quick access to the Mode command in MCA Presets. It toggles the preset type between *real, live* and *continuous* (defined in the previous paragraphs).

Hardware Settings

The initial **Hardware Settings** shown in Figure 44 are based on the current probe and on the energy range and memory size (number of channels) set in the MCA Page of the InSpector's Configuration Editor (page 121).

Though you can change the parameters here, it's generally best to leave the high voltage at its default setting for the attached probe and to leave the Coarse and Fine Gain set at 1.

- **High Voltage**: Sets the detector's high voltage. (Not available if a Stabilized Probe is attached to the InSpector.)
- **Coarse Gain**: Sets the amplifier's coarse gain.
- **Fine Gain**: Sets the amplifier's fine gain.
- **ADC Gain**: Sets the ADC's gain.

- **Conv. Gain**: Selects the MCA's conversion gain.
- **LLD**: Adjusts the ADC's LLD threshold; the range is 0–100%.

Note: If the Conv. Gain is adjusted, the relationship between the spectrum's channels and their energy levels will change. To compensate for this effect, you must perform a Manual Recal (page 68) before acquiring new data. Failure to recalibrate will result in invalid sample data.

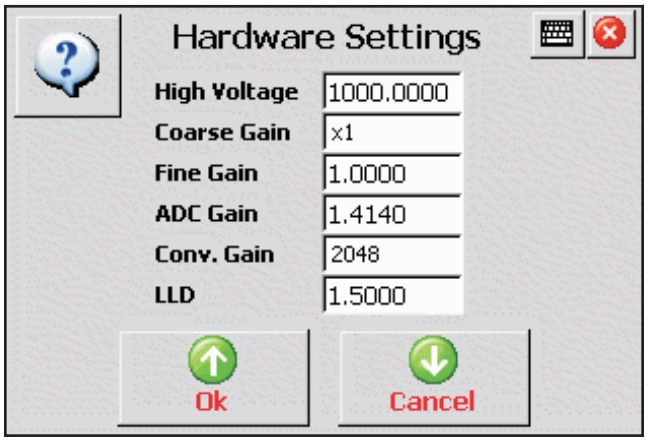


Figure 44 Hardware Settings

Clear All

Select **Clear All** to remove all spectral data and analysis-generated ROIs from the display.

Stabilize

In certain circumstances, the energy output of the InSpector's probe can vary (drift), such as in very high count rate environments or if the probe warms or cools with changes in the ambient temperature. In these cases, some type of spectrum stabilization may need to be used.

The InSpector's integrated digital spectrum stabilizer allows for probe stabilization over the full operating temperature range of the instrument. This is an easy-to-use method which allows selection of the stabilization photopeak.

The InSpector achieves stabilization by continuously monitoring an energy "window" set around the selected stabilization peak and adjusting the probe's high voltage to maintain the peak in the proper position. The optimal width of the energy window is determined automatically by the software.

Using a Stabilized Probe

The Stabilized Probe is very easy to use. When the InSpector finds a Stabilized Probe connected to its DET connector, it will display a message for about 30 seconds, advising you that the probe is stabilizing (Figure 45).

Figure 45 The Probe is Stabilizing

- The blue LED on the probe will blink while stabilization is in process. When stabilization is complete, the LED will glow steadily.

- If stabilization is lost, perhaps due to moving the unit from a warm environment to a cold one (indoors to outdoors), data acquisition will stop and the instrument will restabilize itself (the blue LED will start blinking). When the LED glows steadily, stabilization is complete and acquisition can be restarted.

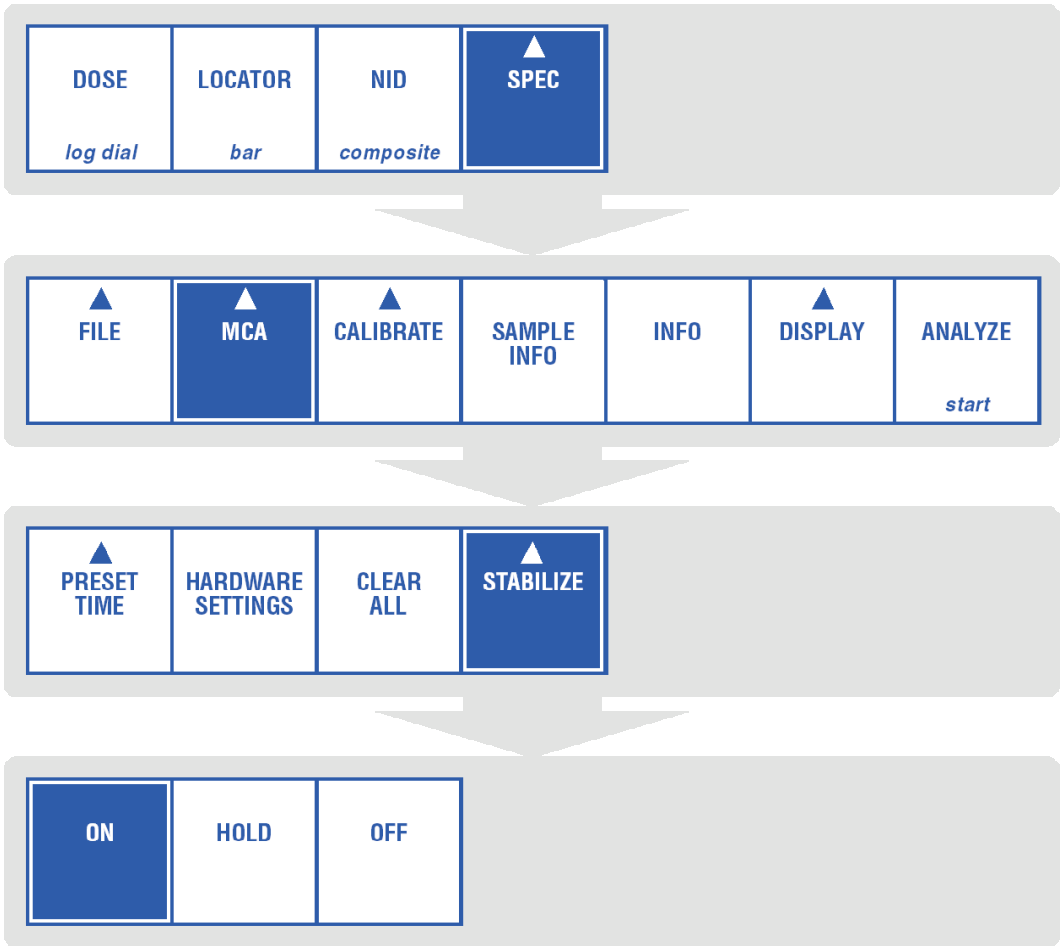
- If you enter a high radiation area, High Field will be displayed at the bottom of the screen, data acquisition will stop, the probe's high voltage and its blue LED will be turned off. When you leave the High Field area, the high voltage will be turned on again and the LED will start blinking as the probe begins stabilizing. When the LED glows steadily, stabilization is complete and acquisition can be restarted.

Using the Stabilize Function

Note: The Stabilize function is available only when one of the standard Gamma Probes is being used. The function is disabled when a Stabilized Probe is attached to the InSpector.

In order to turn on stabilization, you must acquire a spectrum and choose the peak whose position is to be held constant

1. To start the process, select:



2. The InSpector will ask you to Select the stabilization reference peak in the spectrum (Figure 46), then press the **ENTER** key.

Figure 46 Select the Reference Peak

Note: The selected stabilization peak must always be present and free from interference from nearby peaks while stabilization is on.

3. An ROI will be painted on the peak's stabilization window. The InSpector will ask you to Accept the reference peak by selecting the Up Arrow (Figure 47). Stabilization will start.

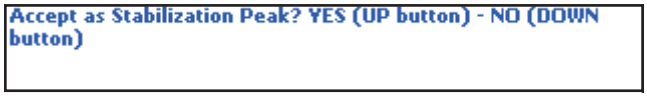


Figure 47 Accepting the Stabilizer Peak

The Stabilizer is now On. If you re-enter the Stabilize menu, you'll see that you can choose only Hold or Off.

Stabilization On will automatically be switched to Off:

- If the High Voltage or any of the Gains are manually adjusted.
- If one of the Recal functions is executed.
- If you enter a high dose rate field.
- If you disconnect / connect the probe.

Stabilization Hold will automatically be switched to Off if the high voltage, gain or LLD settings are manually adjusted.

Calibrate

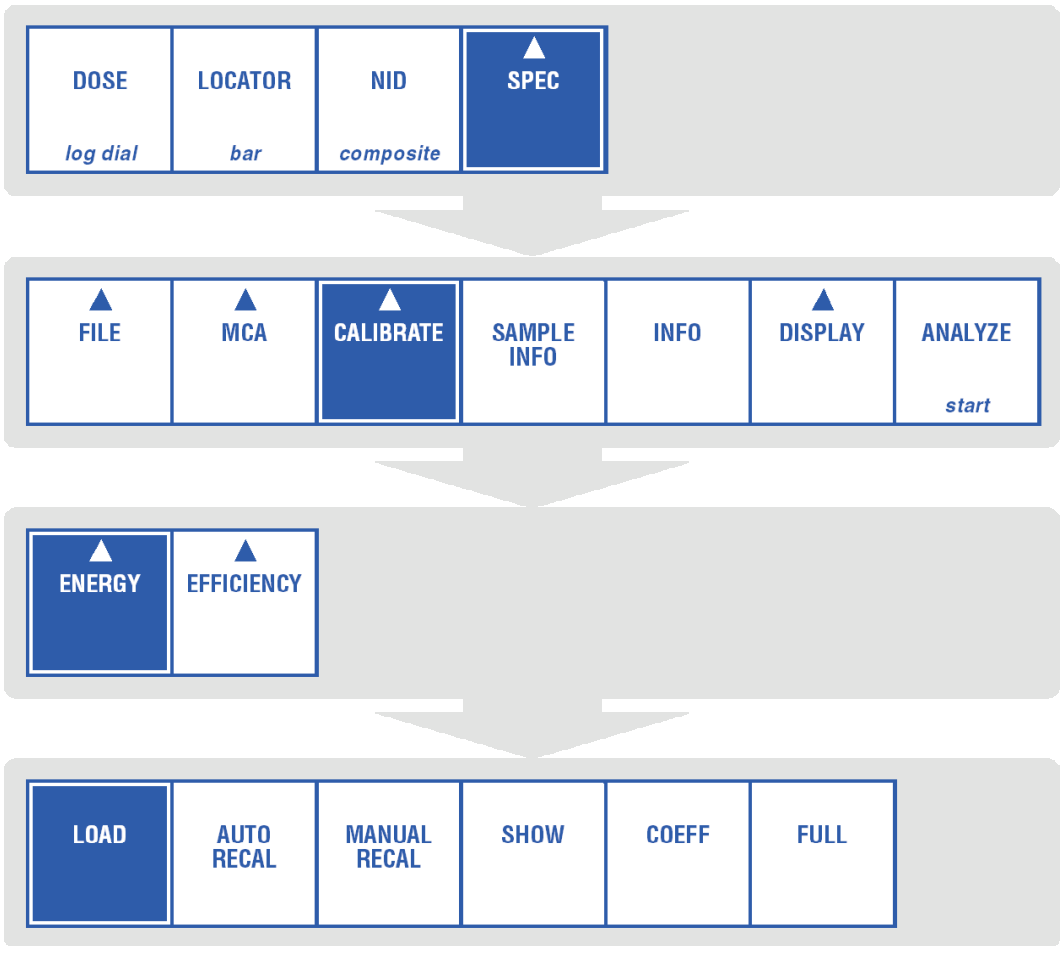
The Calibrate menu offers both Energy and Efficiency calibration.

Energy Calibration establishes a relationship between the spectrum's channels and their energy levels. By calibrating at least three peaks over the entire range of the spectrum, the energy of any other peak can be reliably estimated.

Efficiency Calibration establishes a relationship between measured count rate and source activity as a function of energy. The efficiency calibration allows us to convert count rates to activities for various source nuclide energies.

Energy

The Energy Menu command lets you load a memory-resident calibration (CAL) file, recalibrate the InSpector, show a calibration graphically, display and edit the Energy or Shape (FWHM) calibration's coefficients, and perform a full calibration.



Load

To illustrate a typical file list, Figure shows the energy calibration files for each probe type. You don't need to select one of these files; the InSpector automatically uses the correct one.

- Use the Up/Down Arrow keys to move the highlight bar through the list.
- Use the Left/Right Arrow keys to move to the previous/next page of files.
- Select the **Enter** key to load the highlighted file.
- Select the **Ok** button to confirm your choice.
- At any time, select **Home** to close the file box without selecting a file.

Recalibrating the InSpector

Sodium iodide (NaI) detectors, the kind used by the InSpector, can experience "peak drift" with a change in temperature or due to aging. This is easily compensated for by placing a calibration source in front of the detector and selecting one of the recalibration buttons to correct for the drift.

Auto Recal

Auto Recal automatically adjusts the probe's gain or high voltage so that the energy calibration is valid, correcting for shifts due to temperature or tube aging. To provide Auto Recal with the best possible data, Auto Recal should always be done in a low background area.

If there are many other peaks in the window due to environmental background, or if the calibration peak has drifted too far from its predicted position, the Auto method may not be able to find the peak. In either case, you should use Manual Recal instead.

1. When you start Auto Recal, you'll be prompted to place a mono-line calibration source (10 to 20 nCi) in front of the detector (Figure 48).

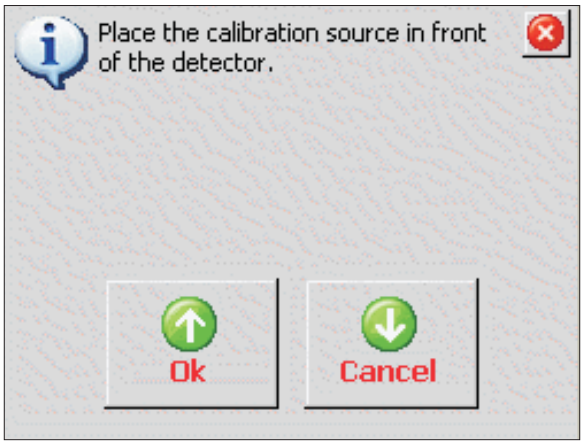


Figure 48 The Calibration Prompt

The most useful calibration source is a cap with a built-in source that fits over the end of the probe, such as the Model CSRCSS-n, where the 'n' matches the Probe's model number. For example, the Model CSRCSS-1 is used with the IPRON-1 probe.

2. The InSpector will make a brief measurement, then analyze the spectrum for peaks and attempt to locate the calibration peak. If the peak cannot be found, a longer measurement will be made. If the peak still cannot be found, the InSpector will report the problem; see Peak Not Found, below, for what to do.

3. You can abort this measurement at any time by selecting the **Home** button.

4. The detector gain and/or voltage are adjusted so that the peak will appear in the correct spot in the spectrum. If the voltage had to be adjusted, steps 2 and 3 will be repeated to fine tune the adjustment.

5. If there are multiple peaks in the spectrum, the InSpector may not be able to pick out the calibration peak. The InSpector will indicate that this has occurred. Check the calibration to see if other peaks appear at the correct energies. If not, use Manual Recal to manually select the calibration peak.

Peak Not Found

If the InSpector cannot find the calibration peak, you should:

1. Make sure that the calibration source is present.

2. Examine the spectrum. If the continuum is very high, the calibration peak may be obscured; move to a location with a lower background rate and repeat Auto Recal.

3. Try to find the calibration peak in the spectrum; it may have shifted outside Auto Recal's range. In this case, use Manual Recal, to manually identify the peak.

The energy of the calibration peak, the amount of shift that Auto Recal can handle, and the strength of the calibration peak can be set in Calibration Setup on page 97.

Manual Recal

The Manual Recalibration function is used to adjust the gamma probe's high voltage bias so that the energy calibration is valid, correcting for shifts due to temperature or tube aging. To use Manual Recal, you must be able to locate the calibration peak in the spectrum yourself.

Spectrum Present

If you have a spectrum, you'll be asked to position the cursor on the 662 keV peak (Figure 49), then select **Enter**. Follow the instructions on the screen.

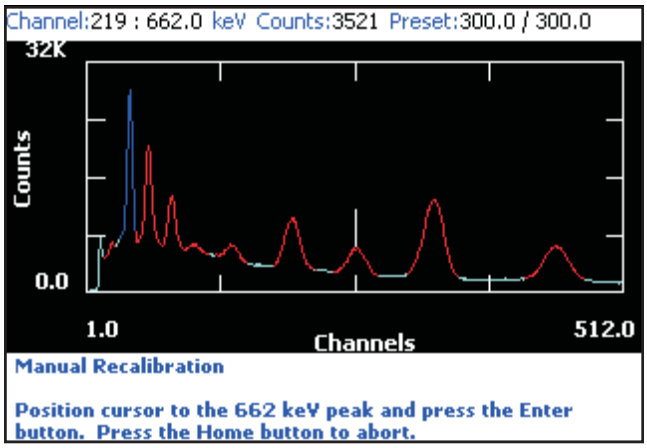


Figure 49 Manual Recalibation

Spectrum Not Present

If there is no spectrum, you'll be prompted to acquire one by placing a mono-line calibration source (10 to 20 nCi) in front of the detector (Figure 50).

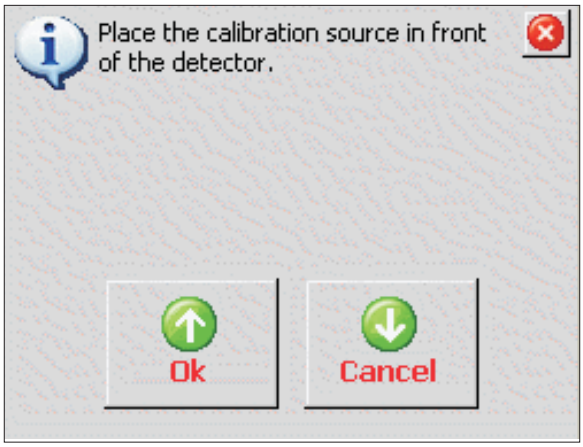


Figure 50 The Calibration Prompt

The most useful calibration source is a cap with a built-in source that fits over the end of the probe, such as the Model CSRCSS-n, where the 'n' matches the Probe's model number. For example, the Model CSRCSS-1 is used with the IPRON-1 probe.

1. Select OK to start Data Acquisition.

2. You can press the **Home** key at any point in this process to abort the operation.

3. Find the calibration peak in the spectrum and position the cursor on it using the Left or Right Arrow keys or by touching the screen.

4. Press the **Enter** key. The InSpector will adjust the probe so that the peak will appear in the right place in the spectrum and the energy calibration is valid.

5. If peak has shifted a large amount, the InSpector may have to adjust the probe's voltage; this is not as accurate as adjusting the probe gain. The InSpector will inform you that the voltage was changed, and you should repeat Manual Recal to fine tune the adjustment.

Show

Select the **Show** button to display the energy calibration as a graph and its equation (Figure 51).

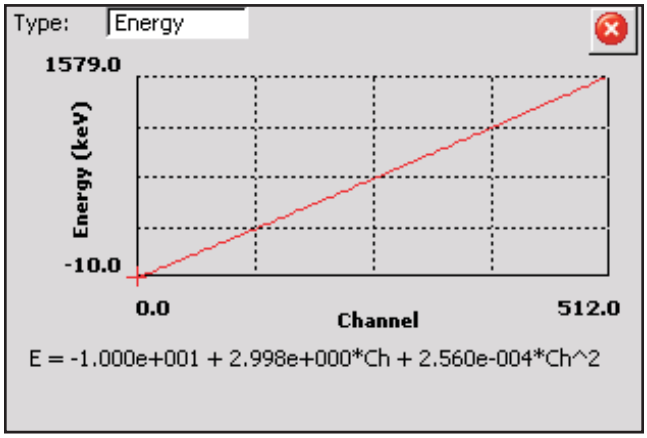


Figure 51 Show Energy Calibration

Type

To display different type of curve:

- Select the **Enter** button to move the highlight to the Type list box.
- Use the Up/Down Arrow keys to move through the list of curve types.
- As the name of each type is shown in the list box, its curve will be displayed.

Coeff

The Coefficients screen (Figure 52) lets you view or manually enter the Offset, Slope and Quadratic coefficients for the Energy Calibration and the Offset and Slope coefficients for the FWHM calibration.

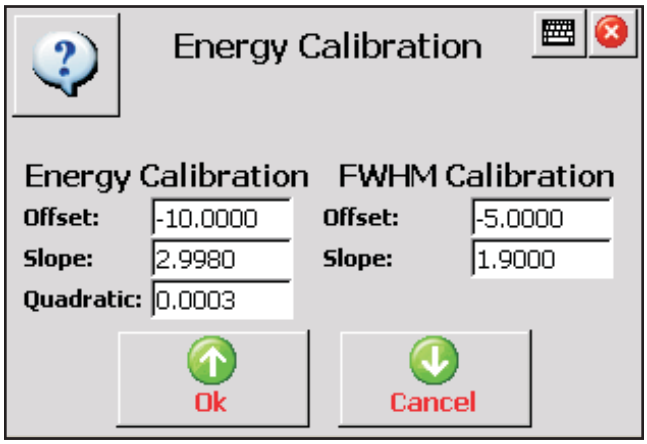


Figure 52 Energy Coefficients

Full

Select **Full** energy calibration to fine-tune the detector's energy calibration. It can also be used on a stored spectrum file. The calibration process requires a multi-photopeak calibration source, such as Canberra's Model MGS-3 Calibration Standard, and assumes that the existing calibration parameters are not too far off; that is, that the calibration source peaks can be found relatively close to their predicted positions.

The function uses a wizard (Figure 53) to step through the calibration process. The Right and Left Arrow keys will step to the next or previous step of the process. Select the **Home** key at any time to abort the calibration.

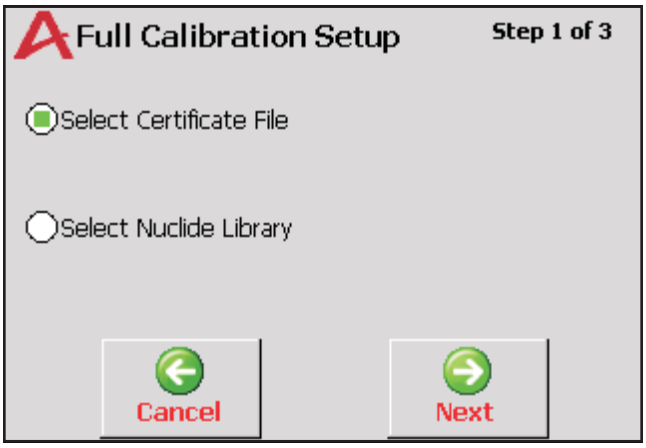


Figure 53 Full Calibration Setup Wizard

1. First indicate the source of the calibration energies: either a Certificate File, or a Nuclide Library.

   - If Certificate File was selected, choose the file that contains the calibration source's photopeak energies.

   - If Nuclide Library was selected, select the library which contains the nuclides in the calibration source. The wizard's next step will list the nuclides in the library. To choose a nuclide, use the Up and Down Arrow keys to highlight the nuclide, then select Enter. Selected nuclides will be highlighted in yellow.

2. When all nuclides have been selected, their photopeak energies are extracted from the library and sorted. Any overlapping energies (those within 1.5 FWHM of each other) will be discarded. At least three energies are required.

   Note that a certificate file will automatically be created; the file contains the photopeak energies of the selected nuclides. The name of the file is created using the names of the selected nuclides.

3. Select the "peak match tolerance"; this determines how far from its predicted position each calibration peak can be and still be considered a valid peak. To change the tolerance value, select the Enter key to highlight the FWHM value, then edit the value. Select Enter to move the highlight to the Previous and Ok buttons, and then select the Right Arrow key to proceed.

   A larger tolerance value allows more variation between the current calibration and the actual position of the peaks, but also increases the possibility of false matches.

If “Do FWHM Calibration?” is set to Yes, a FWHM calibration will be performed at the same time. Set this parameter to No to perform only the energy calibration.

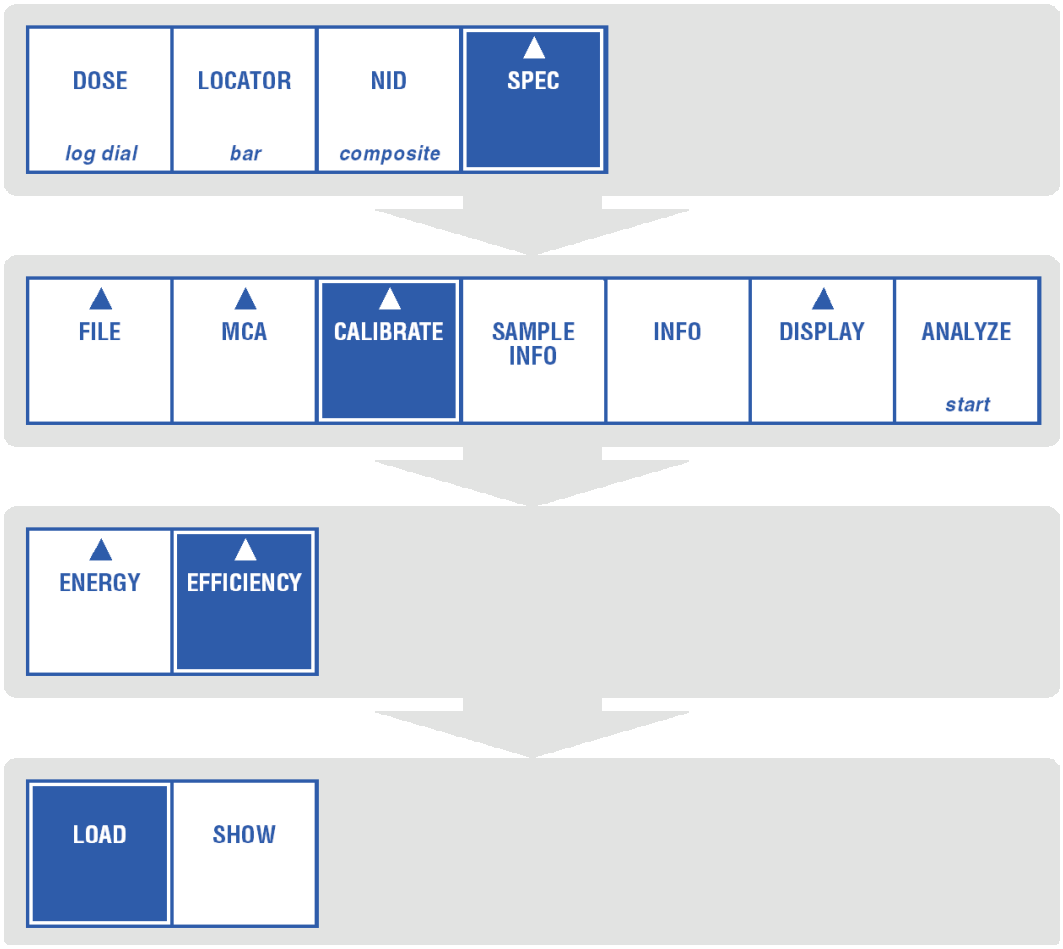
4. To calibrate the probe, place the calibration source on the detector when prompted, then select Ok to start acquisition. When you judge that sufficient data has been collected, press Enter to stop the acquisition.

5. The peaks found in the spectrum will be matched against the photopeak energies specified in the certificate or nuclide library, new calibration coefficients calculated, and the resulting plot of channel vs. energy displayed. If the results are acceptable, press the Up Arrow to save the calibration and the calibration spectrum file; otherwise, press the Down Arrow to discard it.

   If fewer than three calibration peaks are sufficiently close to their predicted positions, the calibration wizard will report an error. You can try again, using a larger tolerance (see step 3) or use one of the RECAL functions to shift the entire spectrum closer to the current calibration.

Efficiency

The Efficiency Menu command lets you load a memory-resident (already down-loaded) CAL file or show a calibration graphically.



Load

When you select **Load**, the InSpector will show you a list of files to choose from.

- Use the Up/Down Arrow keys to move the highlight bar through the list.
- Use the Left/Right Arrow keys to move to the previous/next page of files.
- Select the **Enter** key to load the highlighted file.
- Select the **Ok** button to confirm your choice.
- At any time, select **Home** to close the file box without selecting a file.

Show

Select **Show** to display the efficiency calibration as a graph and its equation (Figure 54).

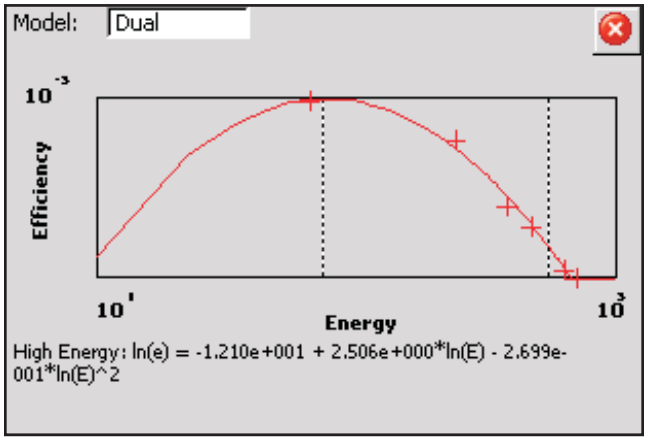


Figure 54 Show Efficiency Calibration

Model

This screen allows you to choose a different Model for the displayed curve: Dual, Linear, Empirical or Interpolated.

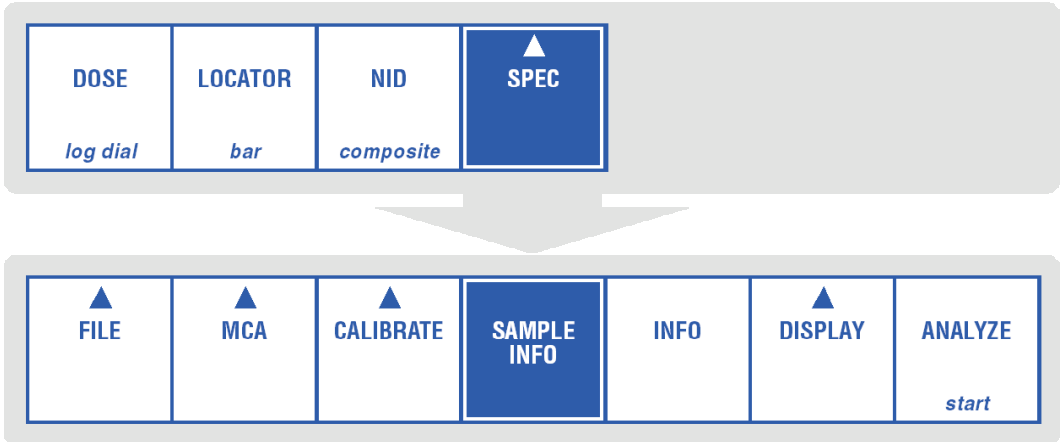
To choose a different model, press the **Enter** button. The model you choose is valid only for the current Show display; the model will default to Dual the next time you open the Show screen.

Note: The chosen model affects only the current Show display; the model used for analysis is set in the analysis sequence's efficiency step.

For technical information about the four efficiency models, refer to Efficiency Calibration Models on page 145.

Sample Info

The Sample Info dialog lets you enter information about the current spectrum.



The Sample Info dialog (Figure 55) lets you to enter information about the current sample. The data you enter will remain in memory until the InSpector is switched off and will be included each time you Save a spectrum (page 57).

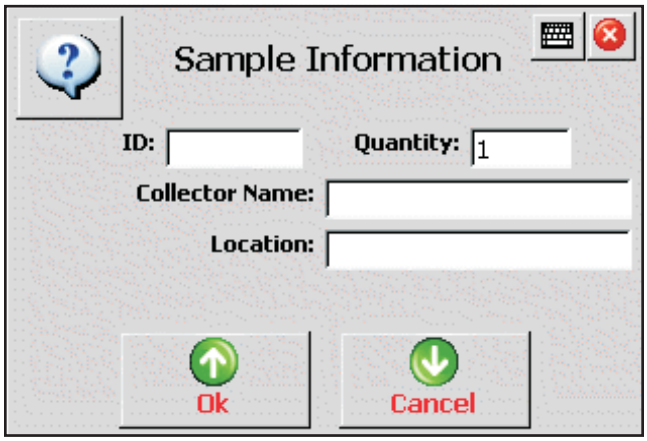


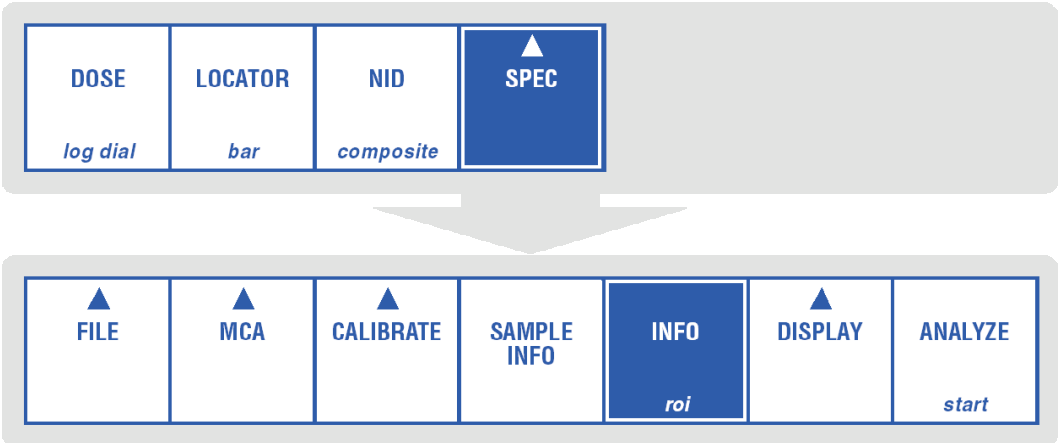
Figure 55 Sample Information

- ID is a textual sample identification of your choice.
- Quantity lets you enter the sample's quantity. Calculated activities are divided by this value, so that if the quantity is set to 1 (the default), total activity is reported. If any other value is entered, concentration is reported.
- Collector Name lets you enter the name of the person who collected the sample.
- Location is a description of the place where the sample was collected.

Info

Detailed information about the current datasource can be seen in the Info page you choose to display.

Each press of the Info button toggles which Info page is displayed below the spectrum. Each page is described in the following sections.



None

Select **None** to remove the Info pages from the display; this makes the spectral display larger.

ROI

The ROI page (Figure 56) shows the Left and Right limits and Centroid of the current ROI, both as a channel number and an energy, the ROI's Area, its Integral, and its FWHM (full width at half max) and FWTM (full width at tenth max) values. This data will be seen only if the cursor is in an ROI.

Figure 56 The ROI Page

Calibration

The **Calibration** page (Figure 57) includes the current calibration's Energy equation, FWHM (full width at half max) equation, and the Efficiency at the cursor's position and its curve model.

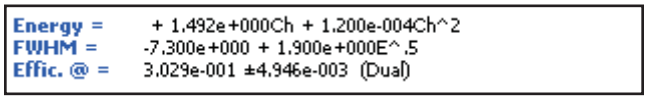


Figure 57 The Calibration Page

Time

The **Time** page (Figure 58) includes the Start time for the current data Acquisition, the percent Dead Time, and the Elapsed and Preset values for both Live Time and Real Time.

Figure 58 The Time Page

Display

The **Display** page (Figure 59) includes the display window's Start and End Channels by number and energy, the display's current VFS (vertical full scale) and, if the cursor is in an ROI, its Net and Total CPS (counts per second).

Figure 59 The Display Page

Nuclide

The **Nuclide** page (Figure 60) includes the Analysis Sequence description, the Identified nuclide at the cursor's position and any other potential nuclides found In Library.

Figure 60 The Nuclide Page

Sample

The **Sample** page (Figure 61) describes the current sample's descriptive information that will be saved with spectral data. This data is used in reports when saved spectra are uploaded to a host PC. None of these values have any significance in analysis except the quantity.

Figure 61 The Sample Page

- ID, an identifier for the sample being measured, Quantity, the amount of sample being measured, and Quantity Units if specified, are taken from data entered in Sample Info (page 76).
- Type is taken from Sample Information data entered on the General page of the InSpector's Configuration Editor (page 117); it cannot be entered directly in the InSpector.

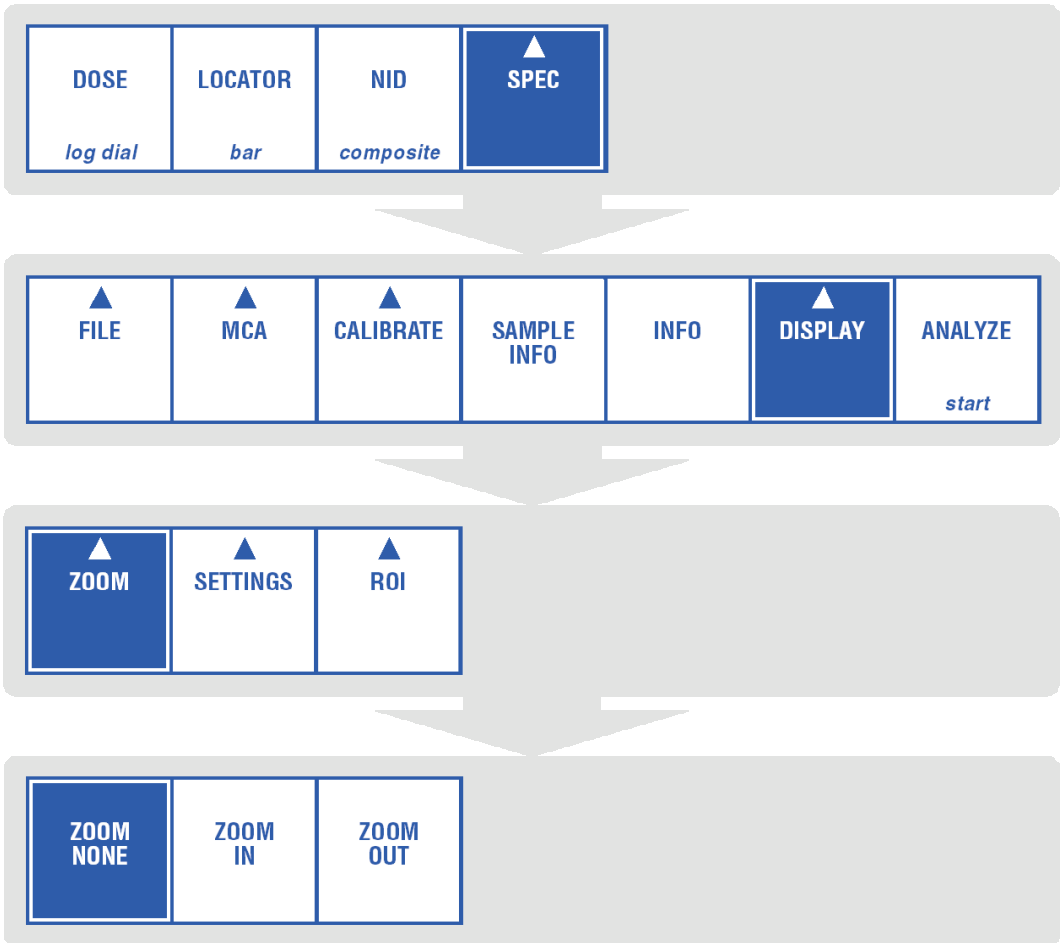
- Geometry displays the data entered in the Eff Geom ID field in Genie 2000's Calibrate | Store menu command.
- Time is the time the sample was taken.
- Efficiency is the name of the file used to efficiency calibrate the sample.

Display

The Display menu includes Zoom commands, display Settings and ROI commands.

Zoom

The **Zoom** command reformats the spectral display, centered on the cursor, to show more or less detail.



Zoom None

The **Zoom None** command disables the zoom ratio, returning the spectrum to its normal appearance.

Zoom In

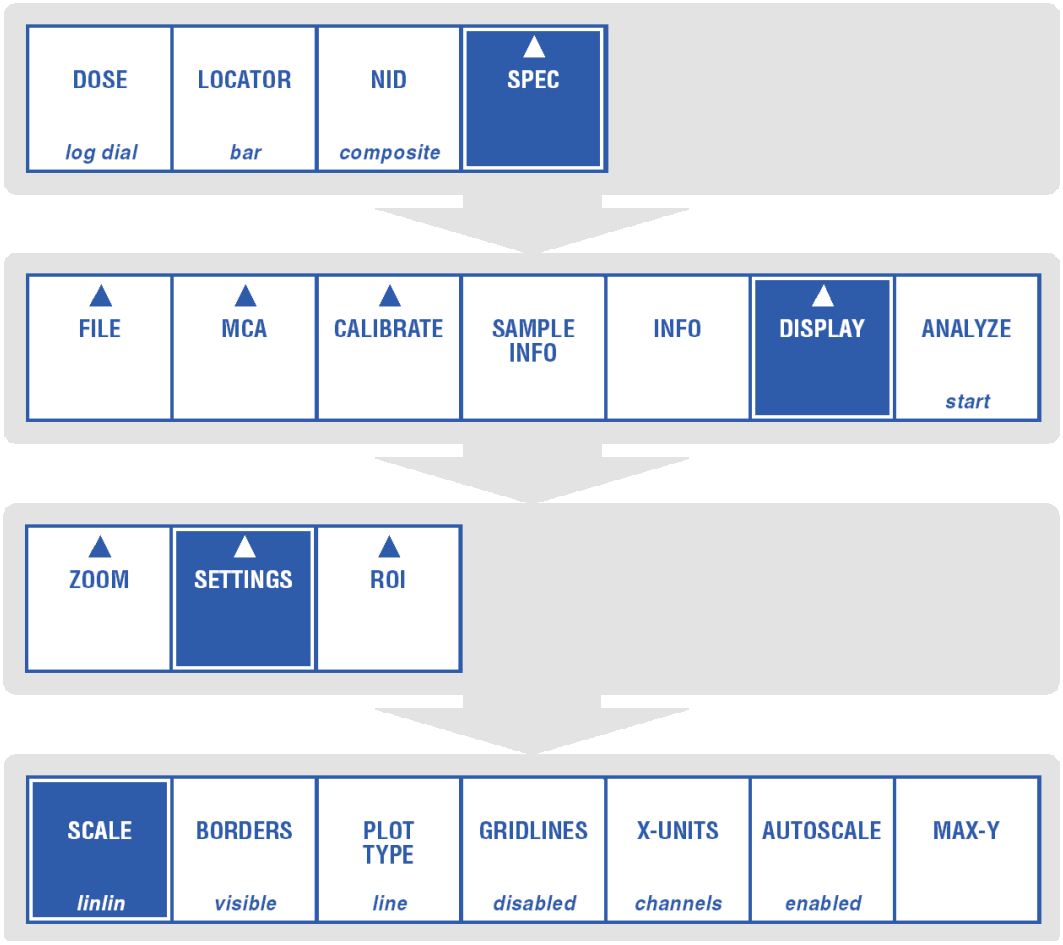
Each time the **Zoom In** command is selected, the zoom ratio is increased, showing a smaller amount of the spectrum in greater detail.

Zoom Out

Each time the **Zoom Out** command is selected, the zoom ratio is decreased, showing a greater amount of the spectrum in less detail.

Settings

The **Settings** parameters configure the appearance of the display.



Scale

Each time the **Scale** command is selected, the spectrum's XY-scales toggle between: *linlin, linlog, loglin, loglog, sqrtlin* and *sqrtlog*.

Borders

The **Borders** command toggles the display's X- and Y-axis borders between *visible* and *none* (Figures 62 and 63).

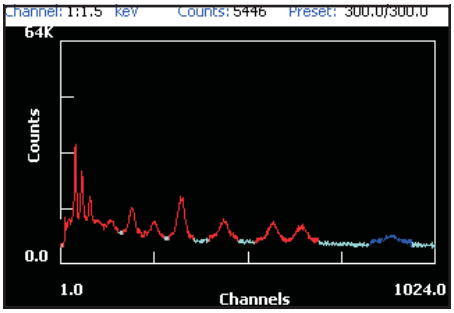


Figure 62 Visible Borders

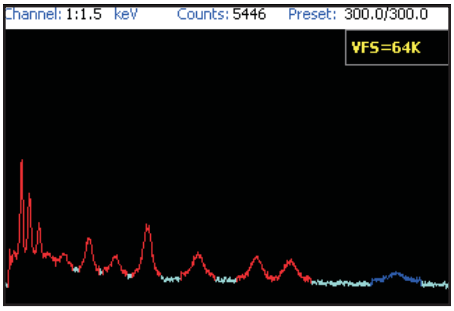


Figure 63 No Borders

Plot Type

The **Plot Type** command toggles the way the spectrum is displayed between *line, area* and *points*.

Line

Line displays the spectrum as a solid line (Figures 62 and 63).

Area

Area displays the spectrum with the area filled in (Figure 64).

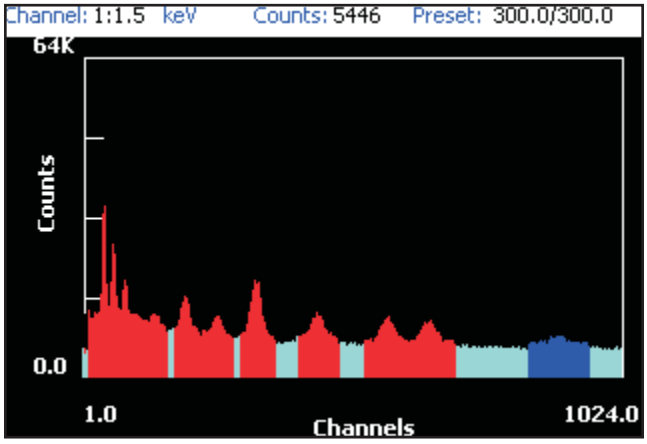


Figure 64 Display Spectrum as Area

Points

Points displays the data as points on a plot (Figure 65).

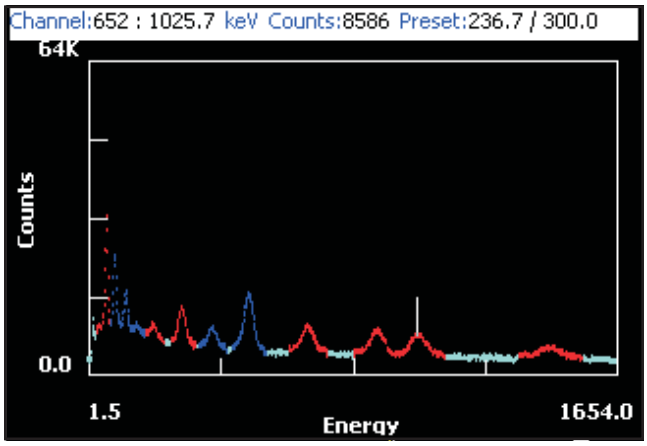


Figure 65 Display Spectrum as Points

Gridlines

The **Gridlines** command toggles the display's X-Y gridlines between *enable* and *disable* (Figure 66).

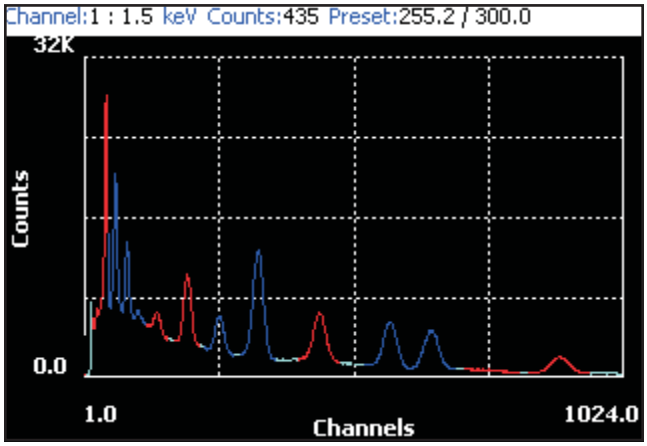


Figure 66 Gridlines Enabled

X-Units

The **X-Units** command toggles the X-axis' label between *channels* (Figure 66) and *energy* (Figure 65).

Autoscale

The **Autoscale** command lets the program automatically set the display's vertical full scale (VFS) As the spectral data increases, the VFS is automatically reset to show all of the data.

Max-Y

If Autoscale is not enabled, **Max-Y** lets you specify the absolute value of the Y-axis scale.

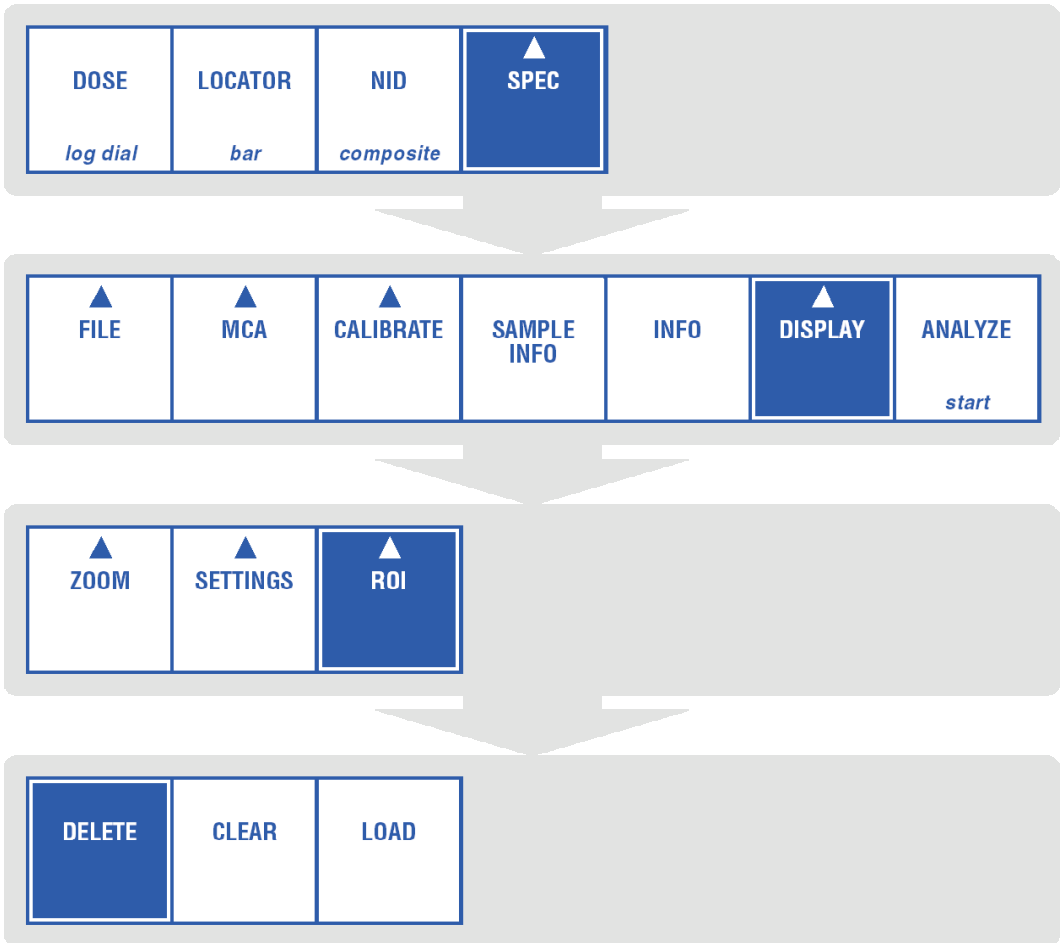
ROI

An ROI is a region of interest, usually marking a photopeak. You can create ROIs by executing an analysis sequence file containing Peak Locate and Peak Analysis algorithms (page 43) or you can load the ROIs from a file (page 45).

Color of the ROIs

Peaks associated with an identified nuclide will be marked with a **blue ROI**. Peaks that cannot be identified will be marked with a **red ROI**.

To access the ROI menu, select the Up Arrow, then select:



Delete

When the cursor is in an ROI, the Delete button will be enabled; selecting the button will delete the current ROI from the display.

When the cursor is *not* in an ROI, the Delete button will be disabled; the button cannot be selected.

Clear

Selecting Clear will remove all ROIs from the spectrum, whether entered by an analysis routine or loaded from a file.

Load

Selecting **Load** will show you a list of ROI files to choose from (Figure 67):

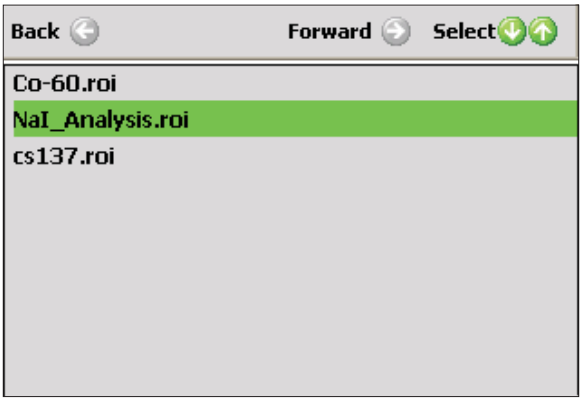


Figure 67 A Typical ROI File List

- Use the Up/Down Arrow keys to move the highlight bar through the list.
- Select the **Ok** to load the highlighted file.
- Use the Left/Right Arrow keys to move to the previous/next page of files.
- Select the **Enter** key to load the highlighted file.
- Select the **Ok** button to confirm your choice.
- At any time, select **Home** to close the file box without selecting a file.

Note: If ROIs loaded from an ROI file are present in a spectrum, they will prevent the display of ROIs generated from an analysis routine. Clearing the loaded ROIs will allow the generated ROIs to be displayed.

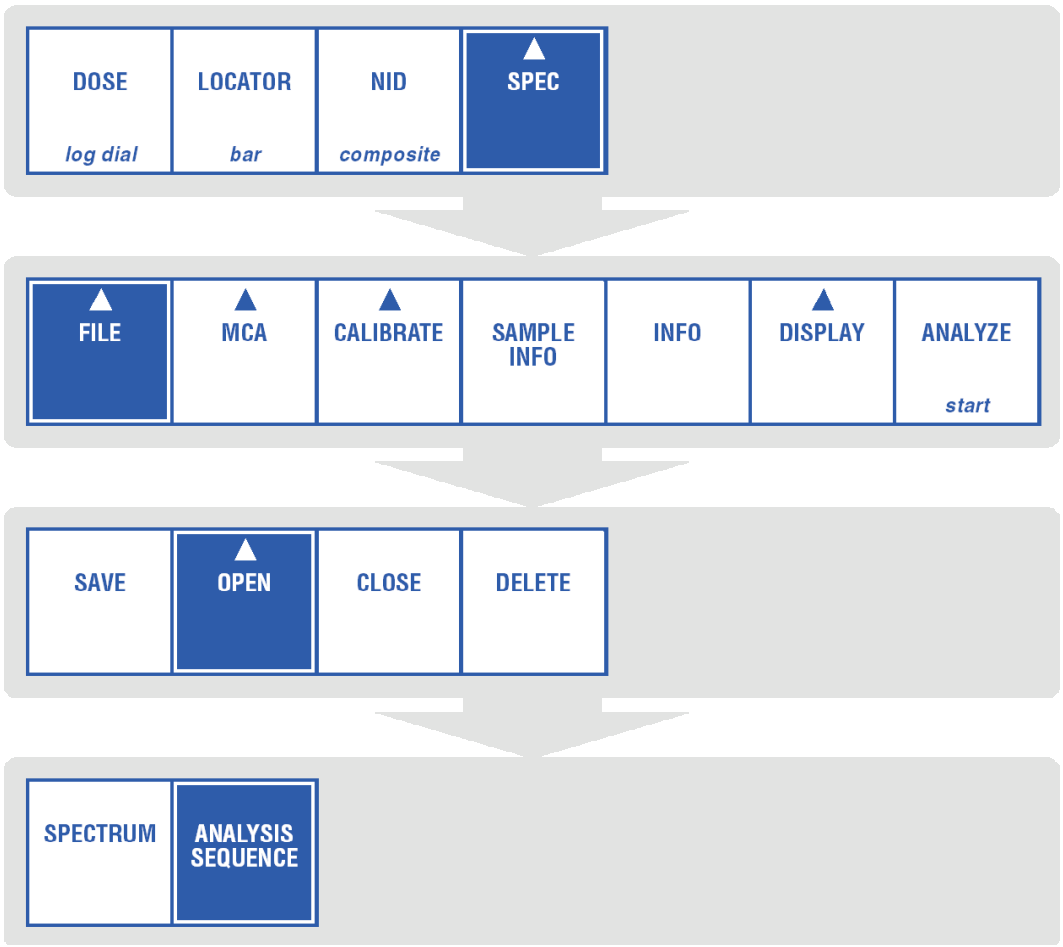
Analyze

The InSpector can perform a full gamma spectroscopy analysis, including peak location and analysis, environmental background subtraction, efficiency calculation, and nuclide identification and activity calculation. This analysis is performed via Analysis Sequence (ASF) files using Genie 2000 algorithms Genie. Each file defines a series of analysis steps and the parameters used by each.

For a discussion of using Genie 2000 to create or edit an ASF, refer to Appendix E, *Using ASFs*, on page 162.

Loading the Sequence File

Analysis requires that a memory-resident sequence file (ASF) be loaded. Select the Up Arrow, then select:



Selecting **Analysis Sequence** will show you a list of files to choose from (Figure 68).

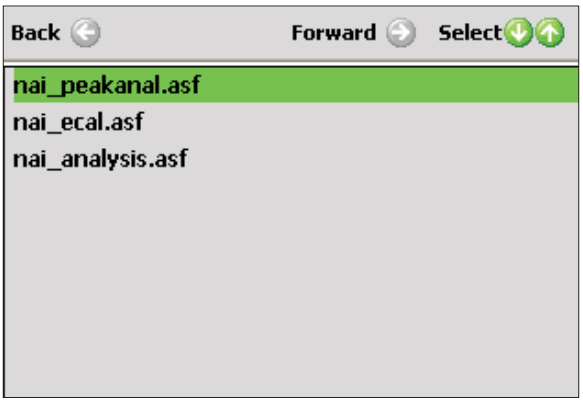
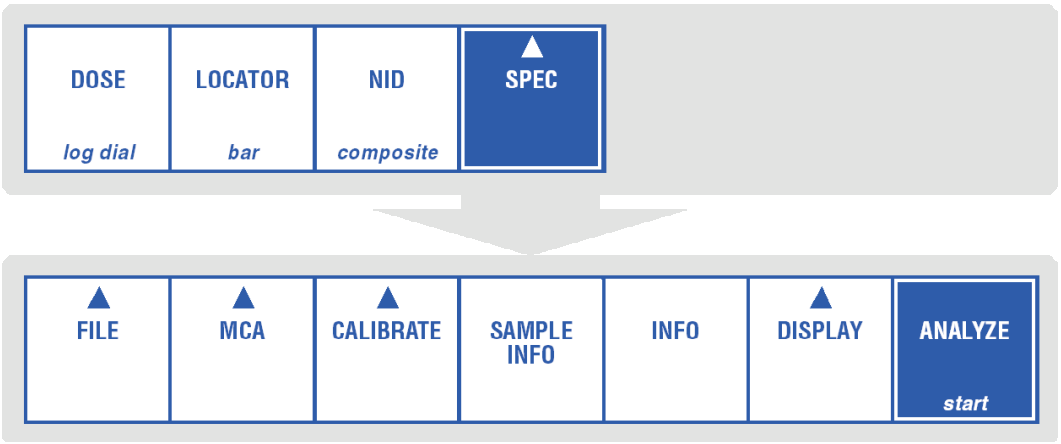


Figure 68 A Typical ASF File List

- Use the Up/Down Arrow keys to move the highlight bar through the list.
- Use the Left/Right Arrow keys to move to the previous/next page of files.
- Select the **Enter** key to load the highlighted file.
- Select the **Ok** button to confirm your choice.
- At any time, select **Home** to close the file box without selecting a file.

Starting an Analysis

To start analysis on the spectrum using the loaded ASF file, select:



When the Analyze button is selected, its legend changes from *start* to *abort*. So to stop an executing analysis, all you have to do is select Spec | Analyze again.

Although you'd usually analyze a spectrum with parameters defined in the ASF, some of the parameters can be changed in Spec Setup (page 96).

When you Save the analyzed spectrum, the changed parameters will be written to the spectrum file.

Stopping an Analysis

When the Analyze button is selected, its legend changes from *start* to *abort*. To stop an executing analysis, select the Analyze button again. The analysis file will stop executing.

9. Setup Mode

Setup Menus

The Setup Mode lets you set both the system parameters for the InSpector™ and the parameters for each data mode. To access the Setup Mode, press the **Enter** and **Home** buttons at the same time (Figure 69).

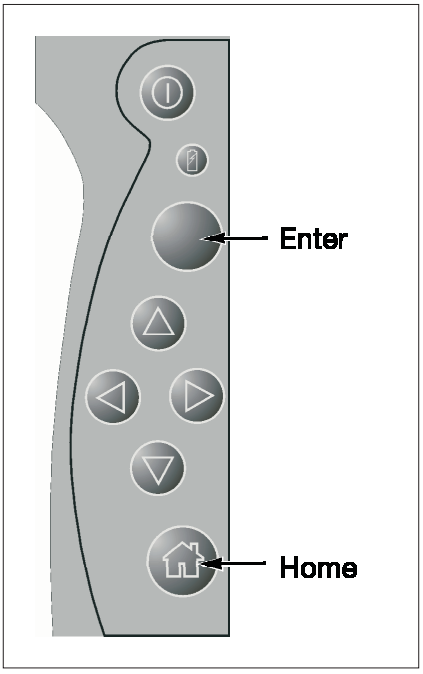


Figure 69 Location of the Home and Enter Keys

Navigating the Setup Dialogs

This section covers the extra navigation tools available in the Setup Mode. In addition to the Parameter Dialog functions on page 37, the Setup Dialogs have four extra keys and a different way of specifying which downloaded (memory-resident) file is to be used.

Apply

Select **Apply** to save the changed parameters in memory without leaving the current dialog page.

The word **Saved** appears at the top of the screen to indicate that the data was stored in the unit's memory.

Previous and Next

Selecting **Previous** or **Next** will save any changes you've made on the current page, then move to the dialog's previous or next page.

Quit

Select **Quit** to exit the dialog. If you have not first selected Apply, any changes will be lost.

Specifying a Memory-Resident File

In Spec Setup (page 96), you can specify which memory-resident file you want to use.

- Select the **Enter** key to move the highlight to the Library list box.
- Use the Up/Down Arrow keys to scroll through the list in the box.
- When you find the file you want to specify, select the **Enter** key to move the focus to the soft keys at the bottom of the dialog.
- Select the Up Arrow (Apply) to use the file.

Dose Setup

There are several pages of parameters for Dose Setup: Units and Range, Dose Rate Warning, Dose Rate Alarm, Annunciator, Cumulative Dose Warning, Cumulative Dose Alarm and Neutron Count Rate Alarm.

How the visual and audio alerts are issued for these warnings and alarms is discussed on page 18.

Units and Range

Selects the displayed units for the Dose Mode and their maximum range. The Dose Units are used throughout these setup pages and in all displays for the Dose Mode itself.

Dose Units

Dose Units are the units in which the Dose Rate and Cumulative Dose will be displayed.

Dose Rate Range

The Dose Rate Range sets the value of the upper limit of the gamma (NaI probe) dose display in the selected Dose Units.

For example, if you select mSv as the Dose Units, and 100 as the Range, the upper limit of the Dose Rate display will be 100 mSv/h.

Neutron Count Range

The Neutron Count Range sets the value of the upper limit of the counts per second histogram bar in the Dose Neutron and Composite Neutron displays.

Dose Rate Warning

Enables the Dose Rate Warning and sets its activation threshold. The Warning sound is selected in Instrument Setup | Sound Setup on page 99.

Enable

- Select **On** to enable the selected audio alert or **Off** to disable it.

Threshold

- When the Dose Rate exceeds this setting, selected alerts are issued.
- The Dose Units you chose on the Units and Range page are used here for the Threshold setting.

Dose Rate Alarm

Enables the Dose Rate Alarm and sets its activation threshold. The Alarm sound is selected in Instrument Setup | Sound Setup on page 99.

Enable

- Select **On** to enable the selected audio alert or **Off** to disable it.

Threshold

- When the Dose Rate exceeds this setting, selected alerts are issued.
- The Dose Units you chose on the Units and Range page are used here for the Threshold setting.

Annunciator

Enables the function and sets the sound generated by detected radiation.

Enable

- Select **On** to enable the Annunciator or **Off** to disable it.

Sound

- **Tone Lin** is a frequency that varies in pitch as a direct function of the rate change.
- **Tone Log** is a frequency that varies in pitch as a logarithm of the rate change.
- **Beep** is a clicking noise that occurs as a direct function of the dose or count rate.

Cumulative Dose Warning

Enables the Cumulative Dose Warning and sets its activation threshold. The Warning sound is selected in Instrument Setup | Sound Setup on page 99.

Enable

- Select **On** to enable the selected audio alert or **Off** to disable it.

Threshold

- When the Cumulative Dose exceeds this setting, selected alerts are issued.
- The Dose Units you chose on the Units and Range page are used here for the Threshold setting.

Cumulative Dose Alarm

Enables the Cumulative Dose Alarm and sets its activation threshold. The Alarm sound is selected in Instrument Setup | Sound Setup on page 99.

Enable

- Select **On** to enable the selected audio alert or **Off** to disable it.

Threshold

- When the Cumulative Dose exceeds this setting, selected alerts are issued.
- The Dose Units you chose in Units and Range (page 91) are used here for the Threshold setting.

Neutron Count Rate Alarm

Enables the Neutron Count Rate Alarm and sets its activation threshold. The Alarm sound is selected in Instrument Setup | Sound Setup on page 99.

Enable

- Select **On** to enable the selected audio alert or **Off** to disable it.

Threshold

- When the Neutron Count Rate exceeds this setting, selected alerts are issued.

Locator Setup

There are two pages of parameters for Locator Setup: Locator and MCS.

Locator

This page sets the vertical scaling and graphing parameters for displaying the Locator data.

Autoscale

Enables/disables automatic vertical scale.

- **On** turns autoscaling on for the Locator Mode; values set for the Dose Rate Scale and CPS Scale are ignored.

- **Off** turns the Locator Mode autoscaling off; the vertical scale is fixed at the values set in Dose Rate Scale and Count Rate Scale.

Dose Rate Scale

Sets the upper limit of the vertical scale when displaying locator dose data. This setting is ignored if Autoscale is enabled. The dose units are set in Dose Setup | Units and Range (page 91).

Count Rate Scale

Sets the upper limit of the vertical scale when displaying count rate data. This setting is ignored if Autoscale is enabled.

This also sets the upper limit of the Input Count Rate bargraph in the Dose Composite mode. The Input Count Rate bargraph is not dependent on the Autoscale setting.

Curve Type

Sets the default type of curve displayed, Line or Bar; the user can change the default setting via the main menu's Locator button.

- **Line** displays a single connected line.
- **Bar** displays a histogram (bar chart) with one bar for each measurement.

MCS

Sets more parameters for displaying Locator data.

Monitor

Sets the Locator display to **Gamma Count Rate**, **Gamma Dose Rate** or **Neutron Count Rate**. The display units for the Gamma Dose Rate are selected in Units and Range (page 91).

Max X

Max X is the width of the locator window, in seconds.

Smoothing

Enables/disables **Smoothing**, which decreases the visibility of random changes in the data.

Integration Width

Integration Width controls the number of dwell time intervals used to weight the smoothing. The larger the value, the more the data will be smoothed.

NID Setup

There is only one page of parameters for NID Setup.

- **Activity Units** – Select either µCi or Bq.
- **Dose Rate Display** – This parameter affects the Simple and Composite NID displays differently.
  - ▶ In the Simple NID display, selecting **On** defaults to the dose rate for each nuclide listed. Selecting **Off** defaults each nuclide's activity instead. The user can change the default by selecting the display's column header.

- In the Composite NID display, selecting **On** enables a column displaying the dose rate for each nuclide listed. Selecting **Off** disables the column displaying the dose rate.

- Note: This parameter does not affect the Dose Rate bargraph below the table in the Composite view.

- **Display** – Composite NID display only. You can display either **Error** (activity uncertainty in percent) or **Confidence** (percent confidence that the nuclide identification is correct) for each nuclide listed.

Spec Setup

There are four pages of parameters for Spectroscopy Setup: Peak Analysis, NID Analysis, Background Subtraction and Calibration Setup.

Notes: If an analysis sequence file is loaded, the current settings for these parameters will be overwritten; the loaded parameters will become the current parameters. If you change any of these parameters *after* loading a sequence file, your changes will become the current parameters.

Parameter changes made here have an effect only if the specified analysis step is present in the analysis file.

When you Save an analyzed spectrum, the changed parameters will be written to the spectrum file.

Peak Analysis

Though you'd normally use the Peak Analysis parameters in the specified ASF file, three of those parameters can be modified here.

- **Start Channel** – the starting channel for the peak search.

- **Significance** – The significance threshold is used to eliminate insignificant peaks from the search. Peaks with a significance value less than threshold value are ignored. This parameter must be greater than 0 and typically ranges from 3 to 5.

- **Library** – The Nuclide Library (NLB) to be used for the peak locate. All library files listed by this control are stored in \GENIECE\CAMFILES.

NID Analysis

Though you'd normally use the NID Analysis parameters in the specified ASF file, three of those parameters can be modified here.

- **Confidence** – Sets the Confidence threshold value – peaks above this threshold will be accepted for analysis. This parameter has a range of 0 (low) to 1 (high).
- **Tolerance** – Sets the tolerance threshold value, in FHWM. For a peak to be considered a match to a nuclide in the library, the peak energy must be within the specified Tolerance of the energy in the specified library.
- **Library** – Selects the Nuclide ID (NLB) file to be used for nuclide identification. All library files listed by this control are stored in \GENIECE\CAMFILES.

Background Subtraction

Though you'd normally use the Background file specified in the ASF file, you can specify a different background file here.

- **Background** – Select the background (CNF) file to be used for subtracting background peak areas from matching peak areas in the current datasource.

Calibration Setup

Selects the parameters for the "Recalibrating the Probe" functions, starting on page 66.

Note: For normal InSpector applications, this function should rarely be used.

- **Cal. Source Energy** refers to the energy of the calibration peak. It must be entered in keV.
- The value in **RECAL count time** field defines how long the calibration source is to be counted by the Auto Recal function. If the calibration peak cannot be found in this time, Auto Recal will resume acquisition until the total count time is three times this value.
- The **RECAL window** is the size, in FWHM, of the region in which the Auto Recal function will attempt to find the calibration peak. The window is centered on the predicted position of the peak.
- **RECAL min rate** is the minimum expected net count rate in the calibration peak. AUTO RECAL uses this value to discriminate among peaks in the search window. If the rate is unknown, enter 0.

MCA Setup

The MCA Setup screen lets you change the MCA's energy range and number of channels. Changing either of these parameters will reset the probe's high voltage to the recommended value for that probe.

If you change any of these parameters, you'll have to use Auto Recal (page 66) to adjust the probe's energy calibration, moving the source peak to its default location. If desired, you can then enable Full calibration (page 71) to fine tune the energy calibration parameters.

- **Energy Range** lets you set the energy of the highest channel in the spectrum. Note: The actual energy achieved may be vary from the setting by up to 10%.
- **Channels** lets you specify the number of channels in memory used to store a spectrum. The lower the Energy Range, the lower the maximum number of channels you can specify.

Instrument Setup

There are two pages of system parameters for setting up the InSpector: Instrument Setup and Sound Setup.

Instrument Setup

Sets the language used, the screen's backlight timeout, the menu's timeout and the mode selected by pressing the Home key.

- **Language** Lets you select the language used for the InSpector's menus and messages.
- The **Backlight** can be always on, always off, or on for a selected number of seconds after the unit becomes inactive. Since it takes about 20 seconds after the user's last action (i.e., a keypress) for the unit to time out to inactive status, the backlight will turn off {Backlight Value + 20} seconds after the last user action.
- **Menu Timeout** defines how long the menus are displayed, in seconds.
- **Home Mode** selects which main menu function is displayed when the Home button is pressed: Spec, NID Composite, NID Simple, Dose EBar, Dose Composite Dose Simple, Dose Linear Dial, Dose Log Dial, or Locator.
- **Easy Mode of Operation** sets the InSpector for the Easy Mode of Operation (defaults to LOCATOR screen).

Sound Setup

Selects the sound emitted to signal various alarms and warnings. Every alarm and warning has a factory-set default which you can redefine here, including turning it off.

- The **Volume**, which applies to all sounds, can be set for 20 to 100, in increments of 10.
- The selection box lets you choose the alarm or warning to be redefined.
- **Sound Type** – There are a number of sounds to choose from, including “None”, which disables the audible alarm or warning specified in the selection box.
- **Play Sound** – Select the Play Sound button to hear the sound for, and verify the parameters of, the selected alarm or warning. Press the button again to turn the audio off.
- **Note** – Selects the pitch of the sound.
- **Interval** – Selects the amount of time between instances of the sound. For instance, selecting 4 means that the sound will be produced every four seconds, with each instance being “Length” in duration.
- **Length** – Selects the duration of the sound. The sound’s Length must be smaller than its Interval. Applicable only to continuous sounds.

Date/Time Setup

This page lets you set and read the system clock and calendar. There are two parameter pages: System Date/Time and Time Zone.

System Date/Time

- Day, Month, Year – Sets the calendar.
- Seconds, Minutes, Hours – Sets the clock.

Time Zone

- Time Zone – Use the Up/Down Arrow keys to select your local time zone.
- Automatically adjust clock for daylight saving – Select this radio button to cause the clock to automatically account for daylight savings.

Touchpad Calibrate

If the InSpector's touchpad becomes misaligned, this function lets you realign it. Select the Touchpad Calibrate button to launch the calibration screen (Figure 70).

- Tap the cross-hairs target in the center of the Calibration screen with a stylus.
- Tap the target each time it moves to a corner of the screen.
- After tapping all five target positions, tap the screen once more to save the calibration.
- The alignment is complete.

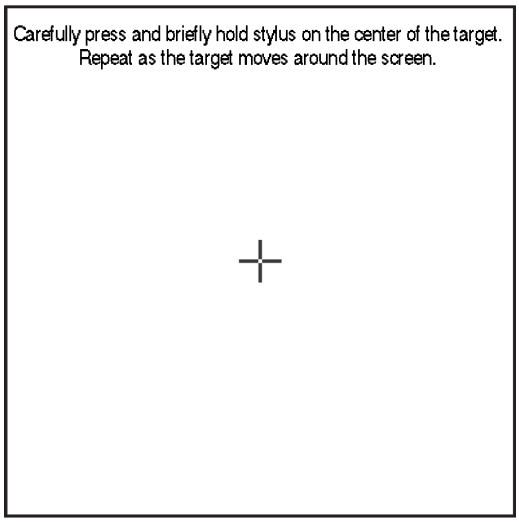


Figure 70 Touchpad Calibration Screen

Allow Remote Setup

The Allow Remote Setup command, which allows remote customization of the InSpector, is not usually needed because the Maintenance Utility program performs the same function automatically. The command is not available while data acquisition is in progress.

Clear Cumulative Dose

Clears the Cumulative Dose data from memory.

Reset Defaults

Select **Reset Defaults** to restore the InSpector's operating parameters to their factory default settings. See "Default Configuration Settings" on page 129 for a complete list of the default parameters.

A. Software Update

For technical assistance, contact our Customer Service Hotline at1-800- 255-6370. Or email techsupport@canberra.com.

Note: During this update procedure, the InSpector must be powered by the AC adapter.

1. Put the InSpector's Update CD into your PC's CD drive.

2. Using your USB cable, connect the InSpector to your PC's USB port. The required ActiveSync link will automatically be established. If the link isn't established, disconnect the USB cable then reconnect it.

3. When the Installation Screen appears (Figure 71), click the button labeled Install InSpector 1000 Software.

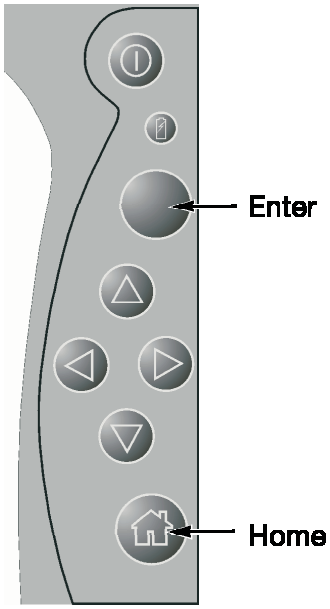
Figure 71 The Installation Screen

4. Use the PC's Start | Run menu command to Browse to and run C:\Canberra\InSpector1000\Install\OSUpdate.exe.

5. When the Operating System has been updated, the system will reboot and the ActiveSync connection should be re-established. If the link isn't established, disconnect the USB cable then reconnect it.

6. Use the PC's Start | Run menu command to Browse to and run C:\Canberra\InSpector1000\Install\setup.exe. This installs InSpector 1000 V1.1.

7. When V1.1 is installed, the last operation is to update the InSpector's default parameters (new ANSI library, new ASF, etc.). Simultaneously press the InSpector's Home and Enter buttons to access to the Setup Mode.



8. Press the NEXT button four times, then Yes, then RESET DEFAULTS.

9. The unit is fully updated and set to the new Easy Mode of Operation (if you want to go back the Standard Mode of Operation, go to the Setup Mode, select "Instrument Setup" and then deselect the Easy Mode of Operation button).

This completes the update.

B. The Maintenance Utility

The InSpector™ 1000 Maintenance Utility connects the InSpector to your PC, transfers files between the InSpector and your PC, deletes files from the InSpector 1000, views spectra stored on the InSpector 1000, and allows you to create or modify the InSpector configuration file.

If you need to install the program, go to “Installing the Maintenance Utility” on page .

Starting the Utility

To start the Maintenance Utility program on your PC, select:

Start | Programs | GENIE-2000 | InSpector 1000 | Maintenance.

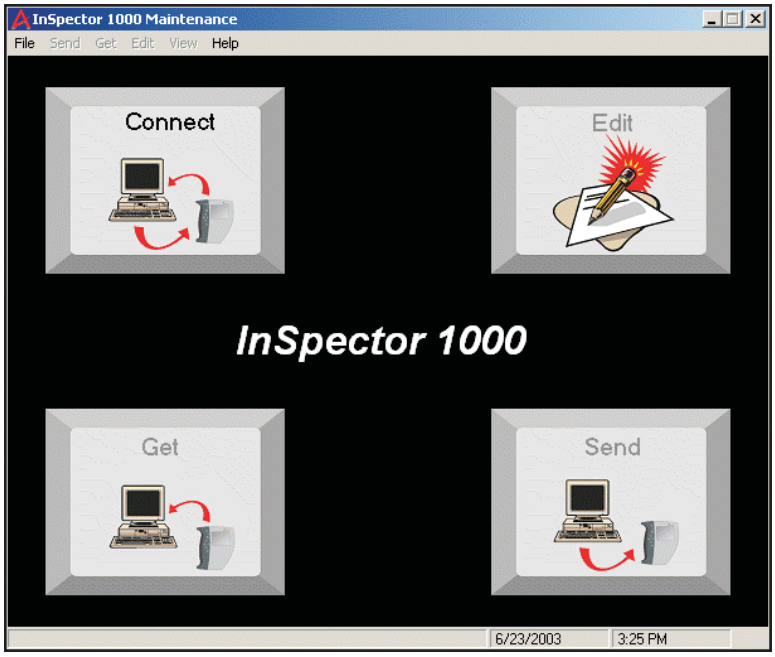


Figure 72 The Maintenance Utility

The Utility's Menu Bar

Most of the utility's menu items duplicate the four large icons: Connect/Disconnect, Edit, Get and Send. Some, however need an explanation.

File – Delete remote files

This command lets you delete files from the InSpector. You can change the list of displayed files by selecting a different file type.

File – Open local preference file

This command lets you select a PC-resident configuration file for editing in the Configuration Editor. The Editor is covered in detail in "Configuration Editor" on page 112.

To open the InSpector-resident configuration file, use the **Edit** button or the **Edit | Settings** menu command.

Send

The several Send commands let you choose a specific file type to transfer from the PC to the InSpector. You can do the same thing by selecting the Send button and choosing the file type.

Get

The **Get | Spectrum** menu command only transfers spectrum files from the InSpector to the PC. To transfer other file types, use the **Get** button.

Edit

This menu item includes commands for editing several different kinds of files for use with the InSpector.

- The **Edit | Current Analysis** command opens the InSpector's current Analysis Sequence file for editing.
- The **Edit | Settings** command opens the InSpector-resident configuration file in the Configuration Editor. The Editor is covered in detail in "Configuration Editor" on page 112. This function does *not* open a PC-resident configuration file. To do that, use the **File | Open local preference file** menu command.

- The **Edit | Load ROI** command lets you choose a PC-resident ROI file for transfer to the InSpector. The file's ROIs will be loaded directly into the current spectrum.

- The **Edit | Load ASF** command lets you choose an ASF (Analysis Sequence File) resident on your PC for transfer to the InSpector.

View

The View command lets you review a spectrum file still resident in the InSpector's memory.

Connect Function

The **Connect** button connects the InSpector to your PC through the supplied USB cable. Microsoft ActiveSync must be installed before the Maintenance Utility can communicate with the InSpector. See "Installing ActiveSync" on page for installation instructions.

1. Referring to "Connecting a Probe or Communications Cable" on page 132, connect the supplied InSpector USB cable between the InSpector and any USB port on your PC. Only one InSpector may be connected at a time.

2. The first time you connect an InSpector to your PC, ActiveSync will ask you to establish a partnership.

3. Select No, then Next. It is not necessary to synchronize information.

4. You'll be connected as a Guest.

Note: A partnership is unique to and valid only for the InSpector that established it. Connecting a different InSpector requires another partnership.

5. If you connect the InSpector to the PC while the Maintenance Utility is running, you may have to select the Maintenance Utility Connect button to notify the program that the InSpector is now connected.

6. You can disconnect the InSpector from the PC at any time unless you have a setup information file open in the Maintenance Utility or are transferring data.

Note: Due to the way ActiveSync works, you may sometimes experience a connection failure when reconnecting to an already established partnership. If this happens, disconnect the InSpector, then reconnect it. This should re-establish the partnership.

Suppressing the ActiveSync Connection Wizard

The following registry value can be used to suppress the ActiveSync Connection Wizard each time the connection is established:

[HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\Windows CE Services]
"GuestOnly"=dword:00000001

If the GuestOnly value is missing or set to zero, the dialog requesting you to set up a partnership will appear. When set to 1, the connection is established without the dialog appearing.

Edit Function

The **Edit** button, like the **Edit | Settings** menu command, opens the local (InSpector-resident) configuration (settings) file in the Configuration Editor. The Editor is covered in detail in “Configuration Editor” on page 112.

This function cannot open a PC-resident configuration file. To do that, use the **File | Open local preference file** menu command.

Get Function

The **Get** button lets you transfer data from the InSpector to your PC. To use this command, the units must be connected with the supplied USB cable. See “Connecting the InSpector to the PC” on page 106.

1. Select the Maintenance Program’s **Get** button.

2. By default, spectrum (CNF) files are copied to the PC. This can be changed in the file type list box.

3. Select the file or files to be copied from the "InSpector 1000 Files" list box on the left.

4. The destination folder on the host PC is shown in the center and the files in that directory are displayed on the right. By default, spectrum files are copied

to a subfolder named for the InSpector's ID (not the Sample Information ID) entered on the Configuration Editor's General tab. The example in Figure 73 shows C:\GENIE2K\CAMFILES\Instrument ID as the Save To path.

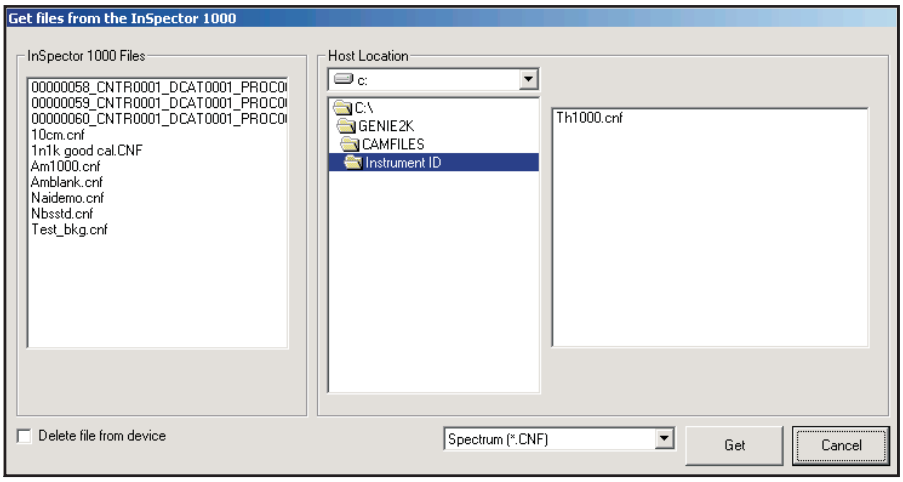


Figure 73 The Get Files List

5. To delete spectrum files from the InSpector after they have been copied, check the "Delete file from device" checkbox.

6. Select the **Get** button again to copy the selected files.

Send Function

The **Send** button lets you transfer data from your PC to the InSpector. To use this command, the units must be connected with the supplied USB cable. See "Connecting the InSpector to the PC" on page 106.

1, Select the Maintenance Program's **Send** button.

2. The Send dialog in Figure 74 defaults to spectrum (CNF) files. This can be changed in the file type list box.

3. Select the **Send** button again to copy the selected files.

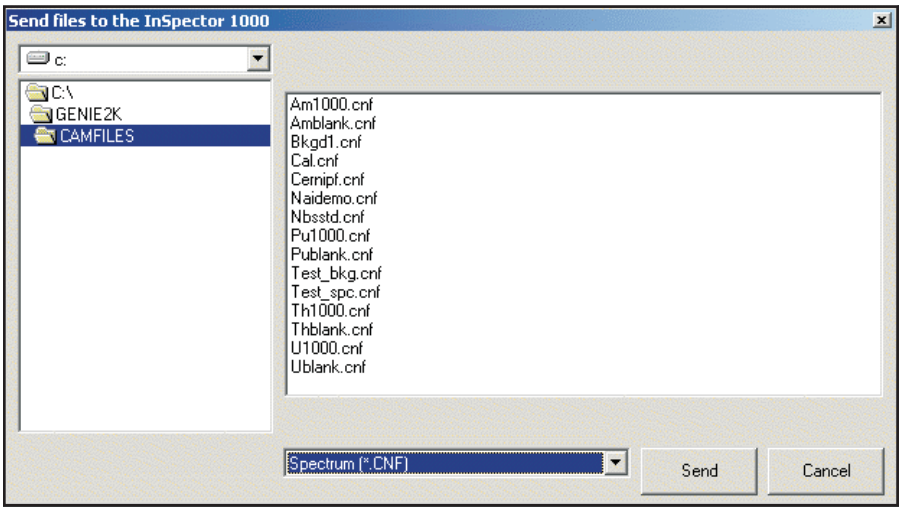


Figure 74 The Send Files List

Viewing an InSpector Spectrum

You can use the View Spectrum function to preview a spectrum file located on the InSpector, and optionally, upload it to your PC.

1. Select View | Spectrum from the menu bar

2. A list of the InSpector's spectrum files will be displayed (Figure 75). Highlight a file then select **Open**.

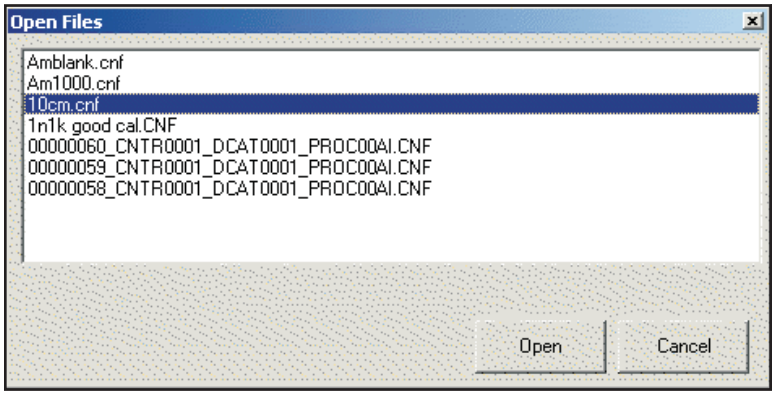


Figure 75 The View Files List

3. The spectrum file will be retrieved from the InSpector and displayed (Figure 76).

4. If you'd like to copy the spectrum to your PC, select **Save**. The Utility will offer to copy the spectrum to the Genie 2000 spectrum files directory: C:\GENIE2K\CAMFILES.

5. Enter a file name and select **Save**.

6. To close the spectrum display, select **OK**.

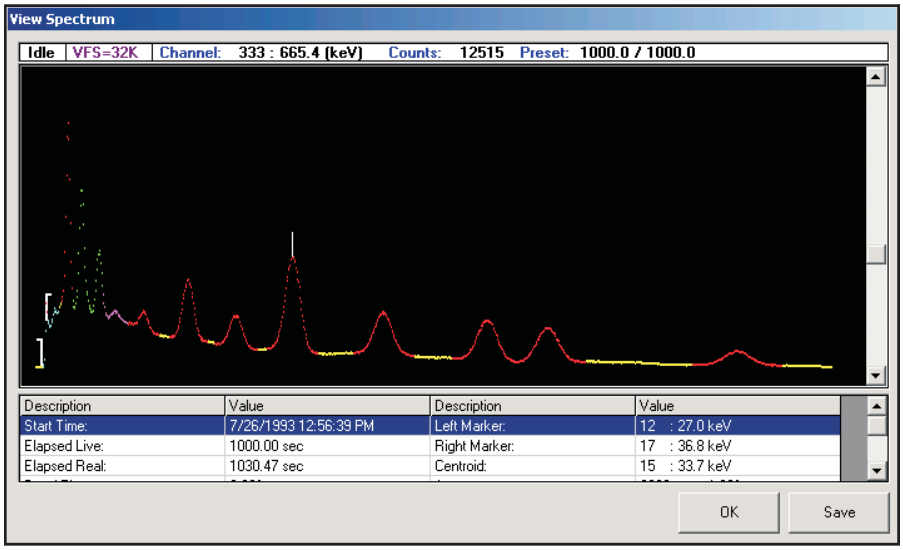


Figure 76 Viewing a Spectrum

Sending ROI Sets

ROI sets can be transferred in two ways:

- Use the Send function to transfer one or more ROI files to the InSpector. Then use the InSpector's Spec | Display | ROI | Load function to load one of the files.

- Use the Edit | Load ROI function to select a local (on your PC) ROI file from which a set of ROIs will be loaded directly (Figure 77).

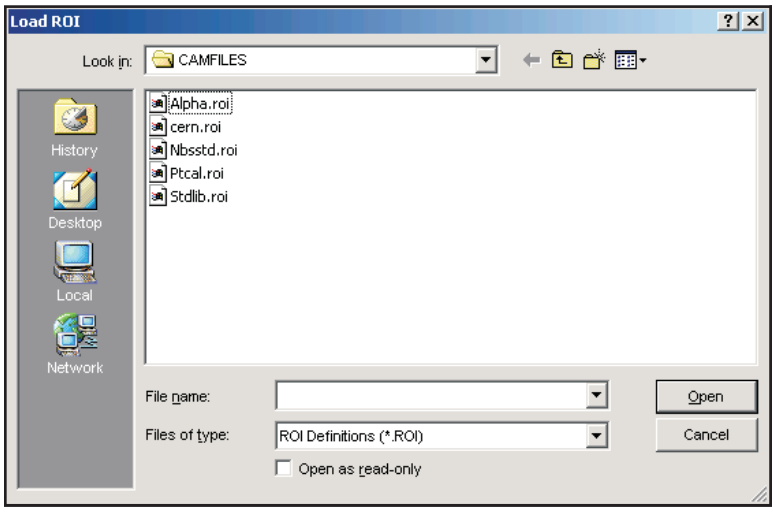


Figure 77 Selecting an ROI File

Defining Spectrum ROIs

To create a ROI (Regions of Interest) file, follow these five steps:

1. Allow the spectrum analysis to define them automatically either…

   - On the InSpector, or
   - In Genie 2000's Gamma Acquisition and Analysis program. If you choose this method, you'll first have to use the Maintenance Utility's Get function to download a spectrum file to your PC.

   An ROI will be created for each peak found in the spectrum. Note that a peak region may contain more than one peak. On the InSpector, a **blue ROI** has been associated with a nuclide. A **red ROI** contains an unidentified peak.

2. Use the Display | ROI menu and the internal markers in Gamma Acquisition and Analysis.

3. Use the Gamma Acquisition and Analysis program's Display | ROIs | Store function to create an ROI file in a spectrum on your PC.

4. Use the Maintenance Utility's Send function to upload the ROI file to the InSpector.

5. On the InSpector, use Spec | Display | ROI | Load to load the ROI file into the spectrum. These ROIs will replace the analysis-generated ROIs, if any.

Configuration Editor

In addition to changing the InSpector's configuration in the Setup Mode, you can also change it via the Maintenance Utility's Configuration Editor. The Editor is opened by selecting the Edit icon on the Maintenance Utility's main screen.

Saving the Configuration

When editing is complete, select OK. The edited configuration file will immediately be downloaded to the InSpector and replace the existing file.

Editing a Configuration File on Your PC

If you have many InSpector 1000 units, and plan to configure them identically, it may be useful to have a single configuration file available on your PC, copying it manually to each InSpector.

1. Connect one of the InSpector 1000s to your PC.
2. Use the Maintenance Utility to configure the InSpector according to your needs. Be sure to close the utility's Configuration File editor when finished.
3. Select Setup | Allow Remote Configuration on the InSpector.
4. Use Windows CE Explorer on the PC to find the InSpector's configuration file: select My Computer, then browse to GenieCE\Ctlfiles\In1kprefs.cnf and copy it to your PC.
5. Press the InSpector's Enter key to cancel the remote setup mode.
6. If desired, more changes can be made to the file using File | Open Local Preference File.
7. To copy the preference file to another InSpector:
    a. Connect that InSpector to the PC
    b. Enable the InSpector's Setup | Allow Remote Setup function (page 100) to allow access to the InSpector file.
    c. Use Windows CE Explorer to copy the In1kprefs.cnf file from the PC to Mobile Device\GenieCE\Ctlfiles.
    d. Disable the Allow Remote Setup function to return the InSpector to the normal operating mode.

The Buttons Page

The checkboxes on the Buttons page (Figure 78) let you change access to the InSpector's soft buttons of the same name. To disable a menu button, such as the InSpector's Setup Mode button, uncheck its checkbox. When the configuration is saved to the InSpector, the disabled buttons will no longer be seen in the InSpector's menus.

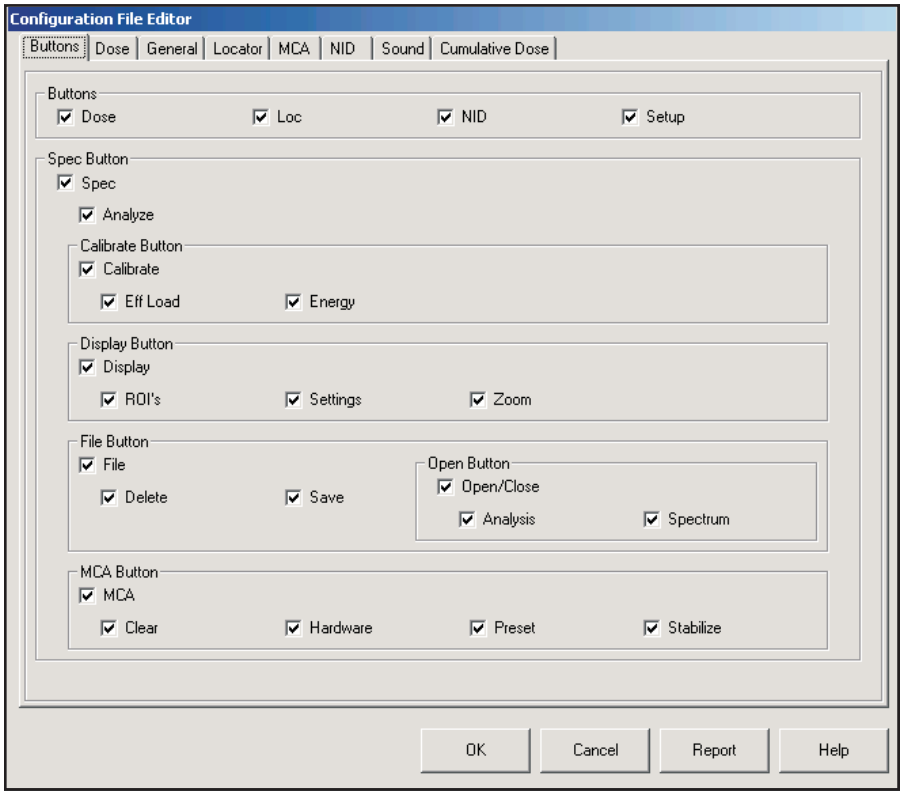


Figure 78 The Buttons Page

The Dose Page

The Dose Page (Figure 79) provides options regarding dose display and alarms. Options for the annunciator (which is driven by either dose rate or count rate) are also provided on this page.

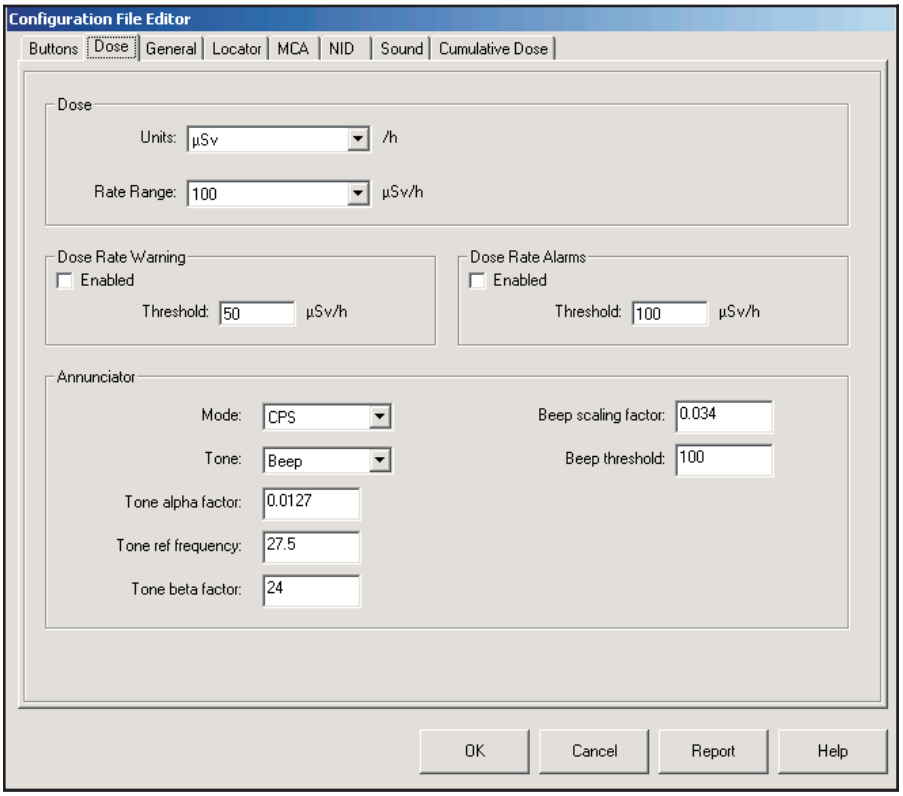


Figure 79 The Dose Page

- Dose Units: The unit in which dose rate is to be displayed. This setting affects all dose and dose rate displays on the InSpector and the Configuration Editor.
- Rate Range: The range over which dose rate is to be displayed. The units are determined by the setting in Dose Units.
- Dose Rate Warning: Enabled: a warning is generated if the dose rate exceeds Threshold.
- Dose Rate Alarm: Enabled: an alarm is generated if the dose rate exceeds Threshold.

Annunciator Mode:

- Off: the annunciator is turned off.
- Gamma Dose Rate: the annunciator is driven by the gamma dose rate.
- Gamma Count Rate: the annunciator is driven by the gamma count rate.
- Neutron Count Rate: the annunciator is driven by the neutron count rate.

Annunciator Tone:

- Beep: the annunciator makes a discrete clicking sound at a rate dependent on the dose or count rate. No sound is made when the dose rate or count rate is below the Beep threshold (see below).
- FM Linear: the annunciator makes a continuous tone, whose frequency depends on the dose rate or count rate.
- FM Log: the annunciator makes a continuous tone, whose frequency depends on the dose rate or count rate.

Tone alpha factor: used in FMLinear mode; see above.

Tone beta factor: used in FMLog mode; see above.

Beep scaling factor: used to convert the dose rate or count rate to beep frequency; see above.

Beep threshold: the dose rate or count rate below which no sound will be made in Beep mode.

The Neutron Page

The Neutron Page (Figure 80) provides options regarding neutron measurement and alarms.

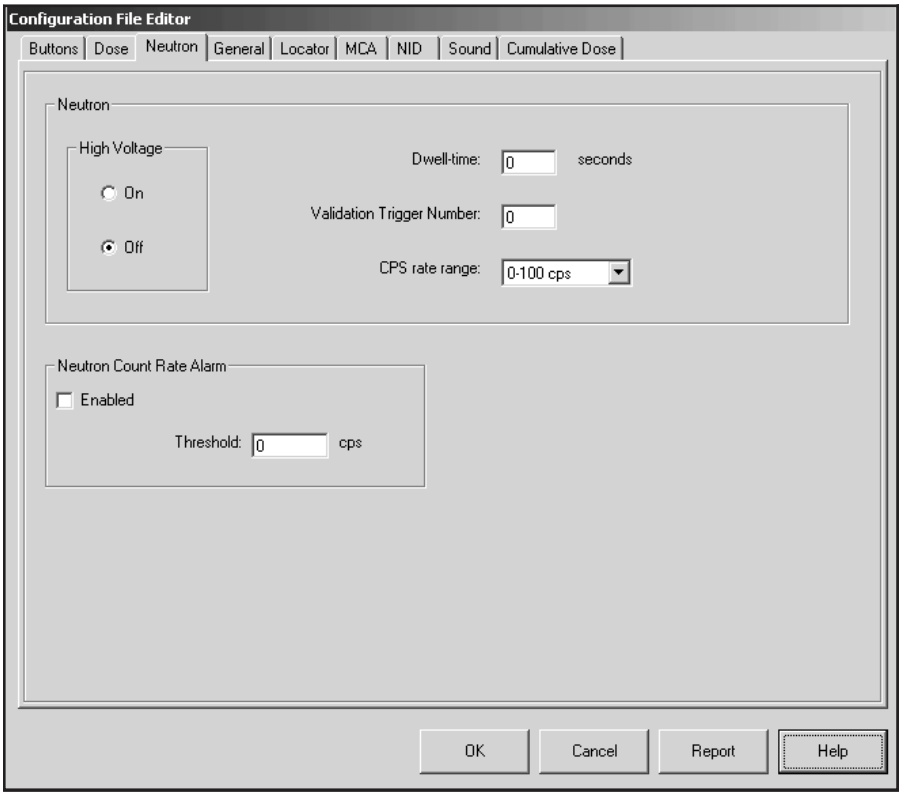


Figure 80 The Neutron Page

- High Voltage: Turns the neutron probes bias voltage On or Off. Note: The standard InSpector 1000 application ignores this setting and leaves the neutron probe bias voltage on at all times while it is running.

- Dwell-time: Sets the neutron measurement dwell-time in seconds. A whole number from 1 to 60 must be entered. The default is 1 second.

- Validation Trigger Number: Sets the number of consecutive times the neutron alarm threshold must be crossed before an alarm is triggered. A whole number from 1 to 32 must be entered. The default is 2.

- CPS rate range: Selects a neutron count range for the bar graph displays. 0-100, 0-1000 and 0-10000 cps ranges are available. The default is 0-100 cps.

- Neutron Count Rate Alarm Enabled: an alarm is generated if the neutron count rate exceeds Threshold for the number of consecutive intervals specified by the Validation Trigger Number.

The General Page

The General settings (Figure 81) apply to all modes of InSpector operation. The Sample Information settings supply the default values for descriptive information that will be saved with spectral data. This data is purely for reporting purposes if saved spectra are brought back to a host PC. None of these values have any significance in analysis except the quantity.

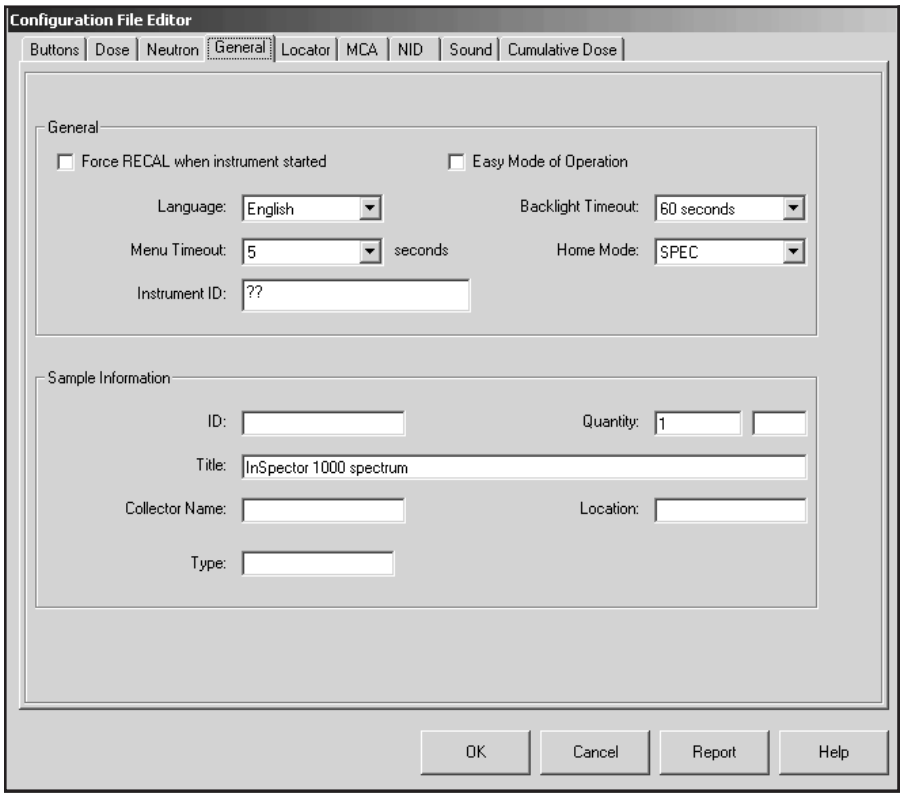


Figure 81 The General Page

General

- Force RECAL when instrument started: forces an automatic energy calibration (via the AUTO RECAL function) each time the InSpector is started.

Note: An IPRON-1, -2 or -3 probe must be allowed to warm up for at least 5 minutes to achieve the gain stability required for successful calibration. Because of this, the "Force RECAL when instrument started" feature should not be used with these probes.

- Easy Mode of Operation: sets the InSpector for the Easy Mode (defaults to LOCATOR screen).

- Language: the language to be used. If the selected language is not installed on the InSpector, English will be used.

- Backlight Timeout: how long the screen backlight stays on after the InSpector becomes inactive (about 20 seconds after the last time the screen or keypad was touched).

- Menu Timeout: how long the menu stays visible.

- Home Mode: the mode in which the InSpector starts, and which the Home button activates.

- Instrument ID: the name or identifying code for this InSpector. This field is not available when editing in off-line mode (see Editing the Configuration Off-Line (page 112).

Sample Information

Note: ID, Quantity and Collector Name can also be entered through the InSpector's Sample Info dialog (page 76).

- ID: A single-word identification of the sample being measured.

- Quantity: the amount of sample being measured. Calculated activities are divided by this value. If the quantity is set to 1 (the default), total activity is reported. If any other value is entered, concentration is reported. The quantity units (e.g., grams) can be entered in the field to the right of the quantity.

- Title: a free-form description of the sample.

- Collector Name: the name of the person who collected or measured the sample.

- Location: where the sample was collected.

- Type: the sample type.

The Locator Page

This parameters on this page (Figure 82) configure the Locator Mode.

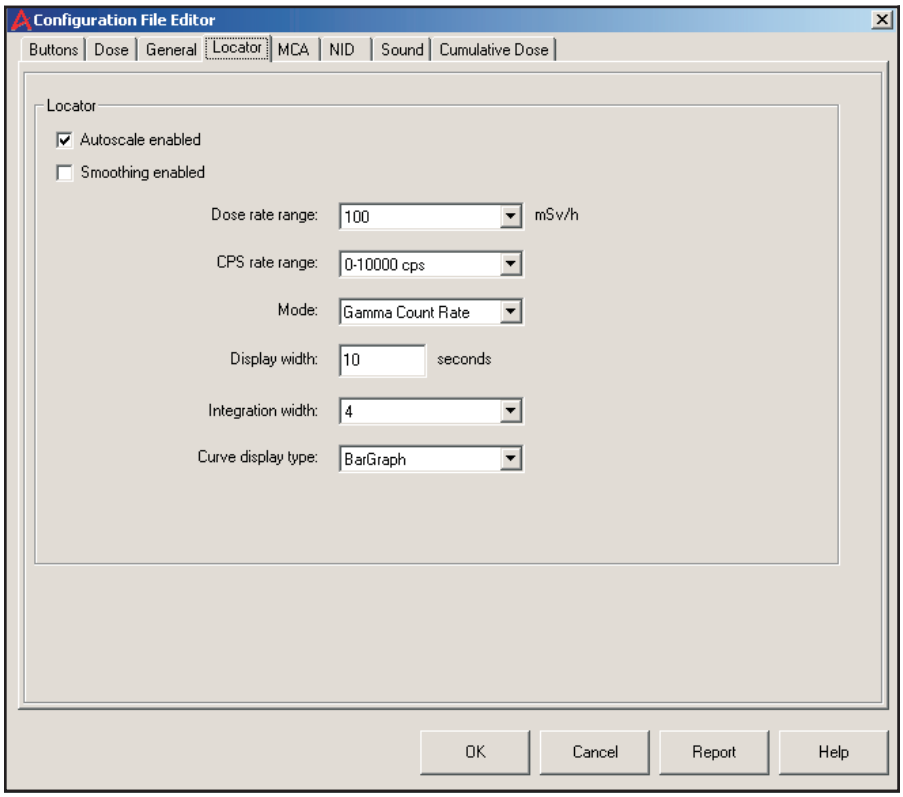


Figure 82 The Locator Page

- Autoscale enabled: the vertical scale of the chart is rescaled automatically so that all data is visible.

- Smoothing enabled: the data is averaged to reduce quick fluctuations. The degree of smoothing is set by Integration width (see below), with larger values smoothing the data more.

- Dose rate range: if Autoscale is not enabled, this parameter sets the vertical scale of the chart when Dose Rate is displayed. The units are those selected in Dose Units on the Dose Page.

- CPS rate range: if Autoscale is not enabled, this parameter sets the vertical scale of the chart when CPS (count rate) is displayed. Regardless of the Autoscale setting, this parameter also sets the upper limit of the Input Count Rate bargraph.

- Mode: indicates if Gamma Count Rate, Gamma Dose Rate or Neutron Count Rate is to be displayed.

- Display width: the amount of data displayed, in seconds.

- Integration width: the number of data points to be averaged (see Smoothing, above).

- Curve display type: how the chart is drawn.

The MCA Page

The MCA Page (Figure 83) provides options specific to the display of spectrum data.

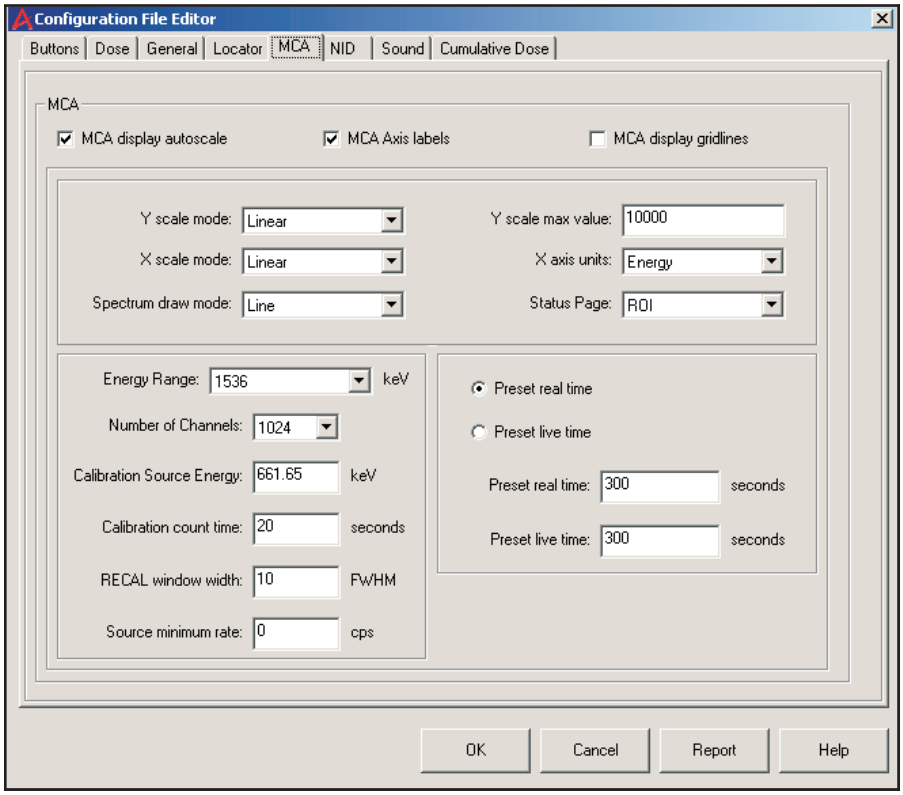


Figure 83 The MCA Page

- MCA display autoscale: sets the vertical scale of the spectrum display to automatically display all data.
- MCA Axis labels: removes axes, tick marks and labels from the display.
- MCA display gridlines: an x-y grid is overlaid on the spectrum.
- Y scale mode: the mode of display for the Counts axis.
- X scale mode: the mode of display for the Channels/Energy axis.
- Spectrum draw mode: how the spectrum is displayed; choices are:

- Points: a single dot is shown for each channel value.
- Line: a connected line is drawn between the highest channel values.
- Fill: same as Line, but the area below the curve is filled in.
- Y scale max value: if Autoscale is not enabled, sets the vertical scale of the spectrum display in counts.
- X axis units: if Axis labels are enabled, determines whether the X axis is shown as Channels or Energy.
- Status page: sets the default Info page displayed below the spectrum.

The following settings are used when a new probe (detector) is connected.

- Energy Range: the approximate energy range desired.
- Number of Channels: the number of channels used in the spectrum. The possible choices depend on Energy Range:
  - Range is 384 keV: 256 or 512 channels.
  - Range is 768 keV: 256, 512 or 1024 channels.
  - Range is 1536 keV: 256, 512, 1024 or 2048 channels.
  - Range is 3072 keV: 256, 512, 1024, 2048, or 4096 channels.

The following settings are used in energy recalibration functions (AUTO RECAL and MANUAL RECAL):

Calibration Source Energy: the energy, in keV, of the calibration source peak. The RECAL functions will change the gain of the MCA so that this peak appears in the proper channel.

Calibration count time: used in automatic recalibration (AUTO RECAL), the initial count time for which the calibration source is collected. If the calibration peak cannot be found on the first pass, collection will be resumed for a second try, for a total count time of three times this value.

RECAL window width: used in automatic recalibration (AUTO RECAL), the size of the region, in FWHM, in which the function will attempt to find the calibration source peak. If a Source Minimum Rate is specified for the calibration peak (see below) and the peak is not found on the first try, the size of the region will be expanded by 50%.

Source minimum rate: used in automatic recalibration (AUTO RECAL), the minimum expected net count rate of the calibration peak.

The following setting controls the length of data acquisition:

- Preset Live or Real time: indicates whether counting is to be done for live time or real time. The default preset times, in seconds, for each mode are entered below. A value of zero indicates an infinite count time.

The NID Page

The parameters on this page (Figure 84) determine how the NID Mode data is displayed:

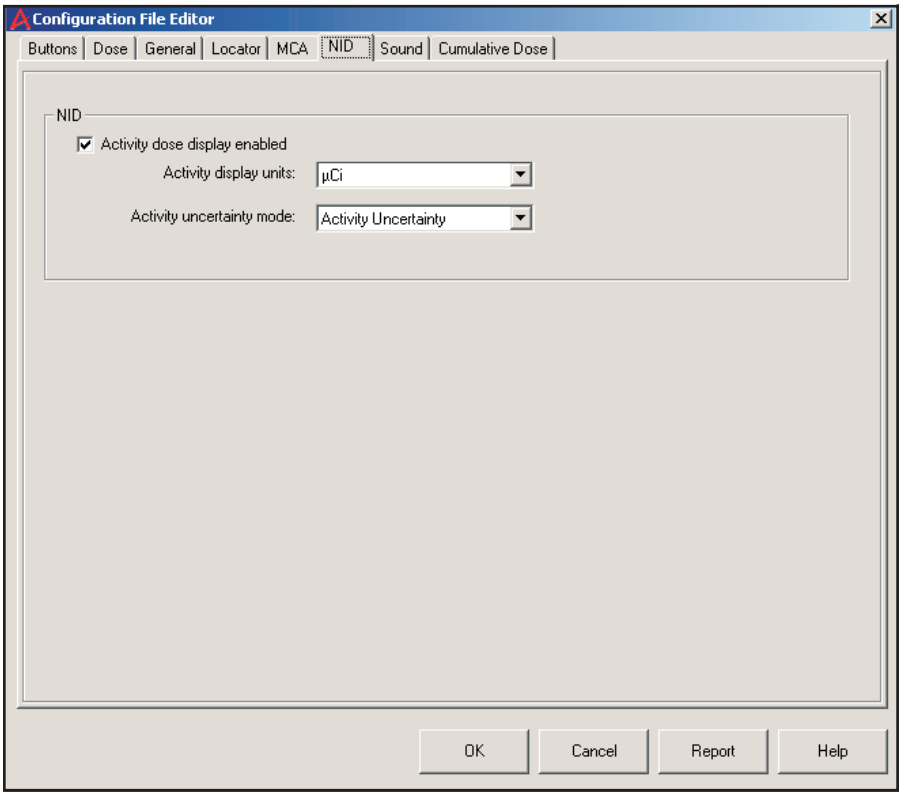


Figure 84 The NID Page

- Activity dose display enabled: allows the display of dose for each isotope in Dose Composite mode and allows the NID Simple mode's activity column to be toggled between activity and dose rate.

- Activity display units: sets the activity units for the display, Bq or µCi.
- Activity uncertainty mode: sets the default uncertainty in Composite mode, percent uncertainty at 1 sigma or percent confidence.

The Sound Page

The tabbed sections of the Sound Page control the sounds made when warnings and alarms are generated for Dose Rate, Cumulative Dose, Activity, Low Battery and Neutron (Figures 85–89).

The sound made for each event is determined by four parameters:

- Sound: the type of noise made. Some of selections are continuous sounds (such as Siren); some are a single discrete sound, such as Handclap.
- Note: the pitch of the sound made. There are a number of choices, ranging from Low C to High G. Some of the selections are combinations of C and G notes.
- Interval: the rate, in seconds, at which the sound is made.
- Length: how long, in seconds, that the sound is made. The Length field is available only for continuous sounds. (Not applicable to the Low Battery alert.)

Example

If the sound chosen is Telephone, with Interval of 3 seconds and Length of 1 second, a one second telephone ringing sound will be made every three seconds for as long as the event persists.

Master Volume

Sets the speaker volume, in percent, for all sounds.

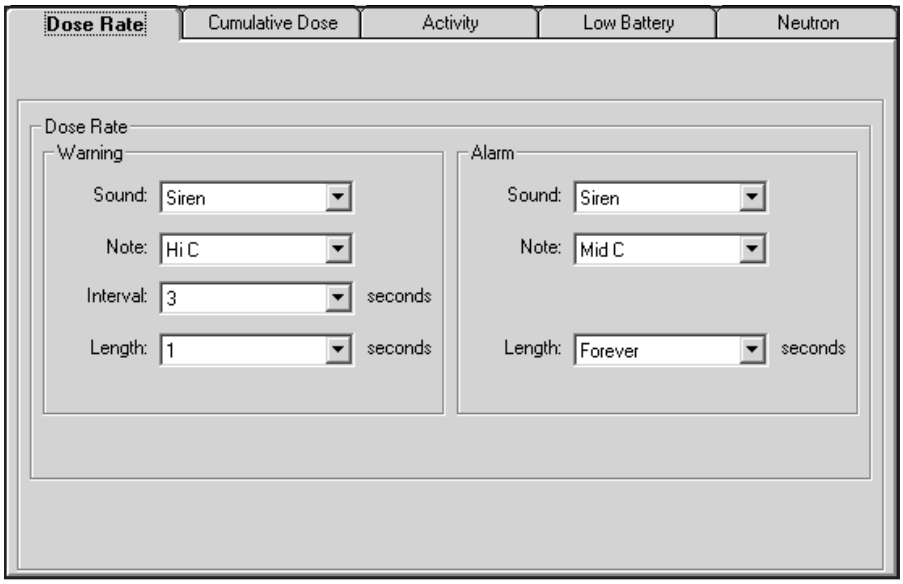


Figure 85 The Dose Rate Sound Page

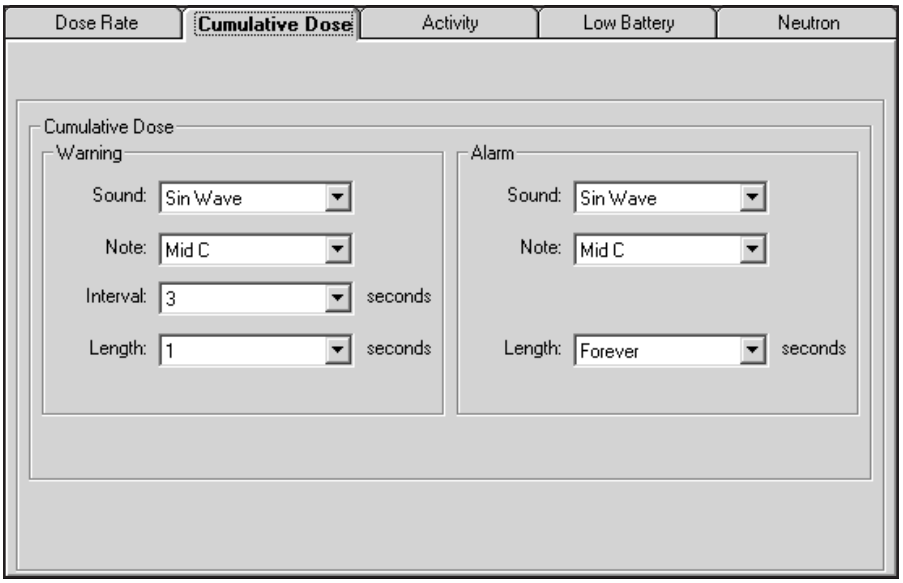


Figure 86 The Cumulative Dose Sound Page

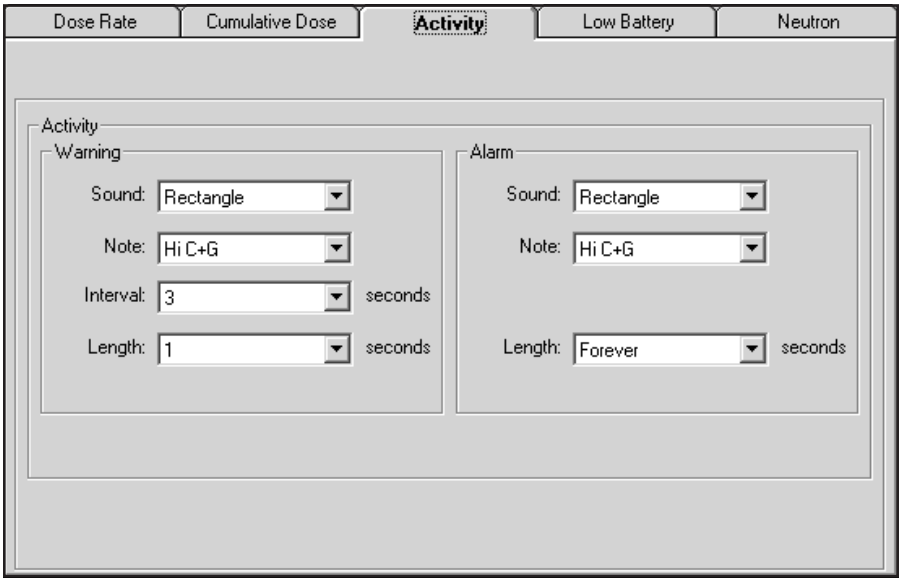


Figure 87 The Activity Sound Page

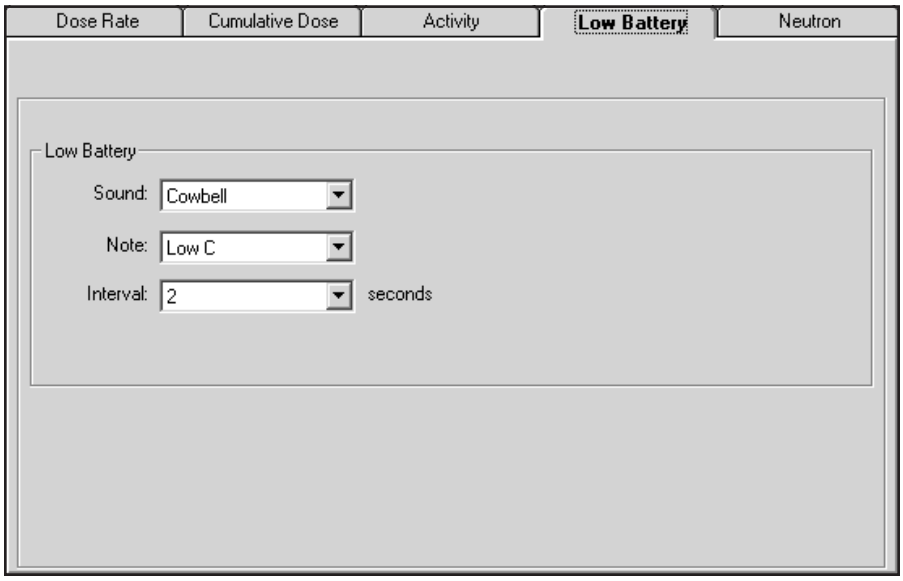


Figure 88 The Low Battery Sound Page

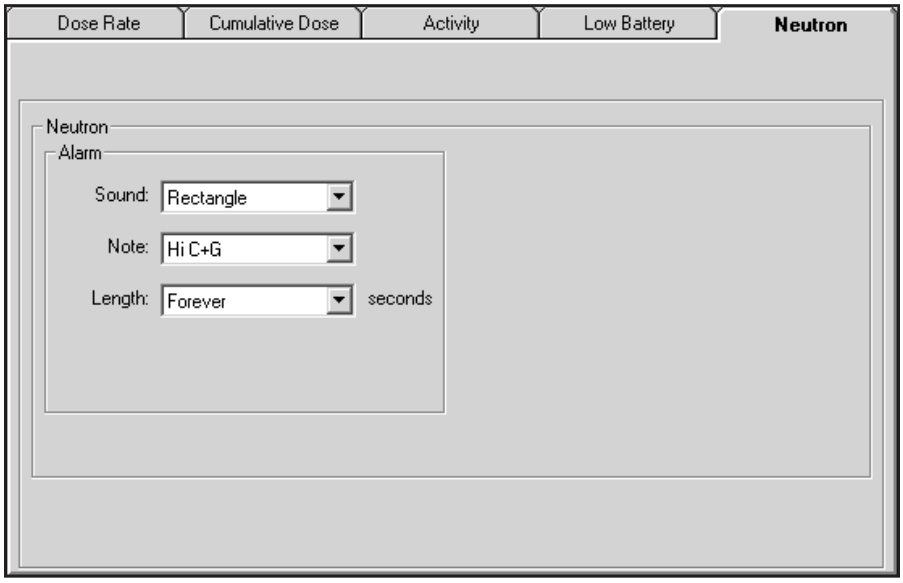


Figure 89 The Neutron Alarm Sound Page

The Cumulative Dose Page

The parameters on this page (Figure 90) set the default conditions for Cumulative Dose.

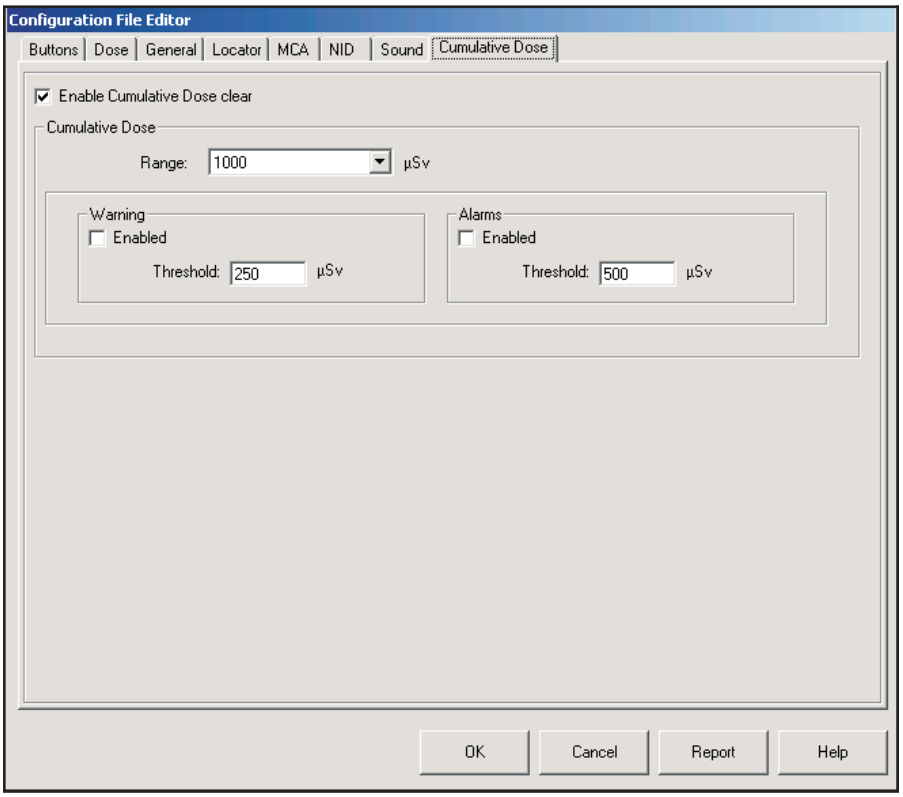


Figure 90 The Cumulative Dose Page

The InSpector 1000 keeps a running total of the dose since the Cumulative Dose memory was last cleared and displays it in Dose mode.

- Enable Cumulative dose clear: check to allow the Clear Cumulative Dose function in the Setup Mode to be accessed. Uncheck to prohibit clearing the dose memory while the InSpector is powered up. Note that no matter how this parameter is set, cumulative dose is always cleared when the InSpector's power is turned on.

- Range: sets the scale of the cumulative dose display in Dose mode. The units are those selected in Dose Units on the Dose page.

- Warning Enabled: a warning is generated if the cumulative dose exceeds Threshold.

- Alarm Enabled: an alarm is generated if the cumulative dose exceeds Threshold.

Printing the Configuration File

To both create and save a text file and produce a printout of the current configuration file, click on **Report**, then click on **Print**. If you click on **OK** instead of Print, the file will not be printed. The text file will be created and will be saved to the default save path, C:\GENIE2K\REPFILES\IN1KPREFS.RPT. Editing the RPT file has no effect; changes can be made only through the Configuration Editor (page 112).

The Default Configuration Settings

The following default parameters are restored to the InSpector when the Setup | Reset Defaults function is invoked (page 101).

Note: If the Easy Mode of Operation parameter, under General Instrument Settings, is set to Disabled, the Home Mode parameter above it is initially set to DOSELOGDIAL.

```
Instrument serial number                    :
Instrument identification                   : ??


General Instrument Settings
———————————————-

Language                                    : English
Backlight timeout                           : 30 seconds
Menu timeout                                : 10 seconds
Home Mode                                   : NIDSIMPLE
Do calibration adjustment at startup        : Disabled
Easy Mode of Operation                      : Enabled

Button Enables
———————

DOSE button                                 : Enabled
SPEC button                                 : Enabled
LOC button                                  : Enabled
NID button                                  : Enabled
SETUP button                                : Enabled
SPEC>File button                            : Enabled
SPEC>MCA button                             : Enabled
SPEC>CALIBRATE button                       : Enabled
SPEC>DISPLAY button                         : Enabled
SPEC>ANALYZE button                         : Enabled
SPEC>FILE>SAVE button                       : Enabled
SPEC>FILE>OPEN/CLOSE button                 : Enabled
SPEC>FILE>OPEN>SPECTRUM button              : Enabled
SPEC>FILE>OPEN>ANALYSIS button              : Enabled
SPEC>FILE>DELETE button                     : Enabled
SPEC>MCA>TIME PRESET button                 : Enabled
SPEC>MCA>CLEAR button                       : Enabled
SPEC>MCA>STABILIZE button                   : Enabled
SPEC>MCA>HARDWARE button                    : Enabled
```

```
SPEC>DISPLAY>ZOOM button                    : Enabled
SPEC>DISPLAY>ROI button                     : Enabled
SPEC>DISPLAY>SETTINGS button                : Enabled
SPEC>CALIBRATE>EFFICIENCY>LOAD button       : Enabled
SPEC>CALIBRATE>ENERGY/SHAPE button          : Enabled

Dose Settings
_____-

Gamma Dose display units                    : mrem
Gamma Dose rate display range               :    100 mrem/h
Gamma Dose warning                          : Enabled
Gamma Dose warning threshold                :    20.00 µSv/h
Gamma Dose alarm                            : Enabled
Gamma Dose alarm threshold                  :  1000.00 µSv/h

Cumulative Gamma Dose clear                 : Enabled
Cumulative Gamma Dose range                 :  1000
Cumulative Gamma Dose warning               : Enabled
Cumulative Gamma Dose warning threshold     :  1000.00 µSv
Cumulative Gamma Dose alarm                 : Enabled
Cumulative Gamma Dose alarm threshold       :  5000.00 µSv

Neutron Settings
________

Neutron High Voltage                        : On
Dwell-time                                  :        1 seconds
Validation Trigger Number                   :        2
Neutron rate display range                  :      100 cps
Neutron alarm                               : Enabled
Neutron alarm threshold                     :       30

Annunciator Settings
__________

Annunciator                                 : Enabled
Annunciator sound type                      : Gamma Count Rate
Annunciator beep threshold                  :   100.0000
Annunciator beep scaling factor             :     0.0340
Annunciator tone ref frequency              :    27.5000
Annunciator tone alpha factor               :     0.0127
Annunciator tone beta factor                :    24.0000
Annunciator tone mode                       : Beep

Locator Settings
________

Locator mode                                : Gamma Count Rate
Locator autoscale                           : Enabled
Locator dose rate range                     :   100 mrem/h
Locator CPS rate range                      : 0-1000 cps
Locator display width                       :    10 seconds
Locator smoothing                           : Disabled
Locator integration width                   :     4 points
Locator curve display type                  : BarGraph

Default Sample Information
_____________

ID                                          :
Title                                       : InSpector 1000 spectrum
Quantity                                    :   1.0
Collector Name                              :
Location                                    :
```

```
Type                                        :

MCA Settings
————

MCA display autoscale                       : Enabled
MCA Y scale mode                            : Square Root
MCA Y scale max value                       :  100000 counts
MCA X scale mode                            : Linear
MCA X axis units                            : Energy
MCA axis labels                             : Enabled
MCA display gridlines                       : Disabled
MCA spectrum draw mode                      : Fill
Default MCA status page                     : Nuclide

Preset time mode                            : Real
Preset real time                            :   300 seconds
Preset live time                            :   300 seconds
Number of channels                          :   512
Energy range                                :  1536 keV

Calibration source energy                   :  661.65 keV
Calibration count time                      :   30 seconds
Calibration source minimum count rate       :    0 cps
RECAL search window width                   :   10 FWHM

NID Mode Settings
————————-

Activity display units                      : µCi
Activity dose display                       : Enabled
Activity uncertainty display mode           : Activity Uncertainty

Sound Settings
————————

Master volume                               : 100%

Gamma Dose warning sound and note           : Siren               Hi C
Gamma Dose warning interval                 :  3000 ms  length:  1000 ms

Gamma Dose alarm sound and note             : Siren               Hi C
Gamma Dose alarm interval                   :  3000 ms  length:     0 ms

Cumulative Gamma Dose warning sound & note  : Sin Wave             Hi C
Cumulative Gamma Dose warning interval      :  3000 ms  length:  1000 ms

Cumulative Gamma Dose alarm sound and note  : Sin Wave             Hi C
Cumulative Gamma Dose alarm interval        :  3000 ms  length:     0 ms

Activity warning sound and note             : Whistle             Low C+G
Activity warning interval                   :  3000 ms  length:  1000 ms

Activity alarm sound and note               : Whistle             Low C+G
Activity alarm interval                     :  3000 ms  length:     0 ms

Low battery alarm sound and note            : Cowbell             Mid C
Low battery alarm interval                  :  2000 ms  length:  2000 ms

Neutron alarm sound and note                : Rectangle           Mid G
Neutron alarm interval                      :  3000 ms  length:     0 ms
```

C. Technical Reference

This Technical Reference includes much useful information about the InSpector™ 1000 not covered elsewhere.

Connecting the InSpector's Cables

This section tells you how to connect the USB and Probe cables to your InSpector. The Gamma Probe connection is on page 133 and the Gamma Probe plus Neutron Probe connections are on page 134.

Where to Connect

The communications cable (USB or RS-232) connects to the left connector (marked in Figure 91). The probe cable connects to the right connector (marked DET).

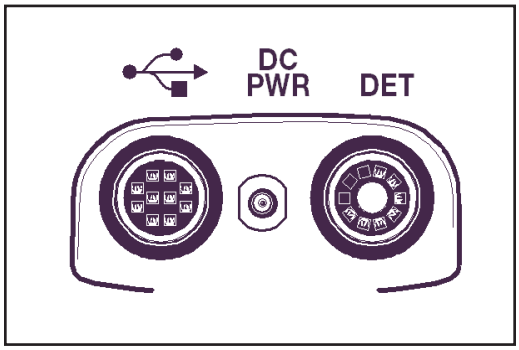


Figure 91 The Cable Connectors

How to Connect

Both cables use a circular Hirose HR10B series microconnector. The proper way to mate the connector with the InSpector is illustrated in Figure 92. To connect the cable, hold the plug at point B, align the guides on the plug and the receptacle, then push straight in. The receptacles' locations are shown in Figure 91. The plug and receptacle should mate easily; if resistance is felt, stop pushing and realign the guides before trying again.

Removing the Cable

To remove the cable, hold the plug at point A and pull straight out.

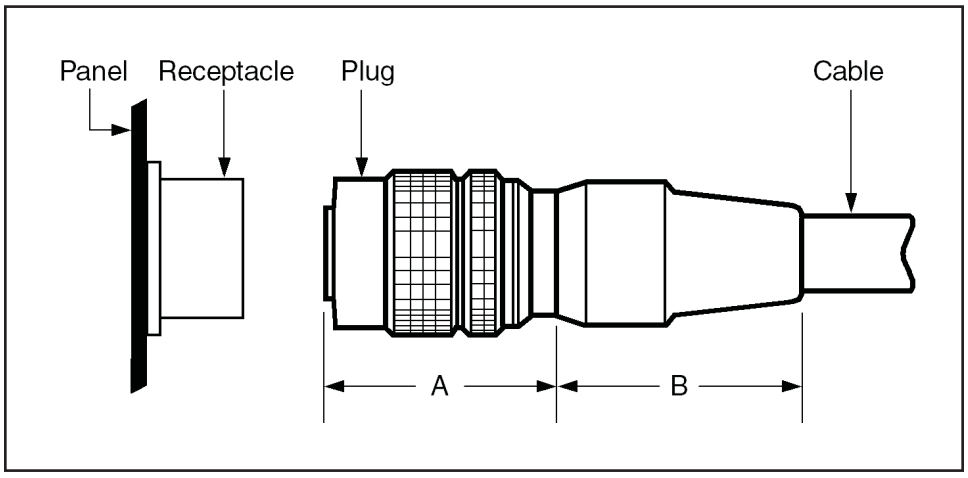


Figure 92 Connecting the Cables

How to Connect a Gamma Probe

Referring to "Where to Connect" and "How to Connect" on page 132, attach the coiled cable between the single connector on the Gamma Probe and the InSpector's DET connector (Figure 93).

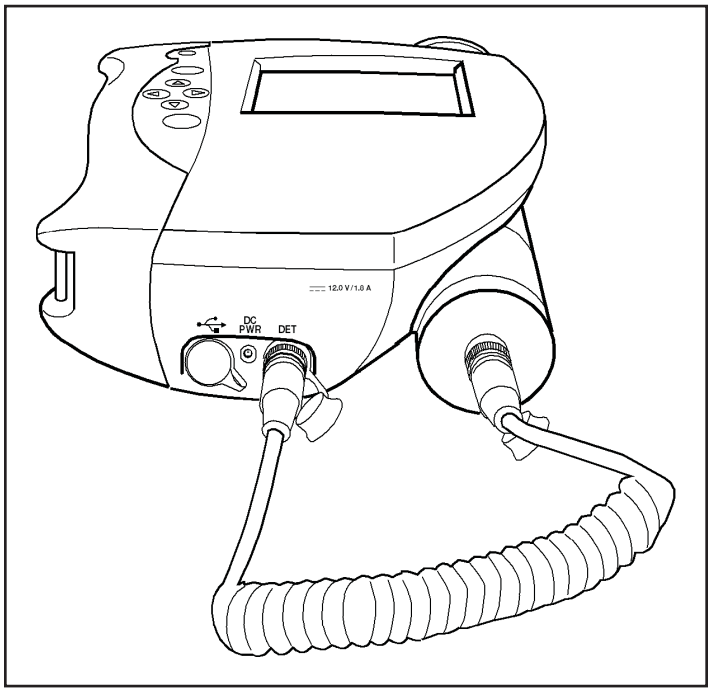


Figure 93 Connecting a Gamma Probe

How to Connect Both Gamma and Neutron Probes

This procedure connects both a Gamma Probe and a Neutron Probe to the InSpector.

Preparing the Cable

Before you can use the coiled cable with the Neutron Probe, you'll have to attach the noise-suppression module to the cable.

1. Using a small screwdriver, pry open the supplied noise-suppression module.

2. Place the noise-suppression module over one end of the coiled connecting cable, near the cable's connector (Figure 94) and snap it closed.

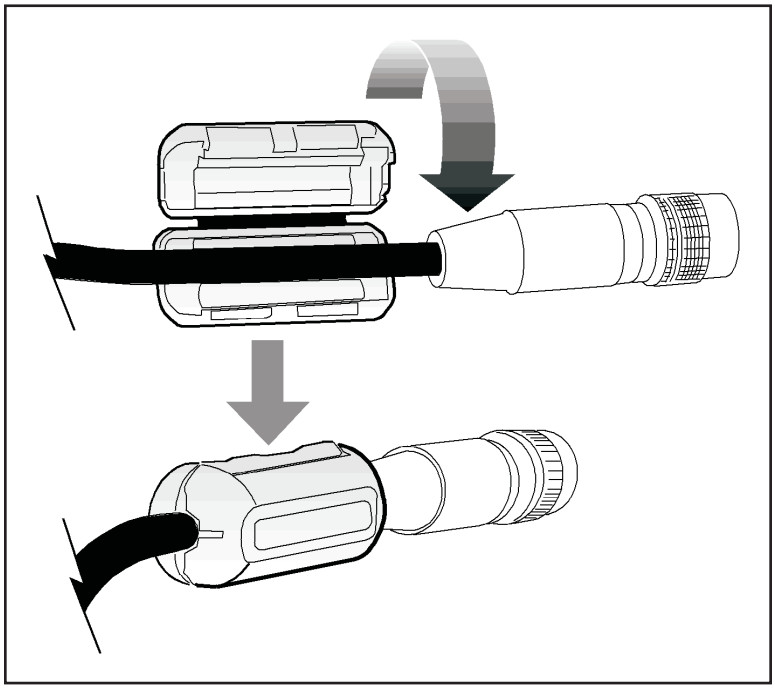


Figure 94 Attaching the Noise-Suppression Module

Attaching the Probes

1. Referring to "Where to Connect" and "How to Connect" on page 132, attach the end of the coiled cable bearing the noise-suppression module to the γ PROBE connector on the Neutron Probe ❶.

Note: Failure to place the noise-suppression module close to the γ PROBE connector may lead to false neutron counts.

2. Connect the other end of the coiled cable to the single connector on the Gamma Probe ❶.

3. Connect the short cable between the Neutron Probe's INST connector ❷ and the InSpector's DET connector ❷ (Figure 95).

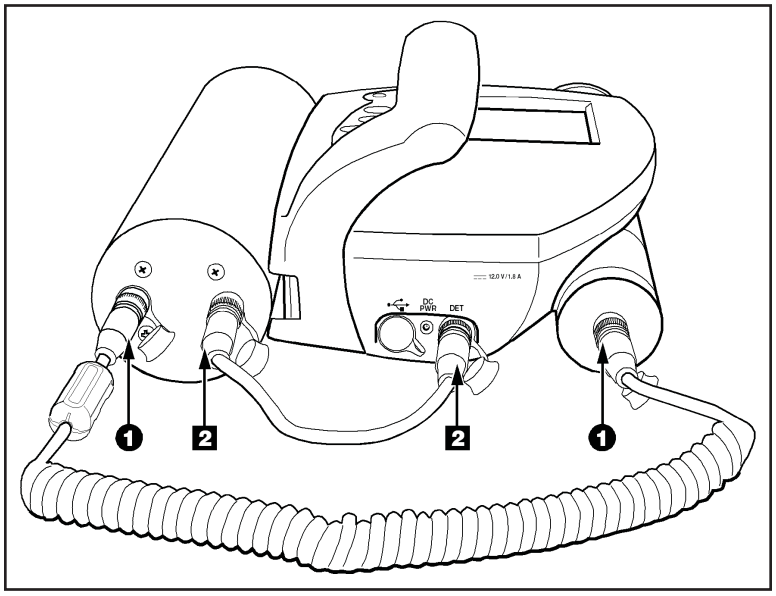


Figure 95 Cabling for Both Probes

Cleaning the InSpector

In applications or environments where there might be exposure to hazardous chemicals Canberra recommends that you protect the InSpector by putting it in a clear wrap or clear bag.

The InSpector is water resistant, so its exterior can be cleaned with a soft cloth moistened with mild detergent and water, rinsed carefully, then dried thoroughly.

WARNING The chemicals listed below must not be used to clean the InSpector. They will react with the unit's case and will cause crazing or stress cracking.

Amines	Esters
Aromatic hydrocarbons	Halogenated hydrocarbons
Ketones	Strong bases, such as ammonia

LCD Screen Protector

To protect the InSpector's LCD screen from scratches and to reduce screen glare, Canberra recommends you use replaceable LCD screen protectors, such as Fellowes part number 98033, or equivalent.

Setting the Hardware Gain

The Coarse Gain and Fine Gain controls in the Hardware Setting dialog are factory-set to 1.000. If these values are changed, gamma events over 3 MeV will be lost, resulting in possible underestimation of the dose rate calculated using probe data.

Location of the GM Tube

In addition to the external gamma probe, the InSpector has an internal Geiger-Müller (GM) tube that is used to extend the dose rate capability well beyond the range of the external probe. It is wrapped with a foil shield to allow for the energy response required to deliver a proper H*(10) dose measurement.

The GM tube is mounted inside the case behind its bottom wall. It's located above the three connectors in Figure 96 and 13 mm (0.5 in.) back from the bottom wall. The dashed line in the figure shows the tube's location and the + shows its center.

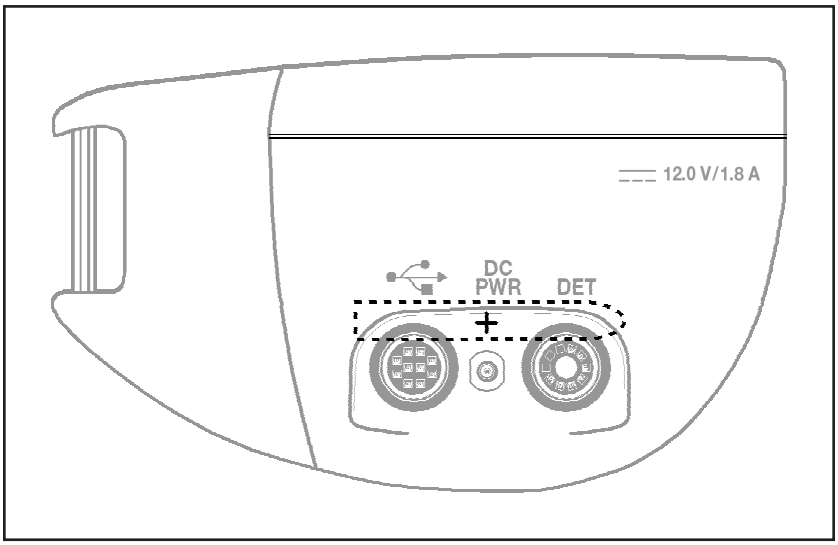


Figure 96 InSpector – Bottom View

Using the Power Converter

You can use the ac/dc converter (Figure 97) to provide power to the InSpector and simultaneously charge its battery. Plug the supplied power cord into the receptacle on the converter, then plug the converter's connecting cable into the InSpector's DC PWR receptacle (Figure 91).

Figure 97 The ac/dc Converter

Intelligent Probes

The InSpector 1000 has been designed for use with an intelligent gamma or neutron probe (IProbe), which allows automatic reconfiguration and recalibration whenever the probe is changed. When a new IProbe is first connected to the instrument, it will be interrogated for its serial number and operating parameters, such as probe type (e.g., IPRON-2), operating high voltage, typical resolution, etc.

Probe Calibration

When an IProbe is connected to an InSpector for the first time, the InSpector will use the probe's default parameters until new ones are entered either in the InSpector's Setup Mode or via the Maintenance Utility.

When energy and efficiency calibrations have been performed for a specific IProbe, the InSpector will retain a permanent record of the calibration information associated with that IProbe.

Before you can use a new IProbe, you must calibrate the system by performing an Auto Recalibration (page 66), using a mono-line source, such as the Model CSRCCS-x (a ^{137}Cs calibration source).

For the greatest calibration accuracy, follow this with a Full energy calibration (page 71), using a multipeak gamma source, such as Canberra's Model MGS-3 Calibration Standard.

The Probe's High Voltage

If the high voltage is changed for a particular IProbe, the new value will be stored in the InSpector; the probe itself does not remember the change. Therefore, this probe's default high voltage setting, stored in the probe, will be used when connecting this probe to another InSpector.

Using a Different Probe

If a different IProbe is attached to this InSpector, the new IProbe's calibration information will be used if it's available in the InSpector's memory. If the new IProbe has not been calibrated with this InSpector, the probe's defaut calibration will be used.

The Generic Geometry

The geometry for the generic efficiency calibration assumes a point source 25 cm from the probe.

Communications Interface Pinout

The communications connector allows for a USB or a diagnostic RS-232 connection to the instrument. The pinout for the InSpector's Communication Interface Connector is shown in the following table.

Pin Number	Signal Description (In/Out Relative to the InSpector)
1	USB Device Power
2	USB Device Data –
3	USB Device Data +
4	USB Device Ground
5	USB Host Power
6	USB Host Data –
7	USB Host Data +
8	USB Host Ground
9	RS-232 Receive
10	RS-232 Transmit

Probe Connector Pinout

The following table lists the pinout used on the InSpector's DET connector and the IPRON-N Neutron Probe's INST and G-PROBE connectors.

Pin Number	Signal Description (In/Out Relative to the InSpector)
1	HV Control output
2	Probe Clock output
3	Probe Data in/out
4	+5 V dc output
5	–5 V dc output
6	Ground
7	Raw Battery/Adapter power output (Future use)
8	Probe spare 1 (Future use)
9	Probe Transmit Data (Future use)
10	Probe Receive Data (Future use)
Center coax	Energy output from probe

Probe Format Data File

The following PFD file example, for the scionix3x3.pfd file, shows the data stored in the intelligent probe, Model IPRON-3, a 3x3 NaI detector.

```
<?xml version="1.0" ?>
<Probe Type="NaI" Version="1.0">
    <Name>Scionix3x3</Name>
    <SerialNumber>1234</SerialNumber>
    <HV>1000</HV>
    <Resolution>12.34</Resolution>
</Probe>
```

The components of the file are:

- In accordance with the XML standard, the data must always start with the ?xml tag.
- *ProbeFamily* must always be the outermost tag. This tag has two possible attributes:
  - *Type* is the type of probe. The only value allowed is “NaI”; this is the default if *Type* is not explicitly specified.
  - *Version* is optional; it indicates the tag version.
- *Name* must be specified and indicates the class of probe and is intended to indicate to the InSpector which set of characterization data is to be used. The names of the current standard probes are:
  - “Scionix1R5x1R5”: The Scionix1.5x1.5 NaI detector (Model IPRON-1)
  - “Scionix2x2”: The Scionix 2x2 NaI detector (Model IPRON-2)
  - “Scionix3x3”: The Scionix 3x3 NaI detector (Model IPRON-3)

  Names for new probes may be added at any time.
- *SerialNumber* must be specified and is the serial number of the probe. The *SerialNumber* must be from 1 to 16 alphanumeric characters (dash and underscore are allowed).
- *HV* must be specified and is the HVPS setting that will place the ^{137}Cs 661.65 keV peak at 22% of full scale (assuming a 3072 keV range). The value of *HV*

can be any standard fixed point or floating point numeric value, using the period as the decimal separator (i.e., “1000”, “1000.00”, and “1.0E03” are all acceptable).

- *Resolution* is the resolution, in percent, of the 661.65 keV peak (i.e., the FWHM in keV divided by 661.65); this tag is optional. The value of *Resolution* can be any fixed point of floating point numeric value, using the period as the decimal separator.

Probe HV Cutoff Level Adjustment

The InSpector 1000 NaI probes may be damaged if operated in a high dose field for an extended period of time: the large light output from the crystal will cause a high current in the photomultiplier tube, which will cause a permanent degradation in the gain of the probe.

WARNING If you increase or delete the cutoff value, your probe can be permanently damaged.

The InSpector 1000 will automatically turn off the high voltage supplied to the Photomultiplier Tube if the dose rate from the GM detector exceeds the cutoff value listed column 1 of the following table. The voltage will be restored when the dose rate falls to one half the cutoff value (column 2).

Probe Model	Cutoff Dose Rate
IPRON-1 (1.5 x 1.5)	20 000 µSv/h
IPRON-2 (2 x 2)	10 000 µSv/h
IPRON-3 (3 x 3)	4250 µSv/h

Changing the Cutoff Value

If desired, the cutoff value can be changed using the following procedure.

1. Referring to “Connecting a Probe or Communications Cable” on page 132, connect the InSpector 1000 to a PC using the USB cable.

2. Navigate to the folder ***Mobil Device\My Computer\GenieCE\CTLFILES*** using the Windows CE Explorer (Figure 98).

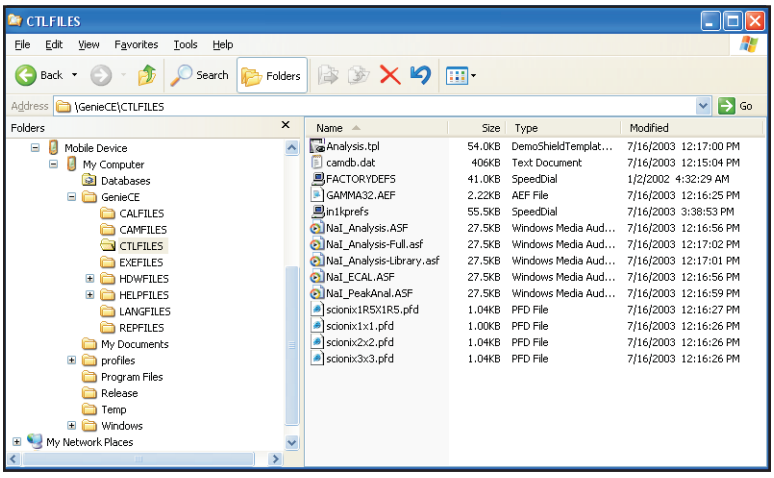


Figure 98 Directory Tree on the InSpector

3. Find the PFD file corresponding to your probe type and copy it to the PC using Copy and Paste. The file name is a combination of the probe manufacturer and size; for example, for the Model IPRON-1, the 1.5 x 1.5 inch probe, the file is scionix1r5x1r5.pfd.

4. Use Notepad or Wordpad to edit the PFD, an XML file, which consists of keywords delimited by angle brackets, and values associated with the keywords.

5. Find the line containing the phrase “<DoseCutoff>”; for example, for the 2 inch probe, the line will look like this:

```
<DoseCutoff>10000</DoseCutoff>
```

6. To change the cutoff value, edit the value between `<DoseCutoff>` and `</DoseCutoff>` coding, which is in µSv/h.

Note: Do not change or delete any part of the XML coding: the angle brackets and the text inside the brackets. Doing so will make the file unuseable.

7. To eliminate the cutoff completely, delete the line.

8. Save the file and use Windows Explorer to copy it back to the InSpector, replacing the original file. Cycle the power on the InSpector to enable use of the new cutoff value.

Reinstalling the software on the InSpector will replace the PFD files, so this procedure must be repeated if an update is installed.

Detector Switching Thresholds

The InSpector uses the count rate data from the internal Geiger-Müller (GM) tube to determine whether the GM data or the NaI probe data will be used for data display.

For each NaI probe, two threshold points are used to implement switching hysteresis. Hysteresis stabilizes the dose reading by preventing erratic switching from one detector to the other.

Probe Model	Low Threshold	High Threshold
IPRON-1	19.8 µSv/hr	39.6 µSv/hr
IPRON-2	17.0 µSv/hr	34.0 µSv/hr
IPRON-3	8.5 µSv/hr	17.0 µSv/hr

- When a falling count rate passes the Low Threshold, the InSpector begins displaying the NaI probe's count rate data.
- When a rising count rate passes the High Threshold, the InSpector begins displaying the GM tube's count rate data.

Alarm Priorities

The InSpector's alarms and warnings occur with the following priorities:

1. Neutron Count Rate Alarm
2. Dose rate alarm
3. Cumulative dose alarm
4. Dose rate warning
5. Cumulative dose warning
6. Activity alarm
7. Activity warning
8. Battery low warning

Efficiency Calibration Models

There are several efficiency models stored in the datasource.

- Dual Polynomial, the default model, using ln() of energies for low and high curve on each side of a crossover point. A minimum of 2^{nd} order (ln-ln) polynomial is allowed and:
  - For Dual in the single-curve mode and for the high energy curve in the two-curve mode, a maximum of 9^{th} order (ln-ln) polynomial is allowed.
  - For the low energy curve in the two-curve mode, a maximum of 5^{th} order (ln-ln) polynomial is allowed.
- Linear Polynomial, using linear 1/E coefficients. A minimum of 2^{nd} order and a maximum of 9^{th} order polynomial are allowed.
- Empirical Polynomial, using ln()of scaling-factor/E coefficients. A minimum of 2^{nd} order and a maximum of 5^{th} order polynomial are allowed
- Interpolated, using a straight-line interpolation in ln-ln domain.

Default InSpector Files

The InSpector uses several types of operational files. For most of these, the default file for each of these types, the one used when the unit is first turned on, can be changed by the user.

Nuclide Library File

The InSpector includes several Nuclide Library files (page 154), defaulting to ANSI_GammaGuru.nlb, the NID by Nuclide Correlation library. A different library can be selected in Spec Setup.

Analysis Sequence File

The InSpector includes several Analysis Sequence Files: nai_analysis.asf, nai_ecal.asf, nai_peakanal.asf, nai_analysis-full.asf, nai_analysis-library.asf, and gammaguru.asf, the default sequence file.

A different sequence file can be selected with the File Open command.

Energy Calibration File

The InSpector includes a default calibration file for each probe type. When a new probe is attached to the InSpector, the appropriate energy calibration file for that probe will automatically be used.

A new calibration file can be created by performing an Auto Recalibration, using a mono-line calibration source. This file can be saved with the File Save command.

- An Auto Recalibration should be performed when using a different probe.
- For greater accuracy, Auto Recalibration should be followed by a Full energy calibration, using a multipeak gamma source.

Efficiency Calibration File

The InSpector includes several efficiency calibration files, one for each probe type. This file cannot be changed by the user. When a new probe is attached to the InSpector, the appropriate efficiency file for that probe will automatically be used.

Input Power Requirements

The InSpector operates from a dc power source between 11 V dc and 14 V dc. The power can be supplied by a universal ac/dc converter with a minimum output capability of 2 A. The dc power connector is an MCX connector.

The Internal Battery

The InSpector's long operating times are obtained through the use of state-of-the-art lithium ion battery technology, using an internal two-cell lithium ion battery with built-in protection circuits to prevent over-temperature, over-current and over-voltage conditions.

When the battery is below a charging voltage threshold and dc power is available, the InSpector's integrated smart charging circuit will apply 1/10 of the fast charge current to pre-qualify the battery before charging and to monitor the battery's voltage. Once the voltage is above the charging voltage threshold, the battery will be fast-charged with a constant current.

When the battery reaches a preset voltage, the charger enters a constant voltage (full charge) mode which is exited when the battery charging current drops below 150 mA. At that point, charging will continue in constant voltage mode for another 45 minutes (top-off mode).

The charge indicator LED is illuminated during the pre-qualification, fast and full charge modes. The LED is not illuminated while the battery is the top-off mode since it is essentially completely charged at this point.

Charging Temperature Range

The lithium ion technology allows for the highest capacity per unit volume of the available battery technologies at the time of design but there are some limitations to charging the lithium ion battery. The instrument will operate off the battery over the temperature range of –10 to 50 °C but the battery will only be charged by the smart charging circuit when the instrument is within the following temperature limits:

- The battery will charge in an ambient temperature range of 0–40 °C while the instrument is operating (On).
- The battery will charge in an ambient temperature range of 0–50 °C while the instrument is not in operation (Off),

Charging Time

The smart battery charger circuit will also charge the battery at different rates, depending on the operating state of the instrument. This allows faster charging when the unit is not in operation.

- It will take about six hours to charge the battery while the instrument is operating (On).
- It will take about three hours to charge the battery while the instrument is not operating (Off).

Changing the Battery

Though the InSpector uses a highly reliable long life Li-ion battery, it will eventually come to the end of its useful life. This section includes two procedures telling you how to replace the battery.

- For a unit with a Gamma Probe, use the procedure on page 148.
- For a unit with a Neutron Probe, use the procedure on page 150.

Gamma Probe Procedure

For an InSpector with a Gamma Probe, refer to Figure 99 and follow the steps listed below. (This is the procedure to use if your InSpector does *not* include a Neutron Probe.)

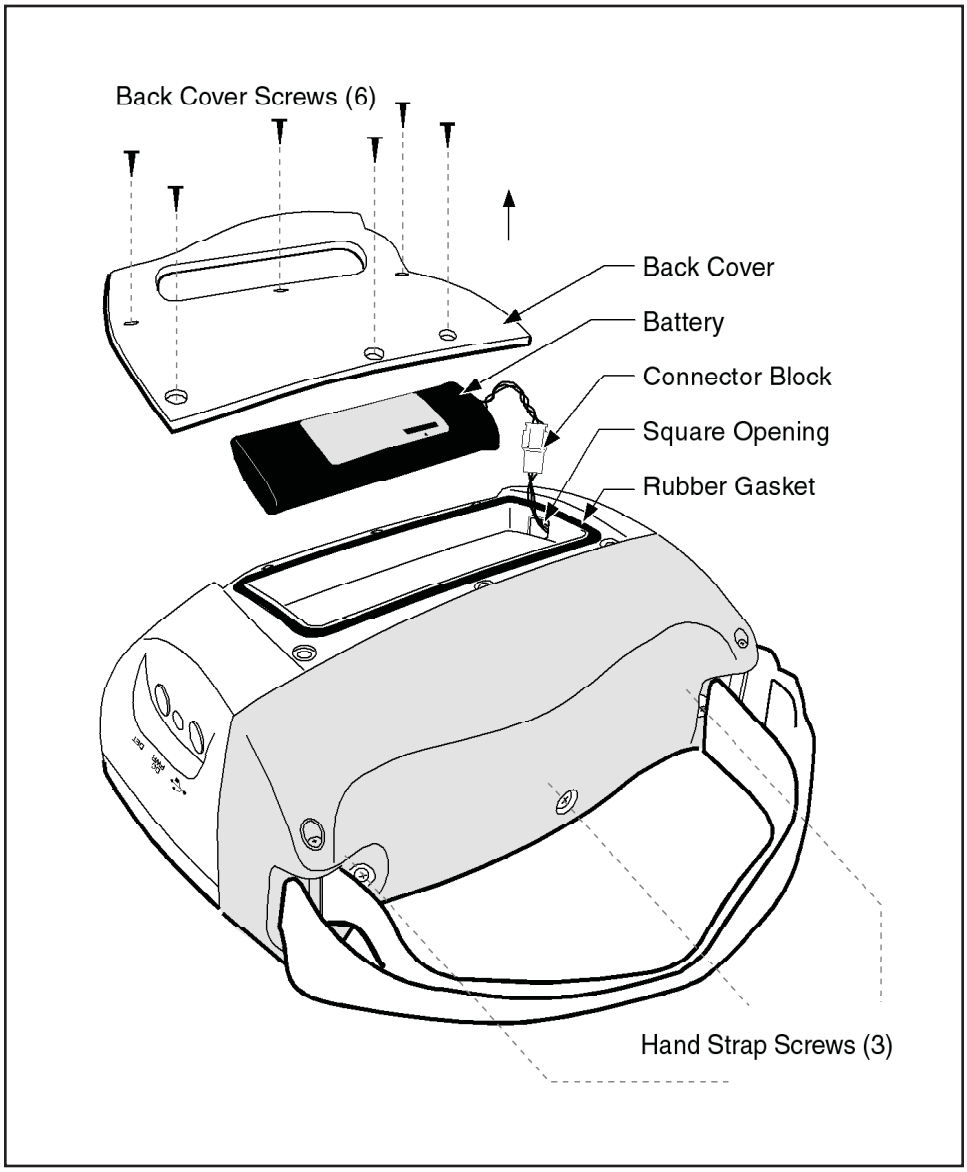


Figure 99 Gamma Probe Procedure

1. Turn off the InSpector's power and remove all connecting cables.
2. Loosen the hand strap.
3. Loosen the three screws under the hand strap.
4. Pull the side piece, the one with the loosened screws, about 1/8 inch (3 mm) away from the unit.
5. Remove the back cover's six screws.
6. Remove the back cover.
7. Carefully remove the battery from its compartment.
8. Gently pull the battery's connecting wires and connector block out of the square opening at the back of the battery compartment.
9. Carefully separate the connector block.
10. Connect the power connector to the new battery and carefully feed the connector block and wires back through the square hole.
11. Seat the battery in its compartment.
12. Before replacing the cover, verify that the cover's gasket is fully seated in its mounting slot. If the gasket is not seated correctly, the unit's resistance to water and dirt will fail, which can cause the unit to malfunction.
13. Replace the rear cover and its six screws.
14. Push the side piece, the one with the hand strap, back into place on the unit.
15. Tighten the three screws under the hand strap.
16. Reconnect all cables.
17. Resume normal operation.

Neutron Probe Procedure

If your InSpector includes a Neutron Probe, follow the steps listed below.

1. Turn off the InSpector's power and remove all connecting cables.

2. Place the InSpector on its face.

3. Remove the three mounting screws that secure the Neutron Probe (Figure 100).

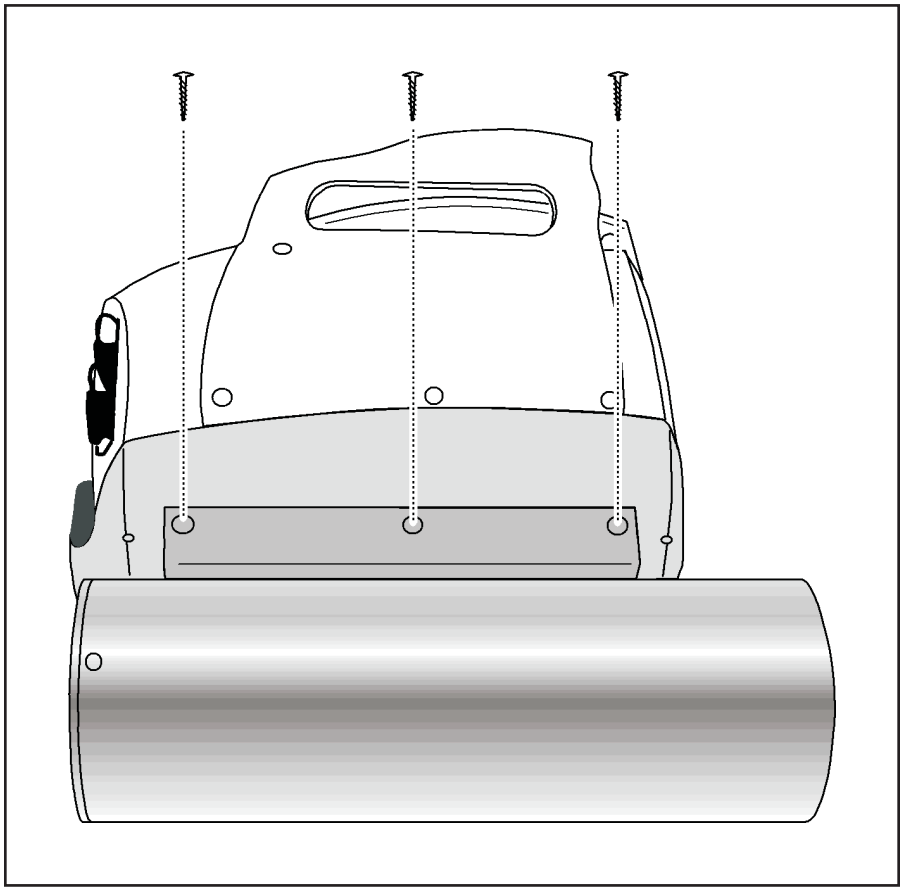


Figure 100 Removing the Probe's Mounting Screws

4. Remove the Neutron Probe from the InSpector by rotating it away from the InSpector and disengaging the lugs (Figure 101).

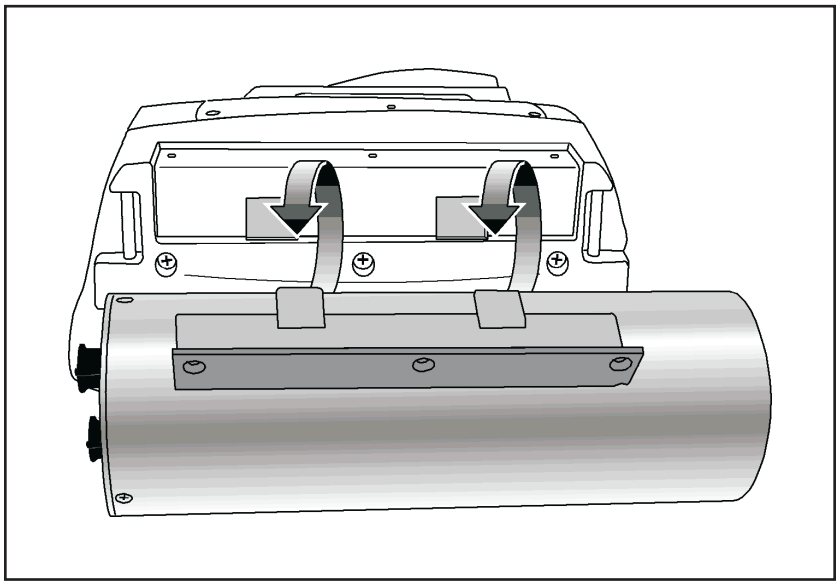


Figure 101 Disengaging the Probe

5. Loosen the three screws that hold the probe mounting piece to the InSpector and pull the mounting piece about 1/8 inch (3 mm) away from the InSpector (Figure 102).

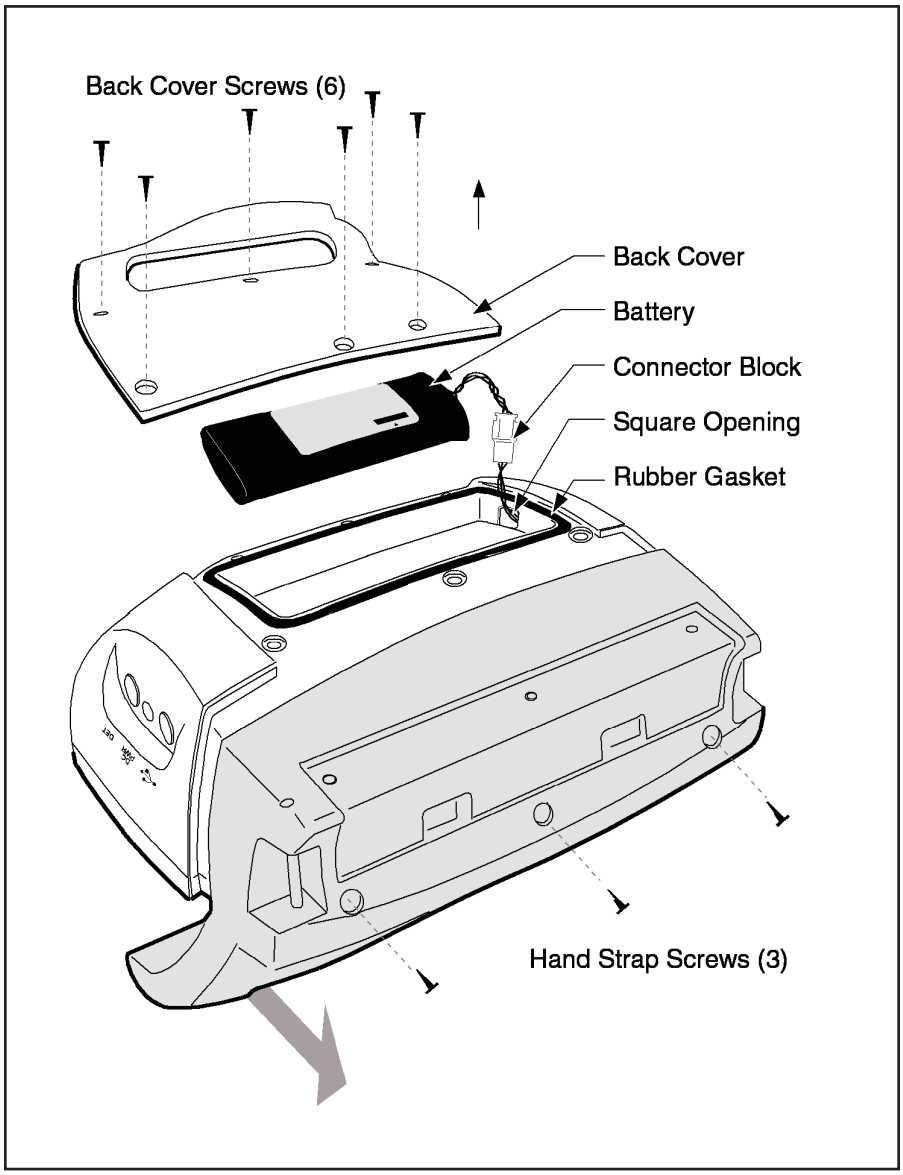


Figure 102 Accessing the Battery Compartment

6. Remove the back cover's six screws.

7. Remove the back cover.

8. Carefully remove the battery from its compartment.

9. Gently pull the battery's connecting wires and connector block out of the square opening at the back of the battery compartment.

10. Carefully separate the connector block.

11. Connect the power connector to the new battery and carefully feed the connector block and wires back through the square hole.

12. Seat the battery in its compartment.

13. Before replacing the cover, verify that the cover's gasket is fully seated in its mounting slot. If the gasket is not seated correctly, the unit's resistance to water and dirt will fail, which can cause the unit to malfunction.

14. Replace the rear cover and its six screws.

15. Push the probe mounting piece back into place on the InSpector.

16. Tighten the three screws the three screws that hold the probe mounting piece to the InSpector.

17. Align the IPRON-N probe's alignment lugs with the InSpector's lug cutouts.

18. Rotate the probe so that the alignment lugs on the probe can mate with the lug cutouts on the InSpector.

19. Insert the lugs in the cutouts and rotate the probe firmly until the lugs are fully engaged in the cutouts

20. Reattach the probe to the InSpector by replacing the three screws removed in step 3.

21. Reconnect all cables.

22. Resume normal operation.

D. Factory Installed Nuclide Libraries

This appendix lists the contents of the nuclide libraries installed in the InSpector™ 1000 at the factory.

- NaI-NORM.nlb for naturally occurring radioactive materials.
- NaI-SNM.nlb for special nuclear materials.
- Naidemo.nlb, a typical mixed gamma source.
- NaI-MED.nlb for medical nuclides.
- NaI_PeakLocate.nlb limits peak search to the specified nuclides.
- NaI-INDU.nlb for industrial nuclides.
- ANSI_GammaGuru.nlb, the NID by nuclide correlation library
- NaI_ANSI.nlb complies with the ANSI 42.34 standard.

The NORM Nuclear Library

Filename: NaI-norm.nlb

Nuclide Name	Half-Life (Seconds)	Energy (keV n)	Energy Uncert. (keV)	Yield (%)	Yield Uncert.(Abs.+-)
K-40	3.992E+016	1460.822*	0.006	10.6600	0.1900
Ra-226	5.049E+010	186.211*	0.013	3.5900	0.0600
Th-232	4.434E+017	74.810	0.002	10.4000	0.3000
		77.110	0.002	17.5000	0.5000
		87.300	0.002	7.8100	0.2500
		238.632	0.002	43.3000	0.4000
		240.986	0.006	4.1000	0.0500
		328.000	0.006	2.9500	0.1200
		338.320	0.003	11.2700	0.1900
		583.191	0.002	30.4000	0.3000
		911.204*	0.004	25.8000	0.4000
		964.766	0.010	4.9900	0.0900
		968.971	0.017	15.8000	0.3000
		1588.200	0.030	3.2200	0.0800
		1620.500	0.100	1.4900	0.0400
		2614.533	0.013	34.6380	0.0040
U-235	2.221E+016	143.760	0.020	10.9600	0.1400
		185.715*	0.005	57.2000	0.8000
U-238	1.410E+017	63.290*	0.020	4.8000	0.7000
		92.590	0.250	5.6000	0.4000
		1001.030	0.030	0.8370	0.0100

* = key line

The SNM Nuclear Library

Filename: NaI-snm.nlb

Nuclide Name	Half-Life (Seconds)	Energy (keV)	Energy Uncert. (keV)	Yield (%)	Yield Uncert.(Abs.+-)
U-233	5.024E+012	71.890	0.002	0.0024	0.0004
		117.159	0.002	0.0023	0.0004
		118.968	0.002	0.0041	0.0000
		120.816	0.001	0.0033	0.0000
		145.337	0.004	0.0015	0.0003
		146.345	0.002	0.0066	0.0001
		148.156	0.008	0.0003	0.0000
		245.345	0.002	0.0036	0.0000
		248.726	0.006	0.0014	0.0002
		288.033	0.005	0.0010	0.0002
		291.354	0.004	0.0054	0.0000
		317.160*	0.010	0.0078	0.0001
		320.541	0.005	0.0029	0.0000
U-235	2.221E+016	143.760	0.020	10.9600	0.1400
		185.715*	0.005	57.2000	0.8000
U-238	1.410E+017	113.500*	0.100	0.0102	0.0015
Pu-239	7.608E+011	129.296	0.001	0.0063	0.0001
		375.054	0.003	0.0016	0.0000
		413.713*	0.005	0.0015	0.0000

* = key line

The NaI Demo Nuclear Library

Filename: Naidemo.nlb

Nuclide Name	Half-Life (Seconds)	Energy (keV)	Energy Uncert. (keV)	Yield (%)	Yield Uncert.(Abs.+-)
CO-57	2.341E+007	122.063*	0.000	85.5100	0.1800
		136.476	0.000	10.6000	0.1800
CO-60	1.663E+008	1173.216	0.000	100.0000	0.0000
		1332.486*	0.000	100.0000	0.0000
SR-85	5.602E+006	513.990*	0.000	99.2700	0.0220
Y-88	9.210E+006	898.021	0.000	93.4000	0.4000
		1836.010*	0.000	99.3800	0.0200
CD-109	4.009E+007	88.032*	0.000	3.7200	0.1100
SN-113	9.945E+006	391.688*	0.000	64.9000	0.7000
CS-137	9.521E+008	661.650*	0.000	85.1200	0.2300
CE-139	1.189E+007	165.850*	0.000	80.3500	0.0800
HG-203	4.026E+006	279.190*	0.000	77.3000	0.8000

* = key line

The Medical Nuclear Library

Filename: NaI-med.nlb

Nuclide Name	Half-Life (Seconds)	Energy (keV)	Energy Uncert. (keV)	Yield (%)	Yield Uncert.(Abs.+-)
Ga-67	2.792E+005	93.311	0.005	39.2000	1.0000
		184.577*	0.010	21.2000	0.3000
		300.219	0.010	16.8000	0.2200
		393.529	0.010	4.6800	0.0600
Tc-99m	2.163E+004	140.511*	0.001	89.0600	0.2400
Pd-103	1.468E+006	357.450*	0.080	0.0221	0.0008
In-111	2.423E+005	537.000*	1.000	87.2000	0.3000
I-123	4.760E+004	346.350	0.050	0.1260	0.0050
		440.020	0.050	0.4280	0.0150
		505.330	0.050	0.3160	0.0110
		528.960*	0.050	1.3900	0.0500
		538.540	0.050	0.3820	0.0130
I-125	5.140E+006	35.492*	0.001	6.6800	0.1300
I-131	6.929E+005	284.305	0.005	6.1400	0.0700
		364.489*	0.005	81.7000	0.8000
		636.989	0.004	7.1700	0.1000
		722.911	0.005	1.7700	0.0300
Xe-133	4.534E+005	80.997*	0.003	38.0000	0.7000
Ir-192	6.377E+006	201.311	0.007	0.4730	0.0080
		205.794	0.000	3.3400	0.0400
		295.956	0.000	28.7200	0.1400
		308.455	0.000	29.6800	0.1500
		316.506*	0.000	82.7100	0.2100
		468.069	0.000	47.8100	0.2400
		484.575	0.000	3.1870	0.0240
		588.581	0.001	4.5170	0.0220
		604.411	0.000	8.2000	0.0400
		612.462	0.000	5.3400	0.0800
Tl-201	2.631E+005	135.340	0.040	2.5650	0.0240
		165.880	0.070	0.1550	0.0050
		167.430*	0.070	10.0000	0.0600

* = key line

The Peak Locate Nuclear Library

Filename: NaI_PeakLocate.NLB

Nuclide Name	Half-Life (Seconds)	Energy (&keV)	Energy Uncert. (&keV)	Yield (%)	Yield Uncert.(Abs.+-)
CO-60	1.663E+008	1173.216	0.000	100.0000	0.0000
		1332.486*	0.000	100.0000	0.0000
CS-137	9.521E+008	661.650*	0.000	85.1200	0.2300

* = key line

The Industrial Nuclear Library

Filename: NaI-indu.nlb

Nuclide Name	Half-Life (Seconds)	Energy (keV)	Energy Uncert. (keV)	Yield (%)	Yield Uncert.(Abs.+-)
Na-22	8.216E+007	1274.530*	0.020	99.9440	0.0140
Co-57	2.348E+007	122.061*	0.000	85.6000	0.1700
		136.474	0.000	10.6800	0.0800
Co-60	1.663E+008	1173.228	0.003	99.8500	0.0300
		1332.492*	0.004	99.9826	0.0006
Ba-133	3.330E+008	80.997	0.001	34.1000	0.3000
		276.400	0.001	7.1640	0.0220
		302.851	0.001	18.3300	0.0600
		356.013*	0.001	62.0500	0.1900
		383.848	0.001	8.9400	0.0300
Cs-137	9.517E+008	661.657*	0.003	85.1000	0.2000
Eu-152	4.273E+008	121.782	0.000	28.6700	0.1500
		244.697	0.001	7.6100	0.0400
		344.279	0.001	26.6000	0.6000
		778.904	0.002	12.9600	0.1500
		867.373	0.003	4.2600	0.0300
		964.079	0.018	14.6500	0.0800
		1085.869	0.024	10.2400	0.0600
		1112.069	0.003	13.6900	0.0700
		1408.006*	0.003	21.0700	0.1100
Ir-192	6.377E+006	201.311	0.007	0.4730	0.0080
		205.794	0.000	3.3400	0.0400
		295.956	0.000	28.7200	0.1400
		308.455	0.000	29.6800	0.1500
		316.506*	0.000	82.7100	0.2100
		468.069	0.000	47.8100	0.2400
		484.575	0.000	3.1870	0.0240
		588.581	0.001	4.5170	0.0220
		604.411	0.000	8.2000	0.0400
		612.462	0.000	5.3400	0.0800
Ra-226	5.049E+010	186.211*	0.013	3.5900	0.0600
Th-232	4.434E+017	74.810	0.002	10.4000	0.3000
		77.110	0.002	17.5000	0.5000
		87.300	0.002	7.8100	0.2500
		238.632	0.002	43.3000	0.4000
		240.986	0.006	4.1000	0.0500
		328.000	0.006	2.9500	0.1200
		338.320	0.003	11.2700	0.1900
		583.191	0.002	30.4000	0.3000
		911.204*	0.004	25.8000	0.4000
		964.766	0.010	4.9900	0.0900
		968.971	0.017	15.8000	0.3000
		1588.200	0.030	3.2200	0.0800
		1620.500	0.100	1.4900	0.0400
		2614.533	0.013	34.6380	0.0040
Am-241	1.364E+010	59.541*	0.000	35.9000	0.6000

* = key line

The NID by Nuclide Correlation Library

Filename: ANSI_GammaGuru.NLB

Nuclide Name	Half-Life (Seconds)	Energy (keV)	Energy Uncert. (keV)	Yield (%)	Yield Uncert.(Abs.+-)
Pu	7.615E+011	33.200	0.000	8.1600	0.0000
		45.200	0.000	18.7180	0.0000
		51.630	0.000	6.5300	0.0000
		94.700	0.000	0.0109	0.0000
		98.800	0.000	0.0273	0.0000
		100.900	0.000	0.0354	0.0000
		103.500	0.000	0.0285	0.0000
		111.300	0.000	0.0326	0.0000
		114.500	0.000	0.0270	0.0000
		117.000	0.000	0.0180	0.0000
		125.300	0.000	0.0225	0.0000
		129.300	0.000	0.0260	0.0000
		203.500	0.000	0.0010	0.0000
		208.000	0.000	0.0040	0.0000
		332.000	0.000	0.0040	0.0000
		335.000	0.000	0.0160	0.0000
		345.000	0.000	0.0210	0.0000
		375.000	0.000	0.0360	0.0000
		413.700	0.000	0.0290	0.0000
Ra+dau	5.049E+010	74.810	0.000	6.0572	0.0000
		77.110	0.000	10.2385	0.0000
		87.200	0.000	3.5405	0.0000
		185.990	0.100	3.1386	0.0500
		241.920	0.000	7.1480	0.0000
		295.220	0.000	18.4000	0.0000
		351.990	0.000	35.5000	0.0000
		609.312*	0.007	44.1000	0.5000
		768.360	0.000	4.6743	0.0000
		934.050	0.000	3.0286	0.0000
		1120.287	0.010	14.4000	0.2000
		1238.110	0.000	5.6611	0.0000
		1377.650	0.000	3.8464	0.0000
		1407.980	0.000	2.3703	0.0000
		1729.600	0.000	2.9157	0.0000
		1764.494	0.014	15.2000	0.2000
Th+dau	4.433E+017	77.110	0.002	16.8000	0.3000
		87.300	0.002	6.0500	0.3000
		238.630	0.002	41.4000	0.3000
		338.322	0.002	11.7000	0.3000
		583.190	0.002	29.7000	0.3000
		727.180	0.002	11.3000	0.3000
		911.070*	0.004	28.2000	0.7000
		966.600	0.000	27.1000	0.0000
		2614.500	0.000	34.5128	0.0000
K-40	4.030E+016	1460.810*	0.000	10.6700	0.1100
Cr-51	2.393E+006	320.082	0.000	9.9200	0.0500
Co-57	2.341E+007	92.000	0.000	8.5000	0.0000
		122.063*	0.000	85.5100	0.1800
		136.474	0.000	10.6800	0.0800
		230.400	0.400	0.0004	0.0000
		339.690	0.210	0.0037	0.0000
		352.330	0.210	0.0030	0.0000
		366.800	0.300	0.0012	0.0000
		570.090	0.200	0.0161	0.0000
		692.410	0.070	0.1490	0.0100

		706.540	0.220	0.0050	0.0000
Co-60	1.663E+008	1173.216	0.000	100.0000	0.0000
		1332.486*	0.000	100.0000	0.0000
Ga-67	2.818E+005	93.100	0.000	41.3700	0.0000
		184.577*	0.010	21.2000	0.3000
		300.219	0.010	16.8000	0.2200
Se-75	1.035E+007	66.052	0.000	1.1120	0.0120
		96.734	0.000	3.4200	0.0300
		121.116	0.000	17.2000	0.4000
		136.000	0.000	58.3000	0.8000
		198.606	0.000	1.4800	0.0500
		264.658	0.000	58.9000	0.4000
		279.542	0.000	24.9900	0.1400
		303.924	0.000	1.3160	0.0090
		400.657	0.000	11.4700	0.0900
Tc-99M	2.167E+004	140.508*	0.000	89.0700	0.2400
		142.680	0.000	0.0210	0.0000
		322.300	0.000	0.0010	0.0000
Pd-103	1.468E+006	39.748	0.008	0.0683	0.0000
		62.410	0.030	0.0010	0.0000
		294.980	0.150	0.0028	0.0000
		357.450	0.080	0.0221	0.0000
		497.080	0.013	0.0040	0.0000
In-111	2.423E+005	171.280	0.030	90.2000	1.0000
		245.400*	0.020	94.0000	1.0000
I-123	4.777E+004	159.100*	0.050	83.0000	0.4000
		346.600	0.000	0.1000	0.0000
		440.400	0.000	0.3500	0.0000
		505.600	0.000	0.2600	0.0000
		529.000	0.000	1.0500	0.0000
		538.500	0.000	0.2700	0.0000
I-125	5.133E+006	27.200	0.001	39.8000	0.1300
		27.470	0.001	74.3000	0.1300
		31.000*	0.001	25.8000	0.1300
		35.492	0.001	6.6800	0.1300
I-131	6.947E+005	30.300	0.000	4.6800	0.0000
		80.180	0.000	2.6210	0.0000
		284.305	0.005	6.1400	0.0700
		364.480*	0.000	81.2000	1.1000
		636.973	0.000	7.2600	0.1000
		722.911	0.005	1.7700	0.0300
Ba-133	3.320E+008	80.997	0.000	23.8200	0.3000
		276.400	0.000	7.1640	0.0220
		302.851	0.000	18.3300	0.0600
		356.013	0.000	62.0500	0.1900
		383.848	0.000	8.9400	0.0300
Ba-133u	3.313E+008	80.997	0.003	36.7200	0.2700
		276.290	0.100	7.1640	0.1000
		302.710	0.100	18.3300	0.1000
		356.005*	0.000	62.0500	3.0000
		383.848	0.000	8.9400	0.0300
Xe-133	4.530E+005	30.800	0.000	34.0000	1.1000
		35.000	0.000	7.2000	0.8000
		80.997	0.003	4.2000	0.7000
Cs-137	9.521E+008	31.817	0.000	2.0000	1.4000
		32.194	0.000	3.6000	2.5000
		36.400	0.000	1.3000	0.9000
		185.700	0.000	3.8500	0.0000
		661.650*	0.000	85.1200	0.2300
Ir-192	6.377E+006	295.956	0.000	28.7200	0.1400
		308.455	0.000	29.6800	0.1500
		316.506*	0.000	82.7100	0.2100
		468.069	0.000	47.8100	0.2400
Tl-201	2.625E+005	69.000	0.000	77.9000	0.7000
		81.300	0.000	21.7000	0.7000

		135.340	0.040	3.7000	0.0240
		167.430	0.070	12.0900	0.0600
Tl-204	1.193E+008	68.895	0.000	0.4770	0.0200
		70.819	0.000	0.8100	0.0400
		80.300	0.000	0.3570	0.0160
U-233	5.024E+012	42.400	0.000	0.1890	0.0000
		54.690	0.000	0.0414	0.0000
		97.210	0.000	0.0601	0.0000
		146.380	0.000	0.0184	0.0000
		164.600	0.000	0.0177	0.0000
		245.340	0.000	0.1070	0.0000
		291.354	0.004	0.0160	0.0000
		317.160*	0.010	0.0231	0.0000
U-235	2.221E+016	143.760	0.020	10.9600	0.1400
		163.330	0.000	5.0800	0.0000
		185.715*	0.005	57.2000	0.8000
		202.110	0.020	1.0800	0.0230
		205.311	0.010	5.0100	0.0700
Np-237	6.766E+013	86.490	0.000	13.1000	0.0000
		300.340	0.020	6.6200	0.0600
		312.170*	0.020	38.6000	0.0400
		340.810	0.030	4.4700	0.0400
U-238	1.410E+017	92.600	0.000	3.5700	0.0000
		766.600	0.000	0.2070	0.0000
		1001.030	0.000	0.5900	0.0000
U238+dau	1.410E+017	63.290	0.000	3.9000	0.0000
		92.600	0.100	5.5700	0.0000
		766.600	0.000	0.2070	0.0000
		1001.030	0.000	0.5900	0.0000
Am-241	3.156E+007	33.196	0.000	0.1260	0.0040
		43.420	0.000	0.5720	0.0040
		47.000	0.000	2.9300	0.0000
		55.540	0.000	0.1170	0.0040
		59.541	0.000	35.9000	0.6000
		70.000	0.000	0.0230	0.0040
		98.930	0.000	0.0290	0.0000
		102.930	0.000	0.0320	0.0000
		122.990	0.000	0.2222	0.0000
		125.260	0.000	0.0159	0.0000
		208.000	0.000	0.0016	0.0000
		335.430	0.000	0.0011	0.0000
		662.420	0.000	0.0008	0.0000
		721.960	0.000	0.0004	0.0000

* = key line

The ANSI Nuclear Library

Filename: NaI_ANSI.NLB

Nuclide Name	Half-Life (Seconds)	Energy (&keV)	Energy Uncert. (&keV)	Yield (%)	Yield Uncert.(Abs.+-)
Ra+dau	3.156E+011	186.100	0.100	3.5000	0.0500
		295.220	0.000	18.4000	0.0000
		351.990	0.000	35.5000	0.0000
		609.312*	0.007	44.1000	0.5000
		1120.287	0.010	14.4000	0.2000
		1764.494	0.014	15.2000	0.2000
Th+dau	4.433E+017	238.630	0.002	41.4000	0.3000
		338.322	0.002	11.7000	0.3000
		583.190	0.002	29.7000	0.3000
		727.180	0.002	11.3000	0.3000
		911.070*	0.004	28.2000	0.7000
		968.971	0.010	17.0000	0.4000
		2614.530	0.013	34.5000	0.3000
K-40	4.030E+016	1460.810*	0.000	10.6700	0.1100
Co-57	2.341E+007	122.063*	0.000	85.5100	0.1800
		136.476	0.000	10.6000	0.1800
Co-60	1.663E+008	1173.216	0.000	100.0000	0.0000
		1332.486*	0.000	100.0000	0.0000
Ga-67	2.818E+005	93.311	0.005	39.2000	0.1000
		184.577*	0.010	21.2000	0.3000
		300.219	0.010	16.8000	0.2200
Tc-99M	2.167E+004	140.508*	0.000	89.0700	0.2400
In-111	2.423E+005	171.280	0.030	90.2000	1.0000
		245.400*	0.020	94.0000	1.0000
I-123	4.777E+004	158.970*	0.050	83.3000	0.4000
		528.960	0.050	1.3911	0.0500
I-125	5.133E+006	35.492*	0.001	6.6800	0.1300
I-131	6.947E+005	284.305	0.005	6.1400	0.0700
		364.480*	0.000	81.2000	1.1000
		636.973	0.000	7.2600	0.1000
		722.911	0.005	1.7700	0.0300
Ba-133	3.313E+008	80.997	0.003	34.0600	0.2700
		356.005*	0.000	60.0000	3.0000
Xe-133	4.532E+005	80.997*	0.000	36.7200	0.7000
Cs-137	9.521E+008	661.650*	0.000	85.1200	0.2300
Tl-201	2.625E+005	135.340	0.040	2.5650	0.0240
		167.430*	0.070	10.0000	0.0600
U-233	5.024E+012	291.354	0.004	0.0054	0.0000
		317.160*	0.010	0.0078	0.0000
U-235	2.221E+016	143.760	0.020	10.9600	0.1400
		185.715*	0.005	57.2000	0.8000
Np-237	6.766E+013	86.477*	0.010	12.4000	0.4000
		143.249	0.020	0.4300	0.0200
U-238	1.409E+017	49.550	0.060	0.0640	0.0080
		113.500*	0.100	0.0102	0.0014
U238+dau	1.409E+017	63.290	0.020	4.8400	0.4900
		92.600	0.250	5.5700	0.9000
		1001.030*	0.000	0.8500	0.0000
Pu-239	7.605E+011	98.780	0.300	0.0012	0.0000
		129.294*	0.000	0.0063	0.0000
		413.712	0.000	0.0015	0.0000
Am-241	1.366E+010	59.540*	0.000	36.3000	0.0000
Pu-241	4.528E+008	164.610	0.020	1.8520	0.0180
		208.000*	0.010	21.1400	0.2300

* = key line

E. Using ASFs

An Analysis Sequence File (ASF) can be created or edited in Genie™ 2000, then the Maintenance Utility can be used to copy it to the InSpector™.

In addition to the editing example on this page, this appendix describes two Genie 2000 analysis algorithms of interest to the InSpector user:

- The NID by Nuclide Correlation algorithm (page 164).
- The Dose by Isotope algorithm (page 165).

Creating or Editing an ASF

As an example of the ASF creation / editing process, use the following procedure to copy an ASF from the InSpector to the PC, edit it, then copy it back to the InSpector.

1. Use the Maintenance Utility's Get function (page 107) to copy an analysis sequence from the InSpector to your PC. The NAI_Analysis.asf file is a good starting point, as it does a complete spectrum analysis.

2. In the Genie 2000 Gamma Acquisition and Analysis program, open a representative spectrum file

3. Still in Genie 2000, load the ASF file obtained in step 1. In the Genie 2000 Menu, select Edit | Analysis Sequence | Load, then select the file from the sequence descriptions list box.

4. In Genie 2000's Analysis Sequence Editor, make any modifications desired.

    - If a new nuclide or peak library is specified in the analysis, ensure that the library is present on the InSpector; use the Maintenance Utility's Send function (page 108) to make the library memory resident on the InSpector.

    - The standard analysis sequences on the InSpector do not contain reporting steps; however, these are very helpful in easily determining the results of the analysis on the PC.

    - The InSpector does not support some analysis steps provided by Genie, specifically: Acquisition, Parent-Daughter Correction, LACE, Action

Level Calculation, QA Analysis, Save Datasource and Post-NID Processing other than Dose by Isotope.

- Genie 2000's Analysis.tpl and DataDmp.tpl report templates are supported by the InSpector.

- If the "New File" setting is turned off in the Report step setup, the InSpector's I1k.rpt file may quickly grow very large, reducing the amount of available memory.

- If you're including a Peak Area step in your ASF, you might want to omit residual peak search; its completion time can be very long.

CAUTION If your ASF file contains any S501 Gamma Analysis steps, S501 must be installed on your Genie 2000 system. If S501 is not installed, editing the file on the Genie 2000 system will cause all S501 Gamma Analysis steps to be deleted from the file.

5. Test the updated analysis sequence by pressing the editor's Execute button.

6. Repeat steps 3 through 5 until the desired results are achieved, except that in Step 3 you must select the sequence editor's Current button to reopen the sequence you're working on.

7. Save the completed analysis sequence with the editor's Store button.

8. Use the Maintenance Utility's Send function (page 108) to send the sequence file to the InSpector.

9. With the file resident in the InSpector's memory, use the InSpector's Spec | File | Open | Analysis Sequence function to Load the sequence; it will be used in all new analyses.

Note: When analysis sequences are transferred between the PC and the InSpector, file paths are automatically adjusted for the destination device. This assumes that a file specified on the PC will be found in the default directory for that type of file on the InSpector.

Using an ASF

For the InSpector to be able to use a Genie 2000 algorithm , it must be part of an Analysis Sequence File (ASF) created in Genie™ 2000, then made resident on the InSpector via the Maintenance Utility's Send Function (page 108).

When the ASF has been made resident, it must be Loaded (page 87) for use. Once loaded, invoke the main menu's Spec ⇒ Next ⇒ Analyze command to analyze the current spectrum with the loaded ASF.

Two Useful Analysis Algorithms

Among Genie 2000's analysis algorithms are Nuclide Correlation NID and Dose by Isotope. Both of these are discussed on the following pages.

NID by Nuclide Correlation

Though Genie 2000 has several nuclide identification algorithms, only one is discussed here, the NID by Nuclide Correlation algorithm* (Figure 103). It uses a standard spectrum with corresponding standard energy, shape and efficiency calibrations and nuclide library to identify nuclides.

If the spectral area is statistically significant and the distribution of the area is sufficiently similar to the expected shape as defined by user-specified parameters, the nuclide is identified.

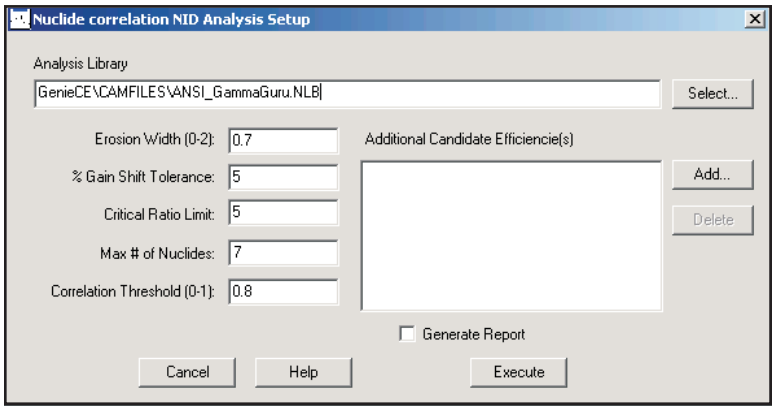


Figure 103 Nuclide Correlation NID Setup

*Patent pending.

For a discussion of the details and use of each of the algorithm's parameters, please refer to the help file, which can be reviewed by pressing the **Help** button on the algorithm's Setup screen. The figure shows the recommended values for each of the parameters, as discussed in the help file.

Dose by Isotope

Invoking Analyze using an ASF which includes a Dose by Isotope step will cause the rate of the dose received from each identified nuclide to be displayed in the Dose Rate (units/h) column of the Composite Dose Nuclide ID views.

Note: If the Dose by Isotope step is not included in the current ASF, the Dose column will display zeros.

F. Specifications

Physical

SIZE – InSpector alone: 19.0 x 16.5 x 6.4 cm (7.5 x 6.5 x 2.5 in.); with an IPRON-N probe: 25.4 x 24.1 x 14.0 cm (10 x 9.5 x 5.5 in.).

MASS – With batteries and an IPRON-2 probe: <2.4 kg (5.4 lb); with batteries, and both an IPRON-2 probe and an IPRON-N probe: 7.65 kg (16.9 lb).

Environmental

OPERATING TEMPERATURE – Range: –10 to +55 °C, ambient.

HUMIDITY – Up to 80%, non-condensing.

SHOCK – Shock proof design (not including the detector). Can withstand a drop from 1 m onto concrete.

PROTECTION RATING – Meets IP 54 specifications (dust and splash/spray protection).

DIRECTIVES – Meets all relevant EU safety, RFI and EMI directives (CE compliance).

Inputs

DC POWER/CHARGER – 12 V, 2 A dc output; universal ac/dc adapter input with IEC 320 power connector.

Outputs

USB HOST – USB interface for future expansion, Connector type bulkhead (combined with USB device connections).

USB DEVICE – USB device interface for connection to host computer for spectrum upload and library/efficiency download.

Detectors

NaI PROBES – External 1.5 x 1.5 in., 2 x 2 in. or 3 x 3 in. NaI(Tl) detector with integrated preamplifier and programmable HVPS.

STABILIZED NaI PROBE – External 2 x 2 in. NaI(Tl) detector with integrated preamplifier and programmable HVPS.

NaI Probes	IPRON-1	IPRON-2	IPRON-3	IPROS-2 Stabilized
Sensitivity (^{137}Cs)	6000 cps/mrem/hr ±3.5%	13 000 cps/mrem/hr ±3.5%	32 000 cps/mrem/hr ±3.5%	13 000 cps/mrem/hr ±3.5%
NaI(Tl) Crystal	1.5 x 1.5 in. (38 x 38 mm)	2 x 2 in. (50 x 50 mm)	3 x 3 in. (76 x 76 mm)	2 x 2 in. (50 x 50 mm)
Case Size (L x D)	230 mm x 45 mm	258 mm x 58 mm	300 mm x 83.2 mm	260 mm x 58 mm
Mass	≤0.54 kg (1.2 lb)	≤0.82 kg (1.8 lb)	≤1.95 kg (4.3 lb)	≤0.82 kg (1.8 lb)

GM TUBE – Internal Geiger-Müller tube for high dose/count rate measurements. Operates in Canberra's patented "time to count" mode.*

NEUTRON PROBE – External detector; moderated ^{3}He tube (8 cm active length – 2 atm); intrinsic neutron sensitivity ≈1%, using an unmoderated ^{252}Cf fast neutron source; mass = 1.36 kg (3 lb).

Display

TYPE – Backlit color LCD and touch panel.

RESOLUTION – 320 x 240 pixels.

LAYOUT – Landscape.

COLORS – 65 536.

Indicator

CHARGE INDICATOR – Yellow LED on keypad.

*U.S. Patent Numbers 4,605,859 and 4,631,411.

Beeper

AUDIO ANNUNCIATOR – Microspeaker driven from main processor.

AUDIBLE COUNT RATE INDICATOR – Off or one beep for every 100, 1000 or 10 000 counts; user selectable.

AUDIBLE ALARM/WARNING INDICATOR – Alarms/warnings using tones; user configurable.

Count/Dose Rate Display

COUNT RATE DISPLAY UNITS – Counts per second or counts per minute; user selectable.

DOSE RATE BARGRAPH FULL SCALE – 0.1, 1.0, 10, 100, 1000, 10 000, Auto; user selectable.

DOSE RATE UNITS – µR/h, mR/h, R/h; µSv/h, mSv/h; µrem/h, mrem/h, rem/h; user selectable.

Battery

TYPE – Two-cell Li-ion battery; rechargeable.

CAPACITY – 2.3 AH.

OPERATING TIME – Approximately 12 hours while acquiring with battery at full charge.

CHARGE TIME – Approximately 3 hours.

Performance

ENERGY RANGE –
For 1.5, 2 and 3 in. NaI detectors – 25 keV to 3 MeV.
For GM detector – 30 keV to 1.4 MeV.

INTEGRAL – 0.1% over top 99% of conversion range.

THROUGHPUT – >50 kcps.

INPUT COUNT RATE – >500 kcps total ICR if not limited by detector/probe.

LIVE TIME CORRECTION – Live Time Correction (LTC) of spectral data.

PRESETS – Live time preset: 1–1 000 000 s; Real time preset: 1–1 000 000 s.

SPECTRAL DATA STORAGE – More than 512 spectra of 1024 channels each (CAM file format).

CHANNEL STORAGE – 32 bits.

Notes

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Warranty

Canberra (we, us, our) warrants to the customer (you, your) that for a period of ninety (90) days from the date of shipment, software provided by us in connection with equipment manufactured by us shall operate in accordance with applicable specifications when used with equipment manufactured by us and that the media on which the software is provided shall be free from defects. We also warrant that (A) equipment manufactured by us shall be free from defects in materials and workmanship for a period of one (1) year from the date of shipment of such equipment, and (B) services performed by us in connection with such equipment, such as site supervision and installation services relating to the equipment, shall be free from defects for a period of one (1) year from the date of performance of such services.

If defects in materials or workmanship are discovered within the applicable warranty period as set forth above, we shall, at our option and cost, (A) in the case of defective software or equipment, either repair or replace the software or equipment, or (B) in the case of defective services, reperform such services.

LIMITATIONS

EXCEPT AS SET FORTH HEREIN, NO OTHER WARRANTIES OR REMEDIES, WHETHER STATUTORY, WRITTEN, ORAL, EXPRESSED, IMPLIED (INCLUDING WITHOUT LIMITATION, THE WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE) OR OTHERWISE, SHALL APPLY. IN NO EVENT SHALL CANBERRA HAVE ANY LIABILITY FOR ANY SPECIAL, EXEMPLARY, PUNITIVE, INDIRECT OR CONSEQUENTIAL LOSSES OR DAMAGES OF ANY NATURE WHATSOEVER, WHETHER AS A RESULT OF BREACH OF CONTRACT, TORT LIABILITY (INCLUDING NEGLIGENCE), STRICT LIABILITY OR OTHERWISE. REPAIR OR REPLACEMENT OF THE SOFTWARE OR EQUIPMENT DURING THE APPLICABLE WARRANTY PERIOD AT CANBERRA'S COST, OR, IN THE CASE OF DEFECTIVE SERVICES, REPERFORMANCE AT CnANBERRA'S COST, IS YOUR SOLE AND EXCLUSIVE REMEDY UNDER THIS WARRANTY.

EXCLUSIONS

Our warranty does not cover damage to equipment which has been altered or modified without our written permission or damage which has been caused by abuse, misuse, accident, neglect or unusual physical or electrical stress, as determined by our Service Personnel.

We are under no obligation to provide warranty service if adjustment or repair is required because of damage caused by other than ordinary use or if the equipment is serviced or repaired, or if an attempt is made to service or repair the equipment, by other than our Service Personnel without our prior approval.

Our warranty does not cover detector damage due to neutrons or heavy charged particles. Failure of beryllium, carbon composite, or polymer windows, or of windowless detectors caused by physical or chemical damage from the environment is not covered by warranty.

We are not responsible for damage sustained in transit. You should examine shipments upon receipt for evidence of damage caused in transit. If damage is found, notify us and the carrier immediately. Keep all packages, materials and documents, including the freight bill, invoice and packing list.

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