



Syclone Portable Gamma-Ray Spectrometer User Manual

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Revision History			
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1	June 25, 2012	N/A	Released
2	August 30, 2012	635	Add minor changes
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Product Manual - Disclaimers:

Due to our efforts to continuously improve this product; specifications, dimensions, operating features and procedures described in this manual are subject to frequent changes. The printed version of this manual reflects only the configuration current at the time of printing. The most current version of the manual is provided in electronic format on the Product Support CD supplied with the instrument. Please refer to the electronic version of the manual for the most accurate interpretation. Contact RadComm Radiation Detection Systems at www.radcommsystems.com

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USERS ARE HEREBY NOTIFIED THAT THIS MANUAL CONTAINS TECHNICAL INFORMATION OF A PROPRIETARY NATURE. THIS INFORMATION IS NECESSARY FOR TECHNICALLY KNOWLEDGEABLE USERS TO UNDERSTAND SYSTEM OPERATION AND TO SATISFY THEMSELVES THAT THE SYSTEM IS PERFORMING CORRECTLY.

RADCOMM ACCEPTS THAT IT IS THE RIGHT OF SUCH USERS TO BE PRIVY TO THIS INFORMATION. HOWEVER THIS DOCUMENTATION IS PROVIDED SOLELY FOR THE BENEFIT OF OWNERS OF THE SYCLONE PORTABLE DETECTOR AND DISSEMINATION OF THE DETAILED TECHNICAL INFORMATION PROVIDED MAY BE CONSIDERED AS LEGALLY CONTRAVENING THE NORMAL SUPPLIER/CUSTOMER RELATIONSHIP.

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1.0 GENERAL SYSTEM DESCRIPTION

The **Syclone Gamma-Ray Portable Spectrometer** - represents a major breakthrough in the field of radiation monitoring, offering the user not only the ability to search for and locate radioactive material but also to automatically identify the radioactive nuclides present. This capability in a fully portable hand-held unit will permit its use in a wide variety of applications including:

- Hazard identification and risk assessment
 - Inspection of incoming and outgoing material for radioactive contamination
 - Inspection of radioactive gauges for leaks
 - SEARCH of waste sites for radioactive material
 - Employee exposure rate and dose monitoring
 - Radioactive source monitoring
 - Government inspection for material compliance
 - Identification of unknown radioactive material
 - Regulatory control of radioactive material
 - Classification of radioactive material for a wide variety of users
-

1.1 SYCLONE HARDWARE

Syclone Portable Gamma-Ray Spectrometer – is a highly sensitive and responsive unit which utilizes the highest quality Thallium doped NaI crystal, combined with an integral high signal to noise ratio PMT, state-of-the-art electronics and embedded microcontroller firmware.

The Syclone portable radiation detector has been designed to detect, find and identify specific and/or multiple isotopes from radioactive materials (even weak gamma sources) hidden from view. The unit has adjustable sensitivity levels and automatically adjusts to the background radiation, which helps prevent nuisance alarms.

The mechanical assembly of the Syclone is robust and durable, designed to be used in field applications where harsh environment are associated.

1.2 SOFTWARE

This manual describes the current firmware release, and all information regarding system (PC) software.

1. Syclone Operating System (Firmware)

The Syclone operating system utilizes sensible easy to read and follow menus. The multi-position joystick and large LCD backlit display provides a user friendly method to navigate through menu selections. Detailed spectral information is clearly and precisely displayed to provide knowledgeable users with the capability to visually identify peaks in the histogram. Various on-screen messages assist the user when immediate attention is required for issues such as preset timing, high radiation levels, alarm settings and Warning messages.

2. Remote SYCLONE PC Spectral Analysis and Data Storage Software

The Syclone is equipped with a large internal memory, to store large amounts of data which is stored by record number, date and time.


Stored data, such as spectral and dose rate information can be easily downloaded to a PC through mini USB or Bluetooth (optional). The downloaded data can be displayed and

managed with the powerful RadView Software. Primary features such as the selection and highlighting of R.O.I. details and Zoom In/Out of the gamma energy histogram can be easily performed. The RadView Software has all the necessary features that will meet the needs of virtually any user.

1.3 BASIC SYSTEM OPERATION

The Syclone is delivered fully charged and ready to operate. The user chooses the mode of operation **MANUAL**, **SIMPLIFIED** or **AUTOMATIC**. This is performed by user selection, when the cover page appears the user holds down the joystick to see the Mode selection screen. Most operators will use either the **SIMPLIFIED** or **AUTOMATIC** mode(s) which are designed to allow for fast and easy inspection of areas, containers or vehicles that may contain radioactive materials, or to verify or separate radioactive materials that have triggered an alarm from a large scale radioactive detector system. The **SIMPLIFIED** Mode is similar to the **AUTOMATIC** Mode, but when a source is found it switches to **IDENTIFY** automatically (the spectra is stored for further analysis, but the Dose Rate is not saved).

Notes:

- When using the Syclone in potentially dangerous situations a maximum Dose Rate or CPS Rate can be preset by the customers' parameters. If the dose rate or cps rises above the set level it triggers an automatic acoustic alarm warning the user to find protection.
- The Syclone when used in Simplified mode will end the identification routine when the first isotope is identified. It is strongly recommended that an additional 30s() be selected from the display to ensure the proper isotope identification.

SYCLONE MODES of Operation:

AUTOMATIC MODE (See [Appendix D](#) for Quick Start):

Restricted to **SEARCH** and **IDENTIFY** functions only, all other functions are disabled to simplify system use for non-technical personnel.

- The Syclone uses a radioactive check source (Cs-137) to maintain the systems' stability (when the unit requests stabilization, the user places the Cs-137 check source on the central mark at the face of the unit, and follows the screen messages).
- The Syclone contains a state-of-the-art microprocessor and internal circuitry designed to automatically set the lowest achievable alarm level and to continuously monitor system operation in order to maintain consistent optimum performance.
- Upon the initial self-test the Syclone will begin operating as soon as it is turned on.
- The Syclone can only use the manufacturers' provided rechargeable lithium batteries. These batteries provide up to 12 hrs(typical 9 hours) of continuous service.
- The Syclone displays the battery condition in the top right corner on the LCD. A **FULL** charge is indicated by all three squares filled with **GREEN**, as the charge reduces to one square, it changes colour to yellow. When the batteries fall below a certain level, an audio warning occurs and the Battery ICON becomes **RED** and flashes. The user has approximately 30 minutes of measuring time left in the battery at this time. When there is no longer enough power to allow measuring, the Syclone turns **OFF**.
- The functions **SEARCH** and **IDENTIFY** are available to the Automatic Mode, while all other functions are not accessible to the operator. (The Automatic Mode is suitable for operators who need only to detect the presence and identification of a radioactive material).

- The Screens SEARCH, IDENTIFY and NUCLIDE IDENTIFY have a navigation menu displayed (see [Chapter 3.0](#)) at the bottom of the screen to help the operator choose joystick control functions.
- When the operation is complete and the Syclone is no longer required, the battery power supply is plugged into the unit. This allows the internal battery charger to charge the battery.
- Connecting the Syclone unit to the PC with the USB Cable or Bluetooth (optional) will allow user to start the data download.

SIMPLIFIED MODE – The Simplified Mode is easy to use and is very suitable for rapid **SEARCH** and detection of Gamma Ray emitting radioactive sources in suspect vehicles and containers. The unit will store any detected spectra for further analysis and can download the samples to the PC using the supplied USB cable or Bluetooth (optional). See [Chapter 4.0](#) for more information.

Note: This mode is very useful when inspecting a volume of containers and/or vehicles such as at a border crossing for radioactive materials.

MANUAL MODE – unrestricted system operation: This mode is used by technicians to setup the Syclone to customers' parameters.

This section is written to provide information and instructions to Users who wish to use the instrument to its full capabilities. It is also used by technicians to setup the Syclone to customers' parameters.

The user has access to all the screens available to the SYCLONE in Manual Mode(see [Chapter 5.0](#)). The SYCLONE in Manual Mode is used to perform the following functions:

Note: Turn the SYCLONE ON by clicking the joystick down to ENTER and allowing the unit to initialize. ENTER = long click down (joystick).

- **SEARCH** – (refer to [Chapter 5.1](#))
From the MAIN Menu select SEARCH, a (long) click down on the joystick will begin the SEARCH Mode.
- **IDENTIFY** – (refer to [Chapter 5.2](#))
From the MAIN Menu select IDENTIFY, a (long) click down on the joystick will begin the IDENTIFY Mode.
- **STABILIZE** – (refer to [Chapter 5.3](#))
From the MAIN Menu select STABILIZE. Press ENTER to begin.
- **MEMORY STORAGE** – (refer to [Chapter 5.4](#))
From the MAIN Menu select MEMORY STORAGE, a (long) click down on the joystick will display the MEMORY STORAGE screen.
- **CONFIGURE** – (refer to [Chapter 5.5](#))
From the MAIN Menu select CONFIGURE, a (long) click down on the joystick will display the CONFIGURE Menu, where the user can select operating parameters to change in accordance with their site design requirements (see [Appendix C](#) for Recommended Parameters).
- **INFORMATION** – (refer to [Chapter 5.6](#))
From the MAIN Menu select INFORMATION, a (long) click down on the joystick will display the INFORMATION Menu, where the user load libraries and view system status.

Operating the SYCLONE for the first time:

Note: While rechargeable batteries are shipped fully charged, they will self-discharge with time if not

in use. It is important to condition new batteries, whether received with the system or purchased separately. To get reliable performance and full capacity out of the batteries throughout their life, it is important to let them fully discharge and then fully re-charge for 4 hours at least once every two months. This will assure that the batteries provide up to 12 hrs (typical 9 hours) of operation.

1. The Syclone is delivered factory set to Manual Mode.
2. Click the joystick down to turn the Syclone ON. The Syclone will initialize the system.
3. Check the condition of the battery icon (it should show a full charge), charge battery if necessary.
4. From the MAIN Menu select CONFIGURE, a (long) click down on the joystick will display the CONFIGURE Menu where the user selects operating parameters to change in accordance with their site design requirements (see [Appendix C](#) for Default Parameters). Changing the operating parameters must only be performed by a qualified technician.
5. Turn the SYCLONE OFF by clicking the joystick up (for approximately 4 seconds) until the countdown is finished and the LCD goes blank.
6. Select the mode of operation; **MANUAL**, **AUTOMATIC** or **SIMPLIFIED** (see [Section 2.3](#)) as desired to use for Normal Operation. Before beginning the Syclone may request stabilization (an integrated 0.25 μ Ci (9.25kBq) Cesium-137 source is present).



Note: The Syclone must be stabilized manually from the MAIN Menu using the STABILIZE option (refer to [Chapter 5.3](#)).

- a. In **Automatic** and **Simplified** Mode(s) the SYCLONE will begin SEARCH Mode immediately after Starting.

Note: During normal operation the system will operate within 2 primary radiation monitoring functions; SEARCH Mode and IDENTIFY Mode. The user will not have access to any other system options.

- b. In **Manual** Mode the MAIN Menu appears after the unit initializes, the user selects SEARCH, a (long) click down on the joystick to begin the SEARCH Mode. Refer to [Appendix E](#) for a guide to Manual Mode Quick Start.

Note: Access to all system options from the MAIN Menu is open to the user, but normally the user will operate the system using the SEARCH and IDENTIFY MODE(s) from the MAIN Menu (2 primary radiation monitoring functions). NUCLIDE IDENT will be displayed as a result of the IDENTIFY Mode.

1.4 NORMAL OPERATION (PRIMARY MONITORING FUNCTIONS)

The Syclone may be operated in two **Primary** radiation monitoring functions:

a) **SEARCH**

In this function, the Syclone acts as a RADIOMETER displaying the current COUNT RATE in counts/sec. A variable-tone **AUDIO** will indicate radiation intensity with an automatic audio meter or user adjusted alarm level. The display will show an increasing count/second (cps) numeric radiation level. This function is typically used to search for radioactive material or to carry out Total-Count Search.

The SEARCH function displays the current DOSE RATE (in selectable units and quantities) as well as ACCUMULATED DOSE from the time the function was enabled. The dose meter is used to determine the relative hazard level and to assess handling requirements of a radioactive material. Dose Search of an area can also be carried out in SEARCH.

b) **IDENTIFY** – (Nuclide Identification)

In this function, the Syclone accumulates spectral data from a sample and analyses the spectrum in terms of emitted energy level and net count contribution. The nuclides responsible for producing the spectrum are identified by comparison to a nuclide library. This essential information can then be used to determine risk assessment.

1.5 SYSTEM FEATURES

a) **INSTRUMENT BODY** - The instrument body consists of two primary parts, the lower case and top panel. The combination of the two parts provides a high degree of system strength, suitable for field operations where mechanical abuse may be unavoidable.

b) **DETECTOR** –

i. **Crystal Detector** - The 1.5" (38mm) x 2" (51mm) Thallium doped sodium-iodide (NaI) crystal is specially designed for rugged environments.

ii. **GM** – the rugged Geiger-Muller tube is mounted just behind the instrument front face and is used to extend the Dose Rate range to 10 R/hr (100 mSv/hr) for special applications.

iii. **Neutron Detector** – He3 or CLYC(Cs₂LiYCl₆) technology, please consult factory.

c) **EFFECTIVE CENTER** – The optimum sensing area for the Sodium Iodide (NaI) detector is the area represented by the central mark located on the front of the Syclone case.

d) **HANDLE** – The handle was carefully designed to allow for a variety of grips, it also gives the unit a measure of strength and provides a comfortable balance which affords the operator hours of stress free usage.

e) **JOYSTICK** - The Syclone has only one operating control - the four position joystick on the handle. All system functions are controlled by the **JOYSTICK** that permits very easy instrument functions (***EVEN WHILE WEARING GLOVES IN A BIOHAZARD SUIT***). The JOYSTICK is a specially designed switch with four actions – UP, DOWN, LEFT, and RIGHT. The JOYSTICK and use of menu driven functions makes the Syclone very easy to operate and avoids the necessity of “memorizing” complex sequences of action.

Note: A joystick Navigation Menu is available at the bottom of each screen in Automatic Mode (see [Appendix D](#)).

f) **DISPLAY** - A LCD is used for the Syclone to permit a full range of alphanumeric and graphic display capabilities. This LCD gives excellent contrast in high light conditions.

g) **REAR CONNECTIONS** – The Syclone has a mini-USB connector mounted on the rear of the unit.



To charge the unit and connect to the PC to transfer data using the mini USB cable.

h) BATTERIES - The Syclone requires manufacturers' supplied lithium batteries.

While rechargeable batteries are shipped fully charged, they will self-discharge with time when not in use. It is important to condition new batteries, whether received with the system or purchased separately. Conditioning is achieved by first totally discharging the batteries in the **SYCLONE** unit and then fully charging them for at least 4 hours.

Note: To get reliable performance and full capacity out of the batteries throughout their life, it is important to let them fully discharge and then fully re-charge for 4 hours at least once every two months. This will assure that the batteries provide up to 12 hrs (typical 9 hours) of operation.

i) BATTERY-CHARGER – the battery charger is an integral part of the unit and requires the supplied power supply, which plugs into a normal wall receptacle using house current.

j) CHECK SOURCE – The Syclone uses a 0.25 μCi Cs-137 check source, which will stabilize the unit under 3 mins.

Note: There is a central mark on the front of the case which represents the effective center of the NaI detector. Place the supplied source at this spot when the unit requests stabilization, and follow the screen messages.

k) SYSTEM SUPPORT SOFTWARE - The **RADVIEW** software is provided with the Syclone unit on a USB. This is a Windows based program that operates under Windows Vista, windows 7 and 8. It provides data downloading, data display, custom library uploading, spectrum display analysis and various other features.

l) HARD SHELL TRANSPORTATION CASE - The system is supplied with a hard shell carrying case for easy transportation of the Syclone.

m) USER MANUAL - This user manual is supplied with the instrument.

2.0 DETAILED OPERATION GUIDE

This section offers a detailed guide to system operation. The “**AUTOMATIC**” mode of operation is described in [Chapter 3.0](#). The “**SIMPLIFIED**” mode of operation is described in [Chapter 4.0](#) and the “**MANUAL**” mode of operation is described in [Chapter 5.0](#).

2.1 JOYSTICK

The Syclone is equipped with a four position JOYSTICK on the instrument handle; referred to in this manual as the JOYSTICK and this is the **ONLY** control on the instrument. The great advantage of this single button control is that besides being very easy to use it also permits full operation **EVEN WHEN WEARING GLOVES** – a definite advantage in many applications where protective clothing is required.

Various Joystick actions are permitted depending on the application:

- CLICK UP/DOWN** - a **SHORT** (up to 0.5 sec) push (CLICK) of the JOYSTICK **UP** (away from the user) or **DOWN** (towards the user) is used to scroll through the system menus.
- ENTER** - holding the JOYSTICK **DOWN** (toward the ON position on the joystick label) for about **ONE SECOND** (in the manual referred to as **ENTER**) is used to activate the selection highlighted on the display.
- CLICK LEFT/RIGHT** – **SHORT** (up to 0.5 sec) click used in some menus to change parameters.

JOYSTICK ACTIONS



2.2 POWER AND STARTUP FUNCTIONS

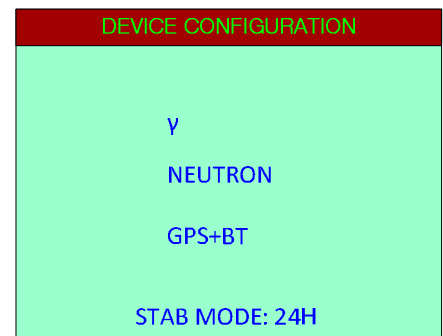
a) POWER ON

System Startup Screen (Cover Screen)

After approx. 2 seconds the display will be replaced by the normal startup screen as shown. The normal startup display remains on the screen for a few seconds.

b) Device Configuration Screen

This screen displays the current device configuration and stabilization mode.



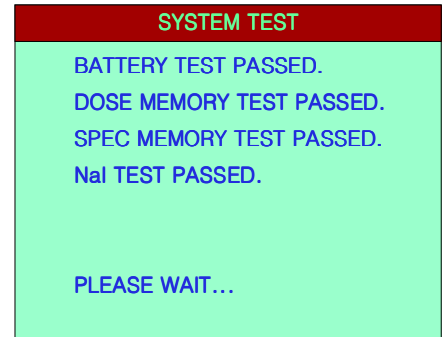
c) **MODE SELECTION** (See [Section 2.3](#) for more information)

The Syclone is delivered fully powered and in the **MANUAL Mode**, so that the customers' technician can setup parameters specific to their usage. To change the Mode setting, startup the unit and hold down the joystick when the cover page appears, the mode selection screen will then appear and the user can use the joystick to choose from **MANUAL**, **AUTOMATIC**, or **SIMPLIFIED MODE**. The Syclone is ready to be used for the selected mode by the operator or technician.



d) **Initialization and Testing**

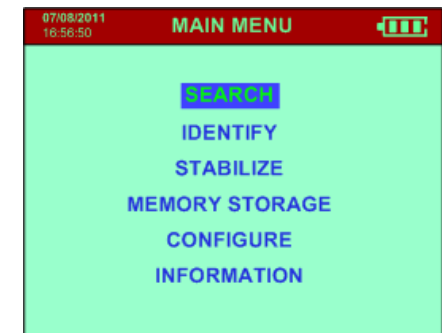
To power the unit **ON**, **CLICK DOWN** (towards the user) the joystick. The display will come on and System Initialization will proceed for a few seconds. The unit is carrying out internal testing to verify that components are functioning correctly. If errors are found, an audio beep will be heard.



e) **MAIN MENU**

After the initial start-up screen, the Syclone Main Menu appears. The user may scroll through the menu items by a short click **UP** or click **DOWN**. Reverse "highlighting" shows the current menu item selected.

Menu items are selected by highlighting the desired item and clicking **ENTER** to activate the selection. When the system is turned ON, user can use the system after a 2 – minute warm up time, however for best performance please let the system warm up for 15 minutes.



f) **POWER OFF - MANUAL**

To power the unit OFF, **CLICK UP** (away from the user) and hold for approx. **4** seconds. The display (see Figure) shows the seconds counting down; **3, 2, 1**. After this countdown the unit powers OFF. At any time during the countdown, releasing the JOYSTICK will cancel the power OFF.

g) **LOW BATTERY WARNINGS**

The Battery ICON at the top right of the display is used to provide the user with an idea of the current battery status.

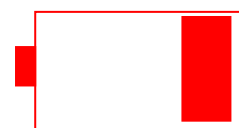
To provide some level of warning of imminent battery life - if the batteries fall below a certain level then an audio warning occurs and the Battery ICON flashes for immediate attention. The user has approximately 30 minutes of measuring time left in the battery at this time. When there is no longer enough power to allow measuring, the Syclone turns **OFF**.



Full Charge



1/3 Charge



Low Battery Warning (Flashing)

Figure 2-2

h) CALIBRATION REQUIRED

The Syclone spectrometer is a finely tuned instrument that provides accurate results when all components are functioning properly. In order for the Syclone to maintain its high level of accuracy, the instrument should be calibrated by a certified company every 12 months. The Syclone will show the message “CALIBRATION REQUIRED” which is informing the operator that the Syclone should be calibrated.

2.3 SWITCHING SYCLONE OPERATIONAL MODES

The unit can be set to either the **AUTOMATIC**, **SIMPLIFIED** or **MANUAL Mode(s)** at any time. Selection between modes is performed from the Mode selection screen. The User makes the selection with the joystick, when the cover page appears the User holds down the joystick to see the Mode selection screen. The User then chooses between **MANUAL**, **AUTOMATIC** or **SIMPLIFIED MODE** with the joystick.

AUTOMATIC MODE: This mode was designed to allow for fast and easy inspection of areas, containers or vehicles that may contain radioactive materials. This mode provides, **SEARCH**, and **Identify** capabilities, which allows the User to collect large amounts of data which can be transferred to the PC for analysis. This mode is also used by experts to quickly identify and locate potentially hazardous radioactive sources for immediate investigation.

SIMPLIFIED MODE – The Simplified Mode is easy to use and is very suitable for express **SEARCH** and detection of Gamma Ray emitting radioactive sources in suspect vehicles and containers. The unit will store any collected spectra for further analysis, the user can download the samples to the PC using the supplied USB cable or Bluetooth (optional). See [Chapter 4.0](#) for more information.

MANUAL MODE: This Mode is available to qualified radiation experts and technicians in order to setup the equipment and change the operating parameter(s) to suit the users' application(s). This mode is also useful to the scientist to acquire data, identify and analyze conditions in the field.

2.4 STATUS BAR MESSAGES

The following is a list of system status messages that may appear in the Search or Identify status bar.

2.4.1 SEARCH

The following messages are only applicable to the Search Mode.

2.4.1.1 NEUTRONS DETECTED!

In the event when the neutron readings Counts Per Second are above the Neutron Alarm threshold, Syclone notifies the user with this message, red LED flashes, audio beeps and the unit vibrates. This message only appears when neutron detector is available.

2.4.1.2 HIGH DOSE RATE.MOVE AWAY!

The system has a preset maximum Dose Rate level – normally set at 10 μ Sv/h (1000 μ R/h). Below this level Dose Rates are considered acceptable for system operation. However above

this level it is recommended that users move away from the source of radiation to reduce the high radiation risk exposure.

2.4.1.3 DOSE RATE EXCEEDS THRSH!

In the event when the Dose Rate exceeds the Dose Rate radiation alarm threshold, Syclone notifies the user with this message, red LED flashes, audio beeps and the unit vibrates.

2.4.1.4 CPS EXCEEDS THRESHOLD!

In the event when the Counts per Second exceeds the CPS radiation alarm threshold, Syclone notifies the user with this message, red LED flashes, audio beeps and the unit vibrates.

2.4.1.5 TEMP EXCEEDS AUTO RANGE!

This message will appear in the status bar if stabilization is in Auto mode and the temperature exceeds the range specified in the Auto Stabilization settings (see [Section 5.5.2](#)).

2.4.1.6 DOSE MEMORY IS FULL!

User can go to CONFIGURATION menu to erase the data samples and spectra saved on the memory or use RadView software to erase it. Before erase the memory, user should download all the saved data to PC by RadView software.

2.4.2 IDENTIFY

The following messages are only applicable to the Identify Mode.

2.4.2.1 MOVE CLOSER!

This message is only applicable to Automatic and Simplified Modes.

Move Closer means that the signal is very weak so if possible the user should move the unit closer to the suspect source of radiation. In many cases this is impossible so no action need be taken, but if possible move the unit closer until the message goes away.

2.4.2.2 MOVE AWAY!

This message is only applicable to Automatic and Simplified Modes.

Move Away means that the signal is stronger than is necessary to take a proper sample. Correct action is to back away until the display shows SCANNING!

IT IS THE USERS CHOICE TO CONTINUE TO OPERATE WITH 'MOVE AWAY' MESSAGE ON THE SCREEN.

2.4.2.3 SPEC MEMORY IS FULL!

User can go to CONFIGURATION menu to erase the data samples and spectra saved on the memory or use RadView software to erase it. Before erase the memory, user should download all the saved data to PC by RadView software.

2.4.3 SEARCH AND IDENTIFY

The following messages are applicable to both the Search and Identify Modes.

2.4.3.1 STABILIZATION OFF. NO ID!

If Stabilization is set to OFF, the unit still has the ability to collect spectrum, but with NO NUCLIDE ID.

2.4.3.2 STABILIZATION REQUIRED!

User can go to CONFIGURATION menu to stabilize the unit or follow the instruction on the screen.

2.4.3.3 CALIBRATION REQUIRED!

The Syclone spectrometer is a finely tuned instrument that provides accurate results when all components are functioning properly. In order for the Syclone to maintain its high level of accuracy, the instrument should be calibrated by a certified company every 12 months. The Syclone will show the message "CALIBRATION REQUIRED" which is informing the operator that the Syclone should be calibrated.

2.4.3.4 SCANNING!

Syclone is scanning.

2.5 STABILIZATION

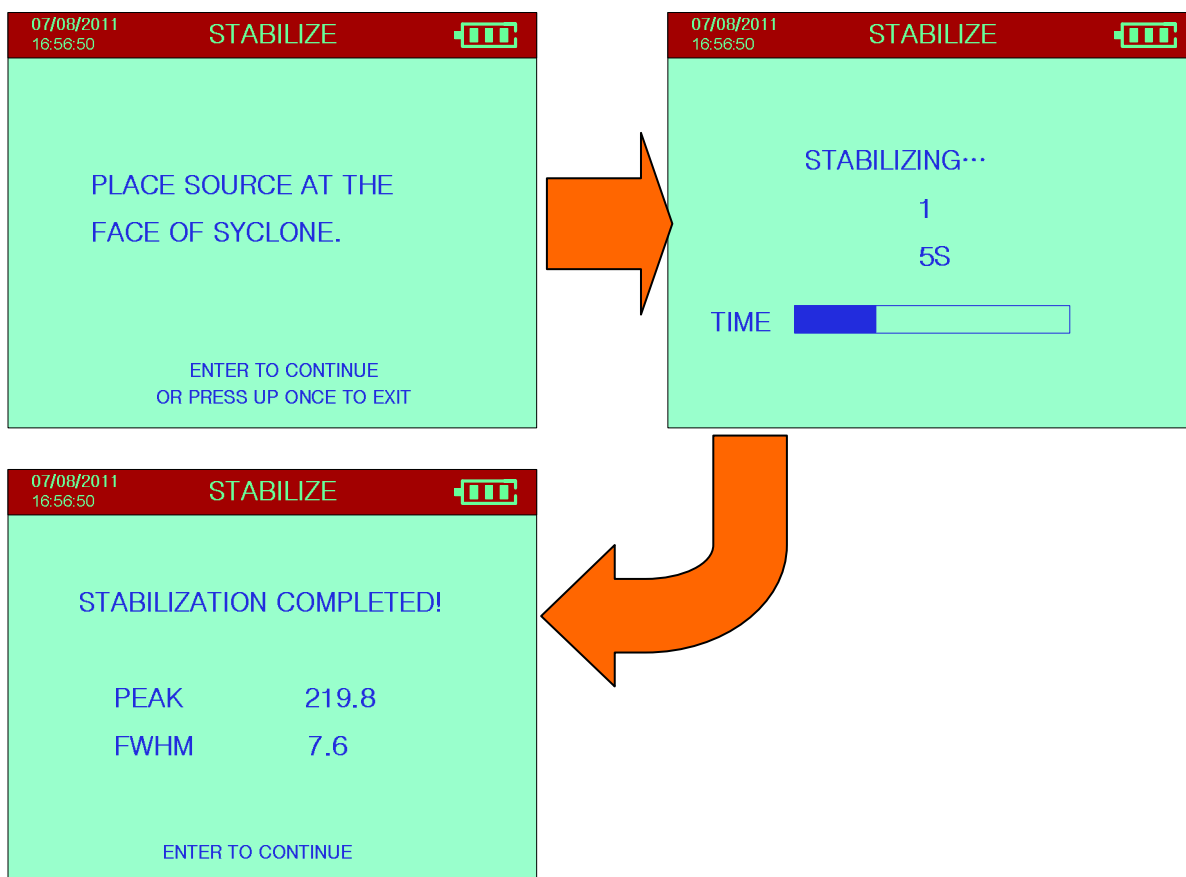
When any spectrometer is turned ON, the internal electronic components exhibit some level of warm-up drift with time, which may be exacerbated by changes in the ambient temperature. Sodium Iodide (NaI) crystals typically exhibit a +/- 15% change in scintillation light output over the -10 to +50°C temperature range. If not corrected this drift could seriously affect data analysis. For this reason, the Syclone incorporates a procedure known as STABILIZATION to remove these effects. Stabilization automatically "fine-tunes" the system to adjust the internal system gain and align the spectrometer correctly.



2.5.1 STABILIZE

The User can activate **STABILIZE** by pressing **ENTER TO CONTINUE**. Stabilization can also be started from the MAIN MENU of Manual Mode. Carry out the stabilization function using the external Cesium source (Cs-137 supplied with unit).

Follow the instructions on the following screens.



The data is described as follows:

PEAK – this is the peak channel of the centroid of the accumulated spectrum. The correct final channel for CESIUM stabilization is **channel 219.8**.

FWHM – the Full-Width-Half-Maximum (7.6) is a measurement of the quality of the detector to resolve narrow peaks. Good operation is possible with units measuring FWHM up to 8.5%. FWHM measurements above 8.5%; spectral peaks are widening, making accurate peak analysis very difficult, and above 9.5%; spectral analysis, especially in the lower energy area, is almost impossible.

2.5.2 STABILIZATION SETTINGS

The User can select from “**Configuration**” – “**Stabilization**” menu, there are several options to stabilize the Syclone. These are: ‘**12 hours**’, ‘**24 hours**’, “**AUTO**” and “**OFF**”.

The options ‘**12**’ and ‘**24 hours**’ adjust the time intervals when the Syclone will notify the user to re-stabilize the unit. ‘**AUTO**’ is an option to avoid frequent Cs-137 source stabilization for NaI detector temperature interval between 5°C to 50°C.

Please note: this temperature interval is for temperature on the detector crystal, not the ambient temperature!

2.5.3 STABILIZATION – AUTO MODE

AUTO – is an option allowing the User to avoid frequent Cs-137 source stabilization, for the NaI detector temperature interval between 5°C to 50°C. This option is only available if unit temperature is within 5-50 °C. If Auto is selected in STAB Mode selection and the unit is

outside this temperature range, the following screen will be displayed.



During identification, if the detector temperature falls above or below the set parameter, the following screen shot will appear and the unit switches from AUTO to '24 hours' time stabilization interval.



If this happens during the Search Mode, Status Bar will display **TEMP EXCEEDS AUTO RANGE!**

ISOTOPE – Cs-137 is the default radioactive isotope used for stabilization.

2.5.4 STABILIZATION OFF AND CANNOT STABILIZE

If Stabilization is set to **OFF**, the unit still has the ability to collect spectra, but with NO NUCLIDE ID. **STABILIZATION OFF. NO ID!**

“STABILIZATION OFF. NO ID!” will be displayed on the Status Bar.

The following Screen will display if the unit cannot be stabilized.

If the Syclone detector fails Stabilization, the unit cannot be used, Call Service, see Appendix Z for information.



IT IS EXTREMELY IMPORTANT THAT STABILIZATION BE CARRIED OUT AS REQUIRED.

AFTER LOADING DEFAULT PARAMETERS - THE ACT OF STABILIZATION SETS ALL THE SYSTEM COMPUTATIONAL REQUIREMENTS FOR CARRYING OUT THE IDENTIFY FUNCTION. WITHOUT THIS STABILIZATION SERIOUS DATA ANALYSIS ERRORS WILL OCCUR!

SEE THE FOLLOWING SECTIONS FOR DETAILS ON OTHER FUNCTIONS.

2.6 CONNECTIONS

USB (COM) Connection: A special cable is supplied with the unit in order to connect the Syclone to a PC and transfer data for analysis.

Power Connection: The USB cable is connected to the supplied wall plug adapter and into the mini-USB connector on the Syclone, which supplies 5VDC to the unit from a standard wall receptacle. A power supply and cable comes with the Syclone and is used with the integrated internal charger to charge the battery in 4 hrs.



3.0 AUTOMATIC MODE OPERATION

The **Automatic Mode** delivers a two step operation:

- **SEARCH** (see [Section 3.3.1](#)) – automatically begins when the Syclone is turned ON.
- **IDENTIFY** (see [Section 3.3.2](#)) – the user chooses the Identify function using the joystick and the Navigation Menu (see [Section 3.1](#)). Once the pre-selected sampling time is complete the Syclone will automatically analyze the sample and return a result (see [Section 3.3.3](#)).

Note: The Syclone is operated in **SIMPLIFIED** Mode when the user requires rapid detection of gamma emitting radioactive sources. Identify will automatically begin when a source is detected. The **AUTOMATIC** Mode is used when the User requires more investigation and analysis. If the customer requires changes to the operating parameters, a qualified user can set the Syclone to **MANUAL** Mode (see [Section 2.3](#)) and change the operating parameter(s) to suit the users' application(s). The system is then returned to the **SIMPLIFIED** or **AUTOMATIC** Mode of Operation for the User.

A typical Screening Test can be performed as follows:

1. Start the Syclone in **AUTOMATIC** Mode, the Syclone will begin the **SEARCH**.
2. Verify the Syclone responds to radiation by placing the Syclone in front of the Cs-137 source (usually 0.25 uCi Cs-137 provided with the unit).
3. The Syclone should detect the radiation and emit an audio tone. Click down on the joystick to select the **IDENTIFY** function and to collect a sample.
4. After the sample time is complete the system automatically analyzes the data to determine the isotope of the source material. (The isotope should be Cs-137).

EYES FREE Audio Warning System:

For Eyes Free operation the unit emits a loud variable pitch audio tone proportional to the intensity of the gamma radiation detected.


Note: The audio warning can be adjusted and/or switched off if required.

3.1 JOYSTICK – NAVIGATION MENUS

Operation of the joystick, detailing all of its functions is discussed in [Section 2.1](#).

Navigation menus have been embedded into the system screens of the Automatic Mode (ONLY) for the following operations:






SEARCH: 
 
 

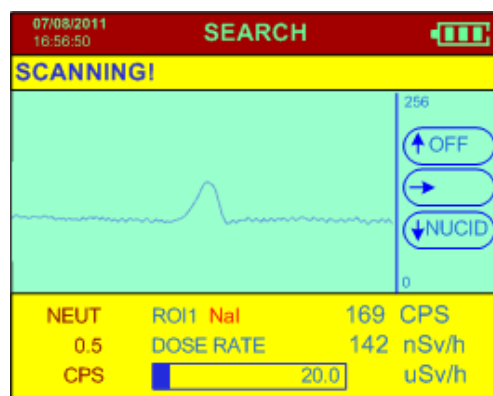
IDENTIFY:   

NUCLIDE IDENT:   




The Navigation Menus are located on the right for the SEARCH function and across the bottom of the screens in the Identify and Nuclide Identify with the joystick functions described below:

SEARCH (Navigation Menu):

-  **no action**
-  **OFF** – approx. 4 secs then unit powers OFF
-  **NUCID** – switches to the IDENTIFY and NUCLIDE IDENTIFY functions






IDENTIFY (Navigation Menu):

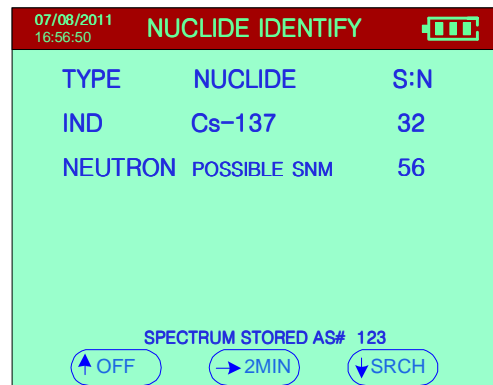
-  **no action**
-  **OFF** – approx. 4 secs then unit powers OFF
-  **STOP** – stops the IDENTIFY sample



NUCLIDE IDENTIFY (Navigation Menu):

-  **2MIN** – initiates an additional 2 minute count that adds to the current spectrum and at the end of the period gives a combined analysis
-  **OFF** – approx. 4 secs then unit powers OFF
-  **SRCH** – switches to the SEARCH

Left click toggles between S:N and H.L(half life).



3.2 STARTUP DISPLAYS

Pull the joystick down to turn the unit **ON** and various displays are seen:

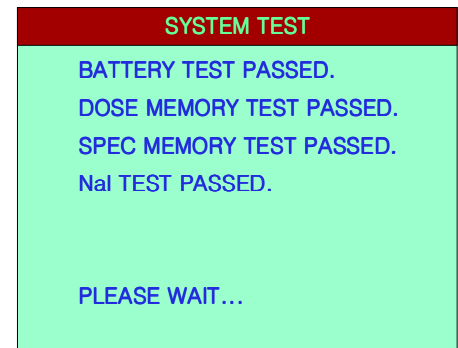
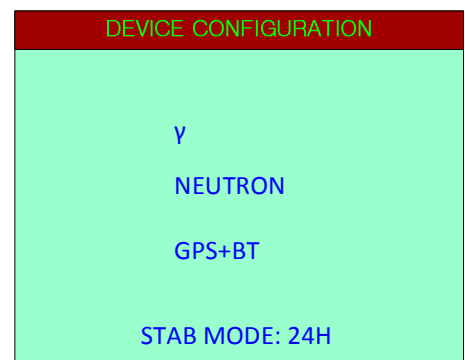
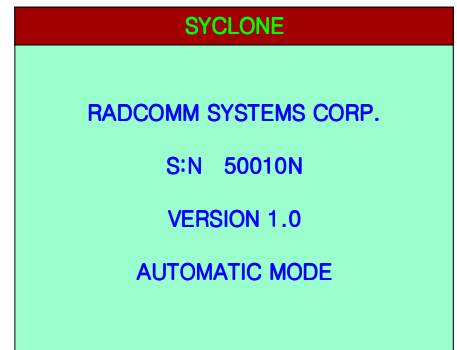
- a) **STARTUP** – this display appears for only a few seconds (see Figure). Data shown as follows:
- S:N 50010N** – instrument serial number
- SYCLONE** – instrument name
- VERSION 1.0** – the firmware version in the unit
- AUTOMATIC MODE ACTIVE** – shows the unit is in the **AUTOMATIC** Mode of operation

b) **Device Configuration Screen**

This screen displays the current device configuration and stabilization mode.

c) **Initialization and Testing**

After the system is turned on, system Initialization will proceed for a few seconds. The unit is carrying out internal testing to verify that components are functioning correctly. If errors are found, an audio beep will be heard.



3.3 SYSTEM USE – AUTOMATIC MODE

The Syclone in the **AUTOMATIC** Mode operates in 2 functions – **SEARCH** and **IDENTIFY**.

SEARCH is used to search and locate radioactive material in vehicles, packages or on people etc. The user can easily scan the suspect item and look for a significant increase in radiation using the tools described in the **SEARCH** section below.

Once a radiation source is detected, **SEARCH** is used to find the location of the radioactive source and then **IDENTIFY** could be used to analyze the sample and determine the isotope.

Note: When radioactivity is detected, the Syclone emits an audio tone that rises in pitch the closer it gets to the source, allowing the user to locate the source quickly.

As described in detail (see [Section 3.3.2](#)), **IDENTIFY** collects a spectrum (default acquisition time 55

seconds) then automatically analyses it and advises the user of the details of any radioactive material(s) found.

3.3.1 SEARCH

This function is used to search for radioactive material(s). When the unit is turned ON in the **AUTOMATIC Mode**, the display shows the **SEARCH** display (see Figure).

SEARCH display:

SEARCH – the function currently activated (i.e. SEARCH)



- battery icon displaying battery status.

Note: The information shown below documents examples taken from the figure above. The Syclone has threshold settings for Dose Rate, Counts per Second (CPS), and Neutrons. “CPS Threshold” by default is OFF, in accordance with parameters (see [Appendix C](#)).

NEUT – shows that measurement is for Neutrons. The example shows 0.5 CPS (Counts per Second of neutrons detected).

ROI 1 NaI – This is the Region of Interest (1) collected by the sodium iodide (NaI) detector.

169 CPS – this is the gamma radiation level in cps (counts per second) in ROI 1. This level will always show some counts even if no apparent radioactive material is present as this is the local radiation background of an area. Typically in low background areas, 50-100cps is common. Resettable **CPS radiation alarm** thresholds are: OFF, 100, 200, 250, 300, 350, 400, 450, 500, 600, 700, 1K, 2K, 5K, 9Kcps.

DOSE RATE – the bar display and the numeric data show the Dose Rate data in the selected units. The numeric data shown above (**169cps** in the figure) is an essential tool to locate radioactive material but the **DOSE** data gives the user an idea of the potential hazard level of such material.

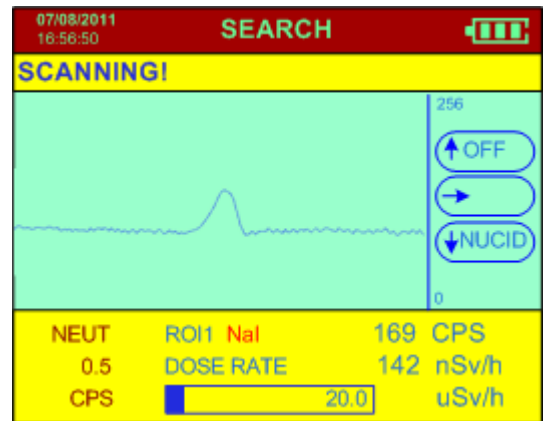
142 nSv/h – this is the current dose rate.

CHART DISPLAY – this is a chart recorder display of the radiation data. The bottom of the chart is **ZERO cps** and the top of the scale (depends upon the scale setting). The display moves from left to right so the **LEFT** hand data is the current data. The chart shows the last 256 samples and is a very useful “view back” at the data making it very easy to see any significant radiation increases. Note that the numeric **cps** data is not energy dependent so very small changes of any type of radioactive material emitting gamma rays can be easily seen.



– the bar graph gives the user an easy visual display of the Dose rate level (Zero on the left and Maximum on the right). The Maximum Dose level allowed is determined by the Users’ technical personnel. This level is then reflected in the system parameters and defines the high radiation threshold for the bar graph. The User is warned when the limit is exceeded. The status bar displays “DOSE RATE EXCEEDS THRSH”.

20.0 - this shows the defined limit selected by the system supervisor that is the maximum range on the bar graph. If this limit is exceeded a special alarm occurs. Note that this user is in the units selected – in the display shown – since the D.RATE is in $\mu\text{Sv/h}$ then the 20.0 = 20.0 $\mu\text{Sv/h}$. At this setting, if the DOSE RATE exceeds 20.0 $\mu\text{Sv/h}$ then the warning alarm will occur. Resettable **Dose Rate radiation alarm**



thresholds are: OFF, 10, 20, 50, 100, 200, 500, 1000, 2000, 4000, 5000, 9000 $\mu\text{R/h}$ (linked to units).

Note: The lower Dose Rate bar graph also shows that the Dose rate is at or above the preset limit. If the radiation goes above the dose rate alarm threshold, the graph bar becomes red, the status bar displays "DOSE RATE EXCEEDS THRESH" and a high pitched sound is emitted.

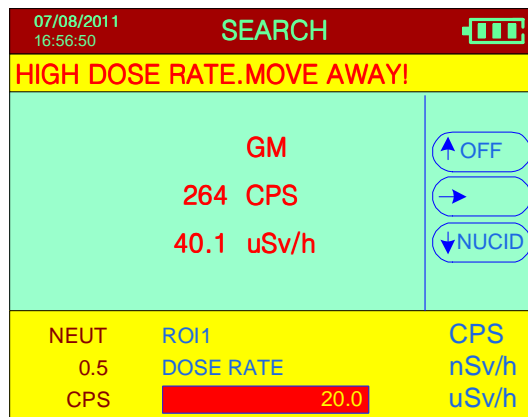
3.3.1.1 HIGH DOSE

The system has a preset maximum Dose Rate level – normally set at $10\mu\text{Sv/h}$ (**1000 $\mu\text{R/h}$**). Below this level Dose Rates are considered acceptable for system operation. However above this level it is recommended that users move away from the source of radiation to reduce the high Dose Rate to an acceptable level. To make things simple, the **Syclone** advises the users automatically if the Dose Rate goes above the preset limit, "**HIGH DOSE RATE. MOVE AWAY!**"

As noted the user should back away until the Dose Rate level falls below this limit and the display warning goes away.

Users should be reminded that short-term operation close to the limit has a negligible hazard level but prolonged operation significantly above this level is not recommended.

If the dose rate exceeds $40\mu\text{Sv/h}$, the unit automatically switches the dose rate measurement from NaI crystal to GM tube.



3.3.1.2 NEUTRON ALARM

If the integrated Neutron detector detects neutrons above the preset alarm threshold then a Neutron Alarm is declared (**NEUTRONS DETECTED!**). A distinctive audio warning tone occurs and the display shows neutron warning (see Figure).

3.3.2 IDENTIFY

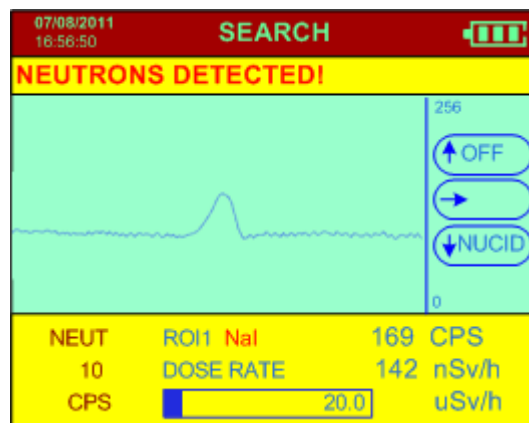
Once the location of the source is detected the user can attempt to identify the type of source by switching to the IDENTIFY function. The IDENTIFY function is activated by pressing **ENTER**, displaying a new screen:

Note: To obtain good results, position the Syclone at the highest point of radioactivity found by the SEARCH function. Keep the Syclone as stable as possible during sampling to get a good result.

IDENTIFY display (Information Line):

SCANNING! – the function currently activated.

IDENTIFY IS IN PROGRESS – advises the user that a sample is in progress for the time period set in the unit so the unit



should be held in a fixed position to enable a proper sample to be taken.

Alternate displays in information line are:


MOVE CLOSER – means that the signal is very weak so **if possible** the user should move the unit **closer** to the suspect source of radiation. In many cases this is impossible so no action need be taken, but if possible move the unit closer until the display shows **OK**.



MOVE AWAY – means that the signal is stronger than is necessary to take a proper sample. Correct action is to back away until the display shows **SCANNING!**



TIME – This shows the time already used for collecting the spectrum. In this case, it is 7s. If the acquisition time is 2 minutes, then the progress bar shows the progress of the 2-minute count time.

 The progress box shows the time progress to the end of the sample period.

25°C – Temperature of the crystal detector

3.3.3 RESULTS

After the sample time is complete the system automatically analyses the data to determine the isotope of the material and displays the results as shown (see Figure).

Note: When the NUCLIDE IDENTIFY result is displayed, the audio beeps (depends on the setting) to remind the user that the result is ready.

NUCLIDE IDENTIFY display:

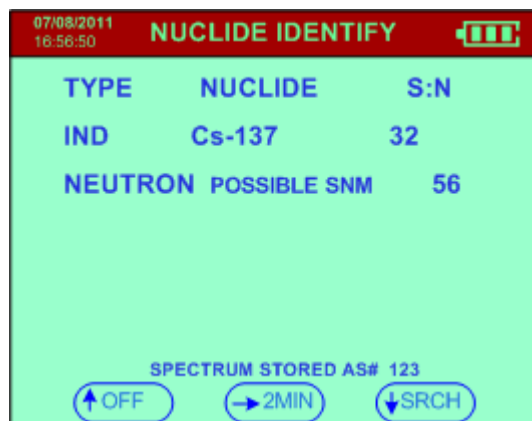
TYPE – shows the category of the isotope identified.

Labels used are:

- **IND** – Industrial isotope
- **MED** – Medical isotope
- **SNM** – Special Nuclear Material
- **NORM** – Naturally Occurring Radioactive Materials

NUCLIDE – is the actual name of the isotope (see [Appendix B](#)).

SPECTRUM STORED AS #(x) - every time an IDENTIFY analysis takes place the radiation data (spectrum) from this analysis is stored in memory where it can be accessed with special software for subsequent analysis as required. “**Spectrum stored as #(x)**” is shown at the lower part of the screen (where x is a sequential number) to advise the user that the spectra is being saved in memory as SPECTRUM #(x) for future retrieval. This number (x) can be anywhere from 1 to 498 and serves to uniquely identify the data in system memory for use during data retrieval and analysis. It is important to keep accurate records of the spectra origin to link the spectra to a



particular source or event.

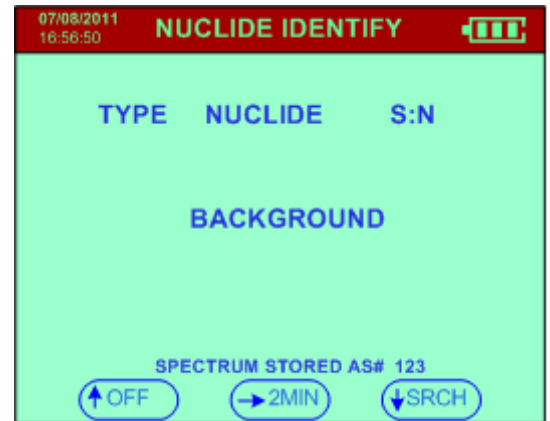
UNKNOWN SOURCE – (and Shielded

Source) The Syclone has a wide selection of radioactive isotopes in its internal library. If after analysis, the isotope or the residual signal/ gamma peak cannot be identified, and the **Dose Rate \leq Base Dose Threshold** the screen displays “**UNKNOWN SOURCE**”.

If the analysis results are such that the **Dose Rate \leq Base Dose Threshold** radiation, and no gamma-peaks found then the Syclone shall display “**BACKGROUND**” as the system is seeing the local background.

Furthermore, the results may contain peaks with no Isotope Identification, scattered radiation with no Isotope Identification, or a combination of an identified isotope and strong peaks with no Isotope Identification and if the **Dose Rate $>$ Base Dose Threshold**. These all may indicate the presence of an **SHIELDED SOURCE**.

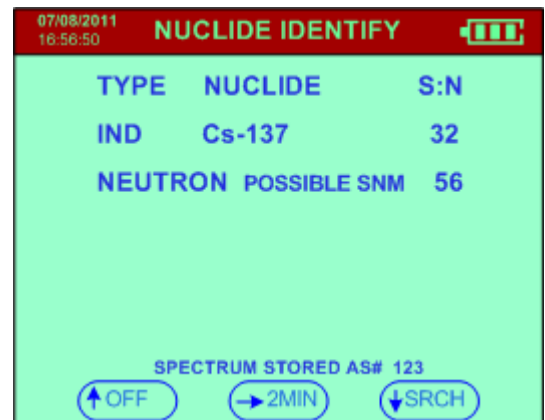
Note: If the isotope cannot be identified, retrieve the stored spectrum and follow your predefined operating protocol, or call the **RadComm Help desk** (see [Appendix Z](#)) who will direct the call to the appropriate person for further analysis.



NEUTRONS DETECTED DURING IDENTIFY

The presence of neutrons may indicate special nuclear material, as the SNM may be associated with neutron emission. If any neutron activity is detected and it is above the preset threshold during **IDENTIFY** analysis, the **NUCLIDE IDENTIFY** screen will display “**POSSIBLE SNM**” – (see Figure).

The unit is more sensitive to neutron radiation in the **IDENTIFY** function, because it collects samples for a longer period of time (55 seconds) as opposed to the **SEARCH** function. A weak neutron source has a better chance to be detected using **IDENTIFY**, when it is missed in **SEARCH**.



OTHER FEATURES:

3.4 POWER OFF - MANUAL

CLICK **UP** (away from the user) and hold for 4 seconds (see Figure). The display will show a special display (see Figure) with the seconds counting down; **3, 2, 1**. After this countdown the unit powers **OFF**. At any time during the countdown, releasing the JOYSTICK will cancel the power OFF.



3.5 BACKLIGHT

The BACKLIGHT function is built into the Syclone so that the display may be viewed in low ambient light conditions. BACKLIGHT is enabled for constant use.

4.0 SIMPLIFIED MODE OPERATION

The **SIMPLIFIED Mode** delivers a one-step operation:

SEARCH + Identify: – automatically begins when the Syclone is turned ON.

A typical Screening Test can be performed as follows:

1. Start the Syclone in SIMPLIFIED Mode, the Syclone will begin the **SEARCH**.
2. Verify the Syclone responds to radiation by placing the Syclone in front of the Cs-137 source (usually 0.25 uCi Cs-137 provided with the unit).
3. The Syclone should detect the radiation and emit an audio tone and automatically switches to the **SPECTRUM ANALYSIS** screen showing the sample time.
4. After the sample time is complete the system automatically analyzes the data to determine the isotope of the source material. (The isotope should be Cs-137).

EYES FREE Audio Warning System:

For Eyes Free operation the unit emits a loud variable pitch audio tone proportional to the intensity of the gamma radiation detected.

4.1 STARTUP DISPLAYS

Pull the joystick down to turn the unit **ON** and various displays are seen:

- a) **STARTUP** – this display appears for only a few seconds (see Figure). Data shown as follows:

SYCLONE – instrument name

S:N 50010N – instrument serial number

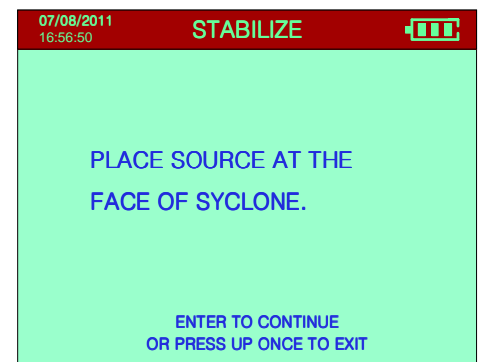
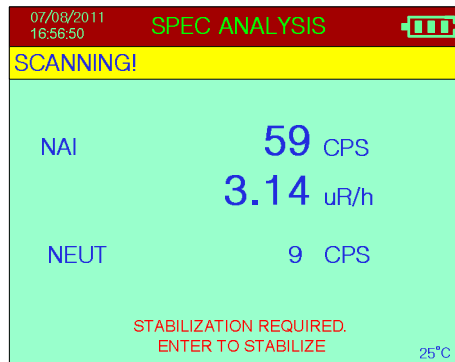
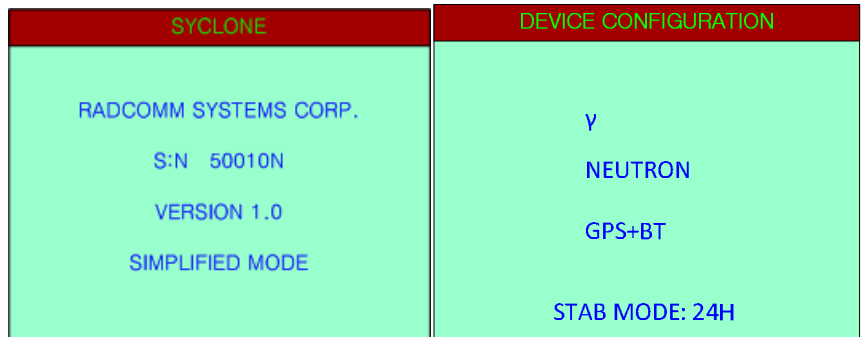
VERSION 1.0 – the software version in the unit

SIMPLIFIED MODE ACTIVE – shows the unit is in the **SIMPLIFIED** Mode of operation

- b) **STABILIZE**

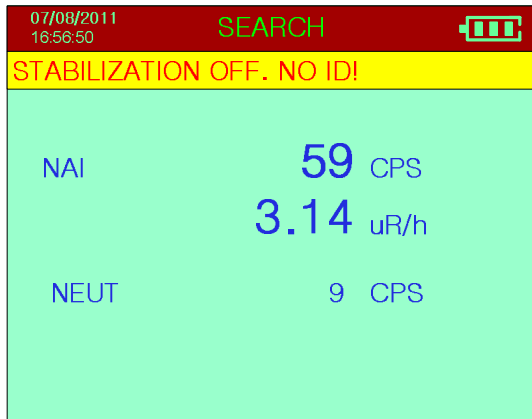
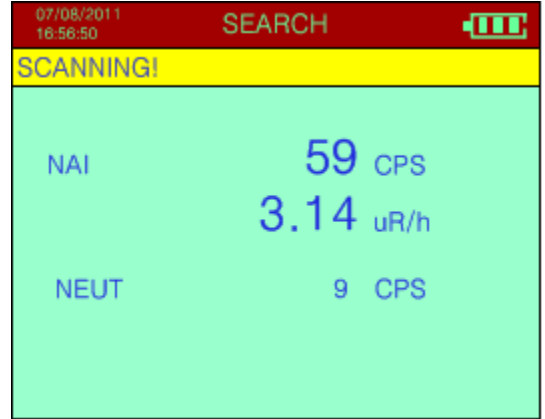
If the Syclone requires stabilization, this screen will be displayed.

Pressing **Enter** will open the **STABILIZE** Screen.



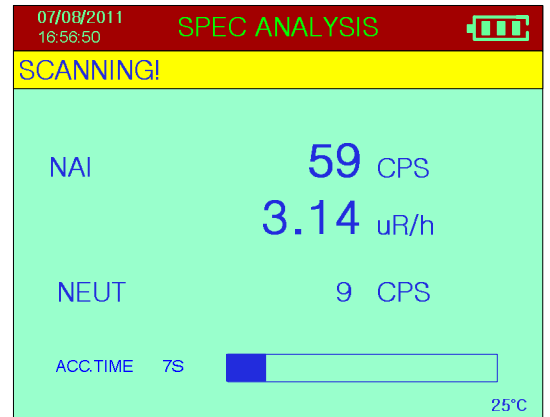
4.2 SYSTEM USE – SIMPLIFIED MODE

This Syclone automatically begins the **SEARCH** function, scanning for radioactive material(s). (see Figure)

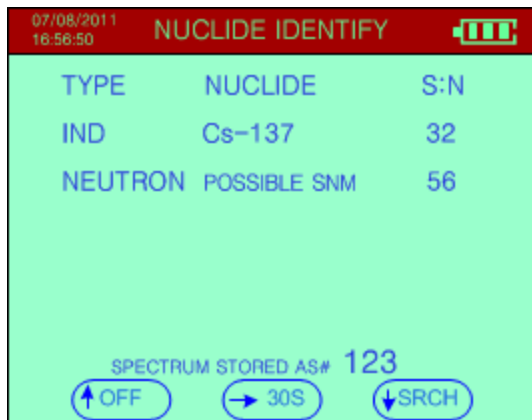


If the Stab Mode is set to OFF, the screen on the left will be shown.

When the unit **FINDS** a source it automatically switches to the **SPECTRUM ANALYSIS** function, and the display shows Sample Time (see Figure below). The audio will beep and the unit will vibrate. Right clicking the joystick will disable the audio and vibration to save the battery power.



After the sample time is complete the system automatically analyses the data to determine the isotope of the source material(s). The **NUCLIDE IDENTIFY** screen opens automatically, showing the result.



At this point the User can resume the Search function by pressing the joystick in the correct direction (see below). See [Section 2.1](#) for Joystick details.

- ➔ **30S** – initiates an additional 30 second count that adds to the current spectrum and at the end of the period gives a combined analysis
- ⬆ **OFF** – approx. 4 secs then unit powers OFF
- ⬇ **SRCH** – initiates a new SEARCH

Left click toggles between S:N and H.L(half life).

Note: Samples are saved to the Syclone memory each time a source is found, to be later uploaded to a PC using the USB cable provided or Bluetooth (optional).



5.0 MANUAL MODE

This Manual is arranged in the same order as the Main Menu as follows:

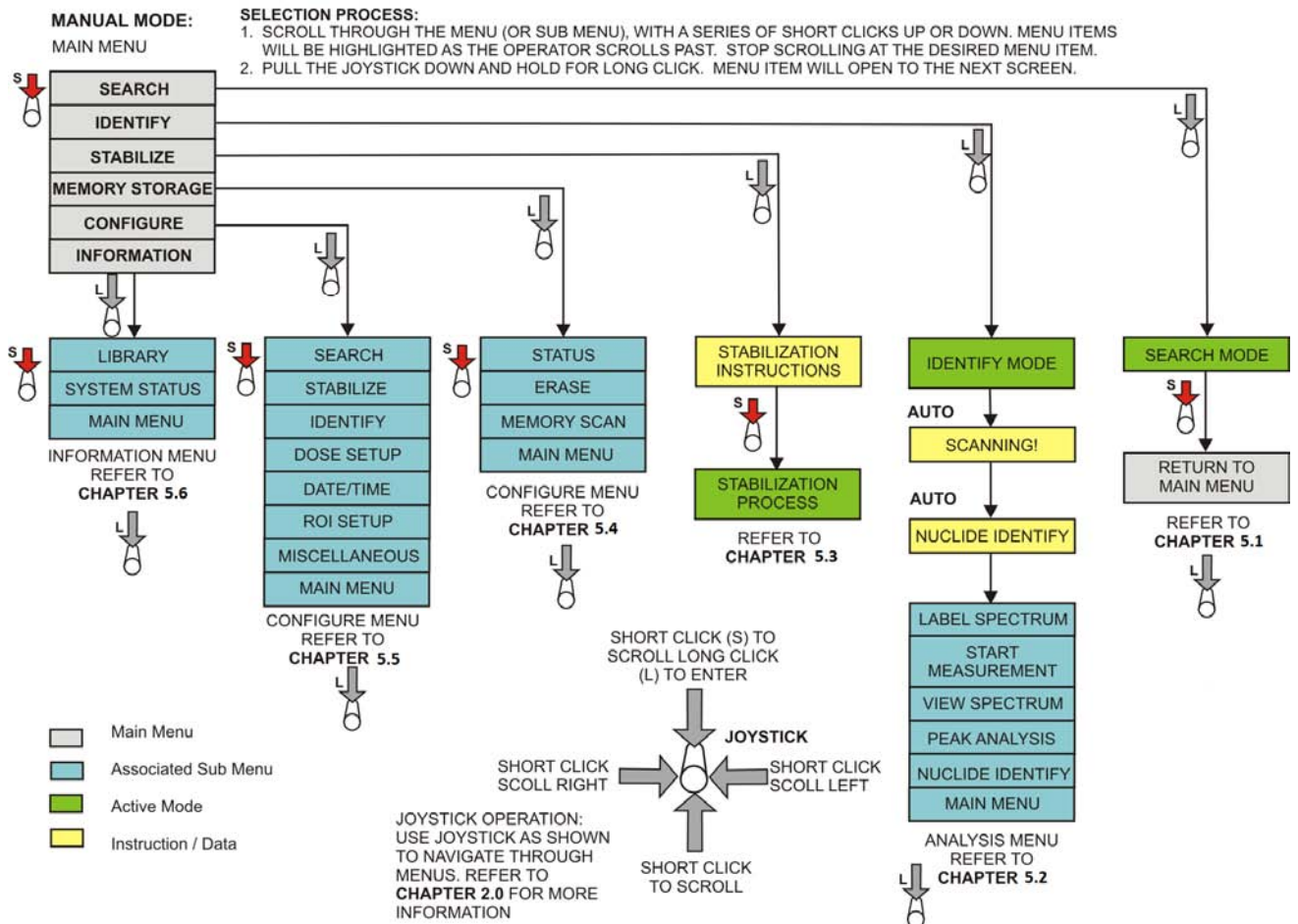
- [Chapter 5.1](#) – SEARCH
- [Chapter 5.2](#) – IDENTIFY
- [Chapter 5.3](#) – STABILIZE
- [Chapter 5.4](#) – MEMORY STORAGE
- [Chapter 5.5](#) – CONFIGURE
- [Chapter 5.6](#) – INFORMATION

Operation of the Joystick, detailing all of its functions is described in [Chapter 2.0, Section 2.1](#).

The figure Syclone Menus and Screens illustrates all of the active modes (Syclone set to Manual Mode), routines and sub-menus associated with the Main Menu. The operator navigates through the menus and sub-menus using short clicks down (joystick is pushed towards the operator) or up (joystick is pushed away from the operator) to scroll through the main menu or sub-menus, individual menu items will highlight as the joystick is pushed. When the desired menu item is highlighted the operator may select this by using a long click, which will open the menu item to an active screen, a selection screen (instructions) or a sub-menu.

Note: A short click  is when the joystick is pushed and released (the joystick will automatically return to the center). A long click  is when the joystick is pushed and held in place until an action occurs on the screen and then released (the joystick will automatically center when released).

SYCLONE - MENUS AND SCREENS

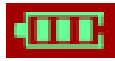


5.1 SEARCH

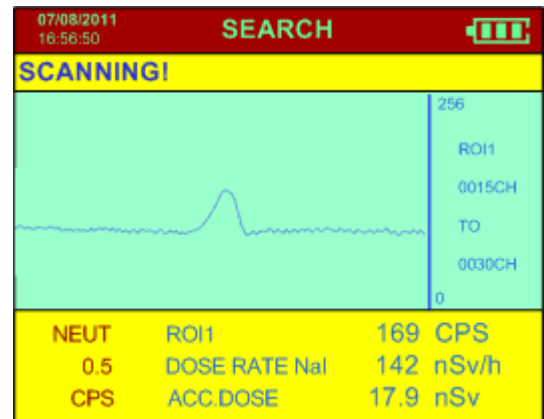
SEARCH MODE:

Select the menu item then **ENTER** to activate – Figure as displayed.

SEARCH - Shows that the system is in the SEARCH mode.



- battery icon displaying battery status.



Note: The information shown below documents examples taken from the figure above. The Syclone has threshold settings for Dose Rate, Counts per Second (CPS), and Neutrons. “CPS Threshold” by default is OFF, in accordance with parameters (see [Appendix C](#)).

NEUT – shows that measurement is for Neutrons. The example shows 0.5 CPS (Counts per Second of neutrons detected).

ROI 1 – This is the Region of Interest (1) collected by the sodium iodide (NaI) detector.

169 CPS – this is the gamma radiation level in cps (counts per second) in the selected ROI, which is ROI1 in this case. This level will always show some counts even if no apparent radioactive material is present as this is the local radiation background of an area. Typically in low background areas, 50-100cps is common. Resettable **CPS radiation alarm** thresholds are: OFF, 100, 200, 250, 300, 350, 400, 450, 500, 600, 700, 1K, 2K, 5K, 9Kcps.

DOSE RATE NaI – the numeric data shows the Dose Rate data in the selected units. The numeric data shown above (**169cps** in the figure) is an essential tool to locate radioactive material but the **DOSE** data gives the user an idea of the potential hazard level of such material. Resettable **Dose Rate radiation alarm** thresholds are: OFF, 10, 20, 50, 100, 200, 500, 1000, 2000, 4000, 5000, 9000 μ R/h (linked to units).

142 nSv/h – this is the current dose rate.

CHART DISPLAY – this is a chart recorder display of the radiation data. The bottom of the chart is **ZERO cps** and the top of the scale (depends upon the scale setting). The display moves from left to right so the **LEFT** hand data is the current data. The chart shows the last 256 samples and is a very useful “view back” at the data making it very easy to see any significant radiation increases. Note that the numeric **cps** data is not energy dependent so very small changes of any type of radioactive material emitting gamma rays can be easily seen. This shows the region of interest (ROI 1) is sampled between channels 0015CH to 0030CH.

ACC.DOSE - this shows the accumulated dose in nSv

5.1.1 HIGH DOSE

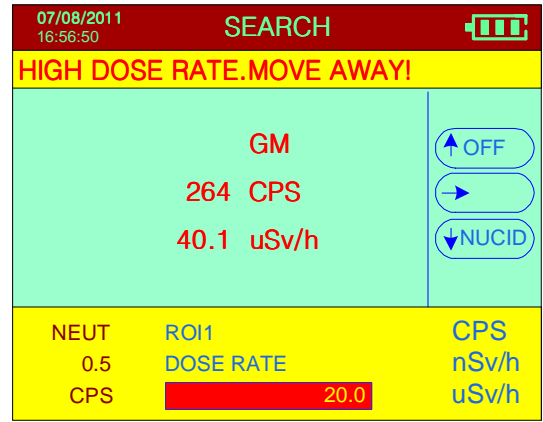
The system has a preset maximum Dose Rate level – normally set at **10 μ Sv/h (1000 μ R/h)**. Below this level Dose Rates are considered acceptable for system operation. However above this level it is recommended that users move away from the source of radiation to reduce the high Dose Rate to an acceptable level. To make things simple, the **Syclone** advises the users automatically if the Dose Rate goes above the preset limit, “**HIGH DOSE RATE. MOVE AWAY!**”

If the level is exceeded a **distinctive** audio warning tone occurs and the display changes.

As noted the user should back away until the Dose Rate level falls below this limit and the display warning goes away.

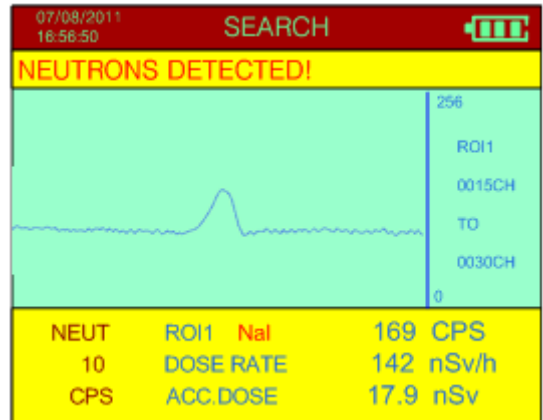
Users should be reminded that short-term operation close to the limit has a negligible hazard level but prolonged operation significantly above this level is not recommended.

If the dose rate exceeds 40µSv/h, the unit automatically switches the dose rate measurement from NaI crystal to GM tube.



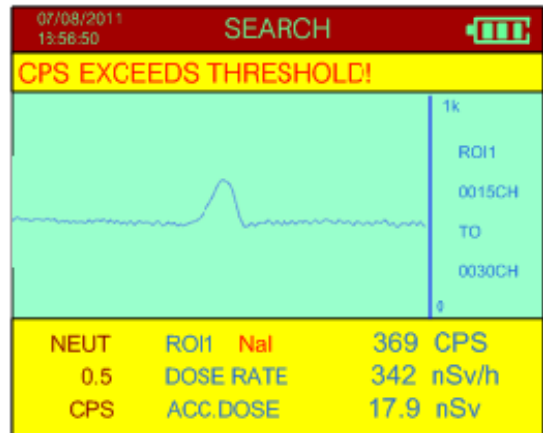
5.1.2 NEUTRON ALARM

If the integrated Neutron detector detects neutrons above the preset alarm threshold then a Neutron Alarm is declared (**NEUTRONS DETECTED!**). A distinctive audio warning tone occurs and the display shows neutron warning (see Figure).



5.1.3 SEARCH ALARM

If the **ALARM LEVEL** parameter (for settings see [Section 5.5.1](#) (e)) is set to a preset value and the radiation field exceeds this value, a distinct audio beep will be heard. As the user moves away from the source, the audio stops and the display changes back to SCANNING.



5.1.4 SEARCH - AUDIO

In the SEARCH mode, the radiation data from the high-sensitivity Sodium-Iodide (NaI) detector is used to create an audio search capability thus permitting the user to have an “**eyes-free**” operational mode. It is very difficult to scan a vehicle and inspect the display continuously.

EYES FREE Audio Warning System:

When radioactivity is detected, the Syclone emits an audio tone that gets louder and rises in pitch the closer it gets to the source. The “**eyes free**” operation permits the user to scan a vehicle without inspecting the display continuously.

The SYCLONE scans the incoming data at a **5 TIMES per SECOND** – and converts the radiation field into a mode that changes the frequency of the audio tone to reflect the radiation field intensity. Various parameters are used (see [Chapter 5.5.1](#) for details) to adjust system performance to suit the user. In the presence of a real radioactive field the audio frequency changes rapidly. With this feature it is very easy to scan back and forwards to readily locate the highest audio pitch that is the maximum radiation intensity.

5.1.5 SEARCH MODE - DATA RECORDING

The data displayed during the SEARCH mode can be recorded in memory. Recording to memory is implemented by menu selection in the **CONFIGURE - SEARCH** menu ([Section 5.5.1](#)). When the “DATA TRANSFER” parameter is set to “MEM” and the SEARCH mode is started, the data is logged into memory at the selected Sample Rate. The message **SEARCH→ MEM** will be displayed at the top of the screen during the SEARCH to indicate that the data is being saved to memory.

Data recording is terminated when the memory is full or the mode is stopped (**ENTER**). Every time the SEARCH mode is stopped then started again, a new header is written so the data can be retrieved later with the appropriate time information. Remember that all SEARCH data will be loaded into memory until the data recording option is disabled in **SETUP** mode.

The data memory can record approximately 100k Sample and 498 Spectra readings at the selected data rate.

Once the Syclone memory is full, the message (DOSE MEMORY IS FULL) will be displayed at the top of the screen **DOSE MEMORY IS FULL!**.

The user should be aware that after activating each new SEARCH Mode, a header is stored in memory. Therefore, if a large number of separate SEARCH samples are stored in memory, slightly less memory is available for samples than if the SEARCH was taken in one complete set.

When the internal **DATA MEMORY** is full, as described above, users should return to MAIN MENU (**ENTER**) and transfer the data to an external PC.

5.2 IDENTIFY

This mode enables detailed spectral analysis and permits spectrum display, peak identification and nuclide identification. The user should observe some simple operating procedures to get best results from the instrument.

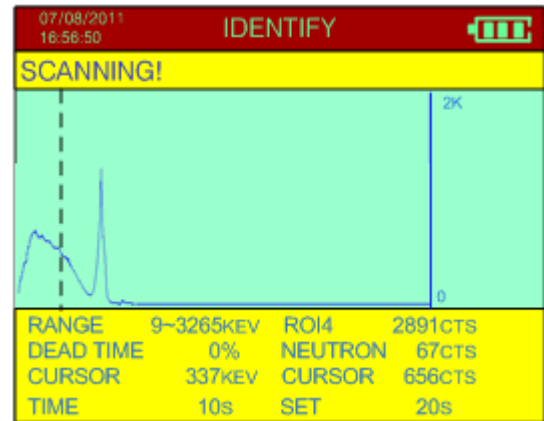
- a) Search and locate a source of radiation in the **SEARCH** mode.
- b) If a source of radiation is found, then use the **SEARCH** mode to estimate its approx. geographic boundaries (by observing the count-rate or audio)
- c) Position the detector facing the approximate center of the area of radiation
- d) Move the unit away (or toward) the source (in the SEARCH mode) until the count rate is between **2000 and 5000 counts/sec** for best results
- e) Highlight **IDENTIFY** in the **Main Menu** and press **ENTER** to select it.
- f) The Syclone immediately begins to acquire a spectrum with the display appearing as shown.
- g) At the termination of the sample the data will be analyzed for radioactive material and the display will show the results
- h) See below for full details

Note: [Section 5.2.1](#) covers instrument behavior if **IDENTIFY** is started from the **MAIN MENU**. [Section 5.2.2](#) covers the **ANALYSIS** Mode of operation.

5.2.1 IDENTIFY DISPLAY

Once the location of the source is detected the user can attempt to identify the type of source by switching to the IDENTIFY function. The IDENTIFY function is activated by pressing **ENTER**, displaying a new screen:

Note: To obtain good results, position the Syclone at the highest point of radioactivity found by the SEARCH function. Keep the Syclone as stable as possible during sampling to get a good result.



IDENTIFY display (Information Line):

SCANNING! – the function currently activated.

Alternative displays in information line are:

MOVE CLOSER – means that the signal is very weak so **if possible** the user should move the unit **closer** to the suspect source of radiation. In many cases this is impossible so no action need be taken, but if possible move the unit closer until the display shows **OK**.

MOVE CLOSER!

MOVE AWAY – means that the signal is stronger than is necessary to take a proper sample. Correct action is to back away until the display shows **SCANNING!**.

MOVE AWAY!

Labels are:

RANGE – **9-3265keV** shows that the full 3MeV spectrum is displayed.

DEAD TIME - shows the Sodium-Iodide dead time as a %.

CURSOR – the cursor position data is displayed in keV.

TIME – shows sample progress (10 secs currently).

ROI 4 – This is the Region of Interest (4) collected by the sodium iodide (NaI) detector. The current cursor position is in ROI 4.

NEUTRON – Shows that measurement is for Neutrons. The example shows 67 counts (Counts of neutrons detected).

CURSOR – the cursor position data is displayed in counts.

SET – shows the preset sample time of 20 seconds.

5.2.2 ANALYSIS DISPLAY

When the sample time terminates, the Nuclide Identification function is automatically activated, displaying the Nuclide Identify Page.

This display shows any Nuclides that have been identified in 3 columns:

TYPE – the Nuclides in the library are divided into 4 categories **IND**ustrial, **SNM** (Special Nuclear Materials), **MED**ical and **NOR**(M). See [Appendix C](#) for a list of isotopes and types.

NUCLIDE – the full name of the nuclide (isotope) (see [Appendix C](#)).

S:N – the relative size of the peaks of the isotope in SD units.

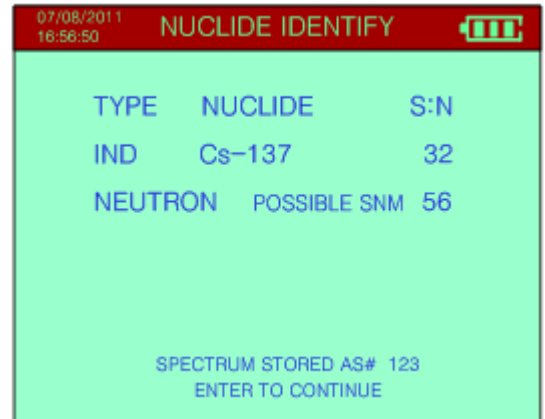
(Standard Deviation units – this gives a good idea of the significance of the peak). For isotopes with multiple peaks the individual peaks SDs are summed.

Left click toggles between S:N and H.L(Isotope half life).

Note: This relatively simplified display is intended to offer quick user analysis capability. For more expert users see the further functions below.

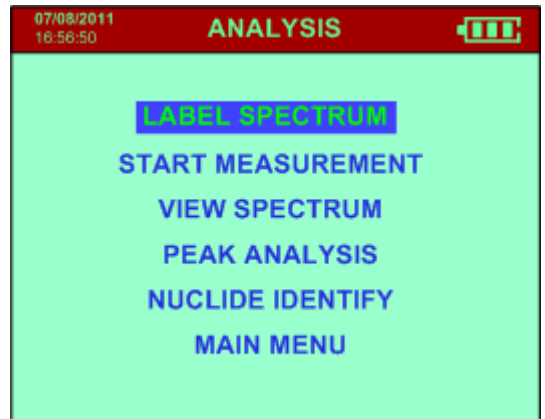
ENTER – pressing ENTER goes to the ANALYSIS menu for further functions.

SPECTRUM STORED AS #(x) - every time an IDENTIFY analysis takes place the radiation data (spectrum) from this analysis is stored in memory where it can be accessed with special software for subsequent analysis as required. **“Spectrum stored as #(x)”** is shown at the lower part of the screen (where x is a sequential number) to advise the user that the spectra is being saved in memory as SPECTRUM #(x) for future retrieval. This number (x) can be anywhere from 1 to 498 and serves to uniquely identify the data in system memory for use during data retrieval and analysis. It is important to keep accurate records of the spectra origin to link the spectra to a particular source or event. (also see [Section 5.2.3.1](#) – Label Spectrum).



5.2.3 ANALYSIS MENU

When Nuclide Identification is complete, pressing ENTER goes to the main ANALYSIS menu where further functions can be selected.



5.2.3.1 LABEL SPECTRUM

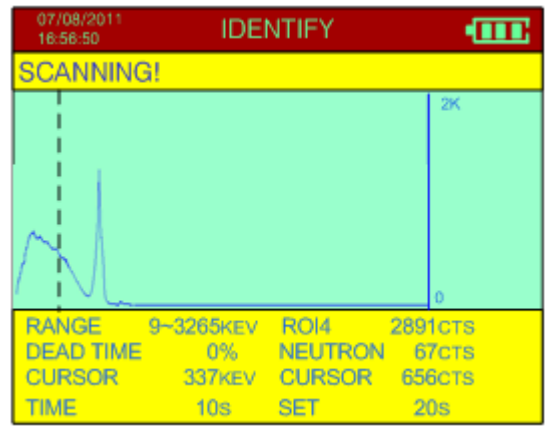
The Spectrum is stored automatically, assigning it a unique Sample Number and tagging it with the date and time of measurement for easy identification. All data recorded in memory can be downloaded to an external computer.

Each spectrum can be labeled by using the keys supplied with the LABEL SPECTRUM page.



5.2.3.2 START MEASUREMENT

This option allows the user to take another spectrum sample without having to go back to the Main Menu and selecting **IDENTIFY** again. If this option is selected the IDENTIFY sampling screen (as shown in [Section 5.2.1](#)) is displayed and data accumulation begins again. As the sample progresses the display is updated at a 1/sec rate as shown until the preset sample time is reached.



Labels are: (See [Section 5.2.1](#) for details)

The sample accumulates until the preset sample time is reached but the user can stop the sample at any time by pressing **ENTER**. When the sample is complete it automatically activates the NUCLIDE IDENT mode and the display results as shown are seen.

5.2.3.3 VIEW SPECTRUM

This display shows the spectrum of the last sample analyzed (**SP#123**). The figure shows a typical display. Data is defined as described in [Section 5.2.1](#). The only difference(s) are:

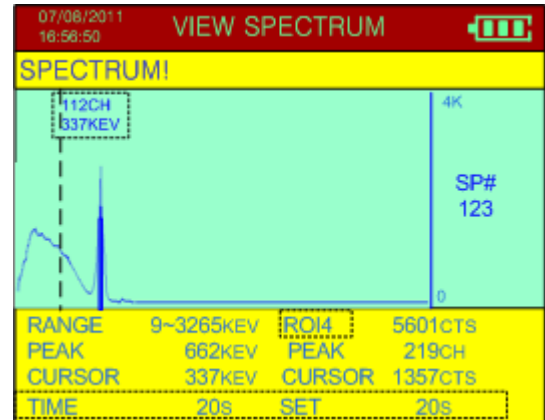
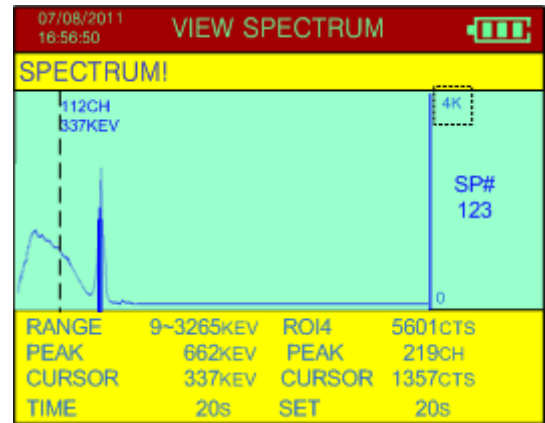
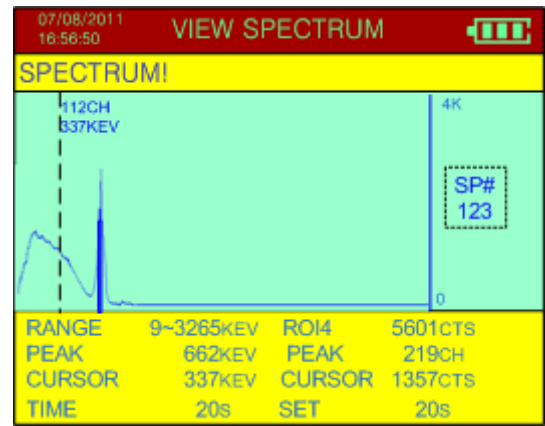
TIME/SET - show the sample preset time period – the fact they are the same means the sample terminated at its' full count.

PEAK ENERGY/CH - show the energy and channel for the peak that the cursor just passed.

ZOOM and SCROLL Functions - In many cases the user wants to inspect the spectrum in greater detail so a zoom and scroll feature is available.

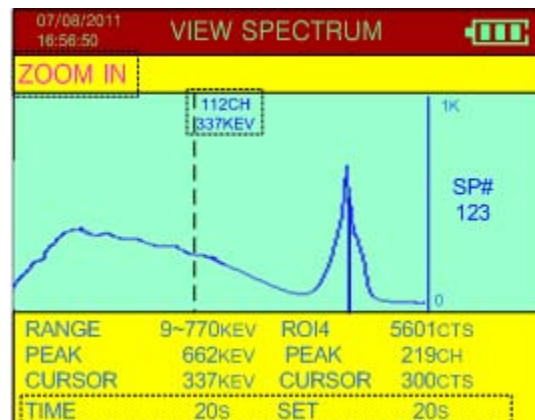
ZOOM Feature – Use short joystick clicks up or down to increase or decrease the scale for the sampled spectrum (the sample figure shows 4K). See [Appendix C](#) for the complete listing of the Graph Scale. The scale will be from LOG, 64cps to 4G in increments of 2X. Clicking up will make the graph larger and clicking down will make the graph smaller.

Scroll Feature – Use short clicks left, or right to scroll thru the sampled spectrum. Holding the joystick left or right will move the cursor



quickly. The cursor will move in the direction of the joystick click. The cursor position as per the sample figure shows the cursor energy (KEV), cursor CH, cursor CTS, cursor position (CH) for the current ROI. Moving the cursor will show the regions of interest as per the setup parameters. The ROI settings are shown in [Appendix C](#).

ZOOM IN – Use a long joystick click down to show the ZOOM IN Screen. The Zoom In screen shows a quarter of the whole spectrum on the display at one time. Use the scroll feature to move the spectrum left or right. The cursor stays centered as the spectrum moves, showing the channel, CTS and energy as the spectrum passes the cursor. When the spectrum reaches the end (the fourth quarter) the cursor will move across the remainder of the sampled spectrum.



5.2.3.4 PEAK ANALYSIS

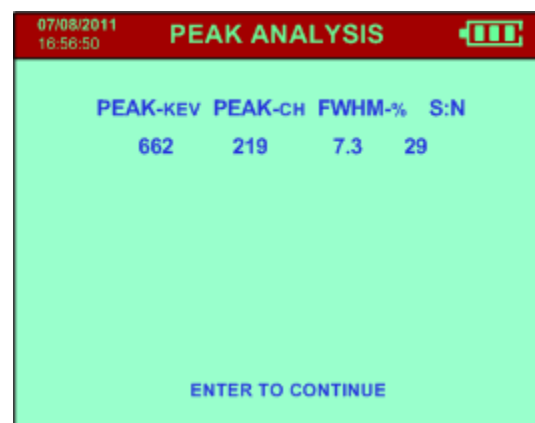
Selecting the PEAK ANALYSIS mode, results in an automatic analysis of the last recorded spectrum to identify peaks. The results are displayed in ascending order, sorted by energy level. Data labels:

PEAK - two data are shown, the peak position in keV (**662**) and channels (**219**)

FWHM - Full Width Half Maximum - The computed FWHM of the located peaks in % gives an idea of the quality of the peak (**7.3**).

S:N - The amplitude of the peak in SD units (**29**).

ENTER TO CONTINUE – Returns the user to the **ANALYSIS** Menu.



5.2.3.5 NUCLIDE IDENTIFY

Nuclide Identification is performed as a result of the IDENTIFY Mode. Analysis of the selected spectrum is carried out.

The TYPE and NUCLIDE is shown

IND – is the isotope label of the identified isotope

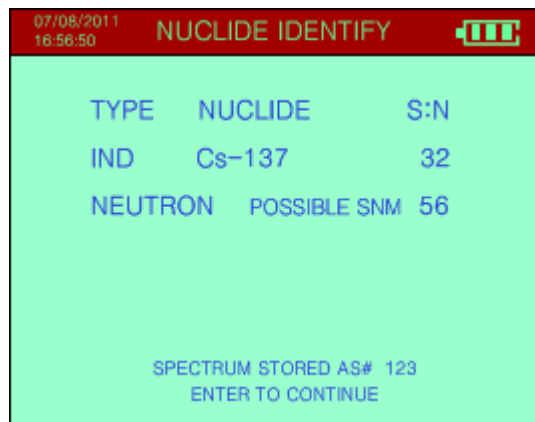
Cesium-137 – isotope.

32 – this is the relative amplitude of the isotope in Standard- Deviation units. In the case of an isotope with multiple peaks this is the sum of all the relevant peaks.

Neutron – Neutron Isotopes have been found.

56 – Accumulated Neutron counts

ENTER TO CONTINUE – selection opens the **ANALYSIS** Menu with **NUCLIDE IDENT** selected.



5.2.3.5.1 NUCLIDE LIST

If this mode is activated then a new Nuclide Identification analysis of the selected spectrum is carried out. The display shows the **NUCLIDE LIST** screen as displayed. Note that this display is a more complex version of the previous NUCLIDE IDENT display as this secondary display is intended to show a higher level of detail for further user analysis.

Th-232 – is the isotope label of the identified isotope

10 – this is the relative amplitude of the isotope in Standard- Deviation units. In the case of an isotope with multiple peaks this is the sum of all the relevant peaks.

SHIELDED – The Syclone has a wide selection of radioactive isotopes in its internal library. If after analysis, the isotope or the residual signal/ gamma peak cannot be identified, the screen displays “**UNKNOWN SOURCE**”, “**SHIELDED SOURCE**” or “**BACKGROUND**” message.

HIGHLIGHTING – when the display appears, the first isotope is highlighted. The joystick can be used to move up/down the displayed list to highlight a required item.

NEUTRON – Neutron Isotopes have been found.

RETURN – pressing **RETURN** goes to the Main Identify Menu.



5.2.3.5.2 NUCLIDE DETAILS

When the highlighted isotope is selected by cursor, then **ENTER** is pressed, the details of that isotope selection are displayed – see the Figure. This display shows all the peaks related to the isotope and various data about them:

Th-232 – is the isotope identified then selected.

2/5 – relates to the isotope identification requirements, in this case 2 peaks are found (345kev and 583kev).

345 – the peak in keV.

114 – the peak in CH

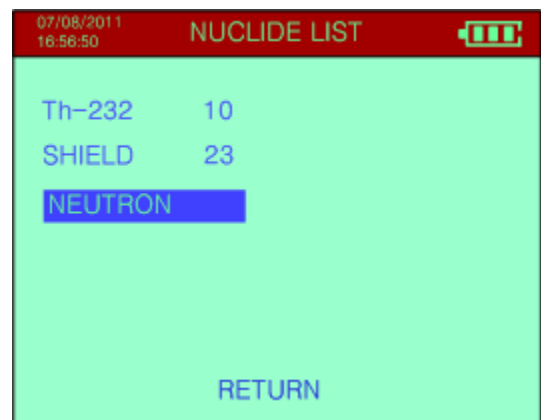
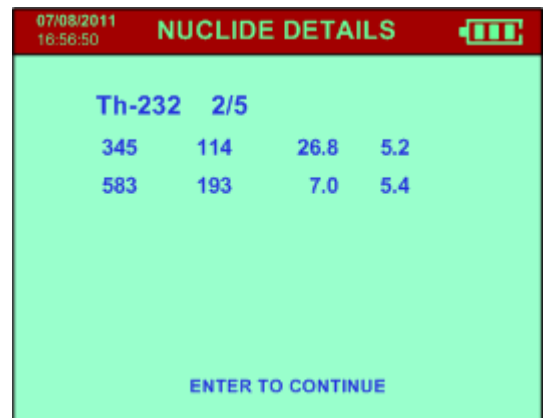
26.8 – the FWHM of the peak, a useful measure of peak quality

5.2 – the amplitude of the peak in SD units

ENTER TO CONTINUE - returns to the IDENTIFY screen

NEUTRONS

If the integrated NEUTRON sensor detects the presence of Neutrons, this data is displayed as COUNTS (shown in the following figures).





In **CONFIGURE** (see [Chapter 5.5.3.3](#)) special parameters are used to optimize Neutron performance.

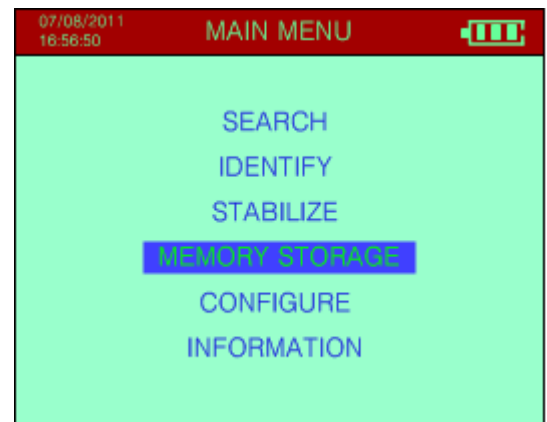
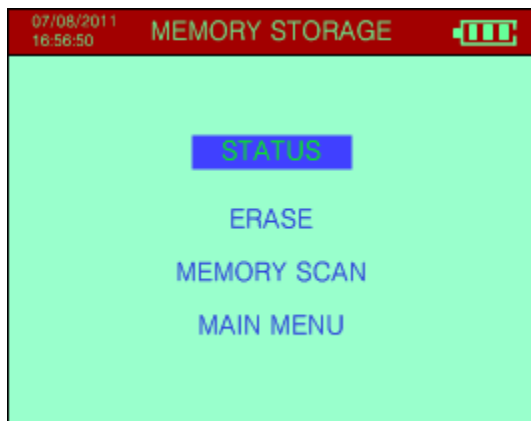
MAIN MENU Exits back to the Main Menu.

5.3 STABILIZE

For details regarding stabilization, see [Chapter 2.5](#).

5.4 MEMORY STORAGE

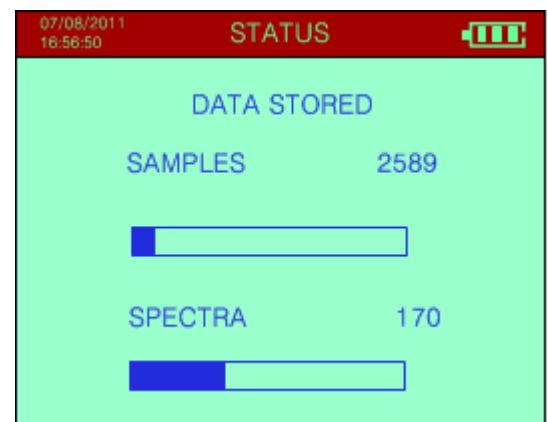
If Data Memory is selected a new menu appears:



5.4.1 STATUS

Selecting STATUS shows the current state of the data memory. The SYCLONE can store data from the 2 operational modes (SEARCH and IDENTIFY) in different formats. Each set of data is tagged with a special header that identifies the type of data.

The SEARCH data is classified as **SAMPLES** (there is room for 100k samples) and IDENTIFY data is classified as **SPECTRA** (there is room for



498 spectra).

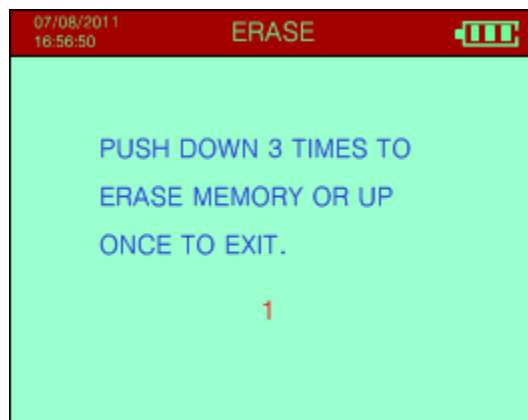
STORAGE – The bar graphs show how much of the storage space is available.

5.4.2 ERASE

WARNING: Users Are Warned That Erased Data Cannot Be Recovered!

Selecting this function produces a new display. The display shows:

Pressing the button down three times erases the data memory completely or up once to EXIT. The third time the button is pressed, the word PLEASE WAIT . . . should appear at the bottom of the display.



5.4.3 MEM SCAN

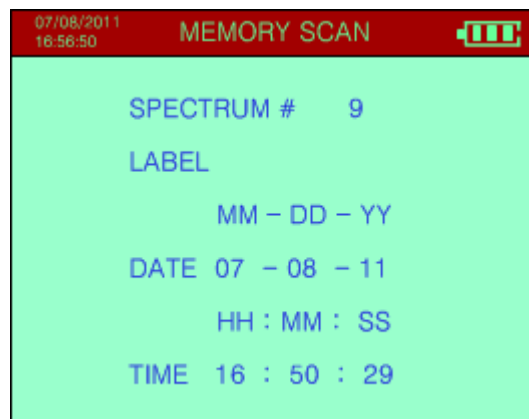
This selection lets the user inspect and re-analyze spectra previously stored in memory. If this option is selected, the most recent spectrum in memory summary is displayed.

For example:

Note the DATE is in: MM – DD – YY or YY – MM – DD format depends on the setting.

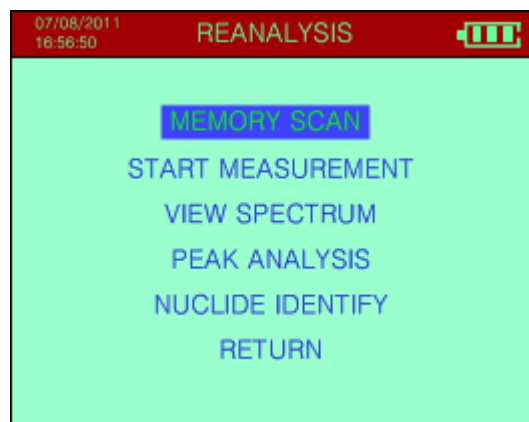
TIME is in: HH : MM : SS

The user must **CLICK LEFT/RIGHT** to select the required spectrum. The spectrum number is the same one used as a label during the spectrum store. The Date/Time of the recorded spectrum is also provided for reference.



Once a spectrum is selected then **ENTER** activates this feature and the **MEM SCAN** menu appears. The user may select PEAK ANALYSIS etc. as required.

The features and displayed data are almost the same as in the IDENTIFY features described in [Chapter 5.2.3](#) for the items listed in the **REANALYSIS** sub-menu.





If no data is available the screen will show MEMORY IS EMPTY.

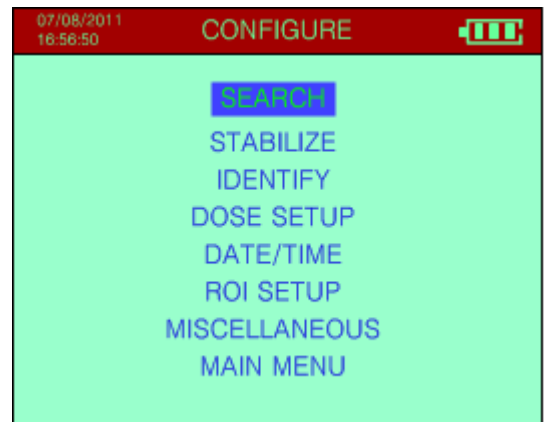
5.5 CONFIGURE

The **Configure Menu** permits a qualified technician to setup the required operating parameters. If this item is selected from the MAIN MENU this display is seen.

Use the cursor UP/DOWN to select (highlight) the required selection, then press **ENTER** to activate the selection.

Inside each menu use UP/DOWN cursor action to select a parameter then LEFT/RIGHT cursor action to change the item.

ENTER to exit and accept the changes.

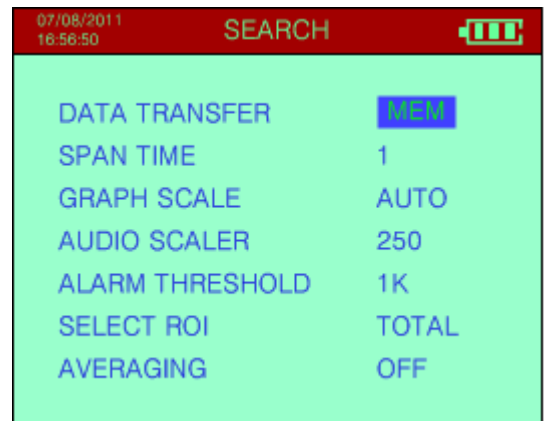


Note: For all the selections below, the normal default selection is shown in large bold print.

5.5.1 SEARCH

Selections are (see Figure):

- a) **DATA TRANSFER** - Options - **OFF**, MEM or PC
 - OFF** – the data is shown on the display but is not recorded into data memory - this is the default operating mode.
 - MEM** – the SEARCH data is to be stored in the Syclone’s internal memory
 - PC** – the data is transferred to the PC.



- b) **SPAN TIME** – this indicates the interval at which SEARCH samples are taken.

Selections are: **1**, 2, 3, 4, 5, 6, 7, 8, 9, 10, 20, 30, 40, 50 or 60 seconds.

Under most conditions, a 5 second sample gives reasonable accuracy however, a 1

second selection is advisable if the unit is being used in a continuous search mode and numeric data is required.

Note: The Audio response is NOT affected by this time selection as it is updated at a fixed 5 times/second rate.

c) **GRAPH SCALE**

This sets the maximum vertical chart scale in counts for the “chart recorder” display. Selections are **64cps, 128, 256, 512, 1K, 2K, 4K, 8K, 16K, 32K, 64K, 128K, 256K, 512K, 1M, 2M, 4M, 8M, 16M, 32M, 64M, 128M, 256M, 512M, 1G, 2G, 4Gcps and AUTO.**

Some users prefer to have a fixed display so they can judge relative changes in the data while “chart recording”. They can select the desired range from the above selections.

Note: If a fixed full scale value is set and exceeded the display will saturate at the top. Thus if you set 1K (1000cps) then the chart display will have 0 at the bottom and 1000cps at the top. As long as the radiation field stays BELOW 1000cps then the display is normal.

If the radiation field goes above 1000cps then it will reach the upper limit and stay there until the radiation comes below 1000cps. The numeric data on the display are unaffected by these limits.

The **AUTO** mode automatically changes the vertical scaling to optimize the “chart recorder” screen display. For example, if the current chart scale is 500 counts and the radiation level is exceeded, the vertical scale changes to the next highest value (in this case to 1K or 1000 counts). If the number of counts exceeds 4G cps, the chart record scale will remain at 4G.

If the radiation level decreases, the vertical scale will remain its current level (say 2K) until the “peak” that caused the scale change disappears from the “chart record” (256 samples of data are displayed at one time).

The vertical scale changes back according to the 50% rule - that is, the scale decreases such that the highest value appearing in the chart record is 50% of the maximum vertical scale. In the above example, the radiation level may drop to 900 counts, at which time the vertical scale returns to 1K.

d) **AUDIO SCALER** - determines the mode of operation of the Audio meter system

Options are **OFF, AUTO, 50, 100, 150, 200, 250cps**

AUTO: In this mode, the variable radiation level digital data displayed on the screen will also give a variable tone audio that directly follows the radiation level. Thus a sudden increase in radiation level will give a corresponding increase in audio pitch. This is a very important feature of the **SEARCH** mode as it permits a very sensitive “eyes free” search tool. The data is sampled at a 200ms rate with an optimized filter to give a quick audio response as radiation increases.

If this mode is selected, then when the **SEARCH** mode is started - the first 3 samples are averaged and a 2 Standard Deviations Audio Alarm Threshold set above this average value. This stays as the permanent Audio Threshold until the mode is de-selected and re-started. This method is suitable for most applications as it automatically averages Background levels to define a reasonable threshold above background.

50..250: These selections permit a fixed count rate audio threshold to be selected rather than the automatic selection as above. Once this threshold is exceeded then the audio gives a variable tone following the variable radiation level.

OFF: This selection switches the audio meter OFF to disable the audio search mode.

- e) **ALARM THRESHOLD:** selections are **OFF, 100, 200,250, 300, 350, 400, 450, 500, 600, 700, 1K, 2K, 5K, 9Kcps**

This selects a specified ALARM THRESHOLD LEVEL. When this threshold is exceeded a special audio warning tone is heard.

- f) **SELECT ROI:** selections are **TOTAL, ROI1, ROI2, ROI3, ROI4**

This selects the data used in the **SEARCH** mode. If **TOTAL** is selected then the display will show TOTAL and the full spectrum data is used – everything above the lower threshold of 20keV.

Any of the Region of Interest (ROI) selections utilize data ONLY FROM THE CHOSEN ROI for the SEARCH mode. Settings for the ROIs are explained in [Section 5.5.6](#). Thus with ROI1 at its default setting for Americium-241 – then if ROI1 is selected then only the Americium data will be used for the **SEARCH** scan.

Note: Users are advised that, in most cases, using the **TOTAL** selection is recommended as this selection gives you the highest count-rate and covers the whole energy range of the system.

- g) **AVERAGING:** selections are **OFF, 3P, 5P, 10P**

This selection permits data filtering. 3P = 3 point filtering – really a 3 point moving average. So at a 1 second base sample rate the data will be displayed at a 3 second average updated at a 1/sec rate. This makes the data chart display smoother and easier to read but users are cautioned that averaging also reduces small peak amplitudes so if the instrument is rapidly moved then small peaks may be missed.

OFF – raw data only, no data averaging

3P = 3 point averaging

5P = 5 point averaging

10P = 10 point averaging

5.5.2 STABILIZE

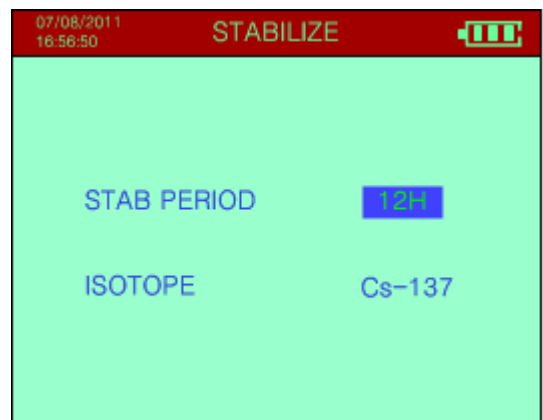
STAB PERIOD

Selections are OFF, 12H, **24H**, AUTO

This parameter is used to advise users when system re-stabilization is required.

OFF - The OFF parameter means that NO WARNINGS are given to the user of when a recommended stabilization is required. Users are advised that although the temperature correction is quite accurate under some special conditions the accuracy of the correction may be inadequate. The rule of thumb is that if during operation you get a “**UNKNOWN SOURCE**”, “**SHIELDED SOURCE**” or “**BACKGROUND**” message then this it is possibly because the gain correction is a little off.

In this case users are advised to stabilize the system and then repeat the measurement. If the same message(s) is received again then this truly is an isotope



whose characteristics are not listed in the system library.

12H, 24H – if either of these parameters is selected, it means that either 12 hours (12H) or 24 hours (24H) after starting the Syclone – a message will appear on the Syclone display requiring system stabilization. The default setting is 24 hours as this is a reasonable time for system operation without the super accurate requirement of stabilization.

AUTO – is an option allowing the User to avoid frequent Cs-137 source stabilization, for the NaI detector temperature interval between 5°C to 50°C. This option is only available if detector temperature is within 5-50 °C. If Auto is selected when the unit is outside this temperature range, the following screen will be displayed.



ISOTOPE – Cs-137 is the default radioactive isotope used for stabilization.

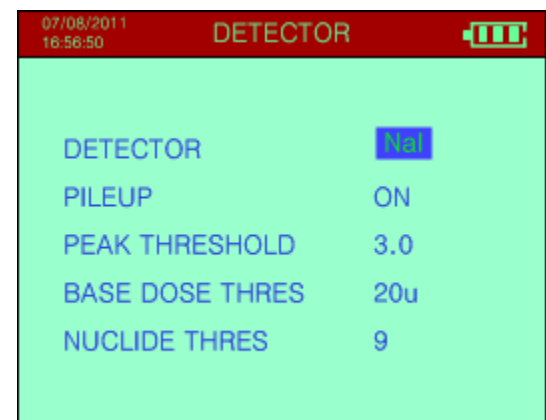
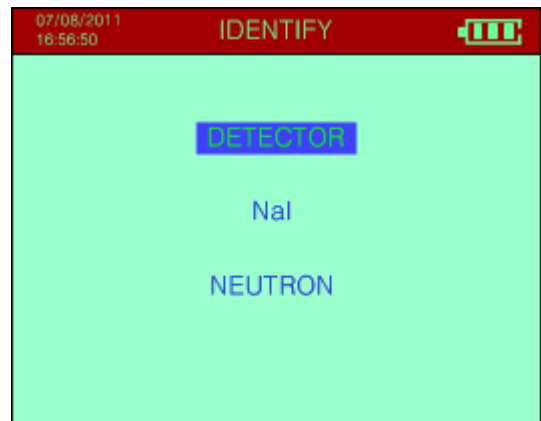
5.5.3 IDENTIFY

There are 3 sub-sections – **DETECTOR**, **NAI**, **NEUTRON**. If the unit doesn't have neutron detector, the third option **NEUTRON** will not appear.

5.5.3.1 DETECTOR

- DETECTOR** – this selects the detector type used in the **IDENTIFY** mode, the current selection is **NaI** – and selects only the Sodium-Iodide (NaI) detector.
- PILEUP** – This sets the Pile-up rejecter **ON** or **OFF**

The Pile-up rejecter only applies to the NaI detector, so this parameter controls only the NaI data collection. For the NaI detector this item automatically detects if 2 pulses are impacting the detector simultaneously. Normally such pulses would combine to produce an incorrect energy pulse. The Pile-up rejecter automatically rejects BOTH pulses and changes the Dead-Time counter to compensate. The OFF selection permits



system testing for special applications.

- c) **PEAK THRESHOLD** – Selections are 2.0, 2.5, **3.0**, 3.5, 4.0, 4.5, 5.0 (SD units)

This parameter is essentially a “sensitivity” setting for Nuclide Identification.

During Nuclide Identification, a spectrum is taken then a Peak Analysis engine is used to select significant peaks. This engine suppresses backscatter peaks etc and other spurious peaks during its action and then defines a list of all peaks found. For each peak the error on that peak is computed and the amplitude of the peak is determined in Standard-Deviation (SD) units.

The **PEAK THRESHOLD** setting is then used to remove low amplitude peaks. So if 3.0 is selected (the default value) then any peak 2.9 SDs or below is eliminated before the peak list is used for Nuclide Identification.

This parameter is useful in some applications where low amplitude peaks need to be excluded for special application. However if this value is set too low then some spurious peaks may occur so the default setting of 3.0 usually gives the best results.

- d) **BASE DOSE THRESHOLD** – Selections are 10, 15, **20**, 30, 40, 50 ($\mu\text{R/h}$ units)

This “NaI Dose Limit” normally set at $20\mu\text{R/h}$ (200nSv/h) is used to show that the radiation level is clearly above the background level indicating some source is present and is used as explained below.

After NUCLIDE IDENT, if NO PEAKS are found or a peak is found that is not in the library and the Dose Rate is **BELOW** the NaI DOSE LIMIT setting the following messages displays:

UNKNOWN SOURCE – (and Shielded Source) The Syclone has a wide selection of radioactive isotopes in its internal library. If after analysis, the isotope or the residual signal/ gamma peak cannot be identified, and the **Dose Rate \leq Base Dose Threshold** the screen displays “**UNKNOWN SOURCE**”.

If the analysis results are such that the **Dose Rate \leq Base Dose Threshold** radiation, and no gamma-peaks found then the Syclone shall display “**BACKGROUND**” as the system is seeing the local background.

Furthermore, the results may contain peaks with no Isotope Identification, scattered radiation with no Isotope Identification, or a combination of an identified isotope and strong peaks with no Isotope Identification and if the **Dose Rate $>$ Base Dose Threshold**. These all may indicate the presence of a **SHIELDED SOURCE**.

Note: If the isotope cannot be identified, retrieve the stored spectrum and follow your predefined operating protocol, or call the **RadComm Help desk** (see [Appendix Z](#)) who will direct the call to the appropriate person for further analysis.

- e) **NUCLIDE THRES** – Selections are 3, 5, **7**, 8, 9, 10, 11, 12, 15 (SD units)

The “NUCLIDE THRESHOLD” = **7SDs** as default. In NUCLIDE IDENT the **PEAK THRESHOLD** parameter is normally set at 3.0SDs to determine whether a peak is used in NUCLIDE IDENT. The Peak Analysis engine produces a list of all peaks found and any peak below this setting (3SDs) are NOT used for NUCLIDE IDENT. This works very well for multi-peak isotopes but many complex spectra can easily produce aberrant peaks because of Pile-Up etc. and these can easily be misconstrued as being present whereas in fact they are scattering effects etc. The parameter **NUCL THRES** requires the SUM of all the peaks in an ID to exceed the default setting (7SDs).

For example, if you have an analysis producing 3 peaks A=5SDs, B=6SDs and C=3SDs and Isotope X requires A+B. Then in this case A+B = 11SDs which is above the 7SD default setting, so identification of isotope X is displayed. In the case where isotope Y requires only 1 peak and this is B, then since B=6SDs and this value is below the 7SDs limit, isotope Y is NOT identified. The net effect of this is that single peak identification is

very significantly improved with very little down side.

5.5.3.2 NaI

The selections are:

- a) **MEASURING TIME** – sets the sample time in seconds for acquiring a Sodium-Iodide spectrum in the IDENTIFY mode– selections are 10, 20, 30, 40, 50, **55**, 60, 70, 80, 90, 100, 200, 300, 400, 500, 600, 1200, 1800, 3600, 5400secs
- b) **MEASURING MODE** - Selections are: LIVE, **CLOCK**, REP

GENERAL COMMENTS regarding LIVE-TIME and DEAD-TIME.

When the spectrometer is acquiring data, each incoming signal pulse from the detector takes a finite time to process (convert from an analog amplitude indicative of energy level to the corresponding channel number in the spectrum).

The time taken to process each pulse is referred to as DEAD-TIME and is usually expressed as a % of the available time. If the incoming count rate is very high then the Dead-Time will be very high. As an example, if Dead-Time = 50% then for every second of sample time, the system is only “available” for 50% of the time = 0.5 seconds to process new pulses, so any incoming pulses encountered during signal processing will be lost. Thus, when accumulating data, the system is “LIVE” only for a fraction of the time.

At very low count rates, the Dead-Time is relatively insignificant. However at higher rates Dead-Time correction is important. The standard way of dealing with Dead-Time is to normalize the data to compensate for this sampling Dead-Time by using the actual system LIVE-TIME, where:

$$\text{LT (Live-Time)} = \text{ST (Sample-Time)} - \text{DT (Dead-Time)}$$

The system LIVE-TIME is automatically accumulated by the Syclone and stored as a data variable that is output on the data stream to permit data correction on external processing systems. The displayed DEAD-TIME is computed at a 1/sec rate for display purposes only by the simple formula -

$$\text{DT}\% = \frac{(\text{ST} - \text{LT})}{\text{ST}} * 100$$

For example, if a 100 second sample had a Live-Time of 91.373 secs then:

$$\text{ST} - \text{SAMPLE -TIME} = 100.000 \text{ sec}$$

$$\text{LT} - \text{LIVE-TIME} = 91.373 \text{ sec}$$

Therefore DT = 8.6% from the above formula.

The DEAD-TIME is only computed for display purposes to advise the user in the ANALYSIS mode of the approximate intensity. As mentioned previously for best data analysis Dead-Time below 20% are advised as above this level the local radiation field is so intense that scattering may cause data analysis problems. Since the radiation falls off as the inverse square - moving a few feet away from a “hot” source will reduce the DT thus giving better data analysis AND reducing the users’ exposure.

To give an idea of Dead-Time:



10% Dead-Time**= a DOSE Rate for Cs-137 of approx. 0.5mR/h****= a count rate of approx. 5000cps in the Search mode**

The **LIVE-TIME** data is what is important and it is used to correct the data for the “lost” sampling time as shown in the following example:

ST = 100.000 secs

LT = 91.373 secs

Channel 128 = 1850 counts after the 100 secs sample = **18.5** counts/secThe **REAL** value for Channel 128 = $1850/91.373 = 20.25$ counts/sec

As can be clearly seen – LIVE-TIME correction is essential for proper data analysis.

To make data analysis simpler, the user has 2 options to correct this effect:

LIVE – This setting enables an **automatic correction method** and this correction essentially increases the sample-time by the Dead-Time to account for all the pulses that would have been lost because the electronics were “too busy” to process the incoming pulse.

If **LIVE** mode is selected, the preset sample period is AUTOMATICALLY extended by the Dead-Time so the final data is automatically Dead-Time corrected. Thus if you set a 100 second sample period and there is a 10% Dead-Time, then the actual sample period will be approximately 110 seconds thus all the “lost” time has been compensated for and the data represents a true 100 second sample. The selection of LIVE mode is an advantage to users who want “automatic” operation to minimize data processing. In low count areas extending the sample period also give slightly more accurate data. The main drawback to this mode of operation is that the actual duration of the sample is **variable**.

CLOCK – In this mode, the preset sample time is the actual sample time and any Dead-Time occurring must be corrected manually. The data output includes the system Live-Time so that correction is quite simple especially if using a spreadsheet program. The CLOCK mode is used primarily when several analyses are being compared without time normalization and it is necessary to have the same sample time.

NOTE

USERS ARE REMINDED THAT IN THE LIVE MODE – ACTUAL SAMPLE TIMES WILL BE MUCH SMALLER IN HIGH COUNT RATE AREAS. IF ONLY NUCLIDE-ID IS REQUIRED THEN USE OF CLOCK WILL ENSURE THAT THE PRESET SAMPLE TIME IS THE ACTUAL SAMPLE TIME.

REP. – This setting enables the unit to do multiple spectrum sampling and analysis. Each spectrum measurement is sampled over the user defined sample time (**MEASURE TIME**) and stored as a unique spectrum #. The routine is stopped by pulling the joystick down (**ENTER**), which will then display the **IDENTIFY** sub-menu.

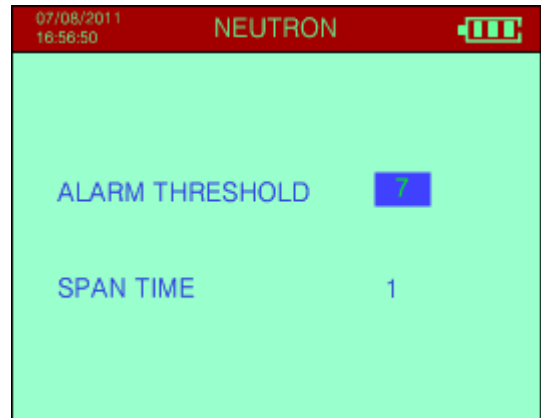
c) **AUDIO ALERT** – selections are **ON**, **OFF**

This sets a mode so that at the end of the data sample the audio will beep to remind users that the sample is complete. The OFF selection sets no beep.

5.5.3.3 NEUTRON

This sets the parameters for the Neutron detector:

- a) **ALARM THRESHOLD** – Sets the neutron alarm threshold in **SEARCH AND IDENTIFY** Mode. Selections are: OFF, 1, 2, **3**, 4, 5, 6, 7, 8, 9, 10, 20, 50, and 100 In the SEARCH Mode. This parameter represents the alarm threshold in CPS. In IDENTIFY Mode, it is used to decide whether the neutron is found or not. If the **ALARM LEVEL** is set to **OFF** no neutron alarm will be generated during SEARCH Mode. Selecting the optimum value for this parameter involves a trade-off between false alarm rate and detection sensitivity.

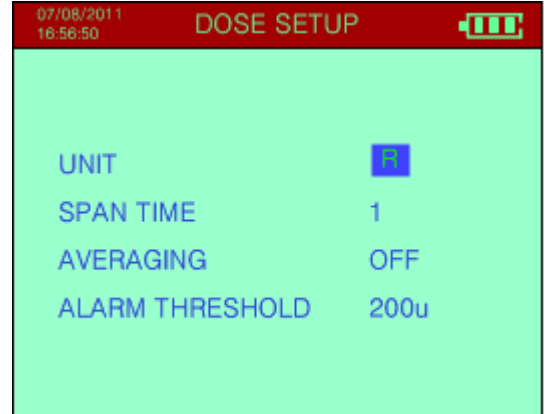


- b) **SPAN TIME** – sets the sampling time period in the **SEARCH** mode. Selections are: **1**, 2, 3, 4, 5, 6, 7, 8, 9, 10, 15, 20, 50, 100 seconds. This parameter represents the repetitive time period in seconds, during which the neutron counts are added and the CPS is presented for further processing.

5.5.4 DOSE SETUP

These selections set the DOSE SETUP parameters.

- a) **UNIT** – sets the Dose measurement units – selections are **R**, Sv, Gy
Gy (GRAYS): – the system is calibrated to the AIR KERMA RATE for Dose in GRAYS
R (Roentgen): – a conversion factor is used **GRAYS → R = x 114** (NUREC #ICRU-47)
Sv (Sievert): – Unit is directly calibrated in **Ambient Dose Equivalent (H*10)**, (H*10 is the International cal standard for Dose).



- b) **SPAN TIME** – sets the Dose update sample time – selectable **1**, 2, 3, 4, 5, 6, 7, 8, 9, 10, 20, 30, 40, 50, 60 seconds

This sets the actual update time in seconds of the DOSE measurement. If a 5 second sample time is selected when the DOSE Mode is started, the display shows “0” for 5 seconds and then displays the current reading. This display will then stay constant for another 5 seconds and then the new value will be seen.

- c) **AVERAGING** – selects data averaging. Settings are OFF, **3P**, 5P, 10P. This uses a selectable running means updated at the sample rate. So a sample rate of 1 second and an Averaging of 3P mean that the data is a 3 point average updated every second.
- d) **ALARM THRESHOLD** -
 This sets the DOSE Alarm Level in micro units. Once set, if the Dose exceeds this level the audio will alarm to warn the user. Note that this setting changes depending on the units selected, as follows:

- **R** - OFF, 10, 20, **50U**, 100, 200, 500, 1000, 2000, 4000, 5000, 9000 **μR/h**
- **SV** - OFF, 0.1, 0.2, 0.5, 1.0, 2.0, 5.0, 10.0, 20.0, 40.0, 50.0, 90.0 **μSv/h**
- **GY** - OFF, 0.1, 0.2, 0.5, 1.0, 2.0, 5.0, 10.0, 20.0, 40.0, 50.0, 90.0 **μGy/h**

Note that a factor of 100 is maintained between R and Gy/Sv that approximates the relationship. Thus if you set 2000μ in the R setting this means a threshold of 2000μR/h – if the units are changed from R to Sv – this value will automatically change to 20.0μSv/h. Thus the parameter setting is always in **micro (μ) units** whether R, Gy or Sv.

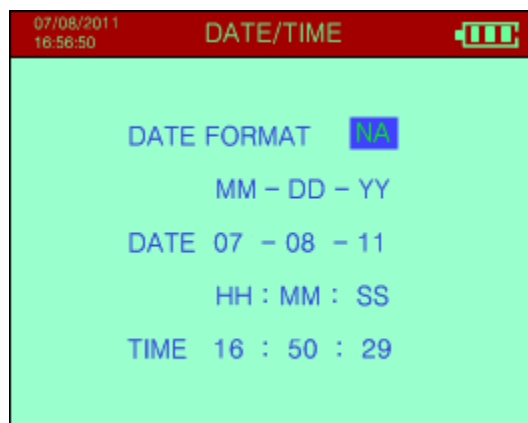
In **AUTOMATIC** mode this parameter sets the upper (right hand) limit of the bar graph.

5.5.5 Date and time

This selection NA (North America) or IN (International) permits the user to set up the local Date and Time. All stored data is date stamped as an aid in locating data for data analysis.

DATE: format NA = MM-DD-YY or IN = YY-MM-DD

TIME: format HH: MM: SS.



5.5.6 ROIs (Regions of Interest)

This selection permits the user to select 4 ROIs to whatever channel range in the spectrum is required.

Default settings are:

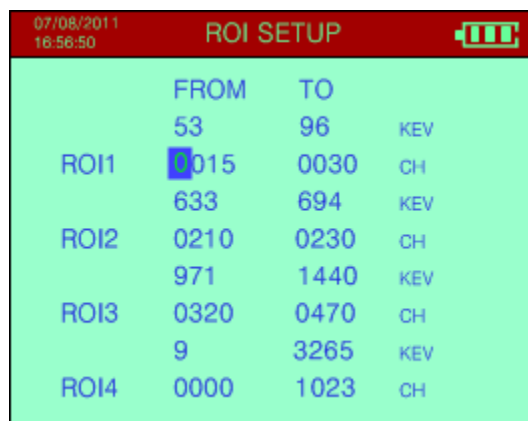
ROI#1 – 15-30 – centered on Americium-241

ROI#2 – 210-230 – centered on Cesium-137

ROI#3 – 320-470 – centered on Cobalt-60

ROI#4 – 840-900 – centered on Thorium-232

ROI#0 – fixed at **20keV-3400keV** = TOTAL COUNT

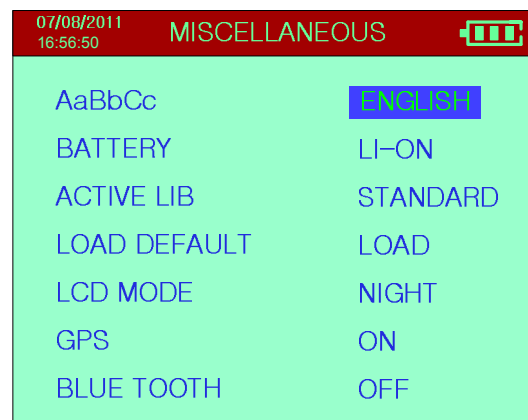


ROIs are used in various ways:

- a) **SEARCH DATA** – some users need the ability to search only for a specific isotope so setting the appropriate ROI in this menu then selecting the appropriate ROI in the SEARCH menu permits this.
- b) In the **SEE SPECTRUM** Mode the ROI contents can be displayed for special applications.

5.5.7 MISCELLANEOUS

- a) **AaBbCc** – selects the language for the displays. In this release, selections are



ENGLISH, Chinese, Japanese, Spanish, German.

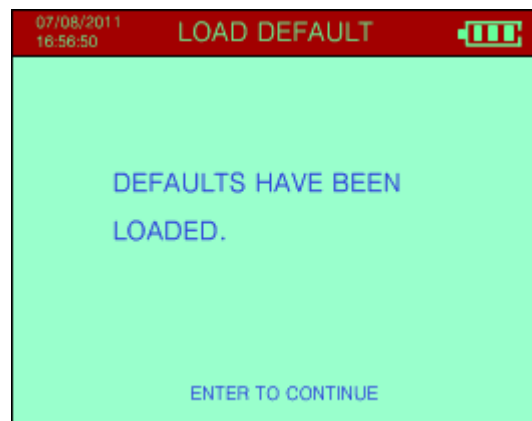
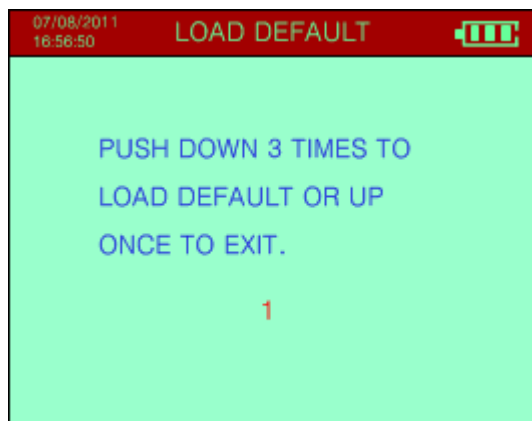
- b) **BATTERY** – sets the battery type. Current selection and default is **LI-ON** – Lithium Ion.
- c) **ACTIVE LIBR** – this sets the Library used for analysis – default is **STANDARD**. **MEDICAL** and **USER** are optional.

Note: The libraries have been selected as optimum for the different applications. However some users have special requirements and require a special library. Contact RadComm for Product Support Information concerning the development of USER Libraries (SEE [Appendix B](#)).

The Syclone is shipped with the **STANDARD** Library as the Default Library. In order to switch between libraries the Syclone must be placed in Manual Mode. Move the joystick (long click down) to navigate from **CONFIGURE** to **MISCELLANEOUS** and a short click down to get to **ACTIVE LIB**. Move the joystick (short click) from side to side to scroll through the selection of libraries as shown above. Remember to switch back to Automatic Mode if required.

Once the parameter setting is selected, the actual isotopes in the library can be viewed in INFORMATION / LIBRARY as described (see [Section 5.6](#)).

- d) **LOAD DEFAULT** – If for some reason the Syclone Unit is reacting poorly, the parameter settings may be incorrectly set. The User may bring the Syclone unit back to its original condition by Loading the Default settings. (See Figures)



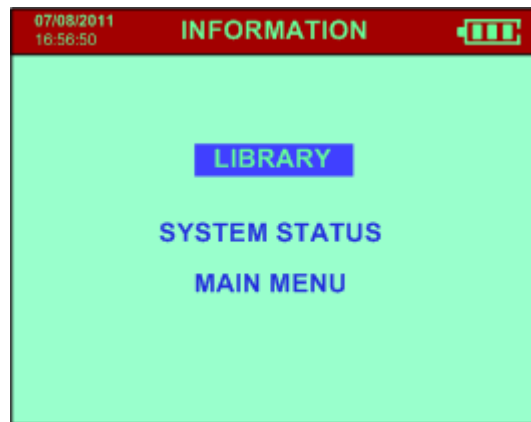
- e) **LCD MODE** – User can select between Day and Night mode.
- f) **GPS** - Turns GPS On or Off.
- g) **Bluetooth** - Turns Bluetooth On or Off.

MAIN MENU Exits back to the Main Menu.

5.6 INFORMATION

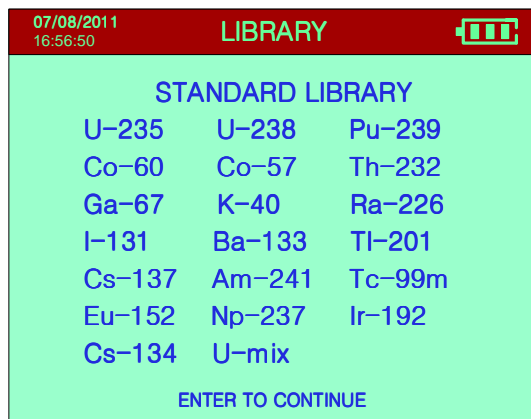
INFORMATION SCREEN

The Information Screen appears when it is chosen from the Main Menu.



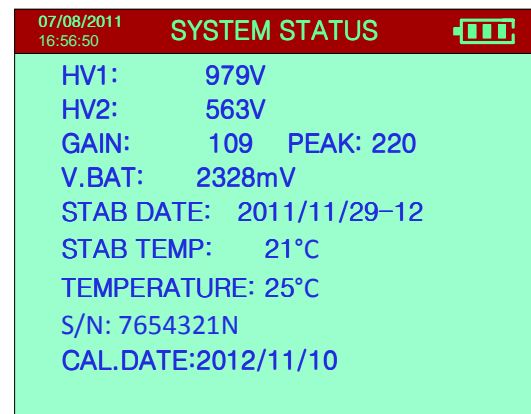
5.6.1 LIBRARY

Selection of this option displays the nuclides in the system library – see Figure. For the current library list refer to [Appendix B](#).



5.6.2 SYSTEM STATUS

This display is for Manufacturers Use only.



MAIN MENU Exits back to the Main Menu.

6.0 SYCLONE SPECIFICATIONS

Note: System Specifications are subject to change without notice.

DETECTORS

GAMMA Detector

- a) Gamma NaI – Size 1.5" (38mm) x 2" (51mm).
Energy Resolution 7.0% or better for 662 KeV
- b) Geiger Mueller – Size 0.59" (15mm) x 1.9" (49mm)

Stabilization: Cs-137 source <3 mins

DOSIMETER

Accumulate dose up to 10 Sv

Span time: 1, 2, 3, ... , 10, 20, 30, ... , 60s

Measurement Units: Selectable – R, Sv, Gy

Energy Range: 20keV – 3.4MeV

Dose Range: NaI Detector: 0 R/h – 4mR/h (0nSv/h – 40 Sv/h)

GM Detector: 4mR/h – 1R/h (40 Sv/h – 10mSv/h) calibrated

Extended Range: 1R/h – 10R/h (10mSv/h – 100mSv/h) verified

Note: NaI detector may overload at higher levels at a different rate depending on the isotope. Approximate maximum levels are 2mR/h for Am-241 and 5mR/h for Cs-137.

NUCLIDE LIBRARIES

Pre-defined: Standard

Optional: Medical (Industrial libraries will be available soon)

CLOCK - CALENDAR

Type: Built in 24-hour clock, 99-year calendar (including leap year).
Full battery backup, 10 year retention time

Precision: +/- 3 s/day at 25°C
+/- 30 s/day over full operating temperature range

DATA STORAGE

Type: Flash memory.

Capacity: 100,000 dose rate samples / 498 Spectra

Stored Data Retrieval: Via USB or Bluetooth (optional) to a PC.

DATA OUTPUT

Type: USB or Bluetooth (optional).
Format: Binary data in packets

USER INTERFACE

Control: Single Multifunction Joystick (All functions and features)
Display Type: TFT Color LCD,
QVGA (320 x 240 resolution)
Display Viewing Area: 3.5" Diagonal
Menus/Screens: English, Chinese, Japanese, Spanish, German

POWER

Adapter Voltage: 5VDC
Internal Source: Rechargeable Batteries – Manufacturers' Lithium Battery
Capacity: 4800mAh, 3.7V
Operating Time: Rechargeable batteries – up to 12 hrs (typical 9 hours)
Battery Charging: typically 4 hours, full charge indication by Battery Icon

CONNECTORS

COMM Port: mini USB data transfer / charging

PHYSICAL

Dimensions: Length – 7.75" (197mm)
Width – 3.5" (89mm)
Height - 3" (76mm), 5.59" (142mm) including handle
Weight: 1.7 kg (3.7lbs) including batteries

ENVIRONMENTAL

Operating Temperature Range: -4°F to 122°F (-20°C to +50°C)
Storage Temperature Range: -4°F to 140°F (-20°C to +60°C)
Protection: Weatherproof, dust sealed, water splash-proof
Relative Humidity: 93% non-condensing at 104°F (40°C)
Vibration: 2 g for 15 min at 10 – 33 Hz in XYZ directions (ANSI N42.34)
Shock: Complies with ANSI N42.34
EM Compatibility: ANSI N42.34 compliant
CE compliant (EU safety, RFI and EMI directives)
FCC CFR 47, Part 15, Subpart B, Class B compliant

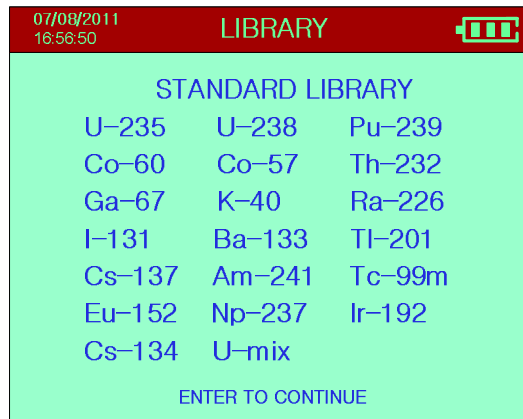
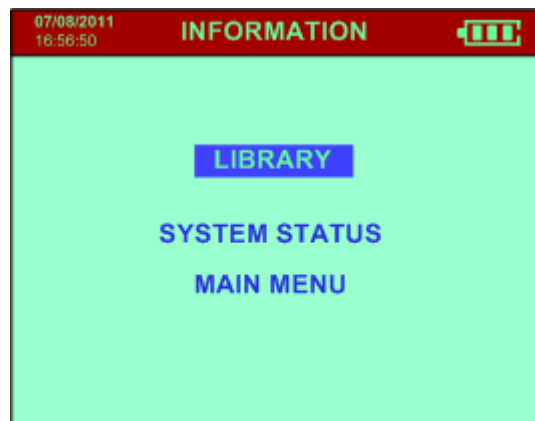
ACCESSORIES

- Standard:**
- PVC Transportation Case
 - USB Communication Cable
 - Cs137 0.25 μ Ci Test Source
 - 5 VDC universal AC/DC Power Adaptor
 - Certificate of Calibration
 - USB with RadView Software and user manual
 - Protective rubber boot

APPENDIX A – USING ISOTOPE LIBRARIES

While the STANDARD library is the default library when RadView Software is installed, other libraries can be used to analyze the spectra downloaded from the Syclone. This enables the user to re-analyze the spectra with the same library as used in the Syclone, or with a different library, thus providing an additional tool in assessing unknown spectral features.

The standard library used with the **Syclone unit** is as shown below. This is the library used to determine the nuclide identification and provide templates in the **IDENTIFY** function.



APPENDIX B – NUCLIDE LIBRARIES

The current list of nuclides in the Standard Library are:		Type of Isotope
Name	Label	
Am-241	Americium-241	I
Ba-133	Barium-133	I
Co-57	Cobalt-57	I
Co-60	Cobalt-60	I
Cs-134	Cesium-134	I
Cs-137	Cesium-137	I
Eu-152	Europium-152	I
Ga-67	Gallium-67	M
I-131	Iodine-131	M
Ir-192	Iridium-192	I
K-40	Potassium-40	N
Np-237	Neptunium-237	S
Pu-239	Plutonium-239	S
Ra-226	Radium-226	N
Tc-99m	Technetium-99m	M
Th-232	Thorium-232	N
Tl-201	Thallium-201	M
U-MIX	Uranium-MIX	N
U-235	Uranium-235	S
U-238	Uranium-238	N

The current list of nuclides in the Medical library are:		Type of Isotope
Name	Label	
Au-198	Gold-198	M
Cr-51	Cromium-51	M
Cs-134	Cesium-134	I
Ga-67	Gallium-67	M
I-123	Iodine-123	M
I-125	Iodine-125	M
I-131	Iodine-131	M
In-111	Indium-111	M
Ir-192	Iridium-192	I
K-40	Potassium-40	N
Ra-226	Radium-226	N
Sn-113	Tin-113	M
Tc-99m	Technetium-99m	M
Th-232	Thorium-232	N
Tl-201	Thallium-201	M
U-235	Uranium-235	S
U-238	Uranium-238	N
V-48	Vanadium-48	M
W-188	Tungsten-188	M

Note: Currently RadComm has no plans to permit users to modify the libraries as library development is so complex that modifications can easily unbalance the analysis capability of the system and significantly degrade its performance. However we will readily work with users to develop an appropriate library to fulfill their special requirements.

Labels in columns

I= Industrial, M=Medical, S=SNM, N=NORM

APPENDIX C – RECOMMENDED PARAMETERS

SETUP	PARAMETER	DEFAULT	SELECTION
MENU			
SEARCH	DATA TRANSFER	OFF	OFF, MEM, PC
	SPAN TIME	1	1, 2,3 -10, 20,30-60 secs
	GRAPH SCALE	AUTO	AUTO, 64, 128, 256, 512, 1K, 2K, 4K, 8K, 16K, 32K, 64K,128K,256K,512K , 1M, 2M, 4M, 8M, 16M, 32M, 64M,128M,256M, 512M, 1G, 2G, 4G cps
	AUDIO SCALER	AUTO	OFF, AUTO, 50, 100, 150, 200, 250cps
	ALARM THRESHOLD	OFF	OFF, 100, 200, 250, 300, 350, 400, 450, 500, 600, 700, 1K, 2K, 5K, 9Kcps
	SELECT ROI	TOTAL	TOTAL, ROI1, ROI2, ROI3, ROI4
	AVERAGING	3P	OFF, 3P, 5P, 10P
STABILIZE			
STABILIZE	STAB MODE	24H	OFF, 12H, 24H, AUTO
	ISOTOPE	Cs-137	
IDENTIFY			
DETECTOR	DETECTOR	NaI	NaI
	PILEUP	ON	ON, OFF
	PEAK THRESHOLD	3.0	2.0, 2.5, 3.0, 3.5, 4.0, 4.5, 5.0
	BASE DOSE THRES	20	10, 15, 20, 30, 40, 50 (µR/h units)
	NUCLIDE THRES	7	3, 5, 7, 8, 9, 10, 11, 12, 15 (SD units)
NaI			
NaI	MEASURING TIME	55	10-50, 55,60-100, 200-600, 1200, 1800, 3600, 5400secs
	MEASURING MODE	CLOCK	LIVE, CLOCK, REP.
	AUDIO ALERT	ON	ON, OFF
NEUTRON			
NEUTRON	ALARM THRESHOLD	3	OFF, 1,2 -10, 20, 50, 100
	SPAN TIME	1	1, 2 - 10, 15, 20, 50, 100
DOSE			
DOSE	UNIT	SV	R, SV, GY
	SPAN TIME	1	1, 2-10, 20-60secs
	AVERAGING	3P	OFF, 3P, 5P, 10P
	ALARM THRESHOLD	50	OFF, 10, 20, 50, 100, 200, 500, 1000, 2000, 4000, 5000, 9000 µR/h (LINKED TO Units)
ROIs			
ROIs	ROI#1	15-30	0–1023 to 0–1023 (Am-241)
	ROI#2	210-230	0–1023 to 0–1023 (Cs-137)
	ROI#3	320-470	0–1023 to 0–1023 (Co-60)
	ROI#4	840-900	0–1023 to 0–1023(Th-232)
MISC - ELLANEOUS			
MISC - ELLANEOUS	AaBbCc-LANGUAGE	ENGLISH	ENGLISH, Chinese, Japanese, Spanish, German
	BATTERY	Lithium	Lithium
	ACTIVE LIB	STANDARD	STANDARD, MEDICAL,USER
	LCD MODE	NIGHT	DAY,NIGHT

APPENDIX D – QUICK START – AUTOMATIC MODE

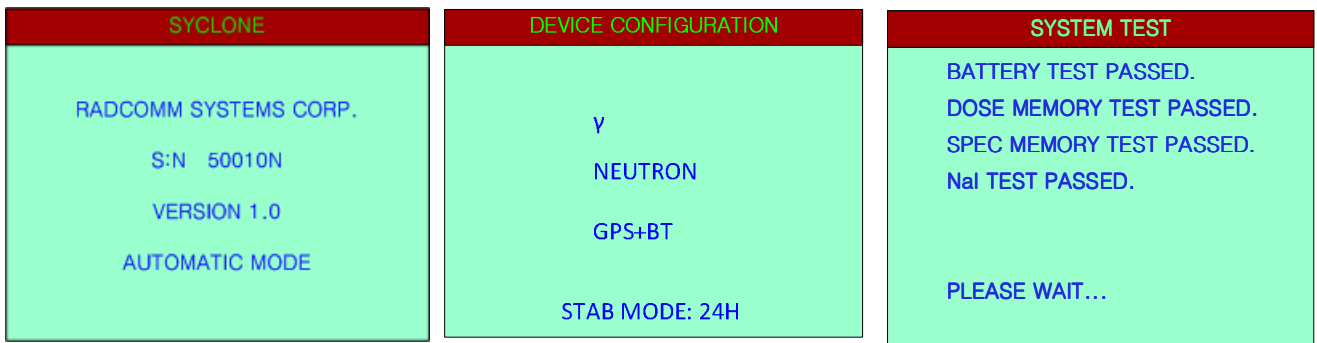
The **Syclone** automatically turns on when the joystick is pulled down. A (0.25 μ Ci (9.25kBq)) Cs-137 stabilization source is supplied with the unit and is used as directed when the unit requires stabilization.

Note: The **Syclone** is limited to two active functions when set to the **AUTOMATIC MODE** of Operation: **SEARCH** and **IDENTIFY**.

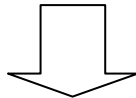
The steps below illustrate the process involved:

Note: If batteries are not loaded see [Section 1.5](#) and Figure **para h) & i)** to properly load batteries.

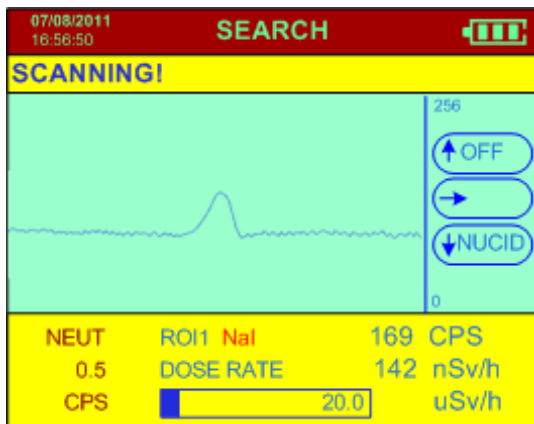
1. The Syclone detector is shipped ready to use. The Syclone is also shipped in **MANUAL MODE**, to facilitate the setup of the detectors parameters by the customers' technician. This will allow the customer to setup the detector to their specific needs. The technician should set the detector to **AUTOMATIC MODE** prior to giving it to the operator.



At startup these screens only appear briefly before an Intro Screen appears. The Active Mode is displayed across the bottom of the Introduction screen (ie. **AUTOMATIC MODE**).



2. The **SEARCH** function of operation:



- a. The User sweeps the area in a slow steady manner listening for an audio tone and when practical glancing at the display for evidence of a source. The system display will show the current count rate in counts/sec while the internal "audio meter" will give an audio response with the tone related to radiation intensity.
- b. When radioactivity is detected, the Syclone emits an audio tone that rises in pitch the closer it gets to the source.
- c. When the user finds the location of the source (peak of the audio tone) **IDENTIFY** is selected by (short click) down with the joystick to analyze a spectrum sample.

3. The **IDENTIFY** function of operation (see **Figure G-1**):

IDENTIFY takes a spectrum sample for a user defined sample time (default 55s) as follows:

- a. To get a good sample, position the Syclone at the highest point of radioactivity found by **SEARCH**, or follow the **MOVE CLOSER /MOVE AWAY** instructions.
- b. Keep the Syclone as stable as possible during sampling to get a good result.

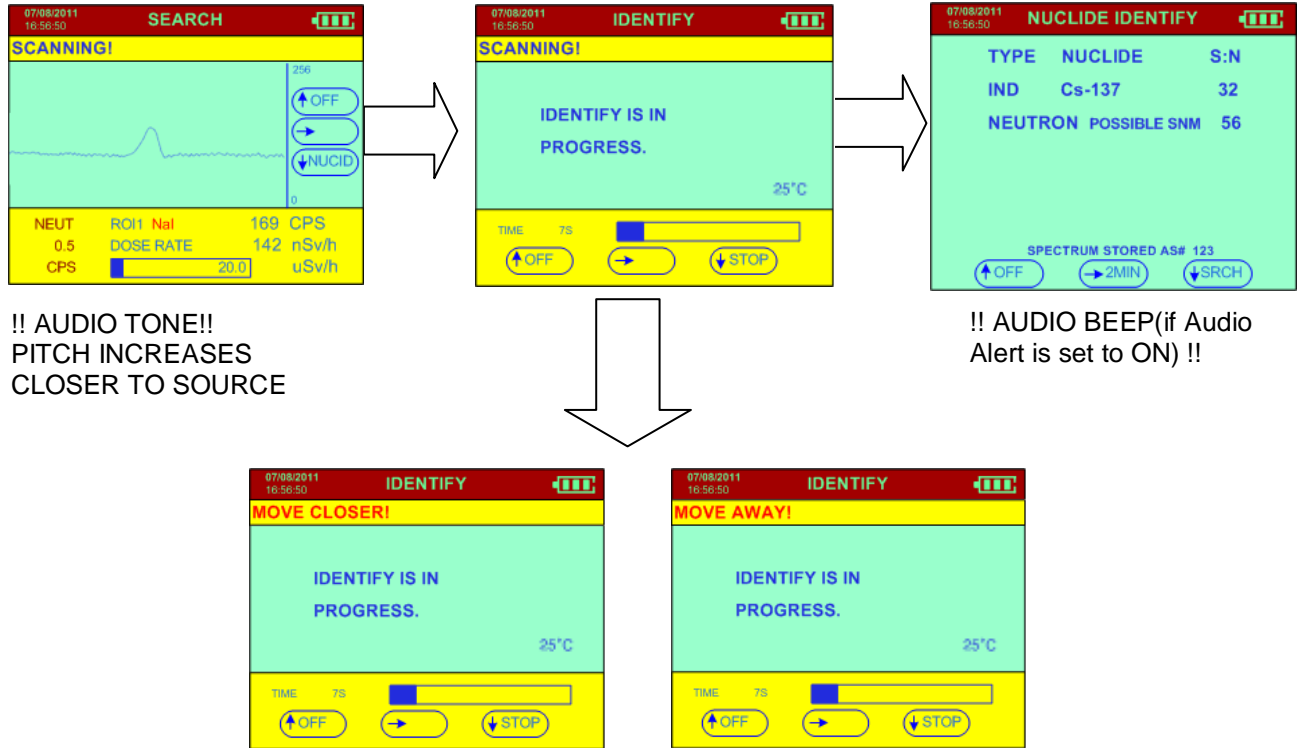
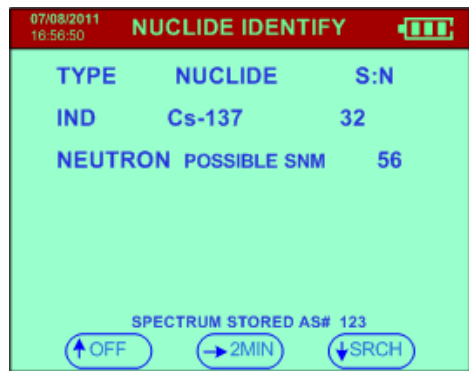


Figure G-1

- c. After the sample time is complete the system automatically analyzes the data to determine the Isotope and displays the results in the NUCLIDE IDENTIFY screen.
- d. When the **NUCLIDE IDENT** Result (see **Figure G-1**) is displayed, the audio beeps (if Audio Alert is set to ON) to remind the user that the data result is ready.
- e. Once the Spectrum is analyzed, the user will use the joystick with a short click down to begin another **SEARCH** session.
- f. Prior to beginning the next search the Spectrum is automatically stored as a # in chronological order.

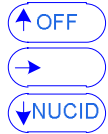


Note: The spectrum can be recalled from data memory and re-analyzed at a later time.

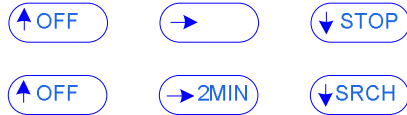
NAVIGATION MENUS

Navigation Menus have been embedded in the system screens (Automatic Mode only).

SEARCH:



IDENTIFY:






NUCLIDE IDENT:






The Navigation Menus are located on the right for the SEARCH function and across the bottom of the screens in the Identify Mode and Identify Results with the joystick functions described below:

Note: In some screens the internal computer is busy so a few seconds may pass before the selected change occurs




SEARCH (Navigation Menu):

-  **no action**
-  **OFF** – approx. 4 secs then unit powers OFF
-  **NUCID** – switches to the IDENTIFY and Nuclide IDENTIFY

IDENTIFY (Navigation Menu):

-  **no action**
-  **OFF** – approx. 4 secs then unit powers OFF
-  **STOP** – stops the IDENTIFY sample

NUCLIDE IDENT (Navigation Menu):

-  **2MIN** – initiates an additional 2 minute count that adds to the current spectrum and at the end of the period gives a combined analysis
-  **OFF** – approx. 4 secs then unit powers OFF
-  **SRCH** – switches to SEARCH

Refer to [Chapter 3.0](#) for a detailed explanation of all the screens and menus.

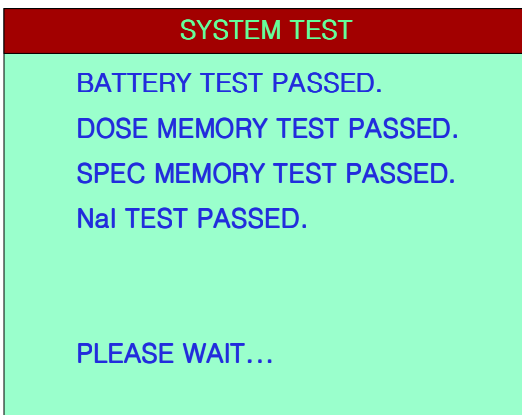
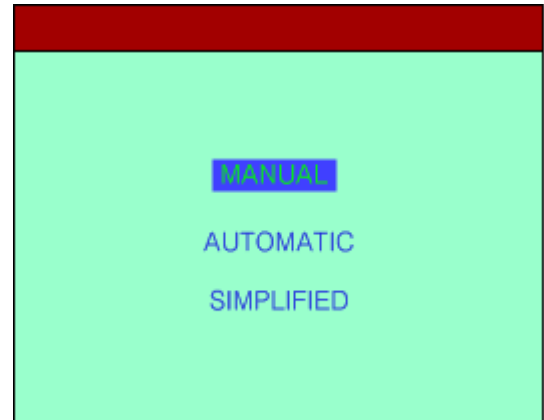
APPENDIX E – QUICK START – MANUAL MODE

The steps below illustrate the process involved when using the Manual Mode:

Note: Ensure batteries are properly recharged.



The SYCLONE will start automatically with a long joystick click (ENTER). At startup these screens only appear briefly before a System initialization. The Active Mode is displayed across the bottom of the Introduction screen (ie. MANUAL MODE).



After the Startup screen disappears the System Test Page appears. Wait for the system to warm up, the system is automatically adjusting its' internal parameters.

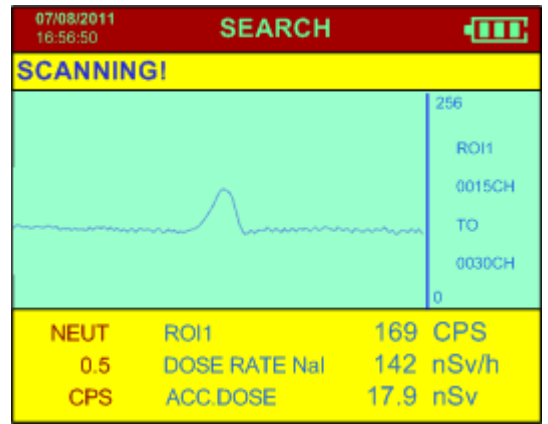
Note: To get reliable performance and full capacity out of the batteries throughout their life, it is important to let them fully discharge and then fully re-charge for 4 hours at least once every two months. This will assure that the batteries provide up to 12 hrs(typical 9 hours) of operation depending on the type.



The system has automatically adjusted the basic system parameters during initialization and the display changes to indicate the system is prepared for operation, choose SEARCH and click the joystick down to ENTER. The SEARCH Mode will start immediately.

3. The **SEARCH** Mode of operation (see Figure):

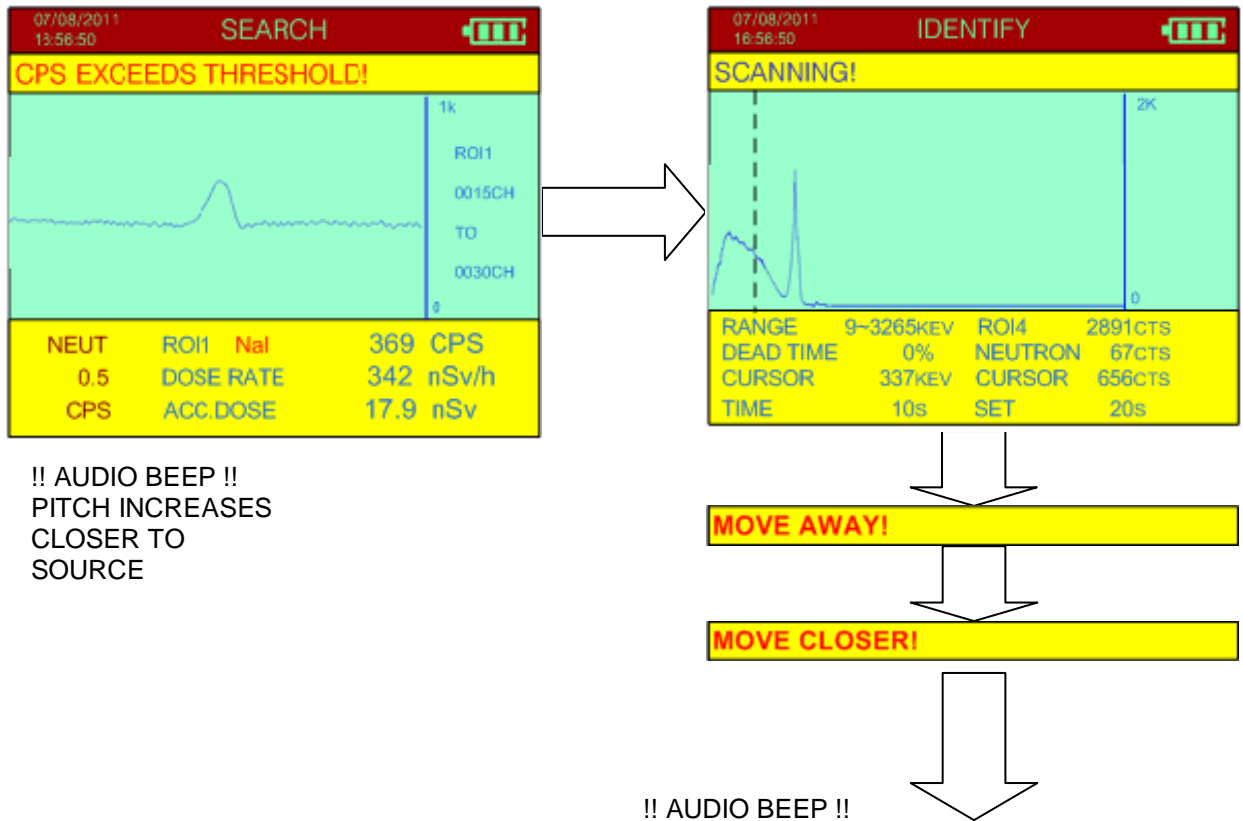
- a. The User sweeps the area with the Syclone in a slow steady manner listening for an audio tone and when practical glancing at the display for evidence of a source. The system display will show the current count rate in counts/sec while the internal “audio meter” will give an audio response with the tone related to radiation intensity.
- b. When radioactivity is detected, the Syclone emits an audio tone which gets louder and rises in pitch the closer it gets to the source.
- c. When the user finds the location of the source the **IDENTIFY** Mode is selected by (**short click**) down with the joystick to analyze a spectrum sample.



4. The **IDENTIFY** Mode of operation (see Figure below):

The **IDENTIFY** Mode takes a spectrum sample for a user defined sample time (default 55s) as follows:

- g. To get a good sample, position the Syclone at the highest point of radioactivity found by the **SEARCH** Mode, or follow the **IDENTIFY** Mode **MOVE AWAY/MOVE CLOSER** instructions.
- h. Keep the Syclone as stable as possible during sampling to get a good result.

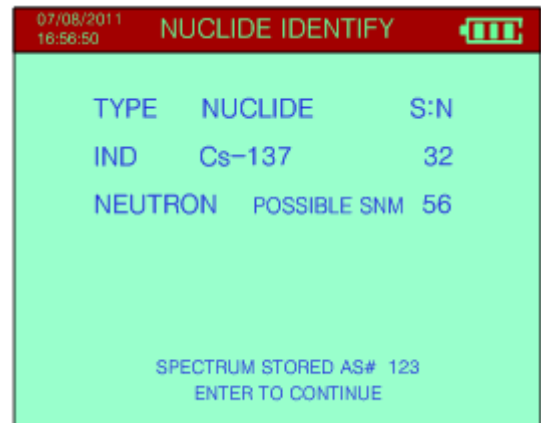


After the sample time is complete the system automatically analyzes the data to determine the

Isotope and displays the results in the NUCLIDE IDENTIFY page.

- i. When the **NUCLIDE IDENTIFY** Result (see Figure) is displayed, the audio beeps only once to remind the user that the data result is ready.
- j. Once the Spectrum is analyzed, the user will use the joystick with a long click down to begin another Search Mode.
- k. Prior to beginning the next search the Spectrum is automatically stored as a # in chronological order.

Note: The spectrum can be recalled from data memory and re-analyzed at a later time (in Manual Mode).



Refer to [Chapter 3.0](#) for a detailed explanation of all the screens and menus.

APPENDIX F – SAFE HANDLING OF CHECK SOURCES


External Check Sources:

- **Licensing Requirements:** Radioactive material contained in this device is exempt from USNRC or US Agreement State licensing requirements. It is also exempt in most countries around the world. However in all cases it is a controlled substance. Users should make themselves familiar with local regulations to ensure compliance.
- **Safe Handling:** Although quantities of radioactive material contained in these products are extremely small, the basic radiation protection principles of time, distance and shielding (ALARA – As Low As Reasonably Achievable) should be practiced as effective methods for minimizing exposure.
- **Use:** These devices should only be used as a method for verifying response of radiation measuring devices, and are to be used in accordance with manufacturer's instructions. These sources are not for human use, introduction into foods, beverages, cosmetics, drugs or medicines, or into products manufactured for commercial distribution. Exempt quantities should not be combined to increase the source activity.
- **Storage:** All devices containing radioactive material should be securely stored when not in use. Any loss of radioactive material must be reported to the local authorities.
- **Disposal:** There are several ways to dispose of radioactive materials. The user is advised to check local regulations and dispose the radioactive material according to these regulations.

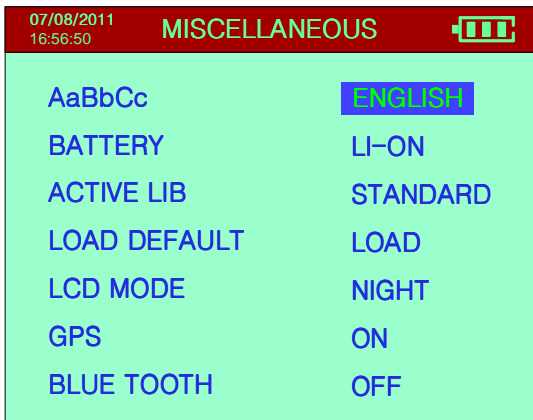
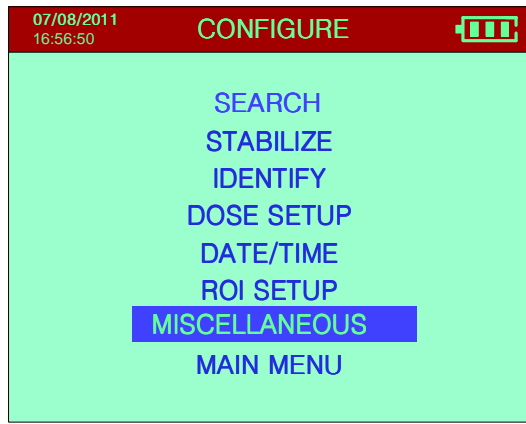
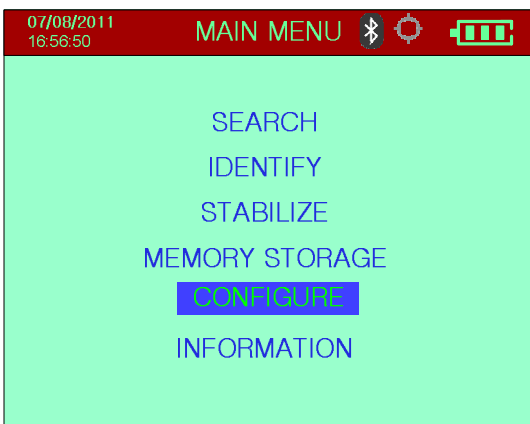
APPENDIX G – OPTIONAL GPS AND BLUETOOTH FEATURE

To activate the optional GPS and Bluetooth features, select **Configure** from the **Main Menu**, then select **Miscellaneous**. The GPS feature allows the user to log GPS coordinates into scans. The Bluetooth feature allows the Syclone to be connected wirelessly to a PC via Bluetooth for data upload.

When activated, the GPS  and Bluetooth  icons will appear in the top red status bar.

When the GPS option is ON and signal is acquired, this symbol will display: 

When the GPS is OFF or GPS option is ON and signal is not acquired, the icon will change to this: 



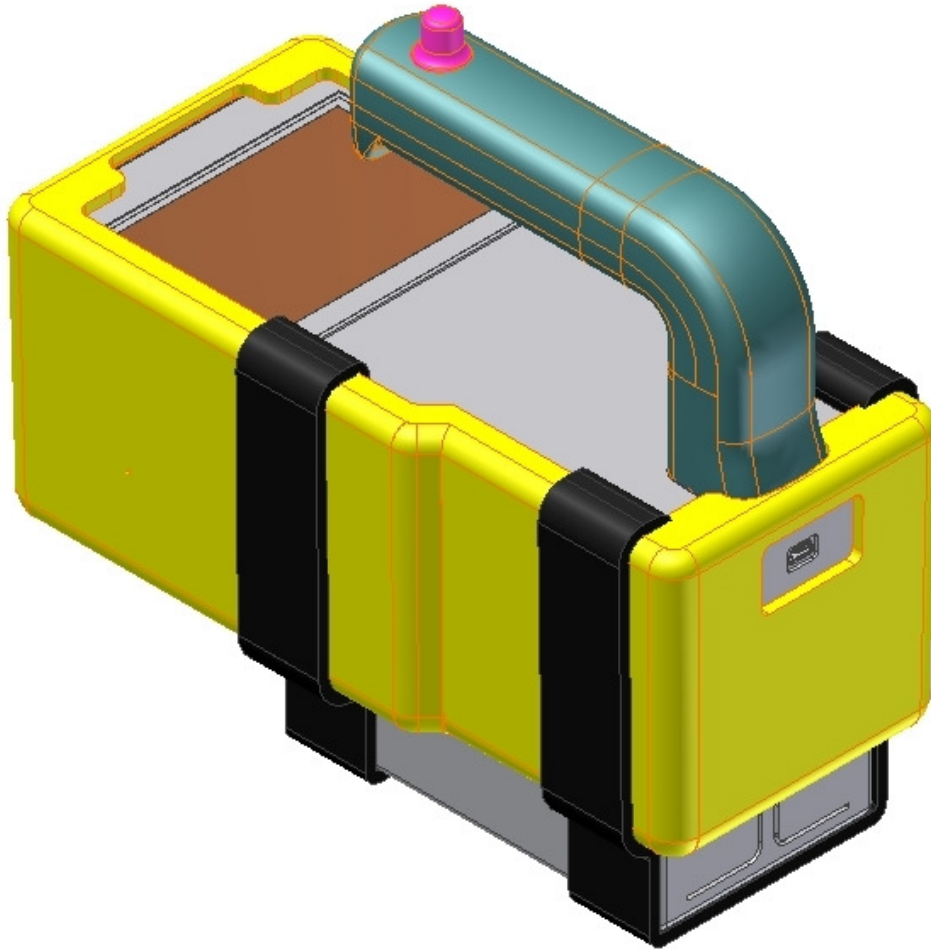
GPS and Bluetooth feature located in **Miscellaneous** menu. The 2 symbols only appear on the Search, Identify and Main Menu Screens.

When Bluetooth is enabled, user can download data through Bluetooth. But in this case, downloading data through USB is not available anymore. In order to use USB to download data again, Bluetooth needs to be turned off.

APPENDIX H – OPTIONAL EXTERNAL BATTERY PACK

The optional battery pack provides backup battery power to the Syclone. It is connected via USB cable to the Syclones USB connector, and is attached to the unit as shown below. The battery is 6000 mAh, IP65 rated water protection and dustproof.

Please note that the battery pack should be recharged fully if it is not used for a period of 3 months.



APPENDIX Z – WARRANTY



RadComm WARRANTY

RadComm warrants the product to be free of defects in material and workmanship for a period of one year from the date of purchase. The warranty does not cover consumables or damage caused by improper use or unauthorized repairs. For details concerning warranty terms refer to the “*Standard Terms and Conditions*” as referenced in your purchasing agreement.

To make a warranty claim, contact the RadComm Help Desk at:

Contact: Help Desk
24 Hour Product Support

Phone: 1 – 905 – 829-8290 ext 3

Fax: 1 – 905 – 829-1406

Email: inquiries@radcommsystems.com