

CRC[®]-55t

OWNER'S MANUAL

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GENERAL

Thank you for purchasing the Capintec, Inc. CRC[®]-55t Radioisotope Dose Calibrator. Every effort has been made to insure that the information in this document is complete, accurate, and up-to-date. Capintec, Inc. assumes no responsibility for the results of errors beyond its control. Mention of products manufactured by other companies does not necessarily constitute endorsement by Capintec, Inc.

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Note: Federal Law restricts this device to sale by or on the order of a physician, pharmacist or other licensed professional.

SYSTEM DESCRIPTION

The CRC[®]-55t Radioisotope Dose Calibrator consists of the following:

- Display Unit (Readout)
- Chamber(s) (up to 2 “R” or 2 “PET”)
- Chamber Remote Display(s) (up to 2 depending on number of chambers) (optional)
- Well Counter (optional)
- Power Cord
- Printer (optional)

The CRC[®]-55t has the following capabilities:

- “R” Chamber
 - perform dose calibration
- “PET” Chamber
 - precisely measure PET nuclides

- Dose Table
- Inventory Functions (“R” or “W” versions only)
- Geometry Test
- Linearity Tests
 - Standard Test
 - Lineator
 - Calicheck
- QC Tests (“R” or “W” versions only)
 - Single Strip
 - Two Strips
 - Tc99m HMPAO
 - Tc99m MAG3
- Well Counter (optional)
 - perform wipe tests,
 - perform lab tests such as Schilling and Blood Volume

YEAR 2000 COMPLIANCE

The CRC[®]-55t measurement system contains information technology that accurately processes date and time data between the years 1999 and 2000. These products, when used in combination with products purchased from other manufacturers, whose products properly exchange date and time information, will accurately process the date and time. All future products are committed to meeting the same Year 2000 compliance.

MEDICAL EQUIPMENT SAFETY CLASSIFICATION

- CLASS I EQUIPMENT energized from an external power source.
- TYPE B EQUIPMENT with no applied parts to the patient.
- Ordinary EQUIPMENT without protection against the ingress of water.
- Suitable for CONTINUOUS OPERATION.
- NOT suitable for use in an OXYGEN or a FLAMMABLE ENVIRONMENT.

ELECTROMAGNETIC INTERFERENCE POTENTIAL

This equipment complies fully with interference immunity requirements of the standard IEC 61326 “Electrical equipment for measurement control and laboratory use – EMC requirements”.

This equipment generates radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to nearby devices. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference, the user is encouraged to try to correct the interference by one of the following measures:

- Increase the separation between the equipment and the affected device.
- Plug the unit into an outlet on a circuit different from that which the affected device is connected.

If this fails to correct the problem, please contact Capintec’s Authorized Service Center.

IMPORTANT SAFETY INFORMATION

The CRC[®]-55t measurement system has been carefully designed to provide years of safe and reliable performance. As with all electrical equipment, however, there are basic precautions that must be observed to avoid injuring yourself, the patient or damaging the equipment.

- **Follow** the unpacking and assembly instructions document, and **read** this manual carefully before using this equipment. Be sure to save all provided documents for future reference.
- **Understand all** warning and caution labels as explained in CHAPTER 1: SAFETY before operating this equipment.

CHAPTER 1

SAFETY

GENERAL	1
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GENERAL

These warnings and instructions for use form an integral part of the CRC[®]-55t and must therefore be kept available for consultation at all times. Precise compliance with the instructions is an essential condition for normal use, correct application and thus safety of the user.

SYMBOL DEFINITIONS

	Dangerous Voltage Present
	Functional Earth Ground
	Attention: consult owner's manual for further information
	Fuse
	AC Voltage
	"ON" (power)
	"OFF" (power)
	In Vitro Diagnostic Medical Equipment
	Date of manufacture

	CE Mark
	Waste in Electrical and Electronic Equipment (WEEE) – This symbol indicates that the waste of electrical and electronic equipment must not be disposed as unsorted municipal waste and must be collected separately.
	Environmentally Friendly Use Period (EFUP) – 20 years from the date of manufacture – Toxic or hazardous substances or elements contained in the unit will not leak or mutate under normal operating conditions resulting in any environmental pollution, bodily injury or damage to assets.

WARNING AND CAUTION LABELS

The system power requirements and the replacement fuse values for power line voltages are located on the back of the Readout Unit (Figure 1-1).

	Please reference CHAPTER 15: CLEANING AND MAINTENANCE, SECTION: FUSE SERVICING for instructions on how to change the fuses of the CRC®-55t.
--	---

	A fire hazard may exist if the wrong size of fuse is installed.
--	---

<p style="text-align: center;">T 2.0AL 250V 100-240V ~ 50/60Hz, 230mA</p>	

Figure 1-1

Located on the bottom of the chamber are 2 labels.

The first label, (Figure 1-2), contains statements denoting not to remove the cover because there are no adjustments that the user can perform in the chamber.

<p>CAUTION: DO NOT REMOVE COVER. NO USER-SERVICEABLE PARTS INSIDE. REFER SERVICING TO AUTHORIZED SERVICE PERSONNEL. PN 7120-1205</p>	<p>MISE EN GARDE : NE RETIREZ PAS LE COUVERCLE. AUCUNE PIÈCE À ENTREtenir PAR L'UTILISATEUR À L'INTÉRIEUR. FAITES EFFECTUER L'ENTRETIEN PAR DU PERSONNEL AUTORISÉ. RÉF 7120-1469</p>
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Figure 1-2

The second label (Figure 1-3) pertains to the electrical safety of the chamber. It is necessary because of the high voltage present (approximately 180 volts for an “R” Chamber and approximately 500 volts for a “PET” Chamber) on the PC board installed in the chamber. A screwdriver is necessary to remove the cover.



Figure 1-3

CAUTIONS AND NOTES

CAUTION

Only qualified/trained personnel should operate or service this unit.

CAUTION

If the equipment is used in a manner not specified in this manual, the protection provided by the equipment may be impaired.

CAUTION

Do not store high activity radioactive samples in the CRC[®]-55t Chamber(s). The Chamber is carefully designed for accurate and precise measurements of high activity radioactive materials. It was not designed to function as a long term storage vessel. Prolonged storage of high activity radioactive samples in the Chamber may cause premature failure of the unit.

CAUTION

In order to obtain a correct reading for a Test Source (Standard Source) Vial, the supplied liner and dipper must be used to achieve the correct geometry. The CRC[®]-55t is not designed to use syringe Test Sources in any application.

CAUTION

Capintec, Inc. does not provide the calibration number for any type of Brachytherapy source. The user should have the source calibrated by a regional Accredited Dosimetry Calibration Laboratory (ADCL) site or obtain a calibrated source from the manufacturer and perform your own in-house calibration (All Brachytherapy sources used in IVBT applications must be calibrated in an ADCL facility).

CAUTION

In order to obtain a correct reading for any Brachytherapy sources including HDR & LDR, use the appropriate source holder for the source type being measured to achieve the correct geometry. (e.g. I125 Seed Holder, Ir192 Ribbon Holder, etc). When making a measurement, use the same source holder that was used in determining the calibration number. Verify that the liner has been removed from the chamber before making the measurement. If additional information is needed, contact Capintec, Inc. for further assistance.

CAUTION

In order to obtain a correct reading for any Brachytherapy sources used in IVBT, use the appropriate source holder (Note that IVBT source holders are individually serialized) for the source type being measured to achieve the correct geometry. (e.g. Novoste Seed Holder). When making a measurement, use the same source holder (same serial number) that was used in determining the calibration number. Verify that the liner has been removed from the chamber before making the measurement. If additional information is needed, contact Capintec, Inc. for further assistance.

CAUTION

IVBT source calibration is only to verify source output and is not to be used in treatment planning.

CAUTION

High voltage is present inside the Chamber(s) (up to 180 volts for an “R” chamber and 500 volts for a “PET” chamber). Due to the presence of this high voltage, opening the covers with the system plugged in may be hazardous. Refer all servicing to qualified personnel.

CAUTION

No internal adjustments inside the Readout or Chamber(s) may be performed by the user within the conditions of the warranty, except for changing the fuse. Due to the presence of high voltages, opening the cover with the system plugged in may be hazardous. Refer all servicing to qualified personnel.

CAUTION

Except for Brachytherapy, never use the calibrator without the Chamber liner(s) in place. Liners are inexpensive and easy to replace. A contaminated Chamber is a very costly mistake. If the unit becomes contaminated, remove the liner and clean the unit as stated in CHAPTER 15: CLEANING AND MAINTENANCE, SECTION: CLEANING INSTRUCTIONS before operating.

CAUTION

Care must be exercised when moving the instrument or when maintenance is performed. The shielded cylinder is heavy (13.6 kg or 30 lb.). In order to provide the required sensitivity, the wall of the ionization chamber is extremely thin and the chamber is filled with pressurized gas. It is therefore, essential to avoid mechanical shock or vibration of any kind.

CAUTION

When working with a heavy sample (especially a CapMac or Moly Assay Canister) always lower it gently into the Chamber. Dropping any heavy object into the Chamber can cause permanent, expensive damage.

CAUTION

The use of multiplication and division factors in Calibration Numbers is only to maintain a degree of consistency with other Capintec dose calibrators. The CRC[®]-55t is a direct reading instrument. If multiplication or division is required, the arithmetic will be done by the system. The actual activity is displayed. DO NOT apply these factors to the displayed activity yourself.

CAUTION

It is desirable to leave the unit powered at all times in order to prevent moisture absorption and to maintain the stability of the instrument (especially if the instrument is subjected to high humidity or low temperature).

CAUTION

The sensitivity of the Chamber is somewhat dependent upon the vertical position of the sample within the well. All calibrations were done with a Standard Sample placed in the supplied sample holder (dipper). It should be noted that in this configuration, the sample is not quite at the bottom of the well. If, for any reason, you make a measurement without using the dipper, be sure that the sample is in the correct vertical position. Both the CapMac and the Standard Moly Assay Canister maintain the same position as the dipper.

CAUTION

This equipment generates radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful Electromagnetic Interference (EMI) to nearby devices. However, there is no guarantee that interference will not occur in a particular installation.

CAUTION

If any printer other than one of the models supplied by Capintec is used, the safety of the unit may be compromised or Electromagnetic Interference (EMI) may be introduced into other devices located in the same general area as the CRC[®]-55t or the CRC[®]-55t may become susceptible to EMI.

CAUTION

The unit contains lead. Appropriate caution should be taken if the interior of the unit is exposed. The unit should be disposed of in accordance with local and national regulations.

CAUTION

The unit contains a Lithium Battery. This should be disposed of in accordance with local and national regulations.

CAUTION

The user should always verify the validity of any measurement or test result in order to minimize measurement errors.

NOTE

It is recommended that periodic (every five years) re-calibration of the unit be performed by Capintec's Authorized Service Center (reference CHAPTER 15: CLEANING AND MAINTENANCE) to guarantee that the instrument's high reliability is maintained).

GENERAL SAFETY TIPS

- Unplug the equipment before cleaning it. Use only a damp cloth; do not use solvents or aerosol cleaners.
- To protect the equipment from overheating, do not use the equipment directly in front of a radiator or heat register.
- Do not use the equipment near water, or spill liquids of any kind into the equipment.
- Be sure that your power source matches the rating listed on the CRC[®]-55t Calibrator.
- The CRC[®]-55t power cord has a grounded, 3-prong plug as a safety feature, and it will only fit into a grounded outlet. Do not use an adapter to defeat the grounding.
- To avoid damaging the power cord, do not place anything on it or place it where it will be stepped on. If the cord becomes damaged, replace it immediately.
- Aside from the routine maintenance described in this manual, do not try to service this equipment yourself. Do not make any adjustments other than those outlined in this manual, as you may in-validate the calibration or cause damage requiring extensive repair work. Refer servicing to qualified service personnel.

CHAPTER 2

FUNCTIONAL & TECHNICAL DESCRIPTION

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FUNCTIONAL DESCRIPTION

The CRC®-55tR includes Chamber(s) that provide a precise, accurate, fast and very convenient method of measuring the activity of a radioisotope sample for Nuclear Medicine and Brachytherapy.

The CRC®-55tPET includes Chamber(s) that are dedicated to the measurement of PET nuclides. The PET Chambers provide a precise, accurate, fast and very convenient method of measuring the activity of a radioisotope sample for Positron Emitting Tomography imaging (PET).

The activity of the sample will be displayed with a proper unit when a sample of unknown strength (activity) of a known radioisotope is placed in one of the detectors (ionization chamber or counter) and the correct calibration number is selected.

The sample must be placed in the same geometry as the reference source used to determine the calibration number by using the appropriate source holder.

Note: For a detailed description of the basic principles of the calibrator, reference APPENDIX I: PRINCIPLE OF THE CALIBRATOR.

Most radioisotopes can be measured in the Chamber.

Eight preset nuclide keys (Chamber Hotkeys) are provided on the Chamber Measurement screen for the most often used radioisotopes.

Twenty user assignable nuclide keys (Nuclide Screen Hotkeys) are provided for commonly used radioisotopes that do not have a preset nuclide key.

For R Chambers, assays may be made reliably from as low as 1 microcurie (0.1 megabecquerel) for most radioisotopes to as high as 8 curies [200 giga (10^9) Becquerel] of Tc99m.

For PET Chambers, assays may be made reliably from as low as 1 microcurie (0.1 megabecquerel) for most radioisotopes to as high as 20 Curies [740 giga (10^9) Becquerel] of F18.

The 6cm diameter and 25cm deep ionization chamber well allows convenient measurements of virtually any radioisotope geometry in clinical use including whole generators, syringes and seed trains.

The external shield of the ionization chamber protects users from exposure to intensive radiation and reduces the effects from background radiation on low-level measurements.

If the system is equipped with two Chambers:

- Simultaneous reading of both Chambers (i.e., both Chambers always active in measurement mode).
- The Chamber Measurement screen switches between Chambers with the touch of a single button.
- The Chamber number is displayed on the Chamber Measurement screen.

OVERALL PROGRAM FLOW

When the power is turned on, the Startup Screen appears. When the **CONTINUE** button is pressed, the Chamber Measurement Screen is displayed and the CRC[®]-55t begins measuring the activity in the Chamber. All Chamber measurements and system functions are accessed from this screen. If the optional Well Counter is attached to the system, a button labeled **WELL** will be displayed in the upper left corner of the screen. The **WELL** button is used to access measurements and functions for the Well Counter.

Functions

The main system functions pertaining to the Chamber(s) and Well Counter consist of setting date and time, choosing Curie or Becquerel operation, printing, screen setup, Curie-Becquerel calculations, Decay calculations and Diagnostics.

The functions for the Chamber are accessed from the Chamber Measurement Screen. These consist of Inventory, Nuclide Key (Chamber Hotkey) assignment, Test Source information, Moly Assay testing, Linearity testing, Remote Display (optional) Nuclide Assignment, Chamber testing, Geometry testing, and QC testing.

The functions for the optional Well Counter are accessed from the Well Main Screen and relate only to the Well Counter. These consist of making measurements, Auto Calibration,

Lab Tests and Quality Assurance tests. The Well Counter setup provides access to the Test Source information, nuclide assignment, nuclide efficiencies and Detector Setup.

TECHNICAL DESCRIPTION

On / Off Switch

The on/off switch (I = on; O = off) is located on the back of the instrument.

Warm Up Period

Approximately 30 minutes should be allowed for the instrument to stabilize. While the instrument is warming up, it is strongly recommended that you become familiar with the CRC[®]-55t.

Environment Requirements

Indoor use only. Pollution Degree 2, Altitude, and Installation Cat. II.

Operational

The instrument should be located where the level of the background radiation is as low and as constant as possible.

The instrument should be located where the temperature is stable within a range of +50°F to +85°F (+10°C to +30°C) and the maximum relative humidity is 90% non-condensing to warrant maximum reliability and accuracy.

The instrument should be located where the barometric pressure is within a range of 27 – 31 inches of mercury (91 – 105 kilopascals).

Storage

The instrument should be stored where the temperature is stable and the range is from +39°F to +110°F (+4°C to +43°C) and the maximum relative humidity is 90% non-condensing to warrant maximum reliability.

The instrument should be stored where the barometric pressure is within a range of 15 – 33 inches of mercury (51 – 112 kilopascals).

CAUTION

*If these environmental requirements are not followed,
the instrument may display erroneous readings.*

Power Requirements

CAUTION

If the input voltage to the following items is not within the stated limits, the unit may not function correctly or may be damaged.

Line Voltage

Readout

100-240VAC, 50/60Hz, 230mA

Printers

Okidata Microline 320 (optional)

120VAC, 60Hz, 0.9A or

230/240VAC, 50/60Hz, 0.5A

Epson LX-300+II printer (optional)

99-132VAC, 50/60Hz, 0.6A (maximum 1.4A depending on the character type)

198-264VAC, 50/60Hz, 0.3A (maximum 1.4A depending on the character type)

Epson TM-295II Slip Printer (optional)

Input: 100-240VAC, 50/60Hz, 1.2A; **Output:** +24VDC, 0.8A

Epson TM-U200D Roll Printer (optional)

Input: 120VAC, 60Hz, 0.45A; **Output:** 33VDC, 1.2A or

Input: 220VAC, 50/60Hz, 1.2A; **Output:** +24VDC, 0.8A

HP DeskJet 940c Inkjet (or equivalent) Printer (optional)

100-240VAC, 50/60Hz, 0.7A

Epson Stylus C86 Inkjet (or equivalent) Printer (optional)

100-240VAC, 50/60Hz, 0.4A

Remote Display Unit

Input: 100~240VAC, 50-60Hz, 1.2A; **Output:** +9.0 VDC, 5A

Line Filter

Line filter is provided internally.

Use of a filtered line is recommended if excessive line noise is anticipated.

Ground Current

Less than .5mA

Power Connector and Cable

A grounded 3-prong plug cord for the instrument that is approved for use at the user's site must be used.

Interconnection of devices must be made using the cables supplied with the instrument.

Dimensions**Console**

Height	42.0cm	....	(9.5in)
Width	23.0cm	....	(9.0in)
Depth	27.0cm	....	(10.5in)
Weight	3.4kg	.....	(7.5lb)

Chamber

Height	43.8cm	....	(17.25in)
Diameter	17.2cm	....	(6.76in)
Weight	13.6kg	.....	(30lb)
Well Diameter	6.1cm	.....	(2.4in)
Well Depth	25.4cm	....	(10.0in)
Cable Length ¹	3.7m	.....	(12ft)

Well Counter (optional)

Height	23.8cm	....	(9.38in.)
Diameter	15.2cm	....	(6in.)
Weight	6.9kg	.....	(15.2lb.)
Well Diameter	1.7cm	.....	(.67in.)
Well Depth	3.8cm	....	(1.5in.)
Cable Length	2.7m	.....	(9ft.)

Cables

Power	1.8m	.....	(6ft)
Printer ²	1.8m	.....	(6ft)

Performance**R Chamber Performance**

Measurement Range:	
Maximum Activity (Co60)	37.4 GBq (1.00 Ci)
Maximum Activity (Co57)	206. GBq (5.57 Ci)
Resolution	0.001 MBq (.01 µCi)
Electrometer Accuracy ³	better than ±2%
System Precision	better than ± 0.1% of FSD
System Linearity	within ±2%
Response Time (Low activity sample)	within 4 or 16 sec.
Response Time (All other samples)	within 2 sec.

PET Chamber Performance

Measurement Range:	
Maximum Activity (Co60)	374 GBq (10.1 Ci)

¹ Longer cables are available. Consult factory.

² Optional

³ Overall accuracy is determined by the calibration for the specific nuclide and the sample configuration and the accuracies of the standard sources used for calibration of the electrometer.

Maximum Activity (Co57)	740 GBq (20.0 Ci)
Resolution	0.01 MBq (0.1 μ Ci)
Electrometer Accuracy	better than $\pm 2\%$
System Precision	better than $\pm 0.1\%$ of FSD
System Linearity.....	within $\pm 2\%$
Response Time (Low activity sample)	within 4 or 16 sec.
Response Time (All other samples)	within 2 sec.

Well Counter Performance (optional)

Type	Drilled-well crystal, NaI(Tl) scintillator
Crystal Dimensions	3.8cm (1.5") \times 4.4cm (1.75")
Shielding	1.3cm (0.5") lead
Cabling	2.75m (9 ft) interconnecting cable
Counting Rate	60 kcps, max
Energy Discrimination	Fixed 6 channel MCA
Channel Ranges	Ch 1: 15-100 keV
	Ch 2: 100-200 keV
	Ch 3: 200-400 keV
	Ch 4: 400-660 keV
	Ch 5: 660-800 keV
	Ch 6: Over 800 keV

Regulatory Listings

The CRC[®]-55t has been independently tested and is manufactured in compliance with the following Standards:

EMC

- IEC 61326: Electrical equipment for measurement control and laboratory use – EMC requirements

Electrical

- EN 61010-1: Safety requirements for electrical equipment for measurement, control, and laboratory use Part 1: general requirements

ETL Listed

- CAN/CSA C22.2 No. 61010-1:2004, 2nd Edition: Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use – Part 1: General Requirements
- CAN/CSA C22.2 No. 61010-2-101:04, 1st Edition: Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use – Particular requirements for in vitro diagnostic (IVD) medical equipment
- ANSI/UL 61010-1:2004, 2nd Edition: Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use – Part 1: General Requirements

CHAPTER 3

GENERAL OPERATING INSTRUCTIONS

GENERAL 1
Chamber Measurement Screen 1
 Layout 1
 Chamber Measurement Screen Tour 2
ENTERING DATA 4
 Numeric Data 4
 Alphanumeric Data 5

GENERAL

This section describes general operating procedures, the touch screen, and how to access all other tests and screens

Chamber Measurement Screen

Layout

The CRC®-55t Chamber Measurement screen is shown below.

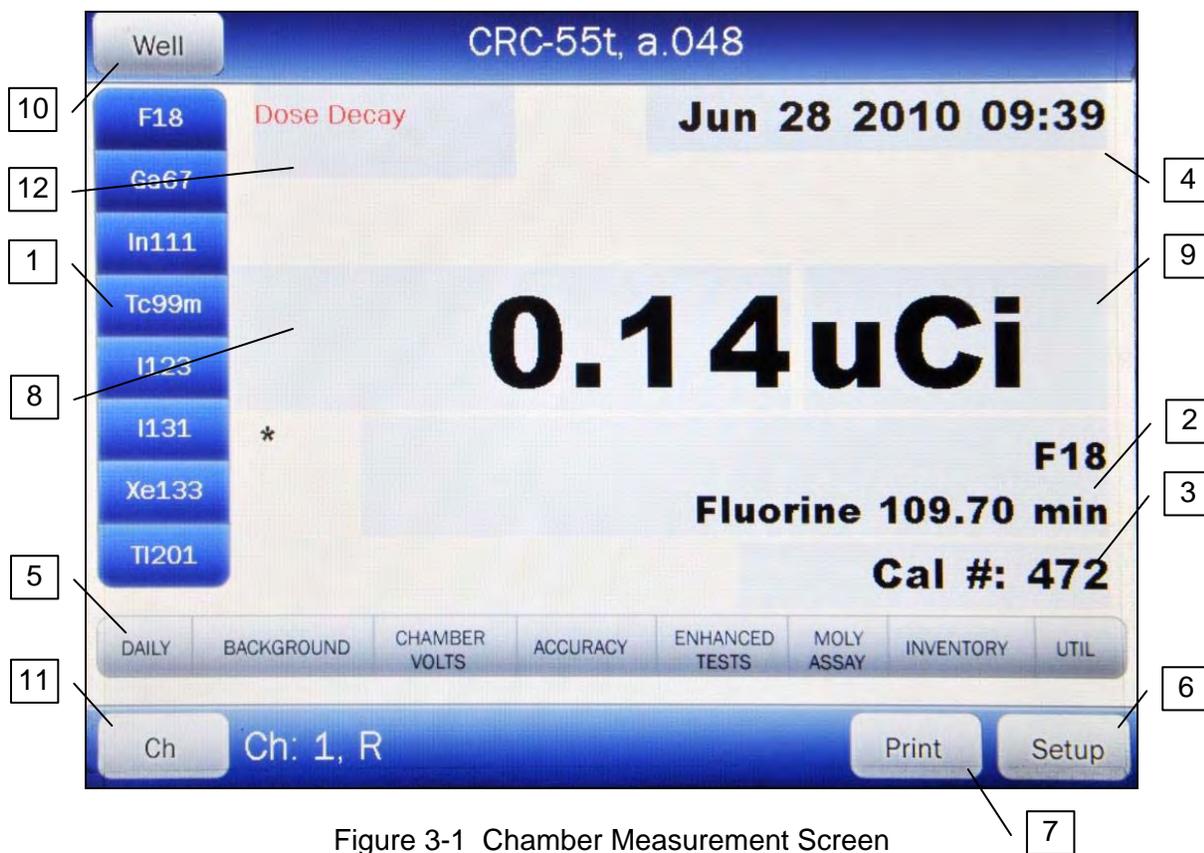


Figure 3-1 Chamber Measurement Screen

Chamber Measurement Screen Tour

General usage of touchable buttons is briefly described. Specific button usage will be given in the appropriate sections.

Chamber Home Screen Hotkeys 1

These are the eight user-definable buttons located at the left edge of the screen. Touching one of the Hotkeys selects the programmed nuclide for measurement. The factory default Hotkeys are listed below.

- R Chambers: F18, Ga67, In111, Tc99m, I123, I131, Xe133, TI201
- PET Chambers: F18, C11, N13, O15, Tc99m, Cs137, Co60, I131

Nuclide Button 2

This button is located below the measurement and displays the currently selected nuclide, nuclide name and half-life. Touching this button allows the user to select any nuclide in memory (including nuclides added by the user).

Cal # Button 3

This is the Calibration Number button and is located below the Nuclide button and displays the currently selected nuclide's Calibration Number or the currently selected

Calibration Number. Touching this button allows the user to input a Calibration Number to be used for the current measurement.

Date/Time Button 4

Touching the date/time will display a screen allowing the setting of the current date/time. A password is required to change the date and/or time.

Test Buttons 5

The bottom of the screen holds 8 buttons that are composed of **DAILY**, **BACKGROUND**, **CHAMBER VOLTS**, **ACCURACY**, **ENHANCED TESTS**, **MOLY ASSAY**, **INVENTORY**, and **UTIL**. Each of these buttons is addressed throughout the manual.

SETUP Button 6

The lower right part of the screen contains the **SETUP** button. This button allows for setting up the system for different tests, formats and printers as explained in later chapters.

PRINT Button 7

Note: *If the system is not set up for use with the optional Printer, this button will not be displayed.*

The **PRINT** button will be displayed in the lower right part of the screen. It allows printing of data displayed on the screen.

Measurement Button 8

The central part of the screen contains the measurement. Touching the measurement (x.xx) allows the user to change the precision of the measurement.

Units Button 9

The central part of the screen contains the measurement unit. Touching the unit (Ci/Bq) allows the user to toggle between Curies and Becquerel if so chosen in Setup.

WELL/CH (CHAMBER) Button 10

Note: *If the optional Well Counter is not attached to the system, this button will not be displayed.*

When the instrument is first powered up, it is in Chamber mode. That is, it is set up to make measurements using the Chamber. The **WELL** button is located in the upper left part of the Chamber Measurement screen.

Pressing the **WELL** button will put the instrument in Well mode, which means it will be set up to make measurements using the Well Counter.

Once the system is in Well mode, the **WELL** button will change to the **CH (CHAMBER)** button. Pressing the **CH** button will put the instrument in Chamber mode, which means it will be set up to make measurements using the Chamber.

CH Button 11

Note: *If only one Chamber is attached to the system, the **CH** button will not be displayed.*

When the instrument is in Chamber mode, if more than one Chamber is connected to the system, the **CH** (Chamber) button will be displayed and is located in the lower left part of the Chamber Measurement screen.

Pressing the **CH** button allows the selection of which Chamber's measurement will be displayed on the Chamber Measurement screen.

Dose Decay Button 12

This button is located to the right of the preset nuclide keys (Chamber Hotkeys) in the upper portion of the Chamber Measurement screen.

This button allows the entry of a future date and time for the current sample being measured. After the date and time are input, the Dose Decay button will display the activity of the current sample at the specified time in red.

ENTERING DATA

Numeric Data

When a numeric only data entry is required, a numeric keypad will appear as shown below. These keypads are touchable for entering the data.

If units of measure are also required, such as Ci, mCi, μ Ci for activity or Yr, Hr, Day, Min, Sec for half-life, they will appear on the keypad between the number pad and the data entry box.

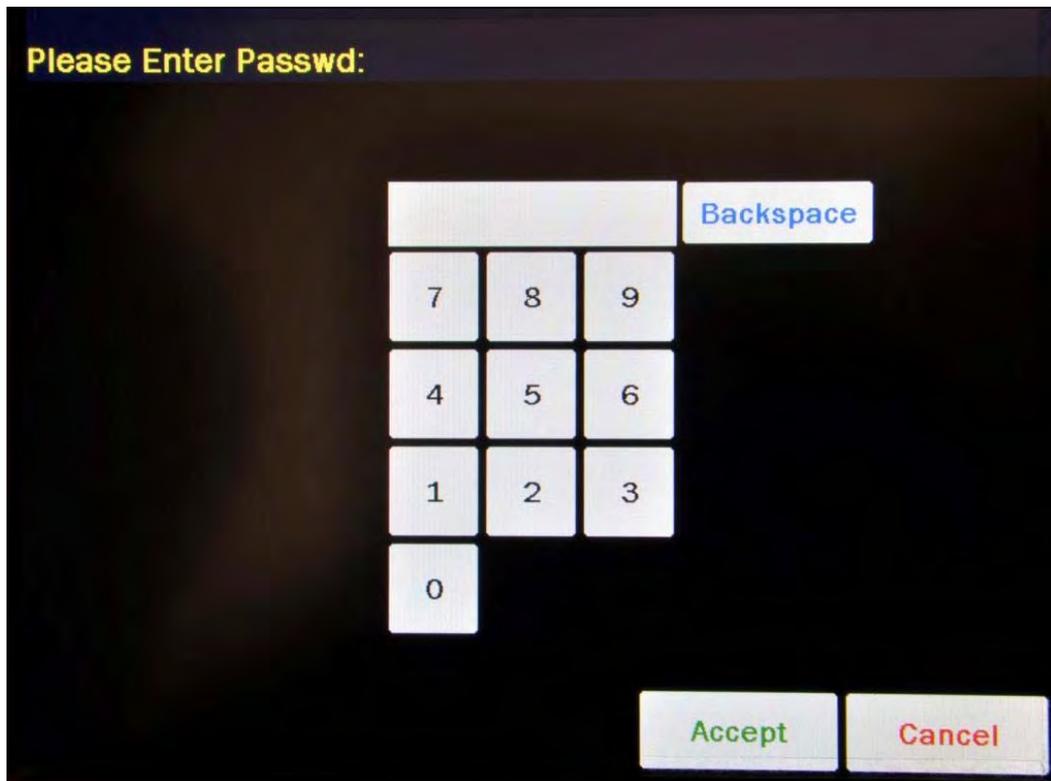


Figure 3-2 Numeric Keypad Screen

Alphanumeric Data

When an alphanumeric data entry is required, an alphanumeric keypad will appear as shown below.

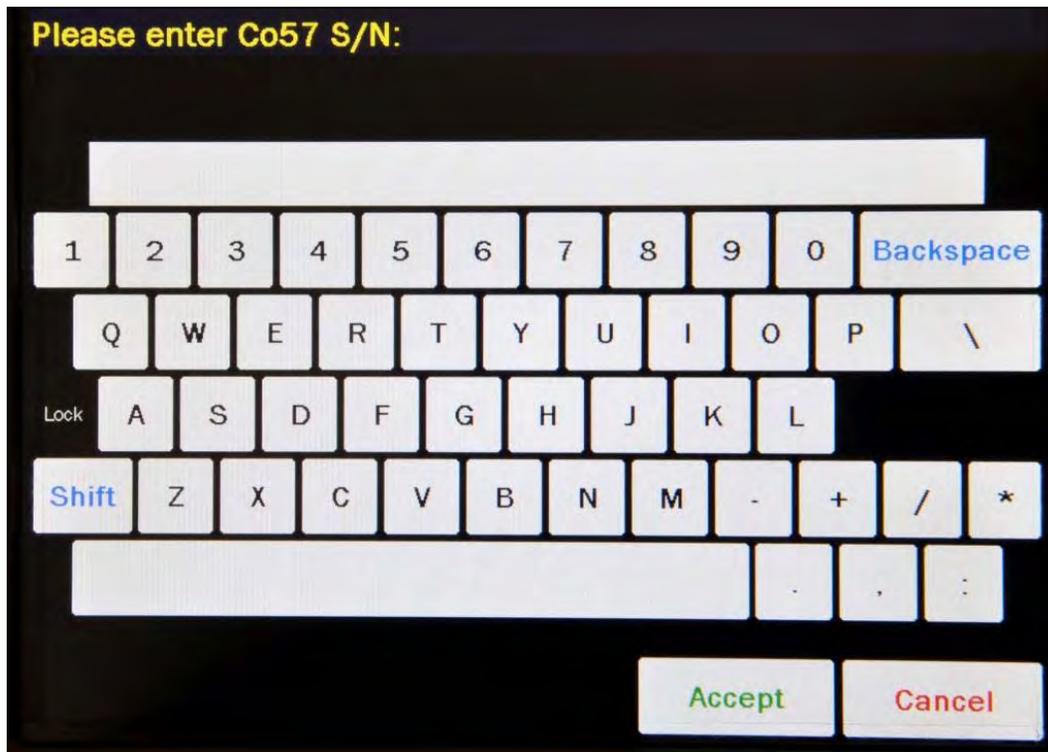


Figure 3-3 Alphanumeric Keypad Screen

Pressing the **SHIFT** key on the alphanumeric keyboard will cycle between 4 modes:

- Lock/Upper Case – If “Lock” is displayed above the **SHIFT** key and upper case letters are displayed on the keys, the keyboard is locked in upper case letters. All selected letters will be in upper case.
- 1Chr/Lower Case – If “1Chr” is displayed above the **SHIFT** key and lower case letters are displayed on the keys, the first letter selected will be in lower case and the keyboard will change to Lock/Upper case mode.
- Lock/Lower Case – If “Lock” is displayed above the **SHIFT** key and lower case letters are displayed on the keys, the keyboard is locked in lower case letters. All selected letters will be in lower case.
- 1Chr/Upper Case – If “1Chr” is displayed above the **SHIFT** key and upper case letters are displayed on the keys, the first letter selected will be in upper case and the keyboard will change to Lock/Lower case mode.

CHAPTER 4

SYSTEM SETUP

GENERAL 1

RECEIVING CONDITION EXAMINATION..... 1

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ASSEMBLY..... 3

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 Printers (optional) 7

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 Well Counter Test..... 11

GENERAL

Initial installation and checkout procedures are described in this section.

RECEIVING CONDITION EXAMINATION

Be sure to verify that the shipping carton(s) is received in good condition, i.e., no damage should be visible and the box(es) should be dry and clean.

Should the instrument be received in a damaged condition, save the shipping container(s) and the packing materials and request an immediate inspection by the carrier.

Capintec, Inc. is not responsible for the damage, which occurs during shipment but will make every effort to help obtain restitution from the carrier.

UNPACKING AND INSTALLATION

The instrument is packed and shipped as a complete unit. All the accessories are contained in the cartons. (If more than one Chamber or an optional Well Counter, printer or Remote Display is included, they will be in separate cartons.)

The instrument is shipped in a plastic bag in order to provide a dry and clean environment during shipment.

CAUTION

*Be sure the instrument has reached room temperature prior to opening the bag.
(Leave the box in the room 24 hours before opening it.)*

1. Remove all outer packing materials and tapes. The shipping and packing materials should be saved for future use.
2. The following equipment should be found upon unpacking:
 - Readout Unit
 - Chamber(s) and Liner(s)/Dipper(s)
 - Well Counter (optional)
 - Power Cord
 - Remote Display and cable (optional)
 - Printer (optional)
 - Okidata Microline 320, or
 - Epson LX-300+II, or
 - Epson Slip printer, or
 - Epson Roll printer, or
 - HP DeskJet 940c Inkjet (or equivalent) printer, or
 - Epson Stylus C86 Inkjet (or equivalent) printer

The Printer should have the following accessories:

- Power Supply
- Printer Ribbon
- Communications Cable
- Roll Paper (If Roll printer ordered)
- Tickets (If Ticket printer ordered)

Note: *If Test Sources are ordered, they will be shipped separately.*

3. Be sure to remove all tape and protective materials from the instrument prior to connecting to the power line.

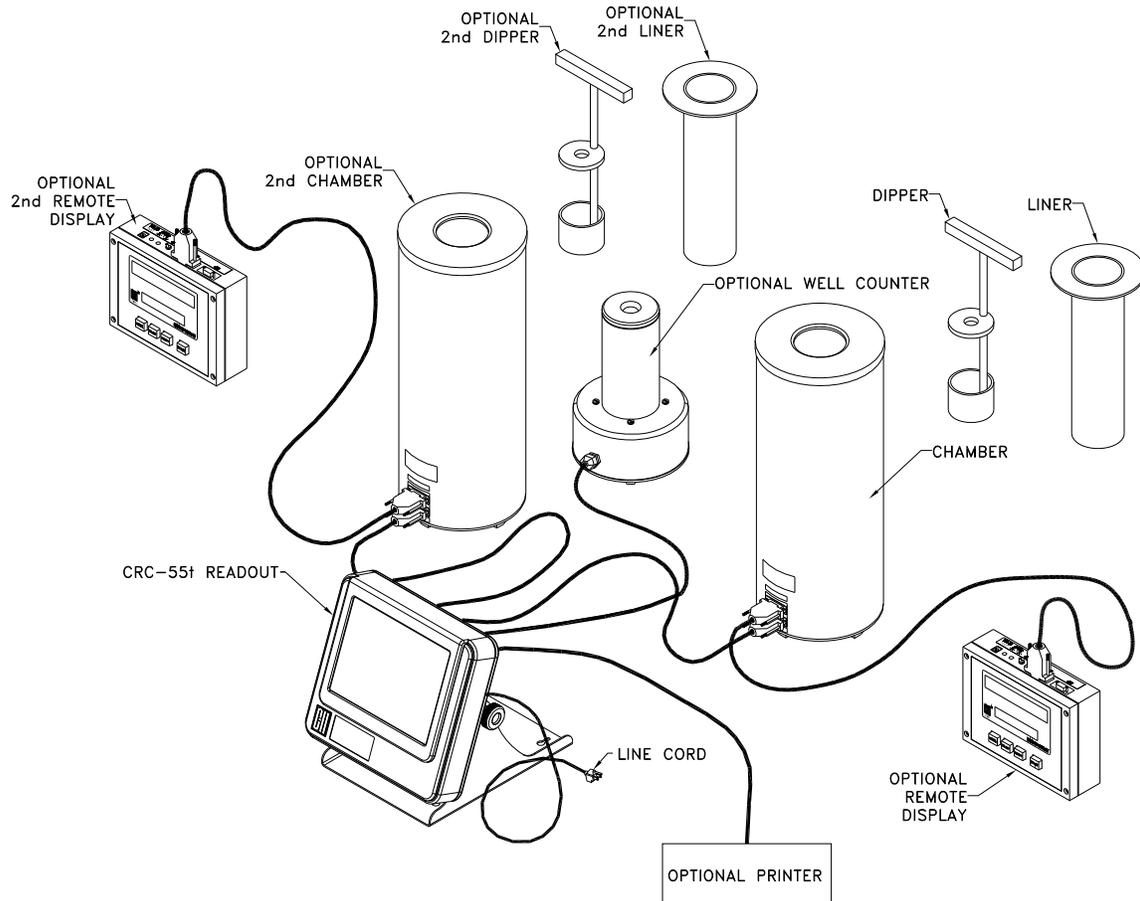
ASSEMBLY

Figure 4-1

4. Verify that all power switches (Readout, Printer and Remote Display) are in the "OFF" or "0" position. (**Note:** If using the Slip-Ticket printer, please unplug from AC Power)

5. Connect the Chamber Cable to the connector on the rear of the CRC[®]-55t Readout labeled "CHAMBER 1".

Note: If two Chambers are part of the system, connect the second Chamber to the connector on the rear of the CRC[®]-55t Readout labeled "CHAMBER 2".

6. Connect the Well Counter Cable to the connector at the rear of the CRC[®]-Ultra Readout labeled "WELL COUNTER".

Note: Do not attach the Well Counter cable to the "CHAMBER 1" or CHAMBER 2" connectors.

7. Attach the Power Cable to the receptacle on the Power Module located on the back of the Readout Unit.

Note: Do not place the Readout unit against a wall or other object so that the power cord can be detached from the back of the Readout unit.

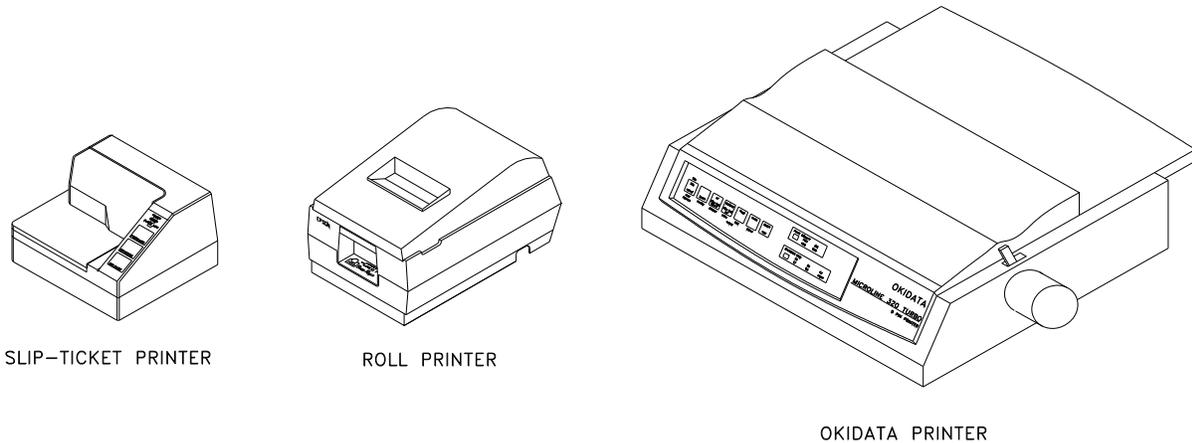


Figure 4-2 Optional RS-232 Printers

8. If the optional printer is an RS-232 (serial) version, attach the printer cable (one end has a 9 pin “D” connector, the other end has a 25 pin “D” connector) to the 9 pin “D” connector at the rear of the CRC[®]-55t Readout marked “PRINTER”. Attach the other end to the printer.

Note: Do not attach the printer cable to the 9 pin “D” connector labeled “RS232”.

If the optional printer is a USB version, attach the printer cable to the USB connector on the rear of the CRC[®]-55t Readout marked “PRINTER”. Attach the other end to the printer.

Note: Do not attach the printer cable to the “PC” connector.

9. For each printer type, verify that the correct paper is installed. (**Note:** The Slip-Ticket printer paper is manually inserted at the time of printing.)

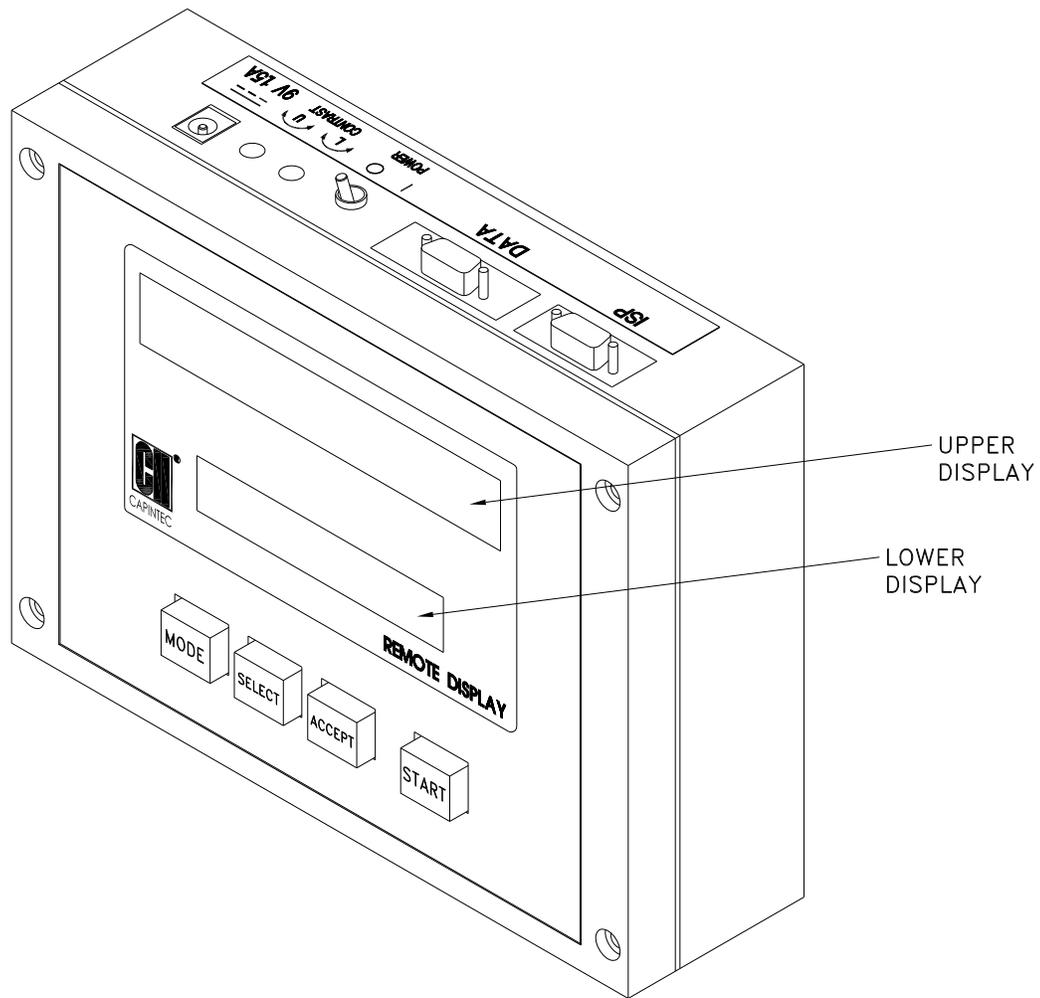


Figure 4-3 Optional Remote Display

10. Connect the Remote Display Cable (both ends have a 15 pin “D” connector) to the connector on the Chamber labeled “REMOTE”. Attach the other end to the Remote Display labeled “DATA”.

Note: Do not attach the Remote Display cable to the Chamber “READOUT” connector.

11. Attach the Remote Display Power Supply to the Remote Display power input jack labeled as “9V 1.5A”.

Liners, Dippers, Optional Dipper and Holders

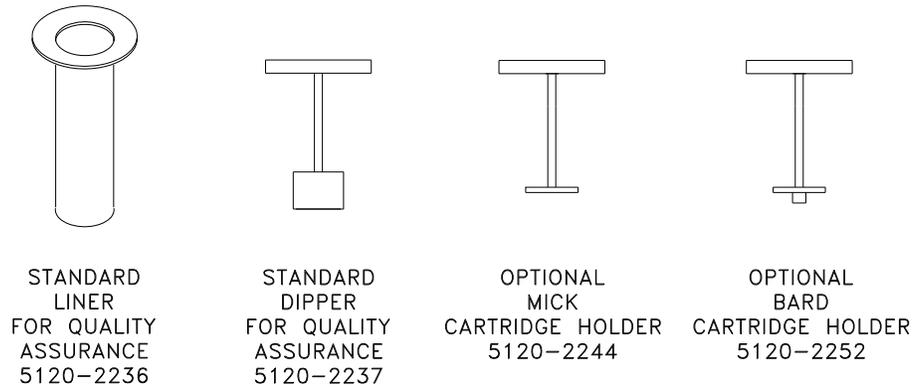


Figure 4-4 Liner and Dippers

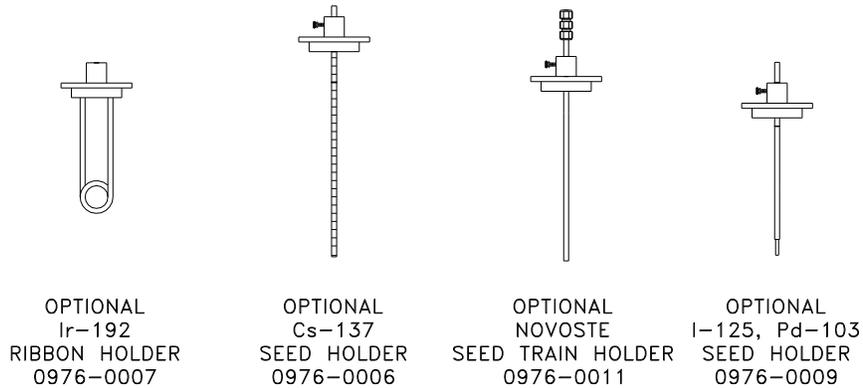


Figure 4-5 Holders

Note: The supplied Chamber Liner (7300-2004) and Dipper (7300-2005) are only to be used for the measurement of Test sources (Standard Sources). For all other source measurements, use the appropriate source holder for the source type being measured in order to obtain a correct reading. If additional information is needed, contact Capintec, Inc. for further assistance.

ENVIRONMENT REQUIREMENTS

Indoor use only. Pollution Degree 2, Altitude, and Installation Cat. II.

The instrument should be located where the level of the background radiation is as low and as constant as possible.

The instrument should be located where the temperature is stable within a range of +50°F to +85°F (+10°C to +30°C) and the maximum relative humidity is 90% non-condensing to warrant maximum reliability and accuracy.

The instrument should be located where the barometric pressure is within a range of 27 – 31 inches of mercury (91 – 105 kilopascals).

CAUTION

*If these environmental requirements are not followed,
the instrument may display erroneous readings.*

POWER REQUIREMENTS

CAUTION

*If the input voltage to the following items is not within the stated limits,
the unit may not function correctly or may be damaged.*

Readout

100-240VAC, 50/60Hz, 230mA

Printers (optional)

Okidata Microline 320 (optional)

120VAC, 60Hz, 0.9A or
230/240VAC, 50/60Hz, 0.5A

Epson LX-300+II printer (optional)

99-132VAC, 50/60Hz, 0.6A (maximum 1.4A depending on the character type)
198-264VAC, 50/60Hz, 0.3A (maximum 1.4A depending on the character type)

Epson TM-295II Slip Printer (optional)

Input: 100-240VAC, 50/60Hz, 1.2A; **Output:** +24VDC, 0.8A

Epson TM-U200D Roll Printer (optional)

Input: 120VAC, 60Hz, 0.45A; **Output:** 33VDC, 1.2A or
Input: 220VAC, 50/60Hz, 1.2A; **Output:** +24VDC, 0.8A

HP DeskJet 940c Inkjet (or equivalent) printer (optional)

100-240VAC, 50/60Hz, 0.7A

Epson Stylus C86 Inkjet (or equivalent) printer (optional)
100-240VAC, 50/60Hz, 0.4A

Remote Display Unit (optional)

Input: 100~240VAC, 50-60Hz, 1.2A; **Output:** +9.0 VDC, 5A

TURN ON PROCEDURES

1. Be sure the interconnecting cable from the Chamber and Well Counter assemblies are properly plugged into the back of the Readout unit.
2. Confirm the power requirements of the instrument.
3. Be sure the power switch is off. (Push lower part of the rocker switch next to the power receptor located on the rear of the main unit.)
4. Plug the power plug into a grounded three-wire outlet of the specified power line.
5. Turn on the Readout Unit using the power switch located at the rear of the unit.
6. After a few seconds, Figure 4-6 Startup Screen will appear.

CAUTION

Accidental connection of the power plug into a DC line or to an AC line which exceeds the specified voltage may result in catastrophic damage to the instrument's circuits.

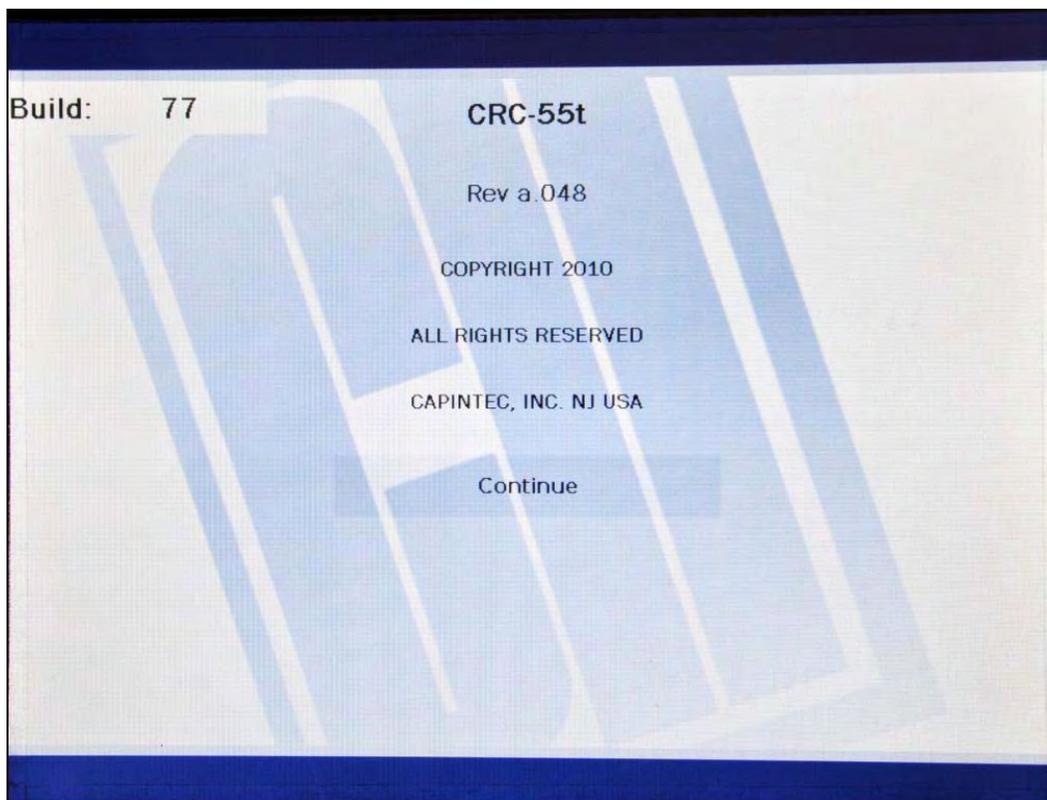


Figure 4-6 Startup Screen

Note: The screen will display the revision level of the installed software.

GENERAL OPERATIONAL SETUP

There are several things that **must** be done before using the CRC[®]-55t Radioisotope Dose Calibrator for the first time. The following briefly describes these steps:

- Verify or set the date/time: Although the date and time are set at the factory, you should verify that the date and time are correct for your location. Reference CHAPTER 5: SYSTEM INITIALIZATION, SECTION: SETTING DATE AND TIME.
- Select proper units: Ci or Bq. Although the system can be changed at any time, it is recommended that the proper units be set prior to using the unit to prevent confusion. Reference CHAPTER 5: SYSTEM INITIALIZATION, SECTION: CHOOSING Ci or Bq.
- Input Test Source Data: Test Sources (Standard Sources) are used for the Accuracy and Constancy tests. The Accuracy may be tested using Co57, Co60, Ba133, Cs137 or Ra226 for an R Chamber or Co57, Co60, Ba133, Cs137 or Na22 for a PET Chamber. There can be a Test Source for each of these nuclides. One or more of the Test Sources must be designated as the source(s) to be used in the Daily Test. Reference CHAPTER 6: CHAMBER INITIALIZATION, SECTION: TEST SOURCE SETUP.

- Input Constancy Test Source: The base source for the Constancy Test is chosen from the sources designated as Daily Sources. Reference CHAPTER 6: CHAMBER INITIALIZATION, SECTION: TEST SOURCE SETUP.
- Verify correct printer setting: The CRC[®]-55t may be used with one of the following printers. Reference CHAPTER 5: SYSTEM INITIALIZATION, SECTION: PRINTING.
 - Okidata Microline 320
 - Epson LX-300+II
 - Epson TM-U295 SLIP Printer
 - Epson TM-U200D Roll Printer
 - USB HP Inkjet
 - USB Epson Inkjet
- Adding a Nuclide: The CRC[®]-55t contains nuclide data (name, half-life, calibration number) for 84 nuclides. The user may add up to 10 nuclides: the name, half-life and calibration number will be added for each one. Reference CHAPTER 6: CHAMBER INITIALIZATION, SECTION: NUCLIDES.
- Changing Calibration Numbers: The user is allowed to change the calibration number of up to 10 built-in nuclides. Reference CHAPTER 6: CHAMBER INITIALIZATION, SECTION: CALIBRATION NUMBERS.
- Selecting Moly Assay Method: Moly Assay can only be performed using R Chamber with the CAPMAC or CANISTER. Reference CHAPTER 6: CHAMBER INITIALIZATION, SECTION: MOLY ASSAY SETUP.
- Setting Mo/Tc Limit: The Mo/Tc limit is set at the factory to 0.15 μ Ci/mCi. The user can change this value. Reference CHAPTER 6: CHAMBER INITIALIZATION, SECTION: MOLY ASSAY SETUP.

ACCEPTANCE TESTING

The following tests should be performed prior to operational use of the unit.

Chamber Tests

Diagnostics Test

Reference CHAPTER 9: DIAGNOSTICS for instructions on how to perform this test.

Daily Test

Reference CHAPTER 8: CHAMBER TESTS, SECTION: CHAMBER DAILY TEST for instructions on how to perform this test.

Accuracy Test

Reference CHAPTER 8: CHAMBER TESTS, SECTION: ACCURACY TEST for instructions on how to perform this test.

Well Counter Test

Reference the CRC[®]-55t Well Counter Owner's Manual for instructions on how to perform these tests.

CHAPTER 5

SYSTEM INITIALIZATION

GENERAL	1
SETTING DATE AND TIME	1
CHOOSING Ci or Bq	3
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Printer Selection	6
Okidata Menu Set-Up	7
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Screen Calibration	15
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Sleep Brightness	16
Brightness	16
SPEAKER VOLUME	17

GENERAL

This section describes initialization and parameter setup, which are common to the Chamber(s) and the Well Counter.

All of these functions are accessed via the Chamber Measurement screen.

SETTING DATE AND TIME

The system date and/or time can be set from the Chamber Measurement screen or the Well Main Screen.

To change the date and/or time, touch the displayed date/time in the upper-right part of the screen. A numeric keypad will appear to allowing the user to input a 3-digit password as shown in Figure 5-1 Enter Password: Screen.

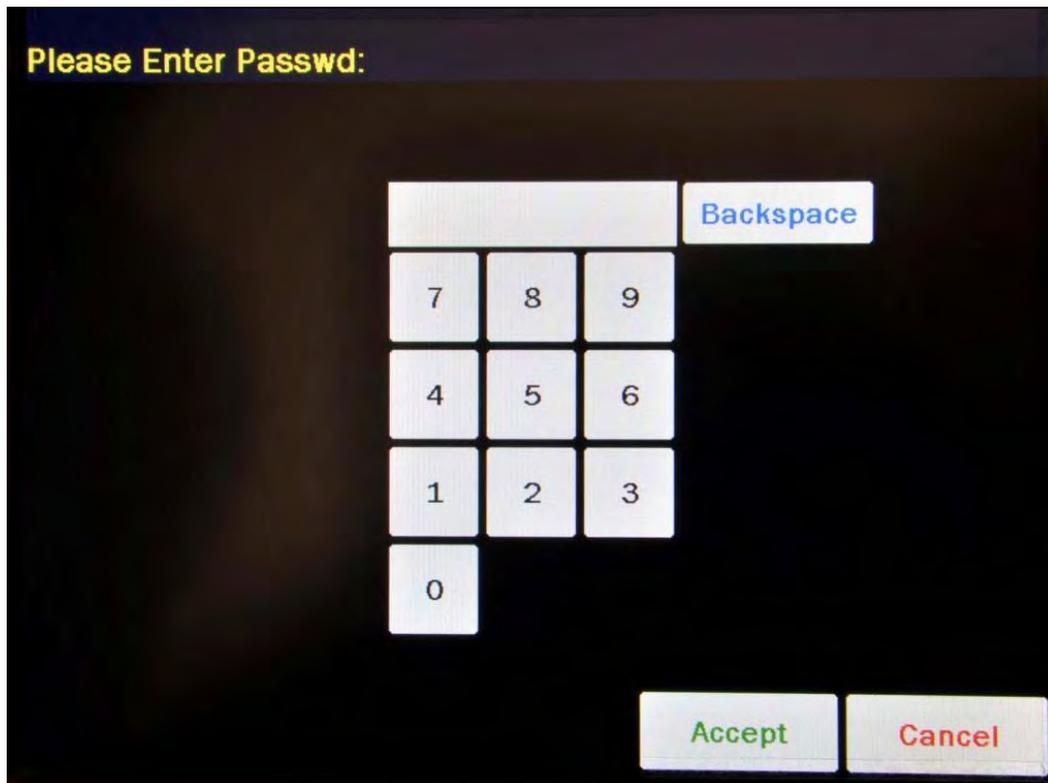


Figure 5-1 Enter Password: Screen

Input the password (last 3 digits of serial number) by touching the appropriate numbers on the keypad. Touch the **ACCEPT** button to accept the password. Figure 5-2 Enter Current Time Screen will appear.

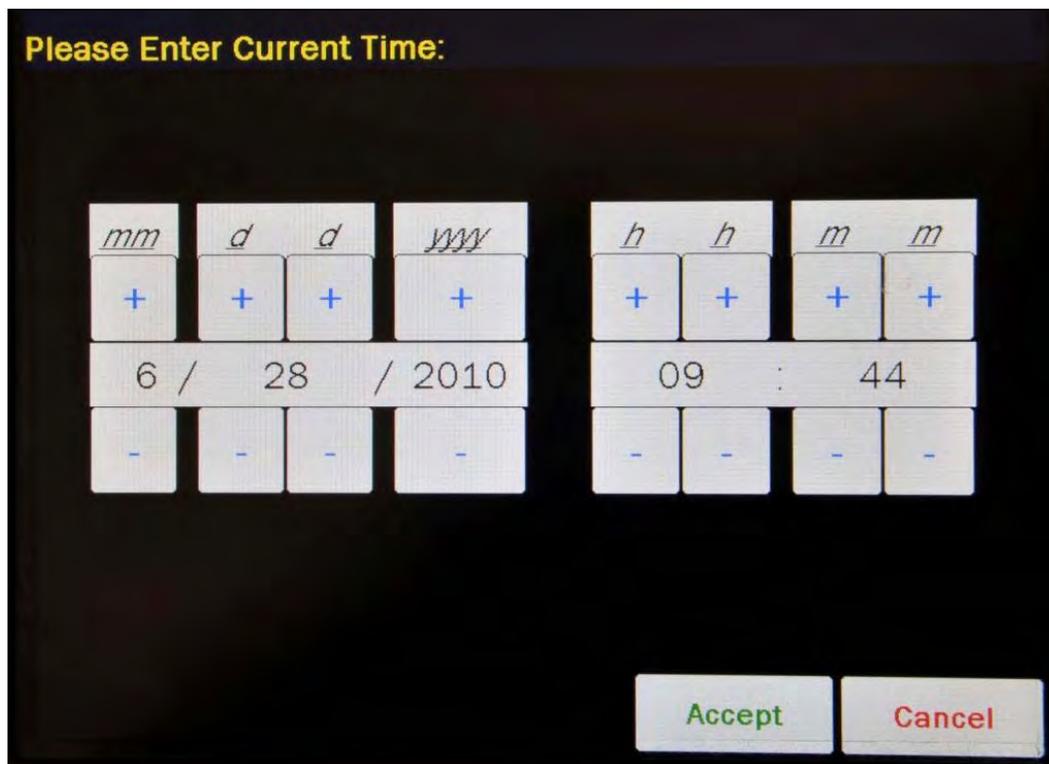


Figure 5-2 Enter Current Time Screen

The screen displays the currently set date and time. Above and below each of the fields are + and – buttons, respectively. To adjust the displayed value for a specific field, touch the + button to increase the displayed value or the – button to decrease the displayed value.

Touch the **ACCEPT** button to accept the new date/time or the **CANCEL** button to cancel any changes. The Chamber Measurement screen will re-appear.

CHOOSING Ci or Bq

Measurements can be displayed in Curies or Becquerels. When the system arrives, it is set up to display in Ci and Bq. Touching the measurement unit on the Chamber Measurement screen will switch the measurement result between Ci and Bq.

In some facilities, it may be decided to disable this feature and allow measurements to be displayed only in Curies or only in Becquerels.

To enable or disable Ci/Bq switching, touch the **SETUP** button located on the Chamber Measurement screen. Figure 5-3 Setup Screen will appear.

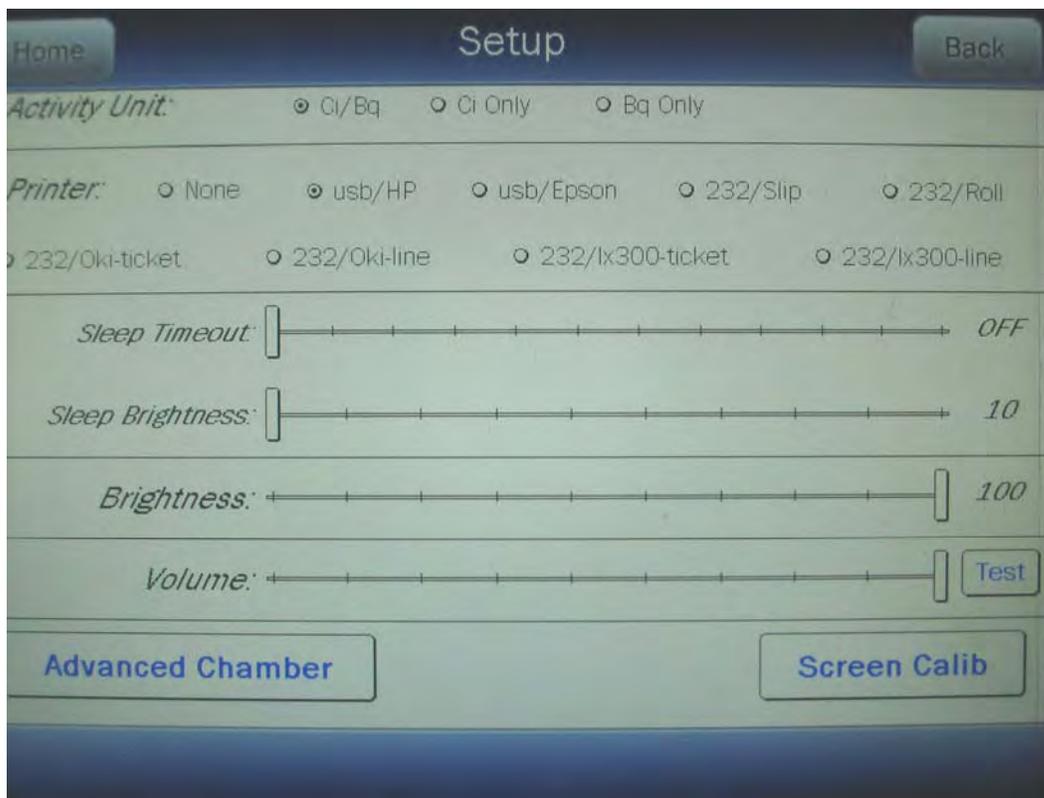


Figure 5-3 Setup Screen

In the **Activity Unit:** section at the top of the Setup Screen, touch the radio button next to the preferred unit for measurements:

- *Ci/Bq* allows the user to switch between Curies and Becquerels,
- *Ci Only* the system will be set to display measurements in Curies only,
- *Bq Only* the system will be set to display measurements in Becquerels only.

Verify that the desired radio button is selected.

Press the **HOME** or **BACK** button to save the changes and return to the Chamber Measurement screen.

PRINTING

CAUTION

If any printer other than one of the models supplied by Capintec is used, Electromagnetic Interference (EMI) may be introduced into other devices located in the same general area as the CRC[®]-55t.

The system does not need a printer to function properly. When a printer is set up to work with the system, a **PRINT** button will appear in the bottom right of all screens in which results can be printed from. If the **PRINT** button is not displayed, then the system is either not set up to work with a printer or printing is not permitted from that particular screen.

The CRC[®]-55t may be used with the following printers:

- USB printers
 - HP DeskJet 940c Inkjet (or equivalent) printer
 - Epson Stylus C86 Inkjet (or equivalent) printer
- RS-232 printers
 - Epson TM-295II Slip printer
 - Epson TM-U200D Roll printer
 - Okidata Microline 320
 - Epson LX-300+II

Note: *If the Okidata Microline 320 or the Epson LX-300+II is used, the Chamber measurement can be printed on a ticket or as a single line on regular paper.*

Other printer models may be used. Please contact the factory for information on which printers can be utilized.

Printer Power Requirements

HP DeskJet 940c Inkjet (or equivalent) printer (optional)
100-240VAC, 50/60Hz, 0.7A

Epson Stylus C86 Inkjet (or equivalent) printer (optional)
100-240VAC, 50/60Hz, 0.4A

Epson TM-295II Slip Printer (optional)
Input: 100-240VAC, 50/60Hz, 1.2A; **Output:** +24VDC, 0.8A

Epson TM-U200D Roll Printer (optional)
Input: 120VAC, 60Hz, 0.45A; **Output:** 33VDC, 1.2A or
Input: 220VAC, 50/60Hz, 1.2A; **Output:** +24VDC, 0.8A

Okidata Microline 320 printer (optional)
120VAC, 60Hz or
230/240VAC, 50/60Hz

Epson LX-300+II printer (optional)

99-132VAC, 50/60Hz, 0.6A (maximum 1.4A depending on the character type)

198-264VAC, 50/60Hz, 0.3A (maximum 1.4A depending on the character type)

Printer Selection

If a printer was included with the CRC[®]-55t, the system will already be set to use the included printer. If a printer is being added or the system did not include a printer at the time of purchase, then the CRC[®]-55t must be set to use the printer in order to provide printed data.

To view and/or change the selected printer, touch the **SETUP** button located on the Chamber Measurement screen. Figure 5-3 Setup Screen will appear.

In the **Printer** section on the Setup Screen, the following options are available:

- *NONE*..... if no printer is attached to the system: the calibrator will continue to function properly but without the ability to print.
- *USB/HP*..... USB printer port, HP DeskJet 940c Inkjet (or equivalent) printer: prints all data on regular paper.
- *USB/EPSON* USB printer port, Epson Stylus C86 Inkjet (or equivalent) printer: prints all data on regular paper.
- *232/SLIP* RS-232 printer port, Epson TM-295II Slip Printer: prints measurements on tickets or regular paper and all other data on regular paper.
- *232/ROLL*..... RS-232 printer port, Epson TM-U200D Roll Printer: prints all data on roll paper.
- *232/OKI-TICKET* RS-232 printer port, Okidata Microline 320 printer: prints measurements on tickets or regular paper and all other data on regular paper.
- *232/OKI-LINE*..... RS-232 printer port, Okidata Microline 320 printer: prints measurements in a single line on regular paper and all other data on regular paper.
- *232/LX300-TICKET*... RS-232 printer port, Epson LX-300+II printer: prints measurements on tickets or regular paper and all other data on regular paper.
- *232/LX300-LINE*..... RS-232 printer port, Epson LX-300+II printer: prints measurements in a single line on regular paper and all other data on regular paper.

The Okidata Microline 320 and Epson LX-300+II printers can print measurements on a ticket or on regular paper. If the printing will be done on tickets, select the printer with the *TICKET* option. If printing will not be done on tickets, select the printer with the *LINE* option.

To select the desired printer, touch the radio button next to the preferred printer type. Verify that the desired radio button is selected.

Press the **HOME** or **BACK** button to save the changes and return to the Chamber Measurement screen.

Okidata Menu Set-Up

If an Okidata Microline 320 printer was ordered with the CRC[®]-55t system, the Okidata printer should be set up to function properly when received.

Should you experience printer difficulties, such as not printing, improper print spacing, printing the wrong characters, etc., make sure that the printer Setup is exactly as indicated in Figure 5-4 Listing of the *Turbo* OKIDATA 320 Printer Setup Data. If any differences are found, they must be corrected.

The buttons referred to are all located on the front panel of the printer. The Paper Lever is on the right side of the top surface of the printer near the paper roller.

To print and correct the Setup:

1. Make sure that the form paper is properly loaded in the printer.
2. Press the **SEL** button (to take printer off-line).
3. Press **SHIFT + MENU (SEL)** to enter the Setup Menu.
4. Press the **PRINT** button and the entire Setup listing will print.
5. If there are no differences between what just printed and Figure 5-4 Listing of the *Turbo* OKIDATA 320 Printer Setup Data go to step 10.
6. Press the **GROUP** button. The first line of the first group of lines of the Setup will print.
7. If all lines in the group just printed match the corresponding lines in Figure 5-4 Listing of the *Turbo* OKIDATA 320 Printer Setup Data, repeat step 6 for the next group.
8. If any line in the group just printed does not match the corresponding line in Figure 5-4 Listing of the *Turbo* OKIDATA 320 Printer Setup Data, it must be corrected. For example, to change the Baud Rate to 4800:
 - a. Press the **GROUP** button until Serial I/F is printed.
 - b. Press the **ITEM** button until Baud Rate is printed.
 - c. Press the **SET** button until 4800 BPS is printed.
9. If any differences remain, return to step 6 for the next group.
10. Press the **SHIFT + MENU (SEL)** buttons to return to **SEL** (on-line).

Note: *The Setup printout shown in Figure 5-4 Listing of the Turbo OKIDATA 320 Printer Setup Data is for example only. Your printer Setup may differ slightly from that shown. Verify that the settings, which are the same between your Setup and that shown, concur.*

Figure 5-4 Listing of the Turbo OKIDATA 320 Printer Setup Data

Printer Control	Emulation Mode	IBM PPR
Font	Print Mode	Utility
Font	DRAFT Mode	HSD
Font	Pitch	10 CPI
Font	Proportional Spacing	No
Font	Style	Normal
Font	Size	Single
Symbol Sets	Character Set	Set I
Symbol Sets	Language Set	American
Symbol Sets	Zero Character	Slashed
Symbol Sets	Code Page	USA
Rear Feed	Line Spacing	6 LPI
Rear Feed	Form Tear-Off	Off
Read Feed	Skip Over Perforation	No
Rear Feed	Page Length	11"
Bottom Feed	Line Spacing	6 LPI
Bottom Feed	Form Tear-Off	Off
Bottom Feed	Skip Over Perforation	No
Bottom Feed	Page Length	11"
Top Feed	Line Spacing	6 LPI
Top Feed	Bottom Margin	Valid
Top Feed	Page Length	11"
Top Feed	Wait Time	1 sec
Top Feed	Page Length Control	by Actual Page Length
Set-Up	Graphics	Uni-directional
Set-Up	Receive Buffer Size	64K
Set-Up	Paper Out Override	No
Set-Up	Print Registration	0
<pre> ||||| SET--- ||||| SHIFT+SET ||||| </pre>		
Set-Up	Operator Panel Functions	Full Operation
Set-Up	Reset Inhibit	Yes
Set-Up	Print Suppress Effective	No
Set-Up	Auto LF	No
Set-Up	Auto CR	No
Set-Up	SI Select Pitch (10CPI)	17.1 CPI
Set-Up	SI Select Pitch (12CPI)	12 CPI
Set-Up	Time Out Print	Valid
Set-Up	Auto Select	No
Set-Up	Centering Position	DEFAULT
Set-Up	ESC SI Pitch	17.1 CPI
Parallel I/F	I-Prime	Buffer Print
Parallel I/F	Pin 18	+5v
Parallel I/F	Bi-Direction	Enable
Serial I/F	Parity	None
Serial I/F	Serial Data 7/8 Bits	8 bits
Serial I/F	Protocol	Ready/Busy
Serial I/F	Diagnostic Test	No
Serial I/F	Busy Line	SSD-
Serial I/F	Baud Rate	4800 BPS
Serial I/F	DSR Signal	Invalid
Serial I/F	DTR Signal	Ready on Power Up
Serial I/F	Busy Time	200 ms

Epson LX-300+II Menu Set-Up

If an Epson LX-300+II printer was ordered with the CRC[®]-55t system, the printer should be set-up to function properly when received.

Should you experience printer difficulties, such as not printing, improper print spacing, printing the wrong characters, etc., make sure that the printer Setup is exactly as shown in Figure 5-6 Epson LX-300+II Printer Current Settings. If any differences are found, they must be corrected.

Follow the steps below to enter Default Setting mode. If single sheets are used, a new sheet of paper will need to be loaded each time the printer ejects a printed page.

The buttons referred to are all located on the front panel of the printer.

1. Make sure that the paper is properly loaded and the printer is off.
2. Hold down the **TEAR OFF (FONT)** button and then turn on the printer.

The printer enters Default Setting mode and prints instructions (as shown in Figure 5-5 Epson LX-300+II Printer Language Selection Instructions) for selecting the language. The current language is indicated by which control panel lights are on. (For English, only the Pause light is on.)

3. If a different language is desired, press the **LF/FF** button until the lights show the preferred language.
4. Press the **TEAR OFF (FONT)** button to print a list of all the current settings as shown in Figure 5-6 Epson LX-300+II Printer Current Settings.

Figure 5-5 Epson LX-300+II Printer Language Selection Instructions

W0007927 2749H

Font LEDs	Pause LED
Voyants Police	Voyant Pause
Schriftart LEDs	Pause LED
Font LEDs	Pausa LED
Indicadores Font	Indicador Pausa
Indicadores Fonte	Indicador Pausa
: : -----: :	
: : :	
■ ■ □ English	
■ □ □ Français	
■ □ □ Deutsch	
□ ■ ■ Italiano	
□ ■ □ Español	
□ □ ■ Português	

□:LED on	/ Voyant Oui	/ LED an	/ Spia acceso	/ Indicador On
	/ Indicador aceso			
■:LED off	/ Voyant Non	/ LED aus	/ Spia spenta	/ Indicador Off
	/ Indicador apagado			
⊠:LED blink	/ Voyant clignote	/ LED blinkt	/ Spia lampeggiante	/ Indicador Intermitente
	/ Indicador intermitente			
⊠:LED 2-blink	/ Voyant 2-clignote	/ LED 2-blinkt	/ Spia 2-lampeggiante	/ Indicador 2-Intermitente
	/ Indicador 2-intermitente			

- Press the LF/FF button to move through the languages listed in the table ; then press the Tear Off button to select the language.
- Appuyez sur le bouton LF/FF afin de choisir la langue à partir du tableau, et validez en appuyant sur le bouton Tear Off.
- Zur Auswahl einer Sprache aus der Tabelle drücken Sie die Taste LF/FF. Bestätigen Sie Ihre Auswahl durch Drücken der Taste Abtrennkante.
- Premete il tasto LF/FF per scegliere una delle lingua disponibili nella tabella. Premete quindi il tasto Strappo per confermare la vostra scelta.
- Pulse LF/FF para seleccionar el idioma de la Tabla y establézcalo pulsando Corte.
- Pressione a tecla Linha/Página para percorrer as linguas indicadas na tabela; em seguida, pressione a tecla Corte para seleccionar a língua.

Figure 5-6 Epson LX-300+II Printer Current Settings

Current settings	
Page length for tractor	11 inch
Skip over perforation	Off
Auto tear Off	Off
Auto line feed	Off
Print direction	Bi-D
Software	ESC/P
0 slash	0
High speed draft	On
I/F mode	Auto
Auto I/F wait time	10 seconds
Baud rate	4800BPS
Parity	None
Data length	8bit
Parallel I/F bidirectional mode	On
Packet mode	Auto
Character table	PC 437
International character set for Italic table	Italic U.S.A.
Manual feed wait time	1.5 seconds
Buzzer	On
Auto CR (IBM 2380 Plus)	Off
IBM character table	Table2
<p>If you want to change any setting, press the Tear Off switch. If you want not to change any settings, turn off the printer.</p>	

5. If there are no differences between what just printed and Figure 5-6 Epson LX-300+II Printer Current Settings, turn off the printer to exit Default Setting mode.
If changes are needed, proceed to step 6.
6. Press the **TEAR OFF (FONT)** button. The printer prints instructions for changing the settings as shown in Figure 5-7a Epson LX-300+II Printer Changing Settings Instructions.

Figure 5-7a Epson LX-300+II Printer Changing Settings Instructions

(1) Select menu by pressing the Tear Off switch.
Following LEDs show menu selected at that time.

```

Font LEDs
::: Pause LED
:::
::: ** Menu **
■■■□ Page length for tractor
■□■■ Skip over perforation
■□□ Auto tear Off
□■■■ Auto line feed
□■■□ Print direction
□□■■ Software
■■■☒ 0 slash
■☒■■ High speed draft
■☒☒ I/F mode
☒■■■ Auto I/F wait time
☒☒■ Baud rate
☒☒■ Parity
□■☒ Data length
□☒■■ Parallel I/F bidirectional mode
□☒☒ Packet mode
□☒☒ Character table
□☒□ International character set for Italic table
☒■□ Manual feed wait time
☒□■ Buzzer
☒□□ Auto CR (IBM 2380 Plus)
☒☒□ IBM character table

```

(2) Change setting value pressing the LF/FF switch.
Following LEDs show setting value selected at that time.

(3) Repeat (1) and (2) according to following guide printing.

<pre> Font LEDs ::: Pause LED ::: ::: ** Page length for tractor ** ■■■□ 3 inch ■□■■ 3.5 inch ■□□ 4 inch □■■■ 5.5 inch □■□ 6 inch □□■■ 7 inch ■■■☒ 8 inch ** Skip over perforation ** ■■■□ Off ■□■■ On ** Auto tear Off ** ■■■□ Off ■□■■ On ** Auto line feed ** ■■■□ Off ■□■■ On ** Print direction ** ■■■□ Bi-D ■□■■ Uni-D </pre>	<pre> Font LEDs ::: Pause LED ::: ::: ■☒■■ 8.5 inch ■☒☒ 11 inch ☒■■■ 70/6 inch ☒■☒ 12 inch ☒☒■ 14 inch □■☒ 17 inch □☒■ Others </pre>
---	--

Figure 5-7b Epson LX-300+II Printer Changing Settings Instructions

Font LEDs		Font LEDs
||| Pause LED		||| Pause LED
** Software **		
■ ■ ■ □ ESC/P		
■ □ ■ IBM 2380 Plus		
** 0 slash **		
■ ■ ■ □ 0		
■ □ ■ ∅		
** High speed draft **		
■ ■ ■ □ Off		
■ □ ■ On		
** I/F mode **		
■ ■ ■ □ Auto		
■ □ ■ Parallel		
■ □ □ Serial		
□ ■ ■ USB		
** Auto I/F wait time **		
■ ■ ■ □ 10 seconds		
■ □ ■ 30 seconds		
** Baud rate **		
■ ■ ■ □ 19200BPS		
■ □ ■ 9600BPS		
■ □ □ 4800BPS		
□ ■ ■ 2400BPS		
□ ■ □ 1200BPS		
□ □ ■ 600BPS		
■ ■ □ 300BPS		
** Parity **		
■ ■ ■ □ None		
■ □ ■ Even		
■ □ □ Odd		
□ ■ ■ Ignore		
** Data length **		
■ ■ ■ □ 8bit		
■ □ ■ 7bit		
** Parallel I/F bidirectional mode **		
■ ■ ■ □ Off		
■ □ ■ On		
** Packet mode **		
■ ■ ■ □ Auto		
■ □ ■ Off		

Figure 5-7c Epson LX-300+II Printer Changing Settings Instructions

```

Font LEDs
::: Pause LED
:::

** Character table **
■■■□ Italic
■□■■ PC 437
■□■■ PC 850
□■■■ PC 860
■□■■ PC 863
□□■■ PC 865
■■■□ PC 861

■■■□ BRASCII
■□■■ Abicomp
□■■■ Roman 8
□■■■ ISO Latin 1
□■■■ PC 858
□■■■ ISO 8859-15
□■■■ Others

** International character set for Italic table **
■■■□ Italic U.S.A.
■□■■ Italic France
■□■■ Italic Germany
□■■■ Italic U.K.
□■■■ Italic Denmark 1
□□■■ Italic Sweden
■■■□ Italic Italy
■■■□ Italic Spain 1

** Manual feed wait time **
■■■□ 1 seconds
■□■■ 1.5 seconds
■□■■ 2 seconds
□■■■ 3 seconds
□■■■ Others

** Buzzer **
■■■□ Off
■□■■ On

** Auto CR (IBM 2380 Plus) **
■■■□ Off
■□■■ On

** IBM character table **
■■■□ Table2
■□■■ Table1

(4) Turn off the printer to finish setting.

```

7. Press the **LF/FF** button to scroll through the options for the selected setting until the desired setting is printed. Then press the **TEAR OFF (FONT)** button to select the next setting to be changed.
8. When all changes are complete, turn off the printer to exit Default Setting mode.

The new settings will remain in effect until they are changed again or the printer is reset to the default settings.

Note: *The Setup printout shown in Figure 5-6 Epson LX-300+II Printer Current Settings is for example only. Your printer Setup may differ slightly from that shown. Verify that the settings, which are the same between your Setup and that shown, concur.*

SCREEN ADJUSTMENTS

The screen's timeout (Sleep Timeout), the screen's brightness level when it is in timeout mode (Sleep Brightness) and the screen's brightness level when it is in operational mode (Brightness) can be adjusted.

To make screen adjustments, touch the **SETUP** button located on the Chamber Measurement screen. Figure 5-8 Setup Screen will appear.

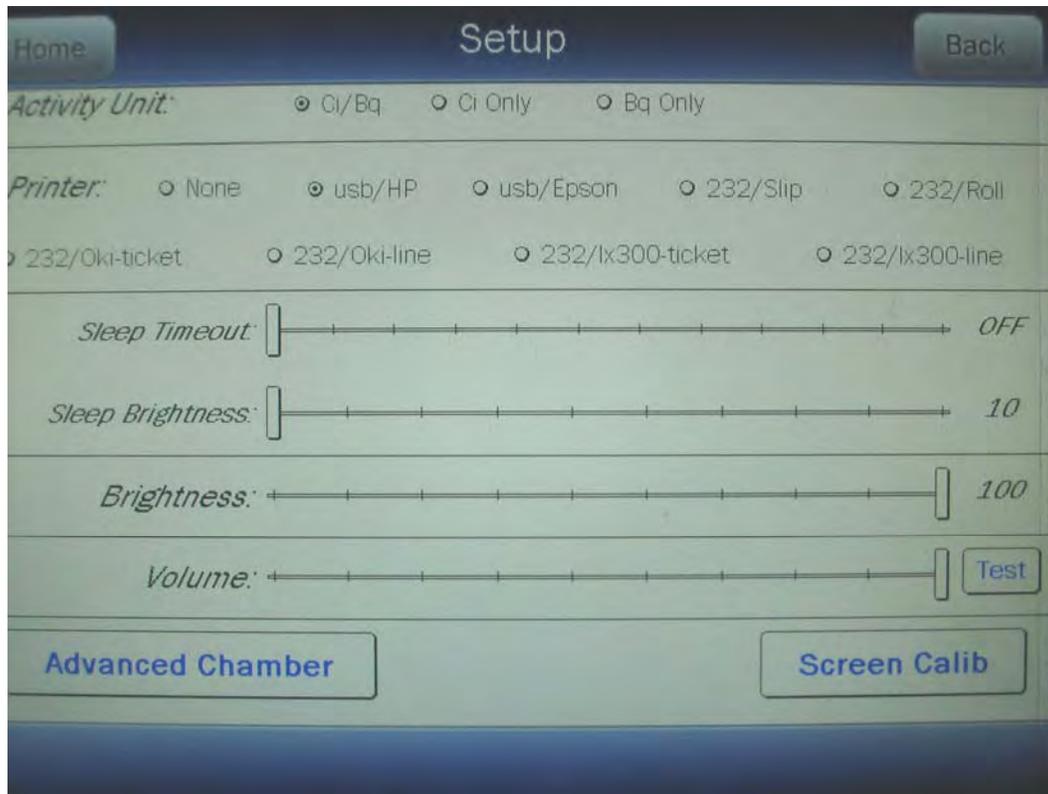


Figure 5-8 Setup Screen

Screen Calibration

The touch screen was calibrated at the factory. However, over time, the calibration of the touch screen may drift slightly. In order to use the touch screen correctly, it needs to be calibrated properly. Without the right calibration, the touches will be off center and may inadvertently select the wrong button.

The CRC[®]-55t has a built-in touch screen calibration utility. To perform a screen calibration, touch the **SCREEN CALIB** button.

A screen will appear displaying a target in the upper left corner. Touch the center of the target. After the target is touched it will disappear and another target will appear in the lower right corner of the screen. Touch the center of this target. After this target is touched it will disappear and another target will appear in the center of the screen. Touch the center of this

target. After the target is touched, Figure 5-3 Setup Screen will re-appear. The touch screen calibration procedure is complete.

Sleep Timeout

Sleep Timeout will blank the screen after the set time period. The Sleep Timeout can be set to anywhere between OFF and 60 minutes in one minute increments.

The timeout period can be adjusted using the following methods:

- Touch and hold the Sleep Timeout slider and drag it along the slider bar to the left to decrease the time it takes for the screen to blank-out. Drag the slider to the right to increase the time it takes for the screen to blank-out.
- Touch anywhere along the slider bar and the slider will move to that location.

The selected timeout period (in minutes) is displayed to the right of the slider bar.

When done making screen adjustments, press the **HOME** or **BACK** button to save the changes and return to the Chamber Measurement screen.

Sleep Brightness

Sleep Brightness adjusts the brightness (intensity) of the screen when the screen is in Sleep Timeout mode. The Sleep Brightness level can be set to anywhere between 10 and 100 in increments of 1.

The level can be adjusted using the following methods:

- Touch and hold the Sleep Brightness slider and drag it along the slider bar to the left to decrease the brightness level. Drag the slider to the right to increase the brightness level.
- Touch anywhere along the slider bar and the slider will move to that location.

The selected Sleep Brightness level is displayed to the right of the slider bar.

When done making screen adjustments, press the **HOME** or **BACK** button to save the changes and return to the Chamber Measurement screen.

Brightness

The Screen Brightness (intensity) adjusts the brightness (intensity) of the screen when in operational mode. The Brightness can be changed to conform to lighting conditions and can be set to anywhere between 10 and 100 in increments of 1.

The intensity can be adjusted using the following methods:

- Touch and hold the Brightness slider and drag it along the slider bar to the left to decrease the brightness level. Drag the slider to the right to increase the brightness level.

- Touch anywhere along the slider bar and the slider will move to that location.

The selected Screen Brightness level is displayed to the right of the slider bar.

When done making screen adjustments, press the **HOME** or **BACK** button to save the changes and return to the Chamber Measurement screen.

SPEAKER VOLUME

The volume of the system speaker can be varied. The **TEST** button located to the right of the Volume slider bar provides a continuous audible tone at the set volume level so that the volume of the speaker can be heard while adjusting the slider. Touch the **TEST** button to hear the tone. Touch the **TEST** button again to turn off the tone.

The speaker volume can be adjusted using the following methods:

- Touch and hold the Volume slider and drag it along the slider bar to the left to decrease the volume level. Drag the slider to the right to increase the volume level.
- Touch anywhere along the slider bar and the slider will move to that location.

When done making volume adjustments press the **HOME** or **BACK** button to save the changes and return to the Chamber Measurement screen.

CHAPTER 6

CHAMBER INITIALIZATION

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GENERAL

This section describes initialization and parameter setup for the Chamber(s).

All of these functions are accessed via the Chamber Measurement screen.

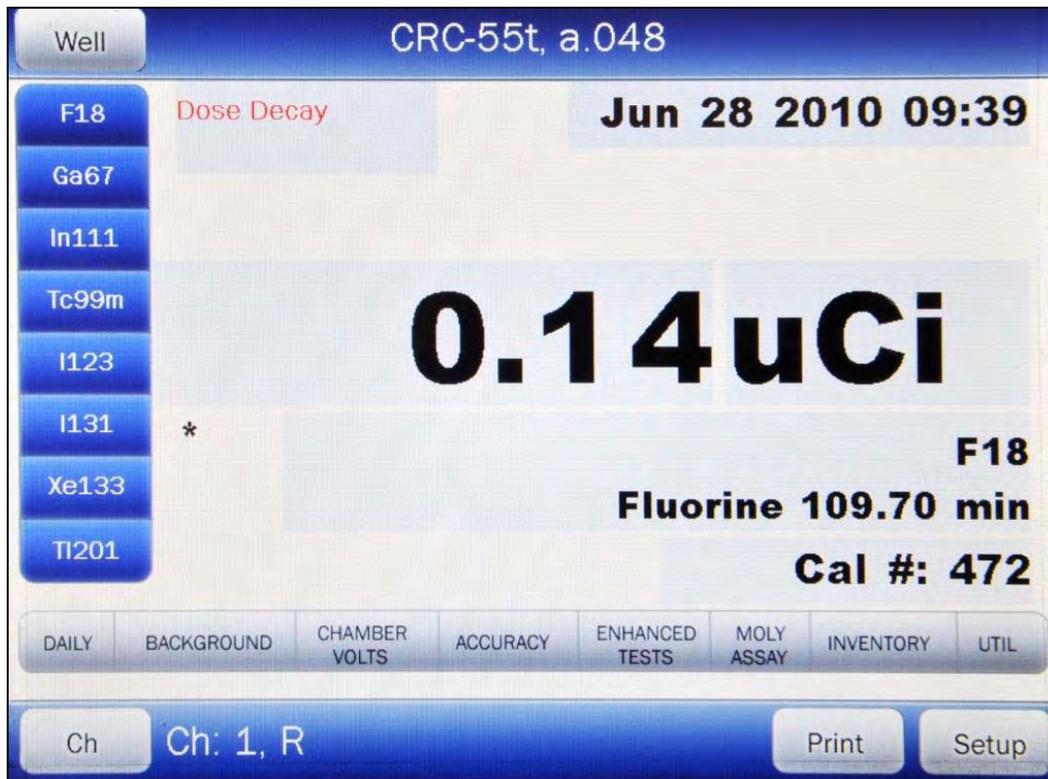


Figure 6-1 Chamber Measurement Screen

CHAMBER HOTKEY ASSIGNMENT

Hotkeys are nuclide shortcut keys that are preconfigured from the factory but are user definable.

There are two separate Hotkey sets:

- Home screen..... These are the eight isotope buttons located at the left edge of Figure 6-1 Chamber Measurement Screen. Touching one of these buttons selects the programmed nuclide for measurement.
- Select Nuclide screen These are the 20 buttons on the left half of Figure 6-7 Select Nuclide Screen. Touching one of these buttons selects the programmed nuclide.

Home Screen Hotkeys

The Home Screen Hotkeys on Figure 6-1 Chamber Measurement Screen are populated by default with the following nuclides:

- For R Chambers:..... F18, Ga67, In111, Tc99m, I123, I131, Xe133, and TI201
- For PET Chambers: .. F18, C11, N13, O15, Tc99m, Cs137, Co60 and I131

Any of the default Home Screen Hotkeys can be changed through the Setup portion of the program.

Touch the **SETUP** button located on Figure 6-1 Chamber Measurement Screen. Figure 6-2 Setup Screen will appear.

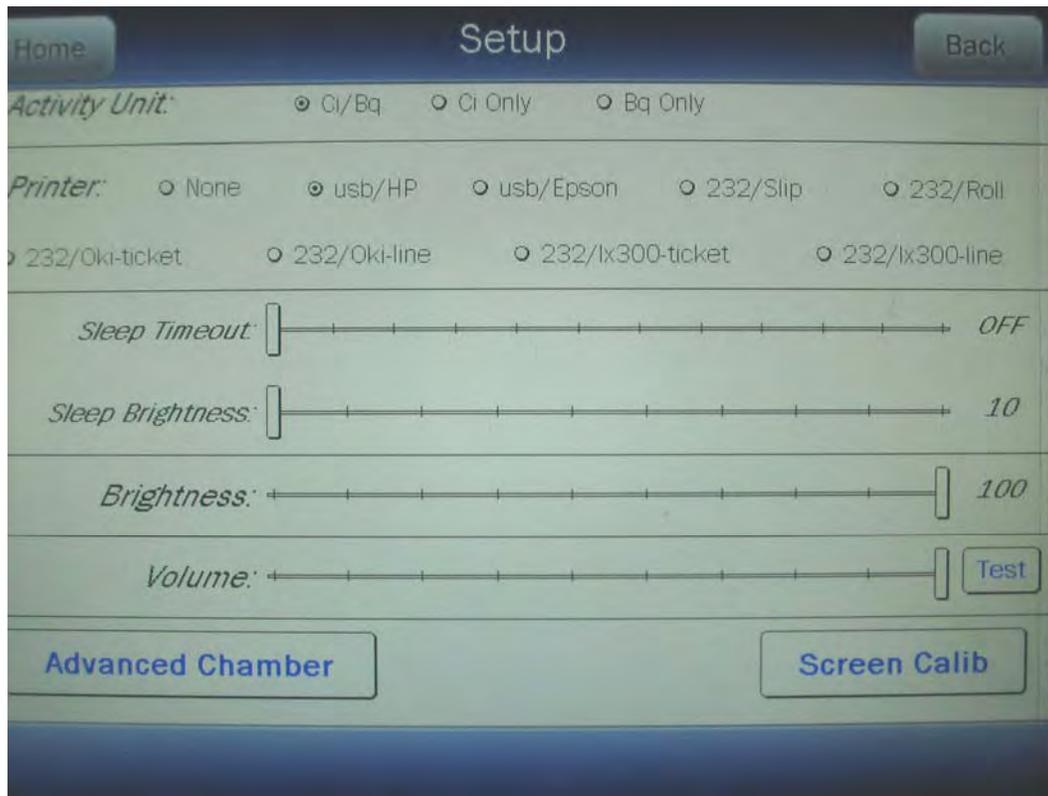


Figure 6-2 Setup Screen

From the Setup screen, touch the **ADVANCED CHAMBER** button. A numeric keypad will appear to allowing the user to input a 3-digit password as shown in Figure 6-3 Enter Password: Screen.

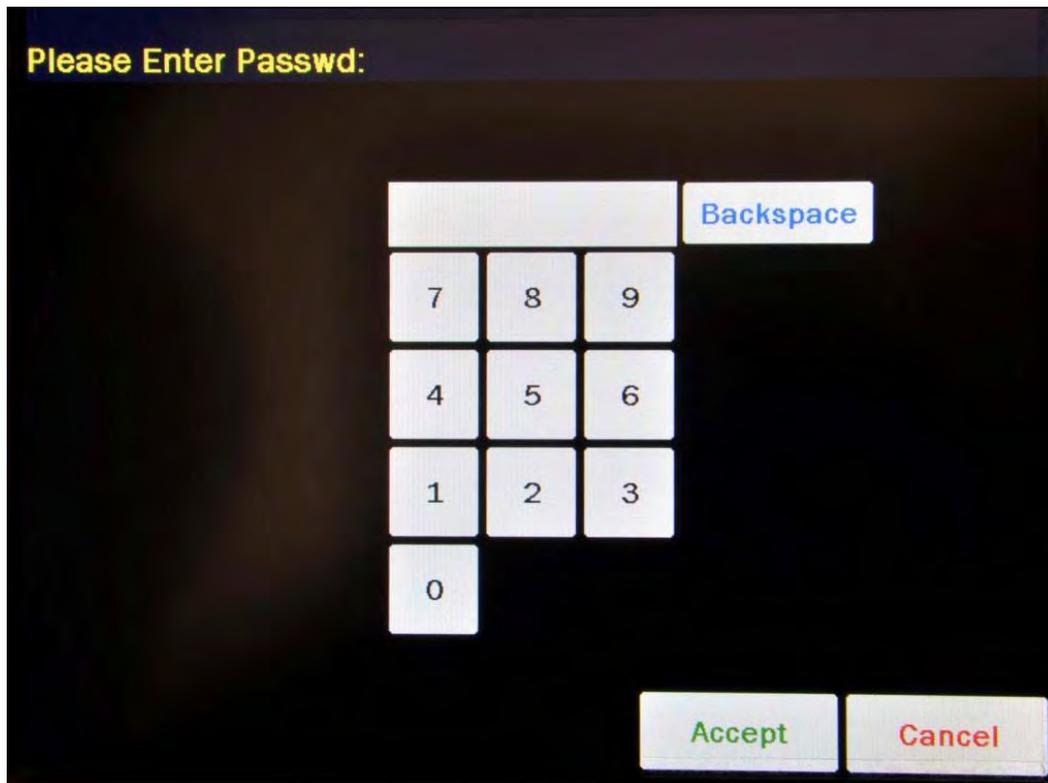


Figure 6-3 Enter Password: Screen

Input the password (last 3 digits of serial number) by touching the appropriate numbers on the keypad. Touch the **ACCEPT** button to accept the password. Figure 6-4 Advanced Chamber Setup Screen will appear.

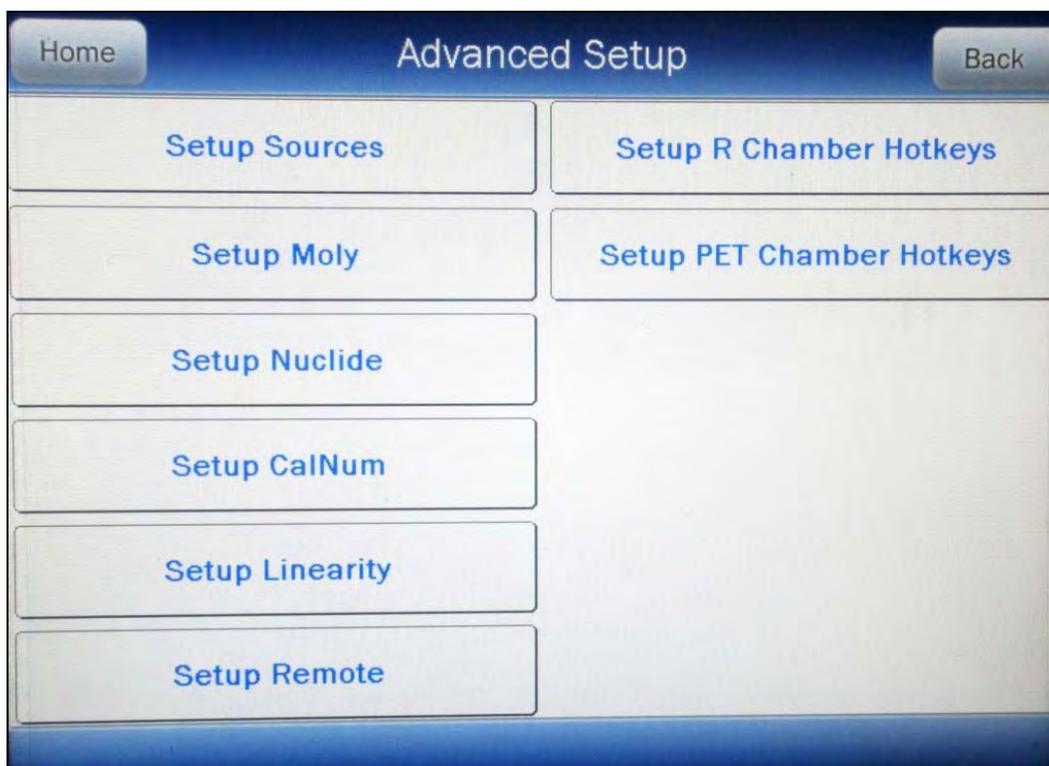


Figure 6-4 Advanced Chamber Setup Screen

To change the Hotkeys for a CRC[®]-55R System, touch the **SETUP R CHAMBER HOTKEYS** button. Figure 6-5 Setup R Chamber Hotkeys Screen will appear.

To change the Hotkeys for a CRC[®]-55tPET System, touch the **SETUP PET CHAMBER HOTKEYS** button. Figure 6-6 Setup PET Chamber Hotkeys Screen will appear.

All examples given will be for an R Chamber.

Setup R Chamber Hotkeys

<i>Home Screen</i>	<i>Nuclide Screen</i>			
F18	F18	Ga67	In111	Tc99m
Ga67	I123	I131	Xe133	Tl201
In111	C11	N13	O15	Am241
Tc99m	Ar41	As72	As74	As76
I123	Au198	Au199	Ba131	Ba133
I131				
Xe133				
Tl201				

Accept
Cancel

Figure 6-5 Setup R Chamber Hotkeys Screen

Setup PET Chamber Hotkeys

<i>Home Screen</i>	<i>Nuclide Screen</i>			
F18	F18	C11	N13	O15
C11	Ba133	Co57	Co60	Cs137
N13	Ga67	I131	Na22	Tc99m
O15	Tl201			
Tc99m				
Cs137				
Co60				
I131				

Accept
Cancel

Figure 6-6 Setup PET Chamber Hotkeys Screen

The left side of the screen displays a list of isotopes titled “Home Screen”. These are the eight Chamber Hotkeys that are displayed on the left side of Figure 6-1 Chamber Measurement Screen. The isotopes shown under the title “Nuclide Screen” are the 20 preset **NUCLIDE** buttons that are displayed on Figure 6-7 Select Nuclide Screen.

To change the assignment of a Home Screen Hotkey, touch the desired isotope field box in the Home Screen column. Figure 6-7 Select Nuclide Screen will appear.

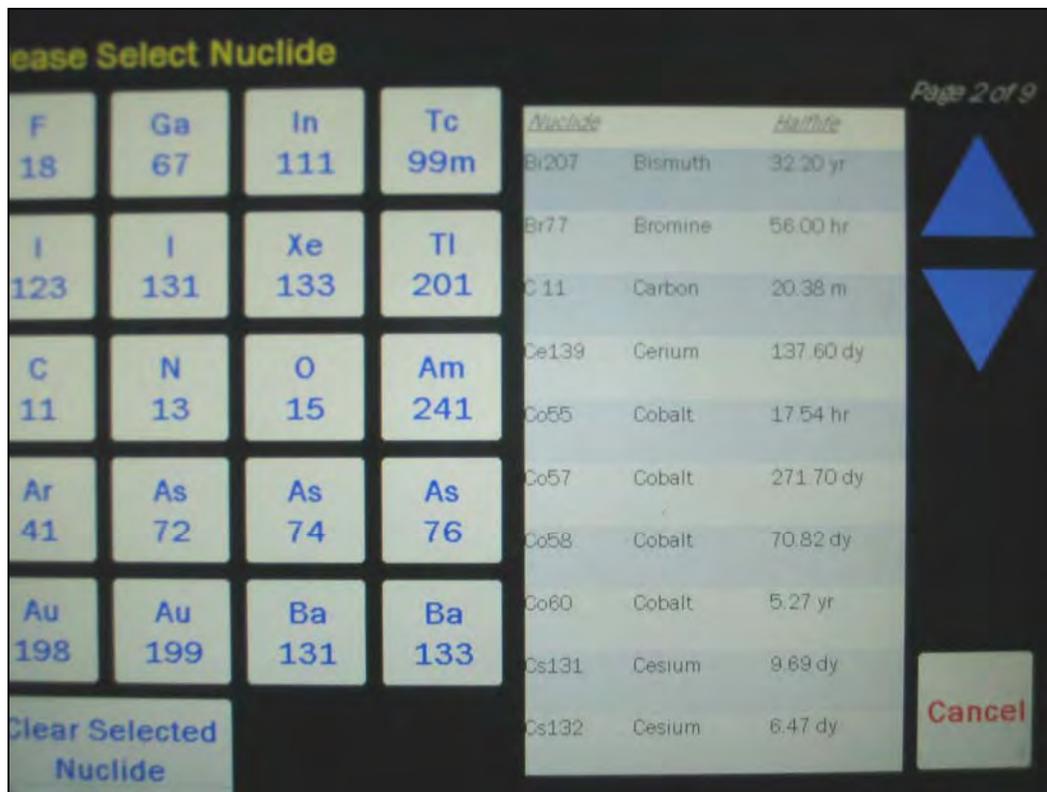


Figure 6-7 Select Nuclide Screen

The left half of the Select Nuclide screen contains 20 preset **NUCLIDE** buttons (these are the Select Nuclide Screen Hotkeys). The right half of the screen displays a listing of nuclides stored in the calibrator’s memory (both default and user added nuclides) that have a Calibration Number assigned to them (Refer to the CALIBRATION NUMBERS section on page 6-27) – 10 at a time.

The nuclide list is in alphabetical order. User added nuclides are displayed at the top of the list. The length of the list will vary depending on which nuclides have a Calibration Number assigned to them (Refer to the CALIBRATION NUMBERS section on page 6-27). The number of pages shown in the upper right corner of the screen indicates the length of the list. To scroll through the list, touch the **DOWN ARROW** button. The next group of 10 nuclides

will be displayed and the **UP ARROW** button will appear allowing the user to scroll up in the list.

To cancel any changes and return to Figure 6-5 Setup R Chamber Hotkeys Screen, touch the **CANCEL** button.

To change the assignment of the chosen Hotkey, do one of the following:

- Touch one of the preset **NUCLIDE** keys. Figure 6-5 Setup R Chamber Hotkeys Screen will re-appear with the selected Nuclide replacing the chosen Hotkey in the “Home Screen” list.
- Touch the Nuclide name on the list on the right. (If necessary, scroll the list until the desired nuclide is displayed.) Once a nuclide is selected from the list, an **ACCEPT** button will appear. Touch the **ACCEPT** button to save the change. Figure 6-5 Setup R Chamber Hotkeys Screen will re-appear with the selected Nuclide replacing the chosen Hotkey in the “Home Screen” list.
- Touch the **CLEAR SELECTED NUCLIDE** button. This will cause the selected Hotkey to be blank (no nuclide assigned to the Hotkey). Figure 6-5 Setup R Chamber Hotkeys Screen will re-appear with the chosen Hotkey in the “Home Screen” list blank.

Select Nuclide Screen Hotkeys

The Select Nuclide Screen Hotkeys on Figure 6-7 Select Nuclide Screen are populated by default with the following nuclides:

- For R Chambers:..... F18, Ga67, In111, Tc99m, I123, I131, Xe133, TI201, C11, N13, O15, Am241, Ar41, As72, As74, As76, Au198, Au199, Ba131 and Ba133
- For PET Chambers: .. F18, C11, N13, O15, Ba133, Co57, Co60, Cs137, Ga67, I131, Na22, Tc99m, and TI201

Any of the default Select Nuclide Screen Hotkeys can be changed.

To change the assignment of a Select Nuclide Screen Hotkey, touch the desired isotope field box in the Nuclide Screen section. Figure 6-7 Select Nuclide Screen will appear.

The left half of the Select Nuclide screen contains Select Nuclide Screen Hotkeys. The right half of the screen displays a listing of nuclides stored in the calibrator’s memory (both default and user added nuclides) that have a Calibration Number assigned to them (Refer to the CALIBRATION NUMBERS section on page 6-27) – 10 at a time.

The nuclide list is in alphabetical order. User added nuclides are displayed at the top of the list. The length of the list will vary depending on which nuclides have a Calibration Number assigned to them (Refer to the CALIBRATION NUMBERS section on page 6-27). The number of pages shown in the upper right corner of the screen indicates the length of the list. To scroll through the list, touch the **DOWN ARROW** button. The next group of 10 nuclides will be displayed and the **UP ARROW** button will appear allowing the user to scroll up in the list.

To cancel any changes and return to Figure 6-5 Setup R Chamber Hotkeys Screen, touch the **CANCEL** button.

To change the assignment of the chosen Hotkey, do one of the following:

- Touch one of the preset **NUCLIDE** keys. Figure 6-5 Setup R Chamber Hotkeys Screen will re-appear with the selected Nuclide replacing the chosen Hotkey in the “Nuclide Screen” list.
- Touch the Nuclide name on the list on the right. (If necessary, scroll the list until the desired nuclide is displayed.) Once a nuclide is selected from the list, an **ACCEPT** button will appear. Touch the **ACCEPT** button to save the change. Figure 6-5 Setup R Chamber Hotkeys Screen will re-appear with the selected Nuclide replacing the chosen Hotkey in the “Nuclide Screen” list.
- Touch the **CLEAR SELECTED NUCLIDE** button. This will cause the selected Hotkey to be blank (no nuclide assigned to the Hotkey). Figure 6-5 Setup R Chamber Hotkeys Screen will re-appear with the chosen Chamber Hotkey in the “Nuclide Screen” list blank.

TEST SOURCE SETUP

Test Sources (Standard Sources) are used for the Chamber Accuracy and Constancy Tests.

The Chamber Accuracy and Constancy may be tested using Co57, Co60, Ba133, Cs137 or Ra226 for R Chambers and Co57, Co60, Ba133, Cs137 or Na22 for PET chambers. There can be a Test Source for each of these nuclides. One or more of the Test Sources can be designated as the source(s) to be used in the Accuracy part of the Daily Test. One of the sources designated as a Daily source can be chosen as the base source to be used for the Constancy Test.

To input Test Source data, touch the **SETUP** button located on the Chamber Measurement screen. Figure 6-8 Setup Screen will appear.

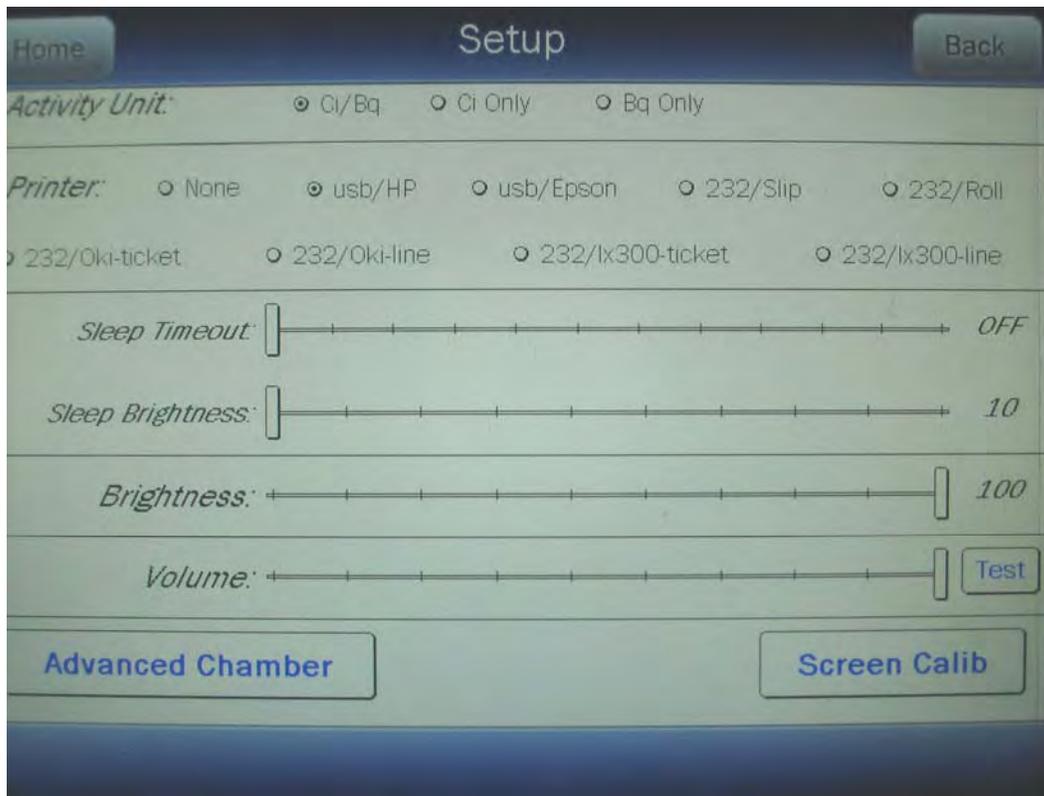


Figure 6-8 Setup Screen

Touch the **ADVANCED CHAMBER** button. A numeric keypad will appear to allowing the user to input a 3-digit password as shown in Figure 6-9 Enter Password: Screen.

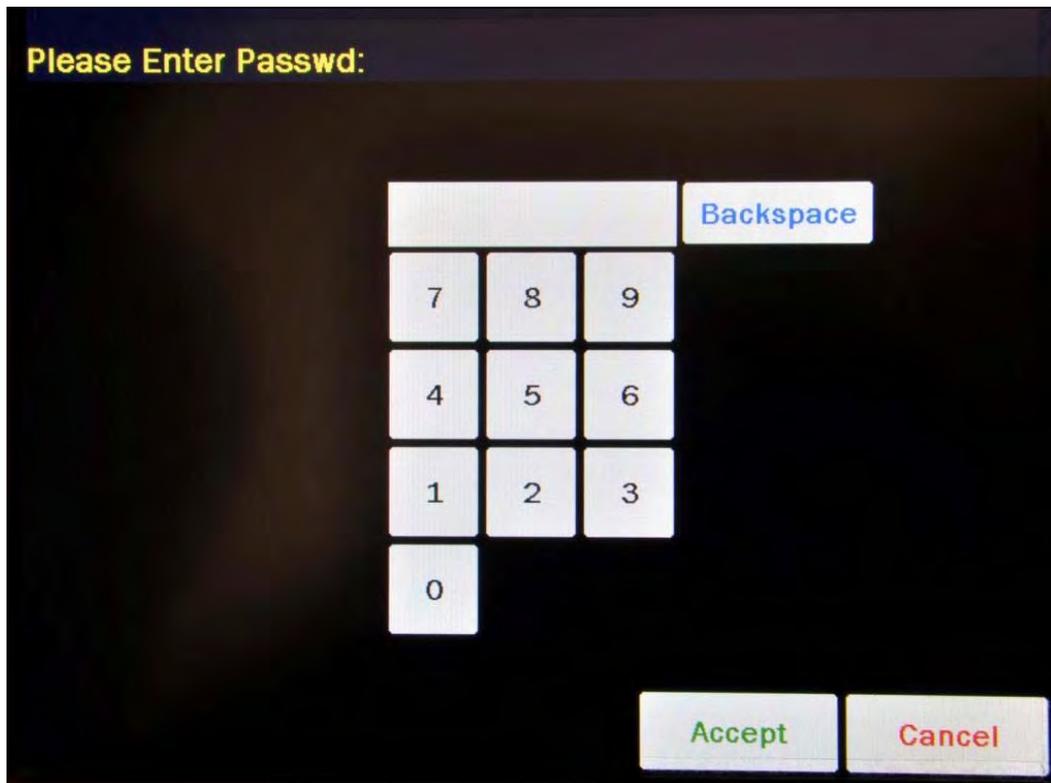


Figure 6-9 Enter Password: Screen

Input the password (last 3 digits of serial number) by touching the appropriate numbers on the keypad. Touch the **ACCEPT** button to accept the password. Figure 6-10 Advanced Chamber Setup Screen will appear.

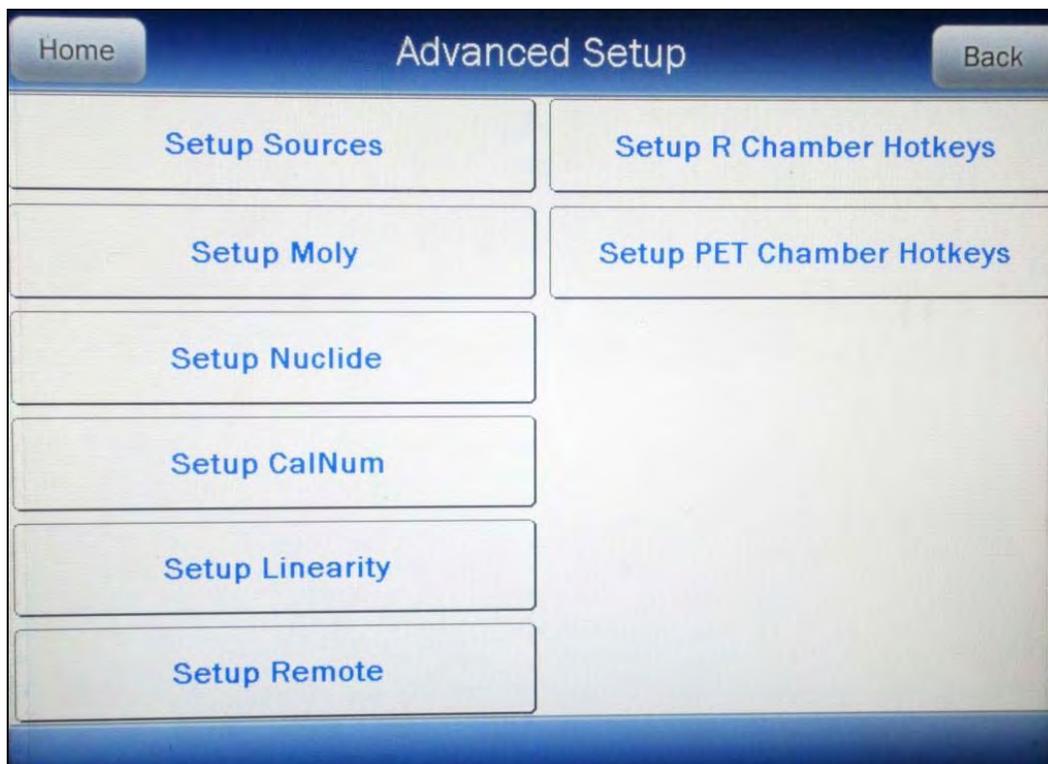


Figure 6-10 Advanced Chamber Setup Screen

Touch the **SETUP SOURCES** button. Figure 6-11 Setup Sources Screen will appear.

Setup Sources						
<i>NUC</i>	<i>S/N</i>	<i>ACTIVITY</i>	<i>DATE</i>	<i>DAILY</i>	<i>CONST</i>	
<i>Co57</i>	GFD	10 uCi	Jun 10 2001 10:57	<input checked="" type="checkbox"/>	<input type="radio"/>	Clear
<i>Co60</i>				<input checked="" type="checkbox"/>	<input type="radio"/>	Clear
<i>Ba133</i>				<input checked="" type="checkbox"/>	<input type="radio"/>	Clear
<i>Cs137</i>	RTE	0.5 uCi	Jun 10 1999 10:58	<input checked="" type="checkbox"/>	<input checked="" type="radio"/>	Clear
<i>Ra266</i>				<input checked="" type="checkbox"/>	<input type="radio"/>	Clear
<i>Constancy Channels</i>						
C11 Carbon	As74 Arsenic	F18 Fluorine				
					Accept	Cancel

Figure 6-11 Setup Sources Screen

The Setup Sources screen allows data to be input for each Test Source and to choose which Test Source(s) will be used for the Accuracy part of the Daily Test and which source will be used as the base source for the Constancy Test. The Constancy Channels section allows nuclides to be selected for use in the Constancy Test.

Adding a Source

Note: All fields (S/N, Activity, Date) for the selected source must be completed before exiting the Setup Sources screen or the entered information for that source will not be saved.

To input information for the desired Test Source, touch the field's box and input the appropriate data for that source.

Serial Number (S/N) Field

For the Test Source Serial Number (S/N) data, Figure 6-12 Enter Serial Number Screen will appear.

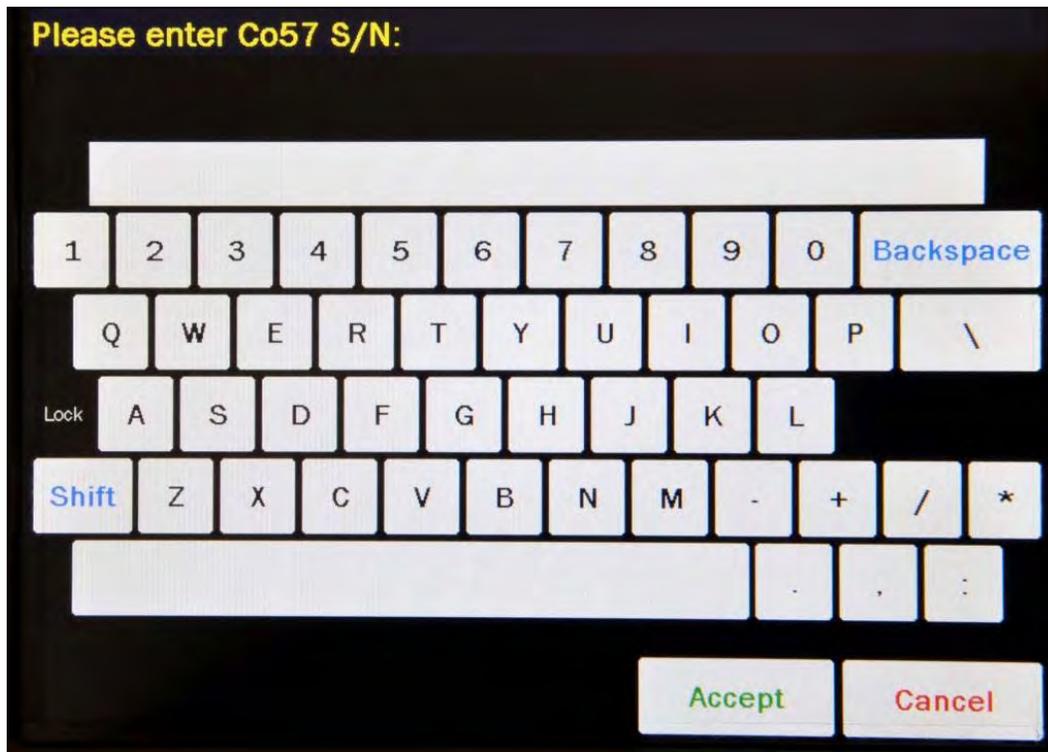


Figure 6-12 Enter Serial Number Screen

Input the serial number data of the Test Source and touch the **ACCEPT** button. The Setup Sources screen will re-appear with **S/N** field box populated with the entered serial number. The serial number can contain up to 10 characters

To cancel any changes and return to Figure 6-11 Setup Sources Screen, touch the **CANCEL** button.

Activity Field

For the Test Source Activity data, Figure 6-13 Enter Activity Screen will appear.

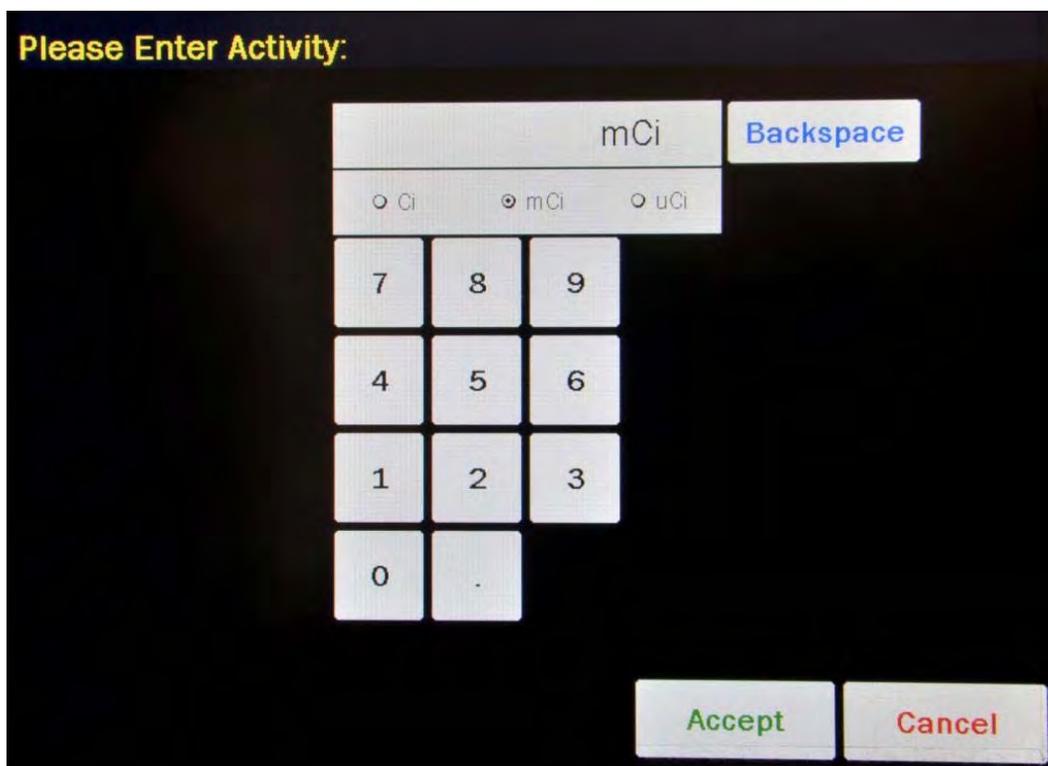


Figure 6-13 Enter Activity Screen

The Calibration activity must be less than 1 Curie. The current activity (calibration activity decayed to the present time) must be greater than the activity in the table below.

Note: Capintec strongly recommends replacing the Test Source when the activity decays below the recommended "Minimum at Current Time" limits

Source	Minimum at Current Time		Maximum	
	Ci	Bq	Ci	Bq
Co57	50.0 μ Ci	1.85 MBq	1.0 Ci	37000 MBq
Co60	50.0 μ Ci	1.85 MBq	1.0 Ci	37000 MBq
Ba133	50.0 μ Ci	1.85 MBq	1.0 Ci	37000 MBq
Cs137	50.0 μ Ci	1.85 MBq	1.0 Ci	37000 MBq
Ra226	10.0 μ Ci	0.37 MBq	1.0 Ci	37000 MBq
Na22	50.0 μ Ci	1.85 MBq	1.0 Ci	37000 MBq

Table 6-1 Test Source Calibration Activity Limits

Input the activity value using the keypad and touch the appropriate radio button for the unit of measure of the Test Source.

Note: *The available units will change depending on which unit of measurement is in use on the Chamber Measurement screen. i.e. if set for Curies, the available units will be Ci, mCi and μ Ci; if set for Becquerels, the available units will be GBq and MBq.*

Touch the **ACCEPT** button. The Setup Sources screen will re-appear with **Activity** field box populated with the entered activity.

To cancel any changes and return to Figure 6-11 Setup Sources Screen, touch the **CANCEL** button.

Date Field

For the Test Source calibration Date, Figure 6-14 Date/Time Screen will appear.

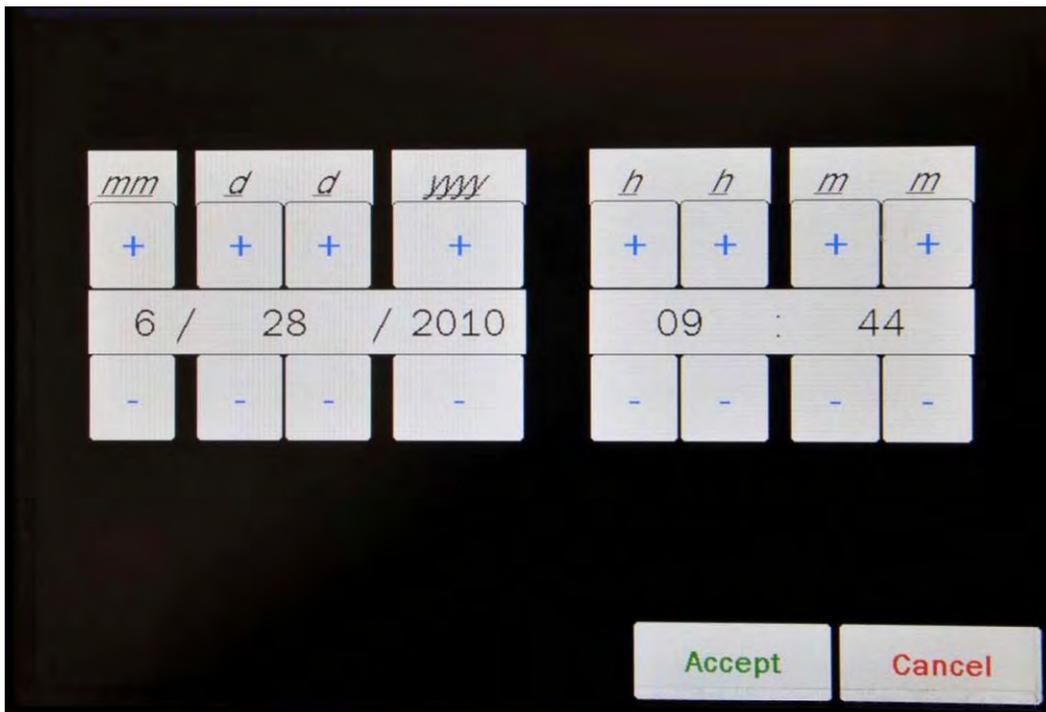


Figure 6-14 Date/Time Screen

The screen displays the currently set date and time. Above and below each of the fields are + and – buttons, respectively. To adjust the displayed value for a specific field, touch the + button to increase the displayed value or the – button to decrease the displayed value.

Adjust the displayed date and time to show the calibration date/time of the Test Source.

Touch the **ACCEPT** button to accept the set calibration date and time. The Setup Sources screen will re-appear with **Date** field box populated with the entered calibration date.

To cancel any changes and return to Figure 6-11 Setup Sources Screen, touch the **CANCEL** button.

Daily Field

By default, the **Daily** checkbox is checked (refer to Figure 6-11 Setup Sources Screen). At least one source must be designated as a Daily Test source for the Accuracy Test. If the selected source is not going to be used as a Daily Test source, touch the checkbox next to the selected source to remove the check from the checkbox.

Editing Source Data

Any data for any source can be edited simply by touching the desired field box and inputting the new data as described in the **Adding a Source** section above beginning on page 6-13.

Deleting a Source

Test Sources are removed in one of two ways: by touching the **CLEAR** button to the right of the Test Source to be deleted or by erasing the data from either the **S/N** field box or the **Activity** field box for the desired source.

To erase a selected source by erasing the data from either the **S/N** field box or the **Activity** field box,

1. Touch either the **S/N** or the **Activity** field box of the particular source.
2. When the data entry screen appears, verify that the data entry box contains no data.
3. Touch the **ACCEPT** button.
4. The Setup Sources screen will re-appear with the selected field box blank.
5. Touch the **ACCEPT** button in the lower part of the Setup Sources screen. Figure 6-10 Advanced Chamber Setup Screen will appear.
6. Touch the **SETUP SOURCES** button. Figure 6-11 Setup Sources Screen will re-appear with the particular source's information blank.

The selected Test Source is now erased from the system.

Constancy Test Source

The Constancy may be tested using Co57, Co60, Ba133, Cs137 or Ra226 for R Chambers and Co57, Co60, Ba133, Cs137 or Na22 for PET Chambers. There can be a Test Source for each of these nuclides. One or more of the Test Sources can be designated as the source(s)

to be used in the Accuracy part of the Daily Test. One of the sources designated as a Daily source must be chosen as the base source to be used for the Constancy Test.

The screenshot shows a screen titled "Setup Sources" with a table of sources and a section for "Constancy Channels".

<i>NUC</i>	<i>S/N</i>	<i>ACTIVITY</i>	<i>DATE</i>	<i>DAILY</i>	<i>CONST</i>	
Co57	GFD	10 uCi	Jun 10 2001 10:57	<input checked="" type="checkbox"/>	<input type="radio"/>	Clear
Co60				<input checked="" type="checkbox"/>	<input type="radio"/>	Clear
Ba133				<input checked="" type="checkbox"/>	<input type="radio"/>	Clear
Cs137	RTE	0.5 uCi	Jun 10 1999 10:58	<input checked="" type="checkbox"/>	<input checked="" type="radio"/>	Clear
Ra266				<input checked="" type="checkbox"/>	<input type="radio"/>	Clear

Below the table is a section titled "Constancy Channels" with a grid of input fields:

C11 Carbon	As74 Arsenic	F18 Fluorine	

At the bottom right are "Accept" and "Cancel" buttons.

Figure 6-15 Setup Sources Screen

To select the Daily source to use as the base Constancy source, touch the associated radio button in the **Const** column. In the example above, Cs137 is set as the Constancy base source.

Constancy Channels

The Constancy Channels are the nuclides that will be tested during the automated Constancy Test during the Accuracy Test. Up to 12 nuclides may be selected.

When the Accuracy Test for the base Constancy source is complete, an **AUTO CONSTANCY** button will appear next to the results of the base source.

The automated Constancy Test is then performed by touching the **AUTO CONSTANCY** button. The test will automatically run and will display the results at the completion of the test.

Adding Nuclides

To select nuclides for use in the Constancy Test, touch the desired **Constancy Channels** field box. Figure 6-16 Select Nuclide Screen will appear.

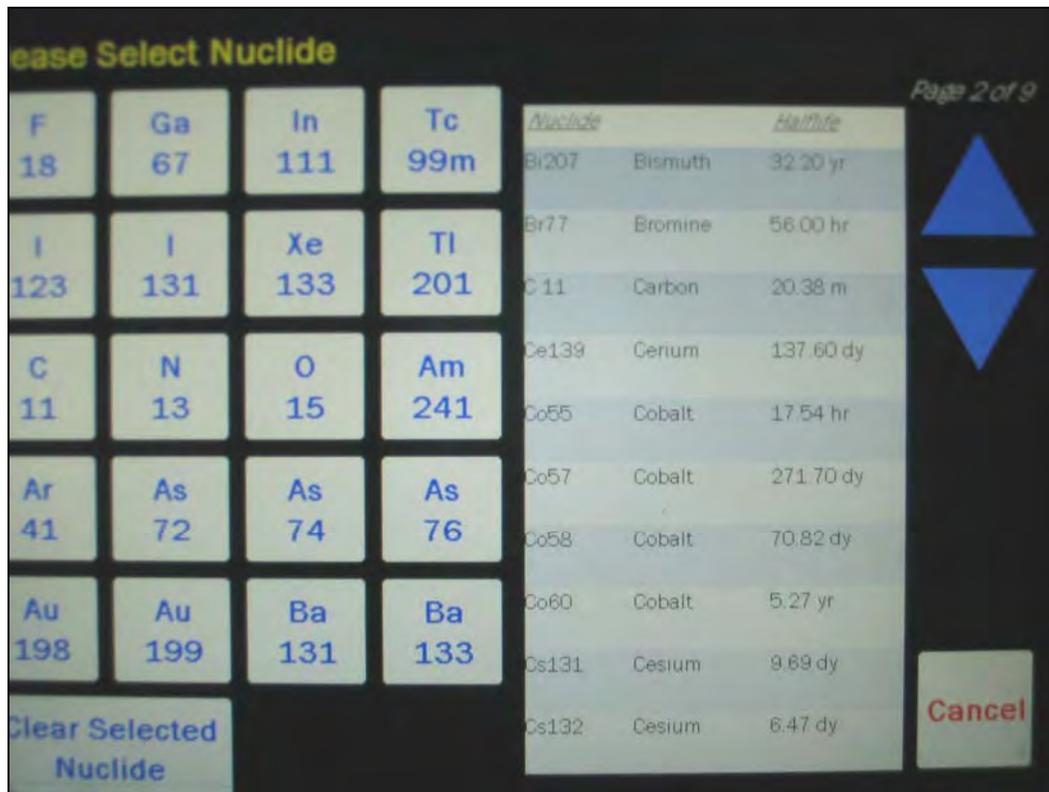


Figure 6-16 Select Nuclide Screen

The left half of the Select Nuclide screen contains the 20 preset **NUCLIDE** buttons (these are the Select Nuclide Screen Hotkeys). The right half of the screen displays a listing of nuclides stored in the calibrator's memory (both default and user added nuclides) that have a Calibration Number assigned to them (Refer to the CALIBRATION NUMBERS section on page 6-27) – 10 at a time.

The nuclide list is in alphabetical order. User added nuclides are displayed at the top of the list. The length of the list will vary depending on which nuclides have a Calibration Number assigned to them (Refer to the CALIBRATION NUMBERS section on page 6-27). The number of pages shown in the upper right corner of the screen indicates the length of the list. To scroll through the list, touch the **DOWN ARROW** button. The next group of 10 nuclides will be displayed and the **UP ARROW** button will appear allowing the user to scroll up in the list.

To cancel any changes and return to Figure 6-15 Setup Sources Screen, touch the **CANCEL** button.

To assign a nuclide for use as a Constancy Channel, do one of the following:

- Touch one of the preset **NUCLIDE** keys (Select Nuclide Screen Hotkeys). Figure 6-15 Setup Sources Screen will re-appear with the selected nuclide shown in the chosen Constancy Channel field box.

- Touch the Nuclide name on the list on the right. (If necessary, scroll the list until the desired nuclide is displayed.) Once a nuclide is selected from the list, an **ACCEPT** button will appear. Touch the **ACCEPT** button to save the selected nuclide. Figure 6-15 Setup Sources Screen will re-appear with the selected nuclide shown in the chosen Constancy Channel field box.

Removing Nuclides

To remove a nuclide from the Constancy Channels, touch the desired **Constancy Channels** field box to delete from the Constancy Channels. Figure 6-16 Select Nuclide Screen will appear.

Touch the **CLEAR SELECTED NUCLIDE** button. Figure 6-15 Setup Sources Screen will re-appear. The selected **Constancy Channels** field box will now be blank.

MOLY ASSAY SETUP

Note: *Moly Assay can only be performed using an R Chamber.*

Moly Assay can be performed using a CAPMAC or CANISTER.

When the Moly Assay button is touched from the Chamber Measurement screen, Figure 6-17 Moly Assay Method Selection Screen will appear. However, if only one method is always used (either a CAPMAC or a CANISTER), the Moly Assay Method Selection screen can be omitted by selecting either CAPMAC or CANISTER from the Moly Setup.

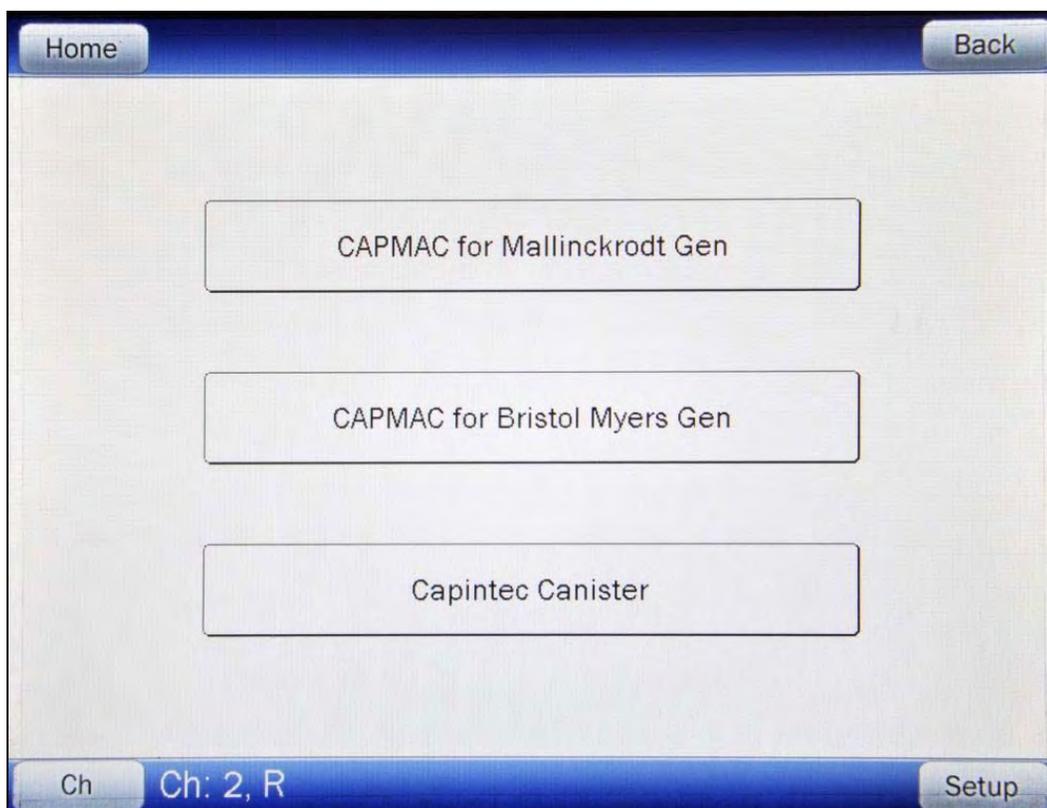


Figure 6-17 Moly Assay Method Selection Screen

Moly Setup can be accessed in two ways:

1. From Figure 6-1 Chamber Measurement Screen, touch the **MOLY ASSAY** button. Figure 6-17 Moly Assay Method Selection Screen will appear. Touch the **SETUP** button. A numeric keypad will appear to allowing the user to input a 3-digit password as shown in Figure 6-9 Enter Password: Screen. Input the password (last 3 digits of serial number) by touching the appropriate numbers on the keypad. Touch the **ACCEPT** button to accept the password. Figure 6-18 Setup Moly Screen will appear.
2. From Figure 6-1 Chamber Measurement Screen, touch the **SETUP** button. Figure 6-8 Setup Screen will appear. Touch the **ADVANCED CHAMBER** button. A numeric keypad will appear to allowing the user to input a 3-digit password as shown in Figure 6-9 Enter Password: Screen. Input the password (last 3 digits of serial number) by touching the appropriate numbers on the keypad. Touch the **ACCEPT** button to accept the password. Figure 6-10 Advanced Chamber Setup Screen will appear. From the Advanced Chamber Setup Screen, touch the **SETUP MOLY** button. Figure 6-18 Setup Moly Screen will appear.

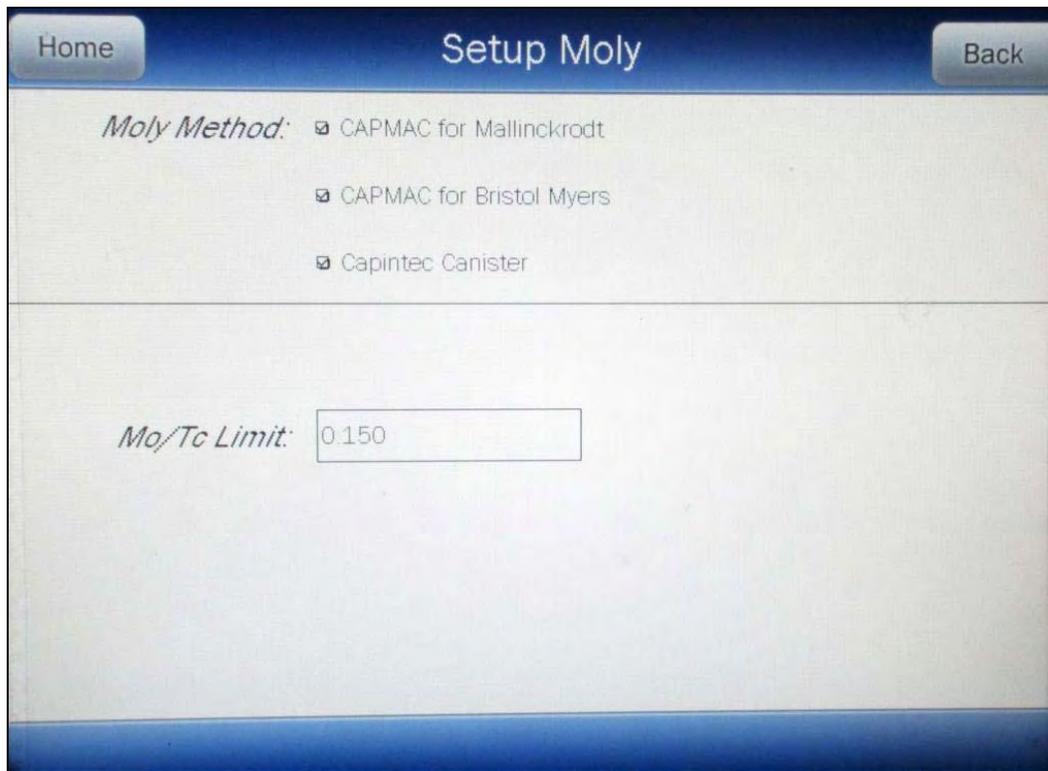


Figure 6-18 Setup Moly Screen

Selecting Moly Assay Method

In the **Moly Method:** section, the current selections are displayed (default is all are selected).

Select the desired method(s) by touching the appropriate checkbox. Each touch will toggle the check between on or off.

Moly Assay Limit

The Moly Assay default limit is set to 0.150 $\mu\text{Ci}/\text{mCi}$ (or 0.150 MBq/GBq). This value can be changed.

Note: The minimum value that can be input is 0.001 $\mu\text{Ci}/\text{mCi}$ (0.001 MBq/GBq). The maximum value that can be input is 9.99 $\mu\text{Ci}/\text{mCi}$ (9.99 MBq/GBq).

Touch the **Mo/Tc Limit:** field box. A numeric keypad will appear allowing for the entry of a new value.

Input the new Mo/Tc value using the keypad and touch the **ACCEPT** button. The Setup Moly screen will re-appear with **Mo/Tc Limit:** field box populated with the entered value.

To cancel changing the Mo/Tc Limit, touch the **CANCEL** button on the numeric keypad.

To input information for the desired nuclide, touch the desired field box and input the appropriate data for the nuclide.

All field boxes (**Nuclide**, **Element**, **Half-life** and at least one **Cal# - R** or **P**) for the nuclide being added must be completed before touching the **ACCEPT** button to exit the Setup Nuclide screen or the message "SETUP NUCLIDE ERROR - PLEASE COMPLETE PARTIAL NUCLIDE ENTRY. ROW(S)x – OK" will appear. Touch the **OK** button to dismiss the message and input the missing Nuclide information.

After all necessary Nuclide information is input for all added nuclides, touch the **ACCEPT** button on Figure 6-19 Setup Nuclide Screen. The added nuclide(s) is/are now saved in the system.

To cancel adding Nuclides, touch the **CANCEL** button.

Nuclide Field

This field is the nuclide designation (i.e. Tc99m, Cs137) and consists of up to 6 alphanumeric characters.

For the **Nuclide** data, the alphanumeric keyboard will appear. Input the data and touch the **ACCEPT** button.

To cancel any changes and return to Figure 6-19 Setup Nuclide Screen, touch the **CANCEL** button.

Element Field

This field is the nuclide element name (i.e. Technetium, Cesium) and consists of up to 14 alphanumeric characters.

For the **Element** data, the alphanumeric keyboard will appear. Input the data and touch the **ACCEPT** button.

To cancel any changes and return to Figure 6-19 Setup Nuclide Screen, touch the **CANCEL** button.

Half-life Field

This field is the half-life of the nuclide (i.e. 6.01 hr, 30.00 yr) and consists of up to 6 characters (5 digits and a decimal).

For the **Half-life** data, the numeric keypad will appear. Input the value using the keypad and touch the appropriate radio button for the time unit of the nuclide. The available time units for half-life are: Yr (year), Hr (hour), Day, Min (minute) and Sec (second).

Touch the **ACCEPT** button when the value and time unit are correctly set.

To cancel any changes and return to Figure 6-19 Setup Nuclide Screen, touch the **CANCEL** button.

Cal#(R)/Cal#(P) Fields

These fields are the Calibration Number for the nuclide for R Chambers (i.e. 080, 220), Cal#(R), and/or PET Chambers (i.e. 090, 243), Cal#(P). At least one these fields must contain a Calibration Number.

For the Calibration Number data, the numeric keypad will appear as shown in Figure 6-20 Enter Cal# Screen.

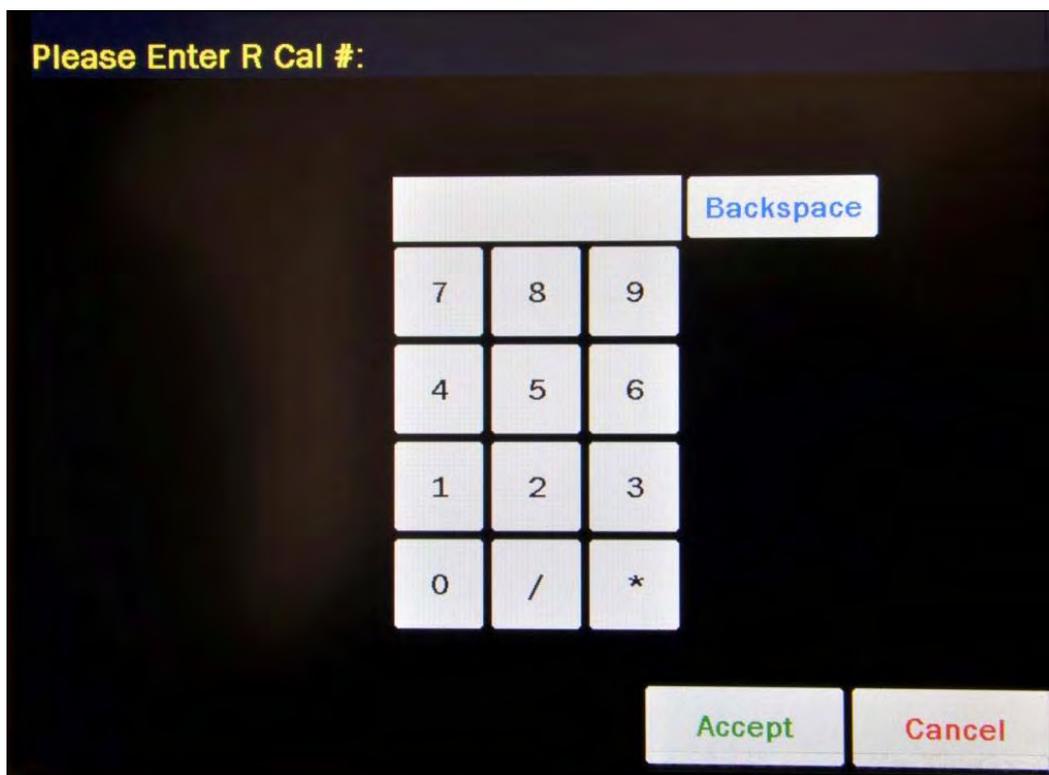


Figure 6-20 Enter Cal# Screen

A calibration number may include a multiplication sign (* on the keypad) or a division sign (/ on the keypad). However, the Chamber is always direct reading and the multiplication or division sign is only used to be consistent with existing Calibration Numbers.

For multiplication, the number can only be multiplied by 10 or 100. For division, the number can only be divided by 2. Refer to Table 6-2 Calibration Number Limits Table.

	Minimum Calibration # (a)	Maximum Calibration # (a)
Direct Entry (a)	10	1200
Multiplication (a × 10)	10	1200
Multiplication (a × 100)	10	999
Division (a ÷ 2)	400	1200

Table 6-2 Calibration Number Limits Table

If the Calibration Number is known for the nuclide, input the number and touch the **ACCEPT** button. If the Calibration Number is not known, input 450 and the **ACCEPT** button. The Calibration Number can then be determined using the following procedure.

To cancel any changes and return to Figure 6-19 Setup Nuclide Screen, touch the **CANCEL** button.

Determining Calibration Numbers

An initial Calibration Number (as an initial starting point, choose 450) must be input into the CRC[®]-55t for the nuclide.

Note: *In order to obtain a correct reading for a Vial or Syringe, the supplied liner and dipper must be used to achieve the correct geometry. If the source is contained in a different type of container, then contact Capintec, Inc. for further assistance.*

1. Place the standard source of the nuclide in the chamber and record the displayed activity.
2. If the displayed activity is **higher** than the measured/calculated activity of the standard source, **increase** the Calibration Number. If the displayed activity is **lower** than the measured/calculated activity of the standard source, **decrease** the Calibration Number.
3. Re-measure the activity of the standard source.
4. Continue to increase or decrease the Calibration Number (e.g. repeat steps 2 and 3) until the displayed activity matches the measured/calculated activity of the standard source.
5. Record the Calibration Number of the nuclide for future reference.
6. Input the Calibration Number following the instructions in section CALIBRATION NUMBERS on page 6-27.

Deleting a Nuclide

Any nuclide added by the user may be deleted.

Nuclides are removed by touching the **CLEAR** button to the right of the Nuclide to be deleted.

Touch the **ACCEPT** button on Figure 6-19 Setup Nuclide Screen. The selected nuclide is now erased from the system.

CALIBRATION NUMBERS

Calibration Numbers may be added or changed for up to 40 nuclides.

To add a calibration number to a nuclide that does not have a calibration number, change an existing calibration number or restore the original calibration number, touch the **SETUP** button located on the Chamber Measurement screen. Figure 6-8 Setup Screen will appear.

Touch the **ADVANCED CHAMBER** button. A numeric keypad will appear to allowing the user to input a 3-digit password as shown in Figure 6-9 Enter Password: Screen.

Input the password (last 3 digits of serial number) by touching the appropriate numbers on the keypad. Touch the **ACCEPT** button to accept the password. Figure 6-10 Advanced Chamber Setup Screen will appear.

Touch the **SETUP CALNUM** button. Figure 6-21 Setup CalNum Screen will appear.

Home Setup CalNum Back

Nuclide:

Default R Cal#: Default P Cal#:

User R Cal#: User P Cal#:

Figure 6-21 Setup CalNum Screen

Select a nuclide by touching the **Nuclide:** field box. Figure 6-16 Select Nuclide Screen will appear.

The left half of the Select Nuclide screen contains the 20 programmable **NUCLIDE** Hotkeys. To use one these nuclides, touch the desired key. Figure 6-21 Setup CalNum Screen will re-appear with the chosen nuclide displayed in the **Nuclide:** field box along with the Default Calibration Numbers for both R and PET Chambers.

The right half of the screen displays a listing of nuclides stored in the calibrator's memory – 10 at a time. The nuclide list is in alphabetical order. The number of pages shown in the upper right corner of the screen indicates the length of the list. To scroll through the list, touch the **DOWN ARROW** button. The next group of 10 nuclides will be displayed and the **UP ARROW** button will appear to allow scrolling up in the list.

To select a nuclide in the list, touch the desired nuclide and the entire line for the selected nuclide will become highlighted and an **ACCEPT** button will appear. Touch the **ACCEPT** button to select the highlighted nuclide. Figure 6-21 Setup CalNum Screen will re-appear with the chosen nuclide displayed in the **Nuclide:** field along with the Default Calibration Numbers for both R and PET Chambers.

To abort selecting a nuclide and return to Figure 6-21 Setup CalNum Screen, touch the **CANCEL** button.

To input a new calibration number, touch the desired **Cal#:** field box (**User R Cal#:** or **User P Cal#:**). The numeric keypad will appear. Input the new calibration number by touching the appropriate numbers on the keypad. Touch the **ACCEPT** button to accept the Cal#. Touch the **CANCEL** button to abort any changes.

A calibration number may include a multiplication sign (* on the keypad) or a division sign (/ on the keypad). However, the Chamber is always direct reading and the multiplication or division sign is only used to be consistent with existing Calibration Numbers.

For multiplication, the number can only be multiplied by 10 or 100. For division, the number can only be divided by 2. Refer to Table 6-2 Calibration Number Limits Table on page 6-26.

If the Calibration Number change is accepted, in the Nuclide database list, the Nuclide will now appear with an * (asterisk) in front of the nuclide name indicating that the Cal # has been changed from the default value.

Restoring Original Calibration Numbers

To restore the default calibration number for a nuclide that had its number changed, touch the **Nuclide:** field box. From the Select Nuclide screen, choose the desired nuclide by touching one of the preset nuclide buttons or selecting the nuclide from the list.

When the Setup CalNum screen re-appears, touch the desired **Cal#:** field box (**User R Cal#:** or **User P Cal#:**). The numeric keypad will appear. Verify that the data entry box is blank and touch the **ACCEPT** button.

The Setup CalNum screen will re-appear with the selected **Cal#:** field box (**User R Cal#:** or **User P Cal#:**) blank.

The selected nuclide will now use the original (default) calibration number(s).

To exit the Setup CalNum screen, touch the **BACK** button at the top of the screen and Figure 6-10 Advanced Chamber Setup Screen will appear or touch the **HOME** button at the top of the screen and Figure 6-1 Chamber Measurement Screen will appear.

LINEARITY TEST DEFINITION

Three methods of performing Linearity Tests are available: Standard (Decay), Lineator and Calicheck.

In order to perform a Linearity Test, at least one Linearity Test Method must be defined. All three test methods can be defined. If a Linearity Test Method is not defined, Figure 6-22 Please Setup Linearity Tests Message Screen will appear.

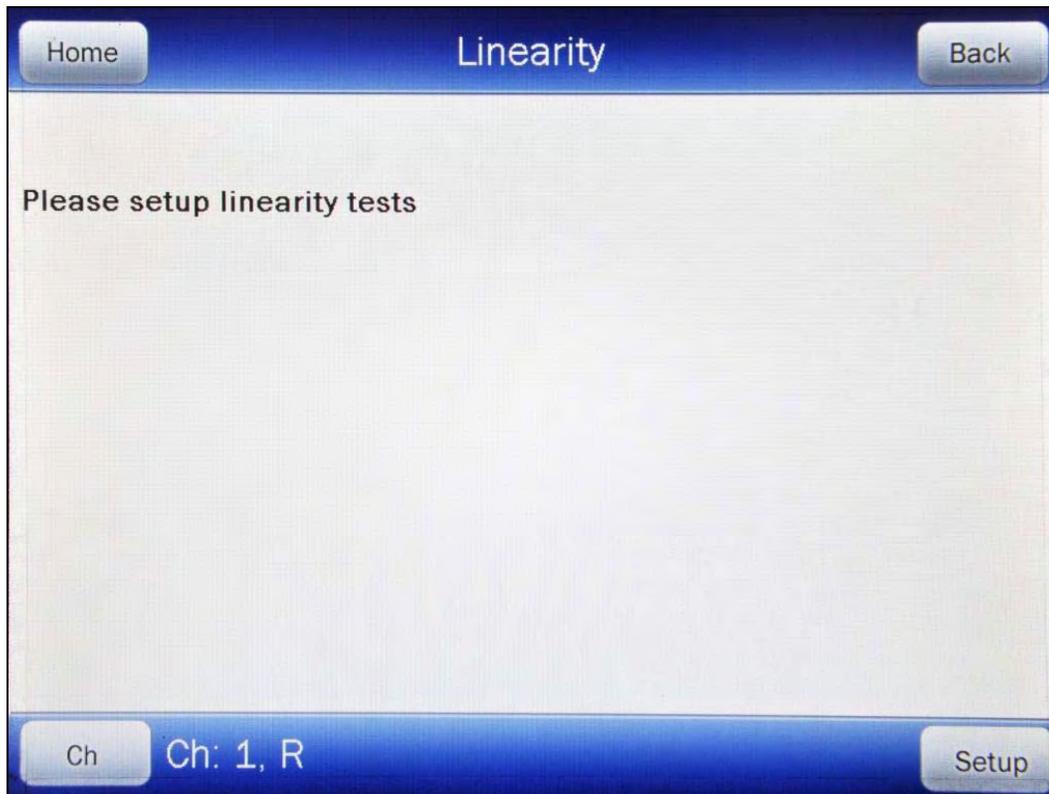


Figure 6-22 Please Setup Linearity Tests Message Screen

To define the Linearity Test Method, touch the **SETUP** button located on the Chamber Measurement screen. Figure 6-23 Setup Screen will appear.

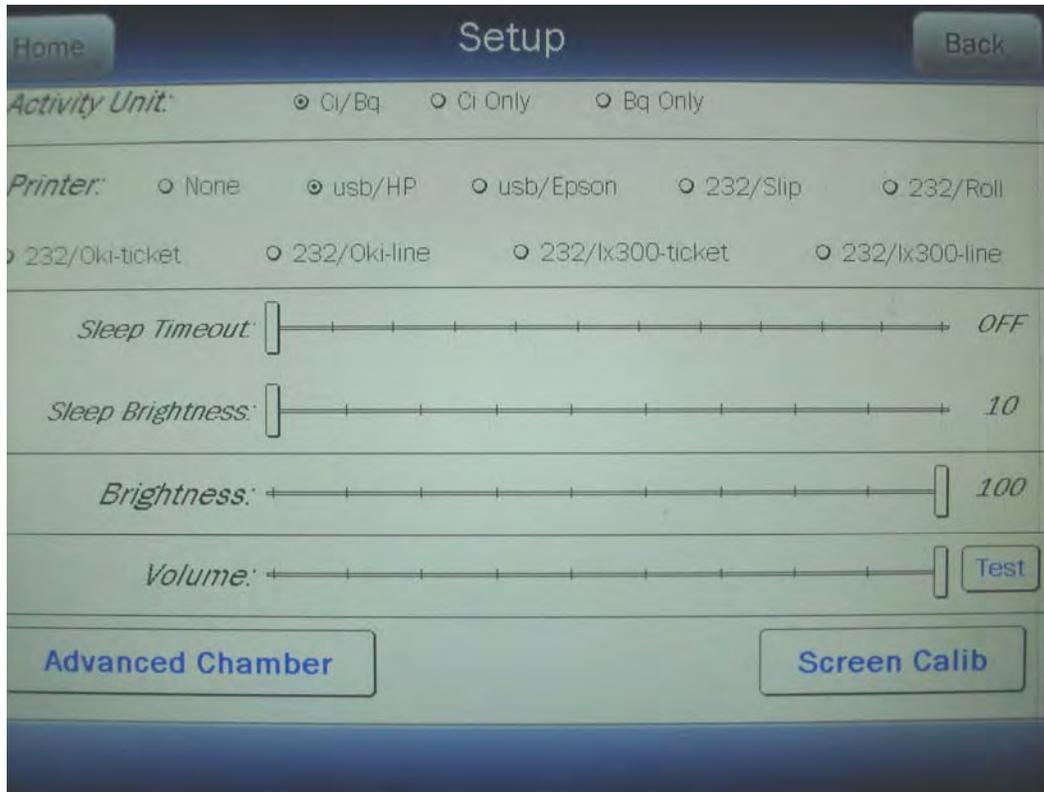


Figure 6-23 Setup Screen

Touch the **ADVANCED CHAMBER** button. A numeric keypad will appear to allowing the user to input a 3-digit password as shown in Figure 6-24 Enter Password: Screen.

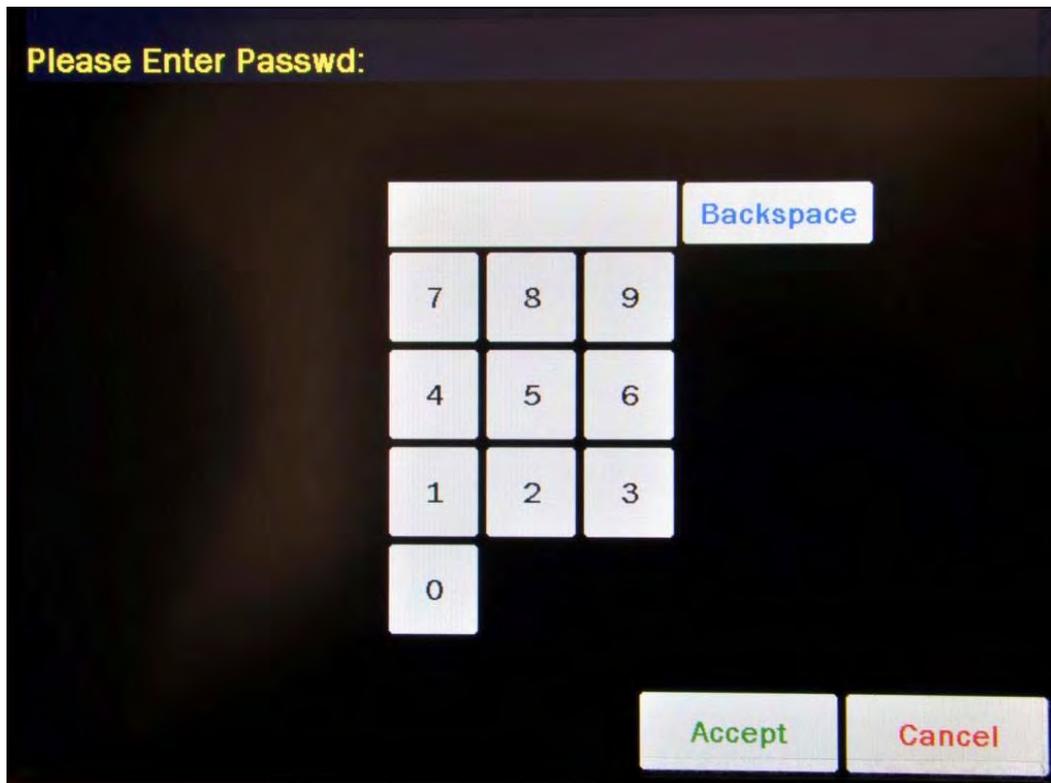


Figure 6-24 Enter Password: Screen

Input the password (last 3 digits of serial number) by touching the appropriate numbers on the keypad. Touch the **ACCEPT** button to accept the password. Figure 6-25 Advanced Chamber Setup Screen will appear.

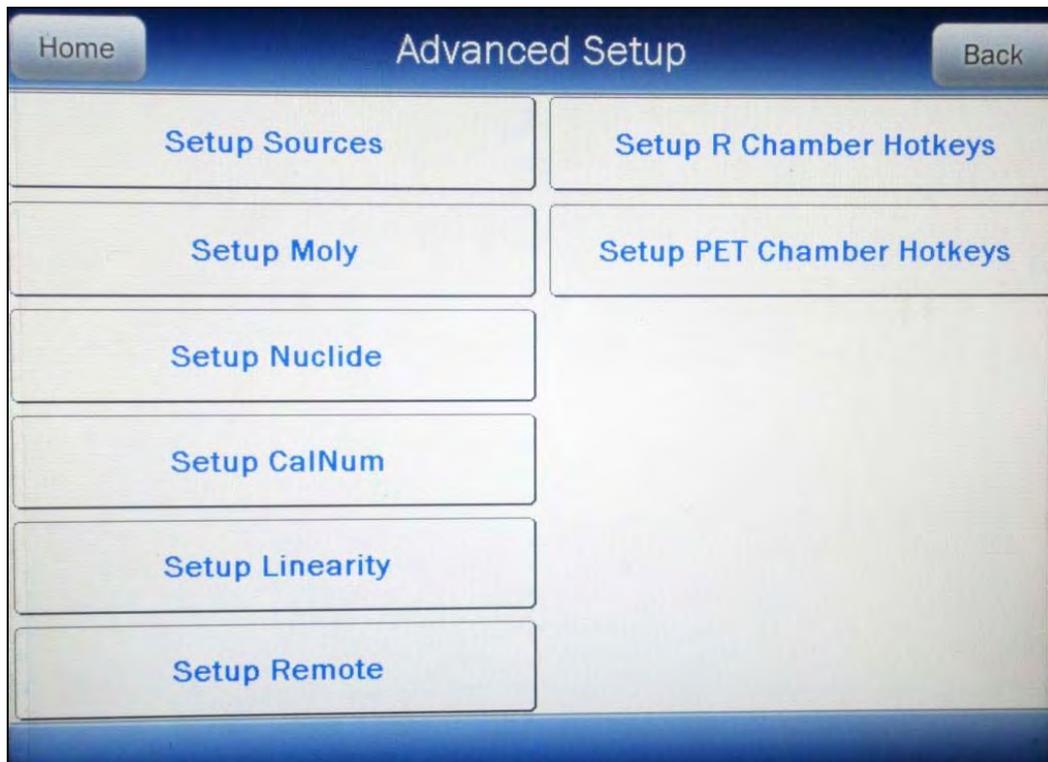


Figure 6-25 Advanced Chamber Setup Screen

Touch the **SETUP LINEARITY** button. Figure 6-26 Setup Linearity Screen will appear.

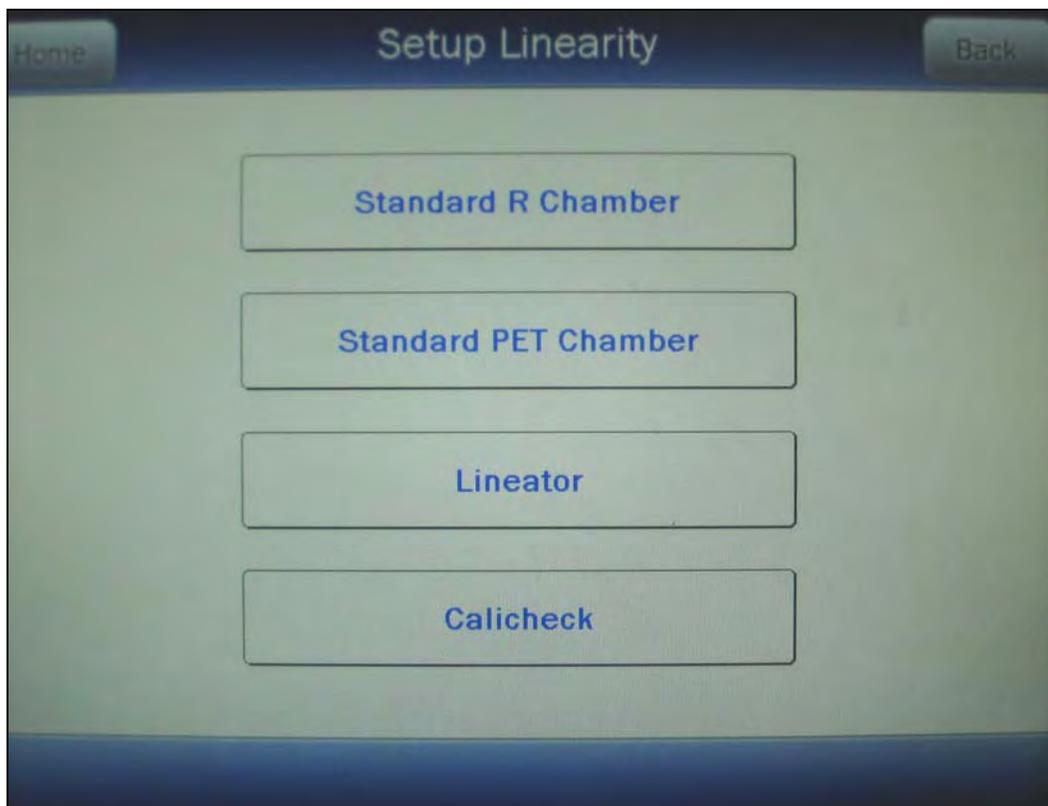


Figure 6-26 Setup Linearity Screen

Refer to the following sections for instructions for defining the desired Linearity Test.

Standard Linearity Test

Defining a Standard Linearity Test

For an R Chamber, the Standard Test is normally performed by tracking the decay of a strong Tc99m source. However, any nuclide can be selected.

For a PET Chamber, the Standard Test is performed by tracking the decay of a user selected nuclide.

Note: *The selected nuclide must have a Calibration Number assigned to it. (Reference **CALIBRATION NUMBERS** on page 6-27) If the desired nuclide does not have a Calibration Number, it will not be displayed in the Select Nuclide list.*

The Standard Test measures the activity of the selected nuclide over a defined period of time. When the defined number of measurements have been made, a least-squares fit is performed and the deviation of the results from this fit are reported.

To set up a Standard Linearity Test, touch the **STANDARD R CHAMBER** button if setting up for an R Chamber or touch the **STANDARD PET CHAMBER** button if setting up for a PET Chamber. Figure 6-27 Setup Linearity Standard Screen will appear.

Note: The example shown is for an R Chamber using 6 measurements of Tc99m.

Figure 6-27 Setup Linearity Standard Screen

Select Nuclide

Tc99m is set as the default nuclide. To select a different nuclide, touch the **Nuclide:** field box. Figure 6-16 Select Nuclide Screen will appear.

The left half of the Select Nuclide screen contains the preset **NUCLIDE** Hotkeys. To use one these nuclides, touch the desired key. Figure 6-27 Setup Linearity Standard Screen will re-appear with the chosen nuclide displayed in the **Nuclide:** field box.

The right half of the screen displays a listing of nuclides stored in the calibrator’s memory that have a Calibration Number assigned – 10 at a time. The nuclide list is in alphabetical order with user added nuclides at the top of the list. The number of pages shown in the upper right corner of the screen indicates the length of the list. To scroll through the list, touch the **DOWN ARROW** button. The next group of 10 nuclides will be displayed and the **UP ARROW** button will appear to allow scrolling up in the list.

To select a nuclide in the list, touch the desired nuclide and the entire line for the selected nuclide will become highlighted and an **ACCEPT** button will appear. Touch the **ACCEPT** button to select the highlighted nuclide. Figure 6-27 Setup Linearity Standard Screen will re-appear with the chosen nuclide displayed in the **Nuclide:** field box.

To abort selecting a nuclide and return to Figure 6-27 Setup Linearity Standard Screen, touch the **CANCEL** button.

Number of Measurements

The Standard Test can be performed with a minimum of 5 to a maximum of 12 measurements.

Touch the **Num of Measurements:** field box. A numeric keypad will appear allowing for the entry of the total number of measurements to be performed.

Input the number of measurements using the keypad and touch the **ACCEPT** button. Figure 6-27 Setup Linearity Standard Screen will re-appear with an empty field box beside the second measurement through the total number of measurements input.

Time Interval

For each measurement (starting with the measurement 2), the nominal time (in hours) with respect to the first measurement that the measurement will be performed is input. The minimum time (in hours) is 1 and the maximum time (in hours) is 999. The example shown in Figure 6-27 Setup Linearity Standard Screen represents 6 measurements.

The first measurement is 0 hours and is the base time of when the first measurement is made. Measurements 2 through 6 are the times from the first measurement that the next measurement is scheduled.

Once all 6 measurement times are input, touch the **ACCEPT** button. The Standard Test definition will be saved. Figure 6-26 Setup Linearity Screen will re-appear. If the set times are not in ascending order, the message "SETUP LINEARITY ERROR – PLEASE ENTER HOURS IN ASCENDING ORDER – OK" will appear. Touch the **OK** button to correct the error.

To abort setting up the Standard Test, touch the **CANCEL** button. Figure 6-26 Setup Linearity Screen will re-appear.

To exit the Setup Linearity screen, press the **BACK** button on the top of the screen and return to Figure 6-25 Advanced Chamber Setup Screen or touch the **HOME** button to return to Figure 6-1 Chamber Measurement Screen.

Deleting a Standard Linearity Test Definition

The Standard Linearity Test definition may be deleted.

The definition is removed by touching the **CLEAR** button on Figure 6-27 Setup Linearity Standard Screen.

Next, touch the **ACCEPT** button. Figure 6-27 Setup Linearity Standard Screen will re-appear and the definition is now erased from the system.

Lineator Test

Defining a Lineator Test

The Lineator Test requires 8 measurements using a strong Tc99m source along with a Lineator Test tube set. A Lineator Calibration procedure must be performed before any Lineator tests.

The purpose of this test is to perform linearity quickly and not have to wait the time required to perform the Standard Linearity test. This is accomplished by measuring the attenuation of the tubes surrounding the source and storing the results. At any later time, the tubes are used to confirm that the attenuation has not changed.

To set up for a Lineator linearity test, from Figure 6-26 Setup Linearity Screen, touch the **LINEATOR** button. Figure 6-28 Setup Linearity Lineator Screen will appear.

Figure 6-28 Setup Linearity Lineator Screen

Lineator Serial Number

The Lineator Serial Number must be input. To input the serial number, touch the **Lineator Serial:** field box. The alphanumeric keyboard will appear. Input the serial number and touch the **ACCEPT** button. Figure 6-28 Setup Linearity Lineator Screen will re-appear with **Lineator Serial:** field box populated with the entered serial number. The serial number can contain up to 10 characters

To cancel any changes and return to Figure 6-28 Setup Linearity Lineator Screen, touch the **CANCEL** button.

Calibration Procedure

The Tubes must be inserted in the order indicated, i.e. Tube #1 first, then Tube #2, etc...

Remove the Dipper from the Chamber (leaving the Liner in place) and place the Tc99m test source into Tube 1 and then place Tube 1 into the Chamber. Touch the **Tube #1 (1):** field box to perform a measurement. A measurement window will appear as shown in Figure 6-29 Lineator Test Measurement Screen.

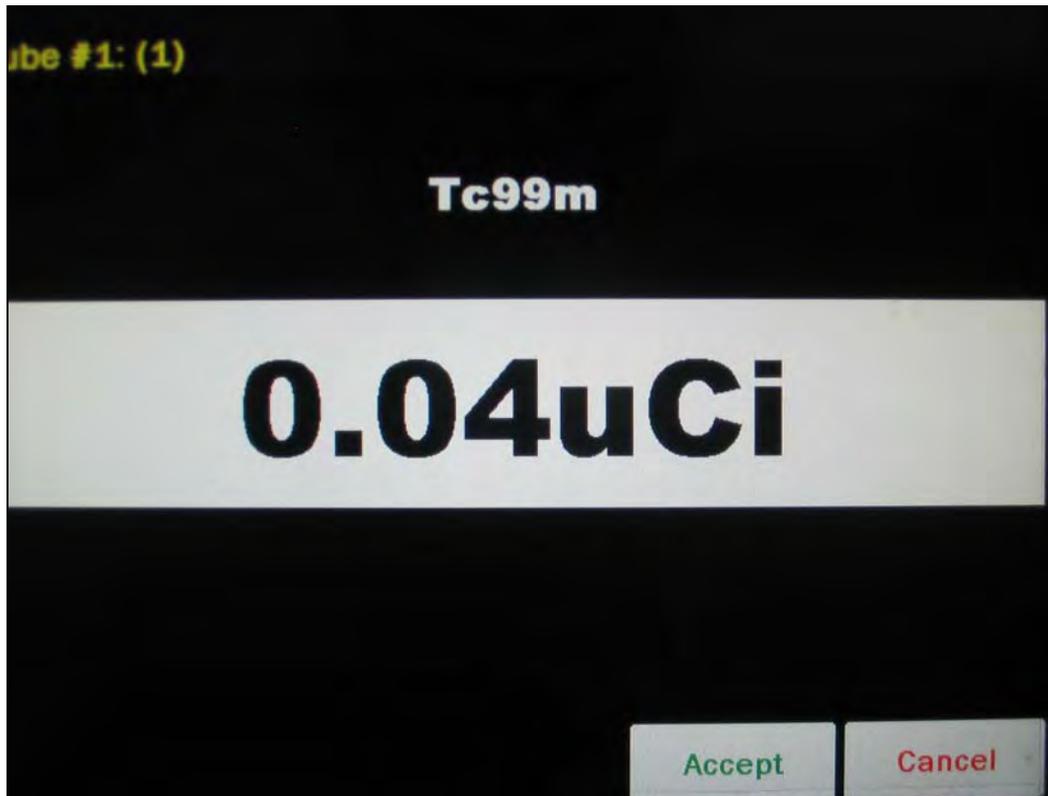


Figure 6-29 Lineator Test Measurement Screen

To abort the measurement, touch the **CANCEL** button. Figure 6-28 Setup Linearity Lineator Screen will re-appear without saving the measurement.

To save the measurement, touch the **ACCEPT** button. Figure 6-28 Setup Linearity Lineator Screen will re-appear with the **Tube #: (1):** field box populated with the accepted measurement.

Repeat the above steps for the remaining combination of tubes as indicated by touching the appropriate measurement field box.

Once all 8 tubes are measured, Figure 6-30 Setup Linearity Lineator Results Screen will appear.

Tube Label	Measured Value	New Factor
Tube #1 (1):	1.181Ci	1.00
Tube #2 (1 + 2):	117.4mCi	10.06
Tube #3 (1 + 3):	11.71mCi	100.71
Tube #4 (1 + 2,3):	1.176mCi	1002.89
Tube #5 (1 + 4):	117.1uCi	10062.29
Tube #6 (1 + 2,4):	11.67uCi	100963.36
Tube #7 (1 + 3,4):	11.15uCi	105645.32
Tube #8 (1 + 2,3,4):	6.56uCi	178981.45

Buttons: **Accept** (green), **Cancel** (red)

Figure 6-30 Setup Linearity Lineator Results Screen

If a printer is attached to the system, a **PRINT** button will appear on the screen. Touch the **PRINT** button to print the Lineator Calibration results.

To save the Lineator Calibration results, touch the **ACCEPT** button. Figure 6-26 Setup Linearity Screen will re-appear. The results will be stored and used as the reference when performing the Lineator test.

Note: If all measurements have not been performed when the **ACCEPT** button is touched, the message “**SETUP LINEATOR ERROR – PLEASE FILL IN ALL MEASUREMENTS – OK**” will appear. Touch the **OK** button to return to Figure 6-28 Setup Linearity Lineator Screen and continue the calibration procedure.

To exit the Lineator Calibration without saving the results, touch the **CANCEL** button. Figure 6-26 Setup Linearity Screen will re-appear without saving the results.

Deleting a Lineator Definition

The Lineator Test definition may be deleted.

From Figure 6-26 Setup Linearity Screen, touch the **LINEATOR** button. Figure 6-31 Setup Linearity Lineator View Results Screen will appear showing the current factor under each Tube #. There will also be a **DELETE CURRENT SETTINGS** button in the lower left of the screen.

Tube #	Current Factor
Tube #1 (1):	1.00
Tube #2 (1 + 2):	10.06
Tube #3 (1 + 3):	100.63
Tube #4 (1 + 2,3):	137.89
Tube #5 (1 + 4):	183.81
Tube #6 (1 + 2,4):	220.05
Tube #7 (1 + 3,4):	551.31
Tube #8 (1 + 2,3,4):	1102.17

Figure 6-31 Setup Linearity Lineator View Results Screen

The definition is removed by touching the **DELETE CURRENT SETTINGS** button. Figure 6-32 Delete Lineator Settings Screen will appear.

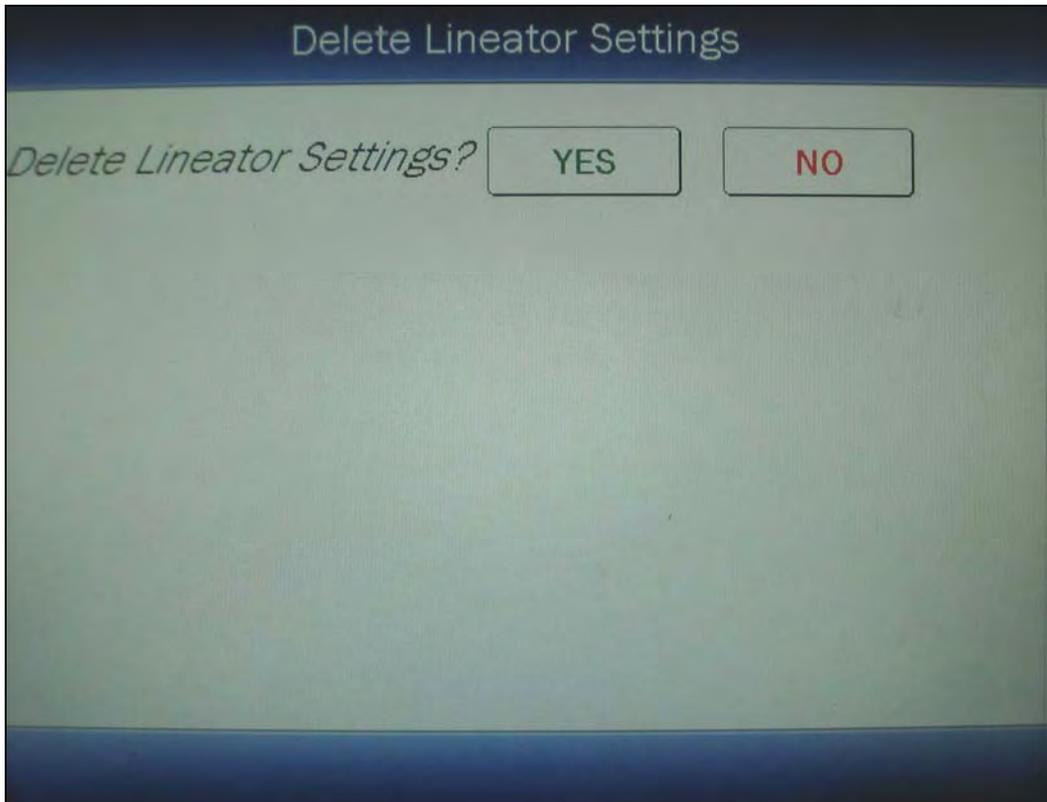


Figure 6-32 Delete Lineator Settings Screen

To abort deleting the Lineator Calibration, touch the **NO** button. Figure 6-31 Setup Linearity Lineator View Results Screen will re-appear.

To delete the Lineator Calibration, touch the **YES** button. Figure 6-28 Setup Linearity Lineator Screen will re-appear and the definition is now erased from the system.

Touch the **CANCEL** button. Figure 6-26 Setup Linearity Screen will re-appear.

Calicheck Test

Defining a Calicheck Test

The Calicheck test requires 5 to 12 measurements. A Calicheck calibration procedure must be performed before any Calicheck tests.

The purpose of this test is to perform linearity quickly and not have to wait the time required to perform the Standard Linearity test. This is accomplished by measuring the attenuation of the tubes surrounding the source and storing the results. At any later time, the tubes are used to confirm that the attenuation has not changed.

To set up for Calicheck linearity, from Figure 6-26 Setup Linearity Screen, touch the **CALICHECK** button. Figure 6-33 Setup Linearity Calicheck Screen will appear.

Ch: 1

Setup Linearity Calicheck

Chamber Serial: 000111 Num: 5 Calicheck Serial: 7654

1) Black:

2) Black + Red:

3) Black + Orange:

4) Black + Yellow:

5) Black + Green:

Accept Cancel

Figure 6-33 Setup Linearity Calicheck Screen

Calicheck Serial Number

The Calicheck Serial Number must be input. To input the serial number, touch the **Calicheck Serial:** field box. The alphanumeric keyboard will appear. Input the serial number and touch the **ACCEPT** button. Figure 6-33 Setup Linearity Calicheck Screen will re-appear with **Calicheck Serial:** field box populated with the entered serial number. The serial number can contain up to 10 characters

To cancel any changes and return to Figure 6-33 Setup Linearity Calicheck Screen, touch the **CANCEL** button.

Number of Measurements

The Calicheck Test can be performed with a minimum of 5 to a maximum of 12 measurements.

Touch the **Num:** field box. A numeric keypad will appear allowing for the entry of the total number of measurements to be performed.

Input the number of measurements using the keypad and touch the **ACCEPT** button. Figure 6-33 Setup Linearity Calicheck Screen will re-appear with an empty field box beside the number of measurements input.

Calibration Procedure

The Tubes must be inserted in the order indicated, i.e. 1) Black: first, then 2) Black + Red:, etc...

Place the Linearity Test Source in the calibrator with Black Tube. Touch the **1) Black:** field box to perform a measurement. A measurement window will appear as shown in Figure 6-34 Calicheck Test Measurement Screen.



Figure 6-34 Calicheck Test Measurement Screen

To abort the measurement, touch the **CANCEL** button. Figure 6-33 Setup Linearity Calicheck Screen will re-appear without saving the measurement.

To save the measurement, touch the **ACCEPT** button. Figure 6-33 Setup Linearity Calicheck Screen will re-appear with the selected measurement's field box populated with the accepted measurement.

Repeat the above steps for the remaining combination of tubes as indicated by touching the appropriate measurement field box.

Once all tubes are measured, Figure 6-35 Setup Linearity Calicheck Results Screen will appear.

Ch: 2, R Setup Linearity Calicheck

Chamber Serial: 120609 Num: 5 Calicheck Serial: MNBV

1) Black: 1.181Ci
New Factor: 1.00

2) Black + Red: 117.4mCi
New Factor: 10.06

3) Black + Orange: 11.71mCi
New Factor: 100.76

4) Black + Yellow: 1.172mCi
New Factor: 1007.16

5) Black + Green: 118.2uCi
New Factor: 9981.48

Print Accept Cancel

Figure 6-35 Setup Linearity Calicheck Results Screen

If a printer is attached to the system, a **PRINT** button will appear on the screen. Touch the **PRINT** button to print the Calicheck Calibration results.

To save the Calicheck Calibration results, touch the **ACCEPT** button. Figure 6-26 Setup Linearity Screen will re-appear. The results will be stored and used as the reference when performing the Calicheck test.

Note: If all measurements have not been performed when the **ACCEPT** button is touched, the message “**SETUP CALICHECK ERROR – PLEASE FILL IN ALL MEASUREMENTS – OK**” will appear. Touch the **OK** button to return to Figure 6-33 Setup Linearity Calicheck Screen and continue the calibration procedure.

Also, if the Calicheck Serial has not been entered when the **ACCEPT** button is touched, the message “**SETUP CALICHECK ERROR – PLEASE FILL IN CALICHECK SERIAL NUMBER – OK**” will appear. Touch the **OK** button to return to Figure 6-33 Setup Linearity Calicheck Screen and input the Calicheck Serial number.

To exit the Calicheck Calibration without saving the results, touch the **CANCEL** button. Figure 6-26 Setup Linearity Screen will re-appear without saving the results.

Deleting a Calicheck Definition

The Calicheck Test definition may be deleted.

From Figure 6-26 Setup Linearity Screen, touch the **CALICHECK** button. Figure 6-36 Setup Linearity Calicheck View Results Screen will appear showing the current factor under each Tube #. There will also be a **DELETE CURRENT SETTINGS** button in the lower left of the screen.

Ch: 2, R Setup Linearity Calicheck

Chamber Serial: 120609 Num: 5 Calicheck Serial: NMB

1) Black:
Current Factor: 1.00

2) Black + Red:
Current Factor: 5.03

3) Black + Orange:
Current Factor: 890.75

4) Black + Yellow:
Current Factor: 506.95

5) Black + Green:
Current Factor: 5069.80

Delete Current Settings Print Accept Cancel

Figure 6-36 Setup Linearity Calicheck View Results Screen

The definition is removed by touching the **DELETE CURRENT SETTINGS** button. Figure 6-37 Delete Calicheck Settings Screen will appear.

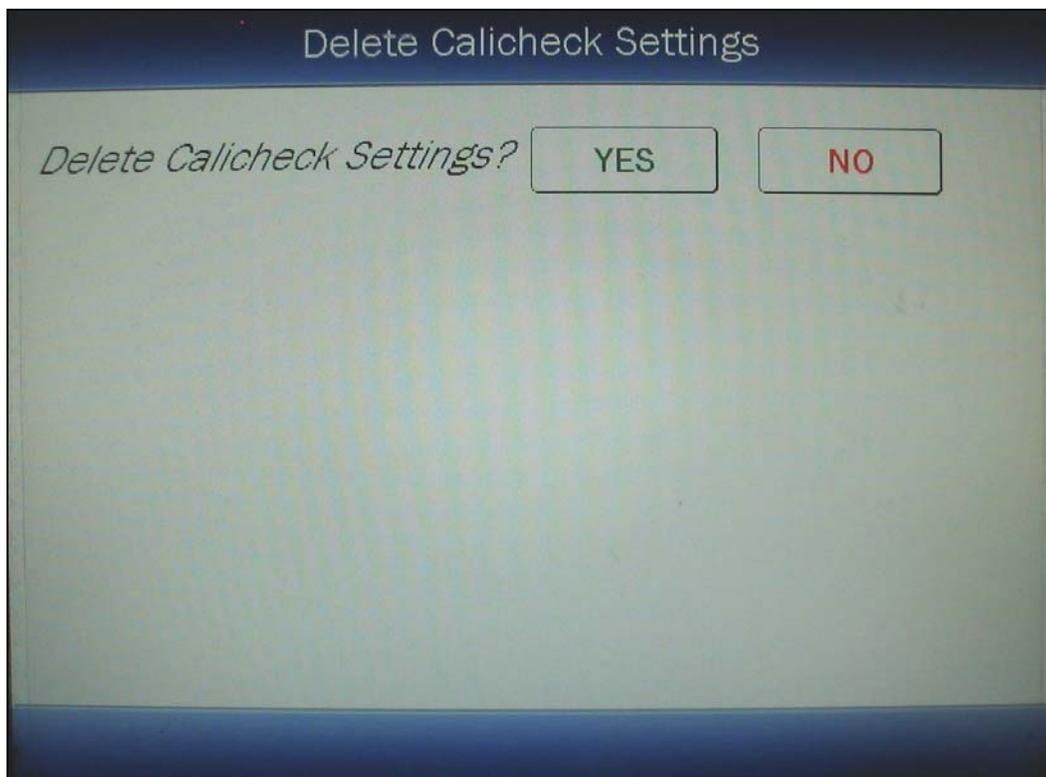


Figure 6-37 Delete Calicheck Settings Screen

To abort deleting the Calicheck Calibration, touch the **NO** button. Figure 6-36 Setup Linearity Calicheck View Results Screen will re-appear.

To delete the Calicheck Calibration, touch the **YES** button. Figure 6-33 Setup Linearity Calicheck Screen will re-appear and the definition is now erased from the system.

Touch the **CANCEL** button. Figure 6-26 Setup Linearity Screen will re-appear.

REMOTE DISPLAY NUCLIDE ASSIGNMENT

If a Remote Display unit is part of the CRC[®]-55t system, up to 8 nuclides can be assigned to the Remote for R Chambers and another 8 for the PET Chambers. This allows the user to select any one of the assigned nuclides from the Remote Display without having to return to the Main Readout.

To set up Remote nuclides, touch the **SETUP** button located on the Chamber Measurement screen. Figure 6-38 Setup Screen will appear.

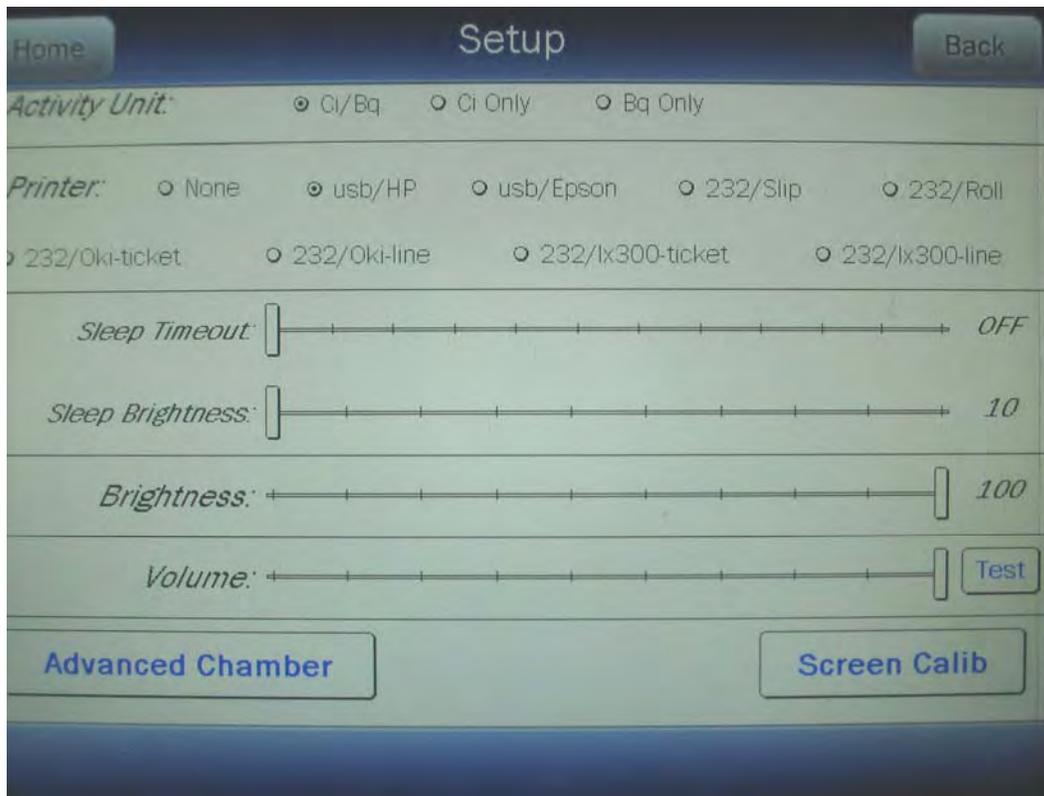


Figure 6-38 Setup Screen

Touch the **ADVANCED CHAMBER** button. A numeric keypad will appear to allowing the user to input a 3-digit password as shown in Figure 6-39 Enter Password: Screen.

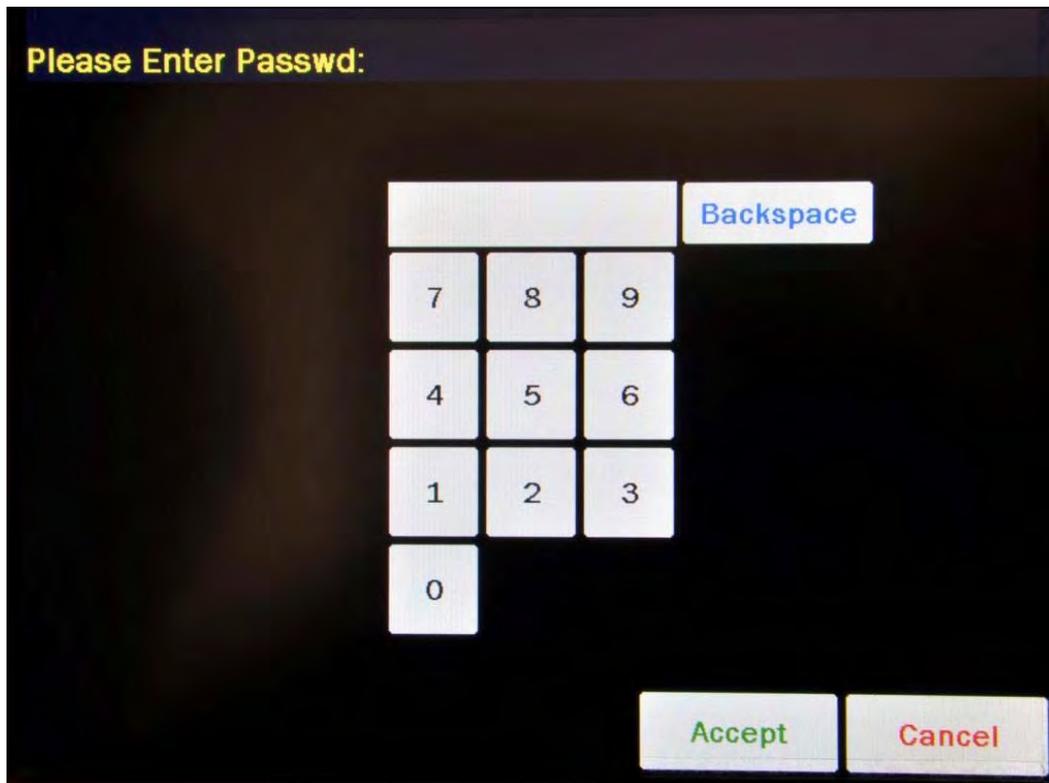


Figure 6-39 Enter Password: Screen

Input the password (last 3 digits of serial number) by touching the appropriate numbers on the keypad. Touch the **ACCEPT** button to accept the password. Figure 6-40 Advanced Chamber Setup Screen will appear.



Figure 6-40 Advanced Chamber Setup Screen

Touch the **SETUP REMOTE** button. Figure 6-41 Setup Remote Nuclides Screen will appear.

R Chamber			
Tc99m	In111	Ga67	F18
I123	I131	Xe133	TI201
P Chamber			
O15	N13	C11	F18

Figure 6-41 Setup Remote Nuclides Screen

The following is a list of the default nuclides for each Chamber type.

- R Chambers:Tc99m, In111, Ga67, F18, I123, I131, Xe133, and TI201
- PET Chambers:O15, N13, C11, and F18

Adding or Changing Nuclides

To add a new nuclide or change the current assignment of the nuclides, touch the desired nuclide field box. Figure 6-42 Select Nuclide Screen will appear.

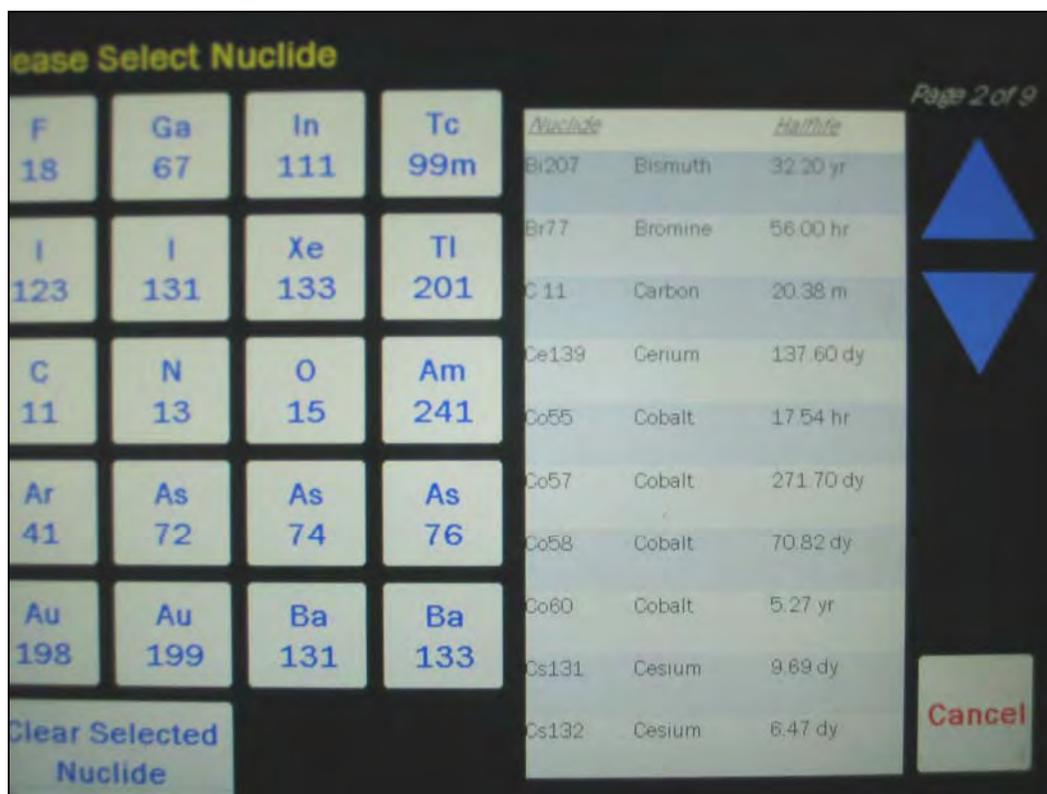


Figure 6-42 Select Nuclide Screen

The left half of the Select Nuclide screen contains the preset **NUCLIDE** buttons (these are the Select Nuclide Screen Hotkeys). To use one of these nuclides, touch the desired button. Figure 6-41 Setup Remote Nuclides Screen will re-appear with the chosen nuclide displayed in the selected nuclide field box.

The right half of the screen displays a listing of nuclides stored in the calibrator's memory that have a Calibration Number assigned to them (Refer to the CALIBRATION NUMBERS section on page 6-27) – 10 at a time. The nuclide list is in alphabetical order. User added nuclides are displayed at the top of the list. The length of the list will vary depending on which nuclides have a Calibration Number assigned to them (Refer to the CALIBRATION NUMBERS section on page 6-27). The number of pages shown in the upper right corner of the screen indicates the length of the list. To scroll through the list, touch the **DOWN ARROW** button. The next group of 10 nuclides will be displayed and the **UP ARROW** button will appear to allow scrolling up in the list.

To select a nuclide in the list, touch the desired nuclide and the entire line for the selected nuclide will become highlighted and an **ACCEPT** button will appear. Touch the **ACCEPT** button to select the highlighted nuclide. Figure 6-41 Setup Remote Nuclides Screen will re-appear with the chosen nuclide displayed in the selected nuclide field box.

To abort selecting a nuclide and return to Figure 6-41 Setup Remote Nuclides Screen, touch the **CANCEL** button.

Deleting Nuclides

To remove nuclides from the Remote Display, touch the desired nuclide field box. Figure 6-42 Select Nuclide Screen will appear.

Touch the **CLEAR SELECTED NUCLIDE** button. Figure 6-41 Setup Remote Nuclides Screen will re-appear. The selected nuclide field box will now be blank.

CHAPTER 7

ACCEPTANCE & QUALITY ASSURANCE TESTS

GENERAL 1

ACCEPTANCE TESTS 1

Diagnostic Test 1

Chamber Daily Test..... 2

Accuracy Test..... 2

Well Counter Test..... 2

QUALITY ASSURANCE TESTS..... 2

Chamber Daily Tests..... 2

Well Counter Test..... 2

Contamination Test..... 3

QUARTERLY TESTS..... 3

Diagnostic Test 3

Chamber Daily Test..... 4

Accuracy Test..... 4

Linearity Test..... 4

GENERAL

To insure proper operation of the CRC®-55t, the following tests should be preformed at the indicated intervals.

ACCEPTANCE TESTS

The following tests must be preformed in the following order before the initial use of the CRC®-55t:

- Diagnostics – reference CHAPTER 9: DIAGNOSTICS.
- Chamber Daily Test – reference CHAPTER 8: CHAMBER TESTS.
- Accuracy (for those nuclides that are not used in the Daily Test) – reference CHAPTER 8: CHAMBER TESTS.
- Well Counter Test– reference CRC®-55t Well Counter Owner’s Manual.

Diagnostic Test

When *DIAGNOSTICS* is selected, the instrument's memories and the programs are checked and the results printed (if a printer is attached to the system) and displayed. If any of the

tests fail, contact Capintec's Authorized Service Center at 1-800-227-6832. (reference CHAPTER 9: DIAGNOSTICS)

Chamber Daily Test

The Daily Test should be conducted at the beginning of each working day, prior to measuring any samples which will be administered to patients. These tests consist of an Auto Zero operation, a Background adjustment, a Chamber Voltage test, a Data Check, an Accuracy Test, and a Constancy Test. (reference CHAPTER 8: CHAMBER TESTS)

When the test is complete, if a printer is attached to the system, a report can be printed. If no printer is available, you may record the data by hand. Copies of the completed reports (either printed or hand written) should be retained in a safe place.

Accuracy Test

If your Accuracy Test setup includes nuclides that are not used in the Daily Tests, the Accuracy Test should be performed with those nuclides. It will not be necessary to repeat the test for those nuclides that were included in the Daily Test. (reference CHAPTER 8: CHAMBER TESTS)

If a printer is attached to the system, the test results can be printed at the end of all source measurements.

Well Counter Test

The Well Counter System Test should be performed every day. It cannot be performed unless Well Background and Auto Calibration have been measured for the current day. (Reference CRC[®]-55t Well Counter Owner's Manual)

If a printer is attached to the system, the test results can be printed at the end of the source measurement.

QUALITY ASSURANCE TESTS

Chamber Daily Tests

The Daily Test should be conducted at the beginning of each working day, prior to measuring any samples, which will be administered to patients. These tests consist of an Auto Zero operation, a Background adjustment, a Chamber Voltage test, a Data Check, an Accuracy Test, and a Constancy Test. (reference CHAPTER 8: CHAMBER TESTS)

Well Counter Test

The Well Counter System Test should be performed every day. It cannot be performed unless Well Background and Auto Calibration have been measured for the current day. (Reference CRC[®]-55t Well Counter Owner's Manual)

If a printer is attached to the system, the test results can be printed at the end of the source measurement.

Contamination Test

This test is normally performed at the end of each workday. At the very least, it should be performed once per week. To test for contamination of the Dipper and/or Liner:

1. Make sure that the Dipper is in the Chamber and there is no source in the Dipper.
2. From the Chamber Measurement screen, select Co57 as the nuclide. This is done by touching the **NUCLIDE** button located below the measurement and selecting Co57 from the Nuclide List.
3. Record the displayed activity.
4. Remove the Dipper from the Chamber and record the displayed activity.
5. Subtract the activity in step 4 from the activity in step 3. This is the amount of contamination of the Dipper.
6. Remove the Liner from the Chamber and record the displayed activity.
7. Subtract the activity in step 6 from the activity in step 4. This is the amount of contamination of the Liner.
8. Should either the Dipper or the Liner exhibit contamination greater than 3 μCi or 0.1 MBq, they should be decontaminated or replaced.
9. Return the Liner to the Chamber.

CAUTION

Never use the calibrator without the liner being in place. Liners are inexpensive and easy to replace. A contaminated Chamber is a very costly mistake.

QUARTERLY TESTS

The Quarterly Tests consist of:

- Diagnostic Test – reference CHAPTER 9: DIAGNOSTICS.
- Chamber Daily Test – reference CHAPTER 8: CHAMBER TESTS.
- Accuracy Test (for those nuclides that are not used in the Daily Test) – reference CHAPTER 8: CHAMBER TESTS.
- Linearity Test – reference CHAPTER 11: CHAMBER ENHANCED TESTS

Diagnostic Test

The Diagnostics Test should be performed as a part of the Quarterly Tests. When *DIAGNOSTICS* is selected, the instrument's memories and the programs are checked and

the results printed (if a printer is attached to the system) and displayed. If any of the tests fail, contact Capintec's Authorized Service Center at 1-800-227-6832. (reference CHAPTER 9: DIAGNOSTICS)

Chamber Daily Test

The normal Daily Tests should be performed as a part of the Quarterly Tests. The operation of the Daily Tests is fully described in CHAPTER 8: CHAMBER TESTS. At least one Accuracy measurement must be included in the test sequence.

Accuracy Test

If the Accuracy Test setup (CHAPTER 8: CHAMBER TESTS) includes nuclides that are not used in the Daily Tests, the Accuracy Test should be performed with those nuclides as a part of the Quarterly Test. It will not be necessary to repeat the test for those nuclides, which were included in the Daily Test.

This test is the same as the Accuracy Test described in CHAPTER 8: CHAMBER TESTS, SECTION: ACCURACY and CONSTANCY TEST IN DAILY TEST. This test is performed independently from the other portions of the Daily Test sequence.

The Accuracy Tests cannot be conducted until the Test Source data has been entered (reference CHAPTER 6: CHAMBER INITIALIZATION, SECTION: TEST SOURCE SETUP).

If there is a printer attached to the system, the test results can be printed at the end of all source measurements.

Linearity Test

The linearity of the CRC[®]-55t should be checked over the entire range of activities which are reasonably anticipated to be used. This can be done by any of several methods. The three most common methods are described in CHAPTER 6: CHAMBER INITIALIZATION, SECTION: LINEARITY TEST DEFINITION and CHAPTER 11: CHAMBER ENHANCED TESTS, SECTION: PERFORMING LINEARITY TEST.

CHAPTER 8

CHAMBER TESTS

GENERAL 1
BACKGROUND 1
CHAMBER DAILY TEST 6
 Auto Zero 7
 Background 8
 Chamber Voltage..... 9
 Data Check 10
 Accuracy and Constancy Test in Daily Test..... 10
CHAMBER VOLTS 11
ACCURACY TEST 12
 Constancy Test 18

GENERAL

This section describes the tests of the Chamber.

The Enhanced Tests are described in CHAPTER 11: CHAMBER ENHANCED TESTS.

Moly Assay is described in CHAPTER 10: CHAMBER MEASUREMENT PROCEDURES; SECTION: MOLY ASSAY.

BACKGROUND

Background measurements are performed by touching the **BACKGROUND** button from Figure 8-1 Chamber Measurement Screen for the selected Chamber (Background measurement is also part of the Daily Test – reference this chapter, SECTION: Background on page 8-8). Figure 8-2 Background Remove Sources Screen will appear.

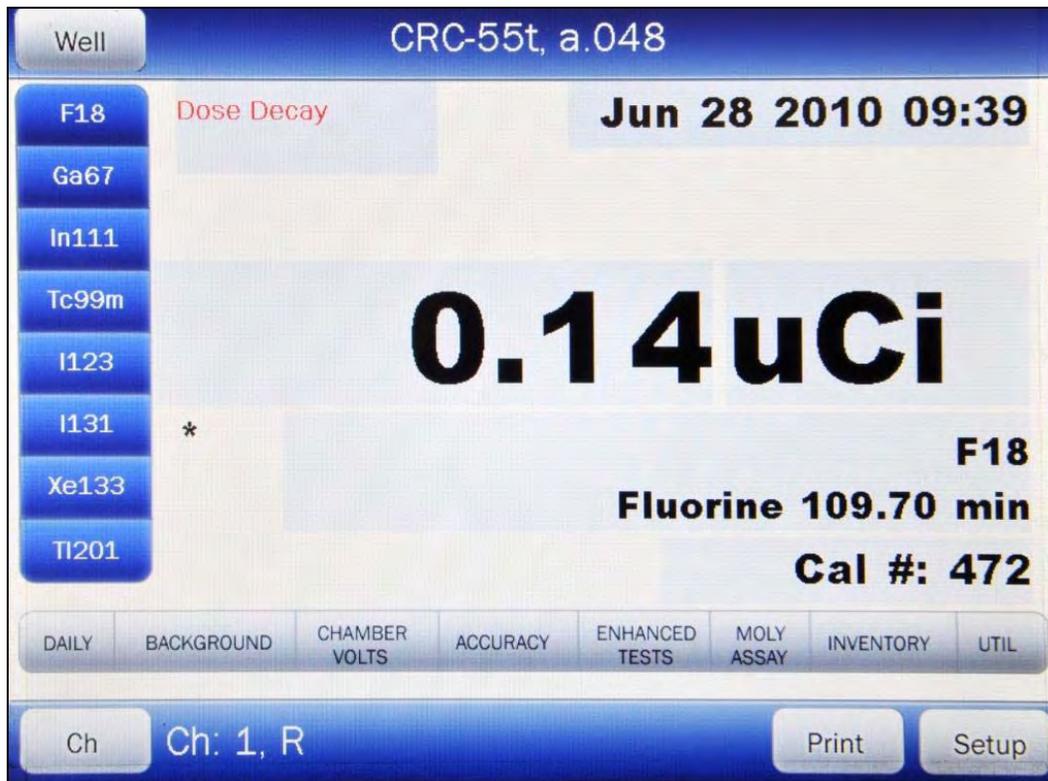


Figure 8-1 Chamber Measurement Screen

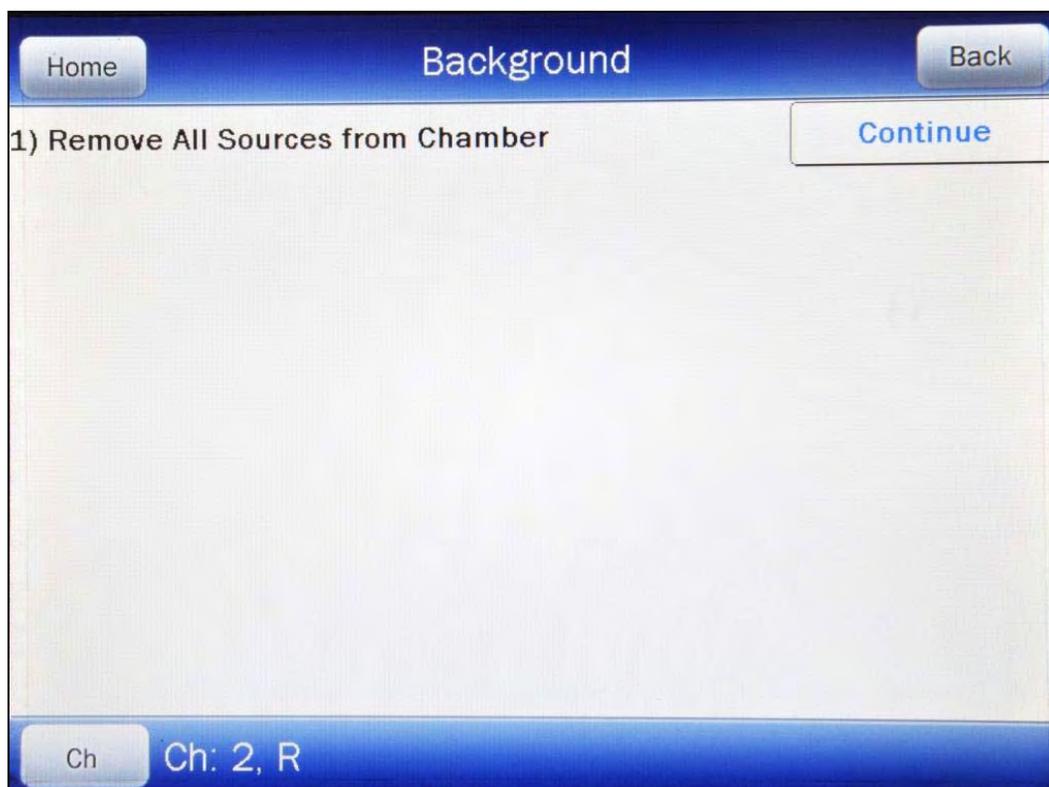


Figure 8-2 Background Remove Sources Screen

Remove all sources from the vicinity of the Chamber and touch the **CONTINUE** button. A progress bar will appear until a measurement is available.

When the measurement is available, Figure 8-3 Background Measurement Screen will appear.

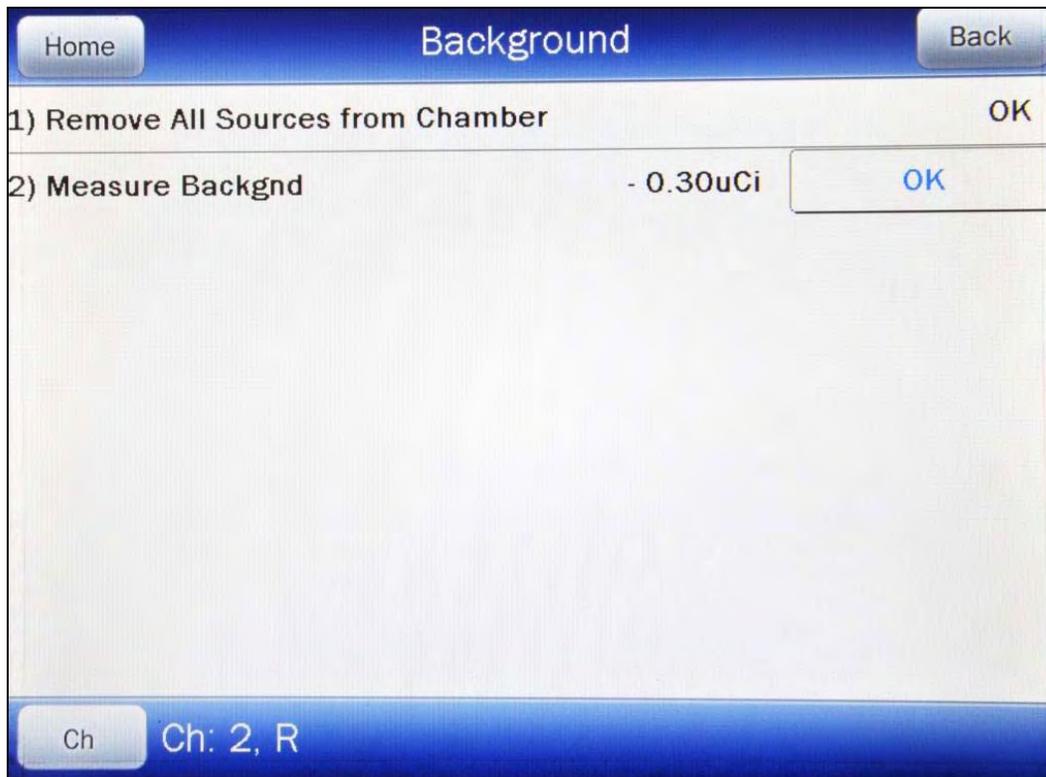


Figure 8-3 Background Measurement Screen

If the background is high but still acceptable ($> 10\mu\text{Ci}$ and $< 530\mu\text{Ci}$ or $> 0.4\text{MBq}$ and $< 20\text{MBq}$), the message “HIGH” will appear instead of next to the measurement. Although the value is acceptable, the reason for the high value should be investigated. If any sources are found nearby, repeat the measurement.

If the background is above the acceptable range ($> 530\mu\text{Ci}$ or $> 20\text{MBq}$), the measurement will not be shown but Figure 8-4 Background Too High Screen will appear.

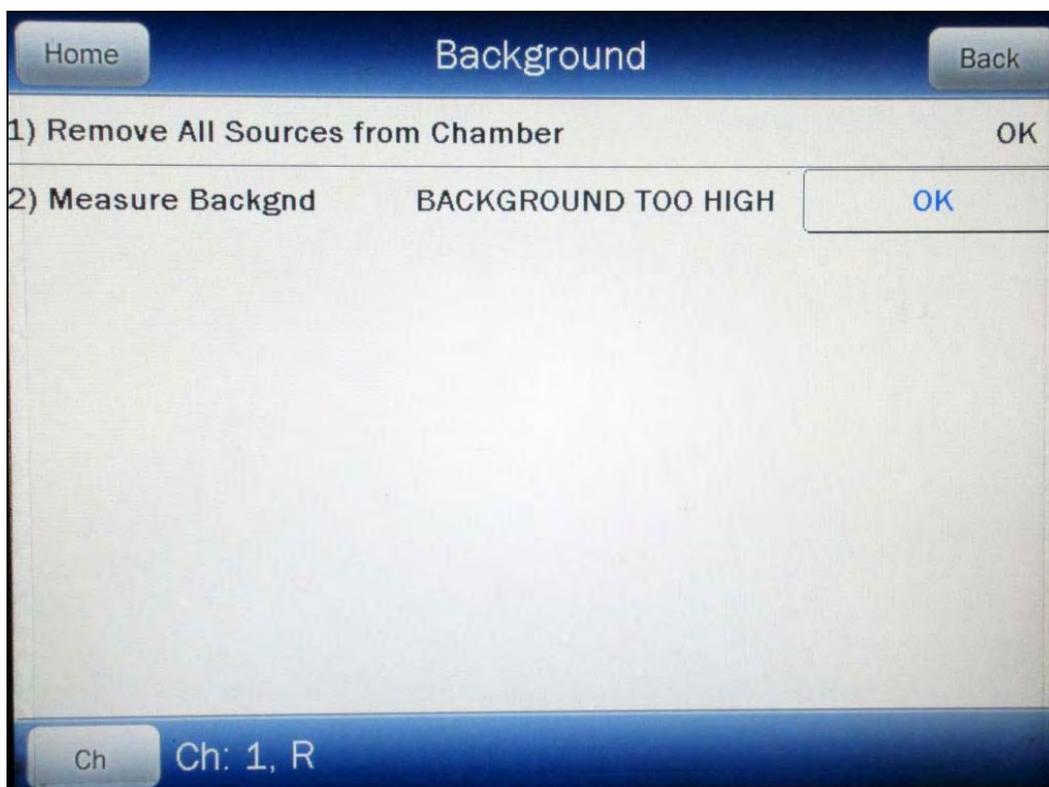


Figure 8-4 Background Too High Screen

This “TOO HIGH” background cannot be accepted by the CRC[®]-55t. Touch the **OK** button to acknowledge the message. If the cause of the high reading (nearby source, contaminated well etc.) cannot be found, contact Capintec’s Authorized Service Center at 1-800-227-6832.

Touch the **OK** button to accept the result. Figure 8-5 Background Results Screen will appear.

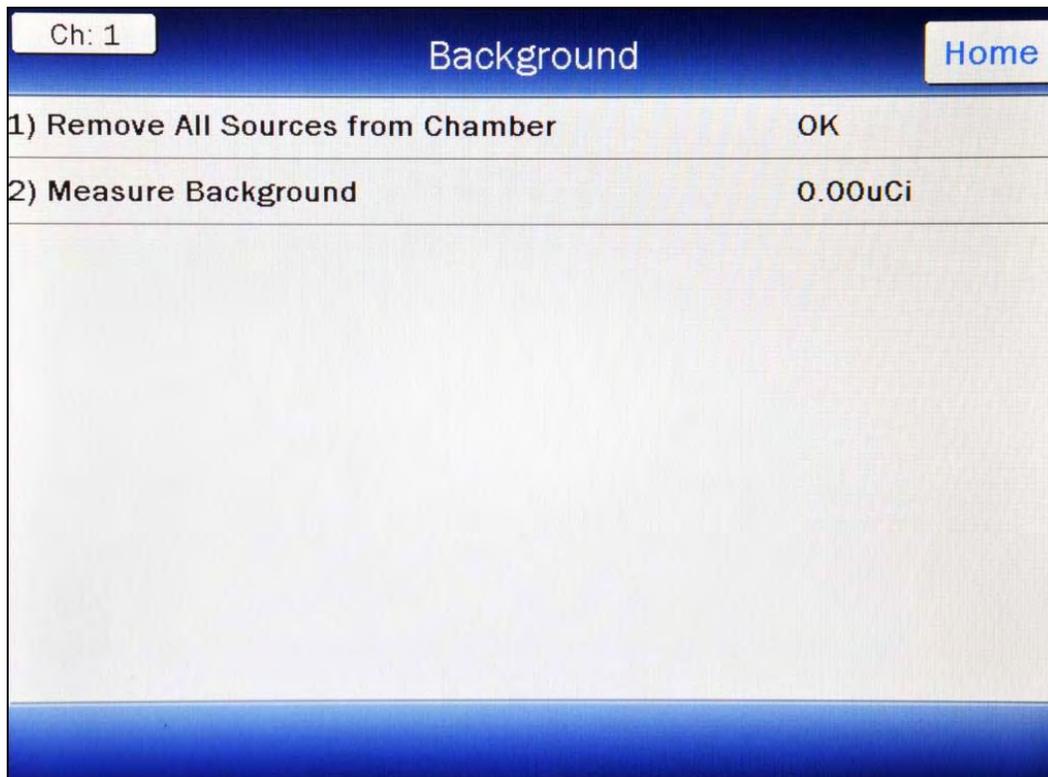


Figure 8-5 Background Results Screen

Touch the **HOME** or **BACK** button to accept the result and return to Figure 8-1 Chamber Measurement Screen.

CHAMBER DAILY TEST

The Chamber Daily Test consists of:

- Auto Zero
- Background
- Chamber Voltage
- Data Check
- Accuracy Test
- Constancy Test

To perform the Daily Test, touch the **DAILY** button from Figure 8-1 Chamber Measurement Screen for the selected Chamber. Figure 8-6 Daily Test Screen will appear.

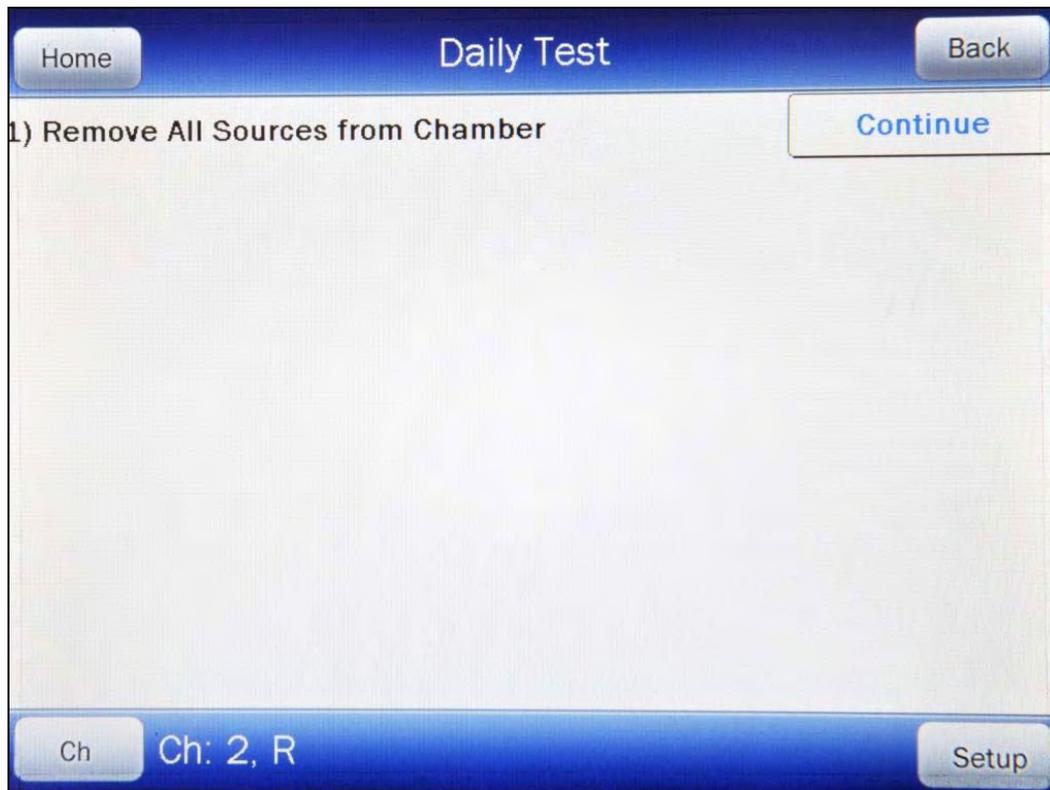


Figure 8-6 Daily Test Screen

Auto Zero

The first part of the Daily Test is the Auto Zero.

Remove all sources from the vicinity of the Chamber and touch the **CONTINUE** button. A progress bar will appear until a measurement is available.

When the measurement is available, Figure 8-7 Auto Zero Measurement Results Screen will appear.

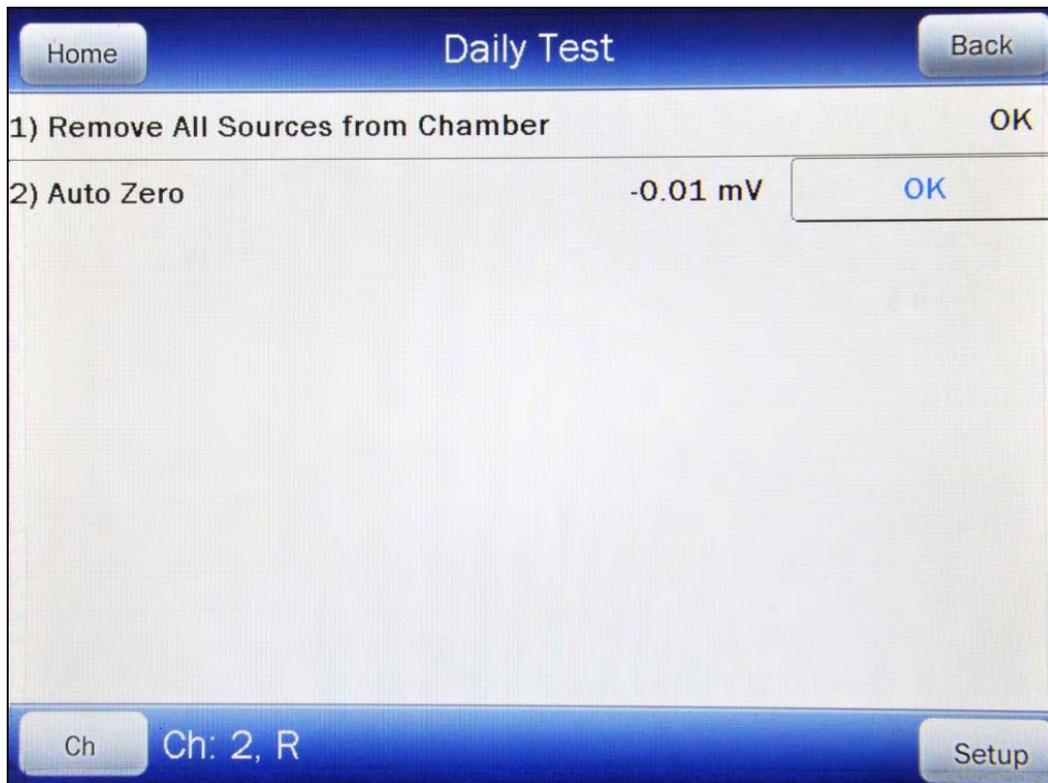


Figure 8-7 Auto Zero Measurement Results Screen

If the measured value has drifted more than $\pm 0.3\text{mV}$ since the last measurement, the message “ZERO DRIFT” will be displayed. Check to make sure that no sources are in the area. If any sources are found, remove them and verify the measurement.

If the measured value is out of range ($>\pm 10\text{mV}$), the message “ZERO OUT OF RANGE” will be displayed. Check to make sure that no sources are in the area. If any sources are found, remove them and verify the measurement. If no sources were found, contact Capintec’s Authorized Service Center in Pittsburgh at 1-800-227-6832.

Background

The second part of the Daily Test is Background measurement.

Touch the **OK** button to accept the Auto Zero result and continue the Daily Test. A progress bar will appear until a measurement is available.

When the measurement is available, Figure 8-8 Background Measurement Results Screen will appear.

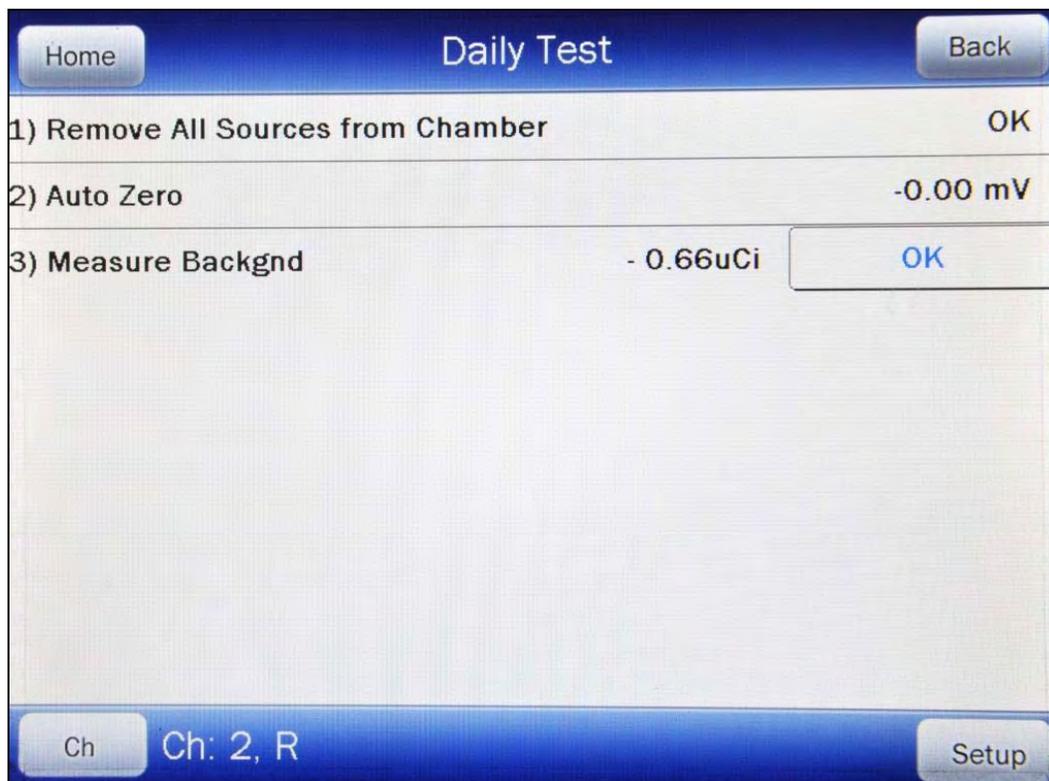


Figure 8-8 Background Measurement Results Screen

If the background is high but still acceptable ($> 10\mu\text{Ci}$ and $< 530\mu\text{Ci}$ or $> 0.4\text{MBq}$ and $< 20\text{MBq}$), the message "HIGH" will appear next to the measurement. Although the value is acceptable, the reason for the high value should be investigated. If any sources are found nearby, repeat the measurement.

If the background is above the acceptable range ($> 530\mu\text{Ci}$ or $> 20\text{MBq}$), the measurement will not be shown but Figure 8-4 Background Too High Screen will appear.

This "TOO HIGH" background cannot be accepted by the CRC[®]-55t. Touch the **OK** button to acknowledge the message. If the cause of the high reading (nearby source, contaminated well etc.) cannot be found, contact Capintec's Authorized Service Center at 1-800-227-6832.

Chamber Voltage

The third part of the Daily Test is the Chamber Voltage test.

Touch the **OK** button to accept the Background result and continue the Daily Test. A progress bar will appear until the measurement is available.

When the measurement is complete, Figure 8-9 Daily Test Results Screen will appear.

Test Step	Result
1) Remove All Sources from Chamber	OK
2) Auto Zero	0.00 mV
3) Measure Backgnd	1.05uCi
4) Check Chamber Voltage	156.1V OK
5) Data Check	Passed
6) NO DAILY SOURCE DATA	

Figure 8-9 Daily Test Results Screen

The Chamber Voltage measurement is compared with the value input at the factory. If the results are out of range, the message “FAIL” appears. If this occurs, contact Capintec’s Authorized Service Center at 1-800-227-6832.

Data Check

The next part of the Daily Test is a check of the built-in nuclide data. The results of the Data Check are indicated in Figure 8-9 Daily Test Results Screen.

If this test fails, turn the power off and then back on. This will reload the program and data into memory. Repeat the Daily Test. If the Data Check test continues to fail, contact Capintec’s Authorized Service Center at 1-800-227-6832.

Accuracy and Constancy Test in Daily Test

The next part of the Daily Test is the Accuracy Test.

The Accuracy Test shows that the CRC-55t is providing correct readings over the entire energy scale. The Test Sources that were entered in Setup and chosen as a Daily Test Source (reference CHAPTER 6: CHAMBER INITIALIZATION, SECTION: TEST SOURCE SETUP), are measured in the Chamber. The measured activity is then compared to the calibrated activity corrected for decay.

If no sources were designated as Daily Test sources, then the message “NO DAILY SOURCE DATA” will appear and the Daily Test will be completed. The Accuracy and Constancy tests are not performed.

At this point, the following options are available:

- If a Daily Test Source(s) has been setup, the Accuracy Test can be performed by touching the **ACCURACY** button. Refer to the ACCURACY TEST section on page 8-12 for detailed information.
- If it desired to input or change Test Source information, touch the **SETUP** button to enter the Setup utility. (**Note:** *When the **BACK** button is pressed from the Setup screen, the Daily Test must be repeated*),
- If a printer is attached to the system, the Daily Test results can be printed by touching the **PRINT** button, or
- Touch the **HOME** button to exit the Daily Test and return to Figure 8-1 Chamber Measurement Screen.

CHAMBER VOLTS

To perform the Chamber Voltage Test, touch the **CHAMBER VOLTS** button from Figure 8-1 Chamber Measurement Screen for the selected Chamber. A progress bar will appear until the measurement is available.

When the measurement is complete, Figure 8-10 Chamber Measurement Results Screen will appear.

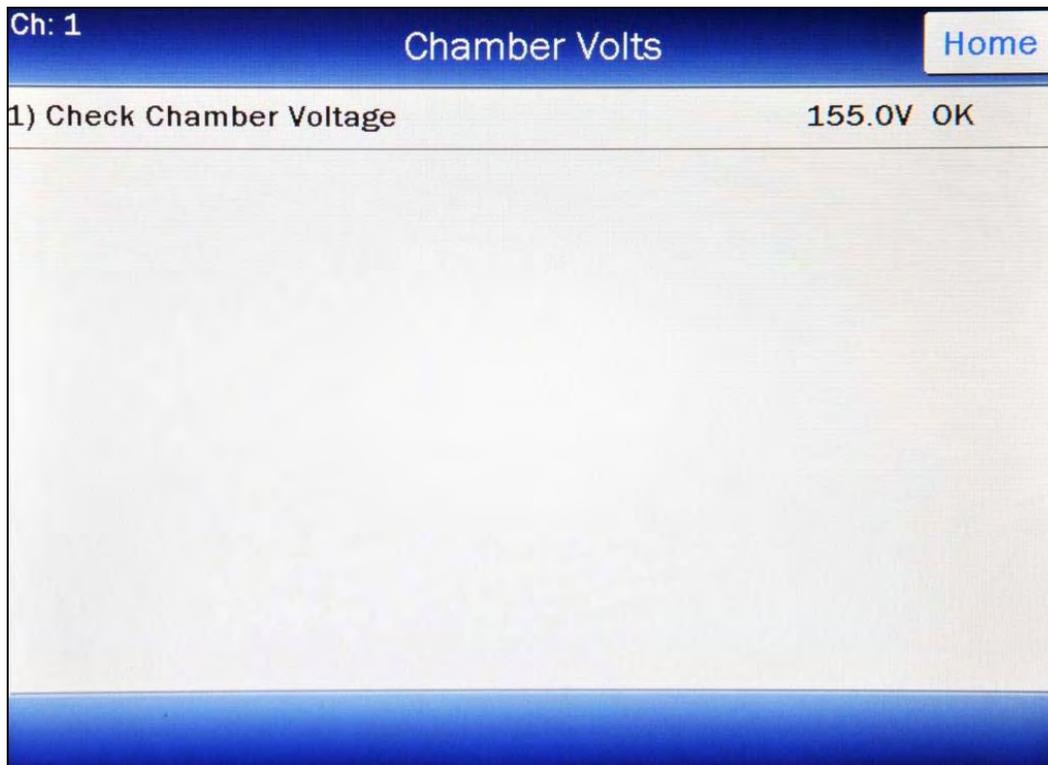


Figure 8-10 Chamber Measurement Results Screen

The Chamber Voltage measurement is compared with the value input at the factory. If the results are out of range, the message “FAIL” appears. If this occurs, contact Capintec’s Authorized Service Center at 1-800-227-6832.

Touch the **HOME** or **BACK** button to accept the result. Figure 8-1 Chamber Measurement Screen will re-appear.

ACCURACY TEST

The Accuracy Test shows that the CRC[®]-55t is providing correct readings over the entire energy scale. The Test Sources that were entered in Setup and chosen as a Daily Test Source (reference CHAPTER 6: CHAMBER INITIALIZATION, SECTION: TEST SOURCE SETUP) are measured in the selected Chamber. The measured activity is then compared to the calibrated activity corrected for decay.

Note: *The Accuracy Tests cannot be conducted until the Test Source data has been entered (reference CHAPTER 6: CHAMBER INITIALIZATION, SECTION: TEST SOURCE SETUP). If no Test Sources have been entered, Figure 8-11 Accuracy Test No Source Data Screen will appear.*

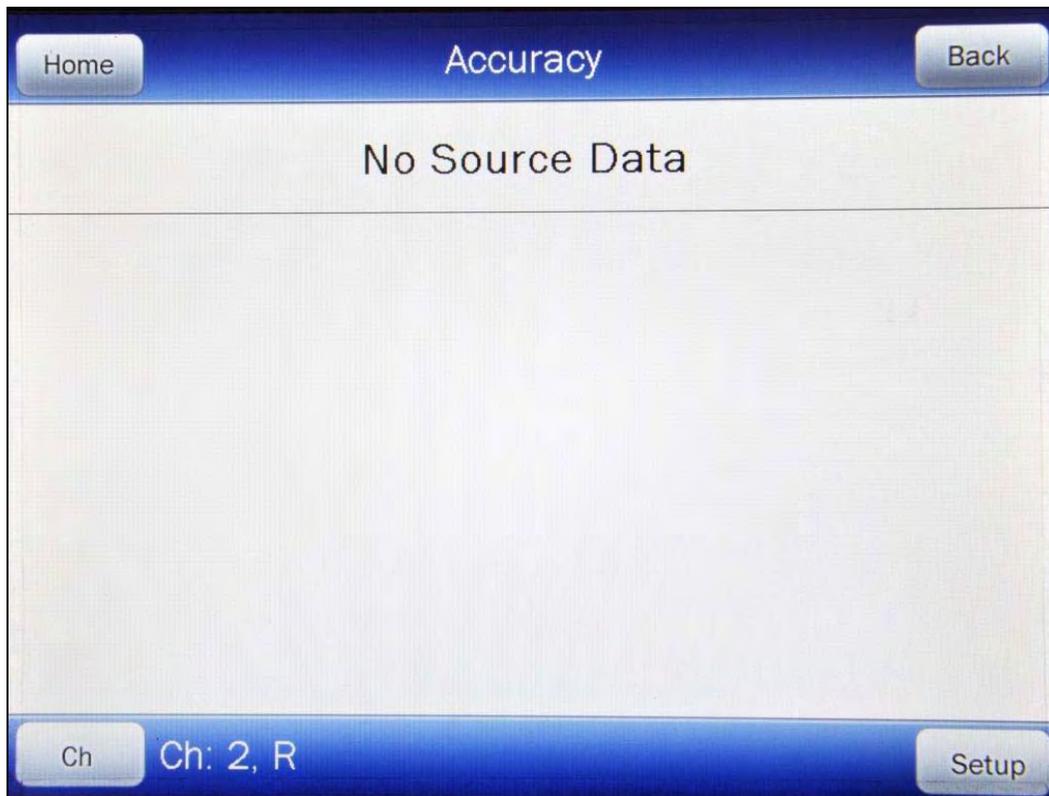


Figure 8-11 Accuracy Test No Source Data Screen

The Accuracy Test can be made directly from Figure 8-1 Chamber Measurement Screen for the selected Chamber by touching the **ACCURACY** button and duplicates the Accuracy Test performed in the Daily Test. Figure 8-12 Accuracy Test Screen will appear. The actual Test Sources and serial numbers will, of course, depend upon how the test was initially defined.

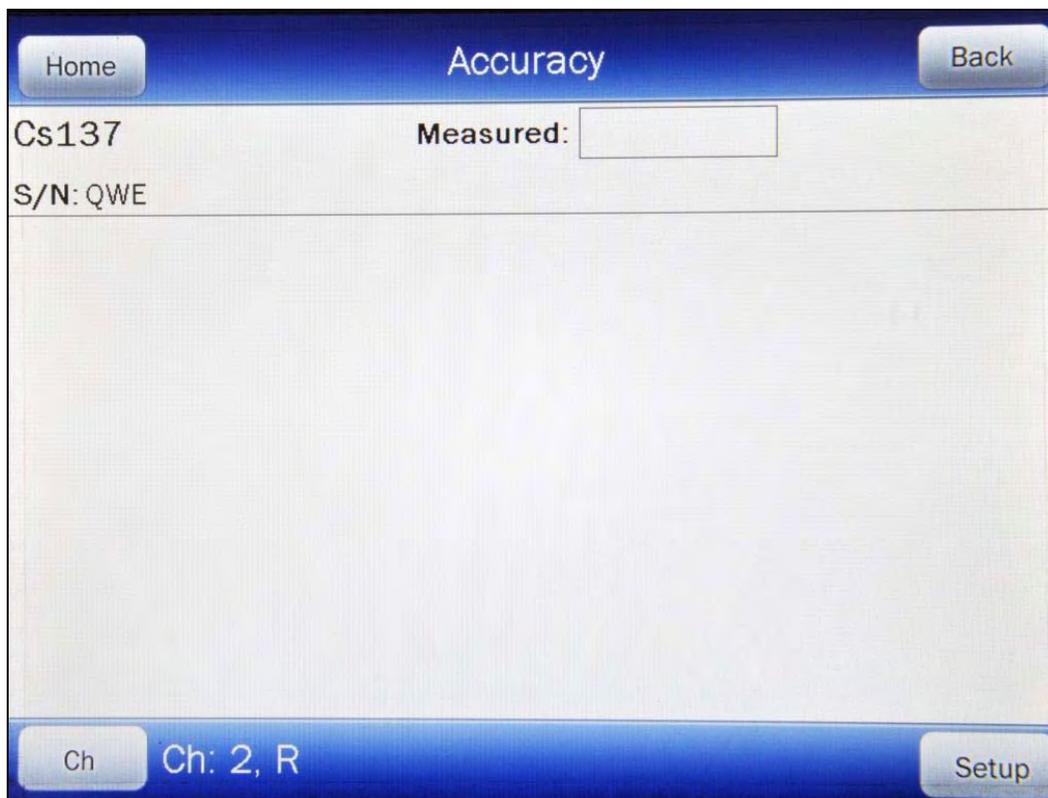


Figure 8-12 Accuracy Test Screen

Begin the test by inserting the check source into the well. Touch the **Measured:** field box next to the Test Source to be measured. A display similar to that illustrated in Figure 8-13 Accuracy Test Measurement Screen will appear.

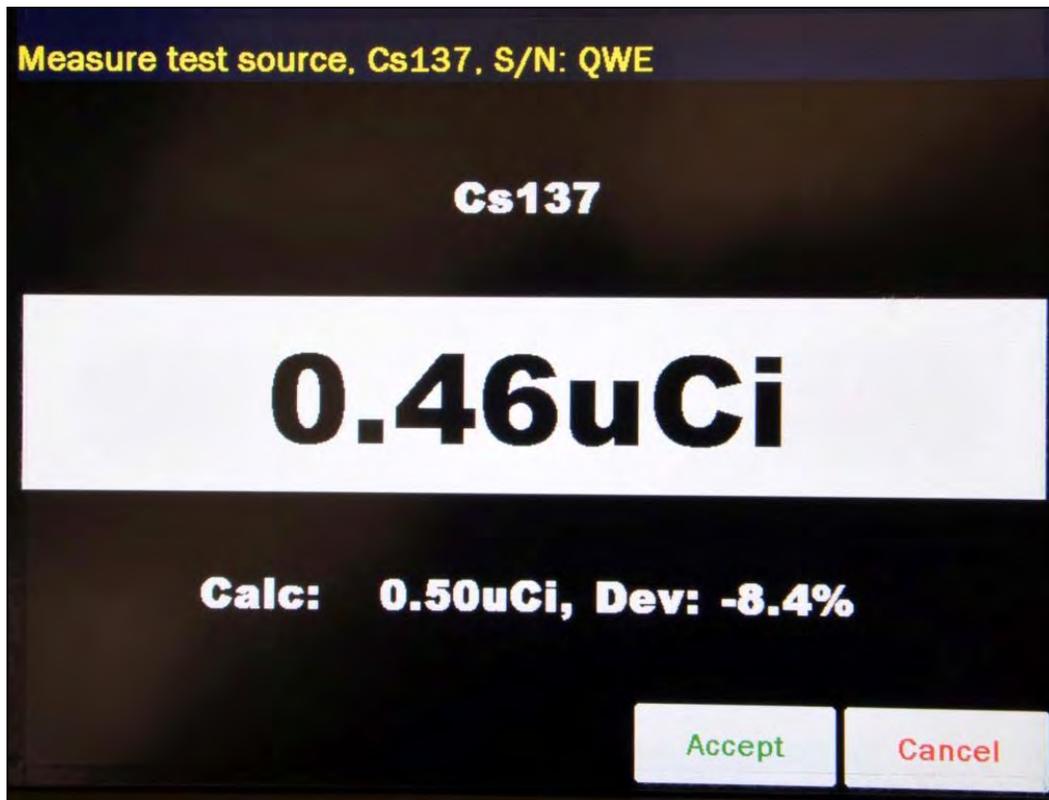


Figure 8-13 Accuracy Test Measurement Screen

The displayed measurement is the measured activity.

The “Calc:” number is the anticipated actual activity of the check source based upon the initial calibration of the source, corrected for decay.

The “Dev:” number is the percent deviation of the measured activity from the anticipated activity. If the deviation is greater than $\pm 20\%$, the reading will be replaced by “ERROR” and the entire line will be displayed in red as shown in Figure 8-14 Accuracy Test Measurement Error Screen.

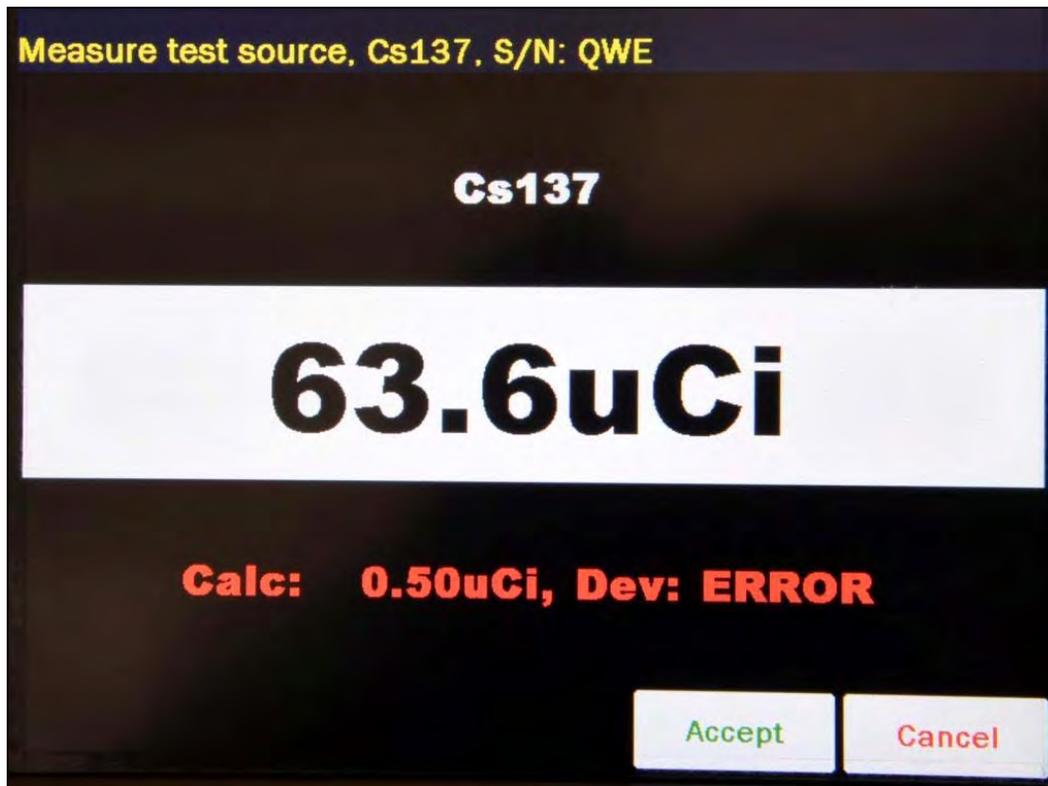


Figure 8-14 Accuracy Test Measurement Error Screen

Touch the **CANCEL** button to abort the measurement and return to Figure 8-13 Accuracy Test Measurement Screen.

Touch the **ACCEPT** button to accept the measurement. The screen will be similar to that shown in Figure 8-15 Accuracy Test Results Screen.

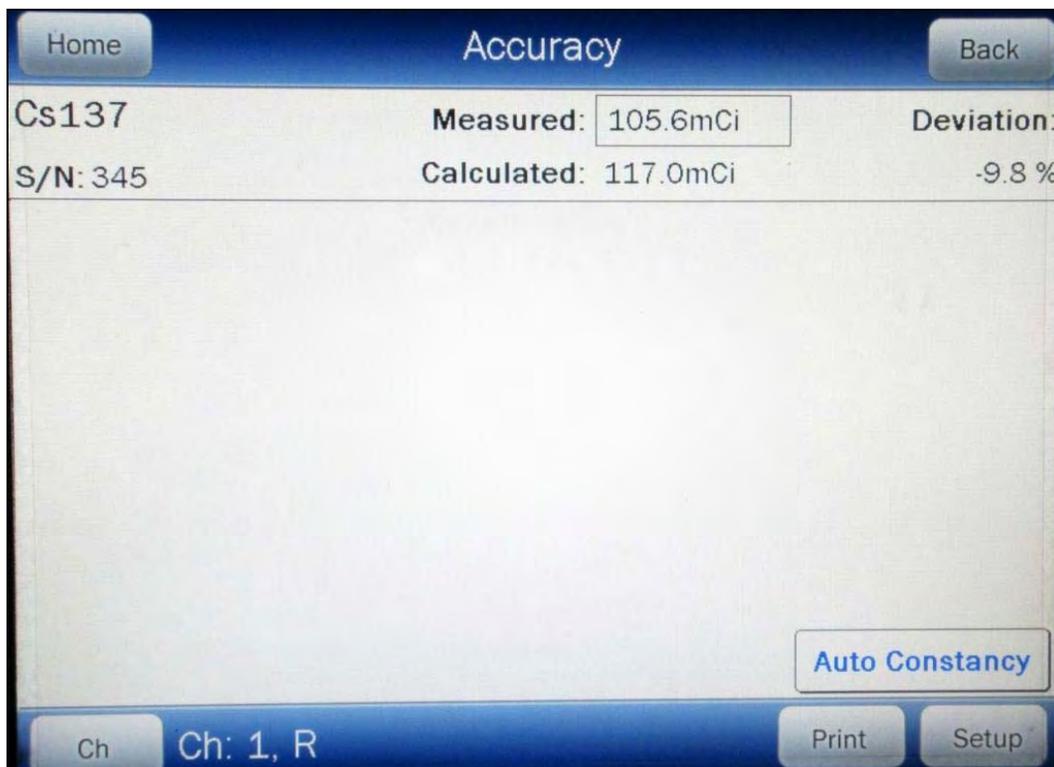


Figure 8-15 Accuracy Test Results Screen

If there is data for more than one Test Source, repeat the above the test sequence as many times as required.

When all Test Sources have been measured, the following options are available:

- If Constancy Channels have been setup (reference CHAPTER 6: CHAMBER INITIALIZATION, SECTION: TEST SOURCE SETUP), the Constancy Test can be performed by touching the **AUTO CONSTANCY** button. Refer to the **Constancy Test** section on page 8-18 for detailed information.
- If it desired to input or change Test Source information, touch the **SETUP** button to enter the Setup utility. (**Note:** When returning from the Setup screen, the Accuracy Test must be repeated),
- If a printer is attached to the system, the Accuracy Test results can be printed by touching the **PRINT** button, or
- Touch the **HOME** button to exit the test and return to Figure 8-1 Chamber Measurement Screen.
- If performing the Accuracy Test from within Daily Test, touch the **BACK** button to exit the Accuracy Test and return to Figure 8-6 Daily Test Screen.

Constancy Test

The Constancy Test measures precision. This test shows that when using a source with a long half-life (the base Constancy Source (reference CHAPTER 6: CHAMBER INITIALIZATION, SECTION: TEST SOURCE SETUP)), readings are repeatable over time on any isotopes that are used on a daily basis. The Constancy Channel nuclides' activities are then calculated based on the base Constancy Source. The calculated values are compared with previously recorded values to determine if constancy is being maintained.

The Constancy Test is automated. From Figure 8-15 Accuracy Test Results Screen, touch the **AUTO CONSTANCY** button.

The CRC[®]-55t will be step through all of the Constancy Sources (channels) without user intervention. Figure 8-16 Constancy Test Results Screen will appear.

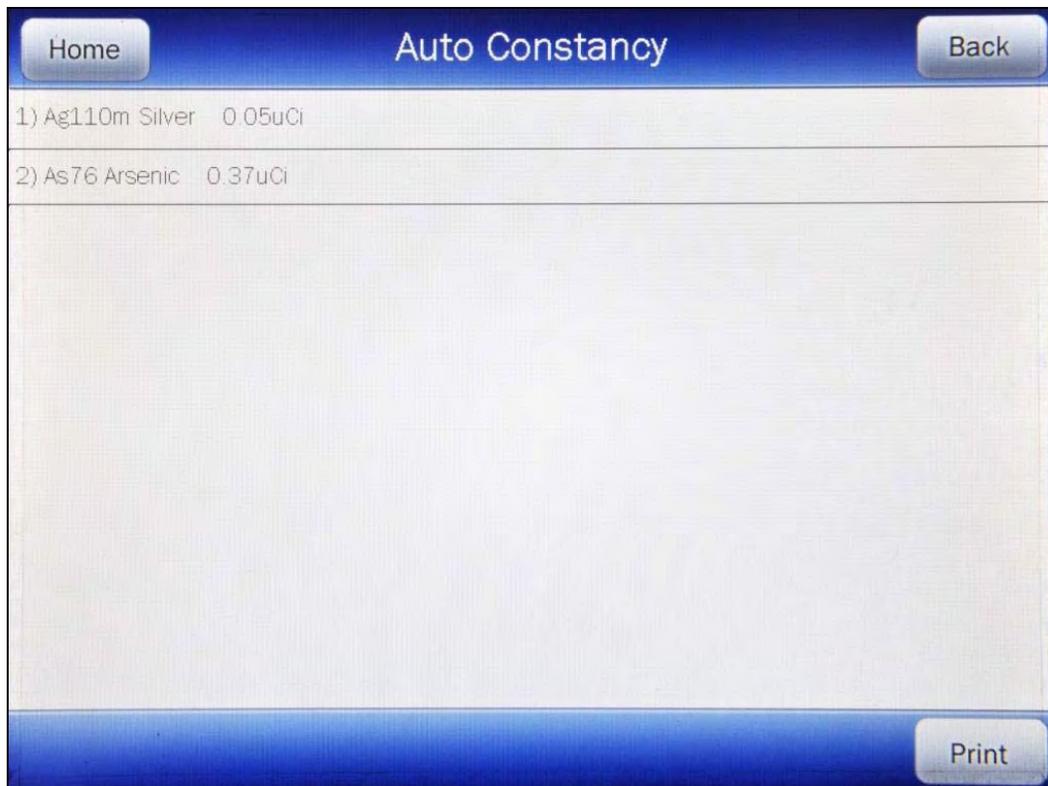


Figure 8-16 Constancy Test Results Screen

When the Constancy Test is complete, the following options are available:

- If a printer is attached to the system, the Constancy Test results can be printed by touching the **PRINT** button, or
- Touch the **HOME** button to exit the test and return to Figure 8-1 Chamber Measurement Screen.

- Touch the **BACK** button to exit the Auto Constancy Test and return to Figure 8-15 Accuracy Test Results Screen.

CHAPTER 9

DIAGNOSTICS

GENERAL	1
DIAGNOSTICS.....	1

GENERAL

Diagnostics performs functions to test the integrity of the system.

If a printer is attached to the system, a report will be printed containing the system configuration information.

DIAGNOSTICS

From Figure 9-1 Chamber Measurement Screen, touch the **UTIL** button. Figure 9-2 Utility Screen will appear.

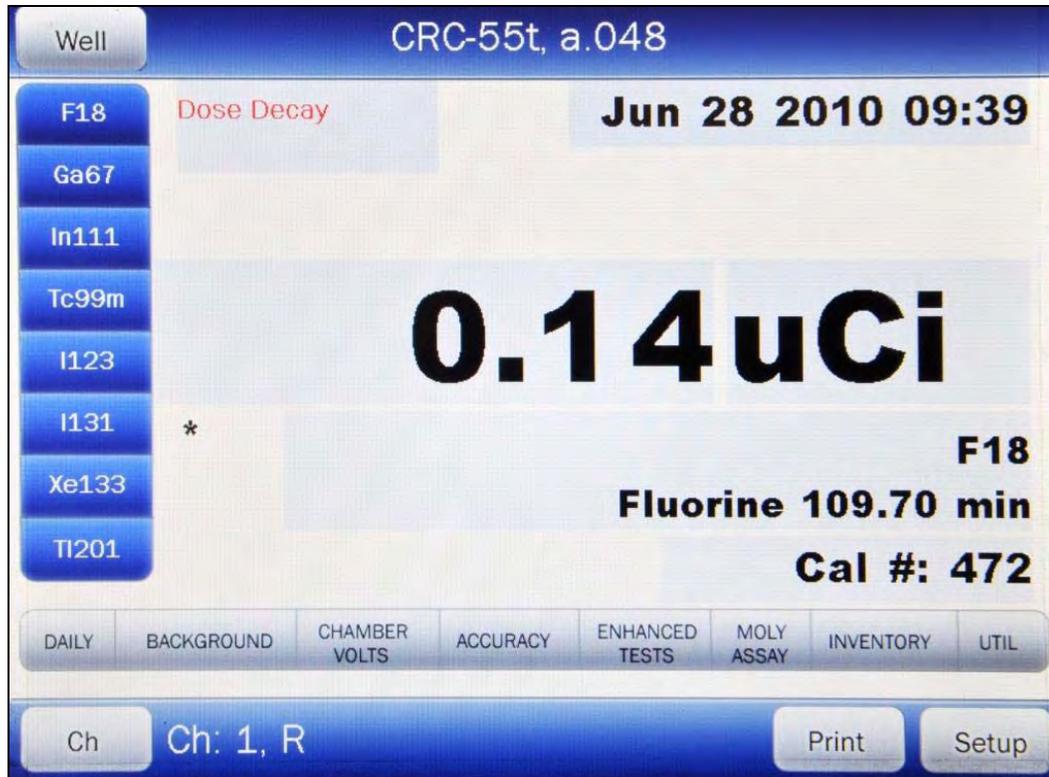


Figure 9-1 Chamber Measurement Screen

Home Utility Back

[Ci, Bq Conv] Input Activity:

[Decay Calculator]

Nuclide:

FROM: act

TO: act

Diagnostics

Dose Table

S/N: 000000

Figure 9-2 Utility Screen

Touch the **DIAGNOSTICS** button.

When *DIAGNOSTICS* is selected, the system diagnostic testing will begin. The instrument's memories and the programs are checked. When the test is complete, the message "SYSTEM TEST – PASS: xxxx" will be displayed as shown in Figure 9-3 Utility Screen with Diagnostics System Test PASS.

Note: The value displayed after PASS is for example only and is not a real value. The value displayed will depend upon the current revision of the installed software.

Home Utility Back

[Ci, Bq Conv] Input Activity:

[Decay Calculator]

Nuclide:

FROM: act

TO: act

Diagnostics SYSTEM TEST
PASS: 6ca8

Dose Table

S/N: 000000

Figure 9-3 Utility Screen with Diagnostics System Test PASS

If a printer is attached to the system, the results will be printed. When the test is complete, the message “SYSTEM TEST – PASS: xxxx” will be displayed as shown in Figure 9-3 Utility Screen with Diagnostics System Test PASS.

If any of the tests fail, contact Capintec’s Authorized Service Center at 1-800-227-6832.

The following data is printed:

- A list of the nuclides, their half-lives and calibration numbers.
- User Added Nuclide information.
- The Test Source data.
- Chamber System Parameters.

If the Diagnostics test fails, the message “SYSTEM TEST – FAIL: xxxx” will appear.

At power-up, the CRC[®]-55t’s program is copied from the SD card into RAM memory. If the System Test fails, restart the unit and perform the test again. If it fails again, contact Capintec’s Authorized Service Center (reference CHAPTER 15: CLEANING AND MAINTENANCE, SECTION: SERVICING) for more information, since this will indicate a SD card error or a system malfunction.

Touch the **HOME** or **BACK** button to return to Figure 9-1 Chamber Measurement Screen.

CHAPTER 10

CHAMBER MEASUREMENT PROCEDURES

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GENERAL

Instructions for measuring a source with the Chamber are given in this section.

The Chamber Measurement Screen is shown below along with a description of each section.

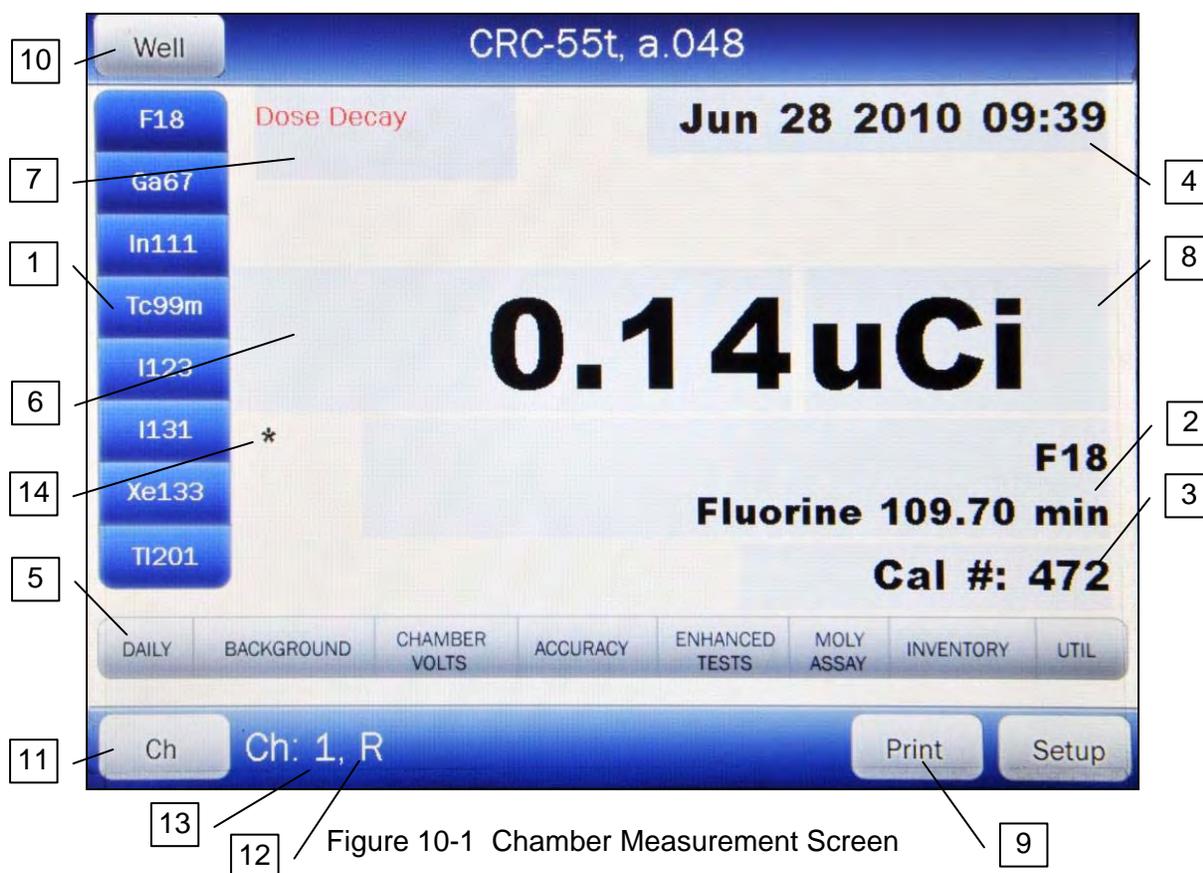


Figure 10-1 Chamber Measurement Screen

1. Home Screen Hotkeys
2. **NUCLIDE** button – displays the currently selected nuclide.
3. **CAL#** button – displays the Calibration Number of the selected nuclide.
4. **DATE/TIME** button – displays the current Date and Time.
5. **TEST** buttons – provides access to system functions.
6. **MEASUREMENT** button – displays the measured activity of the selected nuclide.
7. **DOSE DECAY** button – allows the entry of a future date and time.
8. **UNITS** button – allows toggling between Curies and Becquerel if chosen in setup.
9. **PRINT** button – appears only if the system is set to use a printer.
10. **WELL** button – appears only if the optional Well Counter is part of the system.
11. **CH** button – appears only if the optional 2nd Chamber is part of the system.
12. The “R” indicates that the selected Chamber is an R Chamber. If a PET Chamber is selected, “PET” will appear in that position.
13. The “1” indicates the number of the selected Chamber.
14. The “*” indicates that a Remote Display is attached to the Chamber. If there is not a Remote Display connected to the Chamber, this symbol will not be displayed.

If the message “NO DETECTORS FOUND. NO CHAMBER ATTACHED. NO WELL ATTACHED” appears on the screen, verify that the Chamber/Well Counter (optional)

cable(s) is/are attached securely to the connectors on the Readout and Chamber (and optional Well Counter). If the error message continues to appear, contact Capintec's Authorized Service Center (reference CHAPTER 15: CLEANING AND MAINTENANCE, SECTION: SERVICING) for more information.

MEASUREMENT PROCEDURES

Note: *In order to obtain a correct reading for a Vial or Syringe, the supplied liner and dipper must be used to achieve the correct geometry. If the source is housed in a different type of container, then contact Capintec, Inc. for further assistance.*

General Activity Measurement Procedure

To measure the activity of a sample:

- Insert the sample into the Chamber.
- Specify the Nuclide via a Home Screen Hotkey, the **NUCLIDE** button or input a Calibration Number via the **CAL#** button.

To print a record of the measurement (if a printer is attached to the system):

- Touch the **PRINT** button.

To determine what the activity will be at a different time:

- Touch the **DOSE DECAY** button.

Specifying Nuclide

A nuclide may be specified via one of the Home Screen Hotkeys or via the **NUCLIDE** button.

Home Screen Hotkeys

Touch one of the 8 Home Screen Hotkeys (defaults are listed):

- R Chambers:.....F18, Ga67, In111, Tc99m, I123, I131, Xe133, TI201
- PET Chambers:F18, C11, N13, O15, Tc99m, Cs137, Co60, I131

NUCLIDE Button

Other Nuclides can be selected by touching the **NUCLIDE** button and selecting the Nuclide from 20 **NUCLIDE** Hotkeys on the left side of the screen or from the Nuclide List on the right half of the screen as shown in Figure 10-2 Select Nuclide Screen.

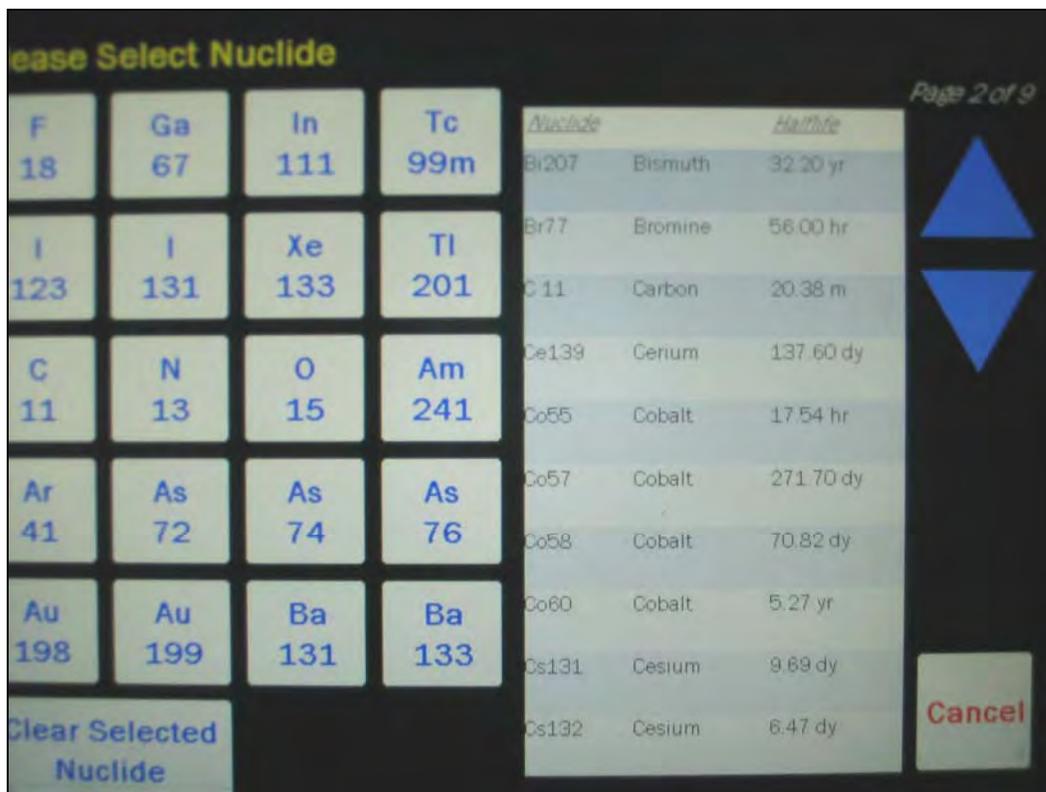


Figure 10-2 Select Nuclide Screen

Entering Calibration Number

A measurement may also be made by entering a Calibration Number instead of selecting a nuclide.

From Figure 10-1 Chamber Measurement Screen, touch the **CAL#** button. A numeric keypad will appear.

Input the desired Calibration Number by touching the appropriate numbers on the keypad. Touch the **ACCEPT** button to accept the entry. Figure 10-1 Chamber Measurement Screen will re-appear showing the new Calibration Number.

A calibration number may include a multiplication sign (* on the keypad) or a division sign (/ on the keypad). However, the Chamber is always direct reading and the multiplication or division sign is only used to be consistent with existing Calibration Numbers.

For multiplication, the number can only be multiplied by 10 or 100. For division, the number can only be divided by 2. Refer to Table 10-1 Calibration Number Limits Table.

	Minimum Calibration # (a)	Maximum Calibration # (a)
Direct Entry (a)	10	1200
Multiplication (a × 10)	10	1200
Multiplication (a × 100)	10	999
Division (a ÷ 2)	400	1200

Table 10-1 Calibration Number Limits Table

If the **CAL#** button was accidentally pressed, touch the **CANCEL** button. Figure 10-1 Chamber Measurement Screen will re-appear showing the previously entered Calibration Number.

Selecting Measurement Precision

The central part of the screen contains the measurement. Touching the **MEASUREMENT** (x.xx) button will change the precision of the measurement. The measurement can display up to 5 digits and a decimal point.

Units Button

The central part of the screen contains the measurement unit. Touching the **UNIT** (Ci/Bq) button allows the user to toggle between Curies and Becquerel if so chosen in the setup.

DOSE DECAY

Note: *This feature is only available when a nuclide is specified because the half-life of the nuclide must be known.*

It is often desirable to know the activity of the sample at another time (usually in the future).

When another date/time is chosen, the specified date and time will be displayed on the **DOSE DECAY** button along with the calculated activity at that time based on the half-life of the nuclide being measured.

To determine the activity at a different time,

1. Insert the sample into the Chamber.
2. Specify the nuclide via a Home Screen Hotkey or the **NUCLIDE** button.
3. Touch the **DOSE DECAY** button. Figure 10-3 Date/Time Screen will appear.

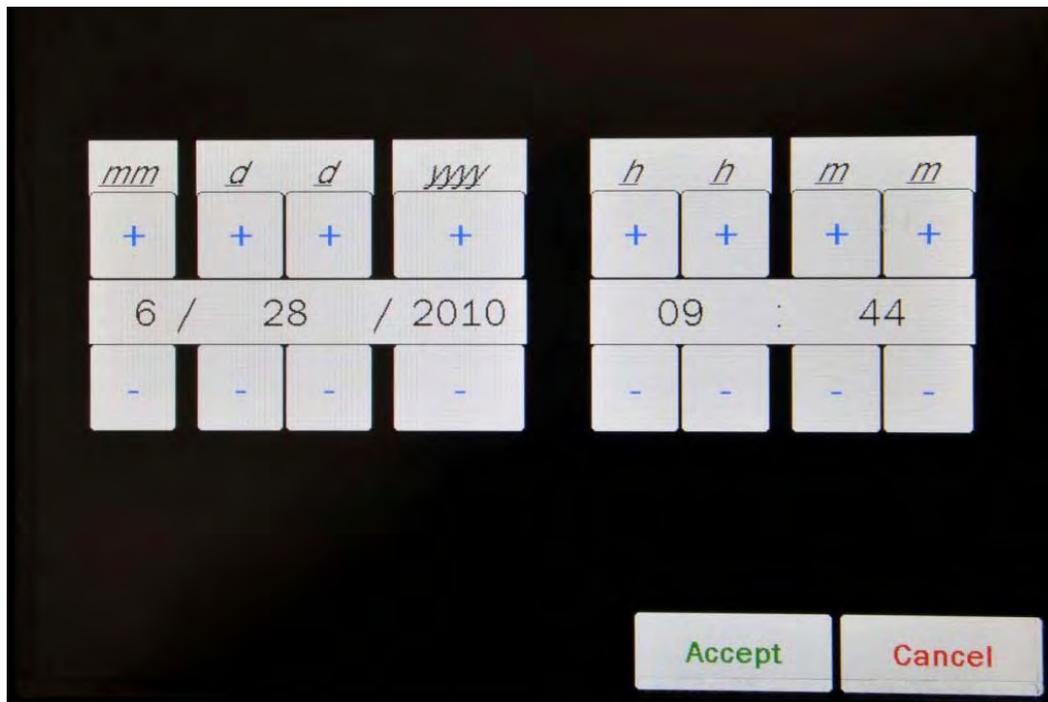


Figure 10-3 Date/Time Screen

The screen displays the currently set date and time. Above and below each of the fields are + and – buttons, respectively. To adjust the displayed value for a specific field, touch the + button to increase the displayed value or the – button to decrease the displayed value.

Touch the **ACCEPT** button to accept the set date and time. Figure 10-4 Chamber Measurement Screen with Dose Decay will appear with the Dose Decay button populated with the calculated future activity at the specified date and time.

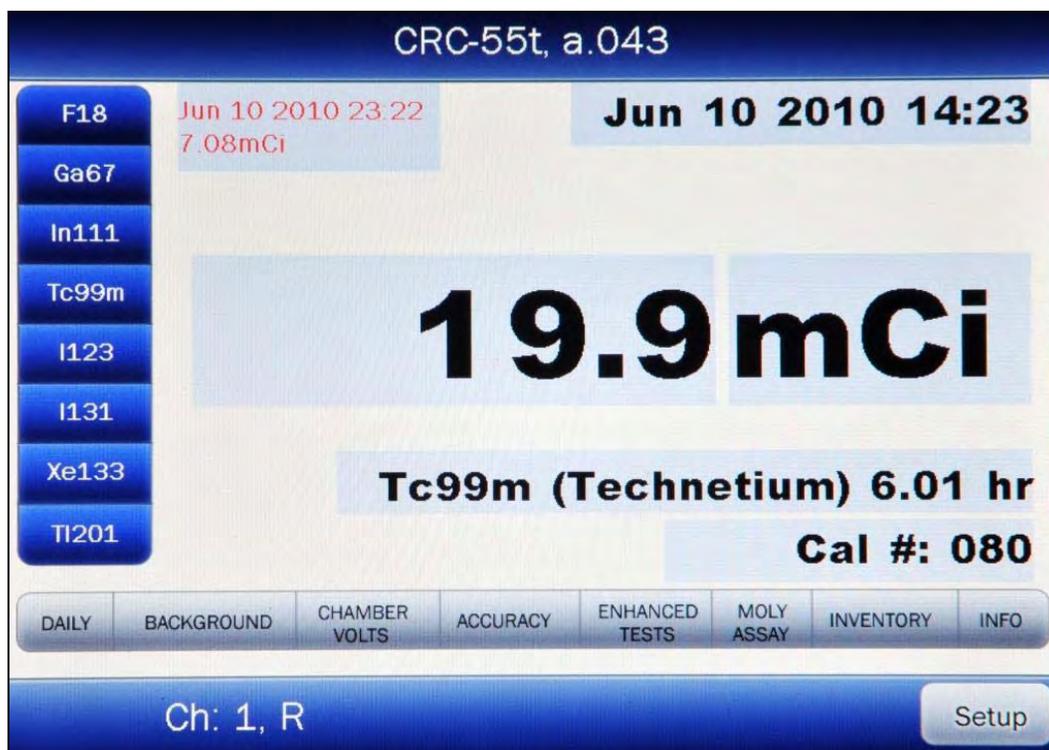


Figure 10-4 Chamber Measurement Screen with Dose Decay

If a printer is attached to the system, touch the **PRINT** button to print the Dose Decay results.

CHANGING CHAMBER

If there is more than one chamber in the system, the readout can display measurements from either of the chambers attached to the system.

Note: *If only one Chamber is attached to the system, the **CH** button will not be displayed.*

When the instrument is in Chamber mode, the **CH** button is located in the lower left section of the Chamber Measurement screen.

Pressing the **CH** button allows the selection of which Chamber's measurement will be displayed on the Chamber Measurement screen.

To select a specific chamber, touch the **CH** button. Figure 10-5 Select Chamber Screen will appear.

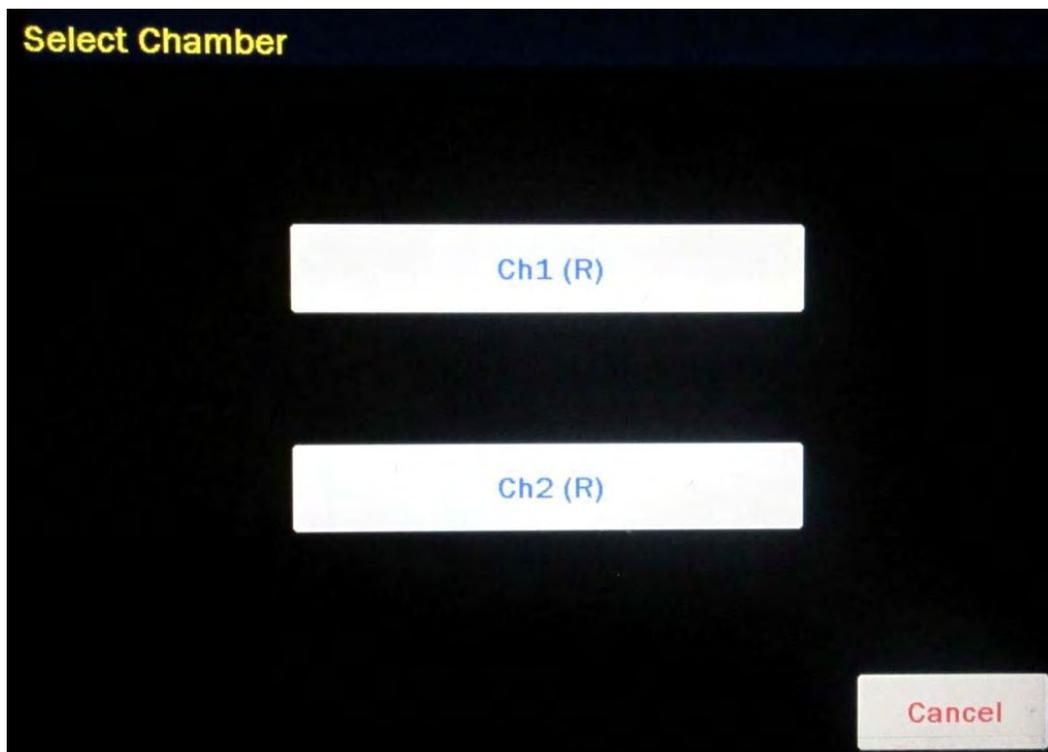


Figure 10-5 Select Chamber Screen

Touch the desired Chamber button. Figure 10-1 Chamber Measurement Screen will re-appear displaying the selected chamber next to the **CH** button.

PRINTING A RECORD OF THE MEASUREMENT

To print a record of a measurement, a printer must be set up as described in CHAPTER 5: SYSTEM INITIALIZATION; SECTION: PRINTING.

Follow the directions below for the selected printer:

OKIDATA Printer

Ticket Chosen:

- If the printer is set up for continuous feed, press **PARK** (on printer).
- Move the right hand lever back to single-sheet.
- Place the ticket between the guides with CAPINTEC, INC down and facing away from you. The ticket will automatically be advanced into the printer.
- Press the **SEL** pad on the printer so that the **SEL** light is lit.
- Input the User ID if desired.
- Press **ENTER** (on the readout).

Single Line Chosen:

- Input the User ID if desired.
- Press **ENTER** (on the readout).

Epson LX-300+II Printer**Ticket Chosen:**

- If the printer is set up for continuous feed, press **LOAD/EJECT** (on printer).
- Move the paper release lever back to single-sheet.
- Slide the left edge guide until it locks in place at the guide mark.
- Adjust the right edge guide to match the width of the ticket.
- Insert the ticket between the guides with CAPINTEC, INC down and facing away from you. The ticket will automatically be advanced into the printer.
- Input the User ID if desired.
- Press **ENTER** (on the readout).

Single Line Chosen:

- Input the User ID if desired.
- Press **ENTER** (on the readout).

Roll Printer

- Input the User ID if desired.
- Press **ENTER** (on the readout).

Slip Printer

- If the **RELEASE** light (on printer) is not lit, press **RELEASE** (on printer).
- Place Ticket in printer, face up.
- Slide the ticket under the mechanism until the **PAPER OUT** light is off.
- Input the User ID if desired.
- Press **ENTER** (on the readout).

Note: Tickets cannot be printed using an Inkjet printer.

MOLY ASSAY

The CRC[®]-55t steps the user through a Moly Assay procedure. The assay may be performed in the CapMac or the Canister.

Note: Moly Assay can only be performed with an R Chamber. If the **MOLY ASSAY** button is touched when using a PET Chamber, the message "PET CHAMBER – THE PET CHAMBER CAN NOT RUN A MOLY ASSAY – OK" will appear. Touch the **OK** button to close the message window.

If one method (CAPMAC or CANISTER) is to be used all the time, choose the method in Setup. (Reference CHAPTER 6: CHAMBER INITIALIZATION, SECTION: MOLY ASSAY SETUP)

To perform a Moly Assay, touch the **MOLY ASSAY** button from Figure 10-1 Chamber Measurement Screen.

If the assay method has not been uniquely specified, Figure 10-6 Moly Assay Method Selection Screen will appear. The method must be chosen first.

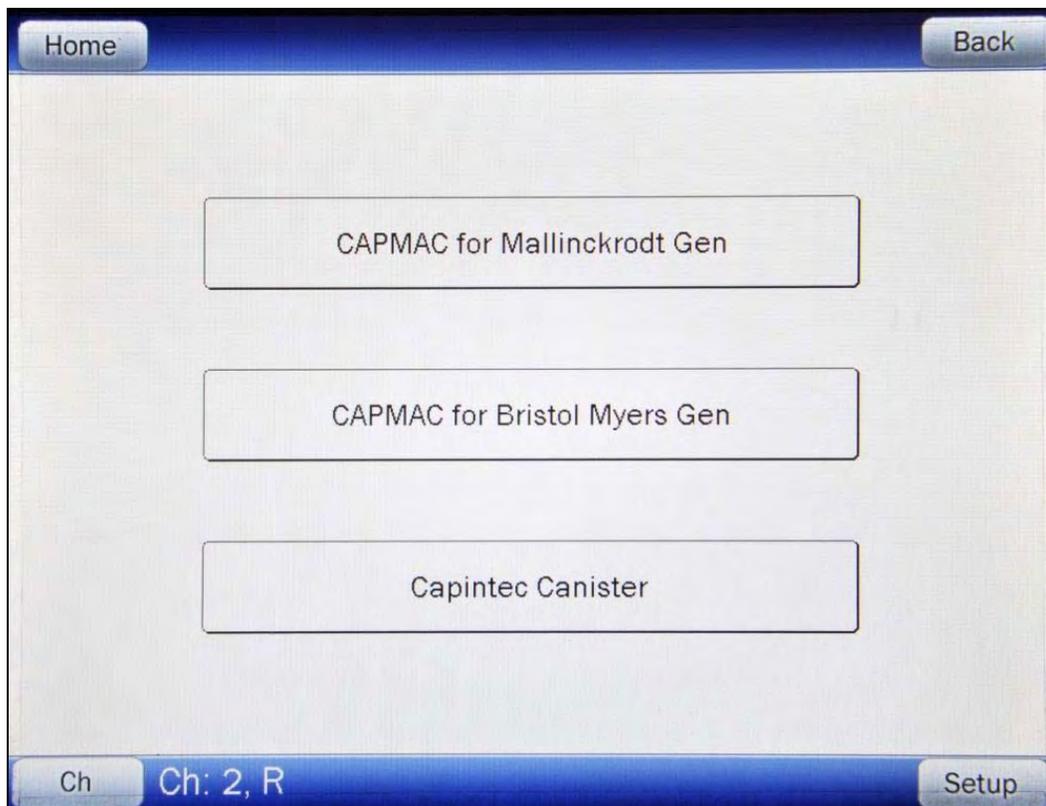


Figure 10-6 Moly Assay Method Selection Screen

Select the method to be used for the current test only by touching the appropriate method button.

If only one method has been chosen in Moly Setup, Figure 10-6 Moly Assay Method Selection Screen will be skipped and Figure 10-7 Moly Assay Background Choice Screen will appear (example shown is for CAPMAC – Mallinckrodt).

Mo99 Background

Measuring the background for Mo99 is optional. This background will only be used for the current assay. If it is skipped, the previously measured background will be used.

Note: The following examples are for CAPMAC. CANISTER will be exactly the same except that the screens will prompt for measurements in the CANISTER.

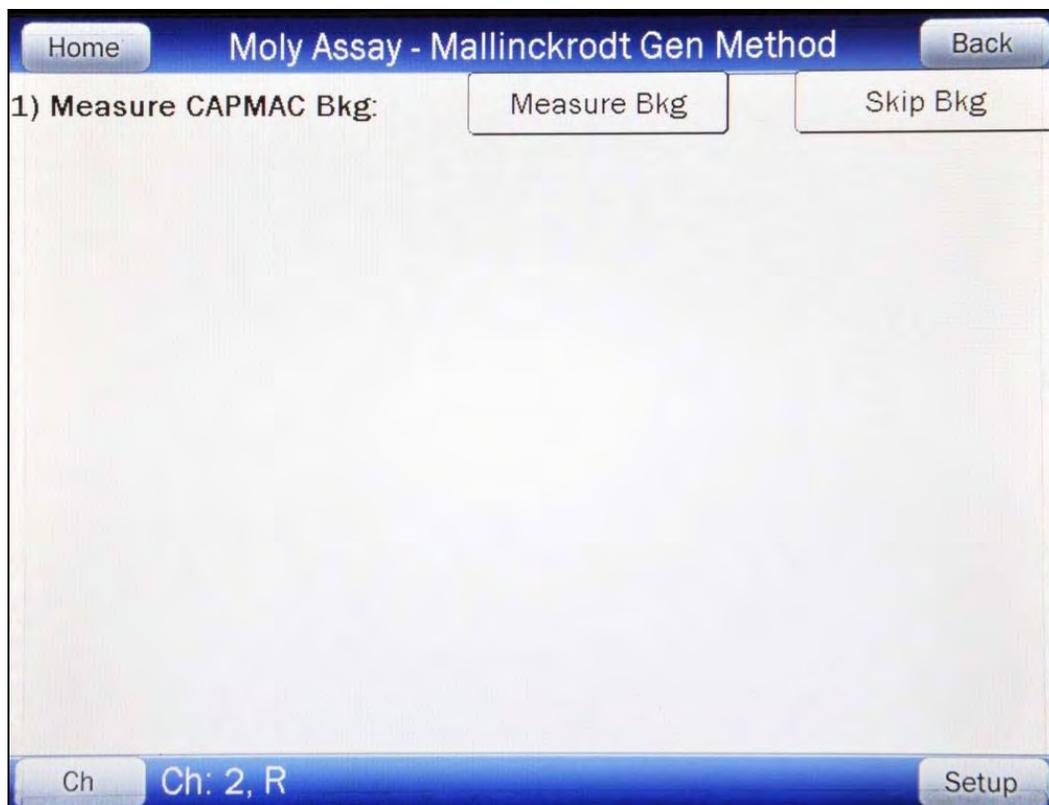


Figure 10-7 Moly Assay Background Choice Screen

Touch the **SKIP BKG** button to skip measuring the background now and use the previous background measurement.

To measure the background now, Remove all sources from the vicinity of the Chamber and touch the **MEASURE BKG** button. A progress bar will appear until a measurement is available.

When the measurement is available, Figure 10-8 Moly Assay Background Measurement Accept Screen will appear.

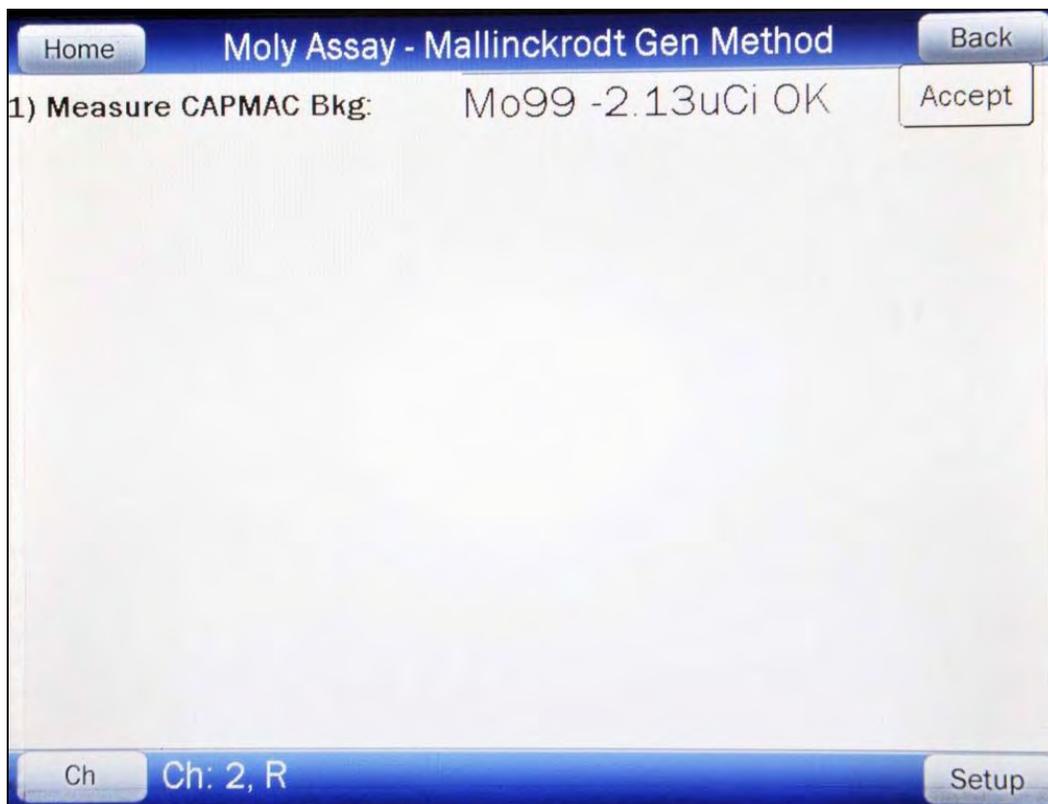


Figure 10-8 Moly Assay Background Measurement Accept Screen

If the background is high but still acceptable ($>113.1\mu\text{Ci}$, (4.18MBq) to $x.xx\mu\text{Ci}$ ($x.xx\text{MBq}$)), the message "HIGH" will appear instead of "OK". Although the measurement is acceptable, the reason for the high measurement should be investigated. If any sources are found nearby, repeat the measurement.

If the background is above the acceptable range, the measurement will not be shown but Figure 10-9 Moly Assay Background Measurement Too High Screen will appear.

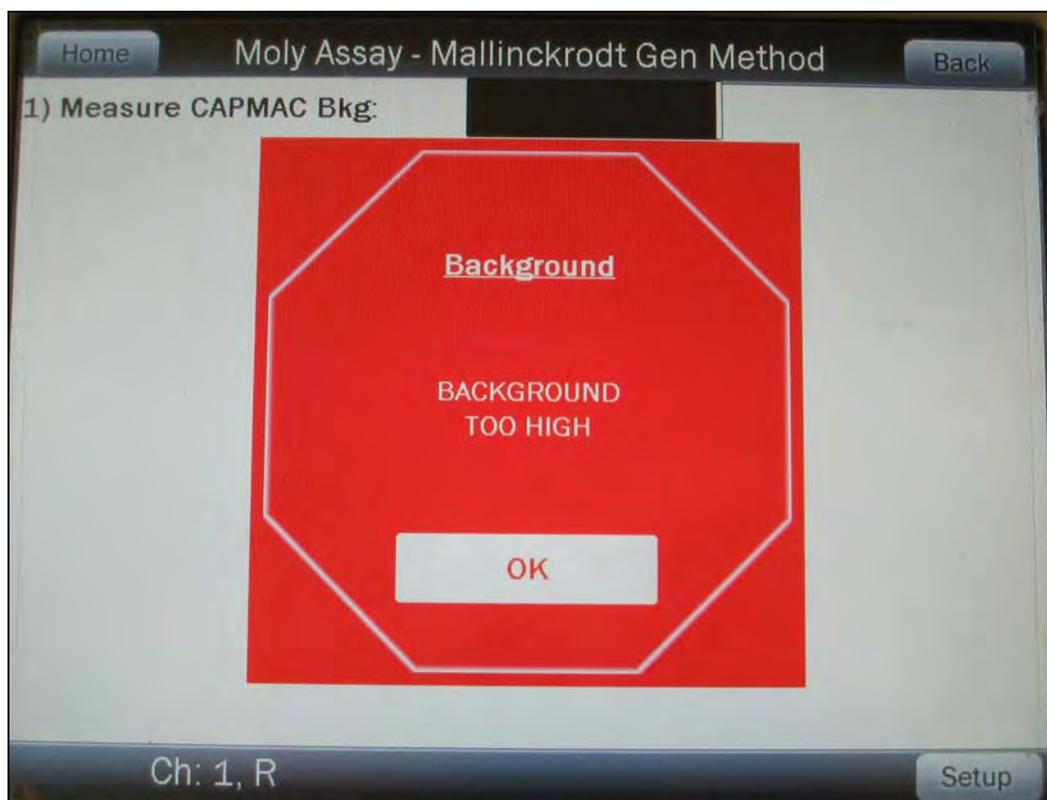


Figure 10-9 Moly Assay Background Measurement Too High Screen

This “TOO HIGH” background cannot be accepted by the CRC[®]-55t. If the cause of the high reading (nearby source, contaminated well etc.) cannot be found, contact Capintec’s Authorized Service Center at 1-800-227-6832.

Touch the **OK** button to dismiss the Background Too High message window. Press any key to terminate the Mo99 background measurement. The *Tests Menu* will re-appear.

Mo99 Assay

The next step is to measure the eluate in the CapMac or Canister.

Touch the **ACCEPT** button to accept the background measurement and continue on to the Mo99 Assay. A progress bar will appear until a measurement is available.

When the measurement is available, Figure 10-10 Moly Assay Eluate Accept Screen will appear.

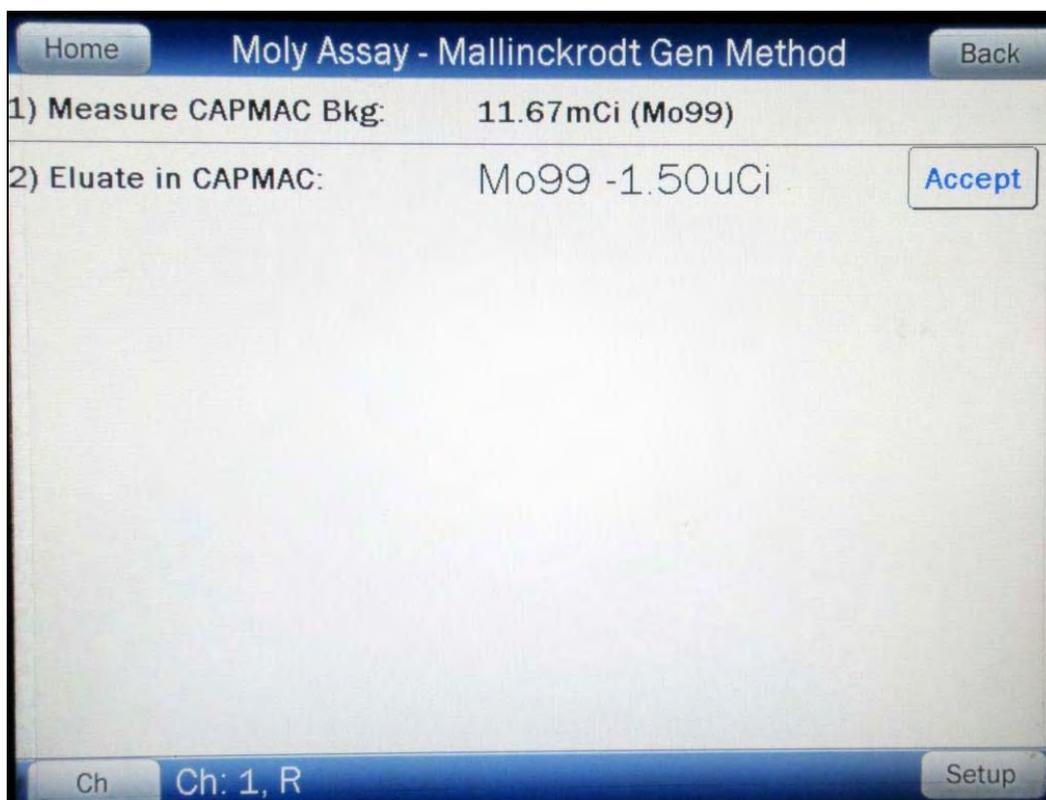


Figure 10-10 Moly Assay Eluate Accept Screen

Since this is also a measurement of a very low activity, the screens are similar to background.

Note: *The activity will be tested to see if it's too high the same way that Mo99 Background is tested.*

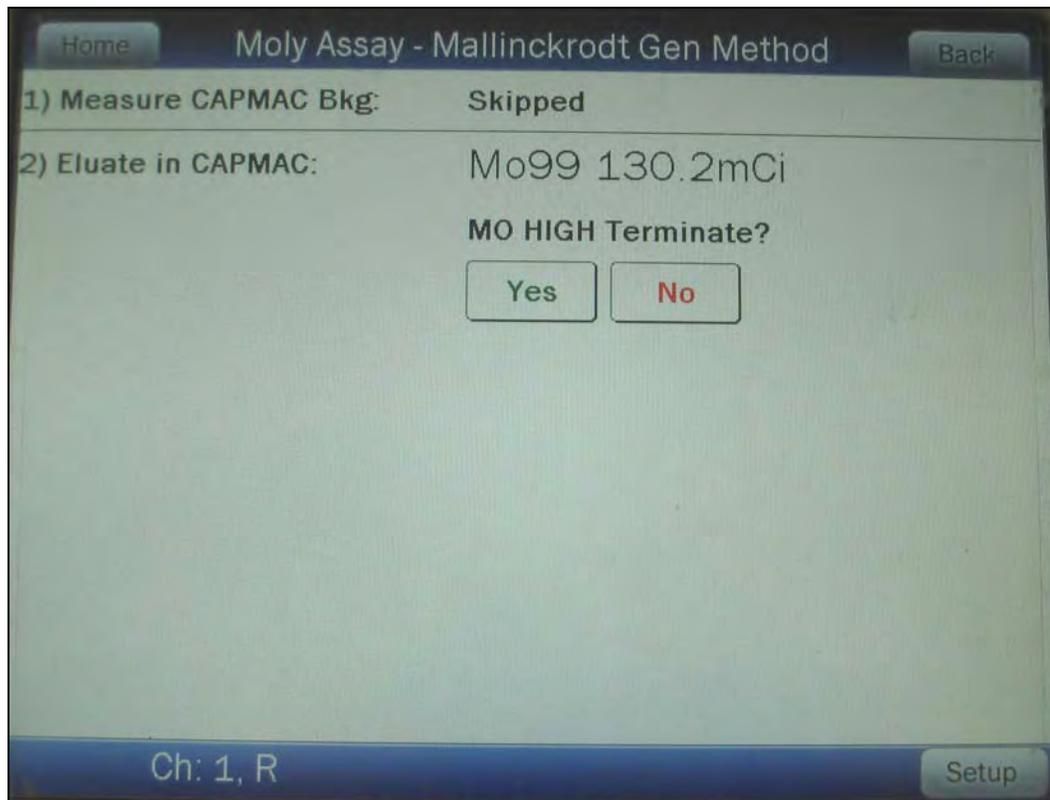


Figure 10-11 Mo High screen

Tc99m Assay

The Tc99m Assay is performed next.

Touch the **ACCEPT** button to accept the Mo99 Assay measurement and continue on to the Tc99m Assay. Figure 10-12 Moly Assay Tc99m Accept Screen will appear.

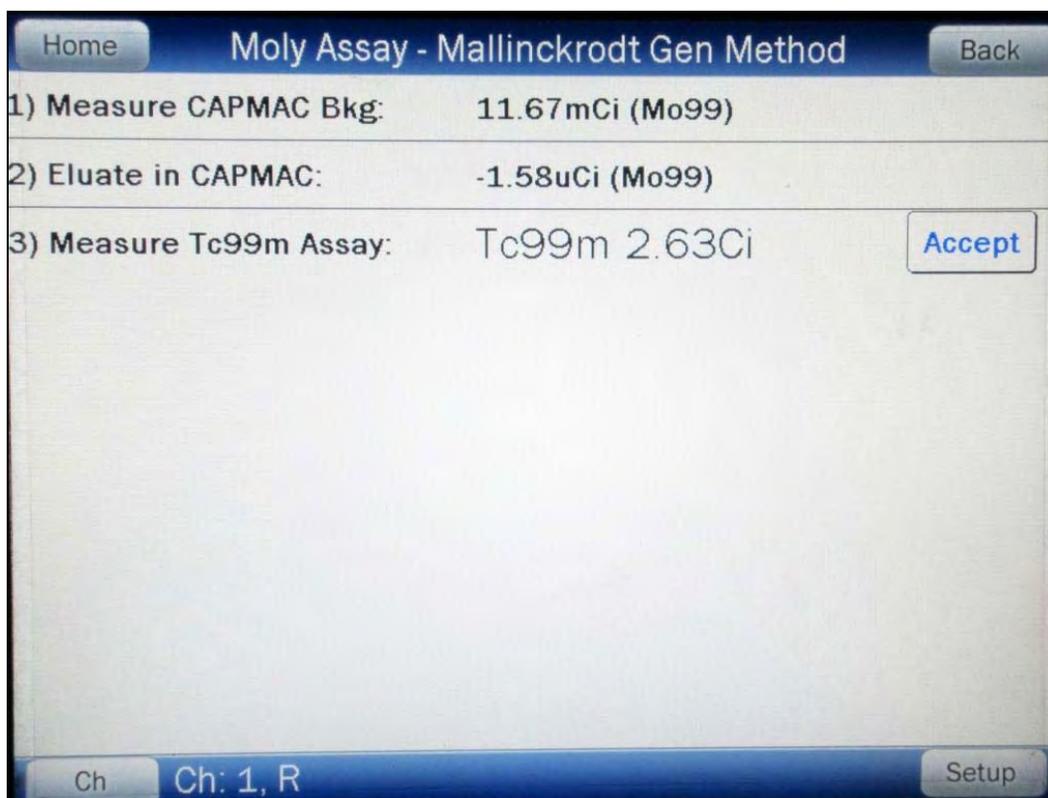


Figure 10-12 Moly Assay Tc99m Accept Screen

Enter Volume

Touch the **ACCEPT** button to accept the Tc99m Assay measurement. A numeric keypad will appear allowing for the entry of the volume of the elution in milliliters.

Note: *The minimum value that can be input is 1.000. The maximum value that can be input is 100.0.*

Input the volume using the keypad and touch the **ACCEPT** button. The concentration of the elution is calculated and displayed on the Moly Assay Results Screen.

Moly Assay Results

If the measured Tc99m activity is below 1.0 mCi, the message "ACTIVITY TOO LOW ERROR" will appear on the screen in red. Touch the **HOME** or **BACK** button to return to Figure 10-1 Chamber Measurement Screen.

The Mo99/Tc99m ratio is calculated and compared to the allowable value (which can be changed in Moly Setup – Reference CHAPTER 6: CHAMBER INITIALIZATION, SECTION: MOLY ASSAY SETUP).

If the calculated Mo/Tc ratio is higher than the allowable limit, the message “MO TOO HIGH – DO NOT USE” will appear as shown in Figure 10-13 Moly Assay Eluate Measurement Too High Screen. Touch the **HOME** or **BACK** button to return to Figure 10-1 Chamber Measurement Screen.

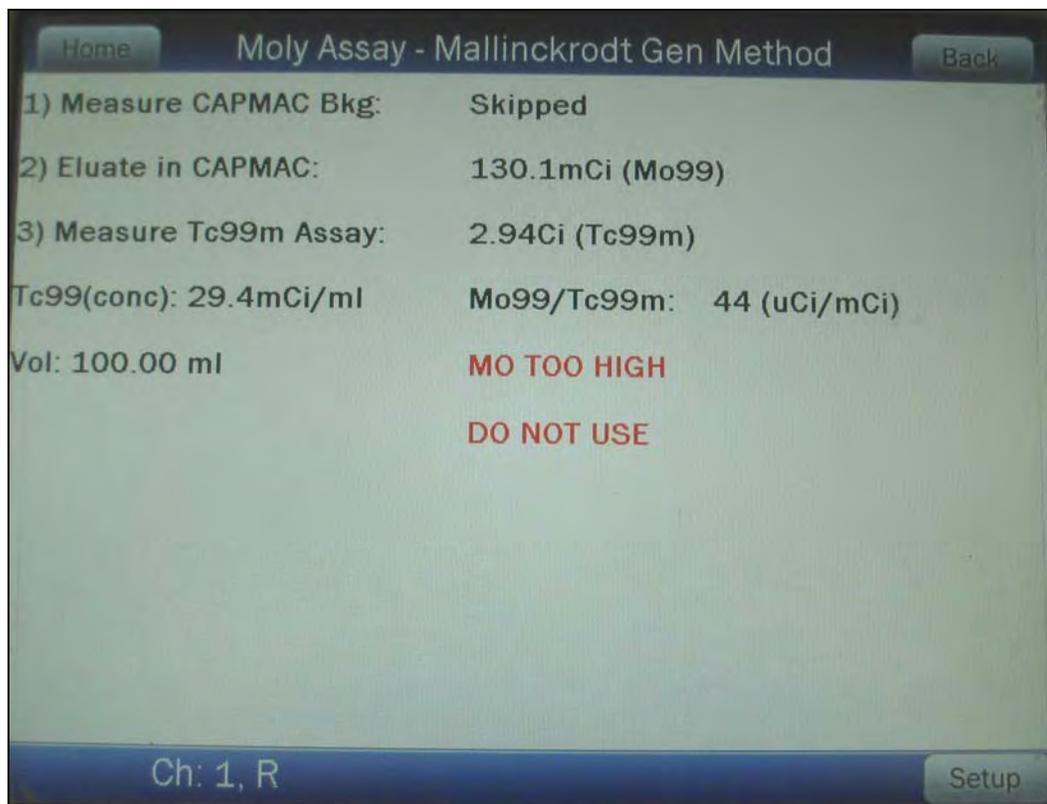


Figure 10-13 Moly Assay Eluate Measurement Too High Screen

If the calculated Mo/Tc ratio is within the allowable limit, the time when the ratio will exceed this limit is also calculated.

If the calculated usable time is less than 12 hours, a usage caution message is displayed depending upon the useable time for the elution. An example of such a case is shown in Figure 10-14 Moly Assay Results – Less than 12 hours Screen.

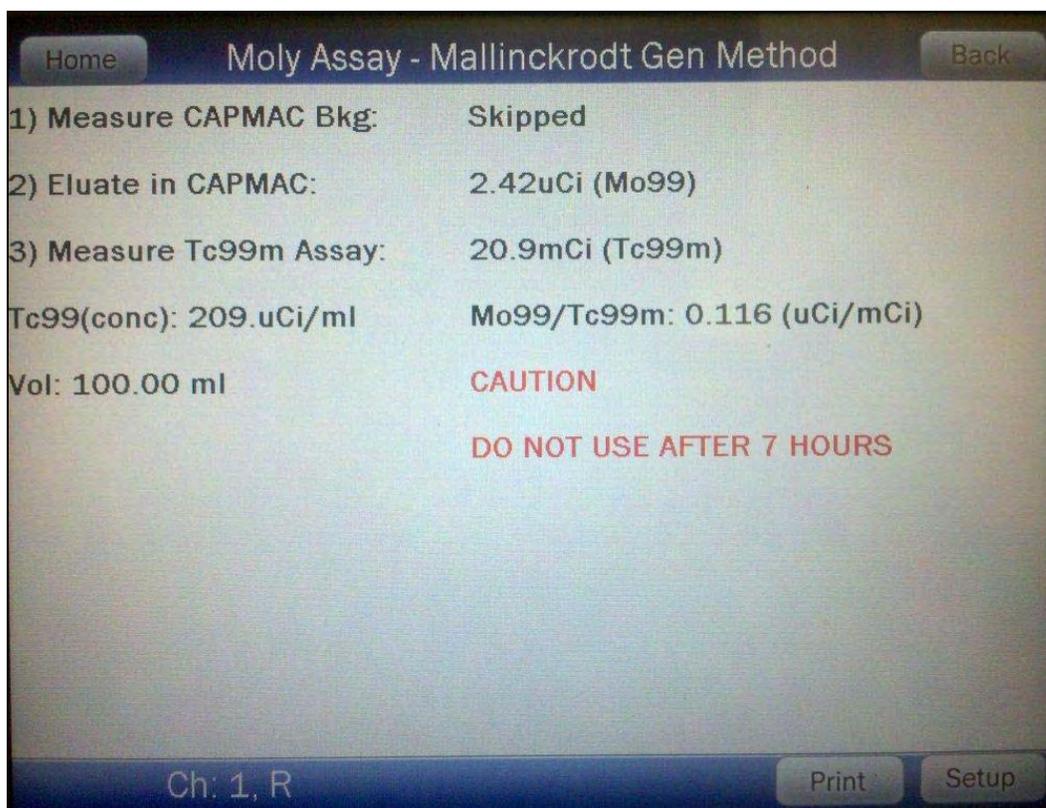


Figure 10-14 Moly Assay Results – Less than 12 hours Screen

If the calculated usable time is more than 12 hours, no message is displayed as shown in Figure 10-15 Moly Assay Results – More than 12 hours Screen.

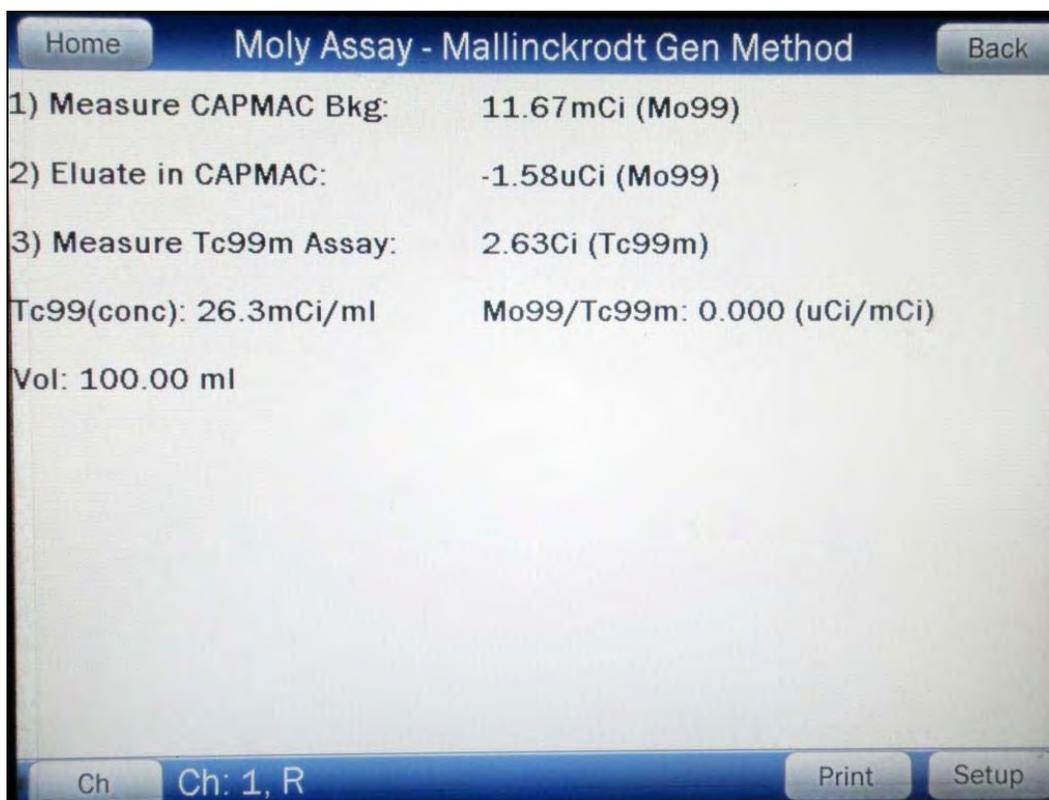


Figure 10-15 Moly Assay Results – More than 12 hours Screen

If a printer is attached to the system, touch the **PRINT** button to print a ticket with the details of the assay.

Touch the **HOME** or **BACK** button to return to Figure 10-1 Chamber Measurement Screen.

CHAPTER 11

CHAMBER ENHANCED TESTS

GENERAL 1
 GEOMETRY TEST 3
 Measurement Results 9
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 Two Strip Test 21
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GENERAL

This section describes the tests that are accessed via the **ENHANCED TESTS** button located on the Chamber Measurement screen.

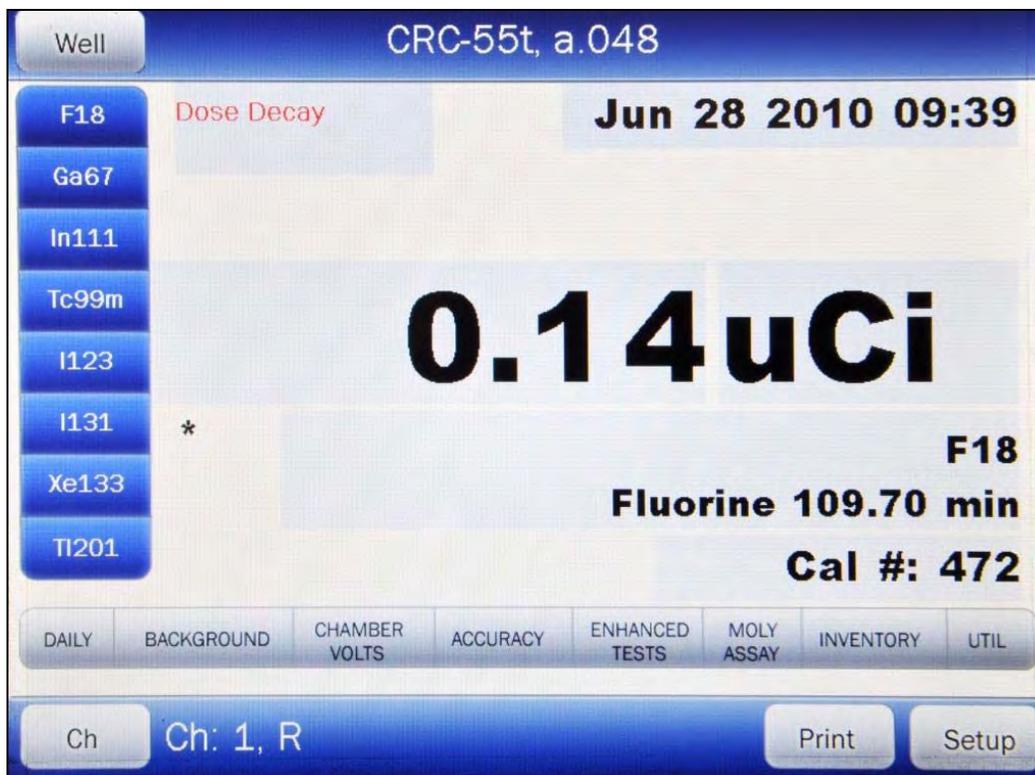


Figure 11-1 Chamber Measurement Screen

From the Chamber Measurement screen, touch the **ENHANCED TESTS** button.

If the Chamber is an R Chamber, Figure 11-2a Enhanced Tests Screen for R Chambers will appear.

If the Chamber is a PET Chamber, Figure 11-2b Enhanced Tests Screen for PET Chambers will appear. The QC Tests are not available for PET Chambers.

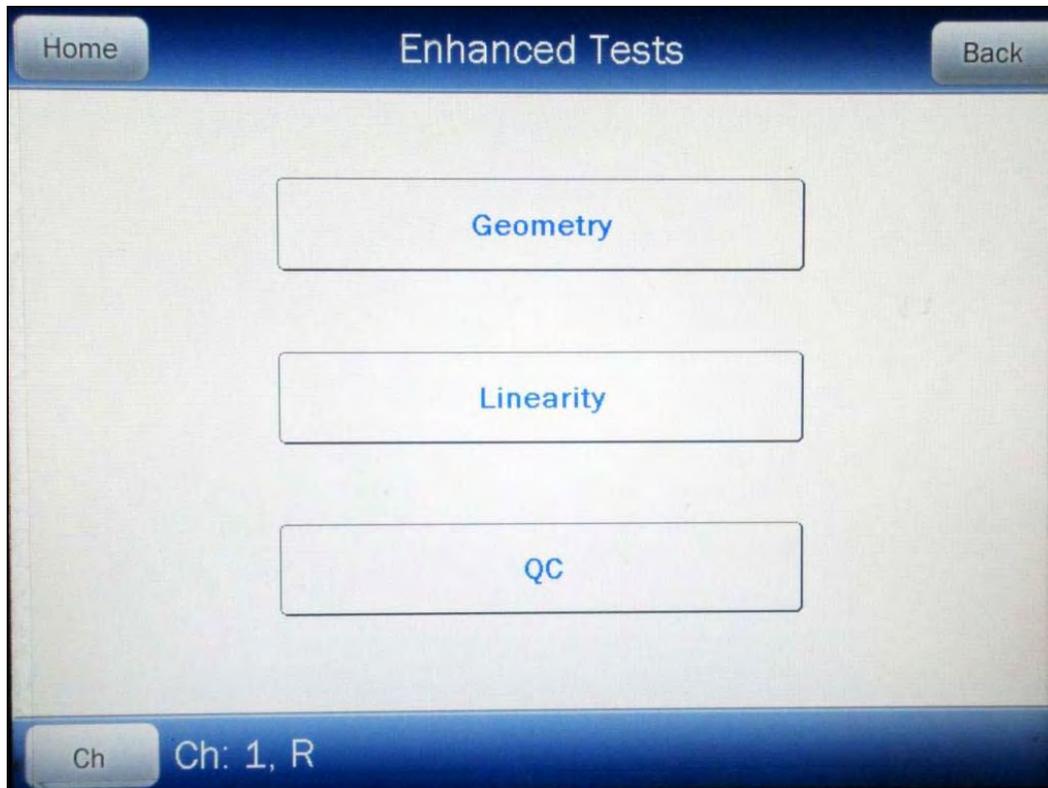


Figure 11-2a Enhanced Tests Screen for R Chambers

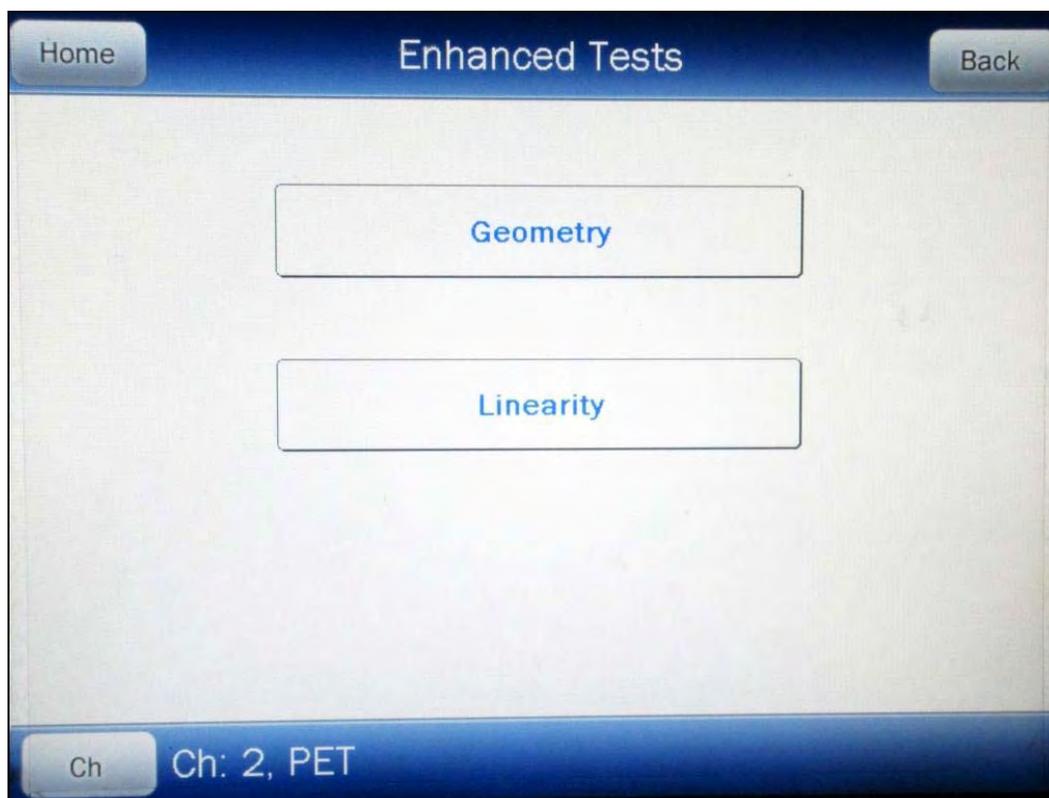


Figure 11-2b Enhanced Tests Screen for PET Chambers

If more than one Chamber is connected to the system, the **CH** (Chamber) button will be displayed and is located in the lower left part of the Enhanced Tests screen. Each test must be performed on each Chamber.

Pressing the **CH** button allows the choice of which Chamber the selected test will be performed on.

GEOMETRY TEST

The Geometry Test determines the effect of volume changes on the calibrator's accuracy. It is carried out using Tc99m and should be performed upon installation of the CRC[®]-55t.

An example Geometry Test would be to place 1ml of Tc99m (~25 mCi) in a 10 ml syringe. Place the sample in the Chamber and record the measurement. The sample is then diluted with water to 2 ml, 3 ml, 5 ml, and 10 ml. After each dilution, a measurement is performed and recorded. The data are reviewed to reveal the effect of sample geometry on the CRC[®]-55t's reading. If the Chamber is geometry-dependent, it may be necessary to routinely correct the readings.

To begin the Geometry Test, touch the **GEOMETRY** button. Figure 11-3 Geometry Test Screen will appear.

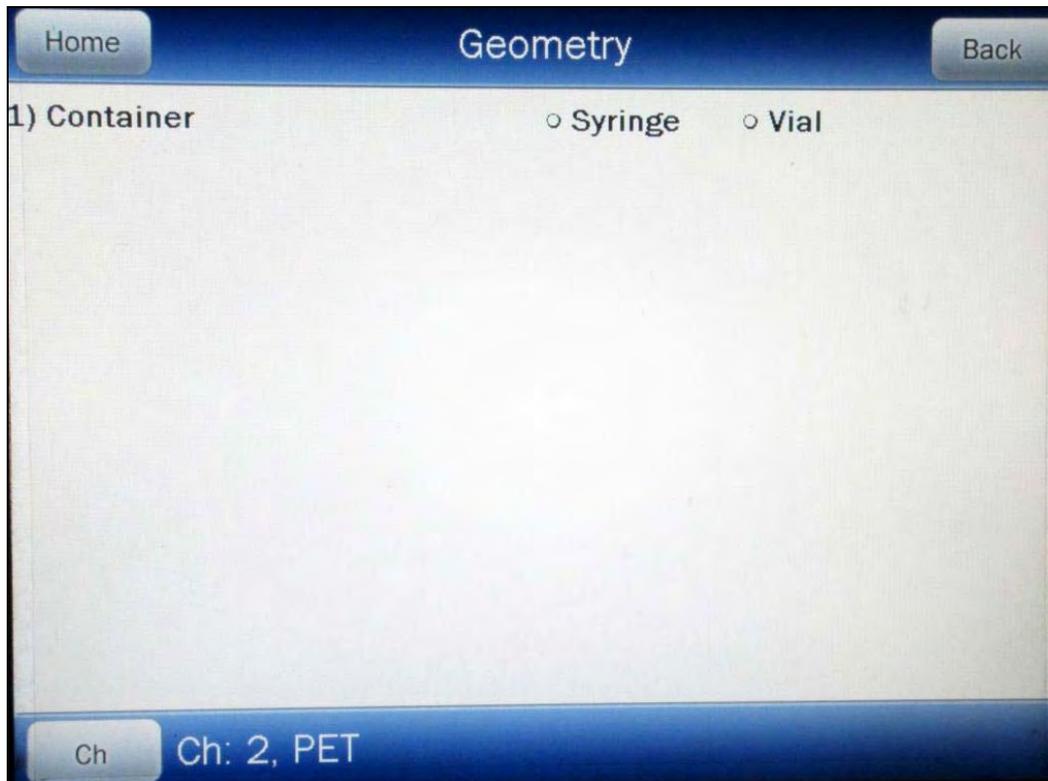


Figure 11-3 Geometry Test Screen

The test can be performed using a syringe or a vial.

A minimum of 2 samples must be measured. The maximum number of samples is 10.

From Figure 11-3 Geometry Test Screen, touch either the **Syringe** or **Vial** radio button. Figure 11-4 Geometry Test Initial Volume Entry Screen will appear. The examples shown are for testing using a Vial but are identical if using a Syringe.

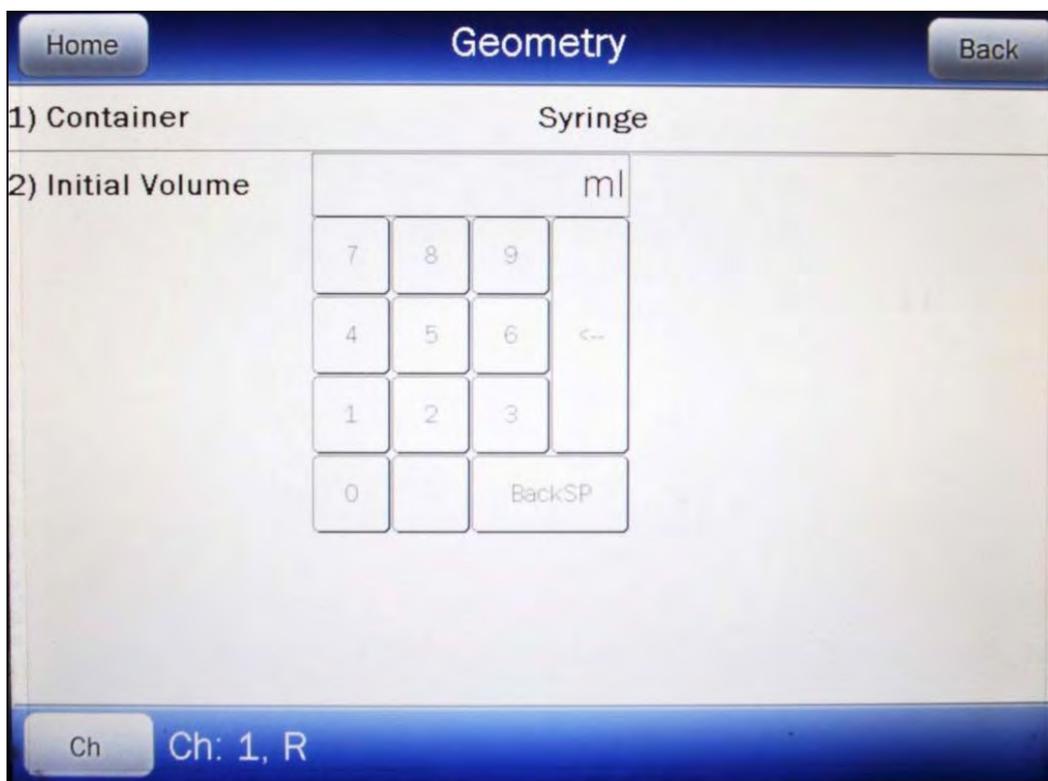


Figure 11-4 Geometry Test Initial Volume Entry Screen

Input the initial volume of the sample by touching the appropriate numbers on the keypad. Touch the **ENTER** (<-->) key to accept the entered volume. Figure 11-5 Geometry Measurement Screen will appear for each measurement.

Note: *The minimum value that can be input is 0.1 ml. The maximum value that can be input is 98.9 ml. The overall volume of the sample cannot be greater than 98.9ml; i.e. when the Initial Volume of the sample and all Added Volumes are added together, they cannot total more than 98.9ml.*

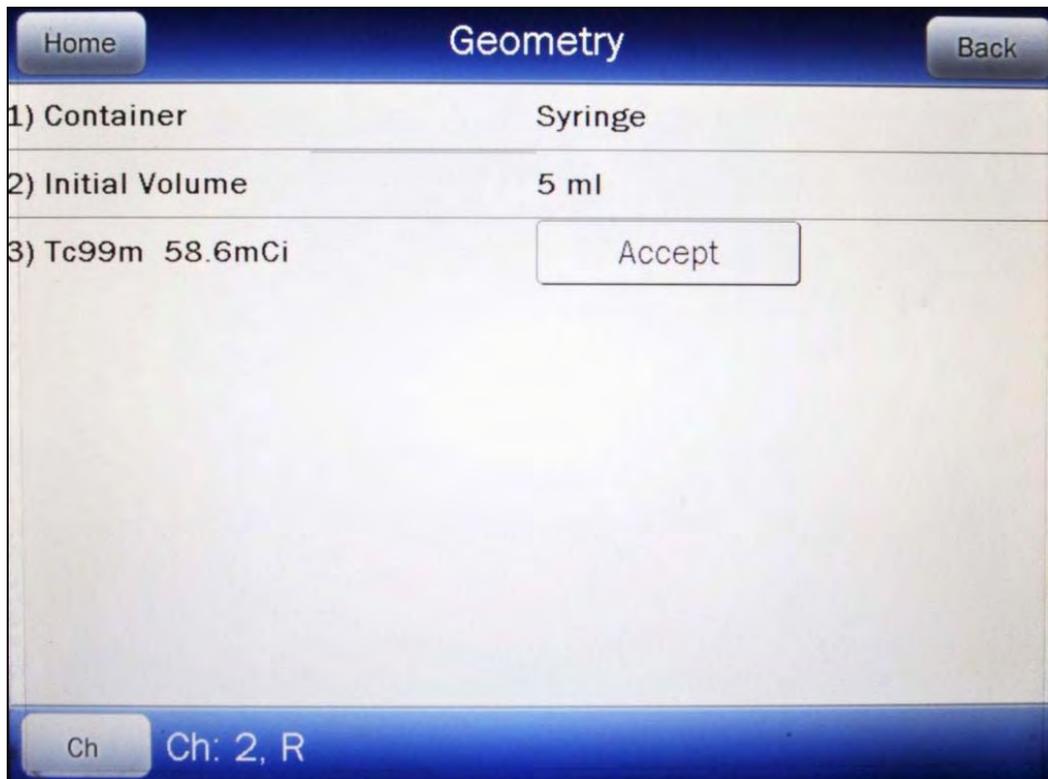


Figure 11-5 Geometry Measurement Screen

Place the sample in the Chamber. The syringe's activity will be displayed as shown in Figure 11-5 Geometry Measurement Screen.

Touch the **ACCEPT** button to accept the measurement. Figure 11-6 Geometry Test Added Volume Entry Screen will appear for the second measurement.

Home Geometry Back

1) Container Syringe

2) Initial Volume 5 ml

3) Initial Measurement Tc99m 58.6mCi

4) Added Volume ml

7	8	9	
4	5	6	<--
1	2	3	
0		BackSP	

Ch Ch: 2, R

Figure 11-6 Geometry Test Added Volume Entry Screen

A minimum of 2 samples must be measured.

Input the first volume added to the sample by touching the appropriate numbers on the keypad. Touch the **ENTER** (<-->) key to accept the entered volume. Figure 11-7 Geometry Measurement with Added Volume Screen will appear.

Geometry	
1) Container	Syringe
2) Initial Volume	5 ml
3) Initial Measurement	Tc99m 58.6mCi
4) Volume	Added Vol: 2.000ml Total Vol: 7.000ml
5) Tc99m 58.6mCi	<input type="button" value="Accept"/>

Ch Ch: 2, R

Figure 11-7 Geometry Measurement with Added Volume Screen

Touch the **ACCEPT** button to accept the measurement.

After the 2nd and subsequent measurements, Figure 11-8 Geometry Test More Measurements / Finished Screen will appear allowing more samples to be measured or finishing the test.

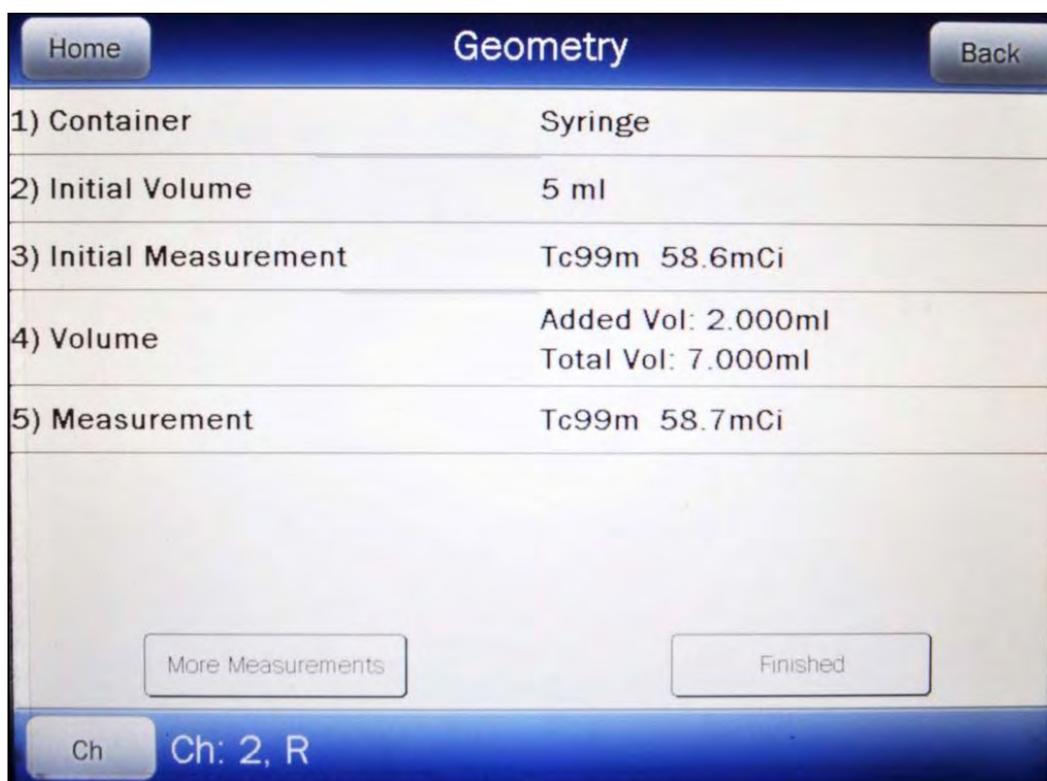


Figure 11-8 Geometry Test More Measurements / Finished Screen

If the previous sample was not the last sample to be measured, touch the **MORE MEASUREMENTS** button. Figure 11-6 Geometry Test Added Volume Entry Screen will re-appear.

Note: The maximum number of samples is 10.

Input the next volume added to the sample by touching the appropriate numbers on the keypad. The total volume input for all samples must be less than 99.0ml; if it is not less, the message "VALID RANGE IS XX.XXXml TO 0.1ml" will appear. (XX.XXX is the maximum volume remaining after subtracting the current total volume from the maximum of 99.0ml.)

Touch the **ENTER** (<-->) key to accept the entered volume. Figure 11-7 Geometry Measurement with Added Volume Screen will appear.

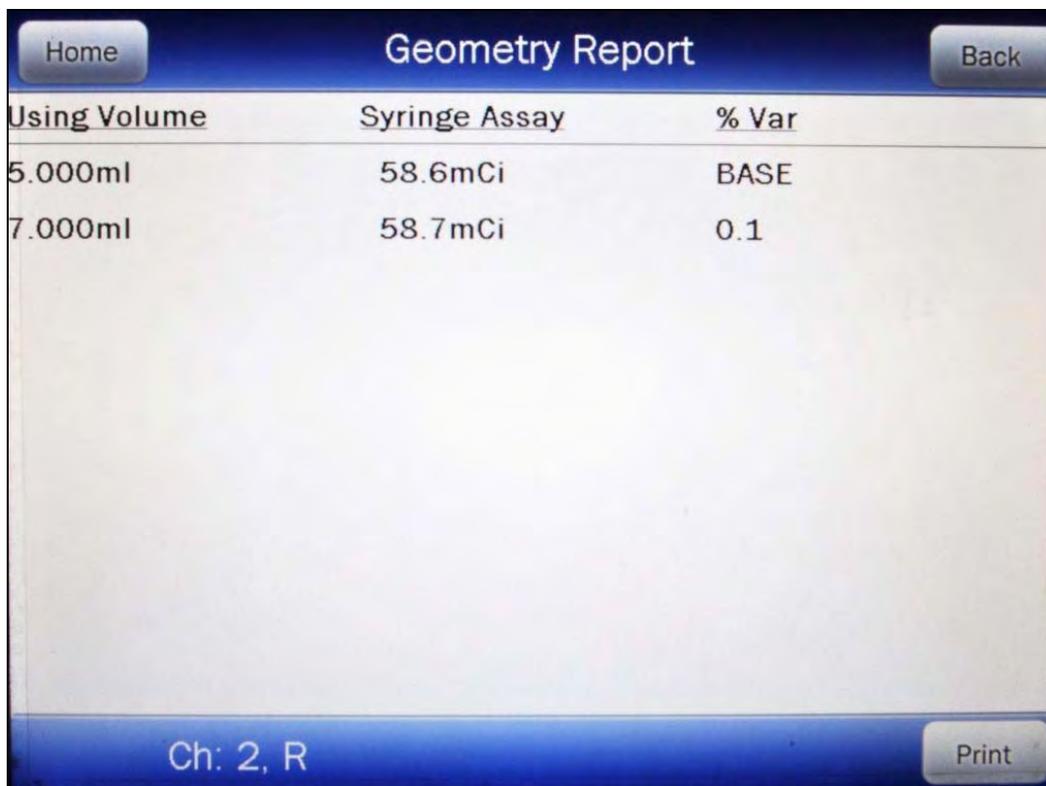
Touch the **ACCEPT** button to accept the measurement.

If the previous sample was the last sample to be measured, touch the **FINISHED** button. Figure 11-9 Geometry Report Screen will appear.

Measurement Results

After the last sample has been measured, Figure 11-9 Geometry Report Screen will appear.

The first measurement made is considered the Base Measurement. The base measurement is the measurement that all other measurements will be compared to. The variance is calculated using the base measurement.



Using Volume	Syringe Assay	% Var
5.000ml	58.6mCi	BASE
7.000ml	58.7mCi	0.1

Figure 11-9 Geometry Report Screen

If a printer is attached to the system, the Geometry Report can be printed by touching the **PRINT** button

Touch the **BACK** button to exit the Geometry Report and return to Figure 11-3 Geometry Test Screen.

Touch the **HOME** button to exit the Geometry Report and return to Figure 11-1 Chamber Measurement Screen.

PERFORMING LINEARITY TEST

In order to perform a Linearity Test, at least one Linearity Test Method must be defined. All three methods can be defined.

From the Enhanced Tests screen, touch the **LINEARITY** button.

If a Linearity Test Method is not defined, Figure 11-10 Please Setup Linearity Tests Message Screen will appear. Touch the **SETUP** button and reference CHAPTER 6: CHAMBER INITIALIZATION, SECTION: LINEARITY TEST DEFINITION.

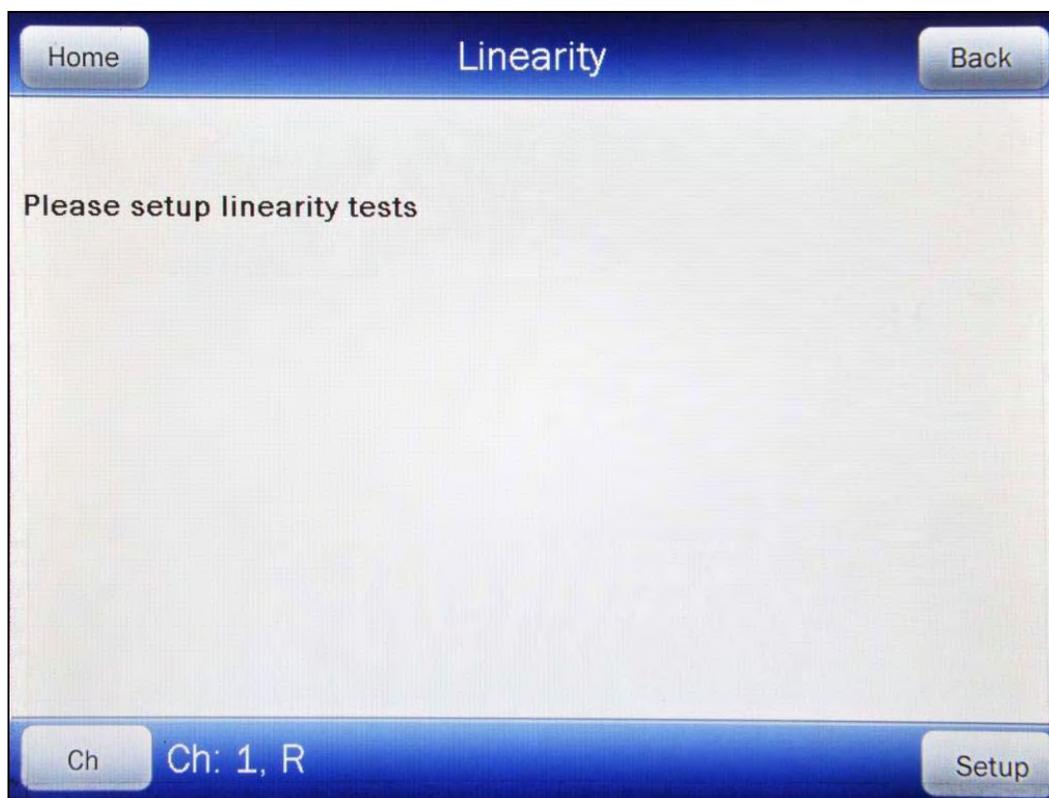


Figure 11-10 Please Setup Linearity Tests Message Screen

If Linearity Test Method(s) have been defined, the Linearity screen will display the defined Linearity test(s).

Standard Test

If the Standard Linearity Test has been defined, the **STANDARD** button will be displayed on the screen.

For an R Chamber, the Standard Test is normally performed by tracking the decay of a strong Tc99m source. However, the required nuclide was defined in the setup.

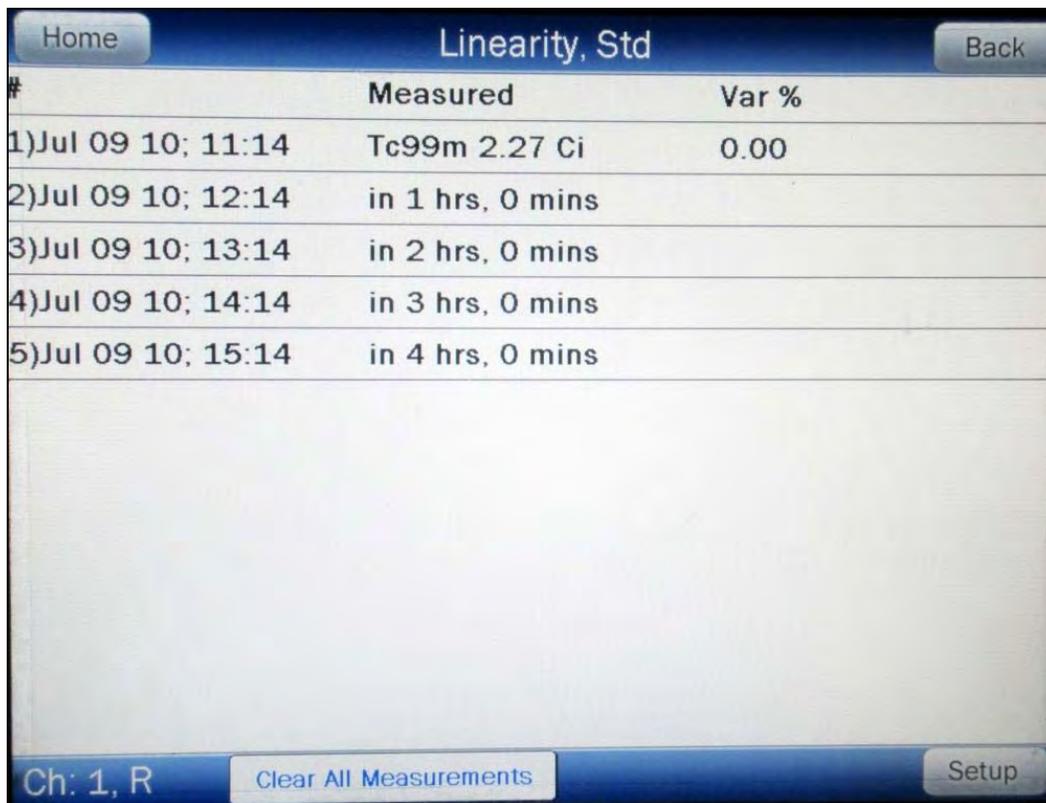
For a PET Chamber, the Standard Test is performed by tracking the decay of the user selected nuclide that was defined in the setup.

The Standard Test measures the activity of the selected nuclide over a defined period of time. When the defined number of measurements have been made, a least-squares fit is performed and the deviation of the results from this fit are reported.

First Measurement

To begin the Standard Linearity Test, touch the **STANDARD** button. Place the required linearity source in the Chamber. The activity of the source will be displayed.

Touch the **ACCEPT** button to accept the measurement. Figure 11-11 Standard Linearity Test Remaining Measurements Screen will appear showing percentage variance for the first (base) measurement and the times to perform the remaining measurements.



The screenshot shows a mobile application interface titled "Linearity, Std". It features a table with three columns: "#", "Measured", and "Var %". The first row shows a measurement of "Tc99m 2.27 Ci" with a variance of "0.00". The subsequent four rows show remaining measurement times: "in 1 hrs, 0 mins", "in 2 hrs, 0 mins", "in 3 hrs, 0 mins", and "in 4 hrs, 0 mins". The screen also includes a "Home" button at the top left, a "Back" button at the top right, and a "Clear All Measurements" button at the bottom center. The bottom left corner displays "Ch: 1, R" and the bottom right corner has a "Setup" button.

#	Measured	Var %
1)Jul 09 10; 11:14	Tc99m 2.27 Ci	0.00
2)Jul 09 10; 12:14	in 1 hrs, 0 mins	
3)Jul 09 10; 13:14	in 2 hrs, 0 mins	
4)Jul 09 10; 14:14	in 3 hrs, 0 mins	
5)Jul 09 10; 15:14	in 4 hrs, 0 mins	

Figure 11-11 Standard Linearity Test Remaining Measurements Screen

To repeat the measurement, touch the **CLEAR ALL MEASUREMENTS** button. Touch the **ACCEPT** button to accept the measurement. Figure 11-11 Standard Linearity Test Remaining Measurements Screen will re-appear showing percentage variance for the first (base) measurement and the times to perform the remaining measurements.

At this time, note the times of the remaining measurements.

Second through Last Measurements

Perform the remaining measurements at time intervals close those entered when the test was defined. The actual elapsed time will be used in the calculations.

From Figure 11-1 Chamber Measurement Screen, touch the **ENHANCED TESTS** button. The Enhanced Tests screen will appear.

Touch the **LINEARITY** button. The Linearity screen will appear.

Touch the **STANDARD** button. Figure 11-12 Standard Linearity Test Results Screen will appear.

#	Measured	Var %
1)Jul 09 10; 11:14	2.27 Ci	0.00
2)Jul 09 10; 12:14	in 1 hrs, 0 mins	<input type="button" value="Measure Now"/>
3)Jul 09 10; 13:14	in 2 hrs, 0 mins	
4)Jul 09 10; 14:14	in 3 hrs, 0 mins	
5)Jul 09 10; 15:14	in 4 hrs, 0 mins	

Figure 11-12 Standard Linearity Test Results Screen

The percentage variance from the base measurement is displayed after each measurement.

To repeat all measurements and start the test over, touch the **CLEAR ALL MEASUREMENTS** button. All measurements will be cleared.

If a printer is attached to the system, the Standard Linearity Test report can be printed by touching the **PRINT** button

Touch the **BACK** button to exit the Standard Linearity Test results and return to the Linearity screen.

Touch the **HOME** button to exit the Standard Linearity Test results and return to Figure 11-1 Chamber Measurement Screen.

Lineator Test

If the Lineator Linearity Test has been defined, the **LINEATOR** button will be displayed on the screen.

The Lineator Test requires 8 measurements using a strong Tc99m source along with a Lineator Test tube set.

The purpose of this test is to perform linearity quickly and not have to wait the time required to perform the Standard Linearity test. This is accomplished by measuring the attenuation of the tubes surrounding the source and storing the results. At any time, the tubes are used to confirm that the attenuation has not changed.

The Lineator Test steps the user through the measurement of each tube.

To begin the Lineator Linearity Test, touch the **LINEATOR** button. Figure 11-13 Lineator Linearity Test First Measurement Screen will appear.



Figure 11-13 Lineator Linearity Test First Measurement Screen

Remove the Dipper from the Chamber (leaving the Liner in place) and place the Tc99m test source into Tube 1 and then place Tube 1 into the Chamber. The activity of the source will be displayed as shown in Figure 11-13 Lineator Linearity Test First Measurement Screen.

Touch the **ACCEPT** button to accept the measurement. Figure 11-13 Lineator Linearity Test First Measurement Screen will now show the factor and the ratio for the first tube. The factor will be always 1.00 and the ratio will always be 100.00% since this is the first (base) measurement.

Place the requested tube(s) into the Chamber. Touch the **ACCEPT** button to accept the measurement. Figure 11-13 Lineator Linearity Test First Measurement Screen will now show the current factor and the current ratio for the measured tube(s).

Repeat the above steps for the remaining combination of tubes as indicated.

Review the **% Ratio** column. This is the ratio of the current factor to the initial factor determined when performing the Lineator Calibration procedure (reference CHAPTER 6: CHAMBER INITIALIZATION, SECTION: LINEATOR TEST). Verify that each ratio is within the specified limits for the facility's license.

If a printer is attached to the system, a **PRINT** button will appear on the screen. Touch the **PRINT** button to print the Lineator Linearity Test results.

Touch the **BACK** button to exit the Lineator Linearity Test results and return to the Linearity screen.

Touch the **HOME** button to exit the Lineator Linearity Test results and return to Figure 11-1 Chamber Measurement Screen.

Calicheck Test

If the Calicheck Linearity Test has been defined, the **CALICHECK** button will be displayed on the screen.

The Calicheck Test requires between 5 and 12 measurements (as defined in the Calicheck Setup – reference CHAPTER 6: CHAMBER INITIALIZATION, SECTION: LINEATOR TEST) using a strong Tc99m source along with a Calicheck Test tube set.

The purpose of this test is to perform linearity quickly and not have to wait the time required to perform the Standard Linearity test. This is accomplished by measuring the attenuation of the tubes surrounding the source and storing the results. At any later time, the tubes are used to confirm that the attenuation has not changed.

The Calicheck Test steps the user through the measurement of each tube.

To begin the Calicheck Linearity Test, touch the **CALICHECK** button. Figure 11-14 Calicheck Linearity Test First Measurement Screen will appear for the first measurement. The examples shown are for 5 tubes.



Figure 11-14 Calicheck Linearity Test First Measurement Screen

Remove the Dipper from the Chamber (leaving the Liner in place). Place the Tc99m test source into the Black Tube and then place the Tube into the Chamber. The activity of the source will be displayed as shown in Figure 11-14 Calicheck Linearity Test First Measurement Screen.

Touch the **ACCEPT** button to accept the measurement. Figure 11-15 Calicheck Linearity Test Next Measurement Screen will now show the measurement result and the Percent Variance from the Mean for the Black Tube. The Percent Variance will always be 0.00 since this is the first measurement.

#	Result	% Var
1)Black	6.04 Ci	0.00
2)Black/Red	Tc99m 589.mCi	Accept
3)Black/Orange		
4)Black/Yellow		
5)Black/Green		

Ch: 2, R Setup

Figure 11-15 Calicheck Linearity Test Next Measurement Screen

Place the requested tube(s) into the Chamber. Touch the **ACCEPT** button to accept the measurement. Figure 11-15 Calicheck Linearity Test Next Measurement Screen will now show the measurement result and the current Percent Variance from Mean for the measured tube(s) and the adjusted Percent Variance from Mean for the previously measured tube(s).

Repeat the above steps for the remaining combination of tubes as indicated.

Review the **Result** and **% Var** columns. The screen shows the Result and the Percent Variation from Mean for each tube. The Result is the actual measurement for the selected tube multiplied by the corresponding Calibration Factor that was determined when the Calicheck Calibration procedure was performed (reference CHAPTER 6: CHAMBER INITIALIZATION, SECTION: CALICHECK TEST). The Mean is the sum of the Results divided by the total number of measurements performed. The Percent Variance is the ratio of the Result to the Mean.

Verify that each Percent Variance is within the specified limits for the facility's license.

If a printer is attached to the system, a **PRINT** button will appear on the screen. Touch the **PRINT** button to print the Calicheck Linearity Test results.

Touch the **BACK** button to exit the Calicheck Linearity Test results and return to the Linearity screen.

Touch the **HOME** button to exit the Calicheck Linearity Test results and return to Figure 11-1 Chamber Measurement Screen.

QUALITY CONTROL (QC)

Radiochromatography Quality Control tests can be performed using four methods.

From the Enhanced Tests screen, touch the **QC** button.
Figure 11-16 QC Test Selection Screen will appear.

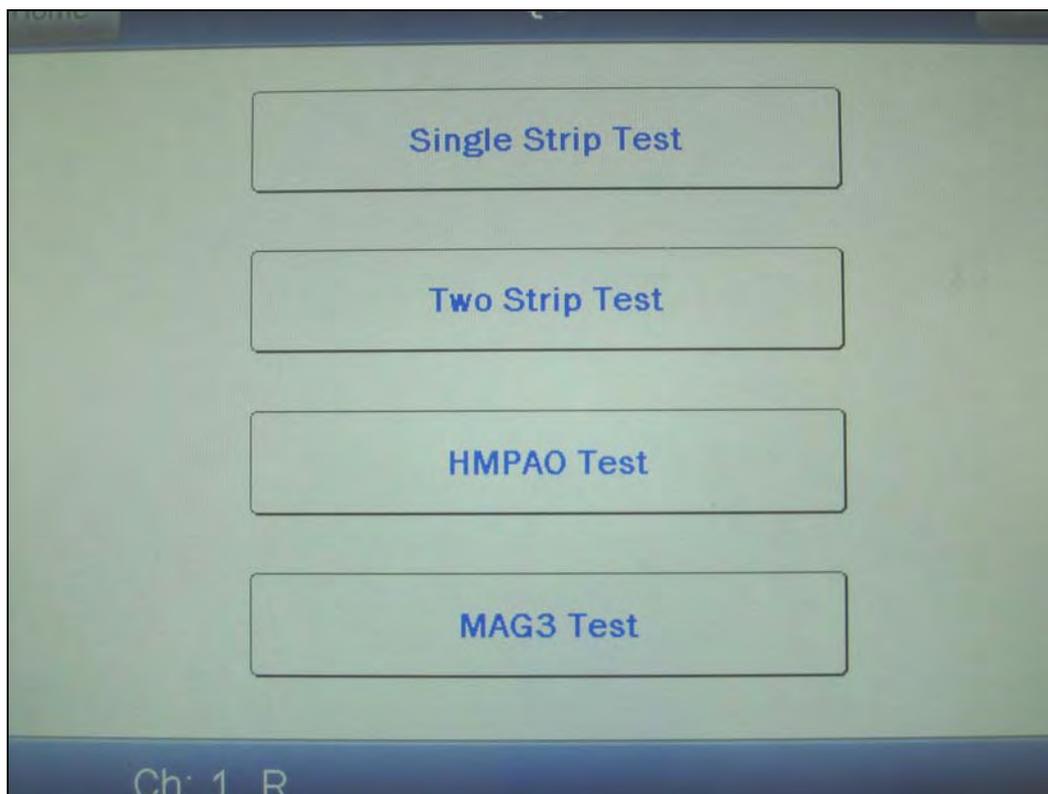


Figure 11-16 QC Test Selection Screen

Single Strip Test

The Single Strip Test consists of 2 measurements: the top of the strip and then the bottom of the strip.

To begin the Single Strip Test, touch the **SINGLE STRIP TEST** button. Figure 11-17 One Strip Test – Top of Strip Measurement Screen will appear.

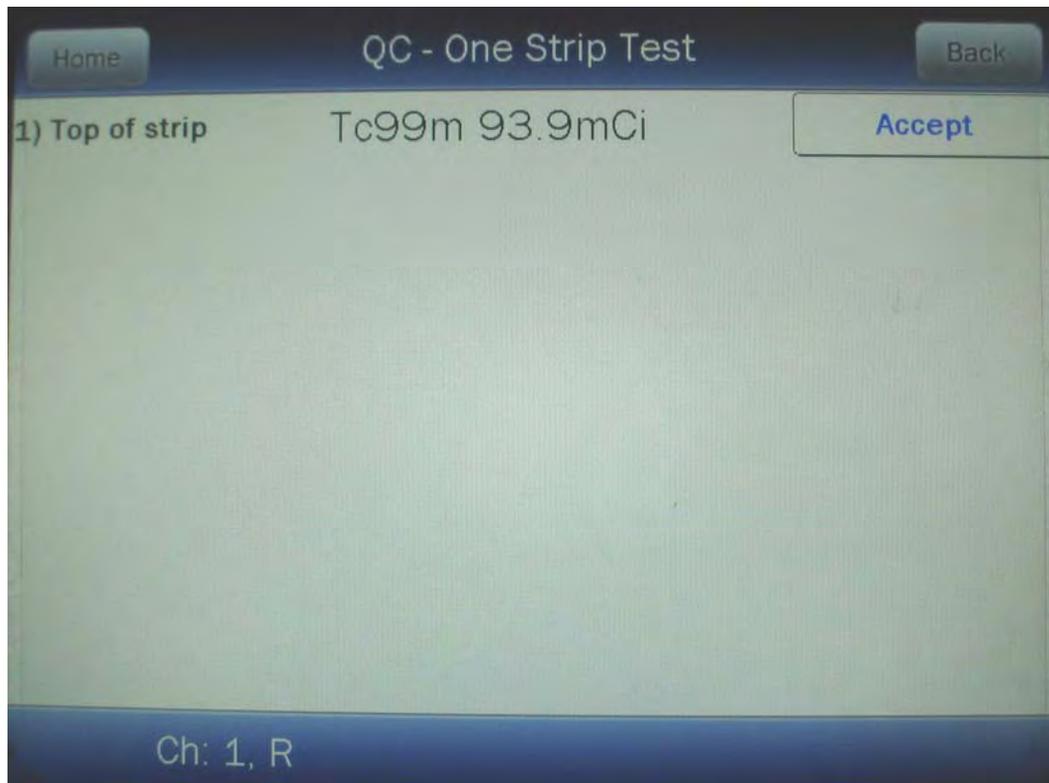


Figure 11-17 One Strip Test – Top of Strip Measurement Screen

Place the Top of Strip into the Chamber. The activity will be displayed as shown in Figure 11-17 One Strip Test – Top of Strip Measurement Screen.

Touch the **ACCEPT** button to accept the measurement. The screen will show the Top of Strip measurement result and the Bottom Of Strip measurement as shown in Figure 11-18 One Strip Test – Bottom of Strip Measurement Screen.

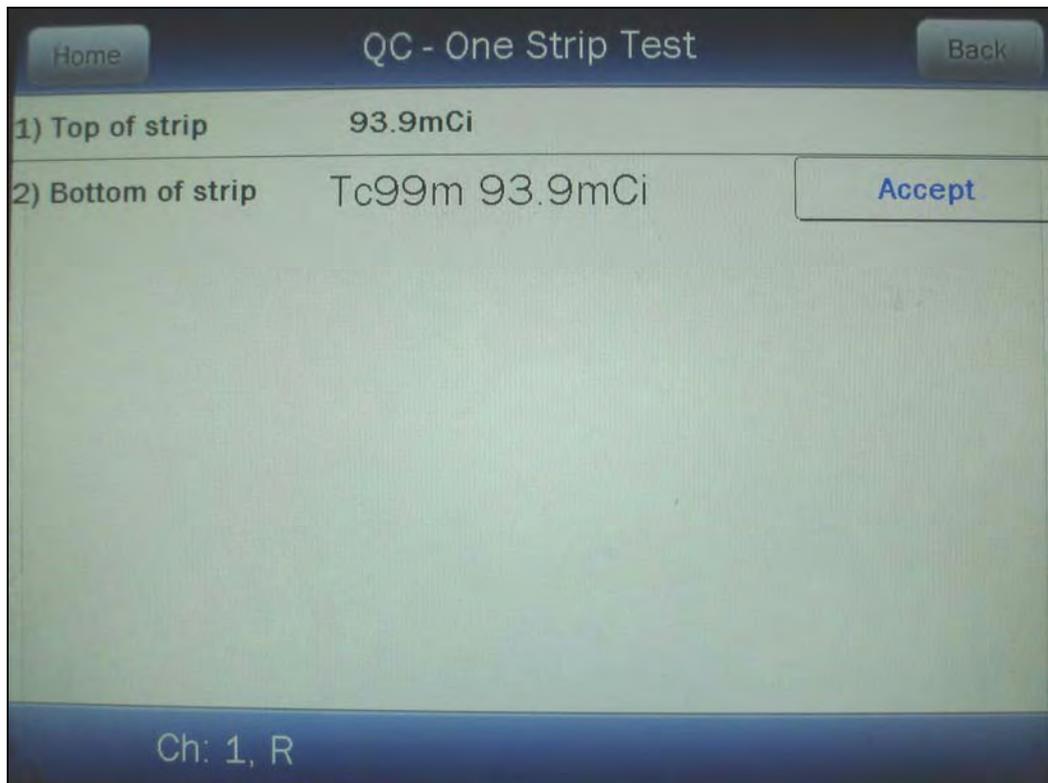


Figure 11-18 One Strip Test – Bottom of Strip Measurement Screen

Place the Bottom of Strip into the Chamber. The activity will be displayed as shown in Figure 11-18 One Strip Test – Bottom of Strip Measurement Screen.

Touch the **ACCEPT** button to accept the measurement. The screen will display the Top and Bottom of Strip measurements and the results as shown in Figure 11-19 One Strip Test Results Screen.

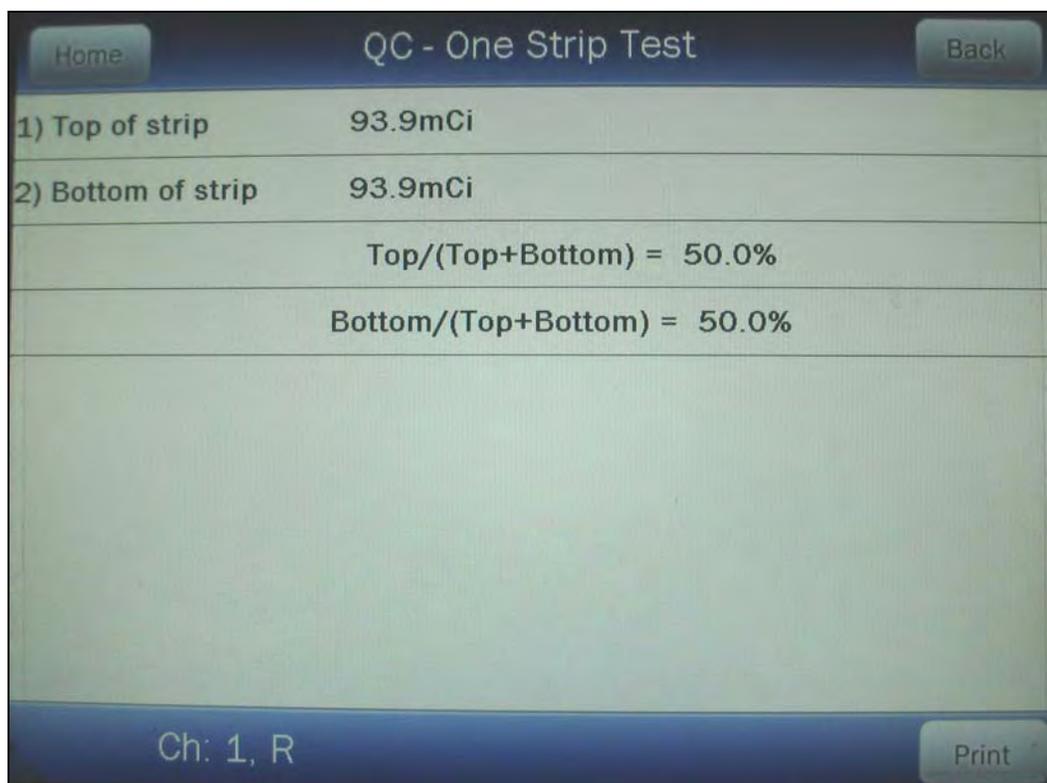


Figure 11-19 One Strip Test Results Screen

If a printer is attached to the system, a **PRINT** button will appear on the screen. Touch the **PRINT** button to print the One Strip Test measured values and results.

Touch the **BACK** button to exit the One Strip Test and return to Figure 11-16 QC Test Selection Screen.

Touch the **HOME** button to exit the One Strip Test and return to Figure 11-1 Chamber Measurement Screen.

Two Strip Test

The Two Strip Test consists of 4 measurements: the top and then the bottom of strip A, and the top and then the bottom of strip B.

To begin the Two Strip Test, touch the **TWO STRIP TEST** button. The screen will appear similar to that shown in Figure 11-17 One Strip Test – Top of Strip Measurement Screen.

Place the Top of Strip A into the Chamber. The activity will be displayed similar to that shown in Figure 11-17 One Strip Test – Top of Strip Measurement Screen.

Touch the **ACCEPT** button to accept the measurement. The screen will now show the Top of Strip A measurement result and the Bottom of Strip A measurement as shown in Figure 11-20 Two Strip Test – Bottom of Strip A Measurement Screen.

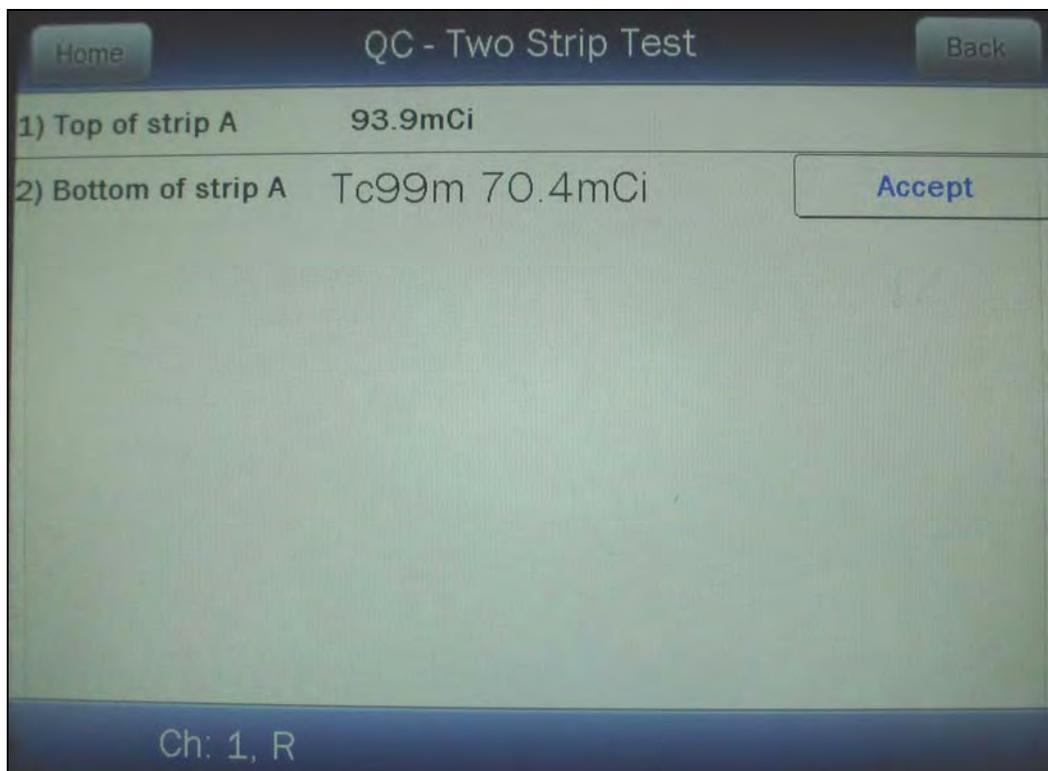


Figure 11-20 Two Strip Test – Bottom of Strip A Measurement Screen

Place the Bottom of Strip A into the Chamber. The activity will be displayed. Touch the **ACCEPT** button to accept the measurement. The screen will now show the Bottom of Strip A measurement result and the Top of Strip B measurement as shown in Figure 11-21 Two Strip Test – Top of Strip B Measurement Screen.

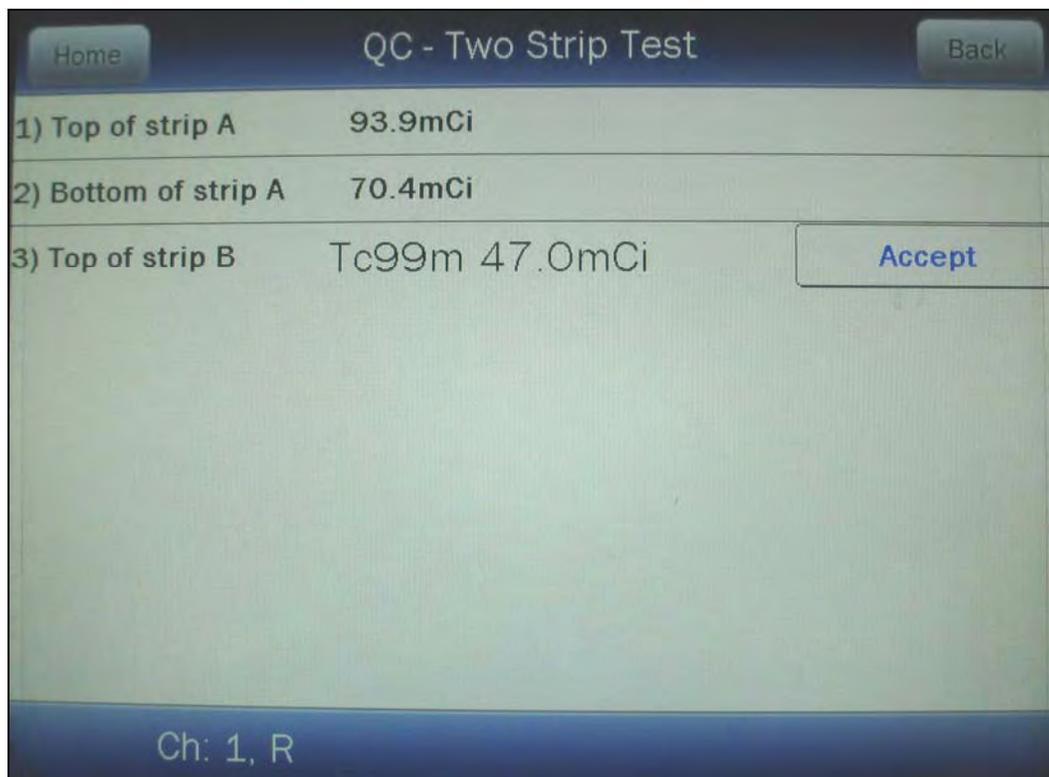


Figure 11-21 Two Strip Test – Top of Strip B Measurement Screen

Repeat the above steps to measure the Top and Bottom of Strip B. After accepting the Bottom of Strip B measurement, the results will appear as shown in Figure 11-22 Two Strip Test Results Screen.

QC - Two Strip Test	
1) Top of strip A	93.9mCi
2) Bottom of strip A	70.4mCi
3) Top of strip B	47.0mCi
4) Bottom of Strip B	35.2mCi
Free Tc99m : 57.1%	
Reduced/Hydrolyzed: 42.9%	
Purity : 0.0%	
Ch: 1, R	

Figure 11-22 Two Strip Test Results Screen

If a printer is attached to the system, a **PRINT** button will appear on the screen. Touch the **PRINT** button to print the Two Strip Test measured values and results.

Touch the **BACK** button to exit the Two Strip Test and return to Figure 11-16 QC Test Selection Screen.

Touch the **HOME** button to exit the Two Strip Test and return to Figure 11-1 Chamber Measurement Screen.

HMPAO Test

The Tc99m HMPAO Test consists of 6 measurements: the top and then the bottom of strip A, the top and then the bottom of strip B, and the top and then the bottom of strip C.

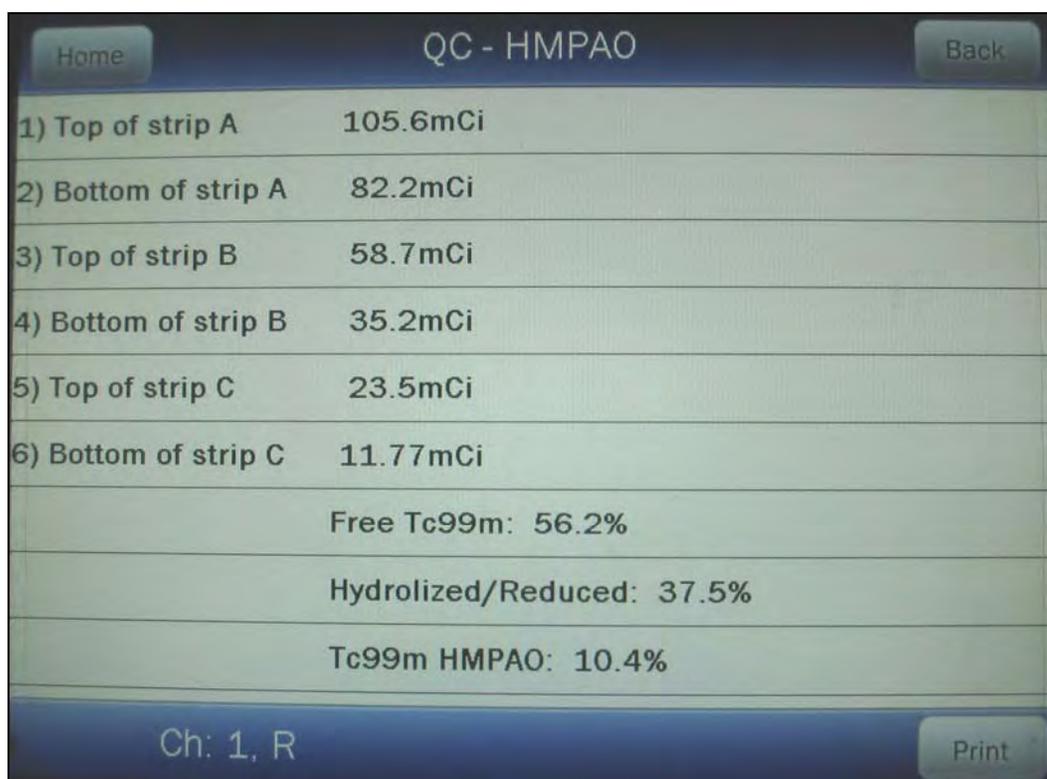
To begin the HMPAO Test, touch the **HMPAO TEST** button. The screen will appear similar to that shown in Figure 11-17 One Strip Test – Top of Strip Measurement Screen.

Place the Top of Strip A into the Chamber. The activity will be displayed similar to that shown in Figure 11-17 One Strip Test – Top of Strip Measurement Screen.

Touch the **ACCEPT** button to accept the measurement. The screen will now show the Top of Strip A measurement result and the Bottom of Strip A measurement similar to that shown in Figure 11-20 Two Strip Test – Bottom of Strip A Measurement Screen.

Place the Bottom of Strip A into the Chamber. The activity will be displayed. Touch the **ACCEPT** button to accept the measurement. The screen will now show the Bottom of Strip A measurement result and the Top of Strip B measurement similar to that shown in Figure 11-21 Two Strip Test – Top of Strip B Measurement Screen.

Repeat the above steps to measure the Top and Bottom of Strips B and C. After accepting the Bottom of Strip C measurement, the results will appear as shown in Figure 11-23 HMPAO Test Results Screen.



QC - HMPAO	
1) Top of strip A	105.6mCi
2) Bottom of strip A	82.2mCi
3) Top of strip B	58.7mCi
4) Bottom of strip B	35.2mCi
5) Top of strip C	23.5mCi
6) Bottom of strip C	11.77mCi
Free Tc99m: 56.2%	
Hydrolized/Reduced: 37.5%	
Tc99m HMPAO: 10.4%	

Ch: 1, R

Figure 11-23 HMPAO Test Results Screen

If a printer is attached to the system, a **PRINT** button will appear on the screen. Touch the **PRINT** button to print the HMPAO Test measured values and results.

Touch the **BACK** button to exit the HMPAO Test and return to Figure 11-16 QC Test Selection Screen.

Touch the **HOME** button to exit the HMPAO Test and return to Figure 11-1 Chamber Measurement Screen.

MAG3 Test

The Tc99m MAG3 Test consists of 3 measurements: Fraction #1, Fraction #2 and the Cartridge.

To begin the MAG3 Test, touch the **MAG3 TEST** button. The screen will appear as shown in Figure 11-24 MAG3 Test – Fraction #1 Measurement Screen.

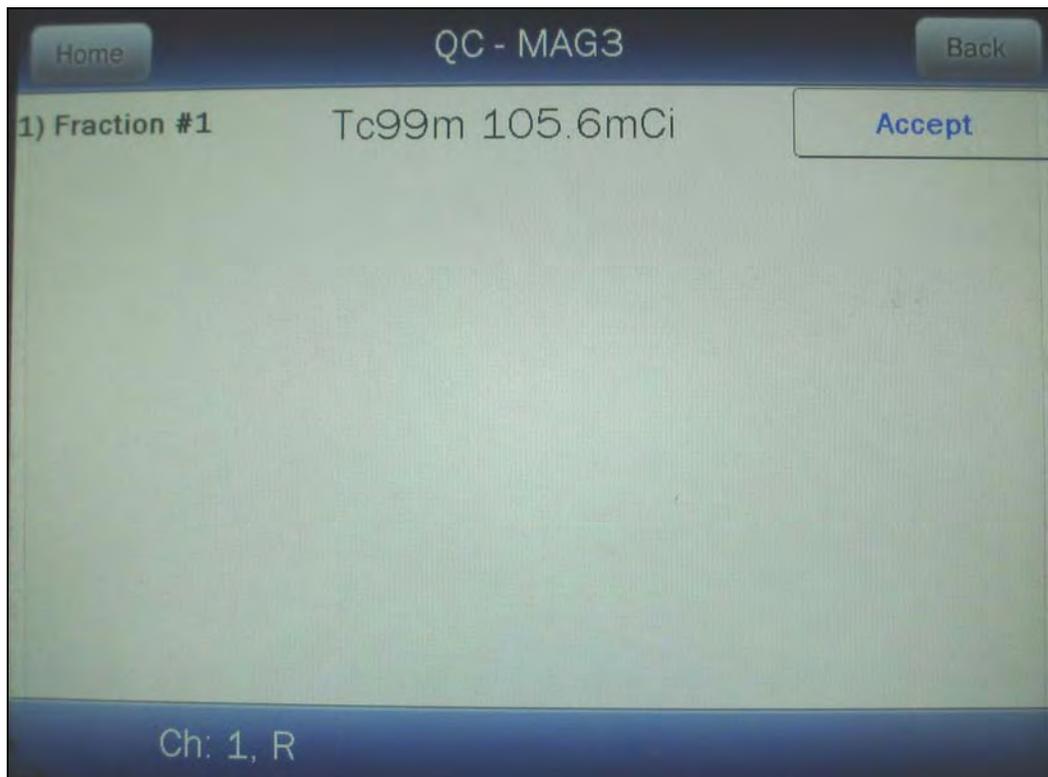


Figure 11-24 MAG3 Test – Fraction #1 Measurement Screen

Place the Fraction #1 into the Chamber. The activity will be displayed similar to that shown in Figure 11-24 MAG3 Test – Fraction #1 Measurement Screen.

Touch the **ACCEPT** button to accept the measurement. The screen will now show the Fraction #1 measurement result and the Fraction #2 measurement.

Place the Fraction #2 into the Chamber. The activity will be displayed. Touch the **ACCEPT** button to accept the measurement. The screen will now show the Fraction #2 measurement result and the Cartridge measurement as shown in Figure 11-25 MAG3 Test – Cartridge Measurement Screen.

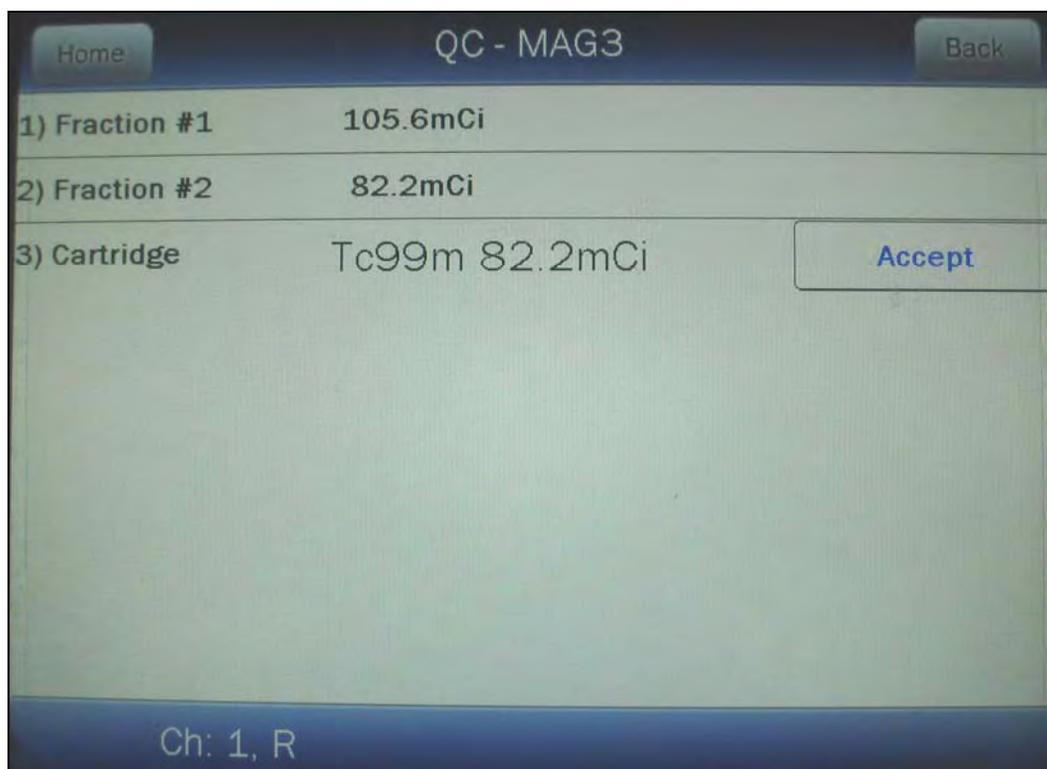
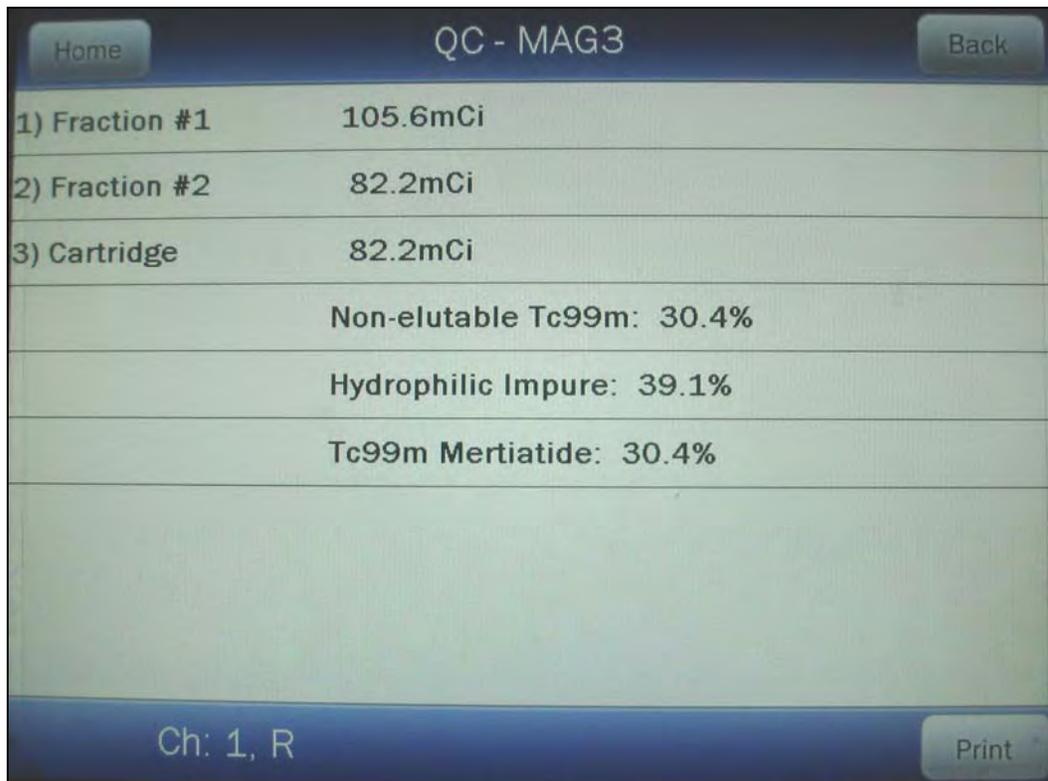


Figure 11-25 MAG3 Test – Cartridge Measurement Screen

Touch the **ACCEPT** button to accept the measurement. The results will appear as shown in Figure 11-26 MAG3 Test Results Screen.



QC - MAG3	
1) Fraction #1	105.6mCi
2) Fraction #2	82.2mCi
3) Cartridge	82.2mCi
Non-elutable Tc99m: 30.4%	
Hydrophilic Impure: 39.1%	
Tc99m Mertiatide: 30.4%	

Ch: 1, R

Print

Figure 11-26 MAG3 Test Results Screen

If a printer is attached to the system, a **PRINT** button will appear on the screen. Touch the **PRINT** button to print the MAG3 Test measured values and results.

Touch the **BACK** button to exit the MAG3 Test and return to Figure 11-16 QC Test Selection Screen.

Touch the **HOME** button to exit the MAG3 Test and return to Figure 11-1 Chamber Measurement Screen.

CHAPTER 12

INVENTORY

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GENERAL

This section describes the use of the Inventory feature. Up to 30 items can be stored in Inventory.

Inventory is accessed via the **INVENTORY** button located on the Chamber Measurement screen.

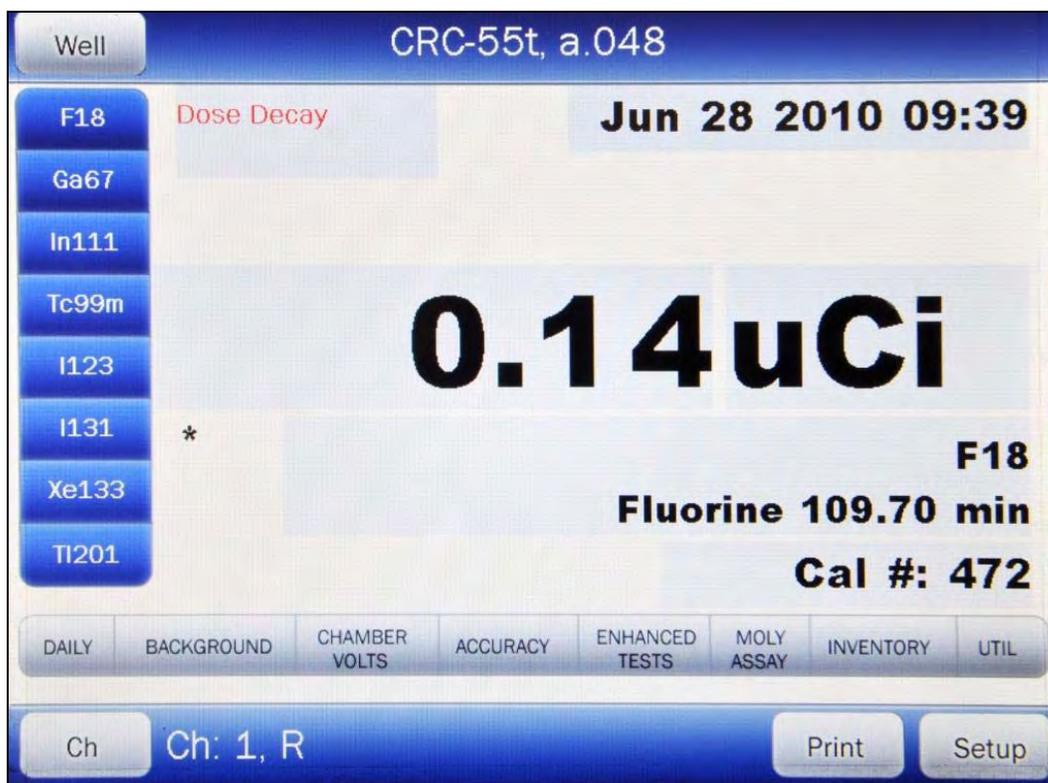


Figure 12-1 Chamber Measurement Screen

Note: Inventory can only be used with an R Chamber. If the **INVENTORY** button is touched when using a PET Chamber, the message "PET CHAMBER – THE PET CHAMBER CAN NOT ACCESS INVENTORY FUNCTIONS – OK" will appear. Touch the **OK** button to dismiss the message window.

From the Chamber Measurement screen, touch the **INVENTORY** button. Figure 12-2 Inventory Main Screen will appear.

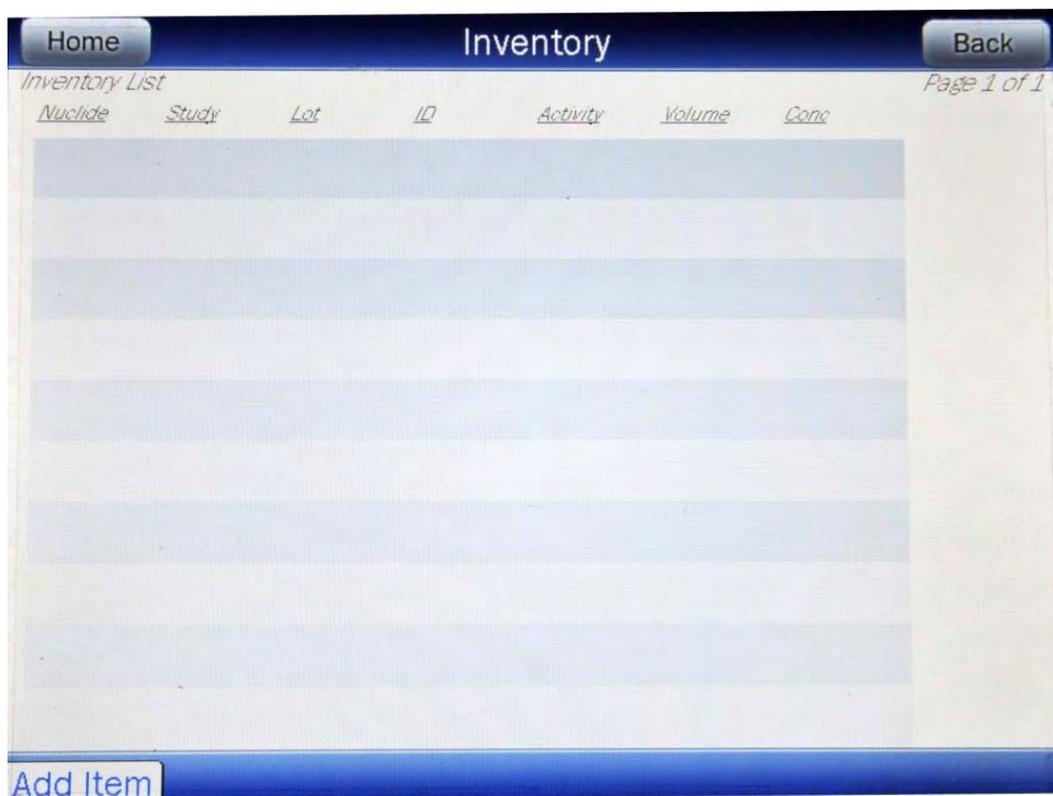


Figure 12-2 Inventory Main Screen

ADDING TO THE INVENTORY

To add an item to the Inventory, touch the **ADD ITEM** button located on the lower left part of Figure 12-2 Inventory Main Screen. Figure 12-3 Add Inventory Item Screen will appear.

The screenshot shows a mobile application interface for adding an inventory item. The screen is titled "Add Inventory Item" and has a blue header with "Home" and "Back" buttons. The main area contains six input fields: "Nuclide", "ID", "Lot", "Volume", "Activity", and "Date". The "Nuclide", "Volume", "Activity", and "Date" fields are highlighted in pink, indicating they are required. The "ID" and "Lot" fields are white, indicating they are optional. At the bottom left, there is a "Ch" button, and at the bottom center, the text "Ch: 2, R" is displayed.

Figure 12-3 Add Inventory Item Screen

The required fields (**Nuclide**, **Volume**, **Activity** and **Date**) flash pink. The fields not flashing (**ID**, **Lot** and **Mo/Tc**) are not required.

To exit Figure 12-3 Add Inventory Item Screen without saving any data input and return to Figure 12-2 Inventory Main Screen, touch the **BACK** button.

To exit Figure 12-3 Add Inventory Item Screen without saving any data input and return to Figure 12-1 Chamber Measurement Screen, touch the **HOME** button.

If more than one Chamber is attached to the system, the **CH** button will be displayed on the lower left part of Figure 12-3 Add Inventory Item Screen. Touch this button to switch between the Chambers.

To input information for the Inventory Item, touch the desired field box and input the appropriate data for the nuclide.

Select Nuclide

Note: The **Nuclide:** field box is required.

To select the desired nuclide to add to Inventory, touch the **Nuclide:** field box. Figure 12-4 Select Nuclide Screen will appear.

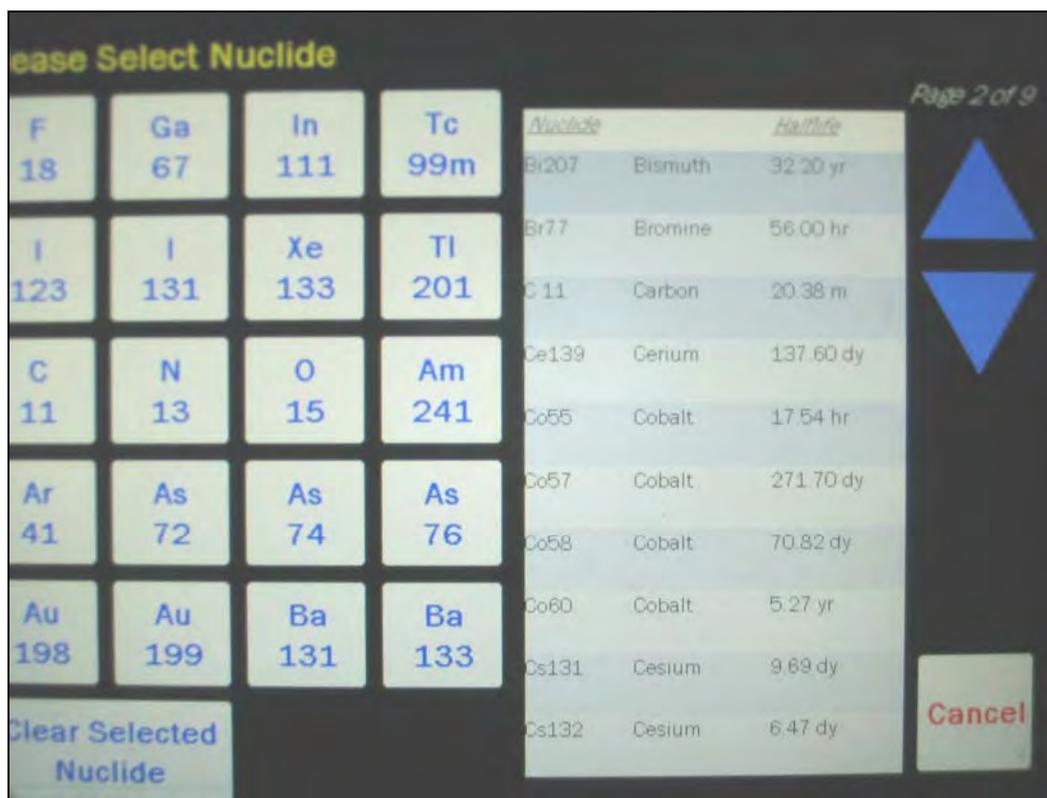


Figure 12-4 Select Nuclide Screen

The left half of the Select Nuclide screen contains the 20 preset **NUCLIDE** buttons (these are the Select Nuclide Screen Hotkeys). The right half of the screen displays a listing of nuclides stored in the calibrator's memory (both default and user added nuclides) that have a Calibration Number assigned to them) – 10 at a time.

The nuclide list is in alphabetical order. User added nuclides are displayed at the top of the list. The length of the list will vary depending on which nuclides have a Calibration Number assigned to them. The number of pages shown in the upper right corner of the screen indicates the length of the list. To scroll through the list, touch the **DOWN ARROW** button. The next group of 10 nuclides will be displayed and the **UP ARROW** button will appear allowing the user to scroll up in the list.

To cancel the nuclide selection and return to Figure 12-3 Add Inventory Item Screen, touch the **CANCEL** button.

To assign a nuclide for use as a Constancy Channel, do one of the following:

- Touch one of the preset **NUCLIDE** keys (Select Nuclide Screen Hotkeys). Figure 12-3 Add Inventory Item Screen will re-appear with the selected nuclide shown in the **Nuclide:** field box.

- Touch the Nuclide name on the list on the right. (If necessary, scroll the list until the desired nuclide is displayed.) Once a nuclide is selected from the list, an **ACCEPT** button will appear. Touch the **ACCEPT** button to save the selected nuclide. Figure 12-3 Add Inventory Item Screen will re-appear with the selected nuclide shown in the chosen **Nuclide:** field box.

If Tc99m is the selected nuclide, **Study:** and **Mo/Tc:** field boxes will appear as shown in Figure 12-5 Inventory – Added Tc99m with Study: Field Box Screen.

The screenshot shows the 'Add Inventory Item' screen with the following fields and values:

Nuclide:	Tc99m (Technetium) 6.01 hr	STUDY:	
ID:			
Lot:			
Volume:			
Activity:		Measure	
Date:			
Mo/Tc:			

At the bottom left, there is a 'Ch' button and the text 'Ch: 2, R'. At the top left is a 'Home' button and at the top right is a 'Back' button.

Figure 12-5 Inventory – Added Tc99m with Study: Field Box Screen

Study

Note: The **Study:** field box is not required.

If Tc99m is the selected nuclide, the **Study:** field box will be displayed.

Touch the **Study:** field box. Figure 12-6 Inventory – Tc99m Select Study Screen will appear.

Home Add Inventory Item Back

Nuclide: Tc99m (Technetium) 6.01 hr STUDY:

ID:

Lot:

Volume:

Activity: Measure

Date:

Mo/Tc:

Please select study:

- None
- Bone
- Lung
- Hida
- Heart
- Renal
- Liver
- Brain
- Lymph

Ch Ch: 2, R

Figure 12-6 Inventory – Tc99m Select Study Screen

If plain Tc99m (not a kit) is being added, touch the *NONE* radio button. If the Tc99m being added is for a kit, touch the corresponding radio button to the study for which the kit is intended. Figure 12-5 Inventory – Added Tc99m with Study: Field Box Screen will re-appear with the chosen study name in the **Study:** field box.

Input ID

Note: The **ID:** field box is not required.

A 2-digit ID number may be input to distinguish the item being added from another one with the same nuclide and study. For the ID data, a numeric keypad will appear.

Input the ID number and touch the **ACCEPT** button. Figure 12-7 Inventory – ID: Field Box Screen will appear with the **ID:** field box populated with the entered ID number.

The screenshot shows a mobile application interface for adding an inventory item. The title bar is blue with 'Home' and 'Back' buttons. The main area is white with a list of input fields. The 'Nuclide' field is pre-filled with 'Tc99m (Technetium) 6.01 hr'. The 'ID' field contains '11'. The 'Lot', 'Volume', 'Activity', 'Date', and 'Mo/Tc' fields are currently empty or highlighted in pink. A 'Measure' button is located to the right of the 'Activity' field. A 'STUDY:' label is positioned to the right of the 'Nuclide' field. At the bottom, a blue bar displays 'Ch' and 'Ch: 2, R'.

Figure 12-7 Inventory – ID: Field Box Screen

To cancel any changes and return to Figure 12-5 Inventory – Added Tc99m with Study: Field Box Screen, touch the **CANCEL** button.

Input Lot Number

Note: The **Lot:** field box is not required.

An optional Lot Number of up to 15 characters (digits or letters) may be input.

For the **Lot:** data, an alphanumeric keyboard will appear. Input the data and touch the **ACCEPT** button. Figure 12-8 Inventory – Lot: Field Box Screen will appear with the **Lot:** field box populated with the entered Lot number.

Home Add Inventory Item Back

Nuclide: Tc99m (Technetium) 6.01 hr STUDY:

ID: 11

Lot: QW234

Volume:

Activity: Measure

Date:

Mo/Tc:

Ch Ch: 2, R

Figure 12-8 Inventory – Lot: Field Box Screen

To cancel any changes and return to Figure 12-5 Inventory – Added Tc99m with Study: Field Box Screen, touch the **CANCEL** button.

Volume

Note: The **Volume:** field box is required.

For the **Volume:** data, a numeric keypad will appear. Input the volume of the item using the keypad and touch the **ACCEPT** button. Figure 12-9 Inventory – Volume: Field Box Screen will appear with the **Volume:** field box populated with the entered volume.

Note: The minimum value that can be input is 1.00. The maximum value that can be input is 1000.00.

The screenshot shows a mobile application interface for adding an inventory item. The title bar at the top is blue and contains 'Home' on the left, 'Add Inventory Item' in the center, and 'Back' on the right. Below the title bar, there are several input fields arranged in a list:

- Nuclide:** Tc99m (Technetium) 6.01 hr
- ID:** 11
- Lot:** QW234
- Volume:** 100.000 ml
- Activity:** (empty field) with a blue 'Measure' button to its right.
- Date:** (empty field)
- Mo/Tc:** (empty field)

At the bottom of the screen, there is a blue bar with 'Ch' on the left and 'Ch: 2, R' in the center.

Figure 12-9 Inventory – Volume: Field Box Screen

Activity

Note: The **Activity:** field box is required.

The activity of the item may be measured or it may be input if the activity and time of a previous measurement are known.

Input Activity

To input the item's activity, touch the **Activity:** field box. Figure 12-10 Enter Activity Screen will appear.

The screenshot shows a dark background with yellow text at the top left that reads "Please Enter Activity:". Below this is a white input field containing "mCi". To the right of the input field is a "Backspace" button. Below the input field is a unit selection menu with three radio buttons: "Ci", "mCi" (which is selected), and "uCi". Below the unit selection menu is a numeric keypad with buttons for digits 0-9 and a decimal point. At the bottom of the screen are two buttons: "Accept" in green and "Cancel" in red.

Figure 12-10 Enter Activity Screen

Input the activity value using the keypad and touch the appropriate radio button for the unit of measure of the item.

Note: *The available units will change depending on which unit of measurement is in use on the Chamber Measurement screen. i.e. if set for Curies, the available units will be Ci, mCi and μ Ci; if set for Becquerels, the available units will be GBq and MBq.*

Touch the **ACCEPT** button. The Add Inventory screen will re-appear with **Activity:** field box populated with the entered activity.

To cancel any changes and return to the Add Inventory screen, touch the **CANCEL** button.

Measure Activity

To measure the item's current activity, touch the **MEASURE** button next to the **Activity:** field box. Figure 12-11 Inventory – Measure Activity Screen will appear.

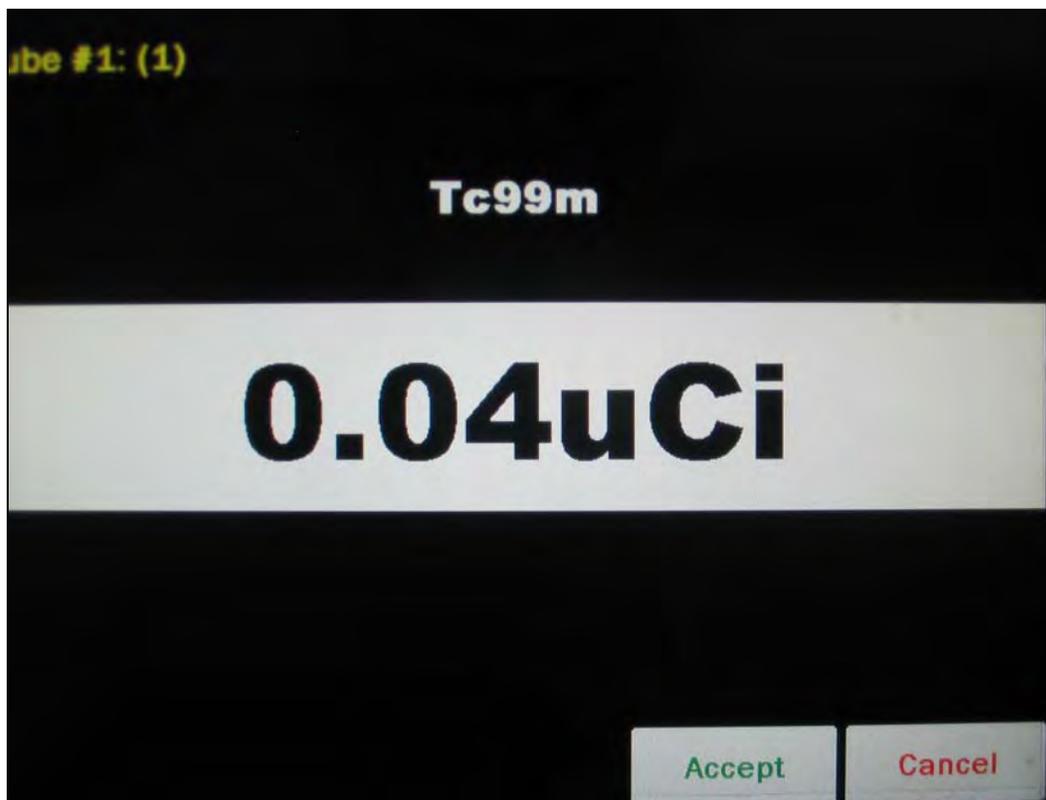


Figure 12-11 Inventory – Measure Activity Screen

Place the Inventory item into the Chamber.

To save the measurement, touch the **ACCEPT** button. The Add Inventory screen will re-appear with the **Activity:** field box populated with the accepted measured activity and the **Date:** field box will be populated with the measurement's date and time.

To abort the measurement, touch the **CANCEL** button. The Add Inventory screen will re-appear without saving the measurement.

Date

Note: *The **Date:** field box is required.*

If the activity of the item was measured as described above, the **Date:** field box will be populated with the accepted activity measurement's date and time. However, if the activity of the item was input, the **Date:** field box will be blank and therefore must be input.

To input the date for an item whose activity was input, touch the **Date:** field box. Figure 12-12 Date/Time Screen will appear.

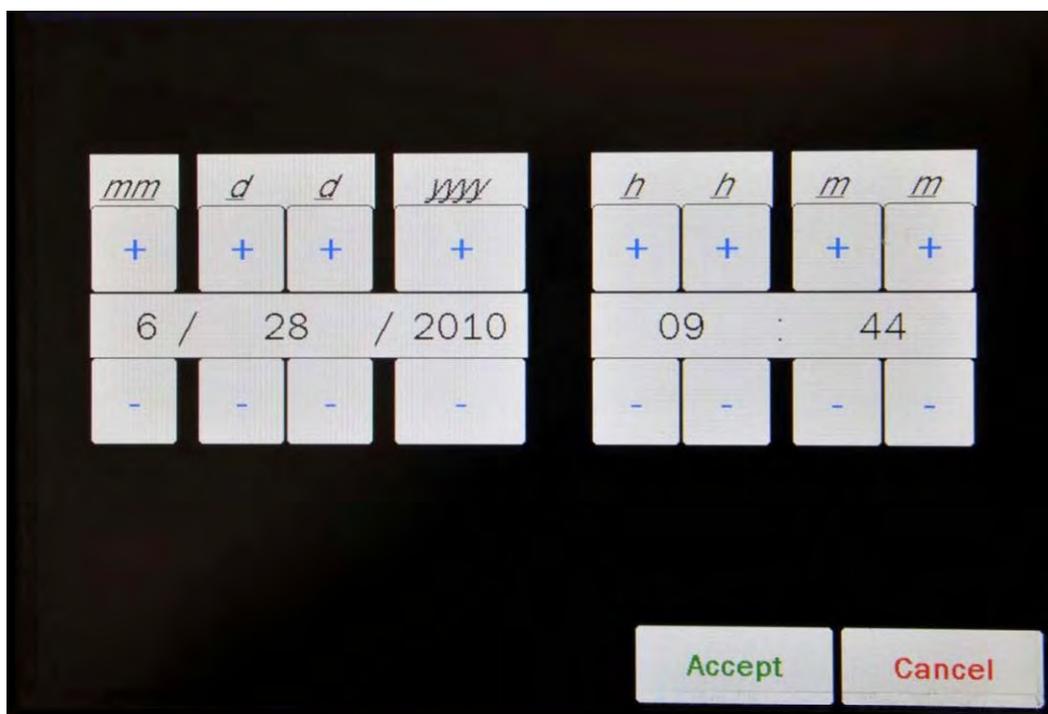


Figure 12-12 Date/Time Screen

The screen displays the currently set date and time. Above and below each of the fields are + and – buttons, respectively. To adjust the displayed value for a specific field, touch the + button to increase the displayed value or the – button to decrease the displayed value.

Adjust the displayed date and time to show the calibration date/time of the item being added to Inventory.

Touch the **ACCEPT** button to accept the set date and time. The Add Inventory screen will reappear with **Date** field box populated with the entered calibration date.

To cancel any changes and return to the Add Inventory screen, touch the **CANCEL** button.

Mo/Tc

Note: The **Mo/Tc:** field box is not required and will only appear if Tc99m is being added to the Inventory (with or without a study).

Note: The minimum value that can be input is 0.01 $\mu\text{Ci}/\text{mCi}$ (0.01 MBq/GBq). The maximum value that can be input is 99.00 $\mu\text{Ci}/\text{mCi}$ (99.00 MBq/GBq).

By default, the system will use the preset Mo/Tc limit that is set in the Moly Assay setup. (reference to CHAPTER 6: CHAMBER INITIALIZATION, SECTION: MOLY ASSAY SETUP). To use the default setting, leave this field blank.

If it is preferred to use a custom Mo/Tc limit for the item added to the Inventory, touch the **Mo/Tc**: field box. A numeric keypad will appear allowing for the entry of a new value.

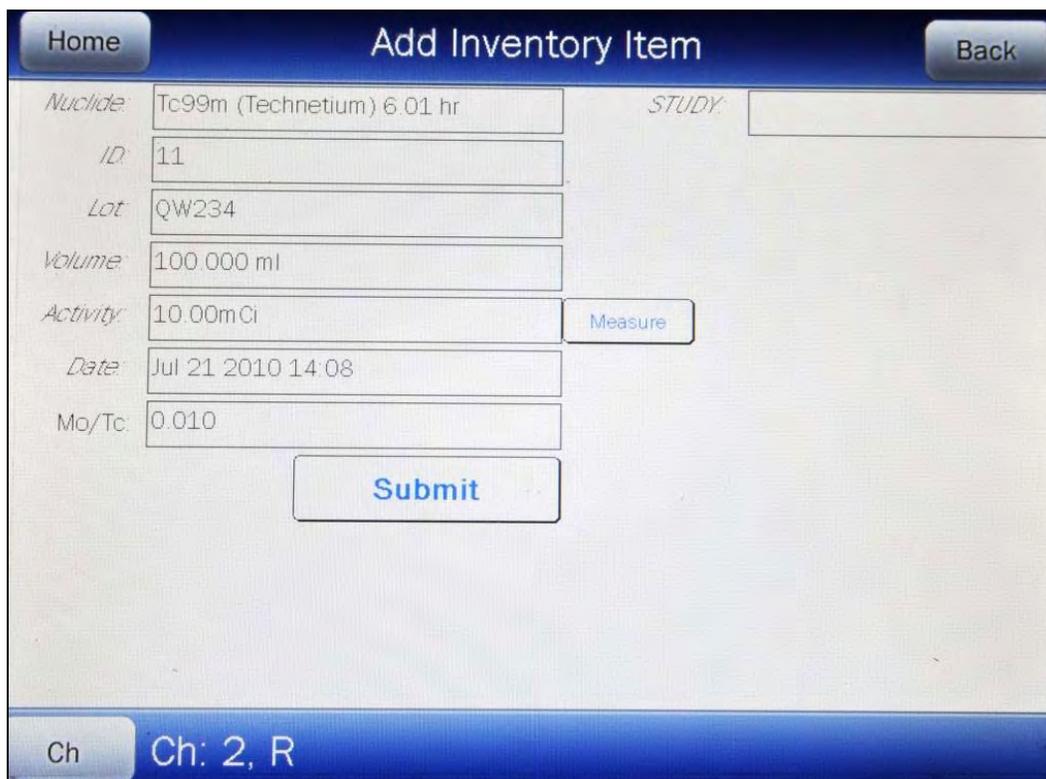
Input the new Mo/Tc value using the keypad and touch the **ACCEPT** button. The Add Inventory Item screen will re-appear with **Mo/Tc**: field box populated with the entered value.

To cancel changing the Mo/Tc limit, touch the **CANCEL** button on the numeric keypad.

The new value will only affect to the associated Tc99m Inventory item. Each Tc99m item added to Inventory can have a custom Mo/Tc limit.

Save Item to Inventory

After all of the required field boxes have been entered, a **SUBMIT** button will appear on the screen as shown in Figure 12-13 Inventory – Add Item with Submit Button.



The screenshot displays the 'Add Inventory Item' screen with the following fields and controls:

- Home** button (top left)
- Back** button (top right)
- Nuclide:** Tc99m (Technetium) 6.01 hr
- STUDY:** (empty field)
- ID:** 11
- Lot:** QW234
- Volume:** 100.000 ml
- Activity:** 10.00mCi
- Measure** button (next to Activity field)
- Date:** Jul 21 2010 14:08
- Mo/Tc:** 0.010
- Submit** button (centered below the Mo/Tc field)
- Ch** button (bottom left)
- Ch: 2, R** (bottom center)

Figure 12-13 Inventory – Add Item with Submit Button

If any of the displayed information is incorrect, touch the appropriate field box and make the necessary corrections.

When all of the displayed information is correct, touch the **SUBMIT** button. The screen will appear similar to that shown in Figure 12-14 Inventory Main Screen with Added Item.

The screenshot shows the 'Inventory' main screen. At the top, there are 'Home' and 'Back' buttons. The title 'Inventory' is centered. Below the title is the text 'Inventory List' and 'Page 1 of 1'. A table with the following columns is displayed: Nuclide, Study, Lot, ID, Activity, Volume, and Conc. The first row contains the data: Tc99m, QW234, 11, 9.97mCi, 100.0, and 99.7uCi. At the bottom of the screen, there are three buttons: 'Add Item', 'Delete All', and 'Print'.

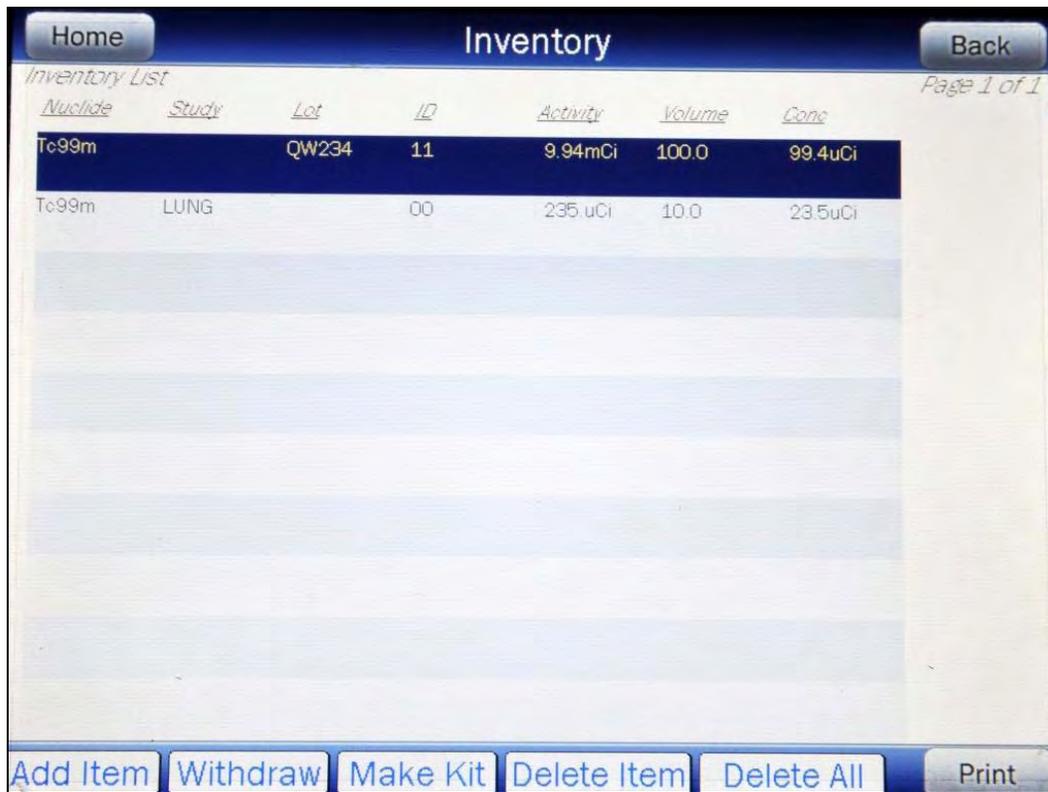
<i>Nuclide</i>	<i>Study</i>	<i>Lot</i>	<i>ID</i>	<i>Activity</i>	<i>Volume</i>	<i>Conc</i>
Tc99m		QW234	11	9.97mCi	100.0	99.7uCi

Figure 12-14 Inventory Main Screen with Added Item

MAKING A KIT

A kit can only be made from plain Tc99m. In other words, a kit can only be made from Tc99m Inventory item that is not used for a study.

To make a kit, select a plain Tc99m Inventory item in the list by touching the item. The entire line for the selected item will become highlighted and the **MAKE KIT** button will appear on the lower part of the screen as shown in Figure 12-15 Select Tc99m for Kit Screen.



Home Inventory Back

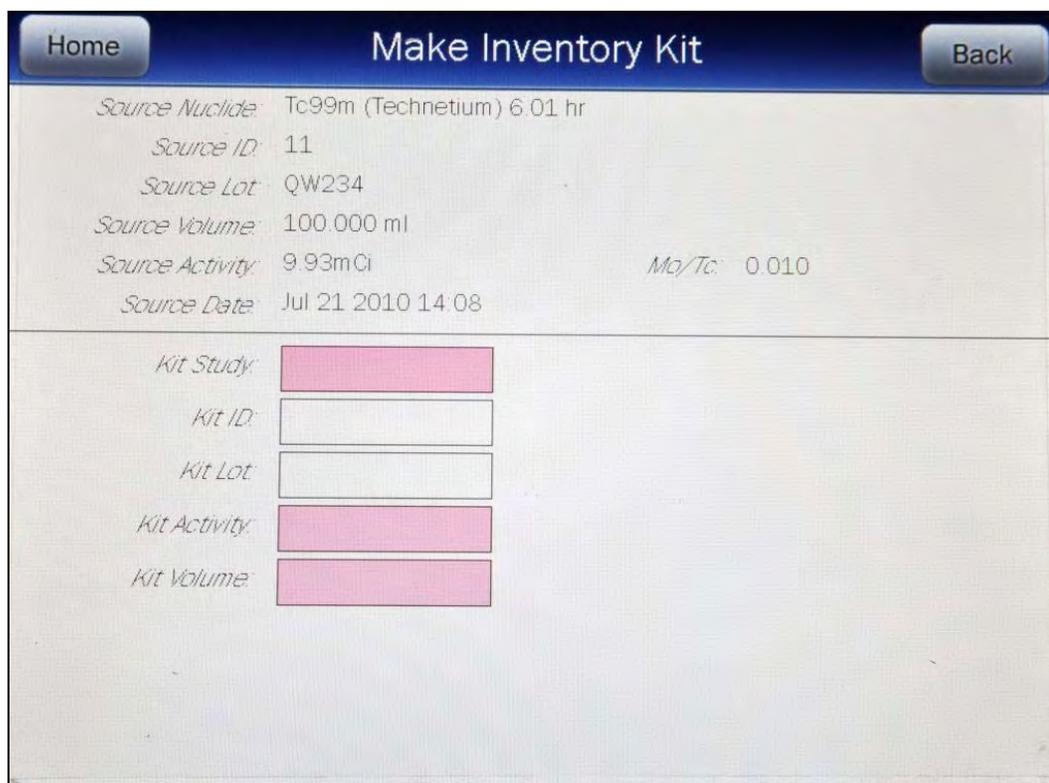
Inventory List Page 1 of 1

<i>Nuclide</i>	<i>Study</i>	<i>Lot</i>	<i>ID</i>	<i>Activity</i>	<i>Volume</i>	<i>Conc</i>
Tc99m		QW234	11	9.94mCi	100.0	99.4uCi
Tc99m	LUNG		00	235 uCi	10.0	23.5uCi

Add Item Withdraw Make Kit Delete Item Delete All Print

Figure 12-15 Select Tc99m for Kit Screen

Touch the **MAKE KIT** button. Figure 12-16 Make Inventory Kit Screen will appear.



Source Nuclide:	Tc99m (Technetium) 6.01 hr	
Source ID:	11	
Source Lot:	QW234	
Source Volume:	100.000 ml	
Source Activity:	9.93mCi	Mo/Tc: 0.010
Source Date:	Jul 21 2010 14:08	
<hr/>		
Kit Study:	<input type="text"/>	
Kit ID:	<input type="text"/>	
Kit Lot:	<input type="text"/>	
Kit Activity:	<input type="text"/>	
Kit Volume:	<input type="text"/>	

Figure 12-16 Make Inventory Kit Screen

The required fields (**Kit Study**, **Kit Activity**, and **Kit Volume**) flash pink. The fields not flashing (**Kit ID**, and **Kit Lot**) are not required.

To exit Figure 12-16 Make Inventory Kit Screen without saving any data input and return to Figure 12-2 Inventory Main Screen, touch the **BACK** button.

To exit Figure 12-16 Make Inventory Kit Screen without saving any data input and return to Figure 12-1 Chamber Measurement Screen, touch the **HOME** button.

Kit Study

Note: The **Kit Study:** field box is required.

Touch the **Kit Study:** field box. Figure 12-6 Inventory – Tc99m Select Study Screen will appear.

Home Back

Make Inventory Kit

Source Nuclide: Tc99m (Technetium) 6.01 hr
 Source ID: 11
 Source Lot: QW234
 Source Volume: 100.000 ml
 Source Activity: 9.93mCi Mo/Tc: 0.010
 Source Date: Jul 21 2010 14:08

Kit Study: **Please select study.**

Kit ID: None Renal

Kit Lot: Bone Liver

Kit Activity: Lung Brain

Kit Volume: Hida Lymph

Heart

Figure 12-17 Make Kit – Please Select Study Screen

A study must be selected for the kit. Touch the corresponding radio button to the study for which the kit is intended. Figure 12-16 Make Inventory Kit Screen will re-appear with the chosen study name in the **Kit Study:** field box.

Kit ID

Note: The **Kit ID:** field box is not required.

A 2-digit ID number may be input to distinguish the item being added from another one with the same nuclide and study. For the ID data, a numeric keypad will appear.

Input the ID number and touch the **ACCEPT** button. Figure 12-16 Make Inventory Kit Screen will appear with the **Kit ID:** field box populated with the entered ID number.

To cancel any changes and return to Figure 12-16 Make Inventory Kit Screen, touch the **CANCEL** button.

Kit Lot Number

Note: The **Kit Lot:** field box is not required.

An optional Lot Number of up to 15 characters (digits or letters) may be input.

For the **Kit Lot:** data, an alphanumeric keyboard will appear. Input the data and touch the **ACCEPT** button. Figure 12-16 Make Inventory Kit Screen will appear with the **Kit Lot:** field box populated with the entered Lot number.

To cancel any changes and return to Figure 12-16 Make Inventory Kit Screen, touch the **CANCEL** button.

Kit Activity

Note: The **Kit Activity:** field box is required.

The required activity of the item must be input.

To input the required activity, touch the **Kit Activity:** field box. Figure 12-18 Enter Activity Screen will appear.

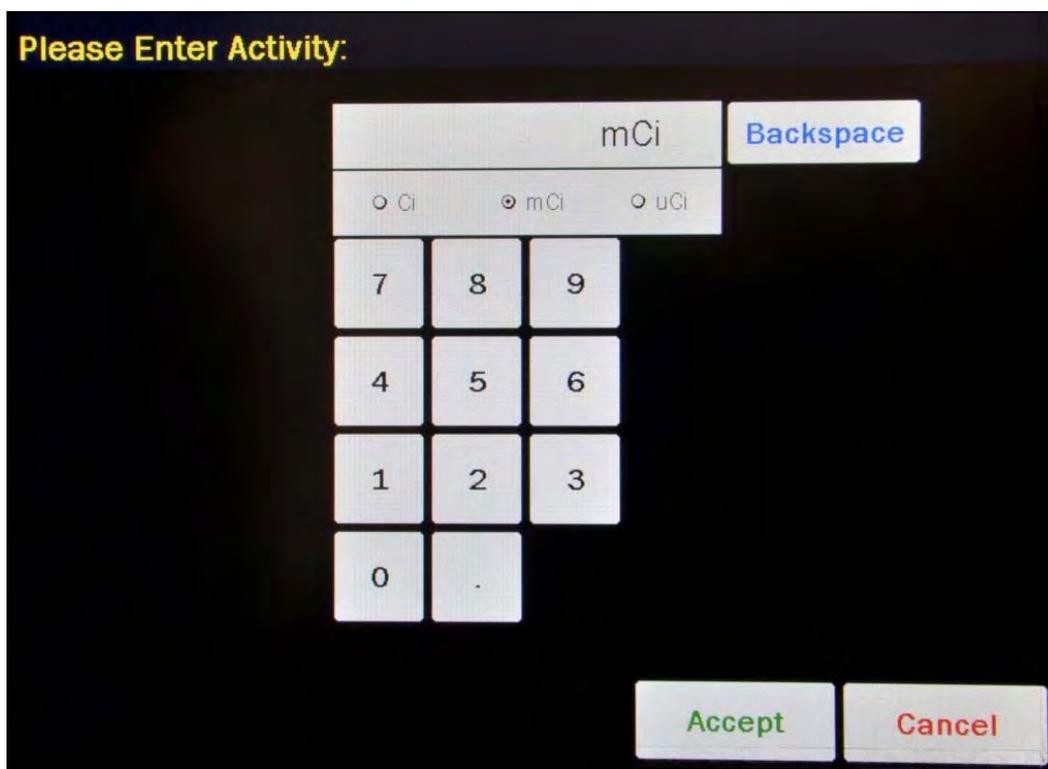


Figure 12-18 Enter Activity Screen

Input the activity needed using the keypad and touch the appropriate radio button for the unit of measure of the item.

Note: The available units will change depending on which unit of measurement is in use on the Chamber Measurement screen. i.e. if set for Curies, the available units will be Ci, mCi and μ Ci; if set for Becquerels, the available units will be GBq and MBq.

Touch the **ACCEPT** button. Figure 12-16 Make Inventory Kit Screen will re-appear with **Kit Activity:** field box populated with the entered activity.

The activity needed for the kit cannot exceed the activity of the Inventory item chosen for the kit. If the entered activity is greater than what is available, a message will appear in red that states "KIT ACTIVITY GREATER THAN THAT IN SOURCE" as shown Figure 12-19 Make Kit High Activity Message Screen.

The screenshot shows the 'Make Inventory Kit' screen with the following data:

Source Nuclide:	Tc99m (Technetium) 6.01 hr	
Source ID:	11	
Source Lot:	QW234	
Source Volume:	100.000 ml	
Source Activity:	9.88mCi	Mo/Tc: 0.010
Source Date:	Jul 21 2010 14:08	
Kit Study:	LUNG	
Kit ID:		
Kit Lot:		
Kit Activity:	25.0mCi	KIT ACTIVITY GREATER THAN THAT
Kit Volume:	1.000 ml	IN SOURCE

Figure 12-19 Make Kit High Activity Message Screen

To cancel any changes and return to Figure 12-16 Make Inventory Kit Screen, touch the **CANCEL** button.

Kit Volume

Note: The **Kit Volume:** field box is required.

For the **Kit Volume:** data, a numeric keypad will appear. Input the volume of the item using the keypad and touch the **ACCEPT** button. Figure 12-16 Make Inventory Kit Screen will appear with the **Kit Volume:** field box populated with the entered volume.

Note: The minimum value that can be input is 1.00. The maximum value that can be input is 100.00.

The kit volume selected must be enough to accommodate the activity needed.

If the entered volume not sufficient enough to draw the required activity, a message will appear in red that states “KIT VOLUME LESS THAN THE XX.XXX ml DRAW FROM SOURCE” as shown Figure 12-20 Make Kit Too Little Volume Message Screen. The XX.XXX ml is the minimum volume needed to fulfill the activity requested.

The screenshot shows the 'Make Inventory Kit' screen with the following data:

Source Nuclide:	Tc99m (Technetium) 6.01 hr	
Source ID:	11	
Source Lot:	QW234	
Source Volume:	100.000 ml	
Source Activity:	9.89mCi	Mo/Tc: 0.010
Source Date:	Jul 21 2010 14:08	
Kit Study:	LUNG	
Kit ID:		
Kit Lot:		
Kit Activity:	5.00mCi	KIT VOLUME LESS THAN THE 50.567 ml DRAW FROM SOURCE
Kit Volume:	1.000 ml	

Figure 12-20 Make Kit Too Little Volume Message Screen

Measure Kit Activity

When the Kit Volume is sufficient, withdraw the required volume that is displayed on the screen from the Tc99m Inventory item used for the kit.

To measure the kit's activity, touch the **MEASURE ACTIVITY** button. Figure 12-21 Kit Please Measure Withdrawal Screen will appear.

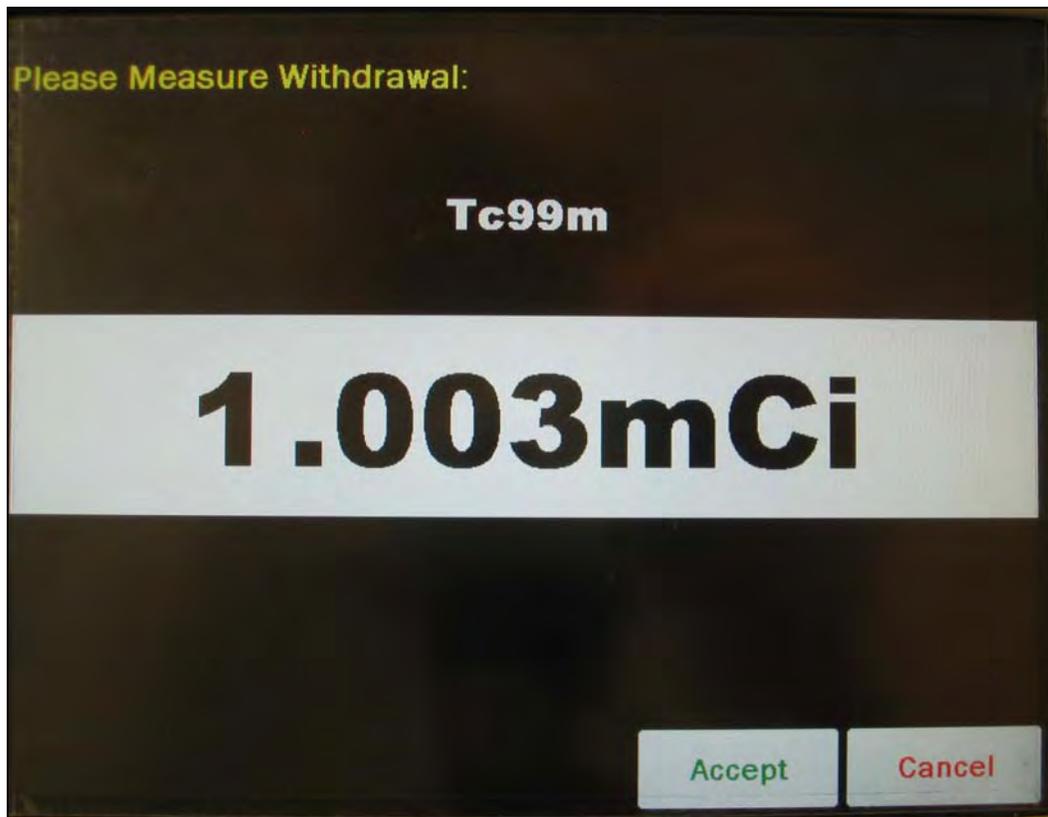


Figure 12-21 Kit Please Measure Withdrawal Screen

Place the kit into the Chamber.

To save the measurement, touch the **ACCEPT** button. The Inventory Main screen will re-appear with the added kit shown in the Inventory List.

To abort the measurement, touch the **CANCEL** button.

WITHDRAWING FROM INVENTORY

To withdraw activity from an item in Inventory to be used for a patient (not for a kit), select an Inventory Item from the list by touching the desired item. The entire line for the selected item will become highlighted and the **WITHDRAW** button will appear on the lower part of the screen as shown in Figure 12-22 Inventory Screen with All Buttons.

Home Inventory Back

Inventory List Page 1 of 1

<i>Nuclide</i>	<i>Study</i>	<i>Lot</i>	<i>ID</i>	<i>Activity</i>	<i>Volume</i>	<i>Conc</i>
Tc99m		QW234	11	9.88mCi	100.0	98.8uCi
Tc99m	LUNG		00	234 uCi	10.0	23.4uCi

Add Item Withdraw Make Kit Delete Item Delete All Print

Figure 12-22 Inventory Screen with All Buttons

Touch the **WITHDRAW** button.

Both fields are required (***Withdraw Activity*** and ***Time of Use***) and flash pink.

To exit without saving any data input and return to Figure 12-22 Inventory Screen with All Buttons, touch the **BACK** button.

To exit without saving any data input and return to Figure 12-1 Chamber Measurement Screen, touch the **HOME** button.

Withdraw Activity

Touch the ***Withdraw Activity***: field box. Figure 12-23 Enter Activity Screen will appear.

Please Enter Activity:

mCi Backspace

Ci mCi uCi

7 8 9

4 5 6

1 2 3

0 .

Accept Cancel

Figure 12-23 Enter Activity Screen

Input the activity value using the keypad and touch the appropriate radio button for the unit of measure of the item.

Note: *The available units will change depending on which unit of measurement is in use on the Chamber Measurement screen. i.e. if set for Curies, the available units will be Ci, mCi and μ Ci; if set for Becquerels, the available units will be GBq and MBq.*

Touch the **ACCEPT** button. The **Withdraw Activity:** field box will be populated with the entered activity.

To cancel any changes, touch the **CANCEL** button.

Time of Use

Input the date and time that the item withdrawn will be used by touching the **Time of Use:** field box. Figure 12-24 Date/Time Screen will appear.

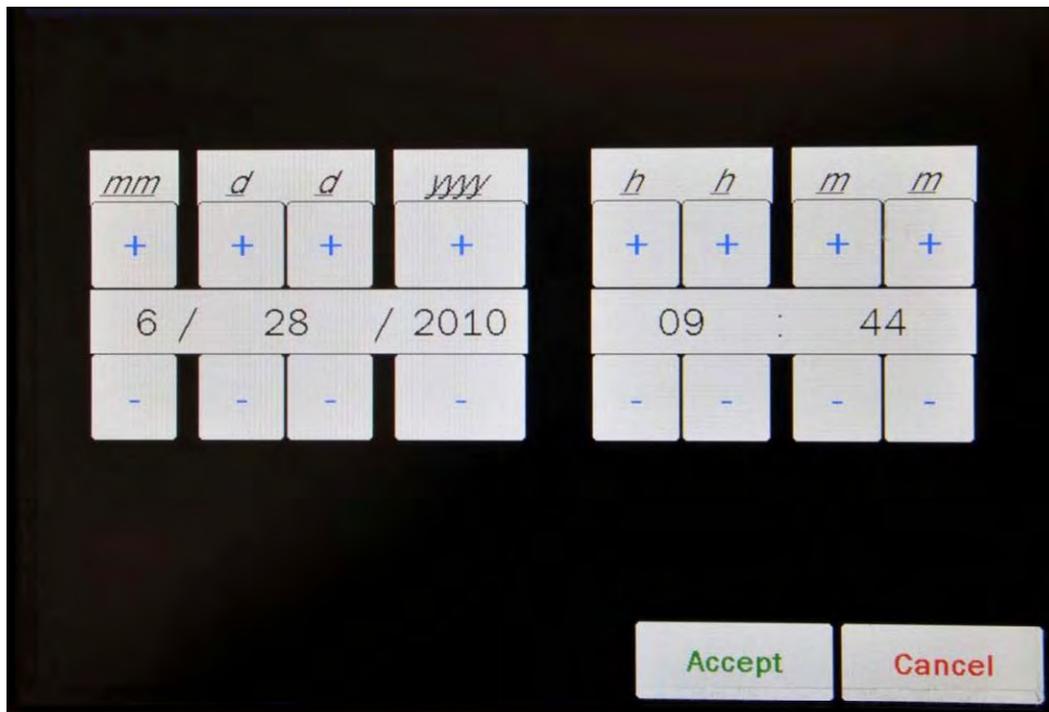


Figure 12-24 Date/Time Screen

The screen displays the currently set date and time. Above and below each of the fields are + and – buttons, respectively. To adjust the displayed value for a specific field, touch the + button to increase the displayed value or the – button to decrease the displayed value.

Adjust the displayed date and time to show the calibration date/time of use of the item being withdrawn.

Touch the **ACCEPT** button to accept the set date and time. The Add Inventory screen will reappear with **Date** field box populated with the entered calibration date.

To cancel any changes and return to the Add Inventory screen, touch the **CANCEL** button.

Measure Activity

Withdraw the required volume that is displayed on the screen from the Tc99m Inventory item.

To measure the activity, touch the **MEASURE ACTIVITY** button. Figure 12-25 Please Measure Withdrawal Screen will appear.

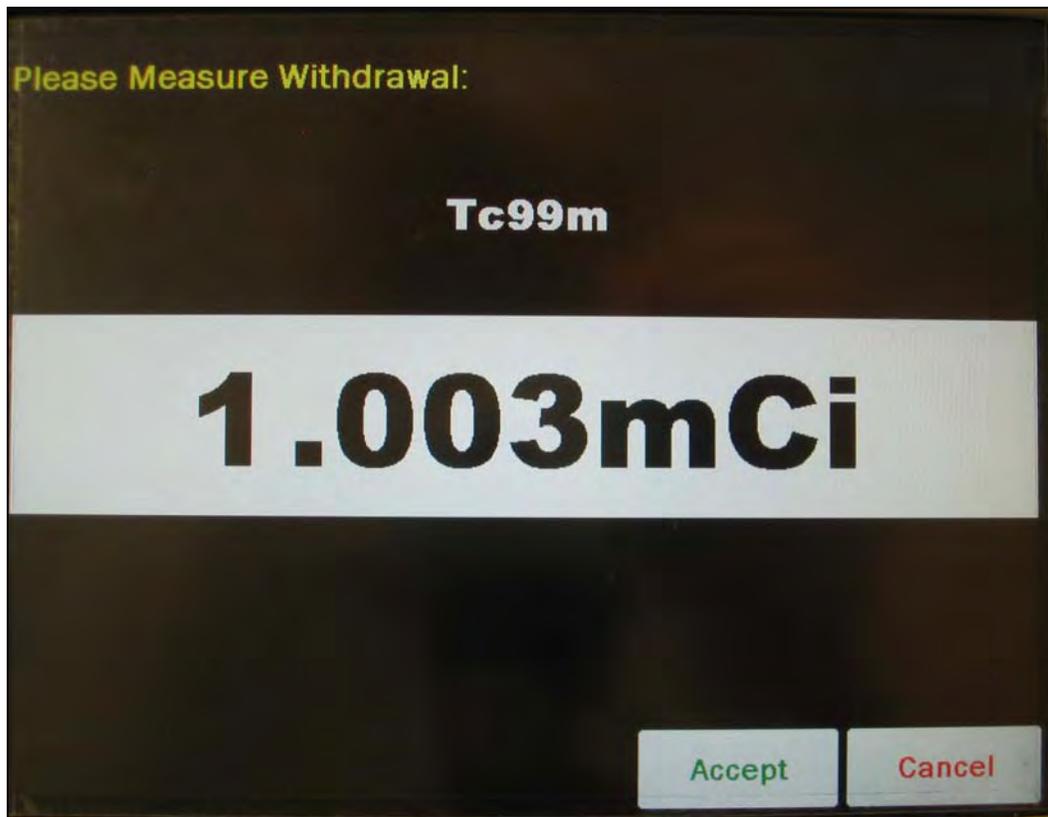


Figure 12-25 Please Measure Withdrawal Screen

Place the sample into the Chamber.

To save the measurement, touch the **ACCEPT** button. The Inventory Main screen will re-appear with the added kit shown in the Inventory List.

To abort the measurement, touch the **CANCEL** button. The measured activity amount will be subtracted from the selected Inventory item.

PRINTING THE INVENTORY

If a printer is attached to the system, a **PRINT** button will appear on the screen. Touch the **PRINT** button to print the Inventory List.

The contents of the Inventory will be printed, showing the current volume, current activity and for Tc99m, the current Mo to Tc ratio (unless no value was entered).

DELETING FROM INVENTORY

Items can be deleted from inventory in two ways: individually or all items

Delete Individual Items

To delete individual items, select an Inventory Item from the list by touching the desired item. The entire line for the selected item will become highlighted and the **DELETE ITEM** button will appear on the lower part of the screen as shown in Figure 12-26 Inventory Screen with All Buttons.

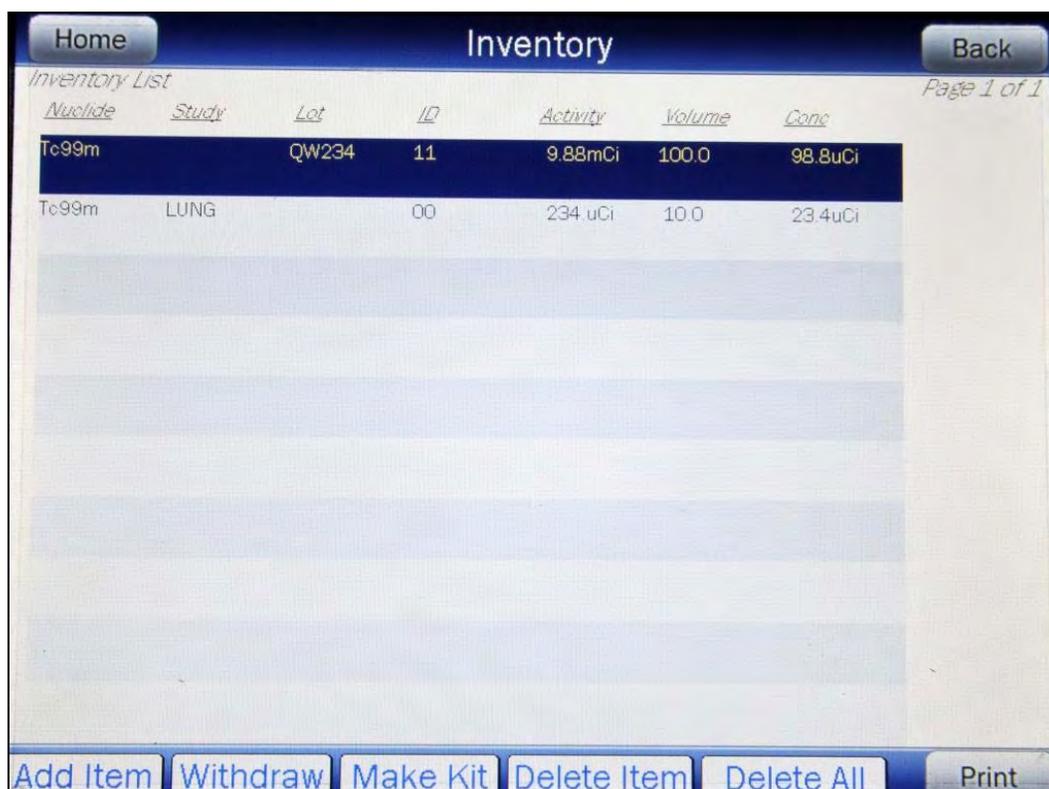


Figure 12-26 Inventory Screen with All Buttons

Touch the **DELETE ITEM** button.

To delete the selected Inventory item, touch the **DELETE INVENTORY** button. Figure 12-26 Inventory Screen with All Buttons will re-appear with the selected item removed from the Inventory List.

To exit without deleting the selected item and return to Figure 12-26 Inventory Screen with All Buttons, touch the **BACK** button.

To exit without deleting the selected item and return to Figure 12-1 Chamber Measurement Screen, touch the **HOME** button.

Delete All Items

To delete all items in the Inventory, touch the **DELETE ALL** button located on the lower part of the screen as shown in Figure 12-26 Inventory Screen with All Buttons.

To delete the all Inventory items, touch the **YES** button. Figure 12-26 Inventory Screen with All Buttons will re-appear with all of the Inventory items removed from the Inventory List.

To exit without deleting all Inventory items and return to Figure 12-26 Inventory Screen with All Buttons, touch the **NO** or **BACK** button.

To exit without deleting all Inventory items and return to Figure 12-1 Chamber Measurement Screen, touch the **HOME** button.

CHAPTER 13

DOSE TABLE

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GENERAL

The Dose Table function is used to print a table showing the volume to be withdrawn from a measured sample to obtain a desired dose at future times for the activity that is being measured.

From Figure 13-1 Chamber Measurement Screen, touch the **UTIL** button. Figure 13-2 Utility Screen will appear.

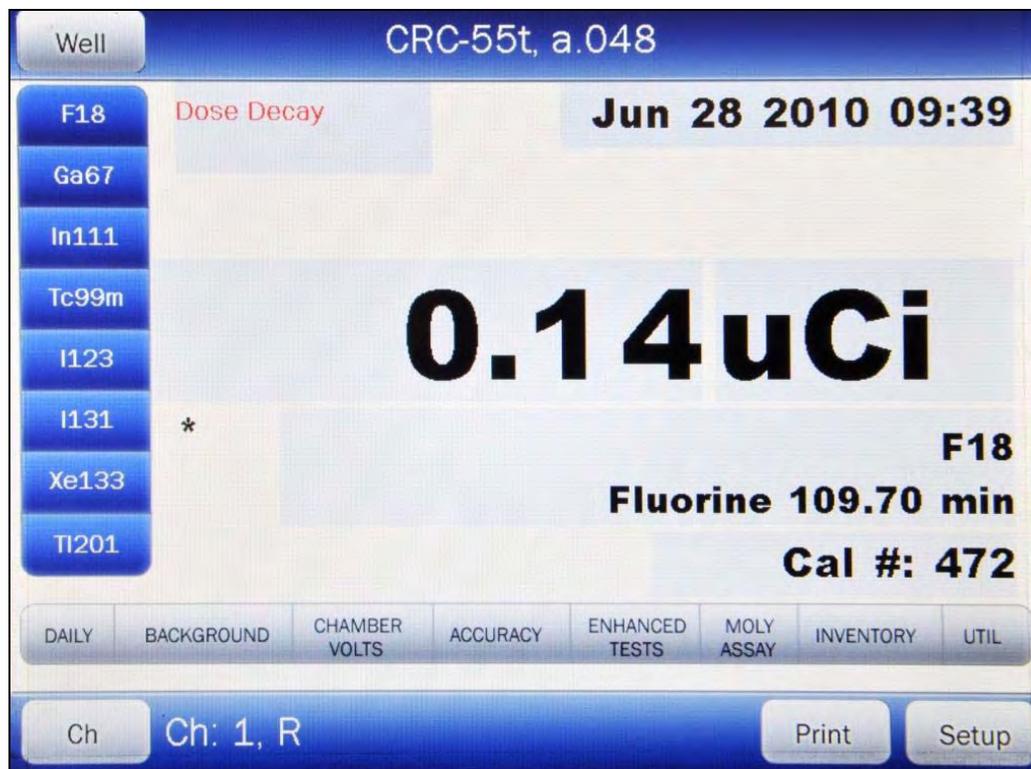


Figure 13-1 Chamber Measurement Screen

Home Utility Back

[Ci, Bq Conv] Input Activity:

[Decay Calculator]

Nuclide:

FROM: act

TO: act

Diagnostics

Dose Table

S/N: 000000

Figure 13-2 Utility Screen

Touch the **DOSE TABLE** button.

To exit without saving any data input and return to Figure 13-2 Utility Screen, touch the **BACK** button.

To exit without saving any data input and return to Figure 13-1 Chamber Measurement Screen, touch the **HOME** button.

NUCLIDE

When entering the Dose Table function, the nuclide that was being measured on Figure 13-1 Chamber Measurement Screen will be set as the default nuclide.

To select a different nuclide, touch the **Nuclide** field box. Figure 13-3 Select Nuclide Screen will appear.

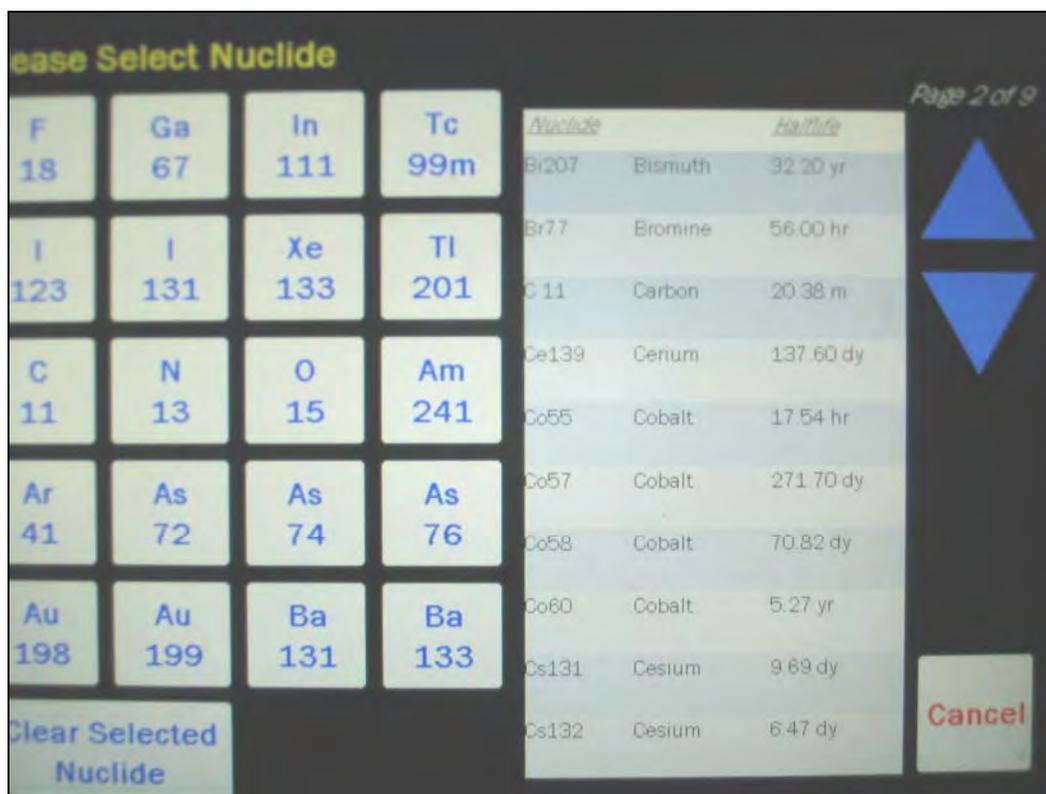


Figure 13-3 Select Nuclide Screen

The left half of the Select Nuclide screen contains the 20 preset **NUCLIDE** buttons (these are the Select Nuclide Screen Hotkeys). The right half of the screen displays a listing of nuclides stored in the calibrator's memory (both default and user added nuclides) that have a Calibration Number assigned to them) – 10 at a time.

The nuclide list is in alphabetical order. User added nuclides are displayed at the top of the list. The length of the list will vary depending on which nuclides have a Calibration Number assigned to them. The number of pages shown in the upper right corner of the screen indicates the length of the list. To scroll through the list, touch the **DOWN ARROW** button. The next group of 10 nuclides will be displayed and the **UP ARROW** button will appear allowing the user to scroll up in the list.

To cancel the nuclide selection, touch the **CANCEL** button.

To assign a nuclide for use for the Dose Table, do one of the following:

- Touch one of the preset **NUCLIDE** keys (Select Nuclide Screen Hotkeys). The selected nuclide and its half-life will be shown in the **Nuclide** field box.
- Touch the Nuclide name on the list on the right. (If necessary, scroll the list until the desired nuclide is displayed.) Once a nuclide is selected from the list, an **ACCEPT** button will appear. Touch the **ACCEPT** button to select nuclide. The selected nuclide and half-life will be shown in the **Nuclide** field box.

ACTIVITY

To measure the nuclide's current activity, touch the **Activity** field box. Figure 13-4 Measure Activity Screen will appear.

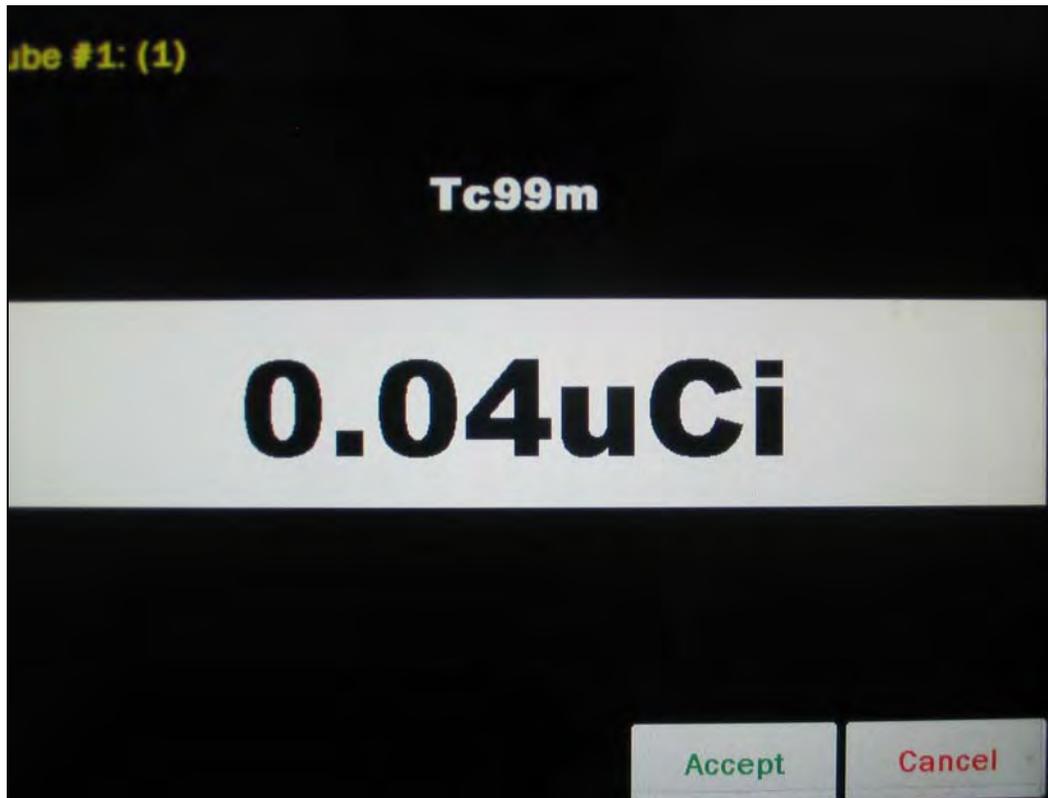


Figure 13-4 Measure Activity Screen

Place the nuclide into the Chamber.

To save the measurement, touch the **ACCEPT** button. The **Activity** field box will be populated with the accepted measured activity.

To abort the measurement, touch the **CANCEL** button.

VOLUME

To input the volume of the sample that the dose will be drawn from in ml, touch the **Volume** field box. A numeric keypad will appear. Input the volume using the keypad and touch the **ACCEPT** button. The **Volume** field box will be populated with the entered volume.

Note: The minimum value that can be input is 1.00 ml. The maximum value that can be input is 1000.00 ml.

To abort the entering the volume, touch the **CANCEL** button.

DOSE

To input the desired activity of the dose, touch the **Dose** field box. Figure 13-5 Enter Activity Screen will appear.

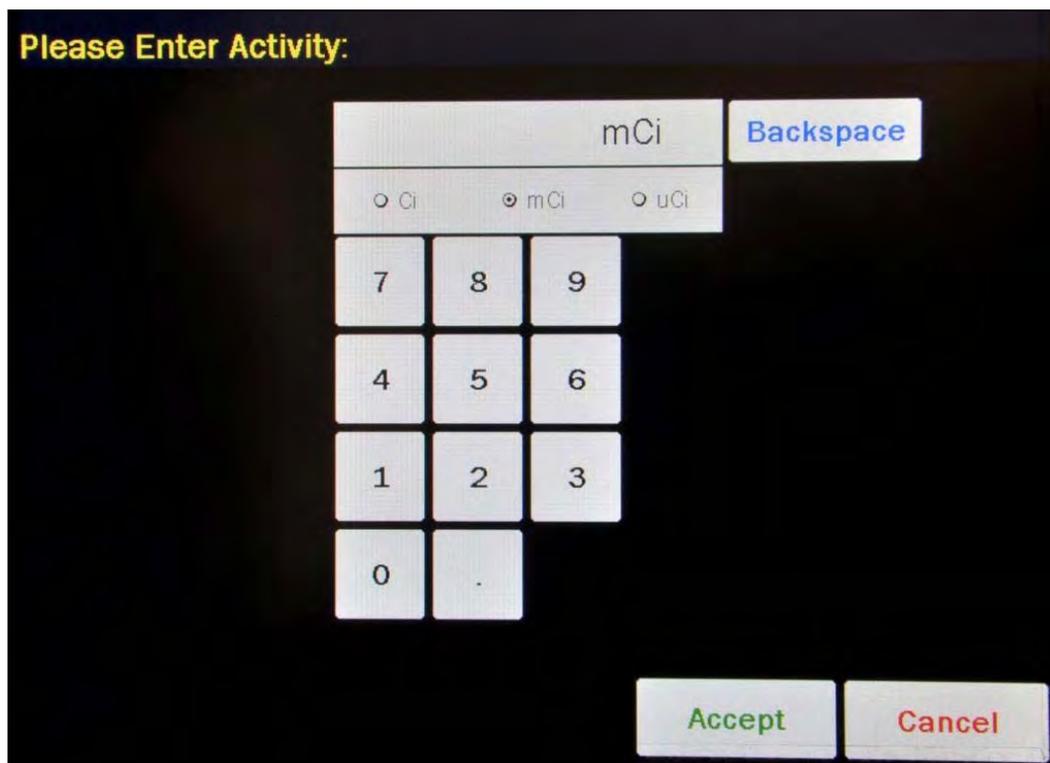


Figure 13-5 Enter Activity Screen

Input the desired activity of the dose using the keypad and touch the appropriate radio button for the unit of measure of the item.

Note: The available units will change depending on which unit of measurement is in use on the Chamber Measurement screen. i.e. if set for Curies, the available units will be Ci, mCi and μ Ci; if set for Becquerels, the available units will be GBq and MBq.

To cancel any changes, touch the **CANCEL** button.

Touch the **ACCEPT** button. The **Dose** field box will be populated with the entered activity.

RESULTS

After all field boxes are filled in, the calculated results will be displayed with the time and required volume for the desired dose at the specified time intervals appropriate to the nuclide (based on the half life) for up to 30 time intervals as shown in Figure 13-6 Dose Table Results Screen.

<i>Nuclide</i>	<i>Activity</i>	<i>Volume</i>	<i>Dose</i>	<i>Interval</i>
Tc99m, 6.01hr	199.5mCi	100.000 ml	20.0mCi	30 min
14:25 - 10.03 ml	19:25 - 17.86 ml	00:25 - 31.81 ml		
14:55 - 10.63 ml	19:55 - 18.92 ml	00:55 - 33.69 ml		
15:25 - 11.26 ml	20:25 - 20.05 ml	01:25 - 35.70 ml		
15:55 - 11.93 ml	20:55 - 21.24 ml	01:55 - 37.82 ml		
16:25 - 12.64 ml	21:25 - 22.50 ml	02:25 - 40.06 ml		
16:55 - 13.39 ml	21:55 - 23.84 ml	02:55 - 42.44 ml		
17:25 - 14.18 ml	22:25 - 25.25 ml	03:25 - 44.96 ml		
17:55 - 15.02 ml	22:55 - 26.75 ml	03:55 - 47.63 ml		
18:25 - 15.92 ml	23:25 - 28.34 ml	04:25 - 50.46 ml		
18:55 - 16.86 ml	23:55 - 30.02 ml	04:55 - 53.46 ml		

Figure 13-6 Dose Table Results Screen

If there is not enough volume for the dose, the last time will show the message “EXCEEDS INTIAL”. This indicates that the volume required for the dose at that time exceeds the sample’s initial volume that was entered.

INTERVAL

The **Interval** field box is the time in minutes from the current time that will be used for calculating the required volume for the dose at the times specified. The default interval is 30 minutes.

To change the default time interval, touch the **Interval** field box. A numeric keypad will appear. Input the time interval using the keypad and touch the **ACCEPT** button. **Error!**

Reference source not found. will appear with the *Interval* field box populated with the entered time.

Note: *The minimum time interval that can be input is 1 minute. The maximum time interval that can be input is 999 minutes.*

The Interval can be changed repeatedly to obtain new results based on the entered interval.

PRINTING THE RESULTS

If a printer is attached to the system, a **PRINT** button will appear on the screen. Touch the **PRINT** button to print the results.

CHAPTER 14

CALCULATION UTILITIES

GENERAL 1
CONVERSION BETWEEN Ci AND Bq 2
DECAY CALCULATOR 3
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GENERAL

Two calculation utilities are provided with the CRC®-55t:

- Conversion between Ci and Bq and
- Decay Calculation.

To access the calculation utilities, touch the **UTIL** button from Figure 14-1 Chamber Measurement Screen. Figure 14-2 Utility Screen will appear.

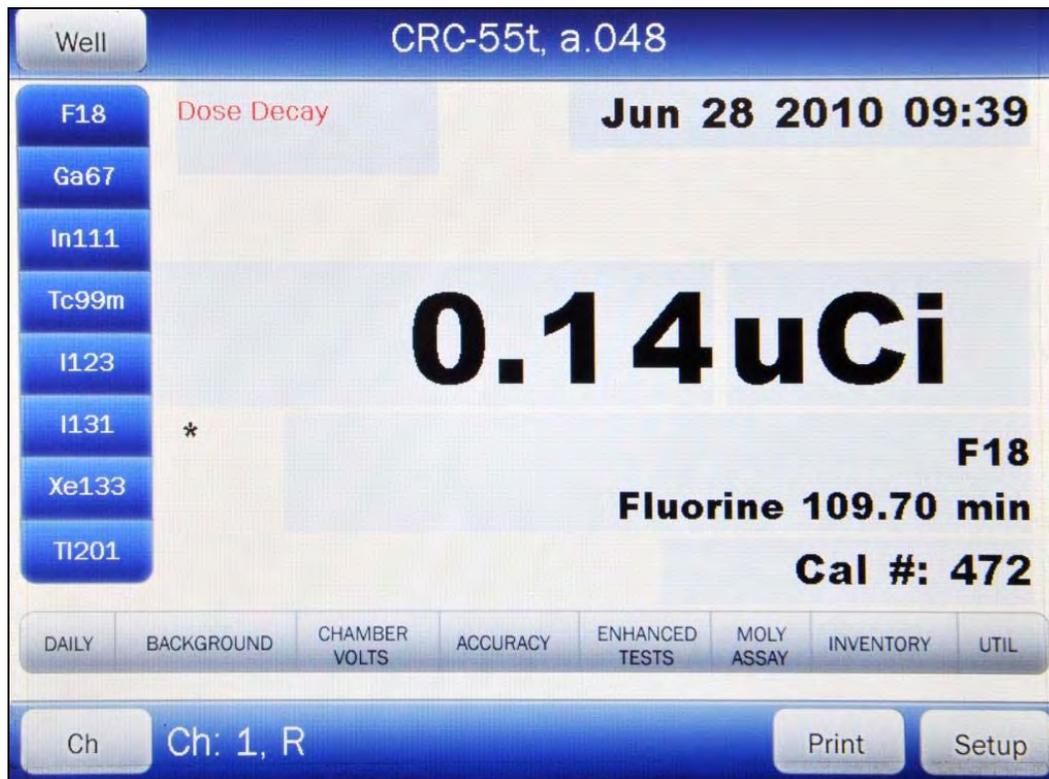


Figure 14-1 Chamber Measurement Screen

Home Utility Back

[Ci,Bq Conv] Input Activity:

[Decay Calculator]

Nuclide:

FROM: act

TO: act

Diagnostics

Dose Table

S/N: 000000

Figure 14-2 Utility Screen

CONVERSION BETWEEN Ci AND Bq

Located in the top section of Figure 14-2 Utility Screen is the Curie/Becquerel converter. An activity is input in Curies and the value is displayed in Becquerels or an activity is input in Becquerels and the value is displayed in Curies.

To perform a conversion, touch the **[Ci,Bq Conv] Input Activity:** field box. Figure 14-3 Enter Activity Screen will appear.

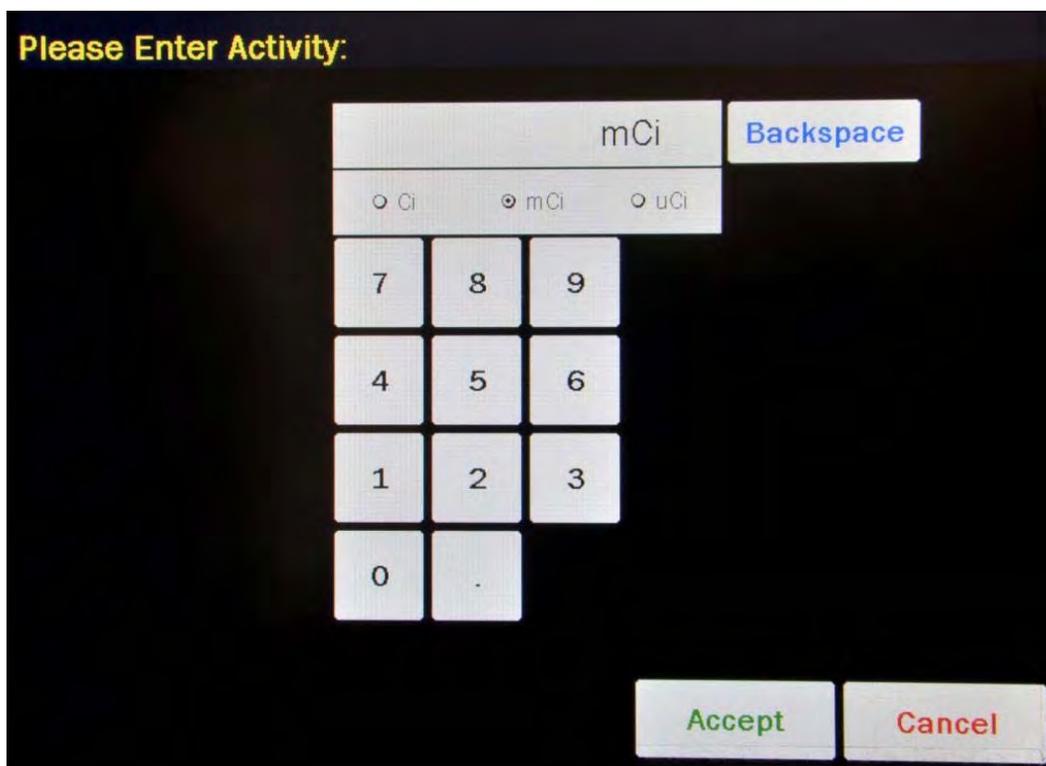


Figure 14-3 Enter Activity Screen

Input the activity to be converted using the keypad and touch the appropriate radio button for the unit of measure.

To exit the Curie/Becquerel converter and return to Figure 14-2 Utility Screen, touch the **CANCEL** button.

Once the activity and units are correct, touch the **ACCEPT** button. Figure 14-2 Utility Screen will re-appear with the **[Ci,Bq Conv] Input Activity:** field box populated with the entered activity. The result of the conversion is located next to the field box.

To perform another conversion, touch the **[Ci,Bq Conv] Input Activity:** field box. Figure 14-3 Enter Activity Screen will appear.

DECAY CALCULATOR

Located in the center section of Figure 14-2 Utility Screen is the Decay Calculator. This utility is used to calculate the activity of a source at a different time (either in the past or the future).

Select Nuclide

To select the desired nuclide, touch the **Nuclide:** field box. Figure 14-4 Select Nuclide Screen will appear.

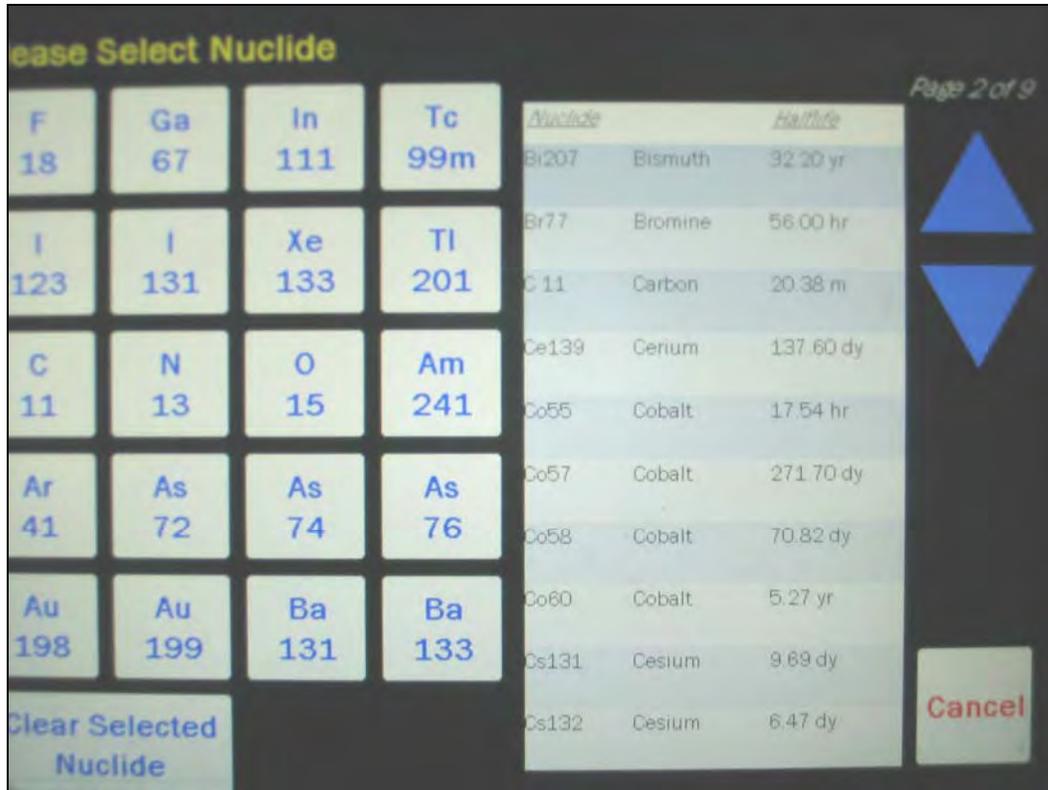


Figure 14-4 Select Nuclide Screen

The left half of the Select Nuclide screen contains the 20 preset **NUCLIDE** buttons (these are the Select Nuclide Screen Hotkeys). The right half of the screen displays a listing of nuclides stored in the calibrator's memory (both default and user added nuclides) that have a Calibration Number assigned to them) – 10 at a time.

The nuclide list is in alphabetical order. User added nuclides are displayed at the top of the list. The length of the list will vary depending on which nuclides have a Calibration Number assigned to them. The number of pages shown in the upper right corner of the screen indicates the length of the list. To scroll through the list, touch the **DOWN ARROW** button. The next group of 10 nuclides will be displayed and the **UP ARROW** button will appear allowing the user to scroll up in the list.

To cancel the nuclide selection and return to Figure 14-2 Utility Screen, touch the **CANCEL** button.

To select a nuclide for calculation, do one of the following:

- Touch one of the preset **NUCLIDE** keys (Select Nuclide Screen Hotkeys). Figure 14-2 Utility Screen will re-appear with the selected nuclide name and half-life shown in the **Nuclide:** field box.
- Touch the Nuclide name on the list on the right. (If necessary, scroll the list until the desired nuclide is displayed.) Once a nuclide is selected from the list, an **ACCEPT** button will appear. Touch the **ACCEPT** button to use the selected nuclide. Figure 14-2 Utility Screen will re-appear with the selected nuclide name and half-life shown in the chosen **Nuclide:** field box.

Date and Activity

The beginning (From) and ending (To) date, time and activity must be input to perform the calculation.

Beginning Date and Time

To input the beginning date and time for the calculation, touch the **FROM:** field box. Figure 14-5 Date/Time Screen will appear.

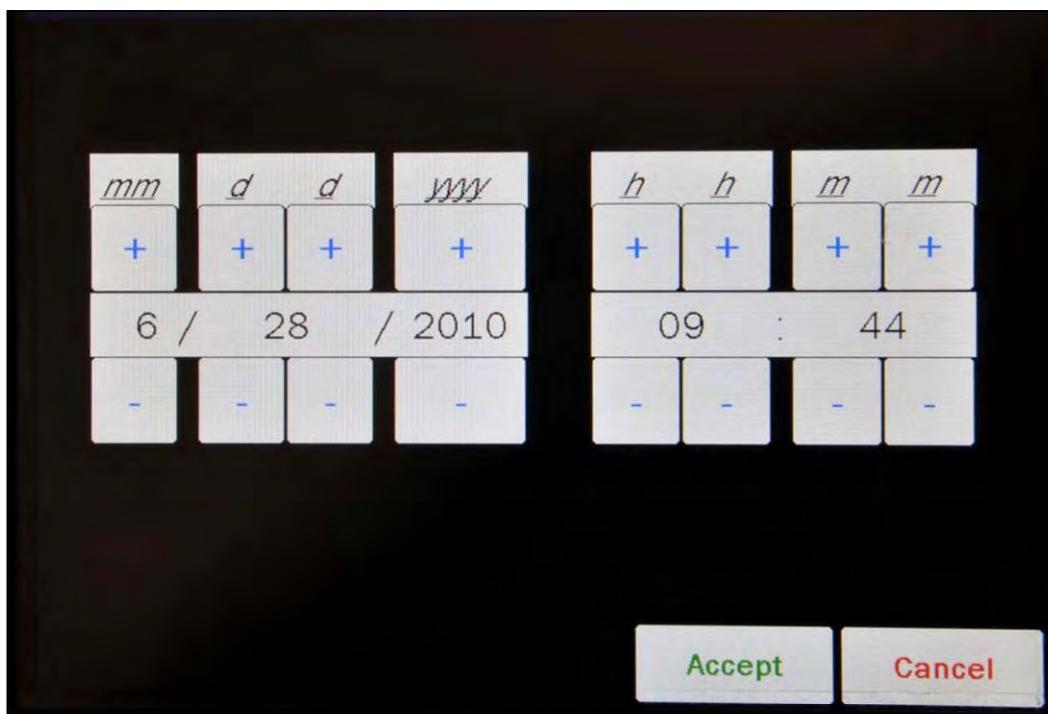


Figure 14-5 Date/Time Screen

The screen displays the currently set date and time. Above and below each of the fields are + and – buttons, respectively. To adjust the displayed value for a specific field, touch the + button to increase the displayed value or the – button to decrease the displayed value.

Adjust the displayed date and time as required to show the beginning date/time of the calculation.

To cancel any changes and return to the Figure 14-2 Utility Screen, touch the **CANCEL** button.

Touch the **ACCEPT** button to accept the set date and time. Figure 14-2 Utility Screen will re-appear with **FROM:** field box populated with the entered date and time.

Beginning Activity

To input the beginning activity for the calculation, touch the **FROM: act** field box. Figure 14-6 Enter Activity Screen will appear.

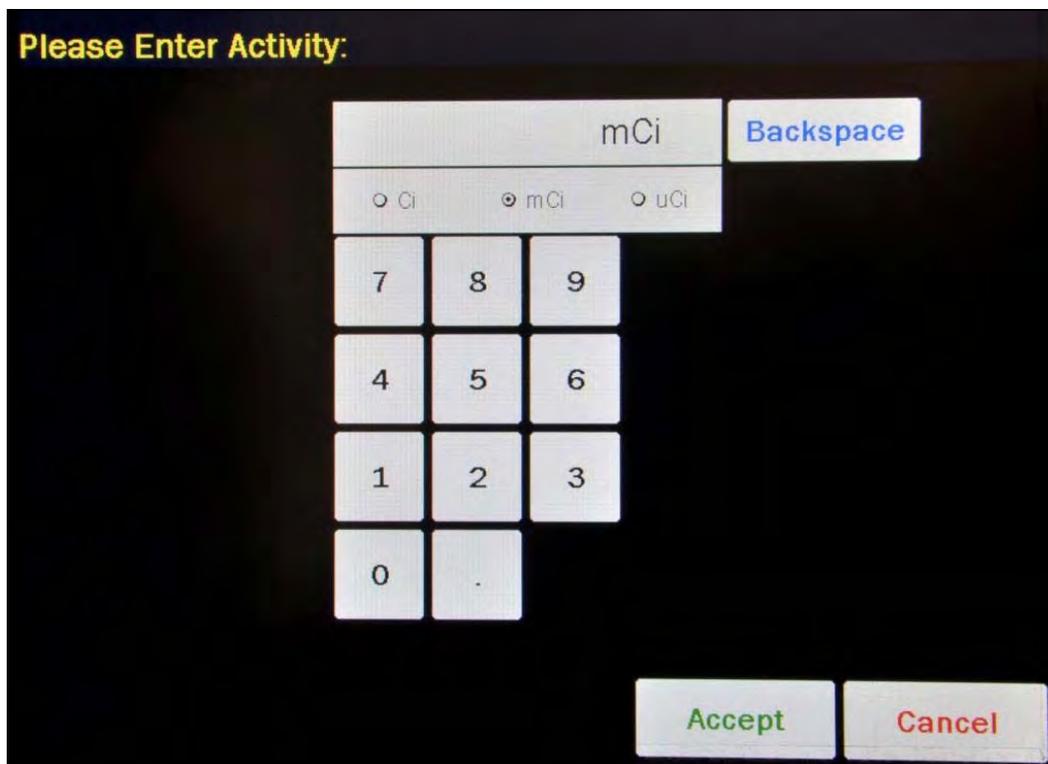


Figure 14-6 Enter Activity Screen

Input the beginning activity to be converted using the keypad and touch the appropriate radio button for the unit of measure.

To cancel any changes and return to the Figure 14-2 Utility Screen, touch the **CANCEL** button.

Touch the **ACCEPT** button to accept entered activity. Figure 14-2 Utility Screen will re-appear with **FROM: act** field box populated with the entered activity.

Ending Date and Time

To input the ending date and time for the calculation, touch the **TO:** field box. Figure 14-7 Date/Time Screen will appear.

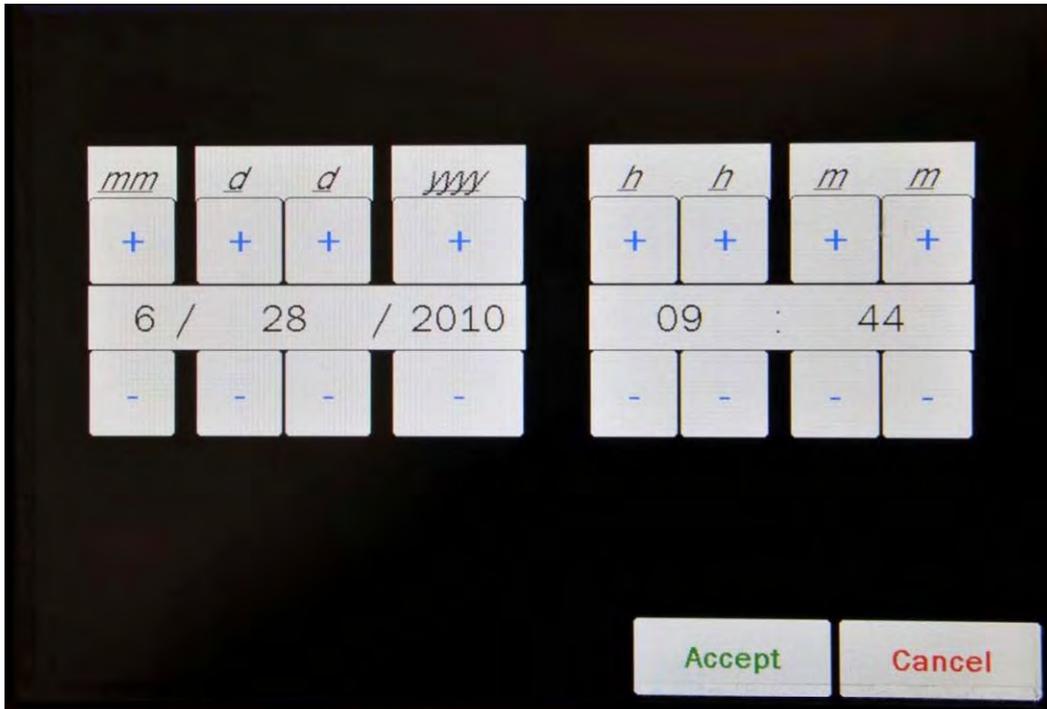


Figure 14-7 Date/Time Screen

The screen displays the currently set date and time. Above and below each of the fields are + and – buttons, respectively. To adjust the displayed value for a specific field, touch the + button to increase the displayed value or the – button to decrease the displayed value.

Adjust the displayed date and time as required to show the ending date/time of the calculation.

To cancel any changes and return to the Figure 14-2 Utility Screen, touch the **CANCEL** button.

Touch the **ACCEPT** button to accept the set date and time. Figure 14-2 Utility Screen will re-appear with **TO:** field box populated with the entered date and time.

RESULTS

After the **FROM:**, **FROM: act** and **TO:** field boxes are filled in, the calculated ending activity results will be displayed and highlighted in green as shown in Figure 14-8 Decay Calculator Results Screen.

The screenshot displays the 'Information' screen of a decay calculator. At the top right is a 'Home' button. The main section is titled '[Ci, Bq Conv] Input Activity:' and shows '100.0mCi = 3.70GBq'. Below this is the '[Decay Calculator]' section. It includes a 'Nuclide:' field with 'Tc99m (Technetium) 6.01 hr'. The 'FROM:' field contains 'Mar 15 2010 11:45' and the 'at' field contains '100.0mCi'. The 'TO:' field contains 'Mar 15 2010 21:45' and the 'at' field contains '31.5mCi', which is highlighted in green. At the bottom left, there are three buttons: 'Diagnostics', 'Dose Table', and 'Gradient'.

Field	Value
[Ci, Bq Conv] Input Activity	100.0mCi = 3.70GBq
Nuclide	Tc99m (Technetium) 6.01 hr
FROM:	Mar 15 2010 11:45
at	100.0mCi
TO:	Mar 15 2010 21:45
at	31.5mCi

Figure 14-8 Decay Calculator Results Screen

CHAPTER 15

CLEANING AND MAINTENANCE

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 Buzzer buzzes continuously. 5
 High background indication..... 5
 Readings appear overly noisy for low activities. 6
 Indication of significant negative activity..... 6
 Printer prints junk or prints with incorrect spacing. 6
 Print head hangs up when printing tickets..... 6
 Printer will not respond. 6
ACCESSORIES AND REPLACEMENT PARTS 7
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GENERAL

This chapter provides the information necessary for the user to perform the basic maintenance of instrument cleaning, fuse replacement, and general preventative maintenance. There are no internal adjustments or calibration settings that may be done by the user within the conditions of the warranty.

REFER ALL SERVICING TO A QUALIFIED SERVICE REPRESENTATIVE !

It is recommended that periodic (every three to five years) re-calibration of the CRC®-55t be performed by Capintec’s Authorized Service Center to guarantee the instrument’s high reliability is maintained. Contact Capintec’s Authorized Service Center in Pittsburgh for servicing or re-calibration at 1-800-227-6832.

CLEANING INSTRUCTIONS**WARNING !**

TO AVOID ELECTRICAL SHOCK OR DAMAGING OF THE CRC[®]-55t, NEVER GET WATER OR LIQUIDS INSIDE THE CHAMBER OR THE READOUT ENCLOSURE.

DO NOT USE AN AEROSOL DISPENSER TO SPRAY THE EQUIPMENT WITH ANY CLEANING SOLUTION OR LIQUID.

TO AVOID DAMAGING THE CASE OR DISPLAY SCREEN, DO NOT USE AROMATIC HYDROCARBONS, CHLORINATED SOLVENTS, OR METHANOL-BASED CLEANING SOLUTIONS.

If the CRC[®]-55t Readout or Chamber requires cleaning, wipe down with a damp cloth; do not use solvents or aerosol cleaners.

For the printer (if included), refer to the printer owner's manual for proper cleaning procedures.

For the Remote Display (if included), refer to the Remote Display owner's manual for proper cleaning procedures.

PREVENTATIVE MAINTENANCE

The Quality Assurance Tests described in CHAPTER 7: ACCEPTANCE & QUALITY ASSURANCE TESTS should be performed periodically as stated.

Tests must be performed in an environment where the temperature is stable within a range of +50°F to +85°F (+10°C to +30°C) and the maximum relative humidity is 90% non-condensing. The unit should be powered-up for at least one-half hour prior to performing any measurements. No other precautions need to be observed.

CAUTION

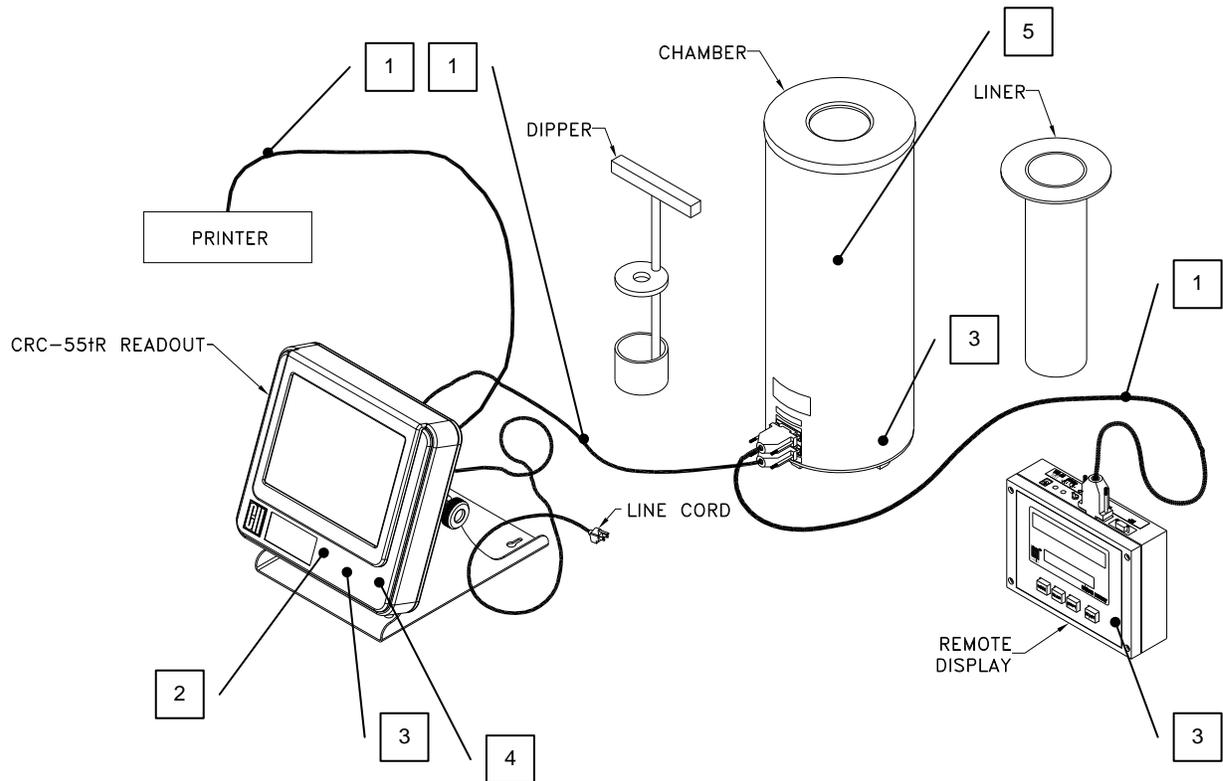
*If these environmental requirements are not followed,
the instrument may display erroneous readings.*

The Quality Assurance Tests should be immediately performed if:

- The equipment has been subjected to extreme physical stress,
- Liquids enter the readout unit, and/or chamber, or
- Any cable shows signs of damage

DISPOSAL

The following items should be taken into consideration before disposing. These items should be disposed of in accordance with local and national regulations. Please contact Capintec, Inc. or an authorized disposal company to decommission your equipment.



No.	Recycling/Material Code	Important Information
1	External Electrical Cables	
2	Lithium Battery	Contained on the Main printed circuit board inside of the readout unit.
3	Printed Circuit Boards	Iometer, Main, Power Supply, LCD Controller, Remote Display
4	Electrolyte Capacitor	Power Supply Printed Circuit Board
5	Lead	Lead Shielding around Chamber

SERVICING

The system is covered by a one year limited warranty, under normal conditions of use.

Other than the Readout Unit fuses (reference Fuse Servicing in this chapter), there is no user serviceable parts contained in the system.

Every five years, the system should be returned to Capintec's Authorized Service Center for a complete verification.

CAPINTEC, Inc.
620 Alpha Drive
Pittsburgh, PA 15238
Phone (412) 963-1988, 1-800-227-6832
Fax (412) 963-0610

FUSE SERVICING

Readout Fuses



For continued protection, replace only with same type and rating of fuse(s). A fire hazard may exist if the wrong size of fuse is installed.

Two fuses are located in the power entry module next to the power cord connector on the back panel of the Readout Unit. These fuses are rated at 2.0A 250VAC delayed type as specified on the label located directly below the power entry module.

To change these fuses:

1. Turn off the CRC®-55t power switch and unplug the line cord from the power entry module.
2. Insert the tip of a small flat bladed screwdriver into the notch of the power entry module just to the left of the switch. Twist the screwdriver to open the fuse cover door. (Refer to Figure 15-1 Readout Fuse Replacement).
3. To remove the first of the two fuse carriers, insert the tip of the screwdriver behind the arrow and pull it out. Repeat this process for the second fuse.
4. Remove the blown fuse(s) from the carrier and replace it (them) with T 2.0AL 250 Volt fuse(s).
5. Re-insert the fuse carriers with the arrows pointing up.

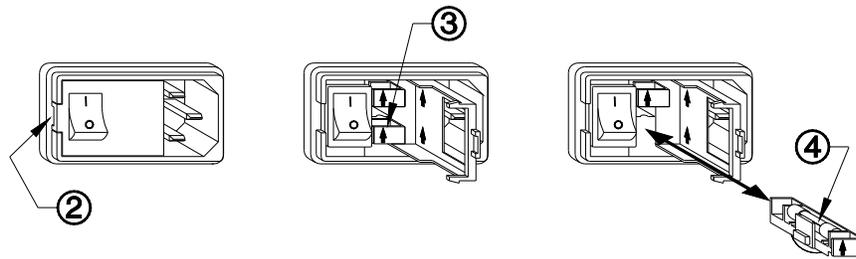


Figure 15-1 Readout Fuse Replacement

6. Close the fuse cover door and snap it into place.
7. Replace the line cord and turn on the power switch for the CRC[®]-55t.
8. Verify the CRC[®]-55t System is functioning correctly by performing the Daily Test as specified in CHAPTER 7: ACCEPTANCE & QUALITY ASSURANCE TESTS.

Printer Fuse

The printer fuse is not accessible from the outside of the printer case and must be replaced by a qualified service representative.

TROUBLESHOOTING

Some problems may be very easy to diagnose and correct in the field with little or no equipment. If a problem should occur, check here before you call for service. You may be able to save a considerable amount of time and money.

Nothing appears on the display.

- Make sure calibrator is plugged into a live outlet and is turned on.
- Check fuse and replace if necessary. Reference: FUSE SERVICING.

Nothing happens when any key is pressed.

- One of the keys may be stuck. Try wiggling each key.
- A brief power line disruption may have caused the program to “lose its place”. Try turning the power off and then on again.

Buzzer buzzes continuously.

- A brief power line disruption may have caused the program to “lose its place”. Try turning the power off and then on again. If the buzzing continues, turn the power off and consult the factory. DO NOT leave the unit buzzing longer than necessary.

High background indication.

- Chamber Well, liner, or dipper may have become contaminated. Reference CHAPTER 7: ACCEPTANCE & QUALITY ASSURANCE TESTS, SECTION: CONTAMINATION TEST.

- Background may actually be high. Check by removing the dipper and placing a lead sheet over the top of the well.

Readings appear overly noisy for low activities.

- Make sure that the chamber is on a solid surface and is not subject to vibration.

Indication of significant negative activity.

- Background level may have changed. Re-do the Background Adjust. Reference CHAPTER 8: CHAMBER TESTS, SECTION: BACKGROUND.

Printer prints junk or prints with incorrect spacing.

- Make sure that the Printer Menu Setup is correct. Reference CHAPTER 5: SYSTEM INITIALIZATION, SECTION: PRINTING.

Print head hangs up when printing tickets.

- On the Okidata Microline 320 printer, the lever on left side of print head must be set to position 2.

Printer will not respond.

- Make sure printer is plugged into a live outlet, turned on, and “selected”.
- Make sure that either paper or a ticket is in the paper path.
- Run the Diagnostic Test and make sure that the system expects to have a printer. If not, Make sure that the Printer Menu Setup is correct. Reference CHAPTER 5: SYSTEM INITIALIZATION, SECTION: PRINTING.

ACCESSORIES AND REPLACEMENT PARTS

The following accessories and replacement parts are available from Capintec. Call Capintec's Authorized Service Center at 1-800-227-6832 for answers to your questions or to place an order.

- CAPMAC Moly Assay Kit (specify generator).....CALL
- Dose Calibrator Reference Sources.....CALL
- Shielded products for PET.....CALL
- Standard Moly Assay Kit5130-0006
- Calicheck Linearity Test Kit5120-2144
- Ionization Chamber Well Inserts (liners).....7300-2004
- Plastic Sample Holders (dippers)7300-2005
- Environmental Shield.....7300-2450
- Flush Mount Mounting Flange7310-2307
- Shielded Platform with 2mm shielded glass5150-3010
- Shielded Platform with 4mm shielded glass5150-3011
- Dosilift™ remote lowering/raising of syringes or vials5120-2175
- Remote Display5130-2224
- Okidata 320 Ticket and Report Printer5110-1150
- Epson LX-300+II Ticket and Report Printer.....5110-0126
- Epson Roll Printer.....5430-0058
- Epson Ticket Printer5430-0100
- Epson Inkjet Printer5430-0113
- Printer Ribbons.....CALL
- Multi-part Tickets, Paper, etc.....CALL
- Additional copies of Owner's Manual9250-0137

Note: *Circuit diagrams, component parts lists, descriptions and calibration instructions are available to appropriately qualified personnel.*

SHIPPING

If for any reason the CRC®-55t must be returned to Capintec, the shipping carton must contain the following or equivalent labeling as shown in Figure 15-2 and Figure 15-3. Label stipulating the maximum environmental conditions for safe storage and shipment.

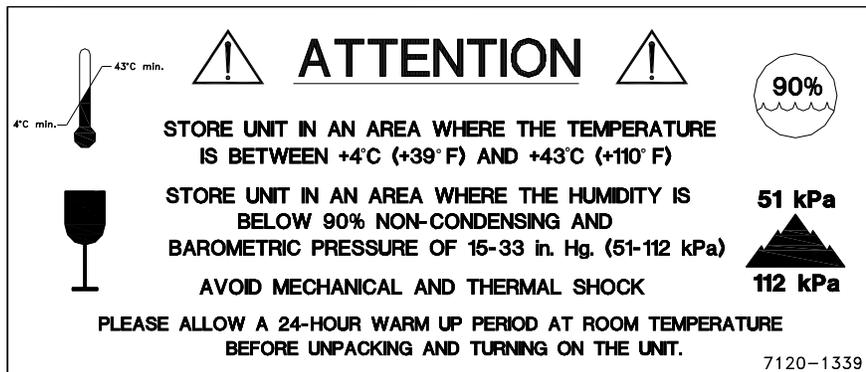


Figure 15-2





Figure 15-3

In order to ship this product, all appropriate Department of Transportation (DOT) and, if shipped by air, the International Aviation and Transportation Administration (IATA) requirements for the shipment of the pressurized (12 Atmosphere) Ionization Chamber Detector must be met.

APPENDIX I

PRINCIPLE OF THE CALIBRATOR

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GENERAL

The definition of activity, the basic principle of the calibrator, and the detailed discussion on the calibration are presented in this section.

DEFINITION OF ACTIVITY

Activity

Activity is defined as:

The activity, A, of a quantity of a radioactive nuclide is the quotient of dN by dt, where dN is the number of spontaneous nuclear transformations which occur in this quantity in time interval dt.

$$A = \frac{dN}{dt}$$

The special unit of activity is Curie (Ci):

$$1 \text{ Ci} = 3.7 \times 10^{10} \text{ s}^{-1} \text{ (exactly)}$$

Note: *The term nuclear transformation is meant to designate a change of nuclide of an isomeric transition. (ICRU REPORT 19, 1971)*

The SI (International System of Units) unit for activity is the reciprocal second, s^{-1} , and is named the Becquerel (Bq), i.e.;

$$1 \text{ Bq} = 1 \text{ Nuclear Transformation per second}$$

$$1 \text{ Ci} = 3.7 \times 10^{10} \text{ Bq}$$

Types of Transformations

α -decay

The nucleus emits a helium nucleus (α -particle).

Electron Capture (ϵ -decay)

The nucleus captures one of its own orbital electrons, usually from the K shell, and a neutrino is emitted.

β^- Decay

The nucleus emits an electron (β^- particle), and a neutrino.

β^+ decay

The nucleus emits a positron (β^+ particle) and a neutrino.

Nuclear Transition

A photon (electromagnetic radiation, γ -decay), electron (Internal Conversion Electron Emission, CE) or electron-positron pair (Internal-pair emission, e^\pm) is emitted by a nucleus in a transition from a higher to lower energy state.

No nuclear transformation occurs if there is no change in the atomic number or the mass number. The de-excitation of a nucleus in its unstable state (metastable state) is, however, included in the definition of activity.

MEASUREMENT OF ACTIVITY

A Nuclear Transformation is always associated with one or more of the following types of radiation:

α , β^+ , β^- and γ Photons

We can, therefore, measure activity by detecting one or more of the above radiations.

α -Particle Radiation

The most energetic α -particle emitted by a radionuclide has an energy of less than 10MeV, which corresponds to a range of about 10mg/cm² (8cm in air). Because of its short range, an α -particle from a radionuclide cannot penetrate to the ionization chamber's sensitive volume and therefore, cannot be detected.

All α -decays, however, are accompanied by photon radiation as the daughter nucleus decays to its ground state. The activity of a nuclide that decays through α radiation can therefore, be measured by detecting the associated photon radiation.

β^+ Radiation

β^+ particle (positron) emitted from a nucleus comes to rest in the media by losing its kinetic energy mainly by direct ionization processes and then annihilates with an electron to produce two photons of 511keV each. These photons are easily detected by the ionization chamber. De-excitation photons are also associated with β^+ decay.

β^- Radiation

The ejected electron loses kinetic energy in matter mainly by direct ionization.

The range of most emitted β 's is very short. It should be noted that in β^+ and β^- emission, the emitted electron or positron has a continuous energy spectrum, which ranges from E_{\max} to zero, where E_{\max} is the maximum transition energy. β -rays (with the exception of a small portion of very high energy β s) will be stopped in the sample, in the chamber liner, and in the chamber wall.

As the electron decelerates, it also produces continuous low energy photon emission called Bremsstrahlung (stopping or braking radiation).

Many radionuclides that decay by β emission also emit de-excitation photons (x-rays, γ -rays), which can be detected by the ionization chamber.

Electron Capture

The actual electron capture process cannot be detected since the electron is not emitted but is captured by the nucleus. The capture of the orbital electron, however, leaves a vacancy in the atomic orbital shell, resulting in x-rays as the atom de-excites.

The energy of K x-ray is approximately

$$E_k \cong \frac{Z^2}{100} \text{ keV}$$

where Z is the atomic number of the daughter nucleus.

γ -rays are also often given off as the daughter nucleus de-excites.

Photon Radiation

Photon radiation is associated with most nuclear transformations. A high-energy photon interacts with matter very weakly. Photon intensity is therefore, not altered substantially by the surrounding media, i.e., measurement of activity can be accomplished with a minimum of disturbance from the sample configuration.

As can be seen from the above, in all cases we are detecting photons. We will therefore, discuss photons and their interactions with matter in detail.

PHOTONS

Photon is the general term for a quantum of radiation. Photons are classified according to their method of production.

γ -Rays

Photons resulting from nuclear transitions, nuclear reaction or annihilation of particles (e.g., electron-positron annihilation) are called Gamma-rays (γ -rays). Radioisotope sources (radionuclides) are the most common means of γ -ray production. Radioisotope γ -sources emit photons of one or more discrete energies.

X-Rays

X-rays are associated with the deceleration of electrons or with orbital electron transitions in atoms.

The radiation from a γ -source is often accompanied by characteristic x-rays from transitions of the orbital electrons in the daughter atom.

Bremsstrahlung

When very fast electrons are brought to rest in a medium (or pass through media) a continuous low energy photon spectrum occurs. This is called Bremsstrahlung ("stopping or braking radiation").

The intensity and the energy spectrum of Bremsstrahlung are highly dependent upon the source configuration and media surrounding the sample.

In this manual, the term photon will be used when the method of production of the radiation has no bearing on the discussion.

Interactions of Photons with Matter

There are three mechanisms by which photons can interact with matter and, thus, deposit their energy. These mechanisms are: Photoelectric effect, Compton Effect, and, pair production. The energy of the photon determines which process (or processes) is possible.

Photoelectric Effect

The photoelectric effect is an interaction between a photon and an electron that is bound to an atom. In the photoelectric process, the photon is absorbed by the atom and a bound electron is ejected. The kinetic energy of the ejected electron is equal to the photon energy minus the binding energy of the electron. The binding energy of an electron is the energy that must be supplied in order to remove the electron from the atom.

In nuclear medicine, we are interested in photon energies of 20keV or greater. At these energies, all the electrons in the materials used for the chambers are able to participate in the photoelectric process. The photoelectric effect is the most important process at low energies. However, for photon energies much greater than electron binding energies, the processes described below become more important and the number of photoelectric interactions occurring becomes small. At a given energy, the number of photoelectric interactions per unit mass varies as the 4th power of the atomic number and is inversely proportional to the atomic weight of the medium (Z^4/A).

Compton Effect

The Compton Effect is a collision between a photon and an electron that can be considered unbound. An electron can be considered to be unbound (or “free”) if the energy of the incident photon is much greater than the binding energy of the electron. The kinetic energy of the scattered electron is not constant, but is a function of the angle through which it is scattered. The scattered photon must interact again in order to impart all of its energy to the medium.

The Compton Effect is the dominant process for photon energies from 100keV to about 10MeV in the region of the atomic numbers for detector materials. At 100keV, the maximum kinetic energy of the scattered electron is about 30 percent of that of the incident photon; at 1MeV, it is about 80 percent; and at 10MeV, it is about 98%. The number of Compton interactions per unit mass varies directly as the atomic number and inversely as the atomic weight of the medium (Z/A).

Pair Production

The process of pair production is difficult to comprehend because it is strictly a relativistic quantum mechanical effect. What is observed to take place is that in the presence of the electric field of a nucleus, the incident photon disappears and an electron and a positron appear. (A positron is a particle with the same properties as an electron, except that it has a positive charge.)

In order to produce an electron-positron pair, the incident photon must have an energy of at least twice the mass of an electron, i.e., 1.022MeV. This process dominates for very high energies, that is, above about 10MeV. The number of pair

production interactions per unit mass is proportional to the square of the atomic number and inversely proportional to the atomic weight of the medium (Z^2/A).

IONIZATION CHAMBER MEASURING PROCESS

An ionization chamber consists of two or more electrodes. The electrodes confine a volume of gas and collect the charge (ions) produced by radiation within the volume. Thus, ionization chambers can be used to measure radiation fields if the relationship between the radiation field and the charge produced is known.

The radiation enters the chamber through the chamber wall and interacts with the gas in the chamber or with the chamber wall. It must be pointed out that photons cannot produce ionization directly, but must first interact with the chamber material (gas and wall) producing electrons. That is, through a series of interactions, the photon transfers its energy to one or more electrons.

The electron is slowed down through collisions with the chamber gas (argon). The collisions knock electrons off the molecules producing positive ions (this is the ionization process).

The collection voltage across the chamber sets up an electric field. The positive ions will drift towards the negative electrode and the electron (and negative ions if they are formed) will drift towards the positive electrode, thus producing a current. The electronic circuitry then measures either the current or the total charge produced during the period of interest.

The number of ions produced in the chamber is directly related to the energy deposited in the chamber by the radiation.

DETAILED DISCUSSIONS

Effects of the Integral Shield

The advantage of the shield is the reduction of radiation exposure to the personnel handling the radioisotopes, as well as reduction of the background effects on the activity measurements.

It is important to note, however, that if a shield is placed around or near a calibrator, the sensitivity of the ionization chamber is enhanced due to backscattering of photons by the shielding. Above about 250keV, the scattering of photons is mainly forward and at the low energy region, attenuation of photons by the outer wall of the chamber becomes significant. For a CRC® calibrator, the backscattering effects are more significant for photons of energies between 70keV and 250keV than photons in other energy regions.

Effects of the Container

The radioactive standard materials in the ampoules now being provided by NIST are a good approximation to an assay of a radiopharmaceutical in a plastic syringe or in a glass syringe

(a wall thickness of about 1.2mm), even for radioisotopes that decay with a significant abundance of low-energy photons.

The user should select, whenever possible, a standardized procedure, volume, and container for all radioactivity measurements. The plastic syringe is convenient since it represents the delivery vehicle to the patient in most clinical situations.

Significant errors will occur in some instances, e.g., if the radioisotope is assayed in an appreciably different material and/or wall thickness than that of the standards.

The ampoules of recently available standards from NIST are uniform. Plastic syringes also have a rather uniform wall thickness and absorption is low. However, a random sampling of 5, 10, 25, 50, and 125ml size multi-injection dose vials from several sources indicated that the wall thickness varied randomly from 1 to 3mm quite independently of the volume of glass vial.

The assay of radioisotopes having a significant abundance of low- energy gamma-, x-, and/or high-energy beta-ray radiation may be affected by changes in the sample configuration used to assay the radio-pharmaceutical if the samples are severely different from the standard source. In such cases, an independent check or determination of a calibration appropriate to a user's needs is advised. Fortunately, most radioisotopes can be accurately assayed independently of the sample size.

Effects of Impurities

An Ionization chamber itself does not have intrinsic energy- discrimination capability. The presence of radioisotope impurities will affect the reading of the instrument unless the effect of impurities is eliminated by photon filtration as is done with Mo99 breakthrough in Tc99m. However, the presence of low-level radionuclide impurity does not negate the usefulness of a radioisotope calibrator, if the user is aware of its presence and has an independently determined calibration including photons arising from the impurities.

APPENDIX II

R CHAMBER CALIBRATION NUMBERS

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DETERMINING CALIBRATION SETTING NUMBERS

A method of determining a calibration setting number is described in this section.¹

Response and Sensitivity

It is very convenient to express the response of the detector to a radioisotope, A, relative to that of a standard reference material, e.g. Co60.

$$R_A \equiv \frac{\left(\frac{\text{Detector Output due to Sample A}}{\text{Activity of Sample A}} \right)}{\left(\frac{\text{Detector Output due to SRM Co60}}{\text{Certified Activity of SRM Co60}} \right)} \quad (1)$$

The sensitivity of the detector for a photon of energy E_i is defined as:

$$S_i \equiv \frac{\text{Detector Output due to } 3.7 \times 10^{10} \text{ Photons of } E_i}{\text{Detector Output due to one Curie of Co60}} \quad (2)$$

The detector response and the sensitivity have the following relation:

$$R_i \equiv \sum_i I_i S_i \quad (3)$$

¹ See Suzuki, A., Suzuki M.N., and Weis A.M.: Analysis of a Radioisotope Calibrator; Journal of Nuclear Medicine Technology Dec. 1976 for more detailed discussions.

Where I_i is the intensity of the photon whose energy is E_i .

The procedure is to measure the response of the detector to all the available primary standard samples and to establish the sensitivity of the detector as a function of photon energy so as to satisfy equation (3) for all standards.

Once the sensitivity curve has been determined, the response of the detector to any radioisotope may be calculated using equation (3), provided that the decay data are known.

The sensitivity curve for a CRC® Ionization Chamber is given in Figure A1-1.

The figure depicts the sensitivity of the ionization chamber as a function of photon energy up to 1.9MeV. Above a photon energy of 200keV, the ionization in the chamber is mainly due to electrons resulting from Compton scattering of photons by the filling gas (argon) and the chamber walls (aluminum).

The peak in the low-energy region of the sensitivity curve is due to the rapid increase in photoelectric effect as photon energy decreases and to the attenuation of low energy photons by the sample holder, the chamber liner and the chamber walls, as well as the absorption of photons in the sample material and its container.

Although a significant fraction of photons with energies below 50keV are stopped in the chamber wall, some photons could enter the sensitive volume of the chamber and could, therefore, contribute to the activity measurement. All photons with energies below about 13keV are stopped before they reach the sensitive volume of the chamber and, therefore, these photons do not contribute to the activity measurement.

Calibration Setting Numbers

The relationship between the response of the detector and the gain setting (relative to that for Co60, in order for the instrument to give a direct reading of the activity) is given by:

$$G_A \equiv \frac{1}{R_A} \quad (4)$$

The calibration setting number is linearly related to the chamber response.

All the calibrators are calibrated with certified Cobalt 60 and Cobalt 57 standard source.

A calibration setting number of 990 was assigned to Co60 and 112 was chosen for Co57.

The calibration setting number of CRC® Calibrator for radioisotope A, N_A , is given by:

$$N_A = \left(R_A - \left(1 - \frac{(R_{Co60} - R_{Co57})}{(N_{Co60} - N_{Co57})} * N_{Co60} \right) \right) * \frac{(N_{Co60} - N_{Co57})}{(R_{Co60} - R_{Co57})} \quad (5)$$

Entering numerical values:

$$\begin{aligned}
 N_{Co60} &= 990 & N_{Co57} &= 112 \\
 R_{Co60} &= 1.000 & R_{Co57} &= 0.189 \pm 2\% \\
 \text{one obtains : } & N_A &= 1076(R_A - 0.080)
 \end{aligned}
 \tag{6}$$

The accuracy of the sensitivity curve and the calibration number determination was tested by calculating calibration numbers for all the radioisotope standards used for the studies of the sensitivity. The agreement between the calculated and the observed responses were all within $\pm 3\%$.

The accuracy of the chamber response calculation for a particular radioisotope, hence the accuracy which can be attained by using a calculated Calibration Setting Number depends not only on the accuracy of the available primary standards used to determine Figure A1-1, on the nuclear data, on the variation in the chamber sensitivity and electrometer gain setting, but also on the sample configuration due to low energy photon absorption.

The calibration Setting Numbers for pure and equilibrium state radioisotopes for the CRC[®] Calibrators are listed in this Appendix. Appendix IV contains tables of multiplication factors for obtaining the activity of a parent nuclide when it is not in equilibrium with the daughter nuclide. A general equation for this situation is also given in that appendix.

Since the determination of the Calibration Numbers and the calibrations (normalization) of the instrument are performed using standard reference materials issued by the NIST and/or the LMR, the Calibration Numbers for radioisotopes are given for sample configuration similar to those issued by the NIST.

All of the NIST standards, with the exception of Xe133, were of the liquid solution form. Approximately 5g of radioactive liquid were sealed in borosilicate glass ampoules having a diameter of about 17mm, a length of 40mm, and a wall thickness of 0.6mm. The Xe133 standard was sealed together with inactive xenon gas in a borosilicate glass ampoule having a volume of about 5ml, a length of 45mm, a diameter of 15mm, and a wall thickness of 1.3mm.

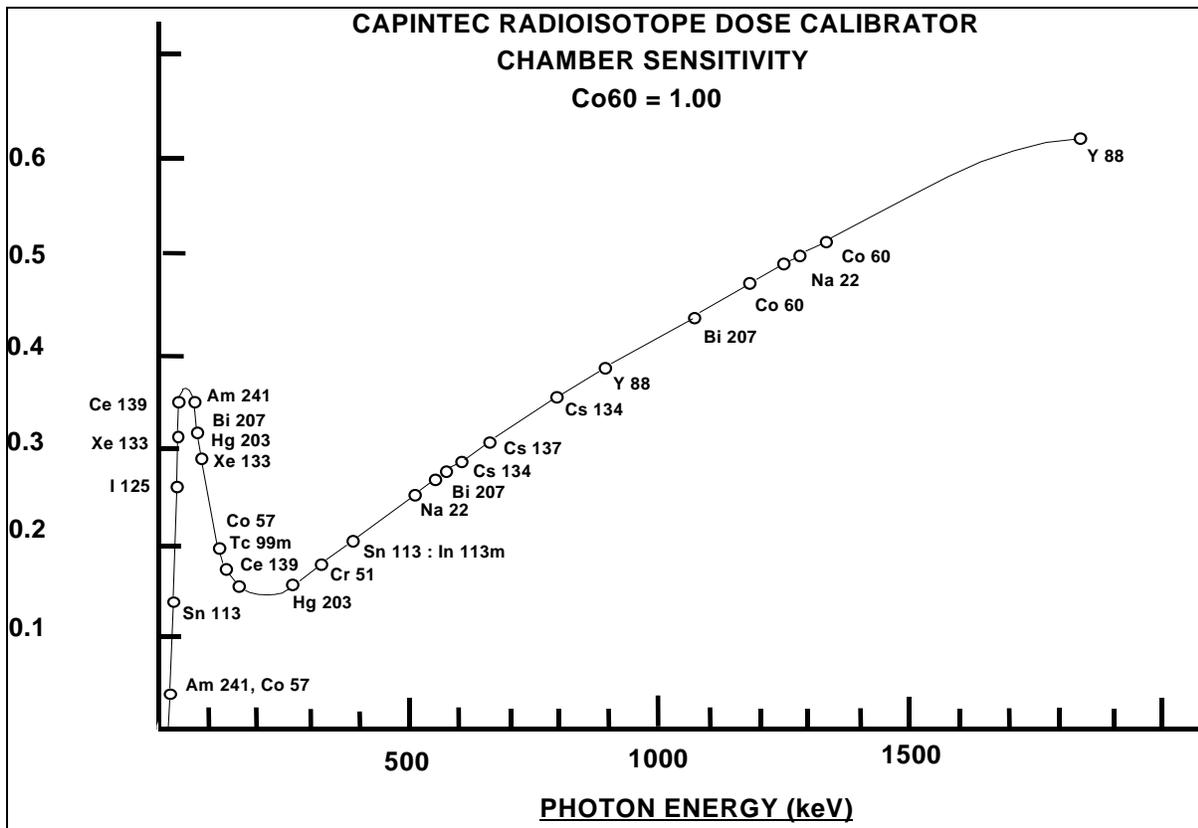


Figure A1-1

CALIBRATION SETTING NUMBERS

The Calibration Setting Numbers in Table I are applicable to the Capintec Radioisotope Calibrator only.

The CRC®-55t is a direct reading instrument. No manual multiplication or division should be performed, even if the Calibration Setting Number is followed by a multiplication sign "×" or a division sign "÷" and a number.

If the sample contains radioactive impurities, the meter indication will always be higher than the actual activity of the principal isotope. It will not, however, be the total activity of the principal isotope and the impurities.

If a Radium Needle is measured, the reading will be lower than the true activity in the needle due to the shielding effects (filtration) of the needle. To estimate the true activity in a needle, increase the reading obtained with a calibration number for Ra226 (778) by 2% for each 0.1mm of platinum wall thickness. For example, add 10% to the reading for a 0.5mm wall platinum needle and add 20% to the reading for a 1.0mm wall platinum needle to estimate the true Radium activity.

ABBREVIATIONS USED IN TABLE I

<u>Abbreviation</u>	<u>Meaning</u>	<u>Abbreviation</u>	<u>Meaning</u>
eqb.	equilibrium	D	days
S	seconds	Y	years
H	hours	E	exponential, i.e.,
M	minutes		$3E5 = 3 \times 10^5$

UNCERTAINTY DUE TO SYRINGE CORRECTION

The Calibration Setting Numbers are given for approximately 5 grams of radioactive solution in a standard source ampoule made of about 0.6mm thick borosilicate glass. The standard radioactive source in the ampoule is, however, a good approximation for a radiopharmaceutical in a plastic syringe or a glass syringe (wall thickness about 1.2mm) for most radioisotopes.

In general, the attenuation of radiation by a plastic syringe is less than for the standard ampoule, while for most glass syringes, the attenuation will be greater than for the standard ampoule.

The anticipated syringe corrections are listed on the table under the column "Uncertainty Due to Syringe Correction". For example, the required correction for I125 activity is estimated to be about, $\pm 25\%$. This means that you should add 25% to the meter reading if the I125 is in a glass syringe or subtract 25% if it is in a plastic syringe.

Since the attenuation of low energy radiation is very dependent upon the material of the container, the value given in the syringe correction column should be used mainly as a guide giving relative magnitude.

If a measurement of activity in a glass vial is anticipated, the container correction for low energy isotopes will be substantial. It could be about 3 to 5 times that for a syringe.

If no value is given in this column, the correction is not significant, except for a container differing greatly from the standard ampoule (e.g. very thick glass container, vial made of glass which contains lead, etc.).

UNCERTAINTY DUE TO PUBLISHED DATA

This is the uncertainty on the value of the activity. From calibration numbers calculated from decay data, the uncertainty given is calculated using only the reported errors on the intensity of the γ and/or x-rays. For calibration numbers measured from NBS standard reference materials (known as SRM;s), the uncertainty given is the reported uncertainty on the activity of the SRM. For these numbers, the reference is given as NBS (or LMR - Laboratoire de Metrologie de la Radioactivite - France), and year of source.

HALF-LIFE

The number before the letter is the value of the half-life. The number following the letter is the reported uncertainty on the half-life.

Examples:

12.34	D1	means	12.34 days	± 0.01 days
12.34	D11	means	12.34 days	± 0.11 days
12.340	D1	means	12.340 days	± 0.001 days
1.234	D1	means	1.234 days	± 0.001 days

REFERENCES

This is the source of the data from which the calibration number was calculated. NBS or LMR means that the calibration number was obtained by measuring a standard reference material (SRM).

NM75 (Nuclear Medicine 75): L.T. Dillman and F.C. Von Der Lage, Radionuclide Decay Schemes and Nuclear Parameters for Use in Radiation-Dose Estimation. NM/MIRD Pamphlet No. 10, 1975.

ORNL76: M.J. Martin Ed., Nuclear Decay Data for Selected Radionuclides. ORNL-5114, Oak Ridge National Laboratory, March 1976.

NDT70: M.J. Martin and P.H. Blichert-Toft. Radioactive Atoms: Auger-Electrons, α -, β -, γ - and X-Ray Data. Nuclear Data Tables A, Vol. 8, Nos.1, 2. October, 1970

NDS: Nuclear Data Sheets, Academic Press.

Martin: M. J. Martin. Evaluated Nuclear Data File. Nuclear Data Project. Oak Ridge National Laboratory.

NCRP-58: National Council on Radiation Protection and Measurement., Report No.58 A HANDBOOK OF RADIOACTIVITY MEASUREMENTS PROCEDURE.

NUCLIDES and ISOTOPES: Chart of the nuclides. Fourteenth Edition. General Electric Company Nuclear Energy Operations. Rev. 1989

NIST, Radionuclide Calibrator Measurements of F18 in a 3ml Plastic Syringe. Applied Radiation and Isotopes. 66, 988-993, J.T. Cessna, M.K. Schultz, T. Leslie, N. Bores, 2008

TABLE I

CAUTION: The calibration numbers given in this table are based upon the NIST SRM geometry (5ml of solution in glass ampoule with 0.6mm wall thickness). Listed numbers should provide an accuracy of $\pm 5\%$ when compared to a NIST SRM. Different source geometries (e.g. capsules, seeds, ribbons) may require geometry correction factors or different calibration numbers. However, no warranty of any kind can be made as to their accuracy, since there are many other uncontrollable factors (as well as the accuracy of the published data) involved in the determination of the overall accuracy of an assay. Reference previous sections of this manual for a discussion of some of the conditions under which the calibration numbers are valid.

Radioisotopes		Calibration Setting Number	Uncertainty Due to Syringe		Half-Life (NCRP-58)	Ref.	Comments
			Corr. %	Published Data %			
⁷ Be	Beryllium	179 x 10			53.284 D 4	NM75	
¹¹ C	Carbon	457			20.38 M 2	ORNL76	
¹³ N	Nitrogen	457			9.965 M 4	ORNL76	
¹⁵ O	Oxygen	462			122.24 S 14	ORNL76	
¹⁸ F	Fluorine	472			109.71 M 2	NIST 08	
²² Na	Sodium	957		1.7	2.602 Y 1	NBS73	Ref. for 0.51, 1.27 MeV
²⁴ Na	Sodium	658 ÷ 2			14.959 H 4	ORNL76	
²⁶ Al	Aluminum	481 ÷ 2			7.2E5 Y 3	ORNL76	
²⁷ Mg	Magnesium	331			9.458 M 12	ORNL76	
²⁸ Mg	Magnesium	719	3	4	20.91 H 3	ORNL76	Pure; NOTE: NM75 yields a Cal. No. of 804
²⁸ Al	Aluminum	583			2.244 M 3	ORNL76	Pure
²⁸ Mg	Magnesium (Eqb. ²⁸ Al)	656 ÷ 2	3	4	20.91 H 3	ORNL76	Reading gives ²⁸ Mg Act. in eqb. sample. Teqb after 15 minutes.
²⁸ Al	Aluminum (Eqb. ²⁸ Mg)	656 ÷ 2			2.244 M 3	ORNL76	Reading gives ²⁸ Al Act. in eqb. sample. Teqb. after 15 minutes
²⁸ Mg	Magnesium Eqb.	656	3			ORNL76	Reading gives sum of ²⁸ Mg & ²⁸ Al activity in equilibrium sample.
²⁸ Al	Aluminum						
³² P	Phosphorus	750 x 100		1.2	14.29 D 2	NBS76	Estimation use only.
³⁸ Cl	Chlorine	470		2	36.51 M 4	NDT70	
⁴⁰ K	Potassium	520 x 10			1.28E9 Y 1	NM75	
⁴¹ Ar	Argon	468			1.827 H 7	ORNL76	
⁴² K	Potassium	033 or 152 x 2		3	12.36 H 1	ORNL76	
⁴³ K	Potassium	430		2	22.3 H 1	ORNL76	
⁴⁴ Sc	Scandium	938			3.927 H 8	ORNL76	

Radioisotopes		Calibration Setting Number	Uncertainty Due to Syringe		Half-Life (NCRP-58)	Ref.	Comments
			Corr. %	Published Data %			
⁴⁴ Ti	Titanium	514	2	2	47.3 Y 12	ORNL76	
⁴⁶ Sc	Scandium	822			83.79 D 2	ORNL76	
⁴⁷ Ca	Calcium	373			4.536 D 2	ORNL76	Pure; ⁴⁷ Ca decays to ⁴⁷ Sc. Eqb. in 90 days.
⁴⁷ Sc	Scandium	026 or 618 × 2			3.351 D 2	ORNL76	Pure; see App. IV for non-eqb.
⁴⁸ V	Vanadium	569 ÷ 2			15.974 D 3	ORNL76	
⁴⁹ Ca	Calcium	956		2	8.72 M 2	NDT70	Pure; decays to ⁴⁹ Sc
⁵¹ Cr	Chromium	100 × 10		1.25	27.702 D 4	NBS76	Ref. for 320 keV
⁵² Mn	Manganese	676 ÷ 2			5.591 D 3	ORNL76	
^{52m} Mn	Manganese	461 ÷ 2			21.1 M 2	ORNL76	Decays to ⁵² Mn
⁵² Fe	Iron	374			8.275 H 8	ORNL76	^{52m} Mn will contribute to dose.
⁵⁴ Mn	Manganese	309			312.14 D 5	ORNL76	
⁵⁵ Fe	Iron	374			2.72 Y 2	ORNL76	
⁵⁵ Co	Cobalt	481		7	17.54 H	NDS76	
⁵⁶ Co	Cobalt	648 ÷ 2			77.9 D 12	NDT70	
⁵⁶ Ni	Nickel	844		4	6.1 D 3	NDT70	Decays to ⁵⁶ Co; See App. IV
⁵⁶ Mn	Manganese	627		2	2.577 H 1	ORNL76	
⁵⁷ Co	Cobalt	112		1.9	271.7 D 2	NBS76	Ref. for 122 keV Capintec Low Energy Reference.
⁵⁸ Co	Cobalt	389			70.82 D 3	ORNL76	
⁵⁹ Fe	Iron	430			44.51 D 2	ORNL76	
⁶⁰ Co	Cobalt	990		1.0-NBS 1.5-LMR	5.2714 Y 5	NBS75	Ref. for 1.17, 1.33 MeV Capintec High Energy Reference
⁶² Cu	Copper	448			9.74 M 2	NM75	Pure
⁶² Zn	Zinc	217			9.22 H	NM75	Pure
⁶² Zn	Zinc (Eqb. ⁶² Cu)	760					Reading gives ⁶² Zn Act. in eqb. sample. Eqb. after 1.5 hours.
⁶² Cu	Copper (Eqb. ⁶² Zn)	745					Reading gives ⁶² Cu Act. in eqb. sample. Eqb. after 1.5 hours.
⁶² Zn	Zinc	333				NM75	Reading gives sum of ⁶² Zn & ⁶² Cu activity in equilibrium sample.
⁶² Cu	Copper						

Radioisotopes		Calibration Setting Number	Uncertainty Due to Syringe		Half-Life (NCRP-58)	Ref.	Comments
			Corr. %	Published Data %			
⁶⁴ Cu	Copper	015 or 115 × 2			12.701 H 2	ORNL76	
⁶⁵ Zn	Zinc	172			243.9 D 1	ORNL76	
⁶⁶ Ga	Gallium	903		2	9.40 H 7	ORNL76	
⁶⁷ Cu	Copper	052		4	2.575 D 3	ORNL76	
⁶⁷ Ga	Gallium	100		1.4	3.261 D 1	NBS78	
⁶⁸ Ga	Gallium	416			68.0 M 2	ORNL76	
^{69m} Zn	Zinc	143			13.76 H 3	ORNL76	
⁷² As	Arsenic	795			26.0 H 1	ORNL76	
⁷² Ga	Gallium	470 ÷ 2		2	14.10 H 1	ORNL76	
⁷³ As	Arsenic	324 × 10	4	3	80.30 D 6	ORNL76	
⁷³ Se	Selenium	748			7.15 H 8	ORNL76	Decays to ⁷³ As.
⁷⁴ As	Arsenic	304		5	17.78 D 3	ORNL76	
⁷⁵ Se	Selenium	258		2.5	119.8 D 1	NBS75	
⁷⁶ As	Arsenic	110		6	26.32 H 7	ORNL76	
⁷⁷ As	Arsenic	481 × 100		26	38.8 H 3	ORNL76	Estimation use only.
⁷⁷ Br	Bromine	091		3	56 H 2	ORNL76	
⁷⁹ Kr	Krypton	050		3	35.04 H 10	ORNL76	
⁸¹ Rb	Rubidium	174			4.58 H	NM75	Pure
^{81m} Kr	Krypton	915 × 10			13 S 1	NM75	Pure
⁸¹ Rb	Rubidium						
^{81m} Kr	Eqb.	270				NM75	Reading gives act. of ⁸¹ Rb or ^{81m} Kr in equilibrium sample. Eqb. after 2 minutes.
^{81m} Kr	Krypton						
⁸² Br	Bromine	536 ÷ 2		2	35.34 H 2	ORNL76	
⁸² Rb	Rubidium	504			1.273 M 2	NM75	
⁸⁴ Rb	Rubidium	347			32.77 D 4	NM75	
^{85m} Kr	Krypton	065		1	4.480 H 8	ORNL76	Decays to ⁸⁵ Kr
⁸⁵ Kr	Krypton	031 × 100		2	10.72 Y 1	ORNL76	
⁸⁵ Sr	Strontium	193		1.0	64.854 D 3	NBS75	
⁸⁶ Rb	Rubidium	411 × 10			18.64 D 2	ORNL76	
⁸⁶ Y	Yttrium	711 ÷ 2			14.74 H 2	ORNL76	
⁸⁶ Zr	Zirconium	167	18	3	16.5 H 1	ORNL76	
⁸⁷ Kr	Krypton	250		6	76.3 M 5	ORNL76	
^{87m} Sr	Strontium	095			2.805 H 3	ORNL76	Pure
⁸⁷ Y	Yttrium	170		1	80.3 H 3	ORNL76	Pure

Radioisotopes		Calibration Setting Number	Uncertainty Due to Syringe		Half-Life (NCRP-58)	Ref.	Comments
			Corr. %	Published Data %			
⁸⁷ Y	Yttrium (Eqb. ^{87m} Sr)	357				ORNL76	Reading gives ⁸⁷ Y Act. in eqb. sample. Eqb. after 18 hours.
⁸⁷ Y	Yttrium	341		2		ORNL76	Reading gives sum of ⁸⁷ Y & ^{87m} Sr activity in equilibrium sample.
^{87m} Sr	Strontium						
⁸⁸ Rb	Rubidium	189		14	17.8 M 1	ORNL76	
⁸⁸ Y	Yttrium	465 ÷ 2		1.8	106.61 D 2	NBS73	
⁸⁹ Rb	Rubidium	768		1	15.2 M 1	ORNL76	
⁹⁰ Y	Yttrium	48 × 10			64.0 H 1	NIST92	Estimation use only.
⁹¹ Y	Yttrium	850 × 10			58.5 D 4	NDT70	Almost pure β decay. Estimation use only.
⁹⁴ Nb	Niobium	673			2.03E4 Y 16	ORNL76	
⁹⁵ Nb	Niobium	285			34.97 D 1	NDT70	Pure
⁹⁵ Zr	Zirconium	271			64.02 D 5	NDT70	Pure
⁹⁵ Zr	Zirconium	145			^{95m} Nb 3.61 D 1	NDT70	Reading gives sum of ^{95m} Nb & ⁹⁵ Nb activity in equilibrium sample. Eqb. after 2 years.
^{95m95} Nb	Niobium						
⁹⁷ Nb	Niobium	249			72.1 M 7	ORNL76	
⁹⁷ Zr	Zirconium	341		12	16.90 H 5	ORNL76	Reading gives sum of ⁹⁷ Zr & ^{97m} Nb activity in equilibrium sample. Eqb. after 10 minutes.
^{97m} Nb	Niobium						
^{97m} Nb	Niobium	271			60 S 1	ORNL76	
⁹⁷ Ru	Ruthenium	116	15	2	2.9 D 1	ORNL76	Decays to ^{97m} Tc
^{97m} Tc	Technetium	256 × 10	65		91.0 D	NM75	Estimation use only.
⁹⁹ Mo	Molybdenum (in Std. Mo Kit)	080 × 5 or 246 × 10 or 030 × 3.5				NTS78	
⁹⁹ Mo	Molybdenum (in CAP-MAC)	030 × 4 or 204 × 10				NBS78	
⁹⁹ Mo	Molybdenum (in MAC-S)	030 × 4 or 204 × 10				NBS78	
⁹⁹ Mo	Molybdenum (Eqb. ^{99m} Tc)	165	2	1.9	65.92 H 2	NBS78	
^{99m} Tc	Technetium	080	2	2.1	6.007 H 1	NBS76	
^{99m} Tc	Technetium (in CAP-MAC)	042		2.1	6.007 H 1	NBS76	

Radioisotopes		Calibration Setting Number	Uncertainty Due to Syringe		Half-Life (NCRP-58)	Ref.	Comments
			Corr. %	Published Data %			
^{99m} Tc	Technetium (Eqb. ⁹⁹ Mo)	175	2			NBS78	
⁹⁹ Mo	Molybdenum Eqb.	145	2			NBS78	Reading gives sum of ⁹⁹ Mo & ^{99m} Tc activity in equilibrium sample.
^{99m} Tc	Technetium						
¹⁰³ Pd	Palladium	562 × 10	50	4	16.97 D 2	ORNL76	Pure
¹⁰³ Pd	Palladium Eqb.	634 × 10	50	5		ORNL76	Reading gives sum of ¹⁰³ Pd & ^{103m} Rh activity in equilibrium sample. Eqb. after 9 hours.
^{103m} Rh	Rhodium						
^{103m} Rh	Rhodium	631 × 100	50	5	56.114 M 6	ORNL76	
¹⁰³ Ru	Ruthenium	165	50	3	39.26 D 2	ORNL76	
¹⁰³ Ru	Ruthenium Eqb.	172	50			ORNL76	Reading gives sum of ¹⁰³ Ru & ^{103m} Rh activity in equilibrium sample. Eqb. after 9 hours.
^{103m} Rh	Rhodium						
¹⁰⁶ Ru	Ruthenium (Eqb. ¹⁰⁶ Rh)	027 or 140 × 2			369 D 2	NDT70	Reading gives ¹⁰⁶ Ru Act. in eqb. sample. Eqb. after 5 minutes.
¹⁰⁶ Ru	Ruthenium Eqb.	480 × 10			369 D 2	NDT70	Reading gives sum of ¹⁰⁶ Ru & ¹⁰⁶ Rh activity in equilibrium sample.
¹⁰⁶ Rh	Rhodium						
^{108m} Ag	Silver	830	3		127 Y 21	ORNL76	
¹⁰⁸ Ag	Silver	099 × 10	6	15	2.37 M 1	ORNL76	Large β contribution.
¹⁰⁹ Cd	Cadmium Eqb.	047 or 180 × 2	40	4	462.6 D 4		Reading gives act of ¹⁰⁹ Cd, ^{109m} Ag, or Total Act. in eqb. sample. Eqb. after 6 minutes.
^{109m} Ag	Silver				39.8 S		
¹⁰⁹ Pd	Palladium Eqb.	435 × 10			13.427 H 14 39.8 S		Reading gives act of ¹⁰⁹ Pd, ^{109m} Ag, or Total Act. in eqb. sample. Eqb. after 6 minutes.
^{109m} Ag	Silver						
^{110m} Ag	Silver	554 ÷ 2		2	249.8 D 1	ORNL76	
¹¹¹ Ag	Silver	054 × 10		30	7.45 D 1	ORNL76	
¹¹¹ In	Indium	303	10	1.36	2.805 D 1	NBS77	
¹¹³ Sn	Tin	022 or 129 × 2	35	5	115.08 D 3	MARTIN77	For pure ¹¹³ Sn.
^{113m} In	Indium	076	7	2	1.658 H 1		Separated for pure ^{113m} In.
¹¹³ Sn	Tin Eqb.	180	15	3.2	NBS73,77		Reading gives act. of ¹¹³ Sn, ^{113m} In, or Total Act. in eqb. sample. Eqb. after 15 hours.
^{113m} In	Indium						
^{115m} In	Indium	058	15	2	4.486 H 4	ORNL76	

Radioisotopes		Calibration Setting Number	Uncertainty Due to Syringe		Half-Life (NCRP-58)	Ref.	Comments
			Corr. %	Published Data %			
^{116m} In	Indium	974		3	54.15 M 6	ORNL76	
^{117m} Sn	Tin	180	15	2	13.61 D 4	ORNL76	
¹¹⁷ Sb	Antimony	082	3	2	2.80 H 1	ORNL76	
^{119m} Sn	Tin	657 × 10	35	4	293.0 D 13	ORNL76	
^{121m} Te	Tellurium	187	12	9	154 D 7	ORNL76	Pure
¹²¹ Te	Tellurium	373	10	3	17 D 1	ORNL76	Pure
^{121m} Te	Tellurium	645					Reading gives act. of ^{121m} Te or ¹²¹ Te in eqb. sample. Eqb. in 120 days. See App. IV for non-eqb. samples.
¹²¹ Te	Eqb.						
^{121m} Te	Tellurium	572					Reading gives sum of ^{121m} Te or ¹²¹ Te in eqb. sample.
¹²¹ Te	Eqb.						
¹²² Sb	Antimony	146		6	2.70 D 1	ORNL76	
¹²³ I	Iodine	277	15	1.9	13.221 H 3	NBS77	Ref. for 28 keV x-ray.
^{123m} Te	Tellurium	177	12		119.7 D 1	NDT70	
¹²⁴ Sb	Antimony	720			60.20 D 3	ORNL76	
¹²⁴ I	Iodine	570	5		4.18 D 2	ORNL76	
¹²⁵ I	Iodine	319	25	1.45	59.6 D 2	NBS76	
¹²⁵ Sb	Antimony	289	10		2.758 Y 1	NDT70	Pure
¹²⁵ Sb	Antimony (Eqb. ^{125m} Te)	371	12		2.758 Y 1	NDT70	Reading gives ¹²⁵ Sb Act. in eqb. sample. Eqb. after 1 year.
¹²⁵ Sb	Antimony	364	12			NDT70	Reading gives sum of ¹²⁵ Te and ^{125m} Te in eqb. sample. See App. IV for non-eqb. activity.
^{125m} Te	Eqb.						
^{125m} Te	Tellurium	259	25		57.40 D 5	NDT70	
¹²⁶ I	Iodine	240	10	18	13.02 D 7	ORNL76	
¹²⁷ Xe	Xenon	371	12	5	36.4 D 1	ORNL76	
^{129m} Te	Tellurium	817 × 10	20	5	33.6 D 1	ORNL76	Pure
¹²⁹ Te	Tellurium	679 × 10	15	13	69.6 M 2	ORNL76	Pure
^{129m} Te	Tellurium	054					Reading gives act. of ^{129m} Te or total act. in eqb. sample. Eqb. in 10 hours.
¹²⁹ Te	Eqb.						
¹²⁹ Cs	Cesium	397	15	20	32.06 H 6	ORNL76	NM75 gives 488
¹²⁹ I	Iodine	166	20		1.57E7 Y 4	ORNL76	
^{129m} Xe	Xenon	362	20	3	8.0 D 2	ORNL76	

Radioisotopes		Calibration Setting Number	Uncertainty Due to		Half-Life (NCRP-58)	Ref.	Comments
			Syringe Corr. %	Published Data %			
¹³⁰ I	Iodine	984			12.36 H 1	ORNL76	
¹³¹ I	Iodine	151		1.65	8.021 D 1	NBS76	Decays to ^{131m} Xe. 1.1% feeding.
^{131m} Xe	Xenon	089	20	3	11.9 D 1	ORNL76	
¹³¹ Cs	Cesium	148	20	3	9.69 D 1	ORNL76	
¹³¹ Ba	Barium	505	10	7	11.8 D 2	ORNL76	
¹³² Te	Tellurium	315	10	5	76.3 H 2	ORNL76	Pure
¹³² I	Iodine	999			2.30 H 3	ORNL76	Pure
¹³² Te	Tellurium (Eqb. ¹³² I)	675 ÷ 2					Reading gives ¹³² Te Act. in eqb. sample. Eqb. after 1 day.
¹³² I	Iodine (Eqb. ¹³² Te)	653 ÷ 2					Reading gives ¹³² I Act. in eqb. sample.
¹³² Te	Tellurium Eqb.	663				ORNL76	Reading gives sum of ¹³² Te and ¹³² I in eqb. sample.
¹³² I	Iodine						
¹³² Cs	Cesium	485	10	2	6.475 D 10	ORNL76	
¹³³ I	Iodine	225			20.8 H 1	ORNL76	Decays to ^{133m} Xe.
^{133m} Xe	Xenon	100	20	3	2.19 D 1		Decays to ¹³³ Xe. See App. IV.
¹³³ Xe	Xenon	188	12	1.95	5.243 D 1	NBS76	
^{133m} Ba	Barium	132	12	3	38.9 H 1	ORNL76	Decays to ¹³³ Ba.
¹³³ Ba	Barium	591	10	3	10.5 Y 1	ORNL76	
¹³⁴ Te	Tellurium	533	3	6	41.8 M 8	ORNL76	
^{134m} Cs	Cesium	037 or 160 × 2	15		2.91 H	NM75	Decays to ¹³⁴ Cs.
¹³⁴ Cs	Cesium	726		2.3	2.065 Y 1	NBS73	
^{135m} Xe	Xenon	181	3		15.29 M 3	ORNL76	Decays to ¹³⁵ Xe. See App. IV.
¹³⁵ Xe	Xenon	085	2		9.09 H 1	ORNL76	
^{135m} Ba	Barium	130	15	4	28.7 H 2	ORNL76	
¹³⁶ Cs	Cesium	489 ÷ 2		4	13.1 D 1	ORNL76	
¹³⁷ Cs	Cesium Eqb.	220		2.0	30.0 Y 2	NBS73	Ref: 661.6 & 32.9 keV. Reading gives ¹³⁷ Cs or Total Activity of eqb. sample. Often referred to as "Cs-137" Source.
^{137m} Ba	Barium				2.553 M 1		
¹³⁹ Ba	Barium	445 × 10	5	12	82.8 M 2	ORNL76	
¹³⁹ Ce	Cerium	352	5	2.6	137.64 D 2	NBS73	Ref: 36.8 keV
¹⁴¹ Ce	Cerium	061	5	5	32.50 D 1	ORNL76	

Radioisotopes		Calibration Setting Number	Uncertainty Due to		Half-Life (NCRP-58)	Ref.	Comments
			Syringe Corr. %	Published Data %			
¹⁴² Pr	Praseodymium	226 × 10		14	19.13 H 4	ORNL76	
¹⁴⁴ Pr	Praseodymium	137 × 10		5	17.28 M 5	ORNL76	Estimation use only. β dominant.
¹⁴⁴ Ce	Cerium	387 × 10	5	2.8	285.0 D 1	NBS73	Ref: 36.7 & 133.5 keV. Reading gives sum of ¹⁴⁴ Ce & ¹⁴⁴ Pr Act. in equilibrium sample. Eqb. after 2 hours.
¹⁴⁴ Pr	Praseodymium						
¹⁴⁵ Pm	Promethium	207	10	3	17.7 Y 4	ORNL76	
¹⁴⁷ Nd	Neodymium	213	5	4	10.98 D 1	ORNL76	
¹⁵⁷ Dy	Dysprosium	424	5		8.1 H 1	NM75	
¹⁶⁹ Yb	Ytterbium	948	3	2.5	32.03 D 1	NBS78	
¹⁷¹ Tm	Thulium	292 × 100	4		1.92 Y 1	NM75	
¹⁷⁵ Yb	Ytterbium	308 × 10	2	13	4.19 D 1	ORNL76	
¹⁷⁷ Lu	Lutetium	450 × 10	2	7	6.71 D 1	ORNL76	
¹⁸¹ Hf	Hafnium	387		6	42.4 D 1	ORNL76	
¹⁸¹ W	Tungsten	165	3	11	121.2 D 3	ORNL76	
¹⁸⁸ W	Tungsten	111 × 100			69.4 D 5	NM75	Decays to ¹⁸⁸ Re. Eqb. after 7 days. See App. IV
¹⁸⁸ Re	Rhenium	496 × 10			16.98 H 2	NM75	
¹⁸⁸ W	Tungsten (Eqb. ¹⁸⁸ Re)	522 × 10					Reading gives ¹⁸⁸ W Act. in eqb. sample. Eqb. after 5 days.
¹⁸⁸ Re	Rhenium (Eqb. ¹⁸⁸ W)	516 × 10					Reading gives ¹⁸⁸ Re Act. in eqb. sample.
¹⁸⁸ W	Tungsten Eqb.	217 × 10					Reading gives sum of ¹⁸⁸ W & ¹⁸⁸ Re activity in equilibrium sample.
¹⁸⁸ Re	Rhenium						
^{190m} Os	Osmium	858			9.90 M	NM75	
¹⁹¹ Os	Osmium	250	2	13	15.4 D 2	ORNL76	
¹⁹² Ir	Iridium	408			73.83 D 1	NDS73	
¹⁹⁴ Ir	Iridium	469 × 10		18	19.15 H 3	ORNL76	
¹⁹⁷ Pt	Platinum	686 × 10	2	6	18.3 H 3	ORNL76	
¹⁹⁷ Hg	Mercury	197	2	2.9	64.1 H 1	NBS76	Ref. for 70 & 77 keV.
¹⁹⁸ Au	Gold	149		1.65	2.696 D 2	NBS78	
¹⁹⁹ Au	Gold	053		6	3.139 D 7	ORNL76	
²⁰¹ Tl	Thallium	205	2	2.0	72.91 H 2	NBS76	
²⁰³ Hg	Mercury	093		1.1	46.60 D 1	NBS73	
²⁰³ Pb	Lead	344		2	51.88 H 1	ORNL76	

Radioisotopes		Calibration Setting Number	Uncertainty Due to Syringe		Half-Life (NCRP-58)	Ref.	Comments
			Corr. %	Published Data %			
²⁰⁴ Tl	Thallium	420 × 100	2	2	3.78 Y 2	NDT70	
²⁰⁷ Bi	Bismuth	846		1.7	32.2 Y 9	NBS73	Ref. for 1064, 569.7, 76.7, & 1772 keV.
²⁰⁸ Tl	Thallium	571 ÷ 2			3.053 M 4	NM75	
²¹² Pb	Lead	101			10.64 H 1	NM75	Decays to ²¹² Bi. Eqb. after 1 hr. See App. IV.
²¹² Bi	Bismuth	489 × 10			60.55 M 6	NM75	
²¹² Pb	Lead (Eqb. ²¹² Bi)	158					Reading gives ²¹² Pb Act. in eqb. sample. Eqb. after 8 hours.
²¹² Bi	Bismuth (Eqb. ²¹² Pb)	135					Reading gives ²¹² Bi Act. in eqb. sample.
²¹² Pb	Lead Eqb.	030 or 146 × 2					Reading gives sum of ²¹² Pb & ²¹² Bi activity in equilibrium sample.
²¹² Bi	Bismuth						
²²⁴ Ra	Radium	646 × 100			3.66 D 4	NM75	
²²⁶ Ra	Radium + chain of daughters	778		0.5	1600 Y 7	NBS73	Reading in grams. Commonly referred to as "Radium "Source. 1.025 g/Ci of Ra-226.
²³⁹ Np	Neptunium	147		6	2.355 D 4	ORNL76	
²⁴¹ Am	Americium	055	4	1	432.2 Y 5	LMR69	Ref. for 59.5 & 14 keV.

APPENDIX III

PET CHAMBER CALIBRATION NUMBERS

CALIBRATION SETTING NUMBERS

The Isotope Calibration Numbers in Table I are applicable to the Capintec CRC[®]-55t PET Chamber(s) only.

The CRC[®]-55t is a direct reading instrument. No manual multiplication or division should be performed, even if the Calibration Setting Number is followed by a multiplication sign "×" or a division sign "÷" and a number.

If the sample contains radioactive impurities, the meter indication will always be higher than the actual activity of the principal isotope. It will not, however, be the total activity of the principal isotope and the impurities.

UNCERTAINTY DUE TO SYRINGE CORRECTION

The Calibration Setting Numbers are given for approximately 5 grams of radioactive solution in a standard source ampoule made of about 0.6 mm. thick borosilicate glass. The standard radioactive source in the ampoule is, however, a good approximation for a radiopharmaceutical in a plastic syringe or a glass syringe (wall thickness about 1.2 mm) for most radioisotopes.

TABLE I

Radioisotopes	Calibration Setting Number	Half-Life (NCRP-58)	Ref.
¹¹ C Carbon 11	467	20.38 Minutes	See Note
¹⁵ O Oxygen 15	474	122.24 Seconds	See Note
¹³ N Nitrogen 13	470	9.965 Minutes	See Note
¹⁸ F Fluorine 18	480	109.71 Minutes	NIST
⁵⁷ Co Cobalt 57	112	271.7 Days	NIST
⁶⁰ Co Cobalt 60	990	5.271 Years	NIST
¹³³ Ba Barium 133	674	10.5 Years	NIST
¹³⁷ Cs Cesium 137	243	30.0 Years	NIST

Note: These Calibration Numbers were determined by inter-comparison with a standard Capintec CRC[®]-15R Dose Calibrator. No NIST standards are yet available. They should be used for estimation purposes only.

APPENDIX IV

MULTIPLICATION FACTORS FOR NON-EQUILIBRIUM RADIOISOTOPES

Note: These Multiplication Factors apply to the R Chamber only.

The activity in a non-equilibrium sample can be determined by using the following equation:

$$\text{Activity of "A"} = \frac{\text{Meter Reading with Cal. Number for Pure "A"}}{1 + F \frac{T_A}{T_A - T_B} \left[1 - \exp \left(- \frac{T_A - T_B}{T_A \times T_B} \times t \times \ln 2 \right) \right]} \frac{R_B}{R_A}$$

where "A" and "B" are parent and daughter nuclide respectively, T's are half lives, and R_A and R_B are the chamber responses to the isotopes A and B, "t" is the elapsed time after the pure parent isotope was produced, and "F" is the decay branching ratio.

The chamber response, "R," may be obtained from the calibration number "N," using the following equation:

$$R = \frac{N}{1075.8} + 0.0797$$

When the half-life of the parent nucleus (T_A) is much shorter than that of the daughter nucleus (T_R), the parent decays down to the daughter. After about $10 \times T_A$, we can assume that only the daughter is left (except if the original activity of the parent was exceptionally high). The equation above for the Activity of "A" can be used to obtain the activity of the parent while it has measurable activity.

Multiplication factors obtained by using the equation are given in the following tables for selected isotopes.

Multiplication factors for Ca47 Activity Measurements:

Use a Calibration Number of 373 and a multiplication factor as indicated in the following table to obtain Ca47 activity at time "t" days after an initially pure source of Ca47 is obtained.

Ca47			
t [days]	Multiplication Factor	t [days]	Multiplication Factor
0	1.000	12	0.672
1	0.950	14	0.648
2	0.906	16	0.627
3	0.869	18	0.609
4	0.836	20	0.594
5	0.806	25	0.566
6	0.781	30	0.545
7	0.757	40	0.519
8	0.737	50	0.496
9	0.718	100	0.485
10	0.701	150	0.484

Multiplication factors for Ni56 Activity Measurements:

Use a Calibration Number of 844 and a multiplication factor as indicated in the following table to obtain Ni56 activity at time "t" days after an initially pure source of Ni56 is obtained.

Ni56			
t [days]	Multiplication Factor	t [days]	Multiplication Factor
0	1.000	9	0.824
1	0.985	10	0.799
2	0.969	12	0.745
3	0.952	15	0.659
4	0.934	20	0.508
5	0.915	25	0.366
6	0.894	30	0.249
7	0.872	40	0.101
8	0.849	60	0.013

Multiplication factors for Zn62 Activity Measurements:

Use a Calibration Number of 217 and a multiplication factor as indicated in the following table to obtain Zn62 activity at time “t” minutes after an initially pure source of Zn62 is obtained.

Zn62			
t [minutes]	Multiplication Factor	t [minutes]	Multiplication Factor
0	1.000	45	0.368
10	0.526	60	0.361
20	0.425	75	0.359
30	0.389	90	0.358

Multiplication factors for Y87 Activity Measurements:

Use a Calibration Number of 170 and a multiplication factor as indicated in the following table to obtain Y87 activity at time “t” hours after an initially pure source of Y87 is obtained.

Y87			
t [hours]	Multiplication Factor	t [hours]	Multiplication Factor
0	1.000	5	0.664
0.25	0.960	6	0.644
0.50	0.926	8	0.618
0.75	0.893	10	0.602
1.00	0.866	12	0.593
1.5	0.820	18	0.582
2.0	0.784	24	0.580
3.0	0.729	48	0.579
4.0	0.691	∞	0.579

Multiplication factors for Zr95 Activity Measurements:

Use a Calibration Number of 271 and a multiplication factor as indicated in the following table to obtain Zr95 activity at time “t” days after an initially pure source of Zr95 is obtained.

Zr95			
t [days]	Multiplication Factor	t [days]	Multiplication Factor
0	1.000	40	0.592
2	0.961	50	0.548
4	0.925	60	0.513
6	0.893	80	0.462
8	0.863	100	0.426
10	0.836	150	0.374
15	0.776	200	0.347
20	0.727	300	0.322
25	0.685	600	0.309
30	0.650	∞	0.308

Multiplication factors for Te121m Activity Measurements:

Use a Calibration Number of 187 and a multiplication factor as indicated in the following table to obtain Te121m activity at time “t” days after an initially pure source of Te121m is obtained.

Te121m			
t [days]	Multiplication Factor	t [days]	Multiplication Factor
0	1.000	40	0.437
1	0.943	50	0.415
2	0.895	60	0.401
5	0.782	70	0.392
10	0.661	80	0.386
15	0.586	90	0.382
20	0.535	100	0.379
25	0.499	120	0.376
30	0.472	140	0.374

Multiplication factors for Sb125 Activity Measurements:

Use a Calibration Number of 289 and a multiplication factor as indicated in the following table to obtain Sb125 activity at time "t" days after an initially pure source of Sb125 is obtained.

Sb125			
t [days]	Multiplication Factor	t [days]	Multiplication Factor
0	1.000	90	0.878
10	0.977	120	0.861
20	0.958	150	0.849
30	0.941	180	0.841
40	0.927	360	0.824
50	0.914	540	0.822
60	0.903	∞	0.821

Multiplication factors for Te129m Activity Measurements:

Use a Calibration Number of 817 and a multiplication factor as indicated in the following table to obtain Te129m activity at time "t" hours after an initially pure source of Te129m is obtained.

Te129m			
t [hours]	Multiplication Factor	t [hours]	Multiplication Factor
0	10.0	6	6.55
1	8.04	8	6.50
2	7.25	10	6.49
4	6.701	12	6.48
			Equilibrium

Multiplication factors for Te132 Activity Measurements:

Use a Calibration Number of 315 and a multiplication factor as indicated in the following table to obtain Te132 activity at time “t” hours after an initially pure source of Te132 is obtained.

Te132			
t [hours]	Multiplication Factor	t [hours]	Multiplication Factor
0	1.000	4	0.342
0.25	0.836	5	0.318
0.50	0.725	10	0.275
1.00	0.586	15	0.266
2.00	0.447	20	0.265
3.00	0.380	24	0.264
			Equilibrium

Multiplication factors for Xe133m Activity Measurements:

Use a Calibration Number of 100 and a multiplication factor as indicated in the following table to obtain Xe133m activity at time “t” days after an initially pure source of Xe133m is obtained.

Xe133m			
t [days]	Multiplication Factor	t [days]	Multiplication Factor
0	1.000	4	0.465
1	0.824	5	0.385
2	0.680	10	0.151
3	0.562	20	0.024

Multiplication factors for Xe135m Activity Measurements:

Use a Calibration Number of 181 and a multiplication factor as indicated in the following table to obtain Xe135m activity at time "t" minutes after an initially pure source of Xe135m is obtained.

Xe135m			
t [minutes]	Multiplication Factor	t [minutes]	Multiplication Factor
0	1.000	60	0.807
10	0.990	75	0.676
20	0.975	90	0.514
30	0.952	120	0.217
45	0.897	180	0.019

Multiplication factors for W188 Activity Measurements:

Use a Calibration Number of 111 and a multiplication factor as indicated in the following table to obtain W188 activity at time "t" hours (or days) after an initially pure source of W188 is obtained.

W188			
t [hours]	Multiplication Factor	t [days]	Multiplication Factor
0	100.0	1	5.09
1	45.6	2	3.75
2	29.9	3	3.40
4	18.2	4	3.30
6	13.4	5	3.26
12	8.0	6	3.25
18	6.0	7	3.24

Multiplication factors for Pb212 Activity Measurements:

Use a Calibration Number of 101 and a multiplication factor as indicated in the following table to obtain Pb212 activity at time "t" hours after an initially pure source of Pb212 is obtained.

Pb212			
t [hours]	Multiplication Factor	t [hours]	Multiplication Factor
0	1.000	5	0.772
0.5	0.924	6	0.768
1.0	0.875	7	0.766
2.0	0.820	8	0.765
3.0	0.793	9	0.765
4.0	0.779	10	0.764
			Equilibrium

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NEW PRODUCT WARRANTY

Conditions and Limitations

CAPINTEC warrants our products to be free from defects in material and workmanship for a period of 12 months after delivery to the original buyer (unless indicated otherwise). Our obligation under this warranty is limited to servicing or adjusting products returned to our factory for that purpose promptly upon any claim under this warranty, provided our examination discloses to our satisfaction that the affected parts were originally defective and have not been subjected to misuse, abuse, mishandling or improper operation. This warranty extends to every part of the product except batteries, fuses, ink, magnetic storage media, toner, transistors, tubes or any other normally consumable item. In no event shall we be liable for transportation, installation, adjustment or any other expenses which may arise in connection with such products or their servicing or adjustment.

This warranty is expressly in lieu of any other express or implied warranties, and we make no warranty that the products sold herein are merchantable or are suitable for any particular purpose. The benefits of this warranty shall extend only to the buyer and to none other. We shall have no liability of any nature arising out of the use or application of the product in conformity with this warranty. If the product shall fail to perform in conformity with the warranty made herein, we shall be liable solely for the repair and replacement of the product as provided hereinabove, and shall have no other liability in respect of such failure or performance, or any consequences therefrom, including, without limitation, business impairment or loss, personal injury or property damage.

No agent, employee, or representative of ours has any authority to bind us to any representation or warranty concerning the product sold herein, and unless a representation or warranty made by an agent, employee or representative is specifically included herein, it shall not be enforceable by the buyer. No waiver, alteration or modification of the foregoing conditions shall be valid, unless made in writing and signed by an executive officer of our corporation.

