CRC®-25W

Manual Stock No. 9250-0123 May 8, 2017
Rev. N 2017/05/08

OWNER'S MANUAL

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TABLE OF CONTENTS

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PREFACE

GENERAL

Thank you for purchasing the Capintec, Inc. CRC®-25W 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.

Please address any comments pertaining to this manual to:

CAPINTEC, Inc.
7 Vreeland Road
Florham Park, NJ 07932
Phone (800) ASK-4CRC
Fax (201) 825-1336

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®-25W Radioisotope Dose Calibrator consists of the following:

- Display Unit (Readout)
- Chamber
- Well Counter
- Power Cord
- Printer (optional)

The CRC®-25W has the following capabilities:

- Chamber
  - perform dose calibration
- Well Counter
  - perform wipe tests,
  - perform lab tests such as Schilling, Plasma, and RBC

The Chamber Enhanced functions provide the following enhancements:

- Inventory Functions
- Geometry Test
- Linearity Tests
  - Standard Test
  - Lineator
  - Calicheck
- QC Tests
  - Single Strip
  - Two Strips
  - Tc99m HMPAO
  - Tc99m MAG3

YEAR 2000 COMPLIANCE

The CRC®-25W 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 or particulates (IP00).
- 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 only Authorized Service Center.

IMPORTANT SAFETY INFORMATION

The CRC®-25W 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.

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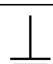
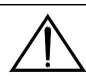
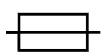
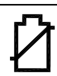
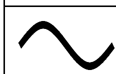
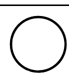
CHAPTER 1

SAFETY

GENERAL

These warnings and instructions for use form an integral part of the CRC®-25W 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
	Caution
	Operator should consult accompanying documents
	Fuse
	Low Battery: Indicates that the internal Lithium Battery has depleted.
	AC Voltage
	“ON” (power)
	“OFF” (power)
IVD	In Vitro Diagnostic Medical Equipment
	Date of manufacture
CE 0413	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

Located on the back of the Readout Unit is a label, (Figure 1-1), providing the system power requirements and the replacement fuse values for power line voltages.

CAUTION: Please reference CHAPTER 19: CLEANING AND MAINTENANCE, SECTION: FUSE SERVICING for instructions on how to change the fuses of the CRC®-25W.

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

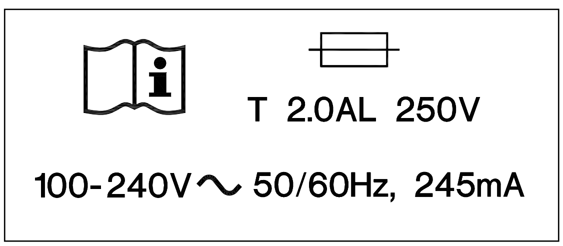


Figure 1-1

The bottom of the Chamber contains the following labels:

- Figure 1-2 contains statements denoting not to remove the cover because there are no adjustments that the user can perform in the Chamber.

CAUTION: DO NOT REMOVE COVER. NO USER-SERVICEABLE PARTS INSIDE. REFER SERVICING TO AUTHORIZED SERVICE PERSONNEL. PN 7120-1205

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

Figure 1-2

- Figure 1-3 pertains to the electrical safety of the Chamber. It is necessary because of the high voltage present (approximately 180 Volts DC) on the PC board installed in the Chamber. A screwdriver is necessary to remove the cover.

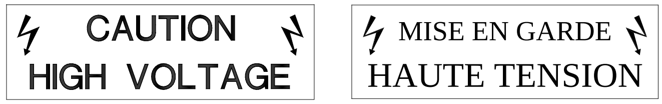


Figure 1-3

Located on the bottom of the Well Counter are labels (Figure 1-3) which pertains to the electrical safety of the Well Counter. It is necessary because of the high voltage present (approximately 1000 Volts DC) on the inside of the Well Counter. A screwdriver is necessary to remove the cover.

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®-25W 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®-25W 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 (up to 180 Vdc) and the Well Counter (up to 1000 Vdc). Due to the presence of these high voltages, opening the covers with the system plugged in may be hazardous. Refer all servicing to qualified personnel.

CAUTION: No internal adjustments inside the Readout, Chamber or Well Counter 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 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 19: CLEANING AND MAINTENANCE, SECTION: CLEANING and DISINFECTING 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®-25W 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®-25W or the CRC®-25W 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 only by Capintec's only Authorized Service Center (reference CHAPTER 19: 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®-25W Calibrator.
- The CRC®-25W 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

INTENDED USE

The CRC®-25W is intended to be used by trained Nuclear Medicine Technologists and Physicians, for performing Wipe Tests, Schillings Test, Plasma Volume Test with I 125, and RBC Volume Test with Cr51.

Also using the system are Health Physicists with expertise in nuclear medicine and radiation safety – typically used for assessing reproducibility of counting instruments with various Quality Assurance procedures (MDA).

OPERATOR PROFILE

The operator profile for the Nuclear Medicine Technologists, Physicians and Health physicists is as follows:

- **Education:**
  - Minimum: at least an Associate Degree
  - No maximum

- **Knowledge:**
  - Minimum: Understands the basic concepts of nuclear medicine.
  - No maximum

- **Language Understanding:**
  - English
  - Other languages are available for instructions for use

- **Experience:**
  - Minimum: Has minimum training or is under surveillance by a trained user.
  - No maximum

OPERATOR TRAINING

This Owner's Manual contains all of the information required to operate the CRC®-25W.

FUNCTIONAL DESCRIPTION

Chamber

The CRC®-25W provides a precise, accurate, fast and very convenient method of measuring the activity of a radioisotope sample for Nuclear Medicine and Brachytherapy.

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 the ionization chamber 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 are provided for the most often used radioisotopes.

Five user assignable nuclide keys are provided for commonly used radioisotopes that do not have a preset nuclide key.

Assays may be made reliably in the Chamber, from as low as 1 microcurie (0.037 megabequerel) for most radioisotopes to as high as 6.6 curies [244 giga (10^9) Becquerels] of Tc99m.

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.

Well Counter

With its NaI drilled-well crystal detector, the Well Counter offers greater sensitivity and faster results than other wipe test monitors that use Geiger-Mueller (GM) tubes.

The microprocessor-controlled CRC®-25W has an automatic internal energy calibration feature, which permits self-calibration of the keV per channel ratio.

It also automatically calculates the efficiency and converts readings in cpm [counts per minute] to dpm [disintegrations per minute]. Most federal and state regulations require survey monitoring results in dpm.

Capabilities and Features	NaI Drilled-Well Crystal	GM-Tube Detector
Counting time required to achieve sensitivity of 1 nCi (2220 dpm), required by regulations	6 to 180 sec (0.1 to 3.0 min)	300 to 6,000 sec (5 min to 10 min)
Counting time recommended for low background levels	1 to 3 min	at least 20 min
Offers energy discrimination, which helps users identify radionuclide contaminants with gamma spectroscopy	Yes	No
Achieves sensitivity of 200 dpm, required for iodine therapy	Yes	No
Handles high count rates (60,000 cps) before exceeding 30% dead time	Yes	No
Evaluates identity of radiopharmaceuticals and brachytherapy sources, helps identify contaminants	Yes	No

The CRC®-25W stores efficiencies and gamma spectroscopy data for 68 radionuclides. Users can add ten more radionuclides to the CRC®-25W memory.

Note: *The CRC®-25W is not designed to provide conclusive identification of radionuclides in samples. The CRC®-25W is designed to provide the first step for users who need to identify contaminants by narrowing down the possibilities of which isotopes are contained in wipe test samples.*

The CRC®-25W can also give “All Channels” results for a wipe sample by grouping all six channels together as one open energy window. This indicates whether a sample exceeds trigger levels, but does not help identify the contaminant.

OVERALL PROGRAM FLOW

When the power is turned on, the Sign-On Screen appears. When the **ENTER** key is pressed, the Chamber Measurement Screen is displayed and the CRC®-25W begins measuring the activity in the Chamber. All Chamber measurements, the Main Menu and the Test Menu are accessed from this screen. The **WELL** key is used to access Well Counter measurements and functions for the Well Counter. The overall program flow is illustrated in Figure 2-1 Overall Program Flow Chart.

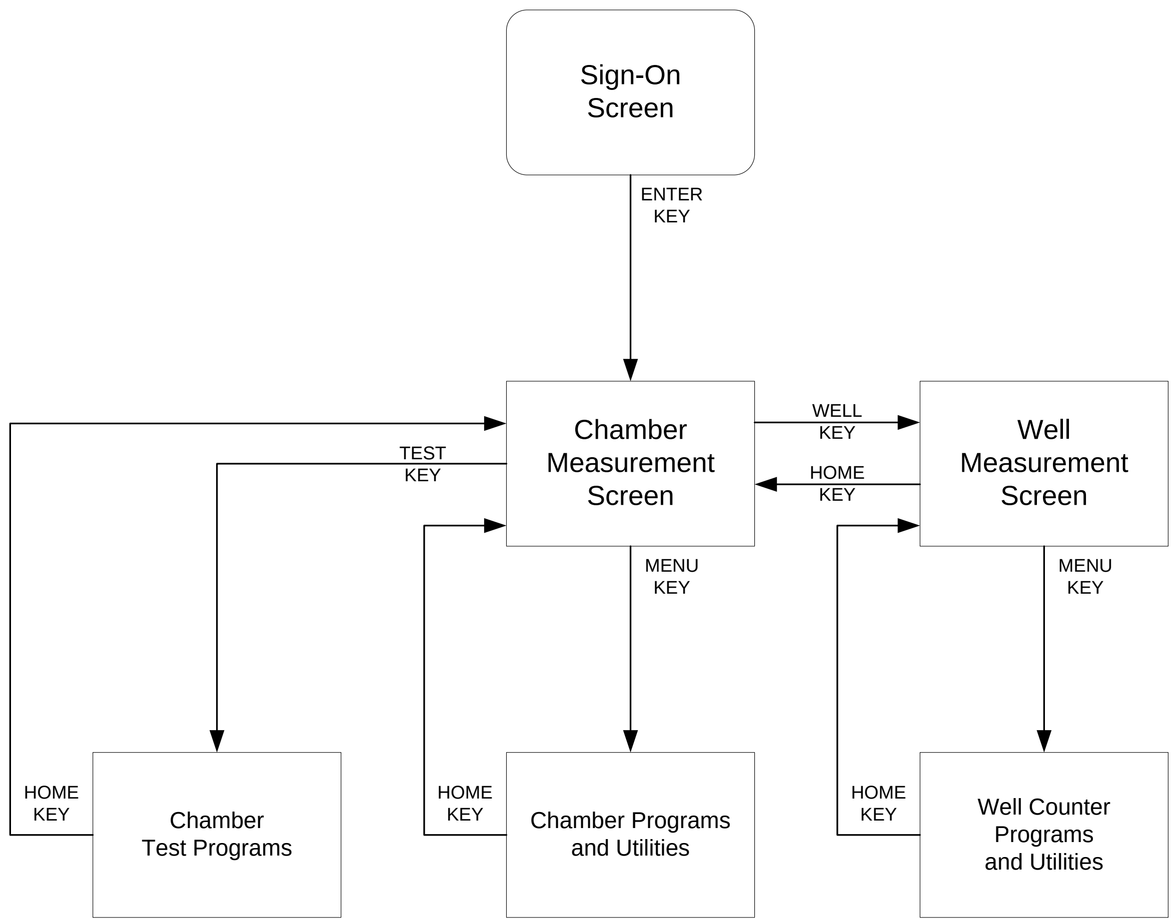


Figure 2-1 Overall Program Flow Chart

Chamber Programs and Utilities

Chamber Programs and Utilities are accessed by pressing the **MENU** key from the Chamber Measurement Screen. These are illustrated in Figure 2-2 Chamber Program Flow Chart.

Chamber Test Programs

The Chamber Test Programs are accessed by pressing the **TEST** key from the Chamber Measurement Screen. These are illustrated in Figure 2-2 Chamber Program Flow Chart.

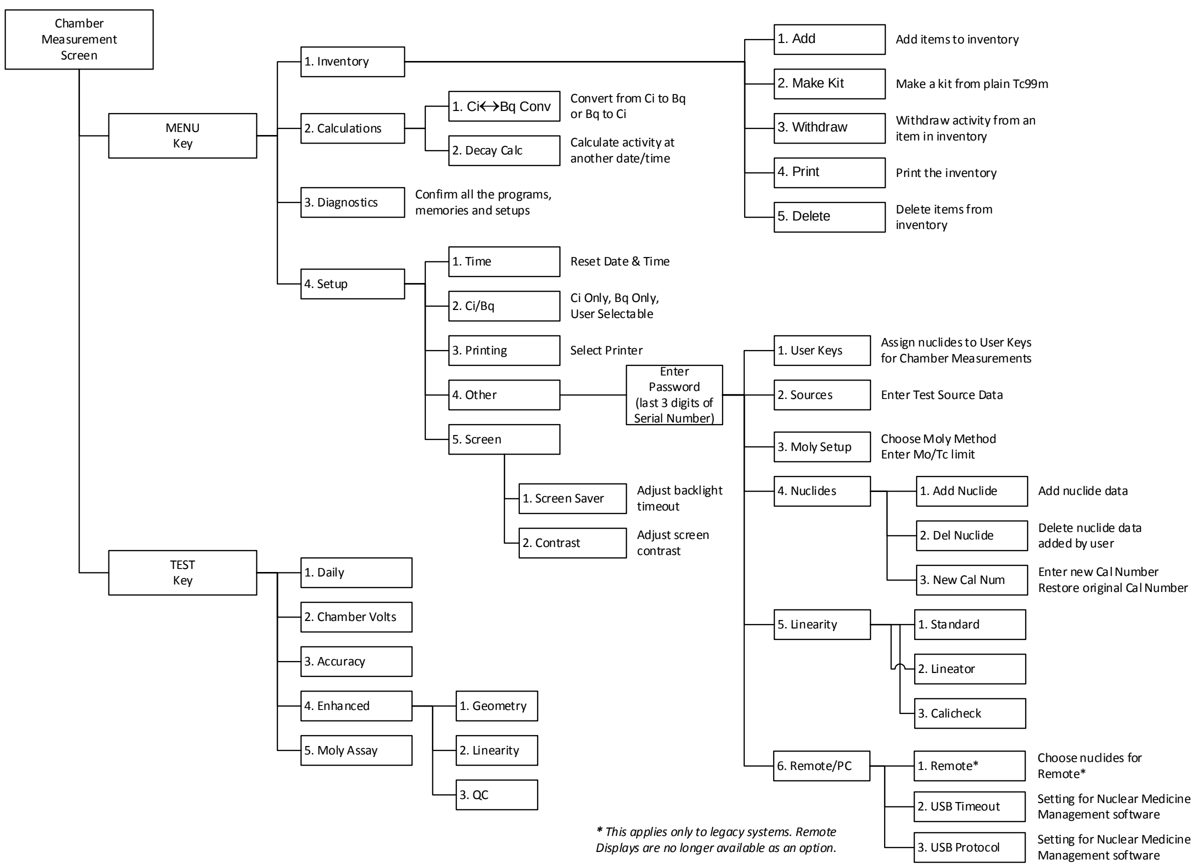


Figure 2-2 Chamber Program Flow Chart

Well Counter Programs and Utilities

Well Counter Programs and Utilities are accessed by pressing the **MENU** key from the Well Measurement Screen. These functions relate only to the Well Counter and are illustrated in Figure 2-3 Well Counter Program Flow Chart.

Well Counter Test

The Well Counter Test is accessed by pressing the **TEST** key from the Well Measurement Screen. These are illustrated in Figure 2-3 Well Counter Program Flow Chart.

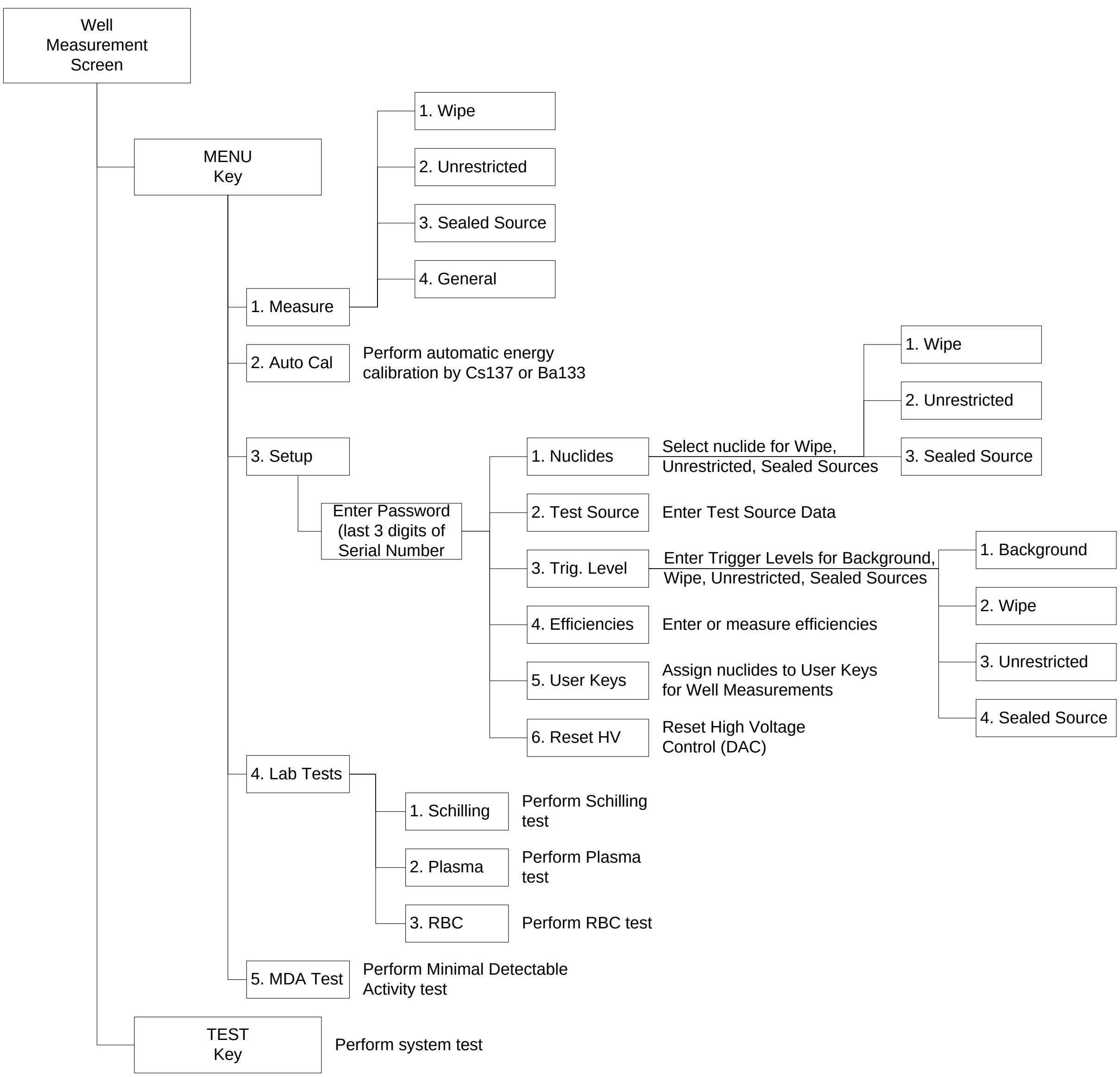


Figure 2-3 Well Counter Program Flow Chart

TECHNICAL DESCRIPTION

On / Off Switch

The on/off switch (I = on; ○ = 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®-25W.

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, 245mA

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-U220D Roll Printer (optional)

Input: 100-240Vac, 50/60Hz, 1.0A max; ***Output:*** 24Vdc, 1.5A

HP DeskJet 6000/8000 Series Inkjet (or equivalent) Printer (optional)

100-240Vac, 50/60Hz, 1.5A

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

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

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 .... 13.7cm .....(5.38in)
Width .... 26.0cm .....(10.25in)
Depth .... 26.7cm .....(10.5in)
Weight .... 1.8kg ....(3.9lb)

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)
Lead Shielding .... 3.2mm ......(1/8”)

Well Counter

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.)
Lead Shielding .... 1.3cm ....(1/2”)

Cables

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

Performance

Chamber Performance:

Measurement Range:
Maximum Activity (Co60).................. 37.5 GBq (1.01 Ci)
Maximum Activity (Co57).................. 206. GBq (5.58 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
Below 20µCi.................................... within 25 seconds
Above 20µCi .... within 4 seconds

[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.

Well Counter Performance:

Type	Drilled-well crystal, NaI(Tl) scintillator
Crystal Dimensions	3.8cm (1.5”) × 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®-25W 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

This section describes general operating procedures: the keyboard, how to enter data and make menu selections.

KEYBOARD

Layout

CRC®-25W keyboard is shown below.

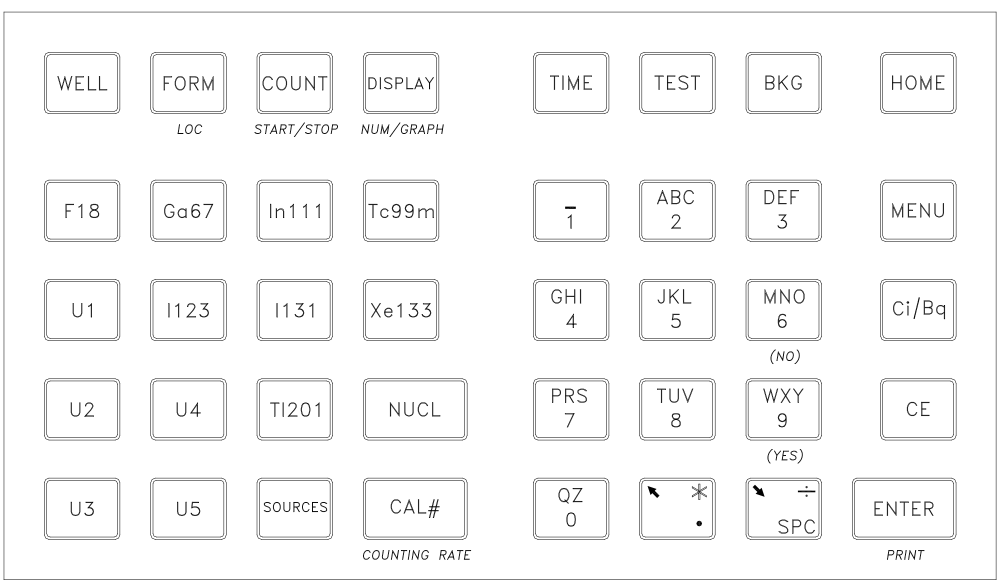


Figure 3-1 Keyboard

Key Usage

General usage of keys is briefly described. Specific key usage will be given in the appropriate sections.

WELL Key

When the instrument is first powered up, it is in Chamber mode. That is, it is set up to make measurements using the Chamber. Pressing the **WELL** key will put the instrument in Well mode, which means it will be set up to make measurements using the Well Counter.

FORM *(LOC)* Key

FORM
In Chamber mode, this key is used when correction factors for different container types (Syringe, Vial, Capsule or none) which have been input via setup. The key scrolls through the possible choices.

LOC
In Well mode, this key is used to change the Wipe location.

COUNT *(START/STOP)* Key

When in Well mode, this key is used to start and stop a measurement.

DISPLAY *(NUM/GRAPH)* Key

DISPLAY
In Chamber mode with a printer attached to the system, pressing this key will activate the Dose Table function.

NUM/GRAPH
In Well mode, pressing this key will switch between text display and graphic display.

NUCLIDE Keys

Pressing one of these keys selects that nuclide.

F18, Ga67, In111, Tc99m, I 123, I 131, Xe133, Tl201

USER Keys

Any nuclide in memory may be assigned to any of the **USER** Keys.

When a key is assigned, it acts just like a Nuclide Key.

There are 2 sets of **USER** Keys:

- Chamber
  U1, U2, U3, U4, U5
- Well Counter
  U1, U2, U3, U4, U5

SOURCES Key

This key is only active in Chamber Mode.

Pressing this key will toggle through the entered Test Sources for the chamber.

NUCL Key

Pressing this key allows the user to select any nuclide in memory (including nuclides added by the user).

The nuclide is chosen using the number/ letter keys.

CAL# *(COUNTING RATE)* Key

CAL#

Pressing this key in Chamber mode allows the user to input a Calibration Number to be used for the current measurement.

COUNTING RATE

Pressing this key in Well mode will calculate and display the cpm (or cps) for all the channels (i.e., no nuclide selected).

TIME Key

This key is only active in Chamber Mode.

After pressing this key, a time and date is input. The activity at the input time of the source being measured is displayed under the current activity along with the input time and date.

TEST Key

Pressing this key will display the Test Menu.

BKG Key

Pressing this key steps the user through the Background Measurement. The background will be measured and stored.

When in Chamber mode, the background will be measured and stored for the Chamber. When in Well mode, the background will be measured and stored for the Well Counter.

HOME Key

Pressing this key in Chamber Mode will return the user to the Chamber Measurement Screen.

Pressing this key in Well Mode will return the user to the Well Measurement Screen. Pressing this key at the Well Measurement Screen will return the user to the Chamber Measurement Screen.

If this key is pressed before ending the task being performed, the task will be terminated without being finished (e.g. entered data will not be stored and previous values are maintained).

MENU Key

Pressing this key in Chamber mode brings up the Chamber Main Menu.

Pressing this key in Well mode brings up the Well Main Menu.

When in a sub-menu, pressing this key will return to the system to the previous menu screen.

Ci / Bq Key

Pressing this key toggles the measurement between Curies and Becquerels.
It is only active if *USER SELECTABLE* has been chosen for Ci/Bq.

CE Key

This is the Clear Entry key and is used to erase the last character when entering data.

ENTER *(PRINT)* Key

ENTER
This key is used to accept entered data.

PRINT
This key is used to print a record of the measurement.

NUMBER / LETTER (Alphanumeric) Keys

The keys with Numbers and Letters on them are used to enter data. The decimal point is the **UP ARROW (⇖)** key. The **DOWN ARROW (⇘)** key is the **SPC** (Space).

ARROW Keys (⇖ and ⇘)

During a Chamber measurement, the arrows are used to change the precision of the displayed measurement for low activity.

When a multi-field entry is being made (e.g. date, time, activity, half-life) the arrows are used to move to the next field or to change the value of the unit.

ENTERING DATA

Numeric Data

Numeric data is entered via the NUMBER / LETTER keys on the right hand side of the keyboard.

The decimal point is on the same key as the **UP ARROW (⇖)**.

If the entry must be an integer, the decimal point will not be allowed.

Press **CE** to erase the last digit entered.

Press **ENTER** when a correct entry has been made.

Alphanumeric Data

Alphanumeric data (numbers and letters) are entered via the NUMBER / LETTER keys.

When a NUMBER / LETTER key is pressed, the number appears. Press the key again to change the number into one of the letters on the same key (e.g. press the **2** key 3 times to get the letter B). To go to the next character, press another key. If the next character is on the same key, press the **UP ARROW (⇖)** to repeat use of that key. The **DOWN ARROW (⇘)** is the **SPC** (Space) key.

When entering a name for an additional nuclide, the entries are constrained to conform to legitimate nuclide names.

MAKING MENU SELECTIONS

All menus appear with a number in front of each selection.

To make a selection, press the NUMBER key corresponding to the desired selection.

RESPONDING TO QUESTIONS (*YES*) OR (*NO*)

There are several occasions where the user is asked a question which is to be answered Yes or No.

Press **Y** (9, WXY) for *(YES)*. Press **N** (6, MNO) for *(NO)*.

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CHAPTER 4

SYSTEM SETUP

GENERAL

Initial installation and checkout procedures are described in this section.

RECEIVING CONDITION EXAMINATION

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

Should the instrument be received in a damaged condition, save the shipping container and the packing material 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 an optional printer is included, it will be in a separate carton.)

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 material and tapes. The shipping and packing material should be saved for future use.

2. The following equipment should be found upon unpacking:
   - Readout Unit
   - Chamber and Liner/Dipper
   - Well Counter
   - Power Cord
   - Printer (optional)
     - Okidata Microline 320, or
     - Epson LX-300+II, or
     - Epson Slip printer, or
     - Epson Roll printer, or
     - HP DeskJet 6000/8000 Series 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 material from the instrument prior to connecting to the power line.

ASSEMBLY

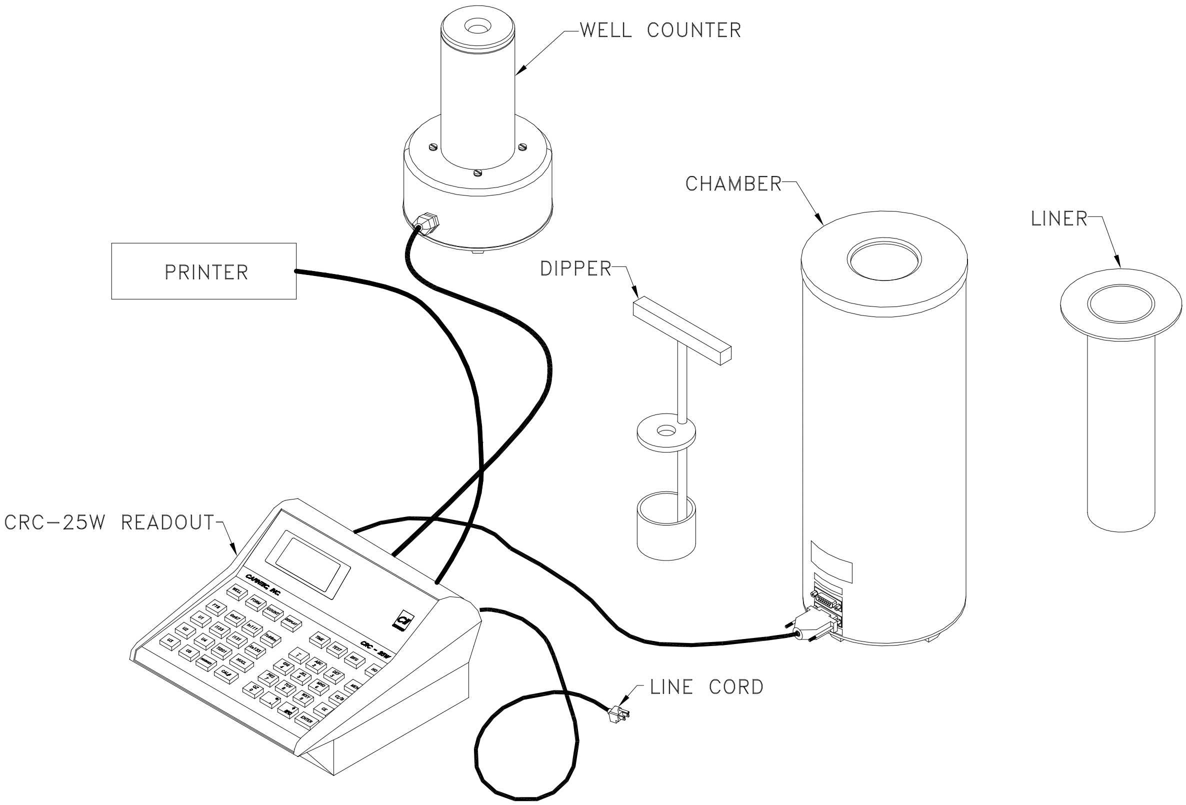

Figure 4-1

1. Verify that all power switches (Readout and Printer) are in the “OFF” or “0” position.

   Note: *If using the Slip-Ticket printer, please unplug from AC Power*.

2. Connect the Chamber Cable to the connector at the rear of the CRC®-25W Readout labeled “CHAMBER”.

   Note: *To avoid damage, do not over-tighten the screws on the Cable connectors. The screws should be finger-tightened only!*

3. Connect the Well Counter Cable to the connector at the rear of the CRC®-25W Readout labeled “WELL”.

   Note: *To avoid damage, do not over-tighten the screws on the Cable connector. The screws should be finger-tightened only!*

4. 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.*

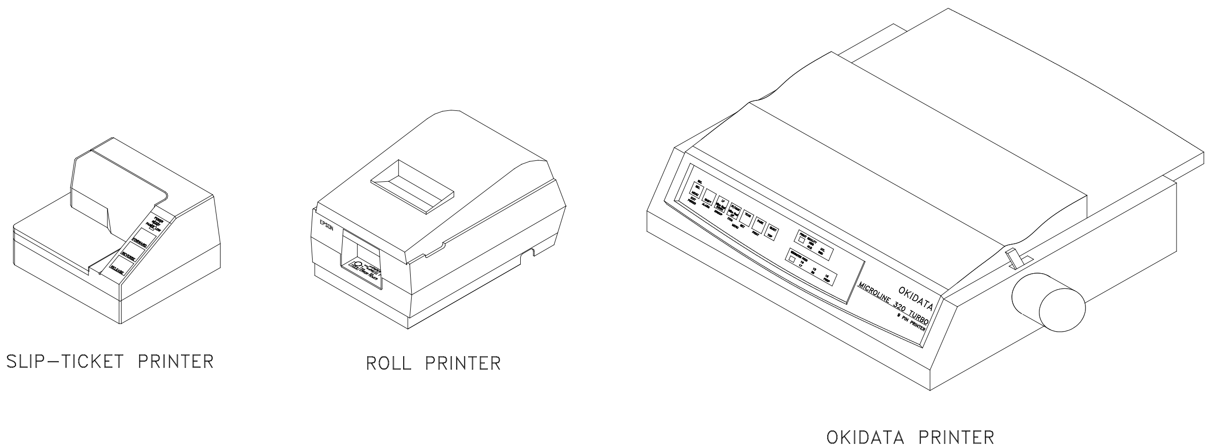

Figure 4-2 Printers

5. 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 connector at the rear of the CRC®-25W Readout marked “PRINTER”. Attach the other end to the printer.

   Note: *To avoid damage, do not over-tighten the screws on the Cable connectors. The screws should be finger-tightened only!*

   Note: *Do not attach the printer cable to the “RS232” connector.*

   If the optional printer is a USB version, attach the printer cable to the connector on the rear of the CRC®-25W Readout marked “PRINTER”. Attach the other end to the printer.

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

6. 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*.

Liner, Dipper, and Optional Holders

The supplied Chamber Liner and Dipper are shown below.

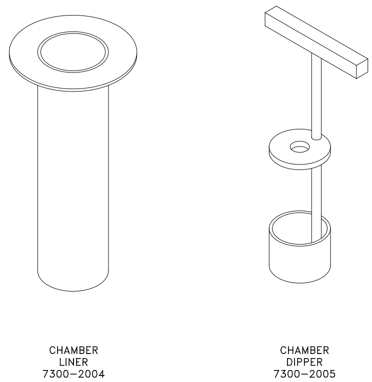

Figure 4-3 Liner and Dipper

The Chamber Liner provides protection against spills. It is made of clear, tough Plexiglass for improved durability. It is recommended that the Liner be installed inside the Chamber at all times.

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

The Dipper (Vial/Syringe sample holder) is specially designed to hold syringes and vials of various sizes. It provides a safe, convenient way to hold a vial or syringe during activity measurement. Proper placement in the Chamber is assured every time. The cup portion will accommodate up to a 30ml vial. The Syringe Guide will accommodate 3, 5 and 10cc syringes. An adapter (7310-1109) is available to accommodate a tuberculin syringe (1cc).

For seed 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.

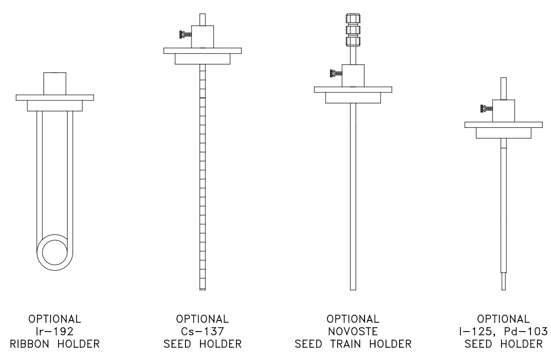

Figure 4-4 Optional Holders

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, 245mA

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-U220D Roll Printer (optional)
Input: 100-240Vac, 50/60Hz, 1.0A max; ***Output***: 24Vdc, 1.5A

HP DeskJet 6000/8000 Series Inkjet (or equivalent) printer (optional)
100-240Vac, 50/60Hz, 1.5A

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

TURN ON PROCEDURES

1. Be sure the interconnecting cable from the Chamber and Well Counter 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. The unit should now display the CRC®-25W start up screen (Figure 4-5)

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.

```
      CRC^R-25W
        Rev X.XX
      COPYRIGHT 2006
  ALL RIGHTS RESERVED
CAPINTEC, INC. NJ USA

  ENTER to Continue
```

Figure 4-5

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®-25W 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 in 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 user set the proper units prior to using the unit to prevent confusion. Reference CHAPTER 5: SYSTEM INITIALIZATION, SECTION: CHOOSING Ci or Bq.
- Enter Test Source Data for Chamber: Test Sources (standard sources) are used for the accuracy and constancy tests. The accuracy may be tested using Co57, Co60, Ba133, Cs137 or Ra226. 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 SOURCES.
- Enter Constancy Test Source: The source for the Constancy Test is chosen from the sources designated as Daily Sources. Reference CHAPTER 6: CHAMBER INITIALIZATION, SECTION: CONSTANCY TEST SOURCE.
- Enter Test Source Data for Well Counter: Test Sources (standard sources) are used for the Daily Test. The Test Source can be Cs137 or Ba133. Reference CHAPTER 7: WELL COUNTER INITIALIZATION, SECTION: TEST SOURCE DATA.
- Verify correct printer setting: The CRC®-25W 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-U220D Roll Printer
  - USB HP Inkjet
  - USB Epson Inkjet

The following items should be performed before use if required:

- Assign **USER** Keys for Chamber: The **USER** Keys (U1, U2, U3, U4, U5) are a quick way to select a nuclide. A nuclide may be assigned to each key. Reference CHAPTER 6: CHAMBER INITIALIZATION, SECTION: USER KEY ASSIGNMENT.
- Assign **USER** Keys for Well Counter: The **USER** Keys (U1, U2, U3, U4, U5) are a quick way to select a nuclide. A nuclide may be assigned to each key. Reference CHAPTER 7: WELL COUNTER INITIALIZATION, SECTION: USER KEY ASSIGNMENT.
- Adding a Nuclide for Chamber: The CRC®-25W contains nuclide data (name, half-life, calibration number) for over 80 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: ADDING A NUCLIDE.

- Adding a Nuclide for Well Counter: Nuclide data (name, half-life, efficiency) for 14 nuclides. The user may add up to 10 nuclides: the name, half-life and efficiency will be added for each one. Reference CHAPTER 7: WELL COUNTER INITIALIZATION, SECTION: EFFICIENCY DATA.
- 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 be performed using the CAPMAC or CANISTER. Reference CHAPTER 6: CHAMBER INITIALIZATION, SECTION: SELECTING MOLY ASSAY METHOD.
- Setting Mo/Tc Limit: The Mo/Tc limit is set at the factory to 0.15µCi/mCi. The user can change this value. Reference CHAPTER 6: CHAMBER INITIALIZATION, SECTION: MOLY ASSAY LIMIT.

ACCEPTANCE TESTING

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

Chamber Tests

Diagnostics Test

Reference CHAPTER 8: DIAGNOSTICS for instructions on how to perform this test.

Daily Test

Reference CHAPTER 10: CHAMBER BACKGROUND AND TESTS, SECTION: DAILY TEST for instructions on how to perform this test.

Accuracy Test

Reference CHAPTER 10: CHAMBER BACKGROUND AND TESTS, SECTION: ACCURACY TEST for instructions on how to perform this test.

Well Counter Test

Reference CHAPTER 11: WELL COUNTER TESTS for instructions on how to perform these tests.

OPERATIONAL SUMMARY

While all users the CRC®-25W are strongly encouraged to read the manual, we realize that there are some who would much rather jump right in. If you are one of those people who say, "if all else fails, read the manual", then reference Appendix IV. These very simplified instructions are intended to assist in getting you familiar with the basic operation of the CRC®-25W. They are not intended to replace the detailed operating directions in the main body of the manual.

WARNING

The General Operational Setup and Acceptance Testing sections above must be performed before referring to Appendix IV. The steps described omit several important tests which may be required by your license and which are also required in order to achieve the full accuracy of the system. Samples measured without the complete start-up procedure having been performed should not be administered to patients.

CHAPTER 5

SYSTEM INITIALIZATION

GENERAL

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

All of these functions are accessed via the Chamber Main Menu.

Press **MENU** from the Chamber Measurement Screen. The *Main Menu* will appear.

```
1. Inventory
2. Calculations
3. Diagnostics
4. Setup
```

Figure 5-1 Main Menu

SETTING DATE AND TIME

To view and/or change the date and/or time, select *SETUP*. Figure 5-2 Main Setup Menu will appear.

```
     SETUP
1. Time
2. Ci/Bq
3. Printing
4. Other
5. Screen
```

Figure 5-2 Main Setup Menu

Select *TIME* to view and/or change the date and/or time. Figure 5-3 Date / Time Verification Screen will appear showing the current date and time.

```
Mar 15 2007
09:56

Correct ?
Yes or No
```

Figure 5-3 Date / Time Verification Screen

If the date and time are correct, press **YES**. Figure 5-2 Main Setup Menu will re-appear.

If the date and/or time are incorrect, press **NO** to make necessary changes. Figure 5-4 Date Entry Screen will appear.

```
Enter Date
_

MMDDYYYY
```

Figure 5-4 Date Entry Screen

Input the date in the form MMDDYYYY (example: July 3, 2006 would be 07032006) and press **ENTER**. The date is checked for validity. If the input date is not valid, a beep will sound and “DATE ERROR” will be displayed. The date must be re-entered.

Figure 5-5 Time Entry Screen will appear.

```
Enter Time
_


 hhmm
```

Figure 5-5 Time Entry Screen

Input the time as hhmm in 24-hour time format (example: 1:25 PM would be 1325, 9:15 AM would be 0915) and press **ENTER**. The time is checked for validity. If the entered time is not valid, a beep will sound and "TIME ERROR" will be displayed. The time must be re-entered.

Figure 5-3 Date / Time Verification Screen will re-appear. Press **YES** if it is correct. Figure 5-2 Main Setup Menu will re-appear. Press **NO** to make corrections.

CHOOSING CI OR BQ

Measurement results can be displayed in Ci or Bq. The **Ci/Bq** key is used to switch the measurement result between Ci and Bq. However, in some facilities, it may be decided to disable this feature and allow measurements to be displayed only in Ci or only in Bq. When the system arrives, it is set up to display in Ci and Bq.

To enable or disable Ci/Bq switching, press **MENU** from the Chamber Measurement Screen. Figure 5-1 Main Menu will appear.

From Figure 5-1 Main Menu, select *SETUP*. Figure 5-2 Main Setup Menu will appear.

From Figure 5-2 Main Setup Menu, select *CI/BQ*. The current Ci/Bq selection will appear. The example below is for the default of Selectable (i.e., the user may select Ci or Bq)

```
  Ci / Bq

SELECTABLE

 OK?  Y or N
```

Figure 5-6 Ci / Bq Verification Screen

If the displayed setting is correct, press **YES**. Figure 5-2 Main Setup Menu will re-appear.

If the displayed setting is not correct, press **NO**. Figure 5-7 Ci / Bq Selection Screen will appear.

```
1. Set To Ci
2. Set To Bq
3. Ci or Bq
```

Figure 5-7 Ci / Bq Selection Screen

Press **1**, **2** or **3** to select the desired setting.

After choosing the desired setting, Figure 5-6 Ci / Bq Verification Screen will re-appear showing the new selection.

If **1** was pressed, the Verification Screen will display: FIXED TO Ci.
If **2** was pressed, the Verification Screen will display: FIXED TO Bq.
If **3** was pressed, the Verification Screen will display: Ci / Bq Selectable.

If the displayed setting is correct, press **YES**. Figure 5-2 Main Setup Menu will re-appear.

If the displayed setting is not correct, press **NO**. Figure 5-7 Ci / Bq Selection Screen will re-appear.

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®-25W.

The CRC®-25W may be used with the following printers:

- RS-232 printers
  - Okidata Microline 320
  - Epson LX-300+II
  - Epson TM-295II Slip printer
  - Epson TM-U220D Roll printer
- USB printers
  - HP DeskJet 6000/8000 Series Inkjet (or equivalent) printer
  - Epson Stylus C86 Inkjet (or equivalent) printer

Printer Power Requirements

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)

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

Epson TM-U220D Roll Printer (optional)
Input: 100-240Vac, 50/60Hz, 1.0A max; ***Output***: 24Vdc, 1.5A

HP DeskJet 6000/8000 Series Inkjet (or equivalent) Printer (optional)
100-240Vac, 50/60Hz, 1.5A

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

Printer Selection

If a printer was included with the CRC®-25W, 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®-25W must be set to use the printer in order to provide printed data.

To view and/or change the selected printer, press the **MENU** key from the Chamber Measurement Screen. Figure 5-1 Main Menu will appear.

From Figure 5-1 Main Menu, select *SETUP*. Figure 5-2 Main Setup Menu will appear.

From Figure 5-2 Main Setup Menu, select *PRINTING*. The currently selected printer will be displayed. In the example below, OKIDATA – ONE LINE is used.

```
PRINTER IS

    OKI
 ONE LINE

 OK?  Y or N
```

Figure 5-8 Selected Printer Type

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

If the displayed setting is correct, press **YES**. Figure 5-2 Main Setup Menu will re-appear.

If the displayed setting is not correct, press **NO**. Figure 5-9 Printer Type Screen will appear.

```
   PRINTER IS

1. RS-232
2. USB
3. NONE
```

Figure 5-9 Printer Type Screen

RS-232

RS-232 printers are serial printers that use the RS-232 interface. The printers that can be used with the CRC®-25W are the Epson Slip, Epson Roll, Okidata Microline 320 or Epson LX-300.

From Figure 5-9 Printer Type Screen, select *RS-232*. Figure 5-10 RS-232 Printer Selection screen will appear:

```
     SELECT
1. SLIP - TICKET
2. ROLL
3. OKI
4. LX-300
```

Figure 5-10 RS-232 Printer Selection

Press the number corresponding to your printer.

For this example, the printer being used is an Okidata Microline 320. Select *OKI*. Figure 5-11 Printout Selection will appear.

```
 MEASUREMENT ON

1. TICKET
2. ONE LINE
```

Figure 5-11 Printout Selection

The Okidata Microline 320 can print measurements on a ticket or on regular paper.

If the printing will be done on tickets, select *TICKET*. If printing will not be done on tickets, select *ONE LINE*. For this example, the printing will be done on regular paper; therefore, select *ONE LINE*.

After selecting the printer (and measurement printout for Okidata or Epson LX-300+II), the selection made will be displayed for verification.

```
 PRINTER IS

     OKI
  ONE LINE

  OK?  Y or N
```

Figure 5-12 Selected Printer Type

If the displayed setting is correct, press **YES**. Figure 5-2 Main Setup Menu will re-appear.

If the displayed setting is not correct, press **NO**. Figure 5-9 Printer Type Screen will appear.

The above procedure also applies to the other RS-232 printers except that there is no option for printing on tickets or one line.

Okidata Menu Set-Up

If an Okidata Microline 320 printer was ordered with the CRC®-25W system, the Okidata printer should be set-up to function properly.

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 5-13 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 5-13 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 5-13 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 5-13 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 5-13 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 5-13 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

SET SHIFT+SET

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®-25W system, the printer should be set-up to function properly.

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 5-15 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 5-14 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 5-15 Epson LX-300+II Printer Current Settings.

Figure 5-14 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 Intermite
nte   / Indicador intermitente
   ⌂:LED 2-blink / Voyant 2-clignote / LED 2-blinkt / Spia 2-lampeggiante / Indicador 2-Intermi
tente / 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 línguas indicadas na tabela; em seguida,
  pressione a tecla Corte para seleccionar a língua.
```

Figure 5-15 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

If you want to change any setting, press the Tear Off switch.
If you want not to change any settings, turn off the printer.

5. If there are no differences between what just printed and Figure 5-15 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 5-16a Epson LX-300+II Printer Changing Settings Instructions.

Figure 5-16a 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.

   Font LEDs
   ¦ ¦ Pause LED
   ¦ ¦ ¦
   ** Page length for tractor **
   ■■□        3 inch
   ■□■        3.5 inch
   ■□□        4 inch
   □■■        5.5 inch
   □■□        6 inch
   □□■        7 inch
   ■■▣        8 inch

   Font LEDs
   ¦ ¦ Pause LED
   ¦ ¦ ¦
   ■▣■        8.5 inch
   ■▣▣        11 inch
   ▣■■        70/6 inch
   ▣■▣        12 inch
   ▣▣■        14 inch
   □■▣        17 inch
   □▣■        Others

   ** Skip over perforation **
   ■■□        Off
   ■□■        On

   ** Auto tear Off **
   ■■□        Off
   ■□■        On

   ** Auto line feed **
   ■■□        Off
   ■□■        On

   ** Print direction **
   ■■□        Bi-D
   ■□■        Uni-D
```

Figure 5-16b 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
■□■      Ø

** 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 5-16c Epson LX-300+II Printer Changing Settings Instructions

```
Font LEDs                                        Font LEDs
| |  Pause LED                                   | |  Pause LED
| | |                                            | | |
** Character table **
■■□        Italic                                ■▣■        BRASCII
■□■        PC 437                                ■▣▣        Abicomp
■□□        PC 850                                ▣■■        Roman 8
□■■        PC 860                                ▣■▣        ISO Latin 1
□■□        PC 863                                ▣▣■        PC 858
□□■        PC 865                                □■▣        ISO 8859-15
■■▣        PC 861                                □▣■        Others

** International character set for Italic table **
■■□        Italic U.S.A.                         □■□        Italic Denmark 1
■□■        Italic France                         □□■        Italic Sweden
■□□        Italic Germany                        ■■▣        Italic Italy
□■■        Italic U.K.                           ■▣■        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 5-15 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.*

USB

USB printers are printers that use the USB interface. The printers that can be used with the CRC®-25W are the HP DeskJet 6000/8000 Series Inkjet (or equivalent) and the Epson Stylus C86 Inkjet (or equivalent).

From Figure 5-9 Printer Type Screen, select *USB*. Figure 5-17 USB Printer Selection screen will appear:

```
      SELECT

1. HP
2. EPSON
```

Figure 5-17 USB Printer Selection

Press the number corresponding to your printer.

For this example, the printer being used is an Epson Stylus C86 Inkjet. Select *EPSON*. Figure 5-18 Selected Printer Type will appear.

```
 PRINTER IS

 USB: EPSON


  OK?  Y or N
```

Figure 5-18 Selected Printer Type

If the displayed setting is correct, press **YES**. Figure 5-2 Main Setup Menu will re-appear.

If the displayed setting is not correct, press **NO**. Figure 5-9 Printer Type Screen will appear.

The above procedure also applies to the other USB printer.

NONE

The system does not need a printer to function properly.

If no printer is attached to the system, from Figure 5-9 Printer Type Screen select *NONE*. Figure 5-19 Selected Printer Type will appear.

```
PRINTER IS

  NONE


 OK?  Y or N
```

Figure 5-19 Selected Printer Type

If the displayed setting is correct, press **YES**. Figure 5-2 Main Setup Menu will re-appear.

If the displayed setting is not correct, press **NO**. Figure 5-9 Printer Type Screen will appear.

SCREEN SETUP

The CRC®-25W's screen contrast and screen saver (backlight) timeout can be set by the user.

To view and/or change the selected screen saver and/or to adjust the screen contrast, press the **MENU** key from the Chamber Measurement Screen. Figure 5-1 Main Menu will appear.

From Figure 5-1 Main Menu, select *SETUP*. Figure 5-2 Main Setup Menu will appear.

From Figure 5-2 Main Setup Menu, select *SCREEN*. Figure 5-20 Screen Setup Menu will appear.

```
1. Screen Saver
2. Contrast
```

Figure 5-20 Screen Setup Menu

Screen Saver

To adjust the Screen Saver (backlight) timeout, select *SCREEN SAVER*. The current screen saver time will be displayed for verification (default is 10 minutes).

```
Screen is off

 After 10 min


  OK?  Y or N
```

Figure 5-21 Screen Saver Verification Screen

If the displayed setting is correct, press **YES**. Figure 5-20 Screen Setup Menu will re-appear.

If the displayed setting is not correct, press **NO**. Figure 5-22 Screen Saver Selection Screen will appear.

```
   Screen Off
1. After 5  min
2. After 10 min
3. After 15 min
4. Never
```

Figure 5-22 Screen Saver Selection Screen

Press the number corresponding to the desired timeout. Figure 5-21 Screen Saver Verification Screen will re-appear showing the chosen timeout period.

If the displayed setting is correct, press **YES**. Figure 5-20 Screen Setup Menu will re-appear.

If the displayed setting is not correct, press **NO**. Figure 5-22 Screen Saver Selection Screen will appear.

Screen Contrast

The screen contrast can be changed to conform to lighting conditions.

From Figure 5-20 Screen Setup Menu, select *CONTRAST* to adjust the Screen Contrast. Figure 5-23 Contrast Adjustment Screen will appear.

```
 Use Arrows To
 Adjust Screen


Press Enter When Done
```

Figure 5-23 Contrast Adjustment Screen

The **UP ARROW (⇱)** and **DOWN ARROW (⇲)** keys are used to adjust the contrast.

The **UP ARROW (⇱)** key will make the background of the screen gradually darker and the **DOWN ARROW (⇲)** key will make the background gradually lighter.

When the screen contrast is at an acceptable level, press **ENTER** to save the contrast value and return to Figure 5-20 Screen Setup Menu.

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CHAPTER 6

CHAMBER INITIALIZATION

GENERAL

This section describes initialization and parameter setup for the Chamber.

All of these functions are accessed via the Main Menu.

USER KEY ASSIGNMENT

The **USER** Keys (U1, U2, U3, U4, U5) are a quick way to select a nuclide. A nuclide may be assigned to each key.

To assign keys, press **MENU** from the Chamber Measurement Screen.

Select *SETUP*. The *Setup Menu* appears.

Select *OTHER*. Input the password (last 3 digits of the Readout serial number) and press **ENTER**. Figure 6-1 Other Menu appears.

```
1. User Keys
2. Sources
3. Moly Setup
4. Nuclides
5. Linearity
6. Remote / PC
```

Figure 6-1 Other Menu

From the *Other Menu,* select *USER KEYS*.

Selecting User Key

```
          CHAMBER
 SELECT
 USER KEY
 U1 TO U5
Any Other Key To
Continue Setup
```

Figure 6-2 User Key Selection

Press any other key (except a **USER** key or the **HOME** key) to exit User Key Assignment and return to Figure 6-1 Other Menu.

Current Assignment Display

Press the **USER** Key to which a nuclide is to be assigned. Figure 6-3 User Key Verification screen will appear showing the current key assignment. In the example, Co60 has been assigned to U1.

Note: *From the factory, all **USER** Keys are set to NONE.*

```
U1:  Co60


 OK?  Y or N
```

Figure 6-3 User Key Verification

If no assignment has been made, the word “NONE” will appear after the key name.

If the assignment is correct, press **YES** and Figure 6-2 User Key Selection screen will re-appear.

If the assignment is not correct, press **NO**. Figure 6-4 Nuclide Name Assignment Screen will appear.

Nuclide Name Assignment

```
   SPECIFY
   NUCLIDE


  _
```

Figure 6-4 Nuclide Name Assignment Screen

Press the alphanumeric keys corresponding to the nuclide name. The number on each key will appear. For example, if Cs137 is entered, 27137 will appear on the screen. Press **ENTER** when the nuclide has been specified.

To change the assignment to NONE, press **ENTER** without specifying a nuclide.

Assignment Confirmation

Figure 6-3 User Key Verification screen will re-appear with the nuclide name that was just input.

If the assignment is correct, press **YES**. Figure 6-2 User Key Selection screen will re-appear.

If the assignment is not correct, press **NO**. Figure 6-4 Nuclide Name Assignment Screen will re-appear.

TEST SOURCES

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

The Accuracy and Constancy may be tested using Co57, Co60, Ba133, Cs137 or Ra226. 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. One of the daily sources must be designated as the source to be used for the Constancy Test.

The *Test Source Menu* allows data to be input for any Test Source and to choose which Test Source will be used as a Constancy Source.

To input Test Source Data, press **MENU** from the Chamber Measurement Screen.

Select *SETUP*. The *Setup Menu* appears.

Select *OTHER*. Input the password (last 3 digits of Readout serial number) and press **ENTER**. Figure 6-1 Other Menu appears.

From the *Other Menu,* select *SOURCES*. Figure 6-5 Test Source Menu will appear.

```
1. Co57
2. Co60
3. Ba133
4. Cs137
5. Ra226
6. Constancy
```

Figure 6-5 Test Source Menu

Press **1**, **2**, **3**, **4** or **5** to input, change or delete the Test Source for the designated nuclide.

When shipped from the factory, the CRC®-25W does not have Test Source information entered. When a source is selected, Figure 6-6 No Source Verification Screen will appear. (Co57 is used in the example.)

```
Co57


 NO SOURCE

  OK?  Y or N
```

Figure 6-6 No Source Verification Screen

If there is no source for the selected Test Source, press **YES**. Figure 6-5 Test Source Menu will re-appear.

If there is a source for the selected Test Source, press **NO**. Figure 6-9 Entering Serial Number screen will appear.

Source Verification

If the chosen source had data previously entered, the data will be displayed. The example below is for Co57, which will be used in the Daily Test:

```
Co57
S/N: 1458
Jan 07 2006
100.0 mCi DAILY
  OK?  Y or N
```

Figure 6-7 Test Source Verification

If the data is correct, press **YES**. Figure 6-5 Test Source Menu will re-appear.

To change the data or to delete the source, press **NO**. Figure 6-8 Source Existence screen will appear.

```
 Do You Have
Co57     ?


  Yes or No
```

Figure 6-8 Source Existence

If the selected Test Source is no longer being used, press **NO** and it will be deleted. Figure 6-5 Test Source Menu will re-appear.

To input data for the selected Test Source, press **YES**. Figure 6-9 Entering Serial Number screen will appear.

Entering Serial Number

The serial number may be any combination of 10 numbers and letters.

```
Co57
 ENTER S/N



 _
```

Figure 6-9 Entering Serial Number

To input the serial number of the Test Source, use the NUMBER / LETTER keys. When a key is pressed, the number appears. Press the key again to change the number into one of the letters on the same key (e.g. press the **2** key 3 times to get the letter B). To go to the next character, press another key. If the next character is on the same key, press the **UP ARROW (⇖)** to repeat use of that key. The **DOWN ARROW (⇘)** is the space key

Press **ENTER** when correct serial number has been input. Figure 6-10 Entering Calibration Date will appear.

Entering Calibration Date

The calibration date is input next.

```
Co57
 CALIBRATED
 _


    MMDDYYYY
```

Figure 6-10 Entering Calibration Date

Input the Test Source calibration date in the form MMDDYYYY (example: July 3, 2006 would be 07032006) and press **ENTER**. The date is checked for validity. If the entered date is not valid, a beep will sound and "DATE ERROR" will be displayed. The date must be re-entered.

Note: *The input date cannot be today's date.*

Figure 6-11 Entering Activity will appear.

Entering Calibration Activity

The calibration activity can now be input:

```
Co57
CALIB ACTIVITY:
  value   unit
 _        µCi

-> to change unit
  ENTER to accept
```

Figure 6-11 Entering Activity

The Calibration activity must be less than 1 Ci. 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*

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

Table 6-1 Test Source Calibration Activity Limits

Input the value of the calibrated activity and then press the **RIGHT ARROW (➘)** key. Use the arrow keys to scroll through the activity units: µCi, MBq or mCi. If the value needs to be changed, press **CE.**

When the value and unit are correct, press **ENTER**. Figure 6-12 Daily Use screen will appear.

Indicating Daily Usage

It must now be decided whether the source will be used for the Daily Test.

```
Co57

  Use Daily ?

  Yes or No
```

Figure 6-12 Daily Use

If the Test Source will be used in the Daily Test, press **YES**. If the Test Source will not be used in the Daily Test, press **NO**.

Confirming Calibration Data

Figure 6-7 Test Source Verification Screen will now be displayed with the data that has just input.

If the displayed information is not correct, press **NO**. Figure 6-8 Source Existence will appear.

If the displayed information is correct, press **YES**. Figure 6-5 Test Source Menu will re-appear.

CONSTANCY TEST SOURCE

The source for the Constancy Test is chosen from the Test Sources designated as Daily Sources.

From the Figure 6-5 Test Source Menu, select *CONSTANCY*.

No Daily Source Chosen

If no Test Sources are designated as a Daily Source, Figure 6-13 No Daily Source Was Chosen will appear.

```
      ERROR

NO DAILY SOURCE
WAS CHOSEN

Any Key to Continue
```

Figure 6-13 No Daily Source Was Chosen

A Daily Test Source must be selected in order to perform the Constancy Test. Reference TEST SOURCES (this chapter), SECTION: Indicating Daily Usage for more information.

Press any key to continue. Figure 6-5 Test Source Menu will re-appear.

One Daily Source Chosen

If only one Test Source has been designated as a Daily Source, it will be set as the default Constancy Test Source as shown in Figure 6-14 Constancy Source Verification. (In the example below, Co57 is the only source.)

```
CONSTANCY TEST
    Co57



Any Key to Continue
```

Figure 6-14 Constancy Source Verification

Press any key to continue. Figure 6-5 Test Source Menu will re-appear.

More than One Daily Source Chosen

If more than one Test Source has been designated as Daily Sources, Figure 6-15 Constancy Source Verification will appear. (In the example below, Co57 is set as the Constancy source.)

```
CONSTANCY TEST
    Co57



  OK?  Y or N
```

Figure 6-15 Constancy Source Verification

If the displayed source is correct, press **YES**. Figure 6-5 Test Source Menu will re-appear.

If the displayed source is not correct, press **NO**. Figure 6-16 Constancy Test Source Selection will appear. (In the example below, Co57 and Co60 are set to use as Daily Sources.)

```
CONSTANCY TEST
1.Co57
2.Co60
```

Figure 6-16 Constancy Test Source Selection

Select the Daily Test Source to be used for the Constancy Test. Figure 6-15 Constancy Source Verification screen will re-appear showing the selected source.

MOLY ASSAY SETUP

Moly Assay can be performed using a CAPMAC or CANISTER.

When Moly Assay is chosen from the *Test Menu* (reference CHAPTER 12: CHAMBER MEASUREMENT PROCEDURES, SECTION: MOLY ASSAY), Figure 6-17 Moly Assay Method Selection the Moly Assay Method Selection screen will appear. However, if only one method is always used (either a CAPMAC or a CANISTER), Figure 6-17 Moly Assay Method Selection screen can be omitted by selecting either CAPMAC or CANISTER from the Moly Setup in the *Other Menu*.

```
    SELECT

1. CAPMAC for
   Mallinckrodt Gen
2. CAPMAC for
   Bristol Myers Gen
3. Capintec Canister
```

Figure 6-17 Moly Assay Method Selection

Press **MENU** from the Chamber Measurement Screen.

Select *SETUP*. The *Setup Menu* appears.

Select *OTHER*. Input the password (last 3 digits of Readout serial number) and press **ENTER**. Figure 6-1 Other Menu appears.

From the *Other Menu*, select *MOLY SETUP*. Figure 6-18 Moly Setup Menu will appear.

```
    MO ASSAY

1. Moly Method
2. Mo/Tc Limit
```

Figure 6-18 Moly Setup Menu

Selecting Moly Assay Method

Select *MOLY METHOD* from the *Moly Setup Menu*. Figure 6-19 Current Moly Assay Methods Screen will appear.

The current selections are displayed (default is all are selected):

```
CAPMAC for
Mallinckrodt  Y
CAPMAC for
Bristol Myers Y
CANISTER      Y
  OK?  Y or N
```

Figure 6-19 Current Moly Assay Methods Screen

If all of the current selections are correct, press **YES**. Figure 6-18 Moly Setup Menu will re-appear.

If any or all of the current selections are not correct, press **NO**. Figure 6-20 Moly Assay Method Selection Screen will appear asking if you will use each of the three possible selections.

Press **YES** if the method will be used, or **NO** if the method will not be used. The example for *CANISTER* is shown:

```
Will You Use
CAPINTEC
CANISTER ?
```

Figure 6-20 Moly Assay Method Selection Screen

After answering for all three methods, Figure 6-19 Current Moly Assay Methods Screen will re-appear showing the current settings.

If all of the current selections are correct, press **YES**. Figure 6-18 Moly Setup Menu will re-appear.

If any or all of the current selections are not correct, press **NO**. Figure 6-20 Moly Assay Method Selection Screen will appear asking if you will use each of the three possible selections again.

Moly Assay Limit

The Moly Assay default limit is set to 0.150 µCi/mCi (or 0.150 MBq/GBq). The user may change this value.

Select *MO/TC LIMIT* from Figure 6-18 Moly Setup Menu. The current limit is displayed:

```
Mo/Tc LIMIT:
0.150  µCi/mCi


 OK?  Y or N
```

Figure 6-21 Mo/Tc Limit Verification Screen

If the displayed value is acceptable, press **YES** to keep the value and return to Figure 6-18 Moly Setup Menu.

If the displayed value is not acceptable, press **NO**. Figure 6-22 Mo/Tc Limit Entry Screen will appear. The value is input in µCi/mCi (or MBq/GBq if in Becquerel mode):

```
INPUT
Mo/Tc Limit
in µCi/mCi
 _
```

Figure 6-22 Mo/Tc Limit Entry Screen

Input the new value and press **ENTER**. Figure 6-21 Mo/Tc Limit Verification Screen will re-appear displaying the new value.

Note: *The minimum value that can be input is 0.001 µCi/mCi (0.001 MBq/GBq). The maximum value that can be input is 9.99 µCi/mCi (9.99 MBq/GBq).*

If the displayed value is acceptable, press **YES** to keep the value and return to Figure 6-18 Moly Setup Menu.

ADDING A NUCLIDE

The CRC®-25W contains nuclide data (name, half-life, calibration number) for over 80 nuclides.

The user may add up to 10 nuclides. The name, half-life and calibration number will be input.

Press **MENU** from the Chamber Measurement Screen.

Select *SETUP*. The *Setup Menu* appears.

Select *OTHER*. Input the password (last 3 digits of the Readout serial number) and press **ENTER**. Figure 6-1 Other Menu appears.

From the *Other Menu* select *NUCLIDES*. The *Nuclides Menu* appears.

```
1. Add Nuclide
2. Del Nuclide
3. New Cal Num
4. Corr Factors
```

Figure 6-23 Nuclides Menu

Select *ADD NUCLIDE* to add nuclide data.

Entering Nuclide Name

```
TYPE IN
NUCLIDE NAME

_
```

Figure 6-24 Entering Nuclide Name

Use the alphanumeric keys to input the nuclide name. The first 2 characters will be displayed as letters (press the **SPC** key for a blank if there is only 1 character in the name) and the next 3 characters as numbers. If the nuclide is in a metastable state, use the **Tc99m** key for the “m”.

Press **ENTER** when the nuclide name has been input. Figure 6-25 Inputting Half-life screen will appear.

Entering Half-Life

```
HALF-LIFE:

  value    unit
 _         MIN

-> to change unit
ENTER to Accept
```

Figure 6-25 Inputting Half-life

Input the value of the half-life and then press the **RIGHT ARROW (➘)** key. Use the arrow keys to scroll the half-life from Min to Year to Day to Hour. If the value needs to be changed, press the **CE** key.

When the value and unit are correct, press **ENTER**. Figure 6-26 Nuclide Verification screen will appear.

```
     Y 87


  HL : 80.30H
  OK?  Y or N
```

Figure 6-26 Nuclide Verification

If the source name and/or half-life is/are not correct, press **NO**. Figure 6-24 Entering Nuclide Name screen will re-appear.

If the source name and half-life are correct, press **YES**. Figure 6-27 Enter Calibration Number will appear.

Entering Calibration Numbers

A calibration number must be entered in order to perform measurements on the added nuclide.

A calibration number may include a multiplication sign (* on the keyboard, displayed as X) or a division sign (÷). However, the CRC®-25W 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

```
    ENTER
 CALIBRATION #



   _
```

Figure 6-27 Enter Calibration Number

If the calibration number is known, input the number and press **ENTER**. Figure 6-23 Nuclides Menu will appear.

If the calibration number is not known, input 450 and press **ENTER**. The calibration number can then be determined by the following procedure. Figure 6-23 Nuclides Menu will appear.

Determining Calibration Numbers

An initial Calibration Number (as an initial starting point, choose 450) must be input into the CRC®-25W 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 this chapter in the Entering New Calibration Numbers section on page 6-20.

DELETING A NUCLIDE

Any nuclide added by the user may be deleted.

From Figure 6-23 Nuclides Menu, select *DEL NUCLIDE*. Figure 6-28 Nuclide Name Assignment Screen will appear.

```
    SPECIFY
    NUCLIDE


   _
```

Figure 6-28 Nuclide Name Assignment Screen

To abort deleting a nuclide, press **ENTER** without specifying a nuclide name. Figure 6-23 Nuclides Menu will re-appear.

Press the alphanumeric keys corresponding to the nuclide name. The number on each key will appear. For example, if Cs137 is entered, 27137 will appear. Press **ENTER** when the nuclide has been specified. Figure 6-30 Delete Nuclide Verification Screen will appear showing the selected nuclide name and its half-life.

The entire name does not have to be input. If the nuclide is not uniquely specified, a list of possibilities will appear. For example, if Cesium is the desired source, input **271** (for Cs1) and press **ENTER**. Figure 6-29 Nuclide List Screen will appear.

Note: *If there are more than 5 possibilities, the message "SPECIFY FURTHER" will be displayed. Press any key (except **HOME**) to continue.*

```
1. Cs131
2. Cs132
3. Cs134
4. Cs136
5. Cs137
```

Figure 6-29 Nuclide List Screen

Input the number corresponding to the desired nuclide and press **ENTER**. Figure 6-30 Delete Nuclide Verification Screen will appear showing the selected nuclide name and its half-life.

```
     Y 87


  HL : 80.30H
 DELETE? Y or N
```

Figure 6-30 Delete Nuclide Verification Screen

If the displayed nuclide is not correct, press **NO**. Figure 6-23 Nuclides Menu will re-appear.

If the displayed nuclide is correct, press **YES**. Figure 6-23 Nuclides Menu will re-appear.

CALIBRATION NUMBERS

Up to 40 nuclides (including user added nuclides) may have their Calibration Numbers changed.

A calibration number may include a multiplication sign (* on the keyboard, displayed as X) or a division sign (÷). However, the CRC®-25W 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 6-16.

To input a new Calibration Number, change a current Calibration Number or restore the original Calibration Number:

Press **MENU** from the Chamber Measurement Screen.

Select *SETUP*. The *Setup Menu* appears.

Select *OTHER*. Input the password (last 3 digits of Readout serial number) and press **ENTER**. Figure 6-1 Other Menu appears.

From the *Other Menu*, select *NUCLIDES*. Figure 6-23 Nuclides Menu will appear.

From the *Nuclide Menu*, select *NEW CAL NUM*. Figure 6-31 Choose Nuclide for Calibration Number screen will appear.

```
 Cal Numbers
 CHOOSE NUCLIDE

Press NUCL or
Pre-set nuclide key
or User key
```

Figure 6-31 Choose Nuclide for Calibration Number

The nuclide can be chosen via the **NUCL** key, Pre-Set Nuclide keys or **USER** keys.

Entering New Calibration Numbers

If a the selected nuclide does not have a Calibration Number, Figure 6-32 Change Original Cal#? Screen will appear.

```
Sr89

Orig Cal #: NONE

Change Cal #?
```

Figure 6-32 Change Original Cal#?

To leave the Calibration Number set to NONE, press **NO**. Figure 6-31 Choose Nuclide for Calibration Number screen will re-appear.

To input the new Calibration Number, press **YES**. Figure 6-33 Enter Calibration Number screen will appear.

```
     ENTER
 CALIBRATION #



   _
```

Figure 6-33 Enter Calibration Number

Input the new Calibration Number and press **ENTER**. After the Calibration Number is entered, Figure 6-34 New Cal# Verification Screen will appear.

```
Sr89

Orig Cal #: NONE
 New Cal #: 123

  OK?  Y or N
```

Figure 6-34 New Cal# Verification Screen

If the new Calibration Number is not correct, press **NO**. Figure 6-33 Enter Calibration Number screen will re-appear.

If the new Calibration Number is correct, press **YES**. Figure 6-31 Choose Nuclide for Calibration Number screen will re-appear.

Changing Calibration Numbers

Calibration Numbers can be changed for any nuclide in memory.

```
 Cal Numbers
 CHOOSE NUCLIDE

Press NUCL or
Pre-set nuclide key
or User key
```

Figure 6-35 Choose Nuclide for Calibration Number

Choose the nuclide whose Calibration Number is to be changed via the **NUCL** key, Pre-Set Nuclide keys or **USER** keys. Figure 6-36 Change Original Cal#? will appear. (Tc99m is shown in the example.)

```
TC99m

Orig Cal #: 080

Change Cal #?
```

Figure 6-36 Change Original Cal#?

To leave the Calibration Number set to the original value, press **NO**. Figure 6-35 Choose Nuclide for Calibration Number screen will re-appear.

To change the displayed Calibration Number, press **YES**. Figure 6-37 Enter Calibration Number screen will appear.

```
     ENTER
 CALIBRATION #



    _
```

Figure 6-37 Enter Calibration Number

Input the new Calibration Number and press **ENTER**. After the calibration number is entered, the original and new Calibration Numbers will be displayed for verification as shown in Figure 6-38 New Cal# Verification Screen.

```
TC99m

Orig Cal #: 080
 New Cal #: 082

  OK?  Y or N
```

Figure 6-38 New Cal# Verification Screen

If the new Calibration Number is not correct, press **NO**. Figure 6-37 Enter Calibration Number screen will re-appear.

If the new Calibration Number is correct, press **YES**. Figure 6-35 Choose Nuclide for Calibration Number screen will re-appear.

Restoring Original Calibration Numbers

Choose the nuclide whose Calibration Number is to be restored via the **NUCL** key, Pre-Set Nuclide keys or **USER** keys. Figure 6-39 Restore Cal#? will appear asking if the original calibration number should be restored. (Tc99m is shown in the example with 082 as the new Calibration Number.)

```
TC99m

Orig Cal #: 080
 New Cal #: 082

Restore Orig Cal # ?
```

Figure 6-39 Restore Cal#?

To keep the current Calibration Number, press **NO**. Figure 6-35 Choose Nuclide for Calibration Number screen will re-appear.

To restore the original Calibration Number, press **YES**. Figure 6-35 Choose Nuclide for Calibration Number screen will re-appear.

CONTAINER CORRECTION FACTORS

A container correction factor for Chamber measurements may be input for up to 20 nuclides. These corrections factors are for Syringe, Vial or Capsule.

Determining Correction Factors

To determine the Correction Factor for a nuclide in a particular container, perform the following steps:

1. Obtain a calibrated source of the nuclide.
2. Calculate the current activity of the calibrated source, using the Decay Calculation Utility. (Reference CHAPTER 19: CALCULATION UTILITIES, SECTION: DECAY CALCULATION)
3. Measure the source in the container whose correction factor is to be determined.
4. The Correction Factor (CF) is then calculated as:

$$CF = \frac{\text{Calculated Activity of Calibrated Source}}{\text{Measured Activity}}$$

Entering Correction Factors

Press **MENU** from the Chamber Measurement Screen.

Select *SETUP*. The *Setup Menu* appears.

Select *OTHER*. Input the password (last 3 digits of Readout serial number) and press **ENTER**. Figure 6-1 Other Menu appears.

From the *Other Menu*, select *NUCLIDES*.

When the *Nuclide Menu* appears, select *CORR FACTORS*. Figure 6-40 Choose Nuclide for Correction Factors screen will appear.

```
 CORR. FACTOR
 CHOOSE NUCLIDE

Press NUCL or
Pre-set nuclide key
or User key
```

Figure 6-40 Choose Nuclide for Correction Factors

Choose the nuclide via **NUCL** key, Pre-Set Nuclide keys or **USER** keys. (In the example below, Tc99m has been selected.)

First, Figure 6-41 Corr. Factor for Syringe Screen will appear asking if a Correction Factor for Syringe will be entered:

```
Tc99m
 ENTER
 Corr. Factor
 For:  SYRINGE?

  Yes or No
```

Figure 6-41 Corr. Factor for Syringe Screen

If a Correction Factor will be input for a Syringe, press **YES**. Figure 6-42 Corr. Factor Entry Screen will appear.

If a Correction Factor will not be input for a Syringe, press **NO**. Figure 6-43 Corr. Factor for Vial Screen will appear.

```
Tc99m
 ENTER




  _
```

Figure 6-42 Corr. Factor Entry Screen

Input the Correction Factor value and press **ENTER**. Figure 6-43 Corr. Factor for Vial Screen will appear.

Note: *The minimum value that can be input is 0.100. The maximum value that can be input is 9.999.*

```
Tc99m
 ENTER
 Corr. Factor
 For:  VIAL   ?

  Yes or No
```

Figure 6-43 Corr. Factor for Vial Screen

If a Correction Factor will be input for a Vial, press **YES**. Figure 6-44 Corr. Factor Entry Screen will appear.

If a Correction Factor will not be input for a Vial, press **NO**. Figure 6-45 Corr. Factor for Capsule Screen will appear.

```
Tc99m
 ENTER




  _
```

Figure 6-44 Corr. Factor Entry Screen

Input the Correction Factor value and press **ENTER**. Figure 6-45 Corr. Factor for Capsule Screen will appear.

Note: *The minimum value that can be input is 0.100. The maximum value that can be input is 9.999.*

```
Tc99m
 ENTER
 Corr. Factor
 For:  CAPSULE?

  Yes or No
```

Figure 6-45 Corr. Factor for Capsule Screen

If a Correction Factor will be input for a Capsule, press **YES**. Figure 6-46 Corr. Factor Entry Screen will appear.

If a Correction Factor will not be input for a Capsule, press **NO**. Figure 6-47 Corr. Factor Verification Screen will appear displaying the input values for verification:

```
Tc99m
 ENTER




  _
```

Figure 6-46 Corr. Factor Entry Screen

Input the Correction Factor value and press **ENTER**. Figure 6-47 Corr. Factor Verification Screen will appear.

Note: *The minimum value that can be input is 0.100. The maximum value that can be input is 9.999.*

```
Tc99m  Corr Facs

SYRINGE  1.010
VIAL     0.995
CAPSULE  NONE
  OK?  Y or N
```

Figure 6-47 Corr. Factor Verification Screen

If the displayed values are OK, press **YES**. If the displayed values are not OK, press **NO**. Figure 6-40 Choose Nuclide for Correction Factors will re-appear.

Changing / Deleting Correction Factors

If there are already correction factors for the chosen nuclide, Figure 6-47 Corr. Factor Verification Screen will appear showing the factors for the selected nuclide.

If the Correction Factors need to be changed or deleted for the chosen nuclide, press **NO**.

For each container type, if a correction factor has been entered, it will be displayed for verification. (The example shown is for a Syringe.)

If a correction factor has not been entered for the container type, you will be asked if you want to enter a correction factor.

```
Tc99m

 Corr. Factor
 For:  SYRINGE
 1.010
  OK?  Y or N
```

Figure 6-48 Correction Factor for Syringe Verification Screen

Press **YES** to keep the current Correction Factor. Figure 6-48 Correction Factor for Syringe Verification Screen will re-appear for the next container type.

Press **NO** to change or delete the Correction Factor. Figure 6-49 Corr. Factor for Syringe Screen will appear.

```
Tc99m
 ENTER
 Corr. Factor
 For:  SYRINGE?

  Yes or No
```

Figure 6-49 Corr. Factor for Syringe Screen

Press **NO** to delete the current Correction Factor for the displayed Container.

Press **YES** to change the current Correction Factor

Input the new Correction Factor and press **ENTER**.

The above steps will be repeated for the remaining Container types.

After correction factors have been accepted or entered for all three container types, Figure 6-47 Corr. Factor Verification Screen will appear.

If *"NONE"* is displayed for all the correction factors, the correction factor setting for that nuclide will be deleted.

LINEARITY TEST DEFINITION

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

In order to perform a Linearity Test from the *Enhanced Test Menu* (reference CHAPTER 13: ENHANCED TESTS, SECTION: PERFORMING LINEARITY TEST), a Linearity Test Method must be defined from the Linearity Setup in the *Other Menu*. If a Linearity Method is not defined, Figure 6-50 Linearity Not Defined Error Screen will appear.

```
Must Define
Linearity Test


 Any Key to Continue
```

Figure 6-50 Linearity Not Defined Error Screen

Press **MENU** from the Chamber Measurement Screen.

Select *SETUP*. The *Setup Menu* appears.

Select *OTHER*. Input the password (last 3 digits of Readout serial number) and press **ENTER**. Figure 6-1 Other Menu appears.

From the *Other Menu*, select *LINEARITY*. If a Linearity Test has previously been defined, Figure 6-51 Message if Test Already Defined will appear; otherwise Figure 6-52 Linearity Test Selection Menu will appear.

```
LINEARITY TEST
ALREADY DEFINED
NEW DEFINITION?

  Yes or No
```

Figure 6-51 Message if Test Already Defined

Press **YES** to change the Linearity Test definition. Figure 6-52 Linearity Test Selection Menu will appear.

```
  Select Test

1. Standard
2. Lineator
3. Calicheck
```

Figure 6-52 Linearity Test Selection Menu

Setting Up Standard Linearity Test

The Standard Test is performed by tracking the decay of a strong Tc99m source.

Select *STANDARD* from Figure 6-52 Linearity Test Selection Menu. Figure 6-53 Number of Tests Entry screen will appear.

```
ENTER NUMBER
OF TESTS
8 – 12
 _
```

Figure 6-53 Number of Tests Entry

This test can be performed with 8 to 12 measurements.

Input the number of measurements that will be performed and press **ENTER**.

For each measurement (starting with the 2nd measurement), 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 255. The example below (Figure 6-54 Standard Test – Test Time Entry) is for the second measurement.

```
STANDARD
LINEARITY TEST
TIME FOR
MEASUREMENT 2
IN HOURS
```

Figure 6-54 Standard Test – Test Time Entry

Input the time (in hours) and press **ENTER**. The above screen will be repeated for each measurement.

After all the times are input, the Standard Test Verification screen will appear. The example shown (Figure 6-55 Standard Test Verification) is for 12 tests at 1 hour increments:

```
HOURS FOR TESTS
1:  0  2:   1 3:   2
4:   3 5:   4 6:   5
7:   6 8:   7 9:   8
10:  9 11: 10 12: 11

          OK? Y or N
```

Figure 6-55 Standard Test Verification

If the displayed times are incorrect, press **NO**. Figure 6-53 Number of Tests Entry will re-appear.

If the displayed times are correct, press **YES**. Figure 6-1 Other Menu will reappear.

Setting Up Lineator Test

This test requires 8 measurements. A Lineator Test Calibration procedure must be performed before any Lineator tests.

Select *LINEATOR* from Figure 6-52 Linearity Test Selection Menu. Figure 6-56 Lineator Calibration Prompt screen will appear. The example below is given for the 5th measurement.

```
Measure Tube # 5
1 + 4



 Any Key to Continue
```

Figure 6-56 Lineator Calibration Prompt

Place the Linearity Test Source in the Chamber and press any key to continue the measurement. Figure 6-57 Lineator Measurement Screen will appear.

```
Tc99m

      6.27mCi

  ENTER to Accept
```

Figure 6-57 Lineator Measurement Screen

Press **ENTER** to accept the measurement. Figure 6-58 Lineator Calibration Measurement Verification screen will appear.

```
Tube # 5
1 + 4

Activity:   x.xxmCi
Initial Factor
   n.nn
          OK? Y or N
```

Figure 6-58 Lineator Calibration Measurement Verification

To repeat the measurement, press **NO**. Figure 6-56 Lineator Calibration Prompt will re-appear.

To accept the measurement, press **YES**. The next Lineator Calibration Prompt screen will appear until all 8 tubes are measured.

If a printer is attached to the system, a Lineator Test Calibration report will print and the prompt to print again will appear.

To print the test results again, press **YES**. To return to Figure 6-1 Other Menu, press **NO**.

The report will show the measured activity and initial factor for each tube set.

Setting Up Calicheck Test

This test requires 8 to 12 measurements. A calibration procedure must be performed before any Calicheck tests.

Select *CALICHECK* from Figure 6-52 Linearity Test Selection Menu. Figure 6-59 Number of Tests Entry screen will appear.

```
ENTER NUMBER
OF TUBES
8 – 12
 _
```

Figure 6-59 Number of Tests Entry

Input the number of measurements that will be performed and press **ENTER**. Figure 6-60 Calicheck Calibration Prompt screen will appear. The example below is given for the 5th measurement.

```
Measure Tube # 5
Black + Green



 Any Key to Continue
```

Figure 6-60 Calicheck Calibration Prompt

Place the Linearity Test Source in the Chamber and. press any key to continue the measurement. Figure 6-61 Calicheck Measurement Screen will appear.

```
Tc99m

      6.27mCi

  ENTER to Accept
```

Figure 6-61 Calicheck Measurement Screen

Press **ENTER** to accept the measurement. Figure 6-62 Calicheck Calibration Measurement Verification screen will appear.

```
Tube # 5
Black + Green

Activity:   x.xxmCi
Calibration Factor
   n.nn
          OK? Y or N
```

Figure 6-62 Calicheck Calibration Measurement Verification

To repeat the measurement, press **NO**. Figure 6-60 Calicheck Calibration Prompt will re-appear.

To accept the measurement, press **YES**. The next Calicheck Calibration Prompt screen will appear until all tubes are measured.

If a printer is attached to the system, a Calicheck Test Calibration report will print and the prompt to print again will appear.

To print the test results again, press **YES**. To return to Figure 6-1 Other Menu, press **NO**.

The report will show the measured activity and calibration factor for each tube.

REMOTE NUCLIDE ASSIGNMENT (LEGACY PRODUCTS ONLY)

Note: *This section is only included for legacy systems. Remote Displays are no longer available as an option.*

If a Remote Display unit was part of the legacy CRC®-25W system, up to 8 nuclides can be assigned to the remote. This allows the user to select any one of the assigned nuclides from the Remote Display without having to return to the Main Readout.

Press **MENU** from the Chamber Measurement Screen.

Select *SETUP*. The *Setup Menu* appears.

Select *OTHER*. Input the password (last 3 digits of Readout serial number) and press **ENTER**. Figure 6-1 Other Menu appears:

From the *Other Menu*, select *REMOTE / PC*. Figure 6-63 Remote / PC Menu will appear.

```
1. Remote
2. USB Timeout
3. USB Protocol
```

Figure 6-63 Remote / PC Menu

From the *Remote / PC Menu*, select *REMOTE*. Figure 6-64 Remote Choose Nuclide Screen will appear showing the factory default nuclides.

```
 CHOOSE NUCLIDE
Tc99m  In111  Ga67
F 18   I 123  I 131
Xe133  Tl201
```

Figure 6-64 Remote Choose Nuclide Screen

Remove Nuclides

To remove a Remote nuclide, at Figure 6-64 Remote Choose Nuclide Screen, select the nuclide via the Pre-Set Nuclide keys, **USER** keys or **NUCL** key. Figure 6-65 Remote Choose Nuclide – Delete Nuclide Screen will appear:

```
 CHOOSE NUCLIDE


Already On List
Delete? Y or N
```

Figure 6-65 Remote Choose Nuclide – Delete Nuclide Screen

Press **YES** to delete the selected nuclide from the Remote Nuclide list. Figure 6-64 Remote Choose Nuclide Screen will re-appear without the selected nuclide.

When all changes are complete, press **ENTER**. Figure 6-1 Other Menu will re-appear.

Adding Nuclides

A maximum of 8 nuclides can be set for Remote Displays. If all locations are used, one or more nuclides must be removed before any more can be added.

At Figure 6-64 Remote Choose Nuclide Screen, select nuclides via the Pre-Set Nuclide keys, **USER** keys or **NUCL** key. The name of each nuclide will be displayed as it is selected.

When all desired nuclides are selected, press **ENTER**. Figure 6-1 Other Menu will re-appear.

USB PORT SETTINGS

Two selections are provided for adjusting the USB port settings when connecting the Calibrator to a Nuclear Management software system. They are USB Timeout and USB Protocol. By default, the USB Timeout is “disabled” and the USB Protocol is “Legacy”. The defaults will work with Capintec’s Communications software. These settings may need to be changed if the Calibrator is connected to some other Nuclear Management software system. Please contact Capintec, Inc. for further assistance with these settings.

CHAPTER 7

WELL COUNTER INITIALIZATION

GENERAL

This section describes initialization and parameter setup for the Well Counter.

To access these functions, press **WELL** from the Chamber Measurement screen to proceed to Well Counter Mode.

Note: *If Background has not been measured for the current day, the Background Instruction Screen will appear. Press the **MENU** key. After **MENU** is pressed, the ENTER PASSWORD screen will appear. Input the password (last 3 digits of the readout serial number) and press **ENTER**. Figure 7-2 Well Setup Menu will appear.*

Press **MENU** from the Well Measurement Screen. Figure 7-1 Well Main Menu will appear.

```
1. Measure
2. Auto Cal
3. Setup
4. Lab Tests
5. MDA Test
```

Figure 7-1 Well Main Menu

WELL SETUP MENU

To perform Setup functions, select *SETUP*.

Input your password (last 3 digits of the readout serial number) and press **ENTER**. Figure 7-2 Well Setup Menu will appear.

```
1. Nuclides
2. Test Source
3. Trig. Level
4. Efficiencies
5. User Keys
6. Reset HV
```

Figure 7-2 Well Setup Menu

NUCLIDE SELECTION

The nuclide(s) to be identified in Wipe Tests must be selected.

Press **MENU** from the Well Measurement Screen.

Select *SETUP*. Input your password (last 3 digits of the readout serial number) and press **ENTER**. Figure 7-2 Well Setup Menu will appear.

Select *NUCLIDES*. Figure 7-3 Wipe Nuclide Menu will appear.

```
1. Wipe
2. Unrestricted
3. Sealed Source
```

Figure 7-3 Wipe Nuclide Menu

Wipe Areas

Up to 10 nuclides may be selected for the Wipe Areas.

Select *WIPE* from Figure 7-3 Wipe Nuclide Menu. Figure 7-4 Wipe Choose Nuclide Screen will appear.

```
 WIPE
 CHOOSE NUCLIDE
```

Figure 7-4 Wipe Choose Nuclide Screen

Add Nuclides

Select nuclides via the Pre-Set Nuclide keys, **USER** keys or **NUCL** key. The name of each nuclide will be displayed as it is selected.

Note: *Efficiency data must be entered for nuclides to be added. (Reference this chapter, SECTION: EFFICIENCY DATA)*

```
 WIPE
 CHOOSE NUCLIDE
Tc99m  In111  Ga67
I 123  I 131
```

Figure 7-5 Wipe Choose Nuclide Screen with selected nuclides

When all changes are complete, press **ENTER**. Figure 7-3 Wipe Nuclide Menu will re-appear.

Remove Nuclides

To remove a Wipe Nuclide from the list, at Figure 7-5 Wipe Choose Nuclide Screen with selected nuclides, select the nuclide via the Pre-Set Nuclide keys, **USER** keys or **NUCL** key. Figure 7-6 Wipe Delete Nuclide Screen will appear:

```
 WIPE
 CHOOSE NUCLIDE


Already On List
Delete? Y or N
```

Figure 7-6 Wipe Delete Nuclide Screen

Press **YES** to delete the selected nuclide from the Wipe Nuclide list. Figure 7-5 Wipe Choose Nuclide Screen with selected nuclides will re-appear without the selected nuclide.

When all changes are complete, press **ENTER**. Figure 7-3 Wipe Nuclide Menu will re-appear.

Unrestricted Areas

Up to 10 nuclides may be selected for the Unrestricted Areas

Select *UNRESTRICTED* from Figure 7-3 Wipe Nuclide Menu. Figure 7-7 Unrestricted Choose Nuclide Screen will appear.

```
 UNRESTRICTED
 CHOOSE NUCLIDE
```

Figure 7-7 Unrestricted Choose Nuclide Screen

Add Nuclides

Select nuclides via the Pre-Set Nuclide keys, **USER** keys or **NUCL** key. The name of each nuclide will be displayed as it is selected.

Note: *Efficiency data must be entered for nuclides to be added. (Reference this chapter, SECTION: EFFICIENCY DATA)*

```
 UNRESTRICTED
 CHOOSE NUCLIDE
Tc99m  In111  Ga67
I 123  I 131
```

Figure 7-8 Unrestricted Choose Nuclide Screen with selected nuclides

When all changes are complete, press **ENTER**. Figure 7-3 Wipe Nuclide Menu will re-appear.

Remove Nuclides

To remove an Unrestricted Nuclide from the list, at Figure 7-7 Unrestricted Choose Nuclide Screen, select the nuclide via the Pre-Set Nuclide keys, **USER** keys or **NUCL** key. Figure 7-9 Unrestricted Delete Nuclide Screen will appear:

```
 UNRESTRICTED
 CHOOSE NUCLIDE


Already On List
Delete? Y or N
```

Figure 7-9 Unrestricted Delete Nuclide Screen

Press **YES** to delete the selected nuclide from the Unrestricted Nuclide list. Figure 7-8 Unrestricted Choose Nuclide Screen with selected nuclides will re-appear without the selected nuclide.

When all changes are complete, press **ENTER**. Figure 7-3 Wipe Nuclide Menu will re-appear.

Sealed Sources

Up to 99 nuclides may be entered for Sealed Sources. They are designated S-01 to S-99.

Select *SEALED SOURCE* from Figure 7-3 Wipe Nuclide Menu. Figure 7-10 Sealed Source Choose Nuclide Screen will appear.

```
S-01



 CHOOSE NUCLIDE
```

Figure 7-10 Sealed Source Choose Nuclide Screen

Select nuclides via the Pre-Set Nuclide keys, **USER** keys or **NUCL** key. The name of the nuclide will be displayed as shown in Figure 7-11 Sealed Source Choose Nuclide Screen with selected nuclide.

Note: *Efficiency data must be entered for nuclides to be added. (Reference this chapter, SECTION: EFFICIENCY DATA)*

```
S-01
Tc99m


 CHOOSE NUCLIDE
```

Figure 7-11 Sealed Source Choose Nuclide Screen with selected nuclide

Press **ENTER** to accept the nuclide. The Sealed Source Choose Nuclide Screen for the next Sealed Source will be displayed

When all sealed sources have been entered, press **MENU** to accept the changes and return to Figure 7-3 Wipe Nuclide Menu.

To cancel the changes and return to the Wipe Measurement screen, press **HOME**.

TEST SOURCE DATA

A Test Source is used for the Well Counter calibration and test.

Before performing Auto Cal, Test Source Data must be input. The source may be Cs137 or Ba133.

When shipped from the factory, the CRC®-25W does not have Test Source information entered.

Press **MENU** from the Well Measurement Screen.

Select *SETUP*. Input your password (last 3 digits of the readout serial number) and press **ENTER**. Figure 7-2 Well Setup Menu will appear.

Select *TEST SOURCE*.

Source Verification

If a Well Counter Test Source has been previously input, the data for the source will be displayed for verification as shown in Figure 7-12 Test Source Verification. (Cs137 is used in the example.)

If a Well Counter Test Source has not been previously input, Figure 7-13 Well Test Source Nuclide Selection screen will appear.

```
Cs137
S/N: 123456ABC
Jun 30 1994
0.005 MBq
  0K?  Y or N
```

Figure 7-12 Test Source Verification

If the displayed data is correct, press **YES**. Figure 7-2 Well Setup Menu will re-appear.

To change the previously stored data or if the displayed data is not correct, press **NO**. Figure 7-13 Well Test Source Nuclide Selection screen will appear.

```
 Select Source

1. Cs137
2. Ba133
```

Figure 7-13 Well Test Source Nuclide Selection

Press the number corresponding to the Well Test Source to be used. Figure 7-14 Entering Serial Number screen will appear. The following examples are for Ba133.

Entering Serial Number

The serial number may be any combination of 10 numbers and letters.

```
Ba133
 ENTER S/N


 _
```

Figure 7-14 Entering Serial Number

To input the serial number of the test source, use the NUMBER / LETTER keys. When a key is pressed, the number appears. Press the key again to change the number into one of the letters on the same key (e.g. press the **2** key 3 times to get the letter B). To go to the next character, press another key. If the next character is on the same key, press the **UP ARROW (⇖)** key to repeat use of that key. The **DOWN ARROW (⇘)** is the **SPC** key.

Press **ENTER** when the correct serial number has been input. Figure 7-15 Entering Calibration Date screen will appear.

Entering Calibration Date

The calibration date is entered next.

```
Ba133
 CALIBRATED
 _


    MMDDYYYY
```

Figure 7-15 Entering Calibration Date

Input the Source calibration date in the form MMDDYYYY (example: July 3, 2006 would be 07032006) and press **ENTER**. The date is checked for validity. If the entered date is not valid, a beep will sound and “DATE ERROR” will be displayed. The date must be re-entered.

Figure 7-16 Entering Activity screen will appear.

Entering Calibration Activity

The calibration activity can now be input:

```
Ba133
CALIB ACTIVITY:
  value   unit
 _        µCi

-> to change unit
  ENTER to accept
```

Figure 7-16 Entering Activity

Input the value of the calibrated activity and then press the **RIGHT ARROW (➘)** key. Use the arrow keys to scroll through the activity units: µCi, MBq or mCi. If the value needs to be changed, press **CE.**

Note: *The recommended calibrated activity is in the 0.1-1.0 µCi range. The calibrated activity must not be greater than 10.0 µCi (0.37 MBq).*

When the value and unit are correct, press **ENTER**. Figure 7-17 Test Source Verification screen will appear.

```
Ba133
S/N: 1458
Feb 15 2007
 1.00 µCi
  OK?  Y or N
```

Figure 7-17 Test Source Verification

If the displayed data is correct, press **YES**. Figure 7-2 Well Setup Menu will re-appear.

If the displayed data is not correct, press **NO**. Figure 7-13 Well Test Source Nuclide Selection will appear.

TRIGGER LEVELS

Trigger levels are count limits that determine when the CRC®-25W indicates that a measurement is too high.

Trigger levels for Background, Wipe, Unrestricted and Sealed Sources may be viewed and changed by the user.

The default Trigger Levels set at the factory are listed in Table 7-1 Wipe Trigger Level Defaults.

Type	**Trigger Level**	
	Curies	**Becquerels**
Background	3000 cpm	50 cps
Wipe (Work Areas)	2000 dpm	33.3 Bq
Unrestricted Areas	200 dpm	3.3 Bq
Sealed Source	5.0 nCi	185.0 Bq

Table 7-1 Wipe Trigger Level Defaults

The Trigger Levels minimum and maximum values are listed in Table 7-2 Wipe Trigger Level Limits.

Type	Curies		Becquerels	
	Minimum	**Maximum**	**Minimum**	**Maximum**
Background	60 cpm	9960 cpm	1.000 cps	166.0 cps
Wipe (Work Areas)	60.00 dpm	25000 dpm	1.000 Bq	417.0 Bq
Unrestricted	60 dpm	2500 dpm	1.000 Bq	41.70 Bq
Sealed source	0.100 nCi	270.0 nCi	3.700 Bq	9990 Bq

Table 7-2 Wipe Trigger Level Limits

Press **MENU** from the Well Measurement Screen.

Select *SETUP*. Input your password (last 3 digits of the readout serial number) and press **ENTER**. Figure 7-2 Well Setup Menu will appear.

Select *TRIG. LEVEL*. Figure 7-18 Trigger Level Menu will appear.

```
1. Background
2. Wipe
3. Unrestricted
4. Sealed Source
```

Figure 7-18 Trigger Level Menu

Background Trigger Level

When the measured background is greater than the background trigger level, an error message is displayed and the background result will not be accepted.

Typical background level of CRC®-25W is approximately 600cpm or less in a clean room. If the instrument must be located where high level of high-energy γ-emitters are handled while measurements are made by CRC®-25W, additional shielding may be placed around the Well Counter to reduce background.

If the instrument is contaminated, background will be increased.

To view or change the Background Trigger Level, select *BACKGROUND* from Figure 7-18 Trigger Level Menu.

Figure 7-19 Background Limit Verification Screen will appear showing the current Trigger Level.

Note: *The Trigger Level will be displayed in cpm if Ci is selected or cps if Bq is selected.*

```
  BACKGROUND

3000.0 cpm

 OK?  Y or N
```

Figure 7-19 Background Limit Verification Screen

If the current Background Trigger Level is correct, press **YES**. Figure 7-18 Trigger Level Menu will re-appear.

If the current Background Trigger Level is not correct, press **NO**. Figure 7-20 Background Limit Entry Screen will appear.

```
Input Trigger
Level In cpm
  _
```

Figure 7-20 Background Limit Entry Screen

Input the desired Background Trigger Level and press **ENTER**. Figure 7-19 Background Limit Verification Screen will re-appear showing the new setting.

If the new Background Trigger Level is correct, press **YES**. Figure 7-18 Trigger Level Menu will re-appear.

If the new Background Trigger Level is not correct, press **NO**. Figure 7-20 Background Limit Entry Screen will appear.

Wipe Areas Trigger Level

When the activity of a Wipe for a particular nuclide exceeds the Wipe Trigger Level, its activity will be displayed and printed as “EXCEEDS”.

To view or change the Wipe Areas Trigger Level, select *WIPE* from Figure 7-18 Trigger Level Menu.

Figure 7-21 Wipe Limit Verification Screen will appear showing the current Trigger Level.

Note: *The Trigger Level will be displayed in dpm if Ci is selected or Bq if Bq is selected.*

```
      WIPE

 2000.0 dpm

  OK?  Y or N
```

Figure 7-21 Wipe Limit Verification Screen

If the current Wipe Trigger Level is correct, press **YES**. Figure 7-18 Trigger Level Menu will re-appear.

If the current Wipe Trigger Level is not correct, press **NO**. Figure 7-22 Wipe Limit Entry Screen will appear.

```
Input Trigger
Level in dpm
  _
```

Figure 7-22 Wipe Limit Entry Screen

Input the desired Wipe Trigger Level and press **ENTER**. Figure 7-21 Wipe Limit Verification Screen will re-appear showing the new setting.

If the new Wipe Trigger Level is correct, press **YES**. Figure 7-18 Trigger Level Menu will re-appear.

If the new Wipe Trigger Level is not correct, press **NO**. Figure 7-22 Wipe Limit Entry Screen will appear.

Unrestricted Areas

When the activity of a wipe from an Unrestricted area for a particular nuclide exceeds the Unrestricted Trigger Level, its activity will be displayed and printed as “EXCEEDS”.

To view or change the Unrestricted Areas Trigger Level, select *UNRESTRICTED* from Figure 7-18 Trigger Level Menu.

Figure 7-23 Unrestricted Limit Verification Screen will appear showing the current Trigger Level.

Note: *The Trigger Level will be displayed in dpm if Ci is selected or Bq if Bq is selected.*

```
   UNRESTRICTED

 200.0 dpm

  OK?  Y OR N
```

Figure 7-23 Unrestricted Limit Verification Screen

If the current Unrestricted Trigger Level is correct, press **YES**. Figure 7-18 Trigger Level Menu will re-appear.

If the current Unrestricted Trigger Level is not correct, press **NO**. Figure 7-24 Unrestricted Limit Entry Screen will appear.

```
Input Trigger
Level in dpm
  _
```

Figure 7-24 Unrestricted Limit Entry Screen

Input the desired Unrestricted Trigger Level and press **ENTER**. Figure 7-23 Unrestricted Limit Verification Screen will re-appear showing the new setting.

If the new Unrestricted Trigger Level is correct, press **YES**. Figure 7-18 Trigger Level Menu will re-appear.

If the new Unrestricted Trigger Level is not correct, press **NO**. Figure 7-24 Unrestricted Limit Entry Screen will appear.

Sealed Sources

When the activity of a wipe from a Sealed Source exceeds the Sealed Source Trigger Level, its activity will be displayed and printed as "EXCEEDS".

To view or change the Sealed Sources Trigger Level, select *SEALED SOURCE* from Figure 7-18 Trigger Level Menu.

Figure 7-25 Sealed Source Limit Verification Screen will appear showing the current Trigger Level.

Note: *The Trigger Level will be displayed in nCi if Ci is selected or Bq if Bq is selected.*

```
SEALED SOURCE

 5.0 nCi

OK?  Y OR N
```

Figure 7-25 Sealed Source Limit Verification Screen

If the current Sealed Source Trigger Level is correct, press **YES**. Figure 7-18 Trigger Level Menu will re-appear.

If the current Sealed Source Trigger Level is not correct, press **NO**. Figure 7-26 Sealed Source Limit Entry Screen will appear.

```
Input Trigger
Level in nCi
  _
```

Figure 7-26 Sealed Source Limit Entry Screen

Input the desired Sealed Source Trigger Level and press **ENTER**. Figure 7-25 Sealed Source Limit Verification Screen will re-appear showing the new setting.

If the new Sealed Source Trigger Level is correct, press **YES**. Figure 7-18 Trigger Level Menu will re-appear.

If the new Sealed Source Trigger Level is not correct, press **NO**. Figure 7-26 Sealed Source Limit Entry Screen will appear.

EFFICIENCY DATA

Efficiency data are used to convert the observed counting rate to the activity value.

Efficiency data for 14 nuclides which are known are built into the system.

Existing efficiencies may be changed and/or new ones may be added for nuclides which do not have any.

The efficiencies may be input or measured.

The nuclide is chosen from all nuclides in memory or from those added by the user.

Press **MENU** from the Well Measurement Screen.

Select *SETUP*. Input your password (last 3 digits of the readout serial number) and press **ENTER**. Figure 7-2 Well Setup Menu will appear.

Select *EFFICIENCIES*. Figure 7-27 Well Efficiency Choose Nuclide Screen will appear.

```
 CHOOSE NUCLIDE

Press NUCL or
Pre-set nuclide key
or User key
or CAL# for All Chans
```

Figure 7-27 Well Efficiency Choose Nuclide Screen

Efficiency for “All Channels”

Besides the built-in and user added nuclides, there is also an “All Chans” nuclide. This is an artificial construct and is equivalent to I-131 using the counting rate in all the channels. The activity for “ALL” is always reported for Wipe and Unrestricted categories.

This efficiency cannot be measured and must be input. The default value is 37.04%.

To view / change this value, press **CAL#** at Figure 7-27 Well Efficiency Choose Nuclide Screen. Figure 7-28 “All Channels” Verification Screen will appear.

```
 ALL CHANNELS

% EFF:  37.04

  OK?  Y or N
```

Figure 7-28 “All Channels” Verification Screen

If the current Efficiency is correct, press **YES**. Figure 7-27 Well Efficiency Choose Nuclide Screen will re-appear.

If the current Efficiency is not correct, press **NO** to input a new Efficiency value. Figure 7-29 “All Channels” Efficiency Entry Screen will appear.

```
ENTER %EFF
FOR ALL CHANNELS



 _
```

Figure 7-29 “All Channels” Efficiency Entry Screen

Input the desired Efficiency value and press **ENTER**. Figure 7-28 “All Channels” Verification Screen will re-appear showing the new setting.

If the new Efficiency value is correct, press **YES**. Figure 7-27 Well Efficiency Choose Nuclide Screen will re-appear.

If the new Efficiency value is not correct, press **NO**. Figure 7-29 “All Channels” Efficiency Entry Screen will appear.

Efficiency for Nuclide

At Figure 7-27 Well Efficiency Choose Nuclide Screen, select a nuclide via the Pre-Set Nuclide keys, **USER** keys or **NUCL** key.

After choosing a nuclide, Figure 7-30 Efficiency Verification Screen will appear showing the nuclide's current efficiency and channels if there is existing data for the nuclide. (The example is for Na22.)

```
Na22

% EFF:  43.48
CH:     3 4 5 6

  OK?  Y or N
```

Figure 7-30 Efficiency Verification Screen

If there is no existing data for the selected nuclide, Figure 7-31 Efficiency Verification Screen – No Data will appear. (The example is for Xe133.)

```
Xe133

 No Data


  OK?  Y or N
```

Figure 7-31 Efficiency Verification Screen – No Data

If the current Efficiency is correct, press **YES**. Figure 7-27 Well Efficiency Choose Nuclide Screen will re-appear.

If the current Efficiency is not correct, press **NO** to input a new Efficiency value or change the channels. Figure 7-32 Efficiency Entry Method Menu will appear.

Efficiency may be input or measured:

```
1. Input Eff
2. Measure Eff
```

Figure 7-32 Efficiency Entry Method Menu

Input Efficiency

From Figure 7-32 Efficiency Entry Method Menu, select *INPUT EFF*. Figure 7-33 Efficiency Input Screen will appear.

```
Enter
 % EFFICIENCY


 _
```

Figure 7-33 Efficiency Input Screen

Input the desired efficiency value and press **ENTER**. Figure 7-34 Channel Selection screen will appear.

The channels that will be used to calculate activity must be selected. If previous data has been input, the previous selection will be highlighted as shown in Figure 7-34 Channel Selection screen.

```
Y selects channels
→ CH 1   CH 4
  CH 2   CH 5
  CH 3   CH 6
ENTER when finished
```

Figure 7-34 Channel Selection

Use the **UP ARROW (⇖)** and **DOWN ARROW (⇘)** keys to move the pointer (right arrow ➔) so that it points to the channel to be selected (or de-selected) and then press the **Y** key.

Press **ENTER** when the desired channels are selected. Figure 7-30 Efficiency Verification Screen will re-appear.

If the new Efficiency and channels are correct, press **YES**. Figure 7-27 Well Efficiency Choose Nuclide Screen will re-appear.

If the new Efficiency and channels are not correct, press **NO** to input a new Efficiency value or change the channels. Figure 7-27 Well Efficiency Choose Nuclide Screen will appear.

The new Efficiency for the selected nuclide is now stored in memory as the default.

Measuring Efficiency

Note: *The Well Counter must be calibrated before measuring Efficiency. (Reference CHAPTER 11: WELL COUNTER TESTS, SECTION: AUTO CALIBRATION)*

From Figure 7-32 Efficiency Entry Method Menu, select *MEASURE EFF*. Figure 7-35 Enter Calibration Date will appear.

```
CALIBRATED
   Enter Date
   _


   MMDDYYYY
```

Figure 7-35 Enter Calibration Date

Input the calibration date in the form MMDDYYYY (example: July 3, 2006 would be 07032006) and press **ENTER**. The date is checked for validity. If the input date is not valid, the message “DATE ERROR” will be displayed. The date must be re-entered.

Figure 7-36 Time Entry Screen will appear.

```
Enter Time
_


hhmm
```

Figure 7-36 Time Entry Screen

Input the time as hhmm in 24 hour time format (example: 1:25 PM would be 1325, 9:15 AM would be 0915) and press **ENTER**. The time is checked for validity. If the input time is not valid, the message “TIME ERROR” will be displayed. The time must be re-entered.

Figure 7-37 Enter Calibrated Activity will appear:

```
Calib Activity:

  value    unit
 _         µCi

-> to change unit
  ENTER to accept
```

Figure 7-37 Enter Calibrated Activity

Input the value of the source calibrated activity and then press the **RIGHT ARROW (➘)** key. Use the arrow keys to scroll the activity units: µCi, Ci or mCi in Ci mode or MBq or GBq in Bq mode. If the value needs to be changed, press **CE**.

When the value and unit are correct, press **ENTER**. Figure 7-38 Calibrated Activity Verification Screen will appear showing the source calibration data that was just input.

```
Na22
    0.85µCi
May 01 2005
12:00

  OK?  Y or N
```

Figure 7-38 Calibrated Activity Verification Screen

If the displayed calibration data is not correct, press **NO**. Figure 7-35 Enter Calibration Date screen will re-appear.

If the displayed calibration data is correct, press **YES**. Figure 7-39 Measure Source Instruction Screen will appear.

```
Measure Source

 Any Key to Continue
```

Figure 7-39 Measure Source Instruction Screen

Place the source in the Well Counter and press any key (except **HOME**) to continue. Figure 7-40 Calibration Measurement Start Screen will appear.

```
            60s

 Press COUNT to START
```

Figure 7-40 Calibration Measurement Start Screen

The measurement time may be changed. The minimum time is 60 seconds. The maximum count time is 9999 seconds.

Press **COUNT** ***(START/STOP)*** to begin the measurement.

When the counting is finished, if a printer is attached to the system, the first part of the report will be printed with a screen dump of the measurement.

Figure 7-34 Channel Selection screen will appear allowing the selection of the channels.

Use the **UP ARROW (⇖)** and **DOWN ARROW (⇘)** keys to move the pointer (right arrow ➔) so that it points to the channel to be selected and then press the **Y** key.

Press **ENTER** when the desired channels are selected. The efficiency will be calculated and Figure 7-30 Efficiency Verification Screen will re-appear.

If a printer is attached to the system, the report will finish printing the channels and Efficiency data.

If the measured Efficiency is correct, press **YES**. Figure 7-27 Well Efficiency Choose Nuclide Screen will re-appear.

If the measured Efficiency is not correct, press **NO** to perform a new Efficiency measurement. Figure 7-27 Well Efficiency Choose Nuclide Screen will re-appear.

The new Efficiency for the selected nuclide is now stored in memory as the default.

USER KEY ASSIGNMENT

The **USER** Keys are a quick way to select a nuclide. A nuclide may be assigned to each key.

Up to 5 **USER** Keys can be assigned for use with the Well Counter.

Press **MENU** from the Well Measurement Screen.

Select *SETUP*. Input your password (last 3 digits of the readout serial number) and press **ENTER**. Figure 7-2 Well Setup Menu will appear.

Select *USER KEYS*. Figure 7-41 Well User Key Selection will appear.

```
                WELL
 SELECT
 USER KEY
 U1 TO U5
Any Other Key To
Continue Setup
```

Figure 7-41 Well User Key Selection

Press any other key (except a **USER** key or the **HOME** key) to exit User Key Assignment and return to Figure 7-2 Well Setup Menu.

Current Assignment Display

Press the **USER** key to which a nuclide is to be assigned. Figure 7-42 User Key Verification screen will appear showing the current key assignment. In the example, Co60 has been assigned to U1.

Note: *From the factory, all **USER** keys are set to NONE.*

```
U1:  Co60

 OK?  Y or N
```

Figure 7-42 User Key Verification

If no assignment has been made, the word *"NONE"* will appear after the key name.

If the assignment is correct, press **YES** and Figure 7-41 Well User Key Selection screen will re-appear.

If the assignment is not correct, press **NO** to change the assignment. Figure 7-43 Nuclide Name Assignment Screen will appear.

Nuclide Name Assignment

```
   SPECIFY
   NUCLIDE


  _
```

Figure 7-43 Nuclide Name Assignment Screen

Press the alphanumeric keys corresponding to the nuclide name. The number on each key will appear. For example, if Cs137 is entered, 27137 will appear. Press **ENTER** when the nuclide has been specified.

To change the assignment to NONE, press **ENTER** without specifying a nuclide.

Assignment Confirmation

Figure 7-42 User Key Verification screen will re-appear with the nuclide name that was just input.

If the assignment is correct, press **YES**. Figure 7-41 Well User Key Selection screen will re-appear.

If the assignment is not correct, press **NO**. Figure 7-43 Nuclide Name Assignment Screen will re-appear.

RESETTING HV (HIGH VOLTAGE)

If you are having difficulty calibrating the Well Counter, you may be instructed by Capintec Support to reset the HV DAC to a particular value.

Note: *Over time, the amplification characteristics of a photomultiplier tube change. If the gain of the detector is not adjusted occasionally, the resolution of the detector deteriorates significantly, making it difficult to identify isotopes correctly. Therefore, it is important to check the gain of the detector at least once daily.*

The *RESET HV* menu option allows the operator to manually adjust the gain in order to bring the calibration of the detector back.

To perform this procedure, select *RESET HV* from Figure 7-2 Well Setup Menu. Figure 7-44 Well HV DAC Reset Screen will appear showing the current value of the HV DAC.

```
HV DAC
3645

RESET?
```

Figure 7-44 Well HV DAC Reset Screen

Press **YES** to change the HV DAC value. Figure 7-45 Well HV Entry Screen will appear.

```
Input HV

_
```

Figure 7-45 Well HV Entry Screen

Input the desired HV DAC setting and press **ENTER**. Figure 7-46 Well Reset HV Auto Cal Screen will appear.

Note: *The minimum value that can be input is 0. The maximum value that can be input is 8191.*

```
AUTO CAL MUST
BE PERFORMED

Any Key to Continue
```

Figure 7-46 Well Reset HV Auto Cal Screen

Press any key (except **HOME**) and Figure 7-2 Well Setup Menu will appear.

Auto Calibration (reference CHAPTER 11: WELL COUNTER TESTS, SECTION: AUTO CALIBRATION) must be performed before any other measurements can be carried out.

Note: *If the unit still will not calibrate after resetting the HV, contact Capintec's only Authorized Service Center for evaluation at (800) ASK-4CRC.*

CHAPTER 8

DIAGNOSTICS

GENERAL

Diagnostics performs functions to test the integrity of the system. Also, if a printer is attached to the system, a report will be printed containing the system configuration.

Press **MENU** from the Chamber Measurement Screen. Figure 8-1 Main Menu will appear.

```
1. Inventory
2. Calculations
3. Diagnostics
4. Setup
```

Figure 8-1 Main Menu

When *DIAGNOSTICS* is selected, the system diagnostic testing will begin. The instrument's memories and the programs are checked and the results printed (if a printer is attached to the system) and displayed (Figure 8-2 Diagnostics Screen if OK). If any of the tests fail, contact Capintec's only Authorized Service Center at (800) ASK-4CRC.

The following data is printed:

- A list of the nuclides, their half-lives, their calibration numbers (for the Chamber) and their efficiencies (for the Well Counter).
- User Added Nuclide information.
- The User Key assignments.
- The Test Source data.
- Chamber and Well Counter System Parameters.

```
  DIAGNOSTICS
SYSTEM TEST
  PASS: 719a

 Any Key to Continue
```

Figure 8-2 Diagnostics Screen if OK

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.*

Press any key (except **HOME**) to continue. Figure 8-1 Main Menu will re-appear.

If the Diagnostics test fails, Figure 8-3 Diagnostics Screen if fails will appear.

```
  DIAGNOSTICS
SYSTEM TEST
  FAIL: fc10

 Any Key to Continue
```

Figure 8-3 Diagnostics Screen if fails

Note: *The value displayed after FAIL is for example only and is not a real value.*

At power-up, the CRC®-25W'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 only Authorized Service Center (reference CHAPTER 19: CLEANING AND MAINTENANCE, SECTION: SERVICING) for more information, since this will indicate a SD card error or a system malfunction

Press any key (except **HOME**) to continue. Figure 8-1 Main Menu will re-appear.

CHAPTER 9

ACCEPTANCE & QUALITY ASSURANCE TESTS

GENERAL

To insure proper operation of the CRC®-25W, the following tests should be performed at the indicated intervals.

ACCEPTANCE TESTS

The following tests must be performed in the following order before the initial use of the CRC®-25W:

- Diagnostics – reference CHAPTER 8: DIAGNOSTICS.
- Daily Test – reference CHAPTER 10: CHAMBER BACKGROUND AND TESTS.
- Accuracy (for those nuclides that are not used in the Daily Test) – reference CHAPTER 10: CHAMBER BACKGROUND AND TESTS.
- Linearity – The linearity should be checked over the entire range of activities which are reasonably anticipated to be used.
- Geometry – A geometry test should be performed to determine the effect of volume changes or container variation for isotopes of interest.

- Well Counter Auto Calibration – reference CHAPTER 11: WELL COUNTER TESTS
- Well Counter Test– reference CHAPTER 11: WELL COUNTER TESTS

Diagnostic Test

When *DIAGNOSTICS* is selected, the instrument's memories and the programs are checked and the results are displayed. If a printer is attached to the system, the results will also be printed. If any of the tests fail, contact Capintec's only Authorized Service Center at (800) ASK-4CRC. (Reference CHAPTER 8: 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 10: CHAMBER BACKGROUND AND TESTS)

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

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 10: CHAMBER BACKGROUND AND TESTS)

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

Note: *Accuracy test requires a dedicated check source of known activity which is measured on a daily basis. This test provides both an accuracy value as well as a long term reproducibility check of the instrument.*

Note: *There is no need to perform a constancy test on alternate calibration (nuclide) settings. This provides no value in terms of instrument operation. However, due to numerous procedures which reference this test, operators who prefer to include this test should refer to CHAPTER 10: CHAMBER BACKGROUND AND TESTS.*

Linearity Test

The linearity of the CRC®-25W should be checked over the entire range of activities which are reasonably anticipated to be used. The initial linearity should be performed using decay method of measuring a short lived isotope over time. Thereafter, use of calibrated sleeves is acceptable.

Well Counter Auto Calibration

The Well Counter Auto Calibration should be performed every day. Auto Calibration is performed with the same source as in Well Counter Test. (Reference CHAPTER 11: WELL COUNTER TESTS; SECTION: AUTO CALIBRATION)

If there is a printer connected to the system, the calibration results will automatically be printed at the end of the measurement.

Well Counter Test

The Well Counter Test should be performed every day. It cannot be performed unless Well Background has been measured for the current day. (Reference CHAPTER 11: WELL COUNTER TESTS; SECTION: TEST)

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

DAILY QUALITY ASSURANCE TESTS

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 10: CHAMBER BACKGROUND AND TESTS)

Accuracy Test

If your Accuracy Test includes nuclides that are not used in the Daily Tests, the Accuracy Test should be performed with those nuclides as a part of the Daily Test.

This test is the same as the Accuracy Test described in CHAPTER 10: CHAMBER BACKGROUND AND 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 SOURCES).

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

Note: *Accuracy test requires a dedicated check source of known activity which is measured on a daily basis. This test provides both an accuracy value as well as a long term reproducibility check of the instrument.*

Note: *There is no need to perform a constancy test on alternate calibration (nuclide) settings. This provides no value in terms of instrument operation. However, due to numerous procedures which reference this test, operators who prefer to include this test should refer to CHAPTER 10: CHAMBER BACKGROUND AND TESTS.*

Well Counter Test

The Well Counter Test should be performed every day. It cannot be performed unless Well Background has been measured for the current day. (Reference CHAPTER 11: WELL COUNTER TESTS; SECTION: TEST)

If a printer is attached to the system, the test results will automatically 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 well 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, press **NUCL** and input **2657** for Co57 and press **ENTER**.
3. Press the **DOWN ARROW** (➘).
4. Record the displayed activity.
5. Remove the dipper from the Chamber and record the displayed activity.
6. Subtract the activity in step 5 from the activity in step 4. This is the amount of contamination of the dipper.
7. Remove the liner from the Chamber and record the displayed activity.
8. Subtract the activity in step 7 from the activity in step 5. This is the amount of contamination of the liner.
9. Should either the dipper or the liner exhibit contamination greater than 3 µCi or 0.1 MBq, they should be decontaminated or replaced.
10. Return the liner to the Chamber.

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

QUARTERLY 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 programs are checked and the results are displayed. If a printer is attached to the system, the results can be printed. If any of the tests fail, contact Capintec's only Authorized Service Center at (800) ASK-4CRC. (Reference CHAPTER 8: DIAGNOSTICS).

YEARLY TESTS

Linearity Test

The linearity of the CRC®-25W should be checked over the entire range of activities which are reasonably anticipated to be used. The initial linearity should be performed using decay method of measuring a short lived isotope over time. Thereafter, use of calibrated sleeves is acceptable.

The three most common methods are described in CHAPTER 6: CHAMBER INITIALIZATION, SECTION: LINEARITY TEST DEFINITION and CHAPTER 13: ENHANCED TESTS, SECTION: PERFORMING LINEARITY TEST.

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CHAPTER 10

CHAMBER BACKGROUND AND TESTS

GENERAL

This section describes the tests of the Chamber.

The Enhanced Tests are described in CHAPTER 13: ENHANCED TESTS.

Moly Assay is described in CHAPTER 12: CHAMBER MEASUREMENT PROCEDURES; SECTION: MOLY ASSAY.

BACKGROUND

Background measurements are performed by pressing the **BKG** key from the Chamber Measurement screen (Background measurement is also part of the Daily Test function (Reference this chapter, SECTION: TEST: Background). Figure 10-1 Background No Sources Screen will appear.

```
    MEASURE
  BACKGROUND

  NO SOURCES
Any Key to Continue
```

Figure 10-1 Background No Sources Screen

Remove all sources from the vicinity of the Chamber and press any key (except **HOME**) to continue with the Background measurement.

Figure 10-2 Background Please Wait Screen will appear until a measurement is available.

```
BACKGROUND

PLEASE WAIT
```

Figure 10-2 Background Please Wait Screen

When a measurement is available, Figure 10-3 Background Results Screen will appear.

```
BACKGROUND
  0.56µCi
   OK
ENTER to Accept
```

Figure 10-3 Background Results Screen

If the background is high but still acceptable (> 10µCi [0.4MBq] and < 530µCi [20MBq]) the message “HIGH” will appear instead of “OK”. 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 (> 530µCi [20MBq]), the value will not be shown but Figure 10-11 Background Too High Screen will appear.

```
BACKGROUND
 TOO HIGH
 SEE MANUAL

Any key to Continue
```

Figure 10-4 Background Too High Screen

This "TOO HIGH" background cannot be accepted by the CRC®-25W. If the cause of the high reading (nearby source, contaminated well etc.) cannot be found, contact Capintec's only Authorized Service Center at (800) ASK-4CRC.

Press **ENTER** to accept the result. The Chamber Measurement screen will re-appear.

DAILY TEST

The Daily Test consists of:

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

To perform the Daily Test, press **TEST** from the Chamber Measurement Screen. Figure 10-5 Tests Menu will appear.

```
     TESTS
1. Daily
2. Chamber Volts
3. Accuracy
4. Enhanced
5. Moly Assay
```

Figure 10-5 Tests Menu

Select *DAILY* from Figure 10-5 Tests Menu. Figure 10-6 Auto Zero Instruction screen will appear.

Auto Zero

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

```
AUTO ZERO


NO SOURCES
Any Key to Continue
```

Figure 10-6 Auto Zero Instruction

Remove all sources from the vicinity of the Chamber and press any key (except **HOME**) to continue. Figure 10-7 Auto Zero Please Wait Screen will appear until a measurement is available.

```
AUTO ZERO


PLEASE WAIT
```

Figure 10-7 Auto Zero Please Wait Screen

When a measurement is available, Figure 10-8 Auto Zero Results Screen will appear.

```
AUTO ZERO
 -0.03 mV
    OK

ENTER to Accept
```

Figure 10-8 Auto Zero Results Screen

If the measured value has drifted since the last measurement (±0.30mV), the message "CAUTION ZERO DRIFT" will be displayed. Check to make sure that no sources are in the area. If any sources are found, remove them and repeat the measurement.

If the measured value is out of range, the error message "ERROR – AUTO ZERO OUT OF RANGE – ANY KEY TO CONTINUE" will appear. Check to make sure that no sources are in the area. If any sources are found, remove them and repeat the measurement. If no sources were found, contact Capintec's only Authorized Service Center at (800) ASK-4CRC.

Press **ENTER** to accept the result and continue the Daily Test. Figure 10-9 Background Please Wait Screen will appear until a measurement is available.

Background

The second part of the Daily Test is Background measurement.

Background measurement can also be performed by pressing the **BKG** key from the Chamber Measurement screen. If Background is performed via the **BKG** key, you will first be told to remove all sources from the vicinity of the Chamber and press any key to continue.

Figure 10-9 Background Please Wait Screen will appear until a measurement is available.

```
BACKGROUND

PLEASE WAIT
```

Figure 10-9 Background Please Wait Screen

When a measurement is available and ready, Figure 10-10 Background Results Screen will appear.

```
BACKGROUND
  0.56µCi
   OK
ENTER to Accept
```

Figure 10-10 Background Results Screen

If the background is high but still acceptable (> 10µCi [0.4MBq] and < 530µCi [20MBq]) the message “HIGH” will appear instead of “OK”. 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 (> 530µCi [20MBq]), the value will not be shown but Figure 10-11 Background Too High Screen will appear.

```
 BACKGROUND
  TOO HIGH
  SEE MANUAL

Any key to Continue
```

Figure 10-11 Background Too High Screen

This “TOO HIGH” background cannot be accepted by the CRC®-25W. If the cause of the high reading (nearby source, contaminated well etc.) cannot be found, contact Capintec’s only Authorized Service Center at (800) ASK-4CRC.

Press **ENTER** to accept the result and continue the Daily Test. Figure 10-12 Chamber Voltage Please Wait Screen will appear.

Chamber Voltage

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

Chamber Voltage test can also be performed by selecting *CHAMBER VOLTS* from Figure 10-5 Tests Menu.

Figure 10-12 Chamber Voltage Please Wait Screen will appear until a measurement is available.

```
CHAMBER VOLTAGE


  PLEASE WAIT
```

Figure 10-12 Chamber Voltage Please Wait Screen

When a measurement is available, Figure 10-13 Chamber Voltage Results Screen will appear.

```
CHAMBER VOLTAGE
   151.2V
     OK
 ENTER to Accept
```

Figure 10-13 Chamber Voltage Results Screen

The measurement is compared with the value input at the factory. If the results are out of range, the message “FAIL SEE MANUAL” appears. If this occurs, contact Capintec’s only Authorized Service Center at (800) ASK-4CRC.

Press **ENTER** to accept the result and continue the Daily Test.

Data Check

The next part of the Daily Test is a check of the built-in nuclide data. Figure 10-14 Data Check Results screen will appear.

```
   DATA CHECK

       OK

 Any Key to Continue
```

Figure 10-14 Data Check Results

If this test fails, turn the power off and then back on. This will reload the program and data into memory. Repeat the test. If the test continues to fail, contact Capintec’s only Authorized Service Center at (800) ASK-4CRC.

Press **ENTER** to accept the result and continue the Daily Test.

Accuracy and Constancy Test in Daily Test

The next part of the Daily Test is the Accuracy Test. The CRC®-25W will step through performing the Accuracy Test for all sources that have been designated as a Daily Source (reference CHAPTER 6: CHAMBER INITIALIZATION, SECTION: TEST SOURCES).

Note: *If no sources were designated as Daily Test sources, then the message "NO DAILY SOURCE DATA – Any Key to Continue" will appear and the test will be completed. The Accuracy and Constancy tests will not be performed.*

In the example below, Co57 is the Daily Source and the Constancy Source.

```
MEASURE Co57
S/N:12345

Any Key to Continue
```

Figure 10-15 Accuracy Test in Daily Test Instruction Screen

Place the requested Test Source into the Chamber and press any key (except **HOME**) to continue with the Accuracy Test. Figure 10-16 Accuracy Test Result Screen will appear and is shown below along with a description of each section.

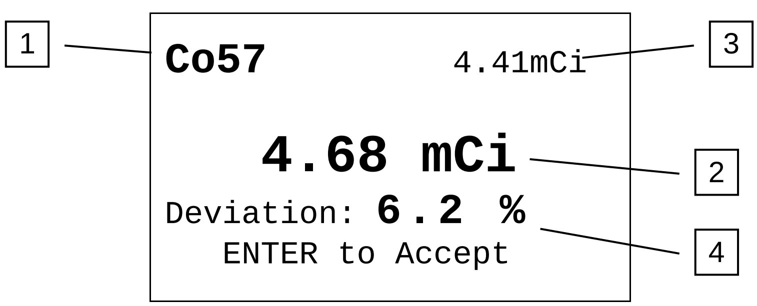

Figure 10-16 Accuracy Test Result Screen

1. The current check source under test.
2. The measured activity of the check source under test.
3. The anticipated actual activity of the check source based upon the initial calibration of the source, corrected for decay.
4. The percent deviation of the measured activity from the anticipated activity. If the deviation is greater than ±20%, the reading will be replaced by a dashed line – this indicates an error condition (perhaps the wrong source is being measured).

Deviations greater than ±5% should be investigated. If the deviation is greater than 10%, contact Capintec's only Authorized Service Center. Note that higher than expected deviations may be within the limit of error, depending the accuracy of the check source being used.

Press **ENTER** to accept the measurement.

If the source being measured is not the Constancy Source, Figure 10-15 Accuracy Test in Daily Test Instruction Screen for the next Daily Source will appear.

If the source being measured is the designated Constancy Source, the Constancy Test will be performed next. Figure 10-17 Constancy Test Instruction Screen will appear.

```
Leave Source
In For
Constancy Test

Any Key to Continue
```

Figure 10-17 Constancy Test Instruction Screen

Press any key (except **HOME**) to continue, Figure 10-18 Constancy Test Measurement Screen for the nuclide that is the Constancy Source will appear.

```
Co57          CONSTANCY
                   TEST
      93.6mCi

Cal #: 112
```

Figure 10-18 Constancy Test Measurement Screen

To perform the Constancy Test for other nuclides, press any Pre-Set Nuclide key, **USER** key or specify nuclide via **NUCL** key.

When all Constancy Tests are complete, press **ENTER** to end the test.

If there is a printer attached to the system, the Daily Test report is printed and the prompt to print again will appear.

To print the test results again, press **YES**. To return to Figure 10-5 Tests Menu, press **NO**.

CHAMBER VOLTS

To perform the Chamber Voltage measurement, press **TEST** from the Chamber Measurement Screen. Figure 10-5 Tests Menu will appear. (Chamber Voltage measurement is also part of the Daily Test function. Reference the DAILY TEST:Chamber Voltage section on page 10-6).

Select *CHAMBER VOLTS*. Figure 10-19 Chamber Voltage Remove Sources Screen will appear.

```
CHAMBER VOLTAGE


 REMOVE SOURCES
 Any Key to Continue
```

Figure 10-19 Chamber Voltage Remove Sources Screen

Remove all sources from the vicinity of the Chamber and press any key (except **HOME**) to continue with the Chamber Voltage measurement.

Figure 10-20 Chamber Voltage Please Wait Screen will appear until a measurement is available.

```
CHAMBER VOLTAGE


  PLEASE WAIT
```

Figure 10-20 Chamber Voltage Please Wait Screen

When a measurement is available, Figure 10-21 Chamber Voltage Results Screen will appear.

```
CHAMBER VOLTAGE
   151.2V
     OK
 ENTER to Accept
```

Figure 10-21 Chamber Voltage Results Screen

The measurement is compared with the value input at the factory. If the results are out of range, the message “FAIL SEE MANUAL” appears. If this occurs, contact Capintec’s only Authorized Service Center at (800) ASK-4CRC.

Press **ENTER** to accept the result. Figure 10-5 Tests Menu will re-appear.

ACCURACY TEST

To perform an Accuracy Test, press **TEST** from the Measurement Screen. Figure 10-5 Tests Menu will appear. (Accuracy Test is also part of the Daily Test function. Reference this chapter, SECTION: DAILY TEST: Accuracy and Constancy Test in Daily Test on page 10-8).

This will allow you to perform the test using any of the Test Sources.

Select *ACCURACY*. Figure 10-22 Accuracy Test Measure Screen will appear for each Test Source (Co57 is used in the example).

```
MEASURE Co57
S/N: 12345

 Yes or No
```

Figure 10-22 Accuracy Test Measure Screen

Press **NO** to skip measurement of the displayed source and proceed to the next Test Source.

Press **YES** to measure the source. Figure 10-23 Accuracy Test Result Screen will appear and is shown below along with a description of each section.

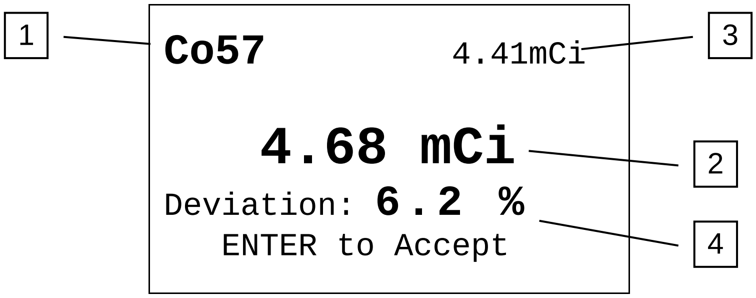

Figure 10-23 Accuracy Test Result Screen

1. The current check source under test.
2. The measured activity of the check source under test.
3. The anticipated actual activity of the check source based upon the initial calibration of the source, corrected for decay.
4. The percent deviation of the measured activity from the anticipated activity. If the deviation is greater than ±20%, the reading will be replaced by a dashed line – this indicates an error condition (perhaps the wrong source is being measured).

   Deviations greater than ±5% should be investigated. If the deviation is greater than 10%, contact Capintec's only Authorized Service Center. Note that higher than expected deviations may be within the limit of error, depending the accuracy of the check source being used.

Press **ENTER** to accept the measurement and proceed to the next Test Source.

When all chosen sources have been measured, if there is a printer attached to the system, the Accuracy Test Report will be printed and the prompt to print again will appear.

To print the test results again, press **YES**. To return to Figure 10-5 Tests Menu, press **NO**.

CHAPTER 11

WELL COUNTER TESTS

GENERAL

This section describes measuring the Well Counter Background, performing the Well Counter Auto Calibration and performing the Well Counter Test.

The Lab Tests are described in CHAPTER 17: WELL COUNTER LAB TESTS.

BACKGROUND

Any presence of contamination may be confirmed by counting without a sample in the Well Counter.

First Background of the Day

When the **WELL** key is pressed from the Chamber Measurement screen, the system checks to see if the Well background has been measured for the current day.

Note: *No measurements can be carried out without performing a Daily Background.*

If the background has not yet been measured, Figure 11-1 Background Instruction Screen if not yet been measured will appear.

```
MEASURE WELL
 BACKGROUND
 NO SOURCES
 MENU Key for Setup
 or Another key
 to Continue
```

Figure 11-1 Background Instruction Screen if not yet been measured

To measure the background, press any key except **MENU** or **HOME**. Figure 11-3 Background Measurement Screen will appear.

If Setup functions are to be performed, press the **MENU** key. After **MENU** is pressed, the ENTER PASSWORD screen will appear. Input the password (last 3 digits of the readout serial number) and press **ENTER**. The Well Counter Setup Menu will appear.

To return to the Chamber Measurement Screen, press **HOME**.

Background from BKG key

Background can also be measured by pressing **BKG** from the Well Counter Measurement Screen.

```
MEASURE WELL
 BACKGROUND
 NO SOURCES


Any Key to Continue
```

Figure 11-2 Background Instruction Screen when using BKG key

To measure Background, press any key except **HOME**. Figure 11-3 Background Measurement Screen will appear.

Background Measurement

```
BKG       20s


 Press COUNT to START
```

Figure 11-3 Background Measurement Screen

Input the counting period via the numeric keypad and press **ENTER**. Counting the background for 20 seconds or longer is recommended.

Note: *The minimum count time that can be input is 2 seconds. The maximum count time that can be input is 9999 seconds.*

Press **COUNT *(START/STOP)*** to begin background counting. Figure 11-4 Background Counting Screen will appear.

```
BKG       13s

     89. c
   552.8 cpm
```

Figure 11-4 Background Counting Screen

The remaining counting period, counts and the counting rate will be displayed and updated every second.

A Bar Graph of the remaining counting period and the counting rate per channel may also be shown and updated every second. To switch to the Bar Graph, press **DISPLAY *(NUM/GRAPH)***. Figure 11-5 Background Bar Graph Counting Screen will appear.

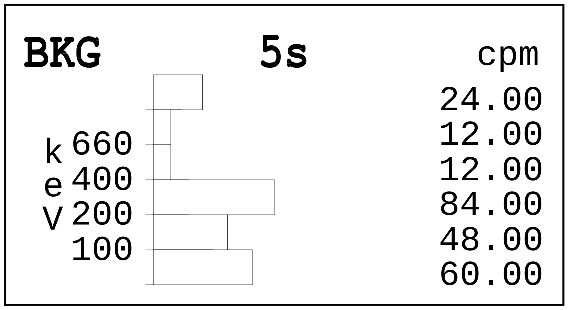

Figure 11-5 Background Bar Graph Counting Screen

To end the measurement before the requested time, press **COUNT (*START/STOP*)**.

To abort the measurement, press **HOME**.

When the measurement is finished, the background counting rate, together with the precision, is displayed as shown in Figure 11-6 Background Result Screen.

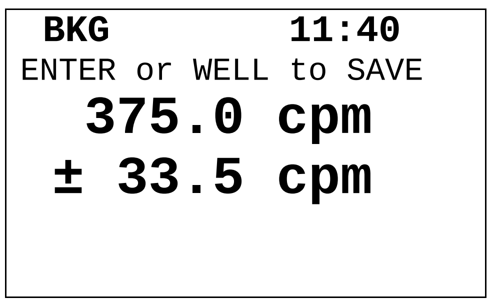

Figure 11-6 Background Result Screen

If the background is greater than the background Trigger Level, the message “TOO HIGH” will appear in the upper right hand corner and the measurement will not be able to be saved. Verify that there are no sources of radiation near the Well Counter and press **COUNT (*START/STOP*)** to re-measure the background. If the background is still too high, the Background Trigger Level may be too low for your environment. Reference CHAPTER 7: WELL COUNTER INITIALIZATION, SECTION: TRIGGER LEVELS for instructions to change the Background Trigger Level.

Press **DISPLAY** (***NUM/GRAPH***) to switch between viewing the Bar Graph and the Result screen.

If a printer is attached to the system,

- press **ENTER** to save (i.e., store it for future measurements) the data and print a record the background measurement., or
- press **WELL** to save (i.e., store it for future measurements) the data and proceed to the Well Counter Measurement Screen.

Note: *"ENTER" will not be displayed in Figure 11-6 Background Result Screen if no printer is attached.*

To abandon the Background Measurement without accepting the background, press **HOME**. If the measurement is the First Background of the Day, the Chamber Measurement screen will appear. If the measurement is a Background from **BKG** key, the Well Measurement screen will appear.

Note: *If **HOME** is pressed before pressing **ENTER** or **WELL**, the result of the new background measurement will not be stored.*

AUTO CALIBRATION

The CRC®-25W uses an automatic calibration (AUTO CAL) procedure for the Well Counter to adjust the high voltage to maintain the correct relationship between energy and channel.

Over time, the amplification characteristics of a photomultiplier tube change. If the gain of the detector is not adjusted occasionally, the resolution of the detector deteriorates significantly, making it difficult to identify isotopes correctly. Therefore, it is important to check the gain of the detector at least once daily.

Auto Calibration must be performed prior to performing a Well Counter Test for the first time and whenever the Well Counter Test fails. Auto Calibration is performed with the same source as in Well Counter Test.

Note: *Auto Calibration should be performed at the very minimum on a weekly basis.*

The calibration is performed automatically by use of a Cs137 source or a Ba133 source.

From the Well Measurement screen, press **MENU**. Figure 11-7 Well Main Menu will appear.

```
1. Measure
2. Auto Cal
3. Setup
4. Lab Tests
5. MDA Test
```

Figure 11-7 Well Main Menu

From Figure 11-7 Well Main Menu, select *AUTO CAL*.

If Test Source Data has not been input, Figure 11-8 Enter Test Source Data Screen will appear.

```
Enter Data in
Setup
Test Source

Any Key to Continue
```

Figure 11-8 Enter Test Source Data Screen

Reference CHAPTER 7: WELL COUNTER INITIALIZATION, SECTION: TEST SOURCE DATA for instructions for inputting Well Counter Test Source Data.

Press any key (except **HOME**) to continue. Figure 11-7 Well Main Menu will re-appear.

If Cs137 has been selected as the Test Source, Figure 11-9a Cs137 Calibration Instruction Screen will appear.

If Ba133 has been selected as the Test Source, Figure 11-9b Ba133 Calibration Instruction Screen will appear.

```
 AUTO CAL

Measure Cs137


Any Key to Continue
```

Figure 11-9a Cs137 Calibration Instruction Screen

```
 AUTO CAL

Measure Ba133


Any Key to Continue
```

Figure 11-9b Ba133 Calibration Instruction Screen

Place the requested Test Source in the Well Counter and press any key (except **HOME**) to continue. Figure 11-10 Calibration Measurement Screen will appear:

Note: *The recommended calibrated activity is in the 0.1-1.0 µCi range. The calibrated activity must not be greater than 10.0 µCi (0.37 MBq).*

```
CAL      20s



Press COUNT to START
```

Figure 11-10 Calibration Measurement Screen

The last counting period used for TEST or AUTO CAL is displayed. Use the numeric keypad to input a different time if desired and press **ENTER** when finished.

Note: *The minimum count time that can be input is 20 seconds. The maximum count time that can be input is 9999 seconds.*

Press **COUNT *(START/STOP*)** to begin Auto Cal. Figure 11-11 Auto Cal in Progress Message appears for approximately 3 seconds.

```
CAL     20s

  AUTO CAL
  IN PROGRESS
  PLEASE WAIT
```

Figure 11-11 Auto Cal in Progress Message

Once the counting begins, Figure 11-12 Auto Cal Counting Screen will appear:

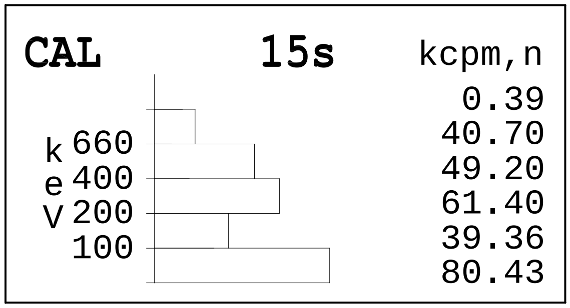

Figure 11-12 Auto Cal Counting Screen

To abort the Auto Cal measurement, press **HOME**. The Well Measurement screen will appear.

AUTO CAL attempts to bring the energy calibration to within 2% of the ideal value.

If the calibration is already within 2%, it attempts to bring the energy calibration to within 1% of the ideal value.

When the Auto Cal has completed, the calibration results are displayed on the screen and if a printer is attached to the system, a report is printed.

The displayed report consists of Figure 11-13 Well Test Activity Deviation and Gain Reference Screen and Figure 11-14 Well Test Noise Ratio Screen (the examples shown are for Cs137):

```
Cs137

Energy
Deviation  0.1%
Gain Ref: 3408
 Any Key to Continue
```

Figure 11-13 Well Test Activity Deviation and Gain Reference Screen

Press any key (except **HOME**) to continue to the next result screen. Figure 11-14 Well Test Noise Ratio Screen will appear.

```
  AUTO CAL
Ch1/(Ch4+Ch5)  0.91


 Any Key to Continue
```

Figure 11-14 Well Test Noise Ratio Screen

Press any key (except **HOME**) to continue. Figure 11-7 Well Main Menu will appear.

The printed report consists of:

- Energy Deviation: the deviation from the ideal value.
- For Cs137:
  Ch 1/ (Ch4+Ch5): the ratio of counts in channel 1 to the sum of the counts in channels 4 and 5.

  or

- For Ba133:
  Ch 1/ (Ch3+Ch4): the ratio of counts in channel 1 to the sum of the counts in channels 3 and 4.
- Gain Reference: this is related to the High Voltage and has a range of 0 to 8191.
- A graphic representation of the net counts in each channel.

Calibration Failure

When AUTO CAL cannot bring the energy calibration to within 2% of the ideal value, the message "AUTO CALIBRATION OUT OF RANGE" is displayed. Make sure that the correct source was used for the calibration and repeat the calibration if necessary.

If the correct source was used, contact Capintec's only Authorized Service Center (reference CHAPTER 19: CLEANING AND MAINTENANCE, SECTION: SERVICING) for more information.

Calibration Method

Cs137 Test Source:

The calibration is accomplished by adjusting the high voltage until the ratio of the counts in channels 4 and 5 is within the limits corresponding to an energy deviation of the Cs137 energy peak of ±2%.

Ba133 Test Source:

The calibration is accomplished by adjusting the high voltage until the ratio of the counts in channels 3 and 4 is within the limits corresponding to an energy deviation of the Ba133 energy peak of ±2%.

TEST

The Well Counter Test should be performed every day. It cannot be performed unless the Well Counter Background has been measured for the current day.

From the Well Measurement screen, press **TEST**.

If Cs137 has been selected as the Test Source, Figure 11-15a Cs137 Well Counter Test Instruction Screen will appear.

If Ba133 has been selected as the Test Source, Figure 11-15b Ba133 Well Counter Test Instruction Screen will appear.

```
        TEST

 Measure Cs137

 Any Key to Continue
```

Figure 11-15a Cs137 Well Counter Test Instruction Screen

```
        TEST

 Measure Ba133

 Any Key to Continue
```

Figure 11-15b Ba133 Well Counter Test Instruction Screen

Place the requested Test Source in the Well Counter and press any key (except **HOME**) to continue. Figure 11-16 Well Counter Test Measurement Screen will appear.

Note: *The recommended calibrated activity is in the 0.1-1.0 µCi range. The calibrated activity must not be greater than 10.0 µCi (0.37 MBq).*

```
TEST     20s



 Press COUNT to START
```

Figure 11-16 Well Counter Test Measurement Screen

The last counting period used for TEST or AUTO CAL is displayed. Use the numeric keypad to input a different time if desired and press **ENTER** when finished.

Note: *The minimum count time that can be input is 20 seconds. The maximum count time that can be input is 9999 seconds.*

Press **COUNT *(START/STOP)*** to begin the Test. Figure 11-17 Test Counting Screen will appear.

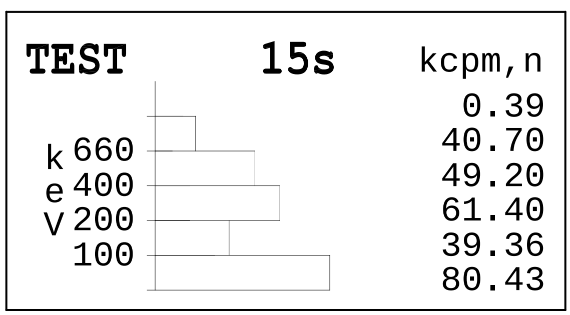

Figure 11-17 Test Counting Screen

To abort the Test measurement, press **HOME**. The Well Measurement screen will appear.

When the Test has completed, the test results are displayed on the screen and if a printer is attached to the system, a report is printed.

The displayed report consists of Figure 11-18 Well Test Activity Deviation Screen and Figure 11-19 Well Test Energy Deviation and Gain Reference Screen (the example is for Ba133).

```
Ba133:  0.46µCi
Measd:  0.43µCi

Deviation: -7.7%
 Any Key to Continue
```

Figure 11-18 Well Test Activity Deviation Screen

Press any key (except **HOME**) to continue to the next result screen. Figure 11-19 Well Test Energy Deviation and Gain Reference Screen will appear.

```
Energy
Deviation: 0.7%

Gain Ref: 3408
 Any Key to Continue
```

Figure 11-19 Well Test Energy Deviation and Gain Reference Screen

Press any key (except **HOME**) to continue to the next result screen. Figure 11-20 Well Test Noise Ratio Screen will appear.

```
Ch1/(Ch3+Ch4): 0.90
  Measured as: 0.90
    Deviation:  0.8 %
 Any Key to Continue
```

Figure 11-20 Well Test Noise Ratio Screen

Press any key (except **HOME**) to continue. The Well Measurement screen will appear.

The printed report consists of:

- Cs137 Standard: current activity of the Cs137 Test source
  or
- Ba133 Standard: current activity of the Ba133 Test source
- Measured as: measured activity of the source
- Deviation: deviation of the measured value from the standard value. If the deviation is more than ±10%, the value is printed in red. If the deviation is more than a factor of 2, **ERROR** is printed in red (probably used wrong source)
- Energy deviation: deviation from the ideal value. If the deviation is more than 3.0%, performing of Auto Cal is recommended. If it is more than 5%, **ERROR** will be printed in red. Confirm the source and perform Auto Cal.
- Ch1/(Ch4+Ch5): the ratio measured during AUTO CAL for Cs137
  or
- Ch1/(Ch3+Ch4): the ratio measured during AUTO CAL for Ba133
- Measured as: the currently measured ratio
- Deviation: the deviation of the measured ratio from the AUTO CAL ratio.
- A graphic representation of the net counts in each channel is printed.
- A list of the background counts in each channel is printed.
- Gain Reference: this is related to the High Voltage and has a range of 0 to 8191.

MINIMUM DETECTABLE ACTIVITY (MDA) TEST

Regulatory guidelines may require instruments that are used to measure wipe samples for radioactive contamination be evaluated to determine the minimum level of activity that can be detected by that instrument.

The Minimum Detectable Activity (MDA) is dependent upon the background levels where the instrument is located and the counting time used to assess the background rate.

Because these variables are user-dependent, it is not possible for Capintec to publish an MDA for the CRC®-25W. Capintec recommends that users determine the appropriate counting time based on the required MDA limit for their application as well as the ambient background rates where the instrument is located.

The CRC®-25W includes a test that will provide MDA values for a specific nuclide selected by the user. The test measures the background in the channels (ROI) that would be used to measure the activity of the selected nuclide and calculates the MDA for that nuclide.

Note: *The selected nuclide must have Efficiency data entered into the system. If the selected nuclide does not have Efficiency data, the error message “EFF DATA NOT ENTERED FOR NUCLIDE – Any Key to Continue” will appear. Reference CHAPTER 7: WELL COUNTER INITIALIZATION; SECTION: EFFICIENCY DATA for information on entering Efficiency data.*

The measurement is performed with no isotope placed in the Well Counter.

The user must also select the counting time and the precision (standard deviations) used in the calculation.

To perform an MDA Test, from Figure 11-7 Well Main Menu, select *MDA TEST*. Figure 11-21 MDA Test Choose Nuclide Screen will appear.

```
 CHOOSE NUCLIDE

Press NUCL or
Pre-set nuclide key
or User key
```

Figure 11-21 MDA Test Choose Nuclide Screen

The nuclide can be chosen via the **NUCL** key, Pre-Set Nuclide keys or **USER** keys. The example shown in Figure 11-22 Selected Nuclide Precision Screen is for Tc99m.

```
Tc99m

Precision is 3

  OK?  Y or N
```

Figure 11-22 Selected Nuclide Precision Screen

The precision must be set. The default precision is 3.

Note: *The allowable range is 1-9 standard deviations.*

If the displayed value is OK, press **YES**. Figure 11-24 Remove Sources Screen will appear.

If the displayed value is not OK, press **NO**. Figure 11-23 Precision Entry Screen will appear.

```
ENTER Precision
1 - 9 std

 _
```

Figure 11-23 Precision Entry Screen

Input the Precision and press **ENTER**. Figure 11-22 Selected Nuclide Precision Screen will re-appear for verification.

When the displayed precision is OK, press **YES**. Figure 11-24 Remove Sources Screen will appear.

```
Remove Sources


Any Key to Continue
```

Figure 11-24 Remove Sources Screen

Remove all sources from the vicinity of the Well Counter and press any key (except **HOME**) to continue with the measurement. Figure 11-25 Measurement Start Screen will appear.

```
            20s



Press COUNT to START
```

Figure 11-25 Measurement Start Screen

The measurement time must now be set. The *recommended* counting time is 600 seconds. Input the desired count time and press **ENTER**.

Note: *The range for the measurement count time is 20-9999 seconds.*

Press **COUNT *(START/STOP)*** to begin the measurement.

MDA Results

When the counting is finished, Figure 11-26 MDA Test Results Screen will appear.

```
      MDA
  For Tc99m
    22.4dpm


Any Key to Continue
```

Figure 11-26 MDA Test Results Screen

Press any key (except **HOME**) to return to Figure 11-7 Well Main Menu.

If a printer is attached to the system, a report of the measurement will be printed showing the selected nuclide, MDA, the selected precision, counts, selected counting time and a bar graph with the channels used in the calculation shaded solid.

Example printouts are shown in Figure 11-27 MDA Test Results (Curies) Printout and Figure 11-28 MDA Test Results (Becquerel) Printout

CRC-25W   REV 1.01   SN: 250067
Jan 10 2008 09:19

Minimum Detectable Activity

Tc99m
MDA   :   22.4dpm

Precision: 3
Counts   : 256
Seconds : 180

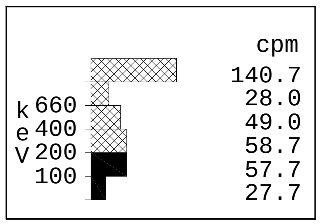

Figure 11-27 MDA Test Results (Curies) Printout

CRC-25W   REV 1.01   SN: 250067
Jan 10 2008 09:25

Minimum Detectable Activity

Tc99m
MDA   :   0.5Bq

Precision: 3
Counts   : 202
Seconds : 120

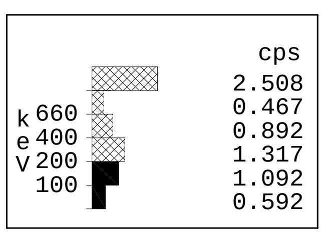

Figure 11-28 MDA Test Results (Becquerel) Printout

MDA Calculation

The minimum detectable counting rate (MDR) is given by:

$$MDR = \frac{p * \sqrt{counts}}{T}$$

where:

- p = precision (the precision can range from 1 to 9 – the default value is 3),
- counts = the sum of the total background counts in all relevant channels (ROI) for the selected nuclide multiplied by the counting time (in minutes for Ci; in seconds for Bq)
- T = counting time (in minutes for Ci; in seconds for Bq).

To obtain the Minimum Detectable Activity, the minimum detectable counting rate (MDR) is divided by the efficiency for the nuclide:

$$MDA = \frac{MDR}{Eff}$$

where:

- Eff = efficiency of the selected nuclide

Example Calculations

1.) Example calculation using the values in Figure 11-27 MDA Test Results (Curies) Printout:

Selected nuclide = Tc99m
Eff = 71.43% (Tc99m efficiency)
p = 3
counts = 27.7 (Tc99m ROI channel 1 counts) + 57.7 (Tc99m ROI channel 2 counts)
T = 3 minutes (180 seconds)

$$MDR = \frac{3 \times \sqrt{(27.7 + 57.7) \times 3}}{3} = \frac{3 \times \sqrt{85.4 \times 3}}{3} = \frac{3 \times \sqrt{256.2}}{3} = \frac{3 \times 16.006}{3} = 16.006$$

$$MDA = \frac{16.006}{.7143} = 22.4$$

2.) Example calculation using the values in Figure 11-28 MDA Test Results (Becquerel) Printout:

Selected nuclide = Tc99m
Eff = 71.43% (Tc99m efficiency)
p = 3
counts = 0.592 (Tc99m ROI channel 1 counts) + 1.092 (Tc99m ROI channel 2 counts)
T = 120 seconds

$$\mathrm{MDR} = \frac{3\times\sqrt{(0.592+1.092)\times 120}}{120} = \frac{3\times\sqrt{1.684\times 120}}{120} = \frac{3\times\sqrt{202.08}}{120} = \frac{3\times 14.215}{120} = 0.355$$

$$\mathrm{MDA} = \frac{0.355}{.7143} = 0.49$$

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CHAPTER 12

CHAMBER MEASUREMENT PROCEDURES

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.

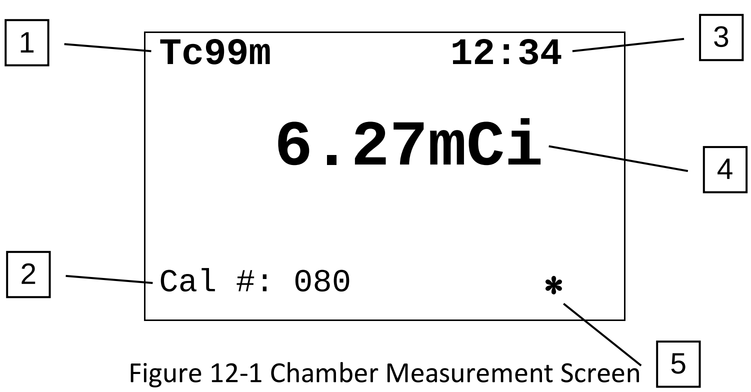

Figure 12-1 Chamber Measurement Screen

1. The currently selected nuclide.
2. The Calibration Number of the selected nuclide.
3. The current time.
4. The measured activity of the selected nuclide.
5. 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. ***Note:*** *This applies only to legacy systems. Remote Displays are no longer available as an option.*

If the message “NO CHAMBER” appears on the screen, verify that the Chamber cable is attached securely to the connectors on the Readout and Chamber. If the error message continues to appear, contact Capintec’s only Authorized Service Center (reference CHAPTER 19: 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 contained 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 or input a Calibration Number.

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

- Press **ENTER**.

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

- Press **TIME**.

Optimizing Low Activity Measurements

The CRC®-25W Calibrator has a stated resolution of 0.01µCi, which means that it is capable of detecting activities in the range of a few hundredths of a microcurie.

However, in order to perform meaningful measurements at such a low level, the following conditions must be met:

- The calibrator must be in excellent (as new) working condition (without excessive low end noise or fluctuations),
- The measurement must be made in a low background area, with constant ambient background rate, and

- The measurement should be made over a 2 minute period, taking measurements every 5-10 seconds and the final value averaged.

A low activity rod source for a long-lived isotope (0.05µCi) would be very useful as a QC source to confirm measurement capabilities at low activities.

Specifying Nuclide

A nuclide may be specified via one of the Pre-Set Nuclide keys, one of the **USER** keys or via the **NUCL** key.

Pre-Set Nuclide key:

Press one of the 8 pre-set nuclide keys

F18, Ga67, Tc99m, In111, I123, I131, Xe133, Tl201

User Key:

Press one of the 5 user assigned nuclide keys

U1, U2, U3, U4, U5

Note: *Before using one of these keys, a nuclide must be assigned to the key. (Reference CHAPTER 6: CHAMBER INITIALIZATION, SECTION: USER KEY ASSIGNMENT)*

NUCL Key:

Press **NUCL**. Figure 12-2 Nuclide Name Assignment Screen will appear.

Note: *If a nuclide is requested which does not have a Calibration Number, the error message "CAL # NOT ENTERED FOR NUCLIDE – ANY KEY TO CONTINUE" will appear. (Reference CHAPTER 6: CHAMBER INITIALIZATION, SECTION: CALIBRATION NUMBERS)*

```
SPECIFY
NUCLIDE


_
```

Figure 12-2 Nuclide Name Assignment Screen

Press the alphanumeric keys corresponding to the nuclide name. The number on each key will appear. For example, if Cs137 is entered, 27137 will appear on the screen. Press **ENTER** when the nuclide has been specified. Figure 12-1 Chamber Measurement Screen will re-appear showing the new nuclide name.

The entire name does not have to be input. If the nuclide is not uniquely specified, a list of possibilities will appear. For example, if Cesium is the desired source, input **271** (for Cs1) and press **ENTER**. Figure 12-3 Nuclide List Screen will appear.

Note: *If there are more than 5 possibilities, the message "SPECIFY FURTHER" will be displayed. Press any key (except **HOME**) to continue.*

```
1. Cs131
2. Cs132
3. Cs134
4. Cs136
5. Cs137
```

Figure 12-3 Nuclide List Screen

Input the number corresponding to the desired nuclide and press **ENTER**. Figure 12-1 Chamber Measurement Screen will re-appear showing the new nuclide name.

If **NUCL** was accidentally pressed, press **ENTER** without any input or press **HOME**. Figure 12-1 Chamber Measurement Screen will re-appear showing the previously selected nuclide name.

Entering Calibration Number

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

Press **CAL#**. Figure 12-4 Enter Calibration # Screen will appear.

```
    ENTER
 CALIBRATION #


   _
```

Figure 12-4 Enter Calibration # Screen

A calibration number may include a multiplication sign (* on the keyboard, displayed as X) or a division sign (÷). However, the CRC®-25W 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 12-1 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 12-1 Calibration Number Limits Table

Input the desired calibration number and press **ENTER**. Figure 12-5 Chamber Measurement Screen after Cal# entered will appear showing the new Calibration Number.

If the **CAL#** key was accidentally pressed, press **ENTER** without any input or press **HOME**. Figure 12-5 Chamber Measurement Screen after Cal# entered will re-appear showing the previous Calibration Number.

```
                12:34

        6.27mCi

Cal #: 555÷2          *
```

Figure 12-5 Chamber Measurement Screen after Cal# entered

SOURCES Key

The **SOURCES** key is used to select the nuclides that have been selected as Test Sources.

Pressing the key will cycle through the selected Test Sources. If no Test Sources have been entered, pressing this key will cause an error beep.

For example – Co57 and Ra226 are the Test Sources:

- Pressing the **SOURCES** key will bring up Co57, pressing a second time will bring up Ra226 and pressing a third time will bring up Co57 again.

Selecting Resolution

When the measured activity is below 140µCi [1.40MBq], the activity can be displayed with greater resolution by pressing the **DOWN ARROW** (➘) key. The activity will now be displayed as 140.0µCi [1.400MBq]. Press the **UP ARROW** (➚) to reverse the process.

ACTIVITY AT A DIFFERENT TIME

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 activity at that date and time will be displayed (and can be printed (if a printer is attached to the system) along with the measured activity.

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

Press **TIME**. Figure 12-6 Time / Date Input Screen will appear.

```
Tc99m        12:34

      549.µCi
  hhmm↘DD↘MM↘YY
```

Figure 12-6 Time / Date Input Screen

The time/date entry format is hhmm/DD/MM/YY where:

- hh = hours (24 hour format) (1 or 2 digit)
- mm = minutes (2 digit)
- DD = day (2 digit)
- MM = month (2 digit)
- YY = year (2 digit)

The minimum input required is the time (hhmm). That is, if the future time is sometime later in the same day, then all that needs to be input is the time. For example:

If the current time is 12:00 and the desired future time is 16:00 today;

- input **1600** and
- press **ENTER**. Figure 12-7 Future Activity – Same Day will appear

If the future time is sometime the next day, then all that needs to be input is the time (hhmm) and day (DD). For example:

If today is July 30 and the desired future time is 9:00 tomorrow;

- input **900** (for the time),
- press the **DOWN ARROW (➘)**,
- input **31** (for the day) and
- press **ENTER**. Figure 12-8 Future Activity – Different Day will appear.

If the future time is sometime the day after tomorrow, then the time (hhmm), day (DD) and month (MM) will need to be input. For example:

If today is July 30 and the desired future time is 9:00 the day after tomorrow;

- input **900** (for the time),
- press the **DOWN ARROW (➘)**,
- input **01** (for the day),
- press the **DOWN ARROW (➘)**,
- input **08** (for the month) and
- press **ENTER**.

If only the time was changed, the new time will be shown as in Figure 12-7 Future Activity – Same Day.

```
Tc99m       12:00

   10.04mCi
  6.33mCi  16:00
```

Figure 12-7 Future Activity – Same Day

If the day was changed, the new time and date will be shown as in Figure 12-8 Future Activity – Different Day.

```
Tc99m       12:00

   10.04mCi
  889.µCi  09:00
     Aug 03 2005
```

Figure 12-8 Future Activity – Different Day

To input a new time, press the **TIME** key again. Figure 12-6 Time / Date Input Screen will re-appear.

To exit Activity at a Different Time, press the **HOME** key. Figure 12-1 Chamber Measurement Screen will re-appear.

USER ID

Note: *A printer must be attached to the system in order to use the User ID feature.*

A two digit identification number (01-99) may be assigned to each user of the CRC®-25W. This ID will be included on the printed record after the label “BY”.

When the ID is input, the digits will not be displayed on the screen. The **CE** key may be used to correct an entry.

If using an ID number, it must be input before pressing **ENTER** to print a record.

For example, if the user’s ID is 12:

- at the Chamber Measurement screen, input **12** and

- press the **ENTER** key.

The printed record will list “12” after the label “BY”.

PRINTING A RECORD OF THE MEASUREMENT

To print a record of the 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®-25W steps the user through a Moly Assay procedure. The assay may be performed in the CapMac or the Canister.

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

To perform a Moly Assay, press **TEST** from Figure 12-1 Chamber Measurement Screen.

Select *MOLY ASSAY*.

If the assay method has not been uniquely specified, Figure 12-9 Moly Assay Method Selection screen will appear. The method must be chosen first.

```
    SELECT

1. CAPMAC for
   Mallinckrodt Gen
2. CAPMAC for
   Bristol Myers Gen
3. Capintec Canister
```

Figure 12-9 Moly Assay Method Selection

Select the method to be used for the current test only.

If only one method (CAPMAC or CANISTER) has been chosen in Moly Setup, Figure 12-9 Moly Assay Method Selection will be skipped and Figure 12-10 Moly Assay Background Choice will appear (example shown is for CAPMAC).

Mo99 Background

Measuring the background for Mo99 is optional. This background will only be used for the current assay. If it is skipped, the background previously measured by pressing **BKG** or during the Daily Test will be used.

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

```
Mo99            BKG
     EMPTY
    CAPMAC
Press N(6) to Skip
Other Key to Proceed
```

Figure 12-10 Moly Assay Background Choice

To skip the Mo99 background measurement with the CAPMAC or CANISTER, press **NO**. Figure 12-14 Moly Assay Instruction Screen will appear to begin the Mo99 Assay.

To proceed with Mo99 background measurement, remove all sources from the vicinity of the Chamber and press any other key (except **HOME**) to continue. Figure 12-11 Moly Assay Background Wait Screen will appear until a measurement is available.

```
Mo99            BKG


   PLEASE WAIT
```

Figure 12-11 Moly Assay Background Wait Screen

When the measurement is available, Figure 12-12 Moly Assay Background Measurement Accept Screen will appear.

```
Mo99          BKG

      .27µCi
      OK
  ENTER to Accept
```

Figure 12-12 Moly Assay Background Measurement Accept Screen

Press **ENTER** to accept measurement and continue to Mo99 Assay. Figure 12-14 Moly Assay Instruction Screen will appear.

If the background is high but still acceptable, the message “HIGH” will appear instead of “OK”. 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, the value will not be shown but Figure 12-13 Moly Assay Background Measurement Too High Screen will appear.

```
Mo99          BKG

    ERROR
   TOO HIGH
 Any key to Terminate
```

Figure 12-13 Moly Assay Background Measurement Too High Screen

This “TOO HIGH” background cannot be accepted by the CRC®-25W. If the cause of the high reading (nearby source, contaminated well etc.) cannot be found, contact Capintec’s only Authorized Service Center at (800) ASK-4CRC.

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.

```
Mo99          ASSAY
   ELUATE IN
    CAPMAC

 Any Key to Continue
```

Figure 12-14 Moly Assay Instruction Screen

Press any key (except **HOME**) to begin the measurement. Figure 12-15 Moly Assay Wait Screen will appear until a measurement is available.

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

```
Mo99          ASSAY



  PLEASE WAIT
```

Figure 12-15 Moly Assay Wait Screen

When the measurement is ready, Figure 12-16 Moly Assay Accept Screen will appear.

```
Mo99          ASSAY

     .47µCi
      OK
   ENTER to Accept
```

Figure 12-16 Moly Assay Accept Screen

Press **ENTER** to accept the measurement and continue to the Tc99m Assay. Figure 12-17 Moly Assay Tc99m Measurement will appear.

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

Tc99m Assay

The Tc99m Assay is performed next.

```
Tc99m        ASSAY

   1.232 Ci

  ENTER to Accept
```

Figure 12-17 Moly Assay Tc99m Measurement

Press **ENTER** to accept the measurement.

Moly Assay Results

If the measured Tc99m activity is below 1.0 mCi, the error message "ACTIVITY TOO LOW – ANY KEY TO CONTINUE" will appear. Press any key (except **HOME**) to continue. The *Tests Menu* will re-appear.

The Mo99/Tc99m ratio is calculated and displayed.

The ratio is compared to the allowable value (which can be changed in Moly Setup – Reference CHAPTER 6: CHAMBER INITIALIZATION, SECTION: MOLY ASSAY SETUP) and the time when the ratio will exceed this limit is calculated.

If the calculated time limit is less than 12 hours, a usage message is displayed depending upon the useable time for the elution. An example of such a case is Figure 12-18 Mo99/Tc99m Exceeds Limits Screen.

```
Mo99/Tc99m:
0.058 µCi/mCi

  DO NOT USE AFTER
    9 HOURS
Acknowledge by ID:
```

Figure 12-18 Mo99/Tc99m Exceeds Limits Screen

Input the User ID number (reference the USER ID section on page 12-8) and press **ENTER** to acknowledge the usage message.

If the calculated ratio is within limits and is useable for more than 12 hours, Figure 12-19 Mo99/Tc99m with Volume Entry screen will appear.

```
Mo99/Tc99m:
0.058 µCi/mCi

VOLUME?  ml

 _
```

Figure 12-19 Mo99/Tc99m with Volume Entry

Input the volume of the elution in ml and press **ENTER**. The concentration of the elution is calculated and displayed as shown in Figure 12-20 Elution Concentration screen.

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

```
Tc99m:
 1.232 Ci
 123.2mCi/ml

 Any Key to Continue
```

Figure 12-20 Elution Concentration

Press any key (except **HOME**) to print (if a printer is attached to the system) a ticket with the details of the assay.

The prompt “PRINT AGAIN” will appear. If **YES** is pressed, another ticket is printed. If **NO** is pressed, the *Tests Menu* will appear.

CHAPTER 13

ENHANCED TESTS

GENERAL

This section describes the tests that are accessed via the *Enhanced Tests Menu*

Chamber Background and Tests are described in CHAPTER 10: CHAMBER BACKGROUND AND TESTS.

ENHANCED TESTS MENU

Press **TEST** from the Chamber Measurement Screen. Figure 13-1 Tests Menu will appear.

```
      TESTS
1. Daily
2. Chamber Volts
3. Accuracy
4. Enhanced
5. Moly Assay
```

Figure 13-1 Tests Menu

Select *ENHANCED*. Figure 13-2 Enhanced Tests Menu will appear.

```
      TESTS

1. Geometry
2. Linearity
3. QC
```

Figure 13-2 Enhanced Tests Menu

GEOMETRY TEST

The Geometry Test determines the effect of volume changes on the calibrator's accuracy. It should be performed on installation.

From Figure 13-2 Enhanced Tests Menu, select *GEOMETRY*. Figure 13-3 Syringe / Vial Selection screen will appear.

```
      SELECT

1. Syringe
2. Vial
```

Figure 13-3 Syringe / Vial Selection

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

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

Measuring with Syringe

From Figure 13-3 Syringe / Vial Selection screen, select *SYRINGE*. Figure 13-4 Initial Volume Entry screen will appear for each measurement:

```
Enter
INITIAL
Volume In ml

 _
```

Figure 13-4 Initial Volume Entry

Input the initial volume (up to 4 digits) for the sample and press **ENTER**. Figure 13-5 Geometry Measurement Screen will appear for each measurement.

Note: *The minimum value that can be input is 0.100. The maximum value that can be input is 99.00.*

```
Tc99m

     6.27mCi

  ENTER to Accept
```

Figure 13-5 Geometry Measurement Screen

Measure the syringe's activity. Press **ENTER** to accept the measurement. Figure 13-6 Added Volume Entry will appear for the second measurement.

```
Enter
ADDED
Volume In ml

 _
```

Figure 13-6 Added Volume Entry

A minimum of 2 samples must be measured.

Input the first added volume (up to 4 digits) to the syringe and press **ENTER**. Figure 13-5 Geometry Measurement Screen will re-appear.

After the 2nd and subsequent measurements, Figure 13-7 Another Sample Question Screen will appear asking if another sample will be measured. The maximum number of samples is 10.

```
Another Sample?

  Yes or No
```

Figure 13-7 Another Sample Question Screen

If the previous sample was not the last sample to be measured, press **YES** to measure another sample. Figure 13-6 Added Volume Entry will re-appear.

Input the added volume (up to 4 digits) for the next sample and press **ENTER**. The total volume input for all samples must be less than 99ml; if it is not less, the message “VOLUME TOO LARGE – ANY KEY TO CONTINUE” will appear.

Press **NO** if the previous sample was the last sample to measured. Figure 13-12 Geometry Test Results Screen will appear.

Measuring with Vial

From Figure 13-3 Syringe / Vial Selection screen, select *VIAL*.

The volume entry screen appears for each measurement. The test begins by entering the initial volume of the vial as shown in Figure 13-8 Initial Volume Entry screen.

```
Enter
INITIAL
Volume In ml

 _
```

Figure 13-8 Initial Volume Entry

Input the initial volume (up to 4 digits) for the vial and press **ENTER**. Figure 13-9 Geometry Measurement Screen will appear for each measurement:

Note: *The minimum value that can be input is 0.100. The maximum value that can be input is 99.00.*

```
Tc99m

    6.27mCi

  ENTER to Accept
```

Figure 13-9 Geometry Measurement Screen

Measure the syringe's activity. Press **ENTER** to accept the measurement. Figure 13-10 Added Volume Entry will appear for the second measurement.

```
Enter
ADDED
Volume In ml

 _
```

Figure 13-10 Added Volume Entry

A minimum of 2 samples must be measured.

Input the first added volume (up to 4 digits) to the syringe and press **ENTER**. Figure 13-9 Geometry Measurement Screen will re-appear.

After the 2nd and subsequent measurements, Figure 13-11 Another Sample Question Screen will appear asking if another sample will be measured. The maximum number of samples is 10.

```
Another Sample?

  Yes or No
```

Figure 13-11 Another Sample Question Screen

If the previous sample was not the last sample to be measured, press **YES** to measure another sample. Figure 13-10 Added Volume Entry will re-appear.

Input the added volume (up to 4 digits) for the next sample and press **ENTER**. The total volume input for all samples must be less than 99ml; if it is not less, the message “VOLUME TOO LARGE – ANY KEY TO CONTINUE” will appear.

Press **NO** if the previous sample was the last sample to measured. Figure 13-12 Geometry Test Results Screen will appear.

Measurement Results

After the last sample has been measured, Figure 13-12 Geometry Test Results 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.

```
    GEOMETRY TEST
Using: Syringe
Volume  Assay    %Var
10.0ml  10.9mCi  BASE
11.0ml  11.0mCi   0.9
12.0ml  10.8mCi  -1.8

 Any Key to Continue
```

Figure 13-12 Geometry Test Results Screen

Press any key (except **HOME**) to continue. If a printer is attached to the system, a report will be printed and the prompt to print again will appear.

To print the test results again, press **YES**. To return to Figure 13-1 Tests Menu, press **NO**.

The report will show the variation of each measurement with respect to the selected base. The variation for the base will be shown as BASE.

PERFORMING LINEARITY TEST

Note: *In order to perform a Linearity Test, a Linearity Test Method must be defined from the Linearity Setup in the Other Menu. (Reference CHAPTER 6: CHAMBER INITIALIZATION, SECTION: LINEARITY TEST DEFINITION), If a Linearity Method is not defined, Figure 13-13 Linearity Not Defined Error Screen will appear.*

```
Must Define
Linearity Test


 Any Key to Continue
```

Figure 13-13 Linearity Not Defined Error Screen

To perform a Linearity Test, press **TEST** from the Chamber Measurement Screen. Figure 13-1 Tests Menu will appear.

Select *ENHANCED*. Figure 13-2 Enhanced Tests Menu will appear.

Select *LINEARITY*. The defined linearity test will begin.

Standard Test

The Standard Test measures the activity of Tc99m over a period of time. When sufficient measurements have been made, a least-squares fit is performed and the deviation of the results from this fit are reported.

First Measurement

Figure 13-14 Standard Linearity Test First Measurement Prompt will appear for the first measurement.

```
Test # 1
First Measurement



 Any Key to Continue
```

Figure 13-14 Standard Linearity Test First Measurement Prompt

Place the linearity source in the Chamber and press any key (except **HOME**) to perform the measurement. Figure 13-15 Standard Test Measurement Screen will appear.

```
Tc99m

      6.27mCi

  ENTER to Accept
```

Figure 13-15 Standard Test Measurement Screen

Press **ENTER** to accept the measurement. Figure 13-16 Standard Linearity Test First Measurement Verification will appear.

```
Measured   x.xxmCi

          OK? Y or N
```

Figure 13-16 Standard Linearity Test First Measurement Verification

To repeat the measurement or if the measurement is not acceptable, press **NO**. Figure 13-14 Standard Linearity Test First Measurement Prompt will re-appear.

If the measurement is acceptable, press **YES**. If a printer is attached to the system, a Standard Linearity Test First Measurement report will print and the prompt to print again will appear.

To print the test results again, press **YES**. To return to Figure 13-1 Tests Menu, press **NO**.

The report will show the predicted and actual activity and the variation.

Second Through Last Measurements

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

From Figure 13-1 Tests Menu, select *ENHANCED*. Figure 13-2 Enhanced Tests Menu will appear.

Select *LINEARITY*. Figure 13-17 Standard Linearity Test – Previous Test Results Screen will appear.

In the example, 2 measurements have been made.

```
 STANDARD LINEARITY
#   MEASURED    %VAR

1    x.xxmCi    x.xx
2    x.xxmCi    x.xx

 New Test? Y or N
```

Figure 13-17 Standard Linearity Test – Previous Test Results Screen

To continue with the previously started test, press **NO**. Figure 13-19 Standard Linearity Test Subsequent Measurement Prompt will appear for the next measurement.

To start a new test, press **YES**. If the test was not complete (measurements performed are less than those entered in test setup), Figure 13-18 Standard Linearity Test – New Test Verification Screen will appear asking to start a new test.

```
TEST NOT
COMPLETE
START NEW TEST?
  Yes or No
```

Figure 13-18 Standard Linearity Test – New Test Verification Screen

To abort starting a new test, press **NO**. Figure 13-1 Tests Menu will re-appear.

To continue with starting a new test, press **YES**. Figure 13-14 Standard Linearity Test First Measurement Prompt will appear.

```
Test # 2
Measure At: 6   Hours
Elapsed: 5  Hr 55 Min


 Any Key to Continue
```

Figure 13-19 Standard Linearity Test Subsequent Measurement Prompt

Figure 13-19 Standard Linearity Test Subsequent Measurement Prompt will appear giving the test number, the time at which the test should be performed and the actual elapsed time. The example is given for the 2nd measurement.

Place the linearity source in the Chamber and press any key (except **HOME**) to perform the measurement. Figure 13-15 Standard Test Measurement Screen will re-appear.

At the measurement screen, press **ENTER** to accept the measurement. Figure 13-20 Standard Linearity Test Subsequent Measurement Verification screen will appear showing the measured and predicted activity.

```
Measured   x.xxmCi
Predicted  x.xxmCi

          OK? Y or N
```

Figure 13-20 Standard Linearity Test Subsequent Measurement Verification

To repeat the measurement or if the measurement is not acceptable, press **NO**. Figure 13-19 Standard Linearity Test Subsequent Measurement Prompt will re-appear.

If the measurement is acceptable, press **YES**. Figure 13-21 Standard Linearity Test – Test Results Screen showing the variation from the predicted results for the measurements that have been performed.

```
 STANDARD LINEARITY
#   MEASURED    %VAR

1    x.xxmCi    x.xx
2    x.xxmCi    x.xx

 Any Key to Continue
```

Figure 13-21 Standard Linearity Test – Test Results Screen

Press any key (except **HOME**) to continue. If a printer is attached to the system, a Standard Linearity Test Measurement report will print and the prompt to print again will appear.

To print the test results again, press **YES**. To return to Figure 13-1 Tests Menu, press **NO**. The report will show the predicted and actual activity and the variance.

After each result screen, a report will be printed.

Lineator Test

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

Figure 13-22 Lineator Measurement Prompt will appear for the first measurement. The examples shown are for tube 5.

```
Measure Tube # 5
1 + 4



 Any Key to Continue
```

Figure 13-22 Lineator Measurement Prompt

Place the requested tube(s) in the Chamber and press any key (except **HOME**) to perform the specified measurement. Figure 13-23 Lineator Measurement Screen will appear.

```
Tc99m

      6.27mCi

  ENTER to Accept
```

Figure 13-23 Lineator Measurement Screen

Press **ENTER** to accept the measurement. Figure 13-24 Lineator Measurement Verification will appear.

```
Tube # 5
1 + 4
Present Factor:
           n.nn
% Ratio:   p.pp

          OK? Y or N
```

Figure 13-24 Lineator Measurement Verification

To repeat the measurement or if the measurement is not acceptable, press **NO**. Figure 13-22 Lineator Measurement Prompt will re-appear.

If the measurement is acceptable, press **YES**. The next Lineator Measurement Prompt screen will appear until all 8 tubes are measured.

After the last measurement, the results screens will appear.

```
   LINEATOR TEST
#   FACTOR   %RATIO
1     x.xx     x.xx
2     x.xx     x.xx
3     x.xx     x.xx
4     x.xx     x.xx
 Any Key to Continue
```

Figure 13-25 Lineator – 1st Test Results Screen

Press any key (except **HOME**) to continue to the next Results screen.

```
   LINEATOR TEST
#   FACTOR   %RATIO
5     x.xx     x.xx
6     x.xx     x.xx
7     x.xx     x.xx
8     x.xx     x.xx
 Any Key to Continue
```

Figure 13-26 Lineator – 2nd Test Results Screen

Press any key (except **HOME**) to continue. If a printer is attached to the system, a Lineator Test report will print and the prompt to print again will appear.

To print the test results again, press **YES**. To return to Figure 13-1 Tests Menu, press **NO**.

The report will show the measured activity, the present factor and the ratio for each tube set.

Calicheck Test

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

Figure 13-27 Calicheck Measurement Prompt will appear for the first measurement. The examples shown are for 8 tubes and the 5th measurement.

```
Measure Tube # 5
Black + Green



 Any Key to Continue
```

Figure 13-27 Calicheck Measurement Prompt

Place the requested tube(s) in the Chamber and press any key (except **HOME**) to perform the specified measurement. Figure 13-28 Calicheck Measurement Screen will appear.

```
Tc99m

      6.27mCi

  ENTER to Accept
```

Figure 13-28 Calicheck Measurement Screen

Press **ENTER** to accept the measurement. Figure 13-29 Calicheck Measurement Verification screen will appear:

```
Tube # 5
Black + Green

Result  n.nnnmCi

          OK? Y or N
```

Figure 13-29 Calicheck Measurement Verification

To repeat the measurement or if the measurement is not acceptable, press **NO**. Figure 13-27 Calicheck Measurement Prompt will re-appear.

If the measurement is acceptable, press **YES**. The next Calicheck Measurement Prompt screen will appear until all tubes are measured.

After the last measurement, the results screens will appear.

```
    CALICHECK TEST
 MEAN:  n.nnnmCi
#    RESULT   % VAR
1   x.xxxmCi   x.xx
2   x.xxxmCi   x.xx
3   x.xxxmCi   x.xx
4   x.xxxmCi   x.xx
 Any Key to Continue
```

Figure 13-30 Calicheck – 1st Test Results Screen

Press any key (except **HOME**) to continue to the next Results screen.

```
    CALICHECK TEST
 MEAN:  n.nnnmCi
#    RESULT   % VAR
5   x.xxxmCi   x.xx
6   x.xxxmCi   x.xx
7   x.xxxmCi   x.xx
8   x.xxxmCi   x.xx
 Any Key to Continue
```

Figure 13-31 Calicheck – 2nd Test Results Screen

If more than 8 tests have been selected in the test setup, a 3rd results screen will appear showing the values for the 9th through last test.

Press any key (except **HOME**) to continue. If a printer is attached to the system, a Calicheck Linearity Test report will print and the prompt to print again will appear.

To print the test results again, press **YES**. To return to Figure 13-1 Tests Menu, press **NO**.

The report will show the result and the variation from mean for each tube.

QUALITY CONTROL (QC)

Radiochromatography Quality Control tests can be performed using four methods.

Press **TEST** from the Chamber Measurement Screen. Figure 13-1 Tests Menu will appear.

Select *ENHANCED*. Figure 13-2 Enhanced Tests Menu will appear.

Select *QC*. Figure 13-32 QC Test Selection Menu will appear.

```
    QC TESTS
1. 1 Strip
2. 2 Strips
3. HMPAO
4. MAG3
```

Figure 13-32 QC Test Selection Menu

Single Strip Test

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

Select *1 STRIP* from Figure 13-32 QC Test Selection Menu. Figure 13-33 1 Strip Measurement Message – Top will appear.

```
Place TOP of Strip
in Chamber

 Any Key to Continue
```

Figure 13-33 1 Strip Measurement Message – Top

Place the Top of Strip in the Chamber and press any key (except **HOME**) to perform the measurement. Figure 13-34 QC Test Measurement Screen will appear.

```
Tc99m

     6.27mCi

  ENTER to Accept
```

Figure 13-34 QC Test Measurement Screen

Press **ENTER** to accept the measurement. Figure 13-35 1 Strip Measurement Message – Bottom screen will appear.

```
Place BOTTOM of Strip
in Chamber



 Any Key to Continue
```

Figure 13-35 1 Strip Measurement Message – Bottom

Place the Bottom of Strip in the Chamber and press any key (except **HOME**) to perform the measurement. Figure 13-34 QC Test Measurement Screen will re-appear.

Press **ENTER** to accept the measurement. Figure 13-36 1 Strip Results screen will appear.

```
        QC TEST
  Single Strip
Top   /(Top+Bottom)
        xx.x%
Bottom/(Top+Bottom)
        xx.x%
 Any Key to Continue
```

Figure 13-36 1 Strip Results

Press any key (except **HOME**) to continue. If a printer is attached to the system, a QC Test 1 Strip report will print and the prompt to print again will appear.

To print the test results again, press **YES**. Press **NO** to continue. Figure 13-37 Perform Another Test Screen will appear.

The report will show the measured values and results.

```
Do Another
Test? Y or N
```

Figure 13-37 Perform Another Test Screen

To perform another test, press **YES**. Figure 13-33 1 Strip Measurement Message – Top will re-appear.

If another test is not desired, press **NO** to exit. Figure 13-1 Tests Menu will appear.

Two Strips Test

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

Select *2 STRIPS* from Figure 13-32 QC Test Selection Menu. Figure 13-38 2 Strips Measurement Message – Top A will appear.

```
Place TOP of
Strip A in Chamber


 Any Key to Continue
```

Figure 13-38 2 Strips Measurement Message – Top A

Place the Top of Strip A in the Chamber and press any key (except **HOME**) to perform the measurement. Figure 13-39 QC Test Measurement Screen will appear.

```
Tc99m

    6.27mCi

  ENTER to Accept
```

Figure 13-39 QC Test Measurement Screen

Press **ENTER** to accept the measurement. Figure 13-40 2 Strips Measurement Message – Bottom A screen will appear.

```
Place BOTTOM of
Strip A in Chamber



 Any Key to Continue
```

Figure 13-40 2 Strips Measurement Message – Bottom A

Place the Bottom of Strip A in the chamber and press any key (except **HOME**) to perform the measurement. Figure 13-39 QC Test Measurement Screen will appear.

Press **ENTER** to accept the measurement. Figure 13-41 2 Strips Measurement Message – Top B screen will appear.

```
Place TOP of
Strip B in Chamber



 Any Key to Continue
```

Figure 13-41 2 Strips Measurement Message – Top B

Place the Top of Strip B in the Chamber and press any key (except **HOME**) to perform the measurement. Figure 13-39 QC Test Measurement Screen will re-appear.

Press **ENTER** to accept the measurement. Figure 13-42 2 Strips Measurement Message – Bottom B screen will appear:

```
Place BOTTOM of
Strip B in Chamber



 Any Key to Continue
```

Figure 13-42 2 Strips Measurement Message – Bottom B

Place the Bottom of Strip B in the Chamber and press any key (except **HOME**) to perform the measurement. Figure 13-39 QC Test Measurement Screen will re-appear.

Press **ENTER** to accept the measurement. Figure 13-43 2 Strips Results Screen will appear.

```
QC TEST   Two Strips
Free Tc99m
        xx.x%
Reduced/Hydrolized
        xx.x%
Purity
        xx.x%
 Any Key to Continue
```

Figure 13-43 2 Strips Results Screen

Press any key (except **HOME**) to continue. If a printer is attached to the system, a QC Test 2 Strip report will print and the prompt to print again will appear.

To print the test results again, press **YES**. Press **NO** to continue. Figure 13-44 Perform Another Test Screen will appear.

The report will show the measured values and results.

```
Do Another
Test? Y or N
```

Figure 13-44 Perform Another Test Screen

To perform another test, press **YES**. Figure 13-38 2 Strips Measurement Message – Top A will re-appear.

If another test is not desired, press **NO** to exit. Figure 13-1 Tests Menu will appear.

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.

Select *HMPAO* from Figure 13-32 QC Test Selection Menu. Figure 13-45 HMPAO Measurement Message – Top A screen will appear.

```
Place TOP of
Strip A in Chamber


 Any Key to Continue
```

Figure 13-45 HMPAO Measurement Message – Top A

Place the Top of Strip A in the Chamber and press any key (except **HOME**) to perform the measurement. Figure 13-46 QC Test Measurement Screen will appear.

```
Tc99m

    6.27mCi

  ENTER to Accept
```

Figure 13-46 QC Test Measurement Screen

Press **ENTER** to accept the measurement. Figure 13-47 HMPAO Measurement Message – Bottom A screen will appear.

```
Place BOTTOM of
Strip A in Chamber



 Any Key to Continue
```

Figure 13-47 HMPAO Measurement Message – Bottom A

Place the Bottom of Strip A in the Chamber and press any key (except **HOME**) to perform the measurement. Figure 13-46 QC Test Measurement Screen will re-appear.

Press **ENTER** to accept the measurement. Figure 13-48 HMPAO Measurement Message – Top B screen will appear.

```
Place TOP of
Strip B in Chamber



 Any Key to Continue
```

Figure 13-48 HMPAO Measurement Message – Top B

Place the Top of Strip B in the Chamber and press any key (except **HOME**) to perform the measurement. Figure 13-46 QC Test Measurement Screen will re-appear.

Press **ENTER** to accept the measurement. Figure 13-49 HMPAO Measurement Message – Bottom B screen will appear:

```
Place BOTTOM of
Strip B in Chamber



 Any Key to Continue
```

Figure 13-49 HMPAO Measurement Message – Bottom B

Place the Bottom of Strip B in the Chamber and press any key (except **HOME**) to perform the measurement. Figure 13-46 QC Test Measurement Screen will re-appear.

Press **ENTER** to accept the measurement. Figure 13-50 HMPAO Measurement Message – Top C screen will appear:

```
Place TOP of
Strip C in Chamber



 Any Key to Continue
```

Figure 13-50 HMPAO Measurement Message – Top C

Place the Top of Strip C in the Chamber and press any key (except **HOME**) to perform the measurement. Figure 13-46 QC Test Measurement Screen will re-appear.

Press **ENTER** to accept the measurement. Figure 13-51 HMPAO Measurement Message – Bottom C screen will appear:

```
Place BOTTOM of
Strip C in Chamber



 Any Key to Continue
```

Figure 13-51 HMPAO Measurement Message – Bottom C

Place the Bottom of Strip C in the Chamber and press any key (except **HOME**) to perform the measurement. Figure 13-46 QC Test Measurement Screen will re-appear.

Press **ENTER** to accept the measurement. Figure 13-52 HMPAO Results Screen will appear.

```
    QC TEST  HMPAO
Free Tc99m
        xx.x%
Hydrolized/Reduced
        xx.x%
Tc99m HMPAO
        xx.x%
 Any Key to Continue
```

Figure 13-52 HMPAO Results Screen

Press any key (except **HOME**) to continue. If a printer is attached to the system, a QC Test HMPAO report will print and the prompt to print again will appear.

To print the test results again, press **YES**. Press **NO** to continue. Figure 13-53 Perform Another Test Screen will appear.

The report will show the measured values and results.

```
Do Another
Test? Y or N
```

Figure 13-53 Perform Another Test Screen

To perform another test, press **YES**. Figure 13-45 HMPAO Measurement Message – Top A will re-appear.

If another test is not desired, press **NO** to exit. Figure 13-1 Tests Menu will appear.

MAG3 Test

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

Select *MAG3* from Figure 13-32 QC Test Selection Menu. Figure 13-54 MAG3 Measurement Message – Fraction #1 screen will appear.

```
Place Fraction #1
in Chamber



 Any Key to Continue
```

Figure 13-54 MAG3 Measurement Message – Fraction #1

Place the Fraction #1 in the Chamber and press any key (except **HOME**) to perform the measurement. Figure 13-55 QC Test Measurement Screen will appear.

```
Tc99m

      6.27mCi

  ENTER to Accept
```

Figure 13-55 QC Test Measurement Screen

Press **ENTER** to accept the measurement. Figure 13-56 MAG3 Measurement Message – Fraction #2 screen will appear.

```
Place Fraction #2
in Chamber



 Any Key to Continue
```

Figure 13-56 MAG3 Measurement Message – Fraction #2

Place the Fraction #2 in the Chamber and press any key (except **HOME**) to perform the measurement. Figure 13-55 QC Test Measurement Screen will re-appear.

Press **ENTER** to accept the measurement. Figure 13-57 MAG3 Measurement Message – Cartridge screen will appear:

```
Place Cartridge
in Chamber



 Any Key to Continue
```

Figure 13-57 MAG3 Measurement Message – Cartridge

Place the Cartridge in the Chamber and press any key (except **HOME**) to perform the measurement. Figure 13-55 QC Test Measurement Screen will re-appear.

Press **ENTER** to accept the measurement. Figure 13-58 MAG3 Results Screen will appear.

```
   QC TEST  MAG3
Non-elutable Tc99m
        xx.x%
Hydrophilic Impure
        xx.x%
Tc99m Mertiatide
        xx.x%
 Any Key to Continue
```

Figure 13-58 MAG3 Results Screen

Press any key (except **HOME**) to continue. If a printer is attached to the system, a QC Test MAG3 report will print and the prompt to print again will appear.

To print the test results again, press **YES**. Press **NO** to continue. Figure 13-59 Perform Another Test Screen will appear.

The report will show the measured values and results.

```
Do Another
Test? Y or N
```

Figure 13-59 Perform Another Test Screen

To perform another test, press **YES**. Figure 13-54 MAG3 Measurement Message – Fraction #1 will re-appear.

If another test is not desired, press **NO** to exit. Figure 13-1 Tests Menu will appear.

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CHAPTER 14

INVENTORY

GENERAL

Instructions for use of the Inventory feature are given in this section.

INVENTORY MENU

Press **MENU** from the Chamber Measurement screen. Figure 14-1 Main Menu will appear.

```
1. Inventory
2. Calculations
3. Diagnostics
4. Setup
```

Figure 14-1 Main Menu

Select *INVENTORY*. Figure 14-2 Inventory Menu will appear.

```
   INVENTORY
1. Add
2. Make Kit
3. Withdraw
4. Print
5. Delete
```

Figure 14-2 Inventory Menu

ADDING TO THE INVENTORY

To add an item to the Inventory, select *ADD* from Figure 14-2 Inventory Menu. Figure 14-3 Choose Nuclide Screen will appear.

```
INVENTORY
 CHOOSE NUCLIDE

Press NUCL or
Pre-set nuclide key
or User key
```

Figure 14-3 Choose Nuclide Screen

Press **MENU** to exit from adding to the Inventory and return to the *Inventory Menu*.

Choose the nuclide of the item to be added to Inventory by pressing one of the Pre-Set Nuclide keys, the **NUCL** key or one of the **USER** keys.

If Tc99m is the selected nuclide, the name of the study will then be selected from Figure 14-4 Tc99m Select Study Screen.

```
  SELECT STUDY

0. NONE
1. BONE   5. RENAL
2. LUNG   6. LIVER
3. HIDA   7. BRAIN
4. HEART  8. LYMPH
```

Figure 14-4 Tc99m Select Study Screen

If plain Tc99m (not a kit) is being added, select *NONE*. Otherwise, press the number corresponding to the study for which the kit is intended. Figure 14-5 Enter ID Screen will appear.

```
ENTER ID
0 FOR NONE



 _
```

Figure 14-5 Enter ID Screen

An optional 2-digit ID number may be input to distinguish the item being added from another one with the same nuclide and study.

Input the 2-digit ID number and press **ENTER**. If an ID number is not required, input **0** for *NONE* and press **ENTER**. Figure 14-6 Enter Lot Number Screen will appear.

```
ENTER LOT
NUMBER



 _
```

Figure 14-6 Enter Lot Number Screen

An optional Lot Number of up to 15 characters (digits or letters) may be input.

Input the Lot Number and press **ENTER**. If a Lot Number is not required, press **ENTER**. Figure 14-7 Enter Volume Screen will appear.

```
Enter
Volume In ml


 _
```

Figure 14-7 Enter Volume Screen

Input the volume in ml and press **ENTER**. Figure 14-8 Measure Activity Question Screen will appear.

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

```
MEASURE
ACTIVITY ?
 Yes or No
```

Figure 14-8 Measure Activity Question Screen

The activity may be measured or it may be input if activity and time of a previous measurement are known.

To input the activity and time, press **NO**. Figure 14-9 Inventory Activity Entry Screen will appear.

To measure the activity, press **YES**. Figure 14-12 Inventory Measurement Screen will appear.

Input Activity

If the activity is to be input, Figure 14-9 Inventory Activity Entry Screen will appear:

```
ENTER ACTIVITY

 value   unit
_         mCi

-> to change unit
 ENTER to Accept
```

Figure 14-9 Inventory Activity Entry Screen

Input the value of the activity and then press the **RIGHT ARROW (➘)**. Use the arrow keys to scroll the activity units: mCi, µCi, Ci if using Curie mode, (or MBq, GBq if using Becquerel mode). If the value needs to be changed, press **CE**.

When the activity value and units are correct, press **ENTER**. Figure 14-10 Inventory Date Entry Screen will appear.

```
     Enter Date
ENTER for NOW
_


    MMDDYYYY
```

Figure 14-10 Inventory Date Entry Screen

If the date/time is the current date/time, press the **ENTER** key for “NOW”. Figure 14-13 Enter Mo/Tc Screen will appear.

Input the date in the form MMDDYYYY (example: July 3, 2006 would be 07032006) and press **ENTER**. The date is checked for validity. If the input date is not valid, a beep will sound and “DATE ERROR” will be displayed. The date must be re-entered. Figure 14-11 Inventory Time Entry Screen will appear.

```
    Enter Time
_

   hhmm
```

Figure 14-11 Inventory Time Entry Screen

Input the time as hhmm in 24 hour time format (example: 1:25 PM would be 1325, 9:15 AM would be 0915) and press **ENTER**. The time is checked for validity. If the input time is not valid, a beep will sound and "TIME ERROR" will be displayed. The time must be re-entered.

Figure 14-13 Enter Mo/Tc Screen will appear.

Measuring Activity

If the activity is to be measured, Figure 14-12 Inventory Measurement Screen will appear (Tc99m is being measured in the example).

```
Tc99m
      6.27mCi
  ENTER to Accept
```

Figure 14-12 Inventory Measurement Screen

When the activity has stabilized, press **ENTER** to accept the measurement. Figure 14-13 Enter Mo/Tc Screen will appear.

Mo/Tc Ratio

If Tc99m is being added (with or without a study), the Mo to Tc ratio may be input.

```
ENTER Mo/Tc
0 FOR NONE


 _
```

Figure 14-13 Enter Mo/Tc Screen

Input the Mo to Tc ratio. If the value is not known, input 0 and press **ENTER**.

Note: *The minimum value that can be input is 0.000. The maximum value that can be input is 1.000.*

The input/measured values will then be displayed for verification.

If the values are correct, press **YES** and the item will be stored in Inventory. Figure 14-2 Inventory Menu will appear.

If there is an error, press **NO** and the Inventory adding procedure will start again from the beginning (Figure 14-3 Choose Nuclide Screen).

MAKING A KIT

A kit may be made from plain Tc99m in Inventory. To make a kit, select *MAKE KIT* from Figure 14-2 Inventory Menu.

If there is no plain Tc99m stored in the Inventory, Figure 14-14 No Plain Tc99m for Kits in Inventory Screen will appear.

```
NO Tc FOR KITS
 IN INVENTORY


 Any Key to continue
```

Figure 14-14 No Plain Tc99m for Kits in Inventory Screen

Press any key (except **HOME**) to continue. Figure 14-2 Inventory Menu will re-appear.

If there is more than one plain Tc99m in the Inventory, a list showing the ID number (if one was entered) will be displayed. Press the number corresponding to the desired Tc99m.

Note: *When making a kit from the Inventory, the Readout Unit must be in the same units (Ci or Bq) as the source was when added to the Inventory. If the selected item is in the other units (Ci or Bq), the following error message will appear – "Ci/Bq MUST BE SELECTED ON MAIN SCREEN TO WITHDRAW FROM ITEM ENTERED IN Ci/Bq – ANY KEY TO CONTINUE".*

The details of the selected item will be displayed, showing the volume, current activity and the current Mo to Tc ratio (unless the entered ratio was 0; if activity is very low, only Mo/Tc: will be displayed without any value).

Press **NO** to make another selection (or return to the *Inventory Menu* if there is only one Tc99m in inventory).

Press **YES** to use the selection. Figure 14-15 Select Study for kit Screen will appear.

```
 SELECT STUDY

1. BONE    5. RENAL
2. LUNG    6. LIVER
3. HIDA    7. BRAIN
4. HEART   8. LYMPH
```

Figure 14-15 Select Study for kit Screen

Select a study for which the kit is intended by pressing the number corresponding to the study name. Figure 14-16 Enter ID for Kit Screen will appear.

```
ENTER ID
0 FOR NONE



 _
```

Figure 14-16 Enter ID for Kit Screen

An optional 2-digit ID number may be input to distinguish the item being added from another one with the same nuclide and study.

Input the 2-digit ID number for the kit and press **ENTER**. If an ID number is not required, input **0** for *NONE* and press **ENTER**. Figure 14-17 Enter Lot Number for Kit Screen will appear.

```
ENTER LOT
NUMBER



 _
```

Figure 14-17 Enter Lot Number for Kit Screen

An optional Lot Number of up to 15 characters (digits or letters) may be input.

Input the Lot Number and press **ENTER**. If a Lot Number is not required, press **ENTER**. Figure 14-18 Kit Activity Entry Screen will appear.

```
ENTER ACTIVITY

  value   unit
 _         mCi

-> to change unit
  ENTER to Accept
```

Figure 14-18 Kit Activity Entry Screen

Input the value of the activity needed to make the kit and then press the **RIGHT ARROW (➘)** key. Use the arrow keys to scroll the activity units: mCi, µCi, Ci if using Curie mode, (or MBq, GBq if using Becquerel mode). If the value needs to be changed, press **CE**.

When the activity value and units are correct, press **ENTER**. The kit input activity and volume required for that activity will be displayed.

Withdraw the displayed volume and prepare the kit. Press any key (except **HOME**) to continue and Figure 14-19 Kit Measure Activity Screen will appear.

```
MEASURE
ACTIVITY


Any Key to Continue
```

Figure 14-19 Kit Measure Activity Screen

Place the kit in the chamber and press any key (except **HOME**) to continue. Figure 14-20 Kit Measurement Screen will appear.

```
Tc99m

      6.27mCi

  ENTER to Accept
```

Figure 14-20 Kit Measurement Screen

When the activity has stabilized, press **ENTER** to accept the measurement. Figure 14-21 Kit Volume Entry Screen will appear.

```
ENTER KIT
Volume In ml


 _
```

Figure 14-21 Kit Volume Entry Screen

Input the volume of the kit in ml and press **ENTER**. Figure 14-2 Inventory Menu will appear.

The activity, volume and Mo to Tc ratio (unless 0 was entered) for the original Tc99m will be updated in the Inventory. Also, the kit will be added to the Inventory.

WITHDRAWING FROM INVENTORY

To withdraw activity from an item in Inventory to be used for a patient (not for a kit), select *WITHDRAW* from Figure 14-2 Inventory Menu.

A list of items in the Inventory appears, showing the nuclide name, study (if any) and ID (if any). If there is more than one screen, use the **UP ARROW (⇖)** and **DOWN ARROW (⇘)** keys to navigate between screens. Press the number in front of the item to select it. Press **MENU** to return to Figure 14-2 Inventory Menu.

Note: *When withdrawing from the Inventory, the Readout Unit must be in the same units (Ci or Bq) as the source was when added to the Inventory. If the selected item is in the other units (Ci or Bq), the following error message will appear – "Ci/Bq MUST BE SELECTED ON MAIN SCREEN TO WITHDRAW FROM ITEM ENTERED IN Ci/Bq – ANY KEY TO CONTINUE".*

When an item is selected, the details will be displayed, showing current activity, current volume and for Tc99m samples, the current Mo to Tc ratio (unless the input ratio was 0).

Press **NO** to return to the Inventory list to make another selection.

Press **YES** to select the item. Figure 14-22 Required Activity Entry Screen will appear.

```
ENTER ACTIVITY

  value   unit
 _         mCi

-> to change unit
  ENTER to Accept
```

Figure 14-22 Required Activity Entry Screen

Input the value of the activity needed to make the kit and then press the **RIGHT ARROW (⇘)** key. Use the arrow keys to scroll the activity units: mCi, µCi, Ci if using Curie mode, (or MBq, GBq if using Becquerel mode). If the value needs to be changed, press **CE**.

When the activity value and units are correct, press **ENTER**. Figure 14-23 Date of Use Entry Screen will appear.

```
 Date of Use
ENTER for TODAY

 _

   MMDDYYYY
```

Figure 14-23 Date of Use Entry Screen

Input the date in the form MMDDYYYY (example: July 3, 2006 would be 07032006) and press **ENTER**. The date is checked for validity. If the input date is not valid, a beep will sound and "DATE ERROR" will be displayed. The date must be re-entered.

If the date of use is today, press **ENTER**.

Figure 14-24 Time of Use Entry Screen will appear.

```
 Time of Use

 _

   hhmm
```

Figure 14-24 Time of Use Entry Screen

Input the time as hhmm in 24 hour time format (example: 1:25 PM would be 1325, 9:15 AM would be 0915) and press **ENTER**. The time is checked for validity. If the input time is not valid, a beep will sound and "TIME ERROR" will be displayed. The time must be re-entered.

The input activity, the date and time of use, and the volume required for that activity will be displayed. The prompt "OK? Y or N" will appear. Press **NO** to return to the Figure 14-22 Required Activity Entry Screen.

If the displayed information is correct, withdraw the displayed volume and press **YES**. Figure 14-25 Measure Activity Screen will appear.

```
MEASURE
ACTIVITY


Any Key to Continue
```

Figure 14-25 Measure Activity Screen

Place the sample in the Chamber and press any key to continue. Figure 14-26 Withdraw Activity Measurement Screen will appear.

```
Tc99m

      6.27mCi

  ENTER to Accept
```

Figure 14-26 Withdraw Activity Measurement Screen

When the activity has stabilized, press **ENTER** to accept the measurement. The Inventory item will update with the new volume and activity and Mo to Tc ratio for Tc99m (unless 0 was entered for the ratio). Figure 14-2 Inventory Menu will re-appear.

PRINTING THE INVENTORY

If a printer is attached to the system, the Inventory can be printed.

To print the Inventory, select *PRINT* from Figure 14-2 Inventory Menu.

The contents of the Inventory will be printed, showing the current activity, current volume and for Tc99m, the current Mo to Tc ratio (unless the entered ratio was 0).

DELETING FROM INVENTORY

To delete one or more items from the Inventory, select *DELETE* from Figure 14-2 Inventory Menu. Figure 14-27 Delete Inventory Menu will appear.

```
      Delete

1. All
2. Single Item
```

Figure 14-27 Delete Inventory Menu

All the items in the Inventory may be deleted, or the Inventory may be deleted one item at a time.

Deleting Individual Items from the Inventory

To delete individual items from the Inventory, select *SINGLE ITEM* from Figure 14-27 Delete Inventory Menu.

A list of items in the Inventory appears, showing nuclide name, study (if any) and ID (if any). If there is more than one screen, use the **UP ARROW (⇖)** and **DOWN ARROW (⇘)** keys to navigate between screens. Press the number in front of the item to select it to be deleted. Press **MENU** to return to Figure 14-2 Inventory Menu.

When an item is selected to be deleted, the details of the selected item will be displayed, showing current activity, current volume and for Tc99m, the current Mo to Tc ratio (unless the entered ratio was 0).

To keep the item in the Inventory, press **NO**. To delete the item from the Inventory, press **YES**.

The Inventory List will re-appear (with the previously selected item no longer on the list, if deletion was confirmed).

Press **MENU** when deletion of individual items has been completed. Figure 14-2 Inventory Menu will re-appear.

Deleting All Items in the Inventory

To delete all the items in the Inventory, select *ALL* from Figure 14-27 Delete Inventory Menu. The option to print the Inventory will be presented allowing a hard copy printout of the Inventory before it is deleted.

```
PRINT INVENTORY?
  Yes or No
```

Figure 14-28 Print Inventory Question Screen

To abort deleting the entire Inventory, press **HOME**. The Measurement screen will appear.

Press **YES** to print the Inventory. Press **NO** to skip printing. Figure 14-29 Delete Whole Inventory Confirmation Screen will appear.

```
ARE YOU SURE
YOU WANT TO
DELETE WHOLE
INVENTORY?
```

Figure 14-29 Delete Whole Inventory Confirmation Screen

If **NO** is pressed, Figure 14-2 Inventory Menu will appear and the Inventory contents will not be changed.

If **YES** is pressed, all the items in the Inventory will be deleted. Figure 14-2 Inventory Menu will appear.

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CHAPTER 15

DOSE TABLE

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.

Note: *A printer must be attached to the system to utilize the Dose Table function.*

The Dose Table is accessed by pressing the **DISPLAY** key. It is accessible only for Pre-Set Nuclide keys (This does not work with the F18, Xe133 keys or any of the **USER** keys). Figure 15-1 Dose Entry Screen will appear.

```
  Enter Dose

value    unit
_         mCi

-> to change unit
  ENTER to Accept
```

Figure 15-1 Dose Entry Screen

Input the desired dose and then press the **RIGHT ARROW (➘)** key. Use the arrow keys to scroll through the activity units: mCi, μCi, or Ci for Curie mode (MBq or GBq for Becquerel mode). If the value needs to be changed, press **CE.**

Note: *The displayed unit (Ci or Bq) is set outside of the Dose Table function. Reference CHAPTER 5: SYSTEM INITIALIZATION; SECTION: CHOOSING Ci or Bq.*

When the value and unit are correct, press **ENTER**. Figure 15-2 Volume Entry Screen will appear.

```
Enter
Volume In ml

  _
```

Figure 15-2 Volume Entry Screen

Input the volume of the sample that the dose will be drawn from in ml.

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

A report will be printed giving the time and required volume for the desired dose at time intervals appropriate to the nuclide for up to 30 time intervals. If there is not enough volume for the dose, the printout will read “REQUIRED VOLUME GREATER THAN EXISTING VOLUME”. A sample printout is shown in Figure 15-3 Dose Table Printout.

```
CRC-25W      REV 0.03  SN: 000000
Mar 20 2007 13:59

    DOSE TABLE

     I 131
  Mar 20 2007     13:59
  Activity:   6.96mCi
    Volume:   10.0ml
      Dose:   5.00mCi

  TIME    VOL (ml)
  13:59     7.18
  18:59     7.31
  23:59     7.45
  04:59     7.58
  09:59     7.72
  14:59     7.86
  19:59     8.00
  00:59     8.15
  05:59     8.29
  10:59     8.45
  15:59     8.60
  20:59     8.75
  01:59     8.91
  06:59     9.08
  11:59     9.24
  16:59     9.41
  21:59     9.58
  02:59     9.75
  07:59     9.93
  Required volume greater
  than existing volume.
```

Figure 15-3 Dose Table Printout

CHAPTER 16

WELL COUNTER WIPE MEASUREMENT PROCEDURES

GENERAL

Wipe measurements are divided into 4 categories:

- Wipe (work areas)
- Unrestricted
- Sealed Sources
- General

Up to 10 nuclides can be assigned to the Wipe category and up to 10 nuclides can be assigned to the Unrestricted category. A different nuclide can be assigned to each Sealed Source location (S-01 through S-99). The General category does not have any nuclides assigned to it. Reference CHAPTER 7: WELL COUNTER INITIALIZATION, SECTION: NUCLIDE SELECTION for instructions for assigning nuclides.

When a measurement is completed, the activity is calculated for each assigned nuclide, *as if it were the only nuclide present.* The activity is also calculated for the “All Channels” nuclide (reference CHAPTER 7: WELL COUNTER INITIALIZATION, SECTION: EFFICIENCY DATA).

A Trigger Level is assigned to the Wipe category, Unrestricted category and Sealed Sources category (Reference CHAPTER 7: WELL COUNTER INITIALIZATION, SECTION: TRIGGER LEVELS). The calculated activity is compared to the Trigger Level for the selected category. If the activity is greater than the Trigger Level, the activity is listed as *"EXCEEDS"*.

MEASUREMENT PROCEDURES

Basic Wipe Test Measurement Procedure

To measure a wipe, follow the procedure outlined below:

1. Press **WELL** from the Chamber Measurement Screen. The Well Measurement Screen will appear.
2. If the background has not been measured earlier in the day, the Background Instruction Screen will appear. You should also measure background whenever appropriate.
3. Press **MENU**. The *Well Main Menu* will appear.
4. Select *MEASURE*.
5. Select the appropriate category (Wipe, Unrestricted, Sealed Source or General).
6. Any presence of contamination may be confirmed by counting without a sample in the sample chamber.
7. If the Location Number is not correct, press **FORM *(LOC)*** and input the correct Location Number and press **ENTER**.
8. If the counting period is not correct, input the correct counting period via the numeric keypad.
9. Place the wipe in the Well Counter.
10. Press **COUNT *(START/STOP)*** to start counting.
11. The measurement may be terminated by pressing **COUNT *(START/STOP)***, if so desired.
12. When the measurement has been completed, press **ENTER** to print the result.
13. **DISPLAY *(NUM/GRAPH)*** may be pressed to view calculated activities and the Bar Graph.
14. For the Wipe and Unrestricted categories, activity for nuclides assigned to the category may be viewed by selecting each nuclide.
15. Press **UP ARROW (⇖)** key to measure the wipe for the next location.
16. Press **DOWN ARROW (⇘)** key to measure the wipe for the previous location.
17. Press **COUNT *(START/STOP)*** to re-measure the current wipe.

⚠ **CAUTION:** Whenever the instantaneous counting rate exceeds 60kcps in any 40msec period, "COUNTING RATE TOO HIGH" will be displayed. When the source is removed, the Well Measurement Screen will re-appear.

Selecting a Category

Wipe measurements are divided into 4 categories:

- Wipe (work areas)
- Unrestricted
- Sealed Sources
- General

To select the category:

From the Well Counter Measurement screen, press **MENU**. Figure 16-1 Well Main Menu will appear.

```
1. Measure
2. Auto Cal
3. Setup
4. Lab Tests
5. MDA Test
```

Figure 16-1 Well Main Menu

Select *MEASURE*. Figure 16-2 Well Measure Menu will appear.

```
1. Wipe
2. Unrestricted
3. Sealed Source
4. General
```

Figure 16-2 Well Measure Menu

Select the desired category for measurement.

Location Number

A Location Number can be assigned to wipe locations to simplify record keeping.

The number in the top left corner of the screen represents the location from where the wipe sample was taken. This number also appears on the printouts (if a printer is attached to the system) after counting the wipe, and is used to document the location of that wipe. The CRC®-25W can store up to 99 Location Numbers for the Wipe, Unrestricted and General categories.

When at a measurement screen, press **FORM (LOC)** to change the location number.

The location number will be erased from the screen. Input the correct Location Number (01-99) and press **ENTER**.

Inputting Counting Period

The last counting period selected for the category is displayed.

Input the counting period via the numeric keypad and press **ENTER**.

The minimum counting period is 2 seconds for Wipe and General categories and 60 seconds for Unrestricted and Sealed Source categories.

The maximum counting period is 9999 seconds.

The counting may be terminated at any time by pressing **COUNT *(START/STOP)*** key.

WIPE OR UNRESTRICTED CATEGORIES

Note: *The example below is for Wipe category. Unrestricted is the same except that "U" is displayed instead of "W".*

From Figure 16-2 Well Measure Menu, select *WIPE* or *UNRESTRICTED*. Figure 16-3 Wipe Measurement Screen will appear.

```
W-02    30s



 Press COUNT to START
```

Figure 16-3 Wipe Measurement Screen

After the location number and counting time are correct, place the wipe sample inside the Well Counter and press **COUNT *(START/STOP)*** to begin the measurement.

Figure 16-4 Wipe Measurement Counting Screen appears and shows the net total counts (C) and the net counts per minute (cpm) for all channels added together and is updated every second.

```
W-01    23s

   36.60kc
   66.37kcpm
```

Figure 16-4 Wipe Measurement Counting Screen

During the counting period, press the **DISPLAY *(NUM/GRAPH)*** key to display a Bar Graph of the net counting rate per channel and remaining counting period as shown in Figure 16-5 Wipe Measurement Bar Graph Counting Screen. The screen is updated every second.

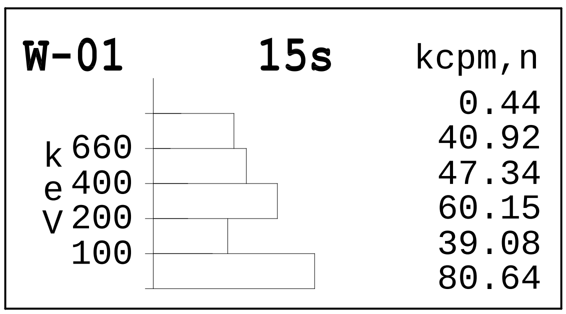

Figure 16-5 Wipe Measurement Bar Graph Counting Screen

Pressing **DISPLAY *(NUM/GRAPH)*** will toggle between Figure 16-4 Wipe Measurement Counting Screen and Figure 16-5 Wipe Measurement Bar Graph Counting Screen.

To end the measurement before the requested counting period has expired, press **COUNT *(START/STOP)***.

When the measurement is finished (time is up or the **COUNT *(START/STOP)*** key has been pressed during measurement), Figure 16-6 Wipe Measurement Results screen will appear showing the net counting rate for all channels.

```
W-01          12:34
              net
   2135 cpm
 ±  57. cpm
```

Figure 16-6 Wipe Measurement Results

The first number (2135 cpm) is the net counting rate (total counts minus background). The number under the net counting rate (± 57 cpm) is the standard deviation of the net counting rate.

In the example shown in Figure 16-6 Wipe Measurement Results, the previous background measurement was counted for 60 seconds with a result of 546.0 cpm. The background count is added to the net count (also counted for 60 seconds) to give a total (gross) count of 2681 cpm. In order to calculate the standard deviation of the net counting rate, the following formula is used:

$$\pm\sqrt{\frac{R_g}{t_g}+\frac{R_b}{t_b}}$$

Where R_g = gross sample count rate in cpm,
R_b = background count rate in cpm,
t_g = gross sample count interval in minutes, and
t_b = background count interval in minutes.

$$\pm\sqrt{\frac{R_g}{t_g}+\frac{R_b}{t_b}}=\sqrt{\frac{2681}{1}+\frac{546}{1}}=\sqrt{3227}=56.8\,\text{(which rounds to 57)}$$

When **DISPLAY *(NUM/GRAPH)*** is pressed, Figure 16-7 Wipe Measurement Exceeds Screen will appear showing a list of any nuclides whose activity exceeds the Trigger Level for the selected category (reference CHAPTER 7:WELL COUNTER INITIALIZATION; SECTION:TRIGGER LEVELS). If there are more nuclides selected than can be displayed on one screen, an asterisk (∗) will appear in the lower right corner of the screen. Press **DISPLAY *(NUM/GRAPH)*** again to view the remainder of the list.

```
         EXCEEDS
                   dpm,n
I 131    81.7 ±   0.4k
```

Figure 16-7 Wipe Measurement Exceeds Screen

In the example above, the data *does not* necessarily indicate that this wipe sample contains excessive counts of Iodine 131. Since Iodine 131 has gamma energy peaks at 364 and 418 keV, this nuclide would be detected mainly in channels 3 and 4.

Figure 16-7 Wipe Measurement Exceeds Screen indicates that if all the counts detected in channels 3 and 4 were from Iodine 131, then the sample is hot.

Remember, the CRC®-25W discriminates between pulses of various amplitudes, or energy levels, dividing the whole spectrum of pulse amplitudes into six channels:

Channel	Energy Range in keV
1	15 to 100
2	100 to 200
3	200 to 400
4	400 to 660
5	660 to 800
6	> 800

Table 16-1 Channel/Energy Ranges

It is up to the user to interpret these results. For example, if there is never any Iodine 131 used around the wipe location, you can feel fairly confident in ruling out that type of contamination.

When **DISPLAY *(NUM/GRAPH)*** is pressed again, Figure 16-8 Wipe Measurement OK Screen will appear showing a list of any nuclides whose activity does not exceed the Trigger Level for the selected category (OK list). If there are more nuclides selected than can be displayed on one screen, an asterisk (*) will appear in the lower right corner of the screen. Press **DISPLAY *(NUM/GRAPH)*** again to view the remainder of the list.

```
      OK
                    dpm,n
ALL       205.2 ± 147.2k
I 131      81.7 ±   0.4k
```

Figure 16-8 Wipe Measurement OK Screen

From Figure 16-8 Wipe Measurement OK Screen, press **DISPLAY** ***(NUM/GRAPH)*** to view the bar graph. Figure 16-9 Wipe Measurement Bar Graph will appear.

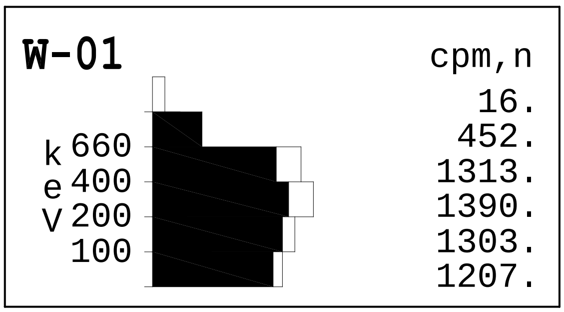

Figure 16-9 Wipe Measurement Bar Graph Results

Press **DISPLAY (*NUM/GRAPH*)** again to return to Figure 16-6 Wipe Measurement Results Screen.

Shading of Bar Graphs

The overall length of each bar in the bar graph always indicates *total counts (wipe sample plus background)* for each channel.

The solid shaded length of each bar in the bar graph always indicates *net counts (wipe sample minus background)* for each channel.

The numbers in the column at the right side of the screen always indicate *net counts (wipe sample minus background)* for each channel. This number corresponds to the solid section of each bar. Consequently, the overall length of a bar for a certain channel may appear larger than the other bars when the corresponding number of net counts is smaller than the others.

When net counts are a smaller percentage of total counts, the bars will be partially shaded as shown in Figure 16-9 Wipe Measurement Bar Graph.

Because the CRC®-25W indicates net counts on the bar graph by shading portions of the bars that represent net counts, bar graphs of background measurements are always un-shaded.

In the example shown in Figure 16-10 Wipe Measurement Bar Graph Results – All Shaded, the net counts are high compared to the background levels; therefore, the background activity is too small to see with the resolution of the display. As a result, the entire bar for each channel is shaded.

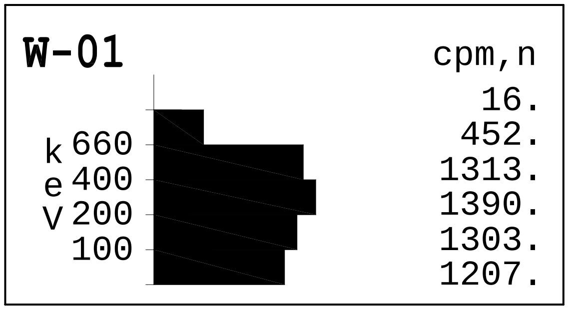

Figure 16-10 Wipe Measurement Bar Graph Results – All Shaded

Negative Numbers

For some wipe samples, you may find negative numbers listed in the net count column (at the right side of Figure 16-9 Wipe Measurement Bar Graph). This does not indicate device malfunction.

Negative numbers occur when total counts minus background counts for a particular channel is less than zero. This can happen when the background activity has changed, when count rates are very low, or when there is no activity on the wipe (particularly with long counting times and a slightly variable background activity).

Negative counts should be small numbers. Large negative numbers indicate a significant change in background activity, and the background count should be repeated.

Results for Selected Nuclide

Results for one of the nuclides assigned to the category (reference CHAPTER 7: WELL COUNTER INITIALIZATION; SECTION: NUCLIDE SELECTION) can be viewed from either Figure 16-6 Wipe Measurement Results screen or Figure 16-9 Wipe Measurement Bar Graph.

A nuclide may be specified via one of the Pre-Set Nuclide keys, one of the **USER** keys or via the **NUCL** key.

Pre-set Nuclide key:

Press one of the 8 pre-set nuclide keys (**F18, Ga67, Tc99m, In111, I123, I131, Xe133, Tl201**). Figure 16-13 Wipe Measurement Results with Selected Nuclide will re-appear showing the new nuclide name. (Tc99m is used in the example.)

Note: *Before using one of these keys, the nuclide must be assigned to current category. (Reference CHAPTER 7: WELL COUNTER INITIALIZATION, SECTION: NUCLIDE SELECTION)*

USER Key:

Press one of the 5 user assigned nuclide keys (**U1, U2, U3, U4, U5**). Figure 16-13 Wipe Measurement Results with Selected Nuclide will re-appear showing the new nuclide name. (Tc99m is used in the example.)

Note: *Before using one of these keys, a nuclide must be assigned to the key. (Reference CHAPTER 7: WELL COUNTER INITIALIZATION, SECTION: USER KEY ASSIGNMENT)*

NUCL Key:

Press **NUCL**. Figure 16-11 Nuclide Name Assignment Screen will appear.

Note: *Before using one of these keys, the desired nuclide must be assigned to current category. (Reference CHAPTER 7: WELL COUNTER INITIALIZATION, SECTION: NUCLIDE SELECTION)*

```
    SPECIFY
    NUCLIDE


  _
```

Figure 16-11 Nuclide Name Assignment Screen

Press the alphanumeric keys corresponding to the nuclide name. The number on each key will appear. For example, if Cs137 is entered, 27137 will appear on the screen. Press **ENTER** when the nuclide has been specified. Figure 16-13 Wipe Measurement Results with Selected Nuclide will re-appear showing the new nuclide name.

The entire name does not have to be input. If the nuclide is not uniquely specified, a list of possibilities will appear. For example, if Cesium 137 is the desired source, input **271** (for Cs1) and press **ENTER**. Figure 16-12 Nuclide List Screen will appear.

Note: *If there are more than 5 possibilities, the message "SPECIFY FURTHER" will be displayed. Press any key (except **HOME**) to continue.*

```
1. Cs131
2. Cs132
3. Cs134
4. Cs136
5. Cs137
```

Figure 16-12 Nuclide List Screen

Note: *Only nuclides assigned to the category may be selected. If a nuclide is selected that is not assigned to the category, the unit will beep and return to Figure 16-6 Wipe Measurement Results screen.*

Input the number corresponding to the desired nuclide and press **ENTER**. Figure 16-13 Wipe Measurement Results with Selected Nuclide will re-appear showing the new nuclide name. (Tc99m is used in the example.)

If **NUCL** was accidentally pressed, press **ENTER** without any input. The Wipe Measurement Results screen will re-appear showing the previously selected nuclide name (or all channels if no previous nuclide was chosen).

```
W-01          12:34
Tc99m
  1239 dpm
 ± 120 dpm
```

Figure 16-13 Wipe Measurement Results with Selected Nuclide

When **DISPLAY *(NUM/GRAPH)*** is pressed, Figure 16-7 Wipe Measurement Exceeds Screen will appear showing a list of any nuclides whose activity exceeds the Trigger Level for the selected category. If there are more nuclides selected than can be displayed on one screen, an asterisk (*) will appear in the lower right corner of the screen. Press **DISPLAY *(NUM/GRAPH)*** again to view the remainder of the list.

When **DISPLAY *(NUM/GRAPH)*** is pressed again, Figure 16-8 Wipe Measurement OK Screen will appear showing a list of any nuclides whose activity does not exceed the Trigger Level for the selected category (OK list). If there are more nuclides selected than can be displayed on one screen, an asterisk (∗) will appear in the lower right corner of the screen. Press **DISPLAY *(NUM/GRAPH)*** again to view the remainder of the list.

When **DISPLAY *(NUM/GRAPH)*** is pressed again, Figure 16-14 Wipe Measurement Bar Graph Results – Selected Nuclide screen will appear.

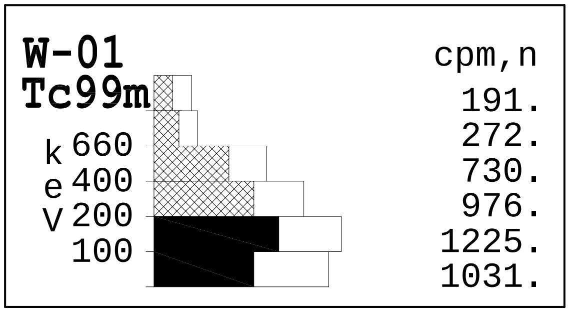

Figure 16-14 Wipe Measurement Bar Graph Results – Selected Nuclide

The net counts for all channels are shaded. The channels that are used to calculate the activity of the selected nuclide are solid; the other channels are hatched.

Counting Rate

To view the counting rate for all the channels, press the **CAL# *(COUNTING RATE)*** key when the Results Screen or Bar Graph Screen is displayed. Figure 16-6 Wipe Measurement Results or Figure 16-9 Wipe Measurement Bar Graph will re-appear with no nuclide specified.

Printing

Note: *A printer must be attached to the system in order to print the results.*

To print a record of the measurement, press **ENTER *(PRINT)*** when the Results Screen or Bar Graph Screen is displayed. If the Bar Graph Screen is displayed, the Bar Graph will also be printed.

Making Another Measurement

To measure the wipe again without changing any parameters, press **COUNT (*START/STOP*)** and the measurement will begin.

To make another measurement with changes in the location number and/or counting period, press the **HOME** key and make necessary changes.

To measure the wipe for the next location, press the **UP ARROW (↖)**.

To measure the wipe for the previous location, press the **DOWN ARROW (↘)**.

SEALED SOURCE CATEGORY

This feature is used to measure wipe samples from Sealed Sources to detect leakage, for example, from a Co60 teletherapy unit.

Only one nuclide can be assigned to each Sealed Source location number. (Reference CHAPTER 7: WELL COUNTER INITIALIZATION, SECTION:NUCLIDE SELECTION for inputting the nuclide for a Sealed Source location.)

From Figure 16-2 Well Measure Menu, select *SEALED SOURCE*. Figure 16-15 Sealed Source Measurement Screen will appear. (In the example, Co57 is assigned to location S-01.)

```
S-01    60s
Co57



 Press COUNT to START
```

Figure 16-15 Sealed Source Measurement Screen

After the location number and counting time are correct, place the wipe sample inside the Well Counter and press **COUNT** ***(START/STOP)*** to begin the measurement.

Note: *The minimum counting period for the Sealed Source category is 60 seconds. The maximum counting period is 9999 seconds.*

Figure 16-16 Sealed Source Measurement Counting Screen will appear showing the total counts (C) and the activity of the sample (nCi or Bq) and will be updated every second.

```
S-01    23s
Co57
   125.1kC
   226.3 nCi
```

Figure 16-16 Sealed Source Measurement Counting Screen

During the counting period, press the **DISPLAY *(NUM/GRAPH)*** key to display a Bar Graph of the net counting rate per channel and remaining counting period as shown in Figure 16-17 Sealed Source Measurement Bar Graph Counting Screen. The screen is updated every second.

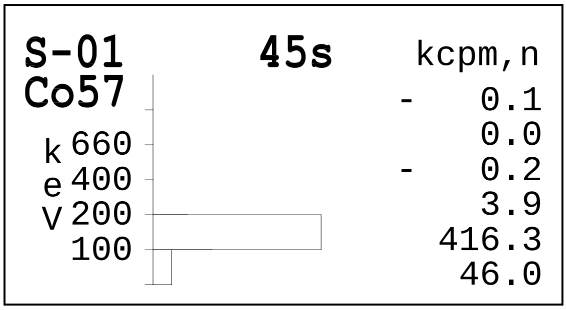

Figure 16-17 Sealed Source Measurement Bar Graph Counting Screen

Pressing **DISPLAY *(NUM/GRAPH)*** will toggle between Figure 16-16 Sealed Source Measurement Counting Screen and Figure 16-5 Wipe Measurement Bar Graph Counting Screen.

To end the measurement before the requested counting period has expired, press **COUNT *(START/STOP)***.

When the measurement is finished (time is up or the **COUNT *(START/STOP)*** key has been pressed during measurement) Figure 16-18 Sealed Source Measurement Results screen will appear showing the activity of the selected nuclide.

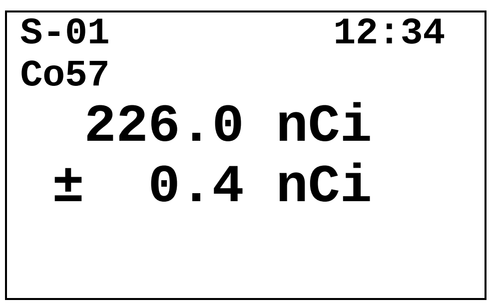

Figure 16-18 Sealed Source Measurement Results

Press **DISPLAY *(NUM/GRAPH)***. Figure 16-19 Sealed Source Measurement Bar Graph Results – Selected Nuclide will appear.

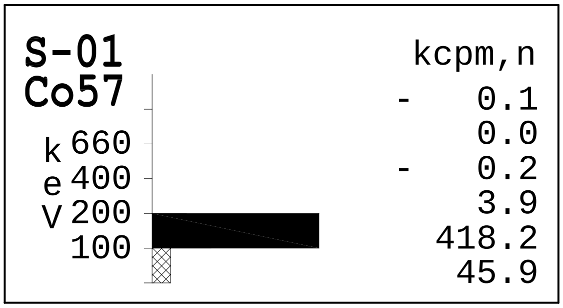

Figure 16-19 Sealed Source Measurement Bar Graph Results – Selected Nuclide

Press **DISPLAY *(NUM/GRAPH)*** to toggle between Figure 16-18 Sealed Source Measurement Results and Figure 16-19 Sealed Source Measurement Bar Graph Results – Selected Nuclide screens.

Printing

Note: *A printer must be attached to the system in order to print the results.*

To print a record of the measurement, press **ENTER *(PRINT)*** when the Results Screen or Bar Graph Screen is displayed. If the Bar Graph Screen is displayed, the Bar Graph will also be printed.

Making Another Measurement

To make another measurement without changing any parameters, press **COUNT (*START/STOP*)** and the measurement will begin.

To make another measurement with changes in the location number and/or counting period, press the **HOME** key and make necessary changes.

To measure the next Sealed Source location, press the **UP ARROW (↖)**.

To measure the previous Sealed Source location, press the **DOWN ARROW (↘)**.

GENERAL CATEGORY

Use the General Category to measure radiation levels in samples. For example, this feature can be used to measure liquid samples of blood or urine for lab procedures. Also if activities are sufficiently low, radiochromatography strips may be counted using the General Category.

A General measurement is not associated with a particular location. There is no Trigger Level for General measurements and no assigned nuclides (which mean that the Pre-Set Nuclide keys are not active). Only counting rate for selected channels (energy peaks for any nuclides you may want to look for) is calculated for General measurements.

The table below shows the correspondence between channels and energy.

Channel	Energy Range in keV
1	15 to 100
2	100 to 200
3	200 to 400
4	400 to 660
5	660 to 800
6	> 800

Table 16-2 Channel/Energy Ranges

From Figure 16-2 Well Measure Menu, select *GENERAL*. Figure 16-20 General Measurement Screen will appear.

```
G-01     6s



 Press COUNT to START
```

Figure 16-20 General Measurement Screen

After the location number and counting time are correct, place the wipe sample inside the Well Counter and press **COUNT (*START/STOP*)**. Figure 16-21 Channel Selection screen will appear.

Note: *The minimum counting period for the General category is 2 seconds. The maximum counting period is 9999 seconds.*

```
Y selects channels
→ CH 1   CH 4
  CH 2   CH 5
  CH 3   CH 6
 COUNT when finished
```

Figure 16-21 Channel Selection

The channels to be used in the calculation of net counting rate must be selected (highlighted). Previously selected channels may be de-selected (highlight removed).

To decide which channels to select, determine which nuclides to look for in this General measurement, and then select the channels that contain the gamma energy peaks[1] for those nuclides.

Note: *At least one channel must be selected.*

Use the **UP ARROW (⬉)** and **DOWN ARROW (⬊)** keys to move the pointer (right arrow ➔) so that it points to the channel to be selected (or de-selected) and then press the **Y** key.

When the desired channels are highlighted, press **COUNT** ***(START/STOP)*** to begin the measurement. Figure 16-22 General Measurement Counting Screen will appear showing the net total counts (C) and the net counts per minute (cpm) for all channels added together and will be updated every second.

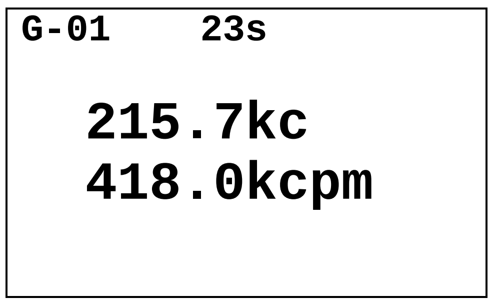

Figure 16-22 General Measurement Counting Screen

During the counting period, press the **DISPLAY** ***(NUM/GRAPH)*** key to display a Bar Graph of the net counting rate per channel and remaining counting period as shown in Figure 16-23 General Measurement Bar Graph Counting Screen. The screen is updated every second.

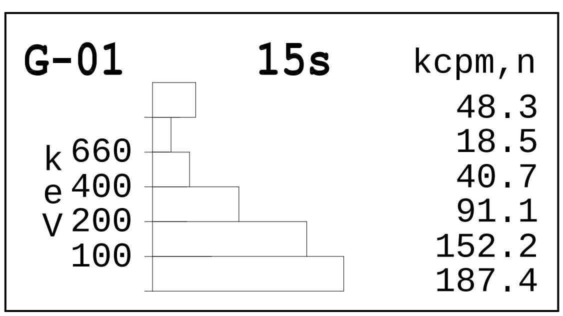

Figure 16-23 General Measurement Bar Graph Counting Screen

[1] Gamma energy peaks for nuclides can be found in: *A Handbook of Radioactivity Measurements Procedures* (NCRP Report No. 58, Appendix A.3, National Council on Radiation Protection and Measurements, Bethesda, Maryland.

Pressing **DISPLAY *(NUM/GRAPH)*** will toggle between Figure 16-22 General Measurement Counting Screen and Figure 16-23 General Measurement Bar Graph Counting Screen.

To end the measurement before the requested counting period has expired, press **COUNT *(START/STOP)***.

When the measurement is finished (time is up or the **COUNT *(START/STOP)*** key has been pressed during measurement) Figure 16-24 General Measurement Results screen will appear showing the counting rate.

G-01 12:34
net
1143 cpm
± 120 cpm

Figure 16-24 General Measurement Results

Press **DISPLAY *(NUM/GRAPH)***. Figure 16-25 General Measurement Bar Graph Results – Selected Channels will appear. The example shown, channels 2, 4 and 5 were selected to be used in the calculation.

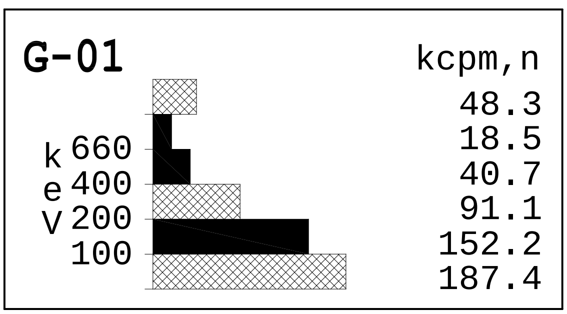

Figure 16-25 General Measurement Bar Graph Results – Selected Channels

Press **DISPLAY *(NUM/GRAPH)*** to toggle between Figure 16-24 General Measurement Results and Figure 16-25 General Measurement Bar Graph Results – Selected Channels screens.

Printing

Note: *A printer must be attached to the system in order to print the results.*

To print a record of the measurement, press **ENTER *(PRINT)*** when the Results Screen or Bar Graph Screen is displayed. If the Bar Graph Screen is displayed, the Bar Graph will also be printed.

Making Another Measurement

To measure the wipe again without changing any parameters, press **COUNT (*START/STOP*)** and the measurement will begin.

To make another measurement with changes in the location number, counting period and/or channels, press the **HOME** key and make necessary changes.

To measure the wipe for the next location using the previously set channels, press the **UP ARROW (⇖)** key.

To measure the wipe for the previous location using the previously set channels, press the **DOWN ARROW (⇘)** key.

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CHAPTER 17

WELL COUNTER LAB TESTS

GENERAL

This chapter describes the Lab Tests that can be performed using the CRC®-25W. They are:

- Urine Tests:
  - Schilling Test
- Blood Tests:
  - Plasma Volume
  - RBC Volume

To access the Lab Tests, press **MENU** from the Well Measurement screen. Figure 17-1 Well Main Menu will appear.

```
1. Measure
2. Auto Cal
3. Setup
4. Lab Tests
5. MDA Test
```

Figure 17-1 Well Main Menu

Select *LAB TESTS*. Figure 17-2 Lab Test Menu will appear.

```
1. Schilling
2. Plasma
3. RBC
```

Figure 17-2 Lab Test Menu

Note: *After each measurement for a Lab Test, the final Bar Graph and the prompt to accept the measurement: "OK Y OR N?" appears. Pressing **YES** accepts the measurement. Pressing **NO** allows the measurement to be repeated. Pressing **ENTER** prints the Bar Graph.*

SCHILLING TEST

The Schilling Test is used to determine B-12 deficiencies from either malabsorption, lack of intrinsic factor (pernicious anemia), or intraintestinal destruction. It entails oral administration of Cobalt 57 labeled Vitamin B-12 to the patient. Thereafter, the urine is collected for 24 or 48 hours. The ratio of excreted to administered Co57 is calculated. If the initial results indicate a reduced amount of excreted vitamin, the test is repeated with a second sample of labeled B-12 and intrinsic factor. For Schilling Test I, abnormal results are generally less than 8%-10%. Normal range is generally 11% to 26%. For Schilling Test II, no change indicates malabsorption, while an improved percentage indicates pernicious anemia.

Note: *The exact normal range for excretion for your facility and patients should be independently determined according to the guidelines provided by the Schilling Test kit manufacturer.*

To perform the actual measurements with this protocol, the system assumes the following samples have been prepared for counting.

1. Aliquot of urine sample collected over the test period.
2. Co57 standard having the identical volume and geometry as the test urine sample above.

Select *SCHILLING* from Figure 17-2 Lab Test Menu. Screens will appear allowing the following values to be input:

Dilution Factor:	The ratio of the activity of the Co57 capsule to the activity of the Co57 standard. When using a 1% standard, the Dilution Factor equals 100.
Aliquot Volume:	Volume of urine taken from the full urine volume collected.
Urine Volume:	Volume of urine collected over the duration of the test period. If the urine has been diluted to a convenient volume (such as 2000 ml), use this value.

```
Schilling Test

 ENTER DILUTION
 FACTOR

   _
```

Figure 17-3 Schilling Test Dilution Factor

Input the Dilution Factor and press **ENTER**. Figure 17-4 Schilling Test Aliquot Volume will appear.

Note: *The minimum value that can be input is 0.1000. The maximum value that can be input is 999999.*

```
Schilling Test

Enter Aliquot
Volume In ml

   _
```

Figure 17-4 Schilling Test Aliquot Volume

Input the Aliquot Volume in ml and press **ENTER**. Figure 17-5 Schilling Test Urine Volume will appear:

Note: *The minimum value that can be input is 0.1000. The maximum value that can be input is 9999.*

```
Schilling Test

Enter  Urine
Volume In ml


   _
```

Figure 17-5 Schilling Test Urine Volume

Input the Urine Volume in ml and press **ENTER**. Figure 17-6 Prompt to Measure Room Background will appear:

Note: *The minimum value that can be input is 0.1000. The maximum value that can be input is 999999.*

Background Measurement

```
SCHILLING TEST

MEASURE ROOM
BACKGROUND
Any Key to Continue
```

Figure 17-6 Prompt to Measure Room Background

The test begins by measuring the room background. Verify that there are no sources in the area and press any key (except **HOME**) to continue. Figure 17-7 Measure Schilling Test Background screen will appear.

```
BKG    20s



Press COUNT to START
```

Figure 17-7 Measure Schilling Test Background

The counting period can be changed at this time. This will be the counting period for the entire test. The minimum counting period is 20 seconds.

Note: *The minimum value that can be input is 20. The maximum value that can be input is 9999.*

If desired, input a new counting time and press **ENTER**.

Press **COUNT** ***(START/STOP)*** to begin the background measurement. Figure 17-8 Background Bar Graph Counting Screen will appear.

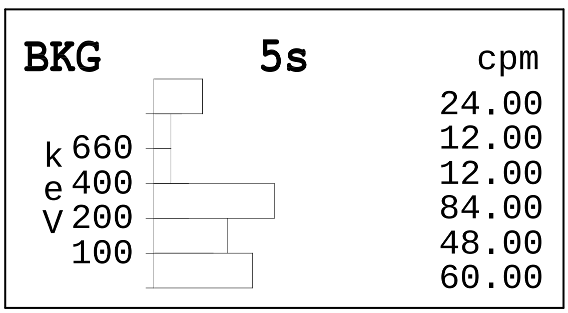

Figure 17-8 Background Bar Graph Counting Screen

Pressing **COUNT** ***(START/STOP)*** at any time during the measurement will abort the measurement and allow you to perform the measurement again. Figure 17-6 Prompt to Measure Room Background will re-appear.

When the measurement is finished, Figure 17-9 Background Bar Graph Results Screen will appear.

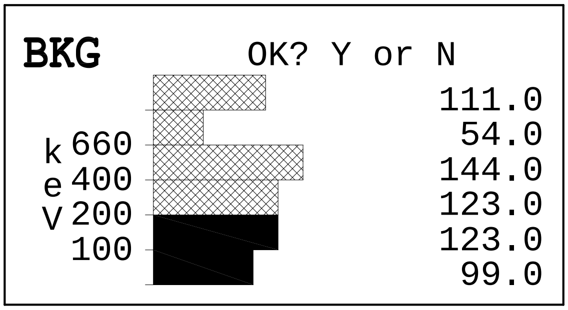

Figure 17-9 Background Bar Graph Results Screen

If a printer is attached to the system, a printout of the measurement Bar Graph may be obtained by pressing **ENTER *(PRINT)***.

If the measurement is unacceptable, press **NO** to repeat the measurement. Figure 17-6 Prompt to Measure Room Background will re-appear.

If the measurement is acceptable, press **YES**. Figure 17-10 Measure Schilling Test Standard screen will appear.

Standard Measurement

SCHILLING TEST

MEASURE
STANDARD
Any Key to Continue

Figure 17-10 Measure Schilling Test Standard

Place the Co57 standard into the Well Counter and press any key (except **HOME**) to begin counting. Figure 17-11 Schilling Test Standard Bar Graph Counting Screen will appear.

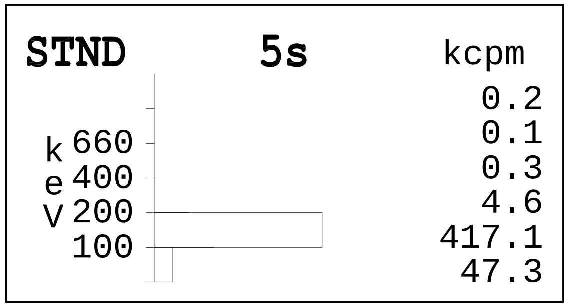

Figure 17-11 Schilling Test Standard Bar Graph Counting Screen

Pressing **COUNT** ***(START/STOP)*** at any time during the measurement will abort the measurement and allow you to perform the measurement again. Figure 17-10 Measure Schilling Test Standard will re-appear.

When the measurement is finished, Figure 17-12 Schilling Test Standard Bar Graph Results Screen will appear.

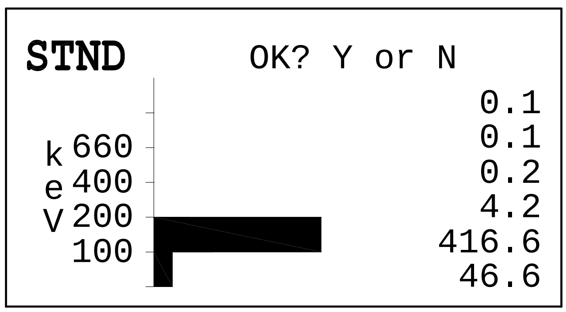

Figure 17-12 Schilling Test Standard Bar Graph Results Screen

If a printer is attached to the system, a printout of the measurement Bar Graph may be obtained by pressing **ENTER** ***(PRINT)***.

If the measurement is unacceptable, press **NO** to repeat the measurement. Figure 17-10 Measure Schilling Test Standard will re-appear.

If the measurement is acceptable, press **YES**. Figure 17-13 Measure Schilling Test Sample screen will appear.

Urine Sample Measurement

```
SCHILLING TEST

MEASURE
SAMPLE
Any Key to Continue
```

Figure 17-13 Measure Schilling Test Sample

Place the Urine sample into the Well Counter and press any key (except **HOME**) to begin counting. Figure 17-14 Schilling Test Sample Bar Graph Counting Screen will appear.

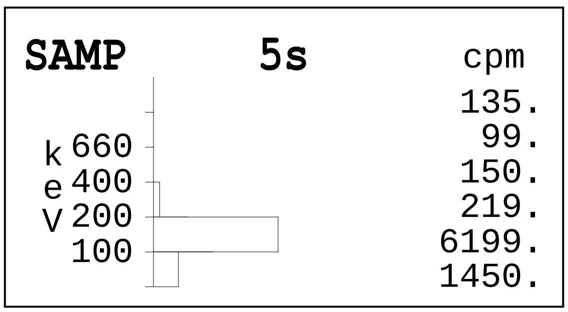

Figure 17-14 Schilling Test Sample Bar Graph Counting Screen

Pressing **COUNT** ***(START/STOP)*** at any time during the measurement will abort the measurement and allow you to perform the measurement again. Figure 17-13 Measure Schilling Test Sample will re-appear.

When the measurement is finished, Figure 17-15 Schilling Test Sample Bar Graph Results Screen will appear.

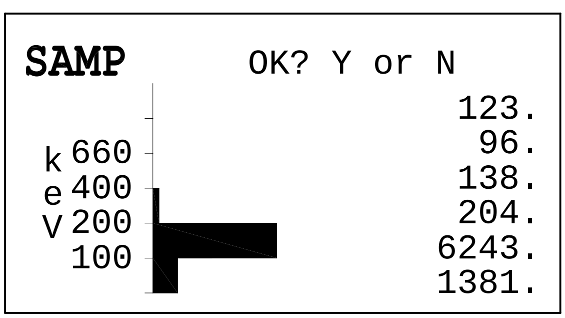

Figure 17-15 Schilling Test Sample Bar Graph Results Screen

If a printer is attached to the system, a printout of the measurement Bar Graph may be obtained by pressing **ENTER *(PRINT)***.

If the measurement is unacceptable, press **NO** to repeat the measurement. Figure 17-13 Measure Schilling Test Sample will re-appear.

If the measurement is acceptable, press **YES**. Figure 17-16 Schilling Test Result Screen #1 screen will appear.

Results

```
df      :  100.0
ALIQUOT: 2.0 ml
URINE  :2000.ml


 Any Key to Continue
```

Figure 17-16 Schilling Test Result Screen #1

Press any key (except **HOME**) to continue to the next result screen. Figure 17-17 Schilling Test Result Screen #2 will appear.

```
BKG  :198.0 cpm
STAND:465.1kcpm
URINE:7624. cpm
EXCRETION: 16.0%
 Press ENTER to Print
 PRESS WELL to Exit
```

Figure 17-17 Schilling Test Result Screen #2

If a printer is attached to the system, a printout of the measurement results may be obtained by pressing **ENTER *(PRINT)***.

To exit the test, press **WELL**. Figure 17-2 Lab Test Menu will appear.

The percent excretion is calculated as:

$$\% \text{ excretion} = 100 \times \frac{\text{U - B}}{(\text{S - B}) \times \text{D}} \times \frac{\text{V}}{\text{A}}$$

where

A = Aliquot Volume
B = Room Background
D = Dilution Factor
S = Standard count rate
U = Urine count rate
V = Urine Volume

PLASMA VOLUME (I 125)

Note: *The CRC®-25W software follows the testing protocol outlined in the Mallinckrodt Blood Volume Kit Instructions.*

Blood Volume determinations involving radioactive tagging are most frequently used in specific disease conditions when the hematocrit may not accurately estimate true blood volume. Such conditions include extensive trauma or burns, certain types of anemia, and polycythemia. In this test, I-125 labeled protein is used as a radioactive tracer for plasma measurements.

Select PLASMA from Figure 17-2 Lab Test Menu. The Plasma Volume screens will appear:

```
PLASMA VOLUME

ENTER DILUTION
FACTOR


  _
```

Figure 17-18 Plasma Volume Dilution Factor

Input the Dilution Factor and press **ENTER**. Figure 17-19 Plasma Volume Sample Volume screen will appear.

Note: *The minimum value that can be input is 0.1000. The maximum value that can be input is 999999.*

```
 PLASMA VOLUME

Enter  Sample
Volume In ml


   _
```

Figure 17-19 Plasma Volume Sample Volume

Input the volume of the sample in milliliters and press **ENTER**. Figure 17-20 Plasma Volume Hematocrit will appear.

Note: *The minimum value that can be input is 0.1000. The maximum value that can be input is 9999.*

```
 PLASMA VOLUME

 ENTER
 HCT in %


   _
```

Figure 17-20 Plasma Volume Hematocrit

Input the hematocrit determined from a whole blood sample drawn from the patient five to ten minutes post injection and press **ENTER**. Figure 17-21 Plasma Volume – Patient's Weight will appear.

Note: *The minimum value that can be input is 0.1000. The maximum value that can be input is 100.0.*

```
 PLASMA VOLUME

 ENTER WEIGHT
 in kg


   _
```

Figure 17-21 Plasma Volume – Patient's Weight

Input the patient's weight in kilograms and press **ENTER**. Figure 17-22 Prompt to Measure Room Background screen will appear.

Note: *The minimum value that can be input is 1.000. The maximum value that can be input is 9999.*

Background Measurement

```
PLASMA TEST

MEASURE ROOM
BACKGROUND
Any Key to Continue
```

Figure 17-22 Prompt to Measure Room Background

The test begins by measuring the room background. Verify that there are no sources in the area and press any key (except **HOME**) to continue. Figure 17-23 Measure Plasma Volume Background screen will appear.

```
BKG    20s




Press COUNT to START
```

Figure 17-23 Measure Plasma Volume Background

The counting period can be changed at this time. This will be the counting period for the entire test. The minimum counting period is 20 seconds.

Note: *The minimum value that can be input is 20. The maximum value that can be input is 9999.*

If desired, input a new counting time and press **ENTER**.

Press **COUNT** ***(START/STOP)*** to begin the background measurement. Figure 17-24 Background Bar Graph Counting Screen will appear.

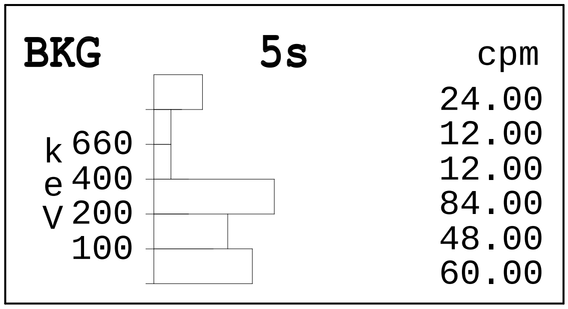

Figure 17-24 Background Bar Graph Counting Screen

Pressing **COUNT** ***(START/STOP)*** at any time during the measurement will abort the measurement and allow you to perform the measurement again. Figure 17-22 Prompt to Measure Room Background will re-appear.

When the measurement is finished, Figure 17-25 Background Bar Graph Results Screen will appear.

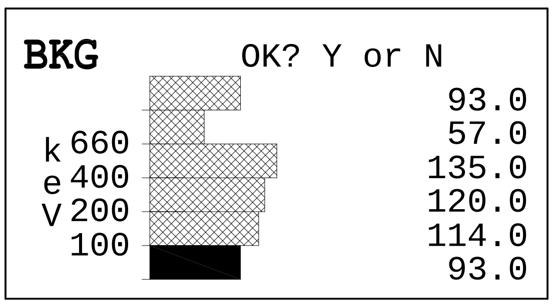

Figure 17-25 Background Bar Graph Results Screen

If a printer is attached to the system, a printout of the measurement Bar Graph may be obtained by pressing **ENTER** ***(PRINT)***.

If the measurement is unacceptable, press **NO** to repeat the measurement. Figure 17-22 Prompt to Measure Room Background will re-appear.

If the measurement is acceptable, press **YES**. Figure 17-26 Measure Plasma Volume Standard screen will appear.

Standard Measurement

```
PLASMA VOLUME


MEASURE
STANDARD
Any Key to Continue
```

Figure 17-26 Measure Plasma Volume Standard

Place the Reference Standard supplied with the kit into the Well Counter and press any key (except **HOME**) to begin counting.

Pressing **COUNT** ***(START/STOP)*** at any time during the measurement will abort the measurement and allow you to perform the measurement again. Figure 17-26 Measure Plasma Volume Standard will re-appear.

After the Reference Standard has been measured, the message "OK? Y or N" will appear at the top of the screen.

If a printer is attached to the system, a printout of the measurement Bar Graph may be obtained by pressing **ENTER** ***(PRINT)***.

If the measurement is unacceptable, press **NO** to repeat the measurement. Figure 17-26 Measure Plasma Volume Standard will re-appear.

If the measurement is acceptable, press **YES**. Figure 17-27 Measure Whole Blood Sample screen will appear.

Whole Blood Sample Measurement

```
PLASMA VOLUME


MEASURE WHOLE
BLOOD SAMPLE
Any Key to Continue
```

Figure 17-27 Measure Whole Blood Sample

After accepting the Reference Standard measurement, the two samples are measured:

Whole Blood Sample:	Sample of whole blood withdrawn from the patient five to ten minutes post injection.
Plasma Sample:	Sample of plasma from the whole blood withdrawn from the patient five to ten minutes post injection.

Place the Whole Blood Sample into the Well Counter and press any key (except **HOME**) to begin counting.

Pressing **COUNT *(START/STOP)*** at any time during the measurement will abort the measurement and allow you to perform the measurement again. Figure 17-27 Measure Whole Blood Sample will re-appear.

After the Whole Blood Sample has been measured, the message “OK? Y or N” will appear at the top of the screen.

If a printer is attached to the system, a printout of the measurement Bar Graph may be obtained by pressing **ENTER *(PRINT)***.

If the measurement is unacceptable, press **NO** to repeat the measurement. Figure 17-27 Measure Whole Blood Sample screen will re-appear.

If the measurement is acceptable, press **YES**. Figure 17-28 Measure Plasma Sample screen will appear.

Plasma Sample Measurement

```
PLASMA VOLUME


MEASURE
PLASMA SAMPLE
Any Key to Continue
```

Figure 17-28 Measure Plasma Sample

Place the Plasma Sample into the Well Counter and press any key (except **HOME**) to begin counting.

Pressing **COUNT *(START/STOP)*** at any time during the measurement will abort the measurement and allow you to perform the measurement again. Figure 17-28 Measure Plasma Sample will re-appear.

After the Plasma Sample has been measured, the message “OK? Y or N” will appear at the top of the screen.

If a printer is attached to the system, a printout of the measurement Bar Graph may be obtained by pressing **ENTER *(PRINT)***.

If the measurement is unacceptable, press **NO** to repeat the measurement. Figure 17-28 Measure Plasma Sample screen will re-appear.

If the measurement is acceptable, press **YES**. The Plasma Volume Results screens will appear.

Results

```
BKG  :50.00 cpm
STAND:535.1kcpm
BLOOD:6299. cpm
PLSMA:1111. cpm

 Any key to Continue
```

Figure 17-29 Plasma Volume Results Screen #1

Press any key (except **HOME**) to continue to the next result screen. Figure 17-30 Plasma Volume Results Screen #2 will appear.

```
 PLASMA VOLUME

     XXXX. ml
       XX. ml/kg

 Any key to Continue
```

Figure 17-30 Plasma Volume Results Screen #2

Press any key (except **HOME**) to continue to the next result screen. Figure 17-31 Plasma Volume Results Screen #3 will appear.

```
BLOOD VOLUME

   XXXX. ml
     XX. ml/kg

Any key to Continue
```

Figure 17-31 Plasma Volume Results Screen #3

Press any key (except **HOME**) to continue to the next result screen. Figure 17-32 Plasma Volume Results Screen #4 will appear.

```
 RBC VOLUME

   XXXX. ml
     XX. ml/kg

Any key to Continue
```

Figure 17-32 Plasma Volume Results Screen #4

Press any key (except **HOME**) to continue to the next result screen. Figure 17-33 Plasma Volume Results Screen #5 will appear.

```
CALCULATED
HEMATOCRIT

    XX.X %
Press ENTER to Print
Press WELL to Exit
```

Figure 17-33 Plasma Volume Results Screen #5

If a printer is attached to the system, a printout of the measurement results may be obtained by pressing **ENTER *(PRINT)***.

To exit the test, press **WELL**. Figure 17-2 Lab Test Menu will appear.

The results are calculated as follows:

$$\text{Plasma Volume (ml)} = 4000 \times \frac{\text{Net Reference Standard Counts}}{\text{Net Plasma Counts}}$$

$$\text{Whole Blood Volume (ml)} = 4000 \times \frac{\text{Net Reference Standard Counts}}{\text{Net Whole Blood Counts}}$$

$$\text{RBC Volume (ml)} = \text{Blood Volume - Plasma Volume}$$

$$\text{Calculated Hematocrit} = \frac{\text{Red Cell Volume}}{\text{Whole Blood Volume}}$$

Note: *A comparison of the calculated hematocrit with the microhematocrit will give an indication of the accuracy of the procedure and calculations.*

The standard, blood, and plasma counts must be taken under identical sample volume and geometric conditions relative to the detector crystal or else the difference must be accounted for in the computations by an appropriate correction factor.

RBC VOLUME (CR51)

Note: *The CRC®-25W software follows the testing protocol outlined in the Mallinckrodt Blood Volume Kit Instructions.*

This test is used to determine red blood cell volume or mass and is most frequently used in specific disease conditions when the hematocrit may not accurately estimate true blood volume. In this test, Cr51 tagged RBCs are used as radioactive tracers for red cell mass determination.

Select *RBC* from Figure 17-2 Lab Test Menu. Figure 17-34 RBC Volume Dose Hematocrit Screen will appear.

```
RBC VOLUME

ENTER Dose
HCT in %

  _
```

Figure 17-34 RBC Volume Dose Hematocrit

Input the Dose Hematocrit (Hematocrit of the tagged RBC suspension determined from the remainder of the suspension of the injection into the patient) and press **ENTER**. Figure 17-35 RBC Volume Patient Hematocrit will appear.

Note: *The minimum value that can be input is 0.1000. The maximum value that can be input is 100.0.*

```
RBC VOLUME

ENTER Patient
HCT in %

  _
```

Figure 17-35 RBC Volume Patient Hematocrit

Input the Patient Hematocrit – Hematocrit of a blood sample withdrawn from the patient ten to twenty minutes post injection and press **ENTER**. Figure 17-36 RBC Volume – Patient's Weight screen will appear.

Note: *The minimum value that can be input is 0.1000. The maximum value that can be input is 100.0.*

```
RBC VOLUME

ENTER WEIGHT
in kg

  _
```

Figure 17-36 RBC Volume – Patient's Weight

Input the patient's weight in kilograms. Figure 17-37 Prompt to Measure Room Background will appear:

Note: *The minimum value that can be input is 1.000. The maximum value that can be input is 9999.*

Background Measurement

```
RBC VOLUME

MEASURE ROOM
BACKGROUND
Any Key to Continue
```

Figure 17-37 Prompt to Measure Room Background

The test begins by measuring the room background. Verify that there are no sources in the area and press any key (except **HOME**) to continue. Figure 17-38 Measure RBC Volume Background screen will appear.

```
BKG    20s




Press COUNT to START
```

Figure 17-38 Measure RBC Volume Background

The counting period can be changed at this time. This will be the counting period for the entire test. The minimum counting period is 20 seconds.

Note: *The minimum value that can be input is 20. The maximum value that can be input is 9999.*

If desired, input a new counting time and press **ENTER**.

Press **COUNT** ***(START/STOP)*** to begin the background measurement. Figure 17-39 Background Bar Graph Counting Screen will appear.

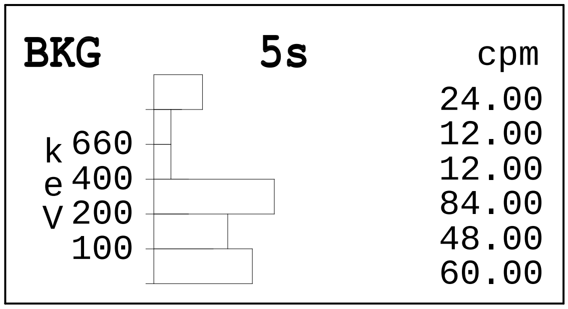

Figure 17-39 Background Bar Graph Counting Screen

Pressing **COUNT** ***(START/STOP)*** at any time during the measurement will abort the measurement and allow you to perform the measurement again. Figure 17-37 Prompt to Measure Room Background will re-appear.

When the measurement is finished, Figure 17-40 Background Bar Graph Results Screen will appear.

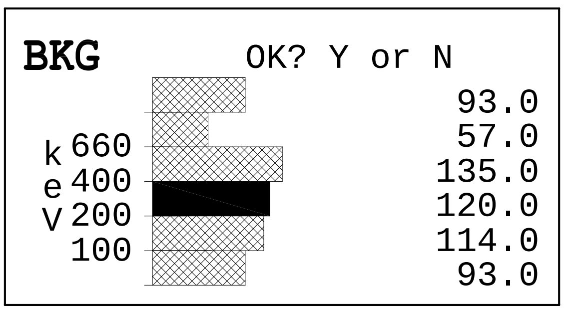

Figure 17-40 Background Bar Graph Results Screen

If a printer is attached to the system, a printout of the measurement Bar Graph may be obtained by pressing **ENTER** ***(PRINT)***.

If the measurement is unacceptable, press **NO** to repeat the measurement. Figure 17-37 Prompt to Measure Room Background will re-appear.

If the measurement is acceptable, press **YES**. Figure 17-26 Measure Plasma Volume Standard screen will appear.

Whole Blood Standard Measurement

```
RBC VOLUME

MEASURE WHOLE
BLOOD STANDARD
Any Key to Continue
```

Figure 17-41 Measure RBC Volume Whole Blood Standard

After accepting the background measurement, the prompt to measure the two Standards will appear.

Whole Blood Standard:	Sample solution made from 1 ml of the tagged RBC suspension diluted with water to 100 ml
Plasma Standard:	Sample solution made from 1 ml of the plasma from the centrifuged tagged RBC suspension diluted with water to 100 ml

Place the Whole Blood Standard into the Well Counter and press any key (except **HOME**) to begin counting.

Pressing **COUNT *(START/STOP)*** at any time during the measurement will abort the measurement and allow you to perform the measurement again. Figure 17-41 Measure RBC Volume Whole Blood Standard will re-appear.

After the Whole Blood Standard has been measured, the message “OK? Y or N” will appear at the top of the screen.

If a printer is attached to the system, a printout of the measurement Bar Graph may be obtained by pressing **ENTER *(PRINT)***.

If the measurement is unacceptable, press **NO** to repeat the measurement. Figure 17-41 Measure RBC Volume Whole Blood Standard screen will re-appear.

If the measurement is acceptable, press **YES**. Figure 17-42 Measure RBC Volume Plasma Standard screen will appear.

Plasma Standard Measurement

```
RBC VOLUME

MEASURE PLASMA
STANDARD
Any Key to Continue
```

Figure 17-42 Measure RBC Volume Plasma Standard

Place the Plasma Standard into the Well Counter and press any key (except **HOME**) to begin counting.

Pressing **COUNT *(START/STOP)*** at any time during the measurement will abort the measurement and allow you to perform the measurement again. Figure 17-42 Measure RBC Volume Plasma Standard will re-appear.

After the Plasma Standard has been measured, the message "OK? Y or N" will appear at the top of the screen.

If a printer is attached to the system, a printout of the measurement Bar Graph may be obtained by pressing **ENTER *(PRINT)***.

If the measurement is unacceptable, press **NO** to repeat the measurement. Figure 17-42 Measure RBC Volume Plasma Standard screen will re-appear.

If the measurement is acceptable, press **YES**. Figure 17-43 Measure Whole Blood Sample screen will appear.

Whole Blood Sample Measurement

```
RBC VOLUME

MEASURE WHOLE
BLOOD SAMPLE
Any Key to Continue
```

Figure 17-43 Measure Whole Blood Sample

After accepting the Plasma Standard measurement, the two samples are measured:

Whole Blood Sample:	Sample of blood withdrawn from the patient ten to twenty minutes post injection.
Plasma Sample:	Sample of plasma from the blood withdrawn ten to twenty minutes post injection.

Place the Whole Blood Sample into the Well Counter and press any key (except **HOME**) to begin counting.

Pressing **COUNT *(START/STOP)*** at any time during the measurement will abort the measurement and allow you to perform the measurement again. Figure 17-43 Measure Whole Blood Sample will re-appear.

After the Whole Blood Sample has been measured, the message “OK? Y or N” will appear at the top of the screen.

If a printer is attached to the system, a printout of the measurement Bar Graph may be obtained by pressing **ENTER *(PRINT)***.

If the measurement is unacceptable, press **NO** to repeat the measurement. Figure 17-43 Measure Whole Blood Sample screen will re-appear.

If the measurement is acceptable, press **YES**. Figure 17-44 Measure Plasma Sample screen will appear.

Plasma Sample Measurement

```
RBC VOLUME

MEASURE
PLASMA SAMPLE
Any Key to Continue
```

Figure 17-44 Measure Plasma Sample

Place the Plasma Sample into the Well Counter and press any key (except **HOME**) to begin counting.

Pressing **COUNT *(START/STOP)*** at any time during the measurement will abort the measurement and allow you to perform the measurement again. Figure 17-44 Measure Plasma Sample will re-appear.

After the Plasma Sample has been measured, the message “OK? Y or N” will appear at the top of the screen.

If a printer is attached to the system, a printout of the measurement Bar Graph may be obtained by pressing **ENTER *(PRINT)***.

If the measurement is unacceptable, press **NO** to repeat the measurement. Figure 17-44 Measure Plasma Sample screen will re-appear.

If the measurement is acceptable, press **YES**. The RBC Volume Results screens will appear.

Results

```
BKG  :50.00 cpm
WHOLE BLOOD
STAND:XXXX. cpm
SAMPL:XXXX. cpm

 Any key to Continue
```

Figure 17-45 RBC Volume Results Screen #1

Press any key (except **HOME**) to continue to the next result screen. Figure 17-46 RBC Volume Results Screen #2 will appear.

```
BKG  :50.00 cpm
PLASMA
STAND:XXXX. cpm
SAMPL:XXXX. cpm

 Any key to Continue
```

Figure 17-46 RBC Volume Results Screen #2

Press any key (except **HOME**) to continue to the next result screen. Figure 17-47 RBC Volume Results Screen #3 will appear.

```
PLASMA VOLUME

   XXXX. ml
     XX. ml/kg

Any key to Continue
```

Figure 17-47 RBC Volume Results Screen #3

Press any key (except **HOME**) to continue to the next result screen. Figure 17-48 RBC Volume Results Screen #4 will appear.

```
BLOOD VOLUME

   XXXX. ml
     XX. ml/kg

Any key to Continue
```

Figure 17-48 RBC Volume Results Screen #4

Press any key (except **HOME**) to continue to the next result screen. Figure 17-49 RBC Volume Results Screen #5 will appear.

```
 RBC VOLUME

   XXXX. ml
     XX. ml/kg
Press ENTER to Print
Press WELL to Exit
```

Figure 17-49 RBC Volume Results Screen #5

If a printer is attached to the system, a printout of the measurement results may be obtained by pressing **ENTER *(PRINT)***.

To exit the test, press **WELL**. Figure 17-2 Lab Test Menu will appear.

RBC Volume is calculated as follows:

$$\text{Red Cell Volume (ml)} = 1000 \times \frac{[\text{B} - \text{C}(1 - \text{A})]\text{E}}{\text{D} - \text{F}(1 - \text{E})}$$

where

A = Hematocrit of Tagged RBC Suspension
B = Net Whole Blood Standard Count
C = Net Plasma Standard Count
D = Net Patient Whole Blood Sample Count
E = Patient Hematocrit
F = Net Patient Plasma Sample Count

$$\text{Whole Blood Volume (ml)} = \frac{\text{Red Cell Volume (ml)}}{\text{Patient Hematocrit}}$$

Plasma Volume (ml) = Whole Blood Volume (ml) - Red Cell Volume (ml)

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CHAPTER 18

CALCULATION UTILITIES

GENERAL

Two calculation utilities are provided with the CRC®-25W:

- Conversion between Ci and Bq and
- Decay Calculation.

From the Chamber Measurement Screen, press **MENU**. Figure 18-1 Main Menu will appear.

```
1. Inventory
2. Calculations
3. Diagnostics
4. Setup
```

Figure 18-1 Main Menu

Select *CALCULATIONS*. Figure 18-2 Calculations Menu will appear.

```
1. Ci↔Bq Conv
2. Decay Calc
```

Figure 18-2 Calculations Menu

CONVERSION BETWEEN CI AND BQ (CI ↔ BQ)

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.

From Figure 18-2 Calculations Menu, select *Ci ↔ Bq CONV*. Figure 18-3 Ci ↔ Bq Activity Entry Screen will appear.

```
 ENTER ACTIVITY

  value   unit
 _         µCi

-> to change unit
  ENTER to Accept
```

Figure 18-3 Ci ↔ Bq Activity Entry Screen

Input the value of the activity to be converted and then press the **RIGHT ARROW (➘)** key. Use the arrow keys to scroll the activity units: µCi, GBq, MBq, Ci, mCi. If the value needs to be changed, press **CE**.

When the activity value and units are correct, press **ENTER**. Figure 18-4 Ci ↔ Bq Result Screen will appear (in the example 100 mCi was entered):

```
 100.0mCi
▶ 3.70GBq
 ENTER to Continue
 MENU to End
```

Figure 18-4 Ci ↔ Bq Result Screen

To perform another conversion, press **ENTER**. Figure 18-3 Ci ↔ Bq Activity Entry Screen will re-appear.

To exit the conversion utility, press **MENU**. Figure 18-2 Calculations Menu will re-appear.

DECAY CALCULATION

This utility is used to calculate the activity of a source at a different time (either in the past or the future).

From Figure 18-2 Calculations Menu select *DECAY CALC*. Figure 18-5 Choose Nuclide for Decay Calculation Screen will appear.

```
 CHOOSE NUCLIDE

Press NUCL or
Pre-set nuclide key
or User key
or CAL# for Half-Life
```

Figure 18-5 Choose Nuclide for Decay Calculation Screen

Choose the nuclide via one of the Pre-Set Nuclide keys, the **NUCL** key or an assigned **USER** key. Figure 18-7 Decay Calculation Activity Entry Screen will appear showing the nuclide name and half-life. In the example, Tc99m was chosen.

If you want to perform the decay calculation for a nuclide which is not in memory, press the **CAL#** key. Figure 18-6 Entering Half-Life for Decay Calculation screen will appear.

```
HALF LIFE:

 value   unit
 _        MIN

-> to change unit
  ENTER to Accept
```

Figure 18-6 Entering Half-Life for Decay Calculation

Input the value of the half-life and then press the **RIGHT ARROW (➘)** key. Use the arrow keys to scroll the half-life from Min to Year to Day to Hour. If the value needs to be changed, press the **CE** key.

When the value and unit are correct, press **ENTER**. Figure 18-7 Decay Calculation Activity Entry Screen will appear showing the input half-life. In the example, Tc99m was chosen. (If the **CAL**# key was pressed (to input the half-life), the nuclide name will be blank. Only the half-life will be displayed.)

```
Tc99m    6.007 H
 ENTER ACTIVITY
 value   unit
 _       µCi

-> to change unit
  ENTER to Accept
```

Figure 18-7 Decay Calculation Activity Entry Screen

Input the value of the activity and then press the **RIGHT ARROW (↘)** key. Use the arrow keys to scroll the activity units: µCi, GBq, MBq, Ci, mCi. If the value needs to be changed, press **CE**.

When the activity value and unit are correct, press **ENTER**. Figure 18-8 Decay Calculation Activity Starting Time / Date Screen will appear.

```
Tc99m     6.007 H
 FROM:
 _

  hhmm↘DD↘MM↘YY
 ENTER for NOW
```

Figure 18-8 Decay Calculation Activity Starting Time / Date Screen

Input the starting time / date as per the instructions below. If the starting time / date is "NOW", press **ENTER**. Figure 18-9 Decay Calculation Activity Ending Time / Date Screen will appear:

The time/date entry format is hhmm/DD/MM/YY where:

- hh = hours (24 hour format) (1 or 2 digit)
- mm = minutes (2 digit)
- DD = day (2 digit)
- MM = month (2 digit)
- YY = year (2 digit)

The minimum input required is the time (hhmm). That is, if the future time is sometime later in the same day, then all that needs to be input is the time. For example:

If the current time is 12:00 and the desired future time is 16:00 today;

- input **1600** and
- press **ENTER**. Figure 18-9 Decay Calculation Activity Ending Time / Date Screen will appear.

If the future time is sometime the next day, then all that needs to be input is the time (hhmm) and day (DD). For example:

If today is July 30 and the desired future time is 9:00 tomorrow;

- input **900** (for the time),
- press the **DOWN ARROW (↘)**,
- input **31** (for the day) and
- press **ENTER**. Figure 18-9 Decay Calculation Activity Ending Time / Date Screen will appear.

If the future time is sometime the day after tomorrow, then the time (hhmm), day (DD) and month (MM) will need to be input. For example:

If today is July 30 and the desired future time is 9:00 the day after tomorrow;

- input **900** (for the time),
- press the **DOWN ARROW (↘)**,
- input **01** (for the day),
- press the **DOWN ARROW (↘)**,
- input **08** (for the month) and
- press **ENTER**. Figure 18-9 Decay Calculation Activity Ending Time / Date Screen will appear.

```
Tc99m      6.007 H
 TO:

 _

  hhmm↘DD↘MM↘YY
 ENTER for NOW
```

Figure 18-9 Decay Calculation Activity Ending Time / Date Screen

Input the ending time / date as per the above instructions. If the ending time / date is “NOW”, press **ENTER**. Figure 18-10 Decay Calculation Results Screen will appear.

```
Tc99m     6.007 H
  200.µCi   15:59
     Jul 20 2005
  99.6µCi   22:01
     Jul 20 2005
```

Figure 18-10 Decay Calculation Results Screen

When finished viewing the results,

- Press the **MENU** key to exit Decay Calculation and return to Figure 18-2 Calculations Menu.
- Press the **HOME** key to return to the Chamber Measurement screen.
- Press any other key to return to Figure 18-5 Choose Nuclide for Decay Calculation Screen.

CHAPTER 19

CLEANING AND MAINTENANCE

GENERAL

This chapter provides the information necessary for the user to perform the basic maintenance of instrument cleaning, fuse replacement, battery 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.

CAUTION: REFER ALL SERVICING TO A QUALIFIED SERVICE REPRESENTATIVE!

It is recommended that periodic (every five years) re-calibration of the CRC®-25W be performed only by Capintec's Authorized Service Center to guarantee the instrument's high reliability is maintained. Contact Capintec's only Authorized Service Center for servicing or re-calibration at (800) ASK-4CRC.

CLEANING AND DISINFECTING

CAUTION:

- DISCONNECT THE POWER BEFORE CLEANING.
- TO AVOID ELECTRICAL SHOCK OR DAMAGING OF THE CRC®-25W, NEVER ALLOW WATER OR LIQUIDS TO PENETRATE THE CHAMBER, WELL COUNTER HOUSING OR THE READOUT ENCLOSURE.
- DO NOT USE AEROSOL DISPENSERS TO SPRAY THE EQUIPMENT WITH CLEANING SOLUTIONS OR LIQUIDS.
- TO AVOID DAMAGING THE CASE OR DISPLAY SCREEN, DO NOT USE AROMATIC HYDROCARBONS, CHLORINATED SOLVENTS OR METHANOL-BASED CLEANING SOLUTIONS.
- PRIOR TO CLEANING OR DISINFECTING THE LINER AND/OR DIPPER, THEY MUST BE REMOVED FROM THE CHAMBER. CAUTION: NEVER USE THE CALIBRATOR WITHOUT THE CHAMBER LINER IN PLACE. LINERS ARE INEXPENSIVE AND EASY TO REPLACE. A CONTAMINATED CHAMBER IS A VERY COSTLY MISTAKE.

Cleaning Instructions

Readout Unit, Chamber and Well Counter

Wipe the surfaces clean using a damp, non-abrasive cloth or sponge and a mild detergent and water; do not use solvents or aerosol cleaners. After cleaning, wipe all surfaces dry with a soft, non-abrasive cloth. To avoid scratches, do not use abrasive pads.

Liner/Dipper

Remove the Liner and/or Dipper from the Chamber and wipe the surfaces clean using a damp, non-abrasive cloth or sponge and a mild detergent and water; do not use solvents or aerosol cleaners. After cleaning, wipe all surfaces dry with a soft, non-abrasive cloth. To avoid scratches, do not use abrasive pads.

Replace the Liner and Dipper in the Chamber.

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

Printer

If a printer was included with the system, refer to the printer owner's manual for proper cleaning procedures.

Remote Display

If a Remote Display Unit was included with a legacy system, refer to the Remote Display owner's manual for proper cleaning procedures. ***Note:*** *This applies only to legacy systems. Remote Displays are no longer available as an option.*

Disinfecting Instructions

All surfaces can be disinfected with bleach using a mixture of 1 cup of bleach per gallon of water. Wipe all surfaces using a non-abrasive cloth lightly dampened with the bleach mixture. After disinfecting, wipe dry with a soft, non-abrasive cloth.

All surfaces can also be wiped with soft cloth lightly dampened with alcohol, such as an alcohol prep pad. After wiping, the surface can be left to air dry.

Liner/Dipper

Remove the Liner and/or Dipper from the Chamber and disinfect as directed above.

Replace the Liner and Dipper in the Chamber.

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

PREVENTATIVE MAINTENANCE

The following preventative maintenance should be performed at the specified intervals. General cleaning is at the discretion of the user (see Cleaning Instructions above). It is recommended to periodically perform the Quality Assurance Tests as described in CHAPTER 9: ACCEPTANCE & QUALITY ASSURANCE TESTS.

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.

If the unit fails to pass Autocalibration Test or any other test, the user **should not** attempt to perform any adjustments to the system. In this event, please contact Capintec for further assistance.

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, and/or Well Counter or
- Any cable shows signs of damage

SERVICING

The system is covered by a two year limited warranty, under normal conditions of use.

Other than the Readout Unit fuses (reference FUSE SERVICING on page 19-6) and internal Lithium Coin Battery (reference BATTERY REPLACEMENT on page 19-7), there are no user serviceable parts contained in the system.

Every five years, the system should be returned to Capintec's only Authorized Service Center for a complete verification.

CAPINTEC, Inc.
7 Vreeland Road
Florham Park, NJ 07932
Phone (800) ASK-4CRC
Fax (201) 825-1336

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.

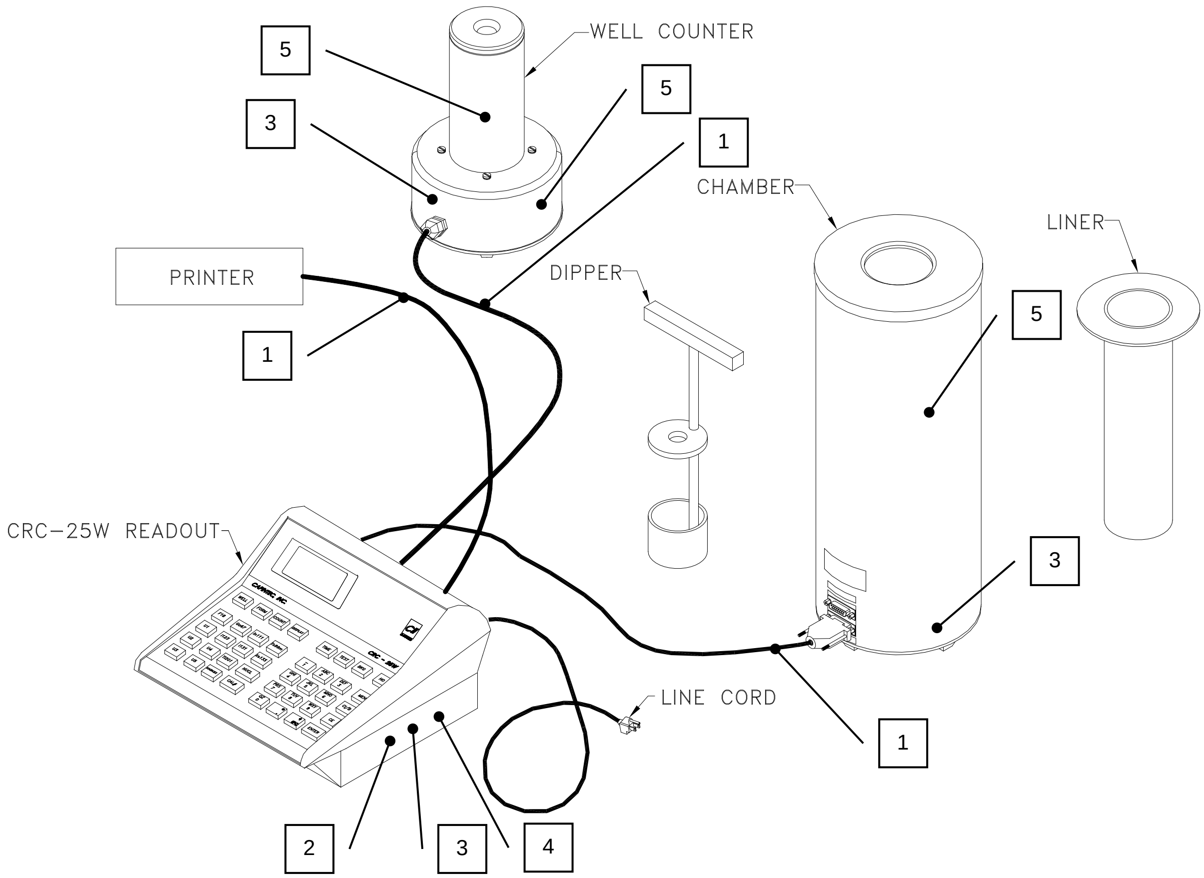

Figure 19-1

No.	Recycling/Material Code	Important Information
1	External Electrical Cables	
2	Lithium Battery	Contained on the CPU printed circuit board inside of the readout unit.
3	Printed Circuit Boards	Iometer, CPU, Power Supply, LCD Controller, HV Power Supply
4	Electrolytic Capacitor	Power Supply Printed Circuit Board
5	Lead	Lead Shielding internal to Chamber and Well Counter Housing and around Well Detector

FUSE SERVICING

Readout Fuses

CAUTION: 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®-25W 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 19-2 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.

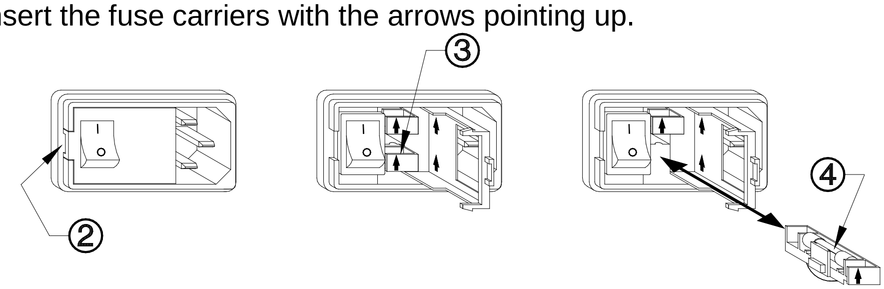

Figure 19-2 Readout Fuse Replacement

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®-25W.
8. Verify the CRC®-25W System is functioning correctly by performing the Daily Test as specified in CHAPTER 9: 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.

BATTERY REPLACEMENT

⚠ **CAUTION:** The replacement battery must be a CR2032 3 volt Lithium Coin.

When the internal 3 Volt Lithium Coin Battery falls below 2.75 Volts, the Low Battery symbol (⍁) will appear in the lower left corner of the display indicating that the battery needs to be replaced.

The procedure outlined below describes how to remove and install the battery and then reconfigure the CRC®-25W Calibrator. Only qualified service personnel should perform this procedure. If there are any questions, please contact Capintec's only Authorized Service Center at (800) ASK-4CRC.

The following question must be answered before proceeding with replacing the battery:

Since the Low Battery symbol appeared on the display, has the time reset to 00:00?

- If the answer is NO, then proceed to step 1 – Save System Data.
- If the answer is YES, then proceed to step 2 – Battery Removal.

1. Save System Data
   a. If a printer is attached to the system, obtain a Diagnostic Printout by pressing the **MENU** key, and then selecting the *DIAGNOSTIC* function. All stored data will be printed. This information will be re-entered in steps 5, 9 and 10 after the new battery has been installed.
   b. If a printer is not available, locate a copy of the original Calibration Sheet that was supplied with the unit and perform the following:
      - For Chamber:
        - Record any new or changed Calibration Numbers,
        - Record any Container Correction Factors,
        - Record any User Added Nuclide information,
        - Record the isotope information that has been stored for all of the User Keys (U1-U5), and
        - Record all Test Source information.
      - For Well Counter:
        - Record the following Calibration Factor that was determined during the last Factory Calibration,
        - Record any changed Limits (Background, Wipes, Unrestricted, Sealed Source),
        - Record the any new or changed Efficiency Data that has been stored for each isotope,

- Record any User Added Nuclide information,
- Record the isotope information that has been stored for all of the User Keys (U1-U5), and
- Record the Test Source information.

This information will be re-entered in steps 5, 9 and 10 after the new battery has been installed.

2. Battery Removal

   a. Turn off the power switch on the back of the Readout Unit and disconnect the power cord and ALL other cables.

   b. Turn the console upside down with the keypad facing down. Locate the rectangular access panel on the bottom of the readout unit. Remove the 3 flat head screws securing the access panel as shown in Figure 19-3.

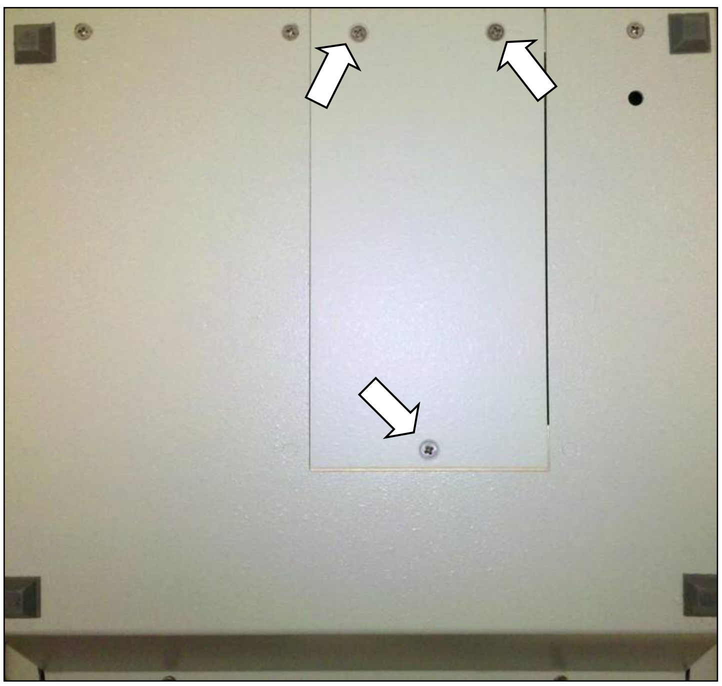

Figure 19-3

c. Remove the access panel as shown in Figure 19-4.

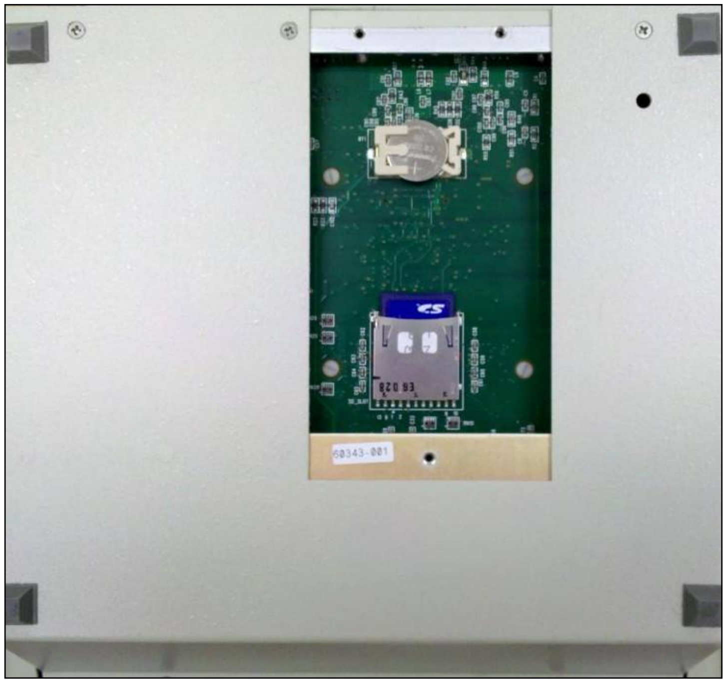

Figure 19-4

d. Gently press the battery in the direction of the arrow (toward the end of the battery holder with the three prongs) as shown in Figure 19-5.

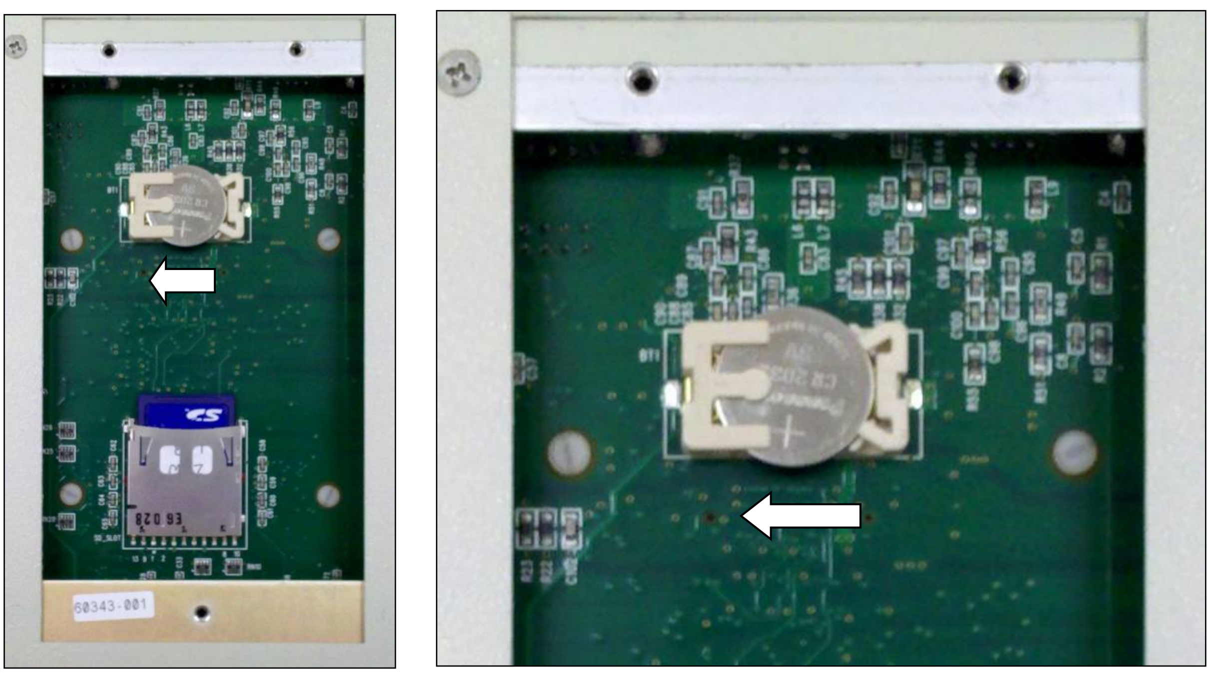

Figure 19-5

e. Lift the other end of the battery up and slide it out. The battery holder will appear as shown in Figure 19-6.

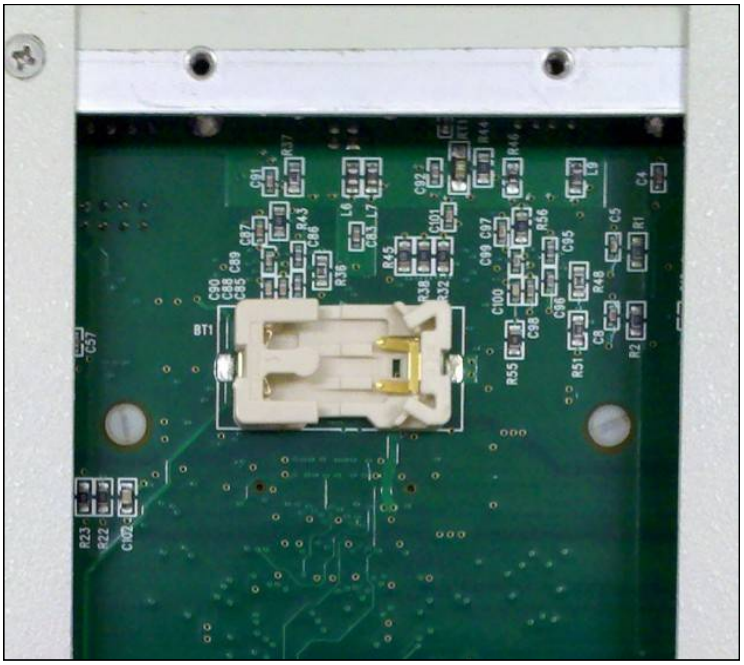

Figure 19-6

3. Battery Installation

a. Locate the new battery and verify the proper orientation as shown in Figure 19-7 – the positive (+) side of the battery must face up.

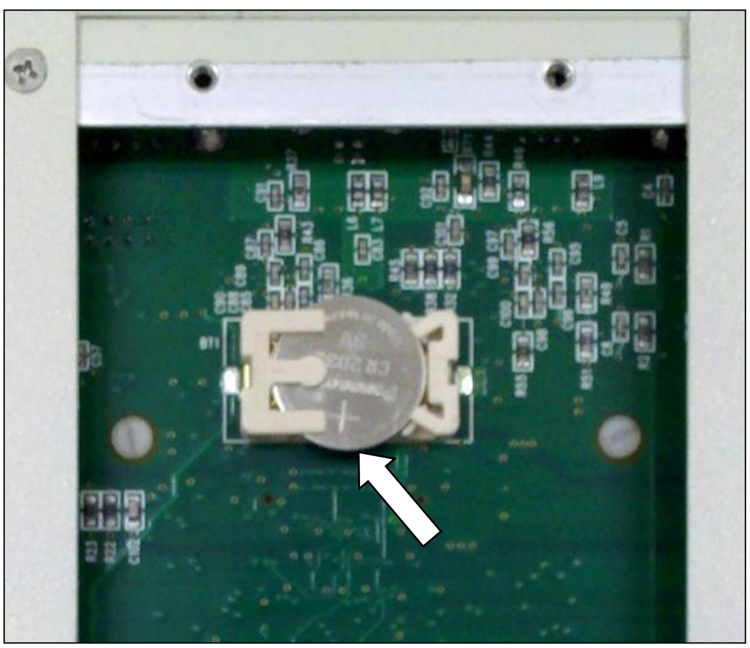

Figure 19-7

b. Slide the battery into the battery holder under the three prongs as shown in Figure 19-8.

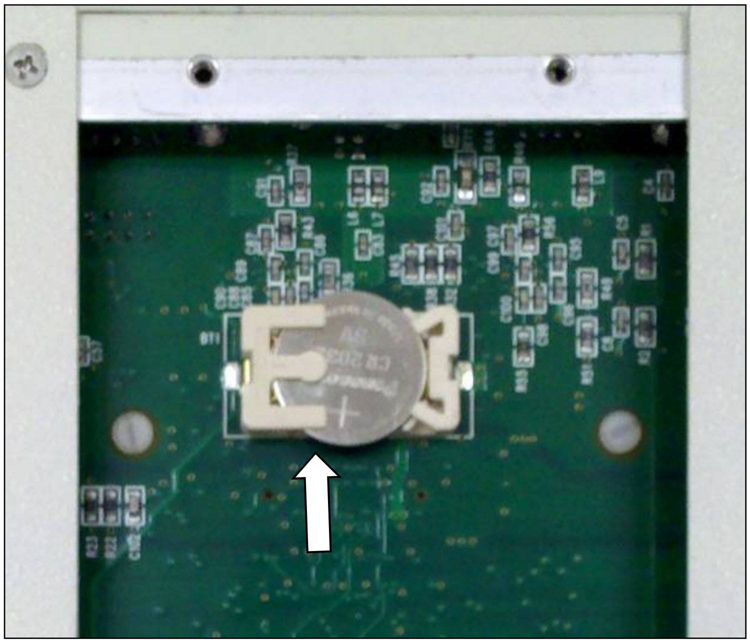

Figure 19-8

c. Press down on the battery as shown in Figure 19-9 until a click is heard.

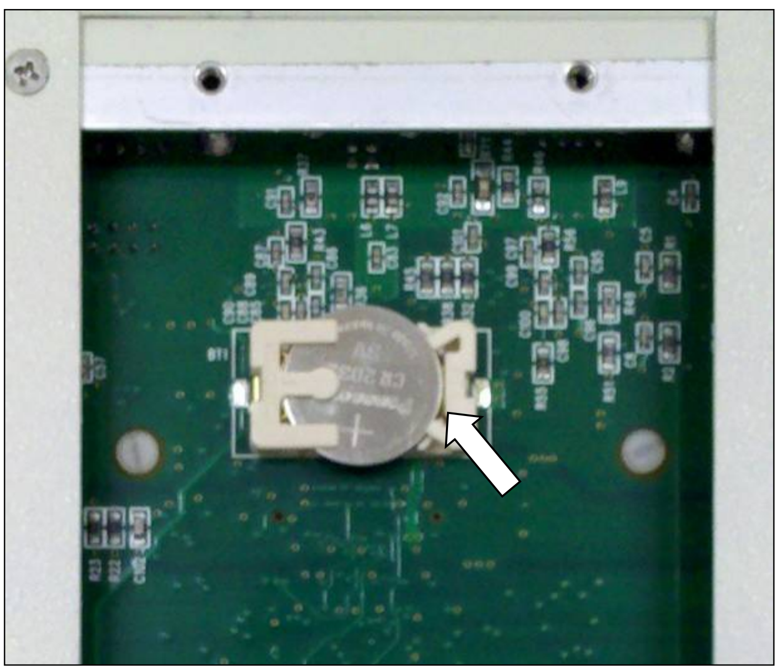

Figure 19-9

d. Verify that the battery is secure in the connector and not loose.

e. Replace the rectangular access panel using the 3 flat head screws.

4. System Power-Up

a. Reconnect the power cord and ALL other cables.

b. Turn on the power to the Readout Unit and verify that Low Battery symbol does not appear on the display.

5. Initialize the System

a. From the Sign-On screen, press **ENTER**.

b. From the Chamber Measurement Screen, press **MENU**.

c. The Factory Password must now be entered. When the menu appears on the display, press the **MENU** key again.

d. When the display goes blank, press **5**, **SPC**, **1**, **3**. (Asterisks will appear on the display while you are typing.)

e. Press **ENTER**. The display will appear as illustrated in Figure 19-10.

```
1. INIT EE
2. SERIAL #
3. CHAMBER
4. COUNTER
```

Figure 19-10

f. Press **1** to select *INIT EE* to initialize the system. Figure 19-11 will appear for several seconds. After the program initialization is complete, Figure 19-10 will re-appear.

```
Please Wait
```

Figure 19-11

g. Figure 19-12Press **2** to select *SERIAL #* to re-enter the Readout Unit's Serial Number. Figure 19-12 will appear.

```
MAIN UNIT

 S/N: 000000


 Correct?
```

Figure 19-12

h. Press **6(NO)** to answer no to the Main Unit Serial Number.

i. Input the serial number of the Main Unit and press **ENTER**.

j. Press **9(YES)** to answer yes to the new serial number. Figure 19-10 will re-appear.

k. Turn off the power switch on the back of the Readout Unit.

6. Re-Initialize the Chamber

   a. Turn on the power to the Readout Unit.

   b. Press **ENTER** at the Sign-On screen to proceed to the Chamber Measurement screen.

   c. Perform a Daily Test as specified in CHAPTER 9: ACCEPTANCE & QUALITY ASSURANCE TESTS to restore the Chamber's parameters to the Readout Unit.

7. Set the date and time as described in CHAPTER 5: SYSTEM INITIALIZATION.

8. If a printer is attached to the system, set the correct printer as described in CHAPTER 5: SYSTEM INITIALIZATION.

9. Re-enter Chamber Data

   a. Re-enter any new or changed Calibration Numbers, Container Correction Factors, user added nuclide information, User keys and Test Source information (as described in CHAPTER 6: CHAMBER INITIALIZATION).

10. Re-enter Well Counter Data

    a. Re-enter the Calibration Factor, Limits, any new or changed Efficiency Data, user added nuclide information, User keys and Test Source information (as described in CHAPTER 7: WELL COUNTER INITIALIZATION).

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.

Chamber

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: the FUSE SERVICING section on page 19-6.

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 9: 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.

Zero activity is indicated with a source in the Chamber.

- System may not be in lowest range. Try pressing **SPC**.

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 10: CHAMBER BACKGROUND AND TESTS, SECTION: BACKGROUND.

The time is reset to 00:00.

- The internal Lithium Coin Battery may be depleted. Reference the BATTERY REPLACEMENT procedure on page 19-7.

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.

Well Counter

WELL key beeps when switching to Well Mode.

- Make sure the Well Counter Cable is plugged into the connector labeled “WELL” on the rear of the Readout unit. Reference CHAPTER 4: SYSTEM SETUP; SECTION: UNPACKING AND INSTALLATION.

High background indication.

- Well liner may have become contaminated. Reference CHAPTER 9: ACCEPTANCE & QUALITY ASSURANCE TESTS; SECTION: CONTAMINATION TEST.
- Background may actually be high. Check by placing a lead sheet over the top of the Well Counter.

Indication of significant negative activity.

- Background level may have changed. Re-measure the Background. Reference CHAPTER 11: WELL COUNTER TESTS; SECTION: BACKGROUND.

RELATED PRODUCTS

The following products are available from Capintec. Call Capintec's only Authorized Service Center at (800) ASK-4CRC 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 Kit... 5130-0006
- Calicheck Linearity Test Kit.. 5120-2144
- Ionization Chamber Well Inserts (liners) 7300-2004
- Plastic Sample Holders (dippers).. 7300-2005
- Syringe Dipper Adaptor (to 1cc).. 7310-1109
- Environmental Shield.. 7300-2450
- Flush Mount Mounting Flange 7310-2307
- Shielded Platform with 2mm shielded glass................................ 5150-3010
- Shielded Platform with 4mm shielded glass................................ 5150-3011
- CAP-Lift remote lowering/raising of syringes or vials 5130-30251
- Test Sources .... CALL
- Well Counter Well Inserts (liners) (pack of 100)........................... 5420-0087
- Well Counter ½" Auxiliary Shield... 5420-2072
- Well Counter PET (1.5") Auxiliary Shield 5420-2141
- Okidata 320 Ticket and Report Printer.. 5110-1150
- Epson LX-300+II Ticket and Report Printer................................. 5110-0126
- Epson Roll Printer... 5430-0058
- Epson Ticket Printer 5430-0100
- HP Inkjet Printer 5430-0146
- Printer Ribbons.. CALL
- Inkjet Cartridges .... CALL
- Multi-part Tickets, Paper, etc. .... CALL
- Fuse: T 2 Amp. 250 Volts. (Readout Unit) 2 Req. 2110-0083
- 3V Lithium Coin Battery (CR2032)... 0500-0039
- Additional copies of Owner's Manual 9250-0123

Note: *Circuit diagrams, component parts lists, descriptions and calibration instructions are available to appropriately qualified personnel.*

SHIPPING

If for any reason the CRC®-25W must be returned to Capintec, the shipping carton must contain the following or equivalent labeling as shown in Figure 19-13 and Figure 19-14. Label stipulating the maximum environmental conditions for safe storage and shipment.

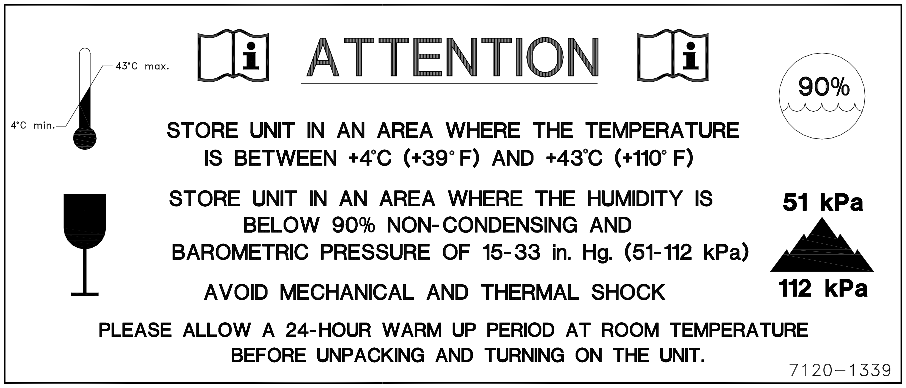

Figure 19-13

Figure 19-14

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

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):

$1\ Ci = 3.7 \times 10^{10}\ s^{-1}$ (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 Bq = 1 Nuclear Transformation per second

$1\ Ci = 3.7 \times 10^{10}\ Bq$

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±) 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/cm^2 (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 βs) 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 4^{th} 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 percent. 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.

SCINTILLATION COUNTER MEASURING PROCESS

Scintillation counting procedures are described briefly. Users of this instrument are encouraged to refer to more detailed discussion elsewhere.

A typical scintillation counter consists of:

- A volume of scintillation phosphor, e.g. NaI(Tl).
- Reflector and protective envelope (with optical window and/or light pipe).
- Photo (light) sensitive detector (photo multiplier, photo diode, micro-channel plate, etc.), and associated circuits.
- Amplifier and signal discrimination circuits, counting and display devices.

A scintillation phosphor is a material which emits light intensity proportional to the energy lost by an ionizing radiation in the phosphorus. The emission of light depends upon the characteristics of the specific phosphorus. NaI(Tl), Thallium activated Sodium Iodide, the most widely used scintillation phosphorus, for example, scintillates at 0.4nm (blue) with the decay constant of 0.23µs.

Photomultipliers (PMT) are often used to convert scintillations to electric signals and to amplify the signals to the level convenient to process further in the counting system.

A wide range of output pulses can be obtained from a PMT. Depending upon the intended applications, the output pulse width is set at 1µs (0.5-3µs) for a typical NaI(Tl) detector.

The output pulse height is proportional to the energy deposited in the scintillator from the event.

Counting Rate Limitations

Any counting system which counts random events will have some limitation in the counting rate range where the instrument can be used for the intended application.

In general, the lower range is limited by the change in the background and the acceptable counting period to achieve required precision. The higher limit is determined by the time resolution of the system, i.e., the dead time, and the pile up of the output signals from the detector.

When a sample of high activity is placed on or near the scintillator, the chances that multiple photons from the sample could interact with scintillator simultaneously within the resolving time of the counting system will be increased. When this occurs, one may not be able to distinguish them as separate events. The pileup events will therefore be counted as one high energy event.

Since a typical resolution of a NaI(Tl) counter is 2-5µs, the counting rate of up to approximately 50kcps can be accurately counted when appropriate counting loss corrections (dead time corrections) is made on the observed counting rate.

The CRC®-25W monitors the instantaneous counting rate. Should the counting rate exceed the present limit, an error message will be displayed.

The activities of samples ranging from 3-4 decades of intensity may be precisely determined by a scintillation counting system.

Comparison of the Scintillation Counter to an Ionization Chamber Type Calibrator in Activity measurements

The CRC® calibrators are widely utilized in nuclear medicine departments. As discussed, an ionization type calibrator provides the means to accurately determine the activity of almost all the samples commonly used in the nuclear medicine department.

However, Ionization type calibrators do not have the capability of discriminating photon energy other than to filter very low energy photons from entering the sensitive volume of the ionization chamber.

The strong dependency of the sample configuration on the measurement, or the effects of variation in the sensitivity of ionization chambers for low energy photons may be reduced by the application of a filter for low energy photon (e.g., 0.2 - 0.5mm copper). For measurement of Sr89, however, application of a filter would not only further reduce a very low output signal from the ionization chamber for Sr89 but would also increase relative sensitivity for Sr85 impurity in the sample to over 100 times that for Sr89.

For example, if a sample of Sr89 containing 0.1% of Sr85 is measured by an ionization chamber with the filter, approximately 10% of the output current would be caused by Sr85, i.e., if the contamination is changed by 0.1% it will result in a change in the activity determination of Sr89 by approximately 10%. Therefore, precise measurement of Sr89 would be difficult by an ionization chamber type calibrator.

As discussed in previous paragraphs, energy discrimination may be achieved by use of a scintillation detector. The impurity in the sample can hence be determined by application of a scintillation counter for Sr89 measurements, and the activity of the sample can be precisely measured.

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APPENDIX II

CHAMBER CALIBRATION NUMBERS

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.

$$\mathrm{R_A} \equiv \frac{\left(\dfrac{\text{Detector Output due to Sample A}}{\text{Activity of Sample A}}\right)}{\left(\dfrac{\text{Detector Output due to SRM Co60}}{\text{Certified Activity of SRM Co60}}\right)} \qquad (1)$$

The sensitivity of the detector for a photon of energy E_i is defined as:

$$\mathrm{S_i} \equiv \frac{\text{Detector Output due to } 3.7\times10^{10} \text{ Photons of } \mathrm{E_i}}{\text{Detector Output due to one Curie of Co60}} \qquad (2)$$

The detector response and the sensitivity have the following relation:

$$\mathrm{R_i} \equiv \sum_i I_i S_i \qquad (3)$$

[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 II-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:

$$\mathrm{G}_{\mathrm{A}} \equiv \frac{1}{R_A} \qquad (4)$$

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:

$$\mathrm{N}_{\mathrm{A}} = \left(\mathrm{R}_{\mathrm{A}} - \left(1 - \frac{\left(R_{Co60} - R_{Co57}\right)}{\left(N_{Co60} - N_{Co57}\right)} * N_{Co60} \right) \right) * \frac{\left(N_{Co60} - N_{Co57}\right)}{\left(R_{Co60} - R_{Co57}\right)} \qquad (5)$$

Entering numerical values:

$$\begin{array}{ll} N_{Co60} = 990 & N_{Co57} = 112 \\ R_{Co60} = 1.000 & R_{Co57} = 0.189 \pm 2\% \\ \text{one obtains:} & N_A = 1076(R_A - 0.080) \end{array} \quad (6)$$

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 ±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 III 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.

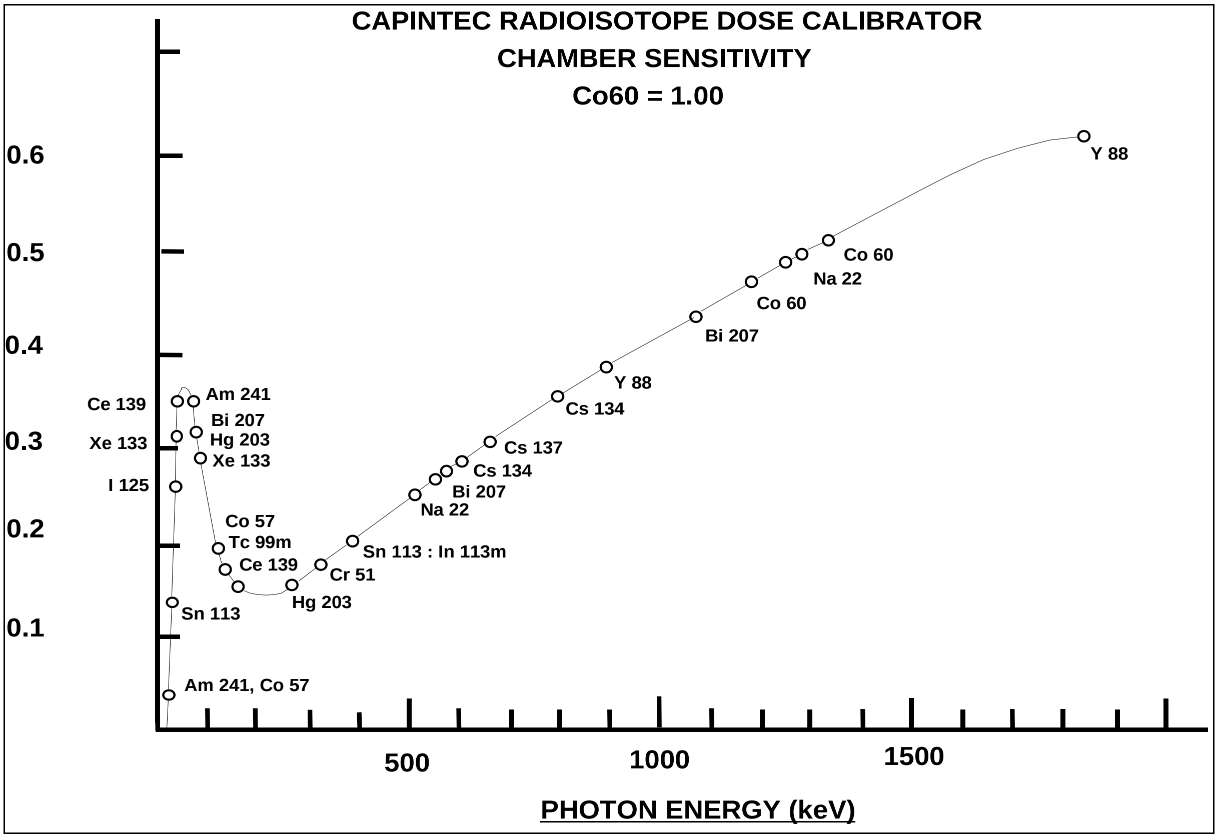

Figure II-1

CALIBRATION SETTING NUMBERS

The Calibration Setting Numbers in Table I are applicable to the Capintec Radioisotope Calibrator only.

The CRC®-25W 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

Abbreviation	Meaning	Abbreviation	Meaning
eqb.	equilibrium	D	days
S	seconds	Y	years
H	hours	E	exponential, i.e.,
M	minutes		3E5 = 3×10^5

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, ±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).

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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 ±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		Half-Life (NCRP-58)	Ref.	Comments
			Syringe 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. eqb. after 15 minutes
^{28}Mg ^{28}Al	Magnesium Eqb. Aluminum	656	3			ORNL76	Reading gives sum of ^{28}Mg & ^{28}Al activity in equilibrium sample.
^{32}P	Phosphorus	750 × 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 × 10			1.28E9 Y 1	NM75	
^{41}Ar	Argon	468			1.827 H 7	ORNL76	
^{42}K	Potassium	033 or 152 × 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 Corr. %	Uncertainty Due to Published Data %	Half-Life (NCRP-58)	Ref.	Comments
^{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 ^{62}Cu	Zinc Eqb. Copper	333				NM75	Reading gives sum of ^{62}Zn & ^{62}Cu activity in equilibrium sample.

Radioisotopes		Calibration Setting Number	Uncertainty Due to Syringe Corr. %	Uncertainty Due to Published Data %	Half-Life (NCRP-58)	Ref.	Comments
^{64}Cu	Copper	015 or 115 $\times$ 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 $\div$ 2		2	14.10 H 1	ORNL76	
^{73}As	Arsenic	324 $\times$ 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 $\times$ 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 $\times$ 10			13 S 1	NM75	Pure
^{81}Rb ^{81m}Kr	Rubidium Eqb. Krypton	270				NM75	Reading gives act. of ^{81}Rb or ^{81m}Kr in equilibrium sample. Eqb. after 2 minutes.
^{82}Br	Bromine	536 $\div$ 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 $\times$ 100		2	10.72 Y 1	ORNL76	
^{85}Sr	Strontium	193		1.0	64.854 D 3	NBS75	
^{86}Rb	Rubidium	411 $\times$ 10			18.64 D 2	ORNL76	
^{86}Y	Yttrium	711 $\div$ 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 Corr. %	Uncertainty Due to Published Data %	Half-Life (NCRP-58)	Ref.	Comments
^{87}Y	Yttrium (Eqb. ^{87m}Sr)	357				ORNL76	Reading gives ^{87}Y Act. in eqb. sample. Eqb. after 18 hours.
^{87}Y / ^{87m}Sr	Yttrium Eqb. Strontium	341		2		ORNL76	Reading gives sum of ^{87}Y & ^{87m}Sr activity in equilibrium sample.
^{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 / $^{95m95}Nb$	Zirconium Eqb. Niobium	145			^{95m}Nb 3.61 D 1	NDT70	Reading gives sum of ^{95m}Nb & ^{95}Nb activity in equilibrium sample. Eqb. after 2 years.
^{97}Nb	Niobium	249			72.1 M 7	ORNL76	
^{97}Zr / ^{97m}Nb	Zirconium Eqb. Niobium	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	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 Corr. %	Uncertainty Due to Published Data %	Half-Life (NCRP-58)	Ref.	Comments
^{99m}Tc	Technetium (Eqb. ^{99}Mo)	175	2			NBS78	
^{99}Mo ^{99m}Tc	Molybdenum Eqb. Technetium	145	2			NBS78	Reading gives sum of ^{99}Mo & ^{99m}Tc activity in equilibrium sample.
^{103}Pd	Palladium	562 × 10	50	4	16.97 D 2	ORNL76	Pure
^{103}Pd ^{103m}Rh	Palladium Eqb. Rhodium	634 × 10	50	5		ORNL76	Reading gives sum of ^{103}Pd & ^{103m}Rh activity in equilibrium sample. Eqb. after 9 hours.
^{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 ^{103m}Rh	Ruthenium Eqb. Rhodium	172	50			ORNL76	Reading gives sum of ^{103}Ru & ^{103m,}Rh activity in equilibrium sample. Eqb. after 9 hours.
^{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 ^{106}Rh	Ruthenium Eqb. Rhodium	480 × 10			369 D 2	NDT70	Reading gives sum of ^{106}Ru & ^{106}Rh activity in equilibrium sample.
^{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 ^{109m}Ag	Cadmium Eqb. Silver	047 or 180 × 2	40	4	462.6 D 4 39.8 S		Reading gives act of ^{109}Cd, ^{109m}Ag, or Total Act. in eqb. sample. Eqb. after 6 minutes.
^{109}Pd ^{109m}Ag	Palladium Eqb. Silver	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.
^{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 ^{113m}In	Tin Eqb. Indium	180	15	3.2	NBS73,77		Reading gives act. of ^{113}Sn, ^{113m}In, or Total Act. in eqb. sample. Eqb. after 15 hours.
^{115m}In	Indium	058	15	2	4.486 H 4	ORNL76	

Radioisotopes		Calibration Setting Number	Uncertainty Due to Syringe Corr. %	Uncertainty Due to Published Data %	Half-Life (NCRP-58)	Ref.	Comments
^{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 / ^{121}Te	Tellurium Eqb. 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.
^{121m}Te / ^{121}Te	Tellurium Eqb. Tellurium	572					Reading gives sum of ^{121m}Te or ^{121}Te in eqb. sample.
^{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 / ^{125m}Te	Antimony Eqb. Tellurium	364	12			NDT70	Reading gives sum of ^{125}Te and ^{125m}Te in eqb. sample. See App. IV for non-eqb. activity.
^{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 / ^{129}Te	Tellurium Eqb. Tellurium	054					Reading gives act. of ^{129m}Te or total act. in eqb. sample. Eqb. in 10 hours.
^{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 Syringe Corr. %	Uncertainty Due to Published Data %	Half-Life (NCRP-58)	Ref.	Comments
^{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 ^{132}I	Tellurium Eqb. Iodine	663				ORNL76	Reading gives sum of ^{132}Te and ^{132}I in eqb. sample.
^{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 ^{137m}Ba	Cesium Eqb. Barium	220		2.0	30.0 Y 2 2.553 M 1	NBS73	Ref: 661.6 & 32.9 keV. Reading gives ^{137}Cs or Total Activity of eqb. sample. Often referred to as "Cs-137" Source.
^{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 Syringe Corr. %	Uncertainty Due to Published Data %	Half-Life (NCRP-58)	Ref.	Comments
^{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 / ^{144}Pr	Cerium Eqb. Praseodymium	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.
^{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 / ^{188}Re	Tungsten Eqb. Rhenium	217 × 10					Reading gives sum of ^{188}W & ^{188}Re activity in equilibrium sample.
^{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 Corr. %	Uncertainty Due to Published Data %	Half-Life (NCRP-58)	Ref.	Comments
^{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 / ^{212}Bi	Lead Eqb. Bismuth	030 or 146 × 2					Reading gives sum of 212Pb & 212Bi activity in equilibrium sample.
^{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.

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APPENDIX III

CHAMBER 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:

$$\text{Activity of "A"} = \frac{\text{Meter Reading with Cal. Number for Pure "A"}}{1 + F\frac{T_A}{T_A - T_B}\left[1 - \exp\left(-\frac{T_A - T_B}{T_A \times T_B} \times t \times 1n2\right)\right]\frac{R_B}{R_A}}$$

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 × 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.

CA47 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

NI56 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

ZN62 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

Y87 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

ZR95 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

TE121M 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

SB125 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

TE129M 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

TE132 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

XE133M 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

XE135M 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

W188 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

PB212 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

APPENDIX IV

OPERATIONAL SUMMARY

Thank you for choosing CAPINTEC. This "Start-Up" aid is designed to allow you to use the CRC®-25W to perform immediate nuclide measurements.

GETTING STARTED WITH CHAMBER MEASUREMENTS

Quality Control & Daily Tests

Prior to making any activity measurements, Daily Tests must be performed.

From the Chamber Measurement screen, press 

. The *Tests Menu* will appear.

TESTS
1. Daily
2. Chamber Volts
3. Accuracy
4. Enhanced
5. Moly Assay

Select Daily by pressing 

. The **Daily Tests** include **Auto Zero**, **Background Adjustment**, **Chamber Voltage Test**, **Data Check**, **Accuracy** and **Constancy.** You will be required to perform your normal or manual Accuracy and Constancy tests if you have not entered your **Reference Source** data in the CRC®-25W. To input **Reference Source** data, refer to CHAPTER 6: CHAMBER INITIALIZATION, SECTION: TEST SOURCES.

Background Adjustment

Background adjustment is performed automatically in the Daily Test sequence. It can also be performed by pressing the Background key.

To perform a Background Adjustment, press BKG. The following screen will appear.

MEASURE BACKGROUND

NO SOURCES
Any Key to Continue

Make sure that no sources are in the vicinity of the Chamber. Press any key, other than the **HOME** key, to begin. When a measurement is ready, the message "OK – ENTER to Accept" will appear.

Press ENTER. The background value will be stored and automatically subtracted from all measurements.

Measuring Nuclide Activity

To measure the activity of a sample, simply place the sample in the dipper, lower it into the Chamber, and select the nuclide from the keypad.

Selecting a Nuclide for Measurement

When measuring the activity of a nuclide, you must indicate the nuclide being measured. This can be accomplished in four (4) simple ways:

1. **PRE-SET NUCLIDE KEYS:** There are 8 pre-defined nuclide keys. Each key is labeled to indicate the corresponding nuclide as shown below.

   F18 Ga67 In111 Tc99m I123 I131 Xe133 Tl201

   Example: To measure Tc99m, place the sample in the Chamber and press Tc99m. The activity for Tc99m is automatically displayed.

2. **USER DEFINED KEYS:** There are 5 User defined keys. You can assign nuclides to these keys. (See CHAPTER 6: CHAMBER INITIALIZATION, SECTION: USER KEY ASSIGNMENT)

   U1 U2 U3 U4 U5

Example: If the assignment for **U1** is Co57, place the sample in the Chamber and press [U1]. The activity for Co57 is automatically displayed.

3. **NUCLIDE KEY:** The Nuclide Key allows you to select a nuclide from the list of nuclides that have been stored in the memory. Simply press the **NUCL** key and use the alphanumeric (number/letter) keys to specify the nuclide. After inputting the values press the **ENTER** key.

   Example: To measure Co60, place the sample in the Chamber and press [NUCL]. Press [ABC 2] [MNO 6] [MNO 6] [QZ 0]. Press [ENTER]. The activity for Co60 is automatically displayed.

4. **CALIBRATION NUMBERS:** To measure the activity of a nuclide that is not stored in the memory, Pre-Set keys, or User defined keys, press the **CAL#** key, input the Calibration Number for the nuclide using the alphanumeric (number/letter) keys, and press the **ENTER** key. The activity can then be measured. Simply place the sample in the Chamber.

   Note: *Calibration Numbers for Chambers are listed in Appendix II.*

   Example: Press [CAL#]. Input the Calibration Number. Press [ENTER].

Future Activity

The CRC®-25W has a special feature that allows you to automatically determine the activity of a sample at some point in the future. From the Measurement screen, press **TIME**.

Example: Press [TIME]. Input the new time & date in the 24-hour format. Press [ENTER]. The “FUTURE” activity is displayed.

Enter Test Source Data

(Reference CHAPTER 6: CHAMBER INITIALIZATION, SECTION: TEST SOURCES)
The Test Source Data must be entered from the *Main Setup Menu*. To access this menu, press [HOME] to return to the Chamber Measurement Screen. Press [MENU] to display the *Main Menu*.

1. Inventory
2. Calculations
3. Diagnostics
4. Setup

Select *SETUP*. The *Setup Menu* will appear.

SETUP
1. Time
2. Ci/Bq
3. Printing
4. Other
5. Screen

Select *OTHER*. Input the password (last 3-digits of the readout serial number) and press ENTER. The *Other Menu* will appear.

1. User Keys
2. Sources
3. Moly Setup
4. Nuclides
5. Linearity
6. Remote / PC

Select *SOURCES*. The *Test Sources Menu* will appear.

1. Co57
2. Co60
3. Ba133
4. Cs137
5. Ra226
6. Constancy

Select Cs137. The system will display

Cs137
[displays Test source data or message “NO SOURCE”]
OK? Y or N

If the Test Source data has been input in the system, verify that these are the dates from your Cs137 Test Source and press **YES**. Press **NO** if the dates are incorrect or if no source data has been entered in the system.

Input the serial number of the Test Source and press **ENTER**. Input the Calibration Day and press **ENTER**. Input the Calibration Activity and press **ENTER**. Press **YES** to answer yes to “Use Daily?”.

The system will display the entered data. Verify the data and confirm with **YES**. To correct any errors, press **NO**.

Press HOME to return to the Chamber Measurement Screen.

GETTING STARTED WITH WELL COUNTER MEASUREMENTS

From the Chamber Measurement screen, press WELL to access the Well Counter.

Background Measurement

Before performing the first measurement of each day, the following screen will appear:

```
MEASURE WELL
 BACKGROUND
 NO SOURCES
MENU key for Setup
or Another key
to Continue
```

Make sure that no sources are in the vicinity of the Well Counter. Press any key except **MENU** or **HOME** to continue with the Background measurement.

The system will prompt you through a Background measurement. When the Background measurement is complete, you will see the message "ENTER or WELL to SAVE". Pressing **ENTER** will print (if a printer is attached to the system) and store the Background value. Pressing **WELL** only stores the Background value. The Background will be subtracted automatically from all measurements.

Background adjustment can be also performed at any time by pressing the Background BKG key from the Well Measurement screen.

Daily Test

Prior to performing any activity measurements, the Daily Test must be performed on the Well Counter. The test requires a Cs137 or Ba133 Standard Source. The source data must be entered into the system. To input Test Source data, reference the ENTER TEST SOURCE section below.

From Well Measurement screen, press TEST. The Test screen will appear.

```
      TEST

 Measure Cs137

Any Key to Continue
```

Place the Cs137 (or Ba133) Test Source into the Well Counter and press any key (except **HOME**) to continue. Press COUNT to start the test. The test procedure checks the calibration of the Well Counter. If the **Activity Deviation** is greater than **±5%**, check your Test Source dates and re-measure the **Efficiency** for the Cs137 (or Ba133) Standard Source (reference the EFFICIENCIES section below). If the test fails, it will be necessary to perform an **Auto**

Calibration (reference CHAPTER 11: WELL COUNTER TESTS; SECTION: AUTO CALIBRATION).

Enter Test Source

(Reference CHAPTER 7: WELL COUNTER INITIALIZATION; SECTION: TEST SOURCE DATA)

The Test Source must be entered from the Well Setup Menu. To access this menu, press HOME to get to the Well Measurement screen.

Press MENU . The *Well Main Menu* will appear.

```
1. Measure
2. Auto Cal
3. Setup
4. Lab Tests
5. MDA Test
```

Select *SETUP* by pressing DEF 3 . Input the password (last 3-digits of the readout serial number) and press ENTER . The *Setup Menu* will appear.

```
1. Nuclides
2. Test Source
3. Trig. Level
4. Efficiencies
5. User Keys
6. Reset HV
```

Select *TEST SOURCE* by pressing ABC 2 . If a Test Source has been previously input, the data for the source will be displayed for verification; otherwise, the Select Test Source screen will appear.

```
Select Source W
1. Cs137
2. Ba133
```

Select the source that will be used.

Input the serial number of the Test Source and press **ENTER**. Input the Calibration Day and press **ENTER**. Input the Calibration Activity and press **ENTER**.

The system will display the entered data. Verify the data and confirm with **YES**. To correct any errors, press **NO**.

Press HOME to return to the Well Measurement screen.

Efficiencies

(Reference CHAPTER 7: WELL COUNTER INITIALIZATION; SECTION: EFFICIENCY DATA)

In order to get an activity reading, it is necessary to measure the Efficiencies for the nuclides that will be used. Obtain a Standard Source for each nuclide and measure the Efficiency in the Well Counter.

Measure Efficiencies

Note: *Before measuring efficiencies, the unit must be in Well Counter mode.*

From the Well Measurement screen, press MENU. The *Well Main Menu* will appear.

```
1. Measure
2. Auto Cal
3. Setup
4. Lab Tests
5. MDA Test
```

Select *SETUP* by pressing DEF 3. Input the password (last 3-digits of the readout serial number) and press ENTER. The *Setup Menu* will appear.

```
1. Nuclides
2. Test Source
3. Trig. Level
4. Efficiencies
5. User Keys
6. Detector
```

Press GHI 4 to select *EFFICIENCIES*. The Choose Nuclide screen will appear.

```
CHOOSE NUCLIDE

Press NUCL or
Pre-set nuclide key
or User key
or CAL# for All Chans
```

Select the Isotope to measure via the keypad and press **ENTER**.

Example: Cs137 Press NUCL. Press ABC 2 PRS 7 - 1 DEF 3 PRS 7

Press ENTER.

The entered nuclide will be displayed. Confirm the entry with **YES**. If there is already an Efficiency for the selected isotope in the system, the values will be displayed.

Press **NO** to re-measure the Efficiency. The *Efficiency Entry Method Menu* will appear.

```
1. Input Eff
2. Measure Eff
```

Select *MEASURE EFF*. Input the Calibration Date of the Standard Source and press **ENTER**. Input the Calibration Time of the Standard Source and press **ENTER**. Input the Calibration Activity of the Standard Source and press **ENTER**.

The system will display the entered data. Verify the data and confirm with **YES**. To correct any errors, press **NO**.

Place the source in the Well Counter and press any key (except **HOME**) to continue.

Press **COUNT** to start the measurement.

After the measurement, the Channel selection screen will appear.

```
Y selects channels
→ CH1   CH4
  CH2   CH5
  CH3   CH6
ENTER when finished
```

The channels that will be used to calculate activity must be selected. Select the Channels that correspond with the main energy peak(s) of the isotope.

Channel	Energy Range in keV
1	15 to 100
2	100 to 200
3	200 to 400
4	400 to 660
5	660 to 800
6	> 800

Use the **UP ARROW (⇖)** and **DOWN ARROW (⇘)** keys to move the pointer (right arrow ➔) so that it points to the channel to be selected (or de-selected) and then press the **Y** key.

Press **ENTER** after all the desired channels are selected.

The new Efficiency will be displayed. Press **YES** to confirm.

Press **HOME** to return to the Well Measurement screen.

Selecting a Nuclide for Measurement

You can select a nuclide in three different ways:

1. **PRE-SET NUCLIDE KEYS:** The Well Counter has 8 pre-defined nuclide keys. Each key is labeled to indicate the corresponding nuclide as shown below.

   Note: *These keys are only valid for Well Counting when Efficiency Data have been measured or input.*

   Note: *Before using one of these keys, the nuclide must be assigned to current category. (Reference CHAPTER 7: WELL COUNTER INITIALIZATION; SECTION NUCLIDE SELECTION)*

   F18 Ga67 In111 Tc99m I123 I131 Xe133 Tl201

   Example: To measure Tc99m, place the sample in the Well Counter press COUNT to start the measurement. When the measurement is complete, press Tc99m. The activity for Tc99m is automatically displayed.

2. **USER DEFINED KEYS:** The Well Counter has 5 user defined keys. Nuclides can be assigned to these keys.

   Note: *Before using one of these keys, a nuclide must be assigned to the key. (Reference CHAPTER 7: WELL COUNTER INITIALIZATION; SECTION: USER KEY ASSIGNMENT)*

   U1 U2 U3 U4 U5

   Example: If the assignment for **U1** is Co57, place the sample in the Well Counter and press COUNT to start the measurement. When the measurement is complete, press U1. The activity for Co57 is automatically displayed.

3. **NUCLIDE KEY:** The Nuclide Key allows a nuclide to be selected from the list of nuclides that have been stored in the memory. Simply press the **NUCL** key and use the alphanumeric (number/letter) keys to specify the nuclide. After inputting the values, press the **ENTER** key.

   Note: *Before using one of these keys, the desired nuclide must be assigned to current category. (Reference CHAPTER 7: WELL COUNTER INITIALIZATION; SECTION: NUCLIDE SELECTION)*

Example: To measure Co60, place the sample in the Well Counter and press COUNT to start the measurement. When the measurement is complete, press NUCL . Press ABC 2 MNO 6 MNO 6 QZ 0 . Press ENTER . The activity for Co60 is automatically displayed.

Measuring Nuclide Activity

To perform an activity measurement, place the sample in the Well Counter.

Input the counting time via the numeric keypad and press **ENTER**. Press **COUNT *(START/STOP)*** to start counting. Pressing **COUNT *(START/STOP)*** again will stop the measurement, if so desired.

During the counting period, press the **DISPLAY *(NUM/GRAPH)*** key to display a Bar Graph of the net counting rate per channel and remaining counting period. Press the **DISPLAY *(NUM/GRAPH)*** key again to return to the counting screen. The screens are updated every second.

When the measurement has been completed, a record of the measurement can be printed by pressing **ENTER *(PRINT)*** when the Counting Results Screen or Bar Graph Screen is displayed. If the Bar Graph Results Screen is displayed, the Bar Graph will also be printed.

Measurement without Nuclide Selection

The CRC®-25W allows measurement without a nuclide selected. The system then calculates and displays the results in cpm (or cps) for all the channels.

Place the sample in the Well Counter and input the counting time via the numeric keypad and press **ENTER**. Press **COUNT *(START/STOP)*** to start counting. Pressing **COUNT *(START/STOP)*** again will stop the measurement, if so desired.

Press CAL# ***(COUNTING RATE)***. No nuclide name is displayed.

For Technical Assistance, contact
Capintec's <u>only</u> Authorized Service Center at (800) ASK-4CRC.

INDEX

NEW PRODUCT WARRANTY

Conditions and Limitations

CAPINTEC warrants our products to be free from defects in material and workmanship for a period of 24 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 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.

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CAPINTEC, INC.

DECLARATION OF CONFORMITY
THE EC DIRECTIVE AND CE MARKING

We, Capintec, Inc.
7 Vreeland Road
Florham Park, NJ 07932
Phone (800) ASK-4CRC
Fax (201) 825-1336

declare under our sole responsibility that the product CRC®-25W RADIOISOTOPE DOSE CALIBRATOR (including use with Epson Roll and Epson Slip printers) to which this declaration relates is in conformity with the Medical Device Directive 93/42/EEC and the In Vitro Diagnostic Device Directive 90/385/EEC.

This product is in conformity with the following standards or other normative documents following:

1. EN61010-1
2. EN61326-1
3. EN61326-2-6

Certified to Annex V of the Directive 93/42/EEC on Medical Devices
Dose Calibrators, Class I with measuring function
Certified through Intertek Semko AB, Notified Body MDD
CE Mark as shown denotes conformance to the above statement.

CE 0413

The Technical Construction File is maintained at:
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