OPERATION MANUAL

Model EIC-1

June 2005

Far West Technology, Inc.
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GENERAL INFORMATION

This instrument is manufactured in the United States of America by:

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Far West Technology has been manufacturing radiation measuring devices since 1972.

REPAIR SERVICE

Although we design and manufacture our instruments to a high standard, we realize that repairs are sometimes necessary. If you believe service is needed on this instrument please call our service department before shipping the instrument to us for repair; often we can help you with simple problems. If you do decide to return it to us for repair then please include:

1. Contact person's name
2. Organization or Company name
3. Address
4. Phone number of contact person
5. Description of the problem
6. Anything else you may think important

We will inform you of the repair charges and wait for your authorization before we repair your instrument.

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I. INTRODUCTION

The EIC-1 is a three terminal guarded tissue equivalent parallel plate ionization chamber. It is usually used for skin sparing measurements. The electrode spacing is continuously adjustable making it a true extrapolation chamber.

The detecting volume (which includes one-half of the insulator thickness on each side) is a right circular cylinder whose height is adjusted by turning an aluminum ring on which the entrance window is mounted. This ring turns on a brass sleeve, and a reference mark permits repeatable settings.

The entrance window is either conductive polyethylene or the optional dag-coated polypropylene window. The collecting electrode and the guard ring are made of conducting tissue equivalent plastic, and the signal insulator is polyethylene. The inner wall of the adjustable ring carrying the entrance window has a 0.150-inch-thick polyethylene liner to prevent electron contamination from the aluminum wall. No metal is exposed to the chamber interior.

II. OPERATION

The extrapolation chamber needs to be connected to an electrometer and a high voltage (HV) power supply to operate. Use low noise cable with BNC connectors on each end to connect to the chamber and electrometer. The electrometer may have a triaxial connector for it's input. In this case a triax to BNC adaptor will be necessary. The HV cable should be an RG-59 type with MHV connectors. The power supply may be equipped with a SHV out, in which case, a HV cable with an SHV connector on one end and a MHV connector on the other end is needed. You may be able to find a MHV to SHV adaptor, which will enable you to use a cable with MHV connectors on both ends. Voltage on this chamber is not to exceed 500 volts so there is no need for the SHV connector, other than convenience.

Caution should be used when HV is applied to the chamber, because the outer shell and window are at HV. If contact is made with the shell, there is a 10 meg resistor in the HV line to prevent severe shock or damage to the instrument. Always turn the HV off when handling the chamber, such as changing the plate spacing. Another area of concern is the thin window, which can be easily damaged. Do not get tape on the window. Just handle it with care. The chamber has spacing up to 4 plus turns and should not be forced when it comes to the stop at either end of its range. The internal stops are polyethylene and will hang up if forced.

The electrometer can be used in the current (ampere, fast) mode or in the coulomb mode. The current mode can be used when there is sufficient source strength. When lower source strengths are measured the electrometer needs to be switched to the coulomb fast mode. Taking data with plus and then minus HV and averaging the current or coulomb readings will minimize recombination error and stem effects. This is important when the current is very low. Take some readings with positive and negative voltages. If there is a significant difference between the two readings, you should use the averaging method.

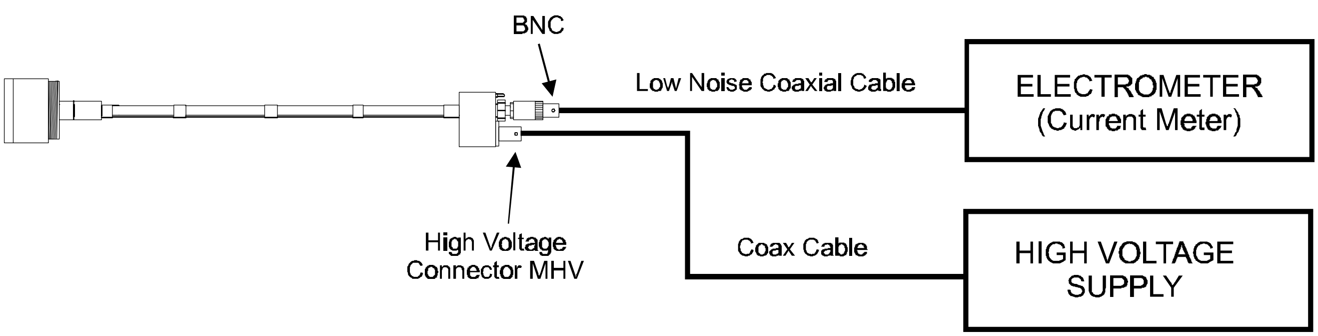

Figure 1 Ionization Chamber Electrical Connection

A. Using the current mode.

The EIC-1 ionization chamber should be used with the source aimed at the window on the end of the chamber. Turn on the HV to ±250 volts (the chamber was calibrated at 250 volts and this voltage will work well for most applications, except use 50 volts when using the chamber at 0 turns). Choose the current (I) range that will give significant numbers. Change the polarity of the HV and see if there is a notable difference in plus and minus readings. If there is not, use one polarity, take three readings and average the data. If there is a notable difference, take three readings in both plus and minus polarity and average the data.

The dose rate is obtained by multiplying the current (I = coul/sec) by the chamber calibration (R/coul). To change R/sec to R/hr, multiply by 3600 sec/hr.

B. Using the Coulomb mode.

Choose the range that will give you a reading in approximately one minute, for good accuracy. If, for instance, you choose 0.4 x 10^{-9} coulombs, with a stopwatch record the time it takes to accumulate that amount. Take three readings with plus 250 volts and three readings with negative 250 volts and average the time. If you are taking readings at several space settings, continue the above for each setting.

To obtain dose rate from your data, divide the coulombs by the average time in seconds to get coulombs per second. Next multiply the coul/sec by your EIC-1 calibration in R/coul, times 3600 to achieve the dose rate in R/hr. For instance, if you were timing the data for 0.4 x 10^{-9} coulombs, the average collection time was 68.32 seconds and your chamber calibration was 3.78 x 10^{9} R/coul, the following equation would be used.

$$\frac{0.4x10^{-9}\,coulombs}{68.32\,\sec onds}\times 3.78x10^{9}\,R/coul\times 5.58x10^{-12}\,coul/\sec\times 3600 = 79.64R/h$$

C. Measuring the distance from a source.

The center of the volume of the chamber should always be used in measuring the distance to the source. If you are using the EIC-1 at 4 turns (4mm) the measurement should be an additional 2 mm from the front of the chamber window. Each complete turn of the shell moves the window 1 mm distance.

D. Using the chamber in the gas flow mode.

The EIC-1's electrode and guard is made of tissue equivalent plastic, so one would want to use tissue equivalent gas if a true tissue equivalency is required. The flow rate of gas should not exceed 5cc/min otherwise bulging of the window may occur or pressure buildup, causing false readings. Readings increase by a fact or of about 1.14 when using tissue equivalent gas (methane base, 64.4% CH_4, 32.5% CO_2, and 3.1% N_2 by volume).

III. BUILDUP DISKS

Buildup disks are used to determine the thickness of material needed for electron equilibrium. The disks are placed in front of the window for this purpose. Some use tape for this purpose. Caution must be used to not get adhesive on the window as it will tear the window. It will also be damaged when trying to remove any tape that is stuck to it.