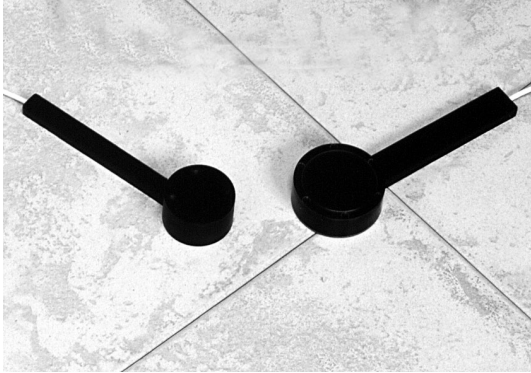


SeeDOS Product User Manual

**MAGNA Mammographic  
Ionization Chamber**



# Table of Contents

Precautions .....	2
Customer Responsibility .....	2
Features & Specifications .....	3
Overview .....	3
Operation .....	4
Calibration of MAGNA .....	7
Maintenance .....	7
Service .....	7
Parts and Accessories List .....	8

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## **Precautions**

- ⚠ CAUTION: Proper use of this device depends on careful reading of all instructions and labels.
- ⚠ CAUTION: This device should never be submerged to clean or scrubbed with an abrasive cleaner.
- ⚠ CAUTION: Do not drop or mishandle unit. Calibration factor changes may result.
- ⚠ CAUTION: Electrical shock hazard when connected to 300 V bias supply. Do not remove cover.
- ⚠ CAUTION: Do not disassemble main unit since it may result in change of calibration factor. Refer all servicing to qualified individuals.
- ⚠ CAUTION: Do not sharply bend triax cable. Damage to the cable may result in high leakage currents.

## **Customer Responsibility**

This product and its components will perform properly and reliably only when operated and maintained in accordance with the instructions contained in this manual and accompanying labels. A defective device should not be used. Parts which may be broken or missing or are clearly worn, distorted or contaminated should be replaced immediately with genuine replacement parts manufactured by or made available from Standard Imaging Inc.

Caution: Federal law in the U.S.A. and Canada restricts the sale, distribution or use of this device to, by or on the order of a licensed medical practitioner. The use of this device should be restricted to the supervision of a qualified medical physicist.

Should repair or replacement of this device become necessary after the warranty period, the customer should seek advice from Standard Imaging Inc. prior to such repair or replacement. If this device is in need of repair, it should not be used until all repairs have been made and the product is functioning properly and ready for use. After repair, the chamber may need to be calibrated. The owner of this device has sole responsibility for any malfunction resulting from abuse, improper use or maintenance, or repair by anyone other than Standard Imaging Inc.

The information in this manual is subject to change without notice. No part of this manual may be copied or reproduced in any form or by any means without prior written consent of Standard Imaging Inc.

## Features and Specifications

Active Volume	1 cm <sup>3</sup> (REF 92600) or 3 cm <sup>3</sup> (REF 92650) parallel-plate chamber	
Materials	Air equivalent plastic, acrylic	
Entrance window	Kapton conductive film	
Connector	Two lug triax (standard) Center pin = Collector Inner Guard = Chamber Guard Outer Housing = HV GND	
Cable Length	1 m (39.4 inches)	
Bias Voltage	Normal operation at +/-300 Vdc	
Leakage Current	Less than $5 \times 10^{-14}$ A	
Reference Point	Scribed line around circumference of Outer Chamber Housing is half way between the collector and the entry window.	
Accuracy	+/- 1.0 %	
Stability	0.2%	
Response	92600: Flat response over 30kVp to 150kVp $\pm$ 2% 92650: Flat response over 30kVp to 150kVp $\pm$ 4%	
Calibration response	3 R / nC (M1) or 9 R / nC (M3)	
Sensitivity	30 pA	
A <sub>ion</sub>	Typically 1.000	
Carrying case	Custom designed with foam holder	
Chamber Dimensions	<u>92600</u>	<u>92650</u>
Height	2.54 cm	2.08 cm
Outside Diameter	4.13 cm	5.33 cm
Inner Plate separation	8 mm	8 mm
Weight	0.2 kg	0.2 kg

Specifications subject to change without notice.

## Overview

The Standard Imaging MAGNA Ionization chamber is a parallel-plate ionization chamber. It is specifically designed for use with both mammography and general diagnostic energy x-ray regions, with the appropriate calibration. The nominal calibration factor for various applications using the MAGNA 1 cm<sup>3</sup> chamber (REF 92600) is 3 R/nC  $\pm$  3% and the MAGNA 3 cm<sup>3</sup> chamber (REF 92650) is 9 R/nC  $\pm$  3% over the entire diagnostic range; it is within  $\pm$  1% between the half value layers of 0.2 mm Al to 0.5 mm Al, which is the mammographic

range. Mammography dose calculations and half value layer measurements depend on accurate exposure calibrations. It is recommended that the chamber be calibrated every two years as is standard practice for other ionization chambers. Calibration factors should be obtained from an ADCL for each x-ray energy that is being measured. The appendix provided with the ADCL calibration report discusses the calibration factors in greater detail. The measurement of all x-ray energies requires an electrometer with a calibrated scale for measuring charges of 0.5 nC.

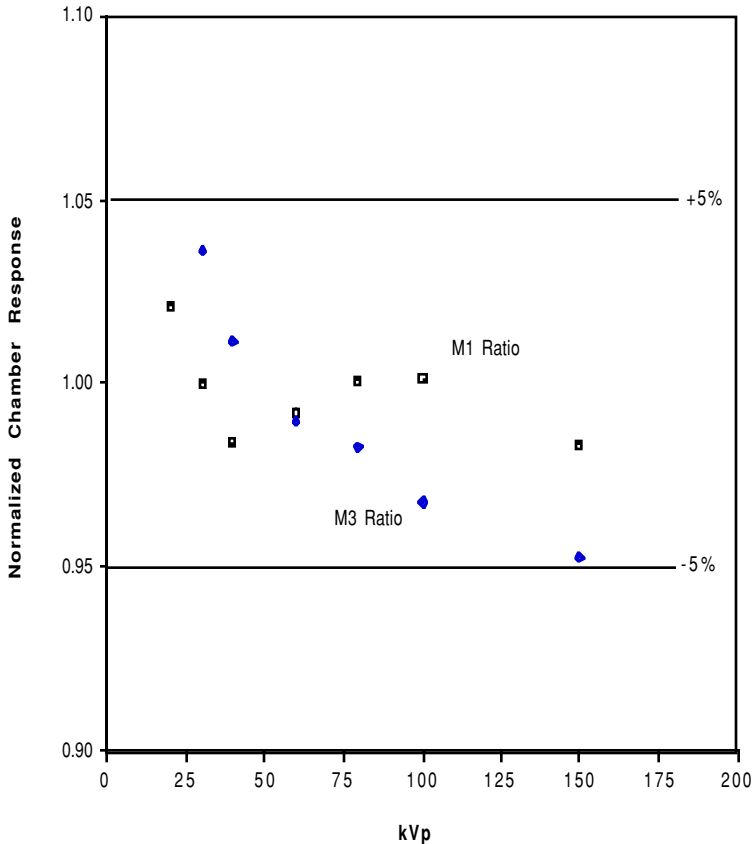
## **Operation**

A typical energy response curve for the MAGNA ionization chamber is shown in **Figure 1**. The MAGNA utilizes a conventional triax connector and cable to be connected to a suitable electrometer. A bias of 300 volts must be applied to the electrometer low-impedance connection relative to chassis ground. The voltage polarity effect is less than 0.1%. A second bias level of 150 volts can also be used to determine the ionic recombination loss at 300 V.<sup>1</sup> The ionic recombination loss is less than 0.05% and can be considered negligible. The MAGNA ionization chamber has a vent hole to maintain the internal air at ambient atmospheric pressure. Thus, the readings obtained must be corrected for ambient temperature and pressure to the temperature and pressure of calibration (22° C and 760 mm Hg) at “normal” relative humidity (50%+/-25% non-condensing) in the usual accepted manner.

### **A. Procedures for measurement of Mammography rays:**

1. Place the MAGNA chamber in the same room as the mammography unit for at least 30 minutes before the measurement to allow it to equilibrate to ambient temperature and pressure.
2. Connect the MAGNA chamber to a suitable electrometer, and apply 300 V bias voltage.
3. Place the MAGNA into a suitable holder (foam insert in MAGNA box can be used to place ion chamber front surface at 4.5cm height from receptor).
4. Set mammography unit for typical exposure and expose for a series of measurements.
5. Read and record the measured charge for each exposure. The readings can be averaged.

<sup>1</sup> The equation used is  $A_{ion} = 4/3 - (Q_1/3Q_2)$ , where  $Q_1$  is the charge or current collected at 300 V and  $Q_2$  is the charge collected at 150 V.



**Figure 1:** Typical energy response shown for the energy range 20 kVp to 150kVp.

6. Use correction factors for temperature/pressure, electrometer correction factor (electrometer must be calibrated) and calibration factor for the MAGNA given by the Accredited Dosimetry Calibration Laboratory to calculate the exposure for the time set on the x-ray unit. The following equation can be used

$$X = R * F * E * C$$

where:

X = the exposure using the calibration factor provided by the ADCL.

R = the reading in coulombs (note that this charge is measured for a set time on the x-ray unit).

F = the temperature and pressure correction factor

E = the correction factor for the electrometer scale

C = the MAGNA calibration factor

**Note:** R can be divided by  $A_{ion}$  if desired to correct for recombination effects. Since the MAGNA has an  $A_{ion}$  of 1.000, this is not necessary.

For example,

if R = 0.21 nC, F = 1.021, E = 0.999 and C = 2.1 R/nC, then  $X = (2.14 \times 10^{-9}) * (1.021) * (0.999) * (2.1 \times 10^9) = 0.45 R$  (450 mR)

## **B. Procedures for the measurement of Diagnostic x-rays:**

1. Allow the MAGNA chamber to equilibrate to ambient temperature and pressure as discussed in step A1.
2. Connect MAGNA chamber to a suitable electrometer and apply 300 V bias voltage.
3. Position the MAGNA chamber at the appropriate distance to be measured around Outer Ring showing center of active volume.
4. Set the x-ray unit for typical exposure and expose for a series of measurements.
5. Read and record the measured charge for each exposure. The readings can be averaged.
6. Use correction factor for temperature/pressure, electrometer correction factor (electrometer must be calibrated) and calibration factor for the MAGNA given by the Accredited Dosimetry Calibration Laboratory to calculate the activity of the given source. The following equation can be used

$$X = R * F * E * C$$

where:

X = the exposure using the calibration factor provided by the ADCL.

R = the reading in coulombs (note that this charge is measured for a set time on the x-ray unit).

F = the temperature and pressure correction factor

E = the correction factor for the electrometer scale

C = the MAGNA calibration factor

**Note:** X can be divided by  $A_{ion}$  if desired to correct for recombination effects. Since the MAGNA has an  $A_{ion}$  of 1.000, this is not necessary. Again the example as given above in A6 with the appropriate values of R, F, E, and C is applicable.

## **Calibration of MAGNA**

As is standard practice for other ion chambers, it is recommended that the MAGNA be calibrated every 2 years. This calibration should be performed by an Accredited Dosimetry Calibration Laboratory. Standard Imaging offers calibrations from the University of Wisconsin Accredited Dosimetry Calibration Laboratory. You need only one purchase order to cover calibrations, shipping and handling, and service. Standard Imaging hand carries all instruments to and from the ADCL.

## **Maintenance**

Since this is a precision piece of equipment, it is recommended that Standard Imaging be contacted to discuss any significant problem with this chamber. The entrance window of the MAGNA is fragile; cleaning should be accomplished by blowing with air only. Exterior cleaning of the remainder of the device can be done with a soft brush and a cloth. Gently brush all surfaces to remove dirt and dust. Remove any remaining dirt with a cloth slightly dampened with a solution of mild detergent and water or a liquid disinfecting agent. Be especially careful that this is an external cleaning only and do not permit any liquid to seep into the MAGNA in any manner during cleaning.

## **Service**

There are no serviceable parts on the MAGNA. If the MAGNA is disassembled, the calibration factor will become invalid necessitating recalibration. Also, the warranty will become void if the MAGNA is disassembled. If the triax connector and external cable are modified, the value of the leakage may be affected.



## Parts and Accessories List

70004	9 meter triaxial extension cable with two lug triax connectors: Other lengths upon request
70006	BNC to TNC adapter
70015	Adapter cable, BNC/M to BNC plus banana
80028	MAGNA Instruction Manual
80050	Chamber Calibration for one energy
92003	Carrying case for M600
92600	MAGNA 1cm <sup>3</sup> Ion Chamber
92650	MAGNA 3cm <sup>3</sup> Ion Chamber
90003	EXCALIBUR CDX 2000 Electrometer
80015	Electrometer calibration, Amp and Coulomb scales

***Notice:** We welcome your evaluation of this manual. Your comments and suggestions help us improve our publications.*

## Warranty

Standard Imaging, Inc. sells this product under the warranty herein set forth. The warranty is extended only to the buyer purchasing the product directly from Standard Imaging, Inc. or as a new product from an authorized dealer or distributor of Standard Imaging, Inc.

For a period of twenty-four (24) months for well chambers and twelve (12) months for all other Standard Imaging, Inc. products from the date of original delivery to the purchaser or a distributor, this product is warranted against functional defects in materials and workmanship, provided it is properly operated under conditions of normal use, and that repairs and replacements are made in accordance herewith. The foregoing warranty shall not apply if the product has been disassembled, altered or repaired other than by Standard Imaging, Inc. or if the product has been subject to abuse, misuse, negligence or accident.

Standard Imaging's sole and exclusive obligation and the purchaser's sole and exclusive remedy under the above warranties are limited to repairing or replacing free of charge, at Standard Imaging's option, a product: (1) which contains a defect covered by the above warranties; (2) which are reported to Standard Imaging, Inc. not later than seven (7) days after the expiration date of the 12 or 24 month warranty period; (3) which are returned to Standard Imaging promptly after discovery of the defect; and (4) which are found to be defective upon Standard Imaging's examination. Transportation charges are the buyer's responsibility. This warranty extends to every part of the product except fuses, batteries, or glass breakage. Standard Imaging, Inc. shall not be otherwise liable for any damages, including but not limited to, incidental damages, consequential damages, or special damages. Repaired or replaced products are warranted for the balance of the original warranty period, or at least 90 days.

This warranty is in lieu of all other warranties, express or implied, whether statutory or otherwise, including any implied warranty of fitness for a particular purpose. In no event shall Standard Imaging, Inc. be liable for any incidental or consequential damages resulting from the use, misuse or abuse of the product or caused by any defect, failure or malfunction of the product, whether a claim of such damages is based upon the warranty, contract, negligence, or otherwise.

This warranty represents the current standard warranty of Standard Imaging, Inc. Please refer to the labeling or instruction manual of your Standard Imaging, Inc. product for any warranty conditions unique to the product.