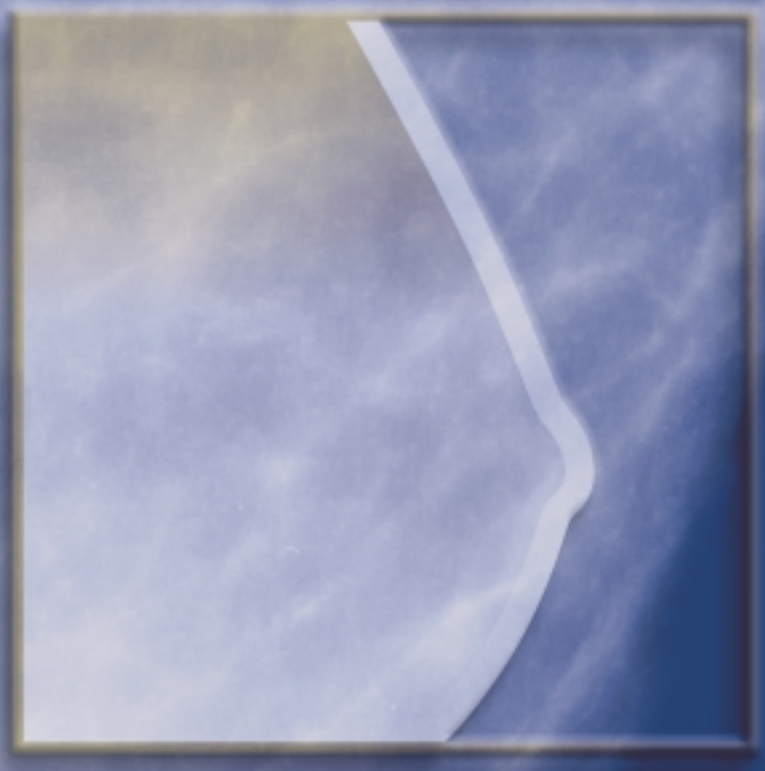
# Quality Control for
# MAMMOGRAPHY



Gammex

GAMMEX rmi®

MAMMOGRAPHY

# INDEX

## PHANTOMS



## TEST INSTRUMENTS



## METERS



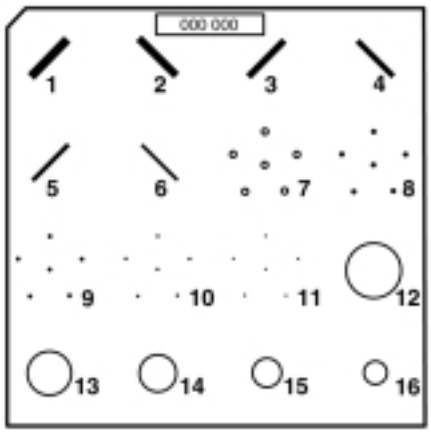
## KITS



## PROCESSORS



## ACCESSORIES




***Target layout of the Gammex 156***

## SPECIFICATIONS - Gammex 156

Phantom Body
Material: ..... Acrylic
Phantom Dimensions: ..... 4.5 x 10.2 x 10.8 cm (HWD) (1.75 x 4 x 4.25 in)
Acrylic Base: ..... 3.3 cm (1.3 in) thick
Cover: ..... 0.3 cm (0.12 in) thick
Acrylic Disk: ..... 4mm thick x 1cm diameter*
..... (used to produce an image to measure the density difference)

*Acrylic disk should be placed on top of the phantom in a consistent location in the image area so it does not obscure details in the phantom and where it cannot cast a shadow on any portion of the AEC detector. According to the ACR Mammography QC Manual, a suitable location is between and slightly below the first and second largest fibers.

Included is a film, which is a contact image of the wax insert of your Gammex 156. It is to be used for location and orientation of the test objects within the phantom only.

Test Objects
Nylon fibrils
Simulated micro-calcifications
Tumor-like masses

**Region Materials**

1. 1.56 mm nylon fiber
2. 1.12 mm nylon fiber
3. 0.89 mm nylon fiber
4. 0.75 mm nylon fiber
5. 0.54 mm nylon fiber
6. 0.40 mm nylon fiber
7. 0.54 mm specks
8. 0.40 mm specks
9. 0.32 mm specks
10. 0.24 mm specks
11. 0.16 mm specks
12. 2.00 mm tumor-like mass
13. 1.00 mm tumor-like mass
14. 0.75 mm tumor-like mass
15. 0.50 mm tumor-like mass
16. 0.25 mm tumor-like mass

# Mammographic Accreditation Phantom

# Gammex 156

Gammex 156 helps radiology professionals ensure that their mammographic system is producing images of the highest quality. These high quality images can lead to the early detection of breast cancer and long-term survival of the patients.

Beginning October 1, 1994, all mammography facilities in the United States were required to comply with the Food and Drug Administration (FDA) requirements of the Mammography Quality Standards Act. According to QMS, published by FDA, all mammography facilities must perform routine quality control tests of mammographic systems. Gammex 156, an integral part of the ACR (American College of Radiology) Mammographic Quality Control Program, was designed to perform weekly QC checks of your mammographic system.

The phantom provides a baseline by which image quality can be compared and minor variations identified before they lead to a reduction in clinical image quality. Without the phantom check to serve as their baseline test, even the most experienced professional can miss the subtle degradation of image quality that occurs gradually over time in sensitive mammographic equipment.

Gammex 156 Mammographic Accreditation Phantom is designed to simulate x-ray attenuation of 4.2 cm compressed human breast composed of 50% adipose and 50% glandular tissue. Test objects of different sizes, shapes and densities are embedded in a wax insert, which is enclosed in an acrylic base. These test objects represent malignancies or small breast structures – simulated micro-calcifications, fibrils and tumor-like masses.

When Gammex 156 is used to create an image, the mammographic system should detect a minimum of 4 fibrils, 3 groups of simulated micro-calcifications and 3 masses. This has been determined to be the standard of image quality that State Departments of Radiologic Health and the ACR use as their criteria. The phantom can also be used to identify other artifacts in the system due to processing, grid and filters. These types of artifacts are difficult to identify on complex mammographic images.

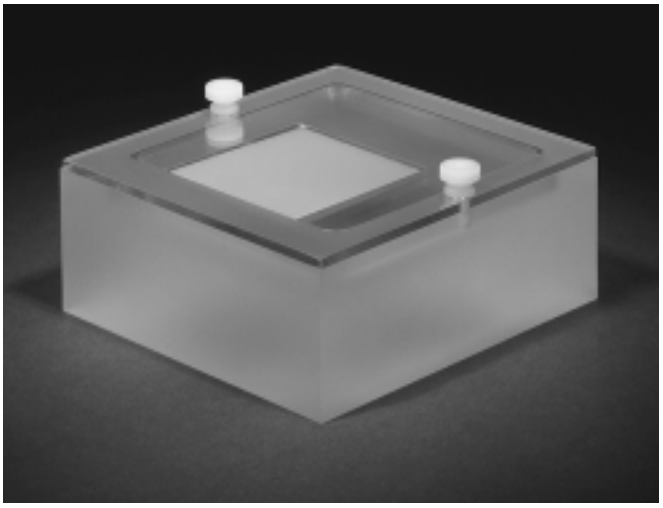
If your phantom image is good and your system maintains its standard of image quality on a weekly basis, no further testing beyond daily processor QC may be required. However, if you cannot see all of the test objects identified when the system was functioning at optimum performance, further testing may be necessary. Variables to check include film processing, film/screen contact, output reproducibility, phototimer accuracy, and kVp accuracy and radiation beam quality.image depth of the line. An optional carrying case Gammex 89-220 is available with the Gammex 156 phantom.

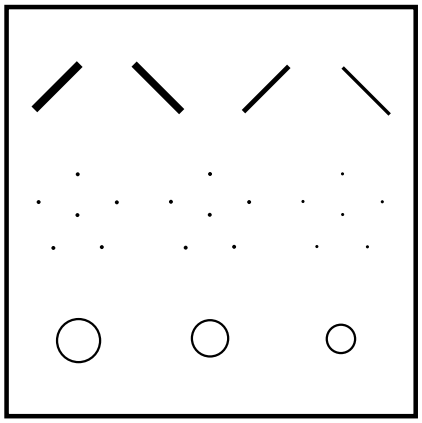
## Digital Mammographic Phantom Gammex 156S

The Digital Mammography Phantom Gammex 156S is a small version of the Mammographic Accreditation Phantom Gammex 156. The Gammex 156S is used for monitoring digital mammography systems currently used for stereotactic biopsy and localization.

The wax insert of the phantom is 5x5cm and contains simulated microcalcification, nylon fibrils and tumor-like masses. These are identical to the test objects in the Mammographic Accreditation Phantom Gammex 156, except the two largest fibers, microcalcification groups and masses are omitted. The four smallest fibers, three smallest microcalcification groups, and three smallest masses are included. These test objects will adequately challenge the digital systems imaging capabilities. The largest simulated microcalcification and tumor-like mass are the image requirement for Screen Film accreditation. The second nylon fibril is the accreditation requirement.

An 8x8 cm acrylic adapter with a cutout for placement of the 5x5 cm wax insert allows users to use the standard Gammex 156 base (supplied with the phantom). It also covers an area larger than the radiation field so that radiation to the CCD does not degrade the image quality.





***Target layout for Gammex 156S***

### SPECIFICATIONS - Gammex 156S

| | |
|---|---|
| Test Objects | |
| Simulated Microcalcifications | 0.32mm, 0.24mm, 0.16mm diameter |
| Nylon Fibrils | 0.89mm, 0.75mm, 0.54mm, 0.40mm diameter |
| Tumor-Like Masses | 0.75mm, 0.50mm, 0.25mm |
| Size of Acrylic Base | 4.5x10.2x10.8cm (1.75x4x4.25 in.) |
| Weight | 0.55kg (1.2 lbs.) |

### SPECIFICATIONS Gammex 169

**Construction:**
Acrylic Case
Molded Tissue Equivalent Breast Material (BR-12)
Mercury Enhanced Film

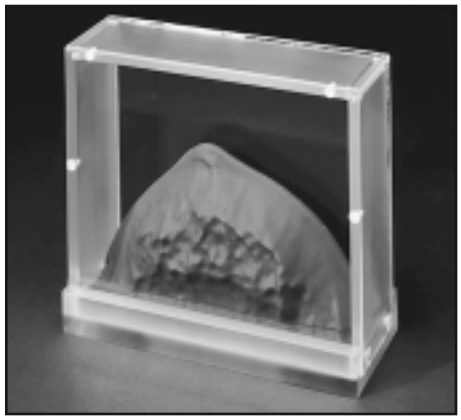
| | |
|---|---|
| Size | 16.2x21.9x7.3 cm (6.37x8.625x2.875 in.) |
| Weight | 1.56 kg (3.48 lbs.) |

This phantom was developed in conjunction with Martin Yaffe, PhD., Sunnybrook Health Science Center, Toronto, Ontario, Canada

## "Rachel" Anthropomorphic Breast Phantom Gammex 169

The "Rachel" Anthropomorphic Breast Phantom Gammex 169 provides an image with the detail and contrast of an actual mammogram. The phantom may be used for evaluation of the effects of variable conditions encountered in mammography. These include differences between machines, varying exposure parameters, processing conditions, and film/screen combination.

The phantom consist of three parts; the base BR-12 (breast equivalent) material, the high resolution film layer, and the outer case. The base material is molded BR-12, formed to provide the variations in thickness which result in differences in radiographic optical density. The film layer is a mercury-



intensified x-ray film of an actual mammogram that has been digitally processed. This film, when aligned with the base, produces fine detailed structures in the image. The outer case provides protection and allows for consistent positioning in the x-ray field. The lip on the edge of the outer case fits against the compression paddle and the table edge to give consistent and realistic positioning.

Gammex

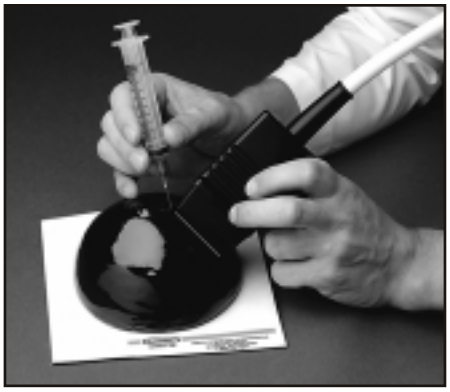
## Ultrasound Biopsy Phantom

## Gammex 429

The use of ultrasound-guided needle biopsy to diagnose the form and structure of lesions is growing world-wide. Until now, there has not been an effective way to develop the skill needed to accurately perform these challenging procedures.

The Gammex 429 simulates the look and feel of a human breast. However, the same eye and hand coordination skills required to perform ultrasound-guided biopsies of other organs can be learned using this phantom. The ultrasonic appearance of the Gammex 429 is similar to soft tissue to allow the use of normal scanner control settings.

Embedded in the phantom are 11 test objects on three different levels, allowing you to practice identification, aspiration and biopsy procedures on



cysts, high-density and low-density lesions. There are three fluid-filled cysts, four high density lesions and four low density lesions. The material in the solid lesions are colored to differentiate them from the surrounding tissue. This provides the user with immediate feedback on the success of the core biopsy. With this variety and number of lesions, most users become proficient in ultrasound-guided biopsies in a single training session.

### SPECIFICATIONS Gammex 429

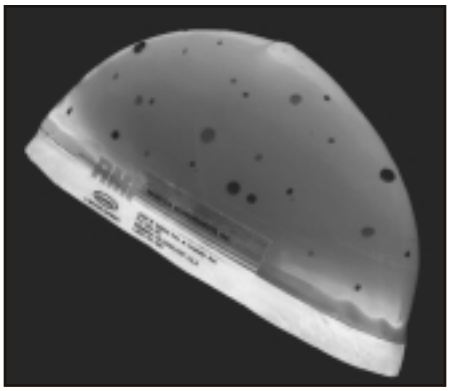
**Test Lesions:**
Water-filled Cysts
High Density Gel
Low Density Gel
Storage Temp. ..... 2 to 38° C (40 to 100° F)
Diameter ..... 12.7 cm (approx. 5 in.)
Height ..... 7.62 cm (approx. 3 in.)
Weight ..... 623.7 g (1 lb 6 oz..)

## Stereotactic Breast Biopsy Phantom

## Gammex 164A

The automated stereotactic breast biopsy procedure depends on several variables for accurate needle placement. Use of the Gammex 164A provides technologists and physicians with the training needed to be confident in performing stereotactic procedures. The phantom provides a good representation of breast tissue, thereby making it close to a real-life learning experience.

The phantom is made of a clear gel encased in a soft vinyl for easy compression and a skin-like resistance to needle insertion. Embedded in the gel are 20 to 25 radiopaque lesions



ranging in size from 2 to 5 mm. The 3 and 5 mm gel lesions are used for practicing core biopsies and the 2 mm liquid lesions allow for the practice of fine needle aspiration and tests the accuracy of the biopsy system and the operator.

### SPECIFICATIONS Gammex 164A

Construction: .....Gel with attenuation properties similar to breast tissue.
Outer casing ..... Vinyl
Radiopaque Lesions ..... 2 to 5 mm
..... Solid Gel for core biopsy
..... Liquid dye for fine needle aspiration
Compressible within biopsy instrument

Developed in conjunction with
Donald R. Jacobson, PhD.
Medical College of Wisconsin
Milwaukee, WI

## Mammographic DCF Test Tool

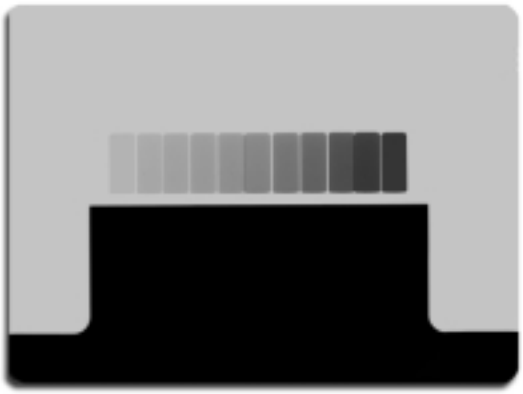
## Gammex 150K

The Gammex 150K Mammographic DCF (Density Control Function) Test Tool allows quick assessment of a mammography unit's Automatic Exposure Control (AEC) accuracy. Currently, medical physicists, engineers and QC technologists may make up to eleven exposures on eleven separate films to test the density control function.

The Mammographic DCF Test Tool is designed to make up to eleven exposures on a single piece of film thereby reducing film costs and processing time. Combining all exposures on one piece of film also saves set-up time and eliminates any processing variations. The resulting film provides a complete density read-out that can be used to satisfy the ACR's AEC system performance assessment and other regulatory requirements.

The Gammex 150K consists of two pieces: a base plate with an engraved density scale and a sliding exposure plate that contains a small window. By sliding the exposure plate, the same mammo cassette and film can be exposed at each of the eleven steps: zero, +1 to +5 and -1 to -5.

Lightweight, convenient, and economical, the Gammex 150K Mammographic DCF Test Tool is an excellent addition to your mammographic QC test program.



***Eleven step film exposure of the Gammex 150K Mammographic DCF Test Tool.***

### SPECIFICATIONS - Gammex 150K

**Construction**

Base Plate: ..... Aluminum
Exposure Plate : ..... Stainless Steel

**Dimensions**

Overall: ..... 15.2 x 30.5 x .95 cm (HWD) (6 x 12 x .375 in.)
Exposure Window: ..... .12 x 18.6 mm (.47 x 1.12 in.)
Weight: ..... 0.8 kg (1.75 lbs.)
Film size: ..... 7 x 9.5 in.

**Features**

Exposure Steps: ..... 11 (-1 to -5, zero, +1 to +5)
Compatibility: ..... Tissue Equivalent Breast material and acrylic .....(Gammex 159, 159A, 159BR and 159A-BR Phantoms)

NOTE: Tissue Equivalent Material sold separately

## Slit Camera

## Gammex MA4976

The Slit Camera has become the standard for mammographic micro-focal spot measurements. It provides an objective measure of the actual focal spot size. The National Electrical Manufacturers Association (NEMA) recommends the slit camera as the preferred method of focal spot measurement.
The camera is a complete assembly with a 10 micron by 5.5 mm slit in a 1.5 mm thick tantalum disk.

### SPECIFICATIONS Gammex MA4976

Slit Width .. 10 µm ( ±1 µm), with 4° relief angles on each jaw
Slit Length ..... 5.5 mm
Slit Material ..... Tantalum, 1.5 mm thick
Size ..... 4.3x0.9 cm (1.75x0.35 in.)
Weight ..... 400 g (14 oz.)

Gammex

## Universal Test Stand

## Gammex 175

### Versatile test stand simplifies x-ray and mammographic quality control.

The Universal Test Stand Gammex 175 can be used to perform a variety of quality control tests for mammographic and radiographic x-ray systems. The height of the tower is easy to adjust and the cassette holder accommodates a variety of film cassette sizes.

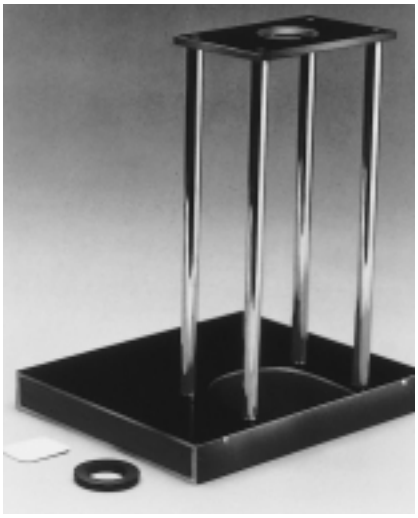
Ideal for measuring focal spot size with a slit camera or star resolution pattern, the Universal Test Stand also includes a number of inserts used to define magnification and simplify alignment of the x-ray system. Half Value Layer measurements can also be performed using the Gammex 175.

The Universal Test Stand features:

- Rugged construction
- Versatility - it performs multiple tests for mammographic, radiographic and fluoroscopic units
- Easy set-up
- Easy accommodation of magnification insert, slit camera/star pattern fixture, phosphorescent screen
- Includes custom carrying case

***Accessories available for the Gammex 175***

| SPECIFICATIONS - Gammex 175 | |
|---|---|
| Dimensions | 10.5 x 8.75 in. at base (26.7 x 22.2 cm) |
| | 4.4 x 4.4 in. at top (11.1 x 11.1 cm) |
| Height | adjustable from 14.3 to 20 in. (36.3 cm to 50.8 cm) |
| Weight | 9.3 lbs. (4.2 kg) |
| **Options** | |
| Slit Camera Gammex 07-624 | |
| 12X Comparator w/case | |
| 50X Pocket Microscope w/scale | |
| Star Test Patterns | |



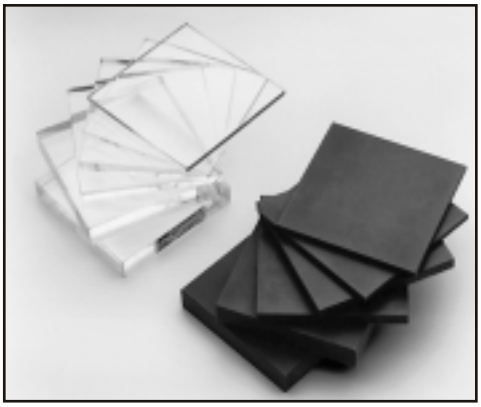
## Mammography Focal Spot Measurement Test Stand

## Gammex MA0609

It is particularly important to verify the size of the focal spot during acceptance testing of new mammographic equipment or when a new x-ray tube is installed. This test stand is designed to make these important procedures easy to perform and ensures accurate results. This test stand includes a magnification insert, alignment device and fluorescent alignment screen.

| SPECIFICATIONS Gammex MA0609 | |
|---|---|
| Dimensions | 9 x 11.5 in. at base (22.8 x 29.2 cm) |
| | 4 x 6 in. at top (10.1 x 15.2 cm) |
| Height | adjustable from 9 to 18 in. (22.8 cm to 45.7 cm) |
| Weight | 11 lbs. (5 kg) |
| **Optional Accessories** | |
| Carrying case (model 89-622) | |
| Pinhole assembly, 0.100 mm, (model 07-611) | |

Gammex



## Mammographic Phototimer Consistency Test Tool

## Gammex 159A and 159A-BR

Automatic Exposure Controls/Phototimers are designed to maintain consistent film density regardless of breast thickness or composition. This consistency needs to be evaluated on a routine basis as a regular quality control procedure. The Phototimer Consistency Test Tool consists of seven (7) pieces of acrylic (Gammex 159A) or seven (7) pieces of Tissue Equivalent Breast Material (Gammex 159A-BR). With this test tool different thicknesses can be imaged and densities measured to confirm that the automatic exposure control/phototimer is operating at its optimum level.

### SPECIFICATIONS - Gammex 159 and 159BR

**Gammex 159A**
Construction ..... 7 pieces of Acrylic
Size:
3 ea. 14x14x1.90 cm ±2.0 mm
(5.5x5.5x0.750 in. ±0.1 in.)
2 ea. 14x14x0.95 cm ±1.5 mm
(5.5x5.5x0.375 in. ±0.06 in.)
2 ea. 14x14x0.48 cm ±1.0 mm
(5.5x5.5x0.188 in. ±0.04 in.)
Weight ..... 0.7 kg (1.7 lbs.)

**Gammex 159A-BR**
Construction .....
7 pieces of Tissue Equivalent Breast Material
Size:
3 ea. 14x14x2.0 cm ±0.4 mm
(5.5x5.5x0.750 in. ±0.2 in.)
2 ea. 14x14x1.0 cm ±0.4 mm
(5.5x5.5x0.375 in. ±0.2 in.)
2 ea. 14x14x0.5 cm ±0.4 mm
(5.5x5.5x0.188 in. ±0.2 in.)
Weight ..... 0.65 kg (1.5 lbs.)

## Breast Compression Test Device

## Gammex 163

Firm compression of the breast in screen film mammography lowers the radiation dose to patients, enhances image contrast and definition, and improves visibility of pathologies. Appropriate compression of the breast may be the single most important parameter of dedicated screen film mammography. The Mammographic Breast Compression Test Device measures the compression force in automatic and manual modes to assure accuracy and reproducibility. The gauge features a maximum force reading memory which indicates the peak force applied.

### SPECIFICATIONS Gammex 163

Force Range ..... 0 to 27 kg (0-60 lbs.)
Accuracy ..... +0.27 kg between 1 and 25 kg
..... (+0.6 lbs. between 15 and 50 lbs.)
Contact Area ..... 8.5 cm diameter
Size ..... 12.2x9x5 cm (4.8x3.5x2 in.)
Weight ..... 0.91 kg (2 lbs.)

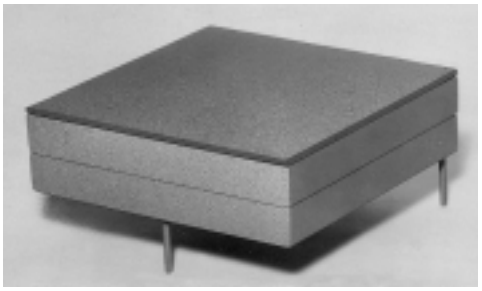
## Patient Phantom/ Penetrometer System

## Gammex DR5121

The phantom protects the phosphor from the direct beam and provides the simulated attenuation needed to check the performance of the image-intensifier systems. The penetrometer permits the determination of system contrast gradient under simulated operating conditions.

The Gammex DR5121 consists of:

- two 7x7x0.75 inch blocks of high purity aluminum
- One 7x7x0.125 inch lead beam-stop plate
- One 7x7x0.03125 inch aluminum penetrometer plate with 0.25, 0.176, 0.125, 0.088 and 0.0625 inch holes for determination of contrast gradient
- Two lengths of legs: one set 1.25 inch long and one set 10.375 inch long



### SPECIFICATIONS Gammex DR5121

Dimensions .....7 x7 x 1.875 in (17.8 x 17.8 x 4.7 cm)
Weight ..... 9.5 lbs. (4.3 kg)
**Optional Accessories**
Aluminum blocks:
Two Type-1100 Al 7.125 x 7.125 x 0.75 in thick

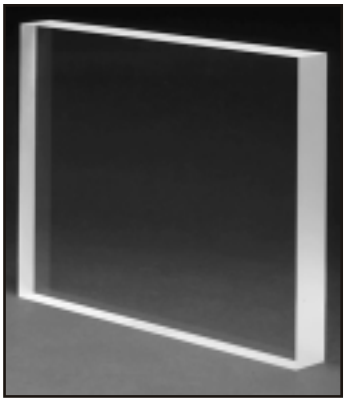
## Artifact Identification Phantom

## Gammex 179

Often it is difficult to identify artifacts produced on clinical and phantom images.

The use of a full-field phantom allows the production of a grey film which demonstrates artifacts caused by the mammographic system (grids/lines) or the film processor.

The Artifact Identification Phantom Gammex 179 is a useful adjunct to every mammography quality control program.



**SPECIFICATIONS**
**Gammex 179**

| | |
|---|---|
| Size | 3.7x30x24 cm (1.5x11.8x9.6 in.) |
| Weight | 3.2 kg (7 lbs.) |

## Mammographic Film/Screen Contact Test Tool

## Gammex 157A

Film/Screen contact can have a significant influence on image quality. Today's mammography film/screen systems have higher resolution than diagnostic radiography x-ray systems and require test tools with finer detail.

Regular testing with the Gammex 157A detects problems and artifacts early. Use of the tool and the evaluation of the resulting images is simple. Areas of poor screen contact appear darker than areas of good contact. Any dark areas greater than 1 cm should be investigated and corrective action taken.

Gammex recommends testing cassettes every six months or when new or repaired cassettes are put into service.

**SPECIFICATIONS**
**Gammex 157A**

| | |
|---|---|
| Screen Size | 24x30 cm (9.4x11.8 in.) |
| Mesh | #40 Mesh - Copper |
| Size | 25.8x31.5 cm (10.2x12.4 in.) |
| Weight | 0.4 kg (0.9 lbs.) |

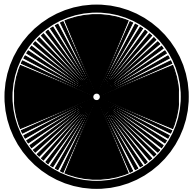
## Star Test Patterns

## Gammex MA0021
## Gammex MA0431
## Gammex MA0054

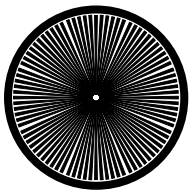
Focal spot size can be determined by observing the regions of blurring which occur when the pattern is radiographed by an x-ray source of finite dimensions.

Radiation from different areas of the focal spot will cause a periodic blurring of the pattern due to the penumbra effects.

Knowledge of the geometric factors and the distance from the center of the pattern to the region where blurring occurs will permit the calculation of the focal spot size.



***Gammex MA0021***



***Gammex MA0431***

**SPECIFICATIONS**
**Star Test Patterns**

A = Angle of Single Line within a Sector
B = Number and Size of Patterned Sectors
C = Focal Spot Size Measured

| | A | B | C |
|---|---|---|---|
| MA0021 | 0.5° | 4-15° | 0.1-0.3 mm |
| MA 431 | 2.0° | 1-360° | 0.1-0.3 mm |
| MA0054 | 0.5° | 4-45° | 0.1-0.3 mm |

Lead Foil Thickness in Millimeters: 0.05
Diameter in Millimeters: 55

## Precision Test Patterns

## Gammex MA0647, Gammex MA0436, Gammex MA0437, Gammex MA0438, Gammex MA0439,

Precision test patterns provide an easy means of measuring the resolution and modulation transfer function of x-ray systems. They are compatible with all x-ray machines and are widely used by radiology equipment manufacturers.

Resolution in lp/mm of a mammographic system is an objective means of monitoring image quality. The Mammographic Gold Line Pair Resolution Test Pattern Gammex MA0647 from Gammex provides 5 to 20 lp/mm resolution in 17 segments. The pattern is constructed of a gold-nickel alloy mounted in an acrylic wafer. This construction provides high contrast resolution patterns in the mammographic energy range. The wafer is equivalent to 25 microns of lead or 2.6 mm of aluminum at 20 KeV. Overall size is 10 mm by 25 mm.

The resolution patterns all have specific applications. Group test patterns have varying numbers of line pair groups, with radiopaque numbers to indicate the resolution (in lp/mm) of each group.

### Resolution Patterns

| | A | B | C | D |
|---|---|---|---|---|
| MA0647 | 5.0 to 20 | 17 | * | 10x25 |
| MA0436 | 0.5 to 5.0 | 6 | 0.10 | 110x40 |
| MA0437 | 0.5 to 5.0 | 1 | 0.10 | 157x50 |
| MA0438 | 0.6 to 5.0 | 20 | 0.01 | 50x50 |
| MA0439 | 0.6 to 5.0 | 20 | 0.10 | 50x50 |

A = Range of Resolution in lp/mm

B = Number of Groups or Sectors

C = Lead Foil Thickness in mm

D = Dimensions in mm

* = Gold nickel alloy equivalent to 25 microns of lead

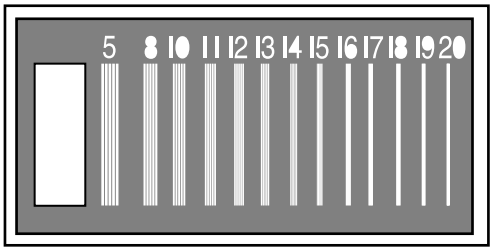
### SPECIFICATIONS - Precision Test Patterns

**Gammex MA0436**
0.5 to 5.0 lp/mm
Sixteen Groups
Size ..... 110x40 mm (4.3x1.6 in.)
Weight ..... 9 g (0.3 oz.)

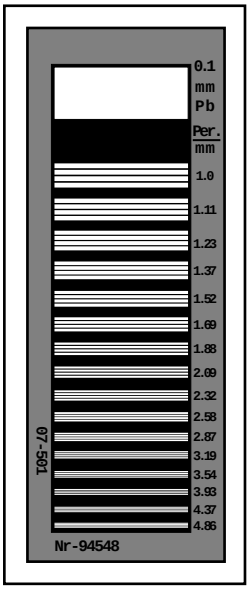
**Gammex MA0437**
0.5 to 5.0 lp/mm
One Sector
Size..... 157x50 mm (6.2x1.9 in.)
Weight ..... 9 g (0.3 oz.)

**Gammex MA0438 and Gammex MA0439**
0.6 to 5.0 lp/mm
Twenty Groups
Size ..... 50x50 mm (1.9x1.9 in.)
Weight ..... 9 g (0.3 oz.)

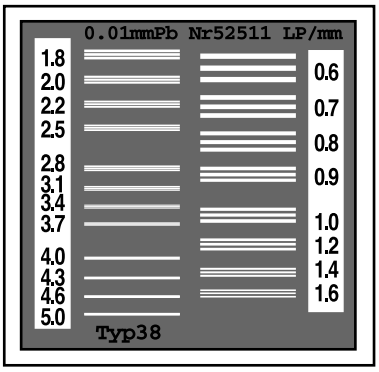
**Gammex MA0647**
5 to 20 lp/mm
Seventeen Segments
Size ..... 10x25 mm (4x10 in.)
Weight ..... 3 g (1 oz.)



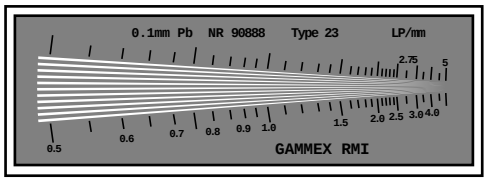

***Gammex MA0647***




***Gammex MA0436***




***Gammex MA0438 and Gammex MA0439***




***Gammex MA0437***

# Digital kV Meter

## Gammex 330

The Gammex 330 Digital kV Meter is a test device for quality control and acceptance testing in radiographic, mammographic and fluoroscopic X-ray systems. The Gammex 330 Digital kV Meter was developed to combine user friendly performance with high accuracy of measurements in different X-ray applications. Its multipurpose design enables the user to measure the new IEC quantity "practical peak voltage" as well as kVp, relative mAs and exposure time.

The meter features built-in automatic functions including auto-start, auto-stop, autorange. It's easy to read display automatically rotates by 180° depending on the orientation of the device to accommodate both radiographic or fluoroscopic applications. In addition to the readings on the built-in display, the unit allows communication with a PC via an RS-232 interface and it has an analog output for connection to an oscilloscope for monitoring voltage waveforms.


### Features of the Gammex 330:

- Non-invasive kVp, ppv acc. IEC 61676, mAs and time meter for acceptance tests and quality control of diagnostic X-ray equipment
- Compact and lightweight
- Auto-start, auto-stop, auto range
- Large easy-to-read 4 line LC Display
- RS-232 Port
- Analog output port

### SPECIFICATIONS - Gammex 330

| | |
|---|---|
| Measuring principle | measurement of the tube voltage of an X-ray installation, using semiconductor detectors and the two-filter method |
| Operating mode | continuous operation |
| Indication of measuring value | graphic display, oscilloscope |
| Radiation direction | overcouch and undercouch application |
| Measuring quantities | tube voltage (kV), time (s), relative mAs |
| Tube voltage | |
| Selectable calculations | PPV, max kVp, mean kVp |
| Measuring range | 40 - 150 kV, 22 - 40 kV (MAM) |
| Digital resolution | 0.1 kV |
| Accuracy | ±1 % or ±1.0 kV, 22 - 150 kV |
| Reproducibility | ±0.5 % |
| Minimum irradiation time for kV measurement | 5 ms |
| Typical autorange settling time: | 6 ms, 1 ms (kV manual) |
| Time | |
| Measuring range: | 0.3 ms - 999 s |
| Digital resolution: | 300 µs |
| Accuracy: | ±0.3 ms (trigger radiation on) |
| Reproducibility: | ±0.3 ms |
| Relative mAs product | |
| Measuring range: | 5 - 999 rel. mAs |
| Digital resolution: | 0.1 mAs |
| Accuracy: | ±2 % typical (min. 100 ms pulse width, kV range manual) |
| Reproducibility: | ±1.0 % |
| Nominal useful range | 1 - 200 mGy/s |
| Dose rate dependence | 0.5 % [IEC61676] |
| Distance dependence | negligible |
| Rotation dependence | negligible |
| Field size dependence | negligible |
| Minimum field size | 34 x 34 mm |
| Filter dependence | internal calibration function for all conventional filters (reference points according to IEC 61676) |
| Typ. minimum measuring signal | 60 kV, 1 mA at focal distance of 50 cm |
| Delay | 0 - 9999 ms |
| Time constant | 140 µs |
| Sampling rate | 25 kHz |
| Power supply | multirange (115 - 230) V; (50 - 60 Hz) line independent by means of internal rechargeable batteries with operating time of 5 hours; automatic, active internal battery charging |
| Rechargeable batteries | 4 rechargeable NiMH batteries |
| charge time | 14 hours |
| Environmental Conditions | |
| Transport and Storage | |
| Ambient temperature | -20 ... +50°C |
| Relative humidity | 10 ... 85% rel. humidity (max. 20 g/m³ absolute humidity) |
| Atmospheric pressure | 600 ...1200 hPa |
| Operation | |
| Ambient temperature | +15 ... +35°C |
| Relative humidity | 20 ... 80% rel. humidity (max. 20 g/m³ absolute humidity) |
| Atmospheric pressure | 700 ...1060 hPa |
| Dimensions and Weight | |
| width | 95 mm |
| depth | 155 mm |
| height | 45 mm |
| weight | approx 770 grams |
| Analog output: 0 ... 4VD | 25 mV equivalent to tube voltage of 1 kV output impedance: 0.2 Ohm, Rload >5 kOhm |
| Communication | RS232 port |

# kV Meter

# Gammex 245

## Accuracy and convenience in one small package.

The very compact Gammex 245 simplifies the determination of actual kV for radiographic, fluoroscopic, and mammographic x-ray systems. This highly accurate meter can be used for a wide range of energies and will store up to ten readings. A remote LCD display makes fluoroscopic readings easy to obtain. With an optional BNC connector the meter can also be connected to an oscilloscope to monitor waveforms.

## Features of the Gammex 245:

- Radiographic, Fluoroscopic, and Mammographic non-invasive measurement modes
- Dual methods of kVp measurements available in a single radiographic or mammographic exposure: (1) the average of kV peaks, (2) effective kVp
- Use of patented Quadcell detector and autogain circuitry for unparalled accuracy in kVp measurements over a wide range of measurement conditions: orientation, positioning, angulation, and x-ray intensity have little effect on measurement results
- Measurements of kVp can be accurately performed over an x-ray intensity dynamic range of 5000:1 at any specific kV
- Internal correction factors for mammographic target/filter combinations
- Automatic resetting for each exposure
- Large LCD display
- Compact size that fits in your hand


## SPECIFICATIONS - Gammex 245

**Kilovoltage**
Displayed Range ..... 22 kV - 200 kV

**Calibrated Range**
Radiographic ..... 50 - 140 kV
Mammographic ..... 25 - 35 kV

**Accuracy**
Radiographic ..... ±2% or 1 kV
Mammographic ..... ±(1 kV + 2%)

**Reproducibility**
Radiographic ..... ±0.5 kV
Mammographic ..... ±0.3 kV
Resolution ..... 0.1 kV

**Minimum Exposure Requirements**
Radiographic ..... 25 mA, 60 kVp @ 24 in.
Fluoroscopic ..... 3 mA, 80 kVp @ 18 in.
Mammographic ..... 80 mA, 24 kVp @ 25 in.
Required Exposures ..... One
Display ..... 31/2 digit LCD
Analog Output ..... Optional BNC connector (Special Order)
Power ..... 9 V alkaline battery (included)
Size ..... 2x4x7.5 in.
Weight ..... 21 oz.
Target/Filter Combinations ..... Mo/Mo, Mo/Ro, Mo/Al, Mo/Pd, W/Al, Ro/Ro, Ro/Al

Developed in conjunction with Frank Ranallo, PhD.
University of Wisconsin, Madison, WI

Gammex

## Dual-Range mAs Meter
## Gammex MA0396


The Digital mAs Meter is an accurate, low-cost instrument that allows service personnel and biomedical engineers to check and adjust the mA settings of x-ray generators. This easy-to-use device is calibrated directly in mAs, thereby avoiding the calculations required with more complicated (and expensive) calibration equipment.

The Dual-Range mAs Meter Gammex MA0396 is very sensitive – it can measure increments of 0.1 mAs. It has a low range of 0 to 199.9 mAs, and a high range of 0 to 1999 mAs.

The greatest use of this meter is in calibrating the high-current, short-time station where a conventional mAs meter is precluded by tube ratings.

This instrument can be used (after verification of generator timing accuracy) to set all mA stations and verify that phototiming error does not exceed the limits of good practice.

To use, simply connect the cable to the x-ray generator and make the required exposure. The mAs reading appears instantaneously on the 4 digit LCD. A display indicator warns of the need for battery replacement.

The meter's small size and light weight make it convenient to carry around in a pocket or tool kit.

Note: This is an invasive test which requires connection to the generator circuit.

### SPECIFICATIONS - Gammex MA0396

| | |
|---|---|
| Range | 0 to 199.9 mAs ("+"overrange indicator above 160 mAs) |
| | 0 to 1999 mAs ("+"overrange indicator above 1600 mAs) |
| Accuracy | ± 2% of reading, ±0.2 mAs |
| Drift | Zero |
| Display | 4 Digit LCD |
| Input | 25 to 1000 mA |
| Operating Temperature | 15 to 30° C (50 to 100° F) |
| Input Jack | Uses two banana jacks |
| Accessories Supplied | 24 in. of cable with banana plugs on one end |
| | and insulated alligator clips on the other |
| Controls | Power (ON/OFF), Range (high-low), Reset |
| Power | Single 9 V Alkaline Battery (included) |
| Size | 3.5x8.9x16.8 cm (1.4x3.5x6.6 in.) |
| Weight | 198 g (7 oz.) |

## X-ray Exposure Meter
## Gammex MA0393


This is a rugged meter for making routine tests of x-ray exposure and rate. This compact instrument consists of an electrometer with display electronics and a built-in ion chamber. Just place the meter on the optional remote detector on the x-ray table, collimate the beam to the detector and make an exposure. The 3 1/2 digit, 1/2 inch liquid display is easy to read and presents up to 2 R and 20 R/min.

### SPECIFICATIONS - Gammex MA0393

| | |
|---|---|
| Range | 0.001 to 2 R, 0.01 to 20 R/min |
| Measurement Area | 20.5 $cm^2$ (5.1 cm diameter) effective |
| Center of Ion Chamber | 1.03 cm below top of chamber |
| Standard Calibration | At 75 kVp w/4 mm Al filtration at 22° C and one atmosphere |
| Reproducibility | Within 2% short term over 100 mR to 2 R |
| Energy Response: | ±5% from 15 to 65 keV (30 to 150 kVp filtered) |
| Electrometer Drift | 0.5 to 1 mR/min typical; 6 mR/min max |
| Maximum Exposure Rate | Minimum 90% collection at 20 R/sec |
| Reset | Automatic or Manual |
| Operating Environment | 10 to 40° C, max 90% relative humidity |
| Display | 3 1/2 digit LCD |
| Controls | Auto/Manual Reset, Zero Reset, Dose/Dose Rate, Integral/Remote Ion Chamber ON/OFF Switch |
| Power | 9V Alkaline Battery (included) |
| Size | 7x15x16 cm (2x6x6.3 in.) |
| Weight | 0.7 kg (1.5 lbs.) |

## Mammographic QC Kit Gammex 182B

Every mammographic system deteriorates with time, gradually producing less accurate images. Without the use of specific quality control techniques, even the experienced professional may not detect the slow and subtle degradation of the image quality. Quality control provides the necessary assurance that your images contain all the information possible for the delivered dose.

Mammographic Quality Control Kit Gammex 182B is used at every type of mammography facility, from small clinics to large medical centers. Each kit is complete and will provide you with the tools used to perform the following tests:

- Image quality
- Film/screen contact
- kVp accuracy
- Automatic exposure control reproducibility
- Timer accuracy
- Half value layer
- Focal spot size
- Output reproducibility and linearity

### Optional Kit:

Gammex 182B-BR: The Acrylic Mammographic Phototimer Consistency Test Tool is replaced with Tissue Mimicking Breast Material.

### SPECIFICATIONS - Gammex 182B

**The Gammex 182B:**
Mammographic kVp Meter Gammex 245
Mammographic Accreditation Phantom Gammex 156
Half Value Layer Attenuator Set Gammex 115H
Phototimer Consistency Test Tool (Acrylic) Gammex 159A
Aluminum Stepwedge Gammex 118
Film/Screen Contact Test Tool Gammex 157A
Digital X-ray Timer Gammex MA2425 (see below)
0.5° Star Test Pattern Gammex MA0021
Pen Dosimeter Gammex 06-007
Dosimeter Charger Gammex 06-912
Quality Assurance Handbook Gammex 781A
Screen Film Mammography Handbook Gammex 582
Tape Measure Gammex 090
Foam Lined Case Gammex 081A

## Digital X-ray Timer Gammex MA2425

The Digital X-ray Timer is a non-invasive instrument that can be used to measure the exposure time of either AC or DC x-rays. It can also measure the duration of radiation output produced by a wide variety of medical x-ray systems. A sensitive x-ray detector in the instrument allows direct measurement of exposure from the x-ray head. Pulses produced by half-wave and full-wave x-rays are measured as 60 or 120 pulses per second. For DC, capacitor discharge and three-phase x-rays, the Gammex MA2425 measures the exposure time in milliseconds. When testing x-ray timers and controls, the time of relay contact closure can be measured using the AC input feature. An output connector on the side of the Digital X-ray Timer allows the user to view a radiation output waveform on an oscilloscope. Using this feature, technicians can diagnose and troubleshoot problems with x-ray generators. For added operator convenience, a remote sensor is available as an option.

### SPECIFICATIONS Gammex MA2425

| | |
|---|---|
| Accuracy | |
| AC Input | ±1 Count |
| DC Input | 2%, ±1 Count |
| X-ray Detection | ±1 Count |
| Sensitivity | |
| AC Input | 65 VAC minimum |
| X-ray Input | 50 kVp, 5 mA at 5 cm from top surface of case |
| Range | 9999 pulses; 9999 milliseconds |
| Display | 0.4" liquid crystal |
| Power | 9-volt battery; alkaline or equiv. |
| Battery Life | 24 hours continuous |
| AC Input Jacks | 130 volts AC maximum; 65 volts AC minimum; Input circuit not affected by reversed polarity. |
| Controls/Indicators | |
| 3-position switch | pulse, Off, Milliseconds |
| Four-digit liquid crystal display (0.4" character) | |
| Low battery indicator | "Low Batt" appears in display when battery voltage reaches 4.8 volts ±0.5 volts |
| Power-on | LED (green) |
| Oscilloscope output | |
| Connections | None required for direct exposure measurement |
| Dimensions | 3.15" x 5.8" x 1.6" (80 mm x 147 mm x 40 mm) |
| Weight | .5 lbs (.21 kg) |

## Routine Mammo QC Kit Gammex 183

Designed to be in accordance with the American College of Radiology (ACR) Mammography Quality Control Manual and MQSA requirements, the Gammex 183 contains all the instruments necessary to complete and maintain a Quality Control (QC) program.

The instruments evaluate processor performance, image quality, film/screen contact, compression force and hypo retention. In addition, the kit contains a camel hair brush and lint free cloths for maintaining your mammographic screens in optimum condition. An ACR Mammographic Quality Control Manual is also included. This manual describes mammography quality control procedures and includes QC forms for recording the data provided by the instruments.


### SPECIFICATIONS - Gammex 183

**The Gammex 183:**
Densitometer Gammex MA0025
Sensitometer Gammex MA5034
Digital Thermometer Gammex TM-99A
Mammographic Accreditation Phantom Gammex 156
4 mm Acrylic Disk Gammex 158
Mammographic Film/Screen Test Tool Gammex 157A
Breast Compression Test Device Gammex 163
Fixer Retention Test Kit Gammex 166B
Lint Free Cloths Gammex 167 (not pictured)
Camel Hair Brush Gammex 168
ACR Mammographic Quality Control Manual
Foam Lined Case Gammex 081A
Size ..... 24x42x63.5 cm (9.5x16.5x25 in.)
Weight ..... 9 kg (20 lbs.)

## Processor QC Kit Gammex 185C

Quality assurance in radiology begins with the film processor. The processor is the single most influential source of problems in the diagnostic imaging department.

To test all the parameters of the processor, Gammex provides the Gammex 185C Processor Quality Control Kit. Included in this kit is a Portable Blue/Green Sensitometer, Portable Densitometer, Digital Thermometer, and the text book *Film Processing in Medical Imaging*.

With these tools daily processor quality control can be completed and early detection of possible problems can be caught before they lead to poor quality films or expensive repairs.


### SPECIFICATIONS Gammex 185C

**The Gammex 185C:**
Densitometer Gammex MA0025
Sensitometer Gammex MA5034
Digital Thermometer Gammex TM-99A
Foam Lined Case Gammex 081A
*Film Processing in Medical Imaging* Gammex 583
Size ..... 24x42x63.5 cm (9.5x16.5x25 in.)
Weight ..... 7 kg (15.5 lbs.)

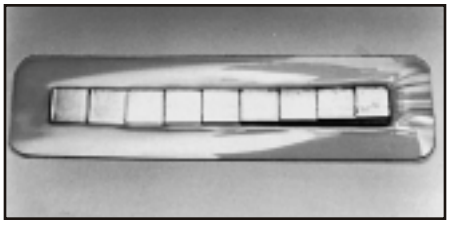
Gammex

## Mammographic Aluminum Stepwedge

## Gammex 118

Constructed of homogeneous, high purity aluminum, the stepwedge provides incremental exposures to mammographic x-ray film by increased aluminum thicknesses in each step.

The Gammex 118 provides a useful means of comparing the characteristic curve of various film/screen combinations, mAs reciprocity, and when carefully performed, sensitometry. For sensitometry totally independent of x-ray generator variation, use a dedicated sensitometer described on page 15 and 16.



**SPECIFICATIONS**
**Gammex 118**

| | |
|---|---|
| Construction | |
| High Purity Aluminum Alloy and Copper | |
| 9 Steps 0.25 cm high and 1.4 cm deep | |
| Size | 14.2x4 cm (5.6x1.9 in.) |
| Weight | 10 g (0.4 oz.) |

## Half Value Layer Attenuator Set

## Gammex 115H

High purity aluminum (greater than 99.9%) has proven to provide more accurate measures of half value layer in mammography than aluminum alloys. In response to this, Gammex provides a set of six (6) 10x10x0.1 mm sheets of aluminum. These sheets are encased in a plastic storage case for maintaining their flatness and ease of transportation. Use the Gammex 115H for accurate mammographic HVL measurements and when performing MQSA compliance testing.


**SPECIFICATIONS**
**Gammex 115H**

| | |
|---|---|
| Construction | 99.9% Pure Aluminum |
| Size | 10x10 cm (4x4 in.) |
| Weight | 0.09 kg (0.2 lbs.) |
| Six (6) Individual Aluminum Sheets | |
| Thickness | 0.1 mm ±5% |

## Digital Thermometer

## Gammex TM-99A

Monitoring your developer temperature on a regular basis helps to achieve and maintain appropriate film speed, contrast, and film fog levels. The Gammex TM-99A is a highly accurate thermometer which features a fast acting probe, degrees Celcius or Fahrenheit and low battery indicator making it a perfect choice for processor quality control procedures.

**SPECIFICATIONS**
**Gammex TM-99A**

| | |
|---|---|
| Range | -40 to 150 ° C ( -40 to 302° F ) |
| Accuracy | ±0.2° F from -40 to 100° F |
| | ±2% from 100 to 300° F |
| Power | 9 V Alkaline Battery (included) |
| Size | 3x7.5x18 cm (1.2x3x7 in.) |
| Weight | 255 g (9 oz.) |

Gammex

## Process Optimization Densitometer

## Gammex MA2043

The Process Optimization Densitometer Gammex MA2043 provides and stores processor control data quickly and accurately for your busy lab or office. Whether you are running one or several film processors, the Gammex MA2043 measures, stores, and reports the QC data you need to help meet the requirements of your institution for governmental agencies and JCAHO accreditation.

Simply insert a sensitometric strip into the Gammex MA2043. The densitometer automatically reads the strip's 21 steps, then calculates and stores the data, speed index, average gradient, contrast index, base plus fog and D-max.

### SPECIFICATIONS Gammex MA2043

| | |
|---|---|
| Density Range | 0 to 4.5 D |
| Density Accuracy | ±2.0% (3.01D to 4.0 D) |
| Density Repeatability | ±0.01 D (0 to 3.0 D) |
| Measuring Area | 1 mm dia. and 2 mm dia. |
| Reading Speed | 1.2 inches per second |
| Power Requirement | |
| 120 VAC Adapter p/n SE 30-61 | |
| 230 VAC Adapter p/n SE 30-62 | |
| Operating Range | 10 to 40° C (50 to 104° F) |
| Size | 18.2 x 15.2 x 6.98 cm (7.2 x 6.0 x 2.75 in.) |

## Portable Densitometer

## Gammex MA0025

Designed to meet today's demanding needs, the Gammex MA0025 Densitometer is portable, lightweight, reliable and highly accurate. The Gammex MA0025 delivers impressive performance characteristics: a 0-4.0 optical density measuring range and an accuracy of ±0.02 optical density. These rigid standards plus its rugged construction make this densitometer ideal for field and hospital use alike. In addition, it comes with its own carrying case, certified stepwedge, and low battery indicator. A battery eliminator to accommodate AC power is also included.

### SPECIFICATIONS Gammex MA0025

| | |
|---|---|
| Range | 0 to 4.0 Optical Density |
| Accuracy | ±0.02 Density |
| Reproducibility | ±0.01 Density |
| Warm-up Time | None |
| Measuring Area | 2 mm dia. and 1 mm dia. |
| Power Supply | |
| Four rechargeable AA Nicad Batteries, 4.8 V total rated at 600 mAh (included) | |
| Battery Charger | SE 30-45 (115 VAC) or SE 30-46 (230 VAC) 50 to 60 Hz |
| Charge Time | Approx. 14 hrs. |
| Size | 5.08x7.46x17.8 cm (2x2.9x7 in.) |
| Weight | 0.7 kg (1.5 lbs.) |
| Certified Stepwedge included | |

## Portable Blue/Green Sensitometer

## Gammex MA5034

Sensitometry is the single most effective way to test the processor operation and consistency. For day to day processor quality control, the Gammex MA5034 Sensitometer provides a versatile, reliable, and highly accurate test. With its 21 step light modulator, a full range of densities can be tested with a single piece of film. The Gammex MA5034 is useful for all types of film, from sensitive x-ray film to roll or cine film. With a flick of a switch, it can test either blue sensitive or green sensitive film. To expose the film all you need to do is close the cover and listen for the tone.

### SPECIFICATIONS Gammex MA5034

| | |
|---|---|
| Time Stability | ±0.02 Log Exposure per Year |
| Reproducibility | ±0.04 Log Exposure |
| Power | 9V Alkaline Battery (included) |
| Warm-up Time | None |
| Blue Color Peak Wavelength | 460 nm ±10 nm |
| Green Color Peak Wavelength | 510 nm ±10 nm |
| Size | 3.8x7.6x17.8 cm (1.5x3x7 in.) |
| Weight | 0.57 kg (1.25 lbs.) |

Gammex

## Table Top Densitometer

## Gammex MA0785

The Gammex MA0785 Table Top Densitometer allows for quick and easy density measurements on any standard size film on a full lighted surface.
The Gammex MA0785 includes an LED display, push-button zeroing and density comparison capability.
An optional RS-232 cable output for data transfer to most PC's and serial printers is available.

### SPECIFICATIONS
### Gammex MA0785

| | |
|---|---|
| Range | 0 to 5.0 Optical Density with 2 and 3 mm apertures<br>0 to 4.0 Optical Density with 1 mm aperture |
| Accuracy | ±0.02 Density |
| Reproducibility | ±0.01 Density |
| Warm-up Time | 60 seconds |
| Operating Temperature Range | 10 to 40° C |
| Power Requirements | |
| 301 (Domestic): | 100 to 130 VAC, 60 Hz |
| 301X (Export): | 200 to 240 VAC, 50 Hz (80 VA max.) |
| Scale Factor Stability | ±1% per 6 months |
| Null Drift | |
| | ±0.03 Optical Density Maximum |
| | ±0.01 Optical Density Typical |
| Size | 13.3x26x38 cm (5.3x10.25x15 in.) |
| Weight | 3.9 kg (8.5 lbs.) |
| Optional RS-232 cable | |

## Automatic Densitometer

## Gammex MA4821

The Gammex MA4821 is a quick, efficient automatic strip-reading densitometer that will simplify the way you've been monitoring your x-ray film processor.

The Automatic Densitometer Gammex MA4821 is an accurate, easy-to-use auto-reading instrument. In less than a minute, it can read and calculate a complete set of control strip data. With the push of a button the densitometer lets you view or print the measurements just taken.

With an Epson serial printer, the Gammex MA4821 can generate a D-Log E Curve for the 21 steps with control parameter measurements included. The Gammex MA4821 measures both blue sensitive and green sensitive x-ray film. A special fixed guide makes it easy to read cine film. Control strips exposed by the Gammex MA0025 sensitometer can be measured with the Gammex MA4821.

### SPECIFICATIONS
### Gammex MA4821

| | |
|---|---|
| Measuring Range | 0 to 4.5 D |
| Accuracy | |
| | ±0.02 D (0 to 3.0 D) |
| | ±1% (3.0 to 3.4 D) |
| | ±3% (3.4 to 4.0 D) |
| Repeatability | ±0.01 D (0 to 3.0 D) |
| Measuring Area | 1 mm dia. and 2 mm dia. |
| Spectral Response | 1.2 inches per second |
| Power Requirement | |
| Gammex 380 (Domestic): | 90 to 130 VAC, 50/60 Hz, 12 VDC at 0.7 amp |
| Gammex 380X (Export): | 190 to 240 VAC, 50/60 Hz, 12 VDC at 0.7 amp |
| Operating Range | 10 to 40° C (50 to 104° F) |
| Size | 7.1x14.6x18.3 cm (2.8x5.8x7.2 in.) |


## Densoquick 2 Densitometer Gammex 2-336

The Densoquick 2 is an easy to calibrate densitometer for point measurements in quality assurance and x-ray quality control measurement of test phantom films.
The Densoquick 2 features:

- Immediate running, no warm-up time necessary
- High accuracy
- Zero reset and calibration with enclosed calibration film strip
- Measurement results displayed via multi-language display

## Sensi C Sensitometer Gammex 2-335

The Sensi C is a highly accurate 21-step calibrated sensitometer for acceptance test of processing control.
The Sensi C features:

- 21 density steps with an increase of D 0.15 per step (Agfa step wedge)
- Exposures with both green (max. 512 nm) and blue (max. 455 nm) spectral ranges possible
- Optimum exposure reproducibility via the microprocessor monitors exposure control
- Prevents faulty exposures – no exposures are possible when batteries are low

### SPECIFICATIONS Gammex 2-336

| | |
|---|---|
| Measure Arm Length | 18 cm (1.4x1.8x2.8 in.) |
| Power | 9.5 volt power adapter |
| Operating Temperature | 15 - 35° C |
| Measuring Point | 7 $mm^2$ |
| Measuring Range | 0 - 4.5 D |
| Repeatability | <±0.02 D |
| Size | 8.25x24.1x10.2 cm (3.25x9.5x4.0 in.) |
| Optional RS-232 port | |

### SPECIFICATIONS Gammex 2-335

| | |
|---|---|
| Homogeneity of exposures over a step | <D 0.02 |
| Exposure Reproducibility | ±D 0.02 |
| Exposure Time Range | 50 - 200 ms |
| Operating Temperature | 23° C ±3°C |
| Density Range of the Step Wedge | D 3.00 |
| Exposure Stability (per year) | ±D 0.02 |
| Power | 9 volt battery or optional power jack |
| Size | 5.8x21.1x12.9 cm (2.3x8.3x5.1 in.) |
| Weight | 0.81 kg (1.8 lbs.) |

## Fixer Retention Test Kit Gammex 166B

Residual fixer on processed films over time can turn films brown. This browning deteriorates the image making the films useless for comparison.

To monitor the amount of residual fixer, Gammex provides the Fixer Retention Test Kit Gammex 166B. The kit contains residual hypo test solution and a hypo estimator test strip. A drop of solution is placed on the emulsion side of a freshly processed film. After waiting two minutes, the area where the solution has dried is compared to the hypo estimator. Residual hypo in the film should be 0.02 grams per square meter.

### SPECIFICATIONS Gammex 166B

| | |
|---|---|
| Residual Hypo Test Solution | 2 fluid ounces |
| Hypo Estimator Test Strip | Four stain densities |
| Size | 3x11x5.5 cm (1.25x4.5x2 in.) |
| Weight | 184 g (2.8 oz.) |

## Lint Free Screen Cleaning Cloths

## Gammex 167

### (not pictured)

Screen film cassettes require special attention to make sure that all dirt and dust particles are removed. These dirt and dust particles have the potential of degrading image quality and/or mimicking a microcalcification.

The Lint Free Screen Cleaning Cloths from Gammex come in a pack of 150 cotton wipes specially designed for critical cleaning, drying, and handling of sensitive components and equipment.

**SPECIFICATIONS**
**Gammex 167**

| | |
|---|---|
| Material | Cotton Twill |
| Quantity | 150 |
| Size | 23x23x5 cm (9x9x2 in.) |
| Weight | 1.10 kg (2.4 lbs.) |

## Camel's Hair Brush

## Gammex 168

For more frequent screen cleanings and when time is not available for complete drying of cassettes cleaned with antistatic solution, Gammex provides a two inch camel's hair brush which is soft and static resistant. The brush provides an easy way to clean a cassette quickly and efficiently.

**SPECIFICATIONS**
**Gammex 168**

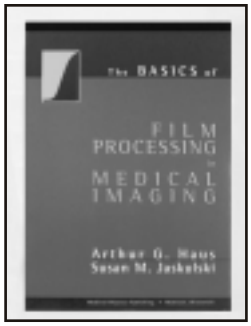
| | |
|---|---|
| Brush Size | 5.1 cm (2 in) |
| Overall Size | 1x5x19 cm(.39x2x7.5 in) |
| Weight | 25 g (1 oz.) |


## "Screen Film Mammography"

## Gammex 582

### Edited by Barnes, G. and Frey, G.D.

Greater emphasis on high quality mammography by the Mammography Quality Standards Act (MQSA), the American College of Radiology (ACR) and the American Cancer Society have increased the need for physics expertise and services in mammography. In response, the Southeastern Chapter of the American Association of Physicists in Medicine (AAPM) organized a mammography symposium and published the proceedings: Screen Film Mammography, Imaging Considerations and Medical Physics Responsibilities. This publication disseminates information on appropriate physics measurements and responsibilities in mammography and also the proper and time efficient measurement techniques.




## "Film Processing in Medical Imaging"

## Gammex 583

### Edited by Arthur G. Haus

In medical imaging and particularly in mammography, there is a growing interest and emphasis on film processing and film processor quality control. This book discusses the state-of-the-art film processing in medical imaging and addresses many areas that have changed over the past decade. Contributions were provided by experts from medical facilities including radiologists, medical physicists and radiologic technologists, industrial scientists, engineers, and film processor dealers.

Gammex

# About GAMMEX rmi®...

GAMMEX rmi® has been a leader in the manufacture and distribution of GAMMEX LASERS® and quality control devices for medical imaging and radiation therapy for over 35 years. GAMMEX, Inc. was incorporated in 1969 as a manufacturer of laser alignment devices for use in medical imaging and oncology treatment. The acquisition of RMI in 1987 gave the company the ability to expand into the manufacture of quality control equipment for ultrasound, diagnostic radiology and mammography.

The GAMMEX rmi® research and development team has patented a number of devices over the years. There are over 20 patents issued to GAMMEX rmi®.

GAMMEX rmi® corporate headquarters are located in Middleton, WI with production facilities in that location as well as in Milwaukee, WI and Benicia, CA. European and other overseas markets are serviced by Gammex-RMI, Ltd. in England and Gammex RMI GmbH in Germany.

With extensive domestic and international experience, ISO-9001 and EN 46000 certifications, GAMMEX rmi® continues to explore new realms of technology while keeping its focus on you and your patients.

When there is little room for error, choose the wide range of GAMMEX rmi® quality assurance products!

# Quality Assurance Products

Gammex is a respected leader in the manufacture and distribution of quality control devices for medical imaging, radiation therapy and laser alignment systems. When there is little room for error, choose the wide range of Gammex quality assurance products:


The Diagnostic Radiology product line offers a wide range of solutions for maintaining the accuracy of medical imaging equipment within the radiographic, fluoroscopic and CT modalities.


The ProbeG has been introduced to the family of red and green lasers. All Gammex lasers are engineered for quick easy installation and unmatched reliability.


Gammex offers a range of quality control products for complete analysis of mammographic x-ray systems.


Solid Water® is an industry standard that Gammex introduced 15 years ago to simplify radiation beam measurements. IMRT Phantoms offer convenience, innovation and reliability.


Gammex offers tissue mimicking phantoms using the latest patented gel technology. The phantoms are designed to maintain the accuracy and consistency of ultrasound scanning equipment.


Backed by its experience in laser innovation, Gammex is a leader in developing integrated CT Sim robotic laser tracking systems. The new CT SimG, with green diode lasers, not only enhances contrast on various skin tones but also uses the latest technology that extends diode life.

Gammex



Call our Mammography Experts: **1-800-GAMMEX 1**

# Ordering Information

All products and specifications are subject to change without notice. Please contact a GAMMEX dealer or representative for a quotation or for a detailed description of our ordering policies, warranties, delivery policy, conditions of sale, damaged goods policy and returned goods policy.

**In the United States, Sales hours are:**
**7:30 a.m. through 5:30 p.m. (Central Time) Monday - Friday.**

| | |
|---|---|
| General Sales Phone: | 608-828-7000 |
| Toll Free (U.S. and Canada only): | 800-426-6391 |
| Fax: | 608-828-7500 |
| Sales e-mail: | sales@gammex.com |

**Service hours are:**
**8:00 a.m. through 5:00 p.m. (Central Time) Monday - Friday.**

| | |
|---|---|
| General Service Phone: | 608-828-7000 |
| Toll Free Service (U.S. and Canada only): | 800-232-9699 |
| Fax: | 608-828-7500 |
| Service e-mail: | support@gammex.com |


**GAMMEX**
2500 W. Beltline Hwy at University Avenue
P.O. Box 620327
Middleton, WI 53562-0327 USA


We accept MasterCard, VISA, and American Express

Visit us on the internet at:
**www.gammex.com**

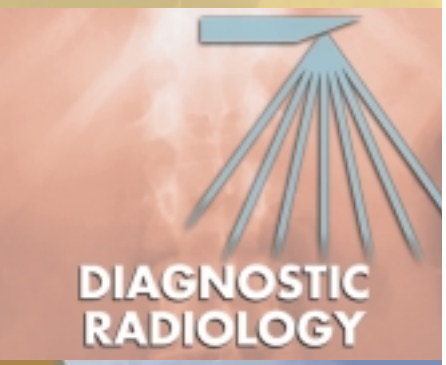
ISO 9001 CERTIFIED

CE

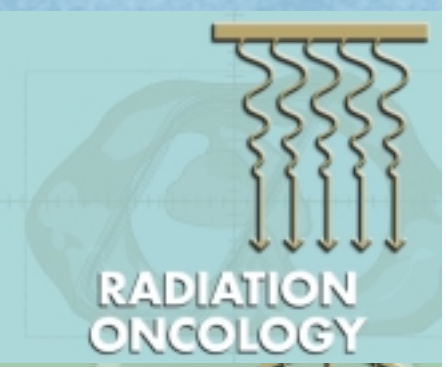


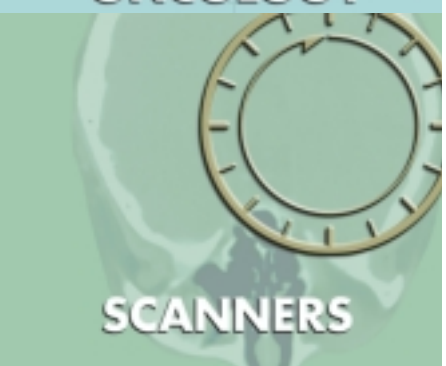
Printed in U.S.A. MAMMO-95-US30-1 Rev 6


MAMMOGRAPHY




Gammex

GAMMEX rmi®

***When there is little room for error, choose the wide range of Gammex quality assurance products!***

Due to our philosophy of continuous product improvement, these specifications may change without notice.

**GAMMEX RMI**
P.O. Box 620327
Middleton, WI 53562-0327 USA
**1-800-GAMMEX 1** (426-6391)
1-608-828-7000
Fax: 1-608-828-7500
**www.gammex.com**
e-mail: sales@gammex.com

**GAMMEX-RMI LTD**
Karlsruhe House
18 Queens Bridge Road
Nottingham NG2 1NB, England
(+44) (0) 115 985-0808
Fax: (+44) (0) 115-985-0344
e-mail: uksales@gammex.com

**GAMMEX-RMI GMBH**
Odesheimer Weg 17
53902 Bad Münstereifel
Germany
(+49) (0) 2257-823
Fax: (+49) (0) 2257-1692
e-mail: desales@gammex.com