

Quality Control for
**DIAGNOSTIC
RADIOLOGY**



GAMMEX rmi®

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CT Sim Robotic Laser Tracking Systems

Gammex A3000A and A3100G Gammex A4000A and A4100G

Gammex A3000A and A3100G CT Sim Robotic Laser Tracking Systems consist of two sidewall cross lasers with a movable horizontal line and one overhead cross laser with a movable sagittal line. These lasers provide movement in two dimensions with the CT couch movement providing the third dimension. All vital features of the CT Sim Robotic Laser Tracking System can be controlled using either the workstation or the remote pendant. Lasers can accept exported coordinates from treatment planning systems, allowing easy and accurate movement to marking location. Diode lasers are available in green or red. Not only does the integrated ProbeG green laser enhance contrast on various skin tones, its unique design incorporates power stabilizing circuitry that extends diode life. Either diode you choose features precision optics and the reliability you have come to expect from Gammex Lasers.

Gammex A4000A and A4100G CT Sim Robotic Laser Tracking Systems consist of two fixed side-wall lasers and one overhead laser with a movable sagittal line. These lasers provide precise positioning in one dimension (X axis) and rely on the CT scanner couch for positioning in the second and third dimensions. All vital features of the CT Sim Robotic Laser Tracking System can be controlled using either the workstation or the remote pendant. Lasers can accept export coordinates from treatment planning systems, allowing easy and accurate movement to marking location. Your choice of Gammex Probe+ red diode, or ProbeG green diode lasers can be used for the fixed sidewall lasers and feature a wide-view turret profile that allows mounting on angled walls. The ProbeG green laser provides enhanced contrast on various skin tones, and its unique design incorporates power stabilizing circuitry that extends diode life.



**Gammex A4100G-PC-SYS 2
Green Laser System**

**Gammex A3000A-PC-SYS 2
Red Laser System**

System configurations: A3000A and A3100G systems include:

- Three moving lasers (choice of red or green diode)
- CT Sim software package
- Hand-held pendant
- CT Sim alignment phantom
- Software manual, calibration kit, controller box and all necessary cabling

A3000A-PC-SYS 2 and A3100G-PC-SYS 2 systems include:

- All items listed with the A3000A and A3100G plus medical grade Gammex approved desktop computer, 15" flat panel LCD monitor.

A4000A and A4100G systems include:

- One moving laser (choice of red or green diode)
- Two fixed side-wall lasers (choice of red or green diode)
- CT Sim software package
- Hand-held pendant
- CT Sim alignment phantom
- Software manual, calibration kit, controller box and all necessary cabling

A4000A-PC-SYS 2 and A4100G-PC-SYS 2 systems include:

- All items listed with the A4000A and A4100G plus medical grade Gammex approved desktop computer, 15" flat panel LCD monitor.

SPECIFICATIONS - CT Sim Robotic Laser Tracking Systems

Laser Beam Output

Power less than 1.0 mW (each beam) Laser Class II
Range 1.5 CE 6.1 m (5 CE 20 Ft.)
Line Width <0.8 mm wide at 3.0 m
Line Length 1.0 m at 3.0 m
Drift no measurable drift
Wavelength Red 6350A (635 nm) visible red
Wavelength Green 5320A (532 nm) visible green
Visibility clearly visible even in strong ambient light

Laser Beam Adjustment

Length of travel 70 cm
Accuracy of travel ± 0.5 mm at 3.0 m
Positioning accuracy ± 0.5 mm at 3.0 m

Laser Dimensions

Laser Unit (Moving Lasers)
..... 117x21x9 cm (HWD) (46x8.27x3.5 in.)
Laser Unit (Probe+ CE A4000A only)
..... 17.3x14x8 cm (HWD) (6.8x5.5x3 in.)
Laser Unit (ProbeG CE A4100G only)
..... 27x14x8 cm (HWD) (10.6x5.5x3 in.)
Power Module
..... 42x21x9 cm (HWD) (16.6x8.25x3.2 in.)
Voltage requirements 110/220 VAC (auto-select)

Certification

Complies with Center for Devices and Radiological Health regulations for Class II lasers and all CE marking requirements. (21 CFR 1040) (IEC 60825-1) (MDD 93/42/EEC).

Warranty

Lasers carry a one year direct Gammex warranty. Computer and peripherals carry the original manufacturer's warranty only.

Minimum Requirements - Computer

Gammex CT Sim Robotic Laser Tracking Systems have specific hardware and software requirements. For ensured compatibility, Gammex recommends the purchase of the complete CT Sim Robotic Laser Tracking System. The CT Sim software has been validated using the computer and flat screen monitor provided with the complete system. If the Gammex supplied computer and monitor are not used, Gammex cannot guarantee software's functionality and performance. Compatibility with user supplied computers is not warranted. Call your Gammex sales representative for more information.



Diagnostic Radiology

Laser Stanchion System

Red Diode Laser

Rack3000 Entire Gantry

Stan3000 Single Tower

Green Diode Laser

Rack3100 Entire Gantry

Stan3100 Single Tower

Versatile Stanchion System minimizes room modification and down-time. The Gammex Laser Stanchion simplifies the installation of patient positioning lasers for radiation oncology, IMRT, CT simulation and related applications.

The stanchion system functions as an independent laser mounting system. The system can be installed without expensive room renovation and its height and length can be customized to meet specific needs. Since only one IEC power connection is required to operate multiple laser units, electrical modifications to an existing room are kept to a minimum. Individual towers are also available.

Features of the Gammex Laser Stanchion System:

- Made from attractive, lightweight extruded aluminum for added strength and durability
- Several standard heights and widths are available; custom sizes can be provided
- Stanchions are available as gantries and towers and support red or green diode lasers
- Single entry point cable management



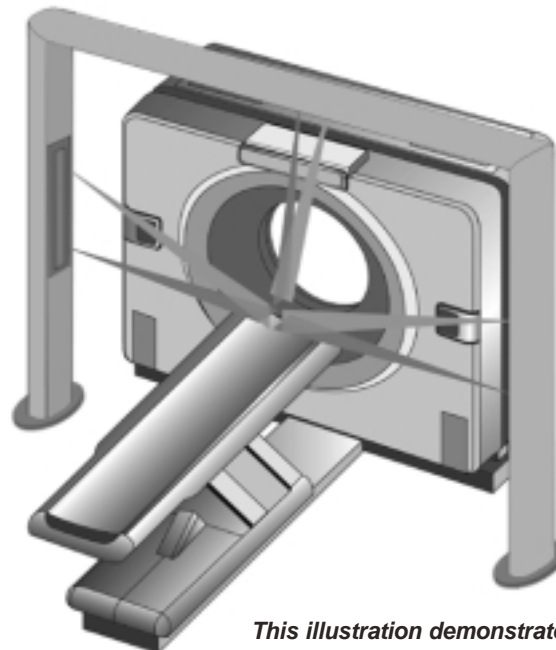
Laser Stanchion Single Tower system

Laser Stanchion Entire Gantry system

SPECIFICATIONS

Laser Stanchion System

Material	Extruded Aluminum
Standard Sizes:	
Towers	6.5 feet high
Gantry:	7.5 feet high x 12 feet across
Gantry:	8.5 feet high x 14 feet across
Custom sizes available, please contact your Gammex sales representative.	



This illustration demonstrates the Gammex CT-Sim Laser Tracking System installed using the Laser Stanchion Entire Gantry System in an integrated CT therapy simulation setting.



Versatile Gammex DAP™ Systems

Gammex DAP-841S

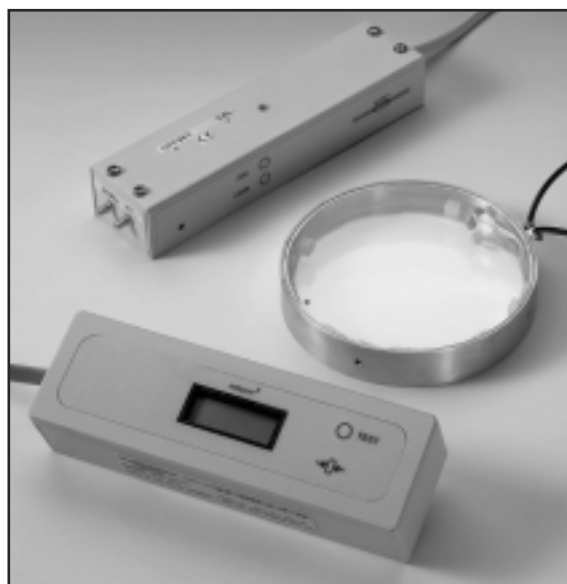
The DAP-841S is a simple self-contained system which installs directly on over-couch or under-couch sets. It is specifically designed to be economical, easy to install and simple to use. The ionization chamber itself is transparent and is encased in a slim rigid frame. The frame slides easily into rails on the collimator. As with all Gammex DAP systems, because the ion chamber is transparent, the collimator light is visible on the patient for easy patient alignment without distortion. The DAP-841S features a full-field ionization chamber and displays Dose Area Product in the range 1mGycm² to 99,999 Gycm².



Ionization Chamber Options

A rectangular chamber of active area 140 mm x 140 mm, with or without integrated local liquid crystal display adapts to the face of the collimator. The filtration is typically <0.5 mm Al equivalent.

A series of circular chambers of varying diameters are available for fitting internally to the collimator housing of different radiographic equipment manufacturers.



SPECIFICATIONS DAP Components

841S	DAP-S System
841C	DAP Chamber
841-SO	DAP Circular Chamber

Gammex may exchange DAP systems at any time following manufacturer's design. Gammex can build other DAP units to meet our customers' patient radiation dose monitoring needs.



Diagnostic Radiology

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 unparalleled 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 a 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	3 1/2 digit LCD
Analog Output	Optional BNC connector (Special Order)
Power	9 V alkaline battery (included)
Size	10x20x19 cm (2x4x7.5 in.)
Weight	0.58 kg (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	



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, auto-range. Its 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, Practical Peak voltage (ppv) according to IEC 61676, mAs and time meter for acceptance tests and quality control of diagnostic X-ray equipment
- Compact and light-weight
- Auto-start, auto-stop, auto-range
- Large easy-to-read four 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	Minimum field size	34 x 34 mm
Operating mode	continuous operation	Filter dependence	internal calibration function for all conventional filters (reference points according to IEC 61676)
Indication of measuring value	graphic display, oscilloscope	Typ. minimum measuring signal	60 kV, 1 mA at focal distance of 50 cm
Radiation direction	overcouch and undercouch application	Delay	0 - 9999 ms
Measuring quantities	tube voltage (kV), time (s), relative mAs	Time constant	140 µs
Tube voltage		Sampling rate	25 kHz
Selectable calculations	PPV, max kVp, mean kVp	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
Measuring range	40 - 150 kV, 22 - 40 kV (MAM)	Rechargeable batteries	4 rechargeable NiMH batteries
Digital resolution	0.1 kV	charge time	14 hours
Accuracy	±1 % or ±1.0 kV, 22 - 150 kV	Environmental Conditions	
Reproducibility	±0.5 %	Transport and Storage	
Minimum irradiation time for kV measurement	5 ms	Ambient temperature	-20 ... +50°C
Typical autorange settling time:	6 ms, 1 ms (kV manual)	Relative humidity	10 ... 85% rel. humidity (max. 20 g/m ³ absolute humidity)
Time		Atmospheric pressure	600 ...1200 hPa
Measuring range:	0.3 ms - 999 s	Operation	
Digital resolution:	300 µs	Ambient temperature	+15 ... +35°C
Accuracy:	±0.3 ms (trigger radiation on)	Relative humidity	20 ... 80% rel. humidity (max. 20 g/m ³ absolute humidity)
Reproducibility:	±0.3 ms	Atmospheric pressure	700 ...1060 hPa
Relative mAs product		Dimensions and Weight	
Measuring range:	5 - 999 rel. mAs	width	9.5 cm (3.75 in.)
Digital resolution:	0.1 mAs	depth	15.5 cm (6.1 in.)
Accuracy:	±2 % typical	height	4.5 cm (1.7 in.)
Reproducibility:	±1.0 % (min. 100 ms pulse width, kV range manual)	weight	approx 0.77 kg (30 oz.)
Nominal useful range	1 - 200 mGy/s	Analog output: 0 ... 4VD	25 mV equivalent to tube voltage of 1 kV output
Dose rate dependence	0.5 % [IEC61676]	impedance:	0.2 Ohm, Rload >5 kOhm
Distance dependence	negligible	Communication	RS232 port
Rotation dependence	negligible		
Field size dependence	negligible		



Digital X-ray Timer

Gammex 07-453

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 07-453 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 07-453

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	80x147x40 mm (3.15x5.8x1.6 in.)
Weight	0.21 kg (0.5 lbs)

SPECIFICATIONS Gammex 06-007

Energy Response

Radiation Detected	
.....	Gamma, x-ray from 20 keV to 2 MeV
.....	Ranges 0 to 200 mR
.....	Energy Response 160 keV to 2 MeV: ±10%
.....	40 keV to 160 keV: +20%, -10%
.....	20 keV to 40 keV: +20%, -30%
.....	Accuracy Within ±10% of true exposure
Rate Response	
.....	Dose rate independent for gamma and x-ray
Electrical leakage	
.....	Less than 0.5% of full scale for 24 hours at 50° C
.....	Relative Humidity Up to 90%
Detector	
.....	Fiber electrometer mounted in an electrically conducting plastic ion chamber

Material

Detector Housing	
..	Very low permeability plastics; hermetically sealed
Clip	Glass fiber-filled, high-strength plastic

Dimensions

Size	1.5x12.4 cm (ØxL) (0.6x4.5 in.)
Weight	0.03 kg (0.06 lb.)

Pen Dosimeter

Gammex 06-007

Low-energy, direct-reading Pen Dosimeters are radiation-measuring devices made with special low-density walls that permit the penetration and detection of diagnostic x-ray energies.

The pen size instruments contain an electrometer and an ionization chamber.

To read the integrated exposure, the user looks through the dosimeter eye-piece while pointing the unit toward any external light source. The exposure is determined by the position of a hairline fiber against a graduated scale.

A Dosimeter Charger is used to re-zero the dosimeter and can also be used to read the integrated exposure. Low-Energy Dosimeters come in two ranges, depending on the application.



Gammex 06-912 (L) , Gammex 06-007(R)

SPECIFICATIONS Gammex 06-912

Voltage Supplied	180 to 240 V
Power	1.5 V "D" Battery
Size	7.6x10x10 cm (HxDxW) (3x4x4 in.)
Weight	0.45 kg (1 lb.)

Dosimeter Charger

Gammex 06-912

This transistorized unit (not pictured) has a power supply that "zeros" all direct-reading dosimeters and can also be used to read the integrated exposure. One standard 1.5 V "D" cell battery permits thousands of operations.

A safety spring in the charging socket prevents damage from excessive pressure on the dosimeter. A protective cap keeps the socket free of dust and moisture when not in use.



Dual-Range mAs Meter Gammex 07-487

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 07-487 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.

This meter excels 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 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.



Gammex 07-487

SPECIFICATIONS Gammex 07-487

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 inches 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.)

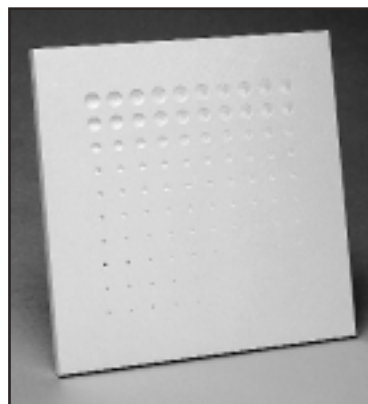
Radiographic Contrast/Detail Phantom

Gammex 1151

The Radiographic Contrast/ Detail Phantom Gammex 1151 allows the user to determine the threshold contrast of a fluoroscopic system and then monitor it on a routine basis.

The Gammex 1151 is constructed of an aluminum plate with a 10 by 10 matrix of holes that vary in diameter and in depth. For a specific hole diameter, the depth of the hole which can just be visualized is defined as the threshold contrast for that diameter.

A contrast detail curve of the fluoroscopic system can be established by plotting the diameter of the hole vs. the depth of the hole that is visualized.



SPECIFICATIONS Gammex 1151

Construction	6061 Aluminum
Hole Depth	0.13 to 2.29 mm (0.005 to 0.09 in.)
Hole Diameter	0.58 to 7.93 mm (0.023 to 0.312 in.)
Size	17.8x17.8x13 mm (7x7x0.512 in.)
Weight	2.2 kg (4.8 lbs.)





Radiographic Survey Phantom

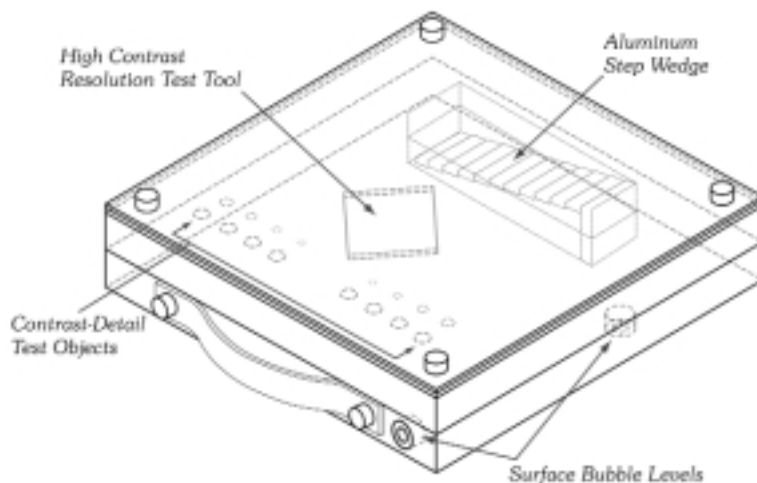
Gammex 170NJ

The Gammex 170NJ phantom provides a simple and reproducible test tool for inter-facility surveys and intra-department comparison of radiographic systems. For routine quality control, the phantom images provide a rapid assessment of high contrast resolution, low contrast detectability, radiographic exposure consistency as well as radiation light-field alignment and collimation accuracy. The phantom is designed for use in three ranges of clinical settings: extremity (no copper plates) in the range of 60 kVP, abdomen or lumbar spine (with 2.4 mm Cu plate) in the range of 75 kVP, and chest (with 2.0 mm Cu plate) in the range of 120 kVP.

The Radiographic Survey phantom is fully compatible with RIT QClick image analysis software that automatically performs MTF, step wedge, resolution, high and low contrast, noise and uniformity tests from your radiographic film image. Results are automatically stored in a database for easy retrieval.

Specified for use by health physicists performing routine inspection, the Gammex 170NJ is designed with features to optimize portability and ease of use. Each phantom is equipped with a carrying strap, tripod mounting assembly and built-in levels for quick set up, and orientation in the variety of clinical settings encountered by inspection teams and consultants.

This diagram shows the test objects found in the Radiographic Survey Phantom Gammex 170NJ



SPECIFICATIONS Gammex 170NJ

Phantom Basis Material

- (2) acrylic blocks, 3.9x3.9x.78 cm (10x10x2 in.) assembled
- (1) 2.0 mm Cu plate, 3.9x3.9 cm (10x10 in.)
- (1) 2.4 mm Cu plate, 3.9x3.9 cm (10x10 in.)

Imbedded Test Objects

- 6061 aluminum step wedge, 11 steps
Dimensions: 5.5" x 1.5" x 1.37",
step depth 0.5", step height 0.125"
- High contrast resolution test tool:
20 line pairs from 0.6 lp/mm to 10 lp/mm
- Contrast-detail test objects:
Eight holes of 0.375" diameter with decreasing depths of: 0.006", 0.009", 0.013", 0.018", 0.025", 0.035", 0.049", 0.068"
Tolerance ± 0.0020 "

Two sets of four holes of 0.068" depth with decreasing diameters of: 0.2", 0.15", 0.1", 0.08"
Tolerance ± 0.0020 "

Alignment and Orientation Markers

- Four corner markers for light field alignment
- Top edge lead reference line for film orientation
- Point alignment marker, 0.08" diameter, 0.75" deep
- Top and front surface bubble levels

Ergonomic Features

- Carrying strap
- Thread for tripod mounting
- Thumb screw fasteners for attaching copper attenuation plates.



Head/Body CT Phantom

Gammex 461A

Accurate testing of all CT scanner parameters is a crucial part of a good QC program. The Head/Body CT Phantom Gammex 461A is designed for a complete CT quality assurance program, including daily quality control tests and periodic, comprehensive QC testing to meet the requirements of the FDA.

The Head/Body Phantom Gammex 461A consists of a head module which is a uniform disc of Solid Water® phantom material. To test a CT scanner in the head scanning mode, a ring of bone mimicking material is mounted on the head module. For testing in the body scanning mode, a body annulus is mounted on the head module. The head module has 5 tapered cavities which accept tapered test inserts and the body annulus ring has 4 cavities, providing for a total of 9 test positions. Standard test inserts make basic QC tests possible, while the optional test inserts allow for more sophisticated tests that may be useful for physicists and engineers. These inserts are designed for maximum flexibility with a minimum of time, effort and cost.

Reproducibility and consistency between tests can be achieved with the Gammex 461A because of its Solid Water construction. This eliminates the problems and inconvenience found with water-fillable phantoms. The versatile design of the Gammex 461A permits custom tests. A carrying case is included.



SPECIFICATIONS - Gammex 461A

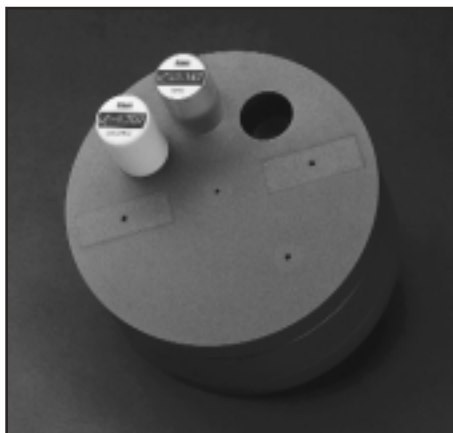
Phantom Construction	Solid Water Material
Inserts Included:	
(9) Uniform Solid Water inserts for measurement of Noise, CT Number, and Uniformity	
(1) Edge/Contrast Scale Response	
(1) Spatial Resolution (1.50 to 0.4 mm at 100% contrast)	
(1) Low Contrast Detectability (0.6%)	
(1) Alignment Artifact (Aluminum Pin)	
(4) Alignment, Slice Thickness, Phantom Position	
(2) Slice Thickness and Sensitivity Profile 2:1 Slope (26.6° Slope)	
(2) Beam Hardening Artifact (Simulated Bone)	
(6) Linearity	
Optional Inserts:	
0.3% Low Contrast Resolution TLD Holder	
Dose Insert	
Wedge	
Impulse Response	
Clear Resin Rod	
Case Size	61x40x22 cm (24x16x8.5 in.)
Weight	16 kg (35 lbs.)

Economy CT Phantom

Gammex 463

The FDA requires documentation of CT scanner quality assurance, and that has been made easier with the Economy CT Phantom Gammex 463. Designed to emphasize versatility and convenience, this one phantom can be used for all your CT Quality Assurance needs. With only two scans, the phantom will provide QC tests of slice thickness, slice position accuracy, high contrast resolution, low contrast detectability, linearity and noise level.

The phantom body is made of Solid Water® which has a CT number of approximately zero. Since there are no liquids to bother with, your QC testing procedures are more convenient and accurate. The Economy CT Phantom Gammex 463 has three cavities for linearity inserts which determine the consistency of the CT numbers of the inserts against the background. Tissue Mimicking Bone and acrylic linearity inserts are included, as is a handy carrying case.



SPECIFICATIONS Gammex 463

Construction	Solid Water Material
Tests Performed:	
Slice Thickness	
Slice Position Accuracy	
High Contrast Resolution	
Low Contrast Detectability	
Linearity	
Noise CT Number	
Case Size	43x33x19 cm (17x13x7.5 in.)
Weight	9.1 kg (20 lbs.)



ACR CT Accreditation Phantom

Gammex 464

The Gammex 464 ACR CT Phantom is designed to be an integral part of the American College of Radiology (ACR) CT Accreditation Program. This voluntary program provides physicians with an opportunity for a comprehensive peer review of their CT facility, personnel qualifications, image quality and quality assurance programs. CT accreditation encourages patient's confidence and demonstrates your commitment to quality healthcare to payers, regulatory agencies and employers. The ACR CT Accreditation Phantom can be used for initial QA assessment and routine monthly QA testing to help ensure that patients are receiving the lowest possible CT dose.

Solid Water® construction makes for a convenient, physically stable test device that provides reproducible results over time. The phantom consists of four modules designed to examine a broad range of scanner parameters. It features white scribed markings on the axial, coronal and sagittal axis, and HEAD, FOOT and TOP markings to ensure proper alignment.



The optional phantom base Gammex 464-CTND (shown with the phantom) provides stability, makes alignment easier and features built-in leveling devices.

SPECIFICATIONS Gammex 464

Phantom Construction

Matrix material Solid Water, 0 ±5 HU or equivalent
 Length 16 cm (6.30 in.)
 Diameter 20 cm (7.88 in.)
 Weight 5.3 kg (11.75 lbs.)

Imbedded Test Objects

Water equivalent linearity rod:
 Solid Water, 0 ±0.5 HU or equivalent
 Bone equivalent linearity rod:
 910 HU Bone tissue equivalent material
 Acrylic linearity rod..... Cast acrylic
 Polyethylene linearity rod..... Low density polyethylene
 Low contrast module matrix: . Ciba Geigy CB4 epoxy or equivalent
 Low contrast rods..... Ciba Geigy CB4 epoxy
(density adjusted to yield 6 ±0.5 HU difference) or equivalent
 Tungsten carbide beads:
 0.011" diameter grade 25 tungsten carbide beads
 Line pair material:
 6061 Aluminum and Solid Water, 0 ±5 HU or equivalent
 Steel beads: 1.00mm grade 25 chrome steel balls
 Intra-module homogeneity:
 The mean ROI values within any module, test objects excluded,
 can differ by no more than 2 HU.
 Intra-phantom homogeneity, modules 1, 3 and 4:
 The average CT number of a module must meet the
 requirements of 0 ±5 HU.

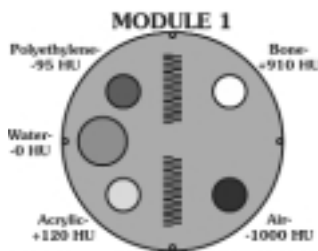
Optional Phantom Stand Dimensions

Length 228.6 mm (9 in.)
 Width 203.2 mm (8 in.)
 Height 47.63 mm (1.875 in.)
 Weight 0.5 kg (1.1 lbs.)

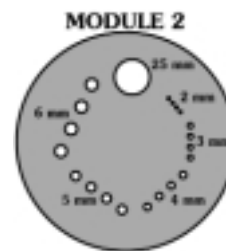
Optional Hard and Soft Cases

Hard 464-HC
 Soft 464-SC

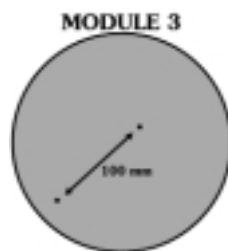
Phantom Module Schematics



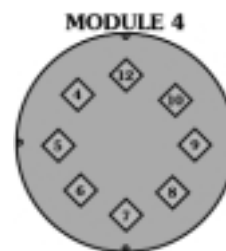
Positioning and alignment, CT number accuracy and slice thickness.



Low contrast resolution. Features a series of cylinders with different diameters, all at 0.6% (6 HU) difference from the background material.



CT number uniformity assessment. Includes two small targets for testing in-plane distance measurement accuracy.



High contrast (spatial) resolution. Contains eight high contrast resolution patterns of 4, 5, 6, 7, 8, 9, 10, and 12 line pairs per cm.

*For outside USA, order Model #438 CT Phantom



Radiographic/fluoro Kits

Gammex 181C and 181F

The Gammex Rad/Fluoro Kits contain the necessary test instruments for doing routine quality control tests of radiographic, fluoroscopic and tomographic x-ray units.

Each test tool within the kits is designed to evaluate one of the many important imaging parameters within the x-ray system.

Instructions for all the tools are bound in a hard cover binder for easy location and availability. The instructions are "cookbook" easy so that personnel will find the procedures easy to perform and understand.

The user will be able to immediately begin recording data on the sample quality control forms that are included with the instructions.

All products included in this kit are explained in detail throughout this catalog.



Gammex 181C

SPECIFICATIONS Gammex 181C

The Gammex 181C includes:

- Digital kVp Meter Gammex 245
- Digital X0ray Timer Gammex 07-453
- Focal Spot Test Tool Gammex 112B
- Half Value Layer Attenuator Set (aluminum) Gammex 115A
- Radiographic Aluminum Stepwedge Gammex 117
- Tomographic Test Tool Gammex 132
- High Contrast Resolution Test Tool Gammex 141
- Film/Screen Contact Test Tool Gammex 143D
- Grid Alignment Test Tool Gammex 144
- Low Contrast Resolution Test Tool Gammex 151
- Collimator Test Tool Gammex 161B
- Beam Alignment Test Tool Gammex 162A
- Low Energy Dosimeter Gammex 06-007
- Dosimeter Charger Gammex 06-912
- "Quality Management for Radiographic Imaging" Gammex 587
- Quality Assurance Handbook Gammex 781A
- Foam Lined Case Gammex 080B
- Tape Measure Gammex 090
- Size 22x61x40 cm (8.7x24x16 in.)
- Weight 25 kg (55 lbs.)

Gammex 181F: This kit is the same as the Gammex 181C except Dosimeter Charger Gammex 06-912 and Low Energy Dosimeter Gammex 06-007 are replaced by the Rad Check Exposure Meter Gammex 06-526.



Gammex 181F



Diagnostic Radiology

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 includes:

Densitometer Gammex 2-331
Sensitometer Gammex 2-396
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.)

Slit Camera

Gammex 07-624-1000

Here is a versatile slit camera manufactured to the highest quality standards and offered at a cost effective price. It provides exceptional performance, accuracy, quality, and reliability. For added cost effectiveness and convenience, the slit camera can be repaired to its original specification in the event it is dropped or damaged. This Slit Camera is ideal for use by equipment manufacturers, service engineers, and physicists.



SPECIFICATIONS Gammex 07-624-1000

Number of slits One
Slit width ... 10 μm \pm 1 μm , with 4^o relief angles on each jaw
Slit length 5.5 mm (\pm 0.1 mm)
Slit material/thickness Tungsten; 1.5 mm
Weight 0.35 lb (0.16 kg)
Available model(s)
07-624-1000 Single Slit Camera, with carrying case



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. (36.2 cm to 66.0 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



Diagnostic Radiology

Precision Test Patterns

**Gammex 1112,
Gammex 07-501, Gammex 07-523,
Gammex 07-527, Gammex 07-538,**

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 (line pairs per mm) of a mammographic system is an objective means of monitoring image quality. The Mammographic Gold Line Pair Resolution Test Pattern Gammex 1112 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
1112	5.0 to 20	17	*	10x25
07-501	0.5 to 5.0	6	0.10	110x40
07-523	0.5 to 5.0	1	0.10	157x50
07-527	0.6 to 5.0	20	0.01	50x50
07-538	0.6 to 5.0	20	0.10	50x50

A = Range of Resolution in lp/mm

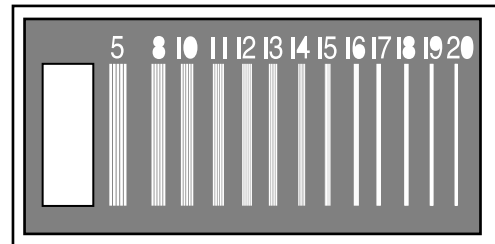
B = Number of Groups or Sectors

C = Lead Foil Thickness in mm

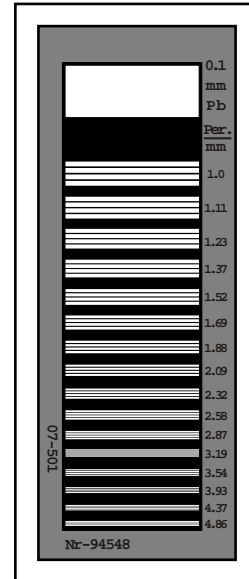
D = Dimensions in mm

* = Gold nickel alloy equivalent to 25 microns of lead

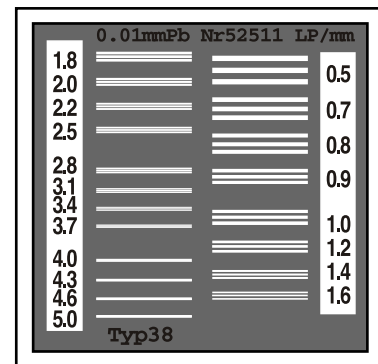
SPECIFICATIONS - Precision Test Patterns	
Gammex 07-501 0.5 to 5.0 lp/mm Sixteen Groups Size 110x40 mm (4.3x1.6 in.) Weight 9 g (0.3 oz.)	Gammex 07-527 and Gammex 07-538 0.6 to 5.0 lp/mm Twenty Groups Size 50x50 mm (1.9x1.9 in.) Weight 9 g (0.3 oz.)
Gammex 07-523 0.5 to 5.0 lp/mm One Sector Size..... 157x50 mm (6.2x1.9 in.) Weight 9 g (0.3 oz.)	Gammex 1112 5 to 20 lp/mm Seventeen Segments Size 10x25 mm (4x10 in.) Weight 3 g (1 oz.)



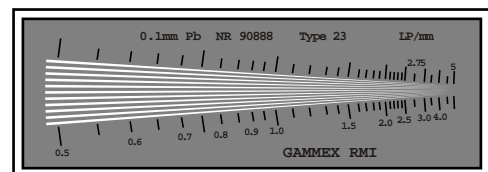
Gammex 1112



Gammex 07-501



Gammex 07-527 and Gammex 07-538



Gammex 07-523





Gammex 115A and 116

Half Value Layer Attenuator Set Gammex 115A

Determining the Half Value Layer (HVL) of the x-ray beam is the standard method for specifying the quality of the x-ray beam. For a given kVp, a measurement of the HVL gives information on the total filtration in the x-ray beam. Too little filtration results in unnecessary radiation to the patient. Too high of a HVL may require increased kVp and mAs, increasing tube loading and reducing tube life.

The Gammex 115A HVL set is made of 1100 alloy aluminum. Use of lower purity types of aluminum can result in inaccurate measured half value layers.

Half Value Layer Attenuator Set Gammex 116

For radiation energies of 140 to 400 kVp, copper is used for specifying the half value layer of the x-ray beam. Gammex provides a pure copper HVL set which includes nine sheets of 10x10 cm copper with thicknesses that range from 0.1 to 2.0 mm.

Half Value Layer Attenuator Set (not pictured) 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 each 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.

Lint Free Screen Cleaning Cloths (not pictured) Gammex 167

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 is a pack of 150 cotton wipes specially designed for critical cleaning, drying and handling of sensitive components and equipment.

SPECIFICATIONS Gammex 115A

Construction 1100 Aluminum Alloy (99.0% Pure)
Size 10x10 cm (4x4 in.)
Weight 0.2 kg (0.4 lbs.)

Nine Individual Aluminum Sheets

Thickness
(1) 2.0 mm
(2) 1.0 mm
(2) 0.5 mm
(1) 0.2 mm
(3) 0.1 mm

SPECIFICATIONS Gammex 115H

Construction 99.99% Pure Aluminum
Size 10x10 cm (4x4 in.)
Weight 0.09 kg (0.2 lbs.)

Six Individual Aluminum Sheets

Thickness 0.1 cm

SPECIFICATIONS Gammex 1116

Construction Pure copper
Size 10x10 cm (4x4 in.)
Weight 0.55 kg (1.1 lbs.)

Nine Individual Copper Sheets

Thickness
(1) 2.0 mm
(2) 1.0 mm
(1) 0.5 mm
(1) 0.25 mm
(4) 0.1 mm

SPECIFICATIONS Gammex 167

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



Diagnostic Radiology

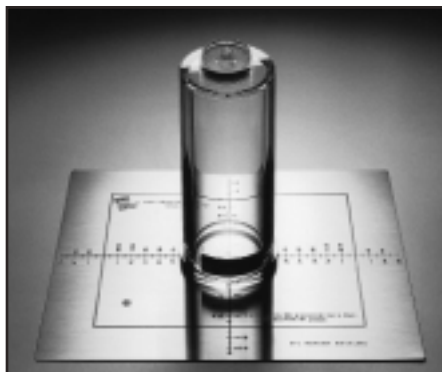
Collimator and Beam Alignment Test Tools

Gammex 161B and Gammex 162A

The Collimator Test Tool Gammex 161B is designed to evaluate the collimator light field and x-ray field congruence according to the Center of Devices and Radiological Health (CDRH) specifications.

The Gammex 161B is constructed of brass so that centimeter etchings on its surface can give a direct ruled dimension on the radiograph with a normal x-ray exposure. The collimator test tool is calibrated to show misalignments to within 0.5 cm.

The Beam Alignment Test Tool Gammex 162A provides a simple test of the x-ray beams alignment. When used with the Collimator Test Tool, x-ray beam misalignments of 1% and 2% can be visualized without the need for measuring or calculating.



The test instrument is constructed of a plastic cylinder 6.3 inches high with two steel balls, one at each end. The steel balls are located directly above one another so that, when level and everything is in alignment, they will be superimposed on the radiograph. A bubble level is included so that accurate tests can be performed with ease.

SPECIFICATIONS Gammex 161B

Construction Etched Brass
Dimensions 20x25 cm (8x10 in.)
Weight 200 g (6.2 oz.)

SPECIFICATIONS Gammex 162A

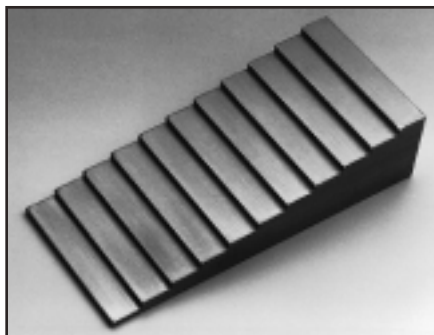
Construction Acrylic Cylinder
Dimensions
Height 16 cm (6.3 in.)
Diameter 7 cm (2.8 in.)
Weight 260 g (9.2 oz.)

Radiographic Aluminum Stepwedge

Gammex 117

This stepwedge is constructed of homogeneous, high purity aluminum and is designed to provide incremental exposures to x-ray film by the increased aluminum thicknesses in each step.

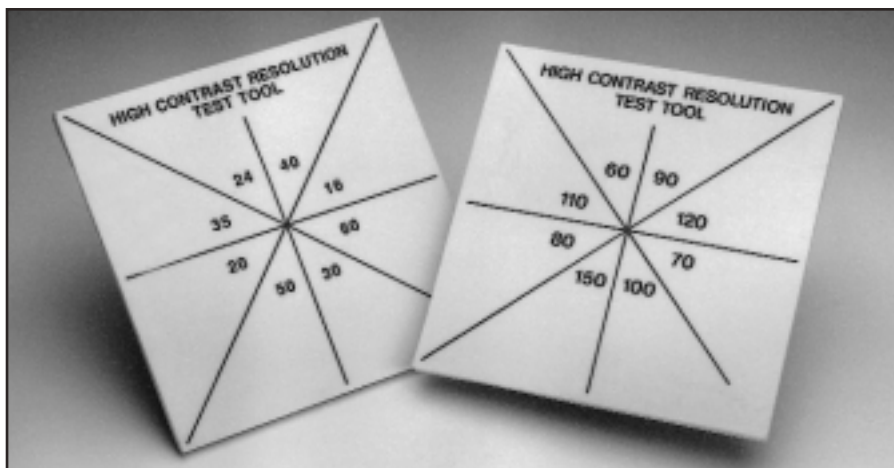
The Gammex 117 provides a useful means of comparing the characteristic curve of various film/screen combinations, mAs reciprocity, and if done very carefully, sensitometry. For sensitometry totally independent of x-ray generator variation, use the dedicated sensitometers described on pages 19-21.



SPECIFICATIONS Gammex 117

Construction High Purity Aluminum Alloy
..... 11 Steps 3 mm high and 12.7 mm deep
Dimensions 14x6 cm (5.5x2.4 in.)
Weight 461 g (1 lb.)





SPECIFICATIONS Gammex 141	
Geometric Progression	2 1/3
Construction	White Plastic (outside)
Eight Wire Mesh Patterns (inside)	16 to 60 mesh
Dimensions	18x18x1 cm (7x7x0.4 in.)
Weight	113 g (4 oz.)

SPECIFICATIONS Gammex 141H	
Geometric Progression	2 1/3
Construction	White Plastic (outside)
Eight Wire Mesh Patterns (inside)	60 to 150 mesh
Dimensions	18x18x1 cm (7x7x0.4 in.)
Weight	113 g (4 oz.)

High Contrast Resolution Test Tools

Gammex 141 and Gammex 141H

One important measure of your fluoroscopy system is its high contrast resolution. This test can access the resolving power of your system and can be accomplished easily with Gammex test tools.

Gammex 141 and Gammex 141H consist of eight patterns of copper wire mesh in a pie shape. Each is labeled with lead numbers for easy visualization.

Gammex 141 is used for standard radiographic systems with resolutions between 16 and 60 mesh. Gammex 141H is used for systems with high resolution such as those used in cardiology suites, where resolution is between 60 and 150 mesh.

Low Contrast Resolution Test Tool

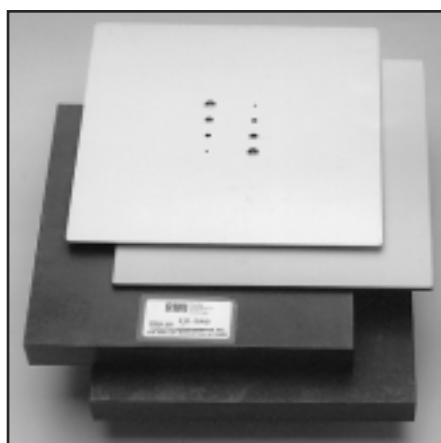
Gammex 151

An Automatic Brightness Control (ABC) for fluoroscopy compensates for variation in patient thickness, x-ray field size, image intensifier magnification modes and other variations of the system.

GAMMEX's Low Contrast Resolution Test Tool evaluates the system's ability to compensate for these variations while maintaining good image contrast and detail.

The Gammex 151 consists of two aluminum blocks, one lead blocker and an aluminum resolution plate with two sets of decreasing diameter holes.

Parts of the Gammex 151 can be used to assist in performing other tests of the radiographic and fluoroscopic x-ray system. The lead plates can be used to drive the automatic brightness control (ABC) to maximum exposure levels. The diagnostic dosimeter can be used in conjunction with the Gammex 151 to measure patient entrance exposures under ABC control or at maximum techniques.



SPECIFICATIONS Gammex 151	
Construction	Two Aluminum Blocks (1) Lead Blocker (1) Aluminum Resolution Plate
Dimensions	18x18x4.5 cm (7x7x1.8 in.)
Weight	4 kg (8.8 lbs.)



Diagnostic Radiology

Tomographic Test Tool

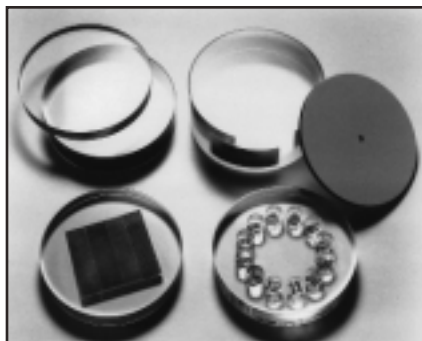
Gammex 132

Designed to test the imaging capabilities of the tomographic x-ray system.

Features of the Gammex 132:

- Determine the location of the cut plane
- Determine the thickness of the cut
- Test the overall resolution in the cut plane
- Test the x-ray exposure uniformity
- Determine the path of the beam during exposure, for both linear and multi-directional units

Used in conjunction with other Gammex test instruments for measuring radiation output (i.e., kV meters, dosimeters, timers) a complete test of the tomographic x-ray system can be performed.



SPECIFICATIONS Gammex 132

Construction

- Six 9 cm Acrylic Discs
- (1) Resolution Disc
- (1) Position/Thickness Disc
- (1) Uniformity/Beam Path Disc
- (3) Acrylic Spacers 1, 2 and 4 cm

Size 10x9 cm diameter (4x3.5 in. diameter)

Weight 0.9 kg (2 lbs.)

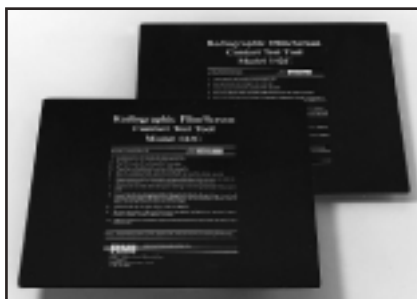
Film/Screen Contact Test Tools

Gammex 142D and Gammex 143D

Inspection of cassettes for good film screen contact and screen integrity is an important but often overlooked quality control procedure. Poor film/screen contact can be the reason for areas of increased density, reduced density and blurring.

Gammex's Film/Screen Contact Test Tools provide for easy evaluation of all cassettes up to 14x17 inches.

Gammex 142D is a wire mesh encased in plastic. The Gammex 143D is perforated brass, also encased in plastic.



SPECIFICATIONS Gammex 142D

Construction Wire Mesh Screen

..... (3 lines/cm) enclosed in plastic

Size 37x44.5 cm (14.5x17.5 in.)

Weight 2.2 kg (4.9 lbs.)

SPECIFICATIONS Gammex 143D

Construction

- Perforated Brass with 24.4 mm (3/32 in.) holes spaced 4 mm (5/32 in.) center to center

Size 37x44.5 cm (14.5x17.5 in.)

Weight 2.8 kg (6.2 lbs.)

NOTE: The Gammex 143D is the International Electrical Commission (IEC) and British standard film screen test tool.



Ranallo Grid Alignment Test Tool

Gammex 144

The Gammex 144 is designed to test proper grid alignment with respect to the central ray of the x-ray tube.

Grid misalignments, such as lateral decentering or tilting of the grid, are not easily recognized and can have an effect on image contrast which could lead to increased patient dose.

These types of misalignments can only be detected through regular quality control testing with the Gammex 144 Grid Alignment Test Tool.

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

SPECIFICATIONS Gammex 144

Construction

- Three Lead Blockers with Precise Hole Locations

Size 9x23.5 cm (3.5x9 in.) One large, Two small

Weight 0.7 kg (1.5 lbs.)



Focal Spot Test Tool

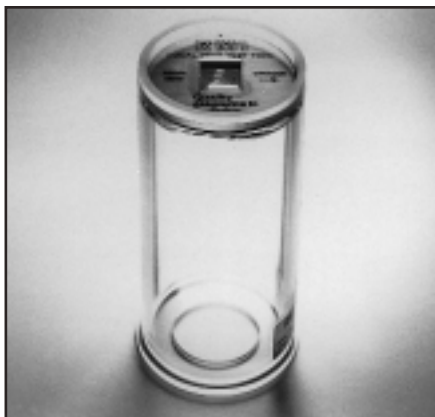
Gammex 112B

The focal spot size of an x-ray tube is of crucial importance in determining the detail of an x-ray image.

Gammex has designed and developed a Focal Spot Test Tool which makes it easy to accurately interpret the effective focal spot size of radiographic x-ray tubes.

The Focal Spot Test Tool consists of a metal target with twelve bar pattern groups. Each group consists of six slots with three slots perpendicular to the other three.

The sizes and spacing of the slots in the twelve groups decrease by steps of 16% from 0.84 lp/mm (line pairs per mm) to 5.66 lp/mm. The test pattern is mounted in the center of an acrylic disc 7.6 cm in diameter that contains a lead shield. The Gammex 112B is easier to interpret than the pin-hole image or star pattern for effective focal spot measurements.



SPECIFICATIONS

Gammex 112B

Construction

Six inch acrylic cylinder with a 12 group bar pattern target mounted on top

Resolution..... 0.84 to 5.66 lp/mm

Size..... 16.5x7.6 cm diameter (6.5x3 in. diameter)

Weight 329 g (11.6 oz.)

Star Test Patterns

Gammex 07-503 Gammex 07-509

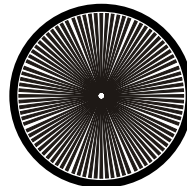
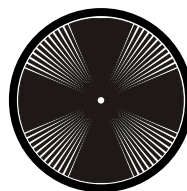
Gammex 07-510 Gammex 07-542

Gammex 07-543 Gammex 07-550

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.



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
07-503	0.5°	4-15°	0.1-0.3 mm
07-509	2.0°	4-45°	1.0-2.0 mm
07-510	2.0°	1-360°	0.1-0.3 mm
07-542	1.0°	4-28°	0.3-0.6 mm
07-543	1.5°	4-35°	0.3-1.5 mm
07-550	0.5°	4-45°	0.1-0.3 mm

Lead Foil Thickness in Millimeters: 0.03

Diameter in Millimeters: 55

Silicon X-Ray Sensor

Gammex 233B

This sensor offers a dynamic means of demonstrating x-ray generator performance non-invasively. It is used with a storage oscilloscope to display the intensity-time relationship of an x-ray beam. The resulting wave-shape patterns are used to calibrate and/or diagnose malfunctions in the x-ray generator.

This shock resistant, solid state diode detector needs no power source. Rise time is less than 0.2 milliseconds. A BNC output connector and ten feet of cable are provided.



SPECIFICATIONS

Gammex 233B

TESTS:

- Timer Calibration
- Loading Characteristics
- Rectifier Malfunction
- Contrast Problems
- Cable or Connector Arching
- Shutter Calibration

Size 3.5x4.5x7 cm (1.4x1.8x2.8 in.)

Weight 56 g (2 oz.)

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





Densiquick 2 Densitometer Gammex 2-336

The Densiquick 2 is a calibratable densitometer for point measurements in quality assurance and x-ray quality control measurement of test phantom films. The Densiquick 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. 512nm) and blue (max. 455 nm) spectral ranges possible
- Optimum exposure reproducibility via the microprocessor monitors exposure control
- Prevents misexposures – no exposures 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.)

DIGITAL THERMOMETER

RMI TM-99A (Not Pictured)

Minor shifts in developer temperature can have a detrimental effect on the film contrast and density. In order to achieve and maintain appropriate film speed, film contrast and film fog levels, the developer temperature must be monitored on a regular basis. To maintain this temperature a high quality, accurate thermometer must be used, such as RMI TM-99A.

This thermometer, with its fast acting probe, degrees Celsius or Fahrenheit and low battery indication is the perfect choice for all processor quality control procedures.



Gammex 166B

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 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.)

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.)



Process Optimization Densitometer

Gammex 2-391U

The Process Optimization Densitometer Gammex 2-391U 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 2-391U measures, stores and reports the QC data you need to help meet the requirements of your institution, governmental agencies and JCAHO accreditation.

Simply insert a sensitometric strip into the Gammex 2-391U. 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 2-391U

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 2-331

Designed to meet today's demanding needs, the Gammex 2-331 Densitometer is portable, light weight, reliable and highly accurate. The Gammex 2-331 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 the Gammex 2-331 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.

Portable Blue/Green Sensitometer

Gammex 2-396

Sensitometry is the single most effective way to test the processor operation and consistency. For day to day processor quality control, the Gammex 2-396 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 2-396 is useful for all types of film, from sensitive x-ray film to roll or cine film. It can test either blue sensitive or green sensitive film. To expose the film simply close the cover and listen for the tone.

SPECIFICATIONS Gammex 2-331

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	

SPECIFICATIONS Gammex 2-396

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.)



Table Top Densitometer

Gammex 2-301

The Gammex 2-301 Table Top Densitometer allows for quick and easy density measurements on any standard size film on a full lighted surface. The Gammex 2-301 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 2-301

Range	0 to 5.0 Optical Density with 2 and 3 mm apertures 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 2-390

The Gammex 2-390 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 2-390 is 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 2-390 can generate a D-Log E Curve for the 21 steps with



control parameter measurements included. The Gammex 2-390 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 2-396 or Gammex 2-393 sensitometers can be measured with the Gammex 2-390.

SPECIFICATIONS Gammex 2-390

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.)

Dual-Color Sensitometer

Gammex 2-393

The Gammex 2-393 Dual-Color Sensitometer provides superior sensitometric performance for x-ray processor quality assurance. The unique internal calibration monitoring circuit helps assure higher accuracy and stability of the light source. Each sensitometer is calibrated for commonly used blue and green sensitive films.



SPECIFICATIONS Gammex 2-393

Unit-to-Unit Repeatability	±0.02 Log
Exposure Stability	±0.02 Log Exposure per Year
Temperature Sensitivity	±0.02 Log Exposure 59 to 86° F
Light Modulation	21 Step Wedge, 0.14 Optical Density per Step
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
Exposure Time	Approx. 0.1 second for normal x-ray film
Recycle Time	2 sec
Size	7.6x13.3x21.6 cm (3x5.3x8.5 in.)
Weight	1.14 kg (2.5 lbs.)



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 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.

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 Nottingham, UK and Gammex RMI GmbH in Bad Münstereifel, Germany.

With extensive domestic and international experience, ISO-9001 and EN 4600 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:

DIAGNOSTIC RADIOLOGY

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.

LASER ALIGNMENT

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.

MAMMOGRAPHY

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

RADIATION ONCOLOGY

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

ULTRASOUND

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.

SCANNERS

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.



Ordering Information

All products and specifications are subject to change without notice. Please contact a GAMMEX rmi 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

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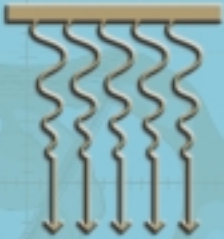
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Due to our commitment to continuous product improvement specifications may change without notice.

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