Manuals+ — User Manuals Simplified.

GCA-07 Series
Geiger Counter

Images Scientific Instruments GCA-07 Series Geiger Counter User Guide

Contents

Images Scientific Instruments GCA-07 Series Geiger Counter

Introduction

The model GCA-07 has an internal Geiger Mueller tube. The model GCA-07W uses an external wand that houses the Geiger Mueller tube.

Scientific Instrument & Industrial Tool
Our Digital Geiger counters have been calibrated and certified accurate in reading radiation levels to within 5% from background radiation to 1000 mR/hr. NRC Certification is available at an additional cost. Perfect for schools and industry. In the laboratory, the Digital Geiger Counter may be used to conduct nu-clear experiments and measurements. Free Windows 7 graphing programs. Graphic Files may be exported to Excel spreadsheets. Communication specifications are provided for users to read the output of the Geiger Counter and write their programs.

Applications

- Education – Classroom demonstrations and experiments
- Emergency Services and Domestic Preparedness
- HAZMAT and Compliance Verification
- Dirty Bomb Screening and EMTs
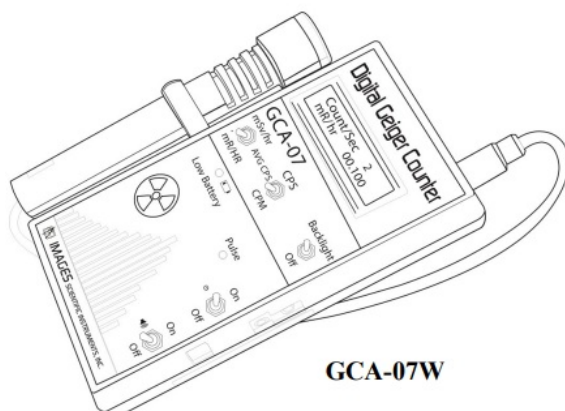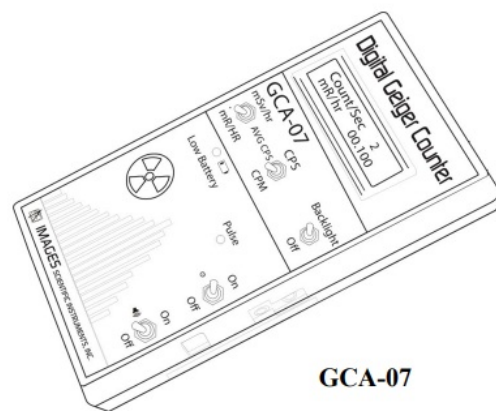
GCA-07W   GCA-07

Nuclear Experiments Online
Images Scientific Instruments publishes several nuclear experiments you can perform with your Digital Geiger counter. Experiments are suitable for schools, teachers, and students. Visit our website at:
http://www.imagesco.com/geiger/nuclear_experiments/experiment1.html

Features

Radiation Detected
Alpha, Beta, Gamma, and X-Rays.

Detector
Geiger-Muller tube Ne + Halogen filled with a .38″ effective diameter 1.5-2.0 mg/cm2 mica end window.

Detector Sensitivity

- Alpha above 3.0 MeV
- A beta above 50 KeV
- Gamma above 7 KeV

Countable Pulse Range	1 (CPM) - 10000 + counts per second (CPS)
Converted Radiation Range	.05 mR/hr - 1000 mR/hr (Imperial)
	.0005 mSv/hr - 10.0 mSv/hr (SI Metric)

The Liquid Crystal Display (LCD) is 16 characters by 2 lines that provide an easy-to-read output, see image to right. LCD has an on-off backlight switch. LCD continuously updates counts per second (or counts per minute) on line one while displaying the converted radiation level second line. The Backlight Switch turns on and off the LCD backlight, The LED marked Low Battery will turn on when the battery power drops to approximately 7 Volts to alert the user to change the battery. Readings taken when a low battery indicator is on may not be accurate. The LED marked Pulse—is a secondary radioactive particle indicator it blinks each time a radioactive particle is detected by the Geiger Counter. The Power Switch turns the power on or off to the GCA-07. The Speaker Switch turns the sound on or off to the internal speaker. The speaker is a secondary radioactive particle indicator. It clicks each time a radioactive particle is detected.

Note: Plugging a headphone in the headphone jack will automatically turn off the internal speaker. The headphone jack is a standard 3.5mm for private listening. Using a headphone automatically turns off the internal speaker of the Geiger counter. An external power jack is available for extended readings where battery operation may not be practical. The power jack is 2.5mm x 5.5mm. Power input is 9VDC or 9VAC @ 200mA min. Current. The mobile operation uses a 9V battery. TTL Serial output for PC is available via 3.5MM stereo connector. Both the GCA-07 and GCA-07W out-put the counts per second.

Main Panel Controls
The first-panel switch starting from the left selects whether the radiation levels are shown in Systems International (SI) metric (mSv/hr) or imperial (mR/hr) measurements.

The middle switch labeled CPS, AVG CPS, and CPM selects one of the three Survey Meter Modes:

- CPS (Counts Per Second) is a one-second counting mode. Real-time radiation readings and displays the count/second and equivalent radiation level in either mR/hr or mSv/hr.

- AVG CPS is a three-second average of the CPS. AVG CPS performs a smoothing function similar to analog meter readings. Displays the 3-second CPS and equivalent radiation level in either mR/hr or mSv/hr.

- CPM (Counts Per Minute) is a one-minute counting mode for measuring low levels of radioactivity and background radiation: Displays accumulated count and equivalent background radiation in either uR/hr or uSv/hr. If the radiation level is significant radiation level is displayed in either mR/hr or mSv/hr.

Operation

Survey Meter Modes
CPS Mode: Set the Conversion switch to mR/hr (milliroentgen/hour). The time function switches to "CPS", the Backlight switch is on and the audio switch is on. Turn on the Geiger counter. If you have a radioactive source bring the source close to the GM tube. For Geiger counters with an external wand, bring the wand close to the radioactive source.

Count Per Second — Count/Sec 46 — **Current Count**
Radiation Reading (Imperial) — mR/hr 02.760

Every radioactive particle detected will cause the Geiger counter to click and the LED to blink. The LCD digital display in this mode updates the count and radiation level every second, see photo above. The display always shows the previous seconds' count and radiation level. The count "Count/Sec" is the number of radioactive particles detected in the previous second. On the second line the equivalent radiation level of that count in mR/hr. You can change the Conversion switch to mSv/hr to read the radiation level in milli-sieverts/hour.

3-Second Average: The three-second average of the CPS. AVG CPS performs a smoothing function similar to analog meter readings. Displays the 3-second CPS and equivalent radiation level in either mR/hr or mSv/hr.

CPM Mode

3-Second Average of Count Per Second — 3-SEC AVG 41 — **3-Second Average Current Count**
3-Second Average Radiation Reading (Imperial) — mR/hr 02.460

The CPM mode displays the counts per minute and converts the radiation level into micro-Roentgens (uR/hr) or micro-Sieverts (uSv/hr). The CPM mode is useful for checking background radiation. First, set the switch to Metric or Imperial measurement. Next set the time function switch to CPM. The LCD changes. The left side of the first line begins a count of up to 60 seconds, increasing by 1 each second. The right-hand side of the first line displays the number of radioactive particles detected. At the end of the CPM count the Digital Geiger counter will display the total CPM and equivalentradioa-

Timer Seconds Count Up — Sec 33 CT 00046 — **Current Count**
Previous Minute Radiation Reading — uR/hr 0071.6

tion level for one second before beginning another CPM counting cycle. If you change to the 1 minute time from 1 second the second line will display the radiation level last calculated from the previous mode. If the Geiger counter is turned on in the 1-minute mode the second line will display the word "Initializing" for the first 60 seconds.

USB / TTL Cable Adapter sold separately
Serial data consisting of the CPS counts may be read by a Windows PC using a USB/TTL Serial Cable, included. USB TTL Serial Cable allows easy interfacing of the GCA-07 via USB. The cable has a USB connector on one end that plugs into the PC, and a 3.5mm stereo jack that plugs into the GCA-07.

3.5mm audio jack output configuration

- tip – TxD
- ring – RxD

- sleeve – GND
  - See page 18 for changing data output to Jack's Tip or Ring. Useful for using 3rd party TTL Serial/ USB cables.

Digital Geiger Counter Graphing Software

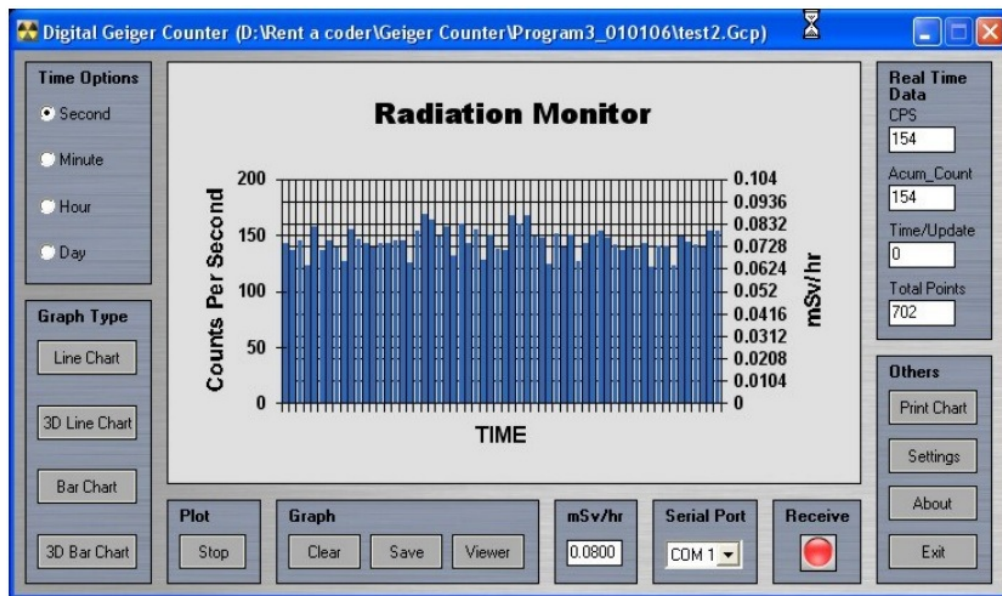- We offer a Windows PC program that reads this serial information for

  charting and recording the measured radiation over time (see screenshot below).

A free lite version of our Geiger graphing software can be downloaded at:

- **www.imagesco.com/geiger/geiger-graph.html**

The Radiation Monitoring and Graphing software is useful for monitoring radiation. The software consistently monitors the Counts Per Second (CPS) values and plots them on the Graph when connected to one of our Digital Geiger Counters. It calculates radiation levels from incoming serial data and plots them along with the CPS values. The software is capable of capturing values for different time units (i.e., Sec-

onds, Minutes, Hours, or Days). The recorded data can be saved and exported as a CSV delimited file for use in various other applications including Word & Excel. Data can be displayed as 1 of 4 types of graphs. One can also set alarm levels for CPS/Radiation Levels. If the values cross the specified levels, the software issues a visual and an audible alert.

Installing the Software Package

Begin by installing the appropriate drivers for the USB/TTL cable included with the purchase of the software program and/or cable. These drivers may also be downloaded from the Images website at:
http://www.imagesco.com/semiconductors/usb-3.5mm.html

Once the drivers are installed, restart your computer and then plug the cable into an available USB port. Now install the Windows Geiger counter program on your computer. The digital Geiger counter has TTL serial output. Connect the Geiger counter to the computer's serial port using the USB TTL serial cable. Make sure the serial/TTL jumper is set to serial, see "Setting the Back Jumpers/Contrast Control" in the Appendix. When opening the application, make sure the program's COM port is set to the correct COM port where the USB cable and Geiger counter have been connected. A troubleshooting guide for the com port is also included in the Appendix. The Geiger counter must be on and connected to the computer for the program to begin graphing. To begin graphing simply click "Start" in the lower left-hand corner of the main interface screen.

The main program interface is comprised of the following components

- The main graph on which the values will be plotted.
- Time options frame. This allows the user to select different time units (Second, Minute, Hour, Day) For example, if you set the time unit to Second, then the program will count the radiation levels per second and plot. If you set it to Minute, the program will count radiation levels per minute and plot.
- Graph type frame. This allows the user to switch between different views of the graph (Line Chart, 3D Line Chart, Bar Chart, and 3D Bar Chart).
- Plot frame. This comprises of the Start button which starts the capturing and plotting process. When capturing is in progress, the same button will act as a Stop button, which stops the capturing and plotting process.
- Graph frame. This comprises a Clear button which clears the graph, a Save button which saves values to the active file, a Save As button which allows one to select a different file for saving, and a Viewer button which launches the Viewer.
- mR/hr frame. This comprises a textbox that displays the current radiation level.
- Serial Port frame. This comprises a combo box that allows com port selection.
- Status frame. This comprises an LED that displays the status of the program. The status LED changes

according to the activity. When no capturing is in progress, the LED will be Off and the status will be Stopped. When the program is receiving values, the LED will be Blue and the status will be Receive. When the program is writing the values, the LED will be Green and the status will be Write.

- ReReal-Timeata frame. This frame displays various real-time values such as Counts Per Second (CPS), total accumulated count (if the program is running on modes other than Second), time left before the next update, and total number of points captured.

- Others frame. This comprises Print Chart button which allows to print current plot, a Settings button which opens the Settings dialog, an About button which displays the information about the program, and an Exit button which quits the program.

The image below outlines where each frame is located and shows data being displayed as a line graph. The image on the previous page shows the data in a bar graph.
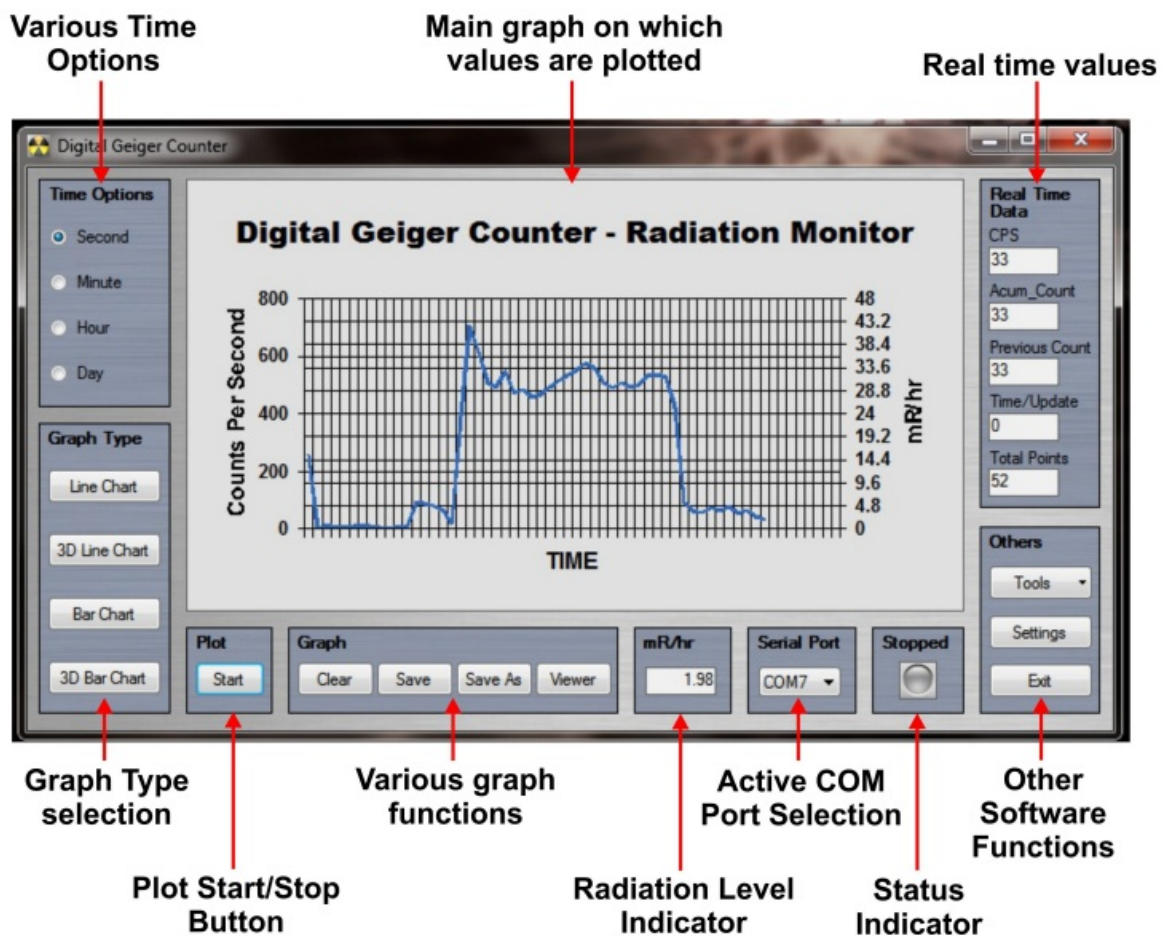
Writing Your Interface Software
It is possible to write your software to read the data from the digital Geiger counter. The data is outputted from a 3.5 MM stereo jack, as shown on the previous page. The +5V serial data is sent out as a two-byte number (most significant byte first) with the following specifications: 9600 Baud, Inverted, 8 data bits, no parity, and one stop bit. The Serial Data Output is a two-byte (8-bit) number every second that represents the previous count per second. The high byte is followed by the low byte. Communication parameters are 9600 Baud, Inverted, 8 data bits, no parity, and one stop bit. These parameters are for anyone wishing to read the data from the Digital Geiger counter.

## Geiger Counter and Radiation Basics

Radioactivity

Radioactivity is the spontaneous emission of energy from the nucleus of certain elements, most notably uranium.

There are three forms of energy associated with radioactivity; alpha, beta, and gamma radiation. The classifications were originally made according to the penetrating power of the radiation.

- **Alpha** rays were found to be the nuclei of helium atoms, two protons and two neutrons bound together. Alpha rays have a net positive charge. Alpha particles have weak penetrating ability; a couple of inches of air or a few sheets of paper can effectively block them.
- **Beta** rays were found to be electrons, identical to the electrons found in atoms. Beta rays have a net negative charge. Beta rays have greater penetrating power than Alpha rays and can penetrate 3mm of aluminum.
- **Gamma** rays are high-energy photons. This has the greatest penetrating power being able to pass through several centimeters of lead and still be detected on the other side. Images Digital Geiger Counters are sensitive to all three types of radioactivity.

The Geiger Mueller Tube

Geiger Mueller tubes are simple devices that detect and measure radioactivity. The original design by H. Geiger and E.W. Mueller in 1928 hasn't changed very much. The basic sensor functioning remains the same. A cutaway drawing of the tube is shown below. The wall of the GM tube is a thin metal cylinder (cathode) surrounding a center electrode (anode). It is constructed with a thin Mica window on the front end. The thin mica window allows the passage and detection of alpha particles. The tube is evacuated and filled with Neon, Argon plus Halogen gas. It is interesting to see how the GM tube detects radioactivity. A 500-volt potential is applied to the anode (center electrode) through a ten mega-ohm current limiting resistor. To the cathode of the tube, a 460-k ohm
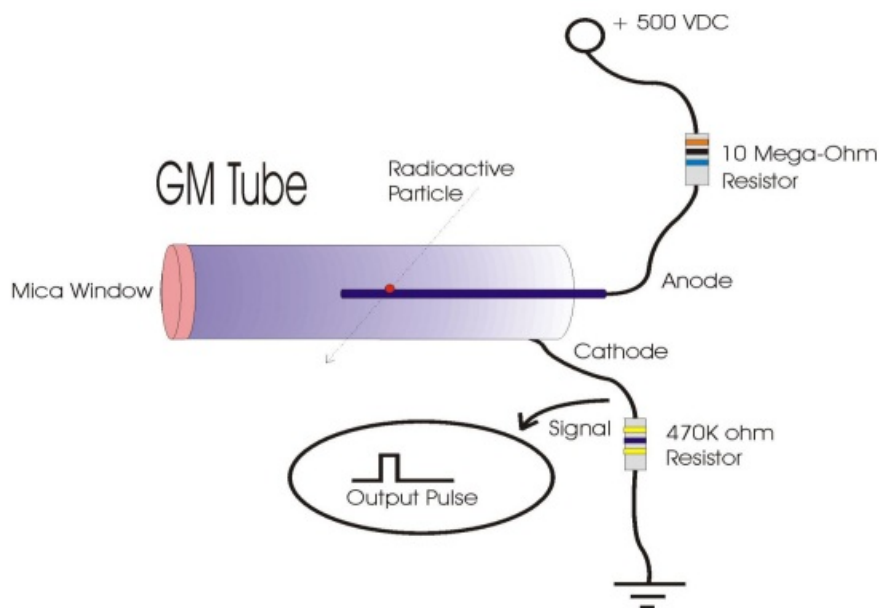
resistor is connected. In the initial state, the GM tube has a very high resistance. When a particle passes through the GM tube, it ionizes the gas molecules in its path. This is analogous to the vapor trail left in a cloud chamber by a particle. In the GM tube, the electron liberated from the atom by the radioactive particle and the positively ionized atom both move rapidly toward the high potential electrodes of the GM tube. In doing so they collide with and ionize other gas atoms. This creates a small conduction path allowing a momentary surge of electric current to pass through the tube. This momentary pulse of current appears as a small voltage pulse across R2. The halogen gas quenches the ionization and returns the GM tube to its high resistance state making it ready to detect radioactivity.

Count Rate vs Dose Rate

Each output pulse from the GM tube is a count. The counts per second give an approximation of the strength of the radiation field. Below is the GM tube used in the GCA-07's response to a cesium-137 source.

Count rate vs. Dose rate (Cs-137)
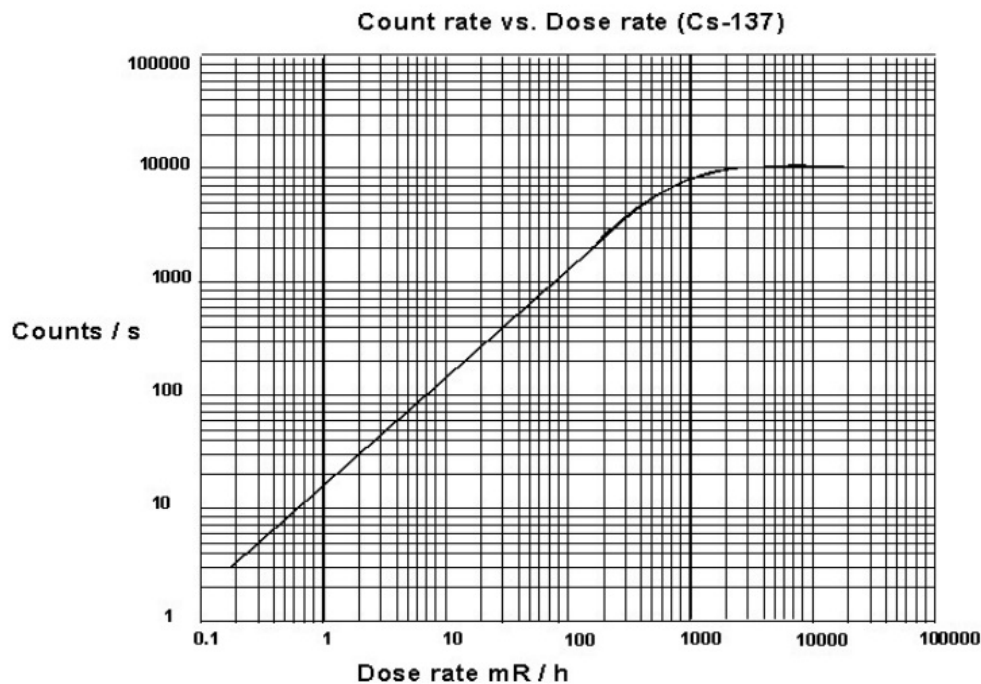
Measurement of Radiation
There are a few scales that one can use to measure radiation. Depending upon your application, one scale may be better than the others.

Radiation Measurements

Roentgen: This is the measurement of energy produced by Gamma or X-ray radiation in a cubic centimeter of air. It is abbreviated with the capital "R". One milliroentgen, abbreviated "mR" is one-thousandth of a roentgen. One micro roentgen, abbreviated "uR" is one-millionth of a roentgen.

RAD: Radiation Absorbed Dose. Original measuring unit for expressing the absorption of all types of ionizing radiation (alpha, beta, gamma, neutrons, etc) into any medium. One rad is equivalent to the absorption of 100 ergs of energy per gram of absorbing tissue.

REM: Roentgen Equivalent Man is a measurement that correlates the dose of any radiation to the biological effect of that radiation. Since not all radiation has the same biological effect, the dosage is multiplied by a "quality factor" (Q). For example, a person receiving a dosage of gamma radiation will suffer much less damage than a person receiving the same dosage from alpha particles, by a factor of three. So alpha particles will cause three times more damage than gamma rays. Therefore, alpha radiation has a quality factor of three. Following is the Q factor for a few radiation types.

The difference between the rad and rem is that the rad is a measurement of the radiation absorbed by the material or tissue. The rem is a measurement of the biological effect of that absorbed radiation.

Radiation: Quality Factor (Q)

- Beta, Gamma, and X-rays 1
- Thermal Neutrons 3
- Fast n, a, and protons 10
- Heavy and recoil nuclei 20

For general purposes, most physicists agree that the Roentgen, Rad, and Rem may be considered equivalent.

System International (SI) of Units
The System International Unit for Radiation Measurements is now the official system of measurements. This system uses the "gray" (Gy) and "sivert" (Sv) for the absorbed dose and equivalent dose respectively. The conversion from one system to another is simple:

- 1 Sv = 100 rem 1 rem = .01 Sv
- 1 mSv = 100 mR (mrem) 1 mR = .01 mSv
- 1 Gy = 100 rad 1 rad = .01 Gy
- 1mGy = 100 mrad 1 mrad = .01 mGy

How Much Radiation is Safe
In the United States, the U.S. Nuclear Regulatory Commission (NRC) determines what radiation exposure level is considered safe. Occupational exposure for workers is limited to 5000 mrem per year. For the general population, the exposure is 500 mrem above background radiation in any one year. However, for long-term, multi-year exposure, 100 mrem above background radiation is the limit set per year. Let's extrapolate the 100 mrem number to an hourly radiation exposure rate. There are 365 days/yr x 24 hr/day equals 8760 hours. Divide 100 mrem by 8760 hours equals .0114 mrem/hr or 11.4/hr microrem. This is an extremely low radiation level. The background radiation in my lab hovers around 32 uR/hr. Am I in trouble? No. Typically background radiation in the United States averages 300 mrem/yr, or 34 microrem/hr. The NRC specifications are for radiation above this 34 rem/hr background radiation. Notice that my lab readings are in microrad (uR/hr) and the exposure limit is given in microrem (rem/hr). I do not know what type of radiation (a b, or y) the Geiger counter is reading in my lab at any particular instant, so I do not know the Q factor of the radiation and therefore can not calculate the mrem. However, for general purposes, I consider them the the same. Remember, the digital Geiger counters are calibrated using a Cs-137 radioactive source. Therefore the highest accuracy in reading radiation levels will be from Cs-137 sources.

Common Radiation Exposure (General Population)
Background radiation consists of three sources; Cosmic radiation from the sun and stars. Terrestrial radiation from low levels of uranium, thorium, and their decay products in the soil, air, and water.

Exposure Source	Dose(conventional)	Dose (SI)
Flight from LA to NY	1.5 mrem	.015 mSv
Dental X-ray	9 mrem	.09 mSv
Chest X-ray	10 mrem	0.1 mSv
Mammogram	70 mrem	0.7 mSv
Background Radiation	620 mrem/year	6.2 mSv/year

Internal radiation from radioactive potassium-40, carbon-14, lead-210, and other isotopes found inside our bodies. Because of the randomness of radioactivity, background radiation can vary from minute to minute and place to place. In my corner of the world, I have background radiation that triggers the counter 22-34 times a minute.

Checking for Radiation
Our line of Digital Geiger Counters is extremely sensitive and will detect and measure background radiation in addition to detecting and measuring radioactivity above background radiation. To test for small increases in radioactivity that may be present in food and other materials to cause an increase in the background radiation one must first establish the background radiation level. To obtain your normal background radiation reading take an hour's worth (60) of one-minute readings. This is the CPM (counts per minute) mode on the GCA-07W. With this data collected. I would add the 60 readings together. I would then take that total and divide it by 60 to get an

average CPM reading. Next, I would look through the 60 CPM readings and mark down the highest count CPM reading, and the lowest count CPM reading. Those two CPM numbers are your Max and Min. With this information, you can determine if the background CPM radiation reading(s) is greater than your MAX CPM number. If the readings are consistently greater, you can make a logical assumption that there is an increase in background radiation. To see the percentage increase you would subtract the average CPM number from your reading to see what the increase in radiation is on average. To increase accuracy, you could also average say five hours worth of data or 300 one-minute CPM samples to obtain the average CPM, Min CPM, and Max CPM. In general the greater the number of samples the greater the level of confidence. The CPM averages may be different for day and night, so you may also want to collect background radiation data for time variances.

The optional Geiger Counter Graphing Software for Windows PC (see page 8), also available on Amazon, ASIN: B00WAK68U4, will allow you to collect, monitor and save this data from the GCA-07W easily.

To run a test, position the probe (or Geiger counter) very close to the top surface of the material you are testing, and run the counter in its CPM mode to check for radiation above your established background radiation.

Finding Consistency in Readings

Because of the randomness of radioactivity, your readings may vary from second to second. To help "even out" the readings, the GCA-07 has a built-in "smoothing feature. This feature is activated by putting the center switch into AVG CPS Mode. The read-out will display a running 3-second average.

Finding Radioactive Sources

The mantle in some Coleman lanterns is radioactive. Bring your Geiger counter to a local hardware store and check them out. Uranium ore from a mineral or a rock store should also emit sufficient radiation to trigger the counter. A more reliable source is to purchase a radioactive source. Small amounts of radioactive materials are available for sale encased in 1-inch diameter by ¼" thick plastic disks. The disks are available to the general public license exempt. This material outputs radiation in the micro-curie range and has been deemed by the Federal government as safe. The cesium-137 is a good gamma-ray source. The cesium 137 has a half-life of 30 years. Radioactive uranium ore and radioactive isotopes are available for purchase from Images Scientific Instruments. **http://www.imagesco.com/geiger/radioactive-sources.html**

Separating & Detecting Alpha Beta and Gamma

By placing shields of different materials in front of the GM tube we can filter out some radiation. For instance, placing a paper shield in front of the GM tube will block all the Alpha radiation. The Geiger counter will now only detect beta and gamma radiations. If we place a thin metal shield in front of the GM tube that would effectively block the alpha and beta radiation, allowing the detection of only gamma radiation.

Radiation Shields for wand are available here: **http://www.imagesco.com/geiger/shields.html**
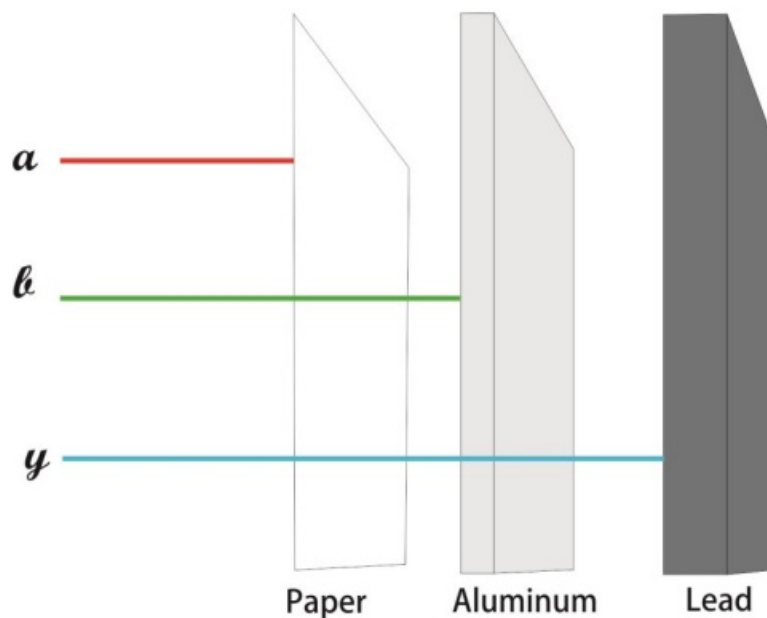
NIST Calibration

We perform calibration of our digital Geiger counters with a Cs-137 source chart against a calibration standard using a NIST traceable Cs-137 source. A Factory Calibration Certificate is provided with each unit. Source number available upon request.

NRC Certification and Why It Is Important

While many Geiger counter manufacturers claim high accuracy for their Geiger counter, it simply is not true. It is not enough to say an instrument is calibrated, nor is it enough to say the Geiger counter has an accuracy of 1%, 5%, 10%, or 20% because anyone can say that! Why? Without a legitimate reference to compare "claimed" accuracy too, a claim of accuracy is meaningless. Fortunately, the United States Government has a license standard for Geiger counter accuracy. This is a Nuclear Regulatory Commission (NRC) certification for accuracy. NRC certification can only be performed by a nuclear laboratory licensed by the United States Government to perform such certifications. Without this certification, you cannot be sure of any claim that a Geiger counteraccuracy is valid. Below is a picture of an NRC certification label for one of our Digital Geiger Counters. After NRC certification, a certification label is attached to the Geiger counter and this certification is valid for one full year. If a manufacturer states their Geiger counter is accurate, ask, "Is your Geiger Counter NRC certified?" If not, their Geiger counter probably cannot pass NRC certification. But many times a representative will hedge their answer and state that the NRC certification is expensive and is not "currently" offered as an option. Ask, "If I purchase your model and send the unit out for NRC certification will it pass? And if it fails NRC, can I return the Geiger counter for a refund?" Their answer will tell you what you need to know to make a sound purchasing decision. Images SI, Inc.'s entire line of Digital Geiger counters are capable of receiving an NRC certification. This certification is available to our customers at an additional cost. Please contact us at 1-**800-230-4535** for more information.

Appendix

Setting the Back Jumpers / Contrast Control

If it becomes necessary to adjust contrast control or to set internal jumpers: Remove the back cover of the GCA-
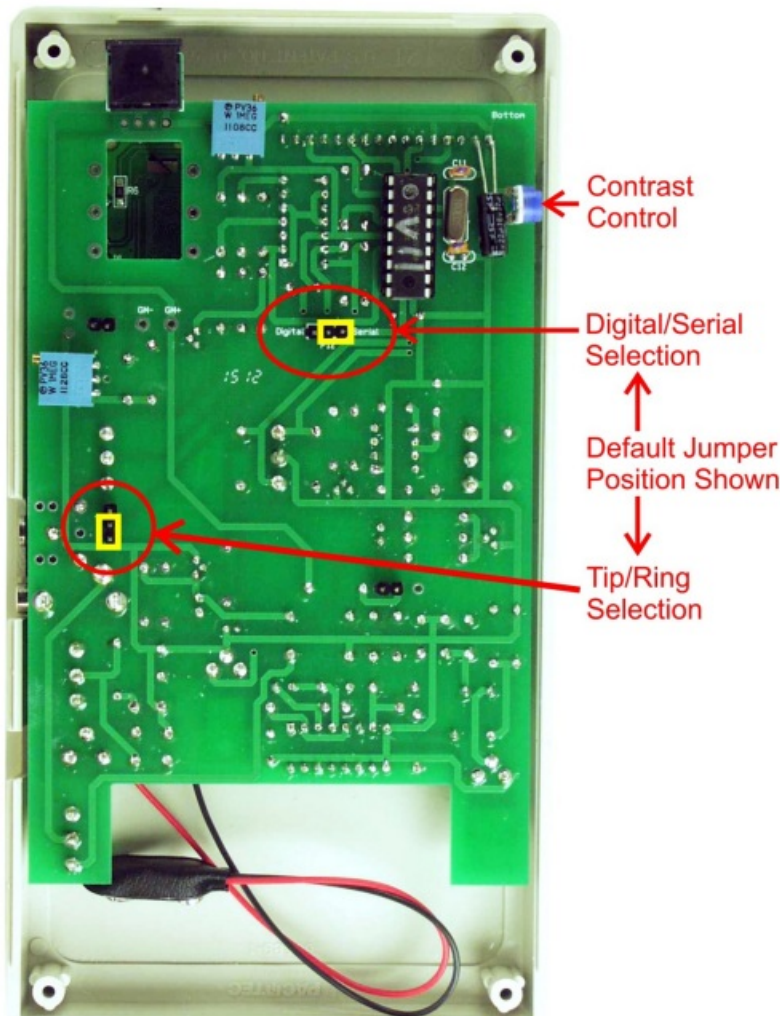
Contrast Control: The contrast control has been optimized for the best viewing of the LCD screen. However, it may be changed using a small Philips screwdriver to adjust the potentiometer shown in the picture to the left. TTL Serial / TTL Pulse: The default setting is for the microcontroller to output serial data for the PC Graphing Program. In some experiments, you may want the raw TTL pulses out-putted for each radioactive particle detected. As one would need for a Gamma Ray telescope experiment, coincidence detectors, or a random number generator. Jumpers: To change Serial Output to TTL pulses (or vice versa,) set the labeled jumper to TTL or Serial as shown the in the Picture to the left. Tip/Ring Adjustment: If one is using a different USB to TTL Serial cabled adapter, it may be necessary to change the data output to the tip and ring of the stereo plug. Data output to the stereo 3.5 MM jack may be changed to Tip/Ring using the labeled jumper shown in the Picture to the left. The picture shows the default settings for these jumpers.

To Change / Install Battery:
The battery compartment is located on the lower back of the Geiger countercase. Turn the Geiger Counter off. Slide the battery compartment lid open. Attach 9 Volt battery to battery clip. Insta all 9 Volt batteries into the battery compartment. Slide the cover back into place. It is important to note that when using the external power supply, there is no need for a 9V battery.

Digital Geiger Counter Technical Specifications

- **Radiation Detected** Alpha, Beta, X-Ray, and Gamma
- **Detector Type** Geiger Muller tube Ne + Halogen filled: Mica end window has a .38" effective diameter, with a density of 1.5-2.0 mg/cm2
- **Detector Sensitivity** Alpha above 3.0 MeV Beta above 50 KeV Gamma above 7 KeV
- **Countable Pulse Resolution Range** 1 Count Per Minute (CPM) – 5000 Counts Per Second (CPS)

- **Radiation Resolution & Range** 1.0uR/hr – 1000 mR/hr .01uSv/hr – 10 mSv/hr

Limited Warranty

Images SI, Inc. warrants this product to the original retail purchaser to be free from defects in materials and workmanship for a period of 90 days of purchase. The Geiger Muller tube is very fragile and is not included in this warranty.

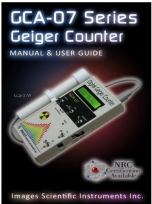This warranty may be extended to a period of 1 year by registering the product on our website at: **http://www.imagesco.com/reg.html** Registration must occur within 30 days of delivery. Images SI, Inc. will, at its own discretion, repair or replace the Geiger counter if it fails to operate properly within the warranty period provided that it has not been subjected to misuse, abuse, or neglect. Modification or repair by anyone other than Images SI, Inc. voids the warranty.

Repairs/Replacements will only be made when the customer properly packages and returns the unit to our facility with prior authorization. Contamination of the Geiger counter with radioactive materials voids the warranty. Contaminated instruments will not be accepted for repair. Images SI, Inc. will not be responsible for any incidental or consequential damages arising from the use of this device.

- **imagesco@verizon.net**
- **800-230-4535**
- Phone: **718-966-3694** Fax: **718-966-3695**
- **www.imagesco.com**

Documents / Resources

	Images Scientific Instruments GCA-07 Series Geiger Counter [pdf] User Guide GCA-07 Series, GCA-07 Series Geiger Counter, Geiger Counter, Counter

References

- 📄 **Radiation Shields for Wand**
- **User Manual**