Geiger Counter / Rate Digital Hand Held

AP1884-002 for external GM tube.

Description:

This unique fully portable battery operated instrument is used:

- To detect and count high energy Alpha particles, Beta particles and Gamma rays
- To count either continuously or over preset periods of 10 sec, 60 sec or 100 sec.
- To measure Rate of counts per second or Rate of counts per minute.

Model AP1884-002 is complete with a socket to accept a remote GM tube to be connected to the instrument by cable. The IEC Tube Holder and Leads (PA1885-050) as supplied on earlier models are fully compatible.

Maximum geiger counting rate is 10kHz. and an audible 'click' for each particle count may be enabled or disabled by press button.

The IEC Geiger Counter & Rate meter will run on 3 standard 'AA' (penlight) batteries for a period of about 100 hours. Alkaline cells will give an even longer operating life. When batteries are approaching the flat condition, 'bAtt' displays momentarily without disturbing counting operations. If the batteries flatten, a socket is provided in the end of the instrument for any normal 240/12V.AC or DC Plug Pack. Polarity is not important.

Length: 195mm	Width: 100mm	Height: 37mm	Weight: 0.42kg

The high voltage for the GM tube is fully adjustable from 300 to 500V.DC. by pressing the VOLTS and ARROW buttons simultaneously when in 'Standby' (display flashing). The voltage is displayed for checking. Different Plateau Voltages may be set from time to time for various experiments and the set voltage is automatically restored on each power-up.

Power: 240/12V.AC. PlugPak (not supplied) permits unlimited operation time.

Internal battery: (3x 'AA' cells supplied) permits approx. 100 hours counting time.

Auto Power Down: The instrument has no "Off" switch. To conserve battery life, if the instrument is performing a count or is in 'Standby' mode, the instrument will automatically power down after 4 minutes. If it is actively counting in the Count / Continuous' mode, the instrument will not power down.

In any mode or in 'Standby' (display flashing), if any of the 5 buttons is pressed, the operating period is extended by another 4 minutes. When re-powered, the previous Mode is restored and the last reading is displayed.

Brief Information:

A label on the rear of the housing provides the user with all the important information required to operate the instrument properly.

Functions of the 5 press buttons:

ON / **VOLTS**: has two functions

- Powers the instrument after an automatic power down. The display self checks and the previous mode is restored and the last reading is displayed.
- Displays the current GM tube plateau voltage if pressed while the display is flashing (instrument in 'Standby' mode).

SOUND ON / **OFF:** Enables and disables the audible 'click' during counting.

STOP / **HOLD:** In any mode, this button stops the counting and holds the last count in the display. Sets the 'Standby' mode and the display flashes.

START / **DOWN ARROW**: has two functions

1) Resets display to zero and starts any selected function.

2) Lowers the Plateau voltage to the tube if pressed whilst the ON / VOLTS button is held depressed when in 'Standby'.

MODE / **UP ARROW**: has two functions

1) When the instrument is in 'Standby' (display flashing), this button provides selection of the six different operational modes. The first press displays the current mode operating:

	Display Shows
Rate of counts per second	RatE 1t
Rate of counts per minute (updates each second and calculates average/minute)	RAtE 60t
Count for 10 seconds and stop	Cntr 10t
Count for 60 seconds and stop	Cntr 60t
Count for 100 seconds and stop	Cntr 100t
Count continuously	Cntr Cont

After the desired mode is selected, the START button must be pressed to zero the display and to initiate the counting.

2) Raises the Plateau voltage to the tube if pressed whilst the ON / VOLTS button is held depressed when in standby.

Battery Replacement: This instrument is supplied with batteries which must be fitted. For best performance, use only good quality batteries. To install or to change batteries, remove the two screws and remove the lower end plastic cover. Partly slide out the front panel and replace the three 'AA' dry cells. To reset the system, momentarily press the mini press button near the battery holder and replace the plastic end cover. When the batteries are replaced, the GM tube voltage is always automatically set to 450V.DC. as the normal operating voltage. To adjust it to a different plateau voltage, refer to information on the UP / DOWN ARROW buttons above.

Parts & accessories:

PA1885-020 Spare GM tube only. Warranty is void unless fitted and tested by IEC.

NOTE: Because of the fragile nature of thin mica window tubes, IEC cannot provide warranty on GM tubes unless IEC fits the tube to the holder and performs operation tests.

AP0030-001 Absorber set. 24x calibrated absorbers from tissue paper, foil, aluminium sheet through to thick lead. With absorber and R/A source holder for radiation study.

More Information On Geiger Counting:

A Geiger Counter is a device that responds to radioactive particles or rays entering a special chamber called a Geiger Muller tube. There are several other types of counting tubes.

The GM tube used in the IEC Geiger Counter has an internal electrode and a very thin window of Mica sealed across the front end of the tube, Mica is a mineral insulating mineral that can be split into very thin layers. The window is very fragile and must not be touched. If ruptured, the tube becomes useless. A plastic grille is placed over the front of the tube but, so that Alpha particles can reach the window, but it is not a complete cover so never permit poking of anything down the grille or the tube window will be ruptured.

Radioactive rays and particles enter the chamber and these create small electric discharges that are counted. Beta and Gamma radiation passes freely through the Mica window but only the higher energy Alpha particles can penetrate the thin Mica.

What Does The Count Mean ?

The number of counts received and their meaning depends of the following factors:

- Size of the GM tube's front window. A large window will have a much larger area and of course it will accept much more radiation.
- Distance away from the Radio Active source. The count varies as the square of the distance away from the source. If you double your distance away, the counts will be about a quarter. For example …. If a small "school grade R/A source" is placed a metre from the instrument, the count rate per minute will rise by a small amount. If the same source is placed up against the tube so all the radiation enters the tube, the count can be hundreds or thousands of counts per second.
- Type of activity being radiated. Alpha particles are considered to be 20 times more dangerous to the human tissue that the others, therefore the type of radiation should be known before "danger levels" can be estimated.
- Strength of the source radiating. Strong sources emanate more particles per sec.

It is then obvious that although the number of counts per second or per minute or over any set period is an indication of the activity in your immediate surroundings, the number does not advise you of the intensity or the "danger level" or the radiation. The count and particularly the rate of counts is very useful to be used as a comparison between strengths of radiation and, in many cases, this comparison is enough to estimate safety.

However, for the count to indicate an absolute "strength of radiation" or "danger level" to the user, the instrument would need to be calibrated against a special standard with all the factors applied (Q factor) and this

calibration must be checked and certified regularly. The IEC "Geiger Counter and Rate Meter" is not designed for this purpose.

Alpha radiation: Consists of particles consisting of 2x protons and 2x neutrons which are identical to the nucleus of the Helium atom …. but without the electrons. Very damaging to human tissue but are very easy to block. Most Alpha cannot penetrate the GM tube window.

Beta radiation: Consists of very high speed particles which are identical to electrons and which come from the nucleus of an atom. Penetrate many materials but can be blocked.

Gamma radiation: Consists of electromagnetic rays or photons that are emitted from the nucleus of an atom. Deeply penetrating and difficult to completely block or absorb.

The Meaning Of "Half-Life": When talking about radioactivity, we often hear the term "half-life". If a radioactive source has a half-life of say 100 years, it means that after 100 years, its activity will be reduced to half of what it was at year 1. In a further 100 years, it would be reduced to be half of what it was in year 100 …. and so on and on.

Their activity eventually approaches zero but the radiation can be very dangerous to humans for a very long time. Some sources have half-lives of seconds or hours or days and others can have half-lives of thousands of years. This is why some strongly radioactive materials present us with a huge problem in storing it away from living creatures.

Information On The Units Used For Radiation:

American Units:

Roentgen: This is the measurement of "exposure" or the ionisations of the molecules of a mass of dry air. Is used only for "X"rays and Gamma. Not used for general purposes.

Curie (Ci): This is the quantity of a radioactive material that will have 37,000,000,000 transformations in one second. A more common unit is mCi millicurie or uCi microcurie or nCi nanocurie.

Rad: (abbreviation for Radiation Absorbed Dose). This is the unit for the absorbed energy into a mass. Defined as: 100 ergs of energy absorbed per gram of material

Rem: (abbreviation for Roentgen Equivalent Man). This is the unit for "equivalent dose" with factors applied to relate directly to the human biology. To get 'Rem', the value 'Rad' is multiplied by a factor 'Q' that is unique to the radiation being emitted, whether Alpha, Beta or gamma or combination.

SI or International Standard units:

Becquerel (Bq): This is the activity of the source at 1 transformation per second … there are therefore 3.7 $x10^{10}$ Bq in one Curie. It is a very small unit and kBq kiloBecquerels or MBq magaBecquerels or GBq gigaBecquerels are more often used.

Gray (Gy): This is the radiation that the cells of any material are absorbing. It is 1x Joule of energy absorbed into 1x kg of mass of a material. This is similar to the 'Rad' unit but the ratio is Ix Gray = 100 'Rads'. Often expressed as centi-grays (hundredths of a Gray). It can be called the "absorbed dose".

Sievert (Sv): This is the "dose equivalent" which relates the "absorbed dose" specifically to the biology of the human body. The absorbed dose (the Gray) is multiplied by a special dose factor "Q" that is unique to the type of radiation emanating. This unit Sievert is similar to the 'Rem' except that the ratio is 1x Sievert = 100 'Rem'. Often expressed in millionths of a Sievert or micro-sievert.

A Useful Description To Better Understand The Units:

If you are in a rainstorm, you can consider that the unit for the total amount of rain falling as 'Becquerels'. The amount of rain falling on you would be as 'Grays' and how wet you are getting would be as 'Sieverts'.

Designed and Manufactured in Australia