RADIATION SENSOR ML69M

USER'S GUIDE

CENTRE FOR MICROCOMPUTER APPLICATIONS

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Short description

The Radiation sensor ML69m senses alpha, beta and gamma radiation.
Alpha, beta, gamma radiation ionize material they strike or pass through. The amount of radiation is generally determined by measuring the resulting ionization. The Radiation sensor uses a Geiger-Müller tube to detect this radiation. The GM tube consists of an anode (positive electrode) positioned in the center of a tubular cathode (negative electrode) filled with a mixture of neon and halogen. The cathode is a thin-walled metallic cylinder sealed at each end with an insulating disk to contain the gas. The anode is a wire that extends into the cylinder. A high voltage is applied to the electrodes to create an electrical field within the chamber. When radiation passes through the chamber and ionizes the gas, it generates a pulse of current. The sensor electronically processes these pulses to display the radiation level in counts per minute. A clicking sound is emitted for each detected radiation event (for each count).

The end of the GM tube has a thin mica window. It allows alpha particles to reach the GM tube and be detected. The mica window will also sense low energy beta particles and gamma radiation that cannot penetrate the plastic case or the side of the tube.

For the short amount of time the GM tube is detecting one particle, it is not able to detect another radioactive particle if it enters the tube. This is called the sensor's dead time. The maximum dead time for the GM tube is 90 microseconds (or 90 µs).

To detect radiation, point the sensor toward the source of radiation. To detect alpha radiation put the sensor close to the source, this is because alpha particles do not travel far through air.

The Radiation sensor is an I2C digital sensor, which gives calibrated values of the measured quantity. This sensor can only be connected to special interfaces that support I2C digital sensors like the CMA MoLab interface.

Sensor specifications

Radiation sensor ML69m is a digital sensor that converts the number of counted detected pulses to a digital value of counts per minute. The maximal sampling rate of the sensor is 1 Hz.

Collecting data

This Radiation sensor works only with specific interfaces. The sensor will be automatically detected when connected to such an interface. For detailed information about measurements with sensors consult the User Manuals of the interface and the Coach 6 software.

Calibration

The Radiation sensor is supplied with a factory calibration in counts per minute (cpm). The Coach 6 program allows shifting the pre-defined calibration if needed. The user calibration is stored in non-volatile user sensor memory.

Suggested experiments

1. Monitoring background radiation
   If the radiation sensor is set up far away from any radioactive sources, it still detects pulses occasionally. This is due to the background radiation that is a result of radiation that occurs naturally from cosmic radiation, geophysical radiation, inherent material radiation, etc. Normal background radiation levels vary at different locations, according to altitude and other factors, such as types of minerals in the ground. The level of background radiation is usually very low.
   Since the background radiation is present in all experiments, it should be measured and subtracted from the experimental readings for these to be reliable.
2. Monitoring radiation of common radioactive materials
   Here the natural source of radiation such as potassium salts or lantern mantels can be used. In such experiments the random nature of the radiation can be presented.
3. Radioactive decay and half-life determination
   The radiation sensor offers the possibility to measure radioactive decay rate and half-life time. In such experiments isotope generators, like a Protactinium generator (with a half-life time of 72 seconds) or a Ba137m generator (with a half-life time of 153 seconds) are ideal radioactive sources for these experiment.
4. Radiation level versus shielding
   In this experiment the radiation level is recorded when absorbers of different thickness are placed between the sensor and radiation source. As absorber an aluminum sheet(s) for beta radiation or a lead sheet(s) for gamma radiation can be used. In this experiment you can also compare the effect of different types of materials to shield alpha, beta or gamma radiation.
5. Monitor radiation from an alpha, beta or gamma radiation source as a function of the distance between the source and the radiation sensor
   In this experiment the radiation level is recorded when a sensor is placed at different distances from the radiation source.

Technical Specifications

Sensor kind	Digital 16-bits resolution (on-sensor digital conversion) communication via I2C
Sensitive to	Alpha, beta, gamma radiation
Measuring range	0 .. 20,000 counts per minute
Resolution	1 count per minute
Accuracy	Typical ± 10 % at 25 ℃
Maximal sampling rate	1 Hz
Temperature range	0 - 50 ℃
GM tube	Neon - Halogen quenched GM-tube
Cathode material	446 Stainless Steel
Cathode wall thickness	0.25 mm
Mica window	Effective diameter 9.1 cm Areal density 1.5 – 2.0 mg/cm^2
Gamma sensitivity	Referenced to Cobalt 60 18 cps/mr/hr
Operating voltage	500 V
Minimum Dead Time	90 µs
Audio output	Clicking sound for each count
Connection	5-pins mini jack plug

Warranty:

The Radiation sensor ML69m is warranted to be free from defects in materials and workmanship for a period of 12 months from the date of purchase provided that it has been used under normal laboratory conditions. This warranty does not apply if the sensor has been damaged by accident or misuse.

Note: *This product is to be used for educational purposes only. It is not appropriate for industrial, medical, research, or commercial applications.*

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