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# OPERATION MANUAL

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## *Model GM-1*

November 2001



**Far West Technology, Inc.**  
330 South Kellogg Ave, Suite D  
Goleta, CA 93117

## GENERAL INFORMATION

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This instrument is manufactured in the United States of America by:

Far West Technology, Inc.  
330 South Kellogg Ave, Suite D  
Goleta, CA 93117-3814

Tel: 805.964.3615

Fax: 805.964.3162

Email: [support@fwt.com](mailto:support@fwt.com)

Web Site: [www.fwt.com](http://www.fwt.com)

Far West Technology has been manufacturing radiation measuring devices since 1972.

## REPAIR SERVICE

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Although we design and manufacture our instruments to a high standard, we realize that repairs are sometimes necessary. If you believe service is needed on this instrument please call our service department before shipping the instrument to us for repair; often we can help you with simple problems. If you do decide to return it to us for repair then please include:

1. Contact person's name
2. Organization or Company name
3. Address
4. Phone number of contact person
5. Description of the problem
6. Anything else you may think important

We will inform you of the repair charges and wait for your authorization before we repair your instrument.

## TABLE OF CONTENTS

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<b>I. INTRODUCTION .....</b>	<b>2</b>
<b>II. PHYSICAL CHARACTERISTICS OF THE INSTRUMENT .....</b>	<b>2</b>
<b>III. ELECTRICAL CHARACTERISTICS .....</b>	<b>2</b>
<b>IV. RADIATION DETECTION CHARACTERISTICS .....</b>	<b>2</b>
<b>V. OPERATION .....</b>	<b>3</b>
<b>VI. CONNECTION .....</b>	<b>3</b>
<b>VII. DETECTOR DIMENSIONS .....</b>	<b>3</b>
<b>VIII. ENERGY RESPONSE .....</b>	<b>4</b>
<b>IX. POLAR RESPONSE .....</b>	<b>4</b>

## I. INTRODUCTION

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The FWT GM-1S is a miniature Geiger counter designed for measurement of gamma-ray exposure rates in a mixed gamma-neutron field. It has been patterned after the work of Wagner and Hurst (Health Physics, 5, 20, 1961).

## II. PHYSICAL CHARACTERISTICS OF THE INSTRUMENT

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The basic detector is a small, 0.61 cm. diameter GM tube, with a 0.64 cm. long active volume. The gas filling is neon with a halogen- quenching agent. The tube wall is an iron-chromium alloy.

This small detector has been enclosed in an energy flattening shield that eliminates the low energy over-response characteristic of metal-walled GM tubes. The energy response with respect to that of air is  $\pm 10\%$  from 2.06 MeV ( $^{24}\text{Na}$ ) to 70 keV. The response below 70 keV falls rapidly.

The detector housing is aluminum and is attached to the end of a 0.64 cm. diameter aluminum rod. The housing is waterproof and measures 1.35 cm. in diameter. The center of the active volume is 1.3 cm. from the end of the housing. The counter wall consists of 90 mg/cm<sup>2</sup> Iron, 807 mg/cm<sup>2</sup> Lead, and 200 mg/cm<sup>2</sup> Aluminum. A Li<sup>6</sup>F shield with 480mn/cm<sup>2</sup> wall is integral with the GM detector. The GM1 counter is very similar to a GM-2 counter with a GM-S removable shield.

## III. ELECTRICAL CHARACTERISTICS

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The connector block contains the preamplifier and the high voltage and signal connectors. It is sturdy and suitable for clamping the detector. The preamplifier uses an integrated circuit with all active components on one chip. The output pulses are approximately +5 V into 1 K $\Omega$  and are approximately 25 microseconds wide. The preamplifier draws its power from the high voltage supply, and no extra power supply is required. The preamplifier will drive 50 feet of cable.

The high voltage connector mates with an MHV cable connector (UG 932 A/U or equal). RG-59/U cable or equal is satisfactory for H.V. connection. The signal connector (SIG) mates with a BNC cable connector (UG-260/U). RG-58 C/U cable or equal is satisfactory for carrying the signal.

The Model GM-1 is designed to plug directly into a NIM bin scaler. The +5 V pulse will easily drive it. The high voltage supply should be adjusted to the voltage shown on the accompanying Calibration Data Sheet. The counting plateau, also given on the Data Sheet, extends from approximately 440 V to approximately 500 V and has a slope of approximately 0.5% per volt. The high voltage supply must be able to provide approximately 2 mA. Maximum high voltage is 550 V.

This counter has a fixed dead time of approximately 25 microseconds per pulse. The actual dead time is given on the Data Sheet. It is blocked during this time; consequently, there will be a loss of counts as the exposure rate is increased. A 10% loss occurs at approximately 3.5 R/hr. Operation at higher rates is possible, but usually counting statistics will not be applicable. Pulsed accelerators will normally cause the device to lock into the accelerator pulse rate (or a submultiple) and will therefore result in meaningless data.

## IV. RADIATION DETECTION CHARACTERISTICS

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The energy response is flat within +10% from 70 keV to 2.06 MeV. The response falls rapidly below 70 keV, and corrections should be made for gamma-ray exposure below this energy for accurate work.

The angular response at 0.661 MeV ( $^{137}\text{Cs}$ ) is approximately  $\pm 12\%$  from 0° (end on) to 90° (side on) and is approximately  $\pm 5\%$  from 0° to 90° at 1.25 MeV ( $^{60}\text{Co}$ ).

The neutron response is not known with high accuracy. Measurements by Wagner and Hurst in low-energy neutron fields indicate approximately 0.5% response relative to gamma tissue kerma. Higher energy neutrons have a calculated response of approximately 0.2%.

The Model GM-1S is not designed for use as an absolute gamma-ray detector. Every effort has been directed towards stability of the calibration; however, it is recommended that frequent comparisons be made with a standard ion chamber in a known gamma field.

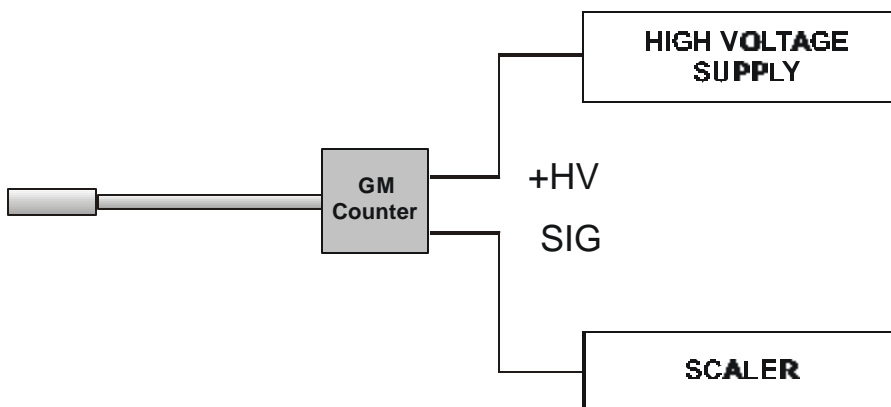
## V. OPERATION

The H.V. power supply is adjusted to the recommended voltage. If a radiation field is present, counts will be accumulating on the scaler. The strength of the field in Roentgens/hr is determined by correcting the observed counting rate for dead time losses and multiplying by the Roentgens/count value supplied with the instrument. The dead time, as given on the Data Sheet, was measured with the two source method. The true counting rate is determined from the observed counting rate as follows:

$$R = \frac{R_0}{1 - R_0 t}$$

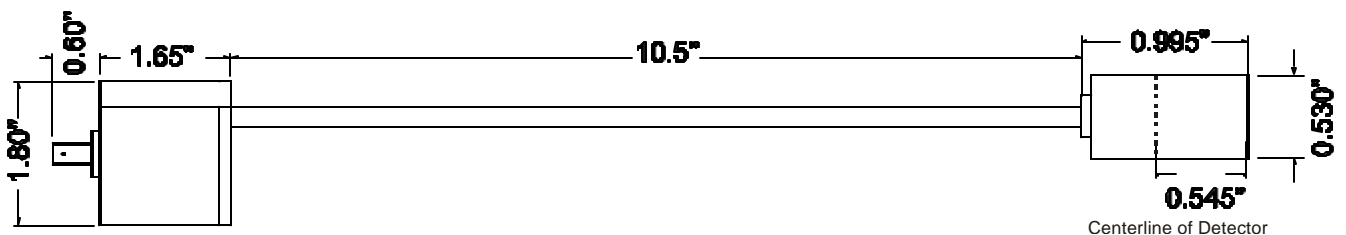
where R is the true counting rate in counts per second,  $R_0$  is the observed rate in counts per second, and t is the dead time in seconds.

## VI. CONNECTION

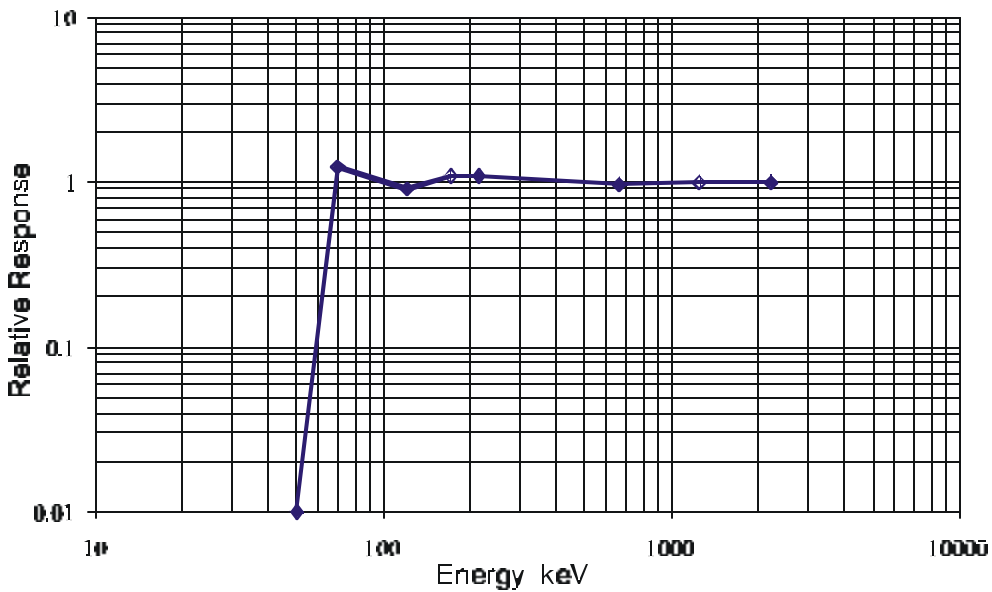


## VII. DETECTOR DIMENSIONS

Dimensions are in inches.



## VIII. ENERGY RESPONSE



## IX. POLAR RESPONSE

