

Direct Reading (Pocket) Dosimeter



Direct Read Pocket Dosimeter

What is a Pocket Dosimeter?

Arrow-Tech dosimeters are rugged, precision instruments about the size of a pocket fountain pen, which are used to measure accumulative doses or quantities of gamma & X-ray radiation. A metal clip is used to attach the dosimeter to an individual's pocket or to any available object in an area to be monitored for total radiation exposure.

It is pocket-size, conductive-fiber electroscopes with an ion chamber for detecting and indication integrated exposure to gamma and x-radiation. It has a thin wall which permits the penetration and detection of radiation.

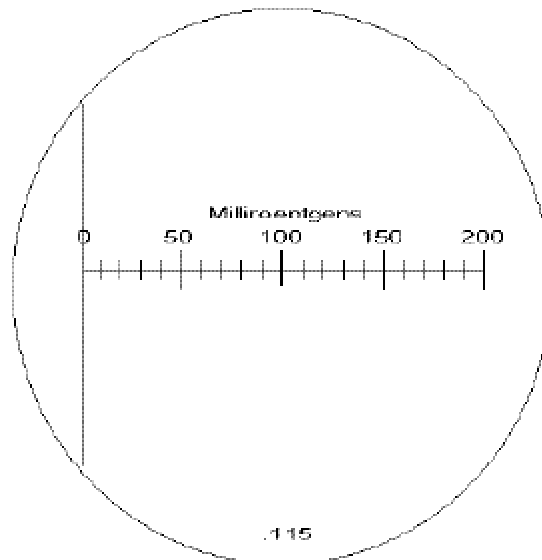
If your Dosimeter is going to be used in harsh conditions where scratching of the lens is a concern we recommend a synthetic sapphire window to protect the lens even in the toughest of conditions.

How does the Dosimeter work?

Reading a Dosimeter



The way we "read" a dosimeter is to just point it at a light source so that we can look through it and see the scale. The conductive fiber moves across a very clear well marked scale that produces the reading.



The graduated scale shown is what is viewed when looking through the Dosimeter

Arrow-Tech dosimeters use an extremely sensitive fiber electrometer type voltmeter and a small volume of air to measure the total amount of radiation to which the instrument has been exposed. A reading may be made at any time by merely looking at a source of light through the eyepiece end of the instrument. The reading here is at zero. This particular dosimeter is the 200 mR model.

Wearing a Dosimeter



You can wear the dosimeter like a pen in your pocket, or clip it to your belt. You can also set it outside for an hour, this will tell you the radiation rate. You don't have to have a radiation meter if you have a dosimeter and are not in a hurry to measure the rate.

Also, if ten or a hundred people are together or going somewhere, only one or two of them need to wear a dosimeter. So long as they all stay together, the radiation dosage that one gets will be what they all get. It is nice to have two or three, so that you can use one to check the other and make sure that they are working.

The dosimeter is charged (reset to zero) so the dosimeter can be used over and over again. This is usually done before each use.

Specifications

Radiation Detected: Gamma and X-ray from 16 KeV to 6 MeV

Ranges: 0 - 200 mR to 0 - 600 R

Energy Response: See Response curve below

Detector: Fiber electrometer mounted in an electrically conducting plastic ion chamber

Detector Housing: Very low permeability plastics - hermetically sealed

Accuracy: Within + or - 10% of true exposure

Rate Response: Dose rate independent for gamma and x-radiation

Electrical Leakage: Less than 0.5% of full scale for 24 hours at 50 degrees C

Temperature Range: -20 degrees C to 50 degrees C

Relative Humidity: Up to 90%

Dimensions: Length 4.5 in. (12.4cm), Diameter: 0.6in (1.5cm)

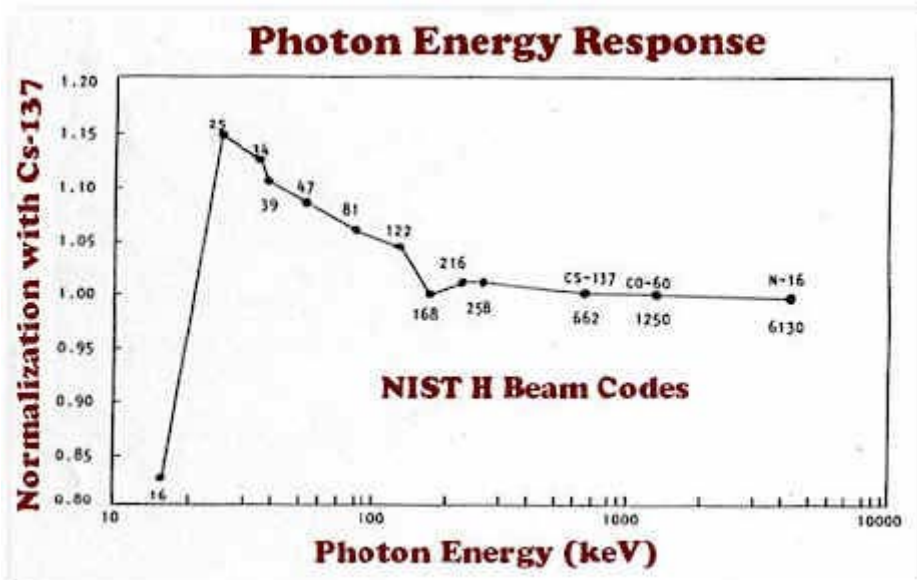
Weight: 1.0 oz. (25 grams)

Finish: Barrell and end caps: Natural matte black
Clips: Metal clips

Warranty: 2 year limited warranty

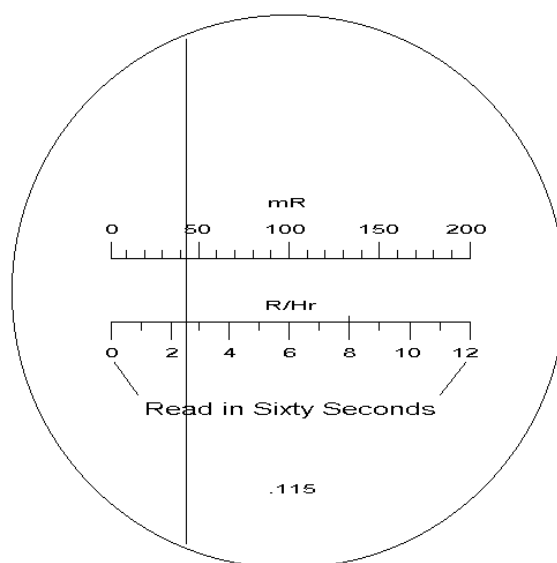
Manufactured in the United States
Superior Energy Response: 16 KeV to 6 MeV
Rugged: Meets ANSI Specifications N13.5 and N322
Low Electrical Leakage
Low Range models can measure Background Radiation

Photon Energy Response



The Dosimeter/Rate Meter looks just like a normal pen type dosimeter. Arrow-Tech, Inc. enhanced the model AT-138 (0 to 200 mR) dosimeter and added a Rate Meter Scale.

The instruments described in our Web site can provide you with vital information about fallout radiation. These are not protective devices. Special shielding- a fallout shelter-is needed if you are to be protective from fallout radiation which can cause serious damage to living tissue. But the instruments which we handle can be used as a type of "radiological ruler" to measure the degree of danger you face, making it possible for you to take certain actions in or about your home or business that might save you life.



The advantage of this instrument is that you can read the total dose received (in mR) on the top scale and the bottom scale can record the Roentgens (R) per hour received when timed for 60 seconds.

Meaning of the Readings

To benefit most from the information obtained from this instrument you must have some understanding of the biological damage resulting from nuclear radiation. The precise effects of nuclear radiation are very complex. (see **The Effects of Nuclear Weapons**, U.S. Department of Defense and the U.S. Atomic Energy Commission; and **Radiation Physics and Bomb Phenomenology**, TB-11-22, Office of Civil Defense Mobilization) However, a complete understanding of them is not required to use your instrument.

Much has been said about the long-range effects from exposure to radiation- increased incidence of leukemia, shortening of the life span, and

genetic implications. No doubt radiation exposure will result in some increases in the small percentages of such occurrences normally expected. Other effects of radiation, called acute effects, can result in sickness or death in a relatively short time. In the event of a nuclear attack on this country it is these acute effects that must be dealt with first, and the equipment here can help you do this.

Scientists generally agree on the amount of radiation damage the body can sustain without causing sickness and death. There are so many variables concerning how radiation will affect you that precise determination of the effects of radiation cannot be made. **The total amount of radiation damage you can incur before becoming ill will depend upon such variables as:**

- The duration of the exposure,
- Your body's ability to repair the damage,
- Your general health,
- Your age
- and vigor.

These variables make it difficult to set exact figures for the individual, but ranges that will apply generally can be given.

Perhaps the most important points to remember are:

1. For a dose of 100 roentgens (R) received in a few days there probably will be no obvious effects, and you will be able to continue your normal routine;
2. When the short-term exposure exceeds about 200 roentgens (R) you will become sick and need medical assistance;
3. A short-term exposure of about 600 R will almost certainly cause death.

Probable Acute Effects of Radiation

(see Emergency Exposures to Nuclear Radiation, TM-11-1, and Medical Aspects of Nuclear Radiation, TB-11-24, Office of Civil and Defense Mobilization.)

Remember: 1 roentgen (R) = 1000 milli-roentgen (mR)

The Arrow-Tech, Inc. Dosimeter/Rate Meter measures from 0 to 200 mR in a full scale reading, and roentgens (R) per hour for a dose rate.

Short-term, whole-body exposure in roentgens.	Probable effect
0 - 100 R	No obvious effects
100 - 200 R	Minor incapacitation
200 - 600 R	Sickness and some deaths
Over 600 R	Few Survivors

The long-range effects, such as shortened life span, decreased resistance to disease, etc, are not considered here.

These effects would be modified considerably if the dose were received over a long period. A short-term dose of 600 R probably would be fatal, but it would not cause death or have any noticeable external effects if the exposure were gradually acquired over a much longer period of time - months to years, for example. The body repairs some of the damage if the exposure is received gradually, and larger doses can be accepted before the individual becomes sick or before death occurs.

As an example of how this might be applied in an emergency situation: If a person restricts his total dose of radiation to 200 R for the first month of exposure, 25 R per week for the next 5 months, and 10 R per week thereafter for the next 6 months, he would have little, if any, radiation sickness or impairment of ability to work.

You must remember that any radiation received - **NO matter how little** - is harmful. Your body can never repair all the damage. Take every precaution necessary to keep your exposure as low as possible.

Total Dose and Dose Rate

In applying the term "dose rate" (in (R) per hour) and "dose" (in milli-roentgens (mR)), an analogy may be useful. Think of roentgens per hour

as you do miles per hour. The ratemeter, when exposed where you are located, indicates the number of roentgens per hour you are receiving, just as the speedometer of an automobile indicates the number of miles per hour you are traveling. When you see your speedometer showing too high a speed for road conditions, you slow down to protect yourself. When the ratemeter indicates too high a radiation rate, you should enter and stay in a shelter to protect yourself. Both instruments are related to time, Driving 60 miles an hour for one hour will carry you 60 miles; and if you are in a location where the dose rate is 6 roentgens (R) per hour and remain there for one hour you will have an exposure rate of 6 roentgens (R).

Radiation levels, like speed levels, change under certain conditions. The dose rate increases while fallout is being deposited, reaches a peak value, and then decreases over a period of time - rather rapidly at first but more slowly as time passes. That's why a dosimeter is needed in measuring radiation. Think of it this way: It would not be practical to figure the number of miles you had driven if your speed had varied and you only a speedometer in your car. That's why every car has an odometer which records the total number of miles driven. Similarly, it would not be practical to figure your total radiation dose if the dose rate had varied and you had only a ratemeter for measuring purposes.

The ratemeter shows you how much radiation is being received at a given time. The dosimeter shows you how much total radiation has been received.



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Direct Reading Dosimeter - **Low Range Models**

The Direct-Reading dosimeter is a pocket-size, carbon fiber electroscop with a thin walled chamber for detecting exposure to gamma and x-ray.

The low energy feature has hospital applications including fluoroscopy, portable radiography and angiography.



This pocket size instrument is light weight and has a sturdy metal clip to attach to individual's pocket. The entire unit can be immersed in water without effecting the instrument readings.

Low Range Models include:	
Model	Range
138	0- 200mR
138-S	0- 2mSv
500	0- 500mR
500-S	0- 5mSv

All models are available with a protective hard (sapphire) window to prevent the lens from being scratched in a harsh environment. **Arrow-Tech, Inc. is one of the few companies in the world that maintains the technology to manufacture the direct reading dosimeter.**

Specifications

Radiation Detected:	Gamma and x-ray from 16 keV to 6 MeV
Ranges:	0 –200 mR, 0 – 500 mR, 0 – 2 mSv, 0 – 5 mSv
Detector:	Fiber electrometer mounted in an electrically conductive plastic ion chamber
Detector Housing:	Very low permeability plastics-hermetically sealed
Accuracy:	Within + or – 10% of true exposure
Rate Response:	Dose rate independent for gamma and x-ray
Electrical Leakage:	Less than 1.0% of full scale for 24 hours at 50 C
Temperature Range:	-20 degrees C to + 50 degrees C
Relative Humidity:	Up to 90%
Dimensions:	Length: 4.5" (12.4 cm) Diameter .6 " (1.5 cm)
Weight:	1.0 oz (25 grams)
Finish:	Barrel and end caps are Natural matte black with metal clip
Warranty:	2 year limited warranty

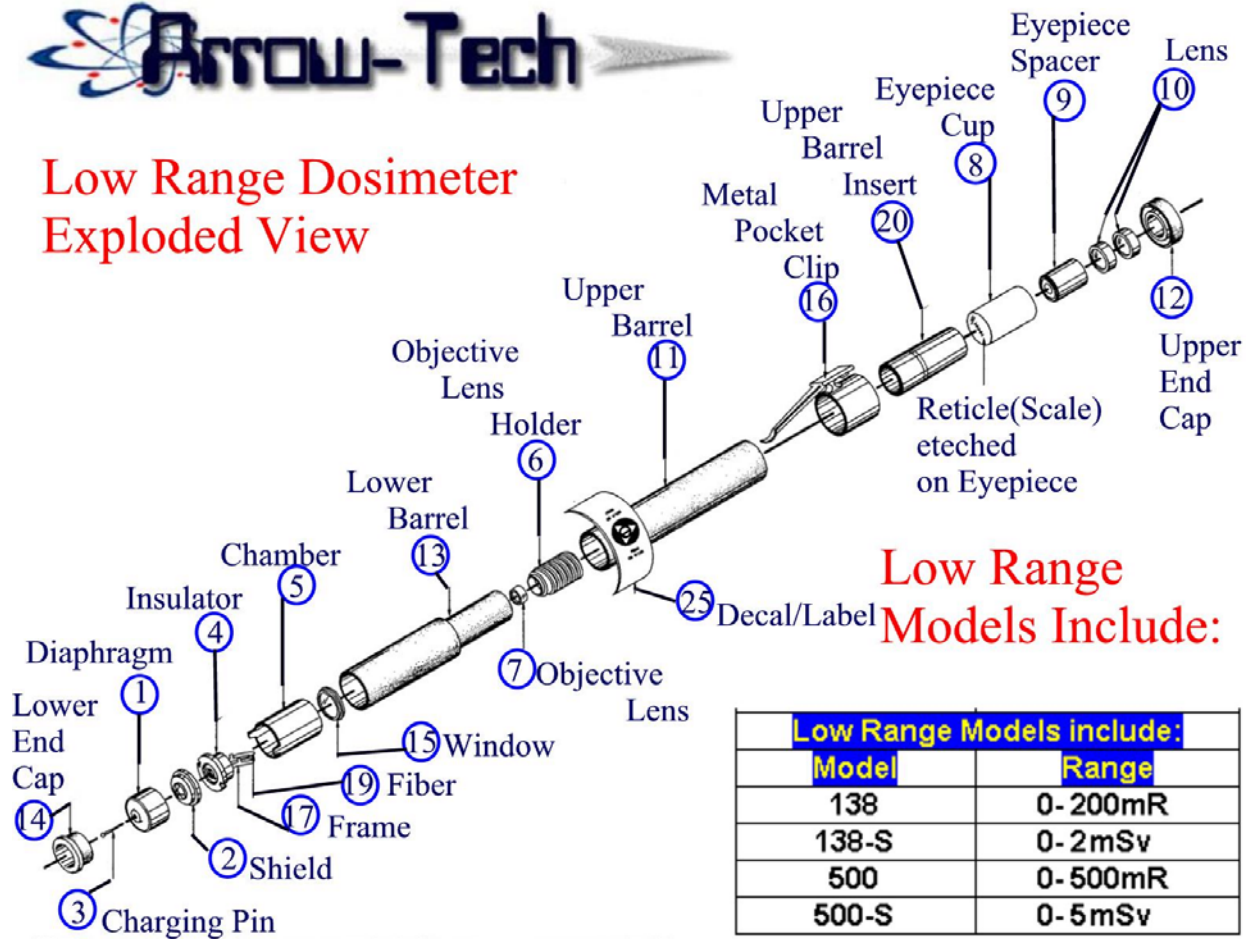
All dosimeters are tested for compliance with ANSI specifications, and customer specification requirements. All test equipment is calibrated, with documentation of traceability to NIST standards. All dosimeters are identified as to model number, range, manufacturer's name, and unique serial number.

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Accumulated radiation is read directly on an internal calibrated scale. A Dosimeter charger is required in order to return the dosimeter to zero after each exposure or when desired.



Low Range Dosimeter Exploded View



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Model	Range
138	0- 200mR
138-S	0- 2mSv
500	0- 500mR
500-S	0- 5mSv

Direct Reading Dosimeters Operation

Item	Description
1	Diaphragm Switch
2	Electrostatic Shield
3	Charging Pin
4	Electrometer
5	Ionization Chamber
6	Objective Lens Holder
7	Objective Lens
8	Eye Piece/Reticle
9	Eyepiece Spacer
10	Eyepiece Lens – 2
11	Upper Barrel
12	Upper End Cap
13	Lower Barrel
14	Lower End Cap
15	Window
16	Metal/Pocket Clip
17	Frame
19	Conductive Fiber
20	Upper Barrel Insert
25	Decal/Label

A conductive fiber dosimeter is a rugged precision instrument consisting of an ionization chamber (5) sensitive to radiation. A conductive fiber electrometer (4) which measures the charge: and a microscope to read the shadow of the fiber on a reticle(scale) (8).

The electrometer embodies two electrodes, one of which is a moveable conductive fiber. When the electrometer is charged to a predetermined voltage, the electrodes assume a calibrated separation.

As the dosimeter is exposed to radiation, ionization occurs in the surrounding chamber decreasing the charge on the electrodes in proportions to the exposure. The deflection of the moveable conductive fiber electrodes is projected, by a light source, through an objective lens(7) to the calibrated reticle and read through a microscope eyepiece (10).

Illumination for the optical system is obtained by pointing the dosimeter at any convenient light source. Light passes through the clear plastic electrostatic shield (2) to illuminate the reticle.

The bottom is sealed by the clear plastic diaphragm switch (1) containing an insulated charge pin (3). When charging, the charging pin moves up to contact the electrometer closing the circuit. Sufficient voltage is applied to recharge the system. The entire system is encased in a liquid crystal polymer (LCP) barrel (11 & 13) with all joints hermetically sealed with epoxy.

Contact Arrow-Tech, Inc. for more information on the Direct Reading Dosimeter.
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