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943 Series

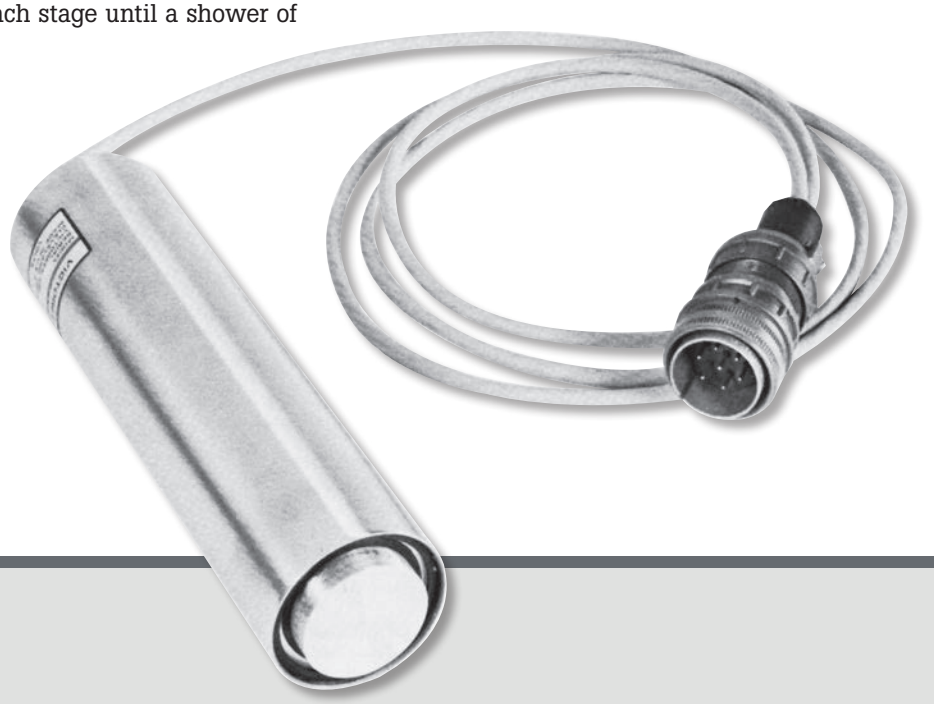
Gamma Scintillation Detectors

The 943 Series Gamma Scintillation Detectors consist of an integral gamma sensitive NaI crystal, a photomultiplier tube, a preamplifier assembly, and various interconnecting cables for connecting the detector, ratemeter, and power supply. All are functionally identical. The size of the crystal employed, the housing material, and whether or not an Americium source is included in the assembly are the only differences. All photomultiplier tube/crystal assemblies are of integral line construction.

The 943 Series Gamma Scintillation Detectors are designed to be sensitive to gamma radiation. The Gamma Scintillation material, photomultiplier tube, and preamplifier are contained within a cylindrical housing. This assembly provides protection from the environment, and provides a mechanism for installation without damaging the detector assembly.

When gamma or X-rays enter the scintillation crystal, pulses of light are emitted. The light pulses striking the photocathode of the photomultiplier tube excite the electrons in the cathode to a high energy state, causing them to escape from the surface of the cathode. The freed electrons are attracted by a voltage potential to the first dynode of the photomultiplier tube. This starts a cascading effect where a charge is passed from dynode to dynode, increasing in size at each stage until a shower of electrons is passed on to the preamplifier.

The preamplifier provides pulse conditioning and cable driving capabilities to match the input characteristics of the Universal Digital Ratemeter or the 960 Digital Radiation Monitoring System (DRMS), used to monitor the detector output. The detector is supplied with an integral eight foot cable that normally terminates in a junction box supplied as a part of a complete monitoring channel.



Key features

- Gamma scintillation detectors
- Detects X-ray or gamma radiation
- For use with the 942A Series or the 960 Series electronics
- Used on process liquid and iodine or noble gas channels
- Count range: 10^7 CPM
- Preamp integral with detector
- Operating temperature range: 32 °F to 122 °F (0 to 50 °C) (max delta T 20 °C/hour)
- Ratemeter may be remotely located up to 1500 feet
- Dead time correction less than 1 % at 10^7 CPM

Detector variations

Model 943-35

The 943-35 Gamma Scintillation Detector consists of an integral 1.5 inch diameter by 1.0 inch thick sodium iodine (NaI) crystal/photomultiplier tube assembly and preamplifier, enclosed in a stainless steel housing. The stainless steel housing completely encloses the scintillator, and is used where direct contact with the process is required. The response of the detector is slightly less than the 943-36 detector, due to the 0.045 inch thick housing.

Model 943-36

The 943-36 Gamma Scintillation Detector consists of an integral 1.5 inch diameter by 1.0 inch thick sodium iodine (NaI) crystal/photomultiplier tube assembly and preamplifier, enclosed in a stainless steel housing. The aluminum crystal housing protrudes through the process end of the detector for maximum efficiency. The detector is normally used for monitoring of radioactive iodine, or in liquid process monitors, where the detector is protected from the process by a stainless steel well that is part of the detector shield assembly. The well is provided separately.

Model 943-36H

The 943-36H is similar in construction to the 943-36, and is modified to operate at process temperatures of up to 160°F with less than a 10% decrease in output at low photon energies (below 662 keV), and less than a 5% decrease in output at high energies (662 keV and above). This detector is recommended for use in applications where the process temperature is above 120°F.

Model 943-37

The 943-37 Gamma Scintillation Detector consists of an integral 2.0 inch diameter by 2.0 inch thick sodium iodine (NaI) crystal/photomultiplier tube assembly and preamplifier, enclosed in a stainless steel housing. The stainless steel housing completely encloses the scintillator and is used where direct contact with the process is required. The 2 inch crystal provides more sensitivity to both ambient and process radiation than the 943-35 or the 943-36 detectors, and is used in applications where low ambient background radiation is anticipated.

Model 943-237

The 943-237A Americium Detector contains a small capsule of Americium 241, which is inserted in the sodium iodine (NaI) crystal. The function of the Americium is to provide a high energy pulse output for regulation of the high voltage power supply under conditions where fluctuations in the process temperature are expected, or where pulse height spectrometry is desired. The Americium doped detectors are designed to be used in conjunction with the 960AM Series Americium Regulator Module or the 942-200-90 SCA/Americium Regulator board for dynamic regulation of the detector high voltage.

Americium 241 is selected as the source of calibrating energy for the regulated detector, because the equivalent energy level of the pulse (approximately 5.4 MeV) is relatively distant from that of the isotopes normally being monitored.

Note: The following detector models are no longer manufactured, and may be replaced as shown below:

Obsolete model	Description	Replacement
943-38	2 x 2 inch crystal carbon steel housing	943-37
943-238A	Carbon steel housin, with americium	943-237A

Technical specifications

Detector

Dimensions
- 943-35:
  9.5 long x 2.5 Ø in
  (24.1 cm x 6.4 cm)
- 943-36/36H:
  9.5 long x 2.5 Ø in
  (24.1 cm x 6.4 cm)
- 943-37/237A:
  10.5 long x 2.5 Ø in
  (26.7 cm x 6.4 cm)

Weight
3 lb (1.4 kg)

Housing material
Stainless steel

End window material
- Aluminum: 943-36/36H
- Stainless steel:
  943-35/37/237A

Photomultiplier tube
2 inch photocathode, 10-stage, integral crystal

Crystal size
- 1.5 in Ø x 1 in thick:
  943-35/36/36H
- 2 in Ø x 2 in thick:
  943-37/237A

Crystal material
- Sodium iodine (Nal): 943-3X
- Sodium iodine (Nal) with americium: 943-23X

Power requirements
- + 1000 V dc @ 500 µA;
- + 15 V dc @ 15 mA,
- - 15 V dc @ 50 mA

Connectors
MS3106E 2427B (supplied with detector)

Detector cable
Model 50-111 (two 50 ohm coax and two #18 AWG) built-in 8 ft (2.4 m) cable

Interconnecting cable detector to ratemeter
Model 50-100 (one 50 ohm coax, one 75 ohm coax, two #18 AWG, four #18 AWG twisted pairs)

Environmental
- Operating temperature:
  32 °F to 122 °F (0 to 50 °C)
  (160 °F for 943-36H)
- Storage temperature:
  32 °F to 122 °F (° to 50 °C)
  (160 °F for 943-36H)
- Relative humidity:
  0 to 95%, non-condensing

Maximum external pressure
15 psig (without well)

Preamplifier

Rise time
< 250 ns

Input impedance
> 50 kilo ohms

Output coupling
AC

Voltage gain
6.1 V/V

Configuration
Voltage sensitive

Current polarity
Negative

Output impedance
50 ohms

Maximum field cable length
1500 ft (457 m)

Maximum pulse amplitude
- 6 V dc

Maximum count rate
2E7 CPM

Ordering information

Model

943-35: Gamma Scintillation Detector with 1.5 inch Crystal

943-45L: Gamma Scintillation Detector With LED

943-36: Gamma Scintillation Detector With Aluminum Crystal Housing

943-36H: Gamma Scintillation Detector for process with temperatures above 120 °F

943-36HT: Gamma Scintillation Detector with preamplifier and RTD installed

943-36L: Gamma Scintillation Detector with LED integrated

943-37: Gamma Scintillation Detector with 2 inch crystal

943-237A: Americium Detector

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