



Trusted  
radiation  
protection.

# 965

## Stack Monitor

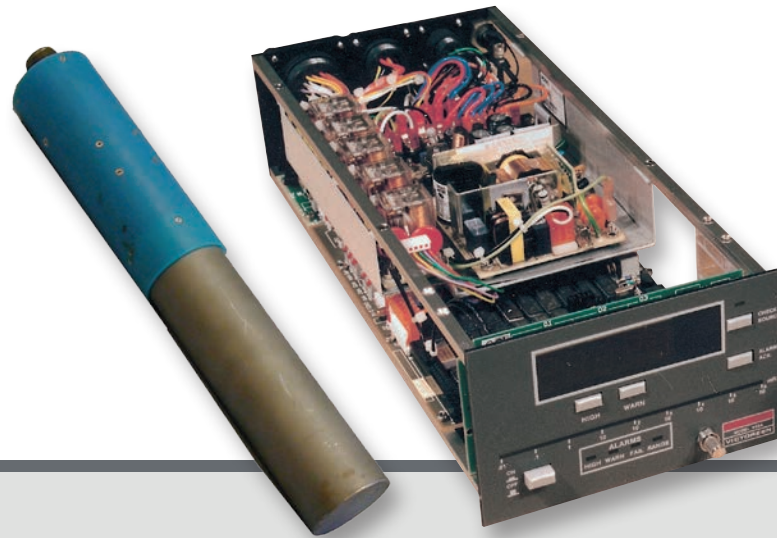
The 965 Stack Monitor is a single-channel radiation monitoring system which operates over the range of 10 to  $10^7$  CPM. The system monitors gamma radiation and provides indication when the radiation level decreases below a fail threshold, exceeds a warn set point, exceeds a high set point or exceeds an overrange set point. The overrange feature provides two significant benefits. First, it prevents the system from displaying an on-scale but inaccurate reading should the detector become saturated. Second, it lessens the risk of damaging the detector by disabling it during an overrange condition. Relay outputs are available to activate alarm annunciators. Analog outputs are available for trend display on a strip chart recorder or computer. Also, the monitoring system has an integral check source to verify operational integrity. The system consists of a 943-36CS Gamma Scintillation Detector and a 942A Universal

Digital Ratemeter (UDR). The 965 Stack Monitoring system can be used in any size or shaped stack. Since the detector mounts directly in the stack, there is no need for an expensive, high-maintenance off-line monitoring system. This monitor can be used as a single channel stand-alone, or grouped together in a multi-channel monitoring system.

The standard UDR is factory-modified to include three option boards to allow for

computer communications, an analyzer to count  $^{15}\text{O}$  only (or other selected isotopes), and flow compensation to measure stack effluent releases.

The 943-36CS Gamma Scintillation Detector consists of a scintillation crystal, a photomultiplier tube, a preamplifier assembly and an integral check source. The 943-36CS detector is sensitive to gamma radiation. The scintillation material, photomultiplier tube and preamplifier are contained within a cylin-



### Key features

- Count Range:  $10^7$  CPM
- Energy response: 15% from 70 keV to 3 MeV
- No external power needed at detector location
- Preamplifier integral with detector
- Ratemeter may be remotely located up to 1500 feet
- Single cable between ratemeter and detector
- 8  $\mu\text{Ci}$   $^{137}\text{Cs}$  check source capsule
- Replaces high maintenance off-line monitoring system
- Deadtime correction < 1% at  $10^7$  CPM
- User adjustable alarm set points
- Seismically tested with high reliability
- Stack flow monitoring and release calculation



Trusted radiation protection.

drical housing. The preamplifier provides pulse conditioning and cable driving capabilities to match the input characteristics of the ratemeter.

The 943-36CS Gamma Scintillation Detector can be used with Universal Digital Ratemeters or with the 960 Digital Radiation Monitoring System (DRMS). Ratemeters are used in systems where individual control room readouts are employed, while the 960 DRMS is used when a complete digital process control system is supplied. The 942A UDR, when connected to a 943 Series Scintillation Detector, comprises a monitoring system that operates over a seven-decade range. The UDR provides display, control, and annunciation functions for the monitoring system, and will display readings in the range of 10 to 10<sup>7</sup> CPM.

Standard features for the ratemeter consist of a five-digit display of the radiation value and a multicolored bar-graph indicator, which covers the entire range of the UDR. The bar graph changes color in the event of an alarm condition (green for normal, amber for warning and red for high). Front-panel alarm indicators and rear-panel relay output contacts for alarm annunciation are also included. Front panel pushbuttons apply power, display alarm limit set points, acknowledge alarms, and activate the check source. Analog outputs of 0 to 10 V dc (1) and 4 mA to 20 mA (2) are provided for recording and computer monitoring. The outputs may also be used to drive a remote meter or a local (i.e. near the detector) indicator. All electronics required to interface with a 943 Series detector are included within the 942A UDR. The electronics consist of a high-voltage power supply, low-voltage DC power supply and the hardware/soft-

ware required for UDR operation. The system also includes an overrange indicator to preclude the possibility of an erroneous down-scale reading when the radiation field is beyond the range of the detector.

## Technical specifications

### Detector

#### Dimensions

2.5 in Ø in x 16 in long  
(63.5 cm x 406.4 cm)

#### Weight

5 lb (2.27 kg)

#### Housing material

Stainless steel

#### Check source housing

PVC plastic

#### Environmental

- Operating temperature: 32 °F to 122 °F (0° to 50 °C)
- Storage temperature: 32 °F to 122 °F (0 to 50 °C)
- Relative humidity: 0 to 95 %, non-condensing

### Crystal characteristics

#### Material

NaI (Tl)

#### Full width half max

< 9 %

#### Configuration

1.5 x 1 in

#### Energy response range

70 keV to 3 MeV

### Electrical characteristics

#### Photomultiplier tube

2 inch Ø, 10-stage, integral crystal

#### Maximum count rate

107 CPM

#### Output pulse polarity

Negative

#### Output impedance

50 ohms

#### Rise time

< 60 ns (preamp alone)

#### Maximum field cable length

1500 ft (457 m)

#### Maximum pulse amplitude

6 V (terminated into 50 ohms)

#### Connector type

MHV high voltage

#### Power requirements

- Detector: 1400 V dc max @ 500 µA
- Preamplifier: ± 15 V dc @ 50 mA

### Universal Digital Ratemeter

#### Main display

5 digits with backlighted radiation units display and floating decimal point. 3 digits plus exponent for data entry/display.

#### Bargraph display (dynamic range)

3 segments per decade, tricolor, indicating channel status (24 segments)

#### Alarm indicators

- HIGH (red LED)
- WARN (amber LED)
- FAIL (red LED)
- RANGE (red LED)
- HIGH and WARN LEDs flash until acknowledged

#### Pushbuttons

Set points:

- HIGH-High Alarm limit
- WARN-Warn Alarm limit

Check source: Activates radioactive check source and associated green LED indicator. Momentary non-latching pushbutton operation.

Alarm acknowledgment: Causes alarm indicators to go to a steady on state after acknowledgment

Power ON/OFF: Alternate action pushbutton for ac power to unit

### Relay outputs (failsafe operation)

- High alarm: One set. DPDT rated 5 A @ 120 V ac (one set 120 V ac powered for use with optional remote alarm)
- Warn alarm: Two sets. DPDT rated 5 A @ 120 V ac
- Fail alarm: Two sets. DPDT rated 5 A @ 120 V ac
- Contact rating for all relays is 5 A @ 28 V dc

### High voltage output

1400 V dc max @ 0.5 mA

### Check source power

+ 15 V dc @ 20 mA

### Analog outputs

4 mA to 20 mA (2) (500 ohms max) and 0 to 10 V dc (1 k-ohm min), logarithmic. May be scaled for any one decade (min) to the full range of the unit (max).

### Alarm acknowledgment input

Optically isolated dc input

### Detector input

Digital pulse, up to 1500 ft from UDR, 50 ohm input impedance

### Detector accuracy (electronic)

$\pm 1\%$  digit ( $\pm 1\%$  of the displayed value), exclusive of the detector energy response

### Dimensions (w x d x h)

5.64 in x 13.73 in x 3.47 in  
(14.33 cm x 34.87 cm x 8.81 cm)

### Weight

4 lb (1.8 kg)

### Power requirements

120 V ac  $\pm 10\%$ , 50/60 Hz,  
28 W (240 V ac optional)

### Environmental

- Operating temperature: 32 °F to 122 °F (0 to 50 °C)
- Storage temperature: 32 °F to 122 °F (0 to 50 °C)
- Relative humidity: 0 to 95 %, non-condensing

### Compatible detectors

943 Series detectors

### Heat loading

Approximately 96 BTU/hr

### Accessories/options

Model 948-1 Rack Chassis

## Model

965: Stack Monitor

## Standard Accessories

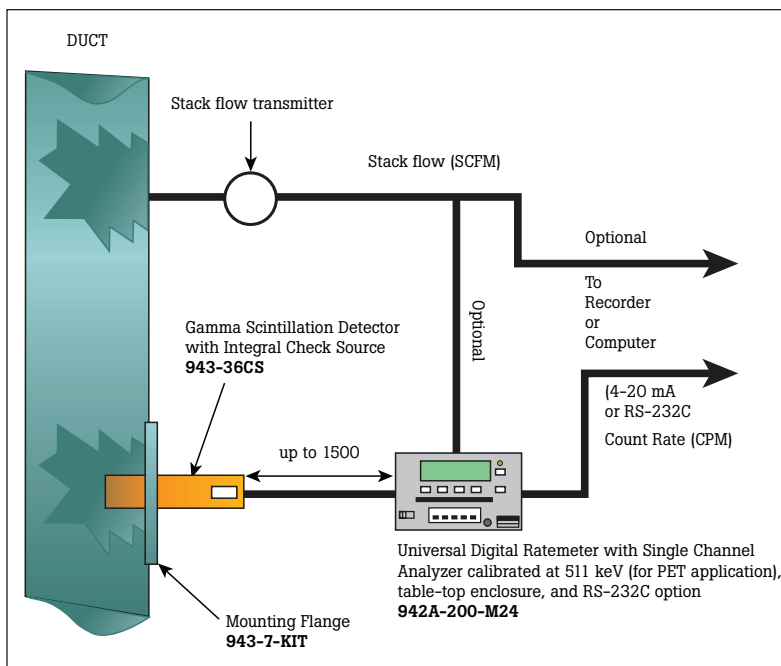
942A: Universal Digital Ratemeter

943-36CS: Gamma Scintillation Detector

960: Digital Radiation Monitoring System

## Optional accessories

948-1: Rack Chassis



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