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Technical Data

1045

Wide-Range Ion Chamber Area Monitor

The 1045 is a wide-range area monitoring system with a detectable range of 10^{-1} to 10^7 mR/h. The system is comprised of a 977-210 Wide Range Ion Chamber Detector, with local preamplifier, and a 1046 Universal Digital Ratemeter (UDR). The detector and preamplifier are connected by two 5-foot cables, encased in a flexible conduit. Other cable lengths, up to 100 feet between preamplifier and detector, are available. Both the detector and preamplifier are wall mounted in an area designated by the customer. The 1046 UDR is either locally wall mounted or remotely rack mounted in the control room.

Area monitors are used for the detection of x-ray or gamma radiation in selected areas. The monitor should be used in any location where personnel may be exposed to an adverse amount of radiation. Applications include nuclear reactors, accel-

erators, hot cells, irradiators and any area where radiation sources are handled. These monitors can be used as single channel monitors or grouped together as a multichannel area monitoring system.

Detector

The 977-210 Wide Range Ion Chamber Detector is a gamma sensitive radiation detection

device that measures radiation in the range of 10^{-1} mR/h to 10^7 mR/h with an energy dependence of less than $\pm 10\%$ from 55 keV to 3 MeV. The preamplifier is housed in a gasket-sealed enclosure. Interconnection between the detector and preamplifier is accomplished via two five-foot cables encased in a flexible conduit.



Key features

- Range: 10^{-1} to 10^7 mR/h
- Energy response: 10% from 55 keV to 3 MeV
- Life expectancy: up to 10^7 rads if preamplifier is remote or shielded
- No external power is needed at detector location
- Three twisted-pair cables with ground conductor and overall shield between detector and ratemeter for maximum noise immunity
- Environmentally hardened for operation in moisture laden environments
- Seismically tested with high reliability
- Microprocessor controlled



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The wide-range ion chamber detector design includes a dual, concentric ion chamber with a volume of approximately 1000 cc. The chamber walls are made of tissue equivalent plastic. An aluminum outer wall is provided to protect the ion chamber and to mechanically interface with the 848-8 Field Test Source. The ion chamber is biased at a nominal 500 V and produces an output current proportional to radiation absorbed in the chamber. The current is approximately 8×10^{-11} A/R/h.

The ion chamber assembly makes use of a double seal design, where the actual ion chamber is filled with nitrogen at atmospheric pressure. The connector area is sealed against moisture and particulates through the use of a sealed, liquid-tight flexible conduit between the detector and pre-amplifier electronics.

Preamplifier

The preamplifier contains a microprocessor controlled, auto-zeroing, integrating electrometer, a programmable gain amplifier, an analog-to-digital converter, an asynchronous serial communication interface, an electronic check source and the detector high voltage power supply. Communications with the UDR is accomplished via the optically isolated serial communication loop driver/receiver circuitry.

Universal Digital Ratemeter

Standard features for the instrument consist of a three-digit display of the radiation value and a multicolored bargraph indicator covering the entire

range of the detector. The bargraph 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 output relay contacts for alarm annunciation are also included. Front-panel pushbuttons are provided to apply power, to display alarm limit setpoints, for alarm acknowledgment and for the activation of a check source function.

Technical specifications

Detector (977)

Detector type

Ionization chamber

Detector volume

Approximately 1000 cc

Detector constant

Approximately 8×10^{-11} A/R/h

Detector capacitance

30 picofarads nominal

Inner chamber gas

Dry nitrogen @ atmospheric pressure

Radiation detected

Gamma rays and x-rays

Range

10^{-1} to 10^7 mR/h

Typical energy dependence

+/- 10% from 55 keV to 3 MeV

Detector accuracy

+/- 15% of true dose for ^{137}Cs

Power requirements

Approximately 500 V dc; high voltage level verified through autocheck routine

Check source

Electronic check source actuated from UDR front panel

Dimensions (w x d x h)

10.2 in x 10.25 in x 11.31 in
(25.91 cm x 26.04 cm x 28.73 cm)

Housing material

Aluminum outer chamber protective cover; inner chambers are conductive, tissue equivalent, plastic

Weight

11 lb (5 kg)

Environmental

- Operating temperature: 0 to 130 °F (-16 °C to 54 °C)
- Storage temperature: 0 to 130 °F (-16 °C to 54 °C)
- Relative humidity: 0 to 95 %, non-condensing
- Maximum external pressure: 15 psig

Preamplifier

Housing material

Carbon steel, NEMA 4 type (stainless steel available).

Interconnecting cable detector to preamplifier

Approximately five feet of signal and high voltage built-in cable contained within a flexible conduit (other lengths, up to 100 feet, available).

Interconnecting cable preamplifier to ratemeter

Serial interface to 1046A UDR. Capable of driving up to 3000 feet of cable at 4800 baud, seven conductors, 16 AWG, for maximum preamplifier/ratemeter distance, excluding local alarm requirements; optional cables available on a per-foot basis.



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Power requirements

- + 15 V dc @ 250 mA,
- - 15 V dc @ 50 mA

Auxiliary alarm output

- 12 V dc @ 150 mA (max)

Auxiliary analog output

0 to 10 V dc, 2 k ohms (min)

Dimensions (*w x d x h*)

9.38 in x 4.36 in x 11.5 in
(23.83 cm x 11.07 cm x 29.21 cm)

Weight

12 lb (5.4 kg)

Environmental

- Operating temperature:
0 to 130 °F (-16 °C to 54 °C)
- Storage temperature:
0 to 130 °F (-16 °C to 54 °C)
- Relative humidity
0 to 95%, non-condensing
- Life expectancy: Approximately
10⁴ rads with no external
shielding

Universal Digital Ratemeter (1046A)

Main display

7 digits with double digit exponent
units display; X.XXE+XX

Bargraph display

LCD simulated display, selectable
range changes color with alarm
status: green (normal), amber
(warn) and red (alarm)

Alarm indicators

HIGH (red LED), WARN (amber
LED), FAIL (red LED) and RANGE
(red LED). HIGH and WARN
LED's flash until acknowledged.

Alarm delay

Three minute alarm mute on
channel power-up

Ports

RS485 (3)
Ethernet (1)
USB (1)

Standard Features

Computer interfaces:
RS-485, analog inputs (2).
Modbus. VICO-LOOP.
Triple channel analyzer.
Selectable analog outputs (3), international
SI units

Pushbuttons

- Setpoints: HIGH-High Alarm
limit, WARN-Warn Alarm limit
- Check source: Activates
electronic Check Source and
associated green LED indicator.
“Latching” pushbutton operation
with timed automatic shut off
- Alarm acknowledgment:
Causes alarm indicators to go
to a steady on state after
acknowledgment
- Power ON/OFF: Alternate action
pushbutton for ac power to the
unit

Relay outputs

(fail-safe 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

Analog outputs

4 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.

Accuracy (electronic)

± 1 % digit (± 1 % of the
displayed value), exclusive of
the detector energy response.

Dimensions Rack Mount

(*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)

Dimensions Wall Mount

(*w x d x h*)

10.0 in x 9.0 in x 22.75 in
(25.4 cm x 22.9 cm x 57.8 cm)

Weight

4 lb (1.8 kg)

Power requirements

120 V ac ± 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

Heat loading

Approximately 96 BTU/hr

Compatible detectors

977 Series Wide Range Ion
Chamber Detectors

Field Test Source (848-8)

Description

Portable, fixed geometry, test fixture
for on-site testing of the 977 Series
Ion Chamber Detector

Dimensions (*w x d x h*)

8.88 in x 13.25 in x 6.63 in (22.5
cm x 33.6 cm x 16.8 cm)

Weight

24 lb (11 kg)

Radioactive source

100 mCi, ¹³⁷Cs (optional 10, 20
and 1 mCi sources available)

External radiation levels

(with 100 mCi source)

- Closed position:
< 5 mR/h at a distance of 1 ft
- Open position:
100 mR/h at 2 ft

Internal radiation levels

(with 100 mCi source)

- Closed position: 50 mR/h
- Intermediate position:
500 mR/h
- Open position: 5,000 mR/h



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Rack Chassis (948-1)

Description

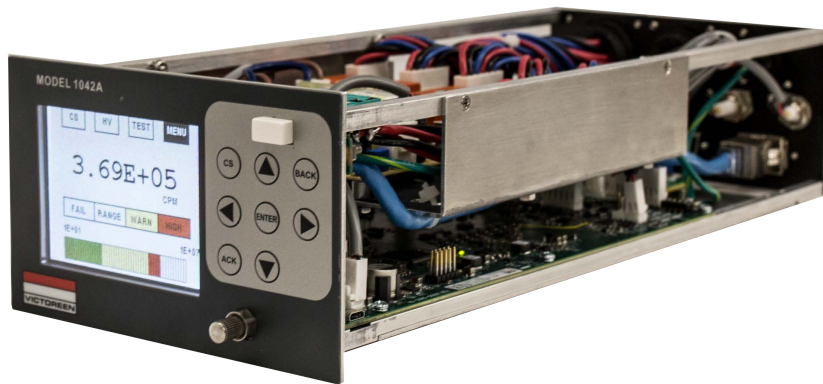
Mounts the 1046A UDR in a 19-inch wide unit control room panel or cabinet. Each rack chassis may accommodate 3 UDRs. The 948A-2 blank panel is available to fill unused positions.

Dimensions (w x d x h)

19.00 in x 14.80 in x 3.47 in
(48.26 cm x 37.59 cm x 8.81 cm)

Weight

10 lb (4.5 kg)



Ordering information

Model

1045: Wide-Range Ion Chamber Area Monitor

Component parts

977-210: Wide-Range Ion Chamber Detector with local preamplifier Detector

1046A: Universal Digital Ratemeter (rack-mount)

1046WM: Universal Digital Ratemeter (wall-mount)

Optional accessories

848-8: Field Test Fixture

948-1: Rack Chassis



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