

IONIZATION CHAMBER TYPE MONITORING POST

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1 INTRODUCTION

For protecting inhabitants from radiation damage and keeping environment clean, it is very important to monitor radiation dose rate around a nuclear power station. Until now, for measurement of dose rate around nuclear power stations, monitoring posts using NaI scintillator or GM tube as a detector were installed, and low dose rate during the normal time was measured. This caused problems such as the case of Three Mile Nuclear Power Station in the United States where a scale-over occurred during high dose rate under the condition of accident. For this reason, in Japan, [Guide Line for Measurement of Dose Rate at the time of Accidents] was indicated by a Nuclear Power Committee. The monitoring post using a ionization chamber as a detector was developed in compliance with the above mentioned Guide Line. The product developed this time by Fuji Electric is an ionization chamber type monitoring post which has measuring range from 1 to 10^7 uR/h and is capable of measuring from low dose rate such as natural background to high dose rate anticipated under the condition of accident.

2 FEATURES

(1) Wide measuring range

Fuji Electric's ionization chamber type monitoring post uses an argon pressurized type spherical ionization chamber as a detector and uses an Fuji Electric's own automatic amplifier gain changeover system in the dose rate meter. Thus, the monitoring post is capable of measuring dose rate accurately and stably from 1 to 10^7 uR/h. In other words, this new monitoring post is capable of covering both low dose rate during normal time and high dose rate under the condition of accident.

(2) Excellent directional characteristics

Because the spherical ionization chamber manufacturing technique is established, the directional sensitivity is even toward all incoming directions of radiation.

(3) Easy outdoor installation

The detector and the dose rate meter are accommodated compactly in a dust/drip-proof case. Therefore, it can be readily used as a monitoring post by preparing a mounting stand and supplying AC power. Further, the monitoring post withstands against 50 °C ambient temperature, and thus, it can be installed directly in outdoor place by taking a simple action to prevent direct sun light. Furthermore, the monitoring post can be used at low temperature down to -30 °C because a space heater is built in the monitoring post.

(4) Easy handling of external output

External output can be handled easily because they are isolated 4 to 20 mA standardized signals. Further, pulse output which is proportional to dose rate can be taken out so that the data can be processed conveniently by a computer.

3 SPECIFICATIONS

- (1) Measurable radiation: Gamma ray
- (2) Measuring range: 1 to 10^7 uR/h
- (3) Measuring accuracy: 1) Logarithmic output:
Less than ± 0.17 decade
2) Pulse output: Less than $\pm 10\%$
of the output frequency
- (4) Energy dependence: 0.3 to 1.5 (50 KeV to 300 KeV)
0.8 to 1.2 (300 KeV to 3 MeV)
(Based on the sensitivity of ^{137}Cs)
- (5) Directional dependence (Sensitivity ratio toward horizontal and vertical directions): Less than $\pm 3\%$
- (6) Outputs: 1) Logarithmic output: 4 to 20 mA
isolated output
2) Pulse output: Pulse output and range output shown in the following table can be taken out in proportion to dose rate.
- (7) Power supply: AC 115 V $\pm 10\%$, 50 or 60 Hz, 30 VA;
150 VA when the space heater is

Fig. 1 Dimensions of ionization chamber type monitoring post

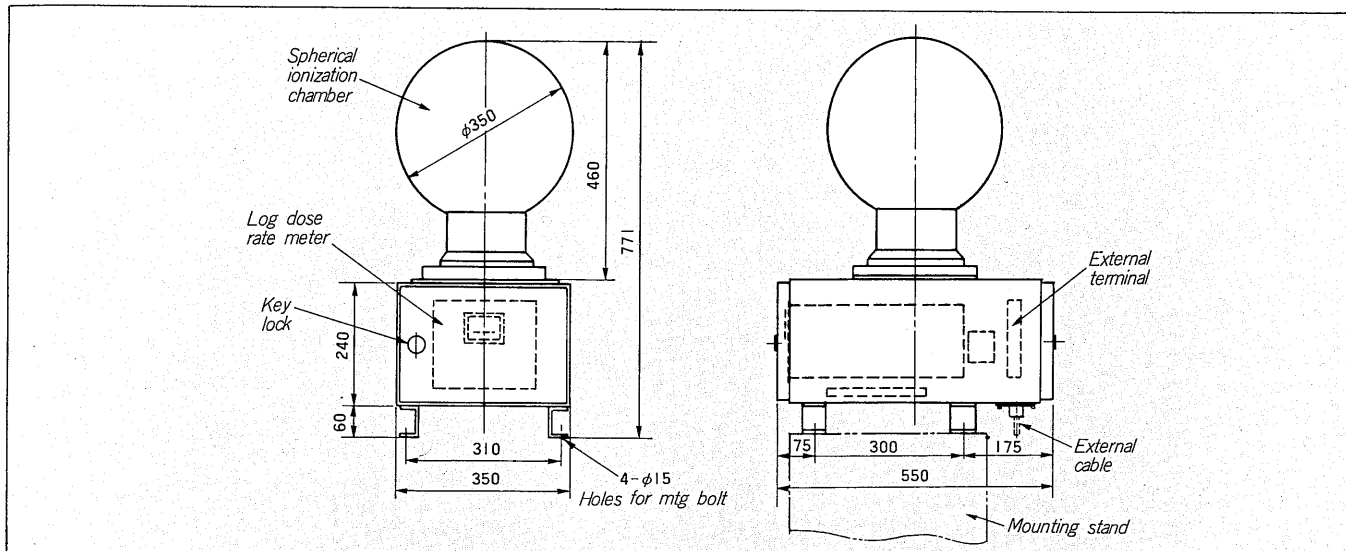
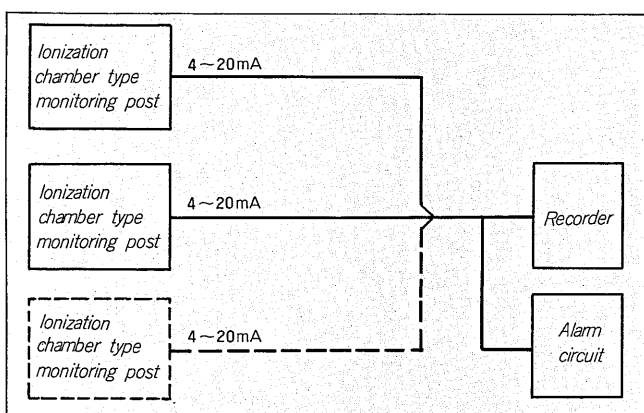


Fig. 2 Block diagram of a simple system



Dose rate (uR/h)	Pulse output (Hz)	Range output
1 ~ 1.9×10^2	20 ~ 3800	L
1.5×10^2 ~ 1.9×10^4	30 ~ 3800	M
1.5×10^4 ~ 1.9×10^6	30 ~ 3800	H
1.5×10^6 ~ 1×10^7	300 ~ 2000	HH

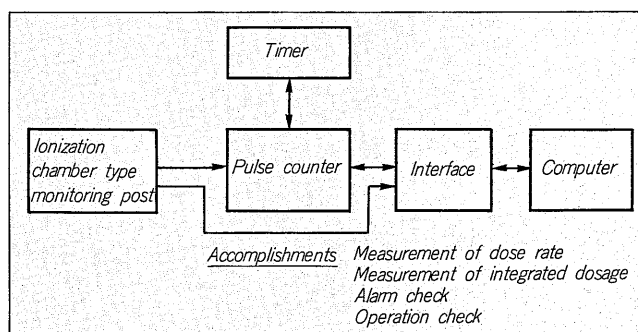
used.

- (8) Ambient temperature: -30°C to $+50^\circ\text{C}$
- (9) Anti-environment structure: Dust/drip-proof;
IP55 of IEC 529
- (10) Weight: Approx. 45 kg
- (11) Dimensions: Refer to Fig. 1.

4 APPLICATION EXAMPLE

With the Fuji Electric's ionization chamber type monitoring post, the following systems can be composed.

Fig. 3 Block diagram of a system connected with a computer



(1) A simple system

Required number of the ionization chamber type monitoring posts are installed around a nuclear power station and the output of each post is led to the central station through cables. Thus, radiation dose rate can be monitored continuously. Further, an abnormal situation can be detected early by adding an alarm circuit that is generated when the actual dose rate exceeds the preset alarm level. Fig. 2 is the block diagram.

(2) A system connected with a computer

Pulse output and range output of the ionization chamber type monitoring post are connected with a pulse counter, and the pulses are counted for the time set in by a timer. The data obtained by the pulse counter is collected by a computer and dose rate data can be obtained by multiplying a coefficient of conversion with the obtained data. Further, integrated dosage can be calculated, upper and lower alarm limits can be checked and records such as daily report can be made. Fig. 3 is the block diagram.