

# POCKET DOSIMETER WITH ALARM

## "REM MASTER-S"

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### 1 INTRODUCTION

The pocket dosimeters with alarm presently used at unclear power stations, laboratories, hospitals, etc. are mainly of GM counter types. These dosimeters have such problems as a short service life and large fluctuation of characteristics.

This time, Fuji Electric developed a new pocket dosimeter with alarm "REM MASTER-S" (Type NRS). This dosimeter uses a semi-conductor detector and has the following features;

- In comparison with the conventional type dosimeters, the measuring range is wider.
- The service life is long.
- Easily carried small dimensions realized by the semi-conductor detector developed by Fuji Electric's own technology.

Further, this new dosimeter is provided with data transmitting/reading functions using an opto-electronic communication method so that individual victim exposures can be managed efficiently.

Fuji Electric holds the largest share in delivering radioactive ray monitors to power supply companies within Japan. When developing the pocket dosimeter with alarm, Fuji Electric fully used its power and experience, proceeded the research from various angles in two steps, the first and second trial manufacturings, and after completion of the semi-conductor detector, succeeded in completing the new dosimeter.

### 2 FEATURES

- (1) With the semi-conductor detector used, the service life is longer in comparison with GM counters, and higher reliability can be expected.
- (2) Dosage can be measured stably even under a high victim exposure dosage.
- (3) The dosimeter is equipped with a precise electronic circuit, yet mechanically rigid.
- (4) Because of its thin shape, it can be conveniently accommodated in a pocket, allowing operators to work easily.

(5) Dosage value can be read directly on the 4-digit digital LED display even in a dark place.

(6) Alarm set value can be seen from the outside through a plastic transparent window, and with the combination of two sets of switch, alarm can be set finely for a wide range.

(7) With the built-in test mode function, the dosimeter can be checked easily.

(8) With a reader used, individual code number and alarm set value can be read out in addition to an integrated dosage value. Further, the dosimeter can be checked simultaneously for operations.

(9) When battery voltage drops below the rated range, alarm tone informs it.

### 3 SPECIFICATIONS

- 1) Type: NRS
- 2) Sensor: Silicon semi-conductor detector (SSD); Type: S104S
- 3) Kind of measured ray: X-ray and  $\gamma$ -ray (100 Kev to 3 Mev)
- 4) Energy dependence: Within  $\pm 20\%$  100 Kev  $\sim$   $^{60}\text{Co}$  (1.3 Mev)  
Reference point:  $^{137}\text{Cs}$  (662 Kev); Refer to Fig. 2.
- 5) Integrated calibration accuracy: Within  $\pm 10\%$  (at 100 mR/h; with  $^{137}\text{Cs}$  radiation source);
- 6) Linearity of dosage ratio: Within  $\pm 15\%$  (at 10 mR/h to 10 R/h; with  $^{137}\text{Cs}$  radiation source); Standard dosage ratio: 100 mR/h; Refer to Fig. 3.
- 7) Display
  - a) Indicator . . . . . 4-digit digital indicator (LED)
  - b) Indication range . . . . . 0 to 9999 mR
  - c) Alarm indication . . . . . When dosage value reaches a set value, 0 lights in the 4th digit, and it flickers in about 3 second cycle.
- 8) Alarm setting

Fig. 1 Block diagram

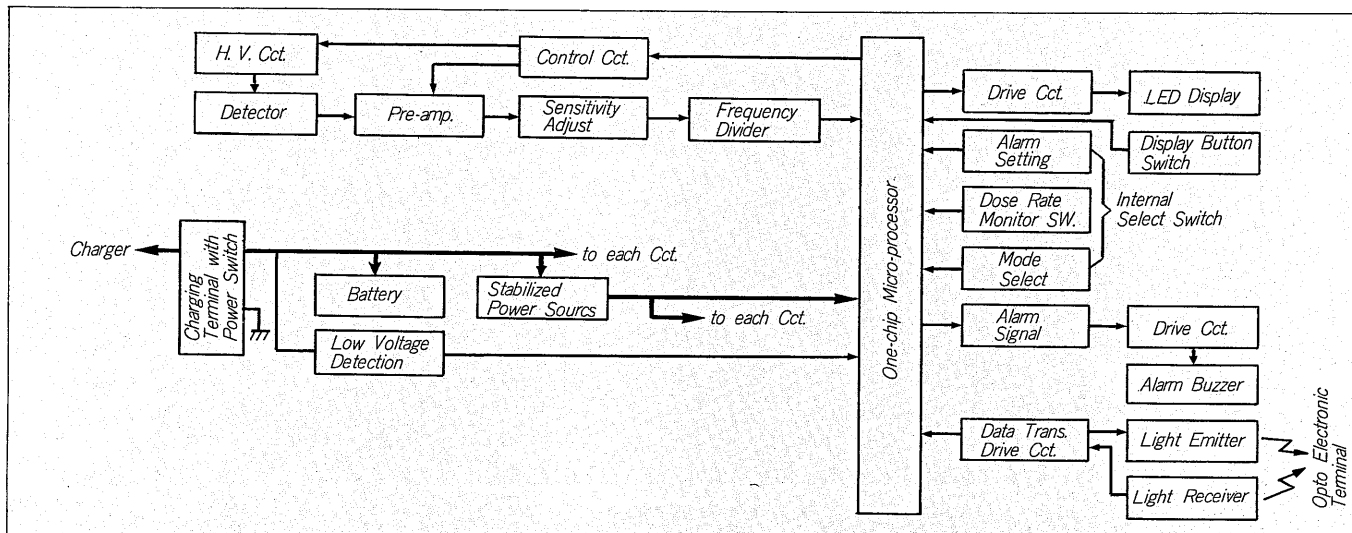


Fig. 2 Energy dependence

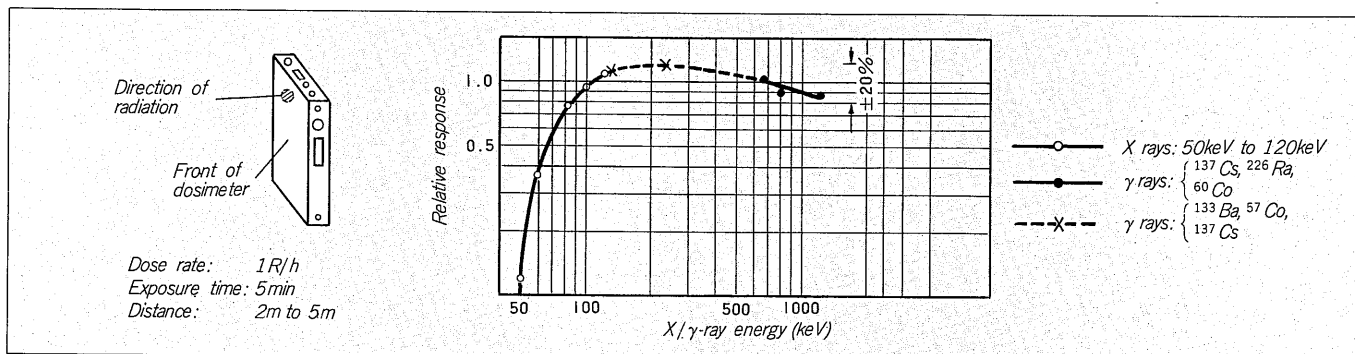


Fig. 3 Technical data

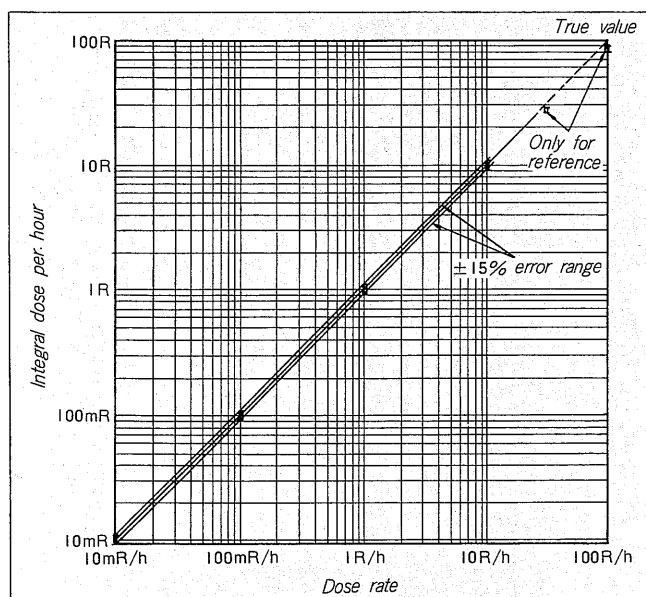
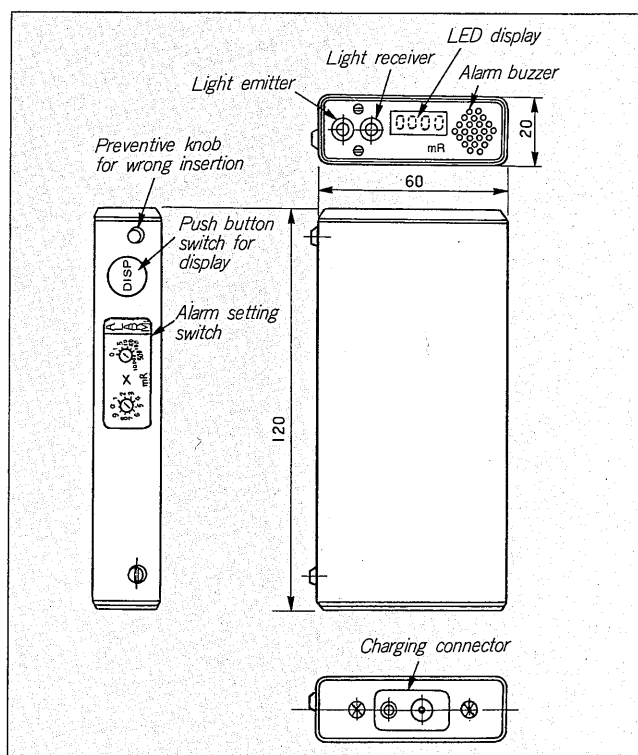


Fig. 4 Dimensional drawing



Alarm can be set in two ways as indicated below.

- a) Internal set method: Alarm can be set freely within range from 1 mR to 9000 mR.

Set method: With the internal digital switch

Set switch: 1, 2, 3, 4, 5, 6, 7, 8, 9 mR

Magnification switch:  $\times 1, 5, 10, 50, 100, 500, 1000$

Set value indication: Can be seen from the outside

- b) External set method: Alarm can be set freely within range from 1 mR to 9000 mR. (Type NRS2 only)

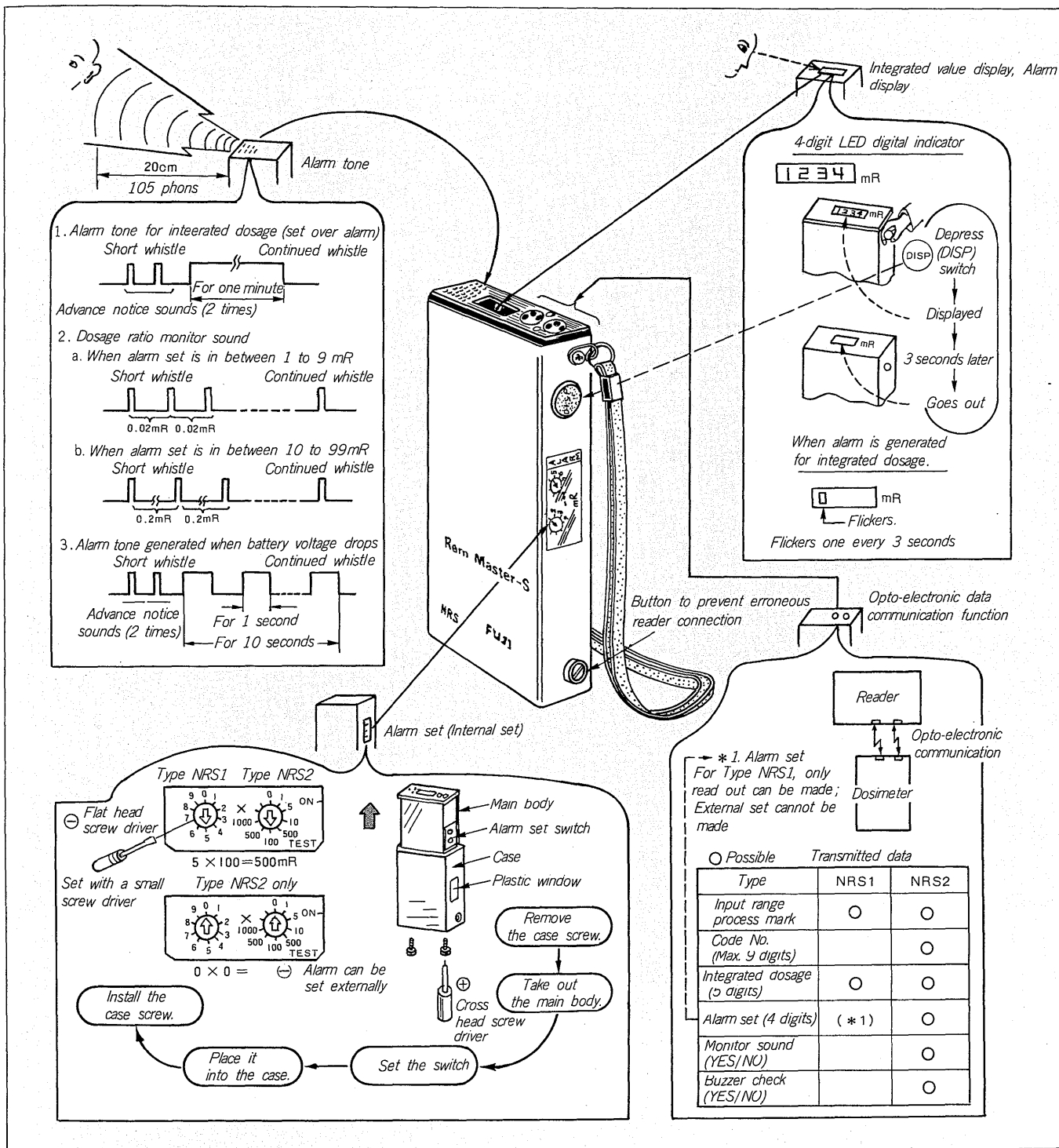
Set method: With a reader or read checker.

- 9) Alarm: When dosage value reaches a set alarm value, the buzzer sounds and indicator makes alarm display.

- 1) Alarm tone

- (a) Sound pressure . . . 105 phons or more (at 20 cm

Fig. 5 Functions of each unit of the pocket dosimeter with alarm



- distance from the buzzer face)
- (b) Sound generation . . . Advance notice sounds are generated twice, successive alarms are generated for one minute, and then, stops.
  - 2) Alarm display
    - a) Indication . . . . . "0" flickers in 4th digit of the indicator indicated in 3-(7)-a) above.
    - b) Stop . . . . . Stops when the dosimeter power is turned off.
  - 3) Others  
Dosage is integrated even during alarm generation.
  - 10) Monitor sound
    - Monitor sound (intermittent sound) is generated whenever a certain dosage is integrated.
    - With a number of monitor sound generations per unit time, high or low dosage ratio can be found.
    - Others . . . . . Dosage is integrated successively even during monitor sound generation.
  - 11) Detection of dropped battery voltage  
When battery voltage drops below the rated level, alarm sound is generated. When five minutes are elapsed after generation of the alarm sound, all the functions stop except for keeping the data memory. (This is called stand-by.)
  - 12) Power supply
    - Battery . . . . . Nickel cadmium rechargeable battery; Type: 4-S116S
    - Charging . . . . . Fast charging; Within one hour
    - Operating voltage . . 6.5 V — About 4.5 V (Down voltage drop detection)
  - 13) Continuously used hours  
12 hours or longer (When used at the normal temperature after charging 100%)
  - 14) Buzzer check  
When the dosimeter is disconnected from a charger, the buzzer sounds automatically allowing the checker to insure that the buzzer is normal.
  - 15) External dimensions and weight
    - 1) Dimensions . . . . . 120 × 60 × 20 mm (L × W × T); Refer to Fig. 4.  
Tolerance: Within ±1.0 mm for the length;  
Within ±0.5 mm for others
    - 2) Weight . . . . . About 200 grams (Dosimeter including battery)
    - 3) Exterior finishing . . Munsell 1PB5/13 (Blue)
    - 4) Material of case . . . Alminum; partially mold
  - 16) Ambient temperature and relative humidity
    - 1) Ambient temperature . . . . . 0 to +50 °C
    - 2) Relative humidity . . . . 35 to 90% RH (at 40 °C)

#### 4 APPLICATION RANGE OF "REM MASTER-S"

This "REM MASTER-S" can be used not only as an alarm dosimeter but also for absorbed dose control systems at small scale laboratories, work shops, and for absorbed dose control systems at nuclear power plants and equivalent laboratories where many number of workers come in and out.

These absorbed dose control system consist of, in addition to the "REM MASTER-S", chargers for dosimeters in the unit of 10 to 50, checker for "REM MASTER-S" entrance or exit gate controller, personal computer for data processing, etc., and an optimum system can be composed for each scale.