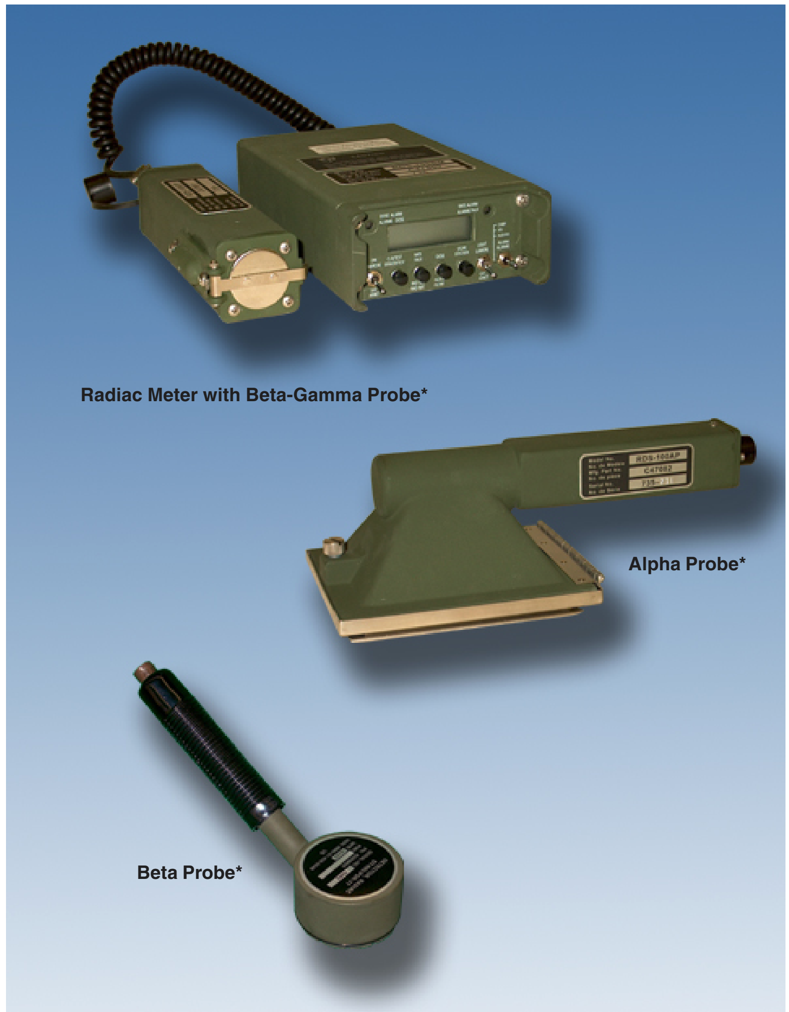
TRADEWAYS LTD

CANBERRA

RDS-100 Radiation Detection System

Features

- Storage of up to 300 data points, including dose rate, date and time
- GPS compatible
- Compatible with “SMART” Probes
- Outstanding linearity over a wide dynamic range
- Can be calibrated using license-free source
- Compatible with Training Probes
- Can be operated and read while wearing fire or hazmat protective clothing
- Will not ignite explosive atmospheres – intrinsically safe
- Waterproof to 3 ft
- Background Subtract feature
- Electronic filter to reduce fluctuations in readings
- Built-in RS-232 interface
- Automatic self-calibration
- An optimal GPS-based Large-Area Training System provides documented assurance that personnel are properly trained, without any exposure to radioactive materials



*Other Probes are available

Description

The RDS-100 Radiation Detection System offers comprehensive radiation management and unsurpassed reliability in a self-contained, portable system.

The Radiac Meter included in this system, is equiped with “SMART” technology, which allows any system probe or training probe to be interchanged and used immediately without calibrating. All calibration data is stored in the probes and read by the Radiac Meter upon connection.

The system also uses Canberra’s patented “Time-to-Count” technique providing outstanding linearity over the entire dynamic range of the instrument. No compensation for high levels is necessary.

For Additional Information Contact:
TRADEWAYS LTD
184 Duke of Gloucester Street
Annapolis, Maryland 21401
United States of America
TEL: 1-410-295-0813
FAX: 1-410-295-0821
E-MAIL: Office@TradewaysUSA.com

RDS-100 Radiation Detection System

Specifications

RDS-100 RADIAC SET

DISPLAY

- Direct Reading Liquid Crystal Display.
- Backlit for night operation.
- Three significant digits.
- Floating decimal point.
- Unit and alarm status indicators.
- Large digits, readable at 2 m.

POWER

- Battery powered by three standard 9 V cells.
- Can be operated on vehicle or aircraft power.

ALARMS

- Pre-settable alarms for dose and dose rate.
- Settable to any values over dynamic range.
- Audible alarm – 90 dB max.
- Visual alarm – bright flashing light.

CONTROLS

- Power ON/OFF.
- Selectable Alarms – Audible, Visual, Aud/Vis.
- Modes – Rate, Dose, Test.

“SMART” TECHNOLOGY

- All system Detector Probes are instantly recognized and functional upon hook-up, without any adjustment, programming or calibration.

COMMUNICATIONS

- Built-in RS-232, data downloadable to standard remote PC.
- GPS compatible.

SIZE AND WEIGHT

- 104 x 48 x 182 mm (W x H x L).
- 1.25 kg (2.75 lb).

DETECTOR PROBES

ACCURACY

- ±15% of true dose and dose rate over the entire dynamic range.

RADIATION TYPES AND RANGE

- GAMMA DOSE RATE – 0.01 μSv/hr – 9.99 Sv/hr.
- GAMMA DOSE – 0.01 μSv – 9.99 Sv.
- ALPHA DOSE RATE – 0–20 000 c/s.
- BETA DOSE RATE – 0–20 000 c/s.

GAMMA ENERGY RESPONSE

- Within ±20%, 80 keV to 3 MeV.

STANDARD DETECTOR COMPLIMENT

- Beta-Gamma Probe.
- Alpha Probe.
- Beta (Pancake) Probe.

OPTIONAL DETECTORS

- X-Ray Probe.
- μSv Gamma Probe.
- Neutron Probe.

SATURATION CHARACTERISTICS

- Will not ever saturate or fall back.

RESPONSE TIME

- 2 s (Unfiltered Mode).
- 5 s (Unfiltered Mode).

EMI SUSCEPTIBILITY

- Not affected by EMI.
- Will not affect other instruments.

NUCLEAR SURVIVABILITY

- Nuclear hardened.

SIZE AND WEIGHT

Beta-Gamma Probe

- 37 x 37 x 170 mm (W x H x L).
- 1.0 kg (2.20 lb).

Alpha Probe

- 133 x 87 x 280 mm (W x H x L).
- 100 cm^2 open area.
- 1.18 kg (2.6 lb).

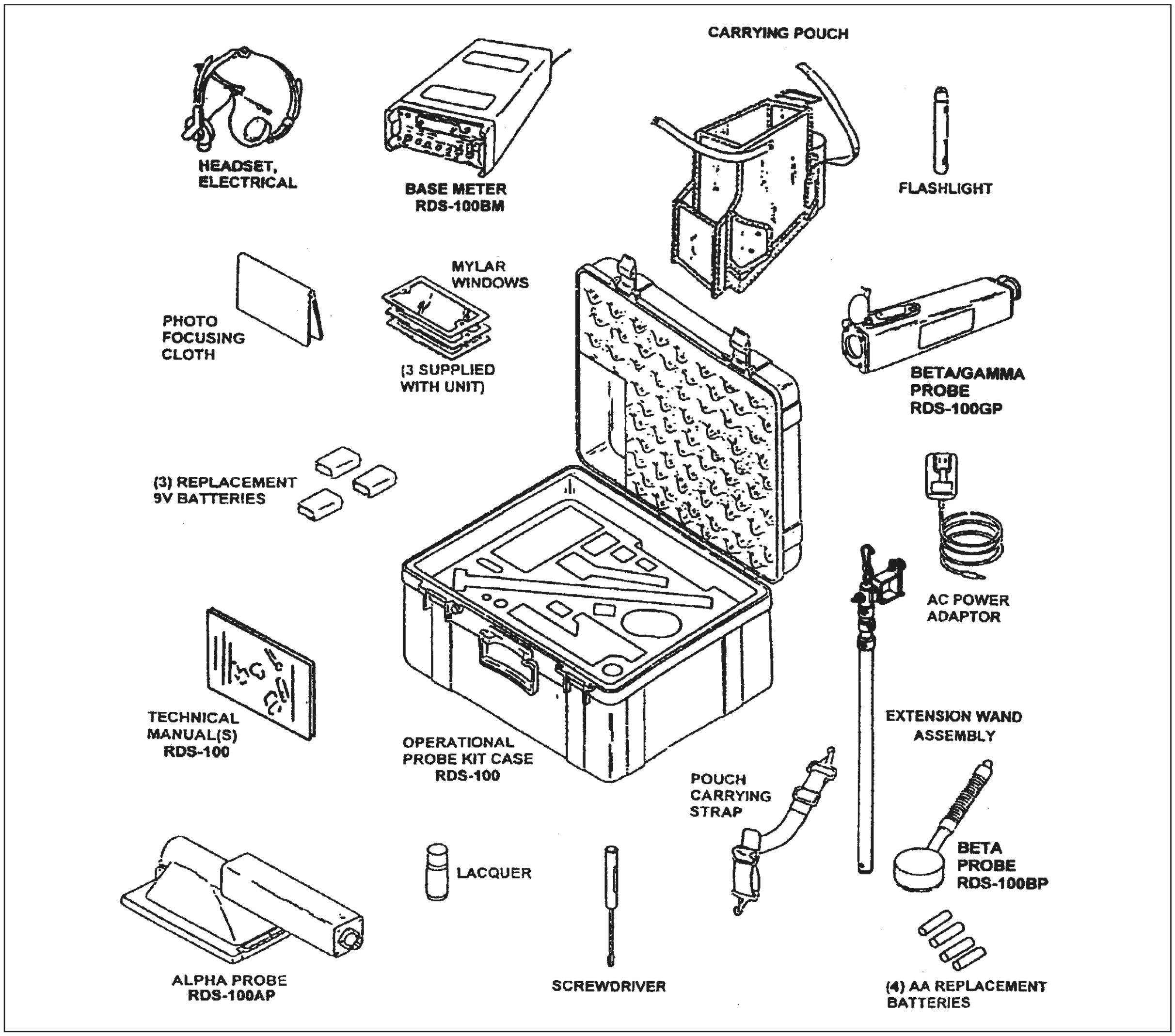
Beta (Pancake) Probe

- 44.5 x 229 mm (W x L).
- 0.40 kg (0.88 lb).

ENVIRONMENTAL

- OPERATING TEMPERATURE RANGE – -40 °C to 50 °C (-40 °F to 122 °F).
- STORAGE/TRANSPORT TEMPERATURE RANGE – -40 °C to 70 °C (-40 °F to 158 °F).
- HUMIDITY – 0 to 100% relative humidity.
- IMMERSION – Water-tight at 3 ft depth for 2 hr.
- SAND – Withstands sand particles in 5700 ft/min wind.
- DUST – Withstands fine dust in 1750 ft/min wind.
- FUNGUS – Built from inherently fungus resistant materials.
- VIBRATION – Withstands vibration associated with transport.
- SHOCK – Withstands shock of dropping during use.
- ALTITUDE – 40 000 ft (1200 m).
- EXPLOSIVE ATMOSPHERES – Will not ignite explosive gas mixture.

RDS-100 Radiation Detection System



System Components

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TIME-TO-COUNT TECHNIQUE

NRC GM tube detectors are operated using a unique technique, which removes many of the limitations associated with the use of G-M tubes operated in the conventional mode.

Conventionally, a G-M tube is operated with a fixed DC voltage continuously applied. Readings of rate are a function of the number of pulses (counts) produced by the tube per unit time. This type of operation is characterized by increasing non-linearity as the field intensity increases. This effect, due to the inherent "dead time" of the tube, limits its range of usefulness. The problems associated with the conventional DC mode of operation are best understood by examining the "Stever Pattern", produced by the tube in response to a radiation field.

Assume the G-M tube is energized and the first pulse is produced by the tube in response to an ionizing event. This initial pulse will be full-size and will typically be properly counted. Following the initiation of this pulse is a recovery period during which the discharge mechanism is operating within the tube. During the recovery time, if another ionizing event occurs in the tube, it cannot be detected. This time is defined as the dead time. If an ionizing event occurs immediately following the dead time, a small pulse, barely detectable, could be observed.

Dead time varies with the dimensions of the tube, the operating impedance, the mobility of the tube gases, and, to a lesser extent, the operating voltage.

The dead time of the low range tube used in NRC GM tube detectors is about 150 microseconds; the high range tube dead time is about 15 microseconds. If an ionizing event takes place a trifle later than the dead time, the pulse produced would be larger.

Finally, a time will occur when the pulse formed is of full height; i.e., equal to the amplitude and shape of the initial pulse observed. This time is called the recovery time, and corresponds to the time when the positive ion sheath (formed during the discharge mechanism) is neutralized at the outer wall of the G-M tube. The dead time, which characterizes all G-M tubes, produces the non-linearity at higher fields and severely limits the range over which the tube is usable.

A second undesirable characteristic of G-M tube operation in the conventional mode is saturation. It can be seen that as the field intensity is increased, more and more ionizing events will arrive in close proximity to the dead time. The pulses produced by the tube will become smaller and smaller and eventually will no longer trigger the input circuit of the instrument in which it is being used, causing the reading to drop to very low values or zero. Most G-M tube instruments currently produced will display this hazardous condition. In the TIME-TO-COUNT technique employed in NRC GM tube detectors, the dead time and saturation effects are eliminated.

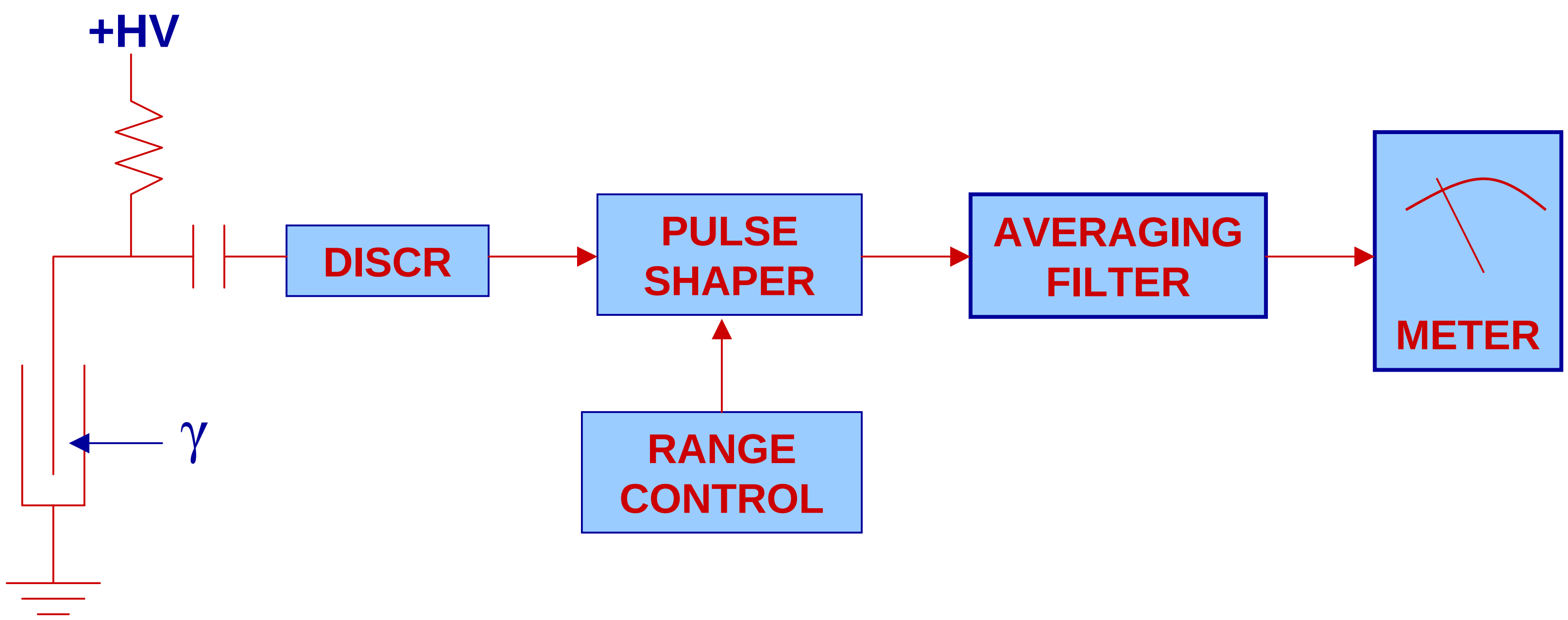
A low DC bias voltage is abruptly raised to 500 volts DC carrying the tube into its operating region. The rise time of this voltage is less than 0.2 microseconds. At the same time, this rapid increase in voltage is applied, a crystal controlled, 1 megacycle oscillator (clock) is gated on and time, in the form of 1 microsecond cycles, starts being counted. Time counting continues until a G-M tube pulse is obtained. At that point, time counting is stopped and the accumulated time is recorded. At the same time, the anode voltage is reduced into the low bias level. The voltage on the anode is maintained at the low bias level for 1.5 to two milliseconds, a time period which is long compared to the dead time and recovery time of the tube.

After two milliseconds, when the G-M tube is fully recovered, the voltage is again applied to the anode. Only one G-M tube pulse can occur in any one 'on' time. Since the tube is fully recovered between on-times, the pulses produced by the tube are full size. The process is repeated many times to obtain a statistically reliable average time-to-count. In this fashion, dead time losses are eliminated and saturation cannot occur.

Thus, the radiation field intensity is proportional to the reciprocal of the time required to obtain a G-M count. Looking at a single event of a random nature would be statistically unreliable. However, if this measurement is repetitively made over a defined period of time (for example: 2 seconds), and the average time to obtain a G-M pulse is determined, we now have a statistically reliable measure of field strength. This precise microprocessor controlled relationship forms the design basis for NRC GM tube detectors and enables many decades of linear performance for the two G-M tubes involved.

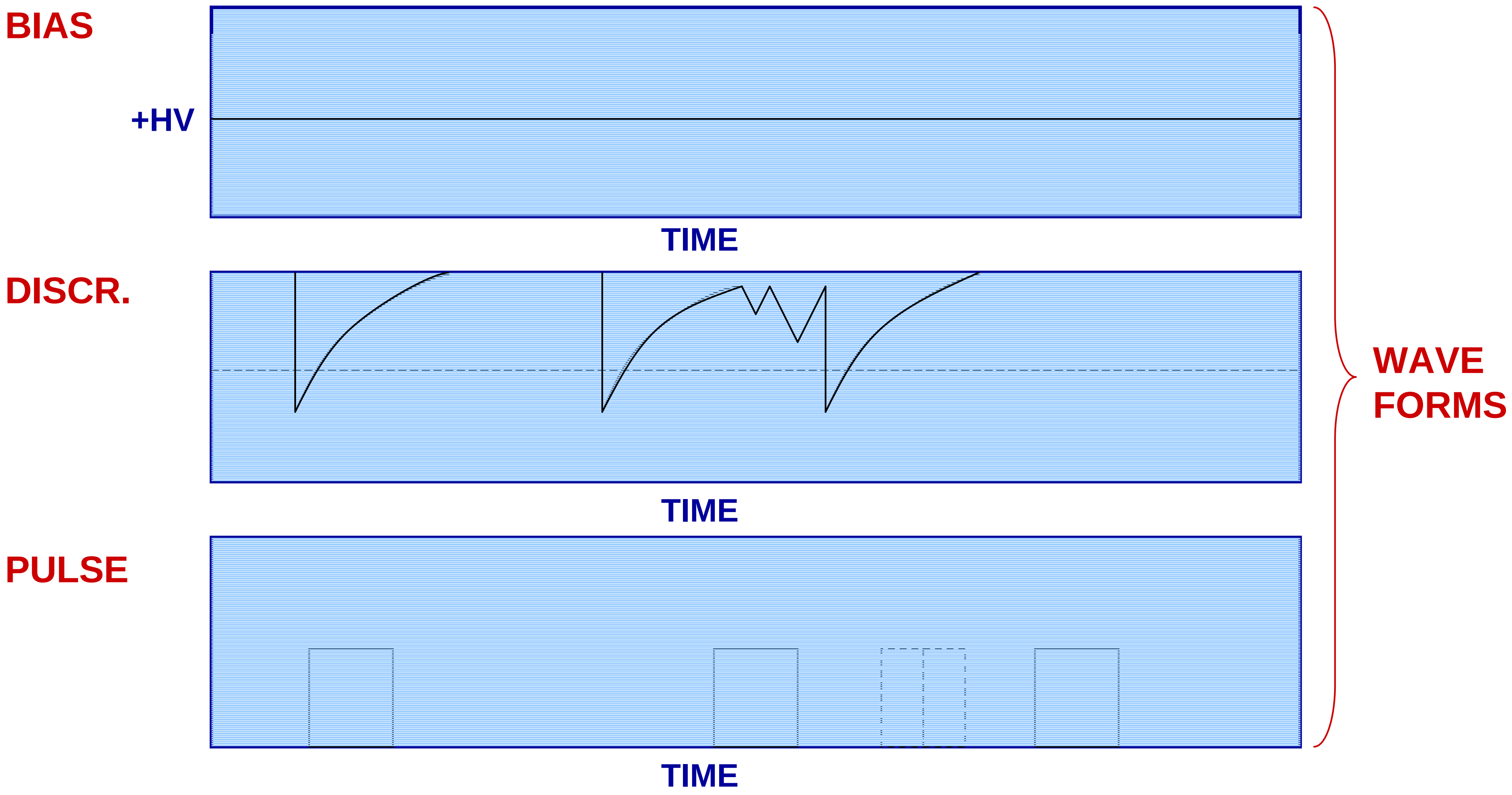
OPERATING PRINCIPLES – OPERATIONAL KIT

Typical GM Tube Instrument



OPERATING PRINCIPLES – OPERATIONAL KIT

Conventional GM Tube Instrument Operation



OPERATING PRINCIPLES – OPERATIONAL KIT

GEIGER-MÜLLER (GM) TUBES

ADVANTAGES

- WORKHORSE
- HIGH GAIN
- SIMPLE ELECTRONICS

DISADVANTAGES

- DEAD TIME NON-LINEARITY
- SATURATION / FOLDOVER
- LIMITED LIFE (10^8 TO 10^{10} COUNTS)

OPERATING PRINCIPLES – OPERATIONAL KIT

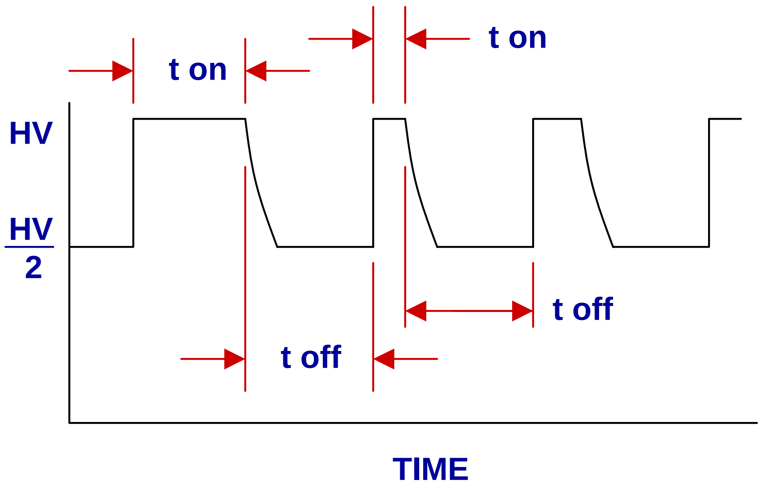
“Time to Count” Operation

Canberra Dover has eliminated the inherent disadvantages of GM Tubes with the development of “Time to Count”.

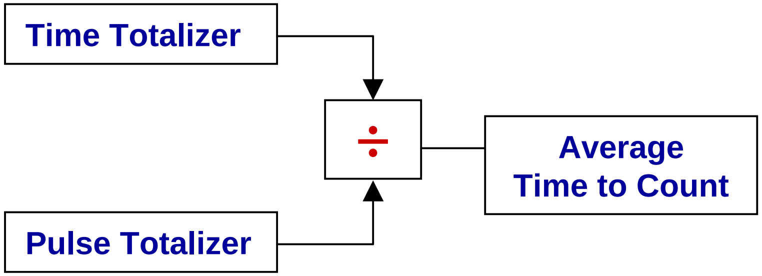
- GATED HIGH VOLTAGE TO GM TUBE
- GUARANTEED FULL RECOVERY
- NO DEAD-TIME NON-LINEARITIES → SINGLE POINT CALIBRATION
- NO DEAD-TIME INDUCED SATURATION OR PARALYSIS
- LONG LIFE (MAXIMUM COUNTRATE 500/SECOND)

OPERATING PRINCIPLES – OPERATIONAL KIT

“Time to Count” Operation



GM TUBE WAVEFORMS

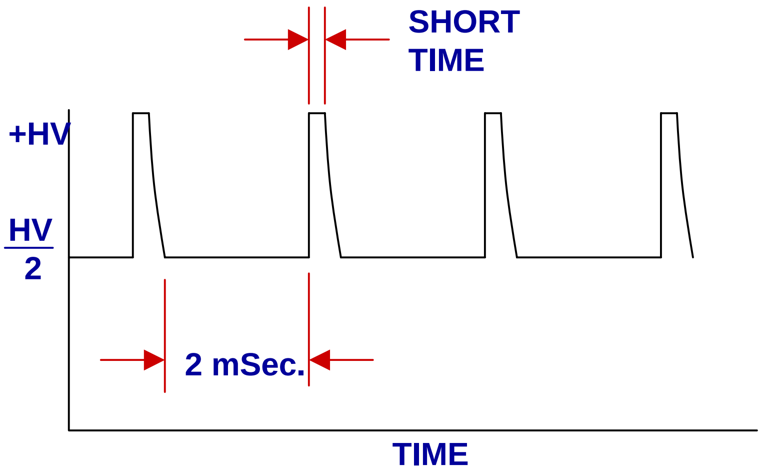


$$\text{RATE} = \frac{K}{\text{TIME TO COUNT}}$$

OPERATING PRINCIPLES – OPERATIONAL KIT

"Time to Count" Operation

HIGH FIELD



LOW FIELD