



MODEL TBM-3S

TA CONTAMINATION METER
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MANUAL OF OPERATION

SURFACE MONITOR

Model# TBM-3

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SURFACE MONITOR

Model TBM-3

- Light Weight
- One Hand Operation
- Built-in Speaker
- Antisaturation Circuit

DESCRIPTION: Small three range Ratemeter with built-in 2" diameter pancake tube and speaker. Reads out in counts per minute (and mr/hr.) Thin window is recessed and protected by sturdy aluminum grill. Instrument will see alpha, beta and gamma radiation. Antisaturation circuit will not fall below full scale in high fields. Tested to 100 R/hr.

APPLICATION: Its small size, light weight and large detector area make this a very useful monitor for surveying bench tops or checking hands, clothes and fingertips for almost any radioactive contamination.



SPECIFICATIONS:

Meters:	TBM-3 — 2 1/4"; 6 cm
Ranges:	3 ranges, linear—0-500, 0-5,000, 0-50,000 cpm (0-.15, 1.5, 15 mr/hr)
Switch Position:	Off, Battery Test, X100, X10, X1
Audio:	TBM-3 — Internally mounted speaker
Detector:	T-1190 "pancake GM tube" Diameter: 2"; 5 cm Window Diameter: 1 3/4"; 4.5 cm Window Thickness: 1.5 mg/cm ² Quench Gas: Halogen for long life Background: Typical 50 cpm. Thin profile of tube (13 mm) gives low background Efficiency: 100% for all betas and alphas that have the energy to penetrate the thin window Voltage: 900 V nominal
Physical Dimensions:	3"; 7.6 cm wide x 5 1/4"; 13.3 cm long x 2 1/4"; 6 cm thick (excluding meter and handle)
Feet:	Replaceable neoprene feet for easy sliding on bench or desk top without contaminating bottom face of instrument or detector
Calibration:	Single master calibration pot as well as individual cal pots for each scale
Power:	9 volt nominal "transistor" battery; Eveready 1222 carbon or Eveready E146X mercury or equivalent
Current Drain:	3 ma typical
Handle:	Swivel type polished anodized aluminum
Weight:	22 oz; 625 gm
Battery Life:	100 hours in normal operation



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THEORY OF OPERATION

High voltage is generated by a blocking oscillator consisting of Q1, R1, R2 and R13, and transformer T1. The transformer T1 steps up the voltage level of this oscillation and feeds to a voltage quadrupler. The voltage is regulated to 900 V by zeners CR1, CR2 and CR3.

The counting circuit consist of a one-shot multivibrator driving a microammeter. Each negative pulse from the detector is applied to the base of Q3 via C5 and R4. Normally Q3 and Q2 are conducting and Q4 is off. A negative pulse of 0.2 volts cuts off Q3 and, in turn, makes Q4 conduct. The drop in voltage at the collector of Q4 is reflected at the base of Q2 through one of the capacitors C7, C8 or C9. Q2 is cut off and starts conducting again when the Q2 base voltage rises determined by the time constant based on R7 and the capacitor selected.

When Q2 and Q3 start conducting again, Q4 is cut off. These negative pulses at the collector of Q4 are fed to the meter circuit consisting of C10 or C22, CR8 and 50uA meter through one of the range callbrating resistors R12, R13, R14 and common CAL resistor R11.

The instrument is powered by a 9V "transistor" battery (Eveready 1222 or equivalent). The battery supply is regulated to 5.6V through R18 and a zener CR7. This voltage is fed to a monostable and metering circuits to prevent change of sensitlvity as a function of battery condition.

To change battery turn instrument off, remove two knurled screws on top of case, unplug battery and remove from clip. Replace with fresh battery and reverse steps. Replacement is required when, with control knob in "BATT" position, scale reading is below the green area.

CALIBRATION

1. Full Calibration: Signal Generator and Radiation Source

Apply 4000 pulses per minute to the detector side of C6. If using a pulse generator, be sure to protect it from the TBM-3 high voltage. Pulses should be negative with amplitude of minus 1 volt and duration of 1 microsecond. Deviation by 10% or more from generated output is corrected by adjusting variable resistor R11 to give reading of 400 on the meter when instrument is in the x10 range. Once this has been done, tracking on individual ranges should be checked at approximately 1/3 and 2/3 scale on each range and adjusting R12, R13 and R14 as needed. Please note that typical ambient background count rates (about 50 cpm) will contribute significantly when adjusting R12 for the x1 range. To account for this contribution in the x1 range, determine the background rate before applying the pulse generator; and, adjust R12 to yield a meter reading which is the sum of this rate and the applied pulse generator rate.

2. Radiation Recalibration

Recalibration of the mR/hr scale is performed at 1/3 and 2/3 on each scale and based on gammas of Cs-137 normal to the face of the detector. If readings are not correct the "touching up" of Cal-pot R11 will usually be sufficient to make correction. If it is not or if tracking does not follow from scale to scale readjust R12, R13 and R14 as needed. It is recommended that recalibration be performed when any repair is made or circuit component is changed, and at yearly intervals.

3. Operation In-Use Check

It is recommended that a check source be used regularly in the field to assure the complete operation of the instrument with its detector a check source reading should be made daily or with each significant use. A note should be made of check source reading when instrument is in proper calibration and any deviation of more than 20% in subsequent checks indicate need for adjustment or repair. The various components of the instrument are of high quality and are underrated and are not anticipated to change value in operation. However, even the highest quality components can change value with age.

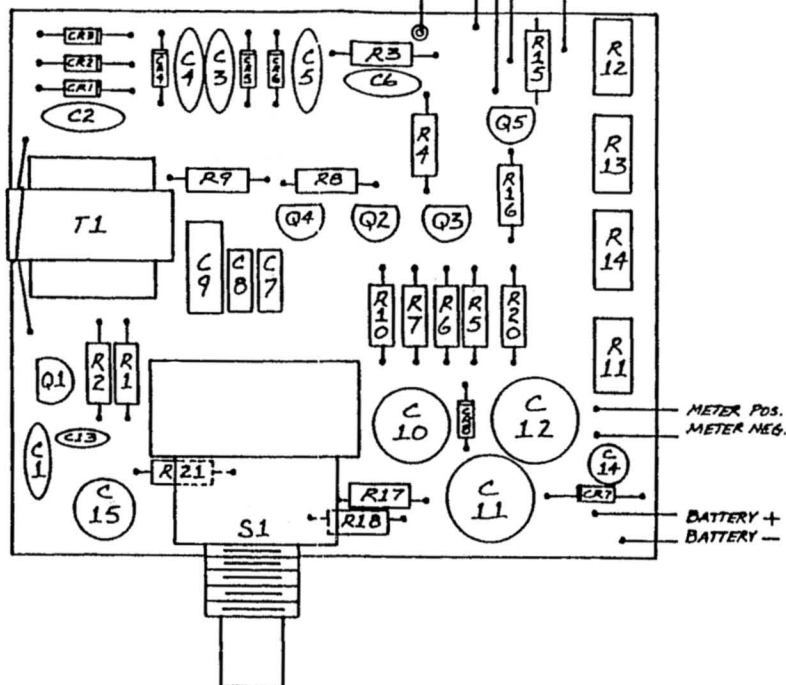
MAINTENANCE

If meter shows no reading when probe sees radiation, check first that the GM tube is properly plugged into the connector. The simplest way to find out whether the tube is good is to plug another tube to the connector and check. Still if there is no indication, check the high voltage at the end of the voltage. This will indicate whether oscillator is bad or the diodes or capacitors in the quadrupler are bad.

If high voltage supply is operated properly and there is still no signal, check with oscilloscope adjusted to trigger on negative going pulses of 50 mV or higher and with a horizontal sensitivity of 1-10 microseconds per centimeter at junction of R4 and C6. If pulses are detected at input then the operation of univibrator is next checked at the collector of Q4. If progressively wider square waves are detected on each range from x100 to x1, fault probably lies in the meter circuit.

Note: When changing batteries, position the high voltage wire as found in unit before disassembly for proper operation of unit.

SPEAKER NEGATIVE
 SPEAKER POSATIVE
 +9V. SONALERT P.C. BOARD
 DETECTOR GROUND
 DETECTOR HIGH VOLTAGE



DWG. # _____
 DWG. # _____
 DET. DWG. # _____
 PPT. DWG. # _____

PARTS LIST A3815 NEXT ASSEMBLY _____ QTY REQD _____

UNLESS OTHERWISE SPECIFIED
 ALL DIMENSIONS ARE IN INCHES
 ALL DIMS ALL DIMS & BREAK SHARP CORNERS
 MEET ALL DIMENSIONS BEFORE PLATING

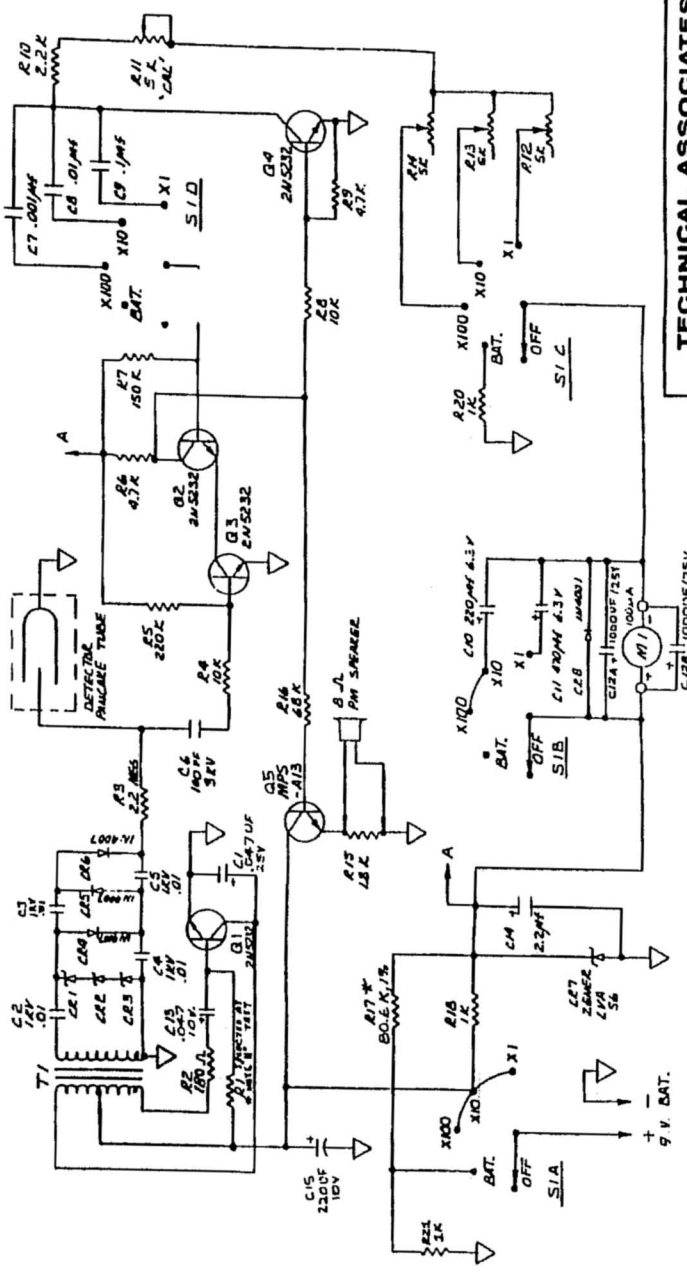
TOLERANCES ARE
 FRACTIONAL - 1/64
 ANGULAR - 0°30'
 FINISH - ✓

DATE: _____
 SH: _____

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REVISIONS		TITLE	
		TBM-3	
		PARTS LAYOUT	
		MAIN P.C. BOARD XB3199	
DRAWN R/S	CHECKED 9/14/88	SCALE 2:1	DRAWING NO. A3814-01
APPROVED			



S1 - CTS-1763
 T1 - DAYTON MODEL 5, LTD.
 P1 - POT. 250Ω
 CR1, CR2, CR3 - 6X4 (200V)
 CR4, CR5, CR6 - 6X4 (200V)
 CR7, CR8, CR9 - 6X4 (200V)
 CR10 - 6X4 (200V)
 ALL RESISTORS 1/4 WATT, 10%
 UNLESS OTHERWISE SPECIFIED

* FOR 100UA METERS: R17=80.6K, 1%;
 C12A=1000UF;
 1000UF ACROSS METER TERMINALS.
 (TBM-3R PRIOR TO 12-1-81)
 R17=80.6K, 1%; C7=802; C9=.02;
 C9=0.2 and TUBE=714.

FOR TBM-3R - RV=600V - REPLACE CR1 BY JUMPER

TECHNICAL ASSOCIATES	
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REVISED BY	DATE
7-888207	6-11-81
BY	TO
W. J. B. / J. B. / J. B.	W. J. B. / J. B. / J. B.
DATE	SCALE
6-11-81	NONE
BY	DRAWING NO.
W. J. B. / J. B. / J. B.	B3199

REF: A3815 PARTS LIST
 REF: A4637 DRILLS DRG.
 REF: A3814 LAYOUT