NDS PRODUCTS

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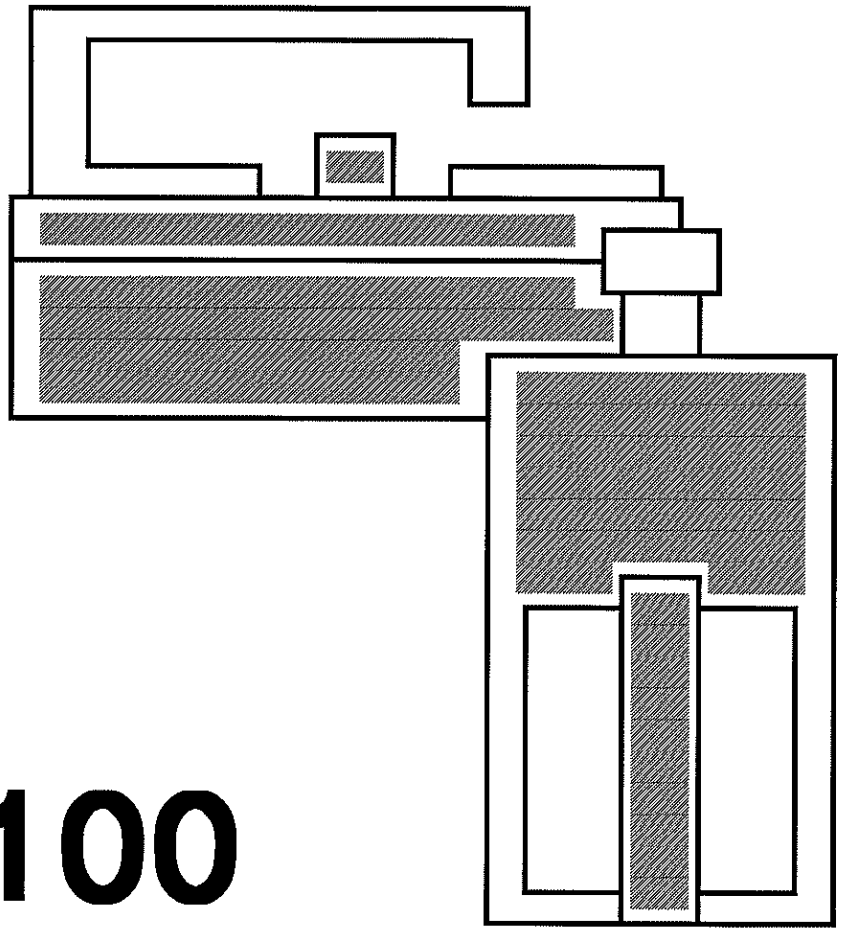

ABG-100

OPERATION MANUAL

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CONTENTS

ABG-100

NOTE: DUE TO NDS PRODUCTS' CONTINUING PROGRAM OF RESEARCH & DEVELOPMENT, ALL SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE AND MAY BE VARIED AT OUR DISCRETION.

3.0 MECHANICAL SPECIFICATIONS:

THE MODEL ABG-100 IS A SENSITIVE, PORTABLE PULSE COUNT RATEMETER AND POWER SUPPLY WHICH WILL DETECT GAMMA AND X-RAY RADIATION. THE INSTRUMENT UTILIZES THE LATEST DESIGN IN SOLID STATE CIRCUITRY AND CONTAINS NO VACUUM TUBES RESULTING IN A RUGGED AND RELIABLE DEVICE. THIS DESIGN ALLOWS THE INSTRUMENT TO OPERATE ON ONLY 2 "D" CELL BATTERIES. IT PROVIDES A BATTERY LIFE OF OVER 150 HOURS WITH CONTINUOUS OPERATION AND LONGER WITH INTERMITTENT USE (THE ABOVE IS TRUE WITH NON-ALKALINE BATTERIES, LONGER WITH ALKALINE BATTERIES).

ABG-100 FEATURES: A METER RESPONSE SWITCH (FAST AND SLOW POSITIONS); AN AUDIBLE MONITORING SYSTEM (SPEAKER), A RUGGED, DUSTPROOF, TWO PIECE NYLON REINFORCED POLYESTER RESIN CASE WITH A NEOPRENE O-RING CASE GASKET AND NEOPRENE GASKETS FOR THE METER INICATOR AND HANDLE.

4.0 ELECTRICAL SPECIFICATIONS:

4.1 POWER SUPPLY

THE HIGH VOLTAGE PWR SUPPLY IS A BLOCKING OSCILLATOR DRIVEN "FLY-BACK" TYPE CIRCUIT. THE BLOCKING OSCILLATOR PORTION OF THE CIRCUIT CONSISTS OF TRANSISTOR Q3, WINDINGS 3-4, AND 5-6 OF TRANSFORMER T1, POTENTIOMETER R17 AND BATTERIES. C8 SERVES ONLY TO SUPPRESS HIGH FREQUENCY PARASITIC OSCILLATION CAUSED BY THE TRANSISTOR PARAMETERS. THE HIGH VOLTAGE POWER SUPPLY PORTION OF THE CIRCUIT CONSISTS OF WINDINGS 1-2 OF T1, RECTIFIER CR5, THE ASSOCIATED RESISTORS AND CAPACITORS, AND DIODES Z1, 2 AND 4. THE LOW VOLTAGE SECTION IS COMPRISED OF WINDINGS 5-6 OF T1, DIODE CR4 AND C7. THE OPERATION OF THE POWER SUPPLY IS AS FOLLOWS: WHEN THE INSTRUMENT IS ON, Q3 CONDUCTS WHILE AN INCREASING CURRENT FLOWS THROUGH WINDING 3-4 AND THE COLLECTOR OF Q3. THIS CURRENT INDUCES A VOLTAGE IN WINDING 5-6 OF SUCH POLARITY AS TO SUSTAIN AND INCREASE THE CONDUCTION OF Q3. THE COLLECTOR CURRENT CONTINUES TO INCREASE UNTIL Q3 AND WINDING 3-4 BECOMES CONSTANT. WHEN THE CURRENT IN WINDING 3-4 BECOMES CONSTANT, THE INDUCED VOLTAGE IN WINDING 5-6 FALLS TO ZERO WHICH CAUSES THE BASE CURRENT TO DROP, WHICH IN TURN, CAUSES THE CURRENT FLOWING THROUGH THE COLLECTOR AND WINDING 3-4 TO DROP. THIS DECREASING CURRENT INDUCES A VOLTAGE IN WINDING 5-6 OF SUCH POLARITY AS TO TURN OFF THE TRANSISTOR. INSOFAR AS THIS IS A REGENERATIVE ACTION, Q3 TURNS OFF EXTREMELY FAST, CAUSING THE FLUX IN T1 TO COLLAPSE SUDDENLY; THIS LATER IS THE "FLY-BACK" ACTION, WHICH INDUCES HIGH VOLTAGE ON ALL WINDINGS. THE MAGNITUDE OF THE VOLTAGE IS PROPORTIONAL TO THE NUMBER OF TURNS ON THE WINDING. THE VOLTAGE INDUCED ON WINDING 1-2 IS EXTREMELY HIGH DUE TO THE LARGE NUMBER OF TURNS. THIS IS RECTIFIED BY CR5 AND FILTERED BY C9 AND R13, AFTER WHICH IT'S REGULATED TO 600V BY Z1, 2 & 4. THE REGULATING ACTION OF THE ZENERS IS REFLECTED BACK THROUGH T1, AND THUS THE VOLTAGE INDUCED AT THE OTHER WINDING IS ALSO REGULATED. THIS IS TAKEN ADVANTAGE OF AT WINDING 5-6 WHERE THE INDUCED VOLTAGE IS RECTIFIED BY CR4 AND USED TO POWER THE REST OF THE INSTRUMENT. THE INDUCED VOLTAGE AT THE BASE THEN RETURNS TO ZERO, ALLOWING Q3 TO CONDUCT AGAIN AND THUS REPEATING THE CYCLE; THE RATE OF REPETITION BEING CONTROLLED BY R17.

4.2 MONOSTABLE MULTIVIBRATOR:

THE MONOSTABLE MULTIVIBRATOR CIRCUIT CONSISTS OF Q1, Q2, CALIBRATION POTS R3, 4, 5, S1, AND ASSOCIATED COMPONENTS. ITS FUNCTION IS TO PROVIDE A UNIFORM CURRENT PULSE OUTPUT FOR EACH PULSE INPUT, REGARDLESS OF THE SHAPE OR MAGNITUDE OF THE INPUT PULSE.

4.3 METER AND TIME CONSTANT CIRCUIT:

THE METERING CIRCUIT CONSISTS OF M1 (METER), R7, C11 & C2 (THE INTEGRATING CAP). WHEN A PULSE CAUSES Q1 TO CONDUCT, THE COLLECTOR CURRENT PASSES THROUGH C2 LEAVING IT CHARGED. IT IS THEN DISCHARGED THROUGH M1 CAUSING IT TO DEFLECT. THE AMOUNT OF DEFLECTION IS PROPORTIONAL TO THE AMOUNT OF CHARGE, WHICH IN TURN IS PROPORTIONAL TO THE AVERAGE CURRENT. THUS M1 READS THE AVERAGE CURRENT THROUGH Q1, WHICH IS PROPORTIONAL TO RATE AND WIDTH. THE RESPONSE TIME OF THE SYSTEM IS A FUNCTION OF THE SIZE OF CAPACITOR C2. THE LARGER THE CAPACITOR THE LONGER IT TAKES TO CHARGE AND AND DISCHARGE, THUS THE RESPONSE TIME CAN BE ALTERED BY CHANGING THE AMOUNT OF CAPACITY IN THE CIRCUIT.

4.4 DETECTOR:

THE DETECTOR USED IN THIS INSTRUMENT IS A Ne/HALOGEN GAS FILLED GEIGER MUELLER TUBE. THE EFFECTIVE LENGTH IS 1.500 INCHES WITH AN EFFECTIVE DIAMETEROF 0.566 INCH; MICA 1.5 - 2.0 mg/cm SQUARED.

THE ABG-100 WILL DETECT ALPHA, BETA AND GAMMA RAD1ATION ABOVE 2.5 MeV; BETA ABOVE 50 KeV AND GAMMA ABOVE 10 KeV.

4.5 RESPONSE SWITCH:

THE RESPONSE TIME ON THE FAST SETTING IS 90% OF THE FINAL READING WITHIN 6 SECONDS; SLOW SETTING IS 90% OF FINAL READING WITHIN 12 SECONDS.

5.0 SURVEY METER LIMITATION (SATURATION) * CAUTION *

IT IS A WELL KNOWN PHENOMENON THAT ALL GEIGER-MUELLER SURVEY METERS SATURATE OR OVERLOAD AT SOME POINT (THIS MAY ALSO BE CALLED FLOODING OR JAMMING). THIS PARTICULAR MODEL WILL SATURATE WHEN IN A RADIATION FIELD IN EXCESS OF 1000 R/hr WHEN IT HAS BEEN PROPERLY MAINTAINED. IF THE RADIATION FIELD IS IN EXCESS OF 1000 R/hr, ONE OF TWO EVENTS WILL OCCUR: 1) THE NEEDLE WILL SWING TO THE EXTREME RIGHT AND WHEN IT REACHES SATURATION, THE NEEDLE WILL FALL BACK TO ZERO, OR 2) IF THE SURVEY METER IS TURNED ON IN A FIELD IN EXCESS OF 1000 R/hr, THE NEEDLE WILL NOT REACT AND STAY AT ZERO.

ALTHOUGH A 1000 R/hr FIELD IS EXTREMELY HIGH AND MAY NEVER BE ENCOUNTERED, PROPER RADIATION SAFETY PROCEDURES AND REGULATIONS SHOULD BE OBSERVED WHEN MAKING ANY TYPE OF RADIATION SURVEY.

6.0 INSTRUMENT OPERATION:

6.1 CHECK THE FOLLOWING BEFORE USING:

6.1.1 TURN SWITCH TO BATTERY CHECK. THE METER SHOULD READ IN THE INDICATED BATT ZONE. REPLACE BATTERIES IF NEEDED. DO NOT USE METER IF NOT REGISTERING IN BATT ZONE.

6.1.2 INSPECT FOR PHYSICAL DAMAGE.

6.1.3 CHECK CALIBRATION DUE DATE. DO NOT USE IF PAST DUE.

6.1.4 USE A CHECK SOURCE OR EQUIVALENT TO ENSURE THAT THE SURVEY METER IS READING RADIATION.

6.1.5 WHEN SECURING THE SURVEY METER LID TO CASE, CLEAN THE CASE GASKET TO ENSURE A PROPER SEAL. TIGHTEN THE 4 SCREWS UNTIL THE TOP AND BOTTOM MEET SECURELY. REPLACE THE GASKET WHEN NECESSARY.

6.2 SELECTING RANGE AND TAKING A READING:

TURN THE INSTRUMENT ON TO THE BATT CHECK POSITION AND SEE THAT THE METER READS IN THE INDICATED ZONE. WITH THE INSTRUMENT ON THE X100 (0-100 mR/hr) RANGE, PLACE THE PROBE IN THE LOCATION TO BE MEASURED. IF THE READING IS LESS THAN 10% OF FULL SCALE, SWITCH TO THE X10 (0-10 mR/hr) RANGE. IF THE READING CONTINUES TO BE LESS THAN 10% OF FULL SCALE, ROTATE TO THE X1 (0-1 mR/hr) OR MOST SENSITIVE RANGE.

THE METER READING SHOULD ALWAYS BE MULTIPLIED BY THE RANGE SWITCH POSITION.

7.0 MAINTENANCE:

7.1 BEFORE OPENING INSTRUMENT CASE FOR ANY REASON, BE SURE INSTRUMENT IS TURNED OFF.

7.2 KEEP CIRCUIT BOARD, SWITCH, BATTERY TERMINALS AND GASKETS FREE OF OIL, MOISTURE, DIRT, BATTERY ACID, ETC.

7.3 CLEAN THE BATTERY TERMINAL CONTACTS WHEN INSTALLING NEW BATTERIES. USE FINE SAND PAPER OR EQUIVALENT TO ENSURE PROPER CONTACT.

7.4 WHEN CLEANING THE CIRCUIT BOARD AND SWITCH, USE A NON-RESIDUE CONTACT CLEANER. LET THE COMPONENTS DRY BEFORE CLOSING CASE OR USING INSTRUMENT.

7.5 * CAUTION * WHEN INSTALLING BATTERIES, NEVER TOUCH THE COMPONENTS OR CIRCUITRY NEVER ADJUST POTENTIOMETERS R3, R4, R5, R17 AND R22. THESE POTENTIOMETERS ADJUST CALIBRATION, CURRENT AND BATT CHECK READINGS. ADJUSTMENT MUST BE MADE BY QUALIFIED PERSONNEL WHO ARE FAMILIAR WITH CORRECT PROCEDURES. INCORRECT ADJUSTMENTS WILL SEVERELY LIMIT THE SURVEY METER'S PERFORMANCE.

7.6 REMOVE BATTERIES WHEN INSTRUMENT IS TO BE STORED.

8.0 CALIBRATION PROCEDURES:

REFERENCE ANSI N323-1978 STANDARDS

8.1 INSPECT CIRCUIT BOARD AND CASE FOR DAMAGE. CLEAN AND REPAIR IF NECESSARY.

8.2 INSPECT MECHANICAL HARDWARE AND TIGHTEN AS NECESSARY.

8.3 ZERO METER MOVEMENT AND CHECK GEOTROPISM.

8.4 CLEAN BATTERY CONTACTS.

8.5 INSTALL FRESH BATTERIES. TURN SURVEY METER TO BATT CHECK AND VERIFY THAT NEEDLE FALLS IN THE INDICATED BATT ZONE.

8.6 CHECK THE HIGH VOLTAGE AT THE GM TUBE ANODE (540-600 VOLTS).

8.7 CHECK THE LOW VOLTAGE AT THE METER MOVEMENT (15-22 VOLTS).

8.8 CHECK THE CURRENT DRAW (17-22 mA).

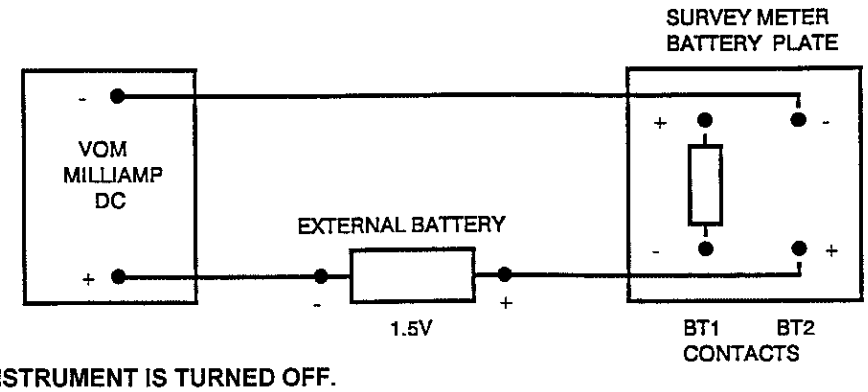
8.9 THERE ARE 3 CALIBRATION POTENTIOMETERS LOCATED ON THE RIGHT SIDE OF THE CIRCUIT BOARD, FROM LEFT TO RIGHT: X100, X10, AND X1.

8.10 TO CALIBRATE, PLACE THE INSTRUMENT (OR PROBE) IN A KNOWN RADIATION FIELD FOR THE THREE RANGES AND WHEN NECESSARY, ADJUST THE CORRESPONDING POTENTIOMETER.

8.11 AFTER ADJUSTMENT, CHECK THE CALIBRATION NEAR THE ENDS OF EACH RANGE, AT APPROXIMATELY 20% AND 80% OF FULL SCALE. INSTRUMENT READINGS SHALL BE WITHIN +\-10% OF KNOWN RADIATION VALUES AT THESE TWO POINTS OF EACH RANGE.

NOTE: THE CALIBRATION SOURCE MUST CONSTITUTE THE SOLE SOURCE OF RADIATION WHEN CALIBRATION IS PERFORMED. CALIBRATION MUST NOT BE UNDERTAKEN WHEN BACKGROUND IS ABOVE NORMAL OR WHEN THE INSTRUMENT IS IN A RADIOACTIVE FIELD OTHER THAN THAT PRODUCED BY THE KNOWN CALIBRATION SOURCE USED.

9.0 CURRENT ADJUSTMENT PROCEDURE:



9.1 ASSURE INSTRUMENT IS TURNED OFF.

9.2 CLEAN CIRCUIT BOARD.

9.3 CLEAN BATTERY TERMINAL CONTACTS WITH STEEL WOOL.

9.4 INSTALL FRESH BATTERIES.

9.0 CURRENT ADJUSTMENT PROCEDURE (continued)

9.5 CHECK HIGH AND LOW VOLTAGES:
- HIGH VOLTAGE: 540-600 V AT GM TUBE. LOW VOLTAGE: 15-22 V AT METER MOVEMENT.

9.6 HOOK UP SURVEY METER AS SPECIFIED IN ABOVE DIAGRAM.

9.7 TURN SURVEY METER ON AND ADJUST R17 TO 17-22 ma.

9.8 AFTER SETTING CURRENT, ROTATE RANGE SWITCH AND CHECK THE CURRENT ON EACH RANGE. IF THE CURRENT IS CHANGING MORE THAN 10%, CLEAN OR REPLACE RANGE SWITCH. REMOVE BATTERIES PRIOR TO CLEANING.

10.0 BATTERY CHECK ADJUSTMENT PROCEDURE:

10.1 FOLLOW CURRENT ADJUSTMENT PROCEDURES STEP 1, 2 & 3.

10.2 TURN SURVEY METER ON AND LET THE SURVEY METER WARM-UP FOR APPROXIMATELY 2 MINUTES. PRESS BATTERY CHECK SWITCH..

10.3 ADJUST R22 UNTIL THE NEEDLE IS AT THE RIGHT HAND EDGE OF THE INDICATED BATT ZONE ON THE METER MOVEMENT.

WARNING: DO NOT USE R17 TO ADJUST THE BATTERY CHECK POSITION.

NOTE: IF THE ABOVE PROCEDURES ARE PERFORMED USING STANDARD NON-ALKALINE BATTERIES, THE INDICATED BATTERY CHECK WILL BE SLIGHTLY HIGHER IF ALKALINE BATTERIES ARE INSTALLED AFTER THE ABOVE ADJUSTMENTS ARE MADE. NON-ALKALINE BATTERIES ARE USED IN FACTORY ADJUSTMENT.

11.0 SERVICING AND TROUBLE-SHOOTING:

11.1 USE ONLY REPLACEMENT PARTS LISTED ON THE PARTS LIST AND CIRCUIT DIAGRAM.

11.2 WHEN REPLACING THE METER MOVEMENT, RTV RUBBER SILICONE MUST BE INJECTED INTO THE METER MOVEMENT MOUNTING HOLES. PLACE METER MOVEMENT INTO INSTRUMENT CASE, SECURE WITH HDW AND REMOVE EXCESS RTV. THIS MUST BE PERFORMED TO ENSURE WATER TIGHTNESS

11.3 THE GM TUBE IS THE MAJOR CAUSE IN SURVEY METER FAILURE. SOME OF THE PROBLEMS A DEFECTIVE TUBE CAN CREATE ARE AS FOLLOWS:

- CRACKED ANODE = DEAD TUBE, WILL NOT DETECT RADIATION OR WILL SATURATE EARLY.

- HIGH BACKGROUND = GAS CONTENT IS DEPLETING; TUBE WILL EVENTUALLY CEASE TO FUNCTION.

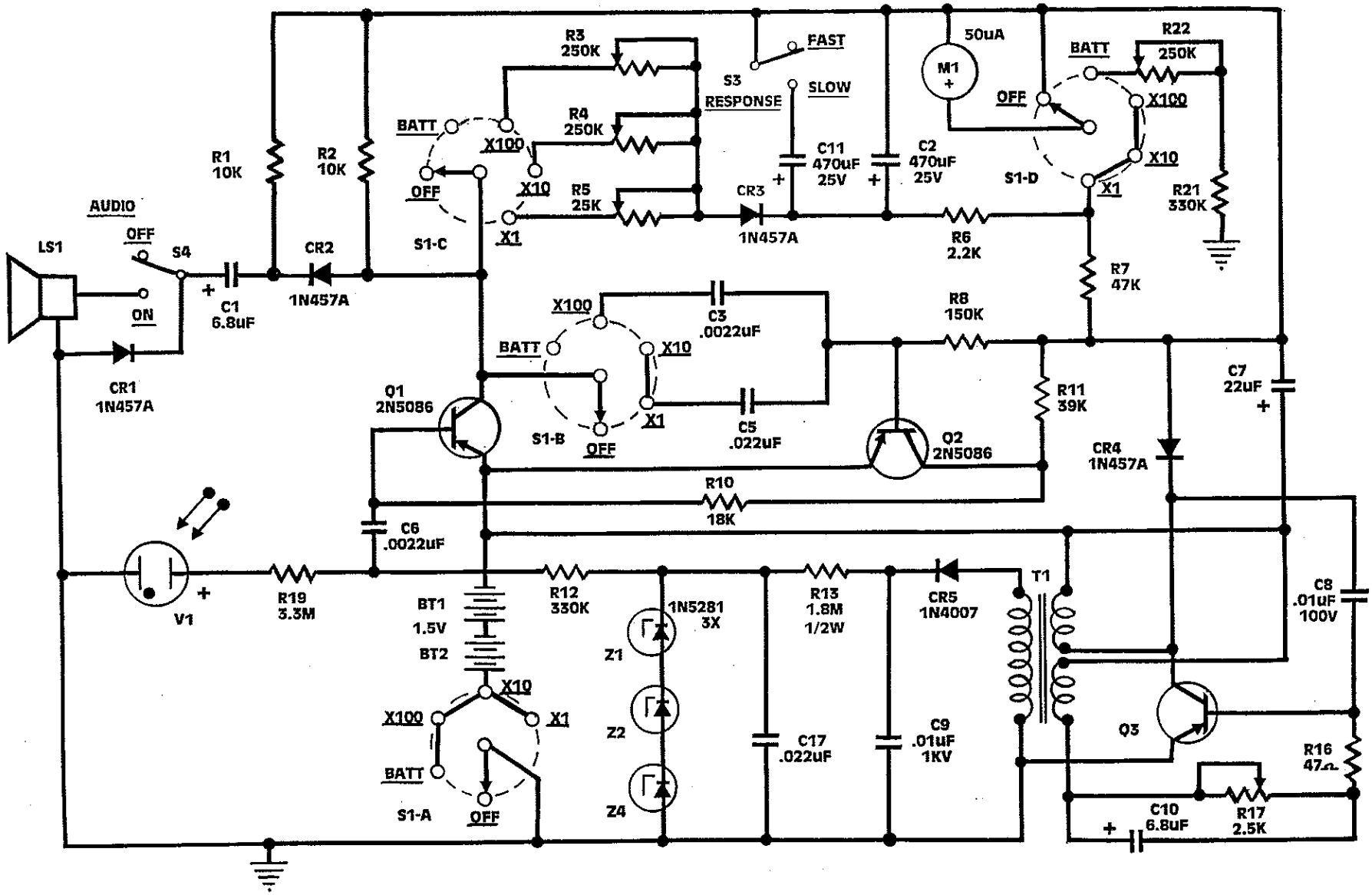
- GM TUBE SHORT = SURVEY METER'S INDICATOR WILL PEG OUT OR SATURATE EARLY.

- EARLY SATURATION = GM TUBE WILL DETECT RADIATION TO A CERTAIN POINT, i.e. 500 mR/hr, AND THEN BEGIN TO FALL DOWN SCALE. SOME TUBES MAY SHORT OUT AND THEN FALL DOWN SCALE.

NOTE: ROUTINE CALIBRATION MAY NOT ALWAYS DETECT THAT A GM TUBE IS SATURATING EARLY. SOME TUBES CAN SATURATE AT ANYTIME, THEREFORE IT IS HIGHLY RECOMMENDED THAT EACH TIME A SURVEY METER IS CALIBRATED, IT SHOULD BE TESTED IN A RADIATION FIELD OF 10 R/hr.

ALL NDS SURVEY METERS ARE TESTED FOR SATURATION AT OUR FACILITIES AFTER EACH CALIBRATION AND OR REPAIR.

25-Feb-98	BILL OF MATERIAL		
980-0100-000	ABG-100 PC ASSY		REV A
ITM	PART NUMBER	DESCRIPTION	QTY	REF DESIG
1	100-1000-222	CAP CER DISC .0022 uF 1 KV	1	C6
2	100-1000-103	CAP CER DISC .01 uF 1 KV	1	C9
3	100-0100-103	CAP CER DISC .01 uF 100V	1	C8
4	100-1000-223	CAP CER DISC .022 uF 1 KV	1	C17
5	105-0035-685	CAP ELE ALUM 6.8 uF 35V	2	C1,10
6	105-0025-226	CAP ELE ALUM 22.0 uF 25V	1	C7
7	105-0006-477	CAP ELE ALUM 470.0 uF 25V	2	C2,11
8	115-0100-222	CAP PLY FILM .0022 uF 100V	1	C3
9	115-0100-223	CAP PLY FILM .022 uF 100V	1	C5
10	150-0100-001	DIODE 1N4007 STANDARD RECOVERY	1	CR5
11	150-0200-001	DIODE 1N457A	4	CR1-4
12	150-0400-001	DIODE 1N5281B ZENER	3	Z1-2,4
13	250-0500-185	RES CF 1/2W 5% 1.8 M OHM	1	R13
14	250-0100-222	RES CF 1/4W 5% 2.2 K OHM	1	R6
15	250-0100-335	RES CF 1/4W 5% 3.3 M OHM	1	R19
16	250-0100-103	RES CF 1/4W 5% 10.0 K OHM	2	R1-2
17	250-0100-183	RES CF 1/4W 5% 18.0 K OHM	1	R10
18	250-0100-393	RES CF 1/4W 5% 39.0 K OHM	1	R11
19	250-0100-470	RES CF 1/4W 5% 47.0 OHM	1	R16
20	250-0100-473	RES CF 1/4W 5% 47.0 K OHM	1	R7
21	250-0100-154	RES CF 1/4W 5% 150.0 K OHM	1	R8
22	250-0100-334	RES CF 1/4W 5% 330.0 K OHM	2	R12,21
23	265-0200-252	RES POT TRIMMER 2.5 K 1/2W	1	R17
24	265-0200-253	RES POT TRIMMER 25.0 K 1/2W	1	R5
25	265-0200-254	RES POT TRIMMER 250.0 K 1/2W	3	R3-4,22
26	350-0300-004	SWITCH ROTARY 3 RANGE 4 POLE 5 POS 2 WAFERS	1	S1
27	450-8050-001	TRANSFORMER DC-DC	1	T1
28	475-0150-001	TRANSISTOR 2N5086 PNP	2	Q1-2
29	475-0200-001	TRANSISTOR SK3004 POWER	1	Q3
30	605-015D-001	BATTERY HOLDER 1.5V D CELL	2	
31	650-015D-001	BATTERY PLATE	1	
990-0100-000	ABG-100 UNIT ASSY			REV A
ITM	PART NUMBER	DESCRIPTION	QTY	REF DESIG
1	600-0150-001	BATTERY 1.5V D CELL EV150	2	BT1-2
2	650-0400-001	BRACKET CIRCUIT BD	1	
3	670-2000-001	CASE NYL/FBRGLS SET	1	
4	690-0100-001	DECAL ABG-100	1	
5	675-2000-002	HANDLE SURVEY INSTRUMENT	1	
6	690-0100-001	KNOB BLK/ALUM INLAY	1	
7	800-0010-001	METER 50uA RUGGEDIZED METAL	1	M1
8	980-0100-000	ABG-100 PC ASSY	1	PC1
9	500-0712-001	TUBE GM 712	1	V1
10	395-2200-001	SWITCH TOGGLE BOOT	2	
11	390-2200-001	SWITCH TOGGLE SPDT	2	S3, 4
12	400-0200-001	TRANSDUCER ASSY	1	LS1



DRAWN: M. SMITH	DATE: 8/96	NDS PRODUCTS	
CHECKED: KES	DATE: 8/96	ABG-100 CIRCUIT DIAGRAM	
ENGINEER: NDS	DATE: 8/96	DWG 870-0100-001	B
DO NOT COPY, DISPLAY, OR USE DRAWING WITHOUT AUTHORIZATION DO NOT SCALE DRAWING		SCALE: ~ SHEET 1 OF 1	REV