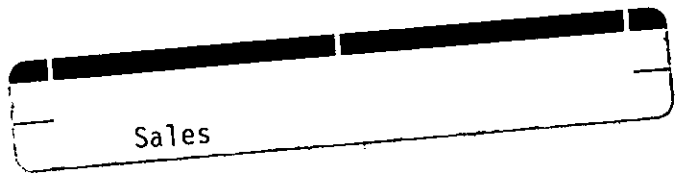
Model RM-14

Radiation Monitor Technical Manual



Eberline *A subsidiary of* ***Thermo Instrument*** *Systems Inc.*

P. O. Box 2108
Santa Fe, New Mexico 87504-2108
(505) 471-3232 TWX: 910-985-0678

List Repair Calibration

EFFECTIVE January 1, 1991
Prices are F.O.B. Santa Fe, New Mexico
Subject to change without notice
Terms: ¾ of 1% 10, net 30 days
Minimum order $40.00

The prices quoted herein do not include state, gross receipts, or local sales tax. The tax will be added as a separate item in the event that the transaction is determined to be taxable.

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P.O. Box 2108
Santa Fe, New Mexico 87504-2108
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FAX: (505) 473-9221

GENERAL INFORMATION

Instruments for repair or calibration should be packaged, marked, or otherwise prepared in accordance with good commercial practices and shipped F.O.B. destination freight prepaid to one of the Eberline facilities below.

Repair and Calibration Facilities

Eberline Instrument Corporation
504 Airport Road
Santa Fe, NM 87504-2108
Attn: Western Service Center
(505) 471-3232
1-800-274-4212

Eberline Instrument Corporation
312 Miami Street
West Columbia, SC 29169
Attn: Eastern Service Center
(803) 822-8843
1-800-234-4212

Normal turn-around time for repair (Eberline instruments) is fifteen working days.

Normal turn-around time for calibration (Eberline instruments) is seven working days.

Prices (Subject to change without notice)

Certified calibration (Eberline portable instruments)(2 points/range)	
Unit and one probe	$90.00
Second probe	45.00
Third or fourth probe (Limited to 4 probes per instrument)	25.00
Certified calibration (other manufacturer's portable instruments)	90.00
ALPHA-3, ALPHA-5, AMS-3, HFM's, Portal Monitors, RM-22, SAM-2, WLM-1A, ESP-2 6112B, 6112D (certified calibration)	145.00
RGM-2 (certified calibration)	405.00
RGM-3 (certified calibration)	235.00
As found readings on any of the above, a charge of 50% of calibration rate shall be made.	
Calibrate "non-removeable" contaminated instruments	QUOTE
Services Contracts (Eberline equipment)	QUOTE
Technical Specification writing and Consultation	QUOTE
Service Engineer at Customers Site	$880.00/day plus expenses at cost +10% adm.
-Over 8 hours or Saturday and Sunday	165.00/hr
-Eberline Holidays	220.00/hr
Consulting	925.00/day
Repair rate (plus calibration and parts at list price)	85.00/hr
Repair "non-removeable" contaminated instruments	95.00/hr
Expediting Fee	50.00/ instrument
Accredited secondary standards laboratory calibration (Cs^{137} and Co^{60} photon)	QUOTE

Note: Repair and Calibration time on non-Eberline instruments is subject to availability of parts and literature for the specific instrument.

Repair or Calibration Warranty

Eberline warrants to replace or repair, at its option, any repaired products or replaced parts thereof (excluding tubes, crystals, batteries and normal consumables) which are found defective in material or workmanship within ninety (90) days from date of repair or the balance of the new purchase warranty, whichever occurs later. Instruments calibrated by Eberline are warranted to be within specified limits at time of shipment. In the event of calibration error, Eberline will again calibrate the instrument without charge to the instrument owner. The aforesaid warranty does not cover life-end failure of components and will be voided if repair has been attempted by other than seller's authorized personnel. In no event shall Eberline be liable for consequential or special damages, transportation, installation, adjustment, work done by customer or other expenses which may arise in connection with such defective product or parts.

Exclusion of Warranties and Limitation of Liability

The foregoing warranty is expressly made in lieu of any and all other warranties express or implied including the warranties of merchantability and fitness for a particular purpose. Under no circumstances shall seller be liable for any indirect, special, incidental, or consequential damages to customer or to any third party.

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LIST OF EFFECTIVE PAGES

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i	Change 4	January 20, 1982
ii	Change 2	May 1, 1979
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3	Change 3	July 9, 1980
4	Change 5	January 20, 1982
5	Change 6	July 31, 1991
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12	Change 15	July 31, 1991
13	Change 14	July 31, 1991
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16	Change 7	July 31, 1991

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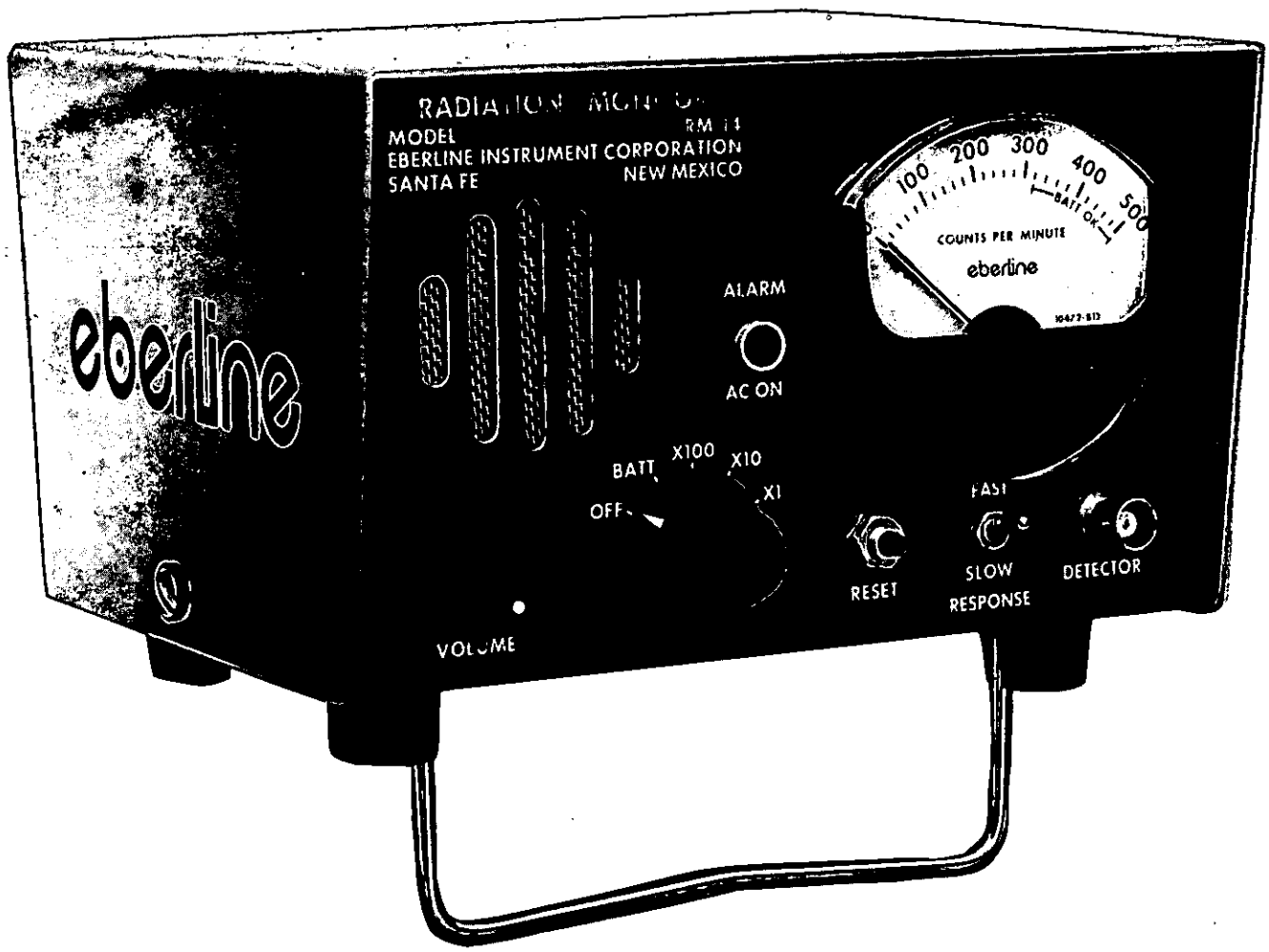

Figure 1-1. Radiation Monitor Model RM-14

SECTION I
GENERAL

A. PURPOSE AND DESCRIPTION

The RM-14 is a small, compact count rate meter operated by ac line or away from ac line by a battery which is continuously trickle charged while the unit is plugged into the line. Battery condition is checked by front panel controls.

This monitor is intended primarily for use with a Geiger-Mueller (G-M) detector, but with slight modifications, can be used with appropriate scintillation detectors.

The radiation count rate is read out on a front panel meter with 0-500 cpm (counts per minute) full scale. Three switch selected ranges of X1, X10 and X100 are provided. Response time of the meter can be selected by a *FAST-SLOW* response switch.

A high limit is provided, adjustable over the scale of the meter by a control on the rear panel. The alarm, when actuated, does not interrupt or affect meter reading and is a locking type which will continue to alarm until the reset switch is depressed.

An audible indication is integral and the loudness can be controlled from no sound to maximum.

External recorder and scaler outputs are provided on the rear panel.

B. SPECIFICATIONS

1. Indicator

a. Visual:

(1) Scale Length: 2.37 inches (6.02 cm).

(2) Scale Marking: 0 to 500 cpm with 25 increments.

(3) Range: Switch controlled multipliers of *X1, X10* and *X100,* yielding 500; 5000; 50,000 cpm full scale.

(4) Response Time: Fast - 2.2 seconds, Slow - 22 seconds (measured to 90 percent of final reading).

(5) Linearity: Within ±5 percent full scale, typically ±2 percent full scale.

(6) Battery Dependence: Calibration change less than 10 percent with *BATT OK* limits on meter.

2. External Connections

a. Scaler Output: 6 V positive pulse

b. Recorder Output: 50 μA full scale

c. Detector Input: BNC connector with 900 V high voltage. Signal capacitively coupled to amplifier, 40 mV input sensitivity. High voltage and input sensitivity can be modified to suit detector. See Section III. C.1 and 2.

3. Aural

Internal mounted speaker, volume controlled manually from zero output to maximum loudness. One audible click is heard per incident of detected radiation.

4. Alarm

a. Alarm Point: Locking type, adjustable over the meter scale from 0.1 scale to over full scale.

b. Visual Alarm: Red light on front panel.

c. Audible Alarm: 1000 Hz tone on speaker independent of volume control setting.

d. Modifications: The alarm may be changed to a non-locking type. See Section III. C. 3.

5. Power

a. Line: 3 wire, 105-125 Vac, 60 Hz.

b. Battery:

(1) Type: 6 V, 900 mA-hours Gel-type battery continuously trickle charged with instrument plugged into line.

(2) Charging Rate: 7 mA with instrument on, 23 mA off.

(3) Charging Time: Approximately 50 hours to full charge from full discharge with circuit off.

6. Portability

Instrument may be operated away from ac power source with a full charge on battery for 50 hours if not alarmed.

7. Mechanical

a. Size: Height: 5¼ inches (13.3 cm).
Depth: 7 inches (17.8 cm).
Width: 7½ inches (19 cm).

b. Weight: 4½ pounds (2 kg).

8. Environmental

a. Temperature: The instrument is operational over the range of -20 °F to +140 °F (-29 °C to 60 °C) with less than ±10 percent full scale change in meter reading and less than ±20 percent full scale change in alarm point.

SECTION II
OPERATION

A. DESCRIPTION OF CONTROLS AND CONNECTORS

1. External (See Figures 1-1 and 2-1)

a. Switch: Five position rotary switch that turns instrument *OFF,* checks *BATT* condition and selects scale multipliers of *X1, X10* and *X100.* This number must be multiplied by the meter reading to obtain the proper count rate.

b. *RESPONSE:* Toggle switch to set response time either *FAST* or *SLOW* for best compromise between speed and fluctuation for the particular usage.

c. *RESET:* Discharges integration capacitor, bringing the meter reading to zero rapidly, also releasing an alarm condition.

d. *VOLUME:* Varies loudness of speaker from no sound to maximum loudness.

e. *DETECTOR:* Connection to detector. BNC series coaxial.

f. *ALARM SET:* Controls point on meter scale that the alarm will actuate. Numbers 1 thru 5 correspond to bold increments on meter scale.

g. *TEST:* Toggle switch inserts 3600 cpm into instrument when on, if power cord is plugged into ac line.

h. *RECORDER:* Connection for external 50 μA recorder. (May be changed to 10 mV. See Section III. C. 4). Mates with 3 wire standard 1/4-inch phone plug.

i. *SCALER:* Connection for external scaler. BNC series coaxial.

2. Internal (See Figure 2-2)

a. Calibration Controls: One control for each range which individually calibrates that range to agree with input count rate.

b. Alarm Set Calibrate: Control to set correlation between alarm set and meter reading at alarm point.

B. PREPARATION FOR USE

1. Inspection

The instrument should be checked for physical damage.

2. Connections

a. Connect proper detector to *DETECTOR* connector.

b. Plug ac cord into 115 V, 60 Hz line. *AC ON* light should light.

C. USING THE INSTRUMENT

1. Starting

Turn the switch to *BATT* check position. The meter should indicate in the *BATT OK* area.

2. Operation Check

Place check source in a repeatable position adjacent to the detector to achieve an upscale reading. Note that the reading is sensitive to the position of the source. The reading may be recorded for future reference.

Push the *RESET* button and the reading should drop to zero rapidly, then climb back to source reading when *RESET* is released. The *RESPONSE* switch may be selected for the best compromise between speed of reading and meter fluctuation.

Rotate the *ALARM SET* counterclockwise until alarm occurs. *ALARM* light should light and 1000 Hz squeal will be heard on the speaker. Push the *RESET* button; the alarm condition should go away until reading exceeds alarm set point.

3. Interpretation of Indications

The meter reading must be multiplied by the scale switch setting to obtain the proper number. The fluctuation of the meter is normal and is caused by the random nature of radioactive decay.

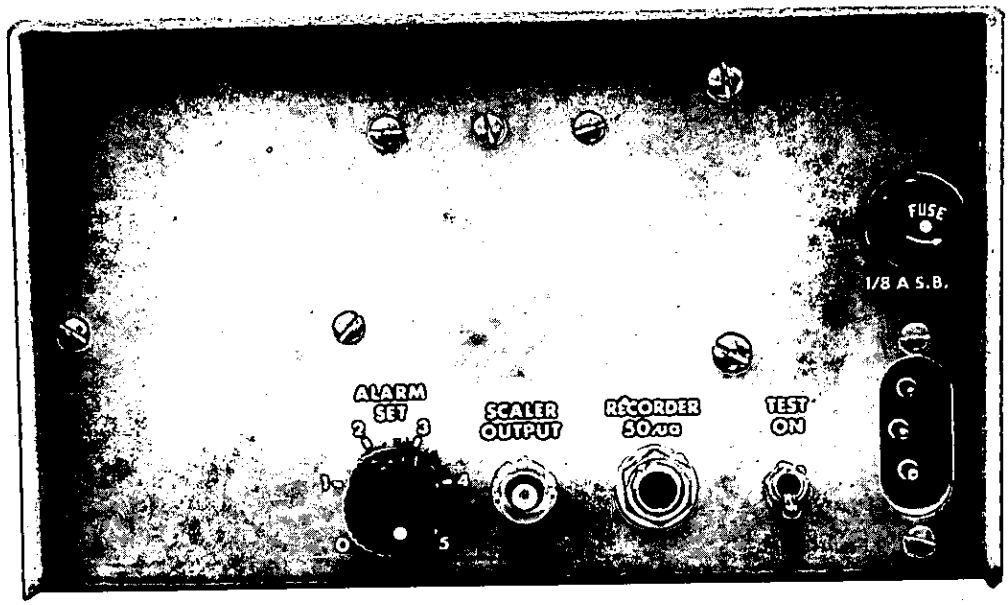

Figure 2-1. Rear View, Cover in Place

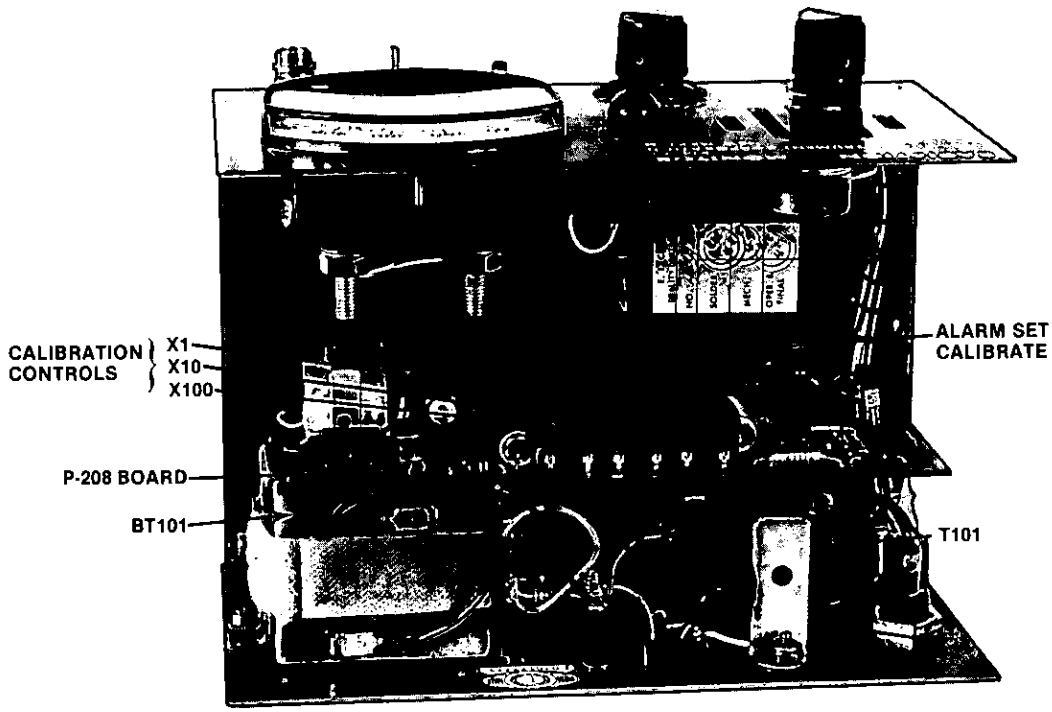

Figure 2-2. Top View, Cover Removed

SECTION III
THEORY OF OPERATION

A. GENERAL (See Figure 3-1)

The G-M tube is supplied +900V from the high voltage supply. When radiation reacts in the G-M tube, negative pulses are generated, which are inverted and amplified by Q5. Trigger circuit A1 converts them to standard pulse width, and meter driver Q5 converts them to standard pulses of current. This current is averaged and drives the meter; thus, the meter deflection is proportional to the average rate of radiation at the G-M tube.

The voltage developed across the meter is applied to the differential alarm amplifier whose reference voltage is controlled by the alarm set control. When the meter voltage exceeds the reference voltage, the alarm amplifier sustains an alarmed condition which lights the alarm light and inserts the high voltage oscillator frequency to the speaker.

B. FUNCTIONAL THEORY (See Figures 3-1 and 6-1)

1. High Voltage Supply

The oscillator transistor (Q1) drives T1 primary and gets its feedback from T1's red-orange winding. The voltage is stepped up by T1's secondary, rectified, filtered and applied to V1. V1 regulates at 900 V. The current through V1 is sensed by Q2, amplified, and used to control the current through Q3. The current through Q3 controls the bias level of oscillator Q1, which tends to hold the current through V1 to a constant value regardless of battery voltage. Consequently, the probe will operate with somewhat discharged (lower voltage) batteries, yet does not waste the power of new batteries, greatly extending battery life.

2. Amplifier

Q5, Q6 and Q7 amplify and invert the negative signal from the detector. The collector of Q7 is near zero until a pulse turns it on and the resulting positive pulse starts the trigger.

3. Trigger

Integrated circuit A1 is connected to operate as a monostable multivibrator whose pulse width is controlled by the RC time constant between its Pins 7 and 3. This time constant is established by the setting of S101A (scale selection) which selects a particular R and C. The calibration controls form the R for each scale, making the pulse width continuously adjustable for calibration.

When the trigger is initiated by the pulse from Q7, the output at Pin 6 goes positive and holds until the predetermined time (RC) elaspes.

4. Meter Driver

The driver Q9 is normally off so no current flows through M101. When the trigger is on, Q9 is turned on and current flows. The amount of current is determined by the voltage on the base of Q9 and R22. The length of time that current flows is determined by the pulse width of the trigger. This (current times time) forms a certain charge which is transferred to C12 (or C11 and C12, depending on response time switch position) for each event counted. C12 discharges thru M101, yielding a certain average current dependent on the rate of input pulses. Changing the pulse width of the trigger (i.e., changing sales or calibration pot setting) changes the average current for a given input pulse rate. This allows the meter to be calibrated to read counts per minute at the detector.

The response time is controlled by the RC time constant of C12 and R23 in the *FAST* position, or C11 + C12 and R23 in the *SLOW* position.

5. Speaker Driver No. 1

Q20 and Q21 amplify the trigger pulse and drive the speaker. One event is heard on the speaker for each event counted. Q21 also drives the external scaler. Speaker loudness is controlled by R104 setting.

6. Alarm Amplifier

Q10, 11, 12 and 13 form a differential amplifier with the alarm set, R103, controlling the reference side of the amplifier. The voltage across R103 is held stable by current source CR12. Alarm point is set by adjusting the reference voltage on the base of Q12. When the voltage on Q10 equals, or exceeds, the voltage on Q12, Q14 will conduct, turning on Q15, lighting the alarm light and activating the No. 2 speaker amplifier. The alarm condition is locked in by the feedback loop consisting of R27 and CR7 which holds Q14 in conduction.

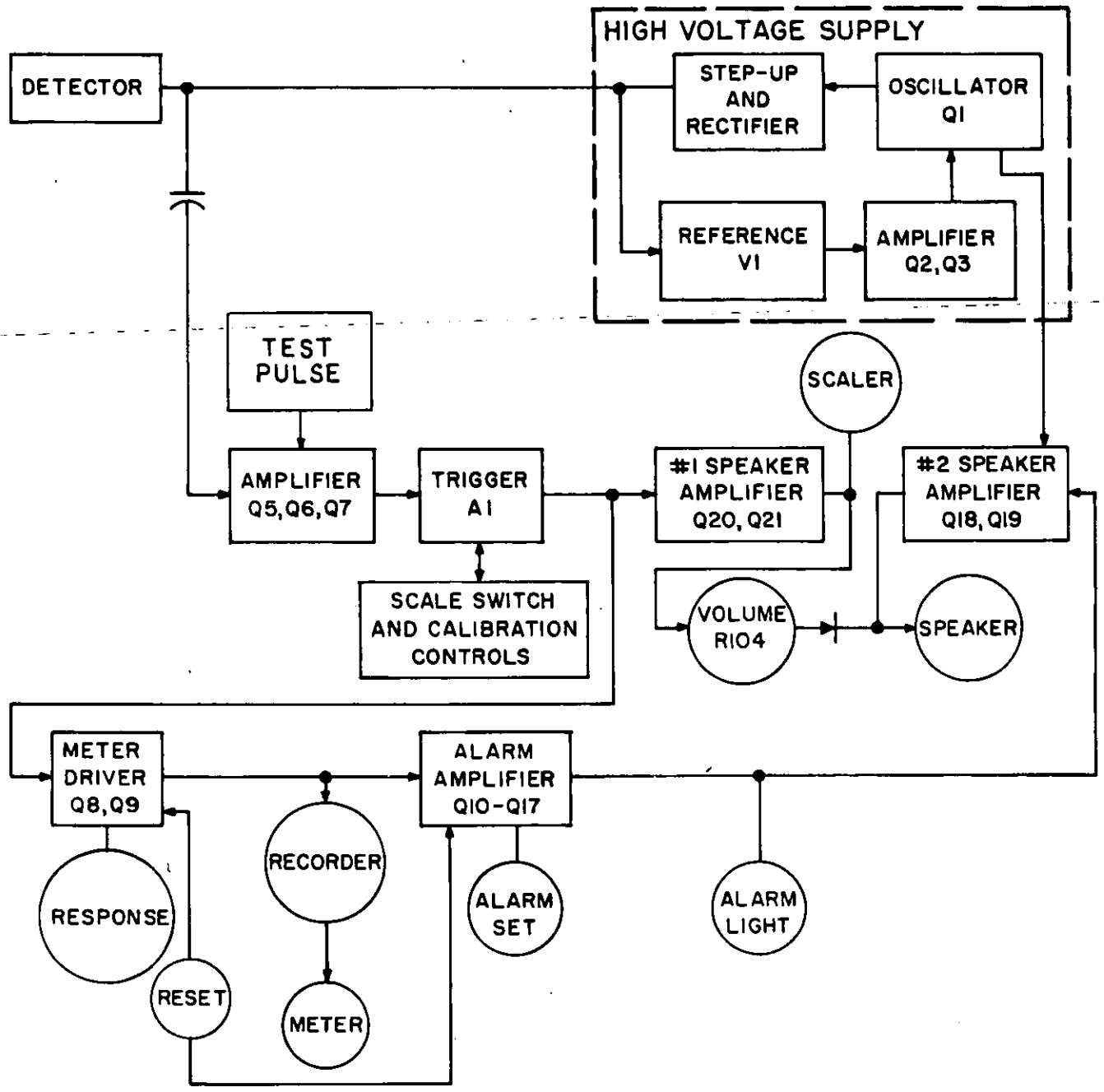

Figure 3-1. System Block Diagram

When the *RESET* switch is closed, a voltage is applied to the base of Q16 and Q17, turning them on. Q17 returns the base of Q10 to near the 2 V reference line and also removes the charge from C11 and C12, returning the meter reading to zero. Q16 puts the base of Q15 at ground turning Q15 off. With Q15 off, the alarm light is turned off, the No. 2 speaker amplifier is disabled, and Q14 is turned off, resetting the alarm amplifier.

7. Speaker Driver No. 2

When Q15 is turned on (alarmed condition) Q18 and Q19 are enabled by grounding the emitter of Q18. The power supply oscillator frequency, approximately 1000 Hz, is amplified by Q18 and Q19 which drives the speaker. CR101 isolates the output from the volume control so alarm loudness is not affected by volume control setting.

8. Power Circuitry

The ac line voltage is stepped down by T101 and rectified by A101 and is used to trickle charge BT101. The charging current is set by R101. Since the line is not switched, the battery will be charging any time the instrument is plugged into the line, and the *AC ON* light will be lit.

The low voltage is regulated by Q4 and CR2.

9. Test

Transistor Q201 is turned on during each positive half cycle of T101 secondary. The pulse on the collector of Q201 resulting from it turning on, is divided by R203 and R204, then capacitively coupled to the *TEST* switch. With the switch off the pulse is grounded and has no effect. With the switch on the pulse is inserted into the amplifier and causes the instrument to count at a 3600 cpm rate.

C. MODIFICATIONS

1. High Voltage

The high voltage can be changed from 900 V to suit the type of detector being used by changing the regulator tube V1.

2. Input Sensitivity

The input sensitivity can be changed to 400 mV to suit certain geiger tubes. This change is made by removing the jumper on the P.C socket at Pins F and 6 and adding jumpers between Pins 6 and 7 and Pins F and H.

3. Alarm

The alarm can be made non-locking by removing the jumper on the P.C. socket between Pins 18 and V.

4. Recorder Output

The output signal may be changed from 50 μA to 10 mV full scale by adding to a 200 Ω resistor across the output terminals.

SECTION IV
MAINTENANCE

A. DISASSEMBLY AND REASSEMBLY

1. To remove cover, remove the two screws on each side of unit and lift cover off.

B. PREVENTIVE MAINTENANCE

1. Keep instrument clean and dry.

2. Whenever possible, keep unit plugged into line when in use.

C. CALIBRATION (ELECTRONIC)

Calibration is made to true frequency. Capacitively couple a pulse generator to the *DETECTOR* connector using a capacitor with a 1 kV or higher voltage rating. The pulse generator must have a negative pulse of approximately 100 mV amplitude and a frequency covering that of the instrument range. Adjust the pulse generator frequency to correspond with approximately 3/4 meter scale (400) and adjust the calibration control for the range selected until the meter reading agrees with the input frequency. Repeat for each range (X1, X10, X100).

The alarm set calibrate control (R35) should be set so the meter reading at the alarm point agrees with the setting of the *ALARM SET* control.

D. CALIBRATION (SOURCE)

After completion of electronic calibration in Section C., the detector and cable of intended use should be connected to the unit. The complete system should then be checked with one or more radiation sources of an isotope and specific activity as appropriate.

E. TROUBLESHOOTING

Typical voltages and waveforms are given on the schematic (Figure 6-1) and component locations are shown in Figure 6-2.

Voltages are measured with a 20,000 Ω/V, or greater, voltmeter except the 900 V point. An electrostatic voltmeter or DVM with a high voltage probe (1000MΩ or greater input pedence) should be used to check the 900 V; however, if one is not available, a conventional meter may be used if loading is accounted for.

SECTION V
PARTS LIST

The following table lists the mechanical items incorporated in the RM-14 and should contain any part necessary for normal repair. Unless otherwise specified, callouts of manufacturers and manufacturers' part numbers are to be considered typical examples only and not restrictions against using equivalent parts with the same operating characteristics. When ordering parts from Eberline, specify model number, serial number, reference designation, value, and Eberline Part No., or a word description if the part has no reference designation. Eberline will automatically substitute equivalent parts when the one called out by the manufacturers' part number is not available.

REF DESIG	PART	DESCRIPTION	MANUFACTURER AND PART NUMBER	EBERLINE PART NUMBER
1. Chassis				
A101	Bridge Rectifier		LITE-ON PBPC302	CRARVS0148(7)
BT101	Battery, 6 V	Gel-Cell	Powersonic 610 or Dynasty JC-610-1B	BTGC2(3)
CR101	Diode	Silicon	1N4002	CRSI1N4002(2)
CR102	Diode	Zener, 6.8 V	1N5342B	CRZR1N5342(2)
DS101	Lamp Holder	Red Lens, Alarm	Dialco No. 101-5030-0971-201	LPAS4(4)
DS101X	Lamp, 6 V	Alarm	328	LPBU5(7)
DS102	Speaker		Lafayette S-433	ADSP3(6)
F101	Fuse	3AG, 1/8 A, Slo-Blo		FUSB2(1)
F101X	Fuse Holder		Littelfuse 342022	FUHO3(5)
J101, J103	Connector	BNC	UG-1094/U	CXBN8(2)
J102	Phone Jack		Switchcraft No. 13B	COAF6(0)
M101	Meter	0-50 μA dc, with face 10472-B13	Jewell MM-2T	MTPA23(4) ZP10472013(0)
R101	Resistor	270 $\pm$5%, 1/2 W		RECC271B23(6)
R102	Resistor	180k $\pm$5%, 1/4 W		RECC184B22(2)
R103	Pot	2.5k, Linear, Alarm Set	Allen-Bradley JA1N056S252UA	PTCC252B05(2)
R104	Pot	50 Ω, Linear, Volume	Ohmite CMU5001	PTCC500B05(4)
R105	Resistor	4.3k $\pm$5%, 1/4 W		RECC432B22(5)
R106	Resistor	10 Ω $\pm$5%, 1/2 W		RECC100B23(7)
S102	Switch	SPDT, Toggle, Response	C&K 7101SYZQ	SWTO12(7)
S103	Switch	SPST, N.O. Pushbutton, Reset	Grayhill 30-1	SWPB5(8)
T101	Transformer	12 V, with center tap	Stancor No. P-8391	TFPO10(2)
	Power Cord		Belden 17952 or Alpha 544	WRAC2(8)

REF DESIG	PART	DESCRIPTION	MANUFACTURER AND PART NUMBER	EBERLINE PART NUMBER
S101	Switch	Range	Eberline 10534-B08	SWRO30(4)
	Knob	Alarm Set	Raytheon 70-2WD-2	HDKN9(2)
	Knob	Range	Raytheon 70-3-2	HDKN7(6)
	Neon Indicator	*AC ON*	Leecraft 36XP165	LPAS8(5)
2. Test Pulser				
C201	Capacitor	0.47 μF, 35 V	CS13	CPTA474P3L(6)
C202	Capacitor	0.01 μF, 50 V	CRL CK103	CPCE103PXN(4)
Q201	Transistor	Silicon, NPN	2N4124	TRSN2N4124(2)
R201	Resistor	51k, 5%, 1/4 W		RECC513B22(2)
R202, R203	Resistor	10k, 5%, 1/4 W		RECC103B22(2)
R204	Resistor	1k, 5%, 1/4 W		RECC102B22(4)
S201	Switch	Toggle SPDT	C&K 7101-S-D-W5-G-E	SWTO30(5)
3. P-208 Board				
A1	IC	RTL, Dual NOR Gate	Motorola MC710G or equivalent	ICRTC0810G(2)
C1	Capacitor	0.047 μF, 10%, 100 V	Sprague 225P47391WD3	CPPF473P3P(2)
C2, C13	Capacitor	3.3 μF, 10%, 15 V	CS13	CPTA335P3H(5)
C3, C15	Capacitor	0.01 μF, 1.6 kV	CRL DD16-103	CPCE103PXV(3)
C4	Capacitor	0.001 μF, 3 kV	Sprague 30GA-D10	CPCE102P3Y(7)
C5, C6, C11	Capacitor	330 μF, 10%, 6 V	Kemet T110D337K006AS	CPTA331M3D(1)
C7	Capacitor	0.001 μF, 10%, 200 V	Sprague 192P10292	CPPF102P3R(5)
C8	Capacitor	0.0068 μF, 10%, 80 V	Sprague 192P6829R8	CPPF682P3O(9)
C9	Capacitor	0.068 μF, 10%, 200 V	Sprague 192P68392	CPPF683P3R(4)
C10	Capacitor	0.68 μF, 10%, 35 V	CS13	CPTA684P3L(0)
C12, C16	Capacitor	33 μF, 10%, 10 V	CS13	CPTA330M3F(1)
C14	Capacitor	0.033 μF, 10%, 200 V	Sprague 192P33392	CPPF333P3R(6)
CR1	Diode	High Voltage		CRSIVA0025(3)
CR2	Zener Diode	5.3 V	10416-A24	CRXX1(8)
CR9, CR10	Diode	Special		CRZRMZ2361(0)
CR4, CR6, CR7, CR11	Diode	Silicon	1N4148	CRSI1N4148(7)
CR5	Diode	Germanium	1N34A	CRGE1N0034(9)
CR8	Diode	Silicon	1N4001	CRSI1N4001(3)
CR12	Current Regulator	0.43 mA	1N5289	CRZR1N5289(7)
CR13	Schottky Diode		Motorola MBR130P	CRSCMBR130(2)

REF DESIG	PART	DESCRIPTION	MANUFACTURER AND PART NUMBER	EBERLINE PART NUMBER
Q1	Transistor	Germanium	2N404A	TRGP2N404A(2)
Q2, Q3, Q4, Q5, Q8, Q10, Q11, Q12, Q13, Q16, Q17, Q18, Q20	Transistor	Silicon	2N4124	TRSN2N4124(2)
Q6, Q7, Q9, Q14	Transistor	Silicon	2N4126	TRSP2N4126(8)
Q15	Transistor	Silicon	2N4401	TRSN2N4401(6)
Q19, Q21	Transistor	Silicon	2N3638	TRSP2N3638(1)
R1, R11	Resistor	270, 5%, 1/4 W		RECC271B22(7)
R2	Resistor	22M, 5%, 1/4 W		RECC226B22(1)
R3	Resistor	1M, 5%, 1/4 W		RECC105B22(7)
R4, R29	Resistor	4.7k, 5%, 1/4 W		RECC472B22(1)
R5	Resistor	330, 5%, 1/4 W		RECC331B22(9)
R6, R21, R26	Resistor	470, 5%, 1/4 W		RECC471B22(3)
R7	Resistor	3.9k, 5%, 1/4 W		RECC392B22(1)
R8	Resistor	39k, 5%, 1/4 W		RECC393B22(9)
R10, R27, R28	Resistor	2.7k, 5%, 1/4 W		RECC272B22(5)
R12	Resistor	27k, 5%, 1/4 W		RECC273B22(3)
R13	Resistor	180k, 5%, 1/4 W		RECC184B22(2)
R14, R20, R38	Resistor	2.2k, 5%, 1/4 W		RECC222B22(0)
R9, R15, R19, R31	Resistor	6.8k, 5%, 1/4 W		RECC682B22(5)
R16, R17, R18, R35	Potentiometer	10k	CTS No. RR9167 (X201R103B)	PTCC103B02(0)
R22	Resistor	220, 5%, 1/4 W		RECC221B22(2)
R23	Resistor	8.2k, 5%, 1/4 W		RECC822B22(7)
R24	Resistor	1.2k, 5%, 1/4 W		RECC122B22(2)
R25	Resistor	680, 5%, 1/4 W		RECC681B22(7)
R30	Resistor	10k, 5%, 1/4 W		RECC103B22(2)
R32, R33	Resistor	120, 5%, 1/4 W		RECC121B22(4)
R34	Resistor	22k, 5%, 1/4 W		RECC223B22(8)
R36	Resistor	470k, 5%, 1/4 W		RECC474B22(7)
R37	Resistor	1.6k, 5%, 1/4 W		RECC162B22(8)
T1	Transformer		Microtan M7120	TFHV2(0)
V1	VR Tube	900 V	Victoreen GV3B-900 or 5841	TUVR900(4)

SECTION VI
DIAGRAMS

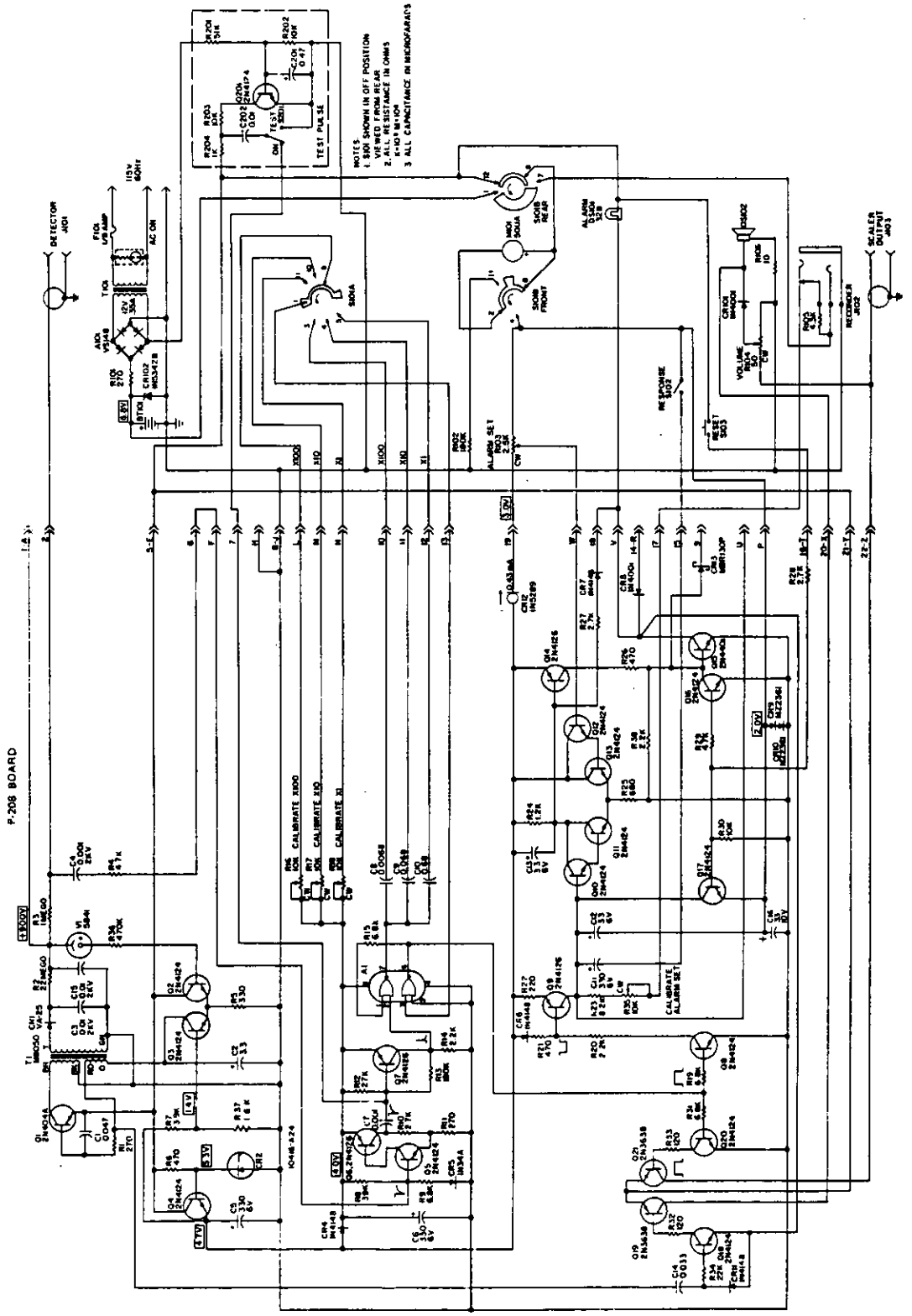

Figure 6-1. Schematic of Model RM-14 (10534-D12P)

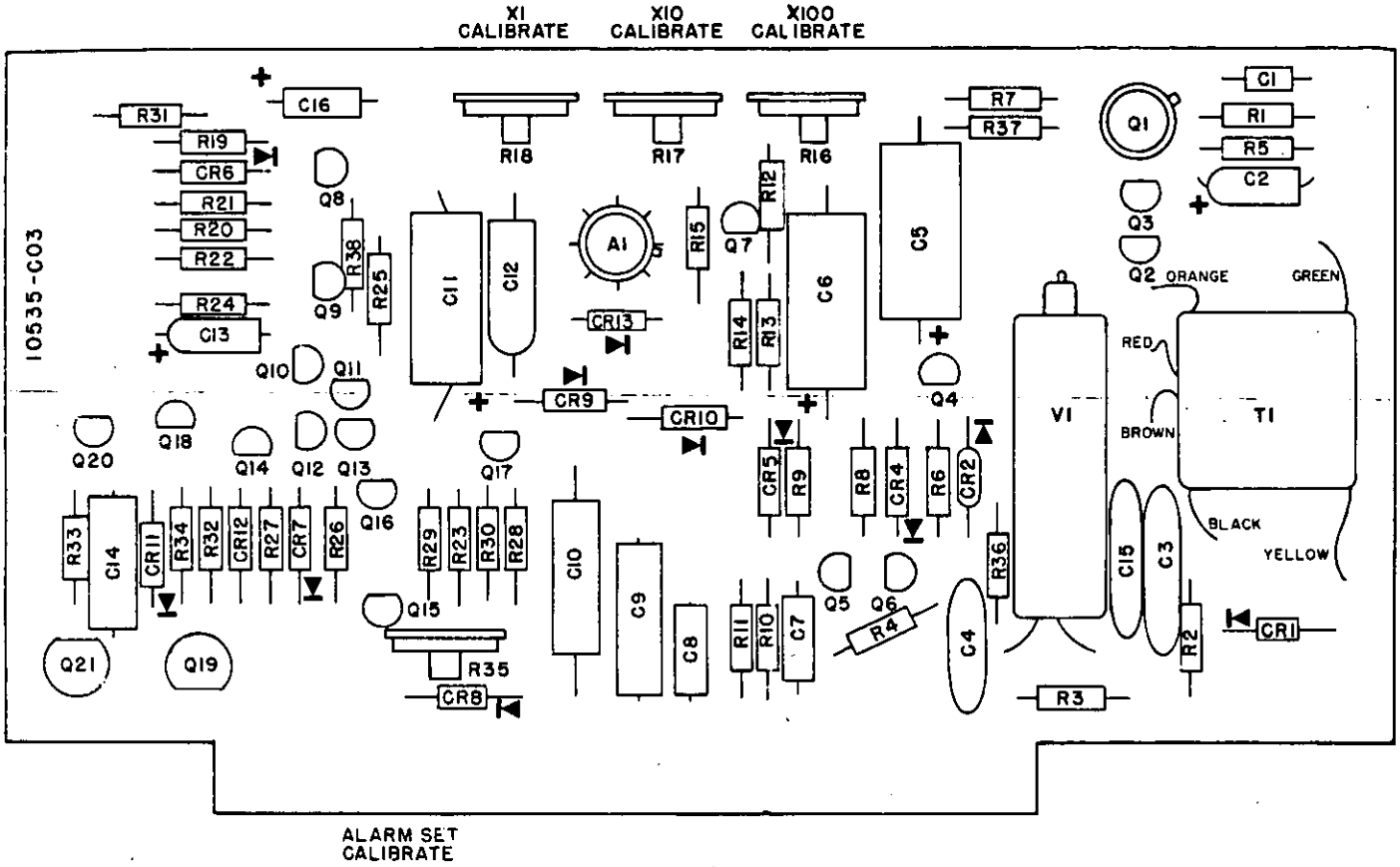

Figure 6-2. Component Layout of P-208 Circuit Board (10535-CO5A-1)

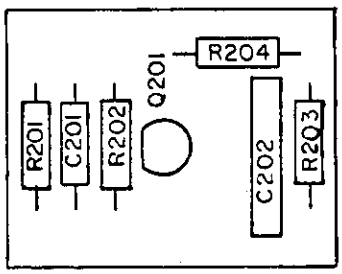

Figure 6-3. Component Layout of Pulser Circuit Board (10534-A38A)