BICRON ◆ NE
6801 Cochran Road
Solon, Ohio 44139
Telephone: (216) 248-7400
(800) 472-5656
Telefax: (216) 349-6581

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Micro Rem / Micro Sievert™ Survey Meters

User's Manual

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FOREWORD

This manual provides the basic operation and maintenance procedures for the Bicron Micro Rem/Micro Sievert™ Tissue-Equivalent Survey Meters.

Section 1.0 Introduction provides a general description of the instrument and its operation, and a detailed listing of its physical and performance specifications.

Section 2.0 Battery Installation describes the procedure for changing the battery and checking its performance.

Section 3.0 High Voltage Test describes how to test the High Voltage.

Section 4.0 Operation provides complete operating instructions for the meter.

Section 5.0 Circuit Description provides a brief description of the two electronic circuits that make up the instrument.

Section 6.0 Calibration provides directions for calibration of the instrument.

The **Appendices** are: A) a QC Acceptance Procedure, which includes complete calibration procedures, B) a detailed spare parts list so instruments can be repaired on-site, and C) schematic and pictorial diagrams to facilitate repair procedures.

There are certain conventions that will be followed for all safety warnings. They are divided into three categories and defined as follows:

- DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury. ***DANGER NOTICES ALWAYS APPEAR IN BOLD, ITALICIZED UPPER CASE LETTERS.***

- WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury. **WARNING NOTICES ALWAYS APPEAR IN UPPERCASE BOLD LETTERS.**

- CAUTION indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices. ***CAUTION notices always appear in bold, italicized letters.***

The definition of these safety warnings is according to ANSI Z535.4. The style of the warnings (bold, italicized, etc) is Bicron's.

In addition to the above, we have added the following warning:

- NOTE indicates a situation which has the potential for erroneous data collection, loss of electronic data, or damage to equipment, but which does not directly affect the safety of the operator with respect to this product. The responsibility for any safety consequences as a result of erroneous data lies solely with the operator. *NOTE notices always appear in italics.*

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ILLUSTRATION

BICRON ♦ NE WARRANTY STATEMENT COVERING PORTABLE MONITORS

Instruments and options manufactured by BICRON ♦ NE are warranted against defects in materials and workmanship for a period of two years from the date of shipment, unless otherwise agreed upon by BICRON ♦ NE and the customer in writing.

BICRON ♦ NE's obligation with regard to such products shall be limited to repair or replacement FOB BICRON ♦ NE factory or authorized repair station, at BICRON ♦ NE's option.

The calibration (when applicable) for each system is warranted to be within its specified accuracy at the time of shipment. If this initial calibration is determined to be in error, the system will be recalibrated at no charge.

The aforesaid warranty does not cover systems, options or probes which are subject to excessive physical abuse or are used for purposes other than those intended. In no event shall BICRON ♦ NE 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 LIMITED WARRANTY

THERE ARE NO WARRANTIES, EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS, WHICH EXTEND BEYOND THE DESCRIPTION ON THE FACE HEREOF. THIS EXPRESS WARRANTY EXCLUDES COVERAGE OF, AND DOES NOT PROVIDE RELIEF FOR, INCIDENTAL OR CONSEQUENTIAL DAMAGES OF ANY KIND OR NATURE, INCLUDING, BUT NOT LIMITED TO, LOSS OF USE, LOSS OF SALES OR INCONVENIENCE. THE EXCLUSIVE REMEDY OF THE PURCHASER IS LIMITED TO REPAIR, RECALIBRATION, OR REPLACEMENT OF THE SYSTEM AT BICRON ♦ NE's OPTION.

This warranty specifically excludes the following items which are covered by their original manufacturers' warranties: photomultiplier tubes, GM and proportional tubes, crystal and other solid-state detectors and batteries.

PROCEDURES and CAUTIONS

The equipment described herein is designed and manufactured in compliance with all applicable safety standards. Nevertheless, certain hazards are inherent in the use of electronic and radiometric equipment.

Adequate warnings are included in the manual and on the product itself to cover hazards that may be encountered in the normal use and servicing of this equipment. No other procedures are warranted by Bicron.

It shall be the owner's or user's responsibility to ensure that the procedures and cautionary notes are heeded.

Failure on the part of the user in any way to follow the prescribed procedures shall absolve Bicron and its agents from any resulting liability.

This instrument is intended solely for the detection and measurement of ionizing radiation. It should be used only by persons who have been trained in the proper interpretation of its readings and in the appropriate safety procedures to be followed in the presence of radiation.

All instructions and warnings contained in this manual or on the instrument must be read before use and must be strictly followed. Failure to follow these instructions and warnings may result in inaccurate readings and/or user hazard.

Indicated battery and other operations tests must be performed prior to each use to ensure that the instrument is functioning properly.

WARNING

FAILURE TO CONDUCT PERIODIC PERFORMANCE TESTS IN ACCORDANCE WITH ANSI N323-1978, PARAGRAPHS 4.6 AND 5.4, AND TO KEEP RECORDS THEREOF IN ACCORDANCE WITH PARAGRAPH 4.5 OF THE SAME STANDARD, COULD RESULT IN ERRONEOUS READING OF POTENTIAL DANGER. ANSI N323-1978 BECOMES, BY THIS REFERENCE, A PART OF THIS OPERATING PROCEDURE.

INSPECTION

Instruments should be examined and tested as soon as received. Claims for transportation damages, if any, should be filed at once with the delivery carrier.

1.0 Introduction

1.1 General Description

The Bicron Micro Rem™ and Micro Sievert™ models are lightweight, portable survey meters for applications where accurate dose rate measurements of low gamma radiation levels are required. They read absorbed dose rate directly, eliminating the need for conversion from mR/h.

The tissue-equivalent scintillator used in these instruments provides flat energy response calibrated in rem (Figures 3 and 4). This rem response is based on the deep dose equivalent index for 1 cm depth, uniparallel directional beam as calculated on the ICRU standard sphere.

The instruments give tissue-equivalent photon response for x-ray and gamma radiation from environmental levels of 0-20 μrem/h (0-0.2 μSv/h) full scale up to normal survey levels of 200 mrem/h (2 mSv/h) full scale. This wide range is achieved by use of five positions on the eight-position control switch, giving factors from 0.1 to 1000 times the scale reading.

Both the Micro Rem and the Micro Sievert Meters are available with a Standard or an Extended Probe and with Standard or Low Energy capabilities, for a total of eight different instrument part numbers.

The Micro Rem and Micro Sievert Meters are distinguished by the lettering on the side of the lower case and by the title on the scale (Figures 1 and 2). The basic unit has a solid lower case.

The extended Probe option is distinguished by a probe on the front of the lower case (Figure 5).

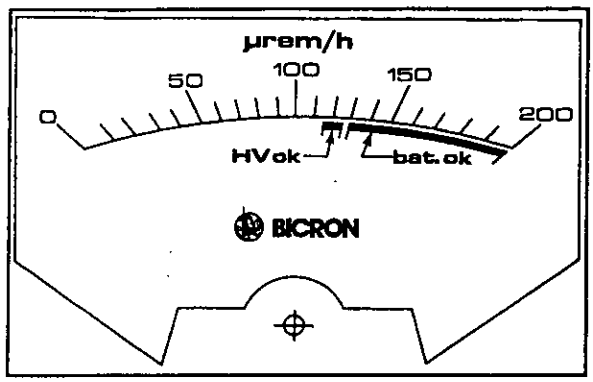

Figure 1
Micro Rem Meter Scale

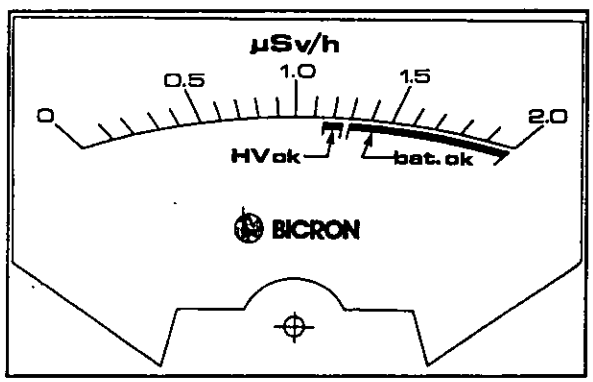

Figure 2
Micro Sievert Meter Scale

The Low Energy option is distinguished by a window opening on the front of the lower case (Figure 6) or the front of the probe (Figure 5).

Rugged construction and quality components make this instrument line very durable. Modular internal construction and a quick opening clasp makes field service easy.

1.0 Introduction (cont'd)
1.1 General Description (cont'd)

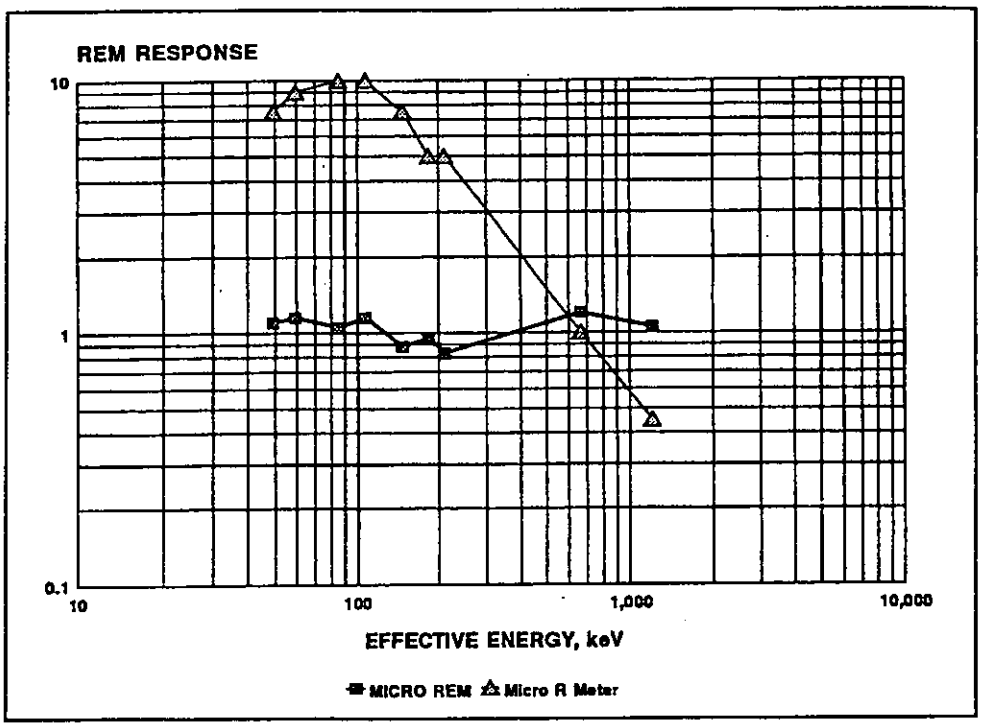

Figure 3
Rem Response value vs. Energy for
Bicron and conventional Micro R Meters.

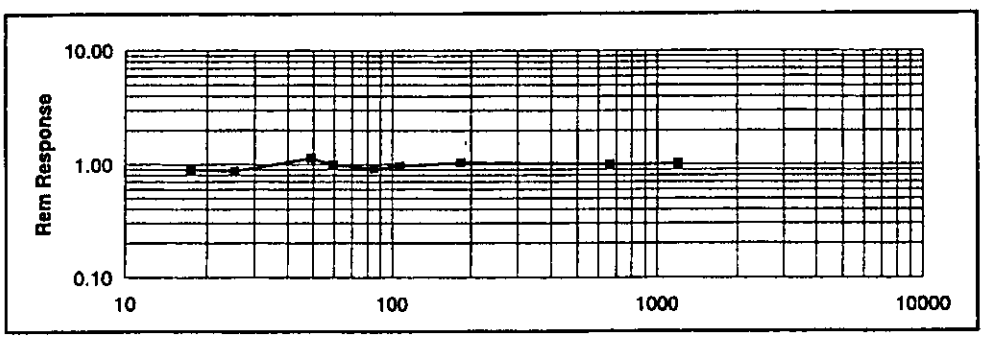

Figure 4
Low Energy Response

1.0 Introduction (cont'd)

1.2 Specifications

Display: Ruggedized, recessed, high-torque 1 mA meter, protected by impact-resistant Lexan® polycarbonate window with 3.35 inch (8.51 cm) scale marked 0-200 μrem/h (0-2.0 μSv/h), with "Bat. ok" and "HV ok" checkbands.

Control: Eight position rotary switch: off, bat., HV, X1000, X100, X10, X1, and X0.1.

Energy Response: See Figures 3 and 4.

Range: Five linear ranges, as shown below.

Range	μrem/h	μSv/h
X0.1	0 to 20	0 to 0.2
X1	0 to 200	0 to 2
X10	0 to 2000	0 to 20
X100	0 to 20,000	0 to 200
X1000	0 to 200,000	0 to 2000

Construction: Splash-proof, shock-proof, two-piece, all-metal case; scratch-resistant laminated control panel and Bicron Kleen Krome® trim on case top; durable black polyurethane paint on handle and case bottom.

Size: 4.25" X 8" X 7.5" (10.8 X 20.3 X 19.1 cm), including handle.

Weight: 3.1 pounds (1.4 kg.).

Radiation Detected: Gamma and x-ray, 40 keV to 1.3 MeV (17 keV to 1.3 MeV with Low Energy response option).

Detector Type: Internally mounted tissue-equivalent organic scintillator (sensitive area of probe extends outside the front of the case bottom with the Extended Detector option).

Figure 5
Micro Rem Meter with Extended Probe and Low Energy Window

1.0 Introduction (cont'd)
1.2 Specifications (cont'd)

Response Time: Optimized for each range, 0-90% of final reading, as follows:

Range	Time
X0.1	< 15 sec
X1	< 15 sec
X10	< 5 sec
X100	< 2 sec
X1000	< 2 sec

High Voltage: Electronically stabilized, factory set during calibration, with check band on the meter.

Accuracy: Within 10% of reading for ^{137}Cs between 20% and 100% of full scale on any range.

Warmup Time: None.

Temperature: Operational from -20 to +50°C.

Humidity: <5% change in reading from 10-95% RH.

Shock: 100g per lightweight machine of MIL-STD 202C, method 202B.

Vibration: 5g in each of three mutually orthogonal axes at one or more frequencies from 10-33 Hz.

Battery Complement: Two 9-volt, MN1604, or equivalent.

Battery Life: > 100 hours.

Geotropism: Within ±2% of full scale.

Reset Switch: A panel-mounted momentary pushbutton switch quickly resets the meter to zero.

Figure 6
Micro Rem Meter with Low Energy Window

1.0 Introduction (cont'd)

1.3 Options

Extended Detector

The internal detector is mounted so that the sensitive area extends 1.75" (4.4 cm) beyond the front of the case bottom. An aluminum extension fitted to the case bottom protects the internal detector.

Expanded Low Energy Response

The front of the detector is manufactured with a thin window. This extends the low energy cutoff to 17 keV (instead of 40 keV for the standard detector with no window). The energy response remains flat, as shown in Figure 4. This option is available either in standard or extended detector mounting.

Part numbers for the instruments with combinations of options are assigned according to Table 1.

Detector	Energy	Micro Rem Part No.	Micro Sv. Part No.
Standard	Standard	1056000	1058000
	Low	1083000	1090000
Extended	Standard	1056002	1058002
	Low	1083002	1090002

Table 1

2.0 Battery Installation

The instrument is delivered with two 9-volt Mallory MN 1604 batteries, or equivalent. Only one battery (in either holder) is required to power the instrument; however, the battery life will be reduced when only one battery is installed.

The following section defines the procedures for replacement and testing.

2.1 Procedure

1. Turn instrument off.
2. Open pull catches at both ends of the case and separate the bottom of the case from the top.
3. Install two batteries into the holders on the bottom circuit board, observing the proper polarity.
4. Replace the bottom part of the case, orienting the rubber pad under the batteries; then close the catches.

2.2 Test

Turn the control switch to the "bat." position; the meter should display a reading within the "bat. ok" checkband. A reading below the "bat. ok" checkband indicates the need for new batteries.

Check the High Voltage, as described in Section 3.0 High Voltage Test.

CAUTION

To confirm proper operation of the instrument, you must check the batteries each time you use the instrument and periodically during extended usage periods.

3.0 High Voltage Test

Turn the control switch to the "HV" position. A meter reading within the "HV ok" checkband should be observed. This test monitors the high voltage potential used by the internal detector.

If the reading falls outside the "HV ok" band, the instrument is in need of service.

CAUTION

To confirm proper operation of the instrument, you must check the High Voltage supply each time you use the instrument and periodically during extended usage periods.

4.0 Operation

4.1 Control Knob

Turn the control switch (Figure 7) to any of the 5 linear ranges (X1000 through X0.1). The meter reading is the total tissue-equivalent exposure rate for all the energies that the internal probe is capable of detecting; in μrem/h (μSv/h).

NOTE: Be sure to multiply the meter reading by the control switch multiplier.

CAUTION

To confirm the proper operation of the instrument, you must use an external radiation source of the type that the meter was designed to measure.

4.2 Reset Switch

This panel-mounted momentary pushbutton switch is used to quickly reset the meter on any dose rate range. Press and release the switch to reset the meter to zero.

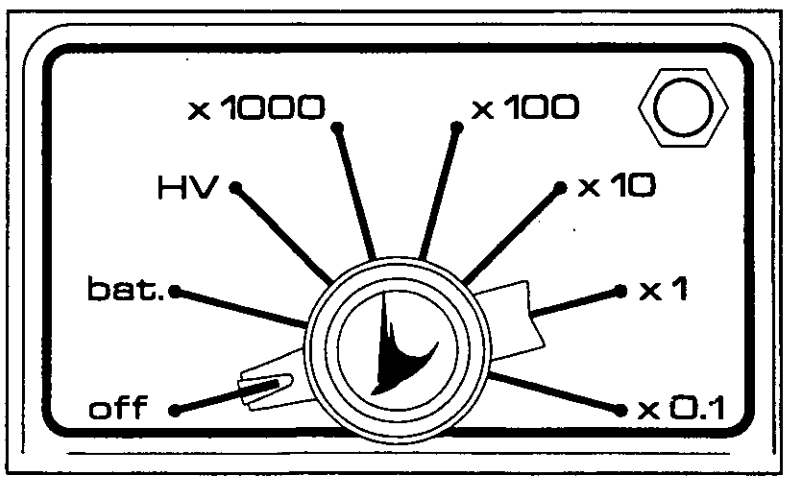

Figure 7
Control Knob Functions

5.0 Circuit Description

The electronic circuitry in the Micro Rem / Micro Sievert is contained on three interconnected printed circuit boards. Modern solid-state integrated circuitry is used throughout. The major components are:

1. High Voltage power supply. This is a feedback regulated, electronically stabilized supply for the detector potential. Additional circuitry provides HV readout on the meter.

2. Meter circuit. A linear amplifier converts detector current into an exposure rate reading on the calibrated meter scale. The circuit also features automatic response time selection and temperature compensation.

6.0 Calibration

The instrument is normally calibrated with ^{137}Cs. Individual calibration controls are provided for each range. The locations of these controls are marked directly on the main circuit board and in Figure 9.

A detailed calibration procedure is part of the QC Acceptance Procedure, which is included in this document as Appendix A. Recalibration is required after servicing and at regular intervals specified by appropriate regulatory agencies.

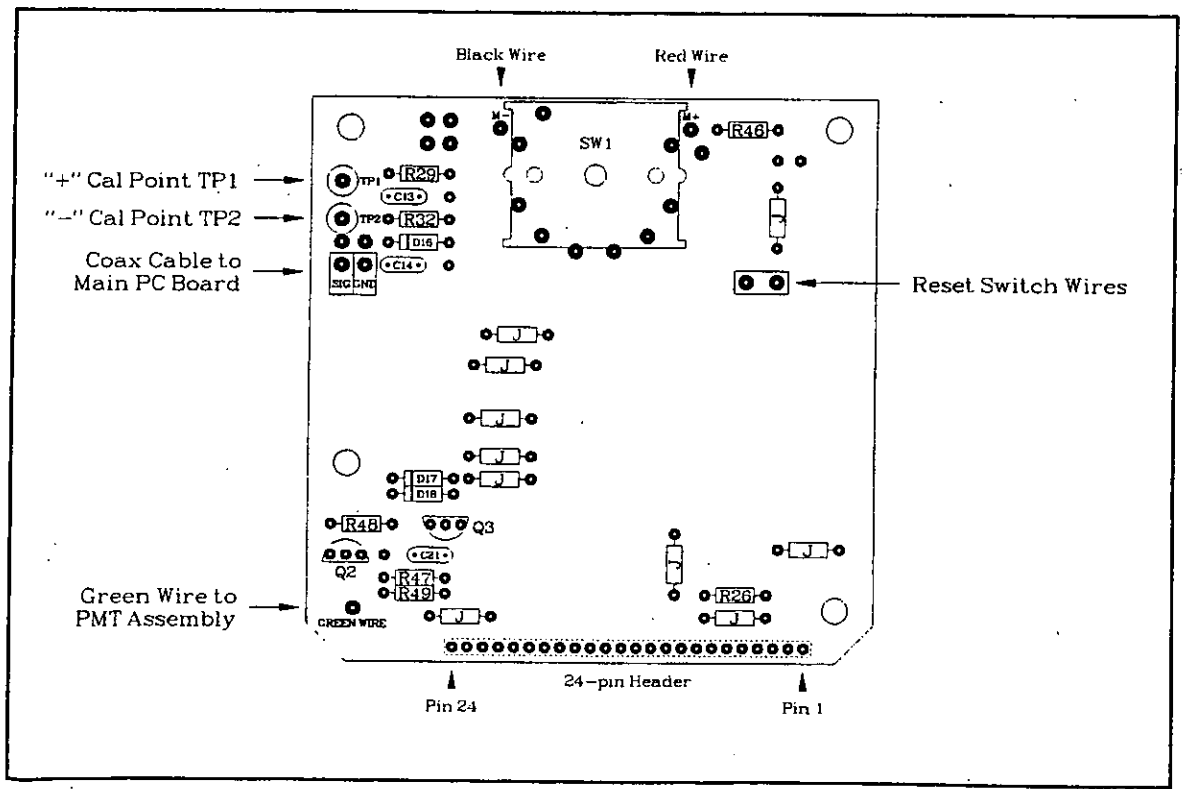

Figure 8
Switch Circuit Board

6.0 Calibration (cont'd)

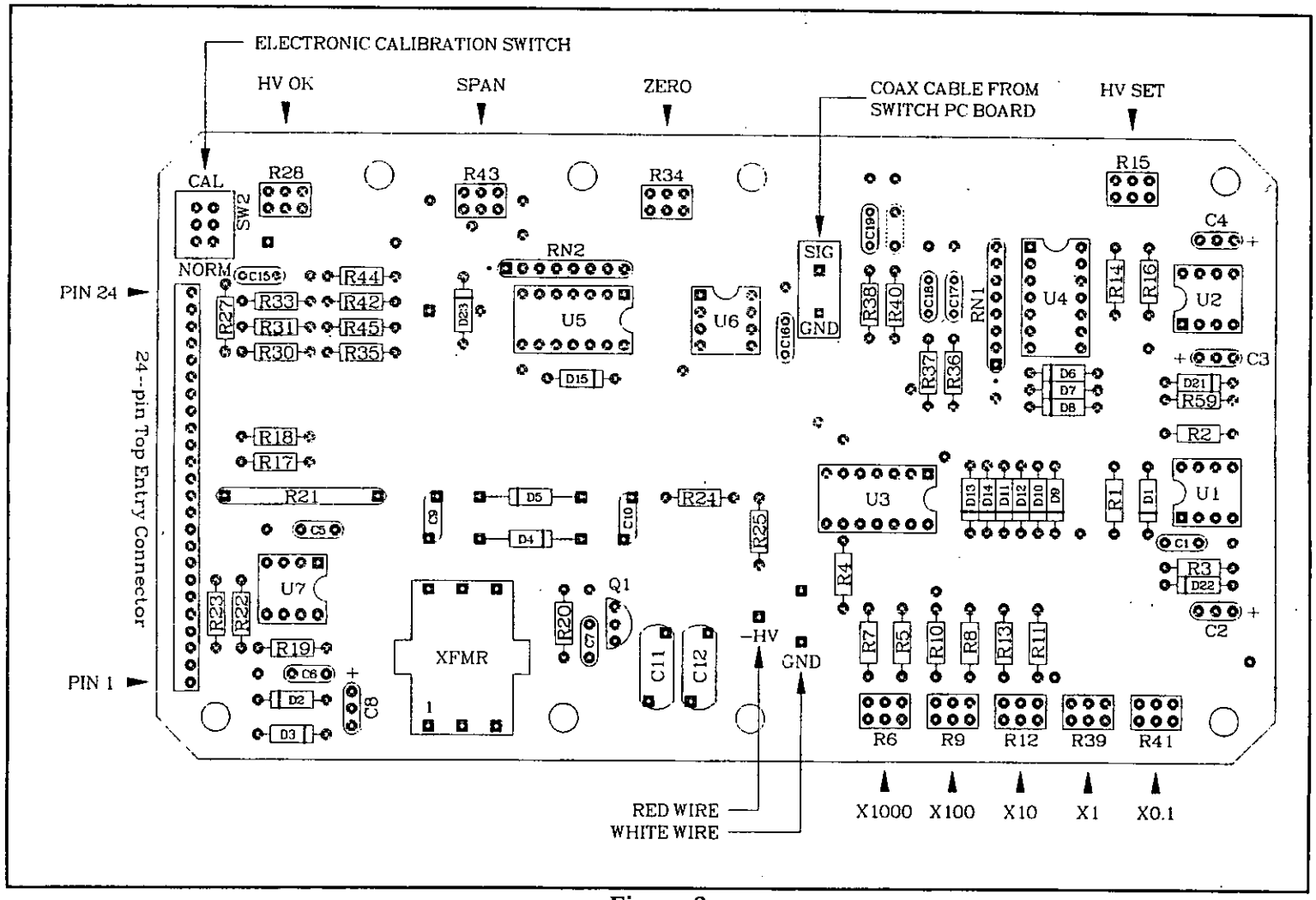

Figure 9
Main Circuit Board

Appendix A

BICRON ◆ NE Quality Control Acceptance Procedure Part No. 1056930 (Publication No. 1056-0-Q-0996-001) follows this page.

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Appendix B

Spare Parts List No. 1056910

Schematic Symbol	Description	Part No
	Main Board Assembly	9420009
C1, C7, C15	Capacitor, 0.047μF, film	9214731
C2, C3, C4, C8	Capacitor, 33μF, 16V, tan.	9233362
C5, C16, C18	Capacitor, 0.01μF, film	9211031
C6, C19	Capacitor, 0.1μF, film	9211041
C9, C10	Capacitor, 0.001μF, 3kV cer.	9201022
C11, C12	Capacitor, 0.01μF, 3kV cer.	9201032
C17	Capacitor, 0.0033μF, film	9213321
D1-D3, D6-D15, D21-D23	Diode, 1N4148	9600004
D4-D5	Rectifier, 2kV PIV	9600001
Q1	Transistor, 2N4124	9610001
R1, R24, R25, R33	Resistor, 1meg, 1/4w, 5%	8110044
R2	Resistor, 300k, 1/4w, 5%	8130034
R3	Resistor, 240k, 1/4w; 5%	8124034
R4	Resistor, 200k, 1/4w, 1%	8520034
R5	Resistor, 100k, 1/4w, 1%	8510034
R6, R9, R12, R15	Trimpot, 5k,	9395022
R7	Resistor, 2k, 1/4w, 1%	8520014
R8	Resistor, 121k, 1/4w, 1%	8512134
R10, R13, R16, R45	Resistor, 4.99k, 1/4w, 1%	8549914
R11, R42	Resistor, 82.5k, 1/4w, 1%	8582524
R14, R23	Resistor, 49.9k, 1/4w, 1%	8549924
R17	Resistor, 470k, 1/4w, 5%	8147034
R18	Resistor, 10 meg., 1/4w, 5%	8110054
R19	Resistor, 2.7k, 1/4w, 5%	8127014
R20	Resistor, 390 ohm, 1/4w, 5%	8139004
R21	Resistor, 1000 meg, 1%	8810071
R22, R40	Resistor, 499k, 1/4w, 1%	8549934
R27, R38	Resistor, 2 meg, 1/4w, 1%	8520044
R28, R29, R41	Trimpot, 5 meg	9395051
R30	Resistor, 1 meg, 1/4w, 1%	8510044
R31	Resistor, 11k, 1/4w, 1%	8511024
R34	Trimpot, 50k	9395031
R35	Resistor, 10k, 1/4w, 5%	8110024
R36, R37	Resistor, 2.99meg, 1/4w, 1%	8549944
R43	Trimpot, 500 ohm	9395011
R44	Resistor, 249 ohm, 1/4w, 1%	8524904
R59	Resistor, 150k, 1/4w, 1%	8515034
RN1, RN2	Resistor Network, 7 X 220k	8822031

Appendix B (cont'd)

Spare Parts List No. 1056910

Schematic Symbol	Description	Part No
SW2	Switch, Slide, 2P2T	9550025
U1	Integrated Circuit, ICL7663CPA	9640003
U2	Integrated Circuit, ICL7660CPA	9640005
U3-U5	Integrated Circuit, CD4016BEX	9650002
U6	Integrated Circuit, CA5160BEX	9640021
U7	Integrated Circuit, LF351, op-amp	9640008
XFMR	Transformer, M8149	9500001
	Connector, 24-pin	9780001
	Switch PC Board Assembly	9420008
C13, C21	Capacitor, 0.001μF, Film	9211021
C14	Capacitor, 0.22μF, Film	9212241
D16	Diode, IN3595	9600010
D17, D18	Diode, 1N4148	9600004
Q2, Q3	Transistor, 2N4124	9610001
R26, R29, R47, R48	Resistor, 1 meg, 1/4w, 5%	8110044
R32	Resistor, 10k, 1/4w, 5%	8110024
R46	Resistor, 681 ohm, 1/4w, 1%	8568104
R49	Resistor, 10meg, 1/4w, 5%	8110054
SW1	Switch, Rotary, 8-pos.	9560005
TP1, TP2	Test Points	9974007
	Header, 24-pin	9780002
	Detector/Battery PCB Ass'y (w/o Detector)	9420010
	Probe Assembly	9100139
	[Probe Assembly, low energy option]	9100317
	Mounting Bolts	9100046
	Miscellaneous	
BT1, BT2	Battery, 9V alkaline, MN1604	9750001
	Knob, round, with pointer	9770001
	User's Manual	1056900
	Spare Parts List	1056910
	Schematic Circuit Diagram	1056920
	QC Acceptance Procedure	1056930

Appendix B (cont'd)

Spare Parts List No. 1056910

Schematic Symbol	Description	Part No
Micro Rem Model Components		
	Case Top Assembly	1056140
SW3	Switch, Pushbutton, Momentary	9550008
	Rubber Switch Boot	9960018
	Handle	9710001
	Meter	9400043
	Meter window	9400011
	Meter Support Bracket Assembly	9850002
	Case Bottom Assembly	1056050
	[Case Bottom Ass'y, w/Extended Detector]	1056052
	[Case Bottom Ass'y, w/Low Energy Probe]	1083050
	[Case Bottom Ass'y, w/Ext'd. Det. & Low En. Probe]	1083052
Micro Sievert Model Components		
	Case Top Assembly	1058140
SW3	Switch, Pushbutton, Momentary	9550008
	Rubber Switch Boot	9960018
	Handle	9710001
	Meter	9400045
	Meter window	9400011
	Meter Support Bracket Assembly	9850002
	Case Bottom Assembly	1058050
	[Case Bottom Ass'y, w/Extended Detector]	1058052
	[Case Bottom Ass'y, w/Low Energy Probe]	1090050
	[Case Bottom Ass'y, w/Ext'd. Det. & Low En. Probe]	1090052

Note: Words in parentheses, ( ), add description to the items they follow;
Items in square brackets, [ ], are options that may be used in place of the preceding item.

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Appendix C

The drawings listed below follow this page.

1056920	Schematic Circuit Diagram
9700230	Component Location Drawing - Switch Printed Circuit Board
9700231	Component Location Drawing - Main Printed Circuit Board

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BICRON

BICRON ◆ NE
6801 Cochran Road
Solon, Ohio 44139
Telephone: (216) 248-7400
(800) 472-5656
Telefax: (216) 349-6581

Micro Rem / Micro Sievert™ Survey Meters

QC Acceptance Procedure

Publication No. 1056-0-Q-0996-001

* * * Release Date * * *

September 13, 1996

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Rev. A

Publication Number: 1056-0-Q-0996-001

Part No. 1056930, Rev. A

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WARNING
THE RISK OF LOW CURRENT, HIGH VOLTAGE ELECTRIC SHOCK EXISTS WHEN PERFORMING THIS PROCEDURE. CARE SHOULD BE EXERCISED WHENEVER WORK IS PERFORMED IN THE VICINITY OF THE INTERNAL HIGH VOLTAGE SUPPLY.

1.0 Initial tests

1. Perform a visual inspection of finished product.

Note: See Figures 1 and 2 for the location of all Circuit Board components.

2. Remove all 9 volt batteries and connect a 9.3 $\pm$0.05 volt power source across one set of battery terminals on the detector/battery board. Perform the following calibrations:

   a. Turn the control switch to the off position. Mechanically set the meter to zero via the rear zero adjustment screw on the meter barrel (requires right angle flat blade screw driver).

   b. Turn the control switch to the "BAT." position. Observe an upscale meter reading. Check the +5V power supply at Pin 1 of U1. The voltmeter should read 5 $\pm$0.5 VDC. Pin 1 of the 24-pin header strip should be used as the ground reference.

   c. Leave the control switch in the "BAT." position. Check the -5V power supply by connecting a voltmeter between pins 1 (ground reference) and the negative lead of C4 located on the main board. You should observe a reading of -4.5 $\pm$0.25 VDC.

   d. Turn the Control Switch to the X1000 position and connect a voltmeter between pins 1 (ground reference) and 21 (meter output) of the 24-pin header strip. Turn the "X1000" trim pot (R6) fully counter-clockwise (to lower the X1000 high voltage to the minimum value). Adjust the "ZERO" trim pot (R34) until the voltmeter reads 1 $\pm$0.5 mV.

   e. Turn the control switch to the bat. position. Adjust the "SPAN" trim pot (R43) (Figure 1) until the meter reads full scale.

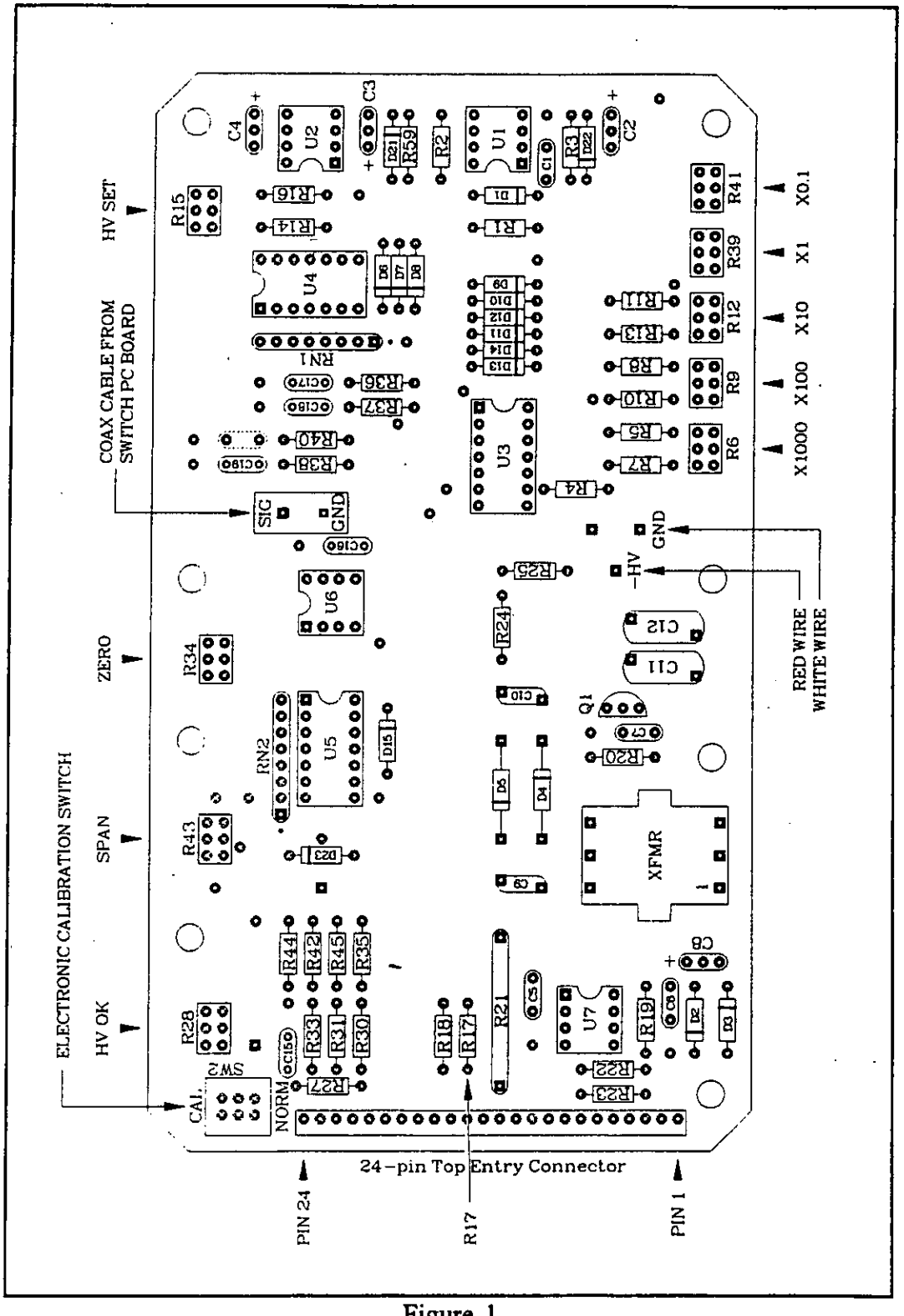


Figure 1
Main Circuit Board

2.0 High Range Isotopic Calibration

This step gives the procedure for calibrating the X1000, X100, X10, and the high end of the X1 range using external sources of radiation.

1. Turn the control switch to the X1000 position. Expose the unit to a ^{137}Cs field of 160 mR/h. Adjust the "X1000" trim pot (R6) (Figure 1) until the meter reads 160,000 μrem/h (1600 μSv/h).

2. Leave the control switch in the X1000 position. Expose the unit to a ^{137}Cs field of 40 mR/h. The meter should read 40,000 μrem/h (400 μSv/h).

3. Turn the control switch to the X100 position. Expose the unit to a ^{137}Cs field of 16 mR/h. Adjust the "X100" trim pot (R9) until the meter reads 16,000 μrem/h (160 μSv/h).

4. Leave the control switch in the X100 position. Expose the unit to a ^{137}Cs field of 4 mR/h. The meter should read 4000 μrem/h (40 μSv/h).

5. Turn the control switch to the X10 position. Expose the unit to a ^{137}Cs field of 1.6 mR/h. Adjust the "X10" trim pot (R12) until the meter reads 1600 μrem/h (16 μSv/h).

6. Leave the control switch in the X10 position. Expose the unit to a ^{137}Cs field of 0.4 mR/h. The meter should read 400 μrem/h (4 μSv/h).

7. Turn the control switch to the X1 position. Adjust the "X1" trim pot (R39) to the midpoint of its travel. Expose the unit to a ^{137}Cs field of 160 μR/h. Adjust the "HV SET" trim pot (R15) until the meter reads 160 μrem/h (1.6 μSv/h).

3.0 Low Range Calibration

This section give two procedures for calibrating the X0.1 range and the low end of the X1 range. Section 3.1 Isotopic gives the calibration procedure for these ranges using a low power (0.61 μCi ^{137}Cs) source and a special fixture. Because this source is only marginally higher than background radiation, an alternate method using electronic pulse generator is described in Section 3.2 Pulse Count.

3.1 Isotopic Method

1. Leave the control switch in the X1 position. Expose the unit to a ^{137}Cs field of 40 μR/h. The meter should read 40 μrem/h (0.4 μSv/h).

2. Turn the control switch to the X0.1 position. Place the instrument in a low background chamber constructed of lead bricks at least 4" thick. Place the check source fixture (Figure 3) on the end of the detector assembly (Figure 4). Put the entire assembly in the low background chamber.

   NOTE: The recommended check source for this calibration procedure is a 0.61 μCi ^{137}Cs source. When placed in the fixture, the check source is spaced 13cm from the center of the tissue-equivalent scintillation detector. This produces a dose rate of 12 μrem/h (0.12 μSv/h) on the detector.

   Adjust the "X0.1" trim pot (R41) until the meter reads 12 μrem/h (0.12 μSv/h). Remove the instrument from the low background chamber. Remove the check source fixture from the instrument. Place the instrument back into the low background chamber. Note the meter reading on the instrument.

   Remove the instrument from the low background chamber, and re-attach the check source fixture. Place the instrument back into the low background chamber. Adjust the "X0.1" trim pot (R41) until the meter reads 12 μrem/h (0.12 μSv/h) plus the background just measured. If this procedure is repeated two or three times, you will have calibrated both the background inside the low background chamber and the X0.1 range of the instrument at approximately 80% of full scale.

3. Leave the control switch in the X0.1 position. Place the instrument, without the check source fixture, inside the low background chamber. The instrument should read actual background.

4. Note all readings (X1000 through X0.1) on a Certificate of Calibration.

This completes the calibration procedure, go to Section 4.0 Wrap up.

3.0 Low Range Calibration (cont'd)

3.2 Electronic Pulse Method

This section describes a procedure for calibrating the low range of the instrument using an electronic pulse generator. The following equipment is needed for this procedure:

- Eberline MP-2 Pulser
- E-Z-Hook No. 102060 Coax Cable with Clip Hooks.

The procedure you will use will depend on which of two versions of the Main PC Board is in your instrument. Revision levels "C" and later have a Calibration Switch (SW2) which disables the Anti-saturation Circuit and turns the High Voltage off. See Figure 1 for the location of this switch. If your instrument has this switch, follow the instructions in Section 3.2.1 New Board. If your instrument does not have this switch, follow the instructions in Section 3.2.2 Old Board.

3.2.1 New Board

1. On the Micro Rem, toggle the Calibration Switch (SW 2) on the Main PC Board (Figure 1) to the CAL position. (This will disable the anti-saturation circuit and turn the High Voltage off.)

   Set the Pulser to the following conditions:

Control	Setting
Frequency Base Switch	16
Frequency Multiplier Switch	1k
Variable Frequency Dial	"Cal."
Amplitude Dial	3 volts
Fine Amplitude Dial	fully counter-clockwise

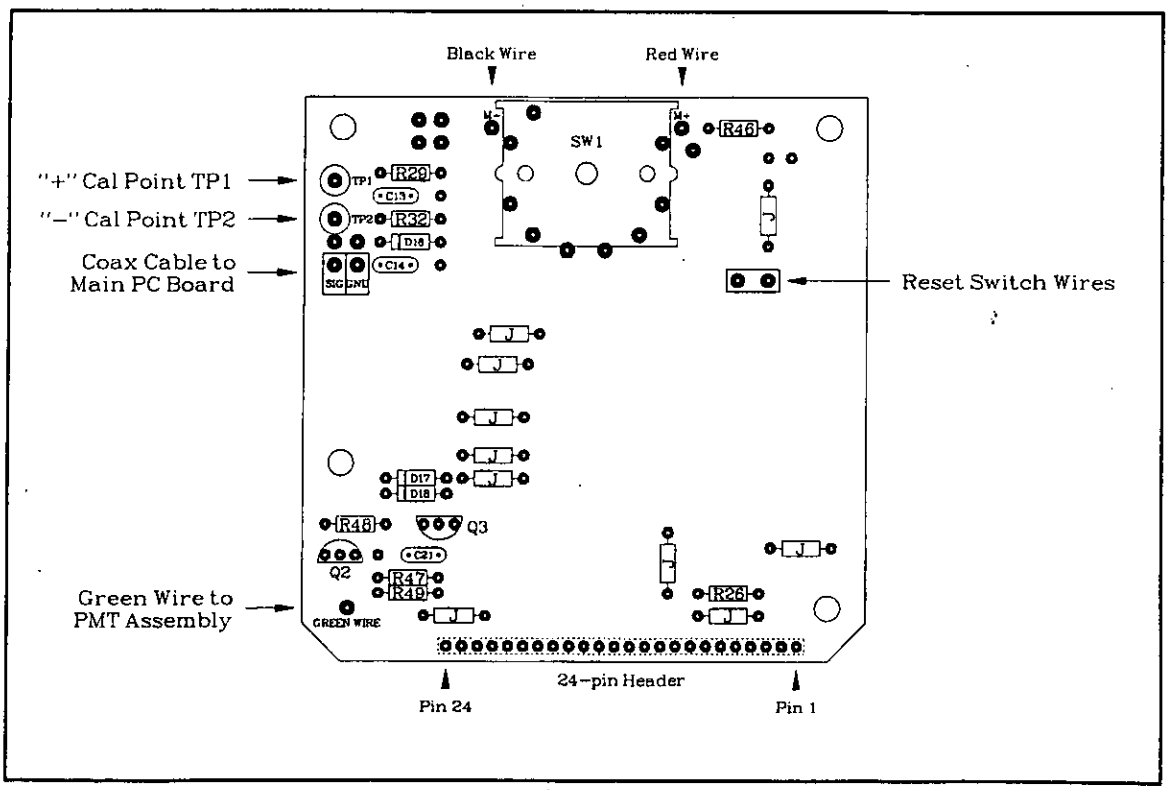


Figure 2
Switch Circuit Board

3.0 Calibration (cont'd)
3.2 Electronic Pulse Method (cont'd)
3.2.1 New Board (cont'd)

Plug the E-Z-Hook Coax Cable into the output jack of the Pulser. On the Micro Rem, connect the red lead to Test Point TP1 on the Switch PC Board. Connect the black lead to the Analog Ground Test Point Test Point TP2 on the switch PC Board.

2. Turn the Micro Rem Selector Switch to the High Voltage Position. The meter should indicate zero. Then turn the Micro Rem Selector Switch to "X1". The unit should not be full scale (if full scale anti-saturation is not disabled).

3. Slowly turn the Fine Amplitude dial clockwise on the Pulser until a reading of 160 μrem/hour (1.6 μSv/hour) is indicated on the Micro Rem Meter.

   On the Pulser, turn the Frequency Base Switch to 4. The Micro Rem should read 40 μrem/hour (0.4 μSv/hour).

4. On the Pulser, set the Frequency Base Switch to 16. Now decrease the Frequency by a factor of ten by switching the Multiplier Switch down to 100.

   Set the Micro Rem Selector Switch to the X0.1 range. Adjust the "X0.1" trim pot (R41) on the Micro Rem until the meter reads 16 μrem/hour (0.16 μSv/hour).

   Now decrease the Frequency of the Pulser by a factor of four, by switching the Base Switch to 4. The Micro Rem should now read 4 μrem/hour (0.04 μSv/hour).

5. Power down the Pulser and then the Micro Rem. Remove the Clip Hooks going to the Micro Rem test Points. On the Micro Rem, toggle SW2 on the Main PC Board to the NORM position to restore the Micro Rem to normal operation.

   Check for normal operation. Set the Micro Rem to the X0.1 Range. The meter should read normal background.

6. Note all readings (X1000 through X0.1) on a Certificate of Calibration.

This completes the calibration procedure, go to Section 4.0 Wrap up.

3.0 Calibration (cont'd)
3.2 Electronic Pulse Method (cont'd)

3.2.2 Old Board

1. On the Micro Rem, disable the HV supply by connecting a jumper wire between pin 1 (analog ground) and either side of resistor R17 (Figure 1).

   Disable the anti-saturation Circuit by connecting a jumper wire between pin 1 (Analog ground) and the collector of transistor Q2 on the Switch Board (Figure 2).

   Set the Pulser to the following conditions:

Control	Setting
Frequency Base Switch	16
Frequency Multiplier Switch	1k
Variable Frequency Dial	"Cal."
Amplitude Dial	3 volts
Fine Amplitude Dial	fully counter-clockwise

   Plug the E-Z-Hook Coax Cable into the output jack of the Pulser. On the Micro Rem, connect the red lead ("+") to the cathode (banded end) of D16 (Figure 2). Connect the black lead ("-") to pin 1 of the 24-pin header.

2. Turn the Micro Rem Selector Switch to the High Voltage Position. The meter should indicate zero. Turn the Micro Rem Selector Switch to "X1". The unit should not show full scale (if full scale anti-saturation is not disabled).

3. Turn the Pulser on. Slowly turn the Fine Amplitude dial clockwise on the Pulser until you see a reading of 160 μrem/hour (1.6 μSv/hour) on the Micro Rem Meter.

   On the Pulser, turn the Frequency Base Switch to 4. The Micro Rem should read 40 μrem/hour (0.4 μSv/hour).

4. On the Pulser, set the Frequency Base Switch to 16. Now decrease the Frequency by a factor of ten by switching the Multiplier Switch down to 100.

   Set the Micro Rem Selector Switch to the X0.1 range. Adjust the "X0.1" trim pot (R41) on the Micro Rem until the meter reads 16 μrem/hour (0.16 μSv/hour).

   Now decrease the Frequency of the Pulser by a factor of four, by switching the Base Switch to 4. The Micro Rem should now read 4 μrem/hour (0.04 μSv/hour).

5. Power down the Pulser and then the Micro Rem. Remove the Clip Hooks from the Micro Rem test Points and remove jumpers from R17 and Q2.

   Check for normal operation. Set the Micro Rem to the X0.1 Range. The meter should read normal background.

6. Note all readings (X1000 through X0.1) on a Certificate of Calibration.

This completes the calibration procedure, go to Section 4.0 Wrap up.

4.0 Wrap-up

1. Test the Reset Pushbutton Switch as follows: Leave the Control switch on the X0.1 range. Press the Reset Switch. The meter should quickly go to zero. Release the Reset Switch. The meter should return to its background reading.

2. Turn the control switch to the HV position. Adjust the "HV OK" trim pot (R28) until the meter indicates a reading in the center of the "HV ok" checkband.

3. Remove all test equipment. Turn the instrument off, and install two 9V alkaline batteries (MN-1604 or equivalent) into the battery holders.

4. Complete, date, and sign a Certificate of Calibration.

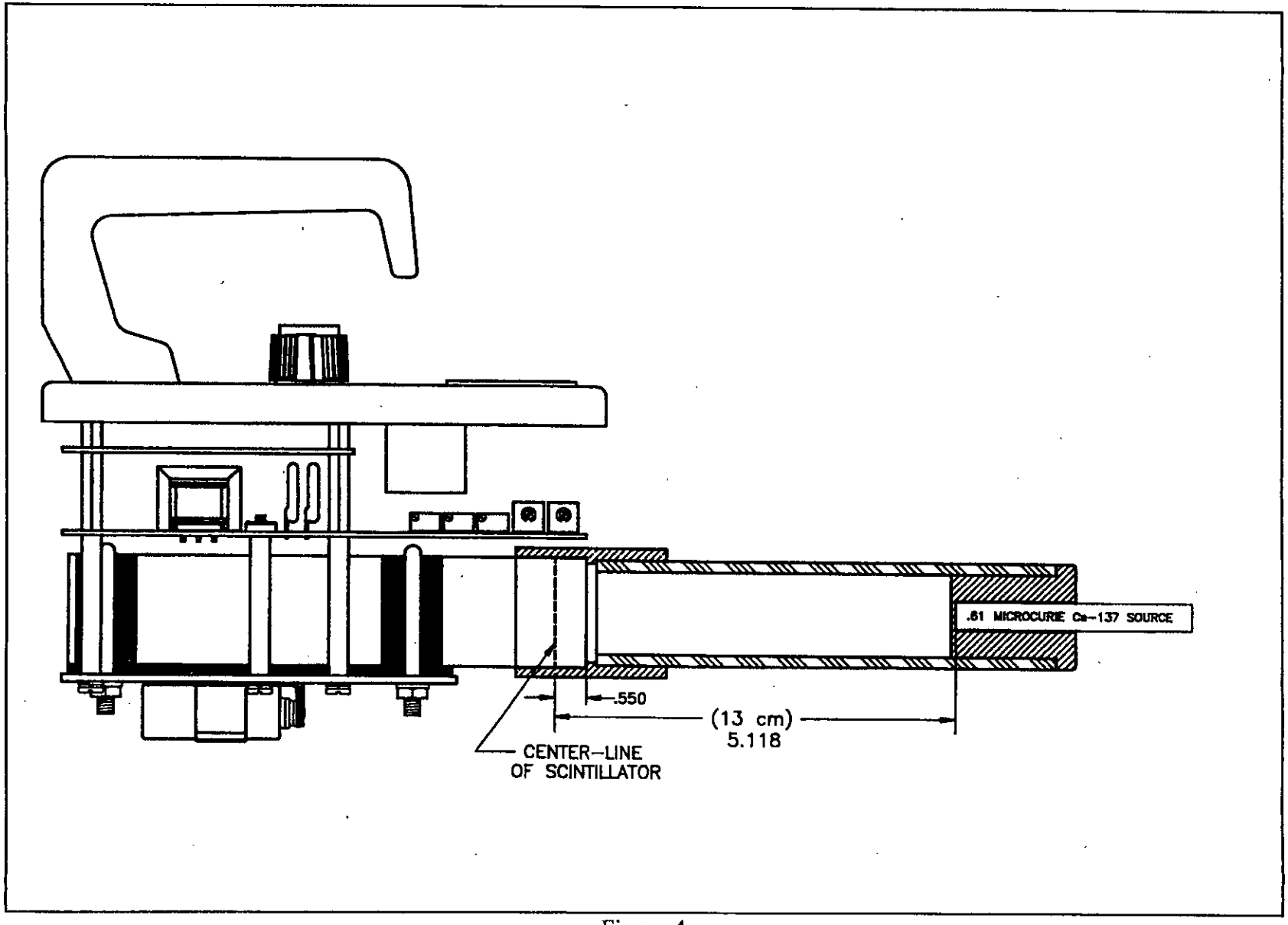


Figure 4
Meter with Check Source Fixture Attached

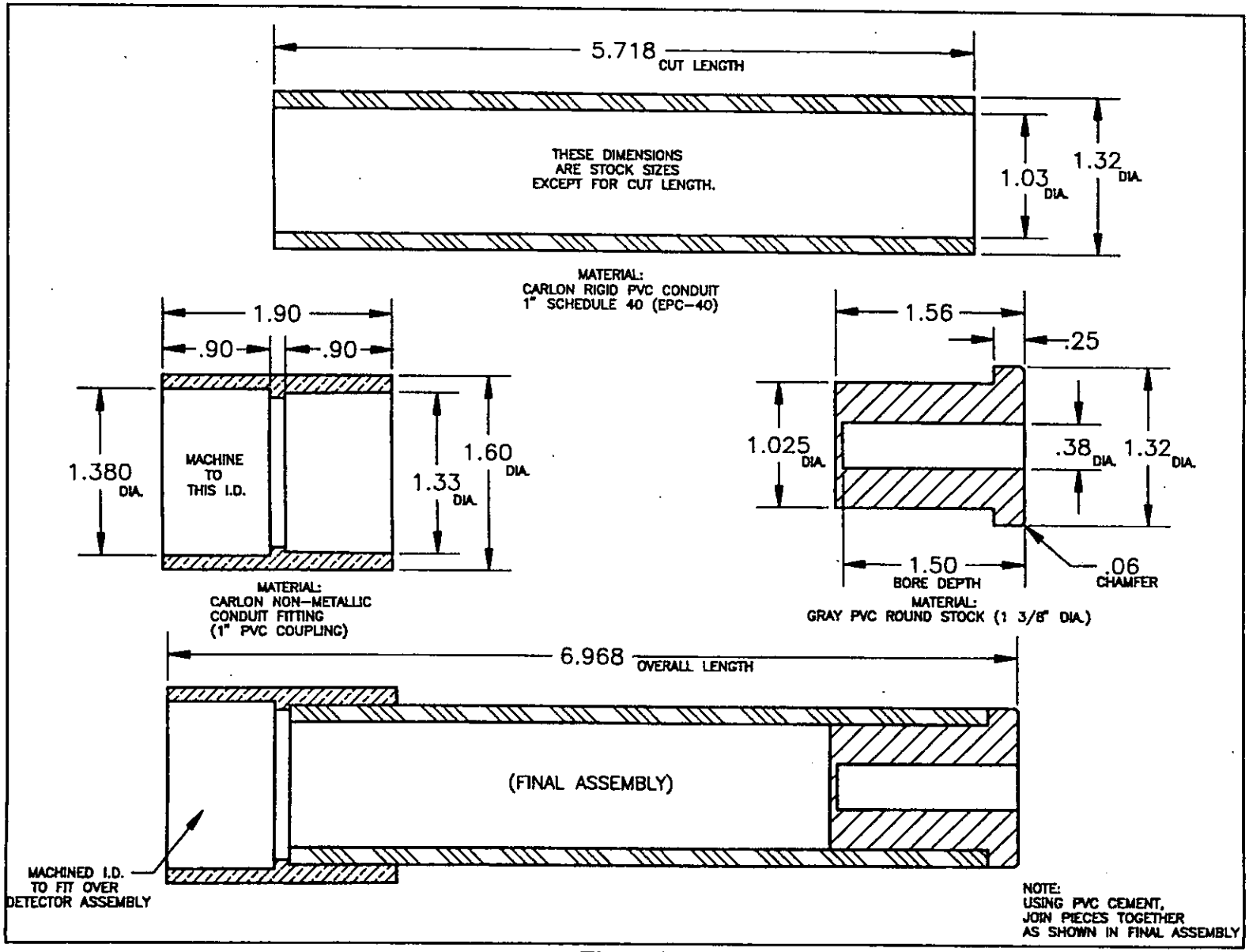


Figure 3
Check Source Fixture

IMPORTANT! Instructions on Returning Items for Calibration or Repair

To help you get your equipment to us for repair or calibration and to help us do the work and return the equipment to you as quickly as we can, we ask that you fill out this form and enclose it with the items you're sending. A reminder: if your instrument uses an external GM probe and is to be calibrated in mR/h, please send the probe with the instrument.

Be sure to read the warranty statement which accompanied your equipment (it's usually in the front of the tech manual). It describes what's covered and what we can do for you under warranty, and provides other useful information as well. If you have any questions or need help filling out this form, just give us a call.

To: BICRON ◆ NE / Electronic Products
6801 Cochran Road
Solon, Ohio 44139 USA

Tel: (216) 248-7400
Toll Free: (800) 472-5656
Fax: (216) 349-6581

Please list what you're sending to us:		Date
Model	Serial Number	P.O. # for this calibration or repair
		If the units are in for calibration only, please mark here. ☐ If you need a cost estimate for calibration or non-warranty repairs, please mark here. ☐

If your units need repair, please describe the problems you're encountering with them (use the back of this form or a separate sheet if necessary).

Whom should we contact about this return?	To what address should we send the units when we're done?
Name	
Company	
Phone #	
Fax #	

BICRON ♦ NE 6801 Cochran Road • Solon, Ohio 44139 USA
Tel: (440) 248-7400 • Toll Free: 800-472-5656 • Fax: (440) 349-6581
http://www.bicron.com

AUTHORIZED REPAIR SERVICE REPRESENTATIVES
October 6, 1998

ALARA CONSULTANTS, INC.
9528-27 Avenue
Edmonton, Alberta
T6N 1B2 Canada
403/944-2557 (Fax) 403/944-2558
Allan Seitz

APPLIED HEALTH PHYSICS
2986 Industrial Blvd.
Bethel Park, PA 15102
412/835-9555 (Fax) 412/835-9559
Robert Gallaghar

GTS INSTRUMENT SERVICES, INC.
2045 Route 286
Pittsburgh, PA 15239
724/733-1900
James Christopher

HEALTH PHYSICS NORTHWEST
11535 South West 67th Street
Tigard, OR 97223
503/620-6617 (Fax) 503/684-5548
Mickey

W. H. HENKEN INDUSTRIES, INC.
415 Lillard Road
Arlington, TX 76012
817/261-5566 (Fax) 817/261-5555
Scott Henken

STAN A. HUBER CONSULTANTS, INC.
200 N. Cedar Road
N. Lenox, IL 60451
815/485-6161 (Fax) 815/485-4433
Stan Huber

JRT CALIBRATION SERVICES
1200 East High St. - Suite 111
Pottstown, PA 19464
610/327-9610
Harold Harbison

K & S ASSOCIATES
1926 Elm Tree Drive
Nashville, TN 37210
800/522-2325 or 615/883-9760
(Fax) 913/789-8758
Phil Green (Repair); Richard Hardison (Calibration)

MID AMERICA CALIBRATIONS
5500 Buena Vista, #101
Shawnee Mission, KS 66205
913/789-8757 (Fax) 913/789-8758
800/488-1391, Karl Artinger

NC SYSTEMS, INC.
5660 Airport Blvd. - Suite 101
Boulder, CO 80301
303/541-0044
Charles H. Rose

NWT ANALYTIC & CONSULTATION
1236 Concannon Blvd.
Livermore, CA 94550
510/443-7967
Don Wadsworth

RADIATION DETECTION COMPANY
162 Wolfe Road
Sunnyvale, CA 94086
408/735-8700
Richard H. Holden

RADIATION MANAGEMENT SERVICES, INC. (RMS)
757 McKay Road, Unit #1
Pickering, Ontario Canada L1W 3C8
905/428-8060 (Fax) 905/428-8451
Michael White

RADIATION SAFETY & CONTROL SERVICES
91 Portsmouth Avenue
Stratham, NH 03885
800/525-8339 or 603/778-2871
Mike Fuller

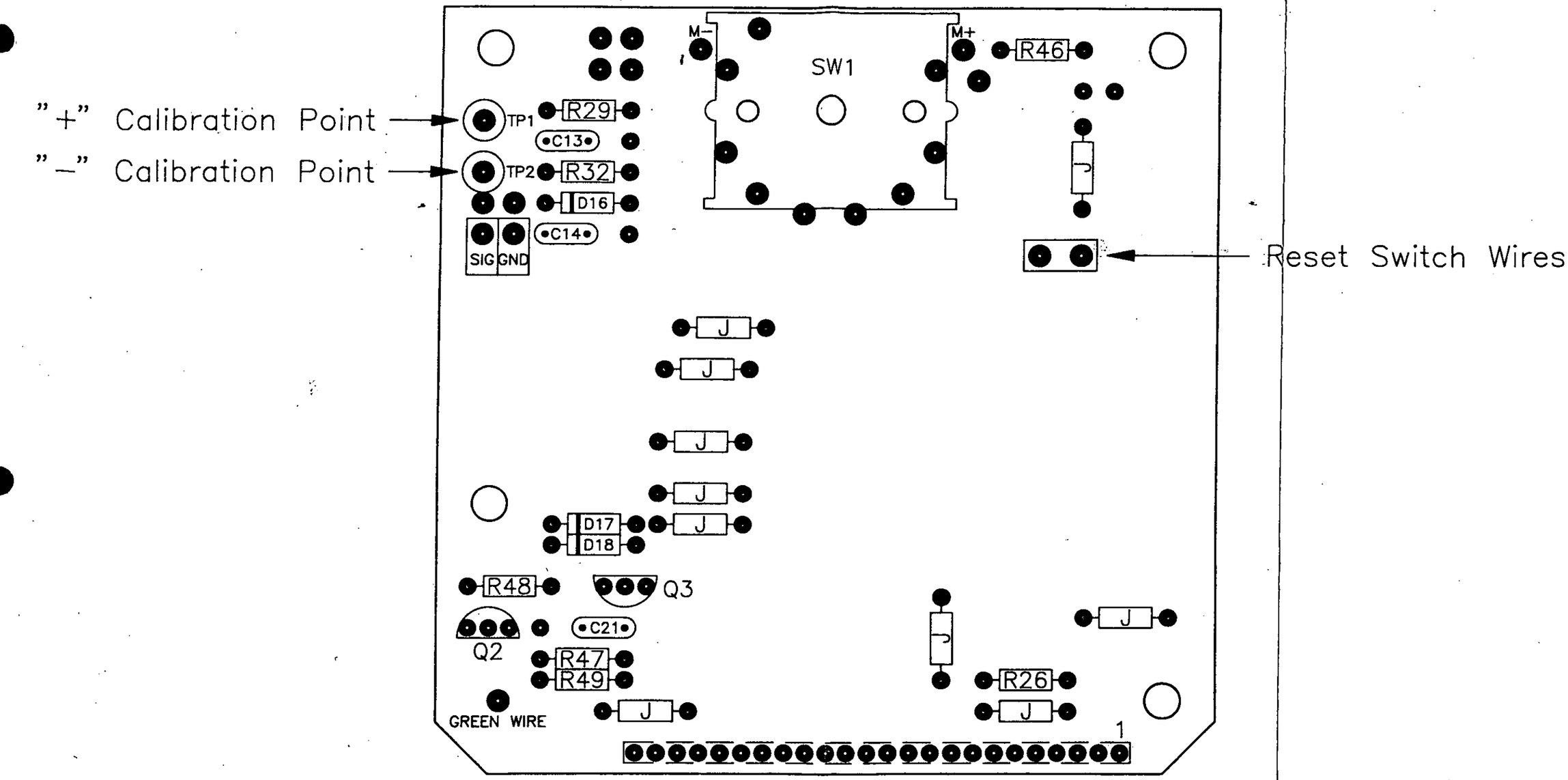
RSSI
6312 W. Oakton St.
Morton Grove, IL 60053-2723
847/965-1999
Eli A. Port

SAN ONOFRE NUCLEAR GENERATING STATION
PO Box 128
San Clemente, CA 92672
949/368-6784
Dick Warnock

SOUTHEASTERN ATOMICS LAB
1354 N. W. 53rd Avenue
Gainesville, FL 32601
904/372-9716
Don Price

TECHNICAL SERVICES GROUP, INC.
675-C Progress Center Avenue
Lawrenceville, GA 30243
404/822-9117
Alan Farriba

R.M. WESTER & ASSOCIATES, INC.
215 Indacom
St. Peters, MO 63376
314/928-9628
Tjaden Meyer



24–pin Header

REV	DATE	DESCRIPTION	ECN
A	9–26 94	Updated component view. KJV	IN–1058
JAR			JAR
BY			BY

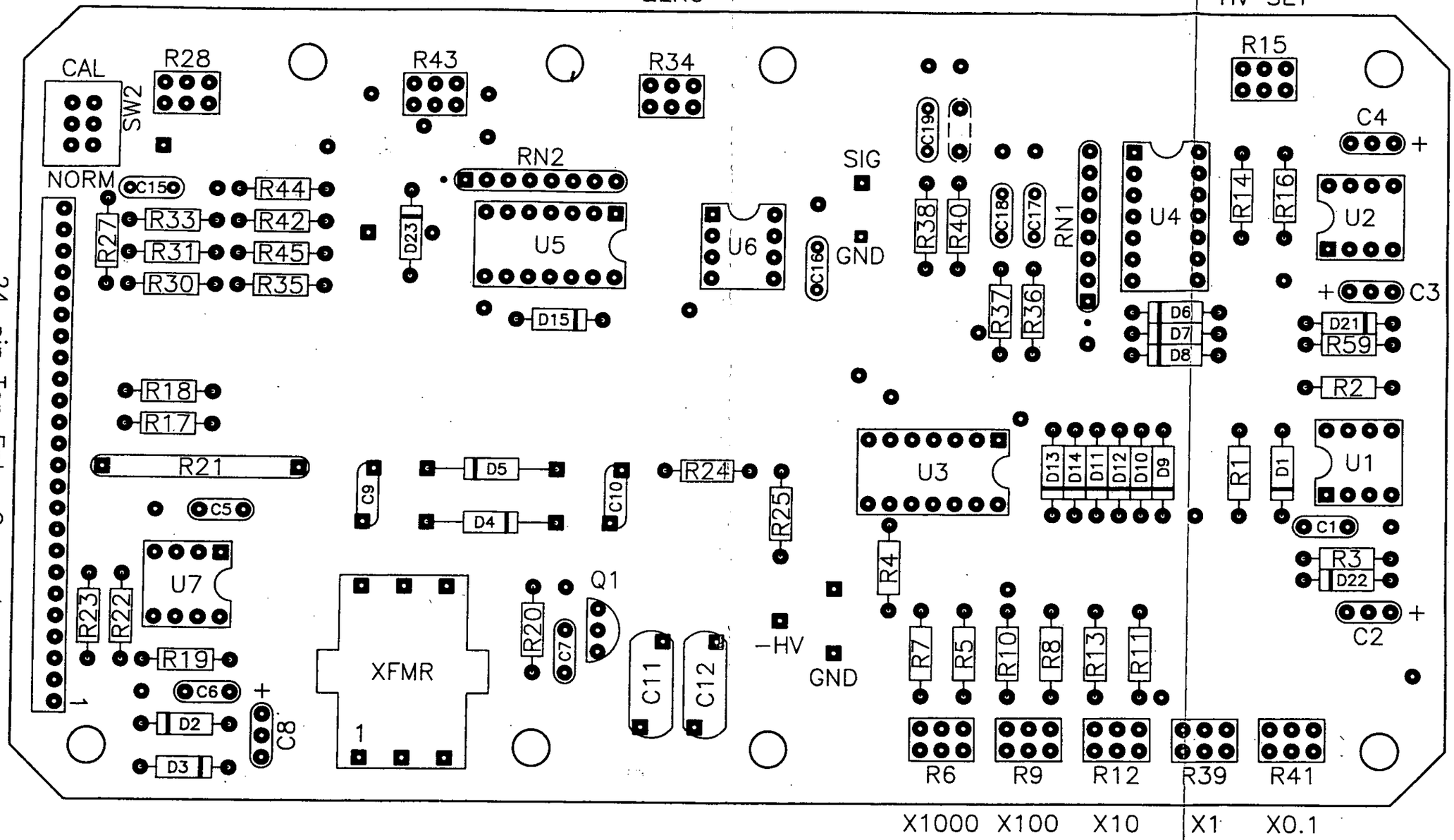
TOLERANCES UNLESS OTHERWISE SPECIFIED	SCALE: 2X
FRAC.:	DRAWN: JAR
.X:	DATE: 10–18–93
.XX:	CHECKED: KJV
.XXX: NONE	DATE: 10–19–94
ANGLES:	
MICRO FIN.: √	
DE–BURR AND BREAK ALL EDGES	DO NOT SCALE PRINT

HARSHAW BICRON RADIATION MEASUREMENT PRODUCTS
SOLON, OHIO U.S.A.

Component Location Drawing

MicroRem/Sievert Switch PCB

DWG. SIZE	BASIC PART NUMBER	REV.
B	9700230	A



A	9–26 94	Updated component view. KJV	IN–1058
JAR			JAR
REV	DATE	DESCRIPTION	ECN
BY			BY

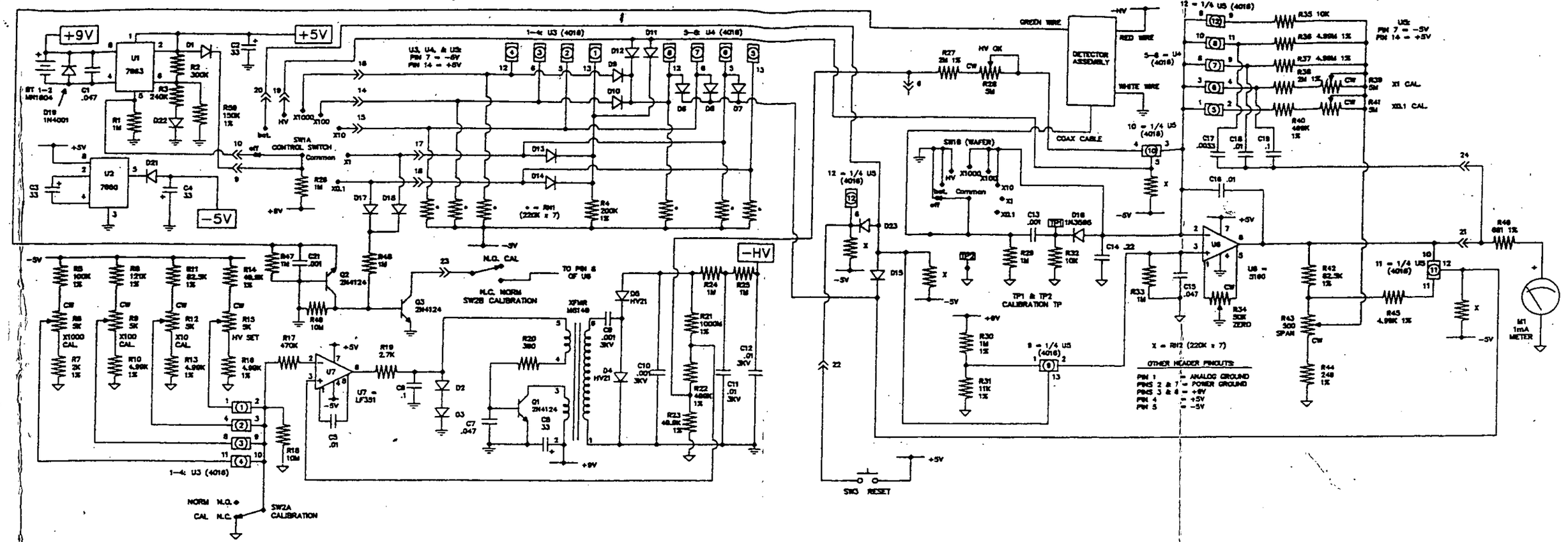
TOLERANCES UNLESS OTHERWISE SPECIFIED	SCALE: FULL
FRAC.:	DRAWN: JAR
.X:	DATE: 10–18–93
.XX:	CHECKED: KJV
.XXX: NONE	DATE: 10-19-94
ANGLES:	
MICRO FIN.: √	
DE–BURR AND BREAK ALL EDGES	DO NOT SCALE PRINT

HARSHAW BICRON RADIATION MEASUREMENT PRODUCTS
SOLON, OHIO U.S.A.

Component Location Drawing
MicroRem/Sievert Main PCB

DWG. SIZE	BASIC PART NUMBER	REV.
B	9700231	A

M



REV	DATE	DESCRIPTION	ECN
E RJD	3-27 97	Returned to Revision "C"	IN-1253
D JAR	11-4 96	Added audio; adj. response to circuit design.	IN-1226
C JAR	9-16 94	Add SW2 & 3; D23; TP1 & 2; Swap D7 & D8; updated notes.	IN-1058
B	10-11 93	D16 was 1N4148; U6 was CA3160E	JAR
BY			BY

TOLERANCES UNLESS OTHERWISE SPECIFIED
FRAC.:
.X:
.XX: ±.010
.XXX: ±.005
ANGLES:
MICRO FIN.: √
DE-BURR AND BREAK ALL EDGES

SCALE: NONE
DRAWN: JAR
DATE: 2-13-87
CHECKED:
DATE: 3-27-97
DO NOT SCALE PRINT

HARSHAW BICRON RADIATION MEASUREMENT PRODUCTS
SOLON, OHIO U.S.A.

Schematic Circuit Diagram
Micro REM

DWG. SIZE	BASIC PART NUMBER	REV
B	1056920	E