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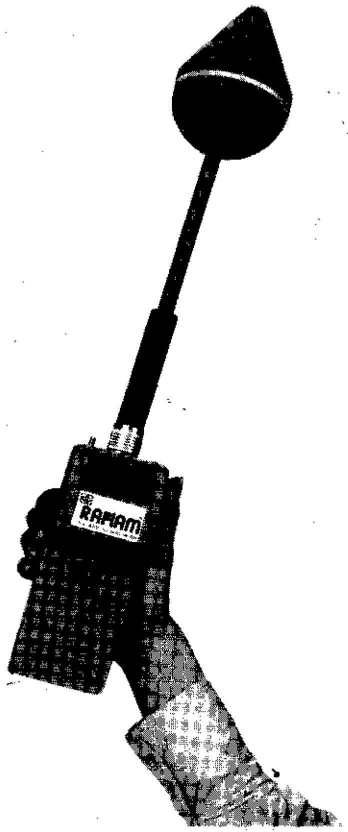

RAHAM™

Model 4C

ISOTROPIC WIDEBAND ELECTROMAGNETIC RADIATION HAZARD M[illegible]RS

OPERATING AND SERV[illegible]ANUAL

General Microwave RAHAM* meets requirements specified for test equipment in the IMPI (International Microwave Power Institute) "Performance Standard on Leakage from Industrial Microwave Systems," dated August 1973, and measures power density levels in accordance with the standards, present and proposed, established by OSHA and the Department of Defense.

READ ON 2·0. SCALE

1 mW/cm² **WARNING** MAX.

REFER TO AS2772.1 1990, ALSO TP01479 (Z) PAGE 39

Harmful effects may result from exposure to electromagnetic radiation in the frequency range from 10 MHz to 100 GHz. The currently approved CW radiation protection guide from the American Standards Institute (ANSI document C95.1-1974) is 1 mW/cm^2. For modulated fields the power density of 1 mW/cm^2 as averaged over any six minute period should not be exceeded. These requirements adhere to Occupational Safety and Health Standard 1910.97-Nonionizing Radiation recommendations, and pertain to both whole body irradiation and partial body irradiation.

More stringent recommendations formulated (but not yet approved) by the American National Standards Institute (ANSI document C95.1-1982) designate different maximum power density levels at different frequency ranges. These are summarized below:

Frequency Range (MHz)	**Power Density** (mW/cm^2)
0.3-3	100
3 -30	900/f^2
30 -300	1.0
300 -1500	f/300
1500 -100,000	5.0

This limitation relates not only to power density but also duration. Consult document C95.1-1982 for further guidelines.

Always approach an unknown field cautiously, starting from as far away as possible and extending the RAHAM probe at arm's length toward the energy source. Allow two or three seconds for the instrument to respond. Observe all safety precautions. Do not walk into a suspected radiation field until the power density is determined to be safe.

*Patent Nos. 3,931,575; 4,207,518 and 4,392,108

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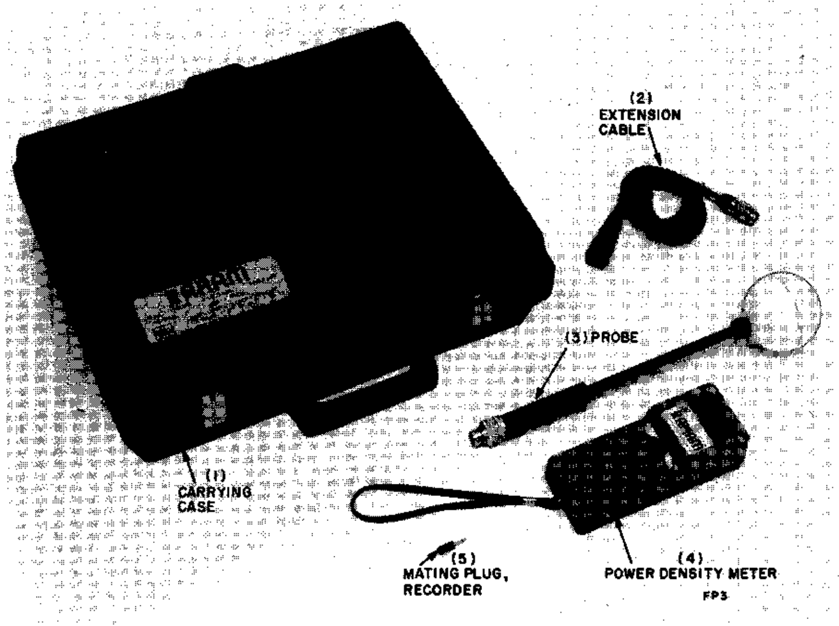

Figure 1. Model 7 RAHAM

SECTION I

INTRODUCTION

1-1. GENERAL. The RAHAM™* Model 4C is a portable, battery-operated meter, as shown in figure 1. It detects and measures potentially hazardous electromagnetic radiation from RF and microwave sources. Electrical, mechanical and performance characteristics of this model are described in table 1. It is ideally suited for use with:

- Microwave Ovens
- Medical Equipment
- Radar Installations
- Microwave Heaters and Dryers
- Communications Systems
- Electronic Warfare Systems

1-2. DESCRIPTION. The Model 4C RAHAM consists of the items in the following list. The index numbers correspond to those shown in figure 1.

INDEX NO.	DESCRIPTION
1	Carrying Case
2	Extension Cable
3	Model 84C Probe
4	Model 484 Meter
5	Mating Plug, Recorder

1-3. SENSING PATTERN. Model 84C Probe employs three orthogonally mounted thin-film circuits on glass substrates that provide isotropic response; they detect radiation from all directions except from or through the handle, as shown in figure 2. The probes are factory calibrated to permit field interchangeability with all Model 484 Power Density Meters.

*RAdiation HAzard Meter

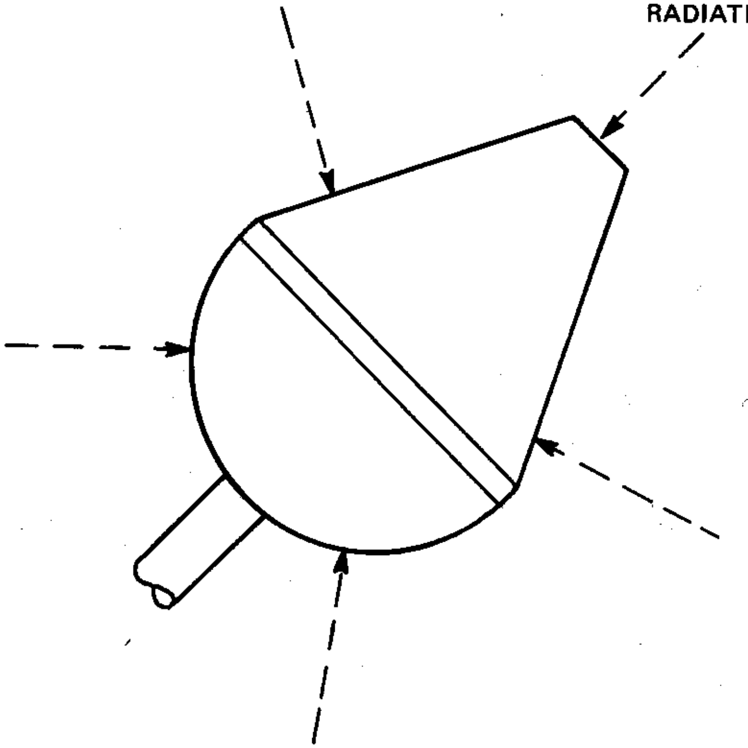

Figure 2. Isotropic Radiation Sensing Pattern

SECTION II

SPECIFICATIONS

Table 1. Model 4C Technical Specifications

FEATURE	DESCRIPTIVE DATA
Frequency Range	200 kHz to 26 GHz
Power Density Ranges	40 dB dynamic range. Four ranges with full scale readings of 0.02 mW/cm^2, 0.2 mW/cm^2, 2 mW/cm^2, and 20 mW/cm^2.
Frequency Sensitivity	±1.25 dB from 200 kHz to 26 GHz
Calibration Frequencies	0.2, 2, 27, 100 MHz 1.2, 2.45, 3.8, 8, 12, 18, 26 GHz
Calibration Accuracy	±0.5 dB
Average Power Overload*	1 W/cm^2
Peak Power Overload*	100 W/cm^2
Pulse Energy Density Overload*	300 W-μsec/cm^2
Isotropy	Response varies ±1.0 dB (max) for energy incident from any direction except from/through handle.
Noise	Less than 3% peak-to-peak on most sensitive range
Response Time	1.5 seconds (approx)
Battery Operation	900 hours (expendable)
Recorder Output	0.124 volt full scale into a nominal resistance of 100K ohms
Operating Temp. Range	0°C to +55°C
Size:	
Power Density Meter	2.50" x 1.63" x 6.38" (64 x 41 x 162 mm)
Probe	14.25" long x 2.75" max dia (362 x 70 mm)
Cable Assembly	4' long (1.22 m)
Carrying Case	15.5" x 12.25" x 4.75" (394 x 311 x 120 mm)
Weight	5.5 lbs (2.5 kg)

*at 25°C

SECTION III

OPERATION

3-1. GENERAL INFORMATION.

The user has the option of mounting the probe directly on the power density meter or connecting it with the extension cable. While the directly connected probe offers convenient one-hand operation, the cable connected arrangement allows greater flexibility in probing for radiation fields in awkward or cramped areas, as well as permitting the operator to more effectively shield himself from potentially hazardous fields.

WARNING

User may be exposed to potentially hazardous electromagnetic radiation levels. Review and adhere to all safety procedures before entering a suspected radiation field.

Power density evaluations should include:

(1) Evaluation of radiating sources from the standpoint of personnel hazard potential; this will include calculation or estimation of expected RF power density levels.

(2) Planning and conducting a comprehensive survey of potential hazard areas.

(3) Correlation of calculated values with measured data to ensure minimum error.

Pre-evaluation of potentially hazardous areas is important. The direction and distance of sources, frequency and strength of the sources, and prominent features of the physical environment are significant to the structure of a radiation field. Differences in power density readings may result from multipath interference, standing waves, or multiple sources with different characteristics. This leads to complex radiation fields with "hot spots" at different locations for different frequencies. Moreover, some fields may fluctuate if the sources are moving antenna beams.

When measuring radiation leakage from poorly designed electronic equipment, the user deals with the field complexities, with the additional problem of locating the radiation source (e.g., a crack in the shielding cabinet or poorly grounded connecting cables). Thus, the technique differs for monitoring antennas as compared to a trial and error survey for detection of leakage or direct radiation from low power equipment.

Calculation of expected power density levels prior to entering the radiation field is desirable. The method of calculation is beyond the scope of this instruction manual. However, to obtain the average radiated power from the antenna and the resultant power density at any point in space requires consideration of the following parameters:

- Rated peak power (PP)
- Pulsewidths (PW)
- Pulse repetition frequency (PRF)
- Operating frequency (f)
- Antenna:

  type and gain
  orientation limits
  beam width
  height above ground

The power density meter indicates in units of mW/cm^2. For some applications it is desired to measure RF signals in field strength (Volts/Meter) rather than in power density (mW/cm^2). To convert from mW/cm^2 to V/M use the following equation:

$$E\,(v/m) = 61.4\sqrt{P}$$

Where P is that value measured on the RAHAM meter in mW/cm^2.

3-2. SAFETY PRECAUTIONS.

The following precautions are mandatory (ANSI C95.3-1973) where calculations indicate the possibility that safe levels may be exceeded:

(1) The transmitting antenna is never pointed directly at monitoring personnel for the initial power measurement at any point. Orientation of the antenna and other procedures related to the survey are performed at the direction of the monitoring personnel.

(2) System operators should observe instructions issued by the monitoring personnel. The transmitting antenna should be moved slowly to prevent accidental exposure to high levels of radiation.

(3) When there is a probability that exposure of monitoring personnel will exceed the recommended levels, remote detecting devices should be used or the average power output reduced and the readings raised proportionately.

(4) Protective clothing or shielded vans should be used by monitoring personnel when exposure to high radiation levels is possible.

(5) To prevent inadvertent exposures to radiation, occupancy of an area must be controlled while measurements are made.

3-3. OPERATING CONTROLS.

INDEX NO. FIGURE 3	CONTROL/ INDICATOR	FUNCTION
1	BATTERY CHECK PUSHBUTTON	Depress to check battery condition. Reading in green zone indicates condition is GOOD; in red zone, that they should be REPLACED.
2	PROBE CONNECTOR	Input to power density meter.
3	RECORDER OUTPUT JACK	To enable a permanent record of power density versus time to be made, or to permit remote monitoring of radiation level.
4	MECHANICAL ZERO	Use ONLY when performing the calibration procedure in section 6.
5	POWER ON-OFF	Set switch to ON to operate unit. When not in use, set switch to OFF to conserve battery life.
6	RANGE SELECTOR	To select a full scale range of 0.02, 0.2, 2 and 20 mW/cm^2.
7	CASE COVER (REAR)	For convenient reference, simplified operating instructions are provided on the rear of the power density meter.
8	ZERO ADJUST	Use to electrically set the meter indicator to zero.
9	METER	Meter indicates readout in mW/cm^2 and battery condition.

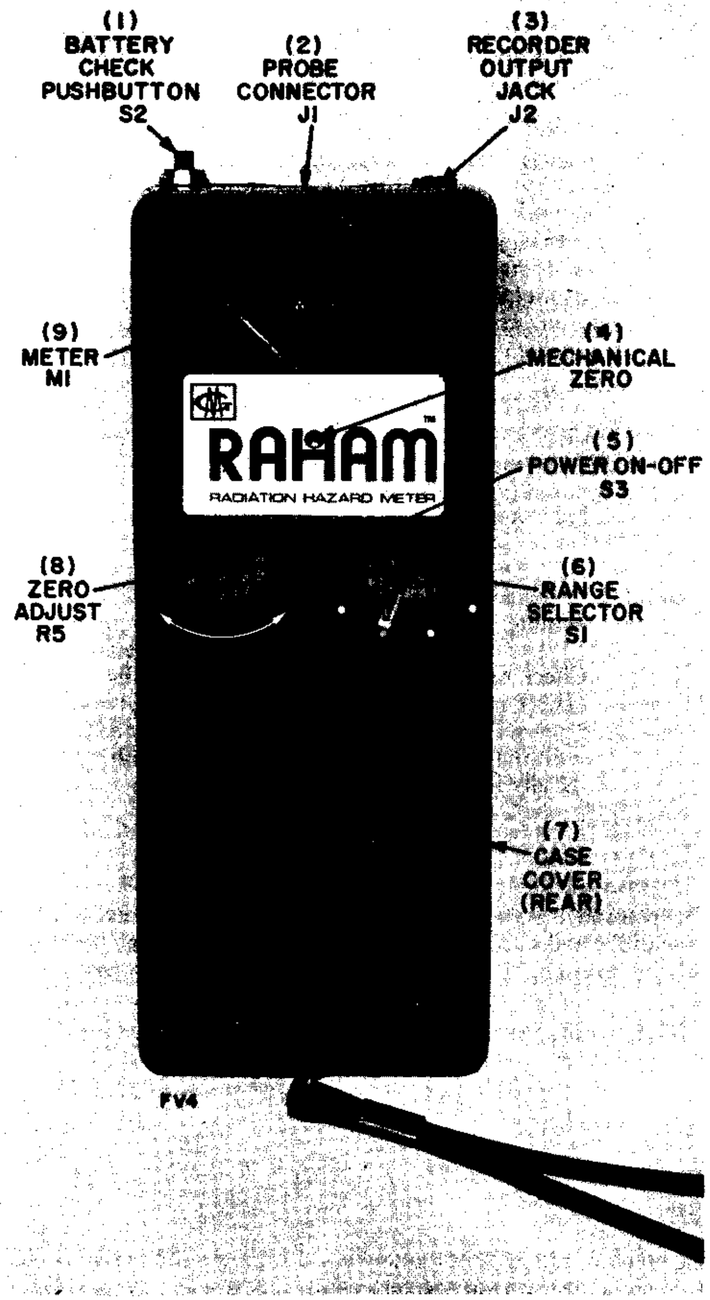

Figure 3. Model 484 Power Density Meter Front View

3-4. OPERATING PROCEDURE.

To operate a RAHAM, connect the probe to J1 of power density meter. Allign the polarizing keyway and finger-tighten the probe coupling nut for a snug fit. When the extension cable is used, install it between the probe and the power density meter.

With the RAHAM assembled for operation and with the probe completely free from any significant radiation field:

(1) Set OFF-ON switch to ON

(2) Momentarily depress BATTERY CHECK pushbutton adjacent to the probe connector while observing meter for indication of battery condition. If REPL is indicated, refer to BATTERY REPLACEMENT instructions.

(3) Set RANGE SELECTOR switch to 0.02 mW/cm^2 (max sensitivity) and zero meter with ZERO ADJUST. Once meter is zeroed, it need not again be adjusted when changing range.

NOTE

If meter fails to zero:

Check batteries. See BATTERY REPLACEMENT instructions.

Failure to zero when both batteries are fresh usually indicates a burned out or defective probe*.

The instrument should be periodically checked during use to ensure that the probe and circuitry remains operational. This may be done quickly by rezeroing the meter with no radiation source present.

*The meter needle will alternately peg downscale and upscale with very slight adjustment of the zero control, or it may have no response to the zero control.

The RAHAM is now ready for use.

WARNING

Always approach an unknown field cautiously, starting as far away as possible and extending the RAHAM probe at arm's length toward the energy source. See figure 2. Allow two or three seconds for the instrument to respond. Observe all safety precautions. Do not walk into a suspected radiation field until the power density is determined to be safe.

(1) Visually inspect area to identify potential or reported radiation hazard source (eg.waveguide joints, cable bends, connectors or cabinet doors).

(2) Select meter range, based on pre-evaluation of source or on-site reports. If the approximate field strength is unknown, always start with the lowest range setting (0.02).

(3) Expose probe to field; allow at least 1.5 seconds for measurement of any point in space. Radiation sensing pattern is shown in figure 2.

NOTE

For maximum accuracy, rotate the probe about its axis and average the minimum and maximum readings for each measurement.

(4) Move through area. At arbitrary survey points, slowly move probe in broad sweep to check for "hot spots", multiple sources or both. If practical, record levels and location of each survey point.

SECTION IV

THEORY OF OPERATION

4-1. GENERAL.

Model 4C is a portable, battery-operated instrument that detects and measures potentially hazardous electromagnetic energy radiating from RF and microwave energy sources. It is capable of direct reading measurments from 0.001 mW/cm^2 to 20 mW/cm^2 over the frequency range from 200 kHz to 26 GHz.

4-2. PROBE OPERATION.

Model 84C Probe design, shown in figure 4, employs three orthogonally oriented detecting circuits that provide isotropic response. Accurate wide-band near and far field power density measurements result from the novel circuit design which provides an almost constant effective aperture to radiation fields, ranging from 200 kHz to 26 GHz, such that frequency sensitivity over the operating band is held within ±1.25 dB. These models have isotropic response that varies ±0.5 dB maximum of energy incident from any direction, except from or through the handle.

To permit field interchangeability to probe and power density meters, a potentiometer R1 in each probe is factory calibrated to compensate for individual variation.

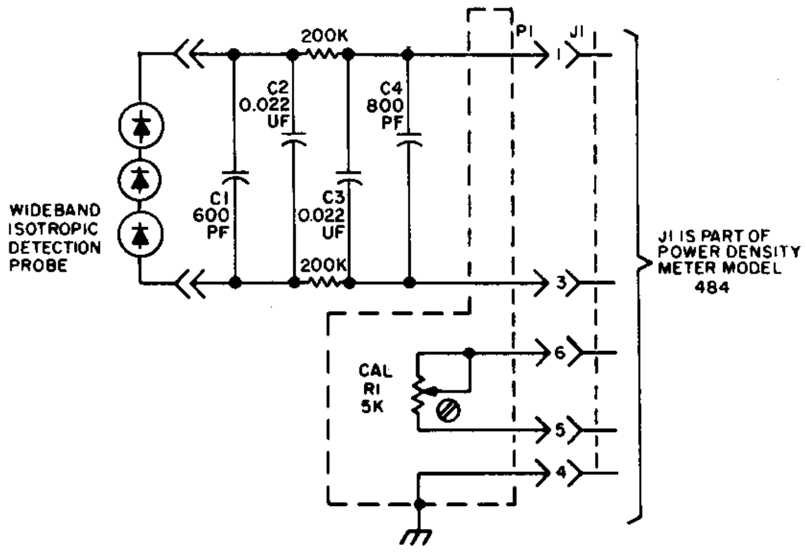

Figure 4. Model 84C Probe Schematic Diagram

4-3. POWER DENSITY METER OPERATION.

The probe output is applied to a highly sensitive solid state DC amplifier in the Model 484 Power Density Meter. Refer to Schematic diagram figure 5. The DC voltage from the probe is applied to a matched pair differential amplifier, U1 and U2. This amplifier is capable of sensing the very small variations in probe output and are further enhanced by operational amplifier U3. Front panel potentiometer R5, ZERO ADJUST, provides fine ZERO control. Course zero control is supplied by potentiometer R7, COURSE ZERO ADJUST. Range selection is provided by switch S1, RANGE SELECTOR, and resistors R10 to R15. These resistors are part of the amplifier feedback loop and vary the gain in proportion to the amplitude of the input voltage. R12 and CR1 are used to set the gain on the 20 mW/cm^2 range and to correct for non-square law performance of the probe.

Capacitors C1 and C2 form an active low pass filter. The circuit is designed to respond from 10% to 90% of the detected voltage in 1.5 seconds.

The amplifier output is read out on indicator meter M1 through the normally closed contacts of BATTERY CHECK pushbutton switch S2. When the BATTERY CHECK pushbutton is depressed, the momentary contracts of S2 connect the batteries to the meter to indicate battery condition. Resistor R19 provides the correct current to the meter for battery condition indication. An external metering device may be connected across R20 through the miniature RECORDER OUTPUT JACK J2.

SECTION V

MAINTENANCE

5-1. GENERAL.

The instrument should be cared for as any meter designed for field use. Connectors should be clean and free from mechanical abrasion or shock. RAHAM probes and meters are interchangeable. Spare assemblies may be stocked. If it is suspected that an instrument is defective, interchange of the probe or meter can be used for verification. The battery-check feature may be operated without connection to a probe; however, the meter is otherwise inoperative without the probe. See figures 3 and 6.

The Model 309 test source provides a convenient means to verify operation of the RAHAM Model 4C System. The test source sets up a power density of nominally 1 mW/cm^2 within its chamber. To verify operation of the RAHAM, simply insert the probe into the chamber. Depress the power button on the 309 Test Source and verify that the power density meter indicates the presence of RF power.

When the mercury batteries in the RAHAM are depleted, they should be removed from the instrument. Dead batteries (3 volts per battery or less) outgas and cause corrosion. This is not the fault of the battery clips.

CAUTION

To avoid damage to the RAHAM:

— Do not leave batteries in instrument when it is to be stored for extended periods of time.

— Store batteries in a cool, dry environment.

— Remove dead batteries promptly.

— Discard batteries after expiration of their two year shelf life.

5-2. BATTERY REPLACEMENT.

Estimated battery life is 900 operating hours. Battery shelf life can extend to two years if the unit is stored in a relatively cool environment. Batteries that have been subjected to different discharge and shelf cycles may give erratic results; hence, they must be changed in pairs. Replace with the following

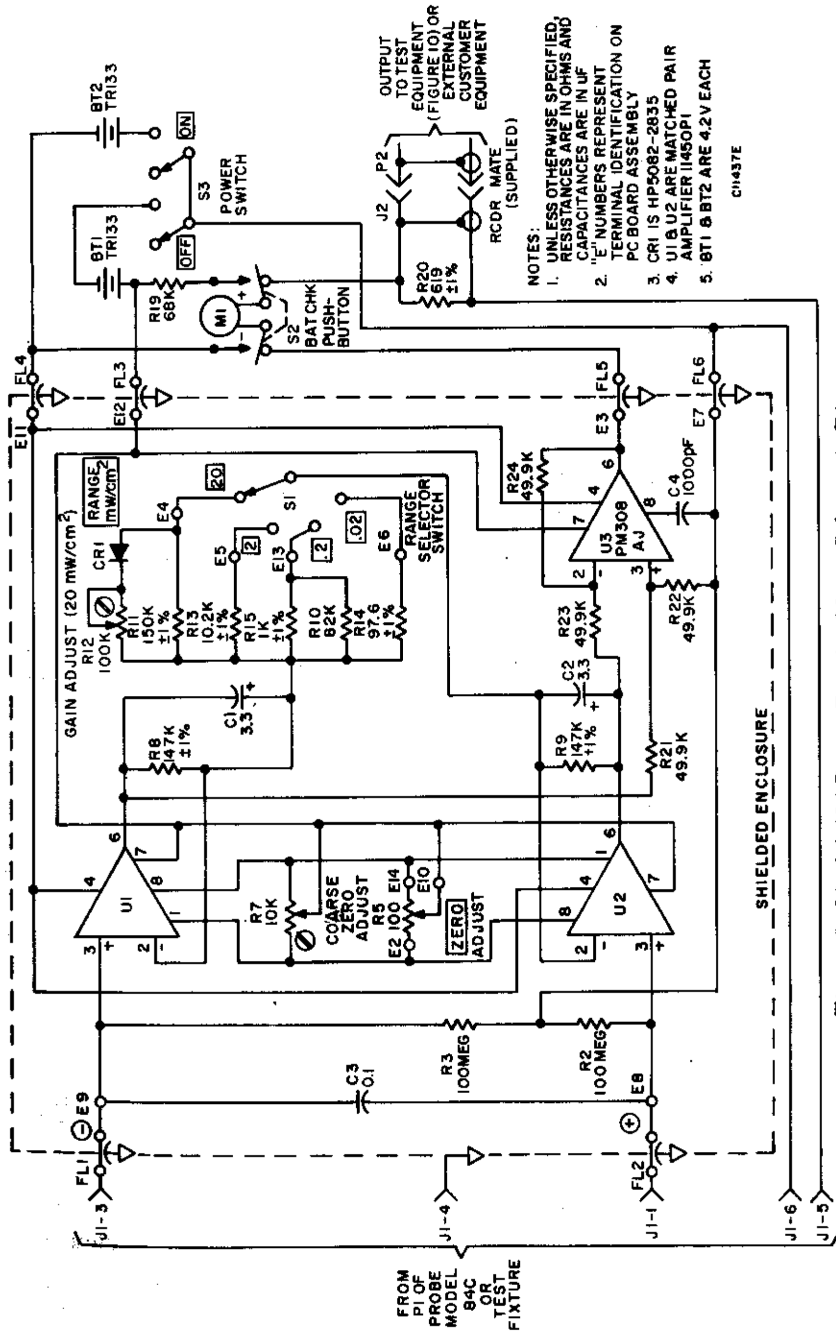

Figure 5. Model 484 Power Density Meter Schematic Diagram

battery type: Part No. TR133 or TR133R, manufactured by Mallory Battery Co., Tarrytown, NY 10591.

If a check of battery conditions indicates replacement, proceed as follows:

(1) Loosen the four rear screws that secure the case cover and remove cover.

(2) Loosen battery clamp screw. Refer to figure 6.

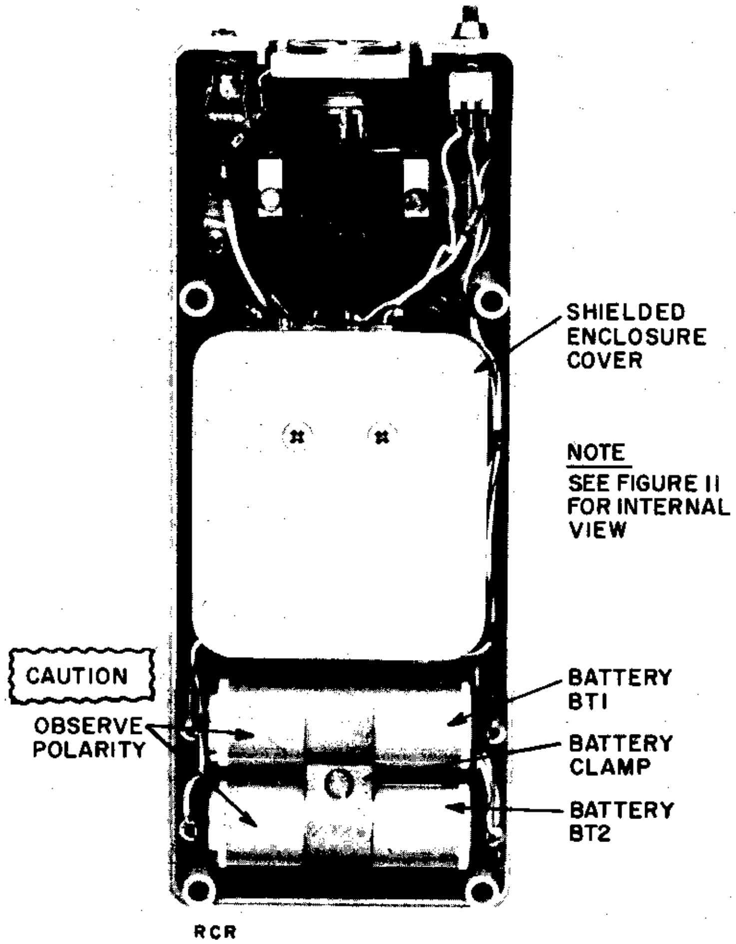

Figure 6. Model 484 Power Density Meter Rear View with Cover Removed

(3) Replace the batteries. Always observe the polarity indications that appear inside the case.

CAUTION

Damage can result from inserting one or both batteries backwards.

(4) Tighten battery clamp captive screw.

(5) Replace case cover and secure screws.

5-3. TROUBLESHOOTING.

5-3-1. PROBE. If the unit fails to operate properly, after batteries are checked, isolate the trouble between probe and power density meter as follows:

Remove the probe from connector J1 of the power density meter and verify that the following resistances are obtained at the probe connector P1. See figure 7 for pin and keyway configuration.

Table of Probe Resistance Measurements

CONNECT OHMMETER* BETWEEN PINS	NOMINAL RESISTANCE VALUE
1 and 3	1.5 Megohms (Forward) Infinity (Reverse)
4 and case	Short circuit
5 and 6	From 100 to 5K ohms

If the resistance values obtained are not as indicated, return the probe to the factory for repair. Field repair or adjustment of a probe should not be attempted. Return defective probe assemblies to the factory. Since probes and power density meters are two-way interchangeable in the field, spare assemblies can be stocked to minimize equipment downtime.

5-3-2. POWER DENSITY METER. When trouble has been isolated to the power density meter, Model 484, routine troubleshooting procedures should disclose the malfunction. As an initial step, it is suggested that the power density meter accuracy check (para 6-3-3) be performed to help isolate the cause.

*Fluke Model 8000A, or equivalent DMM, with test current of $0.1\mu A$.

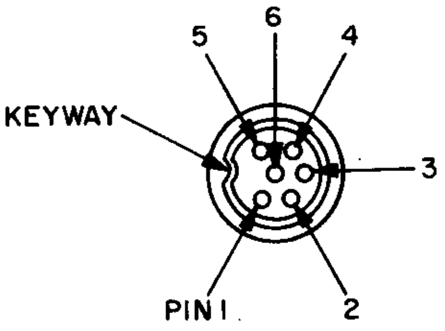

Figure 7. Model 84C Probe Pin and Keyway Configuration

5-4. REPAIR.

Repair of a defective power density meter can be performed in the field. To gain access to the unit, remove the back of the unit as described under Battery Replacement. In addition to the special maintenance precautions described in this manual, observe the usual precautions and good practices associated with replacing components in precision electronic equipment, such as:

(1) Electrostatically neutralize all tools; place them in contact with a large metallic mass or a known ground.

(2) Make resistance checks using the higher ohmmeter ranges only.*

(3) To avoid damage to the printed circuit board, use a temperature controlled 1/8 inch soldering iron set to 700°F, whenever possible, if component replacement is required. The heat of the soldering iron permits the component to be removed through the conformal coating. After component replacement is made, thoroughly remove all flux remains with a clean stiff brush dipped in Freon TMC™ solvent. Then, allow a one-minute drying period and apply Humiseal 1B31™ coating with a second clean stiff brush. Allow a one hour curing period before calibrating the unit.

SECTION VI

CALIBRATION

6-1. GENERAL.

It is recommended that power density meter accuracy be checked at twelve month intervals or after a component is replaced. A test fixture is needed to provide voltages at specified impedances to simulate those provided by a probe. Figure 8 is the schematic diagram of the GMC test fixture. The fixture provides a resistance of 1408 ohms ±0.5% between pins 5 and 6 and 1.02 megohms ±1% between pins 1 and 3. The voltages at pins 1 and 3 depend on the range setting, as follows:

RANGE	VOLTAGE
20 mW/cm^2	112 mV
2 mW/cm^2	15 mV
0.2 mW/cm^2	1.5 mV
0.02 mW/cm^2	0.02 V

6-2. LIST OF TEST EQUIPMENT.

The following equipment, or equivalents, are needed:

1. Test Fixture — See figure 8
2. Digital Multimeter (DMM) — Fluke — 8000A
3. Oscilloscope — Tektronix — 564/3A9

6-3. POWER DENSITY METER CALIBRATION.

6-3-1. PRELIMINARY PROCEDURE.

(1) Set Power ON-OFF switch on the Model 484 unit under test (UUT) to OFF (figure 3)

(2) Remove probe from connector J1 of the UUT

(3) Loosen four captive screws in case cover and remove the rear cover.

(4) Zero the meter with the Mechanical Zero Adjustment on the UUT (figure 3)

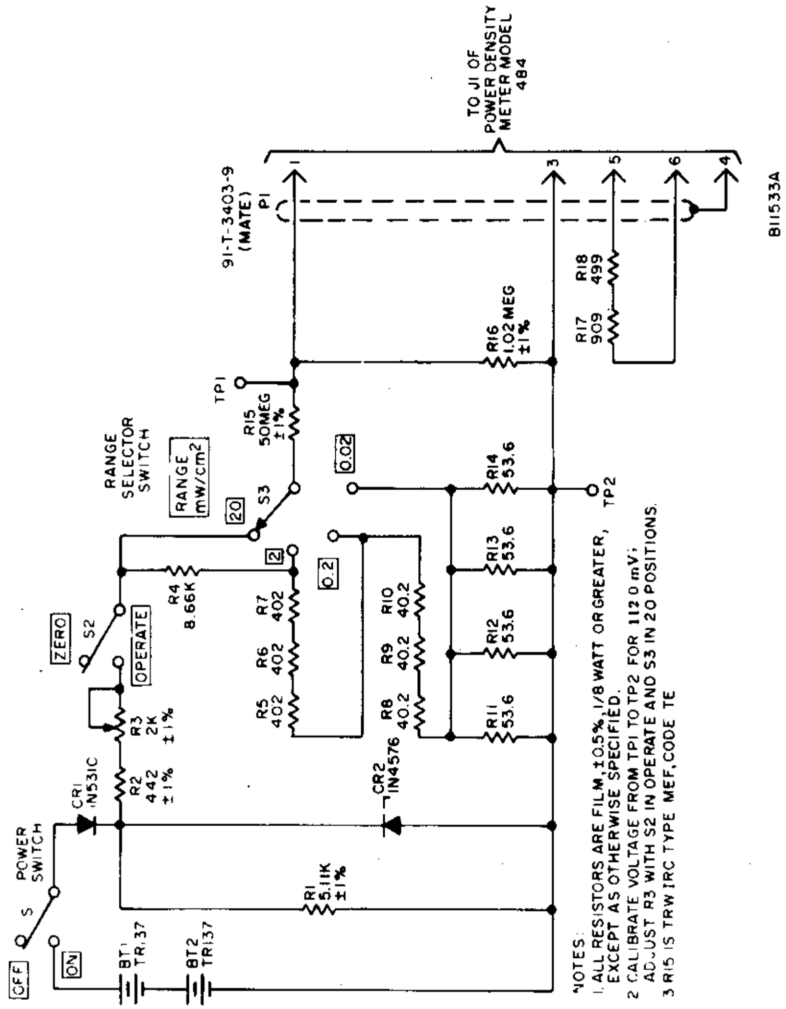

Figure 8. Model 484 Test Fixture Schematic Diagram

(5) Set Power ON-OFF switch on UUT to ON. Allow 10 minutes to stabilize.

(6) Depress Battery Check Pushbutton (S1) (figure 3) on top of case. Meter should show 1.2 nominally.

(7) Set Power ON-OFF switch to OFF.

6-3-2. INTERNAL ZERO SET.

(1) Connect J1 of the UUT to test fixture (figure 9).

(2) Rotate Range Selector switch on UUT (figure 3) and on test fixture (figure 9) to 0.02mW/cm^2

(3) Set Power ON-OFF Switch (on UUT and test fixture to ON position and ZERO-OPERATE switch to ZERO on test fixture (figure 8).

(4) Set front panel ZERO adjust R5 (figure 3) on the UUT to midposition.

(5) Remove two screws on shielded enclosure cover (figure 6) and lift cover off the UUT

(6) Adjust Course Zero Adjust R7 (figure 10) for an indicator Meter M1 reading of approximately Zero (figure 3).

6-3-3. ACCURACY CHECK.

(1) Connect DMM to UUT Recorder Output Jack J2 (figure 9).

(2) Adjust fine ZERO front panel control R5 on UUT for zero readout on DMM at J2.

(3) Set test fixture (figure 9) ZERO-OPERATE switch to OPERATE. DMM should read 124 mV±3mV.

(4) Rotate Range Selector switches on UUT and test fixture to 0.2 mV/cm^2 and repeat steps (2) and (3).

(5) Rotate Range Selector switches on UUT and test fixture to 2 mW/cm^2 and repeat steps (2) and (3).

(6) Rotate Range Selector switches on UUT and test fixture to 20 mW/cm^2 and repeat steps (2) and (3)

(7) Adjust Gain Control R12 (figure 10) on PC board of UUT for DMM reading of 124mV.

(8) Turn power OFF on both UUT and test fixture. Disconnect equipment and replace shielded enclosure cover (figure 6) and rear case cover.

NOTE

After this calibration, use front panel ZERO adjust R5 ONLY to zero the Power Density Meter.

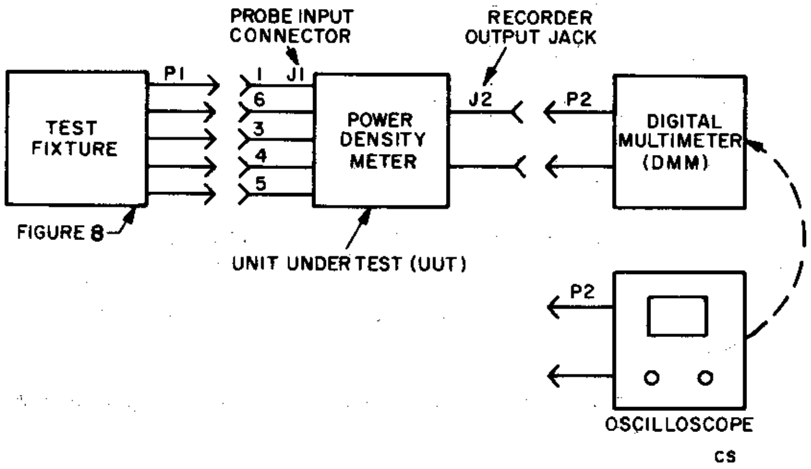

Figure 9. Model 484 Power Density Meter Calibration Setup Block Diagram

6-4. PROBE CALIBRATION.

The recommended calibration interval for the probe is six months. Since highly-specialized test equipment and facilities (such as a radio frequency anechoic chamber) are required, the probe should be sent to General Microwave or another qualified calibration facility for this service.

WITHOUT THESE FACILITIES, NO ATTEMPT TO ADJUST THE CALIBRATION POTENTIOMETER IN THE PROBE SHOULD BE MADE BY THE USER.

Government facilities which can be contacted for Power Density Calibration services are the National Bureau of Standards in Boulder, Colorado and the Bureau of Radiological Health, Division of Electronic Products, in Rockville, Maryland. Although inquiries can be made directly to either of these agencies to determine all details of available services, General Microwave will be pleased to provide assistance if required.

To perform RF calibration of probe:

(1) Obtain sensitivity values (S_F) for the probe at the following frequencies:

0.2, 2, 27, 100 MHz
1.2, 2.45, 3.8, 8, 12.0, 18.0, 26 GHz

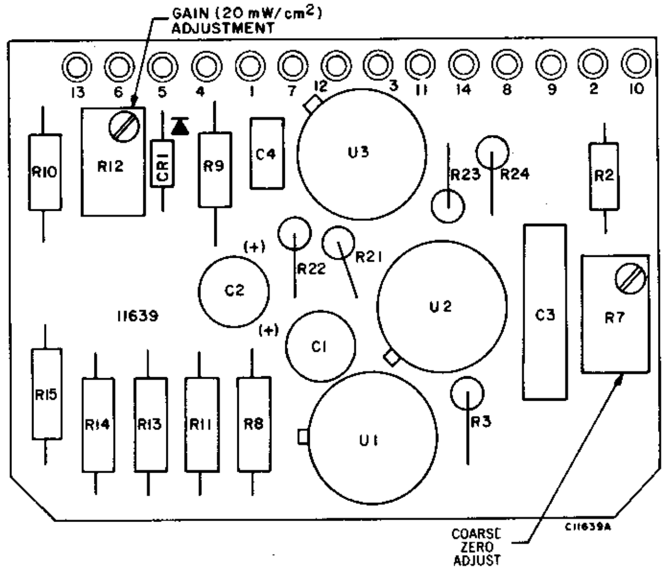

Figure 10. Model 484 PC Board Components/Adjustments Location

where S_F is measured in $mV/mW/cm^2$

Determine largest (S_{MAX}) and smallest (S_{MIN}) of the sensitivity values.

(2) S_{REF} is the mean value of the probe's frequency sensitivity. Calculate S_{REF} using the following formula:

$$S_{REF} = \sqrt{S_{MAX} \cdot S_{MIN}} \text{ in } mV/mW/cm^2$$

(3) Align the unit to reference value S_{REF} by adjusting probe calibration potentiometer R1 for a resistance R_{CAL} as measured between pins 5 and 6 of the probe connector. (The calibration potentiometer is located under the black circular tape on the probe handle.)

$$R_{CAL} = [289\, S_{REF} - 827] \text{ ohms}$$

(4) To establish the correction factor C_F at a given frequency normalize the reading S_F obtained at the tested frequency to the alignment value S_{REF} by obtaining the ratio of the two values:

$$C_F = \frac{S_{REF}}{S_F}$$

(Actual power density value at a given frequency is calculated by multiplying the reading obtained by correction factor C_F).

SECTION VII

REPLACEMENT PARTS

Tables 2A and 2B list parts that can be replaced, if defective. Parts are listed in the following sections:

TABLE	DESCRIPTION
2A	Power Density Meter
2B	Extension Cable

Whenever possible, readily available replacement parts are used. These, or equivalent, are obtainable from a wide range of local sources.

When necessary, special parts are used. These are obtainable from GMC, manufacturers code 11332. See table 3 for other manufacturers codes.

Table 2A. Model 484 Replacement Parts List

REF DES	DESCRIPTION	QTY USED	MFR CODE	PART NO.
BT1,BT2	BATTERY,MERCURY, 4.2V/4.05V	2	90303	TR133/TR133R
CR1	DIODE,HOT CARRIER	1	28480	5082-2835
C1,C2	CAP,FXD,TANTALUM, 3.3μF, 10V	2	56289	199D
C3	CAP,FXD,PLASTIC 0.1μF	1	77569	C280AH/ P100KSR
C4	CAP,FXD,CERAMIC 1000pF ±10%	1	COML	CK05
FL1-FL6	FILTER,FEEDTHRU	6	16546	3223-000
J1	CONNECTOR	1	02660	91T-3403-9
J2	JACK	1	82389	TR-2A
M1	METER	1	11332	9884P1
P2	PLUG (MATE FOR J2)	1	82389	850
R1	NOT USED			
R2,R3	RES,FXD,COMP 100 OHMS	1	11332	CB1075
R4	NOT USED			
R5	RES,VAR,100 OHMS	1	11332	7374-5
R6	NOT USED			
R7	RES,VAR,CERMET 10K	1	02111	64Y103
R8,R9	RES,FXD,FILM, 147K ±1%	1	81349	RN55D1473F
R10	RES,FXD,CARBON FILM, 82K ±5%, 1/4 W	1	81349	RC07GF823J
R11	RES,FXD,FILM, 150K ±1%	1	81349	RN55D1503F

Table 2A. Model 484 Replacement Parts List (continued)

REF DES	DESCRIPTION	QTY USED	MFR CODE	PART NO.
R12	RES,VAR, CERMET 100K	1	02111	64Y104
R13	RES,FXD,FILM, 10.2K ±1%	1	81349	RN55D1023F
R14	RES,FXD,FILM 97.6 OHMS 1%	1	81349	RN55D97R6F
R15	RES,FXD,FILM 1K ±1%	1	81349	RN55D1001F
R16,R18	NOT USED			
R19	RES,FXD,CARBON FILM 68K ±5%, 1/4 W	1	81349	RC07GF683J
R20	RES,FXD,FILM, 619 OHMS ±1%	1	COML	RN55D
R21-R24	RES,FXD, FILM 49.9K ±1%	4	81349	RN55D4992F
S1	SWITCH,ROTARY, SP4T	1	11332	11442P1
S2	SWITCH,PUSHBUTTON DPDT 2 position; locking/ momentary	1	11332	11368P1
S3	SWITCH,SLIDE,DPDT	1	11332	8078-3
U1,U2	AMPLIFIER, MATCHED PAIR	1	11332	11450P1
U3	AMPLIFIER OPERATIONAL	1	06665	PM308AJ

Table 2B. Extension Cable Assembly (11537G1) Replacement Parts List

REF DES	DESCRIPTION	QTY USED	MFR CODE	PART NO.
P1	CONNECTOR, PLUG	1	02660	91T3400-1
P2	CONNECTOR, PLUG	1	02660	91T3403-9
–	ADAPTER, CONNECTOR	1	11332	11561P1
–	ADAPTER, CONNECTOR	1	11332	11562P1
–	CABLE, LOW NOISE	51"	11332	12243P1
–	TERMINATION	1	81349	MX1530A/U
–	TUBING, SHRINK	1/2"	96613	FIT221-3/32

Table 3. Manufacturers' Codes

CODE	MANUFACTURER	ADDRESS
01121	ALLEN BRADLEY CO	MILWAUKEE, WI 53212
02111	SPECTROL ELECTRONICS CORP	CITY OF INDUSTRY, CA 91745
24138	INTERNATIONAL ELECTRONIC CORP	MELVILLE,NY 11746
02660	AMPHENOL CONNECTOR DIV	BROADVIEW, IL 60153
06665	PRECISION MONOLITHICS	SANTA CLARA,CA 95050
11332	GENERAL MICROWAVE CORP	FARMINGDALE,NY 11735
16546	US CAPACITOR CORP	BURBANK,CA 91504
28480	HEWLETT-PACKARD	PALO ALTO,CA 94304
56289	SPRAGUE ELECTRIC	NORTH ADAMS, MA 01247
77569	MEPCO-ELECTRA, NORTH AMERICAN PHILLIPS	NEW YORK,NY 10017
81349	GOVERNMENT SPECIFICATIONS	ANY MANU-FACTURER
82389	SWITCHCRAFT INC	CHICAGO,IL 60630
90303	MALLORY BATTERY CO	TARRYTOWN,NY 10591
96613	ALPHA METALS	JERSEY CITY,NJ 96613
COML	A QUALITY "OFF THE SHELF" COMMERCIAL COMPONENT	

EQUIPMENT WARRANTY

General Microwave Corporation warranties all parts of equipment of its manufacture to be free from defects caused by faulty material or poor workmanship. This warranty excludes electronic tubes, batteries, natural rubber and material normally consumed in operation unless such excepted items fail as a result of improper application by General Microwave.

Liability under this warranty is limited to the obligation to repair, or, at General Microwave's sole option, to replace without charge, FOB General Microwave's Plant, any part found to be defective under normal use and service within the time periods shown below, provided:

(1) General Microwave Corporation is promptly notified within the warranty period in writing upon discovery of such defects;

(2) The original parts or equipment are returned to General Microwave Corporation, transportation charges prepaid;

(3) General Microwave Corporation's examination shall disclose to its satisfaction that such defects have not been caused by abuse after delivery; and

(4) Warranties shall not apply to items which have been repaired or altered by others than General Microwave Corporation or its authorized agency.

The period of warranty is one year after delivery of the instrument to the original purchaser.

The warranty period shall not include any period of time the unit or part fails to perform satisfactorily due to such defect, and any unit, part or component repaired or replaced by General Microwave pursuant to this warranty shall itself be guaranteed as specified above.