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UNCLASSIFIED

TECHNICAL MANUAL

*for*

MICROPHONE PREAMPLIFIER

MODEL MPA-1



THE TECHNICAL MATERIEL CORPORATION  
MAMARONECK, N. Y.

OTTAWA, ONTARIO



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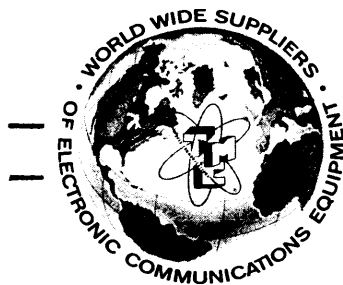
THE TECHNICAL MATERIEL CORPORATION  
MAMARONECK, N.Y.

OTTAWA, ONTARIO

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## NOTICE

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# THE TECHNICAL MATERIEL CORPORATION

C O M M U N I C A T I O N S   E N G I N E E R S

700 FENIMORE ROAD

MAMARONECK, N. Y.

## W a r r a n t y

The Technical Materiel Corporation, hereinafter referred to as TMC, warrants the equipment (except electron tubes,\* fuses, lamps, batteries and articles made of glass or other fragile or other expendable materials) purchased hereunder to be free from defect in materials and workmanship under normal use and service, when used for the purposes for which the same is designed, for a period of one year from the date of delivery F.O.B. factory. TMC further warrants that the equipment will perform in a manner equal to or better than published technical specifications as amended by any additions or corrections thereto accompanying the formal equipment offer.

TMC will replace or repair any such defective items, F.O.B. factory, which may fail within the stated warranty period, PROVIDED:

1. That any claim of defect under this warranty is made within sixty (60) days after discovery thereof and that inspection by TMC, if required, indicates the validity of such claim to TMC's satisfaction.
2. That the defect is not the result of damage incurred in shipment from or to the factory.
3. That the equipment has not been altered in any way either as to design or use whether by replacement parts not supplied or approved by TMC, or otherwise.
4. That any equipment or accessories furnished but not manufactured by TMC, or not of TMC design shall be subject only to such adjustments as TMC may obtain from the supplier thereof.

Electron tubes\* furnished by TMC, but manufactured by others, bear only the warranty given by such other manufacturers. Electron tube warranty claims should be made directly to the manufacturer of such tubes.

TMC's obligation under this warranty is limited to the repair or replacement of defective parts with the exceptions noted above.

At TMC's option any defective part or equipment which fails within the warranty period shall be returned to TMC's factory for inspection, properly packed with shipping charges prepaid. No parts or equipment shall be returned to TMC, unless a return authorization is issued by TMC.

No warranties, express or implied, other than those specifically set forth herein shall be applicable to any equipment manufactured or furnished by TMC and the foregoing warranty shall constitute the Buyers sole right and remedy. In no event does TMC assume any liability for consequential damages, or for loss, damage or expense directly or indirectly arising from the use of TMC Products, or any inability to use them either separately or in combination with other equipment or materials or from any other cause.

\*Electron tubes also include semi-conductor devices.

### *PROCEDURE FOR RETURN OF MATERIAL OR EQUIPMENT*

Should it be necessary to return equipment or material for repair or replacement, whether within warranty or otherwise, a return authorization must be obtained from TMC prior to shipment. The request for return authorization should include the following information:

1. Model Number of Equipment.
2. Serial Number of Equipment.
3. TMC Part Number.
4. Nature of defect or cause of failure.
5. The contract or purchase order under which equipment was delivered.

### *PROCEDURE FOR ORDERING REPLACEMENT PARTS*

When ordering replacement parts, the following information must be included in the order as applicable:

1. Quantity Required.
2. TMC Part Number.
3. Equipment in which used by TMC or Military Model Number.
4. Brief Description of the Item.
5. The *Crystal Frequency* if the order includes crystals.

### *PROCEDURE IN THE EVENT OF DAMAGE INCURRED IN SHIPMENT*

TMC's Warranty specifically excludes damage incurred in shipment to or from the factory. In the event equipment is received in damaged condition, the carrier should be notified immediately. Claims for such damage should be filed with the carrier involved and not with TMC.

All correspondence pertaining to Warranty Claims, return, repair, or replacement and all material or equipment returned for repair or replacement, within Warranty or otherwise, should be addressed as follows:

THE TECHNICAL MATERIEL CORPORATION  
Engineering Services Department  
700 Fenimore Road  
Mamaroneck, New York



# TABLE OF CONTENTS

<u>Paragraph</u>		<u>Page</u>
<u>SECTION 1 - GENERAL INFORMATION</u>		
1-1	Functional Description . . . . .	1-1
1-2	Physical Description . . . . .	1-1
1-3	Technical Specifications . . . . .	1-2
<u>SECTION 2 - INSTALLATION</u>		
2-1	Initial Inspection . . . . .	2-1
2-2	Mechanical Installation . . . . .	2-1
2-3	Electrical Installation . . . . .	2-1
<u>SECTION 3 - OPERATOR'S SECTION</u>		
3-1	General . . . . .	3-1
3-2	Operator's Instructions . . . . .	3-1
<u>SECTION 4 - PRINCIPLES OF OPERATION</u>		
4-1	Introduction . . . . .	4-1
4-2	Circuit Description . . . . .	4-1
<u>SECTION 5 - MAINTENANCE</u>		
5-1	Preventive Maintenance . . . . .	5-1
5-2	Troubleshooting . . . . .	5-2
5-3	Repair and Replacement . . . . .	5-4
<u>SECTION 6 - PARTS LIST</u>		
6-1	Introduction . . . . .	6-1
<u>SECTION 7 - SCHEMATIC DIAGRAMS</u>		

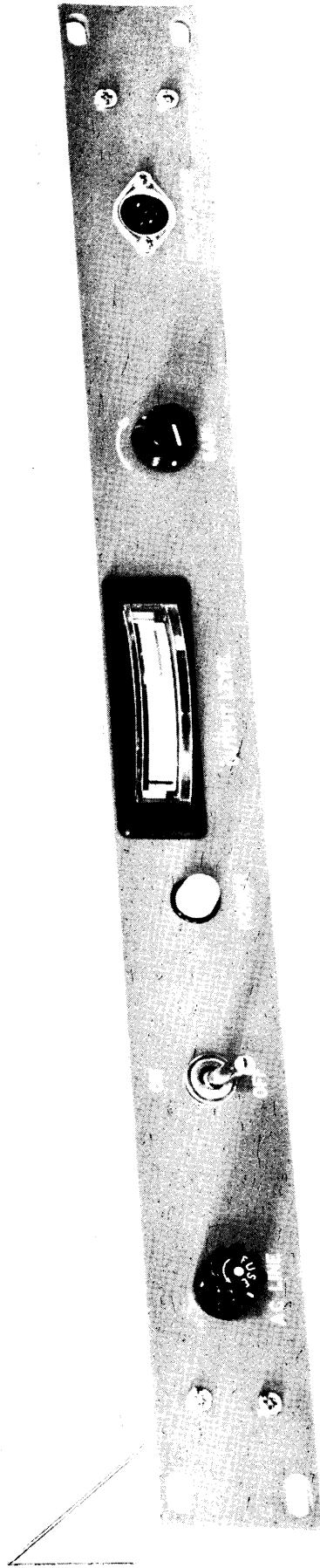
# LIST OF ILLUSTRATIONS

<u>Figure</u>		<u>Page</u>
<u>SECTION 1 - GENERAL INFORMATION</u>		
1-1	Microphone Preamplifier, Model MPA-1 . . . . .	1-0
<u>SECTION 2 - INSTALLATION</u>		
2-1	Transformer Changeover Connections . . . . .	2-2
2-2	Rear Panel Connections . . . . .	2-3
<u>SECTION 3 - OPERATOR'S SECTION</u>		
3-1	Controls and Indicator Locations . . . . .	3-1
<u>SECTION 4 - PRINCIPLES OF OPERATION</u>		
4-1	Functional Block Diagram . . . . .	4-2
<u>SECTION 5 - MAINTENANCE</u>		
5-1	Component Locations, Main Chassis . . . . .	5-5
5-2	Component Locations, Printed Circuit Board A4450 . . . . .	5-6
<u>SECTION 7 - SCHEMATIC DIAGRAMS</u>		
7-1	Schematic Diagram, Model MPA-1 . . . . .	7-2



# LIST OF TABLES

<u>Table</u>		<u>Page</u>
	<u>SECTION 3 - OPERATOR'S SECTION</u>	
3-1	Controls and Indicators . . . . .	3-2
	<u>SECTION 5 - MAINTENANCE</u>	
5-1	Test Equipment Required . . . . .	5-4



9816-1

Figure 1-1. Microphone Preamplifier, Model MPA-1.

# SECTION 1

## GENERAL INFORMATION

### 1-1. FUNCTIONAL DESCRIPTION

Microphone Preamplifier, Model MPA-1 (figure 1-1) is a solid state preamplifier unit, providing microphone preamplification with front panel gain control and output level meter monitoring.

A six-pin microphone input connector is provided at the front panel, with rear panel jumper-wire patching for acceptance of carbon, low impedance or high impedance microphone inputs. The rear panel terminal board also provides push-to-talk and 600 ohm output connection points.

### 1-2. PHYSICAL DESCRIPTION

The MPA is of a compact design, having a standard 19-inch wide front panel measuring 1-3/4-inches high. The front panel displays a signal output level meter, a variable gain control, an input power on/off toggle switch with an associated power indicator lamp and line protective fuse. A six-pin microphone input connector is also front panel mounted, with an a-c input receptacle and twelve-pin terminal board mounted on the rear of the chassis.

### 1-3. TECHNICAL SPECIFICATIONS

MICROPHONE INPUTS:	Carbon, dynamic, crystal, Hi-Z, Lo-Z.
DISTORTION:	Better than 40 db down (IM)
HUM LEVEL:	50 db
OUTPUT:	600 ohms
FREQUENCY RESPONSE:	300 to 3000 cps at 6 db points.

**DIMENSIONS:**

19-inches wide x 1-3/4 inches  
high x 8-3/4 inches deep.

**POWER REQUIREMENTS:**

115 / 230 volts a-c, 50 / 60  
cps, single phase

## **SECTION 2**

### **INSTALLATION**

#### 2-1. INITIAL INSPECTION.

Each MPA has been thoroughly checked and tested at the factory before shipment. Upon receipt of the equipment, unpack it carefully and inspect for damage that may have occurred in transit. Inspect all packing material for parts which may have been shipped as loose items.

With respect to damage to the equipment for which the carrier is liable, the Technical Materiel Corporation will assist in describing methods of repair and the furnishing of replacement parts.

#### 2-2. MECHANICAL INSTALLATION.

The MPA is equipped with a 19-inch wide front panel, suitable for mounting into any standard width equipment rack or console. The unit may be panel mounted to an equipment frame by means of the supplied mounting screws.

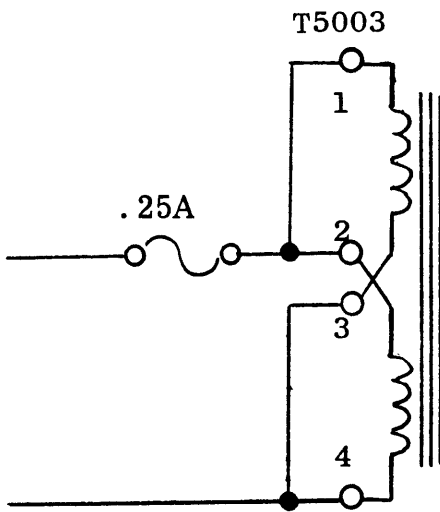
#### 2-3. ELECTRICAL INSTALLATION.

The MPA is factory wired to operate from a line voltage source of 115 volts a-c, applied at rear panel connector J5002. For 230 volts a-c operation, minor input transformer wiring changes are necessary. See figure 2-1.

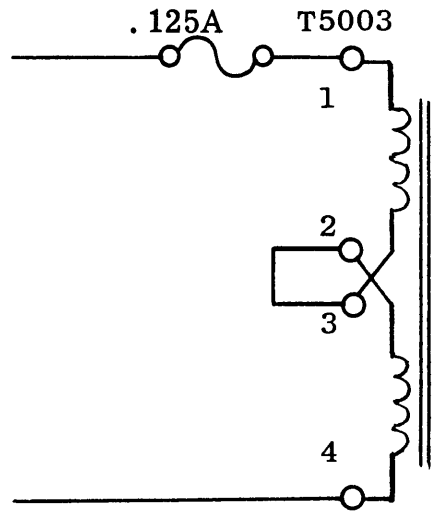
Rear panel terminal board TB5001 connections provide a push-to-talk output at terminal 12, for connection to an associated exciter unit and a 600 ohm output at terminals 10 and 11.

Microphone input patching is also accomplished at TB5001. For carbon mike input, use jumper wires to strap terminal 2 to terminal 3 and terminal 6 to

terminal 7. For low impedance mike input, use jumper wires to strap terminal 2 to terminal 4 and terminal 6 to terminal 8. For high impedance mike input, use jumper wires to strap terminal 2 to terminal 5 and terminal 6 to terminal 9. See figure 2-2 for rear panel connections. Microphone input is applied to front panel connector J5003.



115 VOLTS OPERATION

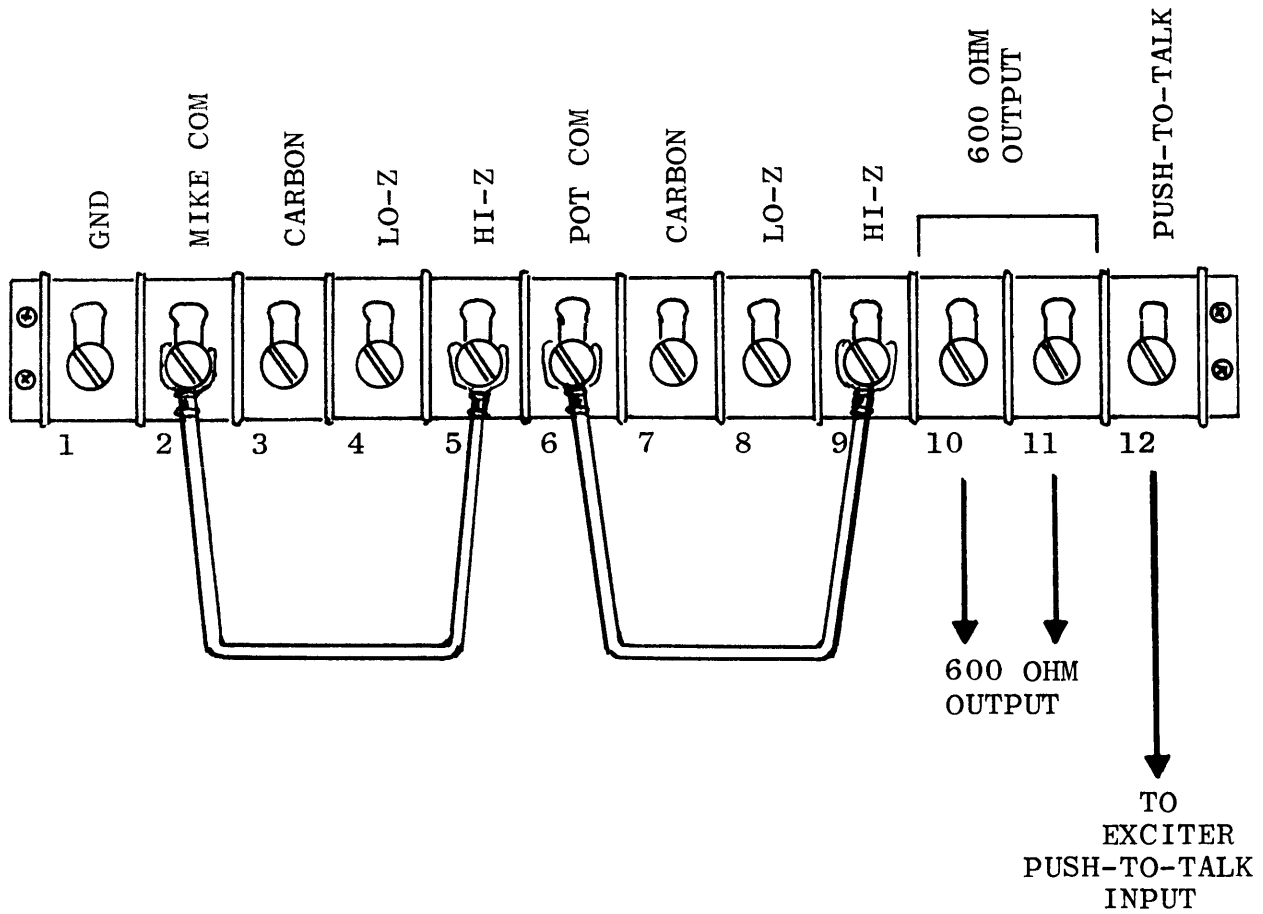


230 VOLTS OPERATION

9816-2

Figure 2-1. Transformer Changeover Connections

TB5001



NOTE: TB5001 shown strap-wired for HI-Z microphone.

9816-3

Figure 2-2. Rear Panel Connections

## SECTION 3 OPERATOR'S SECTION

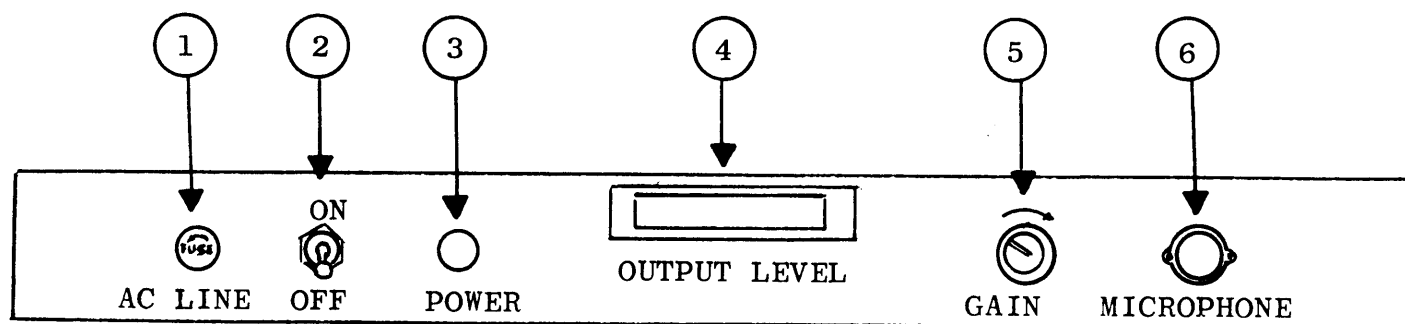
### 3-1. GENERAL

The MPA is a microphone preamplifier unit, used to provide preamplification for a carbon, high impedance or low impedance microphone input. Preamplification output level or gain may be monitored on the front panel horizontal-scale VU-meter, calibrated in db. A variable gain control, also front panel mounted, is used to adjust the output level viewed on the panel output level meter.

### 3-2. OPERATOR'S INSTRUCTIONS

To activate the MPA, the operator must set the power ON/OFF toggle switch at ON; the POWER indicator lamp should light. Ensuring that the rear panel terminal board jumper wires are wired for the correct microphone input, plug microphone into the front panel MICROPHONE connector. OUTPUT LEVEL meter reading should be set for an indication of 0 VU, adjusted by the front panel GAIN potentiometer control.

Refer to table 3-1, used in conjunction with figure 3-1, for control and indicator locations and functions.



9816-4

Figure 3-1. Controls and Indicator Locations



Table 3-1. Controls and Indicators

REFERENCE DESIGNATION (Figure 3-1)	PANEL DESIGNATION	FUNCTION
①	AC LINE, fuse, .25 amp	Input line voltage protective fuse.
②	ON/OFF, toggle switch	Input line voltage on/off switch. When set at ON, applies line voltage to MPA power supply.
③	POWER, indicator lamp, red.	Lights when power on/off switch is set at ON, indicating activation of MPA.
④	OUTPUT LEVEL, horizontal scale VU meter.	Meter calibrated in db, used for monitoring MPA output level.
⑤	GAIN, potentiometer	Used to adjust output gain of MPA, monitored on OUTPUT LEVEL meter. Gain (output level) to be adjusted for OVU (.7v) on meter.
⑥	MICROPHONE, 6-pin receptacle.	Used to accept microphone input.

## **SECTION 4**

### **PRINCIPLES OF OPERATION**

#### 4-1. INTRODUCTION.

The MPA is a solid state preamplifier unit with impedance matching input circuits to accept carbon, low impedance or high impedance microphone inputs. A variable gain control provides for manual adjustment of the MPA output level, monitored on a horizontal-scale VU meter. The microphone input is via the front panel connector, impedance matched via rear panel terminal board jumper wires. See figure 4-1 for functional block diagram.

#### 4-2. CIRCUIT DESCRIPTION.

The microphone input is applied to the MPA preamplifier circuitry via front panel MICROPHONE connector J5003. The input is routed to terminal 2 of rear panel terminal board TB5001. The output of terminal 2 (microphone common) is then made available for connection to the input of any one of three impedance matching circuits.

For carbon mike input, terminal 2 is jumper wire connected to terminal 3, capacitor coupled out of terminal 7, to the preamplifier input via terminal 6.

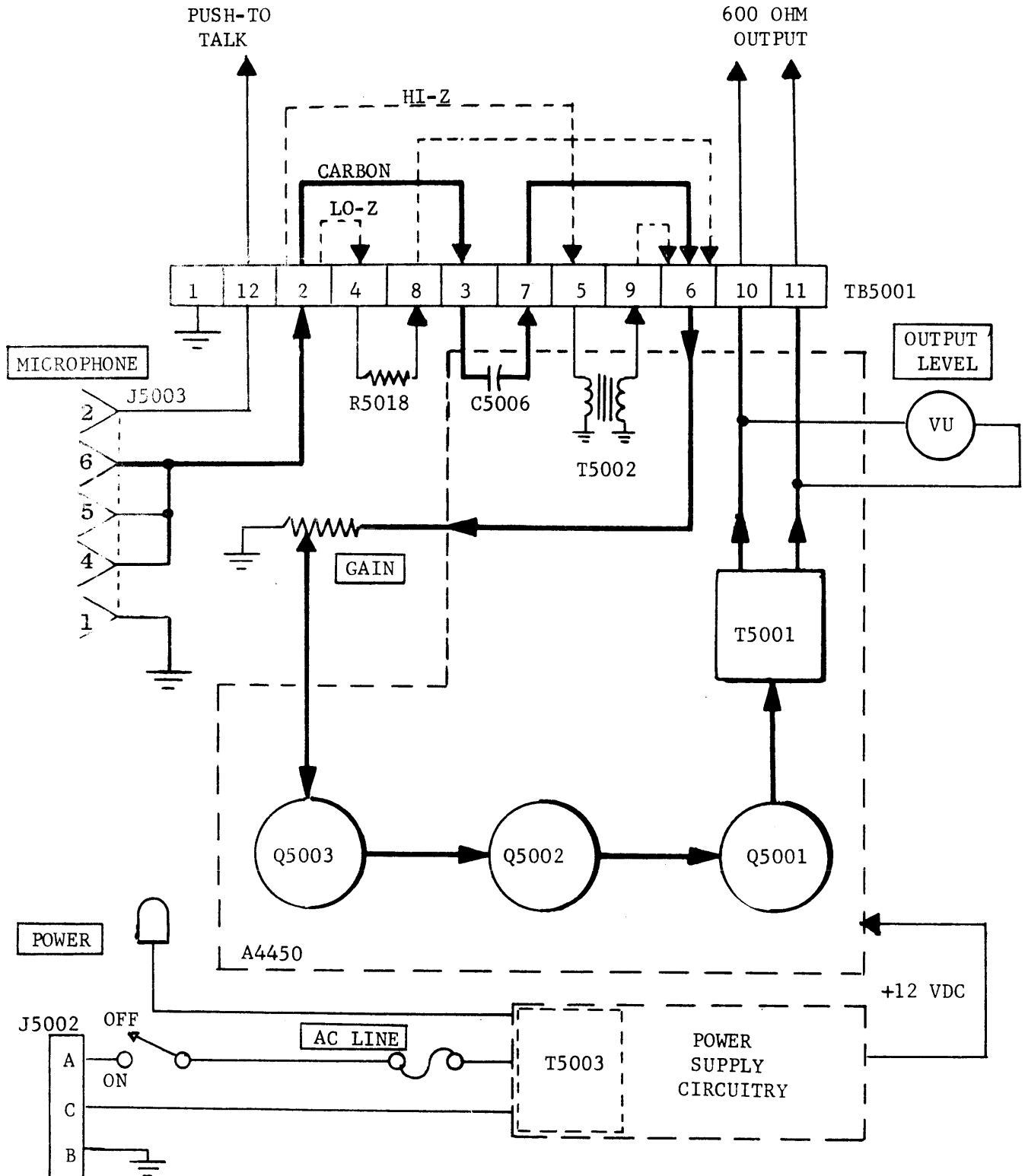
For low-impedance mike input, terminal 2 is jumper wire connected to terminal 4, resistor coupled out of terminal 8, to the preamplifier input via terminal 6.

For high-impedance mike input, terminal 2 is jumper wire connected to terminal 5, transformer coupled out of terminal 9, to the preamplifier input via terminal 6.

The impedance matched microphone input is then applied through an input gain control potentiometer and capacitor coupled to the base of transistor amplifier Q5003.

NOTE: Terminal board TB5001 is shown strap-wired for CARBON microphone input ( heavy signal lines ).

Dotted lines show alternate strap-wiring arrangements for HI-Z or LO-Z microphone inputs.



9816-5

Figure 4-1. Functional Block Diagram

The amplified output from the collector of Q5003 is then capacitor coupled to the base of a second transistor amplifier Q5002. The amplified output from the collector of Q5002 is then capacitor coupled to the base of the final transistor amplifier Q5001.

The amplified microphone intelligence is then transformer coupled, via T5001, from the collector of Q5001 to terminals 10 and 11 of TB5001, providing a 600 ohm output.

A portion of the output level, taken across output transformer T5001, is sampled and applied to OUTPUT LEVEL meter M5001 for front panel monitoring.

The solid state preamplifier circuit board A4450 operates from a voltage source of +12 volts d-c, supplied by the MPA power supply circuit.

See figure 7-1 schematic diagram for detailed circuit layout and component values.

## **SECTION 5**

### **MAINTENANCE**

#### 5-1. PREVENTIVE MAINTENANCE

In order to prevent equipment failure due to dust, dirt or other destructive elements, it is suggested that a schedule of preventive maintenance be set up and adhered to.

At periodic intervals, the equipment should be removed from the equipment rack for cleaning and inspection. The wiring and all components should be inspected for dirt, dust, corrosion, grease or other harmful conditions. Remove dust with a soft brush or vacuum cleaner. Remove dirt or grease with any suitable cleaning solvent. Use of carbon tetrachloride should be avoided due to its highly toxic effects. Trichlorethylene or methly chloroform may be used, providing the necessary precautions are observed.

#### **WARNING**

When using toxic solvents, make certain that adequate ventilation exists. Avoid prolong or repeated breathing of the vapor. Avoid prolonged or repeated contact with skin. Flammable solvents shall not be used on energized equipment or near any equipment from which a spark may be received. Smoking, "hot work", etc. is prohibited in the immediate area.

#### **CAUTION**

When using trichlorethylene, avoid contact with painted surfaces, due to its paint removing effects.

#### 5-2. TROUBLESHOOTING

When a piece of equipment has been operating satisfactorily and suddenly fails, the cause of failure may be due to symptoms of past failures or due to component aging.

The first step in troubleshooting is to ascertain that proper

equipment voltages are present, interconnecting cables are secure and functional, and that the fuse is in functional condition.

### **NOTE**

Never replace a fuse with one of a higher rating unless continued brief operation is more important than probable equipment damage. If a fuse burns out immediately after replacement, do not replace it a second time until the cause of failure has been located and corrected.

If the above mentioned checks fail to locate the fault, and the fault is known to be that of the MPA, disconnect the power and interconnecting cables and remove the unit from its mounting.

Remove the chassis dust covers and perform a visual check. Observe for trouble causing conditions such as arcing, grease, dirt, dust or other harmful conditions, Observe for loose connections, broken or burned wires, charred or discolored components. Perform continuity checks, using schematic diagram. Check component circuit board for similar trouble causing conditions, also observing for hair-line cracks in the circuit board.

If the fault has not been located, reconnect the MPA power cable and perform the following operational test procedure. Refer to table 5-1 for test equipment required.

1. Set POWER switch at ON; measure d-c voltage at high side of R5023. It should read 12 volts.
2. Turn GAIN control fully counterclockwise.
3. Connect jumper wires on terminal board TB5001, terminals 2 to 5 and 6 to 9.
4. Connect 600 ohm dummy load to terminals 10 and 11 of TB5001.
5. Connect audio signal generator, set at 20 mv at 1000 cps, to pins 6 and 1 of J5003.
6. Connect distortion meter across 600 ohm dummy load.

7. Adjust GAIN control on MPA for an indication of 0 VU on panel OUTPUT LEVEL meter.
8. Set DISTORTION FREQUENCY switch at 200 to 2 K position.
9. Set RANGE switch at 100%.
10. Adjust FREQUENCY and AMPLITUDE course controls for a dip.
11. Set RANGE switch at 30%.
12. Repeat step 10.
13. Set RANGE switch at 10%.
14. Adjust FREQUENCY and AMPLITUDE FINE controls for a dip.
15. Set RANGE switch at 3%.
16. Repeat step 14.
17. Set RANGE switch at -10 CAL.
18. Adjust CALIBRATE control for 10 volts on 10 V scale.
19. Reset RANGE switch at 3%.
20. Adjust FREQUENCY and AMPLITUDE FINE controls for a dip; distortion must be less than 2%.
21. Disconnect distortion meter from 600 ohm dummy load.
22. Connect A-c VTVM across 600 ohm dummy load.
23. Readjust panel OUTPUT LEVEL meter for 0 VU if necessary.
24. Slowly decrease audio signal generator frequency until A-c VTVM indicates 6 DB.
25. Frequency at which lower 6 DB point is reached must be less than 300 cps.
26. Increase audio signal generator frequency until upper 6 DB point is reached on A-c VTVM. Frequency must exceed 3000 cps.
27. Reset audio signal generator frequency for 1000 cps and adjust panel OUTPUT LEVEL meter for 0 VU indication.
28. Remove audio signal generator input, (do not disconnect).
29. Set A-c VTVM RANGE control to a lower scale until a reading is observed. Reading indicates hum/noise; must be at least -40 DB.
30. At terminal board TB5001, reconnect strap wires for LO-Z mike. Connect terminal 2 to 4 and terminal 6 to 8.
31. Adjust audio signal generator for an input of 3mv at 1000 cps at J5003.

32. Adjust GAIN control on MPA for 0 VU reading on panel OUTPUT LEVEL meter.
33. At terminal board TB5001, connect terminal 2 to 3 and terminal 6 to 7.
34. Repeat steps 31 and 32.

Table 5-1. Test Equipment Required

ITEM	MANUFACTURER
Audio Signal Generator	Hewlett-Packard, Model 2000D or equivalent
Distortion Meter	Barker Williamson, Model 410 or equivalent
A-c VTVM	Ballantine, Model 314 or equivalent
Multimeter	Simpson, Model 260 or equivalent
Dummy Load, 600 ohm resistor, <u>+5%</u> , 1 watt	Any manufacturer meeting the necessary requirements

### 5-3. REPAIR AND REPLACEMENT

Repair of the MPA will consist mainly of component replacement, requiring no alignment. When replacing components, the technician should observe for correct component positioning and polarity. The replacement component should be of the same or equivalent type, as indicated in section 6, Parts List.

When replacing components on the printed circuit board, do not use a soldering iron with a power rating of more than 100 watts. Use a pair of long-nose pliers as a heat sink to protect components while soldering. When soldering is completed, check solder joints. Cold or loose solder connections can cause trouble at a later date.

See figure 5-1 for chassis mounted component locations.

See figure 5-2 for printed-circuit board component locations.



Z5001  
(SEE FIGURE 2)

TB5001

R5023

R5022

R5021

CR5002

R5020

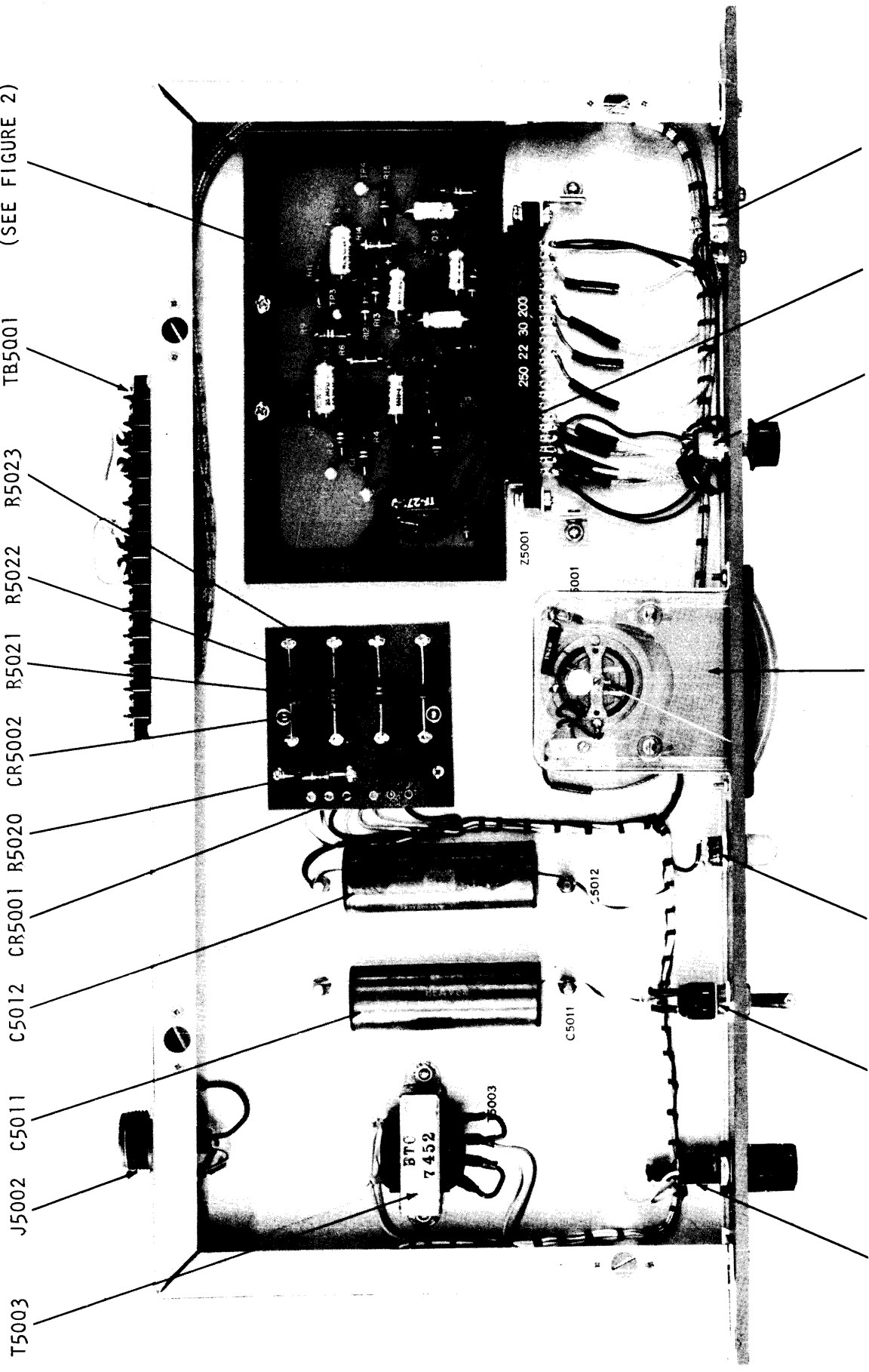
CR5001

C5012

C5011

J5002

T5003



J5003

P5001

R5019

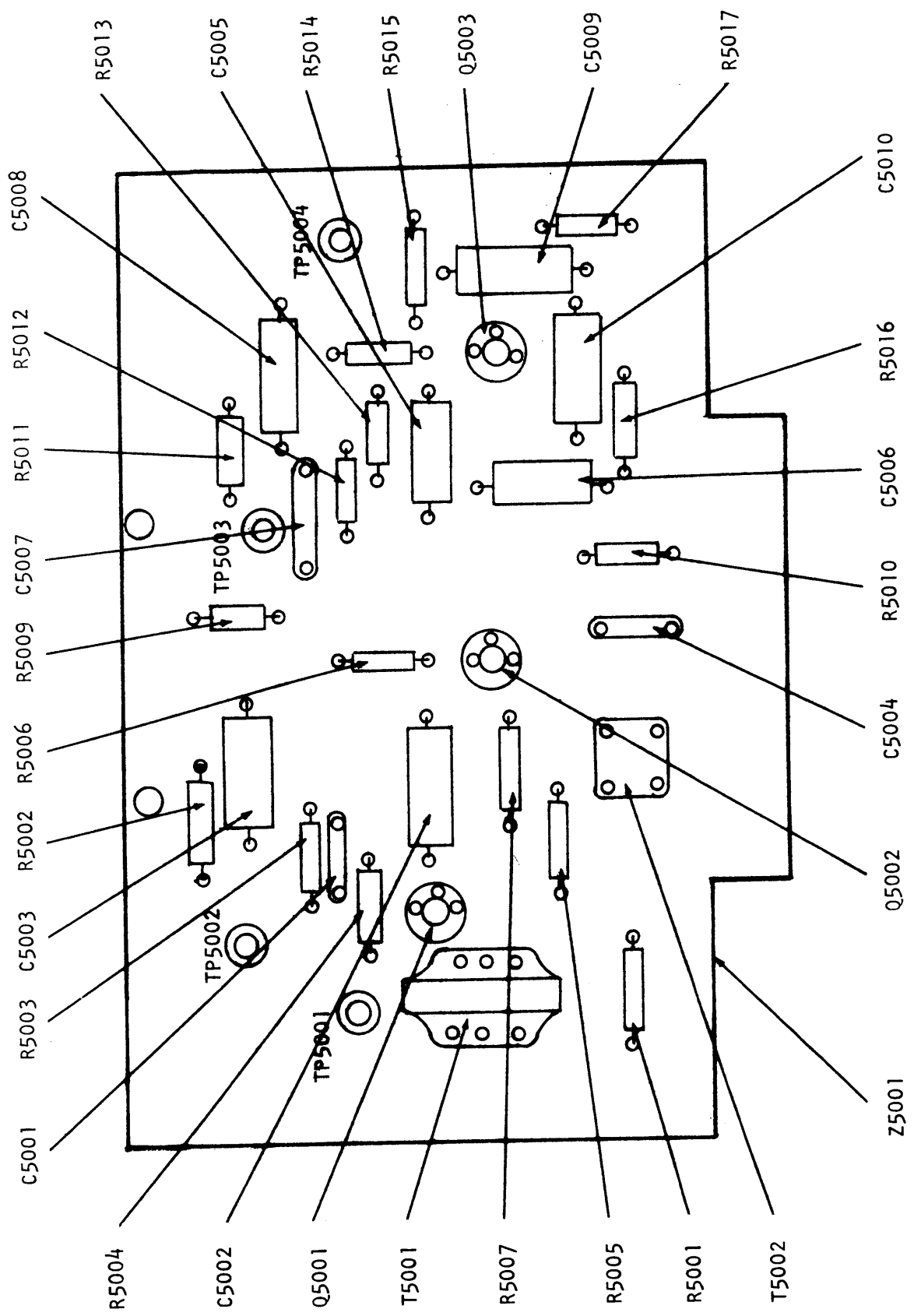
M5001

XDS5001

S5001

FX5001

Figure 5-1. Component Locations, Main Chassis



9816-7 (A4450)

Figure 5-2. Component Locations, Printed Circuit Board A4450

# SECTION 6

## PARTS LIST

### 6-1. INTRODUCTION

The parts list presented in this section is a cross-reference list of parts identified by a reference designation and TMC part number. In most cases, parts appearing on schematic diagrams are assigned reference designations in accordance with MIL-STD-16. Wherever practicable, the reference designation is marked on the equipment, close to the part it identifies. In most cases, mechanical and electro-mechanical parts have TMC part numbers stamped on them.

To expedite delivery when ordering any part, specify the following:

- a. Reference symbol.
- b. Description as indicated in parts list.
- c. TMC part number.
- d. Model and serial numbers of the equipment containing the part being replaced; this can be obtained from the equipment nameplate.

For replacement parts not covered by warranty (refer to warranty sheet in front of manual), address all purchase orders to:

The Technical Materiel Corporation  
Attention: Sales Department  
700 Fenimore Road  
Mamaroneck, New York

<u>Assembly or Sub-assembly</u>	<u>Page</u>
Microphone Preamplifier, Model MPA-1, Main Chassis . . . . .	6-2
Printed Circuit Board Assembly, A4450 . . . . .	6-4

PARTS LIST  
for  
MICROPHONE PREAMPLIFIER, MODEL MPA-1, MAIN CHASSIS

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C5001 thru C5010	Part of Printed Circuit Board Assembly, A4450.	
C5011	CAPACITOR, FIXED, ELECTROLYTIC: 20 uf, 350 WVDC; polarized.	CE116-12VN
C5012	Same as C5011.	
CR5001	SEMICONDUCTOR DEVICE, DIODE: rectifier bridge; peak reverse voltage 200 V; output current 1.5 ADC at 50°C or 1.0 ADC at 100°C; one cycle peak surge current 15 amps, recurrent forward current 5 amps; max. forward voltage drop 1 V at 100°C.	DD130-200-1.5
CR5002	SEMICONDUCTOR DEVICE, DIODE: silicon	1N4743
DS5001	LIGHT, INDICATOR: w/white translucent lens, sub-miniature type.	TS153-5
F5001	FUSE, CARTRIDGE: 1/4 amp; time lag; 1-1/4" long x 1/4" dia.; slo-blo.	FU102-.250
J5001	CONNECTOR, RECEPTACLE, ELECTRICAL: 22 female contacts rated for 5 amps at 1,800 V RMS; polarized.	JJ319-22SFD
J5002	CONNECTOR, RECEPTACLE, ELECTRICAL: male	MS3102A14S1P
J5003	CONNECTOR, RECEPTACLE, ELECTRICAL: 6 female contacts.	JJ212
M5001	METER: calibration	MR191-9
R5001 THRU R5007	Part of Printed Circuit Board Assembly, A4450.	
R5008	NOT USED	
R5009 thru R5017	Part of Printed Circuit Board Assembly, A4450.	
R5018	NOT USED	
R5019	RESISTOR, VARIABLE, COMPOSITION: 10,000 ohms, $\pm 10\%$ ; 1/2 watt.	RV106UX10B103A
R5020	RESISTOR, FIXED, COMPOSITION: 10 ohms, $\pm 5\%$ ; 1/2 watt.	RC20GF100J

PARTS LIST (CONT)

MICROPHONE PREAMPLIFIER, MODEL MPA-1, MAIN CHASSIS

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
R5021	RESISTOR, FIXED, COMPOSITION: 180 ohms, $\pm 5\%$ ; 1/2 watt.	RC20GF181J
R5022	Same as R5021.	
R5023	RESISTOR, FIXED, COMPOSITION: 10,000 ohms, $\pm 5\%$ ; 1/2 watt.	RC20GF103J
S5001	SWITCH, TOGGLE: SPST; 28° angle of throw; bat type handle.	ST12A
T5001	Part of Printed Circuit Board Assembly, A4450.	
T5002	Part of Printed Circuit Board Assembly, A4450.	
T5003	TRANSFORMER, POWER, STEP-DOWN: primary 115/230 VAC; 50/60 cps (Hz), single phase; secondary at full load 15.7 V RMS, 18 VDC; current rating 0.1 ADC; no load 18.4 VRMS, 0.1 ADC; six solder lug type terminals; open frame, hermetically sealed case.	TF349
TB5001	TERMINAL BOARD, BARRIER: twelve 6-32 thd. x 1/4" long binder head machine screws; black phenolic body.	TM100-12
XF5001	FUSEHOLDER: extractor post type.	FH100-*
Z5001	Printed Circuit Board Assembly. SEE SEPERATE PARTS LIST FOR BREAKDOWN.	A4450

PARTS LIST  
for  
PRINTED CIRCUIT BOARD ASSEMBLY, A4450

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C5001	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 10,000 uuf, GMV; 500 WVDC.	CC100-16
C5002	CAPACITOR, FIXED, ELECTROLYTIC: 10 uf, -10% +150% at 120 cps (Hz) at 25°C; 15 WVDC; polarized.	CE105-10-15
C5003	CAPACITOR, FIXED, ELECTROLYTIC: 30 uf, -10% +150% at 120 (Hz) at 25°C; 15 WVDC; polarized.	CE105-30-15
C5004	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 3,300 uuf, GMV; 500 WVDC.	CC100-13
C5005	Same as C5002.	
C5006	Same as C5002.	
C5007	Same as C5001.	
C5008	Same as C5003.	
C5009	Same as C5002.	
C5010	Same as C5002.	
Q5001	TRANSISTOR: silicon	2N3691
Q5002	Same as Q5001.	
Q5003	Same as Q5001.	
R5001	RESISTOR, FIXED, COMPOSITION: 3,600 ohms, $\pm 5\%$ ; 1/2 watt.	RC20GF362J
R5002	RESISTOR, FIXED, COMPOSITION: 1,000 ohms, $\pm 5\%$ ; 1/2 watt.	RC20GF102J
R5003	RESISTOR, FIXED, COMPOSITION: 560,000 ohms, $\pm 5\%$ ; 1/2 watt.	RC20GF564J
R5004	RESISTOR, FIXED, COMPOSITION: 270,000 ohms, $\pm 5\%$ ; 1/2 watt.	RC20GF274J
R5005	RESISTOR, FIXED, COMPOSITION: 390 ohms, $\pm 5\%$ ; 1/2 watt.	RC20GF391J
R5006	RESISTOR, FIXED, COMPOSITION: 6,800 ohms, $\pm 5\%$ ; 1/2 watt.	RC20GF682J

## PARTS LIST (CONT)

## PRINTED CIRCUIT BOARD ASSEMBLY, A4450

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
R5007	RESISTOR, FIXED, COMPOSITION: 560 ohms, $\pm 5\%$ ; 1/2 watt.	RC20GF561J
R5008	NOT USED	
R5009	Same as R5004.	
R5010	RESISTOR, FIXED, COMPOSITION: 100,000 ohms, $\pm 5\%$ ; 1/2 watt.	RC20GF104J
R5011	Same as R5002.	
R5012	RESISTOR, FIXED, COMPOSITION: 47,000 ohms, $\pm 5\%$ ; 1/2 watt.	RC20GF473J
R5013	RESISTOR, FIXED, COMPOSITION: 4,700 ohms, $\pm 5\%$ ; 1/2 watt.	RC20GF472J
R5014	Same as R5013.	
R5015	Same as R5010.	
R5016	RESISTOR, FIXED, COMPOSITION: 470 ohms, $\pm 5\%$ ; 1/2 watt.	RC20GF471J
R5017	RESISTOR, FIXED, COMPOSITION: 15,000 ohms, $\pm 5\%$ ; 1/2 watt.	RC20GF153J
T5001	TRANSFORMER, AUDIO OUTPUT: frequency range 50 to 10,000 cps; primary impedance 5,000 ohms CT; secondary impedance 600 ohms CT; power rating 10 mw.	TF271
T5002	TRANSFORMER, INPUT: frequency range 100 cps to 20 KC (KHz); primary impedance 200,000 ohms; DC resistance 6,500 ohms; secondary impedance 1,000 ohms; DC resistance 245 ohms.	TF246-6X

**SECTION 7**  
**SCHEMATIC DIAGRAMS**



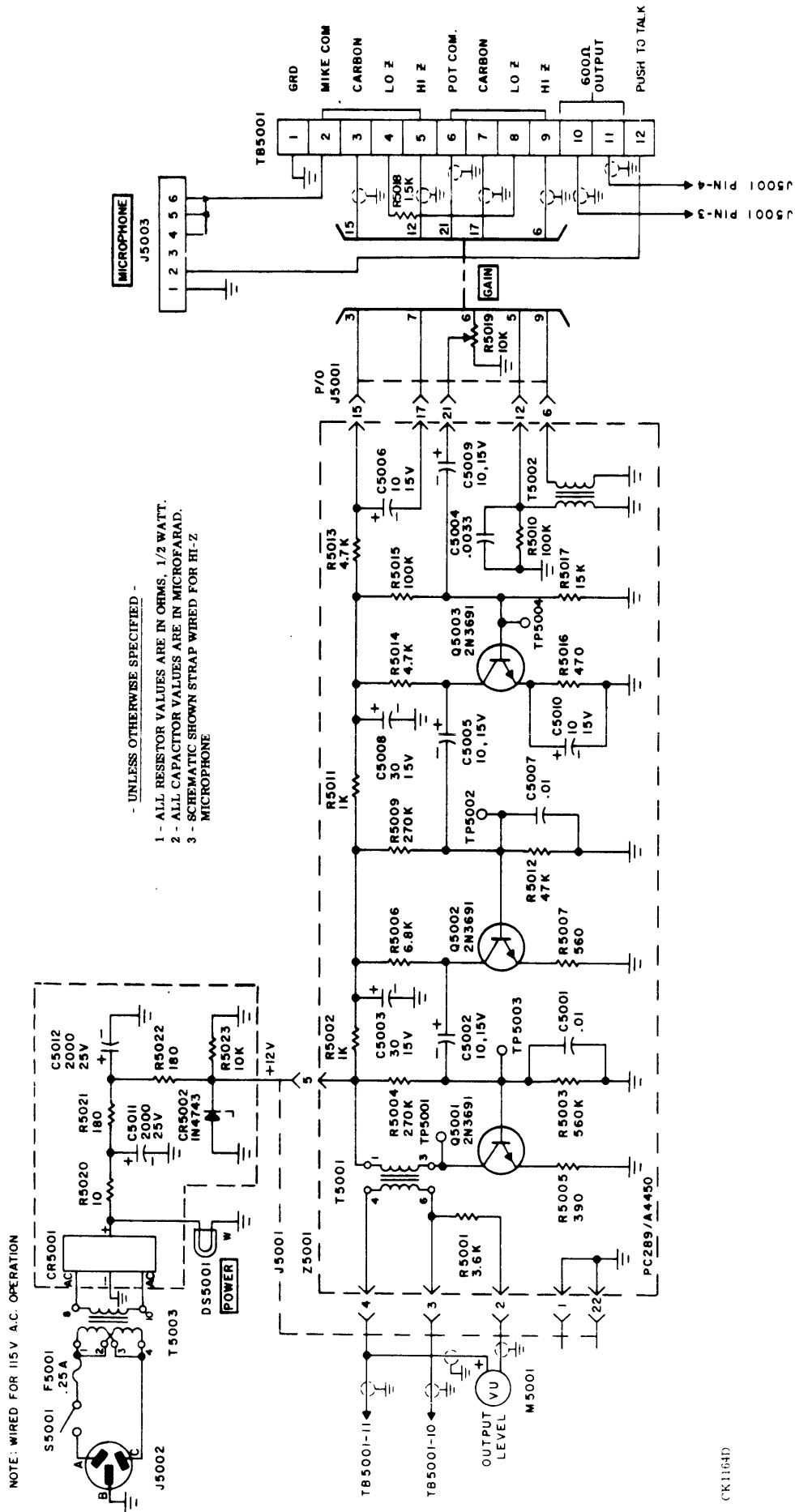


Figure 7-1. Schematic Diagram, Model MPA-1