MASTER COPY

DO NOT DESTROY

UNCLASSIFIED

TECHNICAL MANUAL

for

ANTENNA MULTICOUPLER
LMC-20

TMC (CANADA) LIMITED

Ottawa, Ontario

UNCLASSIFIED

TECHNICAL MANUAL

for

ANTENNA MULTICOUPLER
LMC-20

TMC (CANADA) LIMITED

Ottawa, Ontario

IN-8023

Issue Date: 1 Oct., 1966

THE TECHNICAL MATERIEL CORPORATION
COMMUNICATIONS ENGINEERS
700 FENIMORE ROAD MAMARONECK, N. Y.

Warranty

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

CHANGE NO. 1

TECHNICAL MANUAL CHANGE NOTICE

DATE: 12 July, 1967

MANUAL AFFECTED: Antenna Multicoupler LMC-20 IN: 8023

Page 1-5, table 1-3

Change 2N2084 to 2N2495.

Change 1N68 to 1N68A.

Page 4-3, figure 4-3

Change TX100 to 2N2219A.

Page 4-4, figure 4-4

Change TX100 to 2N2219A.

Change R125 from 68 to 100 ohms.

Change R124 from 470 to 100 ohms.

Change C114 from .01 to .2.

Page 4-5, figure 4-5

Change Q105 and Q106 from 2N2084 to 2N2495.

Change R135 to R136.

Page 4-6, figure 4-6

Change R140, 10 ohms, 2 watts to R112, 10 ohms, 1 watt.

Page 5-3, table 5-1

Change Q105 and Q106 from 2N2084 to 2N2495.

Pages 7-1 to 7-4

Make the following changes and additions to the parts list:

SYM.	DESCRIPTION	FUNCTION	TMC PART NO.
C101 (A,B)	CAPACITOR: dual, electrolytic, 20-20 uf, 450 WVDC	H.V. filter	CE10004-1
C103	CAPACITOR: electrolytic, 2400 uf, 35 WVDC	L.V. filter	CE10005-1
C104	Same as C103	Same as C103	

SYM.	DESCRIPTION	FUNCTION	TMC PART NO.
C105	CAPACITOR: disc, ceramic, 0.1 uf, +80 -20%, 100 WVDC	R.F. bypass	CC100-28
C107	CAPACITOR: disc, 0.01 uf, ±10%, 200 WVDC	Heater decoupling	CC10009
C109	CAPACITOR: ceramic, disc, 0.01 uf, GMV, 1000 WVDC	B+ decoupling	CC100-23
C119	CAPACITOR: mica, 47 pf, ±5%, 500 WVDC	DC collector blocking	CM15F470J03YY
C120	CAPACITOR: mica, 820 pf, ±5%, 500 WVDC	RF bypass	CM20F821G03
C124	Same as C107	RF coupling	
C125	CAPACITOR: mica, 15 pf, ±2%, 500 WVDC	RF coupling	CM15D150G03YY
J102	CONNECTOR: female, coaxial, UHF series	Antenna input jack	SO239A
J119 thru J134	CONNECTOR: coaxial, BNC	Output jacks	UG - 625/U
Q102	TRANSISTOR	Driver	2N2219A
Q105	TRANSISTOR	Oscillator	2N2495
R112	RESISTOR: fixed, composition, 10 ohm, ±5%, 2 w	Same as R101	RC42GF100J
R114	RESISTOR: fixed, composition, 10 ohm, ±5%, ½ w		RC20GF100J
R115	Same as R114		
R118	RESISTOR: fixed, composition, 47 ohm, ±5%, 1 w	Emitter voltage divider	RC20GF470J
R119	RESISTOR: fixed, composition, 100 ohm, ±5%, 1 w	Same as R118	RC32GF101J
R121	Same as R120	Same as R120	
R124	Same as R119	Same as R118	
R125	Same as R119	Same as R118	
R131	Same as R126	Same as R126	
R135	Same as R120		
R136	Same as R134		

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
R138	Same as R134		
R139	RESISTOR: variable, composition, 5 k ohms, ±10%		RV111U502A
R140	RESISTOR: fixed, composition, 39 k ohms, ±5%, ½ w		RC20GF393J
R141	RESISTOR: fixed, composition, 100 ohms, ±5%, 1 w		RC20GF101J
R142	RESISTOR: fixed, composition, 4.7 ohms, ±5%, 1 w		RC32GF4R7J
R144	Same as R142		
S102	SWITCH: rotary, 4 section, 24 position	Output/filter	SW10022
T101	TRANSFORMER: power, single phase, non-repairable item, primary 115/230 V, 60/400 Hz.	AC power	TF10026
T102	TRANSFORMER: RF, broadband, 0.1-2 MHz; non-repairable item	Preamplifier input	TR086
T103	TRANSFORMER: RF, broadband, 0.1-2 MHz; non-repairable item	Preamplifier input	TR084
V101	TUBE: electron, triode, receiving type, 9 pins	Preamplifier	5842/417A
V102	Same as V101	Same as V101	
X101	HOLDER: fuse, lamp indicating, clear	Fuse holder	FH104-2
XD101	LIGHT: red indicator, miniature bayonet	Lamp socket	TS106-1
XV101	SOCKET: electron tube	Tube socket	TS103P01
XV102	Same as XV101		
Y101	CRYSTAL: quartz, 1 MHz	Test oscillator	CR18A/U1000,000

Also change FX101 to FL101 and FX102 to FL102.

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

LIST OF TABLES

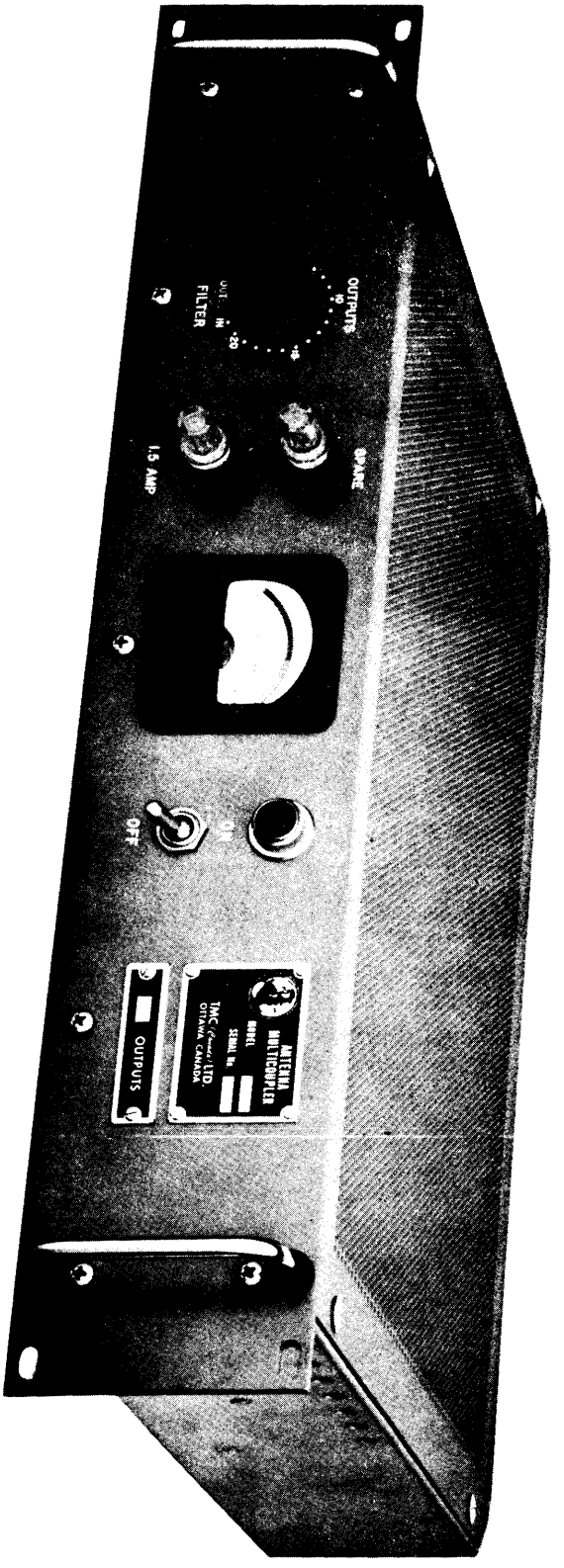


FIGURE 1-1. ANTENNA MULTICOUPLER MODEL LMC-20, FRONT VIEW

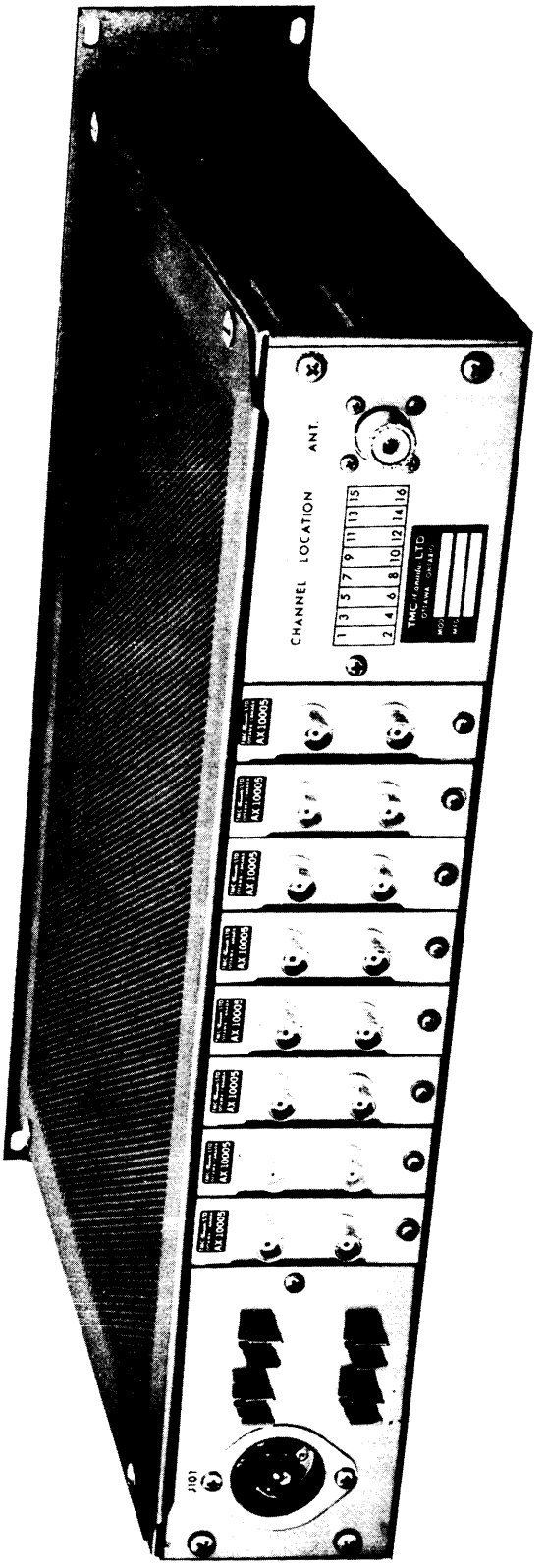


FIGURE 1-2. ANTENNA MULTICOUPLER MODEL LMC-20, REAR VIEW

SECTION 1

GENERAL DESCRIPTION

PURPOSE AND BASIC PRINCIPLES.

The Technical Materiel Corporation's Antenna Multicoupler, Model LMC-20 is a broadband antenna-to-receiver coupling device developed for use where it is desirable to employ a common antenna for a number of communication receivers.

The LMC-20 consists of a broadband vacuum tube preamplifier, a transistorized driver stage, and a varying number of transistorized output stages. An internal power supply furnishes all voltages required to operate the various stages within the unit.

The attenuation of high level signals, by the use of pads in the front end to achieve greater signal handling capabilities, has been held to a minimum to preserve the Signal/Noise plus noise ratio of low level signals, which are of prime importance to the communicator.

The basic LMC-20 provides 16 separate output stages for coupling a single antenna to sixteen receivers. Inherent in the design of the LMC-20 is the capability of reducing or increasing the number of outputs in increments of four stages so that units with 4, 8 and 16 outputs are readily available. These Models are referred to as LMC-20/4, LMC-20/8, LMC-20/16.

Expansion of the capabilities of an LMC-20 Multicoupler with a lesser number of outputs may be accomplished solely by adding plug-in output modules in increments of two modules (four stages).

Unless otherwise noted this manual will describe the LMC-20/16 (with sixteen separate receiver connections). However, the different units may be considered identical with reference to theory, operation, trouble-shooting, maintenance, etc.

An internal low-pass filter is used to attenuate all signals above 600 KHz. When this filter is connected in the input circuitry of the Multicoupler, the optimum range of frequencies over which the unit will operate lies in the 50 KHz to 500 KHz band. However, the Multicoupler is usable up to 4 MHz and down to 15 KHz with the filter out.

The LMC-20 has a nominal input impedance of 50 ohms, unbalanced, and was designed to operate from the non-resonant type of antenna.

The output impedance of the receiver coupling stage is standard at 50 ohms, unbalanced. As outlined in the OPERATOR'S INSTRUCTIONS (SECTION 3) and PRINCIPLES OF OPERATION (SECTION 4), termination at the output stages, impedances of other than 50 ohms, may result in varying readings with the incorporated test meter, but will only slightly affect the overall performance of the Multicoupler.

When the LMC-20 is used in a receiving system it results in a general improvement in the noise factor with no loss of system gain.

Spurious responses generated in the Multicoupler are kept to a minimum and the design of the LMC-20 results in a considerable reduction in the amplitude of signals re-radiated from receiver to receiver or receiver to the common antenna system. The LMC-20 has inherent protection features against overloading by strong RF signals.

If operation of more than 16 receivers from a common antenna is desired, the LMC-20 Multicouplers may be cascaded by connecting the individual outputs of one LMC-20 to the input (antenna) receptacles of additional Multicouplers. Thus, it is possible to operate 16 x 16 or 256 receivers from a single antenna through 17 Multicouplers. Cascading the units in this manner does not seriously impair their performance.

1-2 DESCRIPTION OF UNIT.

The LMC-20 Antenna Multicoupler is shown in Figure 1-1. It required a total of 3½ inches of panel space and 14 inches of depth in a standard 19 inch rack or cabinet. The unit is supported by its own front panel.

Controls and switches for the operation of the LMC-20 are located on the front panel. All vacuum tubes and semiconductors are readily accessible. The output stages are plug-in modular transistorized units; two outputs per module.

The equipment is manufactured in accordance with JAN/MIL specifications wherever practicable. All parts and assemblies meet or exceed highes. quality standards.

The front panel OUTPUTS/FILTER selector switch provides a by-pass of the low-pass filter. Positions 1 to 16 of this switch, together with the panel meter, provide a dynamic testing facility of each output branch while the equipment is in operation.

All coaxial receptacles carrying RF signals to or from the unit are located on the rear apron of the chassis.

Strapping options at the primary of the power transformer allow the LMC-20 Multicoupler to be used on 115 or 230 volts ac, 50 to 400 cps, single phase. The POWER ON/OFF switch, pilot lamp, main and spare fuse holders are mounted on the front panel. The power input receptacle (3 wire, including a ground connection) is located on the rear apron of the chassis.

TABLE 1-1.

TMC PART NO.	ITEM	QUANTITY
CA555-4	AC Power Cord Assembly	1
DL-100-4	Coaxial Load Plugs	25% of the total outputs
UG-625B/U	Coaxial mating connectors, output	1 per output
PL-259A	Coaxial mating connector, input	1
A-10366	Output Module Extender Card	1

Loose Items shipped with the LMC-20 Antenna Multicoupler.

1-3 REFERENCE DATA.

The crated dimensions of the LMC-20 Antenna Multicoupler are 9 inches by 21 inches by 27 inches. It weighs 28 pounds gross packed for shipment.

Tables 1-2 through 1-4 contain additional reference data pertinent to the LMC-20 Antenna Multicoupler.

Figures 1-3 through 1-4 illustrate technical performance characteristics.

TABLE 1-2. ELECTRICAL CHARACTERISTICS, LMC-20.

Connectors:	
Antenna Input	Coaxial Receptacle, Type UHF
Power Input	Receptacle, JJ-175.
RF Outputs	Coaxial Receptacles, Type BNC.
Frequency Range:	50 KHz to 500 KHz (Filter in) usable from 15 KHz to 4 MHz (Filter out).
Gain:	Nominal 0 db.
Frequency Response:	± 1 db. 50 KHz to 2 MHz.
Noise Figure:	Average 7 db.
VSWR:	1.5:1. referred to nominal impedance.
Input Impedance:	50 ohms unbalanced.
Output Impedance:	50 ohms unbalanced.
Number of Outputs:	Minimum 4. Standard models have 8 or 16 outputs.
Intermodulation Distortion:	In no case are 2nd or 3rd order intermodulation products less than 60 db below two 0.25v RMS signals applied at the input. However typical 2nd order products are 70 db down.

TABLE 1-2. ELECTRICAL CHARACTERISTICS, LMC-20 (Cont'd)

Harmonic Distortion:	Negligible at test levels stated above.
Back to Front Isolation:	Better than 100 db.
Output to Output Isolation:	Average 50 db.
Output Phasing Between Jacks:	± 1°
Broadcast Filter:	A switchable broadcast filter is incorporated which provides at lease 40 db attenuation across the broadcast band.
Desensitization:	A 1.0v (10% removed in frequency) input signal will reduce a low level signal by no more than 2 db.
Overload:	10v RMS continuous or 75v for 5 second intervals when applied at the input receptacle will not cause component failure or subsequent degradation of performance.

TABLE 1-3. VACUUM TUBE AND SEMICONDUCTOR COMPLEMENT.

TYPE	FUNCTION	QUANTITY
5842/417A	Pre-Amplifier	2
2N2219A	Driver and Output Stages	1 driver plus 1 per output.
2N2084	Test Oscillator and Buffer	2
1N68	Metering Diodes	2 per output.
1N547	High Voltage Rectifiers	2
1N1613	Low Voltage Rectifiers	4

TABLE 1-4. ELECTRICAL CHARACTERISTICS - POWER SUPPLY.

Input Requirements:	115 or 230 vac ± 10%, 40 to 400 cps, single phase, approximately 40 watts.
Output Voltages:	+ 145vdc unregulated - 20vdc unregulated 6.3 vac.

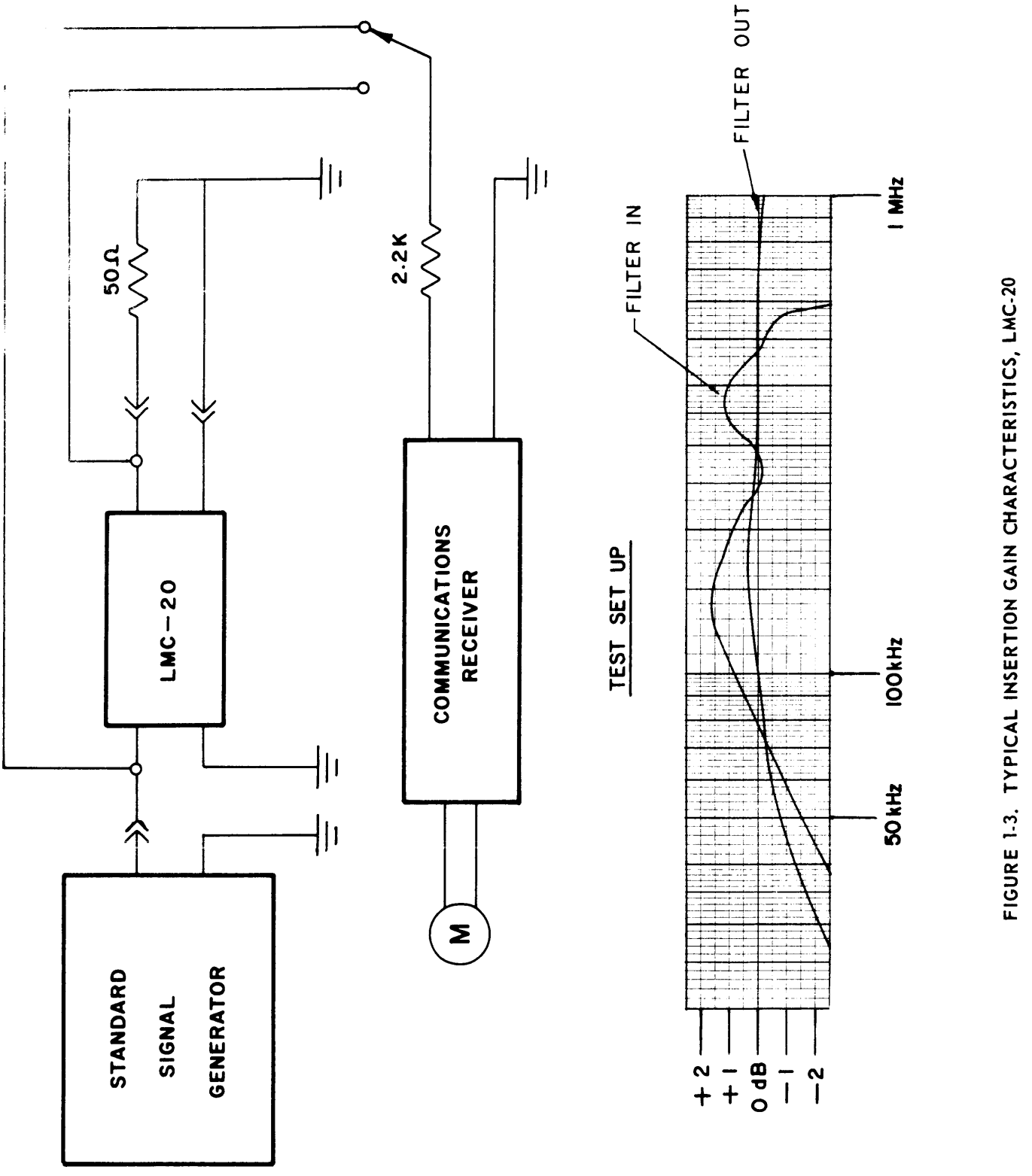
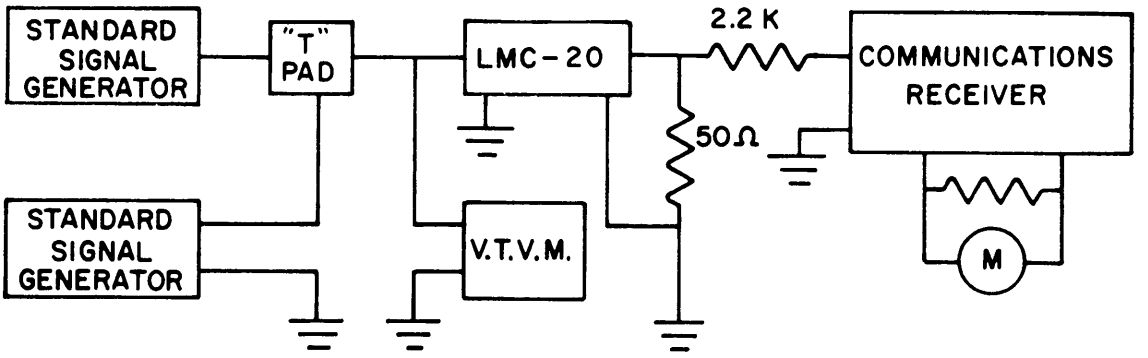


FIGURE 1-3. TYPICAL INSERTION GAIN CHARACTERISTICS, LMC-20



TEST SET-UP

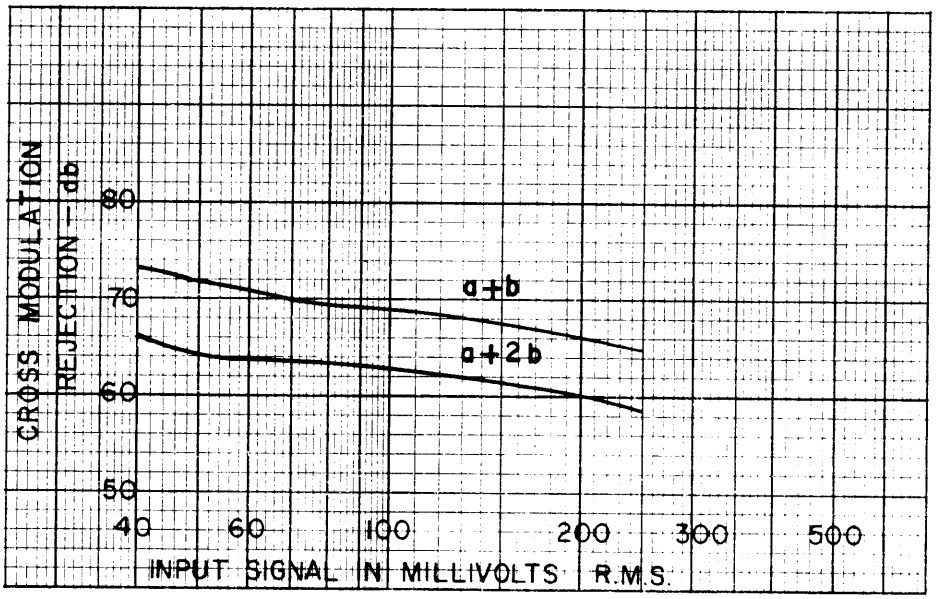


FIGURE 1-4 TYPICAL CROSS MODULATION CHARACTERISTICS, LMC-20.

SECTION 2

INSTALLATION

2-1. INITIAL INSPECTION.

Each LMC-20 Antenna Multicoupler has been thoroughly tested and calibrated at the factory before shipment.

Upon receipt at the operating site, the packing case and its contents should be inspected immediately for possible damage.

Unpack the equipment carefully. Inspect all packing materiel for parts which may have been shipped as loose items (see table 1-1).

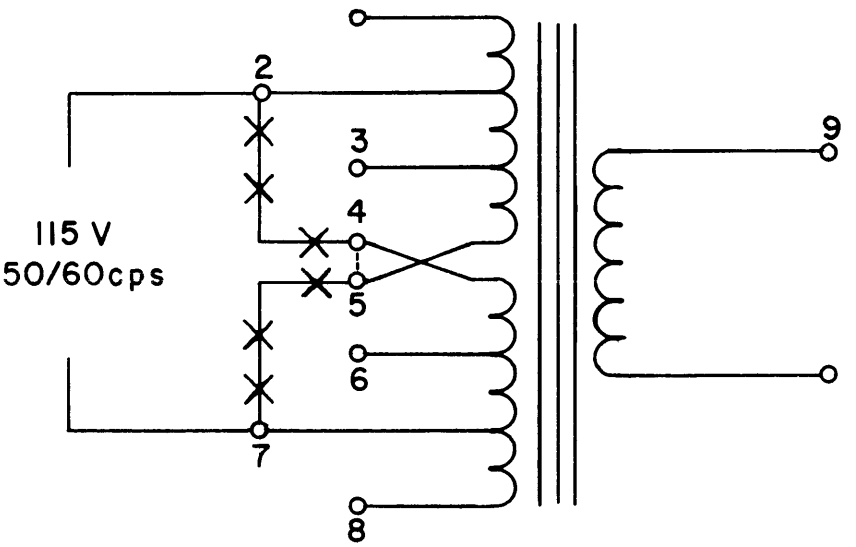
Although the carrier is liable for any damage to the equipment The Technical Meteriel Corporation will assist in describing and providing for the repair or replacement of damaged items. Note that the Standard Warranty does not cover replacement of parts damaged in shipment.

The equipment is shipped with vacuum tubes installed. Check to ensure that these tubes are properly seated in their sockets.

2-2. 115/230 VOLT POWER SUPPLY CONNECTIONS.

The power supply transformer primary is wound to accept 115 or 230 volts ac. single phase, 50 to 400 cps. It is normally factory wired for 115v input, if 230v operation is required, disconnect the jumper wires between terminals 2 and 3. The connections are shown in Figure 2-1.

FIGURE 2-1. INSTALLATION DIAGRAM SHOWING 115 AND 230 VOLT POWER TRANSFORMER CONNECTIONS.



NOTE:
FOR 230 VOLT OPERATION,
REMOVE JUMPERS MARKED —X—X—
ADD JUMPER MARKED --- BETWEEN TERMINALS "4 & 5"

NOTE

For 230 volt operation, the power fuse, F101 should be changed to a slow-blow fuse rated at 0.6 amperes.

2-3 INSTALLATION PROCEDURES.

Install the LMC-20 Antenna Multicoupler in a standard 19 inch rack cabinet or other housing as desired. The equipment may be mounted by its front panel and requires no additional support. Figure 2-2 is an outline dimensional drawing of the LMC-20.

Attach the male type UHF coaxial plug furnished with the LMC-20 to the antenna cable. Insert this plug into the ANTENNA JACK J-102 at the rear of the unit.

Attach the male type BNC coaxial connectors to the 50 ohm single conductor coaxial cables which are to be connected to the antenna input terminals of the associated receivers.

If the receiver inputs are other than 50 ohms, it may be desirable to install impedance matching transformers between the cables and the receivers (at the receivers). Insert the cable connectors into the output jacks at the rear of the chassis of the multicoupler.

When attaching the coaxial plugs to the coaxial cables, both the inner and outer conductors should be soldered to ensure trouble-free service.

The DL-100-4 Dummy Load plugs should be installed on any output jacks which are not actually connected to a receiver.

Determine the main power input voltage and check the power supply for correct transformer connections (refer to paragraph 2-2). Ensure that a correctly rated fuse is inserted into the Main Fuse holder on the front panel. For 115 volt operation, use a 1.2 ampere, slow-blow, 125 volt fuse, for 230 volt operation, use a 0.6 ampere, slow blow, 250 volt fuse.

With the POWER ON/OFF switch in the OFF position, connect the LMC-20 Antenna Multicoupler to the main ac power by installing the power cord assembly (TMC Part No. CA-554-4) furnished with the unit. Connect the female plug to the receptacle J101 at the rear of the chassis, locking the plug by rotating it in a clockwise direction. Connect the male plug to the main power source. The unit may then be turned on by moving the POWER switch to the ON position. Illumination of the POWER lamp will indicate proper installation.

Refer to SECTION 3 - OPERATOR'S INSTRUCTIONS for operating and performance evaluating procedures.

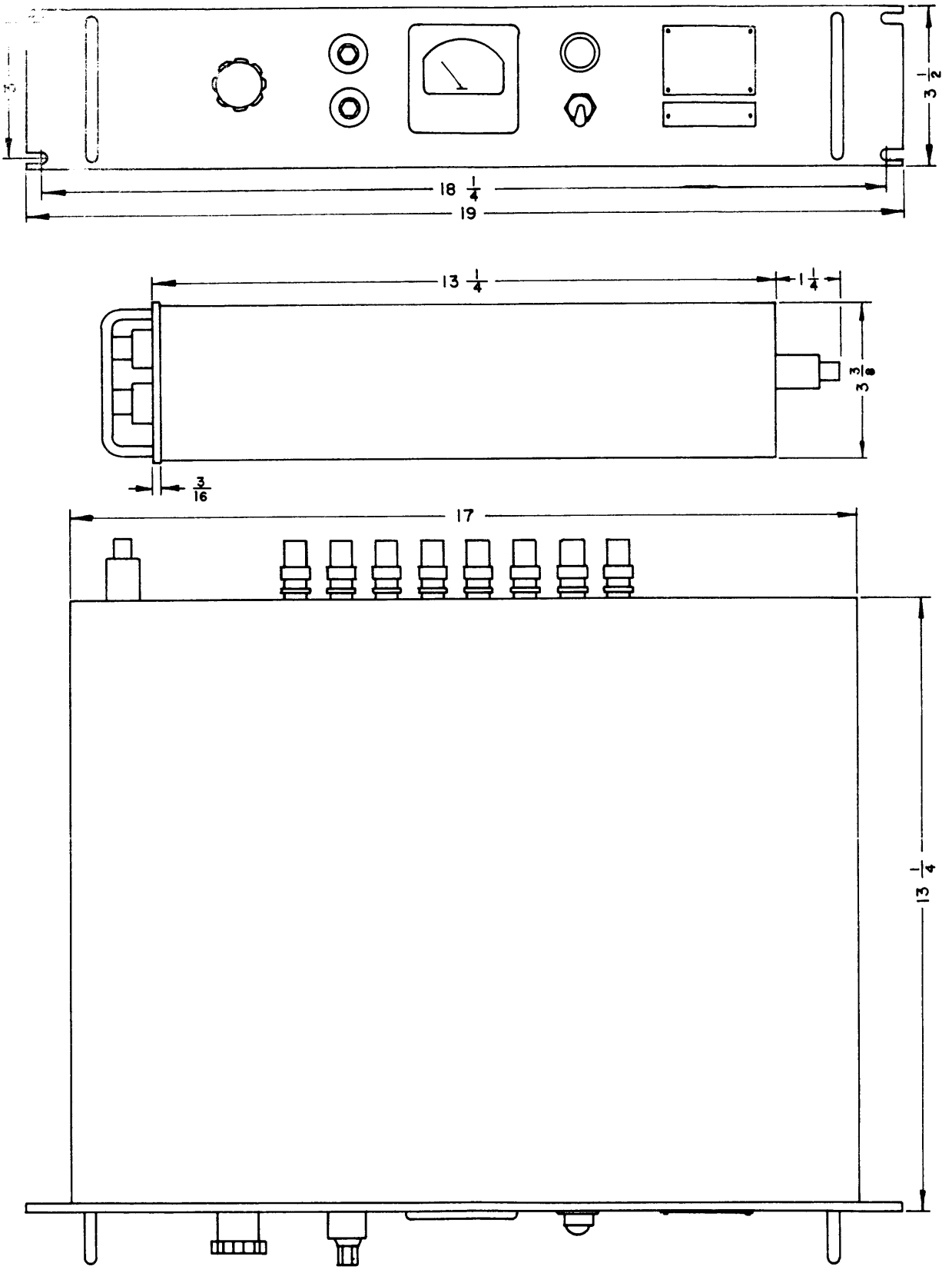


FIGURE 2-2 OUTLINE DIMENSION LMC-20

SECTION 3

OPERATOR'S SECTION

3-1 OPERATOR'S INSTRUCTIONS.

Table 3-1 lists the operating controls, indicators and fuse holders on the front panel of the LMC-20 as shown in Figure 3-1. Also included are the component reference designations used on the schematic, Figure 8-1.

During the initial installation and operation phase, and at periodic intervals, the multicoupler should be checked by means of the internal testing oscillator. This oscillator inserts a 1 MHz signal into the Multicoupler for dynamically checking the performance of each branch of the unit.

Rotation of the OUTPUTS/FILTER control (1) through all the output positions will indicate on the METER (6) the relative performance of each branch under actual signal conditions. The meter pointer should come to rest within the green sector of the scale.

NOTE

The meter is calibrated for proper indication when the output under test has been terminated in a load of approximately 50 ohms.

Most receivers have a very wide variation in input impedance. When checking an output that is connected to a receiver, the meter pointer may not fall within the green sector. If this happens, it is necessary to disconnect the receiver and terminate the output branch with the terminating connector provided at the rear panel. Only if the meter pointer does not fall within the green sector when the output is properly terminated is maintenance indicated.

The Multicoupler incorporates a low pass filter which is used to attenuate signals above 600 KHz. This filter is switched IN or OUT of the circuit by means of the OUTPUTS/FILTER control (1).

When it is desired to tune an associated receiver above 600 KHz, the OUTPUTS/FILTER control should be placed in the OUT position. At all other times this control should be left in the IN position as the filter serves to reduce any cross modulation caused by a high-level signal generated by a local broadcast station.

NOTE

Only when the OUTPUTS/FILTER control (1) is placed in the OUT or IN position is the antenna connected to the input amplifier of the multicoupler. All outputs of the unit are in-operative during the dynamic testing of any single branch.

3-2 OPERATOR'S MAINTENANCE.

The operators should note the general condition of the panel switches and observe whether the POWER indicator lamp (2) lights. The location of the tubes and semiconductors are indicated in the tube and semiconductor location diagram of Figure 5-1. There are tubes only in the pre-amplifier circuit of the multicoupler. If checking of tubes is indicated, use the substitution method.

Power is supplied for operation of the multicoupler by throwing the POWER ON/OFF switch (3) to the ON position. The ON position is indicated by the illuminated POWER indicator lamp (2) on the front panel. Failure of this lamp to light may be due to failure of the ac mains power, a defective switch, burnt out pilot lamp or a blown main power fuse. Failure of the fuse is indicated by illumination of the main fuse holder (4) on the front panel.

CAUTION

Do not replace a fuse with one of a higher rating. If a fuse burns out immediately after replacement, do not replace it a second time until the trouble has been located and corrected.

TABLE 3-1. EQUIPMENT CONTROL DESIGNATIONS.

REFERENCE FIG. 3-1	PANEL DESIGNATION FIG. 3-1.	COMPONENT REFERENCE DESIGNATION FIG. 8-1.
1.	OUTPUTS/FILTER Control Knob	Rotary Switch
2.	Power Indicator	Lamp, I.
3.	ON/OFF Toggle Switch	Switch, S.
4.	Fuse Holder, Main	Fuse, F.
5.	Fuse Holder, Spare	
6.	Meter	Meter, M.

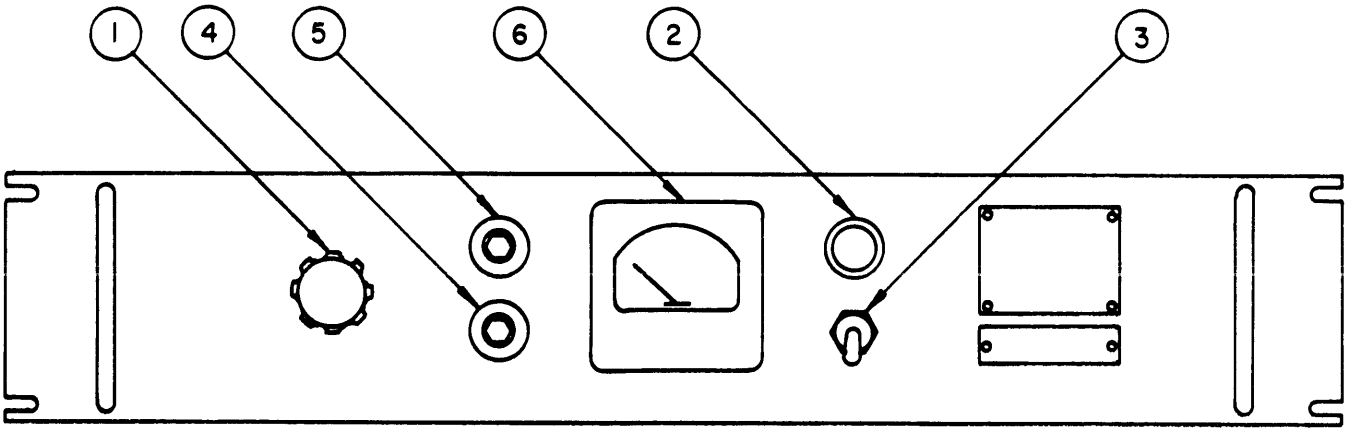


FIGURE 3-1. OPERATING CONTROLS ANTENNA MULTICOUPLER, LMC-20.

SECTION 4

PRINCIPLES OF OPERATION

4-1. GENERAL.

The LMC-20 Antenna Multicoupler is a broadband distribution system interposed between an antenna and the antenna terminals of a group of conventional communication receivers. Impedances into and out of the multicoupler are flat over the specified operating frequency range to ensure high performance when used in a communication receiving system.

The Multicoupler has five major sections as shown in the block diagram, Figure 4-1. These sections are described in detail in paragraphs 4-2 through 4-6.

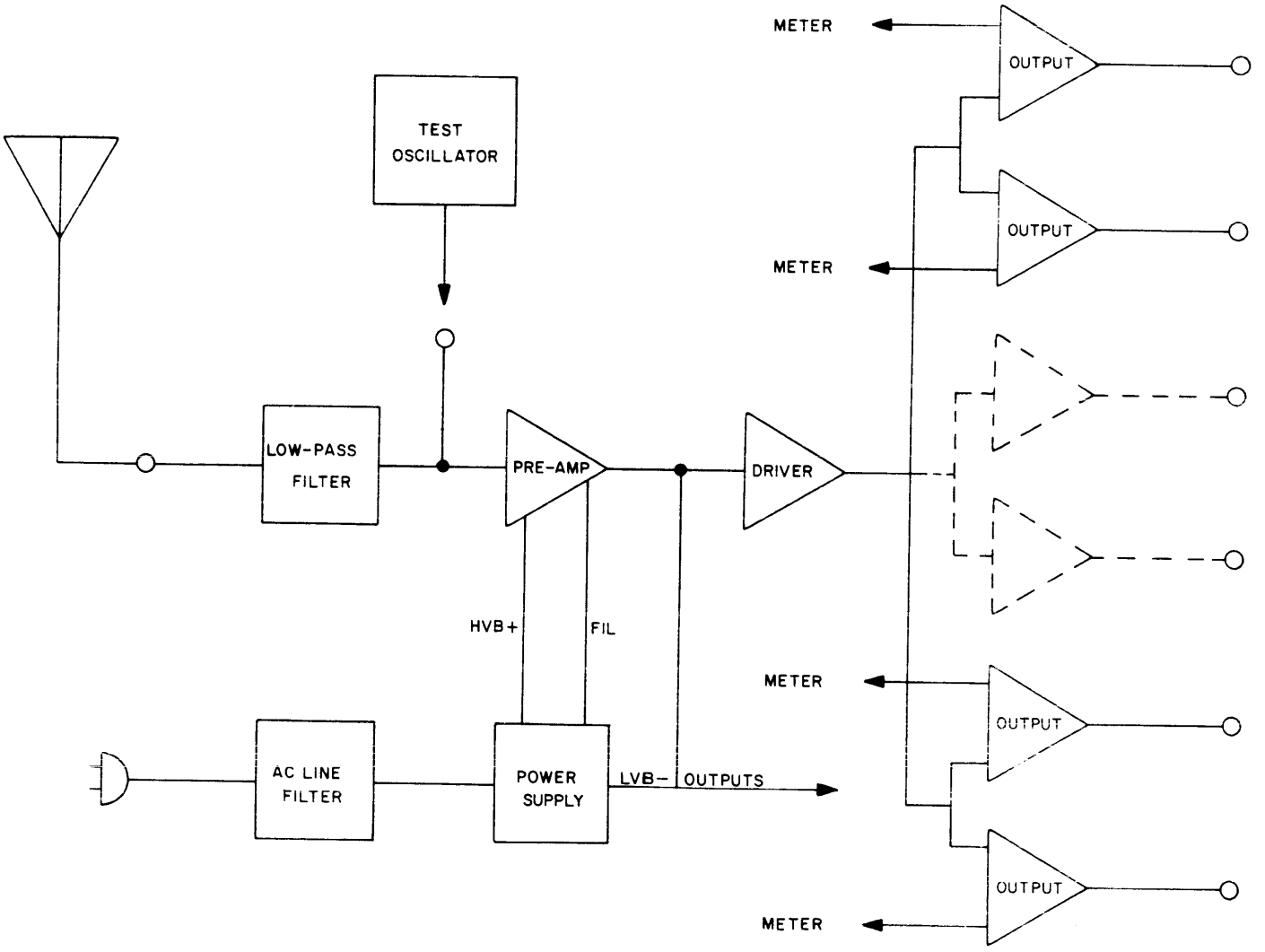


FIGURE 4-1. BLOCK DIAGRAM LMC-20.

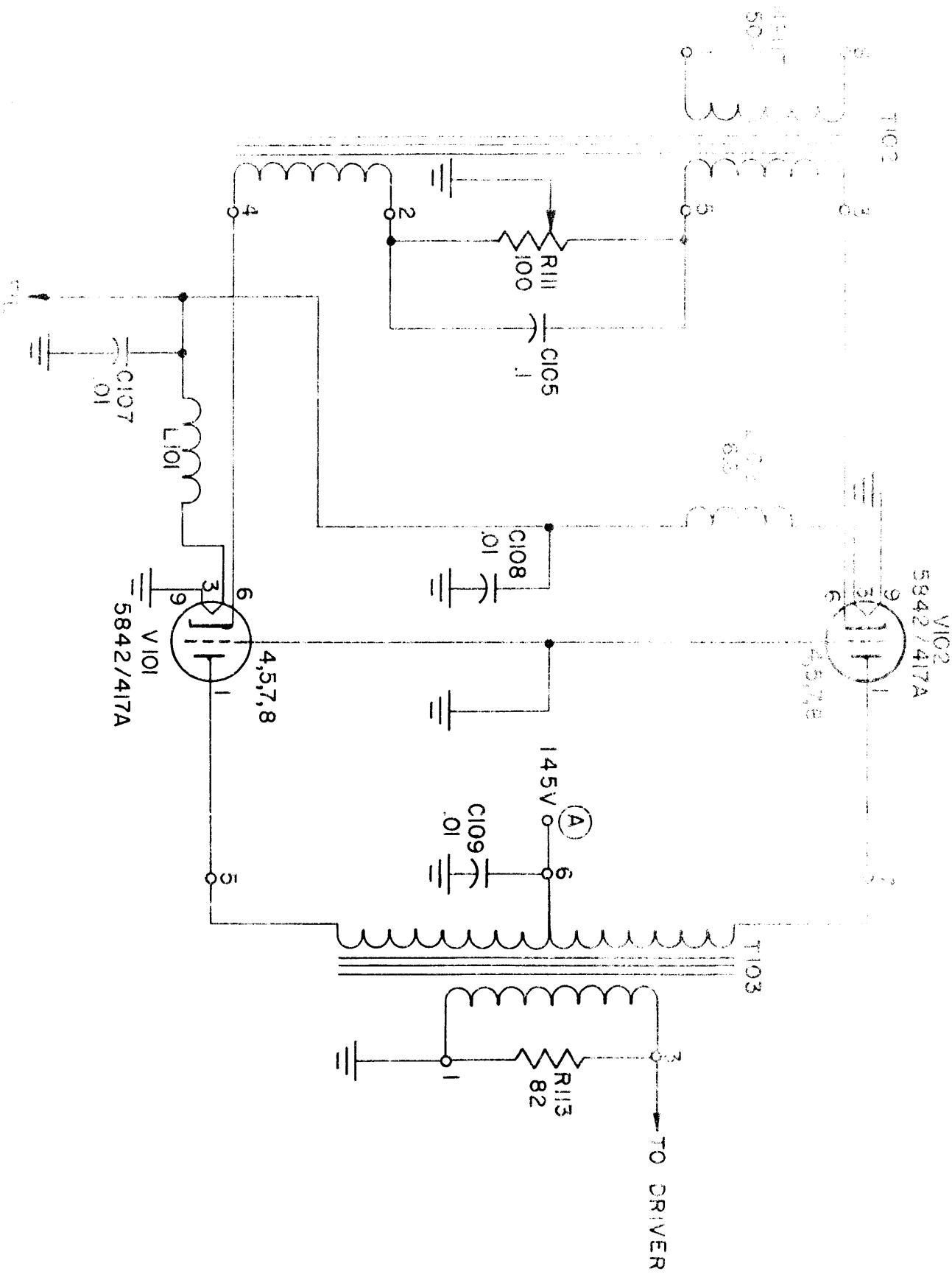


FIGURE 4-2. SIMPLIFIED SCHEMATIC – INPUT AND PRE-AMPLIFIER.

4-2. INPUT AND PRE-AMPLIFIER SECTIONS.

The multicoupler is normally furnished with an input impedance of 50 ohms, other input impedances may be furnished upon special request. Refer to Figure 4-2.

The Antenna is connected through a filter and a rotary switch to the pre-amplifier. The purpose of the switch is four-fold, it permits operation with or without the filter, it turns the dynamic test oscillator on and off and when in the test position it selects the output module to be dynamically tested.

The filter is designed for a maximum attenuation to broadcast band signals.

The pre-amplifier employs a grounded grid push-pull configuration with excellent broadband characteristics. Low noise tubes are used and the balancing circuit (R111) ensures the minimum cross modulation products at the pre-amplifier output. The pre-amplifier is transformer coupled to the driver stage. The gain of the pre-amplifier is nominally 12 db and its bandpass characteristics are flat within ± 1 db from 50 KHz to 2 MHz. The pre-amplifier does not exceed a 7 db noise figure across its operating range.

4-3. DRIVER SECTION. (Refer to Figure 4-3)

The driver stage is transistorized and uses an emitter follower configuration to ensure low noise and distortion. Inductive components are not used in this stage ensuring good broadband characteristics. The output of the driver is RC coupled to the distribution line feeding the output modules. The 2N2219 transistor is operated well below its maximum ratings to ensure low noise and long term reliability.

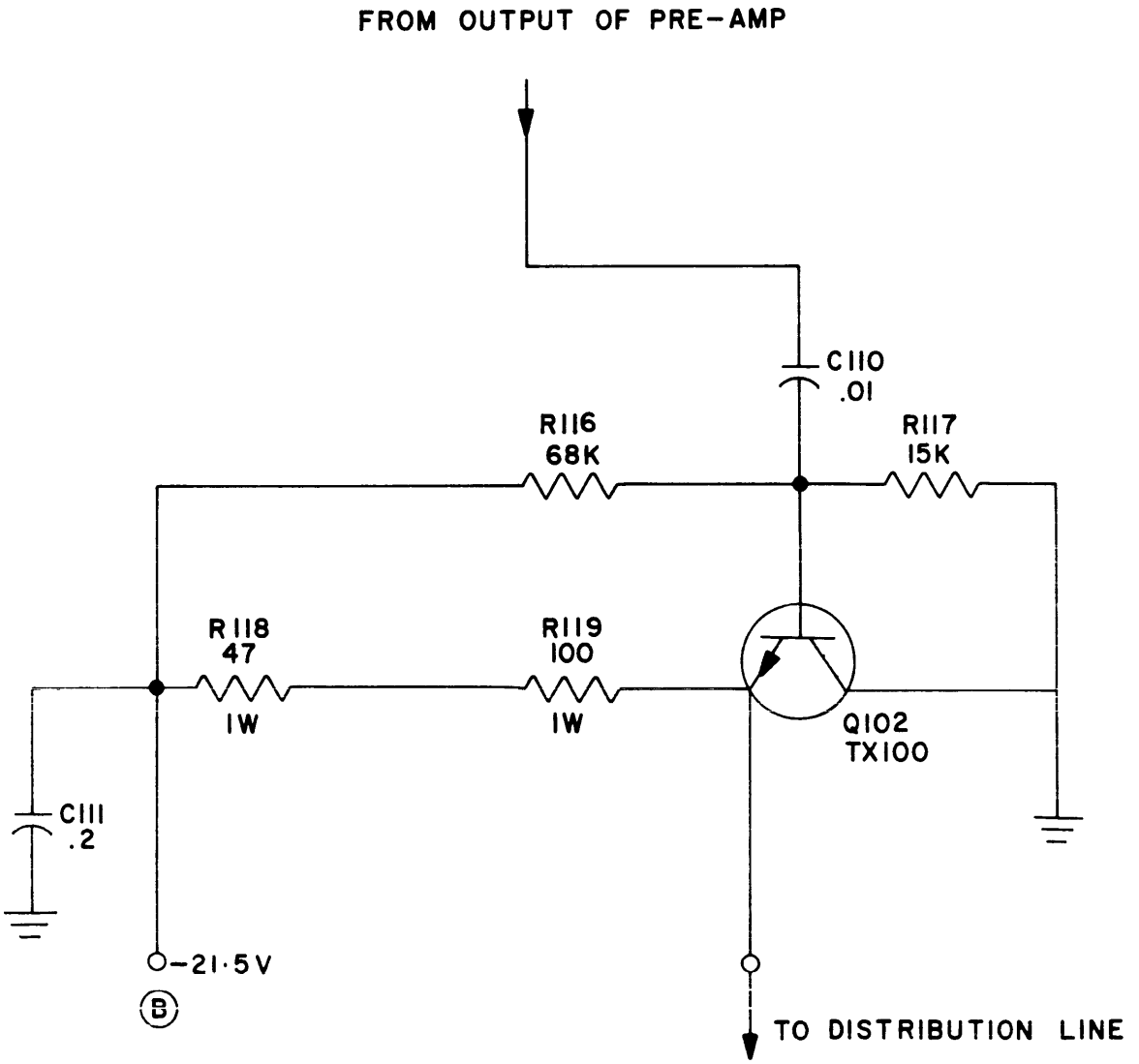


FIGURE 4-3. SIMPLIFIED SCHEMATIC - DRIVER SECTION.

MODULES (Refer to Figure 4-4)

[illegible] as the combined [illegible] output channels. Each channel [illegible] ized emitter follower circuit [illegible] pick-off for dynamic testing. [illegible] in the output modules [illegible] VSWR ratios and low phase differences between output channels. The modules are fully interchangeable so that any one may be plugged into any position. The nominal output impedance is 50 ohms unbalanced but other impedances may be provided for upon request. Dummy loads are provided for correct termination of any output channel not connected to a receiver.

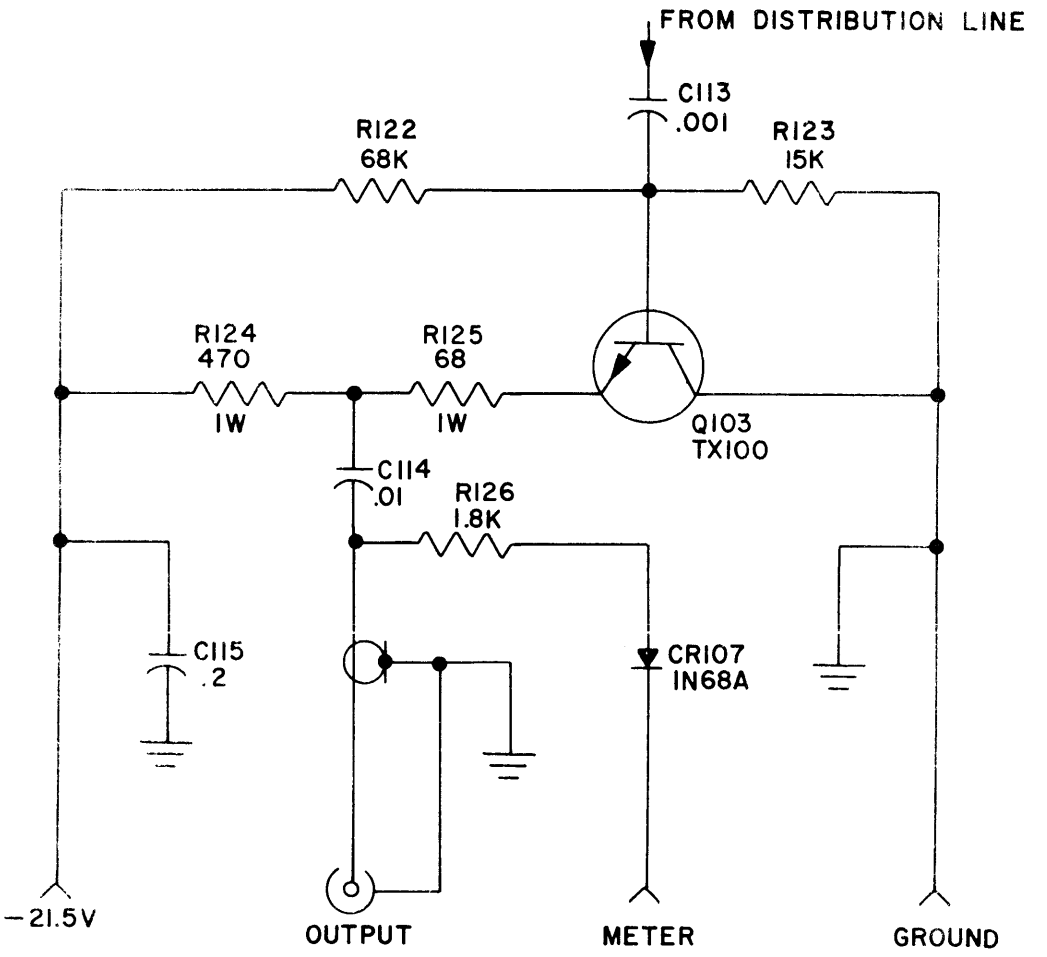


FIGURE 4-4. SIMPLIFIED SCHEMATIC – TYPICAL OUTPUT STAGE.

4-5. DYNAMIC TEST OSCILLATOR SECTION. (Refer to Figure 4-5)

A transistorized 1 MHz oscillator generates the test signal for the dynamic checking of the Multicoupler. The test signal is injected at the input of the pre-amplifier and the rotary switch selects the rectified output of any one of the output channels for display on the front panel meter. This method of checking the signal from the pre-amplifier input to any one of the output stages results in a reliable indication of the actual operating conditions of the Multicoupler from input to any one output. The level of the test signal may be varied by adjustment of a potentiometer R139 located on the oscillator circuit board.

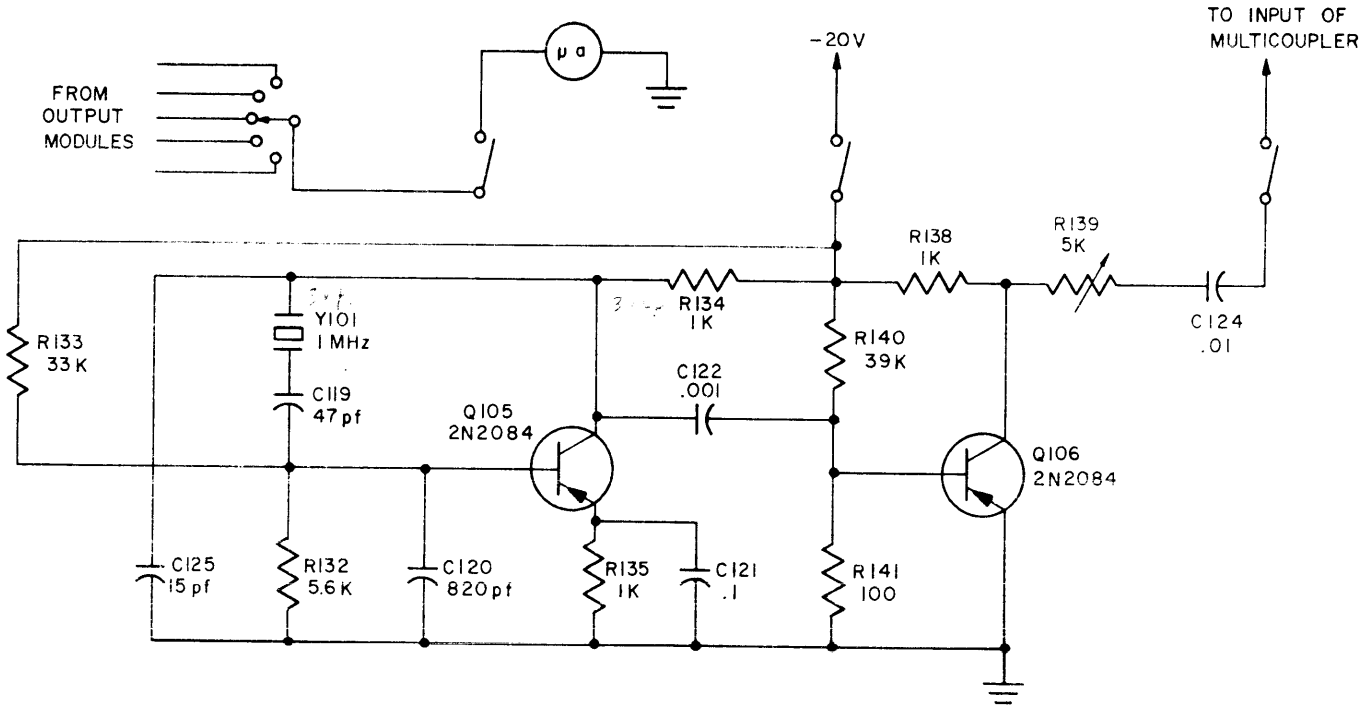


FIGURE 4-5. SIMPLIFIED SCHEMATIC – DYNAMIC TESTING.

4-6. POWER SUPPLY (R f r to Figure 4-6)

An unregulated power supply provides operating voltages for both the pre-amplifier tubes and all of the subsequent transistorized stages. Conservatively rated semi-conductor diodes and a three section RC filter are employed in the high voltage section of the power supply. A full wave bridge using semi-conductor diodes feeds into a string of series dropping resistors which are connected to the filter section. The series dropping resistors may be bridged or left in the circuit as required to provide the correct operating voltage should additional modules be put into service.

All of the power supply components are conservatively rated to ensure long term reliability and to reduce the Multicoupler noise figure to a minimum. The power transformer has provision for operation from either 115 or 230 volts, 50 to 400 cycle mains supply.

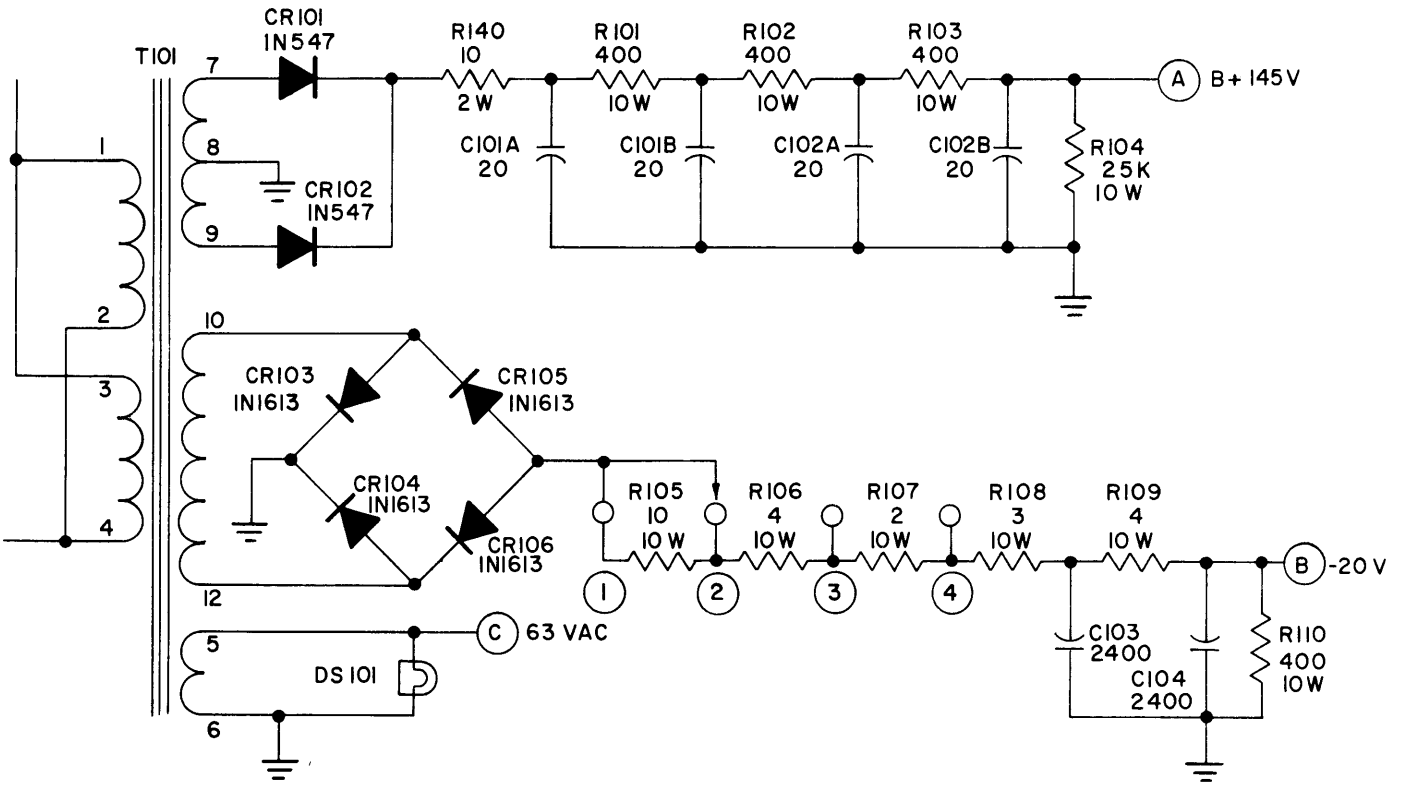


FIGURE 4-6. SIMPLIFIED SCHEMATIC – POWER SUPPLY.

SECTION 5

TROUBLE-SHOOTING

5-1. INTRODUCTION.

This section explains how to locate and diagnose equipment troubles and possible incorrect or faulty inter-equipment connections. The information necessary to remedy troubles and maladjustment will be found in Section 6 of this manual under the heading "MAINTENANCE".

NOTE

Due to the broadband characteristics inherent in the LMC-20 Antenna Multicoupler, there are no "RF alignment" procedures to be followed.

The following aids to trouble-shooting are provided:-

a. General trouble-shooting procedure (see para. 5-2).

b. Trouble-shooting based on operational procedures. (see para. 5-3).

c. Voltage and resistance charts (see para. 5-4 and tables 5-1, 5-2 and 5-3).

d. Trouble-shooting based on circuit sectionalization (see para. 5-5).

5-2 GENERAL TROUBLE-SHOOTING PROCEDURES.

When an LMC-20 Antenna Multicoupler has been operating satisfactorily and suddenly fails, the cause of failure may be readily apparant, either because of circumstances occuring at the time of failure or because of symptoms analogous to past failures.

Abnormal conditions external to the Multicoupler occurring at the time of failure should be immediately suspected as a cause of other-than-normal operation.

a. AC mains over-voltage surge:

(1) Check circuit breakers and/or switches external to the Multicoupler.

(2) Check Multicoupler main fuse.

(3) Check internal Multicoupler voltages (Table 5-1) for possible damage to tubes or semi-conductors.

b. Lightning strike on antenna or other reasons for loss of antenna:

(1) Connect antenna terminal directly to operational receiver and compare output with output received through Multicoupler.

(2) Check internal Multicoupler voltages (Table 5-1) for possible damage to tubes or semi-conductors.

NOTE

When checking tubes and semi-conductors within the LMC-20 Antenna Multicoupler, the voltage chart Table 5-1, should be considered as the primary source of performance evaluation. Faulty components must indicate faulty readings. When replacement is indicated, actual performance after installation in the Multicoupler should be the performance criteria rather than dependence on a tube or transistor checker.

A second short-cut in trouble-shooting although very obvious, is sometimes overlooked, and this is to ascertain that all associated equipment and circuitry, such as main power circuit breakers or switches, individual rack circuit breakers or fuses and individual unit fuses are operating properly and/or in good condition, and that the Multicoupler is, in fact, receiving the proper supply voltage and is connected in the proper manner to the antenna and associated equipment.

A third short-cut is to examine the equipment, section by section, for burned out elements, charring, corrosion, arcing, excessive heat, dirt, dampness, etc. Component defects may be internally or externally caused and the unit should not be returned to service until the actual cause of the failure is determined.

5-3. TROUBLE-SHOOTING BASED ON OPERATION PROCEDURE.

The general purpose of this paragraph is to narrow the area of trouble to one more sections of the Multicoupler in order to minimize the labour of locating the source of trouble. An orderly evaluation of symptoms will usually result in malfunction location in a very short time. During operation of the LMC-20 Antenna Multicoupler the following symptoms may be noted:-

a. Failure of one or more outputs.

b. Weak or noisy signals in all receivers.

c. Weak or noisy signals in one receiver.

d. Complete loss of signals in all receivers.

The following information is based upon specific troubles that may be encountered during operation of the LMC-20 Antenna Multicoupler.

a. Failure of one or more outputs. If low output is observed at one output when tested with

the OUTPUT/FILTER switch or when connected to a specific receiver, failure of a particular output stage is indicated. Semi-conductors and other components in the faulty output stage should be tested utilizing the output module extender card and Table 5-1.

b. Weak or noisy signals in all receivers. If weak or noisy signals occur in all receivers, make a rough check of the antenna system by connecting the antenna lead-in directly to the antenna terminals of a receiver. If the weakness or noise disappears, check the pre-amplifier and driver section of the Multicoupler for security of interconnecting cables or for noisy or low emission tubes (Table 5-1).

c. Weak or noisy signals in one receiver. When only one receiver in the system shows faulty performance, check:-

(1) The receiver itself.

(2) The connections between the Multicoupler and the receiver, or,

(3) The particular output section as outlined in paragraph 5-3 as above.

d. Complete loss of signals in all receivers. If the system fails, (indicated by loss of signals in all receivers), the method discussed in paragraph 5-3(b) above may be used to determine if the trouble is actually in the LMC-20. If this appears to be the case, determine that the pre-amplifier tube filaments are alight and that all other stages are receiving proper operating voltages (Table 5-1), then test the Multicoupler by means of its internal dynamic checking circuit. Low output at all jacks indicates failure of the pre-amplifier or driver circuits or defective interconnecting cables.

5-4. VOLTAGE AND RESISTANCE CHECKING.

Figures 5-1 and 5-2 will assist in locating major components during trouble-shooting. Table 5-1 indicates voltages that are to be found at indicated tube, semi-conductor and power supply terminals.

CAUTION

Continual reference to Figure 8-1, the complete unit schematic should be made while using Table 5-1 as a diagnostic aid. Capacitors and other devices may break down during operating conditions, yet exhibit normally high resistance when checked with an ohmmeter. Where abnormally low voltage (compared to those shown in Table 5-1) is encountered at a point where a normal resistance measurement is made, a capacitor or diode malfunction or breakdown is indicated.

5-5. TROUBLE-SHOOTING BASED ON CIRCUIT SECTIONALIZATION.

When an output signal is not present at an output jack, with the internal test oscillator turned on, that output module should be withdrawn for bench testing.

If all output jacks are dead, the test signal should be traced back from the output jack to the antenna input jack.

Test should be made at the following points in the order shown.

a. The output module connector.

b. The base of the driver stage.

c. The cathodes of the pre-amplifier.

d. The antenna input jack.

Using this procedure the section giving trouble will be readily ascertained.

TABLE 5-1. TUBE AND TRANSISTOR OPERATING VOLTAGES.

TUBE	TYPE	FUNCTION	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V-101	5842	Pre-amp.	145	--	6.4 *	0	0	--	0	0	0
V-102	5842	Pre-amp.	145	--	6.4 *	0	0	--	0	0	0

Voltages measured to chassis ground using standard VTVM.
* ac voltage.

TABLE 5-1. TUBE AND TRANSISTOR OPERATING VOLTAGES. (C ntd)

TRANSISTOR	TYPE	FUNCTION	BASE	COLLECTOR	EMITTER
Q102	2N2219A	Driver	–7.8	0	–8.4
Q105	2N2084	Oscillator	–2.75	–16.5	–3.75
Q106	2N2084	Buffer	–2.75	–16.5	–3.75
All others	2N2219A	Output Stages	–2.7	0	–2.7

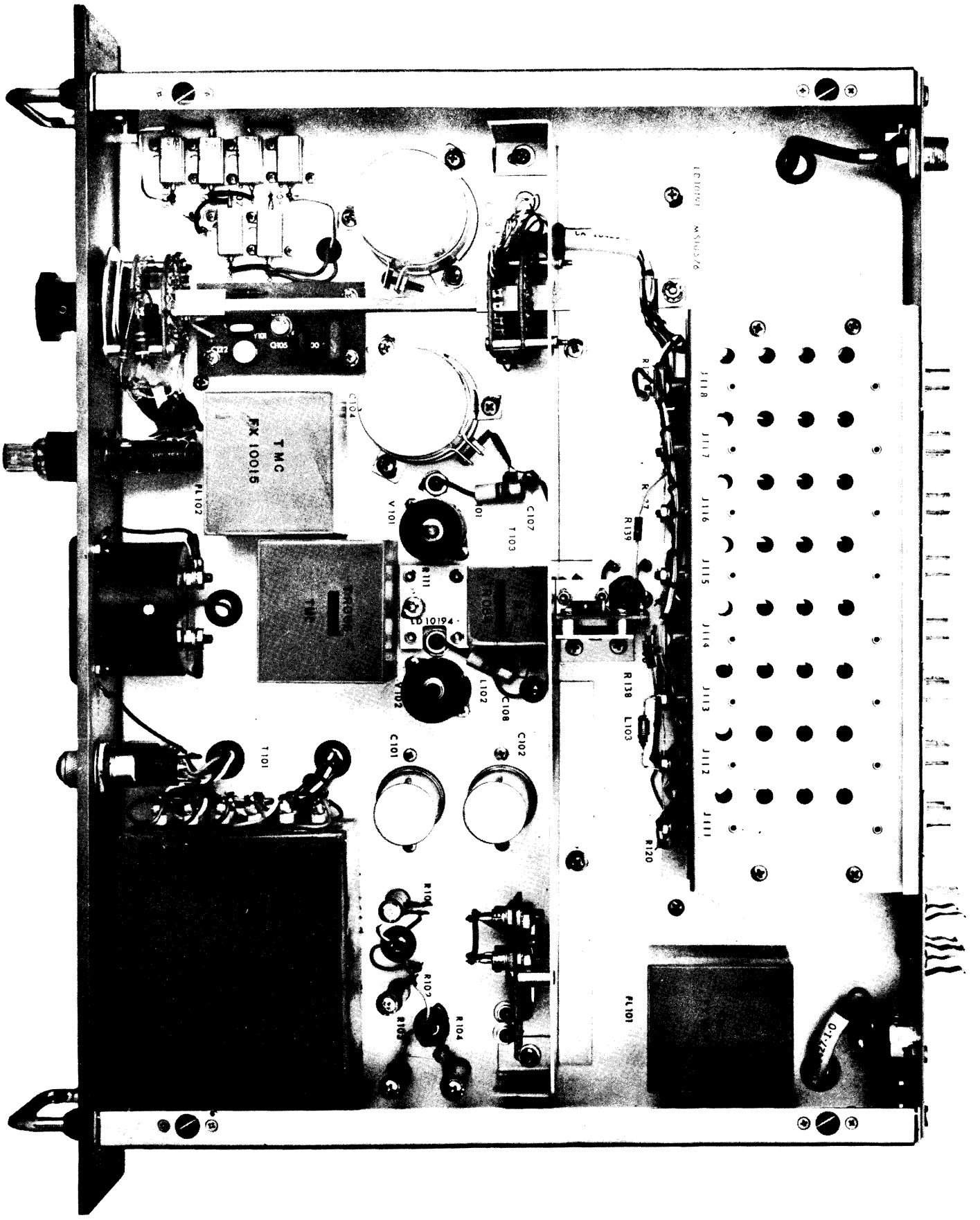


FIGURE 5-1. LOCATION DIAGRAM, MAJOR COMPONENTS, TOP VIEW

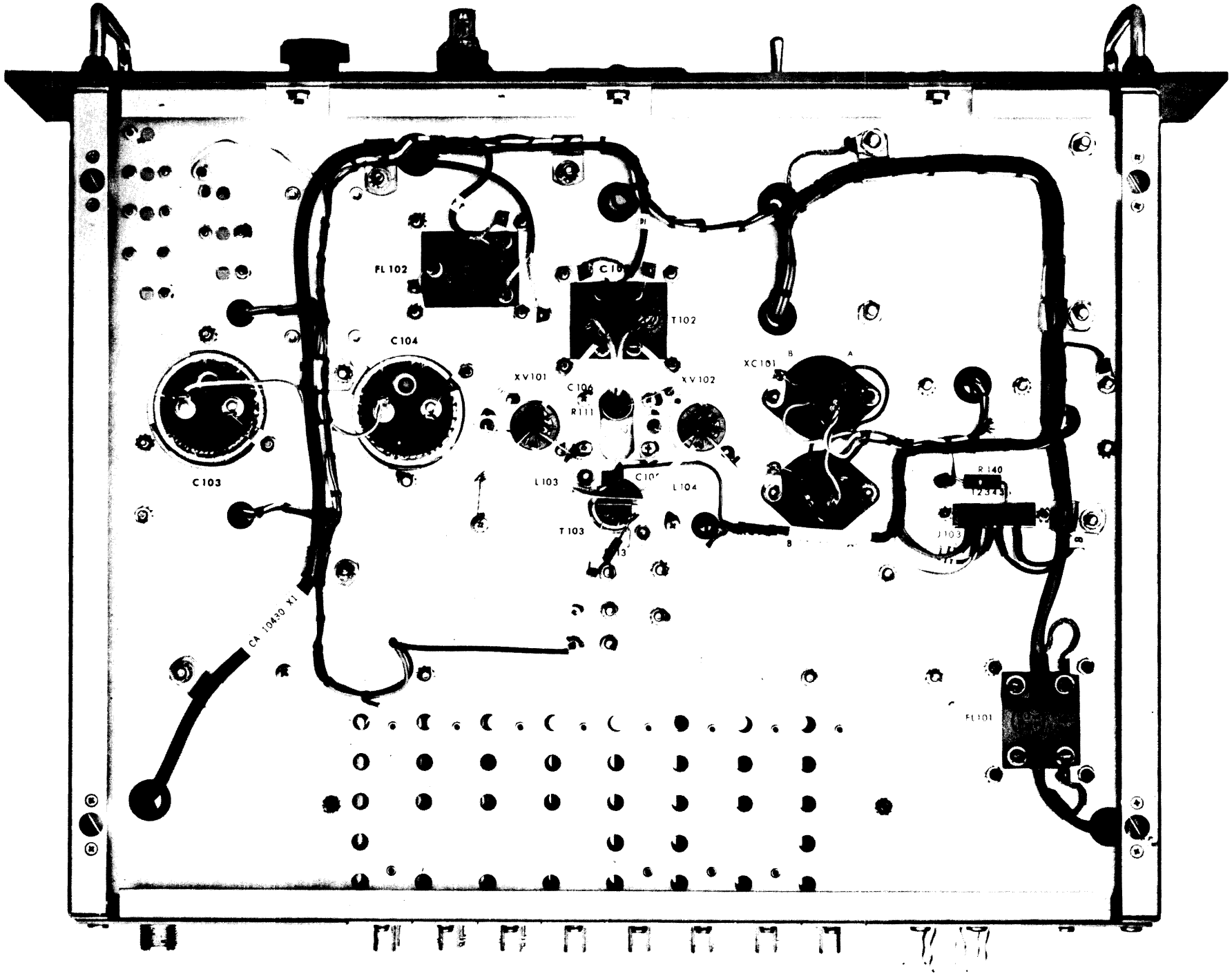


FIGURE 5-2. LOCATION DIAGRAM, MAJOR COMPONENTS, BOTTOM VIEW

SECTION 6

MAINTENANCE

6-1. INTRODUCTION.

Maintenance may be divided into three catagories: Operator's maintenance, Preventive maintenance and corrective maintenance. Operator's maintenance is discussed in SECTION 3.

Corrective maintenance may be considered as consisting of information useful in locating and diagnosing troubles and maladjustments, existing and/or pending, and information necessary to remedy the troubles and maladjustments.

The LMC-20 Antenna Multicoupler is designed to provide long-term, trouble-free operation under continuous duty conditions. Any necessary maintenance should be performed by a competent maintenance technician.

If trouble cannot be corrected by following the procedures outlined in this manual, it is recommended that the LMC-20 be returned to the Technical Materiel Corporation for servicing. To expedite the return of the serviced equipment to you, it is recommended that the equipment be shipped to us by Air Freight and that we be authorized to return it in the same way.

6-2. PREVENTIVE MAINTENANCE.

To prevent failure of the LMC-20 Antenna Multicoupler due to corrosion, dust or other destructive elements, it is suggested that a schedule of preventive maintenance be set up and adhered to. The recommended time interval is every 6 to 12 months depending on the amount of vibration or exposure encountered in service.

The LMC-20 should be removed from the relay rack or other enclosure and placed on a well-lighted, clean workbench for cleaning and inspection. All accessible covers should be removed.

The metalwork, wiring and all components should be inspected for dust, corrosion, charring, discolouring or grease. In particular, tube sockets, module connectors, wafer switch contacts and fuse holders should be carefully inspected for deterioration.

Dust may be removed with a soft brush or vacuum cleaner if one is available. Remove dirt or grease from electrical parts with trichlorethylene. Remove dirt or grease from other parts with any good dry-cleaning fluid.

WARNING

When using trichlorethylene, make certain that adequate ventilation exists. Avoid prolonged contact with the skin.

Carefully inspect for loose solder connections, especially those on solder lugs. Colour codes or printed values on resistors should be easily read. If not, check the component for abnormal heating. Inspect all types of capacitors for signs of discolouration, leading, bulging or cracking.

The output modules and other printed circuit cards should be wiped with a clean, dry cloth.

NOTE

Periodic checking of tubes and semi-conductors is not recommended. Testing devices for these components cannot present a truly valid test result. Only when trouble-shooting, as outlined in SECTION 5, indicates a faulty tube or semi-conductor should these units be replaced. The substitution method of testing is recommended where conditions indicate testing is required.

SECTION 7

PARTS LIST

7-1. INTRODUCTION.

Reference designations has been assigned to identify all maintenance parts of the LMC-20 Antenna Multicoupler. They are used for marking the equipment (adjacent to the part they identify) and are included on drawings, diagrams and the parts list.

The letters of a reference designation indicate the kind of part (generic group) such as a resistor, capacitor, electron tube etc. The number differentiates between parts of the same generic group.

Sockets associated with a particular plug-in device, such as an electron tube or fuse, are indicated by reference designations which include the reference designation of the plug-in device. For example, the socket for tube V101 is designated XV101.

Column 1 of the parts list gives reference designations of the parts in alphabetical and numerical order.

Column 2 gives the name and describes the various parts. Major part assemblies are listed in their entirety; subparts of a major assembly are listed in alphabetical and numberical order with reference to its major assembly.

Column 3 indicates how the part is used within a major component.

Column 4 lists each Technical Materiel Corporation part number.

LMC-20 ANTENNA MULTICOUPLER

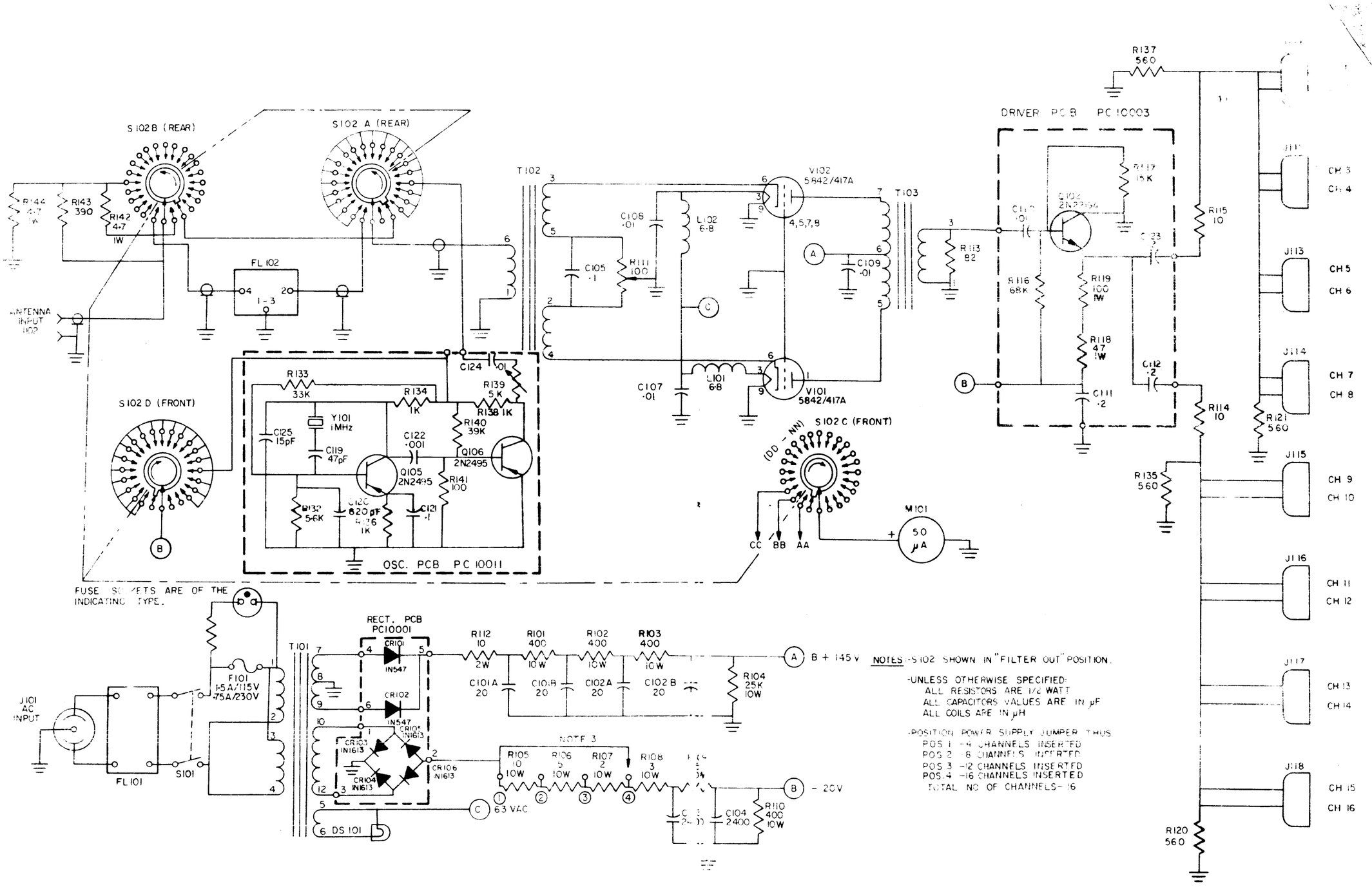
SYM.	DESCRIPTION	FUNCTION	TMC PART NUMBER
C101(AB)	CAPACITOR: dual electrolytic, 20-20 uf, 450 WVDC.	H.V. Filter	CE10004
C102(AB)	Same as C101	Same as C101	
C103(AB)	CAPACITOR: electrolytic, 2400 uf, 35 WVDC.	L.V. Filter	CE10005
C104(AB)	Same as C103	Same as C103	
C105	CAPACITOR: disc, ceramic, 0.1 uf, + 80 -20%, 25 WVDC.	R.F. Bypass	CC100-23
C106	Not used		
C107	CAPACITOR: disc, ceramic, 0.01 uf, GMV, 500 WVDC.	Heater Decoupling	CC100-16
C108	Same as C107	Same as C107	
C109	Same as C107	B + Decoupling	
C110	Same as C107	RF Coupling	
C111	CAPACITOR: disc, ceramic, 0.2 uf, ± 80% -20%, 25 VDC.	B - Decoupling	CC100-33
C112	Same as C111	RF Coupling	
C113	CAPACITOR: disc, ceramic, 0.001 uf, + 10%, 500 WVDC.	RF Coupling	CC100-9
C114	Same as C111	RF Coupling	
C115	Same as C111	B - Decoupling	

SYM.	DESCRIPTION	FUNCTION	TMC PART NUMBER
C116	Same as C113	RF Coupling	
C117	Same as C111	RF Coupling	
C118	Same as C111	B - Decoupling	
C119	CAPACITOR: mica, 47 pf, ± 5%, 500 WVDC.	DC Collector Blocking	CM15C470J
C120	CAPACITOR: mica, 820 pf, ± 5%, 500 WVDC.	RF Bypass	CM20C821J
C121	Same as C105	Emitter Bypass	
C122	Same as C113	RF Coupling	
C123	Same as C111	RF Coupling	
CR101	DIODE: 1N547	HV Rectifier	1N547
CR102	Same as CR101	Same as CR101	
CR103	DIODE: 1N1613	LV Rectifier	1N1613
CR104	Same as CR103	Same as CR103	
CR105	Same as CR103	Same as CR103	
CR106	Same as CR103	Same as CR103	
CR107	DIODE: 1N68A	Meter Rectifier	1N68A
CR108	Same as CR107	Same as CR107	
DS101	LAMP: incandescent, bayonet base, 6-8 volt, 0.25a, T-3¼.		BI101-44
F101	FUSE: cartridge, 1.5a, slo-blo, 250 volt.	Primary Power	FU102-1.5
FX101	FILTER: non-repairable item.	AC Line	FX10013
FX102	FILTER: low pass, non-repairable item.	Broadcast Attenuation	FX10015
J101	CONNECTOR: twistlock, male, polarized.	AC Input Jack	JJ175
J102	CONNECTOR: female, coaxial, UHF series.	Ant. Input Jack	SO239
J103	CONNECTOR: female, 6 contact, PCB receptacle.	Rectifier Jack	JJ285-6
J111	Same as J103	Module Jack	
J112	Same as J103	Same as J111	
J113	Same as J103	Same as J111	
J114	Same as J103	Same as J111	
J115	Same as J103	Same as J111	
J116	Same as J103	Same as J111	
J117	Same as J103	Same as J111	
J118	Same as J103	Same as J111	

LMC-20 ANTENNA MULTICOUPLER

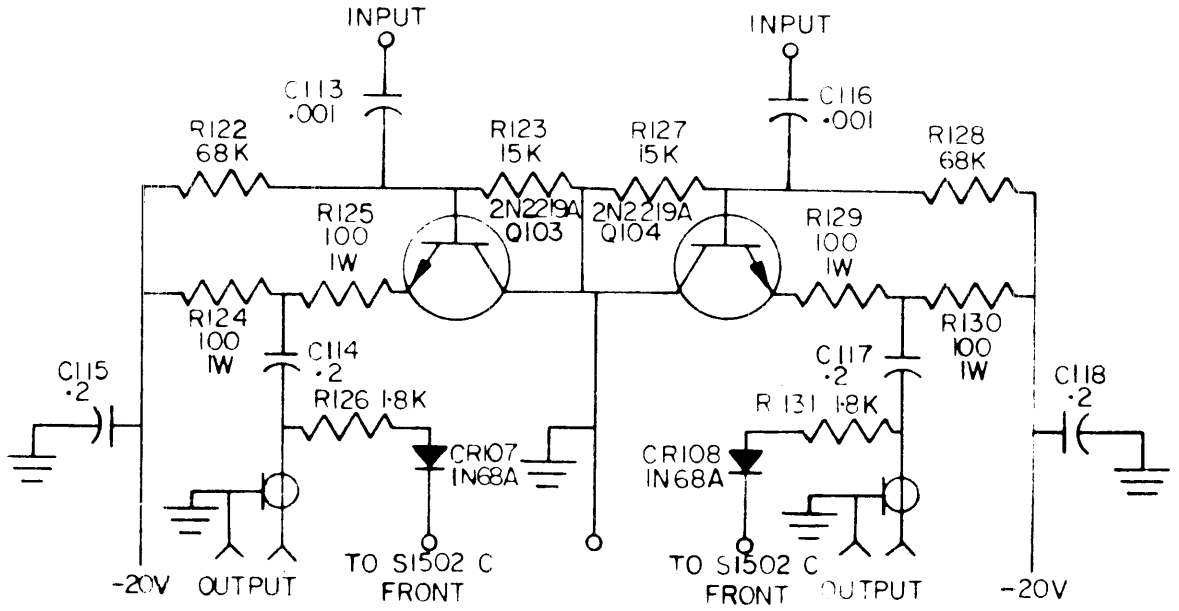
SYM.	DESCRIPTION	FUNCTION	TMC PART NUMBER
J119 thru J135	CONNECTOR: coaxial, BNC.	Output Jacks	UG-625B/U
L101	CHOKE, RF, 6.8 uH.	Filament Choke	CL10005-1
L102	Same as L101		
L103	Not used		
L104	Not used		
M101	METER: DC, ua, special scale.	Dynamic check Indicator	MR10004
Q102	TRANSISTOR: silicon, NPN, JEDEC type 2N2219A, Transistor with beta linearity characteristics.	Driver	TX100
Q103	Same as Q102	Output	
Q104	Same as Q102	Same as Q103	
Q105	TRANSISTOR: germanium, PNP JEDEC type 2N2084 transistor with type TO33 case.	Oscillator	2N2084
Q106	Same as Q105	Buffer	
R101	RESISTOR: fixed, wirewound, 400 ohm, ± 5%, 10w.	Voltage Dropping	RW109-17
R102	Same as R101	Same as R101	
R103	Same as R101	Same as R101	
R104	RESISTOR: fixed, wirewound, 25K ohm, ± 5%, 10w.	Bleeder	RW109-38
R105	RESISTOR: fixed, wirewound, 10 ohm, ± 1%, 10w.	Voltage Dropping	RE65G10R0
R106	RESISTOR: fixed, wirewound 5 ohm, ± 1%, 10w.	Same as R105	RE65G4R99
R107	RESISTOR: fixed, wirewound, 2 ohm, ± 1%, 10w.	Same as R105	RE65G2R00
R108	RESISTOR: fixed, wirewound, 3 ohm, ± 1%, 10w.	Same as R105	RE65G3R01
R109	Same as R106	Same as R105	
R110	RESISTOR: fixed, wirewound, 400 ohm, ± 1%, 10w.	Bleeder	RE65G4000
R111	RESISTOR: variable, composition, 100 ohm, ± 10%, ½w.	D.C. Balance	RV106UX8B101A
R112	Not used		
R113	RESISTOR: fixed, composition, 82 ohm, ± 5%, ½w.	Preamp Load	RC20GF820J
R116	RESISTOR: fixed, composition, 68K ohm, ± 5%, ½w.	Bias	RC20GF683J

SYM.	DESCRIPTION	FUNCTION	TMC PART NUMBER
R117	RESISTOR: fixed, composition, 15K ohm, ± 5%, ½w.	Same as R116	RC20GF153J
R118	RESISTOR: fixed, composition, 47 ohm, ± 5%, 1w.	Emitter Voltage Divider	RC32GF470J
R119	RESISTOR: fixed, composition, 100 ohm, ± 5%, 1w.	Same as R118	RC43GF101J
R120	RESISTOR: fixed, composition, 560 ohm, ± 5%, ½w.	Distribution	RC20GF561J
R121	Same as T120	Same as R120	
R122	Same as R116	Same as R116	
R123	Same as R117	Same as R116	
R124	RESISTOR: fixed, composition, 470 ohm, ± 5%, 1w.	Same as R118	RC32GF471J
R125	RESISTOR: fixed, composition, 68 ohm, ± 5%, 1w.	Same as R118	RC32GF680J
R126	RESISTOR: fixed, composition, 1.8K ohm, ± 5%, ½w.	Meter Isolation	RC20GF182J
R127	Same as R117	Same as R116	
R128	Same as R116	Same as R116	
R129	Same as R125	Same as R118	
R130	Same as R124	Same as R126	
R132	RESISTOR: fixed, composition, 5.6K ohm, ± 5%m ½w.	Bias	RC20GF562J
R133	RESISTOR: fixed, composition, 33K ohm, ± 5%, ½w.	Same as R132	RC20GF333J
R134	RESISTOR: fixed, composition, 1K ohm, ± 5%, ½w.	Collector Load	RC20GF102J
R135	RESISTOR: fixed, composition, 330 ohm, ± 5%, ½w.	Emitter Bias	RC20GF331J
R136	Same as R120		
R137	Same as R120		
R138	RESISTOR: fixed, composition, 10 ohm, ± 5%, ½w.		RC20GF100J
R139	Same as R138		
R140	Same as R138		
R141	RESISTOR: fixed, composition, 4.7 ohm, ± 5%, 1w.		RC32GF4R7J
R142	Same as R141		
R143	RESISTOR: fixed, composition, 390 ohm, ± 5%, ½w.		RC20GF391J
S101	SWITCH: toggle, DPDT	Power ON/OFF	ST22K



SCHEMATIC DIAGRAM, [illegible] 20, FIGURE 8-1 (Sht 1 of 2)

FIGURE 8-1 Sht.(1 of 2)



NOTES:

UNLESS OTHERWISE SPECIFIED:

ALL RESISTOR VALUES ARE IN OHMS, 1/2 WATT.

ALL CAPACITOR VALUES ARE IN μF.

SCHEMATIC, OUTPUT MODULE, FIGURE 8-1 (Sht 2 of 2)