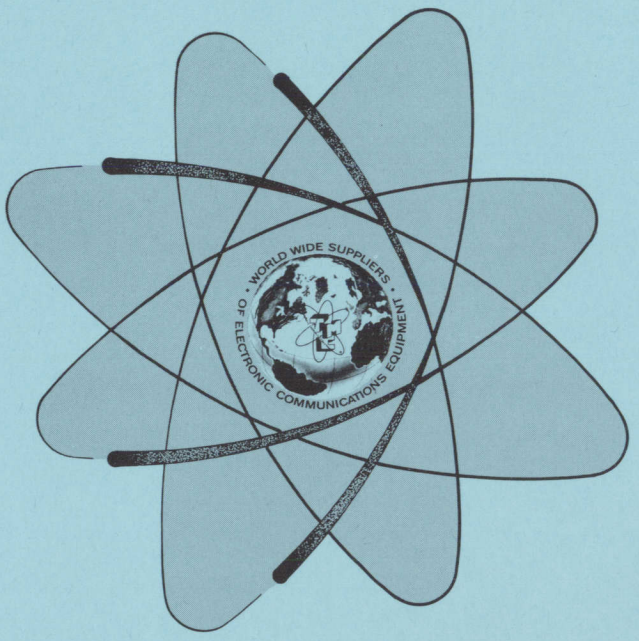
OPERATOR'S MANUAL

for

HIGH GAIN LINEAR POWER AMPLIFIER

MODEL HFL-100



THE TECHNICAL MATERIEL CORPORATION

MAMARONECK, N.Y. OTTAWA, ONTARIO

Printed in U.S.A.

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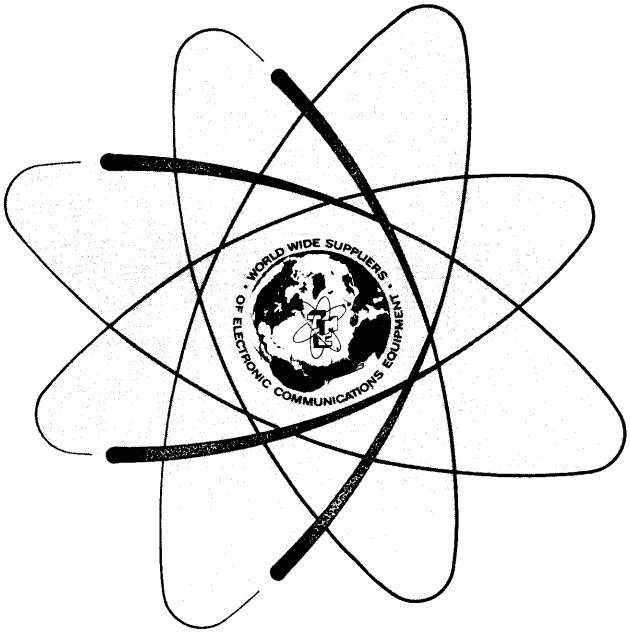

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IN 2201 ISSUE DATE: November 1974

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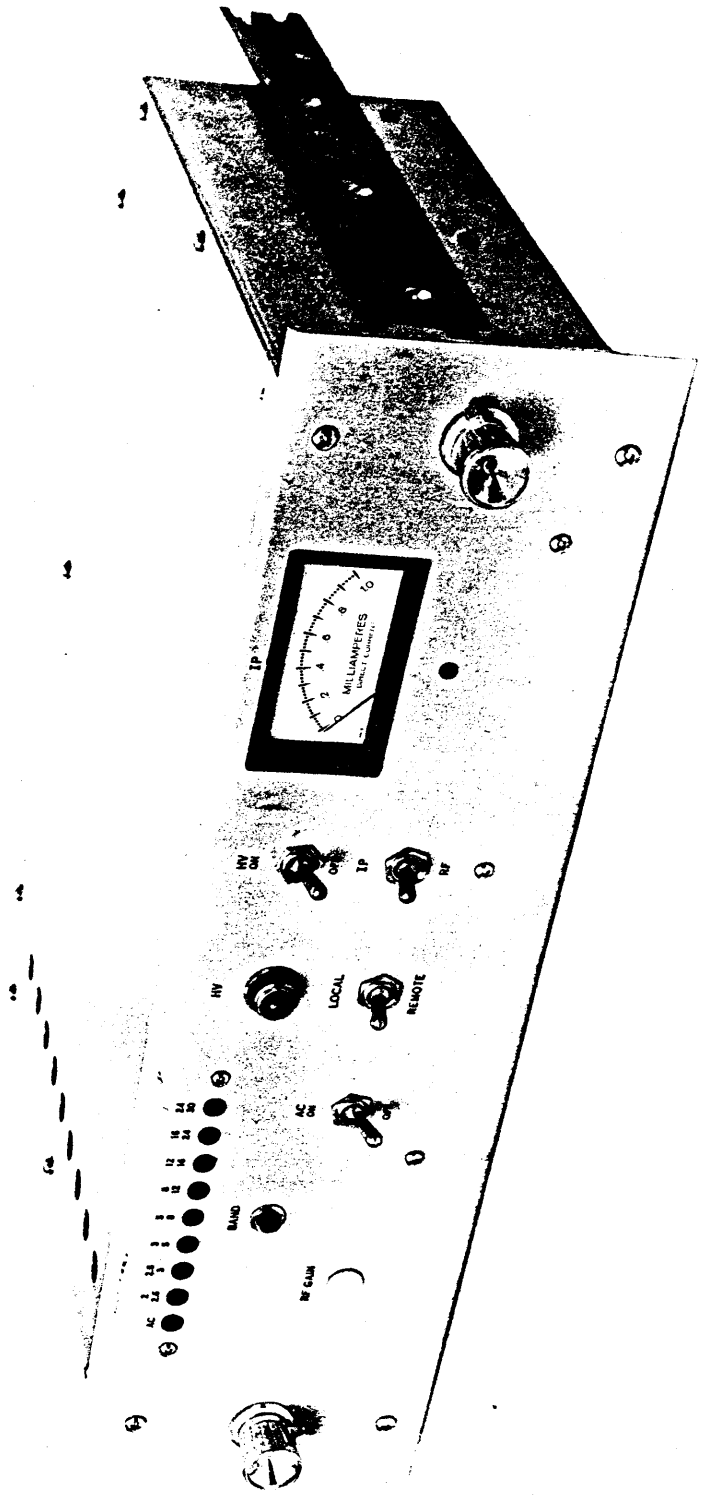


Figure 1-1. High Gain Linear Power Amplifier, Model HFL-100

SECTION 1
GENERAL INFORMATION

1-1. FUNCTIONAL DESCRIPTION

Designed and manufactured by The Technical Materiel Corporation (TMC) of Mamaroneck, New York, the Model HFL-100 shown in figure 1-1 is a high gain linear power amplifier. The amplifier will provide a power output of 100 watts PEP (peak envelope power) or 50 watts average when provided with an input signal of 100 milliwatts. The HFL-100 amplifier will operate satisfactorily at any frequency between 2.0 and 30.0 MHz. When combined with a suitable exciter and followed by an antenna tuner such as the TMC Model ATU-350 the HFL-100 could function as a complete low-power transmitter. The current application of the HFL-100 is as the intermediate drive unit in the TMC Model GPTA-1KJ one kilowatt transmitter. The amplifier will operate from a single phase power source of either 115 or 230 volts, 50 or 60 Hz.

1-2. PHYSICAL DESCRIPTION

The HFL-100 linear power amplifier is a light weight (approximately 20 lbs), comparatively small unit requiring 360 watts of operating power. The eight frequency bands to which the amplifier can be bandswitched may be remotely selected by band signals from a suitable exciter such as the TMC Model MMX(A)-2. However, band selection may be made by the operator, if required, by means of a pushbutton control. An indication of the frequency range to which the amplifier is switched is displayed on the front panel. An instrument, also on the front panel, presents an indication of either the plate current of the power amplifier tube or an indication of the relative power output of the amplifier as determined by the operator. This selection is made by operating a toggle switch on the front panel. All controls and indicators including the ac power and high voltage switches are located on the front panel.

The HFL-100 is 5.25 inches high and 19.0 inches wide. Designed to be slide mounted in a standard equipment rack or cabinet it extends only one foot into the cabinet. Panel locks and slide mount track are provided to position and secure the unit in the cabinet. All connections with associated equipment and the ac power supply are made at the rear. A protective fuse is also accessible from the rear of the unit.

1-3. REFERENCE DATA

FREQUENCY RANGE:	2.0 MHz to 30 MHz
OPERATING MODES:	Capable of all standard modes of operation (CW, AM, AME, ISB, SSB FAX and FSK), but dependent upon the exciter being used.
POWER OUTPUT:	100 watts peak envelope power or 50 watts average; continuous key down service.
OUTPUT IMPEDANCE:	50 ohms unbalanced.
DISTORTION:	Minimum 30 db below either tone of a standard two tone test at full rated PEP.
RF INPUT:	100 milliwatts.
POWER REQUIREMENTS:	360 watts maximum.
PRIMARY POWER:	115 or 230 vac, single phase, 50 or 60 Hz.
TUNING:	Remote or manual.
ENVIRONMENTAL:	Designed to operate in ambient temperatures of 0 to 50C with humidity up to 90 per cent.
COOLING:	Forced air.
SIZE AND MOUNTING:	5.25 inches high, 19 inches wide 12 inches deep. Slide mounted in standard cabinet.

WEIGHT:	Approximately 20 lbs.
SAFETY FEATURES:	Fused input, shielded high voltage, plate overload circuit protects final power amplifier.

SECTION 2

INSTALLATION

2-1. UNPACKING AND INSPECTION

After successfully passing a complete operational test in the TMC test facility ensuring that all specifications have been met, the HFL-100 was carefully packed for shipment. These tests were conducted in conjunction with associated TMC equipment, but the HFL-100 is packed separately with the necessary cabling and connectors as "loose items". These "loose items" including hardware, instruction manuals, and connectors, may, if the HFL-100 is a part of a TMC transmitter, all be included in the main transmitter package. Even though this may be the case, all packing material should be examined carefully so that no items are inadvertently discarded.

Upon arrival at the installation site, the equipment should be inspected for any evidence of damage in transit. All controls should be operable and the tubes set firmly in the sockets. If transit damage is discovered a claim should immediately be filed with the carrier. Assistance in rectifying transit damage will be rendered by The Technical Materiel Corporation by recommending replacement parts and by describing repair methods.

2-2. POWER REQUIREMENTS

Since the HFL-100 will operate equally as well on either 115 volts or 230 volts single phase ac power at 50 or 60 Hz, it is factory wired for the power source specified by the customer. The amplifier may be rewired in the field if a decision is made to use an alternate power source. The wiring changes to the primary winding of T103 shown in figure 2-1 must be made prior to installation to accomodate a change in source voltage.

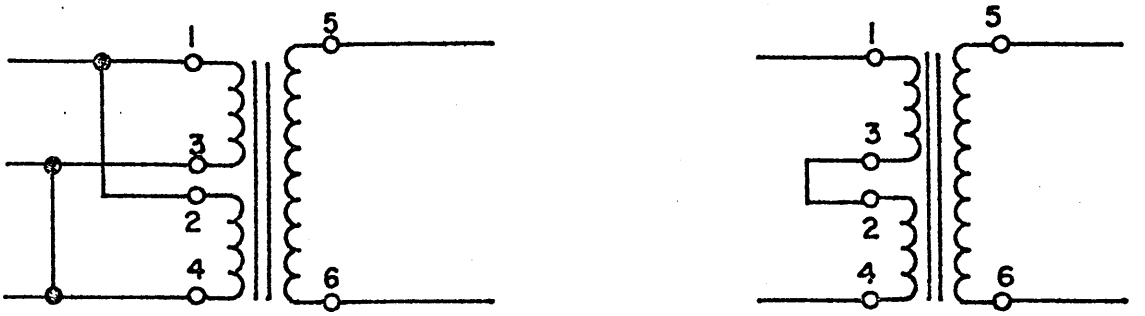


Figure 2-1. 115V to 230V TRANSFORMER WIRING DIAGRAM

WARNING

MAKE CERTAIN THAT THE WIRING IS CORRECT BEFORE SUPPLYING PRIMARY POWER.

2-3. INITIAL INSTALLATION

The HFL linear power amplifier fits easily into place in the equipment cabinet on the slide mounts provided. However, care should be taken to be sure that the coiled lead for primary power at rear of the unit does not become entangled. The panel locks on the front should be secured to hold the equipment firmly in position. All connections to associated equipment are made at the rear panel of the HFL-100 amplifier. These connecting points are clearly marked on the panel and reference to the internal interconnect diagram wiring diagram figure 2-2 and to tables 2-1 and 2-2 will enable the installer to make the proper connections. Connectors for any cable which must be fabricated by the customer are furnished as "loose items".

TABLE 2-1. REAR PANEL CONNECTIONS

REFERENCE DESIGNATION	PANEL NOMENCLATURE	FUNCTION
J101	INPUT	RF signal input from associated exciter.
J102	DC CONTROL	Connects the HFL-100 to the associated exciter for automatic rf gain control.
J103	OUTPUT	Connects amplified rf signal to associated equipment.
TB101	TB101	Refer to table 2-2.

TABLE 2-2. TERMINAL BOARD CONNECTIONS

TERMINAL NUMBER (From left to right)	CONNECTION
1	Key interlock
2	Drive up
3	Tune
4	Tune PTT
5	24.0-30.0 MHz Bandswitch signal
6	16.0-24.0 MHZ Bandswitch Signal
7	12.0-16.0 MHz Bandswitch Signal
8	8.0-12.0 MHz Bandswitch Signal
9	5.0- 8.0 MHz Bandswitch Signal
10	3.0- 5.0 MHz Bandswitch Signal
11	2.6- 3.0 MHz Bandswitch Signal
12	2.0- 2.6 MHz Bandswitch Signal
13	None

TABLE 2-2. TERMINAL BOARD CONNECTIONS (cont)

TERMINAL NUMBER (From left to right)	CONNECTION
14	Exciter Standby
15	None
16	None

Also located on the rear panel of the HFL-100 amplifier are the protective fuses for the primary power circuit (F101) and for the switch operating power circuit (F102).

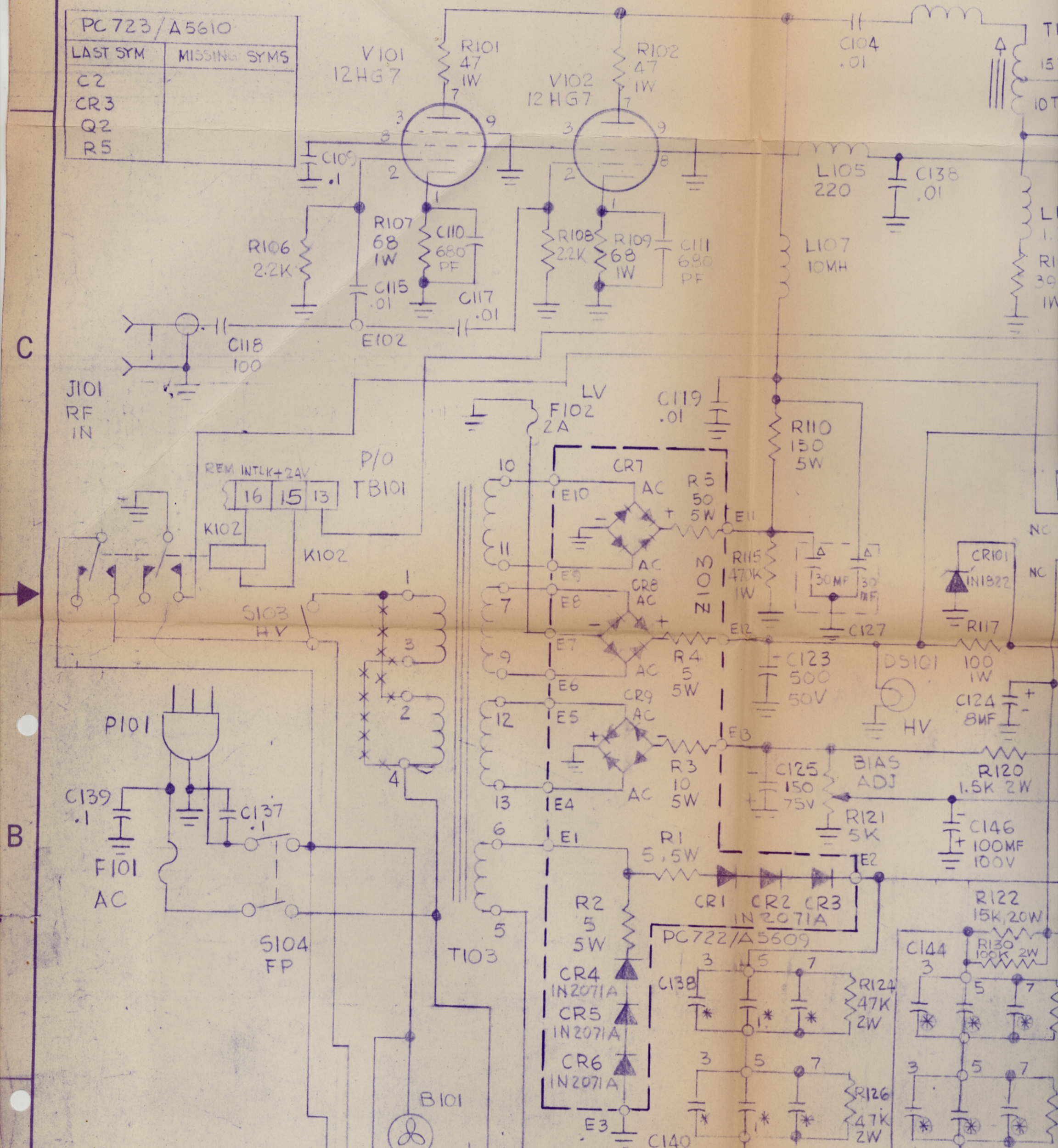
SERIE 100	
LAST SYMBOL	MISSING SYMBOLS
C146, CR105 B101, DS102 F102, L110 J104, K101 M101, R101 R130, S107 T105, TB102 K102	C107, C108, C128 C133, C134, C135 C136, L108, L109 R111, R114, R118, R119

PC721/A5608	
LAST SYMBOL	MISSING SYMBOLS
C13 CR10 Q1 R4	

PC722/A560	
LAST SYMBOL	MISSIN
CR9 R2	

PC719/A560	
LAST SYMBOL	MISSIN
C9 D59	

PC723/A5610	
LAST SYM	MISSING SYMS
C2 CR3 Q2 R5	



5 4

/A5609

L	MISSING SYMBOLS

/A5604

	MISSING SYMBOLS

L101 185 uH

C101 1000 PF 5KV

C102 1000 PF 5KV

L102 4.5 uH

V103 4CX350

T105 15T 10T

C105 .01

E101

C132 22

L104 220

C113 .01

C106 .1 500V

RING 1 2,4,6 8

R105 5 5W

C112 .1

R103 47K 2W

R104 2.2K 1W

L106 1.2 MH

R112 390 1W

C116 .1

R113 10 5W

OPTIONAL R116 1K 2W GAIN

PC723/A5610

E1 E2 E3 E4 E5 E6 E7 E8 E18 E19 E20 E21 E22 E23

METER ADJ

S102 IP

C103 .1

M101

DS102 OVLD

R2 100

CR1 IN100

OVLD ADJ

R 100

C1 100

Q1 2N1595

R3 68

CR2 IN100

C2 100

R4 1K

2N1595 Q2

R3 1.8 K

TO S107

CR3 IN100

C114 - 5PF

P/O J104

12 11 13 14 15

C13 100

C11 .1

R2 2.2K

IN100 CR10

R4 470

R3 2.2K

Q1 2N1776

CR9 IN547

C7 .1

R1 100

CR7 IN100

IN100 CR8

C6 .1

NC NC

K101

CR101 IN1822

R117 00 1W

24 MF

CR102 IN645

CR103 IN3022B

R120 5K 2W

CR105 IN100

TB102

MMX CONT	+24V	TUNE LEVEL	KEY INTLK	-12V	DRIVE UP	PTT CONT	TUNE
1	2	3	4	5	6	7	8

C126 .1

C146 100MF 100V

R122 15K, 20W

R130 100K 2W

R123 25K 10W

R125 47K 2W

R127 47K 2W

TO E7 PC 723

R128 100, 1/2W

4	PTT
3	TUNE
2	DRIVE UP
1	KEY INTLK
14	STBY

P/O TB101

L111 120

S105

REVISIONS							
E.M.N.NO	DRAFT	CHKD	ZONE	LTR	DESCRIPTION	DATE	APPROVED
				X	ORIGINAL ISSUE		
	F.I.			X1	R130 CHANGED AND RELOCATED, L109 DELETED, R119 ADDED, R2 OF PC721 CHANGED. S101E WAS S101F	1-24-75	
				X2	K2 & CR104 ADD R4 WAS 10Ω	2-7-75	
	F.I			X3	R119 DELETED; R14 ADDED TO AS608	2-18-75	
	FI			X4	CR105 ADDED, CONNECTIONS TO R116 CHANGED.	2-24-75	

J103
OUTPUT

T101
2-12 mc

S101E

T102
HF 12-30 mc

C120 50 5KV
C121 100 5KV
C122 25 PF 5KV
L110 6UH
S101C

S101D

P/O J104
15 S

R2 2.2K
IN100 CR10
C12 .1
C10 .1
Q1 2N1776
C8 .1

PC721/A5608 102

TB101
5 6 7 8 9 10 11 12
24-30 16-24 12-16 8-12 5-8 3-5 2.6-3 2-2.6

E 4 D 3 C 2 B A F H J K

J104

L M N R P

C4 .1
C3 .1
C2 .1
C5 .1
C1 .1
CR2 IN100
CR6 IN100
CR4 IN100
CR3 IN100
CR5 IN100
CR1 IN100

E6 E5 E4 E3 E2 E1 E15 E17 E16 E9 E10 E11 E12 E13 E14

E1 DS1 2-2-6
C1 .1 DS2 2.6-3
E2
C2 .1 DS3 3-5
E3
C3 .1 DS4
E4
DS5 5-8
C4 .1
E5 DS6 8-12
C5 .1
E6 DS7 12-16
C6 .1
E7 DS8 16-24
C7 .1
E8 DS9 24-30
C8 .1
E9 AC
C9

NOTES
1- ALL CAPACITANCE VALUES ARE IN MICROFARADARADS
2. ALL RESISTANCE VALUES ARE IN OHMS.
3- ALL INDUCTANCE VALUES ARE IN MICROHENRIES.

BAND	FREQ
1	2-2.6
2	2.6-3
3	3-5
4	5-8
5	8-12
6	12-16
7	16-24
8	24-30

CK2084

R5
C109 .1
R106 2.2K
R107 68 1W
C110 680 PF
C115 .01
C117 .01
R108 2.2K
R109 68 1W
C111 680 PF
L105 220
C138 .01
L107 10MH
L1 1.2
R11 390 1W
C118 100
E102
J101 RF IN
LV
F102 2A
C119 .01
R110 150 5W
P/O TB101
REM INTLK+24V
16 15 13
K102
K102
CR7
AC
R5 50 5W
E10
E11
E9
E8
E7
E6
E5
E4
E1
E2
E3
CR8 AC
CR9 AC
AC
R4 5 5W
R3 10 5W
R1 5,5W
R2 5 5W
CR4 IN2071A
CR5 IN2071A
CR6 IN2071A
CR1 CR2 CR3 IN2071A
PC722/A5609
10
11
7
9
12
13
6
5
R115 470K 1W
30MF
30MF
C127
C123 500 50V
DS101
HV
CR101 IN1822
R117
100 1W
C124 8MF
R120 1.5K 2W
BIAS ADJ
C125 150 75V
R121 5K
C146 100MF 100V
R122 15K,20W
R130 100K 2W
C144
C145
C138
R124 47K 2W
R126 47K 2W
C140
NC
NC
S103 HV
P101
C139 .1
C137 .1
F101 AC
S104 FP
T103
B101
C129 .1
C141 .1
C142 .1
C143 .1
T104
V103
V102
VT01
1
2
3
4
5
6
7
* FAN REMAINS CONNECTED TO 115 AC WHEN INPUT IS 220 AC
FOR 220V OPERATION ON T103 & T104 DISCONNECT JUMPERS 1,2,3 AND 4 MARKED XXX AND CONNECT 2 AND 3 MARKED ---
* DENOTES 20MFD
C
B
A
8
7
6

L106
1.2 MH

R112
390
1W

R104
2.2K
1W

C116
.1

R105
5
5W

C112
.1

R103
47K
2W

R113
10
5W

OPTIONAL R116 1K 2W GAIN

C1
100

R
100
ADJ

Q1
2N1595

R3
68

CR2
IN100

C2
100

R4
1K

2N1595
Q2

R3
1.8
K

E6

E7

TO
S107

CR3
IN100

E4

E3

C114 - 5PF

P/O J104

12 11 13 14 15 S

C13
100

C11
.1

R2
2.2K

IN100
CR10

C12
.1

R4
470

C10
.1

E23

E22

R3
2.2K

E21

Q1
2N1776

C8
.1

CR9
IN547

C7
.1

E19

R1
100

CR7
IN100

IN100
CR8

C6
.1

C5
.1

IN100
CR6

E20 E6 E5

E7 E8 E18

S101A

NC

NC

K101

CR105
IN100

TB102

1	2	3	4	5	6	7	8
MMX CONT	+24V	TUNE LEVEL	KEY INTLK	-12V	DRIVE UP	PTT CONT	TUNE

CR102
IN645

CR103
IN3022B

C126
.1

R128
100, 1/2W

4	PTT
3	TUNE
2	DRIVE UP
1	KEY INTLK
14	STBY

P/O
TB101

L111
120

S105

C130
.1

REMOTE

LOCAL

S106

CR104
IN547

R123
25K
10W

R125
47K
2W

R127
47K
2W

TO E7
PC723

R129
1.2K

S107
BAND

C131
50
50V

ENOTES
OMFD

	HFL-100	
QTY / UNIT	MODEL USED ON	ASS'Y NO.
APPLICATION		
	CODE	

UNLESS
DIMENS
AND INCLU
OR

TO

DECIMAL
.X ± .05
.XX ± .0
.XXX ± .0

MATERIAL

FINISH

5 4 3

NOTES:
1. ALL CAPACITANCE VALUES ARE IN MICROFARADARADS
2. ALL RESISTANCE VALUES ARE IN OHMS.
3. ALL INDUCTANCE VALUES ARE IN MICROHENRIES.

BAND	FREQ
1	2-2.6
2	2.6-3
3	3-5
4	5-8
5	8-12
6	12-16
7	16-24
8	24-30

HF 12-30 mc

C120 50 5KV
C121 100 5KV
C122 25 PF 5KV
L110 6UH
S101C
S101D
S101B

J104 E 4 D 3 C 2 B A F H J K

TB101: 24-30 | 16-24 | 12-16 | 8-12 | 5-8 | 3-5 | 2.6-3 | 2-2.6 — 5 6 7 8 9 10 11 12

E6 E5 E4 E3 E2 E1 E15 E17 E16 E9 E10 E11 E12 E13 E14

L M N R P

E1 E2 E3 E4 E5 E6 E7 E8 E9

DS1 DS2 DS3 DS4 DS5 DS6 DS7 DS8 DS9

C1 C2 C3 C4 C5 C6 C7 C8 C9 .1

2-2-6 2.6-3 3-5 5-8 8-12 12-16 16-24 24-30 AC

Z101

P719/A5604

R2 2.2K
N100
R10
C12 .1
C10 .1
Q1 2N1776
C8 .1
N102 PC721/A5608

IN100 CR6
IN100 CR5
CR4 IN100
CR3 IN100
CR2 IN100
CR1 IN100

QTY. REQ.	ITEM	PART NO.	DESCRIPTION	SYMBOL

LIST OF MATERIAL

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES AND INCLUDE CHEMICALLY APPLIED OR PLATED FINISHES

TOLERANCES ON

DECIMALS
.X ± .05
.XX ± .01
.XXX ± .005

FRACTIONS
± 1/64
ANGLES
± 0° -30'

MATERIAL

FINISH

FINAL APPROVAL		DATE
MECH. DES.		DATE
ELECT. DES.		DATE
CHECKED		DATE
DRAWN	A. DeLuca	DATE 8-28-14

THE TECHNICAL MATERIEL CORP.
MAMARONECK, NEW YORK

Figure 2-2. Interconnect Wiring Diagram, Model HFL-100

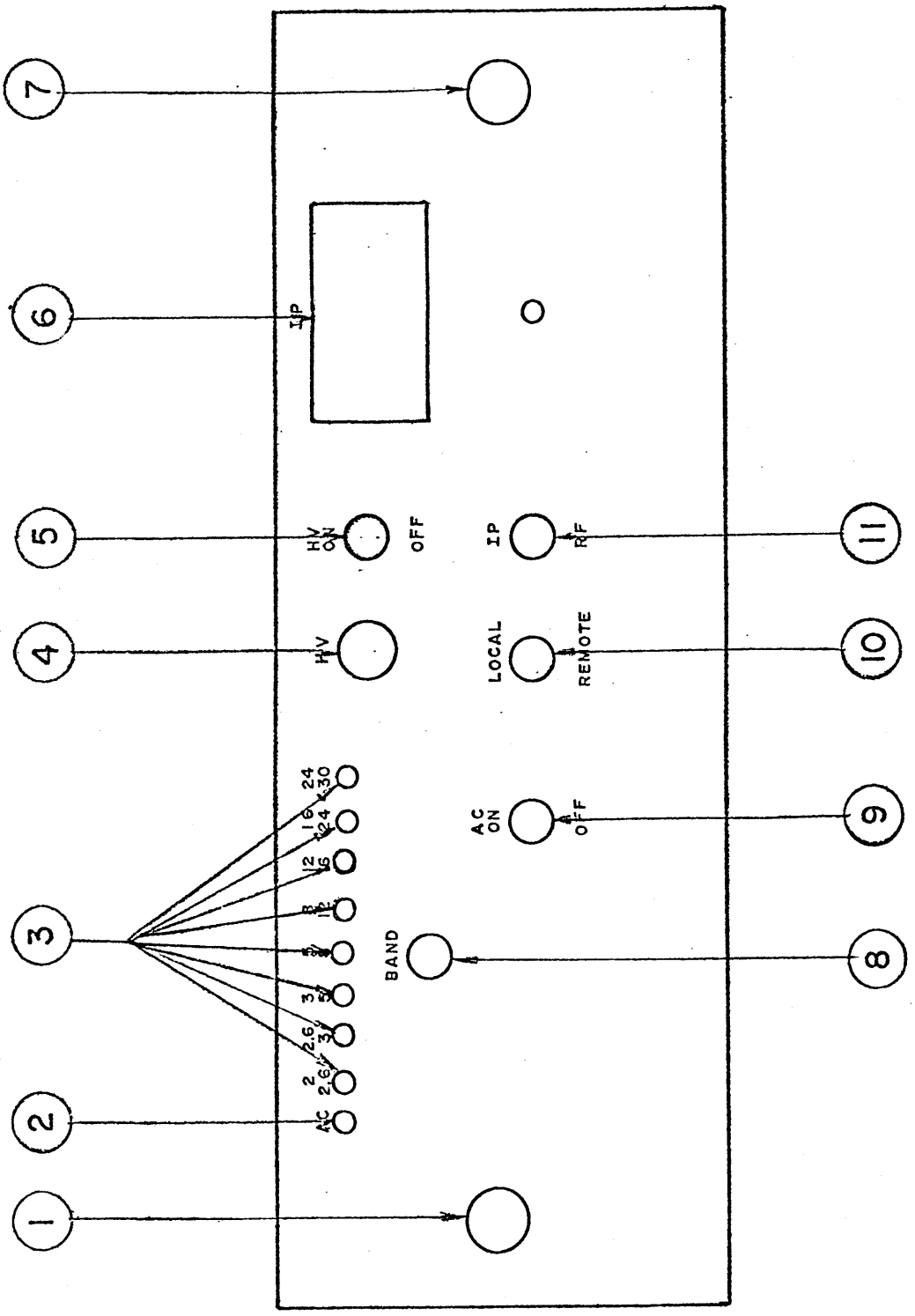


Figure 3-1. Controls and Indicators

SECTION 3

OPERATION

3-1. GENERAL

The HFL-100 linear power amplifier will amplify an input signal of 100 milliwatts to a 50 watt (average), 100 watt (PEP) output signal. This amplifier will operate satisfactorily at any frequency in the 2.0 to 30.0 MHz range. Normally the amplifier is automatically tuned to the correct frequency band, but if required, may be manually tuned.

3-2. OPERATING CONTROLS

All of the controls and indicators are located on the front panel illustrated in figure 3-1. They are functionally identified in Table 3-1.

TABLE 3-1. FRONT PANEL INDICATORS AND CONTROLS (Refer to figure 3-1)

INDEX NUMBER	PANEL NOMENCLATURE	NATURE AND FUNCTION
1	NONE	Panel lock (LH) - Secures unit in cabinet.
2	AC	Indicator light (LED) - When lighted indicates AC power is applied.
3	Band Numbers	Indicator lights (LED) - Indicate frequency-band to which amplifier is tuned.
4	HV	Toggle switch - Controls primary power to high voltage transformer.
5	HV ON	Indicator lamp - Indicates application of high voltage.
6	IP	Milliameter - Indication corresponds to plate current or strength of output signal.
7	NONE	Panel lock (RH) - Secures unit in cabinet.

TABLE 3-1. FRONT PANEL INDICATORS AND CONTROLS (Refer to figure 3-1) (cont)

INDEX NUMBER	PANEL NOMENCLATURE	NATURE AND FUNCTION
8	BAND	Pushbutton - Controls position of bandswitch.
9	AC ON/OFF	Toggle switch - Controls line power input.
10	LOCAL/REMOTE	Toggle switch - Controls operating mode.
11	IP/RF	Toggle switch - Selects quantity displayed on meter. (PA plate current or rf output volts).

3-3. PRELIMINARY PROCEDURES (Refer to figure 3-1)

Set the AC switch (9) and the HV switch (5) to the OFF position prior to connecting the HFL-100 to a source of primary power. Select the operational mode by setting the LOCAL/REMOTE switch (10) to the proper position. Set meter control toggle switch (11) to the IP position. Be sure that the amplifier is held firmly in position by the panel locks (1 and 7) and recheck the interconnections with the associated equipment.

3-4. OPERATING PROCEDURES

a. GENERAL. When the HFL-100 is being operated as a component of a TMC transmitter, as is most often the case, the operating procedures for the system will relate the unit to the overall system operation. In this presentation the amplifier is treated on a unit basis only.

b. LOCAL TUNING. (Refer to figure 3-1)

(1) Connect the plug on ac power lead to a suitable power source.

CAUTION

The output circuit must be connected through J103 to an antenna system or suitable dummy load (50 ohms) before power is applied to the amplifier.

(2) Set the LOCAL/REMOTE switch (10) to the LOCAL position.

CAUTION

Be sure that no input signal is applied to the INPUT jack (J101) before supplying high voltage.

(3) Set the AC switch (9) to the ON position. AC indicator lamp (2) lights. Band indicator (3) lights. Blower starts functioning.

CAUTION

Before applying high voltage allow a reasonable time (40-60 seconds) for the tube filaments to heat.

(4) When the tube filaments have heated, set the HV switch (5) to the ON position.

(5) With the IP/RF switch (11) in the IP position, check the quiescent current of the power amplifier tube as indicated on the IP meter (6). If a reading of other than 50 milliamperes is obtained the bias control must be readjusted.

NOTE

The bias control potentiometer is located on the front left corner of the chassis behind the front panel. After adjustment retighten the locknut.

(6) Press BAND pushbutton (8) sequentially until band indicator (3) shows that the proper tuning band has been selected for the frequency of the rf signal to be used.

(7) Supply a rf signal between 2.0 and 30.0 MHz to the amplifier from the associated equipment through J101.

(8) Increase the rf input slowly until an indication of 75 ma plate current is observed on the IP meter (6).

(9) Set meter control toggle switch (11) to the RF position.

(10) Observe that an indication of the rf output is displayed on the meter.

NOTE

The milliampere indication on the meter is proportional to the rf voltage across the 50 ohm load. A reading of approximately 0.5 milliampers is the equivalent of 50 watts output.

c. REMOTE OPERATION. (Refer to figure 3-1)

(1) Connect the plug on the ac power lead to a suitable power source.

CAUTION

The output circuit must be connected through J103 to an antenna or suitable dummy load (50 ohms) before power is applied to the amplifier.

(2) Set the LOCAL/REMOTE switch (10) to the REMOTE position.

CAUTION

Be sure that no input signal is applied to the INPUT jack (J101) before supplying high voltage.

(3) Set the AC switch to the ON position. AC indicator lamp (2) lights. Band indicator (3) lights. Blower starts functioning.

CAUTION

Before applying high voltage allow a reasonable time (40-60 seconds) for the tube filaments to heat.

(4) When the tube filaments have heated, set the HV switch (5) to the ON position. If the band switching signal is being provided from the associated equipment, the bandswitch will now be automatically positioned to the correct band for the rf frequency to be used.

(5) Check and adjust quiescent plate current if necessary as in step 5 of paragraph 3-4 b.

(6) Supply a rf signal between 2.0 and 30.0 MHz to the amplifier from the associated equipment through J101.

(7) Increase the rf input slowly until an indication of 75 ma plate current is observed on the IP meter.

(8) Set the meter control toggle switch (11) to the RF position.

(9) Observe that an indication of the rf output is displayed on the meter.

NOTE

The milliampere indication on the meter is proportional to the rf voltage across the 50 ohm load. A reading of approximately 0.5 milliamperes is the equivalent of 50 watts output.

(10) Reset the meter control toggle switch (11) to the Ip position.

NOTE

This is the usual position of the toggle switch during operation.

CAUTION

Do not allow the plate current as indicated on the meter to exceed 0.25 ma (equivalent to 250 ma actual).

3-5. OPERATOR MAINTENANCE

The operator performed maintenance on the HFL-100 amplifier consists mainly of cleaning and the replacement of blown fuses or power tubes. Internal inspection of the unit and the replacement of warn or damaged parts should be a part of the regularly scheduled preventive maintenance program of the equipment of which the HFL-100 is a component.