



★  
UNCLASSIFIED

TECHNICAL MANUAL  
for  
**DUAL DIVERSITY RECEIVER**  
**MODEL DDR-8** 3023



THE TECHNICAL MATERIEL CORPORATION  
MAMARONECK, N. Y. OTTAWA, CANADA

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700 FENIMORE ROAD

MAMARONECK, N. Y.

## W a r r a n t y

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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.
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\*Electron tubes also include semi-conductor devices.



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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.

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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*

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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



## FOREWORD

The DDR-8 comprises eight modular units; these modular units are used in various receiver configurations as well as the DDR-8. As a practical matter, individual manuals are written for each modular unit and then combined as required with a system manual to cover the overall receiver.

With this package, an individual manual is provided for each modular unit in the DDR-8 with the exception of Power Control Panel DCP-2, Line Patch Panel LPP-4, and Equipment Rack RAK-31B. Information concerning these units is grouped together in one manual located in the appendix.

The DDR-8 manual given in this package discusses each modular unit only to the extent that it affects the system. Detailed information concerning any modular unit is available in the individual manual.

Commercial and military nomenclature for the DDR-8, the cabinet, and the modular units that constitute the DDR-8 are as listed below. Where the military nomenclature has not been assigned at the date of printing, the appropriate space has been left blank.

### Diversity Radio Receiver

TMC: Dual Diversity Receiver, Model DDR-8  
MIL:

### General Purpose Receiver

TMC: General Purpose Receiver, Model GPR-92  
MIL:

### Variable Frequency Oscillator

TMC: Variable Frequency Oscillator, Model VOX-5  
MIL: Oscillator, Radio Frequency; 0-330 (B)/FR

Fr qu ncy Shift Conv rt r

TMC: Fr qu ncy Shift Conv rt r, Mod 1 CFA-1  
MIL: Conv rt r, Fr qu ncy Shift: CV-763/URR

Diversity Voice Combiner

TMC: Diversity Voice Combiner, Model DVC-1  
MIL:

Bridging Speaker Panel

TMC: Bridging Speaker Panel, Model BSP-2  
MIL:

Power Control Panel

TMC: Power Control Panel, Model DCP-2  
MIL:

Patch Panel

TMC: Line Patch Panel, Model LPP-4  
MIL:

Equipment Rack

TMC: Cabinet Electrical Equipment, Model RAK-31B  
MIL: Cabinet Electrical Equipment:



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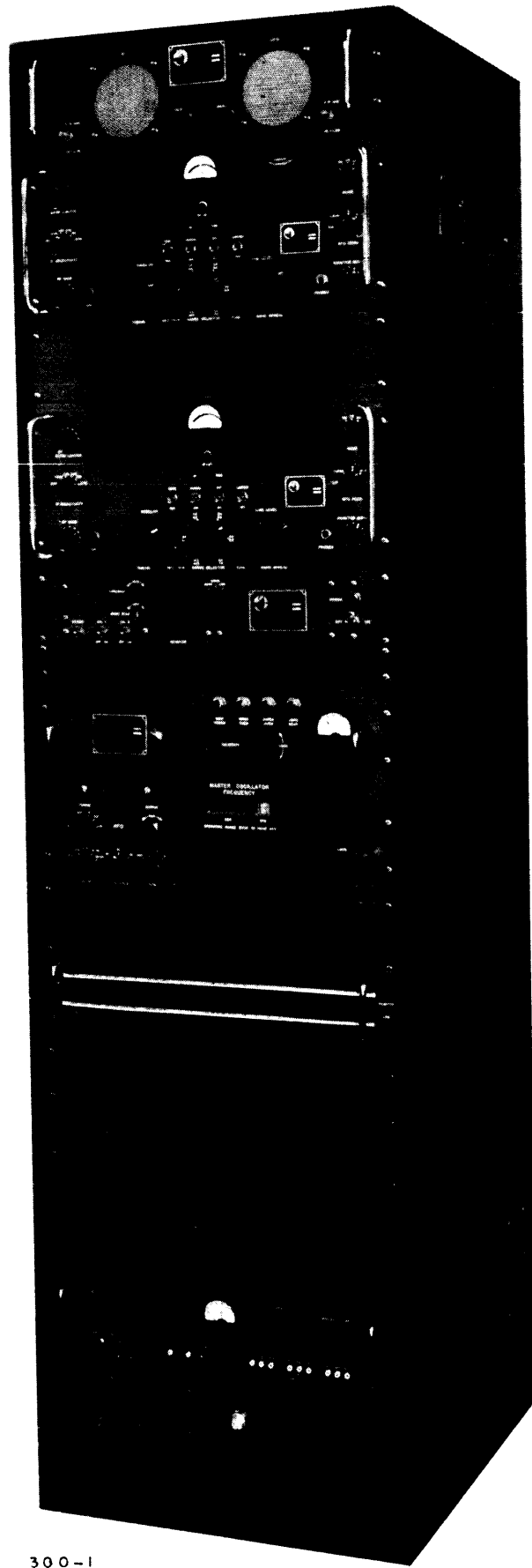
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Figure 1-1. Dual Diversity Receiver, Model DDR-8 (3023)

## SECTION 1

### GENERAL INFORMATION

#### 1-1. GENERAL DESCRIPTION

Dual Diversity Receiver, Model DDR-8 (figure 1-1) is a receiving system covering the frequency range of .54 to 32.3 mc for the reception of SSB, ISB, AM, AM Equivalent, FSK, FAX, CW, and MCW signals. The .54 to 32.3 mc range covered by the DDR-8 is divided into six r-f bands (refer to table 1-1); continuous tuning is provided. Voice frequency demultiplexing, crystal control, diversity voice combining, and selectable IF bandpass are also provided.

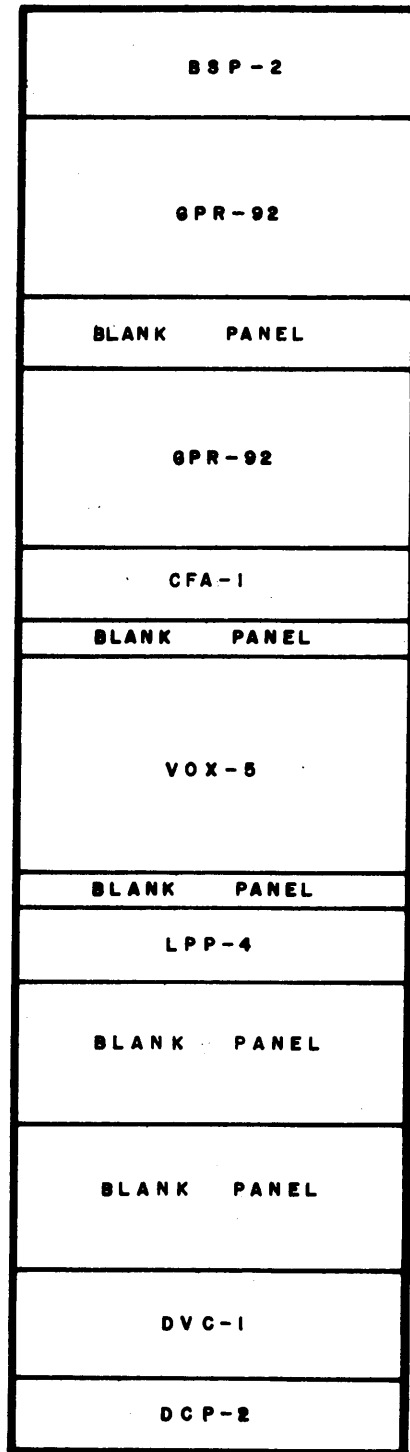
The receiving component of the DDR-8 is TMC's General Purpose Receiver, Model GPR-92. This receiver is a versatile double conversion superheterodyne receiver with an input noise figure of better than 6 db, and sensitivity better than 1 microvolt at full audio output. The GPR-92 contains a multi-tapped solid state power supply for flexibility of operating voltages.

The DDR-8 comprises various modular units (refer to paragraph 1-2) mounted in a single rack and is used in fixed-station or mobile communications systems. Figure 1-2 illustrates the chassis locations of the modular units that are contained in the DDR-8.

Flexibility of space-diversity or single-receiver (non-diversity) operation is provided in order to fulfill various operational requirements and to maintain receiver operability during emergency conditions.

#### 1-2. DESCRIPTION OF UNITS

a. GENERAL - Paragraphs b through h below give a brief description of the modular units used in the DDR-8. For more detailed



300-2

Figure 1-2. DDR-8 Modular Unit Chassis Location

information pertaining to these units, refer to the individual modular-unit manuals.

b. GENERAL PURPOSE RECEIVER, MODEL GPR-92 - General Purpose Receiver, Model GPR-92 is a double conversion superheterodyne receiver covering the frequency range of .54 to 32.3 mc. It provides reception for SSB, CW, MCW, AM, and AM Equivalent signals; ISB, FSK, and FAX signals can also be received with the use of external adaptors. The GPR-92 provides a 455 kc second i-f and an audio output of one milliwatt across 600 ohms, or one watt into 4, 8, or 16 ohms. Chassis-mounted jacks facilitate the use of the i-f or audio output.

c. VARIABLE FREQUENCY OSCILLATOR, MODEL VOX-5 - Variable Frequency Oscillator, Model VOX-5 is a highly stable 14-tube oscillator amplifier designed to provide high-frequency and medium-frequency oscillator injection voltage for the control of one or more receivers or transmitter exciters. The VOX-5 provides the following:

(1) High frequency r-f output voltage, continuously variable over the range of 2 to 64 mc (frequency dependent upon dial settings).

(2) Crystal-controlled HFO voltage over the range of 2 to 64 mc (frequency dependent upon crystals used).

(3) Crystal-controlled BFO voltage over the range of 300 to 500 kc (frequency dependent upon crystals used) for dual-conversion superheterodyne receiver.

(4) Crystal-controlled IFO voltage over the range of 3.2 to 3.9 mc (frequency dependent upon crystals used) for dual-conversion superheterodyne receivers.



d. FREQUENCY SHIFT CONVERTER, MODEL CFA-1 - Frequency Shift

Converter CFA-1 is an audio type dual channel converter designed for use with diversity or single receiver systems. Its function is to convert mark-space signals into dc pulses capable of operating a teleprinter, tape recorder, or any other device requiring make and break signals. The CFA-1 contains a compensating circuit that will accommodate total receiver drifts up to 1500 cps without interruptions in service. A CRT type visual monitor permits simple and rapid tuning of the CFA-1.

e. DIVERSITY VOICE COMBINER, MODEL DVC-1 - Diversity Voice

Combiner, Model DVC-1, accepts two voice signals in the range of 250-3000 cps, separates the voice signal from each receiver into three separate segments, selects the best signal in each segment and recombines the signal into a high quality audio output signal. Sensitivity of the diversity voice combiner is such that a 3 db differential between two audio signals will result in a 20 db suppression of the weaker one.

f. BRIDGING SPEAKER PANEL, MODEL BSP-2 - Bridging Speaker

Panel, Model BSP-2, is a dual-amplifier, speaker assembly used to monitor both single and dual channel receiver operation. Front-panel volume controls permit independent adjustment of audio output levels.

g. POWER CONTROL PANEL, MODEL DCP-2 - Power Control Panel,

Model DCP-2, controls the a-c input voltage to all units of the DDR-8.

The front-panel of the DCP-2 contains a single power switch, two fused convenience outlets for use with external equipment, and an indicator lamp. A convenience outlet provided on the rear panel is used to provide constant power to DDR-8 oscillator ovens.

h. LINE PATCH PANEL, MODEL LPP-4 - Line Patch Panel, Model LPP-4, contains thirty-eight PJ-339 jacks arranged in two rows. The top row of jacks is used for monitoring, and the bottom row is used for patching.

1-3. REFERENCE DATA

Table 1-1 lists the reference data that is pertinent to the DDR-8 receiver. For reference data concerning the modular units contained in the DDR-8, refer to the individual modular-unit manuals.

1-4. EQUIPMENT SUPPLIED

Table 1-2 lists the equipment supplied with the DDR-8.

TABLE 1-1. DDR-8, TECHNICAL SPECIFICATIONS

a. Frequency Range:	.54 to 32.3 mcs, continuous tuning provided.
b. Tuning:	<p>DDR-8 can be tuned to any one of six r-f bands as listed below:</p> <p>BAND 1      .54 to 1.4 mc          BAND 2      1.4 to 3.3 mc          BAND 3      3.2 to 5.6 mc          BAND 4      5.4 to 9.6 mc          BAND 5      9.4 to 17.8 mc          BAND 6      17.3 to 32.3 mc</p>
c. Modes of Reception:	SSB, AM, AM equivalent, CW, MCW ISB, FAX, FSK

TABLE 1-1. DDR-8, TECHNICAL SPECIFICATIONS (Cont)

d. Stability:	2 parts in $10^6$ per day, for a change in ambient temperature of 0 to 50°.
e. Input Impedance:	Nominal 70 ohms. For 300 ohm balanced input, use TMC Model RBT-4, Matching Transformer.
f. Noise Figure:	Better than 5 db from .43 to 31.5 mcs.
g. Sensitivity:	Less than 1 microvolt with 15 kc bandpass will produce full audio output at 10 db signal plus noise to noise ratio.
h. Overload:	250,000 microvolts with full r-f gain and agc on.
i. Image Ratio:	Average 83 db.
j. IF Rejection:	At least 80 db.
k. Noise Limiter:	Adjustable level peak noise limiter circuit for CW or SSB. Adjustment control includes ON/OFF switch to remove limiter from circuit.
l. IF Selectivity:	Front-panel selection provides the following bandwidth: <ol style="list-style-type: none"> <li>1. 250 to 15000 cps</li> <li>2. 250 to 7500 cps</li> <li>3. 250 to 3000 cps</li> <li>4. 250 to 2000 cps</li> <li>5. 250 to 1000 cps</li> <li>6. 250 to 500 cps</li> </ol>
m. IF Response:	Flat within + 0.5 db over the above bandwidths.

TABLE 1-1. DDR-8, TECHNICAL SPECIFICATIONS (Cont)

n. Intermediate Frequencies:	3.955 mc and 455 kc.
o. AGC Characteristics:	80 db rise in input signal from 1 microvolt will produce less than 2 db change in audio output.  SSB 3 millisecond attack 1.2 second decay  AM .9 millisecond attack .33 second decay
p. Squelch:	Continuously variable distortion-free squelch circuit with rear apron contacts for external alarm.
q. IF Output:	.1 volt rms into 50 ohms for IF accessory units.
r. BFO Control:	+ 3 kc; connection available for external BFO injection.
s. Audio Response:	200 to 8500 cycles, + 1.5 db
t. Audio Distortion:	Less than 4% at full output
u. Audio Output:	1. 1 milliwatt across 600 ohms balanced and center tapped. 2. 1 watt into 4, 8, or 16 ohms. 3. Headphones, 600 ohms.
v. Hum Level:	-50 db
w. Primary Power:	115/230 volts AC, single phase, 50/60 phase; power consumption approximately 1100 watts for average configuration.
x. Environmental Conditions:	Designed to operate in any ambient temperature of 0° to 50° C and any value of humidity up to 95%.



TABLE 1-2. EQUIPMENT SUPPLIED

NOMENCLATURE		QTY PER EQUIP.	OVERALL DIMENSIONS (IN)			GROSS SHIPPING WEIGHT	NET WEIGHT (LBS)
NAME	MILITARY DESIGNATION		HEIGHT	WIDTH	DEPTH		
General Purpose Receiver Model GPR-92		2	8-3/4	19	16-1/4		65
Variable Frequency Oscillator, Model VOX-5	0-330(B)/FR	1	10-1/2	19	16	Refer to para- graph 2-1	67
Frequency Converter, Model CFA-1	CV-763/URR	1	3-1/2	19	16		32
Diversity Voice Combiner, Model DVC-1		1	5-1/4	19	16		15
Bridging Speaker Panel, Model BSP-2		1	5-1/4	19	6-1/2		7-1/2
Power Control Panel, Model DCP-2		1	3-1/2	19		Refer to para- graph 2-1	
Line Patch Panel, Model LPP-4		1	3-1/2	19	15-1/8		
Cabinet Electrical Equipment, Model RAK-31B		1	72	20-5/8	22-1/2		340
Cable Assemblies							
Patching Cords CA-566-6							

SECTION 2  
INSTALLATION

2-1. UNPACKING AND HANDLING

The DDR-8 is shipped in 5 boxes as listed in table 2-1; box number and contents are stenciled on the outside of each box. Table 2-2 lists the gross weight and size of shipping boxes. Inspect all boxes for possible damage when they arrive at the operating site. With respect to equipment damage for which the carrier is liable, the Technical Materiel Corporation will assist in describing methods of repair and the furnishing of replacement parts.

Figures 2-1 and 2-2 are typical illustrations of the method used to pack RAK-31B and the DDR-8 modular units respectively for shipment. Using figures 2-1 and 2-2 as a guide, unpack RAK-31B and the modular units. Inspect the contents of each box for possible damage and inspect the packing material for parts that may have been shipped as loose items.

TABLE 2-1. CONTAINER CONTENTS, DDR-8

BOX NO.	CONTENTS
1	Cabinet, Electrical Equipment, Model RAK-31B, 1 each. Bridging Speaker Panel, Model BSP-2, 1 each. Power Control Panel, Model DCP-2, 1 each. Loose items.
2	General Purpose Receiver, Model GPR-92, 2 each
3	Diversity Voice Combiner, Model DVC-1, 1 each. Line Patch Panel, Model LPP-4, 1 each.

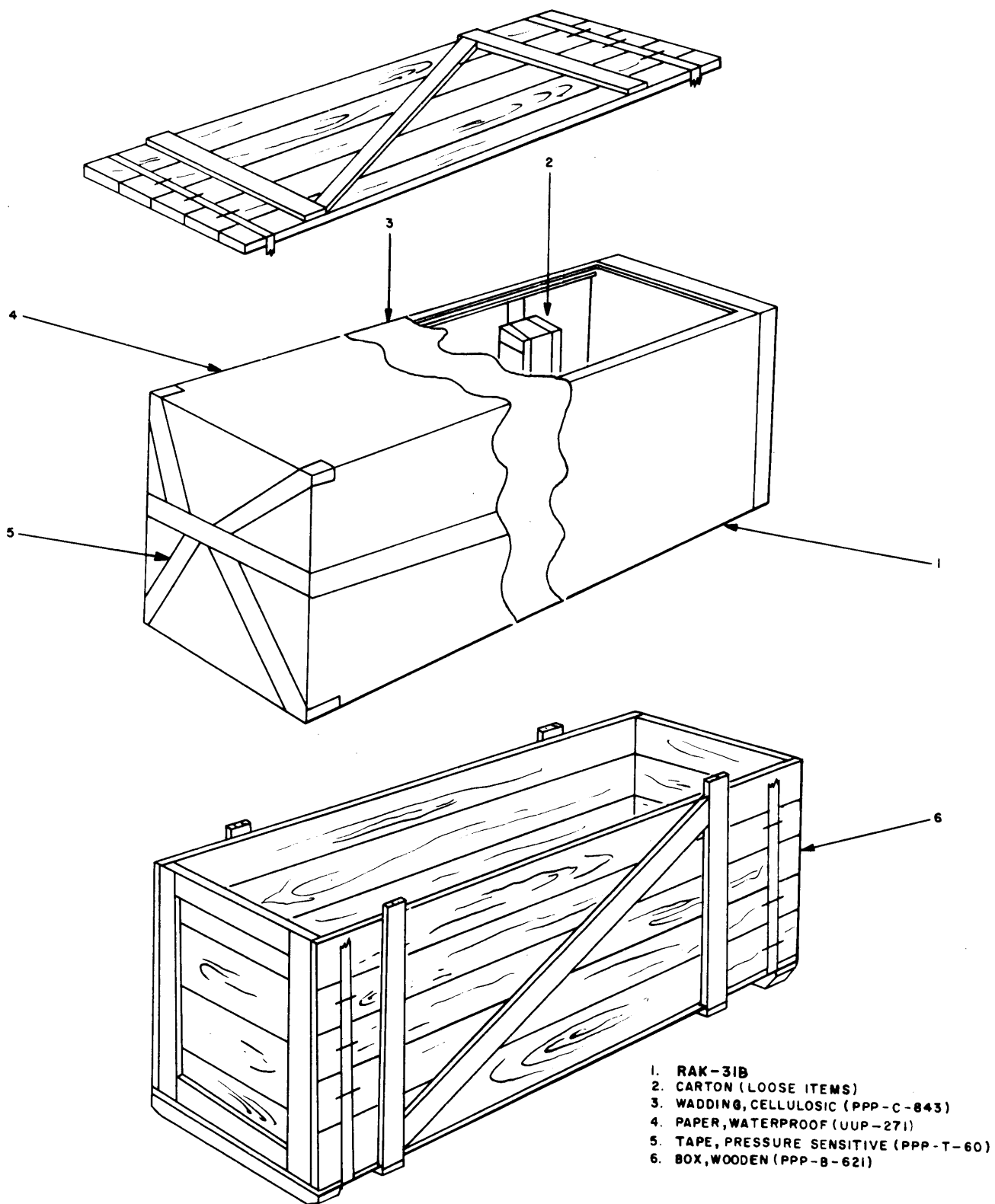
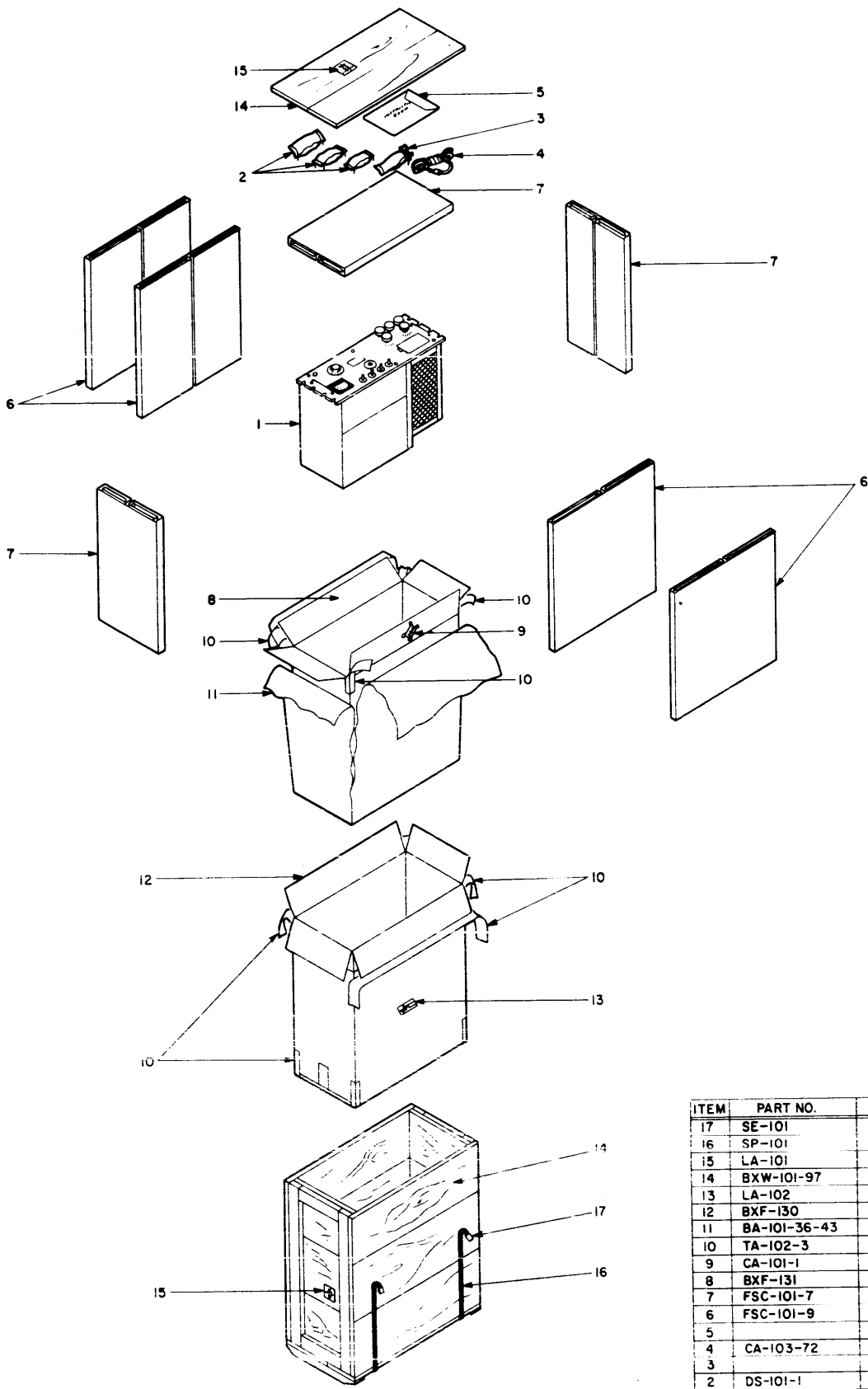


Figure 2-1. RAK-31B, Preparation for Shipment



ITEM	PART NO.	DESCRIPTION
17	SE-101	SEALS, STRAPPING
16	SP-101	STRAPPING, STEEL
15	LA-101	LABEL, FRAGILE
14	BXW-101-97	CONTAINER, SHIPPING
13	LA-102	LA-, METHOD II
12	BXF-130	CONTAINER, OUTER
11	BA-101-36-43	BAG, BARRIER
10	TA-102-3	TAPE, PRESSURE SENSITIVE
9	CA-101-1	CARD, HUMIDITY INDICATOR
8	BXF-131	CONTAINER
7	FSC-101-7	FIBERBOARD SHEET, CREASED
6	FSC-101-9	FIBERBOARD SHEET, CREASED
5		MANUALS, INSTRUCTION
4	CA-103-72	CORD, LINE
3		LOOSE ITEMS
2	DS-101-1	DESICCANT, 16 UNIT
1		MODULAR UNIT

Figure 2-2. Modular Units, Preparation for Shipment, Typical

TABLE 2-1. CONTAINER CONTENTS, DDR-8 (Cont)

BOX NO.	CONTENTS
4	Variable Frequency Oscillator, Model VOX-5, 1 each.
5	Frequency Shift Converter, Model CFA-1, 1 each.

TABLE 2-2. SHIPPING DATA (LEVEL A PACKAGING), DDR-8

BOX NO.	GROSS WEIGHT (LBS)	OUTSIDE DIMENSIONS (IN)			VOLUME (CU.FT.)
		LENGTH	WIDTH	HEIGHT	
1	495	78-5/8	24-7/8	34-1/2	39.0
2	229	32	23-1/2	30-1/2	13.6
3	124	25-3/8	16-1/8	29	6.9
4	145	25-3/8	16-1/8	29	6.9
5	68	23-1/4	20-1/2	10	2.8

2-2. POWER REQUIREMENTS

All units of the DDR-8 leave the factory wired for 115 volt, 50/60 cycle operation. Change may be made to 230 volt, 50/60 cycle operation by making minor wiring changes. Consult the installation section of the individual modular-unit manuals for wiring-change information.

CAUTION

If 230 volt, 50/60 cycle operation is used, all line fuses must be reduced to one half their rated current values to assure adequate circuit protection. Regulated and high voltage fuses remain the same with either line voltage.

Power consumption of the DDR-8 is approximately 800 watts; power cabling of sufficient size to provide 13 amperes at 115 vac, single phase, is adequate. For information concerning the connection of power cables, refer to paragraph 2-3e.

### 2-3. INSTALLATION

a. ANTENNA. - The DDR-8 is normally used with a sloping V, rhombic, or log-periodic antenna. The antenna input to the receiver is 50 ohms unbalanced. Many antennas can be adapted to this 50-ohm unbalanced input by means of Technical Materiel Corporation's Rhombic Antenna Coupler, Model RAC.

b. LOCATION OF RECEIVER. - Before attempting to install the DDR-8, ensure that adequate power (paragraph 2-2) is available at the selected site or location. After unpacking and inspecting the cabinet (RAK-31B), place the cabinet in its operating location. It is advisable to do this while modular units are not installed because the added weight (approximately 530 pounds) of the assembled receiver will make movement more difficult. Refer to the installation and dimensional outline drawing (figure 4) given in the appendix when choosing the operating location. Refer to the appendix for additional information concerning RAK-31B. Sufficient space to open the rear cabinet door is one of the prime considerations when choosing the operating location. The DDR-8 has a self-contained blower system for cooling; air intake for the blower is located on the lower rear of the cabinet. Air intake and exhaust ports should be kept clear to assure adequate heat dissipation.

c. INSTALLATION OF MODULAR UNITS. - With the exception of Bridging Speaker Panel BSP-2 and Power Control Panel DCP-2, all modular units are slide mounted. To mount the BSP-2 or DCP-2, simply place the unit in the rack and secure the front panel to RAK-31B with screws. The compartments of RAK-31B are equipped with tracks that attach to slide mechanism of the associated slide-mounted units. To mount any of these modular units, proceed as follows:

(1) Untape or unstrap cable assemblies, cable retractors and all other components secured to the RAK-31B frame for shipment.

(2) Pull center section of associated compartment track out until it locks in an extended position.

(3) Position slide mechanisms of modular unit in tracks, and ease modular unit forward into rack until lock buttons engage hole in track.

(4) Make the necessary cable and electrical connections as described in paragraph 2-3d.

(5) Depress forward lock buttons, and slide modular unit completely into compartment.

(6) Secure front panel of modular unit to RAK-31B with screws.

d. CABLING. - Untape or unstrap all cable assemblies, cable retractors, and all other components attached to the frame of RAK-31B for shipment, and proceed as outlined in the following paragraphs.

(1) CABLE ENTRY - Cable entry is accomplished through openings with removable covers. These openings are located on both sides of the cabinet near the bottom, on the rear of the cabinet

n ar the bottom, and on the bottom. Antenna cabling should be RG 8, 9, 10, or 11/U, or equivalent. Audio cabling required is 4 audio pairs.

(2) CABLING CONNECTIONS - Figure 2-3 illustrates the cabling and connections between the various DDR-8 modular units. Refer to figure 2-3 and make connections as illustrated; secure cables to cable retractors (refer to appendix for further information concerning retractors).

CAUTION

Cables and electrical wiring should be carefully positioned to prevent snagging or catching as units slide in and out of equipment rack. Ensure that cable retractors used to retract the cable assemblies are functioning properly.

e. POWER CONNECTIONS - Refer to paragraph 2-2 for information regarding DDR-8 power requirements and ensure that the power source is satisfactory. Connect plugs of Bridging Speaker Panel BSP-2, General Purpose Receivers GPR-92 No. 1 and GPR-92 No. 2, Frequency Shift Converter CFA-1, Diversity Voice Combiner DVC-1, and the blower assembly to the receptacles on a-c power strip A-3205 (refer to figure 2-3). Connect plug of Variable Frequency Oscillator VOX-5 to the a-c receptacle located at the rear of Power Control Panel DCP-2. Primary power is applied to the DDR-8 by connecting the power source to the a-c receptacle located at the lower left, rear corner of RAK-31B.

2-4. INSPECTION AND ADJUSTMENT

a. GENERAL - Although each modular unit of the DDR-8 has been aligned and thoroughly checked against the manufacturer's specifications prior to shipment, it is necessary to insure correct installation and proper DDR-8 operating condition by performing the



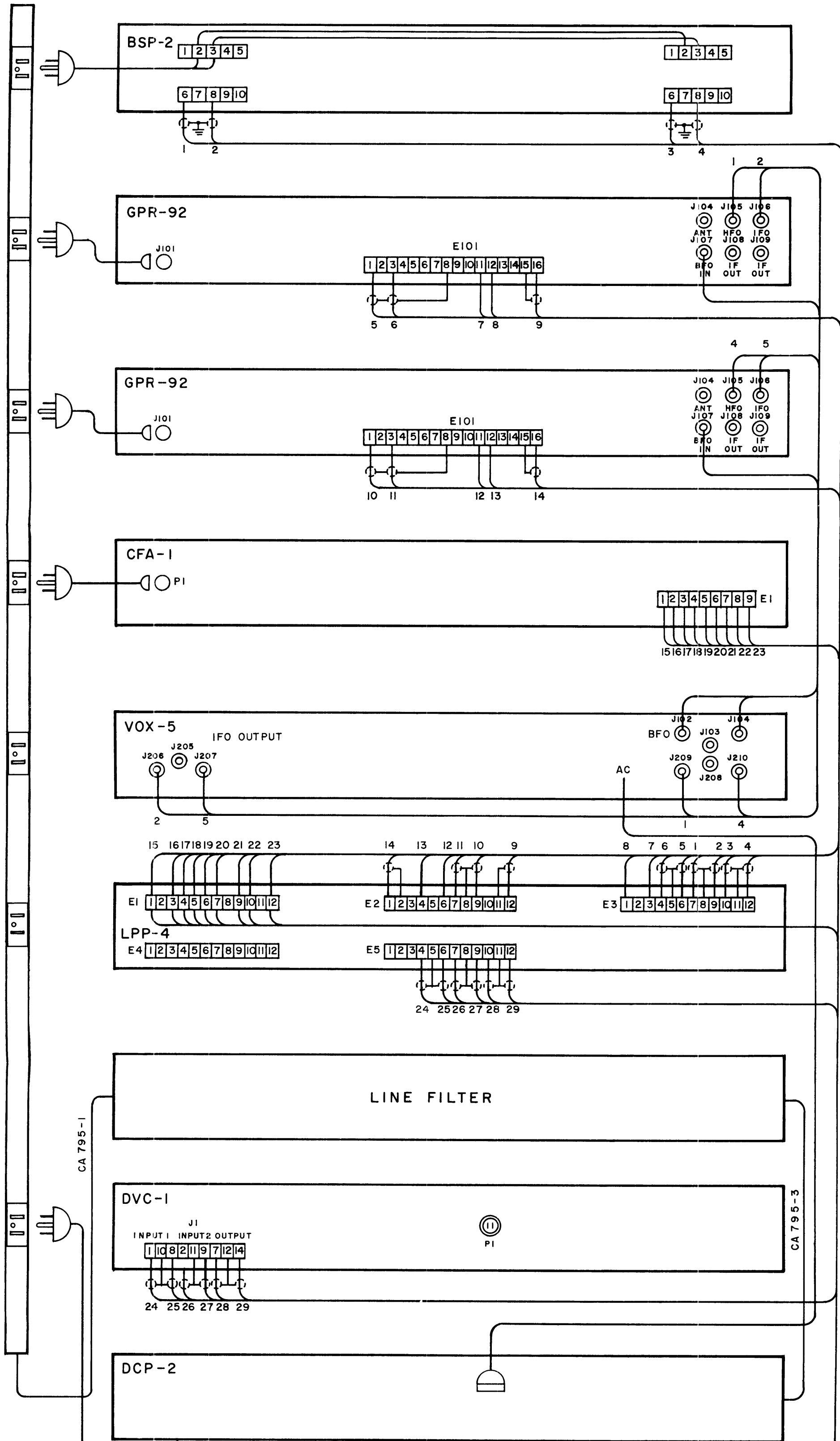
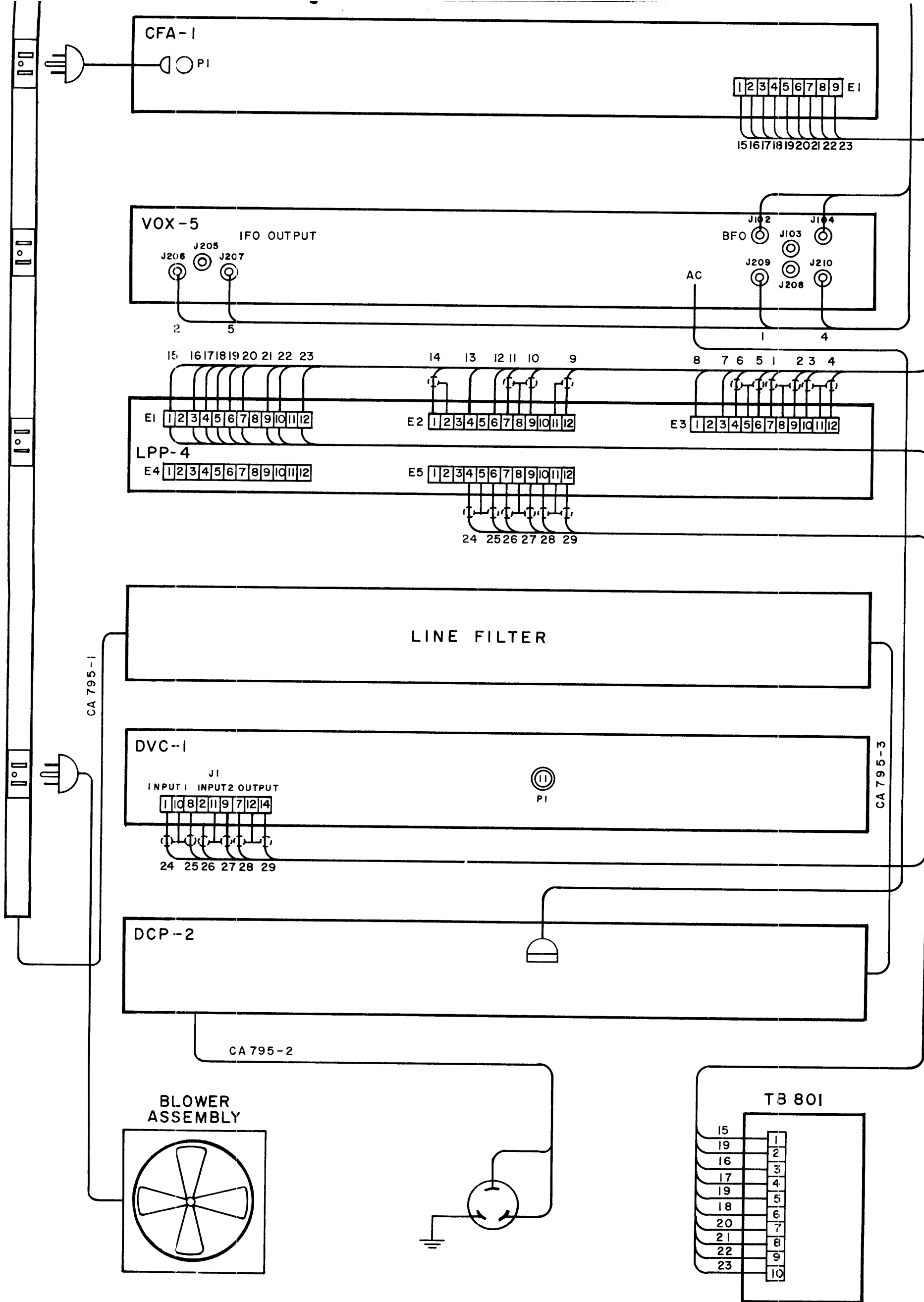


Figure 2-3. Cabling Connections, DDR-8  
2-8/2-9



CK-720

following checkout procedures. These procedures must be performed after the equipment is installed and prior to releasing the equipment to operating personnel. If the results of any particular portion of the procedure are unsatisfactory, refer to the appropriate modular-unit manual for remedial information. Special tools and test equipment required for inspection and adjustment procedures are listed in tables 5-1 and 5-2 respectively.

b. PRELIMINARY OPERATIONS - Refer to figure 3-1 for location of controls and proceed as follows:

NOTE

Numbers enclosed in parenthesis are callouts referenced to figure 3-1.

- (1) Ensure that Power switch (46) of Variable Frequency Oscillator VOX-5 is set at ON; MAIN POWER lamp (50) should be lit.
- (2) On Power Control Panel DCP-2, turn MAIN POWER circuit breaker (69) on; MAIN POWER lamp (70) of DCP-2 should light. Allow 48 hours for warm-up period; maximum stability of receiver system is dependent upon adequate warm-up period.
- (3) Turn RF GAIN control (4) of Communications Receiver GPR-92 No. 2 slightly clockwise until switch clicks on.
- (4) Turn POWER ON-OFF switch (37) of Frequency Shift Converter CFA-1 to ON; POWER indicator lamp (36) should light.
- (5) Set POWER switch (60) of Diversity Voice Combiner DVC-1 at ON; POWER lamp (59) should light.
- (6) Using Simpson Model 260 VOM measure voltage across convenience outlets in a-c voltage strip A-3205 located at right rear of cabinet (RAK-31B). Voltage should measure approximately 115 vac.
- (7) Set switches and controls as listed in table 2-3; switches and controls not mentioned in table 2-3 are of no significance at this time.

TABLE 2-3. PRELIMINARY CONTROL POSITIONS

MODULAR UNIT	SWITCH OR CONTROL DESIGNATION	SERIAL DESIGNATION (FIGURE 3-1)	POSITION
Variable Frequency Oscillator VOX-5	HFO	44	ON
	IFO	43	ON
	METER	47	VMO
	XTAL	37	VMO
	OUTPUT	40	Mid position
General Purpose Receiver GPR-92 No. 1	EXT/INT	17	INT (selects HFO and IFO of GPR-92. Refer to paragraph 3-3c)
	LIMITER/OFF	20	OFF
	NOISE LIMITER	9	OFF
	SEND/REC	11	REC
	MANUAL/AVC	12	AVC
	SQUELCH	10	Fully clockwise
	HFO TRIM	8	0
	TONE	23	Mid position
	BFO PITCH	24	0
	LINE LEVEL	21	Fully Counterclockwise
	MODE	22	AM
MONITOR AUDIO		Fully counterclockwise	

c. CHECKOUT PROCEDURES FOR MODULAR UNITS - Paragraphs (1) through (4) below provide checkout procedures for all modular units contained in the DDR-8 with the exception of Frequency Shift Converter CFA-1. For CFA-1 checkout procedure, refer to Section 2 of the CFA-1 modular-unit manual. For brevity in the following procedures, only GPR-92 No. 1 is discussed; to check GPR-92 No. 2, connect the test equipment to the appropriate jacks and use the procedures as written.

(1) CHECKOUT PROCEDURE FOR GENERAL PURPOSE RECEIVER GPR-92

NO. 1. - Use a Measurements Model 82 signal generator, a Hewlett Packard Model 524C frequency counter, and a Ballantine Model 314 AC VTVM, or their equivalents to check GPR-92 No. 1. Proceed as follows:

NOTE

Numbers enclosed in parenthesis are callouts referenced to figure 3-1.

(a) Ensure that preliminary procedures outlined in paragraph 2-4b have been completed.

(b) Connect signal generator to jack J104 of GPR-92 as shown in figure 2-4. Tune signal generator for 1 mc output signal modulated 30 per cent with 1 kc; adjust signal generator output level for 10 microvolts.

(c) Connect frequency counter and AC VTVM to jack J108 of GPR-92 as shown in figure 2-5.

(d) Set IF SELECTIVITY switch (7) and RF GAIN control (4) of GPR-92 at 15 KC and at full clockwise position respectively; using RANGE SELECTOR switch (19) and TUNING control (5), tune GPR-92 to 1.0 mc.

(e) Adjust signal generator to obtain 1000 cps indication on frequency count r.

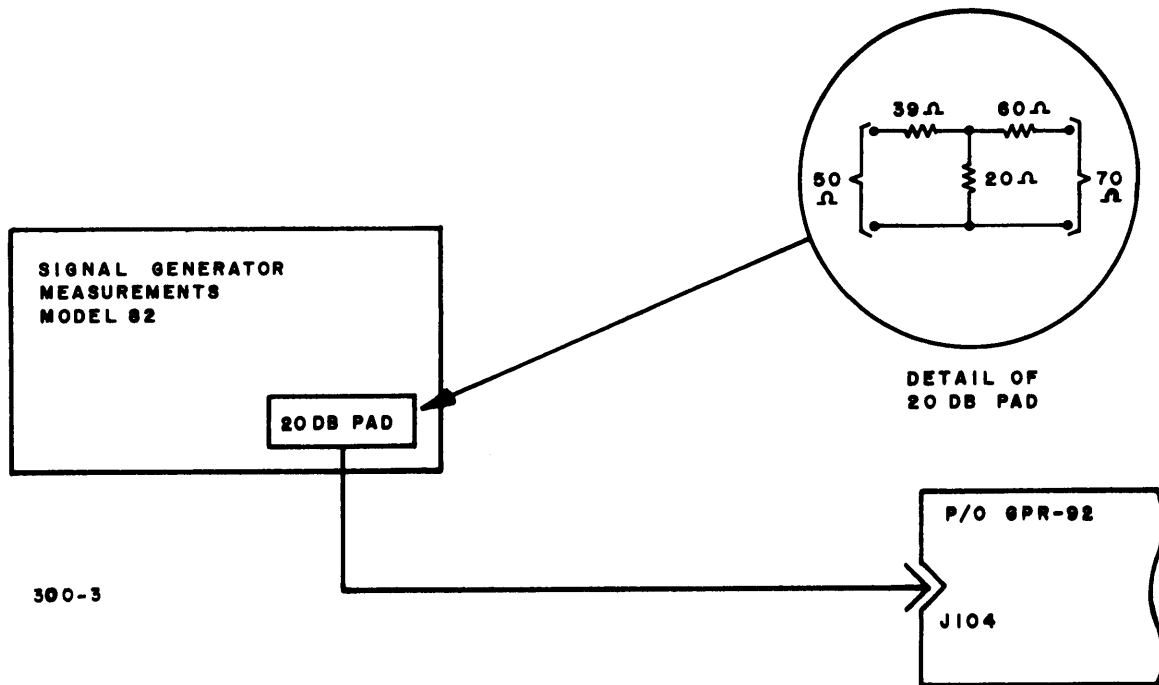


Figure 2-4. Test Setup for Signal Generator

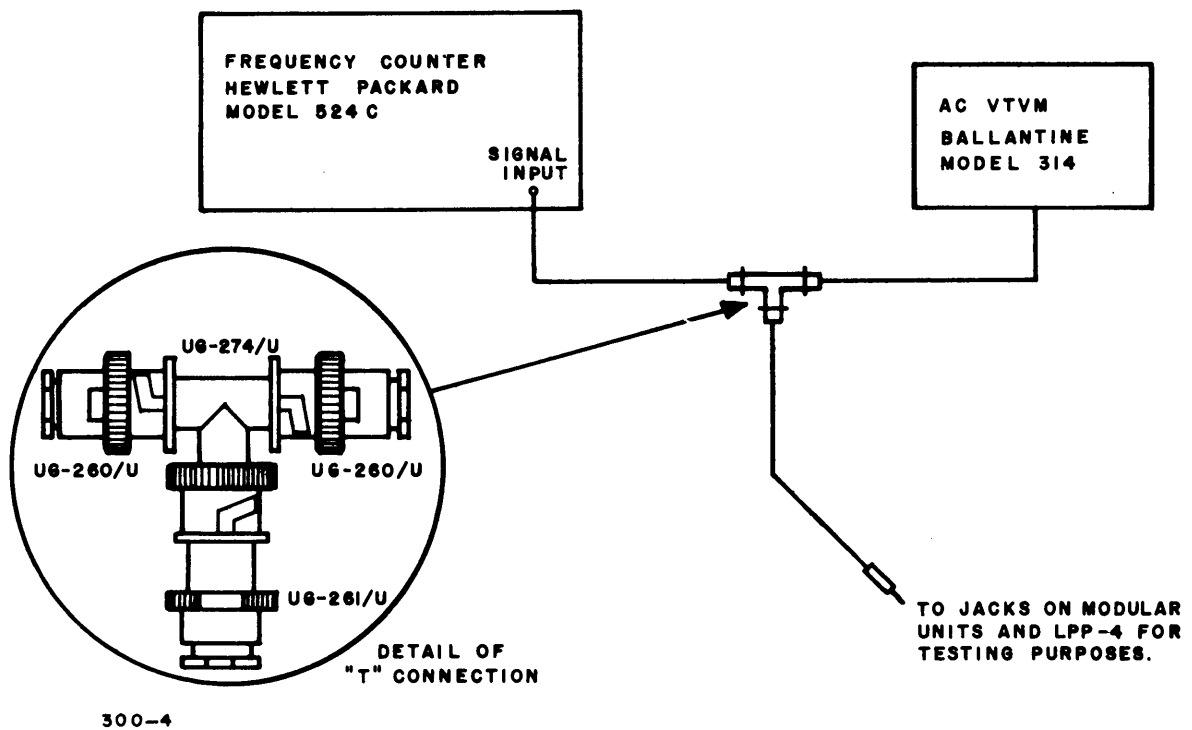


Figure 2-5. Test setup for Frequency Counter and AC VTVM

(f) Adjust ANT/TUNE control (14) for maximum indication on AC VTVM; indication on AC VTVM should be at least 3.0 V.

(g) Increase output level of signal generator to 1000 microvolts; indication on AC VTVM should not change more than 3db. Readjust signal generator for 10 microvolt output level.

(h) Adjust LINE LEVEL control (21) of GPR-92 and INCR (1) of Bridging Speaker Panel BSP-2 as required to obtain audible 1 kc tone on loudspeaker LS-1.

(i) Set IF SELECTIVITY switch (7) at each succeeding position (7.5 KC, 3 KC, 2 KC, and 1.5 KC); indication on frequency counter should not change and indication on AC VTVM should remain constant within 3db. Return IF SELECTIVITY switch to 15 kc.

NOTE

Step (j) checks Line Patch Panel LPP-4 jack wiring for GPR-92 No. 1 and Bridging Speaker Panel BSP-2.

(j) Connect one end of patchcord to GPR #1 LINE jack on LPP-4; audible tone should no longer be heard. Connect other end of patchcord to BSP #2 MONITOR jack on LPP-4; 1 KC tone should be heard on loudspeaker LS-2; it may be necessary to adjust INCR control (2) of Bridging Speaker Panel BSP-2 in order to obtain audible tone on LS-2.

(k) Repeat steps (c) through (f) for input frequency of 2 mc, 4 mc, 6 mc, 12 mc, and 22 mc; tune signal generator to the appropriate frequency modulated 30% with 1 kc. At beginning of checkout procedure for each frequency setting, signal generator output level should be 10 microvolts.

(l) Upon completion, remove test equipment and patchcords.

(2) CHECKOUT PROCEDURE FOR LINE PATCH PANEL LPP-4 - Pro-

ceed as follows:

NOTE

Numbers enclosed in parenthesis are callouts referenced to figure 3-1.

(a) Ensure that preliminary procedures outlined in paragraph 2-4**b** have been completed.

(b) Ensure that Measurements Model 82 signal generator or equivalent is connected to jack J104 of GPR-92 No. 1 and adjusted for 1 kc audio tone at 10 uv output level.

(c) Insert one end of first patchcord in GPR-92 #1 LINE jack; insert one end of second patchcord in GPR-92 #2 LINE jack. Audio tone should be removed from both loudspeakers.

(d) Insert other end of first patchcord in BSP #2 LINE jack; audio from GPR-92 #1 should be heard in loudspeaker LS-2.

(e) Insert other end of second patchcord in BSP-#1 LINE jack; audio from GPR-92 #2 should be heard in loudspeaker LS-1.

(f) Connect third patchcord between AGC #1 LINE jack and AGC #2 LINE jack.

(g) With MANUAL/AVC switch (12) of both GPR-92 receivers set at MANUAL, loudness of audio tone should be controlled by RF GAIN control (4) of either GPR-92 receiver.

(h) Upon completion, remove all patchcords and test equipment.

(3) CHECKOUT PROCEDURE FOR VARIABLE FREQUENCY OSCILLATOR

VOX-5 - Use a Measurement Model 82 signal generator or its equivalent to check the VOX-5. Proceed as follows:



NOTE

Numbers enclosed in parenthesis are callouts referenced to figure 3-1.

CAUTION

When tuning the VOX-5 in this procedure, take care not to exceed the 2000 kc to 4000 kc range limitations. Cam displacement may result otherwise.

- (a) Ensure that preliminary procedures outlined in paragraph 2-4b have been completed.
- (b) Connect signal generator to GPR-92 No. 1 as shown in figure 2-4. Tune signal generator for 2 mc output signal modulated 30 per cent with 1 kc; adjust signal generator output level for 10 microvolts.
- (c) Using RANGE SELECTOR switch (19) and TUNING control (5), tune GPR-92 to 2 mc; 1 kc tone should be heard on loudspeaker LS-1.
- (d) Refer to Variable Frequency Oscillator VOX-5 manual and calibrate VOX-5 at 2450 kc. Tune VOX-5 to 2455 kc; peak HFO tuning and then adjust OUTPUT control (41) as required to obtain 0.2 ma indication on meter (54).
- (e) Set EXT/INT switch (17) of GPR-92 at EXT; volume and clarity of 1 kc tone on loudspeaker LS-1 should not change.
- (f) Repeat steps (b) through (e) for frequencies listed below:

FREQ. OF SIG. GEN.  
AND GPR-92

FREQ. OF VOX-5

4 mc  
6 mc  
12 mc  
22 mc

2227.50 kc  
2488.705 kc  
3988.750 kc  
3288.750 kc

(g) While GPR-92 and VOX-5 are tuned to 22 mc and 3288.750 kc respectively, check operation of VOX-5 BFO circuitry in following manner:

(1) On GPR-92 receiver, restore EXT/INT switch to INT. Set MODE and IF SELECTIVITY switches (7 and 17) at CW and 1 KC respectively.

(2) Adjust signal generator controls as required to obtain 22 mc unmodulated signal at 10 microvolts; audio tone should be heard on loudspeaker LS-1.

(3) Set BFO switch (43) of VOX-5 and EXT/INT switch of GPR-92 at ON and INT respectively; audio tone should still be heard on loudspeaker.

(4) CHECKOUT PROCEDURE FOR DIVERSITY VOICE COMBINER DVC-1 AND OVERALL SYSTEM DIVERSITY OPERATION CHECK - Use two measurements Model 82 signal generators or their equivalents to check the DVC-1 and overall system diversity operation. Proceed as follows:

NOTE

Numbers enclosed in parenthesis are callouts referenced to figure 3-1.

(a) Ensure that preliminary procedures outlined in paragraph 2-4b have been completed.

(b) Using a 20 db pad (50-70 ohm), connect one signal generator to jack J104 of GPR-92 No. 1; in same manner, connect second signal generator to jack J104 of GPR-92 No. 2.

(c) Tune both signal generators for 2 mc output signal at output level of 10 microvolts. Output of one signal generator should be modulated 30% with 500 cps; output of other signal generator should be modulated 30% with 1000 cps.

(d) Using RANGE SELECTOR switch (19) and TUNING control (5) tune both GPR-92 receivers to 2 mc. Fine tune GPR-92 receivers for maximum indication on associated CHANNEL A LINE LEVEL meter.

(e) On Line Patch Panel LPP-4, connect first patchcord between GPR-92 #1 LINE jack and DVC IN #1 LINE jack. Connect second patchcord between GPR-92 #2 LINE jack and DVC IN #2 LINE jack.

(f) Set VU INDICATION switch (64) of DVC-1 at OUTPUT; set OUTPUT LEVEL control (66) at 1/4 clockwise rotation in order to obtain indication on VU meter (65).

(g) Set TERMINATION switch (67) of DVC-1 at 600 $\Omega$ .

(h) Set OUTPUT SELECTOR switch (63) of DVC-1 at REC A. and adjust LINE LEVEL control (21) of General Purpose Receiver GPR-92 No. 1 as required to obtain -3db indication on VU meter.

(i) Set OUTPUT SELECTOR switch of DVC-1 at REC B. and adjust LINE LEVEL control of GPR-92 No. 2 as required to obtain -3db indication on VU meter.

(j) Set OUTPUT SELECTOR switch of DVC-1 at DIV. and adjust OUTPUT LEVEL control for 0db indication on VU meter.

(k) Connect patchcord between DVC OUT LINE jack and BSP #1 LINE jack on Line Patch Panel LPP-4. Set TERMINATION switch of DVC-1 at LINE; clear audio tone should be heard on loudspeaker LS-1 and indication on VU meter of DVC-1 should be approximately +3db.

(l) Decrease output level of signal generator connected to GPR-92 No. 1; indication on VU meter of DVC-1 should not drop below 0db. Readjust signal generator for 10 microvolt output level.

(m) Decrease output level of signal generator connected to GPR-92 No. 2; indication on VU meter should not drop below 0db. Readjust signal generator for 10 microvolt output level.

(n) Remove signal generators from jack J104 of GPR-92 receivers; remove patchcords from Line Patch Panel LPP-4.

(o) Connect signal generators to DVC IN #1 LINE and DVC IN #2 LINE jacks on Line Patch Panel LPP-4. Tune signal generators for 600 cps modulated 20%; output level of signal generators should be 10 microvolts.

(p) Set DVC-1 controls as listed below; then adjust OUTPUT LEVEL control (66) as required to obtain 0 VU indication on VU meter (65).

<u>CONTROL</u>	<u>POSITION</u>
TERMINATION (67)	600 $\mu$
OUTPUT SELECTOR (63)	DIV
VU INDICATION (64)	OUTPUT

(q) Connect AC VTVM to FREQ. RANGE -LOW-103 jack; adjust output level of signal generator as required to obtain a -db reference point on AC VTVM.

(r) Disconnect signal generator from DVC IN #1 LINE jack; indication on AC VTVM should not change more than 3 db. Reconnect signal generator to DVC IN #1 LINE jack.

(s) Disconnect signal generator from DVC IN #2 LINE jack; indication on AC VTVM should not change more than 3 db. Reconnect signal generator to DVC IN #2 LINE jack.

(t) Repeat steps (q), (r), and (s), above with AC VTVM connected to FREQ. RANGE -MID-203 jack and signal generator tuned to 1000 cps.

(u) Repeat steps (q), (r), and (s) above with AC VTVM connected to **FREQ. RANGE -HIGH-303** jack and signal generator tuned to 3000 cps.

(v) Upon completion, remove test equipment.

## SECTION 3

### OPERATOR'S SECTION

#### 3-1. GENERAL

Paragraphs 3-3a through 3-3h provide operating instructions for space-diversity operation. Although the DDR-8 is capable of diversity or non-diversity operation, non-diversity operation is unlikely except in emergencies or during maintenance down time for any of the modular units. If it is necessary to use the DDR-8 in non-diversity operation, refer to the emergency operating procedures given in paragraph 3-4.

#### 3-2. CONTROLS AND INDICATORS

Figure 3-1 illustrates the location of all DDR-8 front-panel controls and indicators used during normal operation. Figure 3-1 is arranged as a pullout page in order that it may serve as a reference for procedures given in Sections 2, 3, and 4. Only the controls and indicators on the upper GPR-92 unit are indicated; further, the upper unit is arbitrarily labeled GPR-92 No. 1, and the lower unit is labeled GPR-92 No. 2. Table 3-1 lists the controls and indicators and the function of each.

TABLE 3-1. CONTROLS AND FUNCTIONS, DDR-8

MODULAR UNIT	SERIAL DESIGNATION (FIGURE 3-1)	PANEL DESIGNATION	FUNCTION
Bridging Speaker Panel BSP-2	1	INCR (potentiometer)	Varies audio level of signals applied to loudspeaker LS-1
	2	INCR (potentiometer)	Varies audio level of signals applied to loudspeaker LS-2.

TABLE 3-1. CONTROLS AND FUNCTIONS, DDR-8 (Cont)

MODULAR UNIT	SERIAL DESIGNATION (FIGURE 3-1)	PANEL DESIGNATION	FUNCTION
General Purpose Receiver GPR-92	3	LOCK	Locks MAIN TUNING control in position.
	4	RF GAIN (switch and potentiometer)	Disables receiver operation when rotated completely count r-clockwise. Varies the gain of the receiver by rotating it in a clockwise direction.
	5	TUNING (Variable capacitor)	Tunes the receiver to any frequency within a band. LOCK control (3) locks the receiver to the desired frequency.
	6	CAL (push-button switch)	By depressing this switch, the calibration oscillator is inserted into the circuit. Thus, the receiver can be calibrated in 100 kc intervals.
	7	IF SELECTIVITY (selector switch)	This filter-switch device varies the i-f bandwidth between 0.5 and 15 kc in six steps.
	8	HFO TRIM (control)	Fine tunes the HFO in the GPR-92.
	9	NOISE LIMITER (switch and potentiometer)	Cuts off peak signal pulses to reduce static interference. Increased reduction of signal peaks is obtained at clockwise position of control. In the OFF position, limiting circuit is inoperative.

TABLE 3-1. CONTROLS AND FUNCTIONS, DDR-8 (Cont)

MODULAR UNIT	SERIAL DESIGNATION (FIGURE 3-1)	PANEL DESIGNATION	FUNCTION
General Purpose Receiver GPR-92 (Cont)	10	SQUELCH (potentiometer)	Adjusts the sensitivity of the GPR-92.
	11	SEND/REC (switch)	SEND position - Disables receiver operation so that an accompanying transmitter can use the same antenna. REC position - In this position, the receiver assumes normal operation.
	12	MANUAL/AVC (switch)	
	13	Dial (no front-panel designation)	Displays frequency selected by operation of TUNING control (5)
	14	ANT/TUNE (Variable capacitor)	Varies impedance matching between antenna and r-f stages of GPR-92.
	15	Meter (no front-panel designation)	Indicates average r-f signal level when RF/AF switch is in normal (RF) position. Indicates level of audio output signal when RF/AF switch is depressed (in AF position)
	16	RF/AF (push-button switch)	This switch is normally in the RF position and causes meter (15) to indicate level of r-f signals. In the AF position, amplitude of audio signals are monitored.



TABLE 3-1. CONTROLS AND FUNCTIONS, DDR-8 (Cont)

MODULAR UNIT	SERIAL DESIGNATION (FIGURE 3-1)	PANEL DESIGNATION	FUNCTION
General Purpose Receiver GPR-92 (Cont)	17	EXT/INT (toggle switch)	EXT position - Used in this position when external HFO and IFO sources rather than internal oscillators are used. INT position - In this position, internal HFO and IFO are used.
	18	Dial (no front-panel designation)	Displays frequency selected by operation of BAND SPREAD control (25).
	19	RANGE SELECTOR (switch)	Sets desired band in which to operate.
	20	LIMITER/OFF (switch)	In the LIMITER position, the switch eliminates spurious r-f signals. In RF position, signals are not filtered.
	21	LINE LEVEL (potentiometer)	Adjusts amplitude of output signals.
	22	MODE (selector switch)	Determines AM, CW, or SSB mode of operation.
	23	TONE (potentiometer)	Varies bass and treble responses in audio output.
	24	BFO PITCH (potentiometer)	Varies pitch of CW signals.

TABLE 3-1. CONTROLS AND FUNCTIONS, DDR-8 (Cont)

MODULAR UNIT	SERIAL DESIGNATION (FIGURE 3-1)	PANEL DESIGNATION	FUNCTION
General Purpose Receiver GPR-92 (Cont)	25	BAND SPREAD (Variable capacitor)	Fine tunes the receiver to a desired frequency. LOCK control (28) locks this control to the desired frequency.
	26	PHONES (jack)	Headphones can be connected here to monitor audio output.
	27	MONITOR AUDIO (potentiometer)	Varies audio level in headphones.
	28	LOCK	Locks BAND SPREAD control in position.
Frequency Shift Converter CFA-1	29	SENSE (switch)	Selects plus or minus phase from tone rectifier V6 and V7 output.
	30	CH 1 (switch)	For single receiver operation, CH 1 toggle switch is set to ON position with CH 2 set to OFF. For dial receiver (diversity) operation, both channel toggle switches are set to the ON position.
	31	CH 2 (switch)	Same as 30.
	32	MARK BIAS (potentiometer)	Varies input level to pulse amplifier V10 control grid
	33	THRESHOLD (potentiometer)	Varies input shift to pulse amplifier V9 control grid.

TABLE 3-1. CONTROLS AND FUNCTIONS, DDR-8 (Cont)

MODULAR UNIT	SERIAL DESIGNATION (FIGURE 3-1)	PANEL DESIGNATION	FUNCTION
Frequency Shift Converter CFA-1 (Cont)	34	MARK-SPACE-LINE (switch)	In MARK and SPACE positions, signal is grounded for test purposes.
	35	MONITOR (oscilloscope)	Displays lateral displacement of pulse pattern thus facilitating correct tuning.
	36	POWER (lamp)	Lights to indicate that POWER switch (37) is set at ON.
	37	ON-OFF (switch)	Applies power to all stages of CFA-1 when set at ON.
Variable Frequency Oscillator VOX-5	38	XTAL (selector switch)	Determines whether VOX-5 output is produced by crystals in positions 1,2,3 and by its VMO.
	39	XTAL FREQ (variable capacitor)	Enables small changes in crystal frequency. Used only when VOX-5 uses a crystal for r-f output.
	40	BAND MCS (selector switch)	Controls tuning elements in HFO circuit.
	41	OUTPUT (potentiometer)	Controls level of output of HFO circuit
	42	TUNING (variable capacitor)	Tunes HFO output circuit. Used to maximize meter reading with METER selector switch in HFO position.

TABLE 3-1. CONTROLS AND FUNCTIONS, DDR-8 (Cont)

MODULAR UNIT	SERIAL DESIGNATION (FIGURE 3-1)	PANEL DESIGNATION	FUNCTION
Variable Frequency Oscillator VOX-5 (Cont)	43	BFO (compartment behind door) (toggle-switch)	Applies d-c screen voltage to BFO tube.
	44	IFO (compartment behind door) (toggle-switch)	Applies d-c plate voltage to IFO tube.
	45	HFO (compartment behind door) (toggle-switch)	Applies d-c plate voltage to IFO tube.
	46	POWER (compartment behind door) (toggle-switch)	Applies line voltage to or disconnects line voltage from power supply circuit.
	47	PHONES (compartment behind door) (jack)	Enables plugged-in receiver to receive beat tones.
	48	METER (compartment behind door) (selector switch)	Enables meter to measure output of HFO, IFO, BFO, and VMO.
	49	BEAT (compartment behind door) (selector switch)	Supplies B+ to VOX-5 100 kc oscillator so that mixer V103 in calibrating chain receives 100-kc and VMO oscillator voltages for production of beat tones.

TABLE 3-1. CONTROLS AND FUNCTIONS, DDR-8 (Cont)

MODULAR UNIT	SERIAL DESIGNATION (FIGURE 3-1)	PANEL DESIGNATION	FUNCTION
Variable Frequency Oscillator VOX-5 (Cont)	50	MAIN POWER (lamp)	Lights when VOX-5 is receiving 60-cycle power.
	51	INNER OVEN (lamp)	Lights when inner oven is receiving heat.
	52	ZERO BEAT	Indicates beat tones when calibrating VMO with 100-kc oscillator at check points.
	53	OUTER OVEN (lamp)	Lights when outer oven is receiving heat.
	54	Output Meter (no front-panel designation)	Registers level of VOX-5 r-f outputs in line with position of METER selector switch (48) located in compartment behind door.
	55	CALIBRATE (slug-tuned inductance)	Calibrates VMO with 100-kc oscillator at check points.
	56	MASTER OSCILLATOR FREQUENCY (variable capacitor)	Controls output frequency of VMO.
		BFO ADJ (potentiometer mounted at rear of chassis)	Controls BFO output level.
		BFO XTAL SW (switch mounted at rear of chassis)	Determine which of two crystals is used for BFO beats.

TABLE 3-1. CONTROLS AND FUNCTIONS, DDR-8 (Cont)

MODULAR UNIT	SIGNAL DESIGNATION (FIGURE 3-1)	PANEL DESIGNATION	FUNCTION
Variable Frequency Oscillator VOX-5 (Cont)	57	LOCK	Locks MASTER OSCILLATOR FREQUENCY CONTROL in position.
	58	MASTER OSCILLATOR FREQUENCY (dial)	Registers output frequency of VOX-5 and tunes main oscillator.
Diversity Voice Combiner DVC-1	59	POWER (lamp)	Lights to indicate that DVC-1 is energized.
	60	POWER (toggle switch)	Energizes DVC-1
	61	A.F. MONITOR (jacks)	Permits monitoring input A, input B, or output.
	62	1. 2. 3. (pin jacks)	Test points for testing: 1 - Filtered B- 2 - B+ Ground 3 - Unfiltered B-
	63	OUTPUT SELECTOR (selector switch)	Permits switching the unit to input A, input B, or to diversity.
	64	VU INDICATION (selector switch)	Switches VU meter circuit to input A, input B, or to output for monitoring.
	65	VU (meter)	Provides visual monitoring of traffic or test levels.
	66	OUTPUT LEVEL (potentiometer)	Permits adjustment of output level.

TABLE 3-1. CONTROLS AND FUNCTIONS, DDR-8 (Cont)

MODULAR UNIT	SIGNAL DESIGNATION (FIGURE 3-1)	PANEL DESIGNATION	FUNCTION
Diversity Voice Combiner DVC-1 (Cont)	67	TERMINATION (selector switch)	Switches DVC-1 output from output line to internal 600-ohm termination for testing.
	68	FREQ RANGE (pin jacks)	Test points for testing: 101-Low frequency channel B output  LOW 102-Low frequency channel diversity control voltage  103-Low frequency combined output  MID 201-Same as 100- 202 series test 203 points for middle frequency channel  HIGH 301 Same as 100- 302 series test 303 points for high frequency channel
Power Control Panel DCP-2	69	MAIN POWER (circuit breaker)	Extends 115/230 vac input to all modular units. Protects modular-unit circuits from current overload.
	70	MAIN POWER (lamp)	Lights to indicate that 115/230 vac is being applied to all modular units.

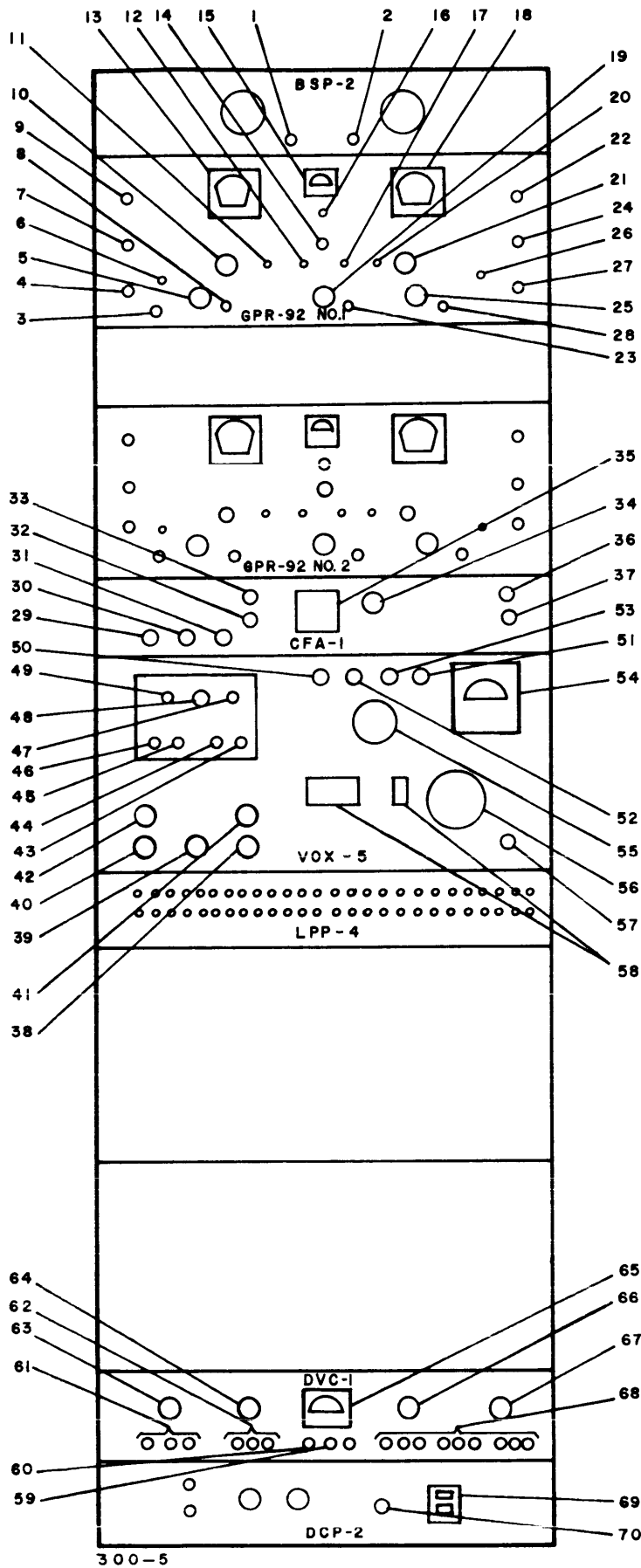


Figure 3-1. Controls and Indicators, DDR-8



### 3-3. OPERATING PROCEDURES

#### WARNING

Voltages employed in the DDR-8 are high enough to be fatal. Every precaution should be taken by operating personnel to minimize the danger of shock.

a. GENERAL - As mentioned in paragraph 3-1, only space-diversity operation will be discussed in the following paragraphs. Haphazard operation or improper setting of controls will result in poor reception; for this reason, the operator should first familiarize himself with all controls and indicators on the DDR-8. Refer to figure 3-1 and table 3-1 for the location and function of DDR-8 controls and indicators, and proceed as described in paragraphs b through g below.

b. STARTING PROCEDURE - Before attempting to start the DDR-8, refer to the cabling instructions provided in Section 2, and ensure that the necessary cabling connections and terminations for the appropriate type of operation have been made. Proceed as follows:

#### NOTE

Numbers enclosed in parenthesis are callouts referenced to figure 3-1.

(1) Set POWER switch (46) of Variable Frequency Oscillator VOX-5 at ON. MAIN POWER lamp (50) should light.

(2) On Power Control Panel DCP-2, turn MAIN POWER circuit breaker (69) on; MAIN POWER lamp (70) of DCP-2 should light.

Allow 48 hour warm up-period; maximum stability of VOX-5 is dependent upon adequate warm-up period.

(3) Turn RF GAIN control (4) of General Purpose Receivers GPR-92 No. 1 and GPR-92 No. 2 slightly clockwise until switch clicks on.

(5) Set POWER switch (60) of Diversity Voice Combiner DVC-1 at ON; POWER lamp (59) should light.

(6) Set modular-unit controls at positions listed in table 3-2.

TABLE 3-2. PRELIMINARY CONTROL POSITIONS

MODULAR UNIT	SWITCH OR CONTROL DESIGNATION	SERIAL DESIGNATION (FIGURE 3-1)	POSITION
Variable Frequency Oscillator VOX-5	HFO	44	ON
	IFO	43	ON
	METER	47	VMO
	XTAL	37	VMO
	OUTPUT	40	Mid position
General Purpose Receiver GPR-92 (both units)	EXT/INT	17	INT (selects HFO and IFO of GPR-92. Refer to paragraph 3-3c.)
	LIMITER/RF	20	RF
	NOISE LIMITER	9	OFF
	SEND/REC	11	REC
	MANUAL/AVC	12	AVC
	SQUELCH	10	Mid position
	HFO TRIM	8	0
	TONE	23	Mid position
	BFO PITCH	24	0
LINE LEVEL	21	Mid position	

TABLE 3-2. PRELIMINARY CONTROL POSITIONS (Cont)

MODULAR UNIT	SWITCH OR CONTROL DESIGNATION	SERIAL DESIGNATION (FIGURE 3-1)	POSITION
Diversity Voice Combiner DVC-1	OUTPUT SELECTOR	63	DIV
	TERMINATION	67	LINE
	VU INDICATION	64	OUTPUT
	OUTPUT LEVEL	66	

c. TUNING RECEIVER - Because the GPR-92 receivers used in the DDR-8 are either double or single conversion units, depending upon the operating frequency, Variable Frequency Oscillator VOX-5 must be set accordingly. Below 5.6 mc, the HFO must be 455 kc above the desired carrier, but above 5.6 mc, the HFO must be 3.995 mc above the desired carrier. Table 3-3 serves to minimize the small amount of arithmetic involved. Synchronize the DDR-8 at a selected frequency in the following manner:

NOTE

Numbers enclosed in parenthesis are callouts referenced in figure 3-1.

Tuning of Variable Frequency Oscillator VOX-5 must not exceed the 2000 kc to 4000 kc range. Incoming signals below 1545 kc, therefore, cannot be received in synthesized operation.

- (1) Start the DDR-8 as outlined in paragraph 3-3b.
- (2) On Variable Frequency Oscillator VOX-5, set BEAT switch (49) at ON. Plug a headset into PHONES jack (47).
- (3) Using information provided in table 3-3, calculate VOX-5 frequency setting. Refer to VOX-5 modular-unit manual and calibrate VOX-5 as close as possible to calculated frequency. Then tune VOX-5 to calculated frequency.

### CAUTION

In order to prevent cam displacement,  
Variable Frequency Oscillator VOX-5  
must not be tuned below 2000 kc or  
above 4000 kc.

(4) Set RANGE SELECTOR switch (19) of both GPR-92 receivers at proper position for desired frequency range.

(5) Using TUNING control (5) and BAND SPREAD control (25), tune both GPR-92 receivers to frequency of incoming signal. If necessary, plug headphones into PHONES jack (26), and calibrate each GPR-92 receiver at 100 kc point nearest to frequency of incoming signal by depressing CAL button (6) and adjusting HFO TRIM control (8) for zero beat.

(6) Adjust BAND SPREAD control and ANT/TUNE control (14) of both GPR-92 receivers for maximum r-f indication on meter (15). Tighten LOCK controls (3 and 28) of both GPR-92 receivers to prevent inadvertent changing of frequency setting.

(7) Set EXT/INT switch (17) of both GPR-92 receivers at EXT, DDR-8 should now be synchronized at frequency of incoming signal.

TABLE 3-3. VOX-5 TUNING CHART

RECEIVED SIGNAL FREQUENCY	VOX BAND	*VOX BAND SETTING
Below 5.6 mc	2-4 mc	Fr + 455 kc
	4-8 mc	(Fr + 455 kc)/2
Above 5.6 mc	8-16 mc	(Fr + 3.955 mc)/4
	16-32 mc	(Fr + 3.955 mc)/8
	32-64 mc	(Fr + 3.955 mc)/16

\*Fr signifies receiver frequency.

d. AM RECEPTION - Because either sideband contains all the intelligence present in an AM signal, reception of AM signals can be accomplished in either of two ways: by conventional AM mode of operation, and by SSB mode of operation. Use of the SSB mode of operation (paragraph 3-3f) makes it possible to eliminate interference occurring in either sideband (upper or lower). To receive signals in the conventional AM mode of operation, proceed as follows:

NOTE

Numbers enclosed in parenthesis are callouts referenced to figure 3-1.

The audio output of GPR-92 No. 1 and GPR-92 No. 2 is normaled through jacks GPR-92 #1 and GPR-92 #2. When used in non-diversity operation (paragraph 3-4), the DVC-1 is not used, and patch-cord connections to DVC IN #1, DVC IN #2, and DVC OUT jacks need not be made as indicated in step 1

- (1) Make patch-cord connections on Line Patch Panel LPP-4 as illustrated in figure 3-2.
- (2) Start the DDR-8 as outlined in paragraph 3-3b.
- (3) Set front-panel controls of both GPR-92 receivers as follows:

<u>CONTROL</u>	<u>POSITION</u>
LINE LEVEL (21)	Counterclockwise
RF GAIN (4)	Clockwise
MANUAL/AVC (12)	AVC
MODE (22)	AM
IF SELECTIVITY (7)	15 KC
NOISE LIMITER (9)	OFF
SEND/REC (11)	REC

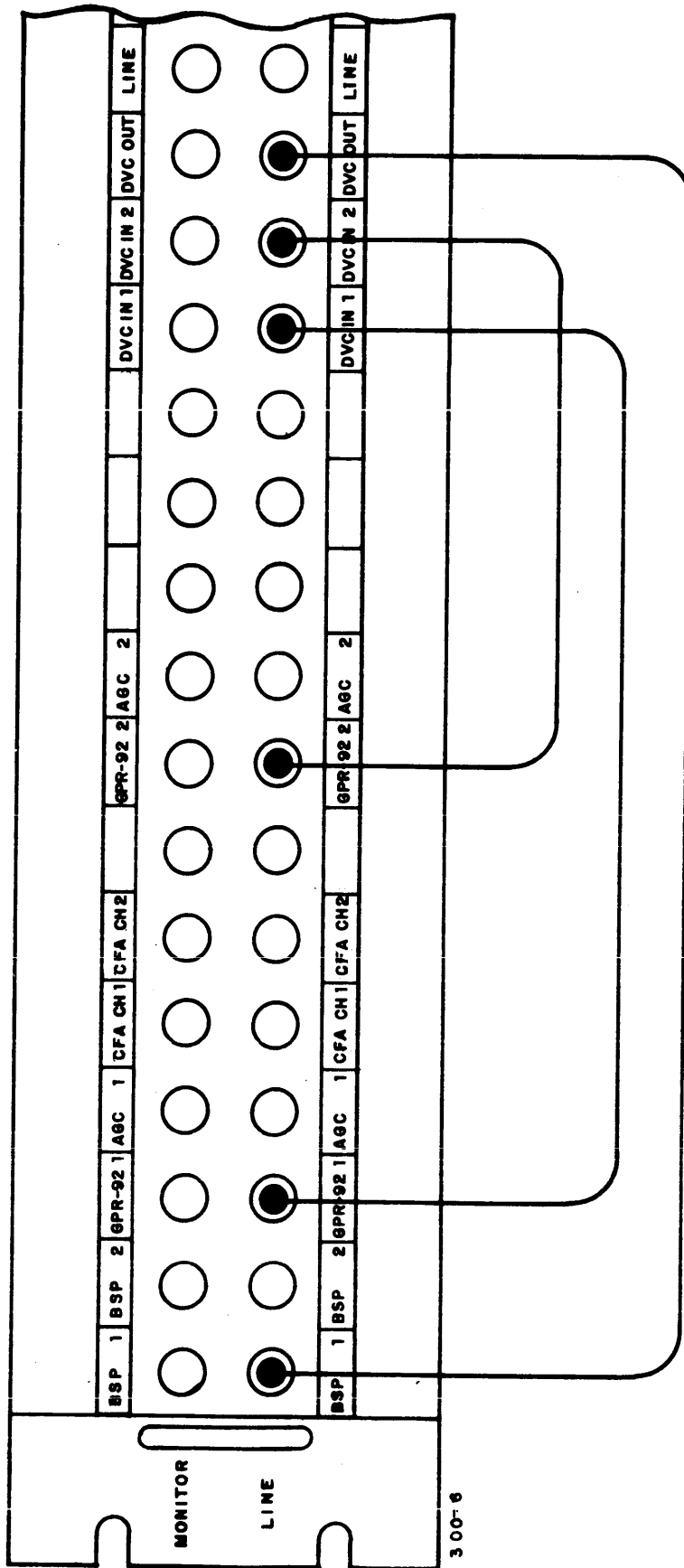


Figure 3-2. Patchcord Connections, Diversity Voice Combiner  
DVC-1 to General Purpose Receiver GPR-92

(4) Using procedure outlined in paragraph 3-3c, tune DDR-8 to frequency of incoming signal.

(5) Adjust RF GAIN controls (4) of both GPR-92 receivers in accordance with nature of received signal. As a general rule, RF GAIN controls are adjusted for 20 DB reading on output meters (15).

(6) On Communications Receiver GPR-92 No. 1 and GPR-92 No. 2, depress RF/AF switch (16) and simultaneously adjust LINE LEVEL control (21) to obtain 0 DBM reading on output meter (15).

(7) To monitor audio output of Communications Receiver GPR-92 No. 1 or GPR-92 No. 2, plug headphones into associated PHONES jack (26). Volume of audio signal in headphones can be varied by adjusting associated MONITOR AUDIO control (27).

(8) Adjust INCR controls (1 and 2) of Bridging Speaker Panel BSP-2 for desired loudspeaker volume. Tone of audio output can be varied to make it more treble or bass by adjusting TONE control (23) of Communications Receiver GPR-92 No. 1 and GPR-92 No. 2.

e. CW RECEPTION - Operate the receiver controls in the same manner as for conventional AM mode of operation (paragraph 3-3d) with the following exceptions:

(1) When starting the DDR-8 as indicated in step (2), ensure that BFO switch (43) of Variable Frequency Oscillator VOX-5 is set at ON.

(2) Set BFO XTAL switch located on rear of VOX-5 at appropriate Y101 or Y102 position to employ 455 kc crystal. Set METER switch (48) at BFO; output meter (54) should indicate BFO output.

(3) In step (3), set MODE switch (22) of both GPR-92 receivers at CW. Set IF SELECTIVITY switch (7) of both GPR-92 receivers at 1 KC or lower position to reduce channel interference. For greatest selectivity, set IF SELECTIVITY switch at .5 KC.

(4) If variation of audio tone is desired, use BAND SPREAD control and detune GPR-92 receivers as required.

(5) If keying is at slow speed so that AVC brings up noise between characters, set MANUAL/AVC switch (12) of both GPR-92 receivers counterclockwise as required to prevent blocking.

(6) If copying CW signals with teletype equipment make patchcord connections on Line Patch Panel LPP-4 as indicated in figure 3-3. Disregard all references in paragraph 3-3d to Diversity Voice Combiner DVC-1, and proceed as follows:

(a) Ensure that teletype terminal equipment is connected to terminals 9 and 10 of terminal block TB-801 located in rear of cabinet (RAK-31B) at lower right side.

(b) Ensure that ON-OFF switch (37) of Frequency Shift Converter CFA-1 is set at ON: Set CFA-1 controls as follows:

<u>Control</u>	<u>Position</u>
MARK-SPACE-LINE (34)	LINE
CH 1 (30)	ON
CH 2 (31)	ON

(c) Set SENSE switch (29) at position that enables receiving teleprinter to function properly.

(d) Adjust MARK BIAS control (32) to correct for fixed mark or space distortion in received signal or in teleprinter. Refer to Operational Checks and Adjustments given in Section 2 of CFA-1 manual.

(e) Adjust THRESHOLD control (33) for shift of received signal. Refer to Operational Checks and Adjustments given in Section 2 of CFA-1 manual.



f. SINGLE SIDEBAND RECEPTION - Operate the receiver controls in the same manner as for AM mode of operation (paragraph 3-3d) with the following exceptions.

(1) When starting the DDR-8 as indicated in step (2), ensure that BFO switch (43) of Variable Frequency Oscillator VOX-5 is set at ON.

(2) In step (3), set MODE switch of GPR-92 receivers at SSB. Set IF SELECTIVITY switch of GPR-92 receivers at appropriate 7.5 KC or 3 KC position in accordance with required bandwidth of received signal.

(3) Set BFO XTAL switch located on rear of VOX-5 at appropriate Y101 or Y102 position to employ 455 KC crystal. Set METER switch (48) at BFO; output meter (54) should indicate BFO output.

(4) As final step in procedure, use BAND SPREAD control (25) and detune GPR-92 receivers as required for most intelligible signal.

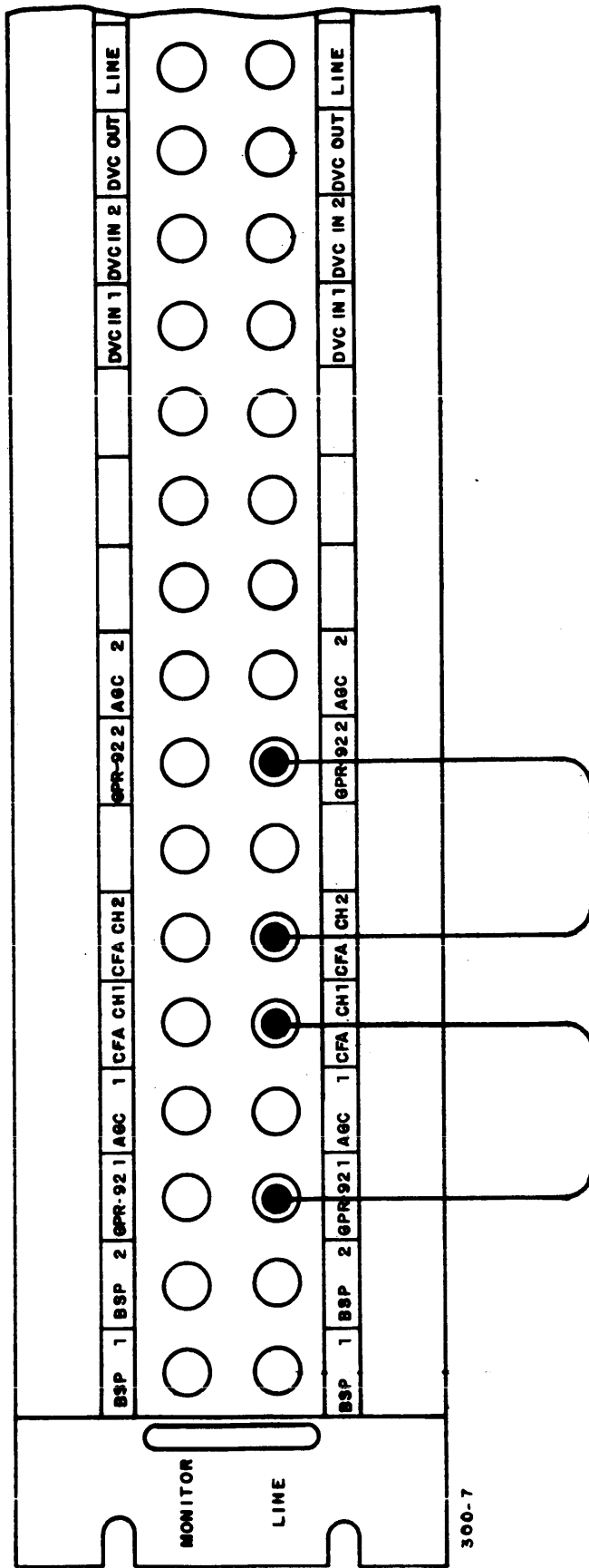
g. RECEPTION OF FSK SIGNALS - Operate the receiver in the same manner as for AM mode of operation (paragraph 3-3d) with the following exceptions:

(1) In step (1), make patchcord connections on Line Patch Panel LPP-4 as indicated in figure 3-3.

(2) Ensure that teletype terminal equipment is connected to terminals 9 and 10 of terminal block TB-801 located in rear of cabinet (RAK-31B) at lower right side.

(3) When starting the DDR-8 as indicated in step (2), ensure that BFO switch (43) of Variable Frequency Oscillator VOX-5 is set at ON.

(4) Set BFO XTAL switch located on rear of VOX-5 at appropriate Y101 or Y102 position to employ 455 kc crystal. Set METER switch (48) at BFO; output meter (54) should indicate BFO output.



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Figure 3-3. Patchcord Connections, Frequency Shift Converter  
CFA-1 to General Purpose Receiver GPR-92

(5) In step (3), set MODE switch (22) of both GPR-92 receivers at CW. Set IF SELECTIVITY switch (7) of both GPR-92 receivers at 1 kc.

(6) Disregard all references in paragraph 3-3d to Diversity Voice Combiner DVC-1, and proceed as follows:

(a) Ensure that ON-OFF switch (37) of Frequency Shift Converter CFA-1 is set at ON: Set CFA-1 controls as follows:

<u>Control</u>	<u>Position</u>
MARK-SPACE-LINE (34)	LINE
CH 1 (30)	ON
CH 2 (31)	ON

(b) Set SENSE switch (29) at position that enables receiving teleprinter to function properly.

(c) Adjust MARK BIAS control (32) to correct for fixed mark or space distortion in received signal or in teleprinter. Refer to Operational Checks and Adjustments given in Section 2 of CFA-1 manual.

(d) Adjust THRESHOLD control (33) for shift of received signal. Refer to Operational Checks and Adjustments given in Section 2 of CFA-1 manual.

#### 3-4. EMERGENCY OPERATING PROCEDURES

As mentioned in paragraph 3-1, the DDR-8 is normally used in space-diversity operation. If it becomes necessary to operate the DDR-8 as a non-diversity receiver, proceed as outlined in paragraphs 3-3b through 3-3g with the following exceptions:

a. Because Variable Frequency Oscillator VOX-5 is not being used, all references to controls and indicators on VOX-5 should be omitted.

b. Because Diversity Voice Combiner DVC-1 is not needed, ensure that patch-cord connections to DVC IN #1, DVC IN #2, and DVC OUT jacks are removed. Disregard all references to controls and indicators located on DVC-1.

c. Set EXT/INT of Communications Receiver GPR-92 No. 1 and GPR-92 No. 2 at INT; in this position the internal oscillators of the GPR-92 receivers are used.

d. Tune each GPR-92 receiver independently as required.

### 3-5. OPERATOR'S MAINTENANCE

a. GENERAL - The operator should observe that modular-unit controls, indicator lamps, and meters are in good condition and functioning properly (see figure 3-1 and table 3-1). Daily during operation, all electrical quantities measurable with built-in meters should be observed and compared with established standards for irregularity. Any noticeable irregularity is an indication of trouble.

b. REPLACEMENT OF FUSES - Table 3-4 lists all fuses contained in the DDR-8 and the location and function of each. Replace fuses as required.

#### NOTE

Do not replace a fuse with one of 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 3-4. FUSE LOCATIONS AND FUNCTIONS, DDR-8

MODULAR UNIT	REFERENCE SYMBOL	CIRCUIT PROTECTED	LOCATION
Frequency Shift Converter CFA-1	F1 2 AMP.	Main line voltage input to CFA-1	Rear apron of CFA-1
Communications Receiver GPR-92	F101	Main line voltage input to GPR-92	
Variable Frequency Oscillator VOX-5	F101 3 AMP	Inner and outer oven circuits.	Rear apron of VOX-5 power supply chassis
	F102 2 AMP	Main line voltage input to VOX-5	Rear apron of VOX-5 power supply chassis
Power Control Panel DCP-1	F1 15A/115V 8A/230V	Convenience outlet	Front panel
	F2 15A/115V 8A/230V	Convenience outlet	Front panel
Diversity Voice Combiner DVC-1	F1 1 AMP	Main line voltage input to DVC-1 power supply	Front panel
Bridging Speaker Panel BSP-2	F101 3/8 AMP/250V	Main line voltage input to BSP-2 power supply.	Front panel
	F102 3/8 AMP/250V	Main line voltage input to BSP-2 power supply	Front panel

c. REPLACEMENT OF ELECTRON TUBES - The operator should check the general condition of electron tubes; tubes that appear to be defective should be checked on a reliable tube tester and replaced as required. When testing or replacing miniature tubes, particular attention should be paid to the following:

(1) When withdrawing miniature tubes from their sockets, pull them straight out; do not rock or turn them.

(2) If pins of miniature tube are bent, straighten them with a proper pin straightener before replacing tube.

SECTION 4  
TROUBLESHOOTING

4-1. INTRODUCTION

This section contains both troubleshooting information and functional analysis of the DDR-8. The information given in this section, coupled with the information provided in the individual modular-unit manuals, will facilitate the location of equipment troubles.

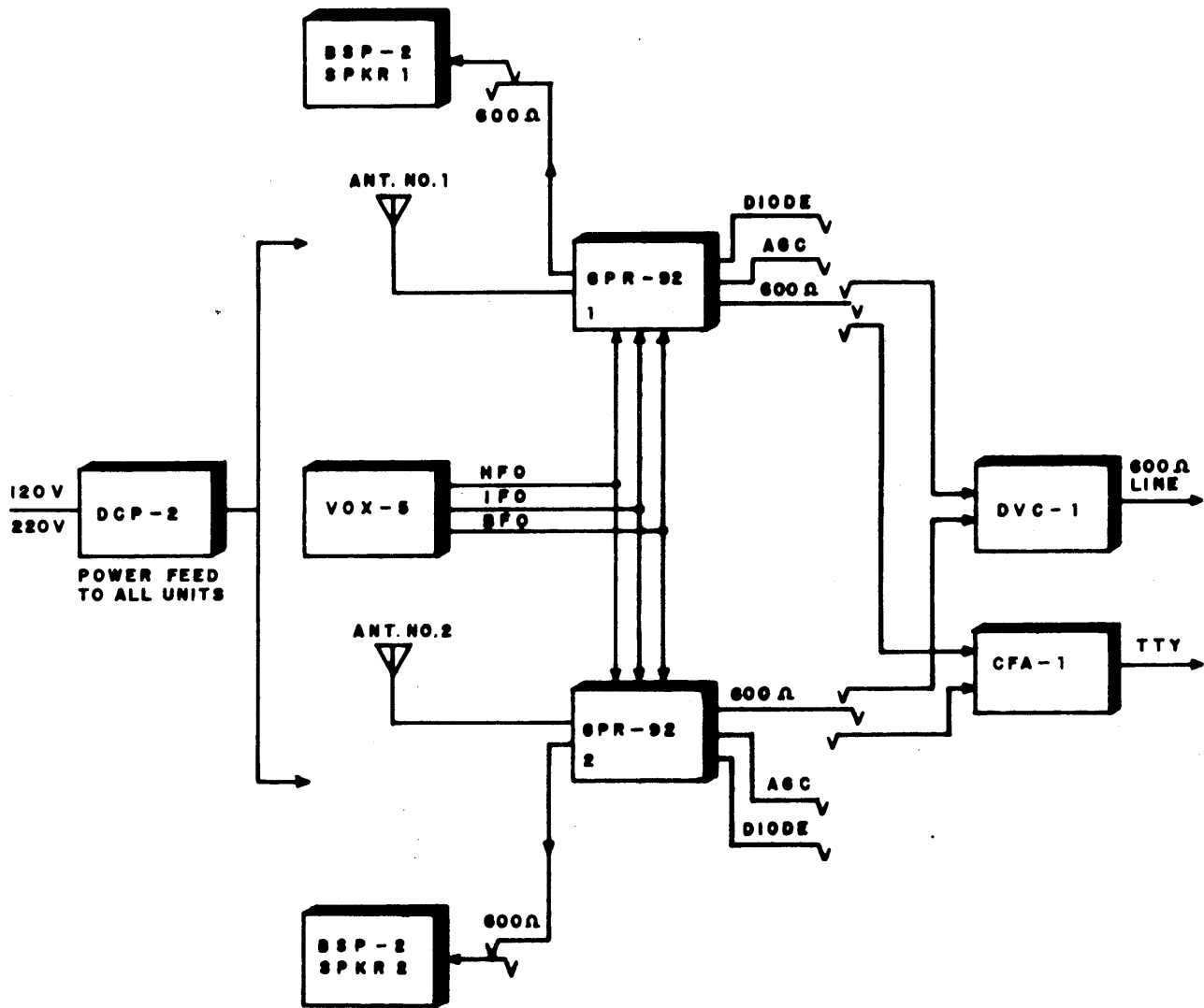
4-2. OVERALL FUNCTIONAL ANALYSIS

The primary difference between space-diversity and non-diversity operation of the DDR-8 is in the origin of HFO, IFO, and BFO voltages employed in the mixer and product detector stages of the GPR-92 receiver. Functional analysis for both types of operation are similiar; therefore only space-diversity operation is discussed in this manual. Functional analysis for AM, CW, FSK or SSB mode of operation resolves itself primarily to analysis of the GPR-92 (refer to GPR-92 modular-unit manual) with the following special features. Refer to figures 4-1 and 4-2.

(a) The HFO voltage for the first mixer stage is obtained from Variable Frequency Oscillator VOX-5 via jack J105 and isolation amplifier V105.

(b) The IFO voltage for the second mixer stage is obtained from Variable Frequency Oscillator VOX-5 via jack J106 and isolation amplifier V108.

(c) In AM and SSB mode of operation, audio output signals are applied to Diversity Voice Combiner DVC-1 where the better signal is selected and applied to Bridging Speaker Panel BSP-2.



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Figur 4-1. Simplified Block Diagram, DDR-8



(d) In CW or FSK mode of operation, audio output signals are applied to Frequency Shift Converter CFA-1 where they are converted to dc pulses and then applied to teletype terminal equipment.

#### 4-3. EQUIPMENT PERFORMANCE CHECK

Figure 4-2 is a detailed block diagram of the DDR-8. When used in conjunction with the checkout procedures given in paragraph 2-4c, figure 4-2 will aid the technician in localizing trouble to a particular modular unit. Once the trouble is localized to a modular unit, refer to the appropriate modular-unit manual for detailed information necessary to verify the probable cause and to locate faulty components. The results of defective front-panel indicator lamps and meters, and the remedial procedures concerned are obvious and, therefore, are not considered in any of the checkout procedures given in this manual.

#### WARNING

Voltages employed in the DDR-8 are high enough to be fatal. Every precaution should be taken by maintenance technicians to minimize the danger of shock.

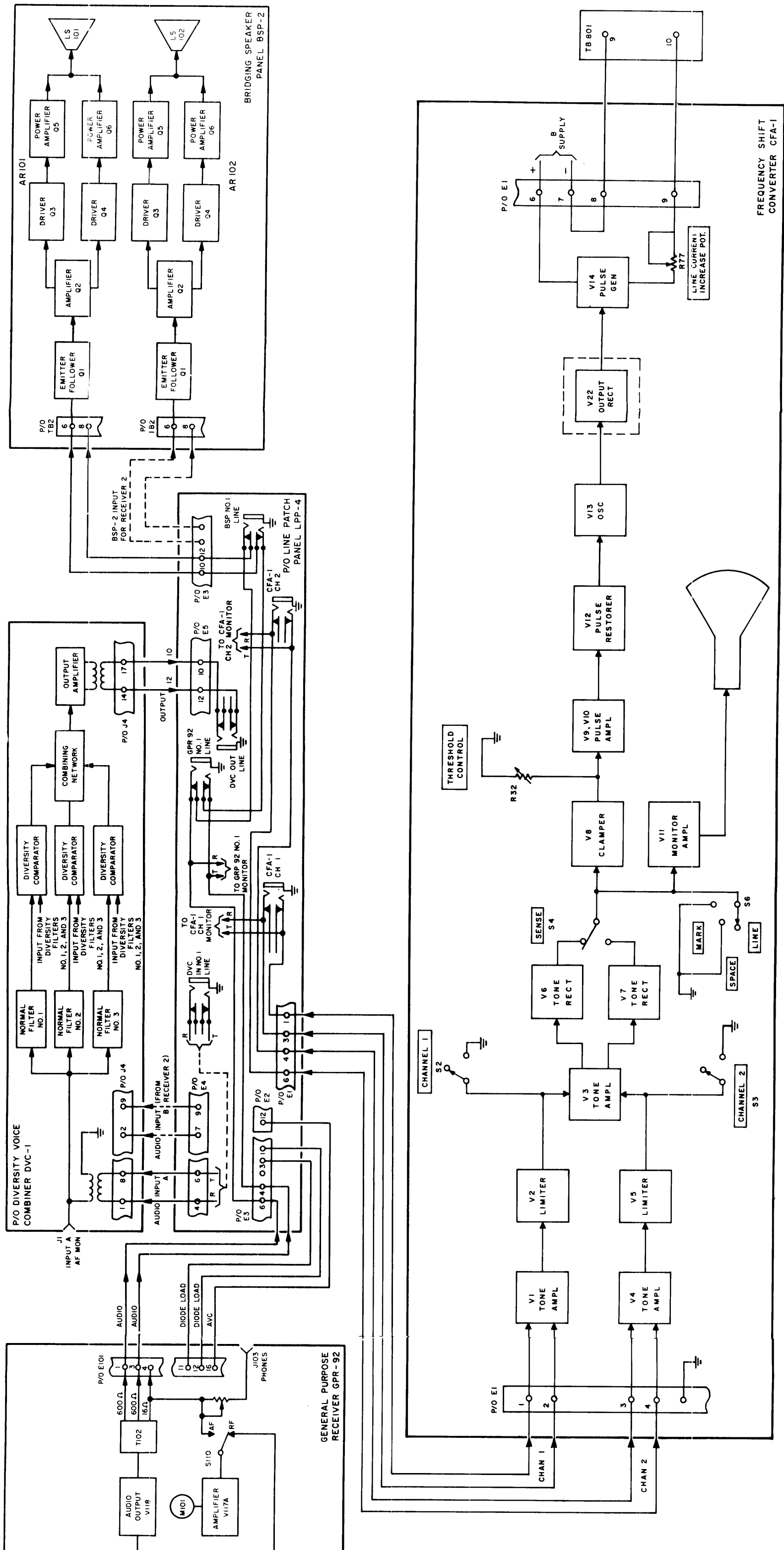
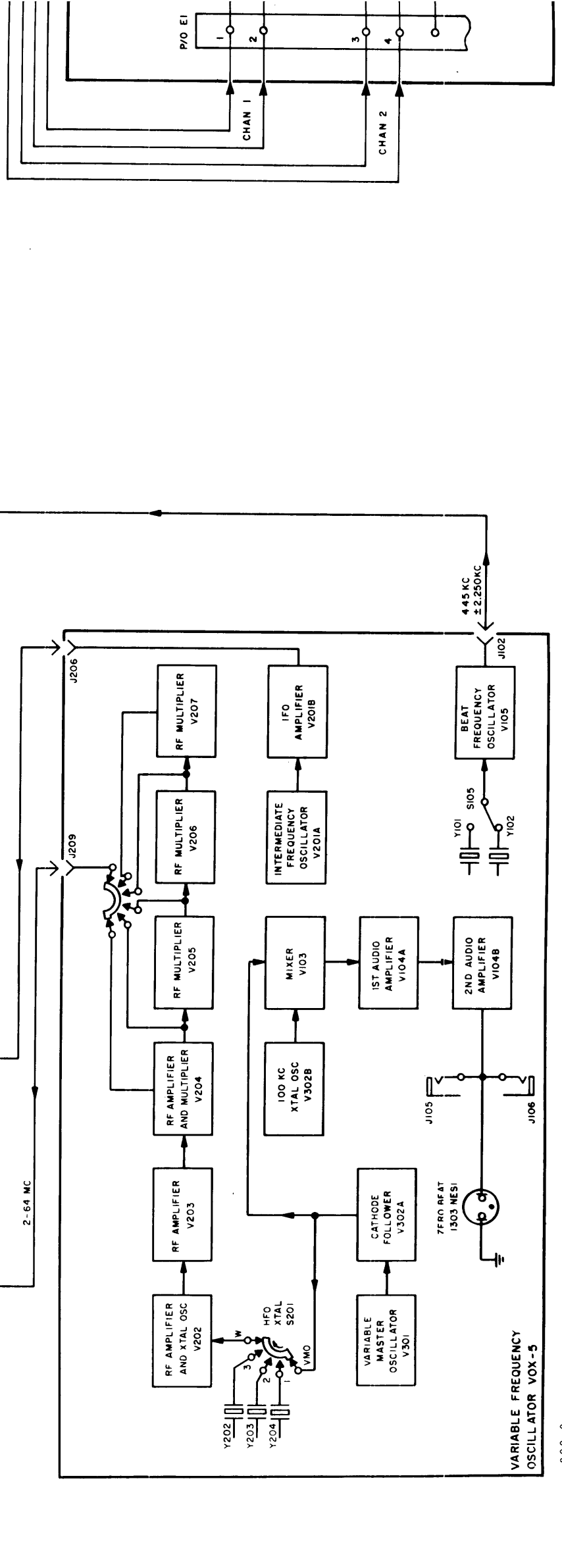
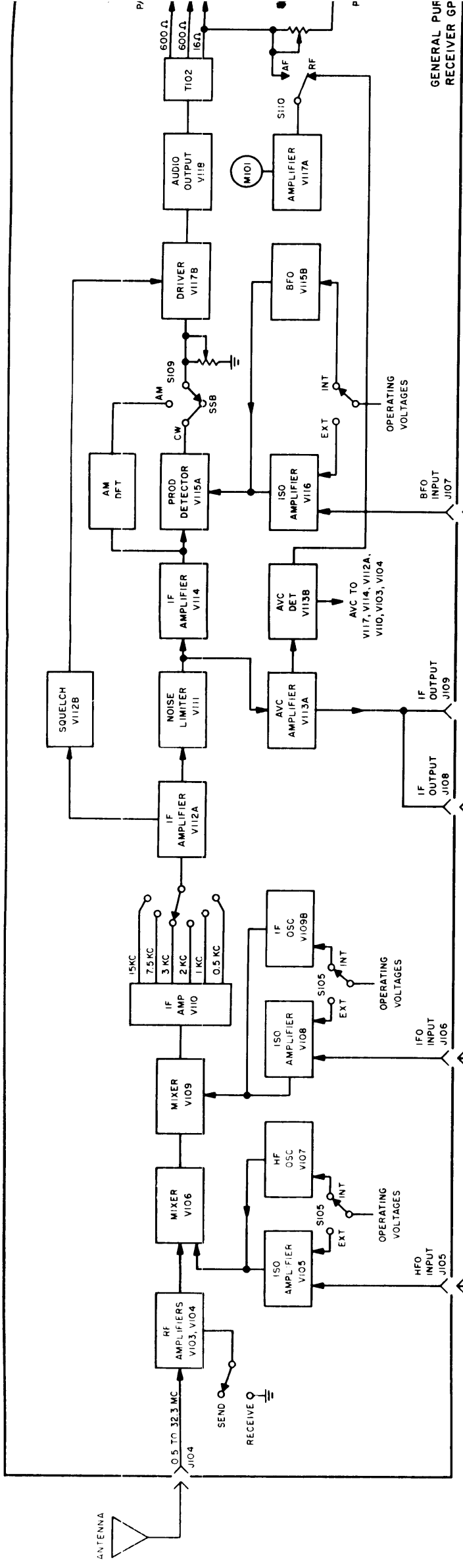


Figure 4-2. Detailed Block Diagram, DDR-8



SECTION 5  
MAINTENANCE

5-1. GENERAL

Maintenance is divided into three categories: operator's maintenance, preventive maintenance, and repair. Repair procedures for RAK-31B components or for any modular unit contained in the DDR-8 are given in the appropriate modular-unit manual. Preventive maintenance includes information necessary to insure optimum performance of the DDR-8. For this reason, alignment and adjustment information is included under preventive maintenance. Operator's maintenance for the DDR-8 is described in Section 3.

5-2. SPECIAL TOOLS AND TEST EQUIPMENT

Table 5-1 lists the special test equipment required for DDR-8 maintenance; no special tools are required.

TABLE 5-1. SPECIAL TEST EQUIPMENT

ITEM	MANUFACTURER
VOM	Simpson, Model 260 or equivalent
Signal Generator	Measurements, Model 82 or equivalent.
Frequency Counter	Hewlett Packard, Model 524C or equivalent.
AC VTVM	Ballantine Model 314 or equivalent.
DC VTVM	Hewlett Packard, Model 410B or equivalent.
Attenuator Pad, 20 db, 50/70 ohms.	

### 5-3. PREVENTIVE MAINTENANCE

a. GENERAL - The DDR-8 has been designed to provide long-term, trouble-free operation under continuous duty conditions. However, similar to any other piece of equipment that contains assemblies of many electrical and mechanical parts, optimum performance and service life of the DDR-8 are dependent upon an adequate preventive maintenance schedule that is strictly adhered to.

b. CLEANING AND INSPECTION - At periodic intervals (at least every six months) each modular unit should be removed from the cabinet for cleaning and inspection. All accessible covers should be removed and the wiring all components inspected for dirt, corrosion, charring, discoloring, or grease; in particular, the tube sockets should be carefully inspected for deterioration. Dust may be removed with a soft brush or a vacuum cleaner if one is available. Remove dirt or grease from electrical parts with trichloroethylene. Remove dirt or grease from other parts with any good dry cleaning fluid.

#### WARNING

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

Carefully inspect equipment for loose solder connections or screws, especially those on solder lugs. Tighten and resolder connections as required.

c. REPLACEMENT OF ELECTRON TUBES - While the modular units are out of the cabinet for periodic inspection, all electron tubes should be checked and replaced as required. Particular attention should be paid to the following:

(1) When withdrawing miniature tubes from their sockets, pull them straight out; do not rock or turn them. If pins of miniature tubes are bent, straighten them with a proper pin straightener before replacing the tube.

(2) Some circuits, for example oscillator circuits, may function better with one tube than with another even though both tubes are new or both tubes measure the same when checked on a tube tester.

(3) Tubes should not be replaced or discarded merely because they have been used for some time. Satisfactory operation in a circuit is the final proof of tube quality; the tube in use may work better than a new tube.

d. GEAR LUBRICATION.- Examine all gears and gear assemblies contained in the modular units. If any of the gears show signs of becoming dry, coat them heavily with a molybdenum disulphide compound such as Molykote Type G made by the Alpha Corporation of Greenwich, Conn.

e. ALIGNMENT AND ADJUSTMENT. - All DDR-8 alignment and adjustment is accomplished on an individual modular-unit basis. Refer to the appropriate modular-unit manual for the necessary alignment or adjustment procedures.