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UNCLASSIFIED

TECHNICAL MANUAL

for

RF TRANSLATOR

MODEL CHGR-3A

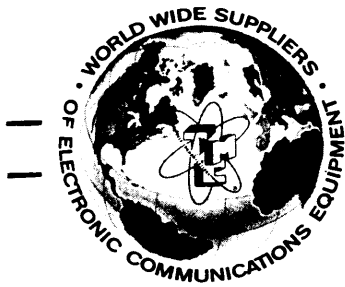


THE TECHNICAL MATERIEL CORPORATION
MAMARONECK, N.Y. OTTAWA, ONTARIO

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THE TECHNICAL MATERIEL CORPORATION

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700 FENIMORE ROAD

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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.
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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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3. TMC Part Number.
4. Nature of defect or cause of failure.
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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.

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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

RF TRANSLATOR
MODEL CHG-3

1. DESCRIPTION

RF Translator, Model CHG-3 is the same as Model CHGR-3A, differing only in the deletion of the automated circuits and components, which are not used in the CHG. This difference restricts the CHG to manual tuning only.

2. ACTION

Due to the similarity in function and operation of the CHG versus the CHGR, the following deletions, additions and corrections will enable the CHGR manual to be applicable to the CHG.

SECTION 1 - GENERAL DESCRIPTION

Paragraph 1-1, page 1-1.

In the first sub-paragraph, delete: "remote control."

In the third sub-paragraph, change to read: Local selection of any of the eight bands and any frequency within the selected band is provided by manually tuning the front panel controls.

SECTION 2 - INSTALLATION

Figure 2-2, page 2-3.
Delete item 11.

Table 2-1, page 2-4.
Delete item 11.

SECTION 3 - OPERATOR'S SECTION

Paragraph 3-2, page 3-1.

In the fourth sentence, delete: "for automatic tuning, this control should be turned fully clockwise."

SECTION 4 - PRINCIPLES OF OPERATION

Paragraph 4-2. c., Page 4-5.

In the first sub-paragraph, third sentence, delete: "both operations are performed by direct relays and stepping switch controls, which are controlled by remote equipment."

Delete second, third and fourth sub-paragraphs of paragraph 4-2. c., pages 4-5, 4-7.

Paragraph 4-2. d., page 4-7
Delete the last sentence.

Figure 4-3, page 4-6.

Delete

Figure 4-4, Page 4-8

Delete

SECTION 5 - MAINTENANCE

Figure 5-4, page 5-13.

Disregard connector J1316 and associated wiring (not used in CHG).

SECTION 6 - PARTS LIST

Delete the following components:

<u>REF. SYMBOL</u>	<u>Page</u>
B1001	6-4
B1002	6-5
G1001	6-12
J1314	6-13

REF. SYMBOL

PAGE

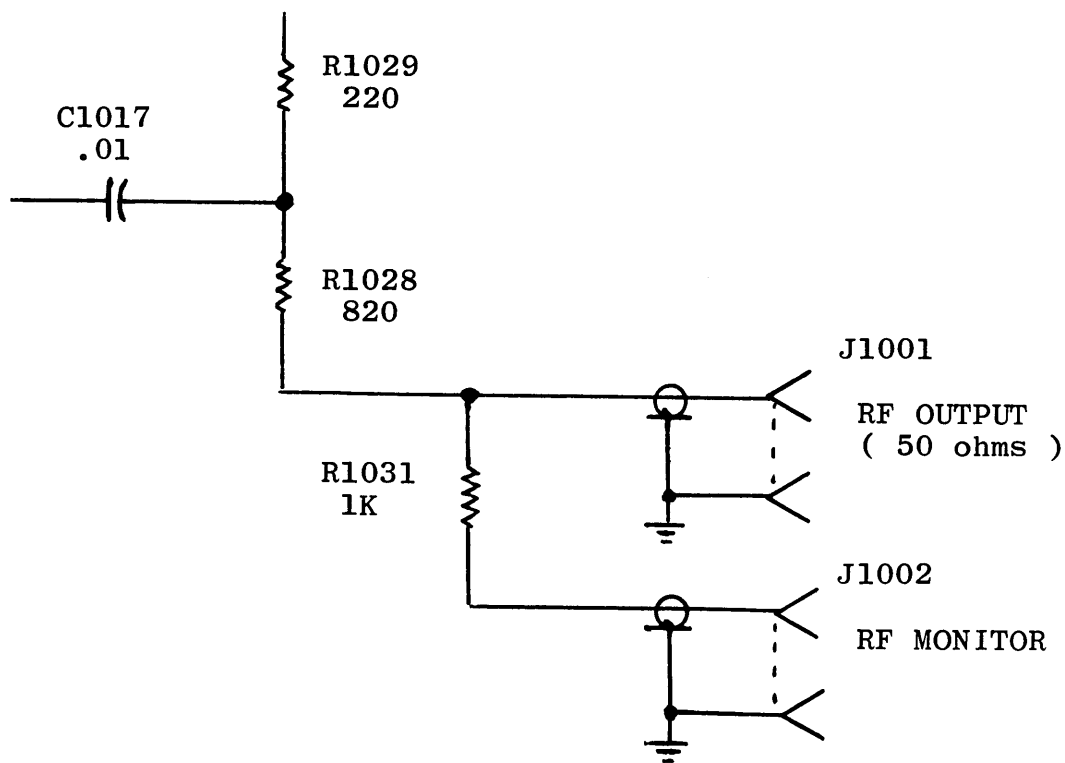
J1315	6-13
J1316	6-13
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S1007	6-22

SECTION 7 - SCHEMATIC DIAGRAMS

Figure 7-1 (sheet 2 of 2), page 7-5/7-6.
Delete

Figure 7-1 (sheet 1 of 2), page 7-3/7-4.

Add RF Monitor jack J1002 as shown below



CHANGE NO. 1 CHGR-3A



INSTRUCTION BOOK CHANGE NOTICE

Date 13 September 1966

Manual affected: RF Translator, Model IN -2012E
CHGR-3A (issue date: 1 June 1966)

Page 7-3/7-4. Figure 7-1

Change figure 7-1 in accordance with figure 1 below.

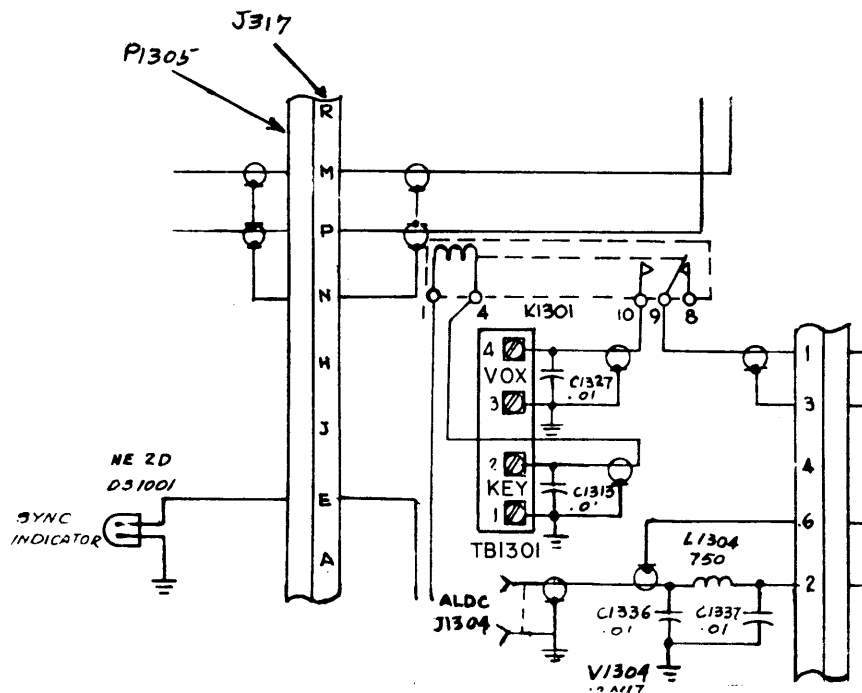


Figure 1.

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Attn.: Director of Eng. Services.

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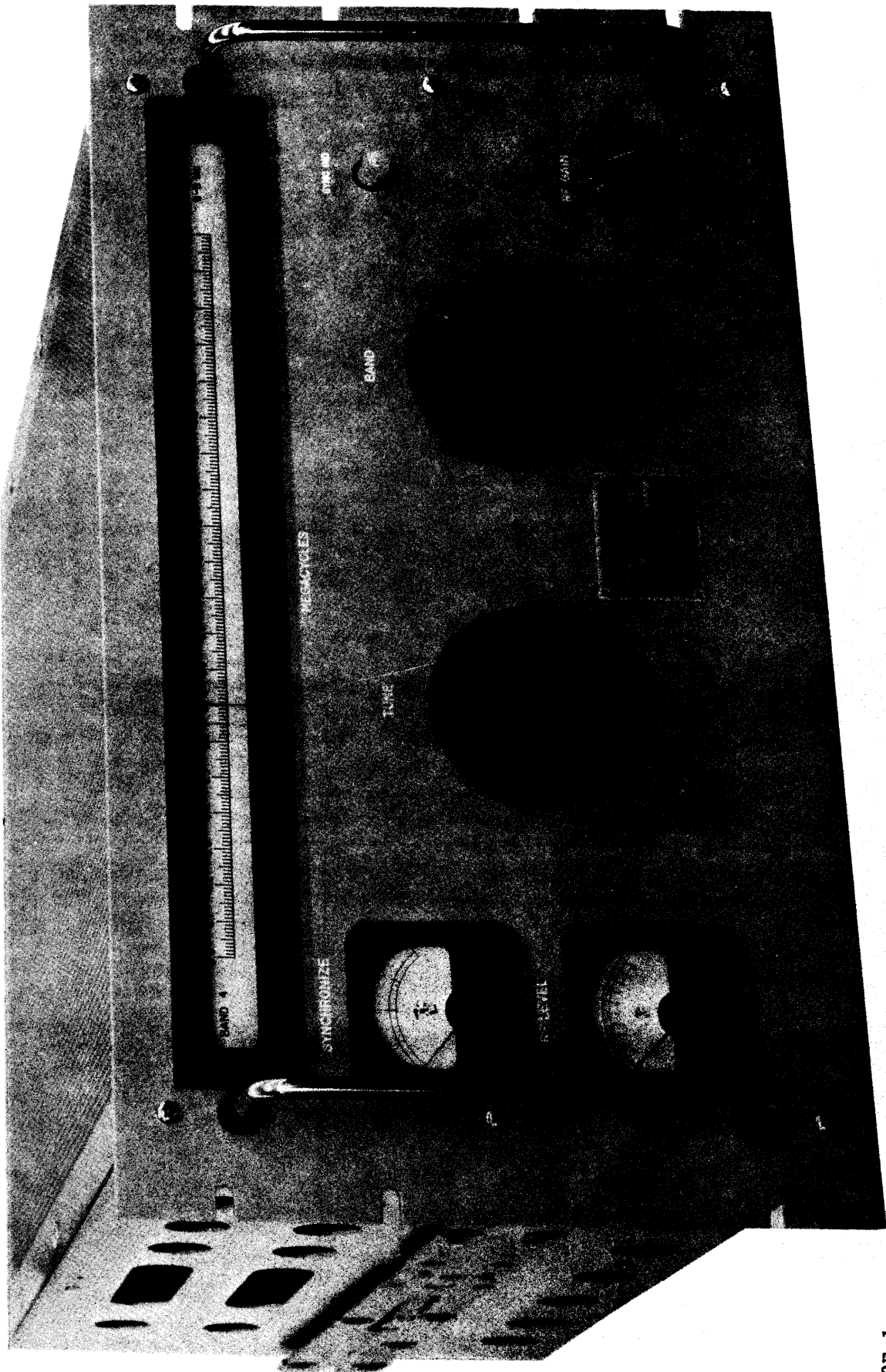


Figure 1-1. RF Translator, Model CHGR-3A

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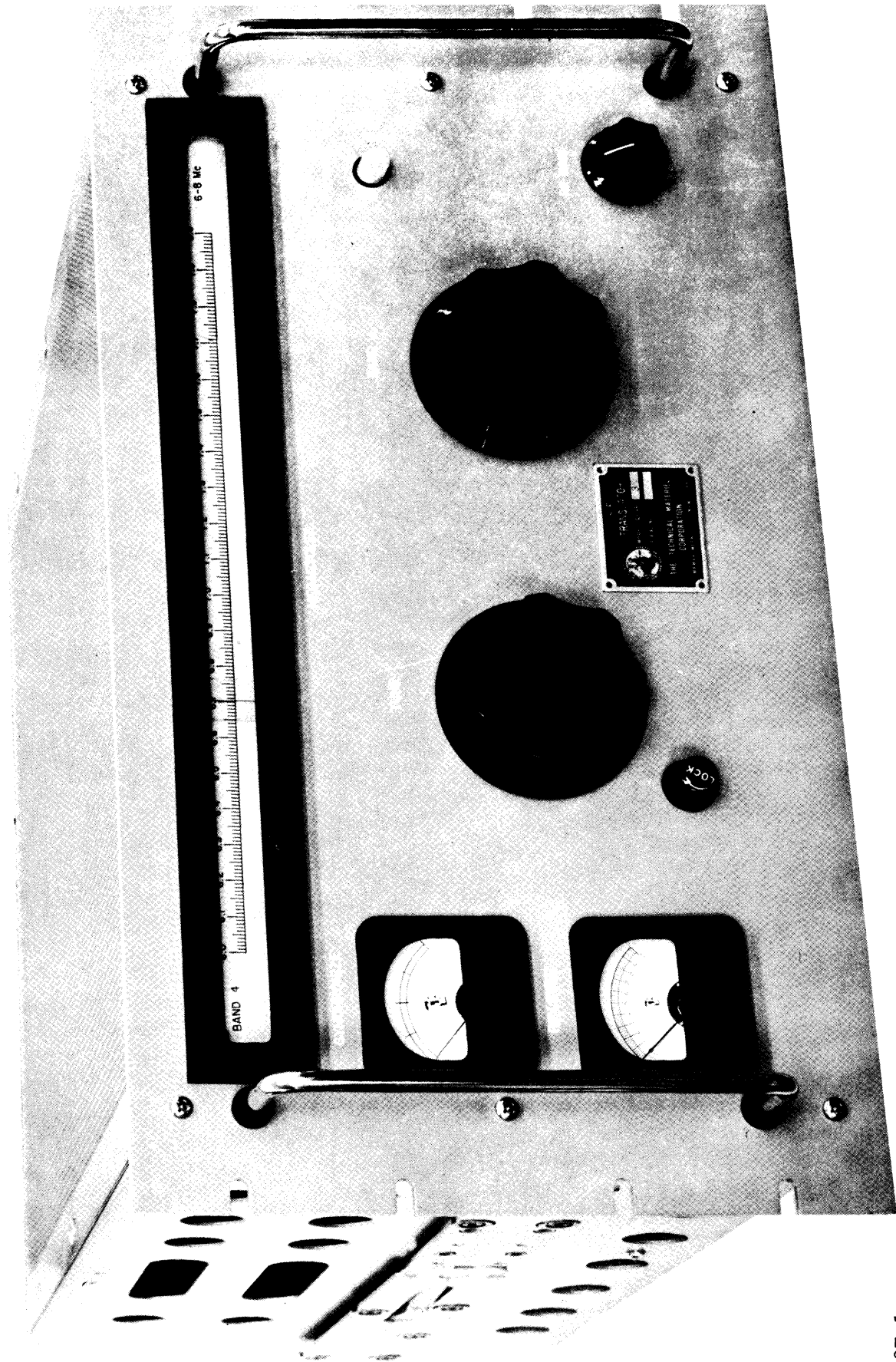


Figure 1-1. RF Translator, Model CHGR-3A

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SECTION 1 GENERAL DESCRIPTION

1-1. FUNCTIONAL DESCRIPTION.

R-F Translator, Model CHGR-3A (figure 1-1), provides controlled (local or remote control) frequencies in the 2- to 32- megacycle range in 100-cps steps. As shown in the functional block diagram (figure 1-2), the CHGR operates in conjunction with a sideband exciter (CMRA), a control synthesizer (HFS), and a power supply (HFP), as a modular unit of a TechniMatic* transmitter system.

The CHGR receives a 1.75 mc input from the sideband exciter (CMRA) and heterodynes this signal to the desired output frequency. A sample of high frequency oscillator output (3.75 to 33.75 mc) of CHGR is applied to the control synthesizer (HFS), and the synthesizer in turn supplies a d-c control voltage to the CHGR to stabilize the high frequency oscillator. CHGR receives a-c and d-c power from the power supply (HFP). The r-f output of the CHGR is in the 2- to 32- megacycle range.

Remote selection of any of the eight bands and any frequency within the selected band is provided through a band switching and a dial tuning mechanism contained within the CHGR and operated by associated equipment.

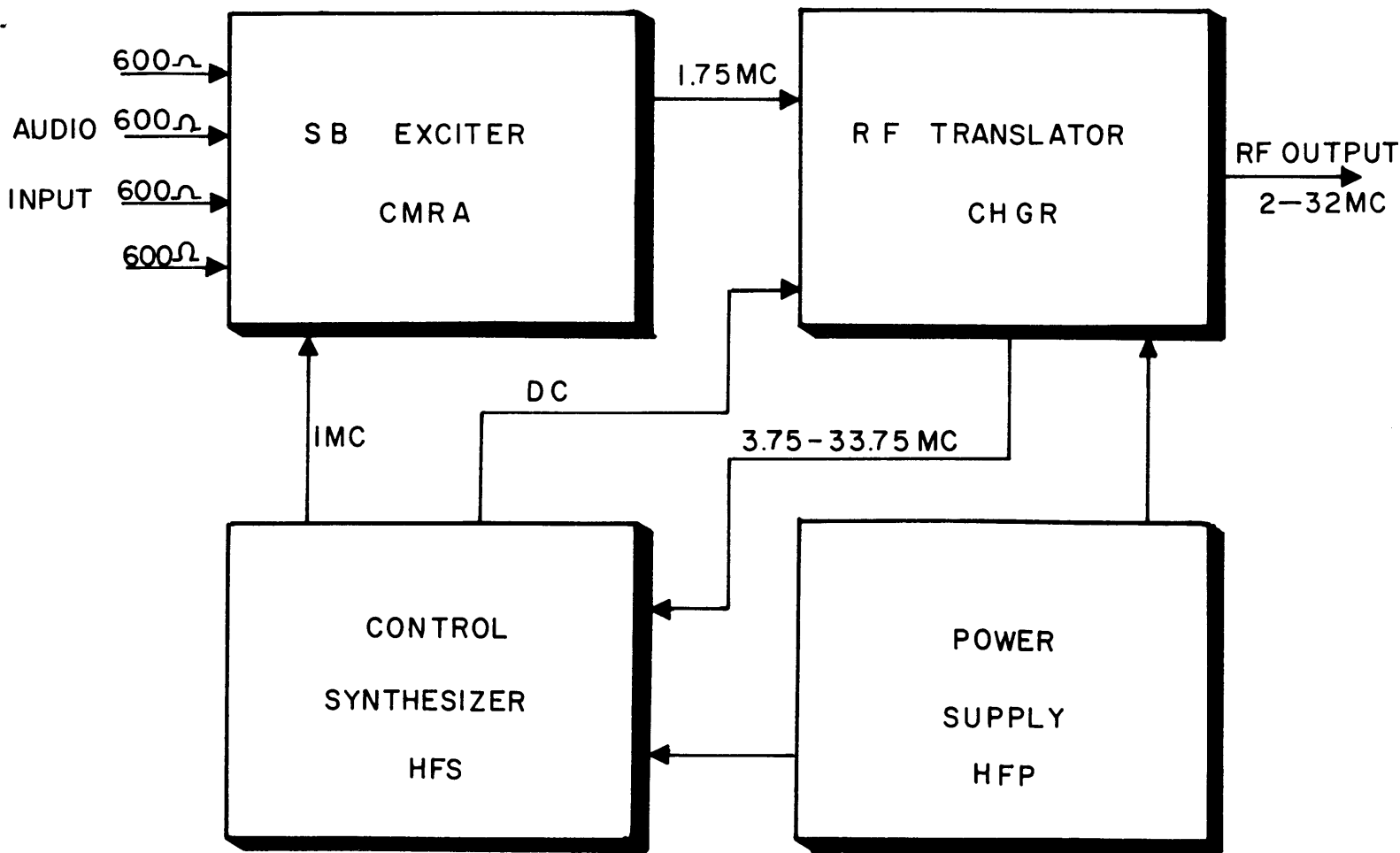
* Patent applied for.

1-2. PHYSICAL DESCRIPTION.

The CHGR is designed for installation in a standard 19-inch wide equipment cabinet. All controls and indicators necessary for operation of the unit are located on the front panel. Tilt-lock slide mechanisms are provided with the CHGR. Removable top and bottom protective covers are provided. The CHGR is 19 inches wide, 10-1/2 inches high, 20 inches deep, and weighs approximately 60 pounds.

1-3. ELECTRICAL SPECIFICATIONS.

Frequency Range:	2 to 32 mc, synthesized, in 100 cps steps 2 to 32 mc, continuous coverage, non-synth.
Stability:	Synthesized, 1 part 10^8 or 10^9 per day (dependent upon synthesier used) Unsynthesized, 20 to 50 parts in 10^6 .
Power Output:	500 milliwatts PEP.
Output Impedance:	50 ohms.
Input Requirements:	1.75 mc, modulated or unmodulated. DC control from synthesizer (optional). 3.75 to 33.75 mc, between 0.8 and 1.5 volts from external hfo (optional)
Output to Associated Units:	3.75 to 33.75 mc to synthesizer. 3.75 to 33.75 mc (when CHGR is master oscillator).
Intermodulation Distortion:	3rd and 5th order products at least 45 db below tone level of a two-tone test at full PEP output.
Power Requirements:	Supplied by Power Supply HFP.



2012E-2

Figure 1-2. Functional Block Diagram, CHGR

SECTION 2

INSTALLATION

2-1. GENERAL.

The CHGR is tested at the factory and is carefully packaged to prevent damage during shipment. When it is delivered at the operating site, inspect the packing case and its content for damage that might have occurred during transit. Unpack the equipment carefully, and inspect all packaging material for parts that may have been shipped as loose items. With respect to damage to the equipment for which the carrier is liable, The Technical Materiel Corporation will assist in describing methods of repair and furnishing of replacement parts.

2-2. MECHANICAL INSTALLATION.

The CHGR is equipped with a standard 19-inch wide front panel; install the CHGR in equipment rack as follows (refer to figures 2-1 and 2-2):

- a. Pull out center sections of tracks, located in equipment rack, until they lock in extended position.
- b. Position slide mechanisms of CHGR in tracks, and ease the unit into the rack until release fingers engage holes in tracks.
- c. Depress release fingers and slide CHGR completely into rack; secure front panel of CHGR to the rack with screws and washers.
- d. Make necessary electrical connections as described in paragraph 2-3.

NOTE

To prevent CHGR cables from snagging, attach reel-mounted springs (NEGATOR B motors) located inside the rack to the cables.

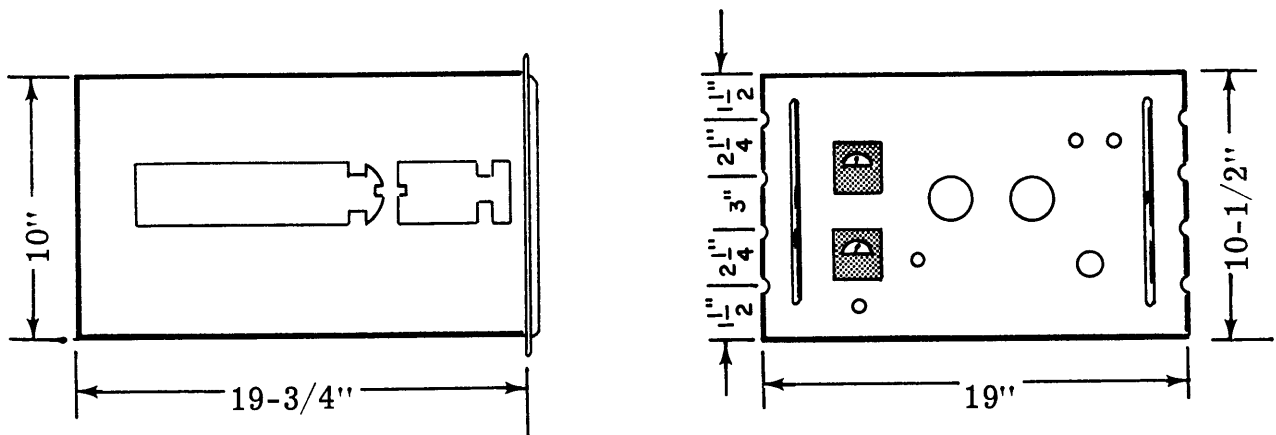
2-3. ELECTRICAL INSTALLATION.

a. INTERCONNECTIONS. - All connections to the CHGR are made at the rear panel (figure 2-3). Refer to the installation section of the applicable system manual and make cabling connections between the CHGR and related units, as indicated.

b. POWER SUPPLY. - With the exception of filament voltage for high-frequency oscillator V1007; all supply voltages (B+, bias, and filament voltage) for the CHGR are provided by an external power supply (such as TMC's model HFP).

A low-voltage power supply contained within the CHGR provides filament voltage for V1007 and heater voltage for an oscillator oven when the unit is so equipped. Although this power supply is designed for 115- or 230-volt, 50-60 cycle, single phase operation, it is factory wired for 115-volt operation; if 230-volt operation is required, minor wiring changes must be made as indicated in figure 2-4.

c. INITIAL ADJUSTMENTS. - The CHGR is checked at the factory in accordance with the manufacturer's specifications and therefore no initial adjustments are required before installation and operation.



2012E-3

Figure 2-1. Dimensional Outline, CHGR

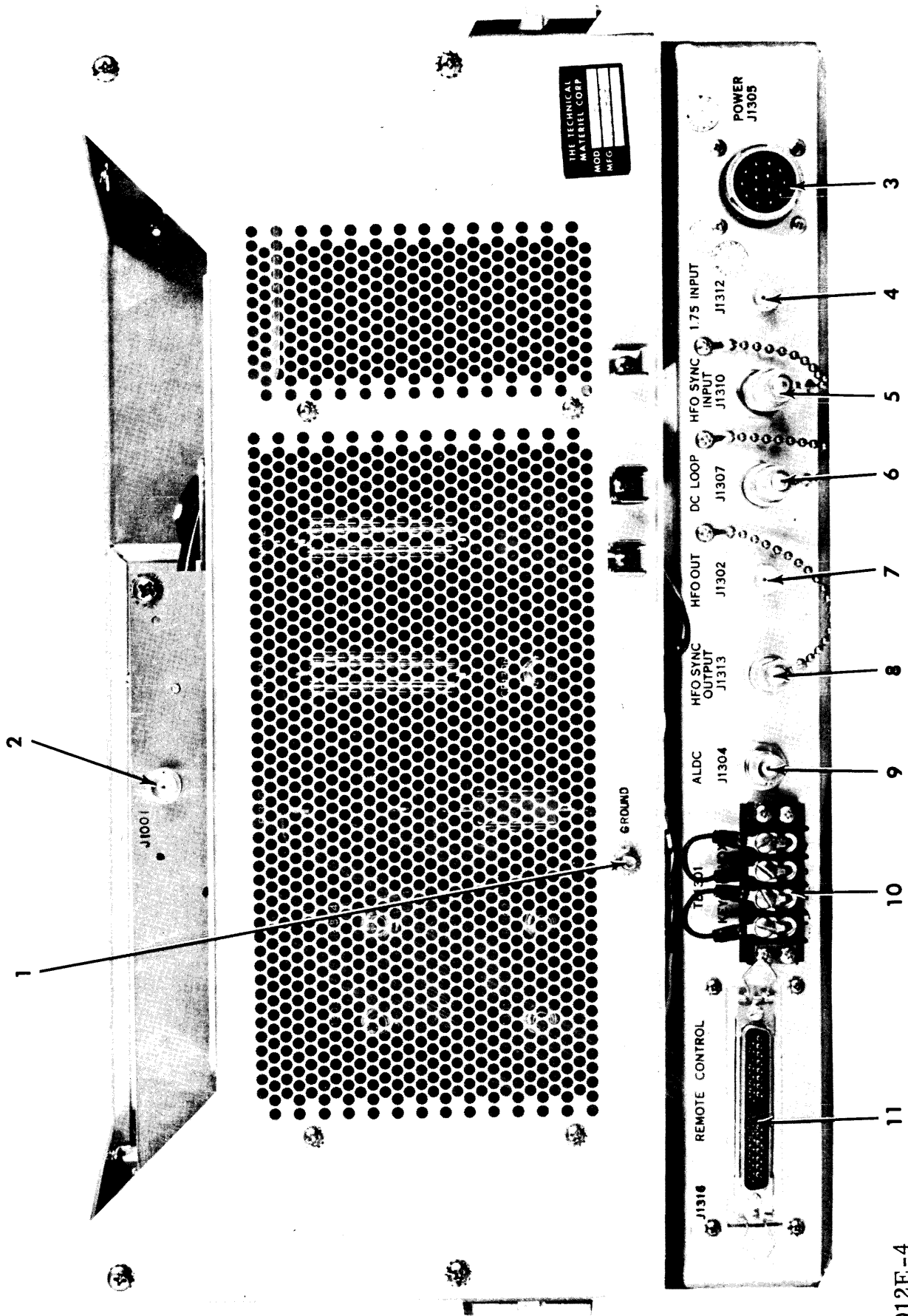


Figure 2-6 Rear Panel, CHGR

TABLE 2-1. REAR PANEL CONNECTIONS, CHGR

ITEM (Fig. 2-3)	DESIGNATION	FUNCTION
1	GROUND	Ground terminal.
2	J1001	RF output, 50 ohms.
3	J1305	Power input from power supply.
4	J1312	1.75 mc input.
5	J1310	High frequency oscillator sync input.
6	J1307	DC loop (d-c corr. voltage).
7	J1302	High frequency oscillator output.
8	J1313	High frequency oscillator sync output.
9	J1304	Automatic load and drive control input.
10	TB1301	KEY= For keying the transmitter. VOX= Provision for VOX operation.
11	J1316	Remote control connection for band switch and tuning servo motors.

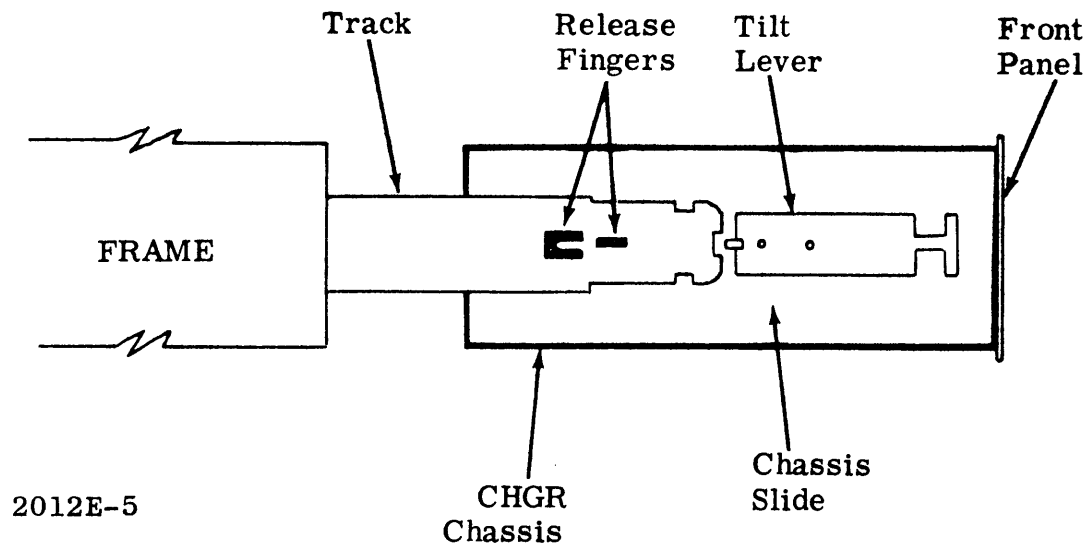


Figure 2-3. Tilt-lock Slide Mechanism Details

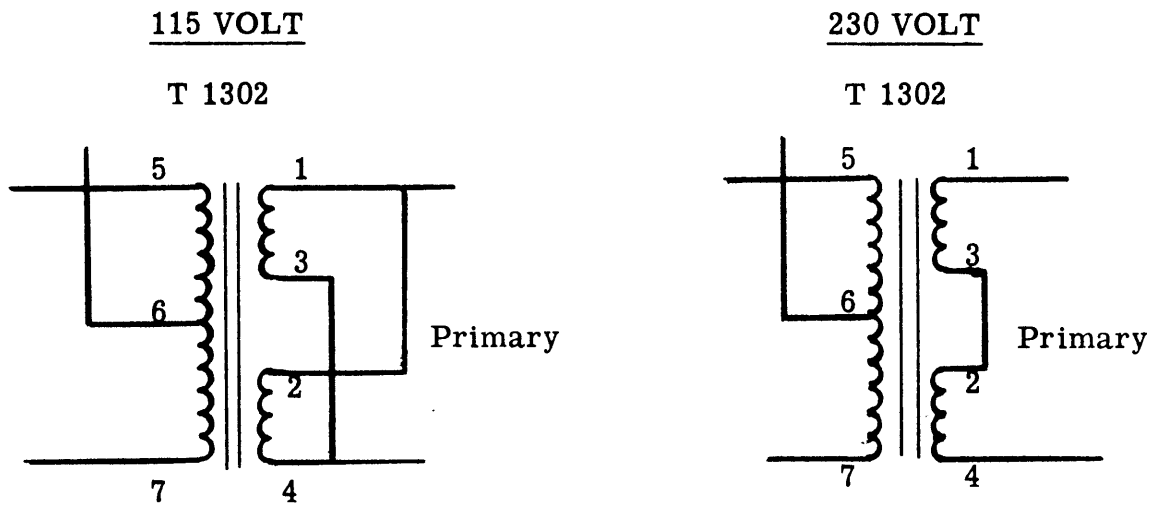


Figure 2-4. Transformer Wiring Diagram, CHGR.

SECTION 3

OPERATOR'S SECTION

3-1. CONTROL AND INDICATOR FUNCTIONS.

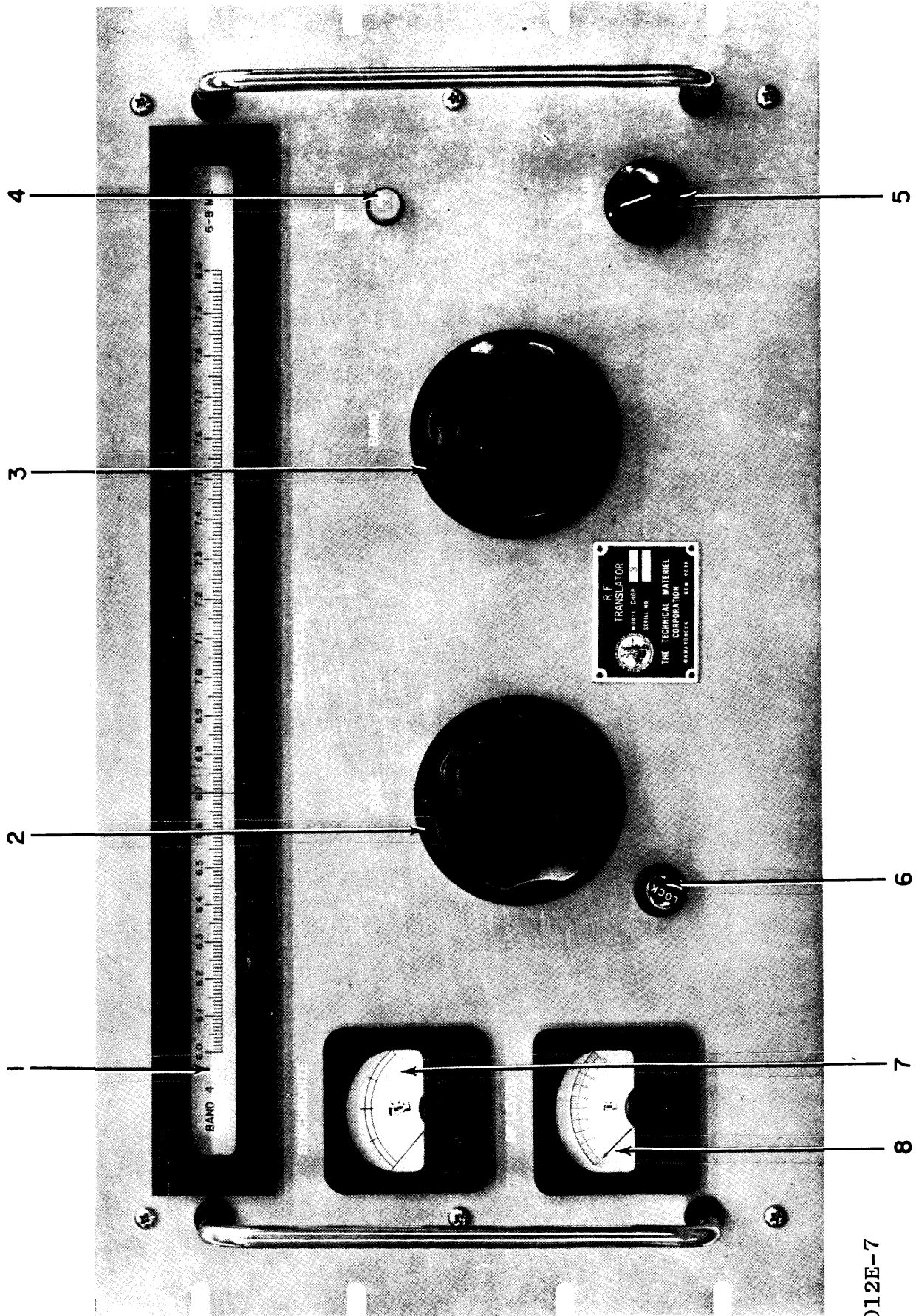
The functions of the controls and indicators of CHGR are explained in table 3-1; all controls and indicators are identified by front panel markings, as shown in figure 3-1. The CHGR operates in non-synthesized continuous coverage or in synthesized 100 cycle steps, within the frequency range of 2 to 32 megacycles (through eight r-f bands).

3-2. OPERATING PROCEDURE.

The CHGR is tuned to the desired frequency by means of the TUNE control after the appropriate frequency band is selected by means of the BAND switch. Adjustment of the RF GAIN control is dependent on the excitation requirement of the transmitter in which the CHGR is used; for automatic transmitter tuning, this control should be turned fully clockwise. Procedures for synchronizing the CHGR with other units for synthesized and non-synthesized operation are included in the appropriate system manual.

3-3. OPERATOR'S MAINTENANCE.

Observe operation of lamps and meters. Check controls for smooth operation. Check cable connections and wire terminals at rear apron.



2012E-7

Figure 3-1. Controls and Indicators, CHGR

TABLE 3-1. OPERATING CONTROLS AND INDICATORS

Item No. (See Fig. 3-1)	Control or Indicator	Function
1	MEGACYCLES dial	Displays illuminated RF band dial, selected by operating BAND control knob, item 3.
2	TUNE control	Moves pointer to appropriate frequency along dial of selected band. (TUNE control is fitted with a lock, item 6.)
3	BAND switch	Rotates MEGACYCLES dial, item 1, and switches in desired RF band, as follows: <p style="text-align: center;"> BAND 1 = 2 - 3 mc BAND 2 = 3 - 4 mc BAND 3 = 4 - 6 mc BAND 4 = 6 - 8 mc BAND 5 = 8 - 12 mc BAND 6 = 12 - 16 mc BAND 7 = 16 - 24 mc BAND 8 = 24 - 32 mc </p>
4	SYNC IND lamp	Lights to indicate system is synchronized (indicates only when CHGR is in synthesized operation).
5	RF GAIN control	Controls amplitude of RF output signal.
6	LOCK knob	Locks TUNE control, item 2, to prevent accidental shift off selected frequency.
7	SYNCHRONIZE meter	Indicates amount and polarity of DC voltage. When system is out of synchronization, meter reads zero (meter functions only when CHGR is in synthesized operation).
8	RF LEVEL meter	Indicates level of r-f output signal.

SECTION 4

PRINCIPLES OF OPERATION

4-1. GENERAL.

The R-F Translator receives a 1.75-mc signal and converts it to the 2- to 32-mc range. The R-F Translator consists basically of the high frequency balanced modulator, the high frequency oscillator, and three r-f amplifiers (refer to figure 4-1). A 1.75-mc signal (from associated sideband exciter) and a translating signal in the 3.75- to 33.75-mc range (from high frequency oscillator) is applied to the balanced modulator. The output of the balanced modulator (the difference product in the 2- to 32-mc range) is routed through three stages of tuned r-f amplification to produce the r-f output. The high frequency oscillator output is also made available for connection to the control synthesizer.

4-2. CIRCUIT ANALYSIS.

a. HIGH FREQUENCY OSCILLATOR. - Refer to figures 4-2 and 7-1.

The HFO and isolation amplifier circuit comprises high frequency oscillator V1007, isolation amplifier V1006, tuning capacitor C1002, a Varicap circuit consisting of C1048, C1049, C1053, R1044, and R1045, and oscillator tuner strips A1002 through A1016, even-numbered assembly designations. Turret contacts engage fixed chassis contacts to connect V1007 and HFO SYNC INPUT jack J1311 to the required elements of oscillator tuner strips A1002 through A1016, tuning capacitor C1002, and the Varicap circuit.

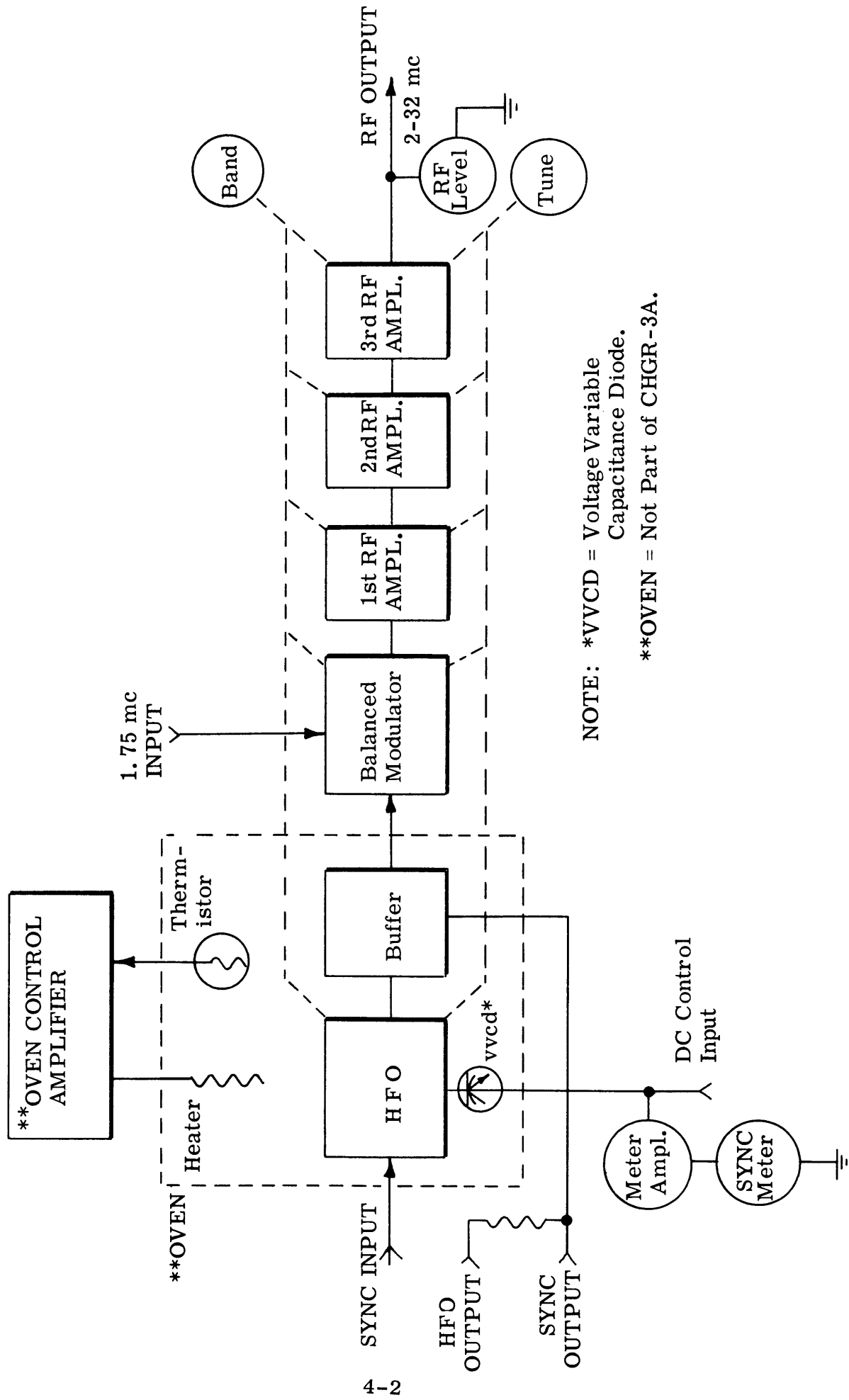


Figure 4-1. Simplified Block Diagram, CHGR

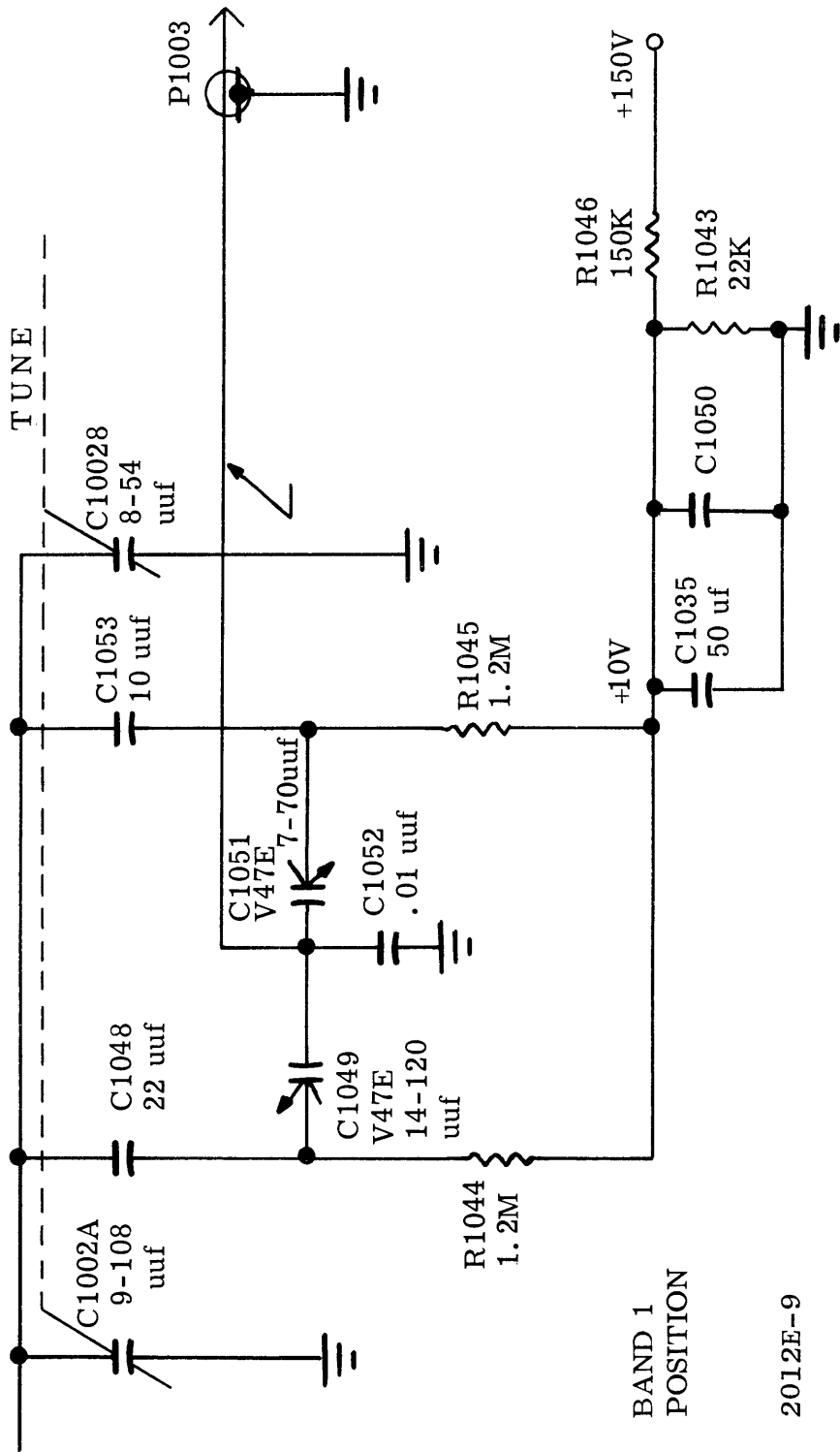


Figure 4-2. Partial Schematic Diagram, Varicap

The HFO is a modified Colpitts (Vacker) circuit. In synthesized operation, HFO frequency is controlled by the Varicap circuit. A d-c correction voltage from the associated synthesizer biases C1049 and C1051, thereby changing the capacity shunting C1002A and C1002B. The Varicap and tuning capacitors are connected to oscillator tuner strip A1002 (BAND 1 position); circuit configurations for oscillator strips A1004 through A1016 are similar. Both sections of C1002 are not utilized with all tuner strips; regardless of the tuner strip engaged, at least one Varicap control is inserted to pull the frequency as required.

Isolation amplifier V1006 presents a constant load to the grid of V1007 and thus prevents HFO frequency modulation.

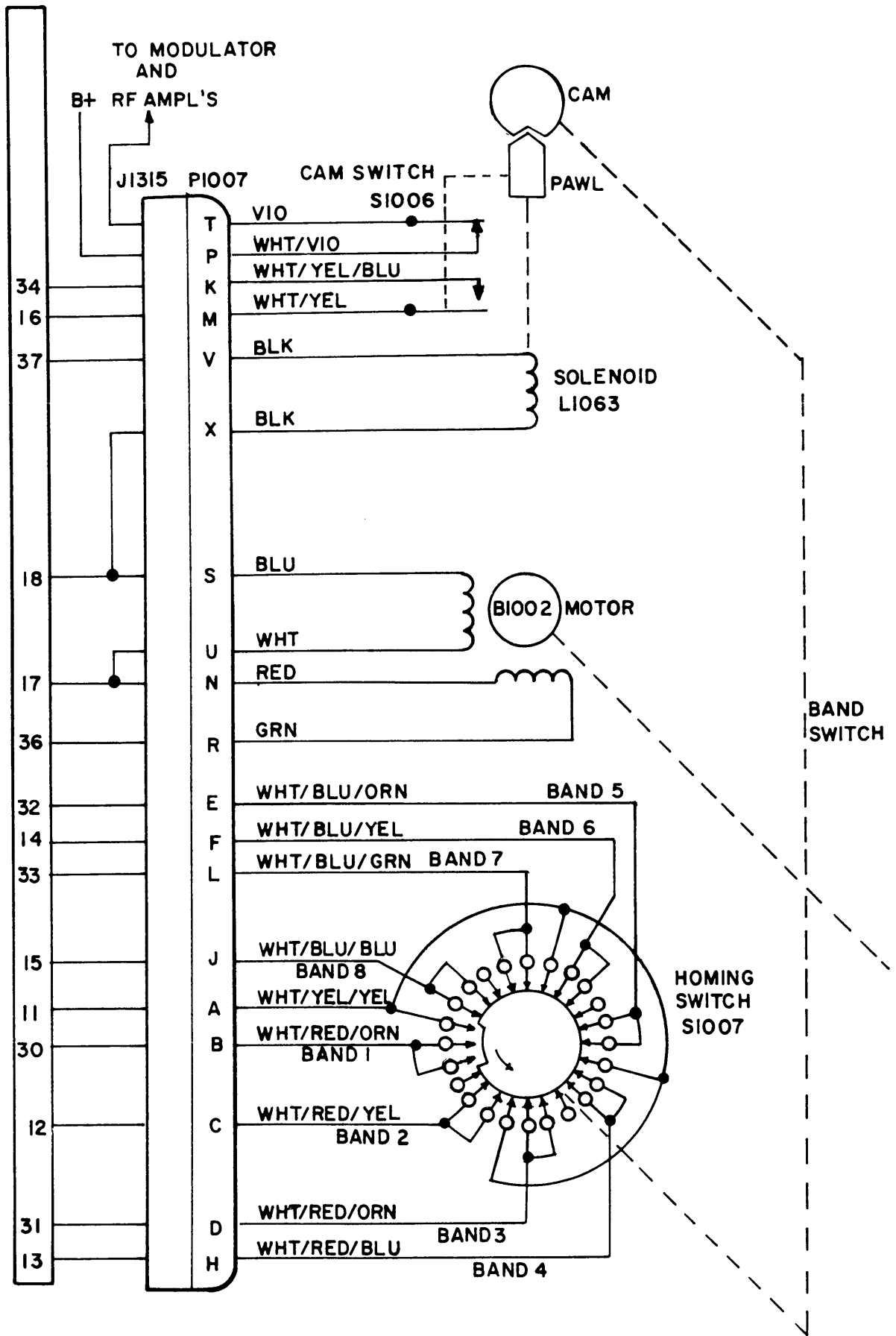
b. BALANCED MODULATOR AND R-F AMPLIFIERS. - Balanced modulator V1005 receives the 3.75 to 33.75 mc output of the high frequency oscillator. This signal is applied to the two halves of the tube in parallel, and the output of the stage is a push-pull circuit. The high frequency oscillator signal is, therefore, self-canceling. The 1.75 mc signal from the associated sideband exciter unit is applied to the balanced modulator in push-pull via jack J1312 and RF GAIN control R1011. The signals at the plates of V1005 include the 1.75 mc i-f input, the 5.5 to 35.5 mc sum products, and the 2- to 32-mc difference products. The tuning circuits for the balanced modulator and succeeding amplifier stages pass only the difference products. The balanced modulator is self-biased by resistors R1006, R1007 and R1008; R1007 is adjusted so that the two halves of the tube conduct equally. Additional bias (ALDC voltage, automatic load and drive control) may be supplied to the grids via jack J1304.

Tubes V1004, V1003 and V1002 are linear r-f amplifiers. The tuning circuits for the modulator and r-f amplifiers comprise sections A through H of capacitor C1001 and tuner strips A1001 through A1015 (odd numbers). Tube V1004 is self-biased. The grid of V1003 is biased -9.5v with respect to ground by the voltage divider consisting of resistors R1010, R1018, and R1019. The grid of V1002 is biased -2.8 v with respect to ground by the voltage divider consisting of resistors R1010, R1023, R1024, and R1032. When pin 4 of TB1301 (VOX) is ungrounded, V1003 and V1002 are cut-off by the -150V. RF LEVEL meter M1002 indicates the peak-envelope-power level of the r-f output signal.

The balanced modulator and r-f amplifiers are disabled by switch S1006, operated by a cam on the band switch shaft, whenever the band switch turret is not correctly positioned to connect the tuner strips to their associated circuits. S1006 is in series with the B+ line for the amplifier stages.

c. TUNING AND BAND-SWITCHING CIRCUITS. - The tuning and band-switching circuitry functions to select the desired band, and to position the dial for the desired frequency; both operations are performed by direct relays and stepping switch controls, which are controlled by remote equipment.

As shown in figure 4-3, a motor, a homing switch, a detent release solenoid and a cam switch are mechanically linked to the band switching shaft. Controlling voltage from external equipment (such as an associated control synthesizer) actuates the band switch motor in the CHGR, moving the band switch control in search of the band se-



2012E-10

Figure 4-3. Automated Band Switch, Circuit Diagram, CHGR

lected by the remote equipment. The homing switch in the CHGR is activated by a master stepping switch in the external equipment, and stops the motor (by cutting off the power supply voltage) in the CHGR at the correct band.

As shown in figure 4-4 remote tuning is accomplished by external master and slave stepping switches which send controlling voltages to the CHGR tune control drive motors. (A relay controls the CHGR tune motor so that it is deactivated whenever the band-switching motor is activated.) External equipment circuitry determines whether the tune motor in the CHGR will search to the left or to the right on the band dial for the desired frequency.

Refer to the system manual for a detailed description of the remote tuning and band-switching operation.

d. POWER SUPPLY. - The low voltage power supply consists of transformer T1301 and a full wave bridge rectifier comprising diodes CR1301, CR1302, CR1303, and CR1304 (refer to figure 7-1). Line voltage (115- or 230-VAC) applied to the primary of transformer T1302 is stepped down to 61 VAC in the secondary, rectified by the full wave bridge, and dropped and regulated at 28 VDC $\pm 5\%$ by resistors R1331 and R1332, and diode CR1305. Plus 28 VDC is extended through jack J1305 to the frequency standard of the associated synthesizer. Plus 28 VDC is further dropped by resistor R1333 and regulated at 6.3VDC by diode CR1306; 6.3 VDC is extended through jack J1306 to the HFO (V1007) filament. In addition to their normal function in the full wave bridge rectifier, the diodes supply 32 VDC to J1316 for the associated control terminator circuits.

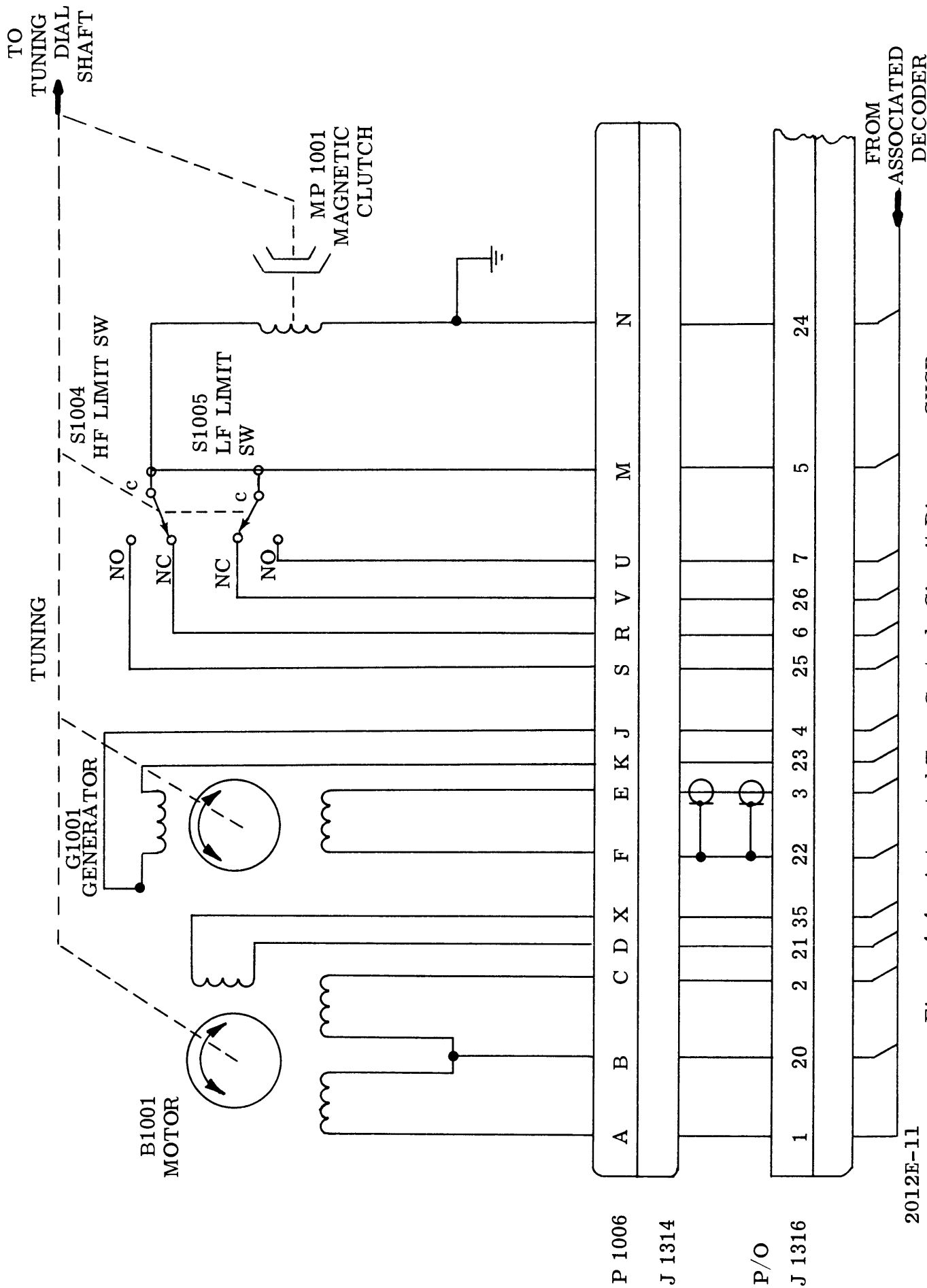


Figure 4-4. Automated Tune Control, Circuit Diagram, CHGR

SECTION 5
MAINTENANCE

5-1. PREVENTIVE MAINTENANCE.

Periodically, remove the CHGR from the rack and inspect for general cleanliness and condition of connections at the rear of the unit. Remove all covers, and check all components for discoloration, damaged wiring, broken or loose solder connections, and corrosion. Clean the components with a soft brush, vacuum cleaner, or clean, dry, filtered, compressed air. Check all hardware for tightness.

WARNING

Electrical parts may be cleaned with any good dry-cleaning fluid, or with trichlorethylene. When using trichlorethylene or carbon tetrachloride, be sure that adequate ventilation exists in the area, and avoid prolonged skin contact with the fluid. Use caution when applying trichlorethylene near painted surfaces, as the fluid may act as a paint remover.

5-2. TROUBLESHOOTING (Refer to figure 7-1).

When the CHGR has been operating satisfactorily and suddenly fails, the cause of failure may be apparent either because of circumstances occurring at the time of failure or because of symptoms analogous to past failures. Also, failure or malfunction of associated equipment may be reflected in the performance of the CHGR. Under such conditions it is unnecessary to follow a lengthy and systematic course of troubleshooting in order to isolate the faulty part.

After ascertaining that the malfunction is in the CHGR, remove the unit from the rack and apply the troubleshooting steps outlined in table 5-2. Refer to table 5-3 for additional troubleshooting aid. Table 5-1 lists test equipment and special tools; test equipment connections are shown in figure 5-1.

Performance measurements procedures are outlined in the following paragraphs.

a. STAGE GAIN MEASUREMENTS. - Connect r-f signal generator to jack J1312. Adjust the generator to deliver a 1.75 mc unmodulated signal at approximately 20 mv. Terminate RF OUTPUT jack J1001 with a 47-ohm resistor. Using a VTVM, check individual stage gain as indicated in figure 5-2.

b. HFO.

NOTE

Resistor R1001 is the 270-ohm resistor in the grid circuit of balanced modulator tube V1005.

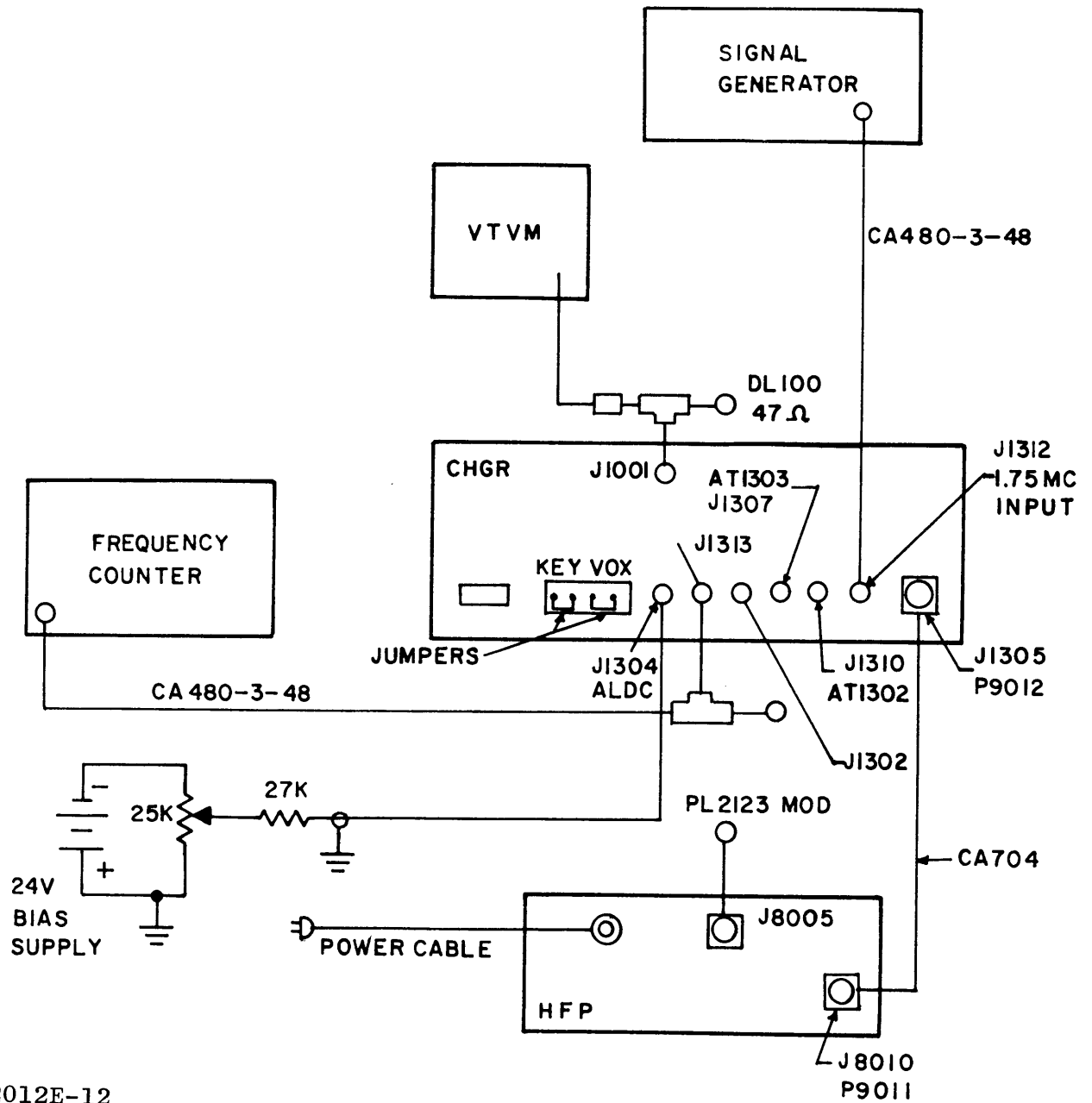
Successively change BAND switch and TUNE control settings so as to cover complete frequency range of the CHGR.

Using a VTVM, measure signal level at the following points in the HFO circuit; signal levels should be:

TEST POINT	MINIMUM ACCEPTABLE LEVEL	MAXIMUM ACCEPTABLE LEVEL
Across R1001	0-8v	1.5v
J1313	0-2v	0.7v
J1302	30 mv	100 mv

TABLE 5-1. TEST EQUIPMENT AND SPECIAL TOOLS

ITEM	MANUFACTURER
R-F Signal Generator	Measurements, Inc., Model 82, or equivalent.
Frequency Counter	Hewlett-Packard, Model 5244L, or equivalent.
Vacuum Tube Voltmeter	Hewlett-Packard, Model 410C, or equivalent.
Volt-ohm-milliammeter (VOM)	Simpson, Model 260 or equivalent.
R-F Microvoltmeter	Millivac Instruments, Model MV28B, or equivalent.
Co-ax Interconnect Cables (2) with BNC plugs	Technical Materiel Corp., (CA480-3-48)
Alignment Tool	Technical Materiel Corp., (TP114)
Alignment Tool	Technical Materiel Corp., (TP115)
Miniature Tube Puller (7-pin)	Kellems #1116
Noval Tube Puller (9-pin)	Kellems #1316
5/16" Spintite (Modify: drill 3/16" hole through plastic handle).	Xcelite HS-10
1/8" Blade Screw drivers (Modify: hollow-grind to 0.013").	Xcelite R188 (8" long)



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Figure 5-1. Test Equipment Connections, CHGR

TABLE 5-2. TROUBLESHOOTING, CHGR

FAILURE	PROBABLE CAUSE	REMEDY
<p>1. No output on any band.</p>	<p>1. HFO tube failure. 2. Isolation amplifier tube failure. 3. Balanced modulator tube failure. 4. RF amplifier tube failure. 5. Driver tube failure. 6. RF output tube failure.</p>	<p>1. Check/replace defective tube. 2. Also measure signal levels stage by stage (refer to paragraph 5-2a); replace defective components.</p>
	<p>7. Defective RF Gain Control.</p>	<p>Check input circuit resistance for opens and shorts; replace defective components.</p>
	<p>8. Shorted tuning capacitor, RF, or oscillator.</p>	<p>Requires repair or replacement.</p>
	<p>9. Open or shorted balanced modulator input transformer (T1001).</p>	<p>Replace balanced modulator input transformer (T1001), and align (refer to paragraph 5-4).</p>
	<p>10. Open or shorted balanced modulator output transformer (T1028).</p>	<p>Replace balanced modulator output transformer (T1028); alignment not necessary.</p>
	<p>11. Defective B+ cut-off switch (S1006).</p>	<p>Replace switch.</p>
<p>2. Individual band failure. (Probable Cause and Remedy is applicable to each band).</p>	<p>1. HFO oscillator failure*. 2. Defective RF strip*.</p>	<p>Replace oscillator strip; realign (refer to paragraph 5-4). Replace RF strip; realign (refer to paragraph 5-4).</p>
	<p>*Check resistance of individual components for shorts or opens.</p>	
<p>3. Output present; RF LEVEL meter fails to indicate.</p>	<p>1. Open meter. 2. Shorted diode (CR1001). 3. Shorted bypass capacitors (C1017, C1018).</p>	<p>Replace.</p>

TABLE 5-3. D-C VOLTAGE CHART, MAIN CHASSIS AND TUNER

SYMBOL TUBE	FUNCTION	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6	PIN 7	PIN 8	PIN 9
V1002 6GM5	RF OUTPUT	+200	X	X	0	6.3	-4.6	+0.5	X	+200
V1003 6GK6	DRIVER	+0.46	(I) -7.5	0	0	6.3	X	+200	+200	0
V1004 6AH6	RF AMPLIFIER	0	0	0	6.3	+200	+137	+1.1	-----	-----
V1005 12AU7	BALANCED MODULATOR	+150	0	(II) +4.85	6.3	6.3	+150	0	(II) +4.85	0
V1006 6AH6	ISOLATION AMPLIFIER	0	(III) +1.72	0	6.3	+140	+140	(III) +1.72	-----	-----
V1007 6AB4	HF OSCILLATOR	+112	-----	0	+6.3	-1.5to -2.5(IV)	-1.5to -2.5(IV)	0	-----	-----
V1302 0A2	+150 VOLTAGE REGULATOR	+150	0	0	0	+150				
V1304 12AU7	SYNCHRONIZE	195	0	(V) +10.5	0	0	+195	0	(V) +10.5	6.3

(I) Measured with VTVM. (II) R1007 adjusted for balance. (III) J1313 terminated with 47 ohms (AT-1301).
 (IV) After alignment, Band 1 to 8. (V) R1321 adjusted for balance.

NOTES: All voltages are +10% and referred to ground. All voltages are measured with Simpson Model 260 meter, unless otherwise indicated.

5-3. REPAIR AND REPLACEMENT.

Maintenance of the CHGR will consist mainly of component replacement. It should be noted that when replacing components having many wires connected, such as switches, relays, etc., the wires should be tagged and marked for accurate identification. When replacing components, refer to the parts list in section 6 for exact or equivalent replacements. Use of the schematic diagram in section 7 is advisable when replacing or disconnecting components; also refer to figure 5-4.

5-4. ALIGNMENT.

a. ALIGNMENT OF HF OSCILLATOR CIRCUITS.

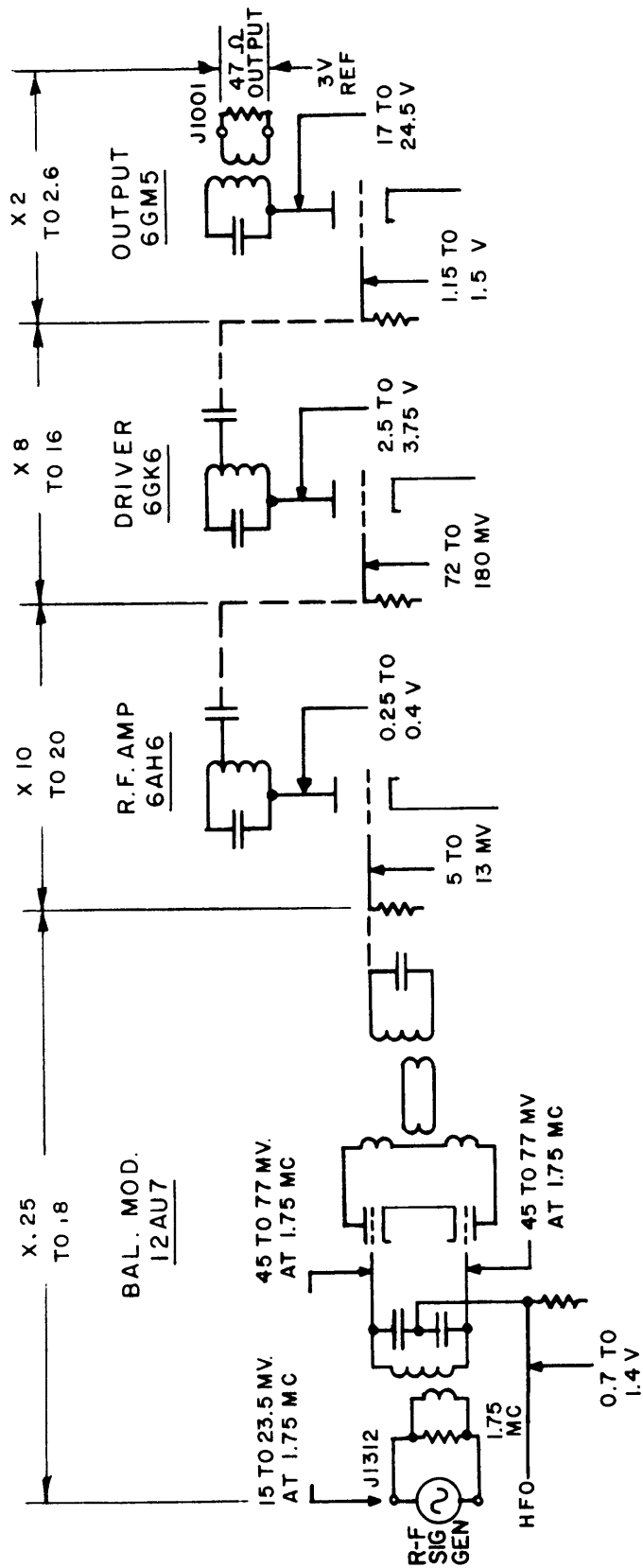
(1) Disconnect the VTVM and the signal generator from the CHGR; connect the frequency counter to the CHGR, as shown in figure 5-1.

(2) With BAND switch set to BAND 1 and TUNE dial to 2 mc, tune inductor L1013 so that the frequency counter indicates 3.7500 mc.

(3) Set TUNE dial to 3 mc, and tune capacitor C1047 to 4.7500 mc on the frequency counter.

(4) Repeat tuning procedure outlined in steps 2 and 3 until L1013 and C1047 are properly tuned.

(5) Using procedure given in steps 2,3, and 4 above, align all bands. Refer to table 5-4 for band and dial tuning settings, and figure 5-3 for location of inductors and capacitors. Tune the inductors and the capacitors to obtain the indicated frequencies.



NOTES

1. Isolate grid from tuned circuit (use thin vinyl sleeving between contact and pin).
2. Use terminated (47Ω) generator coupled to grids through 0.01 capacitor.
3. Use voltmeter (H-P 410C) on r-f stage grids or plates; retune generator when measuring across tuned circuits (plates).
4. Use voltmeter (Ballantine 314) on balanced modulator circuits of 1.75 mc component; disable HFO by pulling HFO power connector.
5. All voltages shown are referred to 3 volt output from BAND 1 to BAND 8.
6. The overall gain must be at least 130 and not more than 200.

Example: Overall gain = $.48 \times 15 \times 10 \times 2 = 144$
 or $\frac{3V \text{ output}}{20.8 \text{ MV input}} = 144$

Figure 5-2. Stage Gain Diagram, CHGR

TABLE 5-4. HF OSCILLATOR ALIGNMENT DATA

BAND	SET TUNE DIAL TO	TUNE OSC. TO	USE ADJUSTMENT	LOCATION (See FIG. 5-3)
1	2	3.7500	L1013	1
	3	4.7500	C1047	2
2	3	4.7500	L1021	1
	4	5.7500	C1073	2
3	4	5.7500	L1053	1
	6	7.7500	C1093	2
4	6	7.7500	L1054	1
	8	9.7500	C1113	2
5	8	9.7500	L1055	1
	12	13.7500	C1132	2
6	12	13.7500	L1042B	1
	16	17.7500	C1151	2
7	16	17.7500	L1147B	1
	24	25.7500	C1172	2
8	24	25.7500	L1052B	1
	32	33.7500	C1193	2

b. ALIGNMENT OF 1.75 MC CIRCUIT

(1) Connect the signal generator to jack J1312 on the CHGR (see figure 5-1). Set frequency at 1.75 mc, modulation OFF, and attenuator to 0.3 volts.

(2) Connect the a-c probe of the VTVM to pin 2 of V1005. Select 1.5V scale.

(3) Disable HFO by disconnecting P1004.

(4) Tune T1001 for maximum output on VTVM. Output should be $0.9V \pm 0.1V$.

(5) Disconnect VTVM from V1005 and reconnect it to jack J1001 (see figure 5-1). Select 5V scale.

(6) Connect P1004 to reactivate HFO.

c. BALANCED MODULATOR - HFO SUPPRESSION.

(1) Set signal generator attenuator to zero.

(2) Connect RF microvoltmeter across R1012 (resistor in RF amplifier grid circuit, V1004, 6AH6). The presence of an HFO voltage will be indicated on meter.

(3) Set CHGR BAND switch to band 7 and TUNE dial to 24 mc.

(4) Adjust R1007 potentiometer for minimum output. The voltage appearing on the microvoltmeter should be less than 10 mv, the normal being 8 mv on band 8, 2 mv on bands 6 and 7, and 1 mv on bands 1 through 5.

(5) Remove microvoltmeter from circuit.

d. ALIGNMENT OF RF CIRCUITS

(1) Connect signal generator and VTVM as shown in figure 5-1.

(2) Set CHGR BAND switch to Band 1, TUNE to 2 mc, and set RF GAIN to maximum output.

(3) Set signal generator to 1.75 mc, modulation OFF, attenuator to 0.3V (reduce as needed to 35 mv).

(4) Tune inductors (use tool TP115) L1005, L1007, L1008, L1009 for maximum output on VTVM. Reduce input as needed to prevent output from exceeding 5V. A clear and distinct indication of tuning should result on each stage except the output (L1009) where the circuits are of lower Q and the tuning somewhat broad.

(5) Set CHGR TUNE at 3 mc, RF GAIN control to maximum (or as needed).

(6) Tune capacitors (use tool TP114) C1024, C1027, C1030, C1033 for maximum output. The same conditions as in step 4 of paragraph 5-3d will prevail.

(7) Repeat steps 4 & 6 (in that order) of paragraph 5-3d until further improvement is discernible on VTVM. Output shall be at least 5v at the output frequency for a 35 mv input of 1.75 mc input frequency.

(8) Steps 4 & 6 of paragraph 5-3d should be used to align all other bands. Refer to table 5-5. All bands are aligned at the end frequencies.

TABLE 5-5. ALIGNMENT CONTROLS and ADJUSTMENTS

DESCRIP- TION	LOCATION (Fig. 5-3)	BAND							
		1	2	3	4	5	6	7	8
OSC TUNER STRIP	1	L1013	L1021	L1053	L1054	L1055	L1042B	L1047B	L1052B
	2	C1047	C1073	C1093	C1113	C1132	C1151	C1172	C1193
RF TUNER STRIP	3	L1005	L1016	L1023	L1029	L1035	L1041	L1046	L1056
	4	C1024	C1065	C1086	C1108	C1135	C1154	C1175	C1200
	5	L1007	L1018	L1025	L1031	L1138	L1043	L1049	L1060
	6	C1027	C1068	C1089	C1116	C1137	C1157	C1179	C1204
	7	L1008	L1019	L1026	L1033	L1039	L1044	L1050	L1061
	8	C1030	C1078	C1098	C1120	C1140	C1160	C1184	C1209
	9	L1009	L1020	L1028	L1034	L1040	L1045	L1051	L1062
	10	C1033	C1081	C1103	C1125	C1144	C1164	C1189	C1215

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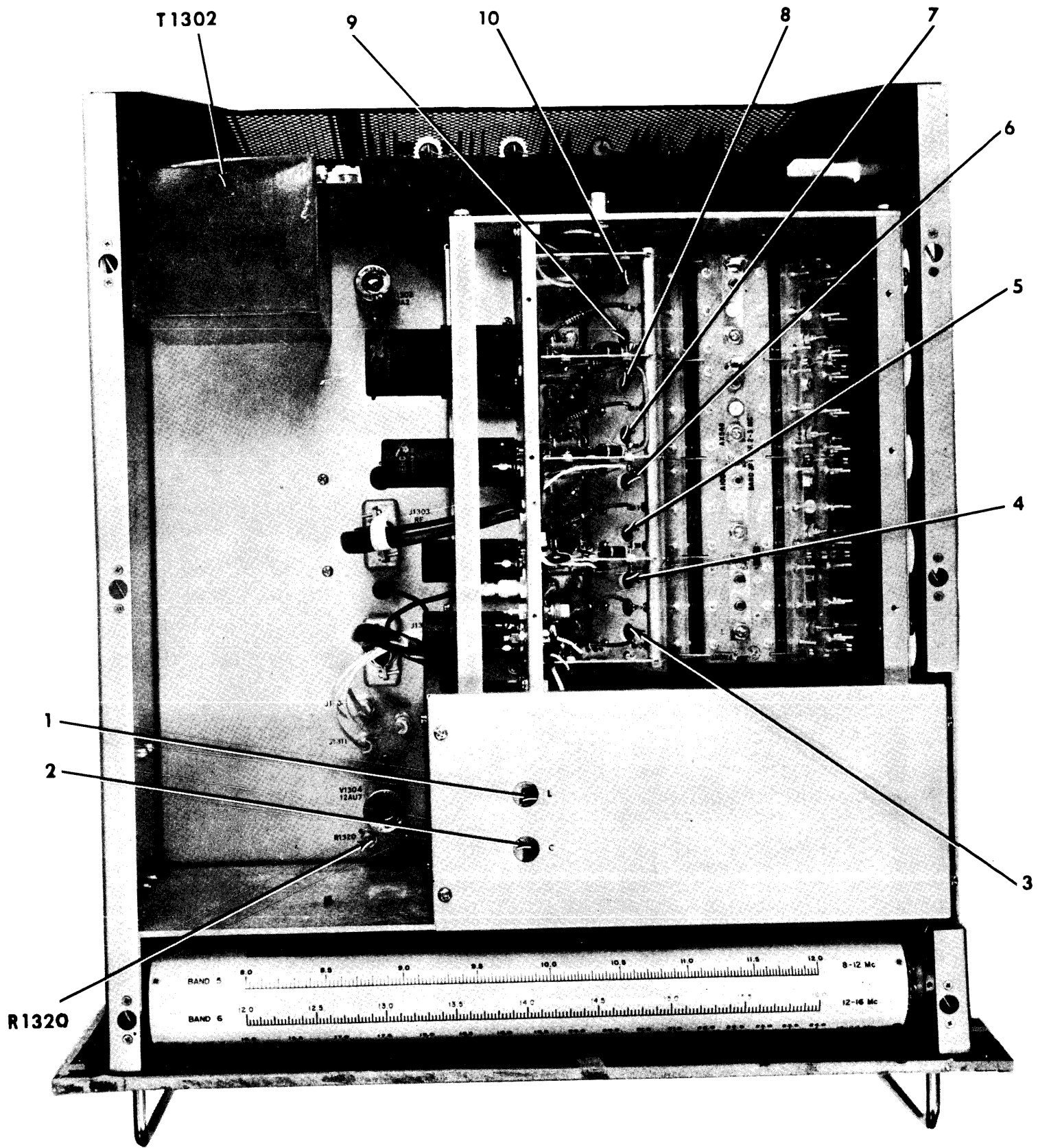
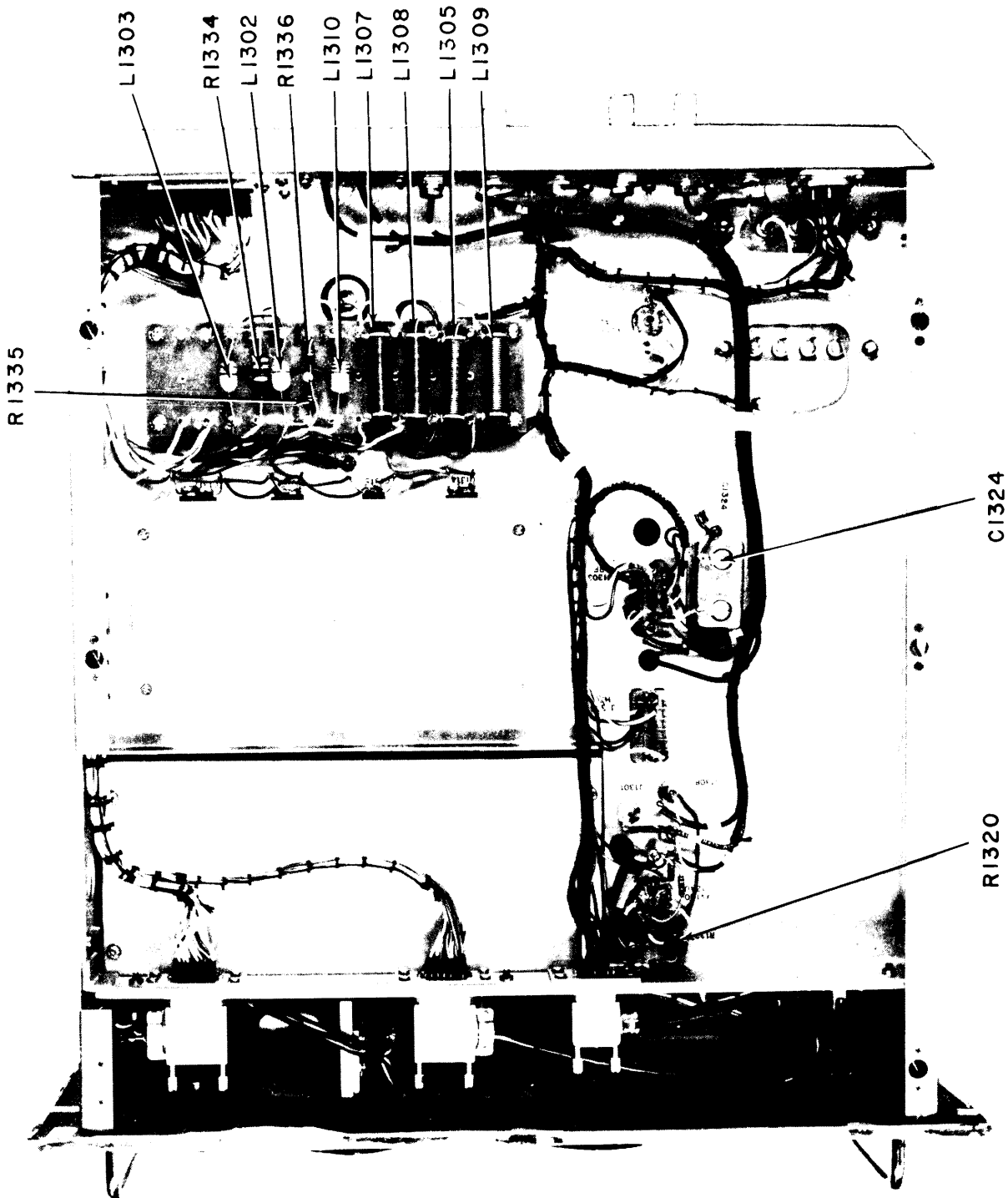


Figure 5-3. Alignment Controls and Adjustment Locations



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Figure 5-4. Bottom View, CHGR

SECTION 6

PARTS LIST

6-1. INTRODUCTION

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

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

- a. Generic name.
- b. Reference designation.
- c. TMC part number.
- d. Model and serial numbers of the equipment containing the part being replaced; this can be obtained from the equipment nameplate.

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

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

PARTS LIST
for
MODEL CHGR-3A

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
AT1301	DUMMY LOAD, ELECTRICAL: 47 ohm resistance, BNC connector type.	DL100-4
AT1302	Same as AT1301.	
AT1303	Same as AT1301.	
A1001	TERMINAL BOARD SUB-ASSEMBLY, RF, BAND #1: consists of one insulated board; 14 capacitors, C1019, C1020, C1024, C1025, C1026, C1027, C1028, C1029, C1030, C1031, C1032, C1033, C1037, C1059; 5 coils, L1005, L1006, L1007, L1008, L1009; 2 resistors, R1033, R1034; 3 transformers, T1002, T1003, T1004; misc. hardware, wire and sleeving.	AX548
A1002	TERMINAL BOARD SUB-ASSEMBLY, OSCILLATOR, BAND #1: consists of one insulated board; 6 capacitors, C1043, C1044, C1045, C1046, C1047, C1054; 2 coils, L1012, L1013; misc. hardware, wire and sleeving.	AX482
A1003	TERMINAL BOARD SUB-ASSEMBLY, RF, BAND #2: consists of one insulated board; 14 capacitors, C1011, C1021, C1057, C1065, C1066, C1067, C1068, C1069, C1076, C1077, C1078, C1079, C1080, C1081; 5 coils, L1016, L1017, L1018, L1019, L1020; 2 resistors, R1050, R1051; 3 transformers, T1005, T1006, T1007; misc. hardware, wire and sleeving.	AX549
A1004	TERMINAL BOARD SUB-ASSEMBLY, OSCILLATOR, BAND #2: consists of one insulated board; 6 capacitors, C1070, C1071, C1072, C1073, C1074, C1075; 2 coils, L1021, L1022; misc. hardware, wire and sleeving.	AX483
A1005	TERMINAL BOARD SUB-ASSEMBLY, RF, BAND #3: consists of one insulated board; 14 capacitors, C1022, C1023, C1086, C1087, C1088, C1089, C1095, C1096, C1097, C1098, C1099, C1101, C1102, C1103; 5 coils, L1023, L1024, L1025, L1026, L1028; 2 resistors, R1052, R1053; 3 transformers, T1008, T1009, T1010; misc. hardware, wire and sleeving.	AX550

PARTS LIST (CONT)

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
A1006	TERMINAL BOARD SUB-ASSEMBLY, OSCILLATOR, BAND #3: consists of one insulated board; 5 capacitors, C1090, C1091, C1092, C1093, C1094; 2 coils, L1027, L1053; misc. hardware, wire and sleeving.	AX484
A1007	TERMINAL BOARD SUB-ASSEMBLY, RF, BAND #4: consists of one insulated board; 14 capacitors, C1060, C1061, C1108, C1111, C1115, C1116, C1117, C1118, C1119, C1120, C1121, C1122, C1123, C1124, C1125; 5 coils, L1029, L1030, L1031, L1033, L1034; 2 resistors, R1054, R1055; 3 transformers, T1011, T1012, T1013; misc. hardware, wire and sleeving.	AX551
A1008	TERMINAL BOARD SUB-ASSEMBLY, OSCILLATOR, BAND #4: consists of one insulated board; 5 capacitors, C1109, C1110, C1112, C1113, C1114; 2 coils, L1032, L1054; misc. hardware, wire and sleeving.	AX485
A1009	TERMINAL BOARD SUB-ASSEMBLY, RF, BAND #5: consists of one insulated board; 14 capacitors, C1034, C1062, C1063, C1128, C1135, C1136, C1137, C1138, C1139, C1140, C1141, C1142, C1143, C1144; 5 coils, L1035, L1036, L1038, L1039, L1040; 1 resistor, R1056; 3 transformers, T1014, T1015, T1016; misc. hardware, wire and sleeving.	AX552
A1010	TERMINAL BOARD SUB-ASSEMBLY, OSCILLATOR, BAND #5: consists of one insulated board; 5 capacitors, C1129, C1130, C1131, C1132, C1133; 2 coils, L1037, L1055; misc. hardware, wire and sleeving.	AX486
A1011	TERMINAL BOARD SUB-ASSEMBLY, RF, BAND #6: consists of one insulated board; 14 capacitors, C1064, C1082, C1154, C1155, C1156, C1157, C1158, C1159, C1160, C1161, C1162, C1163, C1164, C1216; 4 coils, L1041, L1044, L1045, L1048; 2 resistors, R1057, R1058; 3 transformers, T1017, T1019, T1020; misc. hardware, wire and sleeving.	AX553

PARTS LIST (CONT)

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
A1012	TERMINAL BOARD SUB-ASSEMBLY, OSCILLATOR, BAND #6: consists of one insulated board; 5 capacitors, C1148, C1149, C1150, C1151, C1152; 2 coils, L1042A, L1042B; misc. hardware, wire and sleeving.	AX487
A1013	TERMINAL BOARD SUB-ASSEMBLY, RF, BAND #7: consists of one insulated board; 18 capacitors, C1083, C1084, C1167, C1175, C1176, C1177, C1178, C1179, C1180, C1181, C1182, C1183, C1184, C1185, C1186, C1187, C1188, C1189; 4 coils, L1046, L1049, L1050, L1051; 2 resistors, R1068, R1069; 4 transformers, T1018, T1021, T1022, T1023; misc. hardware, wire and sleeving.	AX554
A1014	TERMINAL BOARD SUB-ASSEMBLY, OSCILLATOR, BAND #7: consists of one insulated board; 5 capacitors, C1169, C1170, C1171, C1172, C1173; 2 coils, L1047A, L1047B; misc. hardware, wire and sleeving.	AX488
A1015	TERMINAL BOARD SUB-ASSEMBLY, RF, BAND #8: consists of one insulated board; 19 capacitors, C1085, C1104, C1196, C1200, C1201, C1202, C1203, C1204, C1205, C1206, C1207, C1208, C1209, C1210, C1211, C1212, C1213, C1214, C1215; 4 coils, L1056, L1060, L1061, L1062; 4 transformers, T1024, T1025, T1026, T1027; misc. hardware, wire and sleeving.	AX555
A1016	TERMINAL BOARD SUB-ASSEMBLY, OSCILLATOR, BAND #8: consists of one insulated board; 5 capacitors, C1190, C1191, C1192, C1193, C1194; 2 coils, L1052A, L1052B; misc. hardware, wire and sleeving.	AX489
B1001	MOTOR, CONTROL SERVO: fixed phase- 115 volts, 0.063 amps, 6.4 watts; control phase-series connected, 40 volts, 0.182 amps, 6.4 watts; motor control frequency 50/60 cps, no load speed 3,200 RPM; max. power output 1.1 watts, 1,600 RPM at max. power output; operating temperature range 0°C to +55°C; anodized black case.	MO123

PARTS LIST (CONT)

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
B1002	MOTOR, INDUCTION: AC; 115 volts, +10%; 50/60 cps; 1 phase int. duty; counterclockwise rotation; 1,755 RPM; black anodized case.	MO122-2
C1001A,B, C,D,E,F, G,H	CAPACITOR, VARIABLE, AIR: RF tuning; counterclockwise rotation; section 1A, 0.0 to 50.0 uuf, +1 uuf; section 1B, 0.0 to 100.0 uuf, +1.5 uuf; section 2A, 3A, 4A, trim to +0.75 uuf; section 2B, 3B, 4B, trim to +1 uuf; rotation at 5, 25, 50, 75, 95%; rated for 700 V RMS, 60 cycles.	CB165
C1002A,B	CAPACITOR, VARIABLE, AIR: oscillator tuning; counterclockwise rotation; section 1A, 0.0 to 50.0 uuf, +1 uuf; section 1B, 0.0 to 100.0 uuf, +1 uuf; rotation at 5, 10, 20, 25, 30, 40, 50, 60, 70, 75, 80, 90, 95 percent; rated for 700 V RMS, 60 cycles.	CB164
C1003	CAPACITOR, FIXED, MICA DIELECTRIC: 1,000 uuf, +1%; 100 WVDC; straight wire leads.	CM111F102F1S
C1004	CAPACITOR, FIXED, MICA DIELECTRIC: 2,000 uuf, +2%; 500 WVDC; straight wire leads.	CM112F202G5S
C1005	Same as C1004.	
C1006	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 10,000 uuf, GMV; 500 WVDC.	CC100-16
C1007	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 2,200 uuf, GMV; 500 WVDC.	CC100-11
C1008 thru C1010	Same as C1007.	
C1011	Non-replaceable item. Part of A1003.	
C1012	Same as C1007.	
C1013	Same as C1006.	
C1014	Same as C1007.	
C1015	Same as C1006.	
C1016	Same as C1007.	

PARTS LIST (CONT)

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C1017	Same as C1006.	
C1018	Same as C1006.	
C1019	Non-replaceable item. Part of A1001.	
C1020	Non-replaceable item. Part of A1001.	
C1021	Non-replaceable item. Part of A1003.	
C1022	Non-replaceable item. Part of A1005.	
C1023	Non-replaceable item. Part of A1005.	
C1024 thru C1033	Non-replaceable item. Part of A1001.	
C1034	Non-replaceable item. Part of A1009.	
C1035	CAPACITOR, FIXED, ELECTROLYTIC: tantalum; 50 uf, +50% -15%; 60 WVDC; polarized; tubular case.	CE107-1
C1036	Same as C1006.	
C1037	Non-replaceable item. Part of A1001.	
C1038 thru C1041	Same as C1006.	
C1042	CAPACITOR, FIXED, MICA DIELECTRIC: 1,000 uuf, +2%; 500 WVDC; straight wire leads.	CM112F102G5S
C1043 thru C1047	Non-replaceable item. Part of A1002.	
C1048	CAPACITOR, FIXED, MICA DIELECTRIC: 22 uuf, +5%; 500 WVDC; char. C.	CM15C220J
C1049	CAPACITOR, VOLTAGE VARIABLE, SILICON: 14 to 120 uuf range; 50 WVDC; hermetically sealed glass to metal.	CX106-12
C1050	Same as C1004.	

PARTS LIST (CONT)

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C1051	CAPACITOR, VOLTAGE VARIABLE, SILICON: 7 to 70 uuf range; 65 WVDC; hermetically sealed glass to metal.	CX106-11
C1052	Same as C1006.	
C1053	CAPACITOR, FIXED, MICA DIELECTRIC: 10 uuf, +10%; 500 WVDC; char. B.	CM15B100K
C1054	Non-replaceable item. Part of A1002.	
C1055	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 20, 000 uuf, +80% -20%; 500 WVDC.	CC100-24
C1056	Same as C1006.	
C1057	Non-replaceable item. Part of A1003.	
C1058	Same as C1006.	
C1059	Non-replaceable item. Part of A1001.	
C1060	Non-replaceable item. Part of A1007.	
C1061	Non-replaceable item. Part of A1007.	
C1062	Non-replaceable item. Part of A1009.	
C1063	Non-replaceable item. Part of A1009.	
C1064	Non-replaceable item. Part of A1011.	
C1065 thru C1069	Non-replaceable item. Part of A1003.	
C1070 thru C1075	Non-replaceable item. Part of A1004.	
C1076 thru C1081	Non-replaceable item. Part of A1003.	
C1082	Non-replaceable item. Part of A1011.	
C1083	Non-replaceable item. Part of A1013.	
C1084	Non-replaceable item. Part of A1013.	

PARTS LIST (CONT)

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C1085	Non-replaceable item. Part of A1015.	
C1086 thru C1089	Non-replaceable item. Part of A1005.	
C1090 thru C1094	Non-replaceable item. Part of A1006.	
C1095 thru C1099	Non-replaceable item. Part of A1005.	
C1100	NOT USED	
C1101	Non-replaceable item. Part of A1005.	
C1102	Non-replaceable item. Part of A1005.	
C1103	Non-replaceable item. Part of A1005.	
C1104	Non-replaceable item. Part of A1015.	
C1105	Same as C1006.	
C1106	Same as C1006.	
C1107	NOT USED	
C1108	Non-replaceable item. Part of A1007.	
C1109	Non-replaceable item. Part of A1008.	
C1110	Non-replaceable item. Part of A1008.	
C1111	Non-replaceable item. Part of A1007.	
C1112 thru C1114	Non-replaceable item. Part of A1008.	
C1115 thru C1121	Non-replaceable item. Part of A1007.	
C1122	NOT USED	

PARTS LIST (CONT)

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C1123 thru C1125	Non-replaceable item. Part of A1007.	
C1126	NOT USED	
C1127	NOT USED	
C1128	Non-replaceable item. Part of A1009.	
C1129 thru C1133	Non-replaceable item. Part of A1010.	
C1134	NOT USED	
C1135 thru C1144	Non-replaceable item. Part of A1009.	
C1145 thru C1147	NOT USED	
C1148 thru C1152	Non-replaceable item. Part of A1012.	
C1153	NOT USED	
C1154 thru C1164	Non-replaceable item. Part of A1011.	
C1165	NOT USED	
C1166	NOT USED	
C1167	Non-replaceable item. Part of A1013.	
C1168	NOT USED	
C1169 thru C1173	Non-replaceable item. Part of A1014.	
C1174	NOT USED	

PARTS LIST (CONT)

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C1175 thru C1189	Non-replaceable item. Part of A1013.	
C1190 thru C1194	Non-replaceable item. Part of A1016.	
C1195	NOT USED	
C1196	Non-replaceable item. Part of A1015.	
C1197 thru C1199	NOT USED	
C1200 thru C1215	Non-replaceable item. Part of A1015.	
C1216	Non-replaceable item. Part of A1011.	
C1301 thru C1312	NOT USED	
C1313	Same as C1006.	
C1314	CAPACITOR, FIXED, ELECTROLYTIC: 2,600 uf; 50 WVDC; polarized; tubular case.	CE112-3
C1315	Same as C1314.	
C1316	Same as C1314.	
C1317	CAPACITOR, FIXED, ELECTROLYTIC: 1,700 uf; 75 WVDC; polarized; tubular case.	CE112-2
C1318	Same as C1055.	
C1319	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 100, 000 uuf, +80% -20%; 300 WVDC.	CC100-37
C1320	Same as C1319.	
C1321	Same as C1055.	
C1322	Same as C1055.	

PARTS LIST (CONT)

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C1323	CAPACITOR, FIXED, MICA DIELECTRIC: 1,000 uuf, <u>+2%</u> ; 500 WVDC; char. F.	CM20F102G03
C1324	CAPACITOR, FIXED, ELECTROLYTIC	CE64C100N
C1325	Same as C1319.	
C1326	Same as C1319.	
C1327	Same as C1006.	
C1328 thru C1335	Same as C1319.	
C1336	Same as C1006.	
C1337	Same as C1006.	
C1338	Same as C1319.	
CR1001	SEMICONDUCTOR DEVICE, DIODE	1N100
CR1301	SEMICONDUCTOR DEVICE, DIODE: silicon; 100 V max. peak inverse voltage; 300 ma max. continuous forward current at 150°C; one solder stud, one 10-32 thd stud type terminals; hermetically sealed metal and glass case.	1N1582R
CR1302	Same as CR1301.	
CR1303	SEMICONDUCTOR DEVICE, DIODE: silicon; 100 V max. peak inverse voltage; 300 ma max. continuous forward current at 150°C; one solder stud, one 10-32 thd stud type terminals; hermetically sealed metal and glass case.	1N1582
CR1304	Same as CR1303.	
CR1305	SEMICONDUCTOR DEVICE, DIODE: silicon; Zener type; 27 volts, +5% nominal Zener voltage; 1,500 ma max. DC Zener current at 75°C; one solder stud, one 10-32 thd stud type terminals; hermetically sealed metal and glass case.	1N3323B

PARTS LIST (CONT)

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
CR1306	SEMICONDUCTOR DEVICE, DIODE: silicon; Zener type; 6.5 volts, +20% nominal Zener voltage; 1,350 ma max. DC Zener current at 75°C; one solder stud, one 10-32 thd stud type terminals; hermetically sealed glass case.	VR101-6.5S5
DS1001	LAMP, GLOW: 110/125 volts, 1/15 watt; mid-get flange base; T-2 type blub.	BI111-1
DS1002	LAMP, INCANDESCENT: 6-8 volts, 0.25 amp; bayonet base; T-3-1/4 bulb.	BI101-44AF
DS1003 thru DS1005	Same as DS1002.	
EV1001	NOT USED	
EV1002	SHIELD, ELECTRON TUBE	TS102U02
EV1003	Same as EV1002.	
EV1004	Same as EV1002.	
EV1005	SHIELD, ELECTRON TUBE	TS103U03
EV1006	Same as EV1002.	
EV1007	Same as EV1002.	
EV1301	NOT USED	
EV1302	Same as EV1002.	
EV1303	NOT USED	
EV1304	SHIELD, ELECTRON TUBE	TS103U02
G1001	GENERATOR, TACHOMETER: 60 cycle fixed phase, 26 volts, 0.121 amps, power input 2.86 watts; motor control- 50/60 cps, 0-3,600 RPM; operating temperature range 0°C to +55°C; stainless steel case.	GN100
J1001	CONNECTOR, RECEPTACLE, ELECTRICAL: 1 round female contact, straight type; series BNC to BNC.	JJ172
J1002	NOT USED	

PARTS LIST (CONT)

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
J1003	CONNECTOR, RECEPTACLE, ELECTRICAL: RF type; 1 round male contact, straight type; series BNC to BNC.	JJ211
J1301	Same as J1003.	
J1302	CONNECTOR, RECEPTACLE, ELECTRICAL: RF type; 1 round female contact, straight type; series BNC to BNC.	UG625B/U
J1303	CONNECTOR, RECEPTACLE, ELECTRICAL: female; 3 number 16 contacts rated at 20 amps, 12 number 20 contacts rated at 7.5 amps.	JJ256-2S
J1304	Same as J1001.	
J1305	CONNECTOR, RECEPTACLE, ELECTRICAL: 14 #16 male contacts, rated at 17.0 amperes.	JJ200-2
J1306	Same as J1303.	
J1307	Same as J1001.	
J1308	Same as J1003.	
J1309	NOT USED	
J1310	Same as J1001.	
J1311	Same as J1003.	
J1312	Same as J1302.	
J1313	Same as J1302.	
J1314	CONNECTOR, RECEPTACLE, ELECTRICAL: 20 number 20 female contacts, gold over silver plated spring tempor phosphor bronze; rated for 1,900 volts RMS at sea level; sub-miniature type.	JJ242-6S
J1315	Same as J1314.	
J1316	CONNECTOR, RECEPTACLE, ELECTRICAL: 27 male crimp pins removable style contacts, rated for 5 amps, 500 volts RMS; connector shape polarization.	JJ313-3
J1317	CONNECTOR, RECEPTACLE, ELECTRICAL: female.	JJ242-5S

PARTS LIST (CONT)

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
L1001	COIL, RADIO FREQUENCY: fixed; 120 uh, +5%; 2.9 ohms DC resistance; 330 ma current rating; molded case.	CL275-121
L1002	COIL, RADIO FREQUENCY: fixed; 22.0 uh, +10%; 0.9 ohms max. DC resistance; powdered iron coil form; molded case.	CL240-22
L1003	Same as L1002.	
L1004	Same as L1002.	
L1005 thru L1009	Non-replaceable item. Part of A1001.	
L1010	NOT USED	
L1011	COIL, RADIO FREQUENCY: fixed; 1.0 uh, +5%; 0.062 ohms DC resistance; 2,300 ma current rating; molded case.	CL275-1R0
L1012	Non-replaceable item. Part of A1002.	
L1013	Non-replaceable item. Part of A1002.	
L1014	COIL, RADIO FREQUENCY: fixed; 120.0 uh, +10%; 3.2 ohms DC resistance; molded case.	CL240-120
L1015	NOT USED	
L1016 thru L1020	Non-replaceable item. Part of A1003.	
L1021	Non-replaceable item. Part of A1004.	
L1022	Non-replaceable item. Part of A1004.	
L1023 thru L1026	Non-replaceable item. Part of A1005.	
L1027	Non-replaceable item. Part of A1006.	
L1028	Non-replaceable item. Part of A1005.	
L1029 thru L1031	Non-replaceable item. Part of A1007.	

PARTS LIST (CONT)

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
L1032	Non-replaceable item. Part of A1008.	
L1033	Non-replaceable item. Part of A1007.	
L1034	Non-replaceable item. Part of A1007.	
L1035	Non-replaceable item. Part of A1009.	
L1036	Non-replaceable item. Part of A1009.	
L1037	Non-replaceable item. Part of A1010.	
L1038 thru L1040	Non-replaceable item. Part of A1009.	
L1041	Non-replaceable item. Part of A1011.	
L1042A,B	Non-replaceable item. Part of A1012.	
L1043 thru L1045	Non-replaceable item. Part of A1011.	
L1046	Non-replaceable item. Part of A1013.	
L1047A,B	Non-replaceable item. Part of A1014.	
L1048	Non-replaceable item. Part of A1011.	
L1049 thru L1051	Non-replaceable item. Part of A1013.	
L1052	Non-replaceable item. Part of A1016.	
L1053	Non-replaceable item. Part of A1006.	
L1054	Non-replaceable item. Part of A1008.	
L1055	Non-replaceable item. Part of A1010.	
L1056	Non-replaceable item. Part of A1015.	
L1057	CORE, TOROID: bead type; powdered iron.	CI120-1
L1058	Same as L1057.	
L1059	NOT USED	

PARTS LIST (CONT)

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
L1060 thru L1062	Non-replaceable item. Part of A1015.	
L1063	SOLENOID, ELECTRICAL: pull type; 1 coil; average current rating 6.5 amps, coil resistance 9 ohms, 115 volts, 60 cycle AC; 1/2" axial plunger stroke; 2 wire lead type terminals; steel case.	SZ101
L1064	Same as L1057.	
L1065	COIL, RADIO FREQUENCY	CL349-1
L1066	Same as L1065.	
L1067	Same as L1065.	
L1068	Same as L1057.	
L1301	NOT USED	
L1302	COIL, RADIO FREQUENCY: fixed.	CL140-3
L1303	Same as L1302.	
L1304	COIL, RADIO FREQUENCY: fixed.	CL100-5
L1305	COIL, RADIO FREQUENCY: fixed; 35 uh, $\pm 5\%$; 1 ohm DC resistance.	CL292
L1306	NOT USED	
L1307	COIL, RADIO FREQUENCY: fixed; 95 uh, $\pm 5\%$; 1 ohm DC resistance.	CL291
L1308	Same as L1307.	
L1309	Same as L1305.	
L1310	COIL, RADIO FREQUENCY: fixed; 2.5 uh, $\pm 10\%$; 26 ohms DC resistance; 100 ma current rating; molded case.	CL140-1
M1001	METER, ARBITRARY SCALE: movement 0-1 ma; approx. resistance, 2,000 ohms; black scale on white background; rectangular case.	MR160
M1002	METER, ARBITRARY SCALE	MR149

PARTS LIST (CONT)

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
MP1001	CLUTCH, MAGNETIC: coil rated for 24 VDC, 3.5 watts nominal.	CZ100
P1001	CONNECTOR, PLUG, ELECTRICAL: RF; 1 round female coaxial contact, straight type; miniature bayonet lock series.	PL204
P1002	Same as P1001.	
P1003	Same as P1001.	
P1004	CONNECTOR, PLUG, ELECTRICAL: male; 3 number 16 contacts rated at 23 amps, 12 number 20 contacts rated at 7.5 amps.	PL228-2P
P1005	CONNECTOR, PLUG, ELECTRICAL	PL225-5P
P1006	CONNECTOR, PLUG, ELECTRICAL: 20 number 20 male contacts, gold over silver plated brass; rated for 1,900 volts at sea level; 7.5 amps max.; sub-miniature type, anodized alumium hood.	PL225-6P
P1007	Same as P1006.	
P1008	Same as P1004.	
P1301	NOT USED	
P1302	Same as P1001.	
PS1001	SUPPRESSOR, PARASITIC	AX163
PS1002	Same as PS1001.	
R1001	RESISTOR, FIXED, COMPOSITION: 270 ohms, <u>+5%</u> ; 1/2 watt.	RC20GF271J
R1002	RESISTOR, FIXED, COMPOSITION: 6,800 ohms, <u>+5%</u> ; 1/2 watt.	RC20GF682J
R1003	Same as R1002.	
R1004	RESISTOR, FIXED, COMPOSITION: 470,000 ohms, <u>+5%</u> ; 1/2 watt.	RC20GF474J
R1005	RESISTOR, FIXED, COMPOSITION: 12 ohms, <u>+5%</u> ; 1/2 watt.	RC20GF120J

PARTS LIST (CONT)

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
R1006	RESISTOR, FIXED, COMPOSITION: 680 ohms, <u>+5%</u> ; 1/2 watt.	RC20GF681J
R1007	RESISTOR, VARIABLE, COMPOSITION: 250 ohms, <u>+10%</u> ; 1/2 watt; linear taper.	RV106UX8B-251A
R1008	Same as R1006.	
R1009	Same as R1005.	
R1010	RESISTOR, FIXED, COMPOSITION: 120 ohms, <u>+5%</u> ; 1/2 watt.	RC20GF121J
R1011	RESISTOR, VARIABLE, COMPOSITION: 250 ohms, <u>+10%</u> ; 2 watts.	RV4NAYS251A
R1012	RESISTOR, FIXED, COMPOSITION: 1,000 ohms, <u>+5%</u> ; 1/2 watt.	RC20GF102J
R1013	Same as R1005.	
R1014	RESISTOR, FIXED, COMPOSITION: 33,000 ohms, <u>+5%</u> ; 1/2 watt.	RC20GF333J
R1015	RESISTOR, FIXED, COMPOSITION: 100 ohms, <u>+5%</u> ; 1/2 watt.	RC20GF101J
R1016	Same as R1005.	
R1017	NOT USED	
R1018	RESISTOR, FIXED, COMPOSITION: 1,500 ohms, <u>+5%</u> ; 1/2 watt.	RC20GF152J
R1019	RESISTOR, FIXED, COMPOSITION: 24,000 ohms, <u>+5%</u> ; 1/2 watt.	RC20GF243J
R1020	RESISTOR, FIXED, COMPOSITION: 27,000 ohms, <u>+5%</u> ; 1/2 watt.	RC20GF273J
R1021	Same as R1005.	
R1022	RESISTOR, FIXED, COMPOSITION: 22 ohms, <u>+5%</u> ; 1/2 watt.	RC20GF220J
R1023	RESISTOR, FIXED, COMPOSITION: 220 ohms, <u>+5%</u> ; 1/2 watt.	RC20GF221J
R1024	Same as R1019.	

PARTS LIST (CONT)

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
R1025	RESISTOR, FIXED, COMPOSITION: 5,600 ohms, <u>+5%</u> ; 1/2 watt.	RC20GF562J
R1026	Same as R1005.	
R1027	RESISTOR, FIXED, COMPOSITION: 10 ohms, <u>+5%</u> ; 1/2 watt.	RC20GF100J
R1028	RESISTOR, FIXED, COMPOSITION: 820 ohms, <u>+5%</u> ; 1/2 watt.	RC20GF821J
R1029	Same as R1023.	
R1030	RESISTOR, FIXED, COMPOSITION: 68,000 ohms, <u>+5%</u> ; 1/2 watt.	RC20GF683J
R1031	NOT USED	
R1032	Same as R1007.	
R1033	Non-replaceable item. Part of A1001.	
R1034	Non-replaceable item. Part of A1001.	
R1035	RESISTOR, FIXED, COMPOSITION: 130 ohms, <u>+5%</u> ; 1/2 watt.	RC20GF131J
R1036	RESISTOR, FIXED, COMPOSITION: 22,000 ohms, <u>+5%</u> ; 1/2 watt.	RC20GF223J
R1037	RESISTOR, FIXED, COMPOSITION: 4,700 ohms, <u>+5%</u> ; 1/2 watt.	RC20GF472J
R1038	RESISTOR, FIXED, COMPOSITION: 1,200 ohms, <u>+5%</u> ; 1/2 watt.	RC20GF122J
R1039	RESISTOR, FIXED, COMPOSITION: 47,000 ohms, <u>+5%</u> ; 1/2 watt.	RC20GF473J
R1040	RESISTOR, FIXED, COMPOSITION: 100,000 ohms, <u>+5%</u> ; 1/2 watt.	RC20GF104J
R1041	Same as R1027.	
R1042	Same as R1027.	
R1043	Same as R1036.	
R1044	RESISTOR, FIXED, COMPOSITION: 1.2 megohms, <u>+5%</u> ; 1/2 watt.	RC20GF125J

PARTS LIST (CONT)

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
R1045	Same as R1044.	
R1046	RESISTOR, FIXED, COMPOSITION: 150,000 ohms, <u>+5%</u> ; 1/2 watt.	RC20GF154J
R1047	RESISTOR, FIXED, COMPOSITION: 47 ohms, <u>+5%</u> ; 1/2 watt.	RC20GF470J
R1048	Same as R1015.	
R1049	RESISTOR, FIXED, COMPOSITION: 10,000 ohms, <u>+5%</u> ; 1/2 watt.	RC20GF103J
R1050	Non-replaceable item. Part of A1003.	
R1051	Non-replaceable item. Part of A1003.	
R1052	Non-replaceable item. Part of A1005.	
R1053	Non-replaceable item. Part of A1005.	
R1054	Non-replaceable item. Part of A1007.	
R1055	Non-replaceable item. Part of A1007.	
R1056	Non-replaceable item. Part of A1009.	
R1057	Non-replaceable item. Part of A1011.	
R1058	Non-replaceable item. Part of A1011.	
R1059 thru R1061	NOT USED	
R1062	Non-replaceable item. Part of A1013.	
R1063	Non-replaceable item. Part of A1013.	
R1064	RESISTOR, FIXED, COMPOSITION: 47 ohms, <u>+5%</u> ; 1 watt.	RC32GF470J
R1065	Same as R1064.	
R1066	Same as R1064.	
R1301 thru R1319	NOT USED	

PARTS LIST (CONT)

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
R1320	RESISTOR, VARIABLE, COMPOSITION: 5,000 ohms, <u>+10%</u> ; 1/2 watt; linear taper.	RV106UX8B-502A
R1321	RESISTOR, FIXED, COMPOSITION: 1,800 ohms, <u>+5%</u> ; 1/2 watt.	RC20GF182J
R1322	Same as R1036.	
R1323	RESISTOR, FIXED, COMPOSITION: 3,300 ohms, <u>+5%</u> ; 1/2 watt.	RC20GF332J
R1324	Same as R1323.	
R1325 thru R1327	NOT USED	
R1328	Same as R1047.	
R1329	RESISTOR, FIXED, COMPOSITION: 390 ohms, <u>+5%</u> ; 1/2 watt.	RC20GF391J
R1330	RESISTOR, FIXED, WIREWOUND: 1.0 ohms, <u>+10%</u> ; 25 watts.	RE70G1R00
R1331	RESISTOR, FIXED, WIREWOUND: 15 ohms, <u>+1%</u> ; 50 watts.	RE75G15R0
R1332	Same as R1331.	
R1333	RESISTOR, FIXED, WIREWOUND: 80 ohms, <u>+10%</u> ; 25 watts.	RE70G80R0
R1334	RESISTOR, FIXED, COMPOSITION: 1,800 ohms, <u>+5%</u> ; 2 watts.	RC42GF182J
R1335	Same as R1040.	
R1336	RESISTOR, FIXED, COMPOSITION: 15,000 ohms, <u>+5%</u> ; 1/2 watt.	RC20GF153J
S1001 thru S1003	NOT USED	
S1004	SWITCH, SENSITIVE: with retainer; SPDT; current rating 5.0 amps at 125/250 VAC; 7 amps resistive; 4 amps inductive at 28 VDC; plastic body.	SW353-2

PARTS LIST (CONT)

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
S1005	Same as S1004.	
S1006	SWITCH, PUSH: actuator; DPDT; silver contacts; momentary plunger; solder end terminals.	SW347
S1007	SWITCH SECTION, WAFER: rotary; 1 pole, 24 positions max. per pole, shorting type; indexing 15°; contacts rated for 0.0025 ohms max.; silver alloy terminals.	WS133
T1001	TRANSFORMER, RADIO FREQUENCY	TT269
T1002 thru T1004	Non-replaceable item. Part of A1001.	
T1005 thru T1007	Non-replaceable item. Part of A1003.	
T1008 thru T1010	Non-replaceable item. Part of A1005.	
T1011 thru T1013	Non-replaceable item. Part of A1007.	
T1014 thru T1016	Non-replaceable item. Part of A1009.	
T1017	Non-replaceable item. Part of A1011.	
T1018	Non-replaceable item. Part of A1013.	
T1019	Non-replaceable item. Part of A1011.	
T1020	Non-replaceable item. Part of A1011.	
T1021 thru T1023	Non-replaceable item. Part of A1013.	
T1024 thru T1027	Non-replaceable item. Part of A1015.	

PARTS LIST (CONT)

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
T1028	TRANSORMER, RADIO FREQUENCY: fixed.	TR186
T1301	NOT USED	
T1302	TRANSFORMER, POWER, STEP-DOWN: primary input 115/230 volts, 50/400 cps, single phase; secondary 61 volts, center tap at 4 amps; hermetically sealed rectangular steel case.	TF244
V1001	NOT USED	
V1002	TUBE, ELECTRON	6GM5
V1003	TUBE, ELECTRON	6GK6
V1004	TUBE, ELECTRON: sharp-cutoff pentode; 7 pin miniature.	6AH6
V1005	TUBE, ELECTRON: medium-mu twin-triodes; 9 pin miniature.	12AU7
V1006	Same as V1004.	
V1007	TUBE, ELECTRON: high-mu triode; 7 pin miniature.	6AB4
V1301	NOT USED	
V1302	TUBE, ELECTRON: voltage regulator; 7 pin miniature.	OA2
V1303	NOT USED	
V1304	Same as V1005.	
XDS1001	LIGHT, INDICATOR: with white lens; accepts T-3-1/4 single contact, midget flange lamp.	TS154-1
XDS1002	LAMPHOLDER: accepts T-3-1/4 bayonet base lamp; no mounting bracket.	TS107-3
XDS1003	LAMPHOLDER: accepts T-3-1/4 bayonet base lamp, 1 terminal, no mounting bracket, case ground.	TS107-4

PARTS LIST (CONT)

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
XDS1004	Same as XDS1002.	
XDS1005	Same as XDS1003.	
XV1001	NOT USED	
XV1002	SOCKET, ELECTRON TUBE: 9 pin miniature.	TS179PPW
XV1003	SOCKET, ELECTRON TUBE: 9 pin miniature.	TS103P01
XV1004	SOCKET, ELECTRON TUBE: 7 pin miniature.	TS102P01
XV1005	Same as XV1003.	
XV1006	Same as XV1004.	
XV1007	Same as XV1004.	
XV1301	NOT USED	
XV1302	Same as XV1004.	
XV1303	NOT USED	
XV1304	Same as XV1003.	

SECTION 7
SCHEMATIC DIAGRAMS

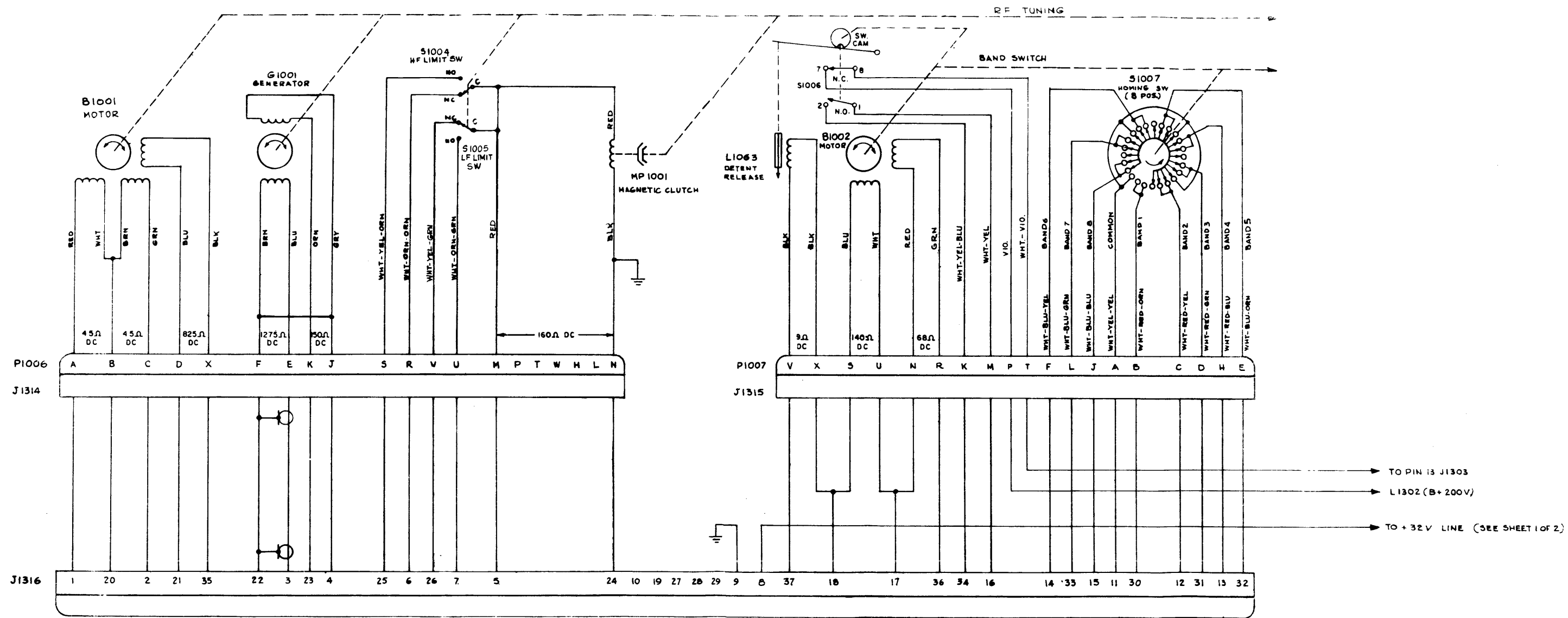


Figure 7-1. Schematic Diagram, CHGR-3. (Sheet 2 of 2)

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