

Serial no. 403

INSTRUCTION MANUAL

OSR-1

RECEIVER





STANDARD WARRANTY

R. L. DRAKE COMPANY warrants each new radio product manufactured by it to be free from defective material and workmanship and agrees to remedy any such defect or to furnish a new part in exchange for any part of any unit of its manufacture which under normal installation, use, and service discloses such defect, provided the unit is delivered by the owner to us or to our authorized radio dealer or wholesaler from whom purchased, intact, for our examination, with all transportation charges prepaid to our factory, within ninety days from the date of sale to original purchaser and provided that such examination discloses in our judgment that it is thus defective. Should a malfunction be suspected, write in detail to our Service Department for suggestions concerning the operation, repair or return of your unit if it should prove necessary.

This warranty does not extend to any of our radio products which have been subjected to misuse, neglect, accident, incorrect wiring not our own, improper installation, or to use in violation of instructions furnished by us, nor extend to units which have been repaired or altered outside our factory, nor in cases where the serial number thereof has been removed, defaced or changed, nor to units used with accessories not manufactured or recommended by us.

Any part of a unit approved for remedy or exchange hereunder will be remedied or exchanged by the authorized radio dealer or wholesaler without charge to the owner.

This warranty is in lieu of all other warranties expressed or implied and no representative or person is authorized to assume for us any other liability in connection with the sale of our radio products.

The R. L. DRAKE COMPANY reserves the right to make any improvements to its products which it may deem desirable without obligating itself to install such improvements in its previously manufactured products.



TABLE OF CONTENTS

		Page
CHAPTER I	INTRODUCTION	1-1
1-1.	GENERAL DESCRIPTION	1-1
1-2.	MANUAL COVERAGE	1-1
	SPECIFICATIONS	1-2
CHAPTER II	PREPARATION FOR USE	2-1
2-1.	UNPACKING	2-1
2-2.	LOCATION	2-1
2-3.	POWER REQUIREMENTS	2-1
2-4.	FUSES	2-1
2-5.	ANTENNAS	2-1
2-6.	SPEAKERS	2-1
2-7.	HEADPHONES	2-1
2-8.	MUTE	2-1
2-9.	IF OUTPUT	2-1
2-10.	ISB WIRING	2-2
2-11.	LINE AMP OUTPUT	2-2
2-12.	GROUND	2-2
2-13.	REPACKING	2-2
CHAPTER III	OPERATION	3-1
3-1.	CONTROLS AND DISPLAYS	3-1
3-2.	OPERATING PROCEDURES	3-1
3-5.	SINGLE OR DOUBLE SIDEBAND SUPPRESSED CARRIER RECEPTION	3-1
3-6.	CW RECEPTION	3-1
	FRONT PANEL CONTROLS	3-4
3-7.	AM RECEPTION (DOUBLE SIDEBAND)	3-4
3-8.	INDEPENDENT SIDEBAND (ISB) RECEPTION	3-4
CHAPTER IV	THEORY OF OPERATION	4-1
4-1.	GENERAL	4-1
4-7.	RF AMPLIFIER	4-2
4-8.	FIRST MIXER	4-2
4-9.	SECOND MIXER	4-2
4-10.	FIRST IF AMPLIFIER	4-3
4-11.	NOISE BLANKER	4-3
4-12.	THIRD MIXER (COMMUNICATIONS CHANNEL) AND SECOND IF AMPLIFIER	4-3

TABLE OF CONTENTS (continued)

		Page
4-13.	THIRD MIXER (ISB CHANNEL) AND SECOND IF AMPLIFIER	4-3
4-14.	FILTER AMPLIFIER	4-4
4-15.	PRODUCT DETECTOR (COMMUNICATIONS CHANNEL)	4-4
4-16.	PRODUCT DETECTOR AUDIO BUFFER (COMMUNICATIONS CHANNEL)	4-4
4-17.	AM DETECTOR AND AUDIO AMPLIFIER (COMMUNICATIONS CHANNEL)	4-4
4-18.	PRODUCT DETECTOR (ISB CHANNEL)	4-4
4-19.	PRODUCT DETECTOR AUDIO BUFFER (ISB CHANNEL)	4-4
4-20.	BFO	4-4
4-21.	AUDIO LINE AMPLIFIER (COMMUNICATIONS CHANNEL)	4-4
4-22.	AUDIO LINE AMPLIFIER (ISB CHANNEL)	4-4
4-23.	AUDIO POWER OUTPUT AMPLIFIER	4-5
4-24.	FREQUENCY SYNTHESIZER	4-5
4-25.	LOCKED OSCILLATOR INJECTION (VCO)	4-5
4-32.	FREQUENCY READOUT	4-7
4-37.	FREQUENCY COUNTER	4-8
4-38.	COUNTER OVERFLOW AND UNDERFLOW	4-9
4-39.	POWER SUPPLY	4-10
CHAPTER V	MAINTENANCE	5-1
5-1.	SERVICE DATA	5-1
5-2.	DISASSEMBLY AND REASSEMBLY	5-1
5-3.	SYNTHESIZER/RF ASSEMBLIES	5-1
5-4.	COUNTER NO. 1	5-1
5-5.	VFO AND DIAL LOCK	5-2
5-6.	INTEGRATED CIRCUITS	5-2
5-7.	TEST EQUIPMENT	5-2
5-8.	REPAIR AND REPLACEMENT	5-2
5-9.	PARTS ORDERING INFORMATION	5-2
5-10.	ALIGNMENT AND CALIBRATION	5-4
5-11.	IF SECTION ALIGNMENT	5-5
5-12.	IF ALIGNMENT – NORMAL CHANNEL	5-5
5-13.	IF ALIGNMENT – ISB	5-5
5-14.	NOISE BLANKER ALIGNMENT	5-5
5-15.	PRODUCT DETECTOR (BFO) COIL ALIGNMENT	5-4
5-16.	VARIABLE BFO ALIGNMENT	5-4
5-17.	AUDIO AMPLIFIER ALIGNMENT	5-5
5-18.	LINE AMPLIFIER ALIGNMENT	5-5

TABLE OF CONTENTS (continued)

	Page
5-19. SYNTHESIZER SECTION ALIGNMENT	5-5
5-20. VCO ALIGNMENT	5-5
5-21. BALANCED MIXER TUNING	5-6
5-22. RF AMPLIFIER ALIGNMENT	5-6
5-23. 20 MHz LOCKED OSCILLATOR ALIGNMENT	5-11
5-24. 25.05 MHz TRAP ADJUSTMENT	5-11
5-25. 5.05 MHz TRAP ADJUSTMENT	5-11
5-26. 15 VOLT POWER SUPPLY SETTING	5-11
5-27. S METER CALIBRATION	5-11
5-28. VFO CALIBRATION	5-11
5-29. FREQUENCY CALIBRATION	5-12
5-30. NOISE BLANKER ADJUSTMENT	5-12
5-31. MISCELLANEOUS TESTS	5-12
5-32. PARTS LISTS	5-12

LIST OF ILLUSTRATIONS

Figure		Page
1-1.	DSR-1 RECEIVER	1-2
2-1.	SWITCH TERMINALS FOR WIRING ISB FILTERS	2-3
2-2.	FILTER WIRING SCHEMATIC	2-3
3-1.	FRONT PANEL CONTROLS	3-2
4-1.	FUNCTIONAL BLOCK DIAGRAM	4-11
5-1.	PROPER ORIENTATION OF SWITCH WIPERS AT REASSEMBLY	5-3
5-2.	PROPER INSTALLATION OF INTEGRATED CIRCUITS	5-3
5-3.	ALIGNMENT LOCATIONS, TOP VIEW	5-7
5-4.	ALIGNMENT LOCATIONS, BOTTOM VIEW	5-8
5-5.	TOP VIEW WITH COVERS REMOVED	5-9
5-6.	BOTTOM VIEW WITH COVERS REMOVED	5-10
5-7.	COMPONENT LOCATIONS, TOP VIEW	5-14
5-8.	COMPONENT LOCATIONS, BOTTOM VIEW	5-16
5-9.	ANTENNA MODULE (A1)	5-18
5-10.	10-30 MHz INPUT (A2)	5-19
5-11.	1-10 MHz INPUT (A3)	5-20
5-12.	10-30 MHz OUTPUT (A4)	5-22
5-13.	1-10 MHz OUTPUT (A5)	5-24
5-14.	0-1 MHz OUTPUT (A6)	5-26
5-15.	VOLTAGE CONTROLLED OSCILLATOR (A7)	5-28
5-16.	BALANCED MIXER (A8)	5-30
5-17.	5 MHz STANDARD OSCILLATOR (A9)	5-32
5-18.	PROGRAMMABLE DIVIDER (A10)	5-35
5-19.	FIRST IF AND NOISE BLANKER (A11)	5-36
5-20.	SECOND IF AND AVC (A12)	5-38
5-21.	DETECTOR (A13)	5-42
5-22.	AUDIO AMPLIFIER (A14)	5-44
5-23.	BFO AND LINE AMPLIFIER (A15)	5-46
5-24.	POWER SUPPLY BOARD NO. 1 (A16-1)	5-48
5-25.	POWER SUPPLY BOARD NO. 2 (A16-2)	5-49
5-26.	COUNTER NO. 2 (A17)	5-50
5-27.	COUNTER NO. 1 (A18)	5-52
5-28.	VARIABLE FREQUENCY OSCILLATOR (A19)	5-54
5-29.	FILTER AMPLIFIER (A20)	5-56
5-30.	SYSTEM BLOCK DIAGRAM	5-57
5-31.	RF AMPLIFIER AND MIXER SCHEMATIC	5-58
5-32.	IF AMPLIFIER, AVC, DETECTOR AND AUDIO AMPLIFIER SCHEMATIC	5-60
5-33.	SYNTHESIZER, VFO AND VCO SCHEMATIC	5-60
5-34.	COUNTER SCHEMATIC	5-61
5-35.	POWER SUPPLY SCHEMATIC	5-62
5-36.	TRANSISTOR AND READOUT INDICATOR LEAD IDENTIFICATION	5-63

CHAPTER I

INTRODUCTION

1-1. GENERAL DESCRIPTION.

This receiver is a commercial grade communications receiver employing the most up to date solid state devices and circuitry. It provides continuous coverage from 10 kHz to 30 MHz with the received frequency displayed on a digital readout to the closest 100 Hz. All frequency injections of the receiver are controlled by a phase-locked digital synthesizer which allows incremental frequency selection in 10, 1 and 0.1 MHz steps. The remaining 0 to 0.1 MHz is continuously adjustable by a highly stable variable oscillator from the fine tuning knob on the front panel. Modular construction on easily accessible printed circuit boards is used throughout this receiver. The generous use of dual gate MOS-FET transistors in this receiver's circuitry contributes to its superior intermodulation, wide AVC dynamic range and overload performance. The front panel controls allow the operator to select frequency, AM or SSB detector, I.F. bandwidth, AF gain, BFO pitch, fast or normal AVC, manual RF gain, and Drake's highly effective series gate noise blanker. Independent sideband (ISB) is a built-in feature of the receiver. Separate I.F. crystal filters, I.F. amplifier, detector and audio output circuits allow two simultaneous communications channels (USB and LSB) to be employed on one frequency assignment,

doubling the information receiving capacity. The receiver may be powered from 115 or 230 VAC, 50 to 420 Hz. An inverter is available, as an accessory, for operating the receiver from a 12 or 24 VDC source.

1-2. MANUAL COVERAGE.

This manual is presented in 5 chapters and is arranged for the convenience of the operator and service technician as follows:

- | | |
|-------------|--|
| Chapter I | Introduction (Self explanatory) |
| Chapter II | Preparation for Use. Describes the procedures to be followed prior to operation. |
| Chapter III | Operation. Presents step-by-step front panel settings for optimum reception in each of the various modes. |
| Chapter IV | Theory of Operation. Describes all critical circuits and networks and references pertinent schematics and block diagrams. |
| Chapter V | Maintenance. Provides sufficient information for servicing by an experienced technician including illustrated parts lists, schematics, and critical disassembly/reassembly instructions. |

Serial no. 403



Figure 1-1. DSR-1 Receiver

SPECIFICATIONS

Frequency Range:	10 kHz to 30 MHz continuous coverage.
Modes of Operation:	USB, LSB, CW, RTTY, AM, ISB.
Frequency Readout:	Complete to 100 Hz on six Nixie tubes.
Frequency Selection:	10 MHz, 1 MHz, 0.1 MHz steps switch selected. 0 to 0.1 MHz continuously variable.
Frequency Stability:	Frequency drift does not exceed 200 Hz in any 8 hour period at constant ambient temperature between 0° and 40°C and $\pm 10\%$ variation from nominal line voltage after 1/2 hour warm up.
Sensitivity:	0.01-0.5 MHz: Less than 4 microvolts for 10 dB SINAD at 2.4 kHz SSB mode. Less than 25 microvolts for 10 dB SINAD at 6 kHz AM mode with 30% modulation. 0.5-30 MHz: Less than 0.3 microvolts for 10 dB SINAD at 2.4 kHz SSB mode. Less than 2 microvolts for 10 dB SINAD at 6 kHz AM mode with 30% modulation.
Image Rejection:	Greater than 60 dB relative to 1 microvolt below 10 MHz. Greater than 50 dB relative to 1 microvolt above 10 MHz.
IF Rejection:	Greater than 60 dB relative to 1 microvolt except in range of 4.5 to 5.5 MHz.

R. F. Blocking:	Greater than 100 dB relative to 1 microvolt. *Desired signal at 60 dB above 1 microvolt with a blocking signal removed 20 kHz and its amplitude adjusted to reduce desired signal 3 dB.		
Crossmodulation:	70 dB relative to 1 microvolt. *Desired signal at 60 dB above 1 microvolt with undesired signal removed 20 kHz and its amplitude adjusted for crossmodulation products 30 dB lower than desired signal.		
Intermodulation:	70 dB relative to 1 microvolt. *Level of two undesired signals, removed at least 30 kHz from the desired frequency, required to produce the equivalent audio output as a desired signal 30 dB greater than 1 microvolt.		
Opposite Sideband Suppression:	Greater than 60 dB at 500 Hz into the opposite sideband.		
I. F. Bandwidth (in kHz):	<u>Selectivity</u>	<u>-6 dB</u>	<u>-60 dB</u>
	6	6	11.5
	2.4	2.4	4.3
centered at 2.5 kHz USB	1.2	1.2	2.4
centered at 800 Hz USB	0.3	0.3	0.6
	Optional filters available for other bandwidths.		
Automatic Volume Control:	Audio output increases less than 3 dB for an RF input change of 110 dB.		
	Attack Time:	1 millisecond	
	Release Time:		
	(normal AVC)	1 second	
	(fast AVC)	100 milliseconds	
Antenna Input Impedance:	10 kHz to 500 kHz	1000 ohms	
	500 kHz to 30 MHz	50 ohms	
Antenna Input Protection:	The receiver has built-in protection to prevent damage from a 30 volt signal applied to the antenna for a 15 minute period.		
Audio Output:	Communications channel: 2 watts at 5% maximum distortion into 4 ohm load (4 ohms unbalanced). 1 milliwatt into 600 ohm load (600 ohms balanced and center tapped). ISB channel: 1 milliwatt into 600 ohm load (600 ohms balanced and center tapped).		
Audio Hum and Noise:	Greater than 60 dB below rated output.		
BFO:	Derived from 5 MHz standard oscillator, or variable over a \pm 3 kHz range from front panel control.		
Power Requirements:	120/240 volts \pm 10% single phase 50 to 420 Hz, 35 watts.		
Dimensions:	5.25 in. High x 19 in. Wide x 15 in. Deep. 13.3 cm High x 48 cm Wide x 38 cm Deep.		
Weight:	17 lbs. (7.7 kg). *Measurement Procedure		

NOTES

CHAPTER II

PREPARATION FOR USE

2-1. UNPACKING.

Carefully remove the receiver from the shipping carton, and examine it for evidence of damage. If any damage is discovered, immediately notify the transportation company that delivered the receiver. Be sure to keep the shipping carton and packing material, as the transportation company will want to examine them if there is a damage claim. Keep the carton and packing material even if no shipping damage occurs. Having the original carton available makes packing the receiver much easier should it ever be necessary to store it or return it to the factory for service.

NOTE

Fill out the enclosed registration card and return it to the factory immediately to insure registration and validation of the warranty.

2-2. LOCATION.

The standard receiver is designed for bench top use but may be used in almost any location.

2-3. POWER REQUIREMENTS.

CAUTION

DO NOT PLUG THE RECEIVER INTO ANY VOLTAGE OUTLET WITHOUT CHECKING THE REAR OF THE CHASSIS FOR THE CORRECT INPUT VOLTAGE.

The standard receiver is shipped from the factory wired for 115 VAC 50/60 Hz operation unless specified otherwise. To operate on 240 VAC, make the jumper connections at the power supply terminal board as illustrated in figure 5-35. A decal above the input power cord at the rear of the chassis specifies the correct input voltage, as shipped from the factory, if it is *other than* 115 VAC. If it is wired for 115 VAC, there is no decal.

2-4. FUSES.

Two fuses are located on the rear of the chassis. The 5 VDC fuse is a Buss Type MDL 1 amp or equivalent. The power line fuse for 115 VAC operation is a Buss Type MDL 3/4 amp or equivalent. For 240 VAC operation use a Buss Type MDL 3/8 amp or equivalent in place of the 3/4 amp fuse.

2-5. ANTENNAS.

The receiver operates most efficiently with a 1,000 ohm antenna through the frequency range of 10 kHz to 500 kHz and a 50 ohm antenna through the frequency range of 500 kHz to 30 MHz. Connect the antenna to the coaxial connector (SO 239) labeled ANT on the rear of the chassis.

2-6. SPEAKERS.

The receiver has a built-in 3" x 5" ceramic magnet, 4 ohm speaker. An external speaker may also be used by plugging it into the jack labeled EXT SPKR on the rear of the chassis. The external speaker jack is connected in parallel with the built-in speaker.

2-7. HEADPHONES.

Headphones of any impedance may be used. When they are plugged into the jack labeled PHONES on the front panel the internal and external speakers are disconnected.

2-8. MUTE.

A shorted phono plug is supplied with the receiver and is normally installed in the jack labeled MUTE on the rear of the chassis. The receiver is muted with the plug removed; however, muting may be accomplished remotely by opening the MUTE jack.

2-9. IF OUTPUT (50 kHz).

A standard phono jack on the rear of the chassis

labeled 50 kHz IF provides an output of 50 millivolts into 50 ohms at the 2nd IF frequency of 50 kHz.

2-10. ISB WIRING.

The receiver is not factory wired for Independent Sideband (ISB) operation unless the user requests this service through R. L. Drake Co. Sales Department prior to delivery. The Independent Sideband capability is a built-in feature of each receiver, but, unless requested otherwise prior to delivery, each standard receiver is shipped with the ISB partially connected to allow the user to wire in the filters which suit his requirements. The standard receiver is shipped from the factory with the LSB filter wired in for channel A. Channel B is open. Three of the five filters supplied with the standard receiver may be rewired for the ISB channel B. These are: the USB filter (2.4 kHz), the 1.2 kHz filter and the 0.3 kHz filter. If the user requires filters for other bandwidths than those provided in the standard receiver it will be necessary to remove one or two of the existing filters and replace them with filters for the required bandwidths. Filters for other bandwidths are available from R. L. Drake Co., Customer

*5.05/9.0
AM kHz
filter*

Service Department. Refer to figures 2-1 and 2-2. These figures illustrate the wiring connections required for ISB operation.

2-11. LINE AMP OUTPUT.

The terminal block on the rear of the chassis provides two 600 ohm centertapped balanced audio outputs at a level of 1 milliwatt. The 3 terminals labeled NORM provide the same audio channel supplied to the speakers and headphones. The 3 terminals labeled ISB provide the independent sideband audio output.

2-12. GROUND.

Connect the post labeled GND on the rear of the chassis to solid earth ground.

2-13. REPACKING.

Repack the receiver for shipment or storage using the original shipping carton and packing material. If the original carton is not available, new cartons and packing material are available from the factory at a nominal cost.

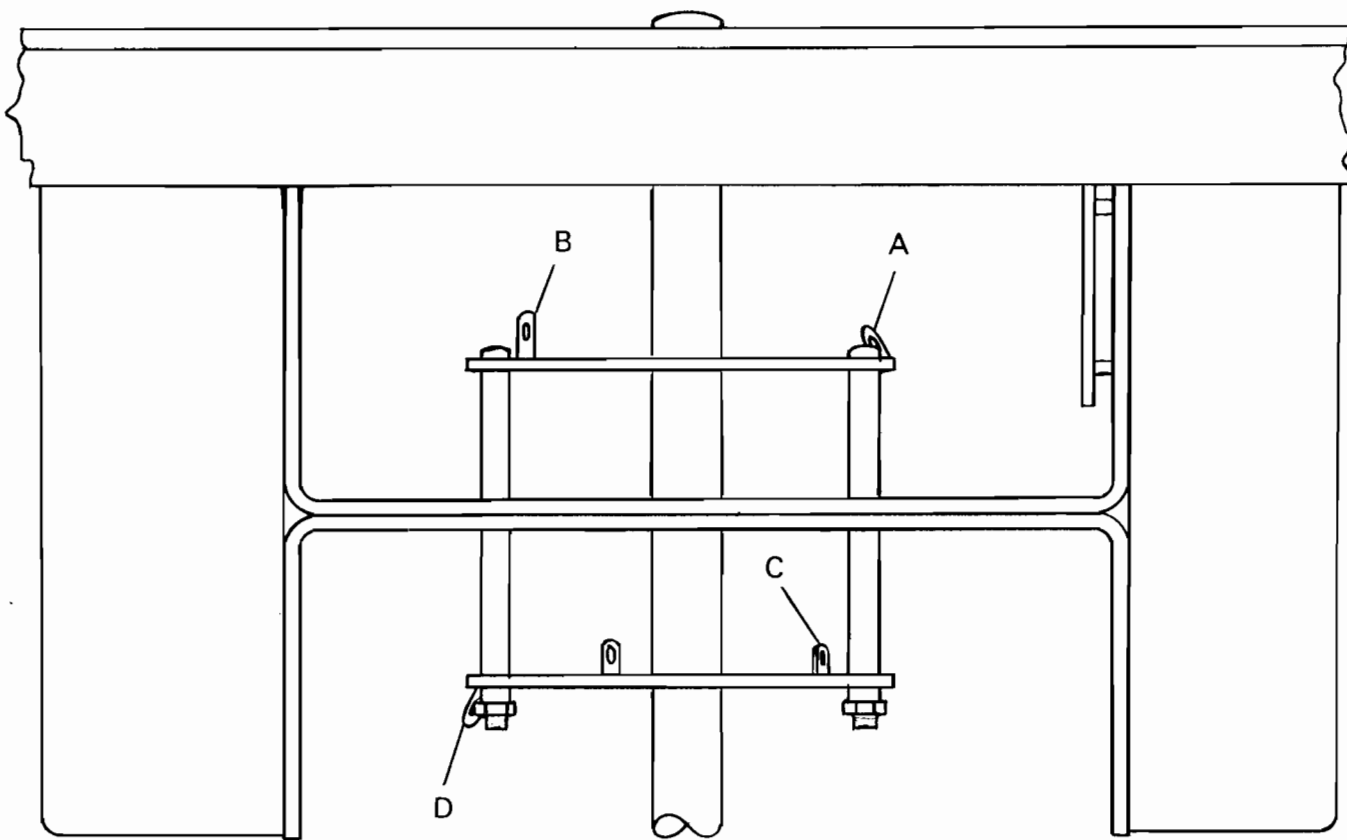


Figure 2-1. Switch Terminals for Wiring ISB Filters

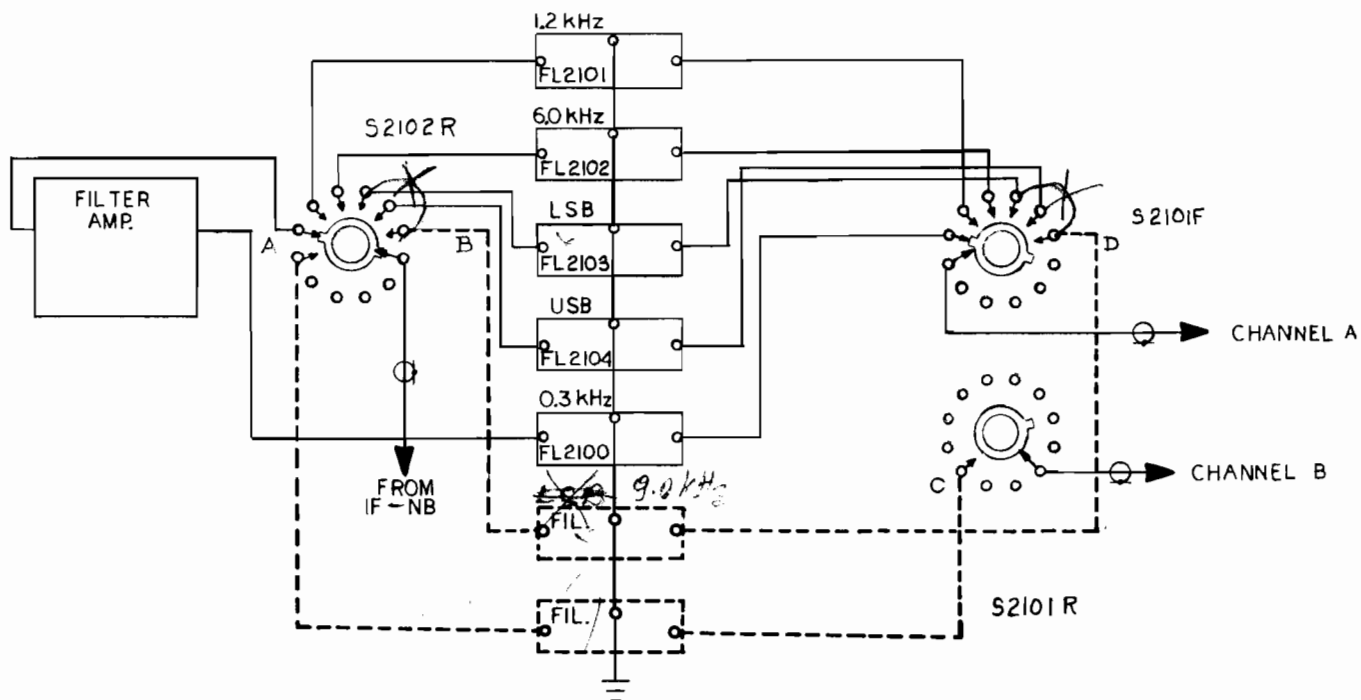


Figure 2-2. Filter Wiring Schematic

NOTES

CHAPTER III OPERATION

3-1. CONTROLS AND DISPLAYS.

All controls and displays necessary for the proper operation of the receiver are located on the front panel. Figure 3-1 illustrates and describes all controls and displays.

NOTE

All controls color coded red have a push-pull feature: pulled out, the control function is enabled; pushed in, the control function is disabled. Normal operating mode is with all red knobs pushed in.

3-2. OPERATING PROCEDURES.

The operating instructions below are presented with the understanding that the receiver has been prepared for use in accordance with the instructions given in Section II.

3-3. **TURN ON.** Rotate the AF GAIN control away from the OFF position.

3-4. **FREQUENCY SETTING.** Refer to figure 3-1 for Frequency Selection and Fine Tuning Control operation (4 controls).

3-5. SINGLE OR DOUBLE SIDEBAND SUPPRESSED CARRIER RECEPTION.

CONTROL	SETTING
NB (Noise Blanker)	Push in for normal operation. Pull out to blank impulse type noise.
RF TUNE	Inoperative over the range of 10 to 500 kHz and 10 to 30 MHz. Tune for maximum S meter reading over the range of 0.5 to 10 MHz.

AF GAIN	Adjust for optimum level.
DETECTOR	SSB/CW.
FAST AVC	Push in.
IF BW kHz	Select desired sideband reception.
RF GAIN	Push in.
BFO	Push in.

3-6. CW RECEPTION.

CONTROL	SETTING
NB (Noise Blanker)	Push in for normal operation. Pull out to blank impulse type noise.
RF TUNE	Inoperative over the range of 10 to 500 kHz and 10 to 30 MHz. Tune for maximum S meter reading over the range of 0.5 to 10 MHz.
AF GAIN	Adjust for optimum level.
DETECTOR	SSB/CW.
FAST AVC	Push in for normal operation. Pull out for break-in operation.
IF BW kHz	LSB or USB for normal operation. May be set on 0.3 or 1.2 for crowded condition. (0.3 filter is centered at 800 Hz USB. 1.2 filter is centered at 2.5 kHz USB).
RF GAIN	Push in for normal operation. May be pulled out and used as manual RF gain control. Pulled out, the AVC is disabled.
BFO	Push in for normal operation. Pull out to adjust for desired tone. (± 3 kHz adjustment).

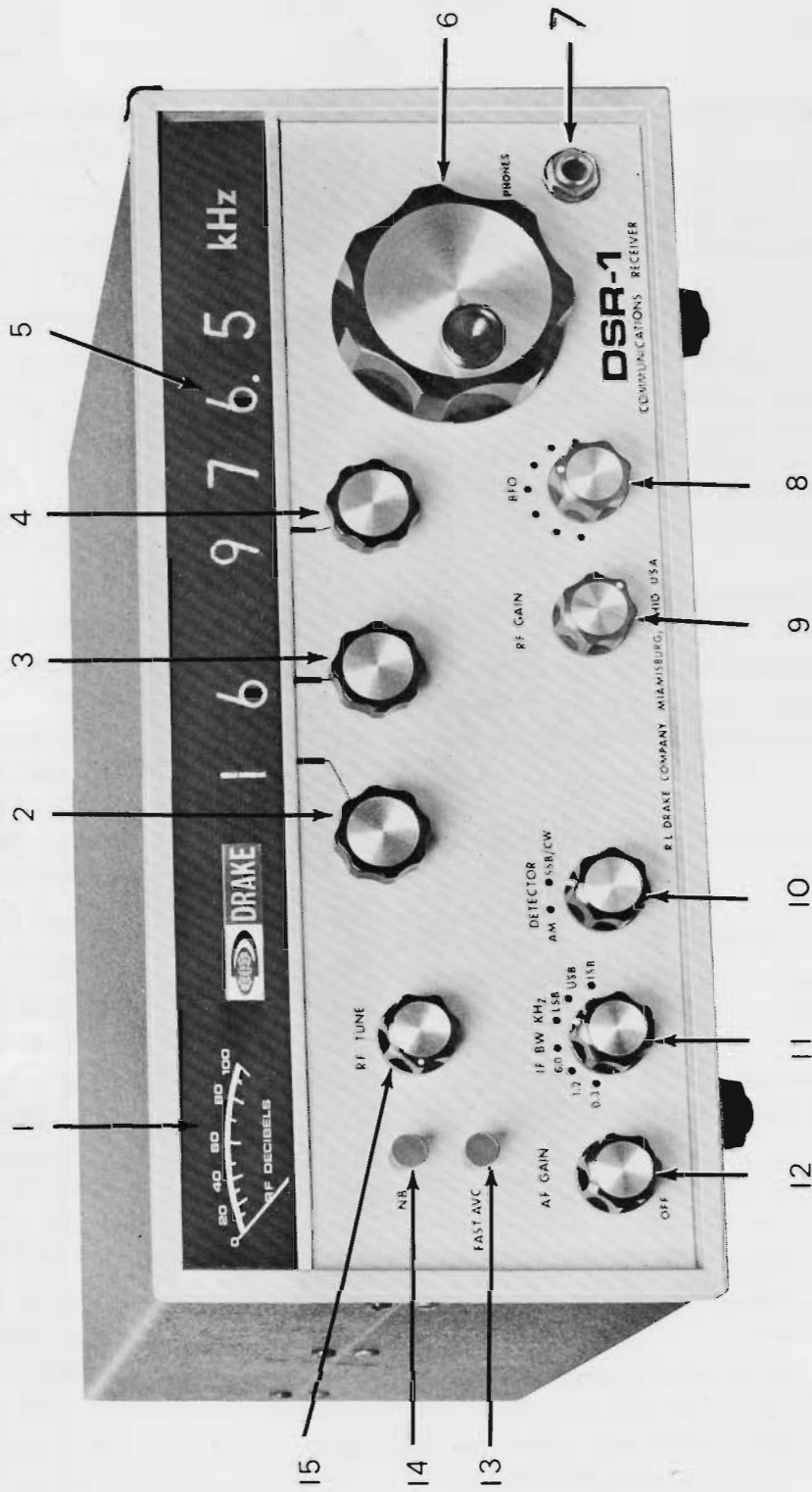


Figure 3-1. Front Panel Controls

FRONT PANEL CONTROLS

1. **S meter:** Indicates relative strength of the received signal.
2. **Frequency Selection switch:** Selects the desired frequency in increments of 10 MHz (0, 10 and 20) and displays it on the Digital Readout in the first position.
3. **Frequency Selection switch:** Selects the desired frequency in increments of 1 MHz (0 thru 9) and displays it on the Digital Readout in the second position.
4. **Frequency Selection switch:** Selects the desired frequency in increments of 0.1 MHz (0 thru 9) and displays it on the Digital Readout in the third position.
5. **Digital Readout:** Displays the frequency selected with controls 2, 3, 4 and 6.
6. **Fine Tuning control:** Provides continuously variable frequency selection over the range of 0 to 0.1 MHz and displays it on the last 3 positions of the Digital Readout.
7. **PHONES jack:** Accommodates headphones of any impedance. With headphones plugged in, internal and external speakers are disabled.
8. **BFO control (PULL OUT for variable BFO):** Provides 50 kHz injection from a variable oscillator and is continuously variable over a range of ± 3 kHz. (**PUSH IN for fixed BFO**): When this control is pushed in, the BFO is supplied by 50 kHz injection from the 5 MHz standard.
9. **RF GAIN control (PULL OUT for variable control of RF GAIN):** Provides manual control of the RF gain. Pulled out, this control disables the AVC. To increase the gain rotate the control clockwise. To decrease the gain rotate the control counterclockwise. (**PUSH IN to activate AVC**): When this control is pushed in the AVC is activated and manual RF gain control is deactivated.
10. **DETECTOR switch:** Provides separate detector circuits for AM reception and SSB or CW reception. In the AM position a diode detector is used. In the SSB/CW position a product detector is used.
11. **IF BW kHz switch:** Selects the bandwidth marked on the panel. LSB and USB positions provide 2.4 kHz at -6 dB. As shipped from the factory, the ISB position is open. See Chapter II for wiring and filter options.
12. **AF GAIN control:** Provides an on-off switch for the receiver and a manual control for the audio output.
13. **FAST AVC switch (PULL OUT for fast AVC):** Provides an AVC decay time of 100 milliseconds. (**PUSH IN for normal AVC**): When this switch is pushed in the AVC decay time is 1 second and the fast AVC function is disabled.
14. **NB switch (PULL OUT for noise blanking):** Switches in Drake's series balanced gate Noise Blanker to blank out noise pulses which interfere with a desired signal (**PUSH IN to deactivate the Noise Blanker**).
15. **RF TUNE control:** Adjusts the RF amplifier for maximum signal through the frequency range of 500 kHz to 10 MHz. Outside this range the control is not required and is inoperative.

3-7. AM RECEPTION (DOUBLE SIDEBAND).

CONTROL	SETTING
NB (Noise Blanker)	Push in for normal operation. Pull out to blank impulse type noise.
RF TUNE	Inoperative over the range of 10 to 500 kHz and 10 to 30 MHz. Tune for maximum S meter reading over the range of 0.5 to 10 MHz.
AF GAIN	Adjust for optimum level.
DETECTOR	AM.
FAST AVC	Push in. Pull out to improve reception if signal fades (QSB).
IF BW kHz	6.0
RF GAIN	Push in.
BFO	Push in.

3-8. INDEPENDENT SIDEBAND (ISB) RECEPTION.

NOTE

This receiver is not normally wired at the factory for ISB operation. Refer to Chapter II for instructions.

CONTROL	SETTING
NB (Noise Blanker)	Push in for normal operation. Pull out to blank impulse type noise.
RF TUNE	Inoperative over the range of 10 to 500 kHz and 10 to 30 MHz. Tune for maximum S meter reading over the range of 0.5 to 10 MHz.
AF GAIN	Adjust for optimum level.
DETECTOR	SSB/CW.
FAST AVC	Push in.
IF BW kHz	Select desired sideband reception.
RF GAIN	Push in.
BFO	Push in.

CHAPTER IV

THEORY OF OPERATION

4-1. GENERAL.

4-2. SIGNAL PATH CIRCUITS. Refer to the block diagram figure 4-1. Signals in the 0 to 0.5 MHz range enter the RF amplifier from the antenna through a low pass filter. All other frequencies are tuned by the input and output circuits of the RF amplifier. The RF amplifier is protected against excessive signal strengths by two reverse biased diodes at its input. Amplified signals of 0 to 10 MHz from the RF amplifier are subtracted, in the first mixer, from the locked oscillator frequency to produce 25.05 MHz. The first mixer output passes through a 14 kHz wide crystal filter, centered on 25.05 MHz, into the second mixer where 20 MHz is subtracted to obtain the 5.05 MHz first IF signal. Signals of 10 to 30 MHz from the RF amplifier are subtracted, in the first mixer, from the locked oscillator frequency to obtain the 5.05 MHz first IF signal. The first IF signal passes through a 14 kHz wide crystal filter centered on 5.05 MHz and through the first IF amplifier to the selected IF bandwidth 8 pole crystal filter. The second mixer is bypassed in the 10 to 30 MHz range. The crystal filter output drives a mixer which subtracts 5 MHz from the first IF signal to obtain the 50 kHz second IF. This mixer output is amplified in the 50 kHz IF amplifier A which operates the AM detector or a product detector for reception of SSB and CW. The detector signal from IF amplifier A is applied to two audio amplifiers. One amplifier operates the internal speaker, and the other amplifier provides a 600 ohm 1 mW balanced output. In the Independent Sideband (ISB) position, the first IF amplifier drives a mixer through a selected 8 pole crystal filter. 5 MHz is subtracted from the ISB channel in this mixer to obtain the 50 kHz second IF. The mixer output is amplified in the 50 kHz IF amplifier B which operates a product detector. The detected ISB signal is amplified and is presented at the terminal board TB2100 as a 600 ohm 1 mW balanced output.

4-3. INJECTION CIRCUITS. The proper injection frequencies for the mixers are derived from a 5 MHz crystal oscillator and a highly stable, temperature compensated VFO. The locked oscillator is mixed with the VFO in a balanced mixer and the difference of these two frequencies is divided by a programmable divider down to 12.5 kHz. The 12.5 kHz from the divided locked oscillator is applied to a phase-locked comparator along with a 25 kHz signal divided down from the 5 MHz crystal oscillator. Any phase error between the two signals causes a DC voltage on the control line which corrects the locked oscillator frequency by controlling the capacity of a varicap diode in the locked oscillator frequency determining circuit. The divider, "N", is determined by the frequency increment controls on the receiver front panel which indirectly selects the received frequency in 0.1 MHz steps. The VFO allows continuous tuning from 0 to 0.1 MHz by varying its input frequency to the balanced mixer. The phase-lock comparator moves the locked oscillator frequency by the same amount that the VFO was changed in order to maintain phase-lock conditions. In this manner the VFO controls the injection frequency continuously from 0 to 0.1 MHz.

4-4. AVC SYSTEM. Three AVC voltages are derived from the 50 kHz second IF amplifier. The AVC voltages are obtained from the combined ISB and normal IF' outputs. When ISB is not in use, the AVC voltages are obtained from the normal communications channel. AVC No. 1 is applied to the 50 kHz IF amplifier and AVC No. 2 controls the RF amplifier and the first IF amplifier. AVC No. 2 has a slower attack time than AVC No. 1 to eliminate AVC attack transients occurring from the reception of sudden strong signals. AVC No. 3 has a delayed threshold and is applied to the RF amplifier to increase its dynamic range.

4-5. **FREQUENCY READOUT.** The received frequency is read out by 6 Nixie tubes. The 10, 1, and 0.1 MHz readout positions are controlled through switch contacts operated by front panel controls. The remaining 0 to 0.1 MHz readout positions are controlled by the frequency counter which counts the 0 to 0.1 MHz portion of the VFO frequency.

4-6. **NOISE BLANKER.** The noise blanker detects short rise time, short duration pulses from the 14 kHz wide crystal filter. These pulses turn the noise blanker gate off for the duration of the interfering pulse which interrupts the IF signal, eliminating the masking effect of the interference.

4-7. RF AMPLIFIER.

a. 10 kHz to 500 kHz. Refer to schematic diagram figure 5-31. Signals in the 10 to 500 kHz range pass from the antenna through L100 and C100, a 25 MHz parallel resonant trap, and through the low pass filter comprised of C101, C102, C103, C109, C108, L101, L102, L103, L104, L106 and T200, to the gate of Q400, the RF amplifier. The drain of the RF amplifier transistor is untuned below 500 kHz and the drain load is the constant current source Q601 connected via S401R, S402AF, R600 and S603F. The signal gate of Q400 is protected against excessive voltage by the normally reverse-biased diodes CR400 and CR401.

b. 500 kHz to 10 MHz. Signals in the 500 kHz to 10 MHz range pass from the antenna through L100 and C100, a 25 MHz parallel resonant trap, through S102F, S103R and into the tap of the RF transformer T200. T200 is tuned to resonance in the 500 kHz to 1 MHz range, in 100 kHz steps, by the connection of L107, C105, C106 and C107 through switches S201F to S102AF, S102R and S103F. T200 is tuned to resonance from 1 MHz through 10 MHz by the inductors and capacitors to switches S302R, S302F and S303R. Inductors L308 through L317 tune the input in 100 kHz steps while the coils and capacitors on S302R tune the input in 1 MHz steps. Capacitor C2100-A is connected to the tuned circuit through capacitor C313 and switch S302, selecting capacitors C310, C311

and C312 for fine tuning the RF input from the front panel. The tuned circuit of T200 and its connecting components are connected to the gate of the RF amplifier Q400 through capacitor C203 and resistor R408. The output of the RF amplifier is tuned in much the same way as the input. The output is tuned in 100 kHz steps from 500 kHz to 1 MHz by switches in the tuned circuits of L600 in combination with either capacitor C601, C602, or C603 through the switches S603F, S402AF and S401R.

c. 10 MHz to 30 MHz. Signals in the 10 MHz to 30 MHz range pass from the antenna through L105 and C104, a 5 MHz parallel resonant trap, and directly to the tap of the RF transformer T200. T200 is tuned to resonance by the inductors and capacitor connected to switches S201F, S201R, S202R, S202F and S203R. C203 carries signals from T200 to the gate of RF amplifier Q400. The drain of Q400 in the 10 MHz to 30 MHz range is tuned by L400 through L415 and C401 through C404, via switches S401R, S401F, S402R, S402F, S403F and S403R.

4-8. FIRST MIXER.

a. 10 kHz to 10 MHz. Signals of 10 kHz to 10 MHz from the RF amplifier are subtracted from the locked oscillator in the first mixer transistor Q600 to obtain a 25.05 MHz output frequency. The drain of Q600 is connected through S601F to T601, the input transformer to the 25.05 MHz crystal filter.

b. 10 MHz to 30 MHz. Signals of 10 to 30 MHz from the RF amplifier are subtracted from the locked oscillator in the first mixer transistor Q600 to obtain a 5.05 MHz output frequency. The drain of Q600 is connected through S601F to T600 which is tuned to 5.05 MHz by C600.

4-9. SECOND MIXER.

The second mixer transistor Q602 is used only in the frequency range of 10 kHz to 10 MHz. Signals of 10 kHz to 10 MHz from the output transformer T602 of the 25.05 MHz crystal filter are subtracted by the 20 MHz locked oscillator in the second

mixer transistor Q602 to obtain a 5.05 MHz output frequency. The purity of the 20 MHz locked oscillator is enhanced by the resonant tuned circuit, L601 and C614. The drain of Q602 is connected through S601F to T600 which is tuned to 5.05 MHz by C600.

4-10. FIRST IF AMPLIFIER.

Refer to schematic diagram figure 5-32. Signals at 5.05 MHz from the first or second mixer are applied to the tap of T1101, and pass through the 5.05 MHz crystal filter to gate 'one' of the first IF amplifier transistor, Q1100. The drain of Q1100 is tuned to 5.05 MHz by T1104 and C1104 and drives the emitter follower, Q1101, through C1105. Amplified signals from Q1101 drive the emitter follower, Q1105, via C1108, T1105 to the series gate comprised of diodes CR1102 and CR1103 and through the balanced circuit of T1106.

4-11. NOISE BLANKER.

A portion of the first IF signal at the drain of Q1100 is coupled through C1103 to the integrated circuit amplifier, U1100. The output of U1100 is tuned to 5.05 MHz by T1103 and C1119 and drives the wave shaping circuit, CR1100, R1115, R1116, R1122, C1115 and C1116. The wave shaping circuit does not allow communications signals to drive the base of Q1102; however, short rise time pulses with amplitudes exceeding the average signal level are passed to the base of Q1102. Interfering noise pulses are amplified by transistor Q1102 and additional pulse shaping is accomplished by C1126, C1113, R1117 and R1118. These pulses are amplified by transistors Q1103 and Q1104. With the noise blanker off or with no noise pulses present, the series gate diodes CR1101 and CR1102 are forward-biased in the "on" state. The collector voltage of Q1104 drops to approximately 0.25 volt for the duration of an interfering noise pulse which also drops the anode voltage of the series gate diodes CR1101 and CR1102 causing them to be reverse-biased and turned "off". With the series gate "off", the signal path through the first IF amplifier is opened and reception is blanked for the duration of the interfering noise pulse. The noise blanker is activated by the front panel switch (S2101) which grounds the emitter of Q1104.

4-12. THIRD MIXER (COMMUNICATIONS CHANNEL) AND SECOND IF AMPLIFIER.

Signals at 5.05 MHz from the first IF amplifier and noise blanker pass through a crystal filter selected by S1101F and S1102R and enter the third mixer at the tap on T1201. T1201 is tuned to 5.05 MHz by C1207 and IF signals are coupled by C1206 to gate 'one' of the third mixer transistor, Q1200. Gate 'two' of Q1200 is driven with a 5 MHz signal from the tuned amplifier transistor, Q1204, through C1214 and R1201. This 5 MHz signal originates in the standard of the synthesizer. The drain of Q1200 is tuned to 50 kHz by T1203 and C1208 and this second IF signal is coupled through C1205 to gate 'one' of the second IF amplifier transistor, Q1202. The drain of Q1202 is tuned to 50 kHz by T1205 and C1210. The link on T1205 drives the emitter follower Q1201 through C1203. The drain of Q1202 also drives the AVC amplifier transistor, Q1208, through C1232.

4-13. THIRD MIXER (ISB CHANNEL) AND SECOND IF AMPLIFIER.

Signals at 5.05 MHz from the first IF amplifier and noise blanker pass through a crystal filter selected by S1101F and S1102R and enter the third mixer for the ISB channel at the tap of T1202. T1202 is tuned to 5.05 MHz by C1225 and IF signals are coupled by C1221 to gate 'one' of the third mixer (ISB channel) transistor, Q1205. Gate 'two' of Q1205 is driven with a 5 MHz signal from the tuned amplifier transistor, Q1204, through C1214 and R1226. The drain of Q1205 is tuned to 50 kHz by T1204 and C1228 and this second IF signal is coupled through C1226 to gate 'one' of the second IF amplifier (ISB channel) transistor Q1206. The drain of Q1206 is tuned to 50 kHz by T1206 and C1222 and drives the AVC amplifier transistor, Q1207, through C1233.

4-14. FILTER AMPLIFIER.

The Filter Amplifier consisting of Q2000 and Q2001 is used with the 0.3 kHz wide crystal filter to compensate for its high insertion loss as compared to the other filters.

4-15. PRODUCT DETECTOR (COMMUNICATIONS CHANNEL).

Signals at 50 kHz from the second IF amplifier emitter follower output are directly connected to the product detector diodes, CR1301 and C1306. The BFO is amplified by Q1301 and applied to the product detector diodes, CR1301 and CR1306 by C1304 and CR1311. The product detector is activated by the switch, S2105R which applies the BFO output and 15 VDC to the BFO amplifier when the front panel DETECTOR switch is in the SSB/CW position. The BFO signal is normally supplied from the 50 kHz signal derived from the synthesizer.

4-16. PRODUCT DETECTOR AUDIO BUFFER (COMMUNICATIONS CHANNEL).

Audio signals from the product detector diodes CR1301 and CR1302 drive the emitter follower audio buffer transistor Q1302 through the filter composed of R1311, C1312, R1312 and C1313, which removes any remaining 50 kHz signal left after detection. The detected audio signal output appears across the emitter load resistor R1315. The audio buffer is activated by the switch, S2105R, which applies 15 VDC to Q1302 when the front panel DETECTOR switch is in the SSB/CW position.

4-17. AM DETECTOR AND AUDIO AMPLIFIER (COMMUNICATIONS CHANNEL).

Signals of 50 kHz from the second IF amplifier emitter follower output drive the AM detector diode CR1300 through C1302. The detected AM signal is amplified in Q1300 before final audio amplification in order to equalize the differences in audio levels between SSB/CW and AM. The AM detector audio amplifier is activated by the switch, S2105R, which supplies 15 VDC to Q1300 when the front panel DETECTOR switch is in the AM position.

4-18. PRODUCT DETECTOR (ISB CHANNEL).

Signals of 50 kHz from the secondary of T1206 are connected to the product detector diodes, CR1303 and CR1304. The BFO is amplified by Q1303 and applied to the product detector diodes, CR1303

and CR1304 by C1317 and C1320. The product detector is activated by the switch, S2105R, which applies the BFO output and 15 VDC to the BFO amplifier when the front panel DETECTOR switch is in the SSB/CW position.

4-19. PRODUCT DETECTOR AUDIO BUFFER (ISB CHANNEL).

Audio signals from the product detector diodes CR1303 and CR1304 drive the emitter follower audio buffer transistor, Q1304, through the filter composed of R1322, C1322, R1323 and C1323, which removes any remaining 50 kHz signal left after detection. The detected audio output appears across the emitter load resistor R1323. The audio buffer is activated by the switch, S2105R, which applies 15 VDC to Q1304 when the front panel DETECTOR switch is in the SSB/CW position.

4-20. BFO.

The normal BFO signal is derived from the standard 5 MHz signal in the synthesizer by dividing this signal down to 50 kHz. This signal is applied to the product detector circuit by S2104 and S2105R. Pulling out the variable BFO front panel knob switches the normal BFO signal to ground through the switch contacts of S2104 and applies DC voltage to the variable BFO oscillator Q1502. This variable oscillator operates at a normal frequency of 12.5 kHz and is tuned by potentiometer R2101. This 12.5 kHz signal is applied to the injection of the product detector circuit through switch S2104 where it is used to drive the amplifier circuits of Q1301 and Q1303 which are tuned to 50 kHz. Variation of potentiometer R2101, controlled by the front panel BFO knob, tunes the resultant BFO signal to 50 ± 3 kHz.

4-21. AUDIO LINE AMPLIFIER (COMMUNICATIONS CHANNEL).

Audio signals from the emitter of Q1302 drive the direct coupled line amplifier transistors, Q1500 and Q1501 through C1501. The collector of Q1501 is matched to the 600 ohm balanced output by T1500.

4-22. AUDIO LINE AMPLIFIER (ISB CHANNEL).

Audio signals from the emitter of Q1304 drive the direct coupled line amplifier transistors, Q1503 and Q1504 through C1505. The collector of Q1505 is matched to the 600 ohm balanced output by T1501.

4-23. AUDIO POWER OUTPUT AMPLIFIER.

Audio signals from the emitter of Q1302 are coupled to the volume control through C1315. The variable arm of the volume control drives the base of Q1400 through C1404. C1401 couples the collector of Q1400 to the base of Q1401 through C1402. A reduction in gain at high frequencies is provided by the combination of C1405 and R1405. The collector of Q1401 drives the base of Q1402 through C1403. The collector of Q1402 drives the base of Q1405 directly, and the base of Q1404 through R1414 and R1415. Q1404 is directly coupled to Q1403 which drives output transistor Q2100. The remaining output transistor, Q2101, is driven by Q1405. Capacitor C1411 couples the audio output signal to the internal speaker, the headphone jack and external speaker jack. Resistor R1415 adjusts the quiescent bias on the output transistors so that they are balanced.

4-24. FREQUENCY SYNTHESIZER.

- a. 5 MHz STANDARD. Refer to figure 5-33. The heart of the frequency synthesizer is the 5 MHz crystal oscillator from which all of the synthesizer outputs are derived. This oscillator is an untuned Pierce circuit utilizing the FET, Q901. Frequency adjustment is performed by the variable capacitor, C914.
- b. 5 MHz INJECTION. The 5 MHz injection signal supplied to the third mixer is derived from the gate of the master oscillator Q907 through C923.
- c. 20 MHz INJECTION. The 20 MHz injection signal supplied to the second mixer Q602 is derived from a phase-locked 20 MHz oscillator. Transistor Q902 is connected as a 20 MHz Colpitts oscillator which is gated by the 5 MHz signal applied to the base of Q905 through C909 from the 5 MHz master oscillator.

- d. 50 kHz INJECTION. The 50 kHz injection frequency supplied to the product detectors is derived from the 5 MHz crystal oscillator by division of 100 by use of the decade counters U900 and U901. The drain of Q907 drives the base of the buffer transistor, Q911 through C912. The collector of Q911 drives U900 which divides the 5 MHz input by 10 and the output of U900 drives U901 which again divides the output by 10 to obtain 50 kHz at its output.

- e. 25 kHz INJECTION. The 25 kHz injection frequency supplied to the phase-lock comparator is derived by dividing the 50 kHz injection by 2. Divider U902 is made up of two separate dividers, allowing division by 2 and 5. The 50 kHz output of U901 is divided by 2 in U902 to obtain 25 kHz injection.

4-25. LOCKED OSCILLATOR INJECTION (VCO).

- a. 0 to 10 MHz. When the 10 MHz front panel decade frequency switch is in its "0" position, the locked oscillator which provides injection to the first mixer operates over a range of 25.05 MHz to 35.05 MHz depending on the position of the 1 MHz and 0.1 MHz switches and the fine tuning frequency controls. Transistor Q700 is connected as a Colpitts oscillator whose frequency is determined by the inductors and capacitors connected to switches S701F, S701R, S702F, S702R, S703F and S703R. The frequency of Q700 is changed in 1 MHz steps by switching in inductors L700 through L709 by switches S702F and S702R. These variable inductors are shunted with the tank circuit of L710 and capacitor C707 to increase the frequency band of that obtained in paragraph 4-25 b. Steps of 0.1 MHz are obtained by applying the output of the voltage divider, R708 through R712, via S703F and S703R to varicap diodes CR701 and CR702 which shunt the drain of Q700 through C708 and C709. The frequency of Q700 is kept in phase-lock by the action of the control line voltage on varicap diode, CR703 through R721. Varicap diodes are diodes whose junction capacitance is a function of the applied reverse bias.

b. 10 MHz to 20 MHz. When the 10 MHz front panel decade frequency switch is in its "10" position, the locked oscillator Q700 operates over a range of 15.05 MHz to 25.05 MHz depending on the position of the 1 MHz, 0.1 MHz, and fine tuning frequency controls. The frequency of Q700 is changed in 1 MHz steps by connecting L700 through L709 through switches S702F and S702R from the drain of Q700 to ground. Steps of 0.1 MHz are obtained by applying the output of the voltage divider, R708 through R712, via S703F and S703R to varicap diodes, CR701, CR702 which shunt the drain of Q700 through C709, C708 and C702. The frequency of Q700 is kept in phase-lock by the action of the control line voltage on varicap diode CR703 through R721.

c. 20 MHz to 30 MHz. When the 10 MHz front panel decade frequency switch is in its "20" position, the locked oscillator has a range of 25.05 MHz to 35.05 MHz. This is the same range as when receiving 0 to 10 MHz. See paragraph 4-25 a. for circuit description.

4-26. VFO. The fine tuning frequency control in the receiver is performed by the Variable Frequency Oscillator (VFO). There are two identical VFO's made up of Q1900 and Q1901, each connected as a Colpitts oscillator. The fine tuning control rotates both sections of the air variable capacitor, C1919, and switch S1900. Capacitor C1919 is in a differential capacitor configuration with a common rotor, and switch S1900 alternately turns off each oscillator through 180 degrees of rotation by shunting either R1912 or R1913 across its respective oscillator coil. The operating oscillator drives the base of Q1902 through either C1905 or C1907 and the VFO output is taken from the collector of Q1902 through the filter consisting of L1902, C1913 and C1917. Two identical VFO's are employed so that continuous rotation of the fine tuning control will result in repeated coverage through the last 100 kHz of the received frequency. For example, continuous clockwise rotation of the fine tuning knob would enable reception of 3500.0 kHz through 3600.0 kHz followed by a short "dead" region where the receiver is muted and the last 3 Nixie tubes are extinguished. This "dead" region is fol-

lowed by a repeat of reception of 3500.0 kHz to 3600.0 kHz.

NOTE

Each VFO has approximately 5 kHz over-travel at each end of its range, so that actual coverage in the above example would be approximately 3495.0 kHz to 3605.0 kHz.

4-27. BALANCED MIXER. The balanced mixer U801, is driven by the locked oscillator via the source follower Q800 through C802 and is also driven by the VFO through C817. The balanced mixer output is tuned to the difference between the locked oscillator and the VFO by the inductors and capacitors connected to switches, S801F, S802R and S802F.

4-28. PREDIVIDER. The output of the balanced mixer is divided by 8 before it arrives at the programmable frequency divider so that the programmable divider's maximum input frequency is not exceeded. The balanced mixer output is amplified in transistors, Q801, Q802, Q803 and Q804. Q804 drives U800 directly which divides the balanced mixer output frequency by 4. The output of U800 is divided by 2 in U1000 providing a total division of the balanced mixer of 8.

4-29. PROGRAMMABLE DIVIDER. Three decade programmable dividers, U1001, U1002 and U1003 are programmed both by switches, S1101F, S1102F, S1102AF, S1002AR, S1003F, S1003R, S1003AF, S1003AR and the diodes CR1000, CR1001 and transistors Q1003 to divide the predivided balanced mixer output by a range of dividers of 110 to 309. The division factor "N" tracks with the locked oscillator so that the output frequency of the programmable divider remains a constant 12.5 kHz.

4-30. PHASE-LOCK COMPARATOR. The 12.5 kHz output of the programmable divider drives the one-shot multivibrator circuit, Q1000 and Q1001 through R1008. The Q1000 and Q1001 one-shot generates pulses 2 microseconds wide which drive the phase inverter Q1002, through R1006. The 25 kHz output of U902 drives the one-shot multivibrator Q909 and Q910 through R928. The Q909

and Q910 one-shot generates pulses 5 microseconds wide at a rate of 25 kHz. These pulses are used to trigger the sample-hold phase detector and frequency discriminator.

4-31. PHASE LOCKED LOOP IN LOCK. The following discussion concerns the operation of the phase-locked loop under locked conditions. Transistor Q903 is turned on by the positive voltage shown in waveform "B", figure 5-33. This in turn causes Q901 to conduct which charges C908 through R909. Capacitor C908 charges at an exponential rate until the negative-going pulse in waveform "B" causes transistor Q903 to turn off along with Q901 which interrupts the charging of C908. This interruption of charging C908 causes a "flat spot" in C908's charging voltage as shown in "A", figure 5-33. The position of this "flat spot" is a function of the phase difference between the two inputs to the phase-lock comparator. The greater the difference (phase error), the higher the voltage C908 will charge to before being interrupted. The voltage developed on C908 is sampled and applied to the locked oscillator to maintain the correct locked oscillator frequency. Capacitor C908 resumes its exponential charging voltage after the 2 microsecond sampling interval until the positive 5 microsecond wide pulse at the collector of Q910 (waveform "C", figure 5-33) drives the base of Q906 through R917 which turns Q906 on and discharges C908 into R911. Resistors R909 and R911 insure that the minimum voltage on C908 is never below 4 volts so that the varicap diode CR703 is never forward-biased by the oscillator peak voltage. When the wave shape at "C" goes negative, C908 again begins charging. The control line voltage is obtained after the negative-going pulse in waveform "B", figure 5-33 is applied to the base of Q908 shutting it off, causing its collector voltage to go positive. The positive collector voltage of Q908 reverse-biases CR902 causing Q904 to turn on allowing C903 to assume the same potential as C908. Transistor Q900 is connected as a source follower to match the high impedance of the sample-hold circuit to the lower impedance of the control line. The output of Q900 which is the control line, is filtered by C904, R903, C924 and C925. Diodes CR900 and CR901 allow the control line voltage to follow sudden changes of level. Under conditions where the phase-locked loop is not in lock, the phase error between the 25

kHz reference and the programmable divider input will not be constant, but will be varying at a rate equal to the frequency difference. The same sample-hold action will take place and the voltage sampled will have a different value each time it is sampled. The sample-hold process will occur every other cycle of the sawtooth waveform "C", figure 5-33, and the sampled voltage will increase or decrease depending on the phase relationship between the two signals. The sample voltage is the control line voltage which is applied to the varicap diode CR703 whose junction capacitance changes with applied reverse voltage which causes the locked oscillator to change frequency in a direction that reduces the frequency error between the phase-lock comparator input signals. When the frequency error is reduced to zero, the phase-lock comparator produces a DC output on the control line which maintains this locked condition and the locked oscillator is phase-locked to the 5 MHz reference standard oscillator.

4-32. FREQUENCY READOUT.

4-33. UNDERFLOW AND OVERFLOW AUTOMATIC CORRECTION. Refer to figure 5-34. Because the fine tuning frequency control has approximately 5 kHz of overtravel at each end of its 100 kHz range, the 10, 1, and 0.1 MHz digits must be automatically changed in order to correctly indicate the received frequency when the fine tuning is in its overtravel region. For example, when receiving 19999.9 kHz and the fine tuning is adjusted 0.1 kHz higher, the frequency readout must change to 20000.0 kHz. Similarly, when receiving 19900.0 kHz and the fine tuning is reduced 0.1 kHz, the frequency readout must change to 19899.9 kHz. The automatic correction for the overflow and underflow in frequency readout is detected by U1700 and U1701. When the VFO (Fine Tuning Control) operates below 4.05 MHz (XXX00.0 kHz), pin 10 of U1701 (underflow), goes positive (high), which initiates reduction of the 10, 1, and 0.1 MHz digits. When the VFO (Fine Tuning Control) operates above 4.15 MHz (XXX99.9 kHz), pin 8 (overflow) of U1701 goes positive (high), which initiates the increase of the 10, 1, and 0.1 MHz digits.

4-34. 10 MHz DIGIT. The 10 MHz digit (0, 10, 20, 30 MHz), is displayed by Nixie tube, DGT-1. The 1, 2, or 3 numeral cathode in DGT-1 is ignited by turning on one of the transistors, Q1804, Q1808, or Q1812, and selection through switches S1801R, S1801AR and S1801BR. Transistor Q1804 and switch S1801AR turn on the 10 MHz digit selected by the front panel 10 MHz frequency switch when there is no underflow or overflow. During underflow conditions, DGT-1 will indicate a numeral one less than that selected by S1801AR, except zero, if the 1 and 0.1 MHz digits are each indicating a "0" and the U1701 underflow output is high. When the 1 and 0.1 MHz digits are indicating "0", Q1800 and Q1802 are turned off which reduces their emitter voltages to zero (low). The emitters of Q1800 and Q1802 are connected to U1803. U1803 with low inputs from Q1800 and Q1802 and a high underflow input, will turn on Q1808 and turn off Q1804 and Q1812. Switch S1801BR, connected to Q1808, selects a numeral one less than S1801AR selects in order to maintain the correct frequency readout. During overflow conditions, DGT-1 will indicate a numeral one greater than that selected by S1801AR if the 1 and 0.1 MHz digits are each indicating a "9" and U1701 overflow output is high. When the 1 and 0.1 MHz digits are indicating "9", Q1801 and Q1807 are turned off which reduces their emitter voltages to zero (low). The emitters of Q1801 and Q1807 are connected to U1803. U1803 with low inputs from Q1801 and Q1807 and a high overflow input, will turn on Q1812 and turn off Q1804 and Q1808. Switch S1801R connected to Q1812, selects a numeral one greater than S1801AR selects in order to maintain the correct frequency readout.

4-35. 1 MHz DIGIT. The 1 MHz digit, (0 to 9 MHz), is displayed by Nixie tube, DGT-2. The 0 to 9 numeral cathodes in DGT-2 are ignited by turning on one of the transistors, Q1805, Q1809 or Q1811 and selection through switches S1802R, S1802AR and S1802BR. Transistor Q1805 and switch S1802R turn on the 1 MHz digit selected by the front panel 1 MHz digit switch when there is no underflow or overflow. During underflow conditions, DGT-2 will indicate a numeral one less than that selected by S1802R if the 0.1 MHz digit is indicating a "0" and the U1701 underflow output is high. When the 0.1 MHz digit is indicating "0", Q1802 is turned off re-

ducing its emitter voltage to zero (low). The emitter of Q1802 is connected to U1804. U1804 with a low input from Q1802 and a high underflow input, will turn on Q1809 and turn off Q1805 and Q1811. Switch S1802AR connected to Q1809, selects a numeral one less than S1802R selects in order to maintain the correct frequency readout. During overflow conditions, DGT-2 will indicate a numeral one greater than that selected by S1802R if the 0.1 MHz digit is indicating "9" and the U1701 overflow output is high. When the 0.1 MHz digit is indicating "9", Q1807 is turned off which reduces its emitter voltage to zero (low). The emitter of Q1807 is connected to U1804. U1804 with a low input from Q1807 and a high overflow input, will turn on Q1811 and turn off Q1805 and Q1809. Switch S1802BR connected to Q1811, selects a numeral one greater than S1802R selects in order to maintain the correct frequency readout.

4-36. 0.1 MHz DIGIT. The 0.1 MHz digit, (0 to 0.9 MHz), is displayed by Nixie tube, DGT-3. The 0 to 9 numeral cathodes in DGT-3 are ignited by turning on one of the transistors, Q1806, Q1810 and Q1815 and selection through switches S1803R, S1803AR, S1803BR. Transistor Q1806 and switch S1803R turn on the 0.1 MHz digit selected by the front panel 0.1 MHz digit switch when there is no overflow or underflow. During underflow conditions, DGT-3 will indicate a numeral one less than that selected by S1803R if the U1701 underflow output is high. The high underflow signal operates U1804 which turns off Q1806 and Q1815 and turns on Q1810. Switch S1803AR connected to Q1810 selects a numeral one less than S1803R selects in order to maintain the correct frequency readout. During overflow conditions, DGT-3 will indicate a numeral one greater than that selected by S1803R if the U1701 overflow output is high. The high overflow signal operates U1804 which turns off Q1806, and Q1810 and turns on Q1815. Switch S1803BR connected to Q1815 selects a numeral one greater than S1803R selects in order to maintain the correct frequency readout.

4-37. FREQUENCY COUNTER.

The frequency counter reads the frequency of the VFO and presents a display readout indicating the

tuned frequency of the receiver. The VFO tunes over a 100 kHz range starting at 4.05 MHz. This frequency is coded to provide a readout starting at 000 and increasing to 100. The three digits of the readout indicate 10 kHz, 1 kHz and 100 Hz. The 100 Hz and the 1 kHz digits of the readout follow directly the corresponding last two digits of the VFO frequency but the 10 kHz digit of the readout is removed from the corresponding digit of the VFO frequency by a constant of 5. This is a result of starting the VFO frequency at 4.05 MHz instead of an even MHz value. This false coding is accomplished by connecting the Nixie tube leads to the decoder-driver so that the $n+5$ digit is illuminated. The VFO signal is applied to the input of the decade counters, U1707 through U1711 converting the count to binary coded decimal (BCD). This BCD information then enters the quad latch circuit U1702 through U1705 on the A, B, C and D inputs. The quad latch consists of four bistable latch circuits which perform a sample and hold function. With the strobe input in the logical 1 state, the output follows the data input, but when the strobe goes to a logical 0 state, the input retains the state of the data input at the time of the transition. This BCD information is applied to the inputs of the BCD/decimal decoder-drivers U1800, U1801 and U1802. Each decimal number is represented by an output of Q1800, U1801 and U1802 that is connected to the corresponding cathode of display tubes V1803, V1804 and V1805. The D output of the n stage provides the input to the $n+1$ stage. The decade counter triggers on the negative edge of a clock pulse, and as D goes low (indicating transition from the 9 state to the 0 state) the $n+1$ stage will receive a count. Thus the D output of each stage provides a divide-by-ten function. The counter display is strobed at a rate of 5 times per second to closely follow the tuning or frequency change of the VFO. A 5 cycle per second pulse is obtained from the 5 kHz derived from the 5 MHz clock standard by appropriate division with U1712, U1713 and U1714 decade counters. This pulse is also used to reset the counter of the VFO. This readout is combined with the switched readout (information obtained from the front panel switch controls, 10 MHz, 1 MHz and 0.1 MHz) to provide 6 figures of readout indicating the tuned frequency of the receiver down to 100 Hz. The operation of the counter is as follows. The VFO frequency is applied to the first of the 4 decade counters through

the buffer stages Q1700 and Q1701. Each decade counter output is applied to the input of the next counter to provide the 4 decades of counting as required. Three counters are utilized to supply the BCD output information to the appropriate quad latches, which in turn apply the proper information to the decade drivers. These 3 counters provide the 100 Hz, 1 kHz and 10 kHz readout as desired. The 5 kHz signal derived from 5 MHz standard is applied to the counter string comprised of U1712-U1714 decade counters. U1712 and U1713 are connected to divide by 10 each and U1714 is connected to provide a count of 5 giving a total of 500 which reduces the 5 kHz signal to 10 Hz. The 10 Hz signal is applied to the one-shot composed of Q1706 and Q1707. Resistors R1718 and R1719 and capacitor C1708 provide a pulse width of about 10 microseconds duration. This pulse drives the base of the transistor Q1704 causing it to conduct, giving a pulse at the emitter output where it is used as the strobe pulse. The 10 Hz is also applied to U1706 which is an integrated circuit flip-flop. The output of this flip-flop is used for the reset pulse. The 5 Hz output of the flip-flop also drives the base of transistor, Q1705 which is in shunt with the input of the strobe transistor, Q1704. This shorts out alternate pulses of the strobe and prevents the quad latch from reading and transferring information during the counter reset time.

4-38. COUNTER OVERFLOW AND UNDERFLOW.

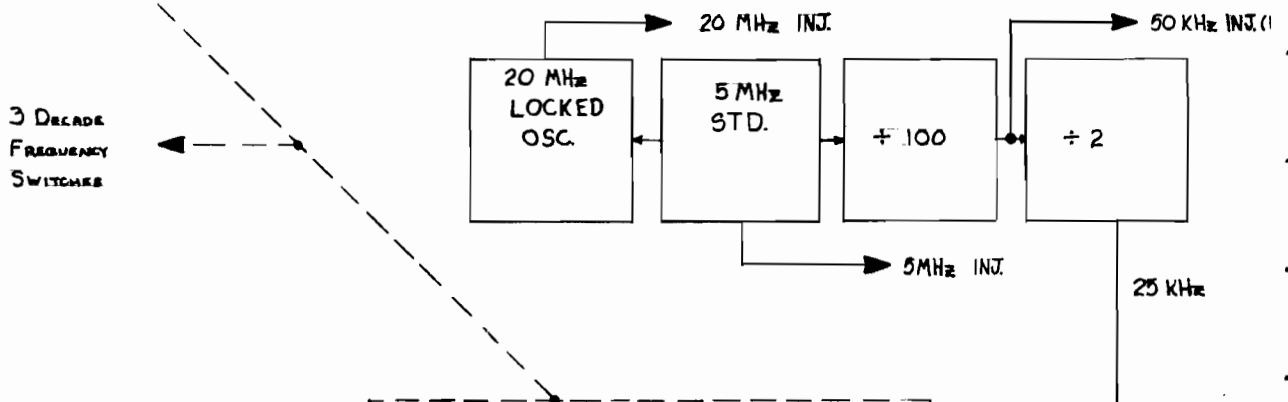
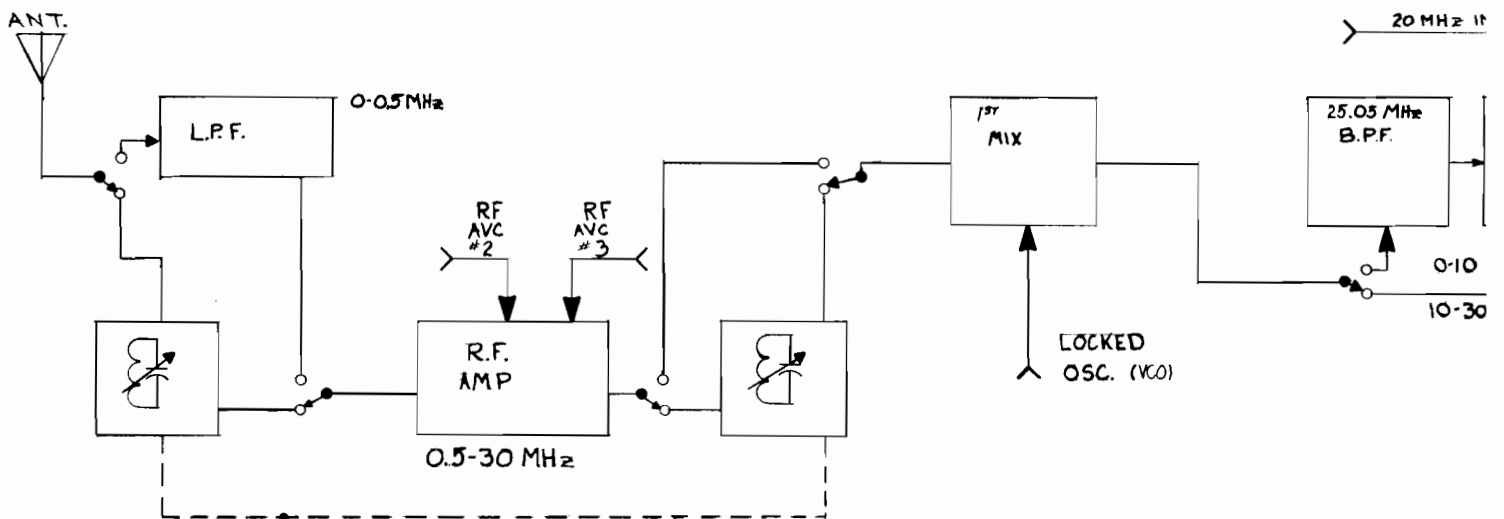
The VFO frequency is variable over a range of 100 kHz (4.05 to 4.15 MHz). Counter No. 2 (Board A17) is used to count the frequency of the oscillator. An extra decade counter (U1711) and an extra quad latch (U1705) are used to indicate when the VFO has overtraveled its range at either end. The logic circuit consisting of U1700 (4-input NAND Gate) and U1701 (Hex Inverter) is used to determine when the VFO is tuned below 4.0500 MHz by reading the BCD information of 04 when the VFO is at 4.0499 MHz or below. This logic circuit provides a 1 output on line 3 of the integral connector on Counter board No. 2 to be used in the counter board as explained in paragraph 4-33. When the VFO frequency exceeds 4.1499 MHz the logic circuit reads the 15 information from 4.150 and

provides a 1 output on line 2 of the integral connector of counter No. 2 for use in carryover of the numerals.

4-39. POWER SUPPLY.

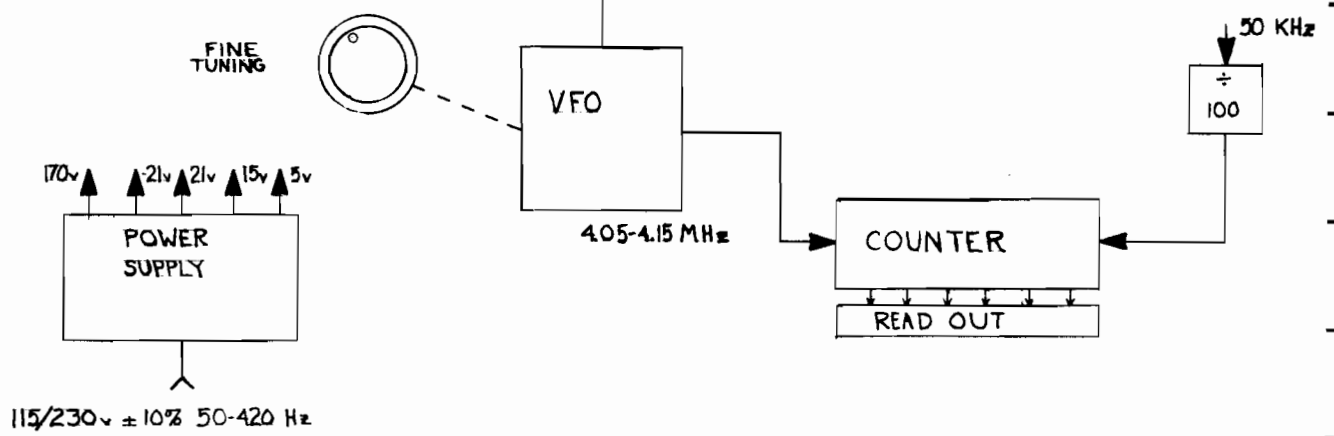
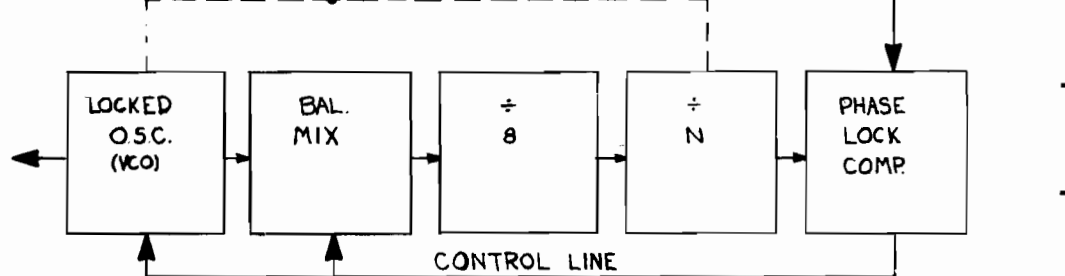
The power supply circuitry shown in Figure 5-35 provides all the required voltage levels for the receiver. The primary of the transformer can be connected for operation on either 120 or 240 volts AC as shown and explained on the schematic. The standard connection is for 120 volts. If the receiver has been factory wired for 240 volts operation it will be so indicated by a label near the power cord on the rear panel. Full wave rectification circuitry is

used to provide the positive voltages to operate the various receiver circuitry. The 21 volts obtained by rectifier diodes CR1601 and CR1602 is applied to a voltage regulator U1600 to provide a well regulated and well filtered supply of the critical circuitry such as the Synthesizer and RF circuits. A current booster Q1600 is used to increase the current capability of the regulator. A general supply CR1600 is used to power the IF circuitry. A half wave rectifier CR1603 is used to supply a negative 21 volt supply for the AVC circuitry. The full wave rectifier, CR1604 and CR1605, is used to supply the 120 volt requirement for the 'nixie' readouts. The full wave rectifier, CR1606 and CR1607, is used in conjunction with the voltage regulator Q1601 and CR1608 to supply the 5 volt requirement for the integrated circuits.



0,10,20 MHz
DECADE SWITCH

POSITION	VCO. RANGE
0	25.05-35.05
10	15.05-25.05
20	25.05-35.05



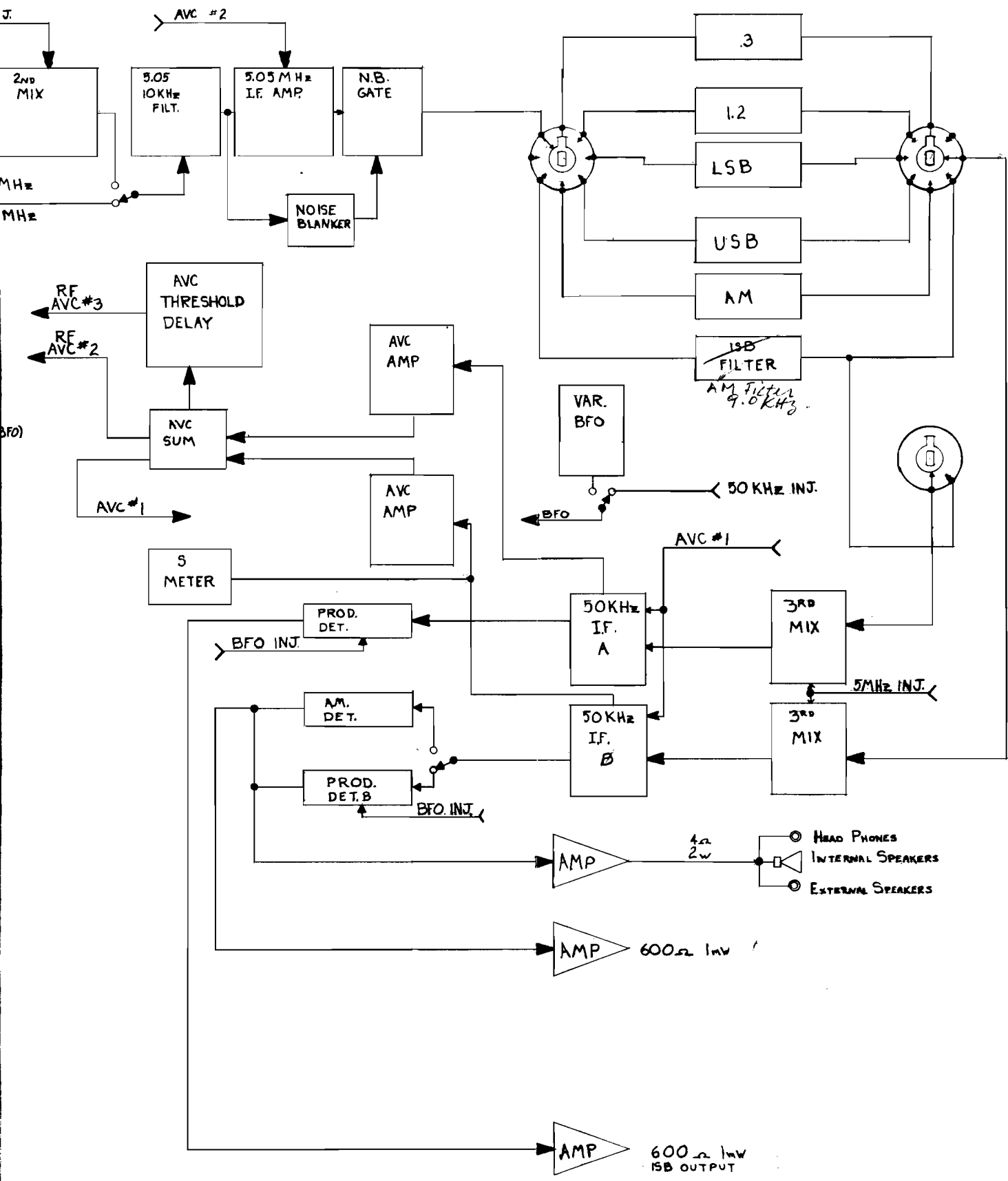


Figure 4-1. Functional Block Diagram

CHAPTER V

MAINTENANCE

5-1. SERVICE DATA.

We will check and align your receiver at the factory for a nominal fee if it has not been tampered with. Transportation charges are extra. Any necessary repairs will be made on a time and material basis. Please write or call the factory for authorization before returning your receiver for alignment or service. Address your request for authorization to:

R. L. Drake Company
540 Richard Street
Miamisburg, Ohio 45342
ATTN: Customer Service Department
Telephone: (Area Code 513) 866-3211
Code-A-Phone Service after
1630 Hours E.S.T.

CAUTION

DO NOT TAMPER WITH THIS RECEIVER. Repairs and adjustments should be made only by a qualified radio technician.

5-2. DISASSEMBLY AND REASSEMBLY.

WARNING

A high voltage hazard exists as soon as the cover is removed from the Power Supply.

5-3. SYNTHESIZER/RF ASSEMBLIES.

If it becomes necessary to remove any of the printed circuit boards in the Synthesizer assembly or the RF-Oscillator-Mixer assembly, the switch decks mounted on these cards must be in alignment and at a predetermined wiper setting. To accomplish this, proceed as follows:

- a. Remove covers from Synthesizer and RF-Oscillator-Mixer assemblies.

- b. Turn the first three frequency selector knobs so that the setscrews in the shaft couplings are facing the top of the receiver.
- c. Loosen only the setscrew in each coupling which is closest to the first Synthesizer card.
- d. Turn receiver power ON.
- e. Rotate each frequency selector knob counterclockwise until a zero appears in its associated readout position.
- f. Turn receiver power OFF.
- g. From the rear of the chassis withdraw all three shafts just far enough to release the card to be removed.
- h. Disconnect interconnecting wires from the push-in wire terminals on the card to be removed. Carefully tag each loose wire to assure correct reassembly.

CAUTION

The proper orientation of the switch wipers is critical at reassembly. Failure to position the switch wipers correctly will result in damage to the receiver.

- i. At reassembly, refer to figure 5-1 to insure proper switch wiper position.

5-4. COUNTER NO. 1.

If it becomes necessary to remove Counter No. 1 printed circuit board, the switch decks mounted on this card must have their wipers aligned properly to avoid damage to the receiver at reassembly. To accomplish this, proceed as follows:

- a. Remove covers marked DISPLAY and COUNTER.
- b. Turn the first three frequency selector knobs so that the setscrews in the shaft couplings are facing the top of the receiver.

- c. Loosen only the setscrew in each coupling which is closest to the counter board switch.
- d. Turn receiver power ON.
- e. Rotate each frequency selector knob counter-clockwise until a zero appears in its associated readout position.
- f. Turn receiver power OFF.
- g. Disconnect and remove plug-in Counter No. 2 board. Tag each loose wire to assure correct reassembly.
- h. Disconnect wires from Counter No. 1 and tag them.
- i. Withdraw all three shaft and knob assemblies.
- j. Release Counter No. 1 board from chassis and remove it. Observe CAUTION notice which follows paragraph 5-3 above.

5-5. VFO AND DIAL LOCK.

It should be noted that the DIAL LOCK assembly is part of the MSR-1 receiver only and is not included in the DSR-1. However, the rest of this procedure applies to both units.

- a. Turn DIAL LOCK knob full clockwise to release the lock (MSR-1 only).
- b. Remove Fine Tuning control knob.
- c. Remove bearing disc from front panel.
- d. Loosen setscrew in hub of lock disc until disc slides free on shaft (MSR-1 only).
- e. Remove 3 screws from top of chassis and remove the VFO assembly. NOTE: the rear screw retains a shim washer between the VFO case and the chassis.
- f. At reassembly, after the setscrew in the hub of the lock disc has been tightened, rotate the shaft several times to check disc clearance. If it rubs or scrapes, reposition it until it rotates freely with the shaft.

5-6. INTEGRATED CIRCUITS.

Refer to figure 5-2. All sockets for integrated circuits have pin 1 identified with an arrowhead on

the printed circuit board as illustrated. Each integrated circuit is marked with a molded-in depression at one end to flag pin 1. At reassembly make sure that each integrated circuit plugs into its socket correctly; that is, with the molded-in depression at the same end of the socket as the arrowhead on the printed circuit board.

5-7. TEST EQUIPMENT.

Following is a list of test equipment recommended for maintenance of this receiver.

- a. VTVM with a minimum range of DC to 30 MHz AC and the capability of reading 0.1 VAC.
- b. Signal Generator with range of 10 kHz to 30 MHz.
- c. Oscilloscope with 5 MHz response.

5-8. REPAIR AND REPLACEMENT.

Whenever possible replace an entire subassembly, printed circuit board assembly or module in order to get your receiver back in service as soon as possible. Refer to the schematic diagrams included in this chapter for signal tracing and fault isolation. Waveforms and voltage levels are shown at critical points throughout the circuits. Component location drawings keyed to parts lists are included to identify components for replacement. Critical components are identified by part number and manufacturer. These critical components *must* be replaced with identical parts. The remaining components are described sufficiently for replacement with any commercial part of the same value, tolerance and package size.

5-9. PARTS ORDERING INFORMATION.

Any subassembly or component listed in the parts lists may be ordered from R. L. Drake Company. To get price and delivery information contact the manufacturer at the address given in paragraph 5-1. Be sure to include the serial number of your receiver and the approximate date of purchase in your request.

TOP OF BOARD

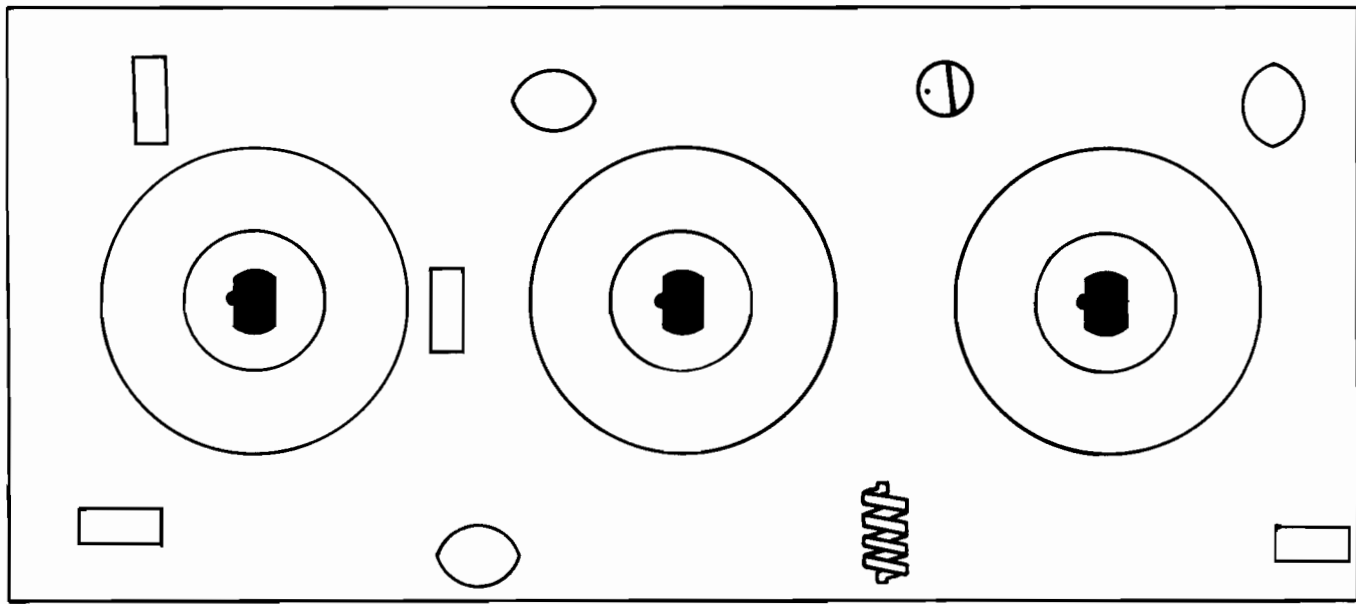


Figure 5-1. Proper Orientation of Switch Wipers at Reassembly

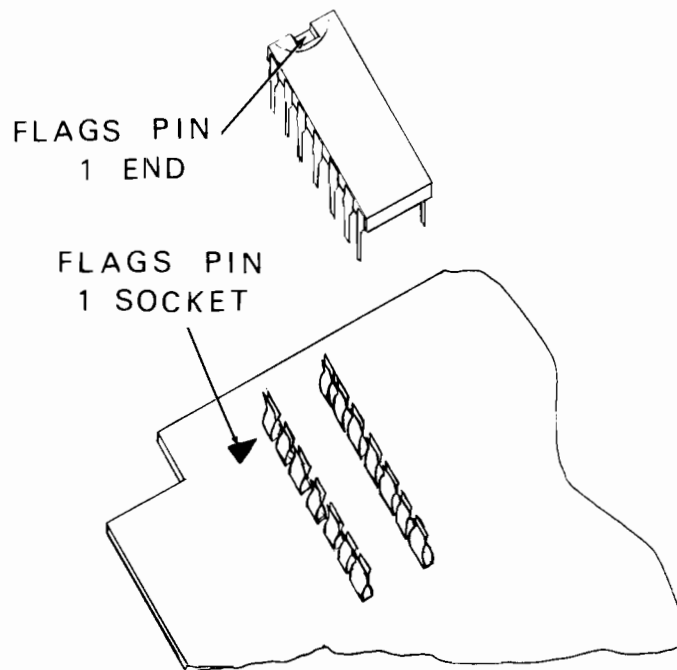


Figure 5-2. Proper Installation of Integrated Circuits

5-10. ALIGNMENT AND CALIBRATION.

It is not necessary to align a new receiver. Each receiver is carefully aligned and checked by the manufacturer's staff of expert technicians before it is shipped from the factory.

5-11. IF SECTION ALIGNMENT.

Refer to figures 5-3 through 5-6 for adjustment locations and test points.

5-12. IF ALIGNMENT—NORMAL CHANNEL.

- a. Set DETECTOR switch to SSB/CW, set the 10 MHz frequency knob to display 1 in the readout and set the IF BW switch to 6.0.
- b. Apply a 5.051 MHz signal at J600 in the RF-OSCILLATOR-MIXER section. This is the 20 MHz injection terminal to the mixer card.

NOTE

A 1 kHz audio tone should be heard during this tuning procedure.

- c. Monitor the AVC voltage with a DC VTVM attached to the right rear terminal of the RF GAIN switch S2100 (AVC Test Point). This voltage will measure approximately 2 volts positive with no signal input.
- d. Adjust the level of the 5.051 MHz signal until the AVC voltage is reduced to approximately +1 volt DC. The generator level should be adjusted throughout the tuning procedure to maintain this level.
- e. Tune the mixer output transformer T600, (located at the top of board A6), the three IF transformers nearest the crystal cans on the 1st IF-NB board, T1101, T1102 and T1104, the three IF transformers along the outside edge of the IF-AVC board and the transformers at the back edge of the board, T1207, T1201, T1203 and T1205 for maximum negative-going AVC voltage.

5-13. IF ALIGNMENT—ISB.

- a. See section II for ISB wiring instructions.
- b. Set the IF BW switch to ISB position and tune

frequency of signal generator to produce a 1 kHz audio tone at ISB output terminals on TB2100 at the rear of the receiver. This may be done by noting the VTVM deflection as the generator is adjusted. The frequency will be approximately 5.05 MHz depending on the frequency of the filter wired into the ISB channel.

- c. Adjust the three remaining IF transformers on the IF-AVC board, T1202, T1204 and T1206 for maximum negative-going AVC voltage. These transformers are located along the inside edge of the IF-AVC board.

5-14. NOISE BLANKER ALIGNMENT.

- a. Refer to figure 5-6. Connect the DC probe of the VTVM to the test point on the IF-Noise Blanker board. Decrease signal generator level until a voltage deflection is noted on the VTVM. This voltage deflection will be in the negative direction.
- b. Tune transformer T1103 for maximum negative-going voltage.

5-15. PRODUCT DETECTOR (BFO) COIL ALIGNMENT.

- a. Refer to figure 5-21. With no signal input to the receiver connect the DC probe of a VTVM to the junction of a 1N541 diode and a 10K resistor (CR1301 and R1306 or CR1302 and R1309) on the Detector Board.
- b. Refer to figure 5-5. Adjust the BFO transformer T1301 on the outside of the board for maximum DC voltage. This tunes the detector for the normal SSB channel.
- c. To tune the ISB channel repeat the above procedure with the DC probe attached to the junction of one of the other diode/resistor pairs (CR1301 and R1319 or CR1304 and R1320).
- d. Adjust the inside transformer T1302 for maximum DC voltage.

5-16. VARIABLE BFO ALIGNMENT.

- a. Adjust the signal generator for a zero audio beat in the normal IF channel.
- b. Pull out the BFO control on the front panel and

turn the pointer to the 12 o'clock position.

- c. Refer to figure 5-6. Adjust the potentiometer R1504 for an audio zero beat.

5-17. AUDIO AMPLIFIER ALIGNMENT.

- a. Attach an oscilloscope across the speaker leads.
- b. Adjust the input for an audio frequency of approximately 1000 Hz.
- c. Adjust the AF GAIN control on the front panel (R2102) for a reasonable audio level. This should be as low a level as will give a readable pattern on the oscilloscope.
- d. Refer to figure 5-6. Facing the variable resistor R1415 from the right side of the receiver, rotate the adjusting ring full clockwise; then rotate the adjusting ring counterclockwise until crossover distortion just disappears on the oscilloscope.

5-18. LINE AMPLIFIER ALIGNMENT.

- a. Attach a 600 ohm load resistor across the "normal" line amplifier output at TB2100 on the rear panel of the receiver.
- b. Adjust the signal generator frequency for an audio tone of approximately 1000 Hz.
- c. Attach the RF probe of a VTVM from ground to either side of the 600 ohm load.
- d. Adjust the variable resistor R1509 on the "normal" line amplifier for 0.4 volts rms. This variable resistor is located on the outside edge of the Line Amplifier-BFO board.
- e. To adjust the ISB line amplifier output, switch the IF BW switch to ISB and load the ISB line amplifier output at TB2100 with 600 ohms.
- f. Attach the RF probe from one side of the load to ground.
- g. Adjust the signal generator frequency for an audio output of approximately 1000 Hz and adjust the ISB amplifier variable resistor R1515 for 0.4 volts rms. This variable resistor is located on the inside edge of the Line Amplifier-BFO board.

5-19. SYNTHESIZER SECTION ALIGNMENT.

5-20. VCO ALIGNMENT.

- a. Refer to figure 5-5. Set the 0.1 MHz frequency switch to display 0.9 and adjust the variable resistor R712 on the VCO board for 9.5 volts as measured at the ring of the variable resistor.

NOTE

The remainder of this procedure must be performed with the cover on the RF-Oscillator-Mixer box.

- b. Refer to figures 5-3 and 5-4. Attach the DC probe of a VTVM to the control line (J902) from the Programmable Divider card in the Synthesizer.
- c. Set the frequency controls on the front panel to display 19 550.0 kHz and adjust the 9 MHz coil L708 on the VCO board for 7 vdc.
- d. Repeat step c for each of the frequency settings shown below and adjust each coil for 7 vdc.

READOUT FREQUENCY

COIL

18 550.0	8 MHz (L708)
17 550.0	7 MHz (L707)
16 550.0	6 MHz (L706)
15 550.0	5 MHz (L705)
14 550.0	4 MHz (L704)
13 550.0	3 MHz (L703)
12 550.0	2 MHz (L702)
11 550.0	1 MHz (L701)
10 550.0	0 MHz (L700)

- e. Switch the frequency controls to 29 550.0 kHz and adjust the variable capacitor C707 for 7 volts.
- f. Switch to 20 550.0 kHz and adjust the shunt coil L710 for 7 volts.
- g. Repeat steps e and f until voltage remains at 7 volts when frequency is changed.

h. Place a scope probe on test point A shown in figure 5-5 on the Standard board and refer to the sawtooth waveform shown in the lower right hand corner of the Synthesizer schematic figure 5-33. A small horizontal step should appear approximately 1/3 of the way up on the leading edge of every other cycle.

5-21. BALANCED MIXER TUNING.

- a. Refer to figure 5-5. Attach an RF probe to test point B on the Balanced Mixer card.
- b. Adjust the front panel frequency controls to display 10 550.0 kHz and adjust the "0" coil (L800) for maximum RF voltage. Further tuning should produce a 'valley between two peaks' on the voltmeter indication. The coil should be adjusted for the valley point.
- c. Repeat the tuning procedure at 11 550.0 kHz with the "1" Coil (L807).
- d. Tune the remaining coils "2" through "9" using the same procedure.
- e. Set the frequency controls to display 22 550.0 kHz and adjust the shunt coil (L810) for maximum RF voltage on test point 'B'.

5-22. RF AMPLIFIER ALIGNMENT.

- a. Attach the DC probe of the VTVM to the AVC line at the rear of the RF GAIN control switch (S2100).
- b. Attach a signal generator to the antenna input (J2101).
- c. For all RF alignment the signal generator output level should be adjusted for approximately + 1 volt AVC voltage.
- d. Adjust the signal generator frequency to correspond to the frequency readout of the receiver listed in the following chart and adjust each of the coils indicated for a maximum negative-going AVC voltage. The cover must be on the RF-Oscillator-Mixer box for this procedure.

<u>READOUT FREQUENCY</u>	<u>COIL</u>	<u>RF TUNE</u>
01 995.0	1.9 A3 & A5	10° from full CW
01 895.0	1.8 A3 & A5	10° from full CW
01 795.0	1.7 A3 & A5	10° from full CW
01 695.0	1.6 A3 & A5	10° from full CW
01 595.0	1.5 A3 & A5	10° from full CW
01 495.0	1.4 A3 & A5	10° from full CW
01 395.0	1.3 A3 & A5	10° from full CW
01 295.0	1.2 A3 & A5	10° from full CW
01 195.0	1.1 A3 & A5	10° from full CW
01 095.0	1.0 A3 & A5	10° from full CW
02 005.0	2 A3 & A5	10° from full CW
03 005.0	3 A3 & A5	10° from full CW
04 005.0	4 A3 & A5	10° from full CW
05 005.0	5 A3 & A5	10° from full CW
06 005.0	6 A3 & A5	10° from full CW
07 005.0	7 A3 & A5	10° from full CW
08 005.0	8 A3 & A5	10° from full CW
09 005.0	9 A3 & A5	10° from full CW
10 100.0	10.1 A2 & A4	Not Used
10 300.0	10.3 A2 & A4	Not Used
10 500.0	10.5 A2 & A4	Not Used
10 700.0	10.7 A2 & A4	Not Used
10 900.0	10.9 A2 & A4	Not Used
11 550.0	11 A2 & A4	Not Used
12 550.0	12 A2 & A4	Not Used
13 550.0	13 A2 & A4	Not Used
14 550.0	14 A2 & A4	Not Used
15 550.0	15 A2 & A4	Not Used
16 550.0	16 A2 & A4	Not Used
17 550.0	17 A2 & A4	Not Used
18 550.0	18 A2 & A4	Not Used
19 550.0	19 A2 & A4	Not Used
23 550.0	L215 A2 L400 A4	Not Used Not Used

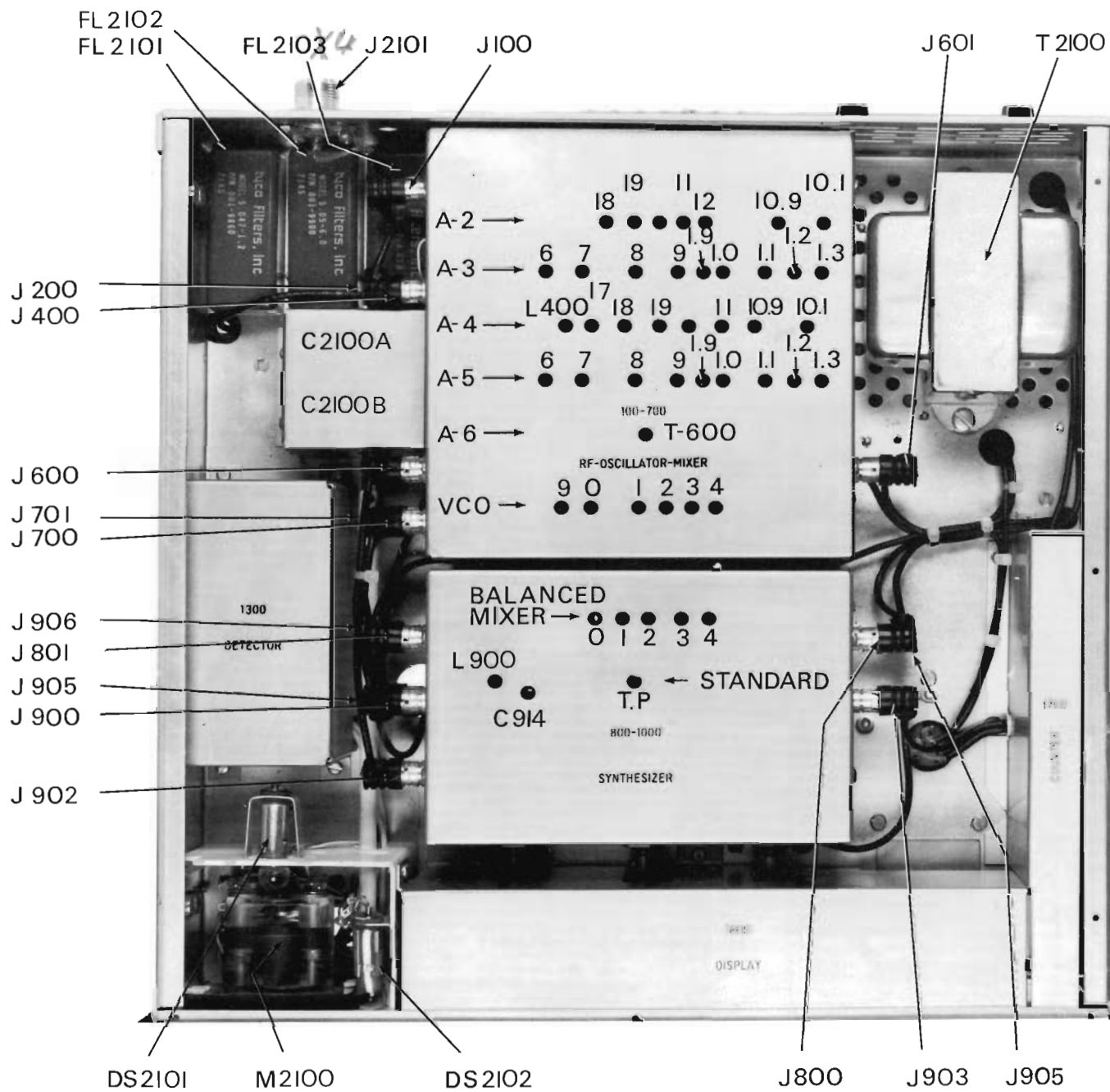


Figure 5-3. Alignment Locations, Top View

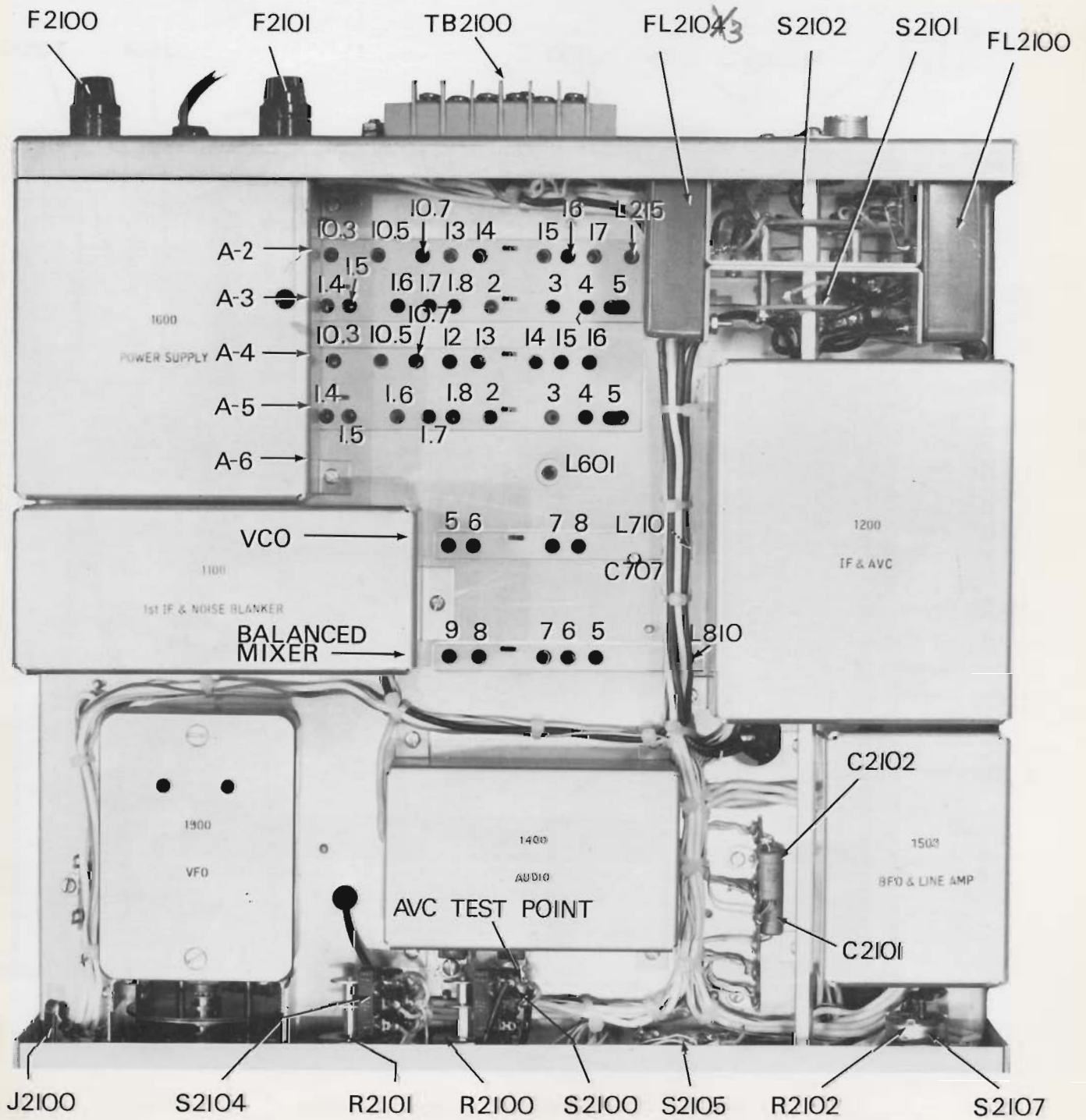


Figure 5-4. Alignment Locations, Bottom View

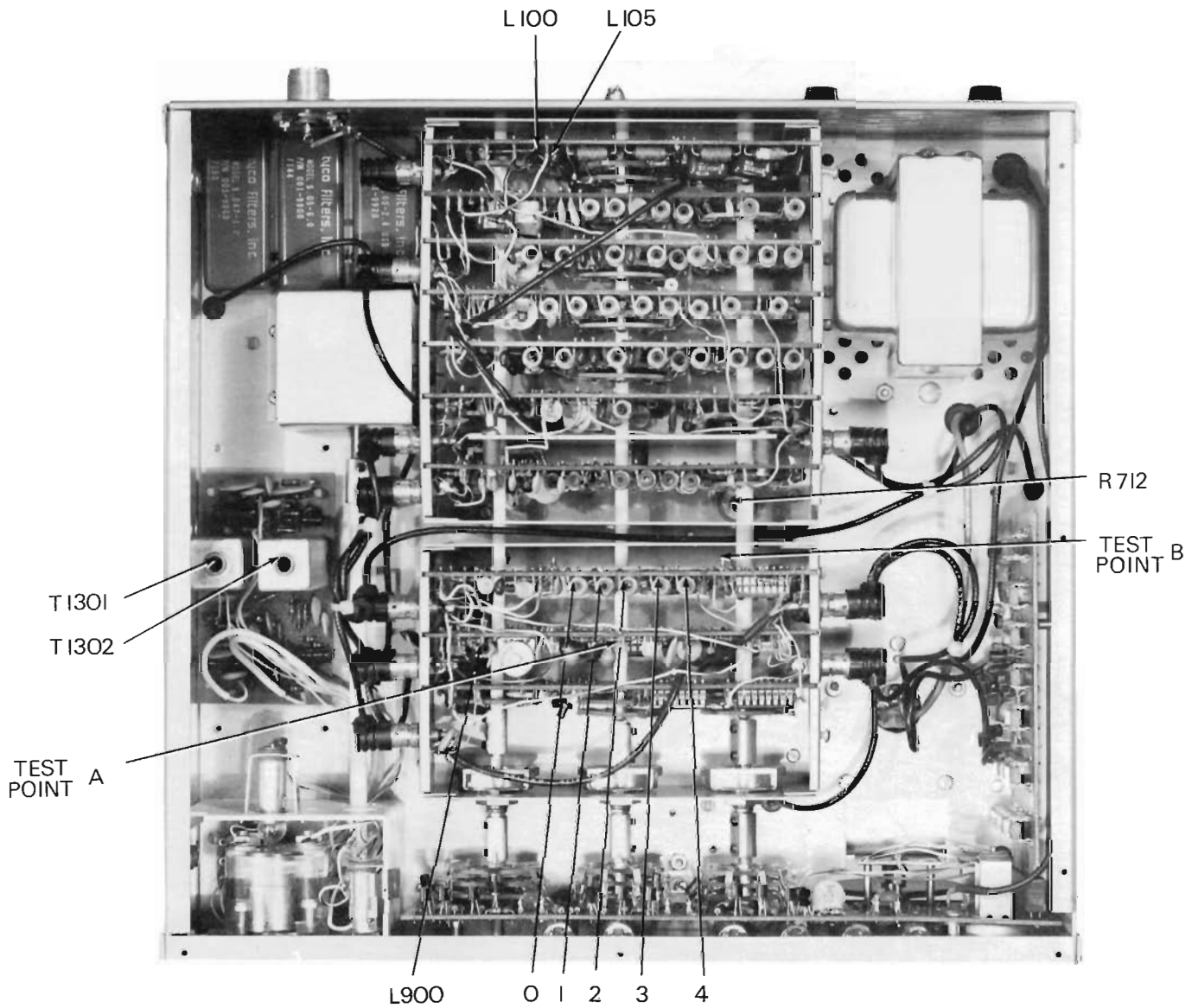


Figure 5-5. Top View with Covers Removed

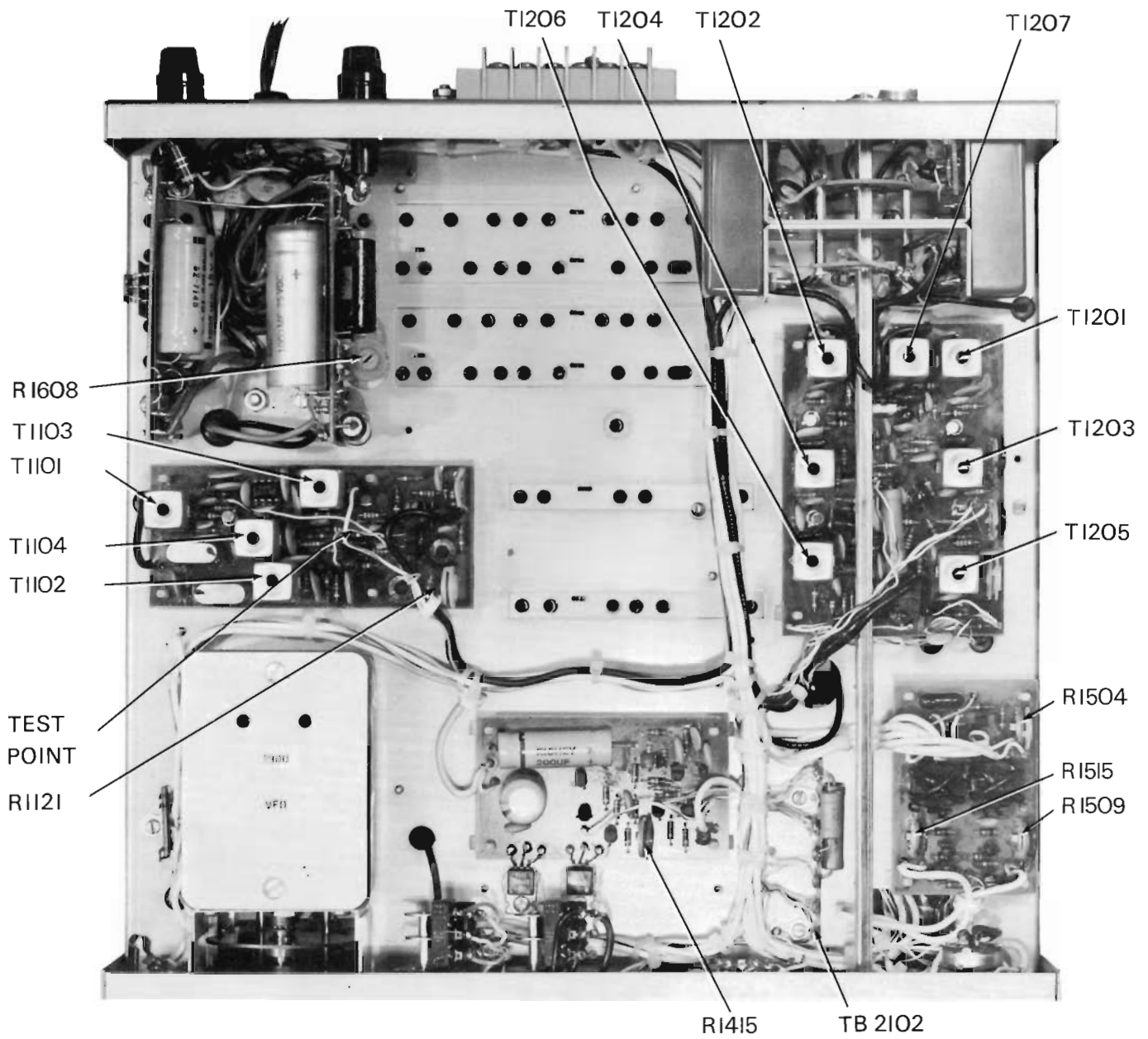


Figure 5-6. Bottom View with Covers Removed

5-23. 20 MHz LOCKED OSCILLATOR ALIGNMENT.

- a. Set receiver frequency readout to 01 995.0 and adjust signal generator for AVC voltage reading.
- b. Remove P900 from the Synthesizer box and increase signal generator level for appropriate AVC voltage.
- c. Adjust L900 for maximum negative-going AVC voltage.
- d. Replace P900 and tune coil L601 on bottom of receiver for maximum negative-going AVC voltage.

5-24. 25.05 MHz TRAP ADJUSTMENT.

- a. Set receiver frequency readout to 07 500.0 kHz.
- b. Remove cover from RF-Oscillator-Mixer box.
- c. At receiver antenna terminal, feed in a 25.05 MHz signal of sufficient strength to produce an AVC voltage of + 1 volt.
- d. Adjust air wound trap L100 on board A1 for minimum negative-going AVC voltage.

5-25. 5.05 MHz TRAP ADJUSTMENT.

- a. Set receiver frequency readout to 07 500.0 kHz.
- b. Feed in a signal of 5.051 MHz and adjust level to produce an AVC voltage of + 1 volt.
- c. Adjust the variable inductor coil L105 on board A1 for minimum negative-going AVC voltage.
- d. Replace cover on RF-Oscillator-Mixer box.

5-26. 15 VOLT POWER SUPPLY SETTING.

Refer to figure 5-6. Place DC probe of VTVM to the 15 volt terminal on terminal strip TB2102 (fifth terminal from the front). Adjust the variable resistor R1608 located on the Power Supply board for 14.5 volts.

5-27. S METER CALIBRATION.

- a. Adjust frequency controls to approximately 7 MHz and adjust the generator level to 10 mv.
- b. Attach VTVM to forward-going AVC line (AVC 2) J200.
- c. Adjust AGC pot R1211 (Blue pot at rear of IF board) for + 2 volts on AVC 2.
- d. Remove signal and adjust zero-adjust pot R1224 (White pot at front of IF board) for S meter zero.
- e. Adjust generator level to 30 mv. and set sensitivity pot R1218 (Black pot on IF board) for a reading of 50 dB on S meter.
- f. Repeat steps c, d, and e until no further improvement can be obtained.

5-28. VFO CALIBRATION.

- a. Set receiver frequency readout to 19 999.9.
- b. Advance VFO knob (front panel Fine Tuning control) in clockwise direction. Display should advance to 20 000.0.
- c. Further clockwise rotation should result in readings of 20 003.0 to 20 007.0 before the last three digits go out. If this is not the case, adjust the appropriate VFO coil until this condition is met.
- d. Continue to advance VFO in clockwise direction. Lights will come back on. Advance further until a reading of 19 900.0 kHz is displayed.
- e. Rotate counterclockwise very slowly. Reading should change to 19 899.9 kHz. Continue in same direction (CCW). Somewhere between the readings of 19 897.0 kHz and 19 893.0 kHz, the last three digits should once again go out. If they do not go out between these limits, adjust the opposite VFO coil from the one adjusted in c above, until this condition is met.
- f. Advance VFO clockwise until 19 999.9 kHz appears on display. Rotating knob further clockwise should produce a reading of 20 000.0 kHz.

- g. Rotating the knob still further to between 20 003.0 kHz and 20 007.0 kHz should cause the last three digits to go out.
- h. Advance the knob still further clockwise until 19 900.0 kHz appears on display.
- i. Now turn the knob counterclockwise slowly. Somewhere between a reading of 19 897.0 kHz and 19 893.0 kHz, the last three digits should go out.

5-29. FREQUENCY CALIBRATION.

- a. Place cover on Synthesizer box.
- b. Set IF BW switch to 6.0 and DETECTOR to AM.
- c. Attach an antenna and tune to WWV at 10, 15 or 20 MHz.
- d. Set frequency controls to precisely 10 000.0, 15 000.0 or 20 000.0 kHz and adjust trimmer C914 on Standard board for exact zero beat.

5-30. NOISE BLANKER ADJUSTMENT.

- a. With no signal input, measure the voltage at the hot end of the white pot R1121 on the First IF-Noise Blanker board.

- b. Adjust the pot for 1.8 volts.

5-31. MISCELLANEOUS TESTS.

- a. Check operation of the RF GAIN control and switch.
- b. Check operation of the slow/fast AVC switch.
- c. Check 6 dB bandwidth of supplied filters using S meter and dial readout in conjunction with an external signal source.
- d. Check for audio quality on both AM and SSB.
- e. Check for audio output power. It should be at least 2 watts (2.83V across 4 ohm load) into 4 ohms with no noticeable peak clipping.
- f. Check for proper mute function.

5-32. PARTS LISTS.

The parts lists which follow present a complete parts breakdown of all electrical subassemblies in the receiver. Printed circuit board illustrations are shown viewing the track side of the board. Reference designations keying the parts lists to the illustrations are identical to those used on the schematic diagrams in the rear of the manual.

MAINTENANCE NOTES

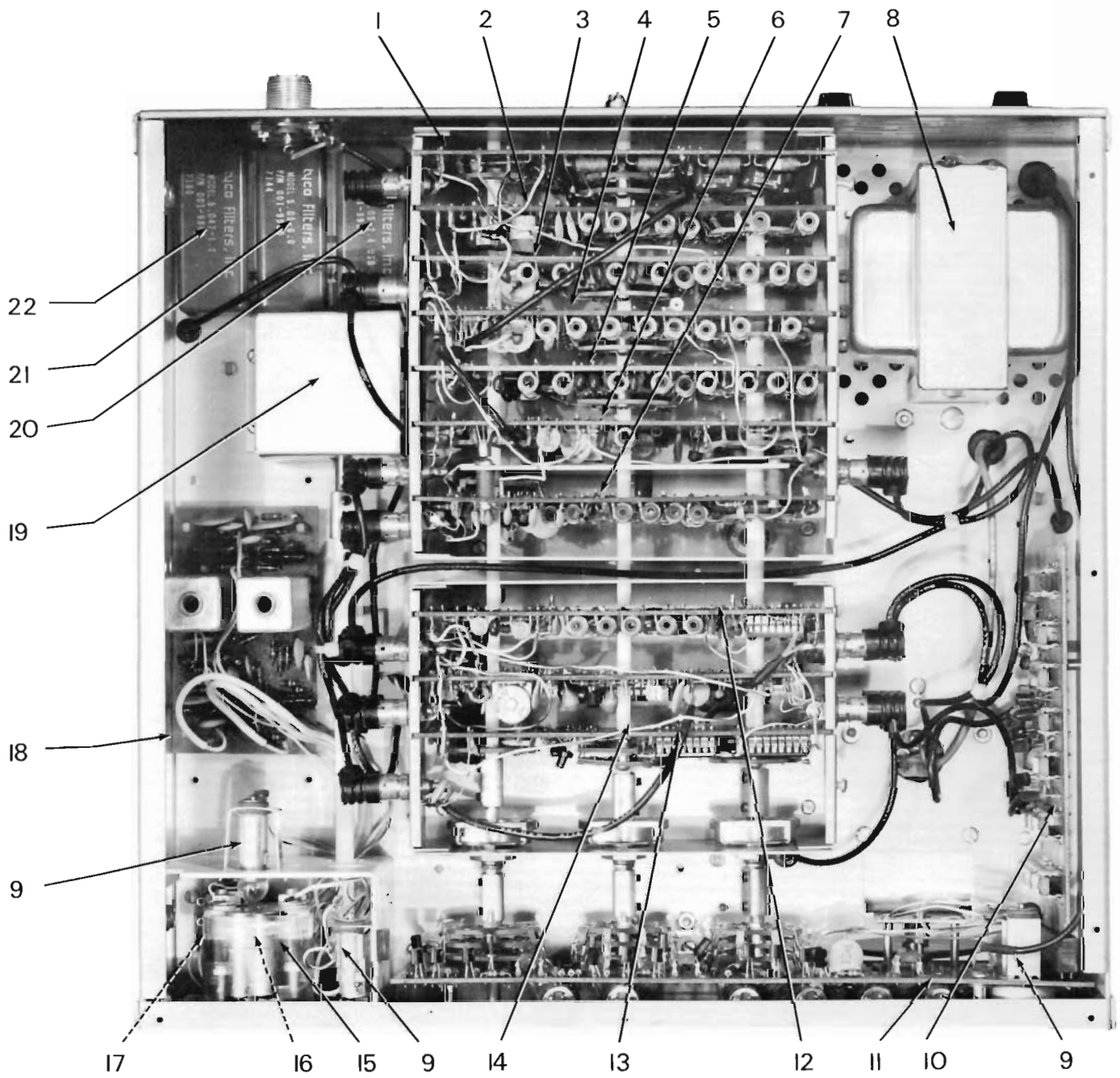


Figure 5-7. Component Locations, Top View

Figure 5-7. Parts List

ITEM	REF DES	DESCRIPTION
1	A1	Antenna Module (R. L. Drake 689-100)
2	A2	10-30 MHz Input (R. L. Drake 689-200)
3	A3	1-10 MHz Input (R. L. Drake 689-300)
4	A4	10-30 MHz Output (R. L. Drake 689-400)
5	A5	1-10 MHz Output (R. L. Drake 689-500)
6	A6	0-1 MHz Output-Mixer (R. L. Drake 689-600)
7	A7	Voltage Controlled Oscillator (R. L. Drake 689-700)
8	T2100	Transformer (R. L. Drake B-2393-E)
9	DS2100 DS2101 DS2102	Lamp, Miniature, Bayonet Base (No. 51)
10	A17	Counter No. 2 (R. L. Drake 689-1700)
11	A18	Counter No. 1 (R. L. Drake 689-1800)
12	A8	Balanced Mixer (R. L. Drake 689-800)
13	A9	5 MHz Standard Oscillator (R. L. Drake 689-900)
14	A10	Programmable Divider (R. L. Drake 689-1000)
15	M2100	Meter (R. L. Drake A-2391-I)
16	S2106	Switch, Slide (Stackpole SS-50)
17	S2101	Switch, Slide (Stackpole SS-50)
18	A13	Detector (R. L. Drake 689-1300)
19	C2100	Capacitor, Variable (R. L. Drake A-2389-C)
<u>USB</u> 20	FL2104	Filter Assembly, 2.4 kHz (R. L. Drake B-2155-V-2)
21	FL2102	Filter Assembly, 6 kHz (R. L. Drake B-2155-V-5)
22	FL2101	Filter Assembly, 1.2 kHz (R. L. Drake B-2155-V-4)

mod. 5.05-2.4 USB
 mod. 5.05-6.0
 Model 5.047-1.2

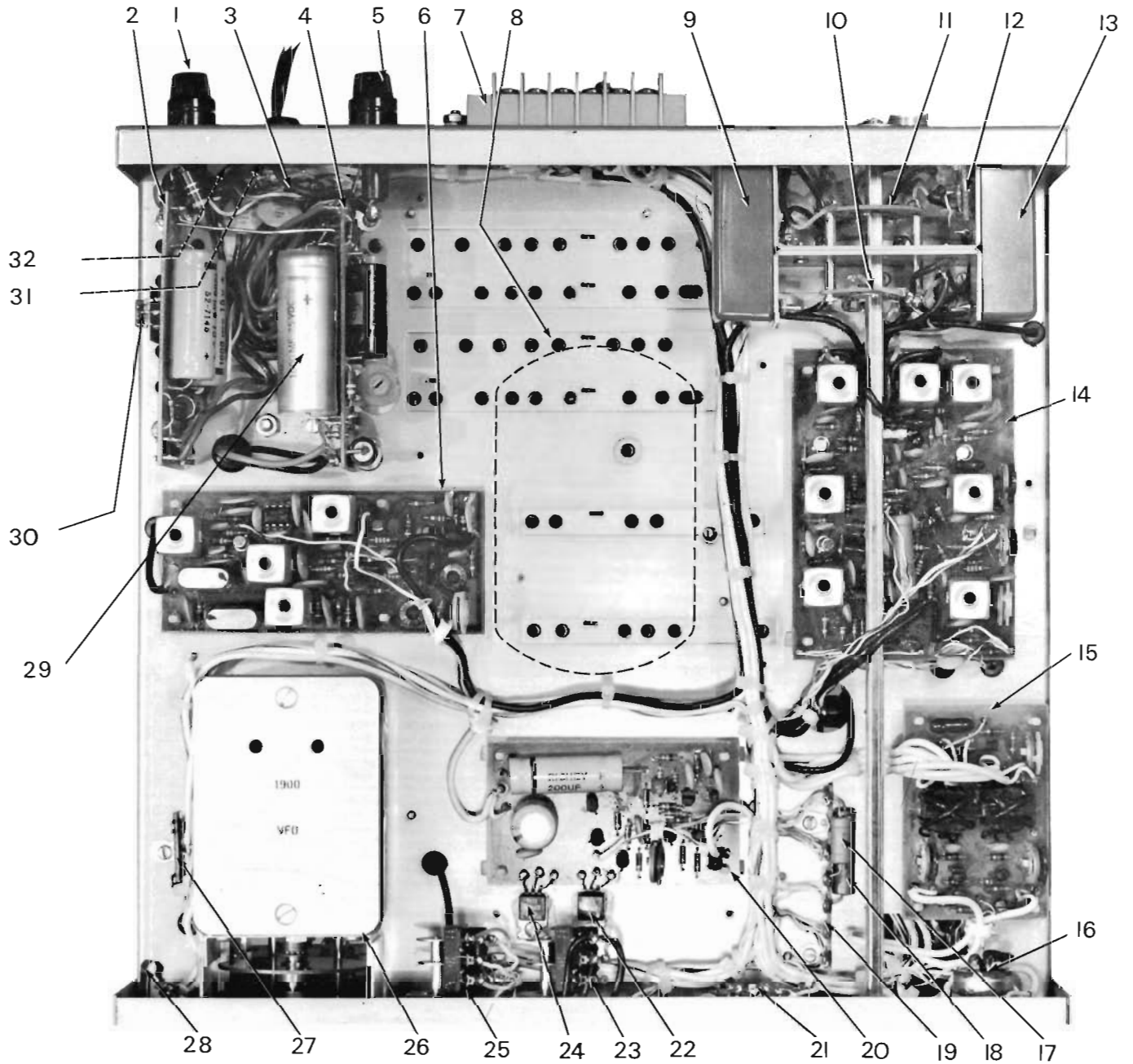


Figure 5-8. Component Locations, Bottom View

Figure 5-8. Parts List

ITEM	REF DES	DESCRIPTION
1	F2100	Fuse, 1 amp (Buss MDL)
2	A16-2	Power Supply Board No. 2 (R. L. Drake 689-1600-2)
3	TB2101	Terminal Board
4	A16-1	Power Supply Board No. 1 (R. L. Drake 689-1600-1)
5	F2101	Fuse, 3/4 amp (Buss MDL)
6	A11	First IF and Noise Blanker (R. L. Drake 689-1100)
7	TB2100	Terminal Block
8	LS2100	Speaker (Mounted in bottom cover) (Rola X26181-53T3)
<i>LSB</i> 9	FL2103	Filter 2.4 kHz (R. L. Drake B-2155-V-1) <i>Mod. 5.05-2,4 LSB</i>
10	S2101	Switch, Rotary output (R. L. Drake A-2258-D)
11	S2102	Switch, Rotary input (R. L. Drake A-2258-D)
12	A20	Filter Amplifier (R. L. Drake 689-2000)
<i>CW</i> 13	FL2100	Filter 0.3 kHz (R. L. Drake B-2155-V-3) <i>Model 5.0492-0.25</i>
14	A12	Second IF and AVC (R. L. Drake 689-1200)
15	A15	BFO and Line Amplifier (R. L. Drake 689-1500)
16	R2102	Resistor, Variable, with Switch (R. L. Drake B-2270-R)
17	S2107	
18	C2102	Capacitor, Tubular, 0.22 uf ± 10%, 50 WVDC
19	C2101	Capacitor, Tubular, 0.47 uf ± 10%, 50 WVDC
20	TB2102	Terminal Board
21	A14	Audio Amplifier (R. L. Drake 689-1400)
22	S2105	Switch, Rotary (R. L. Drake A-2285-D)
23	Q2100	Transistor (TI EP487)
24	R2100	Resistor, Variable, with Switch (R. L. Drake B-2269-R)
25	S2100	
26	Q2101	Transistor (TI EP487)
27	R2101	Resistor, Variable, with Switch (R. L. Drake B-2271-R)
28	S2104	
29	A19	Variable Frequency Oscillator (R. L. Drake 689-1900)
30	TB2103	Terminal Board
31	J2100	Jack, Headphone (Switchcraft L-12A)
32	Q2102	Transistor (TI EP487)
	Q2103	Transistor (TI EP487)
	C2102	Capacitor, Disc, 0.001 uf + 80 -20%, 150 VAC, 1400 VDC
	C2103	Capacitor, Disc, 0.001 uf + 80 -20%, 150 VAC, 1400 VDC

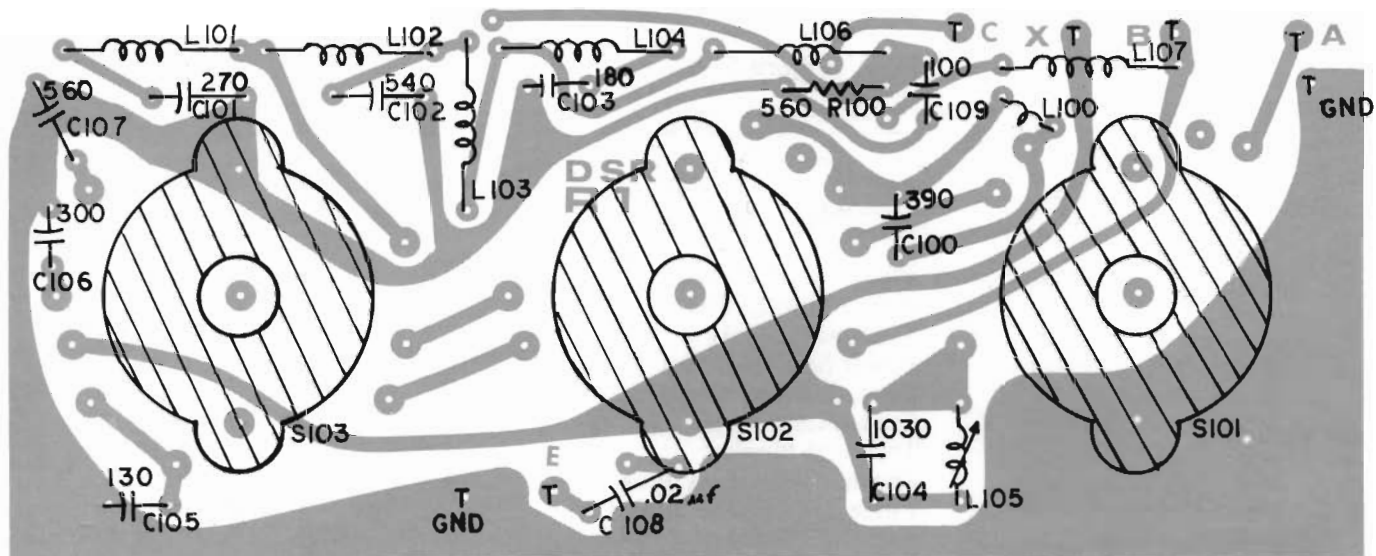


Figure 5-9. Antenna Module, P/N 689-100 (A1)

REF DES	DESCRIPTION
C100	Capacitor, Mica, 390 pf \pm 5%, DM-15
C101	Capacitor, Mica, 270 pf \pm 5%, DM-19
C102	Capacitor, Mica, 540 pf \pm 2%, DM-19
C103	Capacitor, Mica, 180 pf \pm 5%, DM-15
C104	Capacitor, Mica, 1030 pf \pm 1%, DM-20
C105	Capacitor, Mica, 130 pf \pm 5%, DM-15
C106	Capacitor, Mica, 300 pf \pm 5%, DM-15
C107	Capacitor, Mica, 560 pf \pm 5%, DM-19
C108	Capacitor, Ceramic Disc, 0.02 uf + 80 -20%, 100V
C109	Capacitor, Mica, 100 pf \pm 5%, DM-15
L100	Inductor (Paul Smith A-558-1L)
L101	Inductor (R. L. Drake A-2464-L-1)
L102	Inductor (R. L. Drake A-2464-L-2)
L103	Inductor (R. L. Drake A-2464-L-3)
L104	Inductor (R. L. Drake A-2464-L-4)
L105	Inductor, Variable (R. L. Drake A-2505-L-1)
L106	Inductor (R. L. Drake A-2464-L-5)
L107	Inductor (R. L. Drake A-2464-L-6)
R100	Resistor, Carbon Comp., 560 ohm \pm 10%, 1/4 W
S101	Switch, Rotary (R. L. Drake A-2260-DA)
S102	Switch, Rotary (R. L. Drake A-2260-DB)
S103	Switch, Rotary (R. L. Drake A-2260-DC)

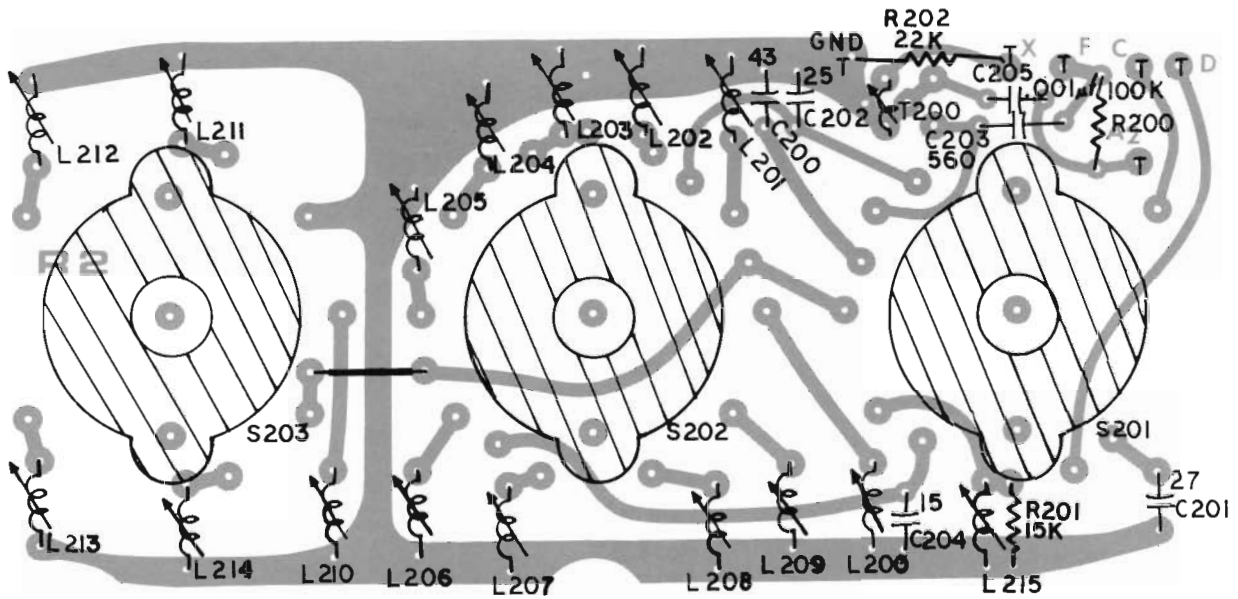


Figure 5-10. 10-30 MHz Input, P/N 689-200 (A2)

REF DES	DESCRIPTION
C200	Capacitor, Ceramic Disc, NPO, 43 pf \pm 5%
C201	Capacitor, Ceramic Disc, NPO, 27 pf \pm 5%
C202	Capacitor, Ceramic Disc, NPO, 25 pf \pm 5%
C203	Capacitor, Mica, 560 pf \pm 5%, DM-19
C204	Capacitor, Ceramic Disc, NPO, 15 pf \pm 5%
C205	Capacitor, Ceramic Disc, .001 uf \pm 20%, Z5U
L200	Inductor, Variable (R. L. Drake A-2505-L-2)
L201	Inductor, Variable (R. L. Drake A-2505-L-2)
L202	Inductor, Variable (R. L. Drake A-2505-L-1)
L203	Inductor, Variable (R. L. Drake A-2505-L-4)
L204	Inductor, Variable (R. L. Drake A-2505-L-4)
L205	Inductor, Variable (R. L. Drake A-2505-L-3)
L206	Inductor, Variable (R. L. Drake A-2505-L-3)
L207	Inductor, Variable (R. L. Drake A-2505-L-3)
L208	Inductor, Variable (R. L. Drake A-2505-L-3)
L209	Inductor, Variable (R. L. Drake A-2505-L-2)
L210	Inductor, Variable (R. L. Drake A-2505-L-6)
L211	Inductor, Variable (R. L. Drake A-2505-L-6)
L212	Inductor, Variable (R. L. Drake A-2505-L-6)
L213	Inductor, Variable (R. L. Drake A-2505-L-6)
L214	Inductor, Variable (R. L. Drake A-2505-L-6)
L215	Inductor, Variable (R. L. Drake A-2505-L-2)
R200	Resistor, Carbon Comp., 100 K \pm 10% 1/4 W
R201	Resistor, Carbon Comp., 15 K \pm 10% 1/4 W
R202	Resistor, Carbon Comp., 22 K \pm 10% 1/4 W
S201	Switch, Rotary (R. L. Drake A-2261-DA)
S202	Switch, Rotary (R. L. Drake A-2261-DB)
S203	Switch, Rotary (R. L. Drake A-2261-DC)

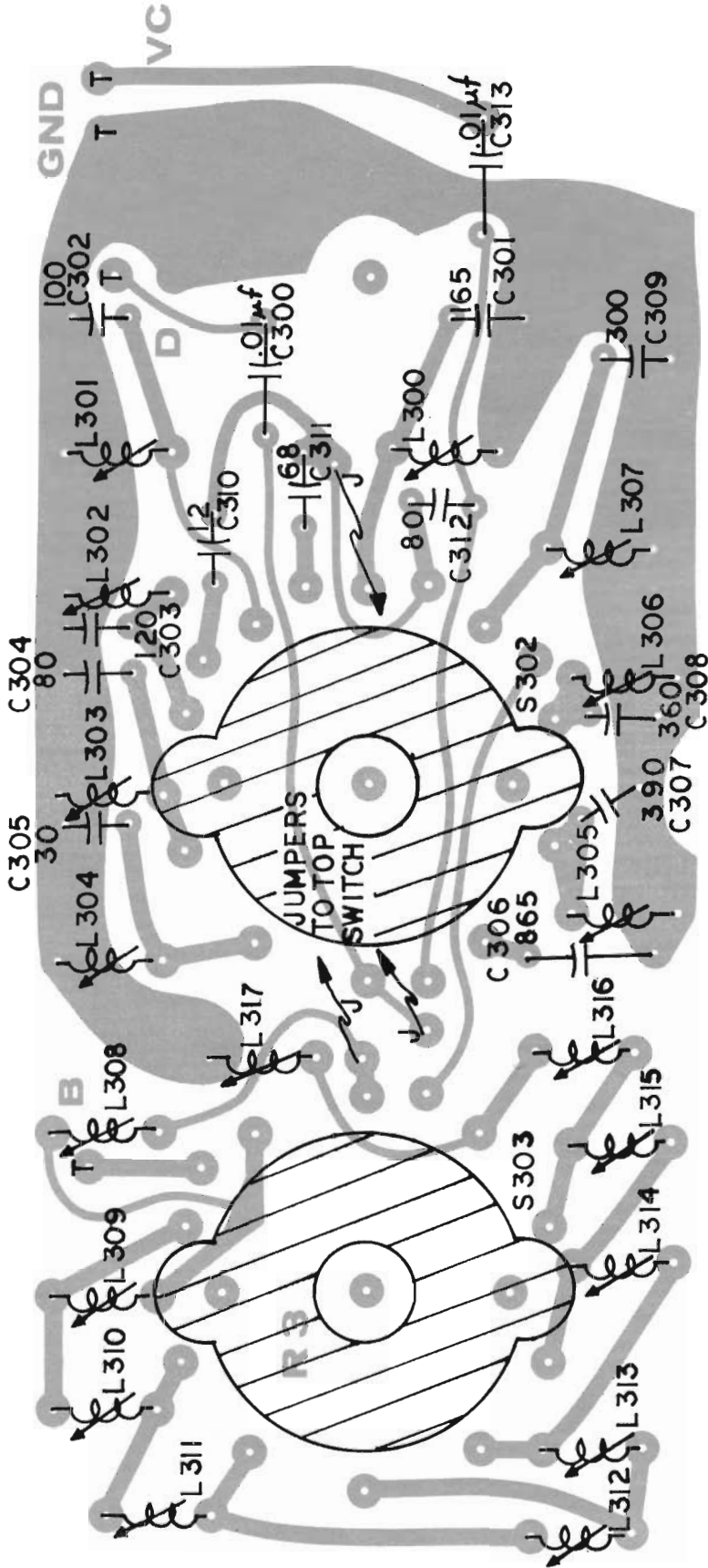


Figure 5-11. 1-10 MHz Input, P/N 689-300 (A3)

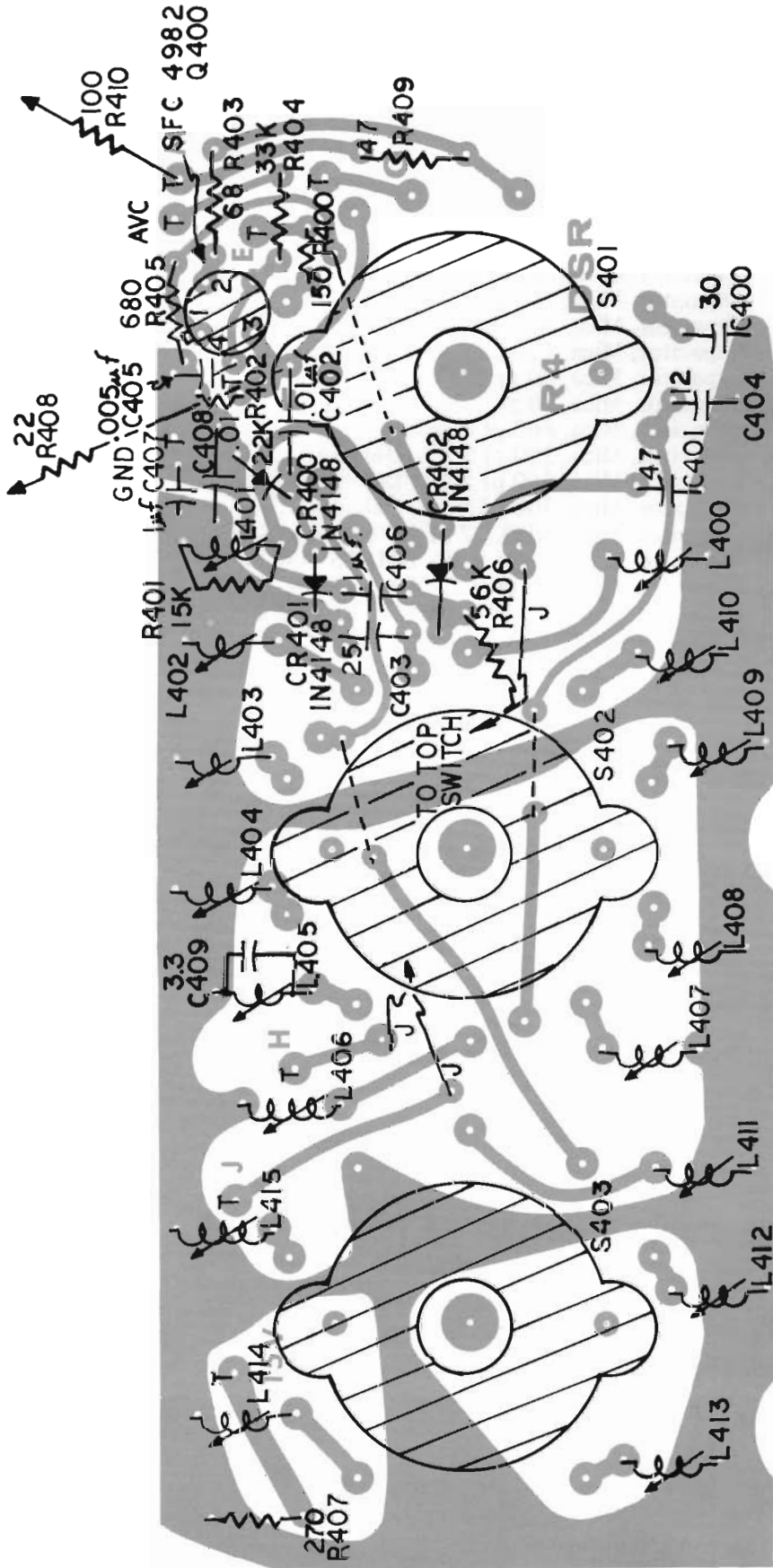


Figure 5-12. 10-30 MHz Output, P/N 689-400 (A4)

Figure 5-12. Parts List

REF DES	DESCRIPTION
C400	Capacitor, Mica, 30 pf \pm 2%, DM-15
C401	Capacitor, Ceramic Disc, NPO, 47 pf \pm 5%
C402	Capacitor, Ceramic Disc, .01 uf \pm 20%, Z5U
C403	Capacitor, Ceramic Disc, NPO, 25 pf \pm 5%
C404	Capacitor, Ceramic Disc, NPO, 12 pf \pm 5%
C405	Capacitor, Ceramic Disc, .005 uf \pm 20%, Z5U
C406	Capacitor, Ceramic Disc, NPO, .1 uf + 80 -20%, 12V
C407	Capacitor, Tantalum, 1.0 uf \pm 20%, 35V
C408	Capacitor, Ceramic Disc, .01 uf \pm 20%, Z5U
C409	Capacitor, Ceramic, 3.3 pf \pm .25, CC20
L400	Inductor, Variable (R. L. Drake A-2505-L-2)
L401	Inductor, Variable (R. L. Drake A-2505-L-3)
L402	Inductor, Variable (R. L. Drake A-2505-L-2)
L403	Inductor, Variable (R. L. Drake A-2505-L-2)
L404	Inductor, Variable (R. L. Drake A-2505-L-1)
L405	Inductor, Variable (R. L. Drake A-2505-L-4)
L406	Inductor, Variable (R. L. Drake A 2505-L-4)
L407	Inductor, Variable (R. L. Drake A-2505-L-3)
L408	Inductor, Variable (R. L. Drake A-2505-L-3)
L409	Inductor, Variable (R. L. Drake A-2505-L-3)
L410	Inductor, Variable (R. L. Drake A-2505-L-3)
L411	Inductor, Variable (R. L. Drake A-2505-L-5)
L412	Inductor, Variable (R. L. Drake A-2505-L-4)
L413	Inductor, Variable (R. L. Drake A-2505-L-6)
L414	Inductor, Variable (R. L. Drake A-2505-L-6)
L415	Inductor, Variable (R. L. Drake A-2505-L-5)
R400	Resistor, Carbon Comp., 150 ohm \pm 10%, 1/4 W
R401	Resistor, Carbon Comp., 15 K \pm 10%, 1/4 W
R402	Resistor, Carbon Comp., 22 K \pm 10%, 1/4 W
R403	Resistor, Carbon Comp., 68 ohm \pm 10%, 1/4 W
R404	Resistor, Carbon Comp., 33 K \pm 10%, 1/4 W
R405	Resistor, Carbon Comp., 680 ohm \pm 10%, 1/4 W
R406	Resistor, Carbon Comp., 56 K \pm 10%, 1/4 W
R407	Resistor, Carbon Comp., 270 ohm \pm 10%, 1/4 W
R408	Resistor, Carbon Comp., 22 ohm \pm 10%, 1/4 W
R409	Resistor, Carbon Comp., 47 ohm \pm 10%, 1/4 W
R410	Resistor, Carbon Comp., 100 ohm \pm 10%, 1/4 W
Q400	Transistor, (TI SFC4982)
CR400	Diode, 1N4148
CR401	Diode, 1N4148
CR402	Diode, 1N4148
S401	Switch, Rotary (R. L. Drake A-2263-DA)
S402	Switch, Rotary (R. L. Drake A-2263-DB)
S403	Switch, Rotary (R. L. Drake A-2263-DC)

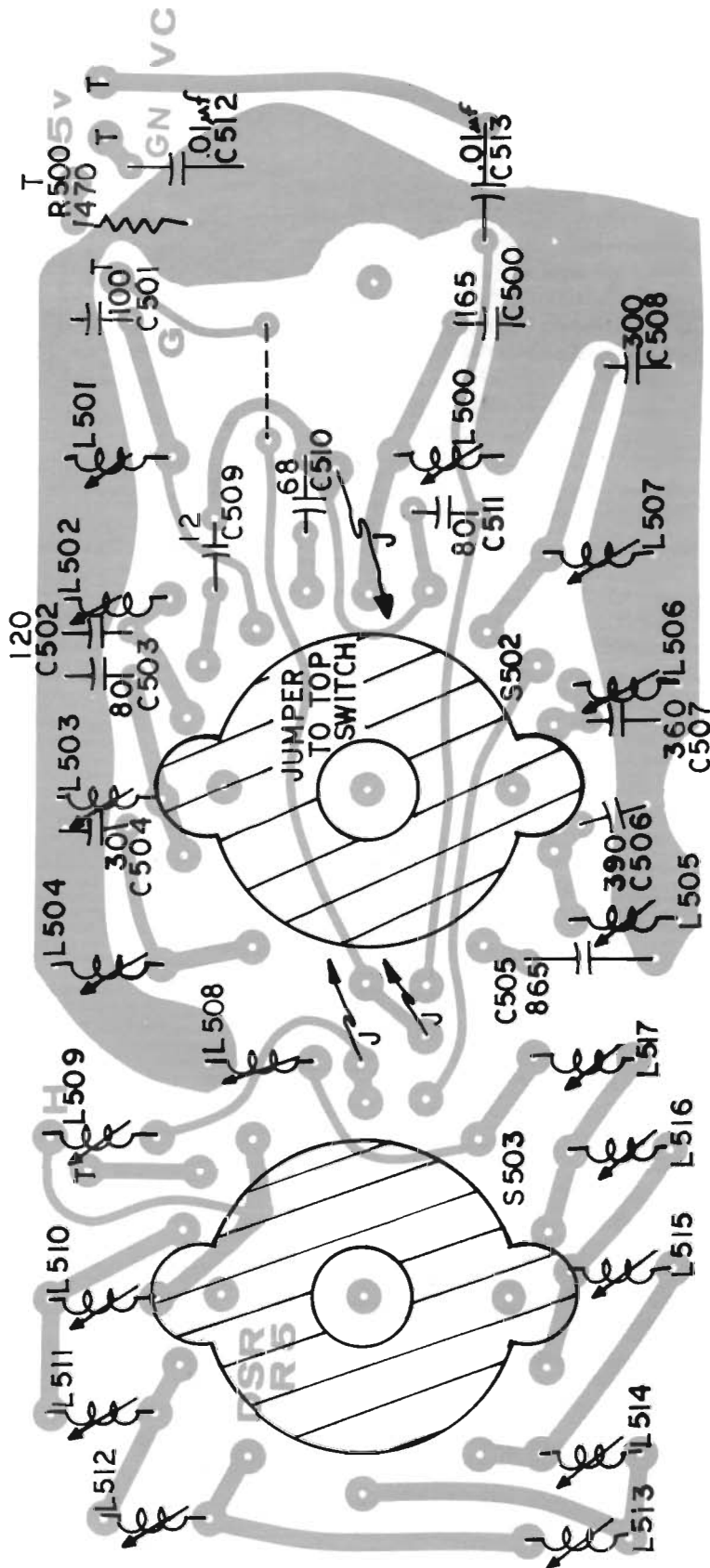


Figure 5-13. 1-10 MHz Output, P/N 689-500 (A5)

Figure 5-13. Parts List

REF DES	DESCRIPTION
C500	Capacitor, Mica, 165 pf \pm 5%, DM-15
C501	Capacitor, Mica, 100 pf \pm 5%, DM-15
C502	Capacitor, Mica, 120 pf \pm 5%, DM-15
C503	Capacitor, Mica, 80 pf \pm 5%, DM-15
C504	Capacitor, Mica, 30 pf \pm 2%, DM-15
C505	Capacitor, Mica, 865 pf \pm 1%, DM-20
C506	Capacitor, Mica, 390 pf \pm 5%, DM-15
C507	Capacitor, Mica, 360 pf \pm 5%, DM-15
C508	Capacitor, Mica, 300 pf \pm 5%, DM-15
C509	Capacitor, Ceramic Disc, NPO, 12 pf \pm 5%
C510	Capacitor, Mica, 68 pf \pm 5%, DM-15
C511	Capacitor, Mica, 80 pf \pm 5%, DM-15
C512	Capacitor, Ceramic Disc, .01 uf \pm 20%, Z5U
C513	Capacitor, Ceramic Disc, .01 uf \pm 20%, Z5U
L500	Inductor, Variable (R. L. Drake A-2505-L-6)
L501	Inductor, Variable (R. L. Drake A-2505-L-6)
L502	Inductor, Variable (R. L. Drake A-2505-L-4)
L503	Inductor, Variable (R. L. Drake A-2505-L-4)
L504	Inductor, Variable (R. L. Drake A-2505-L-6)
L505	Inductor, Variable (R. L. Drake A-2505-L-8)
L506	Inductor, Variable (R. L. Drake A-2505-L-7)
L507	Inductor, Variable (R. L. Drake A-2505-L-6)
L508	Inductor, Variable (R. L. Drake A-2505-L-4)
L509	Inductor, Variable (R. L. Drake A-2505-L-4)
L510	Inductor, Variable (R. L. Drake A-2505-L-4)
L511	Inductor, Variable (R. L. Drake A-2505-L-3)
L512	Inductor, Variable (R. L. Drake A-2505-L-2)
L513	Inductor, Variable (R. L. Drake A-2505-L-2)
L514	Inductor, Variable (R. L. Drake A-2505-L-2)
L515	Inductor, Variable (R. L. Drake A-2505-L-1)
L516	Inductor, Variable (R. L. Drake A-2505-L-1)
L517	Inductor, Variable (R. L. Drake A-2505-L-6)
R500	Resistor, Carbon Comp., 470 ohm \pm 10%, 1/4 W
S502	Switch, Rotary (R. L. Drake A-2264-DB)
S503	Switch, Rotary (R. L. Drake A-2264-DC)

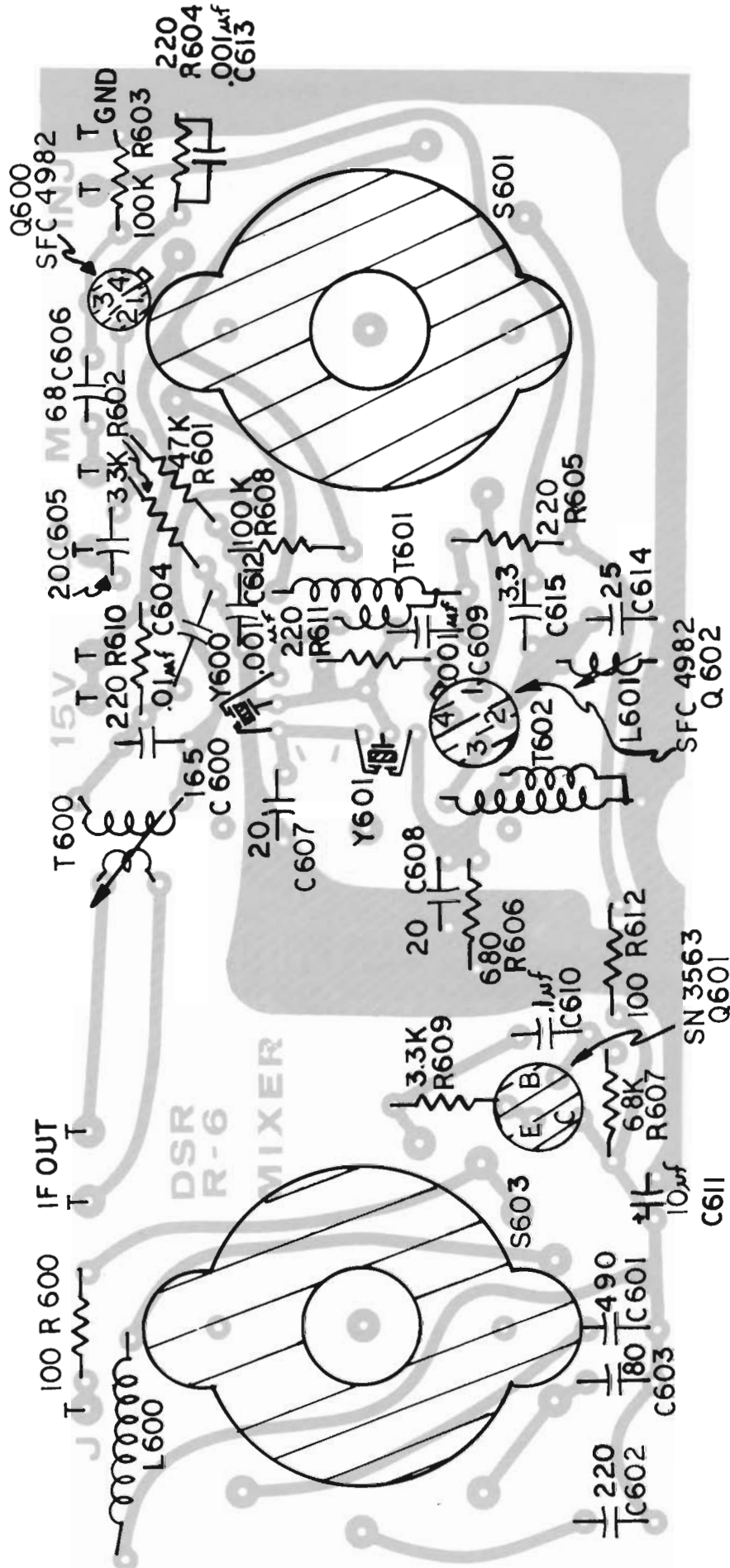


Figure 5-14. 0-1 MHz Output, P/N 689-600 (A6)

Figure 5-14. Parts List

REF DES	DESCRIPTION
C600	Capacitor, Mica, 165 pf \pm 5%, DM-15
C601	Capacitor, Mica, 490 pf \pm 5%, DM-15
C602	Capacitor, Mica, 220 pf \pm 5%, DM-15
C603	Capacitor, Mica, 80 pf \pm 5%, DM-15
C604	Capacitor, Ceramic Disc, 0.1 uf \pm 20%, Z5U
C605	Capacitor, Ceramic Disc, NPO, 20 pf \pm 5%
C606	Capacitor, Mica, 68 pf \pm 5%, DM-15
C607	Capacitor, Ceramic Disc, NPO, 20 pf \pm 5%
C608	Capacitor, Ceramic Disc, NPO, 20 pf \pm 5%
C609	Capacitor, Ceramic Disc, .001 uf \pm 20%, Z5U
C610	Capacitor, Ceramic Disc, .1 uf \pm 80 -20%, 12V
C611	Capacitor, Tantalum, 10 uf \pm 20%, 35V
C612	Capacitor, Ceramic Disc, .001 uf \pm 20%, Z5U
C613	Capacitor, Ceramic Disc, .001 uf \pm 20%, Z5U
C614	Capacitor, Ceramic Disc, NPO, 25 pf \pm 5%
C615	Capacitor, Ceramic Disc, NPO, 3.3 pf \pm .25 pf, N750
Y600	Crystal, Monolithic Filter, (Piezo TF-1592)
Y601	Crystal, Monolithic Filter, (Piezo TF-1592)
L600	Inductor, Fixed (R. L. Drake A-2464-L-7)
L601	Inductor, Variable (R. L. Drake A-2505-L-3)
R600	Resistor, Carbon Comp., 100 ohm \pm 10%, 1/4 W
R601	Resistor, Carbon Comp., 47 K \pm 10%, 1/4 W
R602	Resistor, Carbon Comp., 33 K \pm 10%, 1/4 W
R603	Resistor, Carbon Comp., 100 K \pm 10%, 1/4 W
R604	Resistor, Carbon Comp., 220 ohm \pm 10%, 1/4 W
R605	Resistor, Carbon Comp., 220 ohm \pm 10%, 1/4 W
R606	Resistor, Carbon Comp., 680 ohm \pm 10%, 1/4 W
R607	Resistor, Carbon Comp., 68 K \pm 10%, 1/4 W
R608	Resistor, Carbon Comp., 100 K \pm 10%, 1/4 W
R609	Resistor, Carbon Comp., 3.3 K \pm 10%, 1/4 W
R610	Resistor, Carbon Comp., 220 ohm \pm 10%, 1/4 W
R611	Resistor, Carbon Comp., 220 ohm \pm 10%, 1/4 W
R612	Resistor, Carbon Comp., 100 ohm \pm 10%, 1/4 W
T600	Transformer, Variable (R. L. Drake A-2505-L-9)
T601	Transformer, Fixed (R. L. Drake A-2465-E)
T602	Transformer, Fixed (R. L. Drake A-2465-E)
Q600	Transistor, (TI SFC4982)
Q601	Transistor, 2N3563
Q602	Transistor, (TI SFC4982)
S601	Switch, Rotary (R. L. Drake A-2265-DA)
S603	Switch, Rotary (R. L. Drake A-2265-DC)

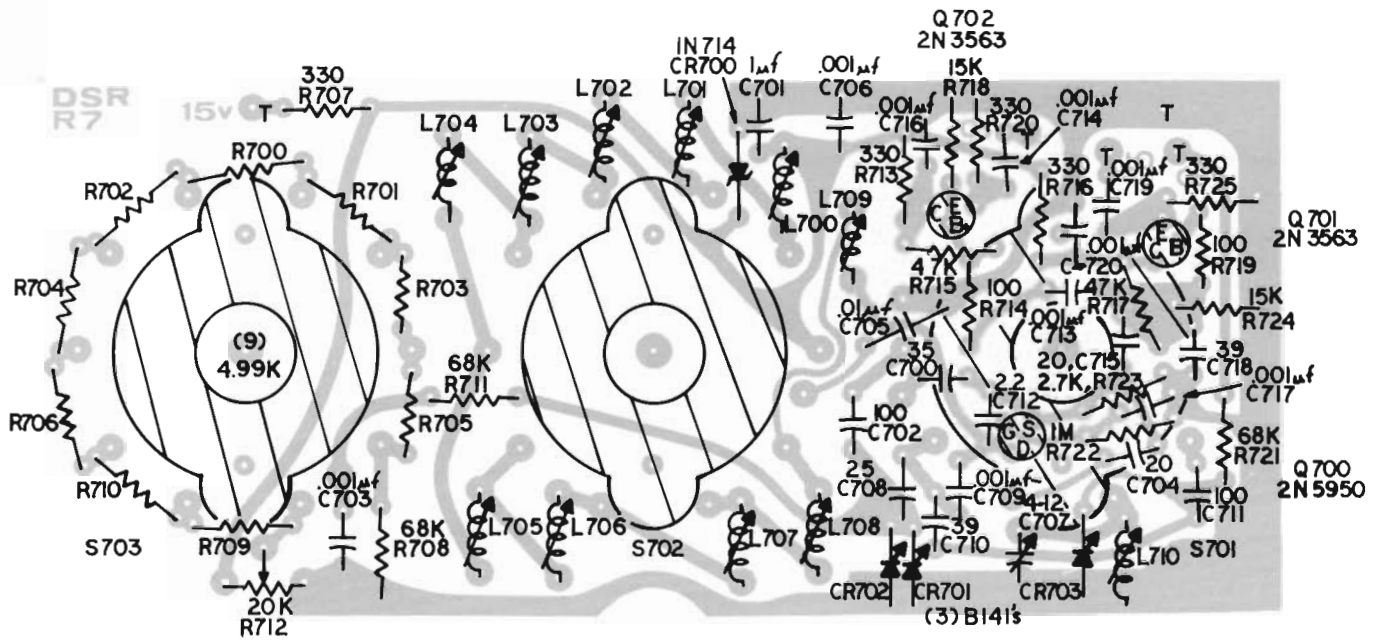


Figure 5-15. Voltage Controlled Oscillator, P/N 689-700 (A7)

REF DES	DESCRIPTION
------------	-------------

C700	Capacitor, Ceramic Disc, NPO, 35 pf \pm 5%
C701	Capacitor, Tantalum, 1.0 uf \pm 20%, 35V
C702	Capacitor, Mica, 100 pf \pm 5%, DM-15
C703	Capacitor, Ceramic, .001 uf \pm 20%, Z5U
C704	Capacitor, Ceramic Disc, NPO, 20 pf \pm 5%
C705	Capacitor, Ceramic Disc, .01 uf \pm 20%, Z5U
C706	Capacitor, Ceramic Disc, .001 uf \pm 20%, Z5U
C707	Capacitor, Variable, Ceramic, NPO, 4-12 pf (Erie 3192-006)
C708	Capacitor, Ceramic, NPO, 25 pf \pm 5%
C709	Capacitor, Ceramic, .001 uf \pm 20%, Z5U
C710	Capacitor, Ceramic, NPO, 39 pf \pm 5%
C711	Capacitor, Mica, 100 pf \pm 5%, DM-15
C712	Capacitor, Tubular, 2.2 pf \pm .25 pf
C713	Capacitor, Ceramic Disc, .001 uf \pm 20%, Z5U
C714	Capacitor, Ceramic Disc, .001 uf \pm 20%, Z5U
C715	Capacitor, Ceramic Disc, NPO, 20 pf \pm 5%
C716	Capacitor, Ceramic Disc, .001 pf \pm 20%, Z5U
C717	Capacitor, Ceramic Disc, .001 pf \pm 20%, Z5U
C718	Capacitor, Ceramic Disc, NPO, 39 pf \pm 5%
C719	Capacitor, Ceramic Disc, .001 uf \pm 20%, Z5U
C720	Capacitor, Ceramic Disc, .001 uf \pm 20%, Z5U
C721	Capacitor, Ceramic Disc, .1 uf \pm 80 -20%, 12V
CR700	Diode, Zener, 1N714
CR701	Diode, Varactor, B-141
CR702	Diode, Varactor, B-141
CR703	Diode, Varactor, B-141

Figure 5-15. Parts List

REF DES	DESCRIPTION
L700	Inductor, Variable (R. L. Drake A-2458-L-8)
L1701	Inductor, Variable (R. L. Drake A-2458-L-7)
L702	Inductor, Variable (R. L. Drake A-2458-L-7)
L703	Inductor, Variable (R. L. Drake A-2458-L-6)
L704	Inductor, Variable (R. L. Drake A-2458-L-6)
L705	Inductor, Variable (R. L. Drake A-2458-L-5)
L706	Inductor, Variable (R. L. Drake A-2458-L-4)
L707	Inductor, Variable (R. L. Drake A-2458-L-3)
L708	Inductor, Variable (R. L. Drake A-2458-L-2)
L709	Inductor, Variable (R. L. Drake A-2458-L-1)
L710	Inductor, Variable (R. L. Drake A-2458-L-4)
R700	Resistor, Metal Film, 4.99 K \pm 1%, 1/4 W (TI MC60D-FT1)
R701	Resistor, Metal Film, 4.99 K \pm 1%, 1/4 W (TI MC60D-FT1)
R702	Resistor, Metal Film, 4.99 K \pm 1%, 1/4 W (TI MC60D-FT1)
R703	Resistor, Metal Film, 4.99 K \pm 1%, 1/4 W (TI MC60D-FT1)
R704	Resistor, Metal Film, 4.99 K \pm 1%, 1/4 W (TI MC60D-FT1)
R705	Resistor, Metal Film, 4.99 K \pm 1%, 1/4 W (TI MC60D-FT1)
R706	Resistor, Metal Film, 4.99 K \pm 1%, 1/4 W (TI MC60D-FT1)
R707	Resistor, Metal Film, 330 ohm \pm 10%, 1/4 W
R708	Resistor, Carbon Comp., 68 K \pm 10%, 1/4 W
R709	Resistor, Metal Film, 4.99 K \pm 10%, 1/4 W
R710	Resistor, Metal Film, 4.99 K \pm 10%, 1/4 W
R711	Resistor, Carbon Comp., 68 K \pm 10%, 1/4 W
R712	Resistor, Variable, Carbon, 20 K (CTS SR9098)
R713	Resistor, Carbon Comp., 330 ohms \pm 10%, 1/4 W
R714	Resistor, Carbon Comp., 100 ohms \pm 10%, 1/4 W
R715	Resistor, Carbon Comp., 47 K \pm 10%, 1/4 W
R716	Resistor, Carbon Comp., 330 ohms \pm 10%, 1/4 W
R717	Resistor, Carbon Comp., 47 K \pm 10%, 1/4 W
R718	Resistor, Carbon Comp., 15 K \pm 10%, 1/4 W
R719	Resistor, Carbon Comp., 100 ohms \pm 10%, 1/4 W
R720	Resistor, Carbon Comp., 330 ohms \pm 10%, 1/4 W
R721	Resistor, Carbon Comp., 68 K \pm 10%, 1/4 W
R722	Resistor, Carbon Comp., 1 Meg \pm 10%, 1/4 W
R723	Resistor, Carbon Comp., 2.7 K \pm 10%, 1/4 W
R724	Resistor, Carbon Comp., 15 K \pm 10%, 1/4 W
R725	Resistor, Carbon Comp., 330 ohms \pm 10%, 1/4 W
Q700	Transistor, 2N5950
Q701	Transistor, 2N3563
Q702	Transistor, 2N3563
S701	Switch, Rotary (R. L. Drake A-2266-DA)
S702	Switch, Rotary (R. L. Drake A-2266-DB)
S703	Switch, Rotary (R. L. Drake A-2266-DC)

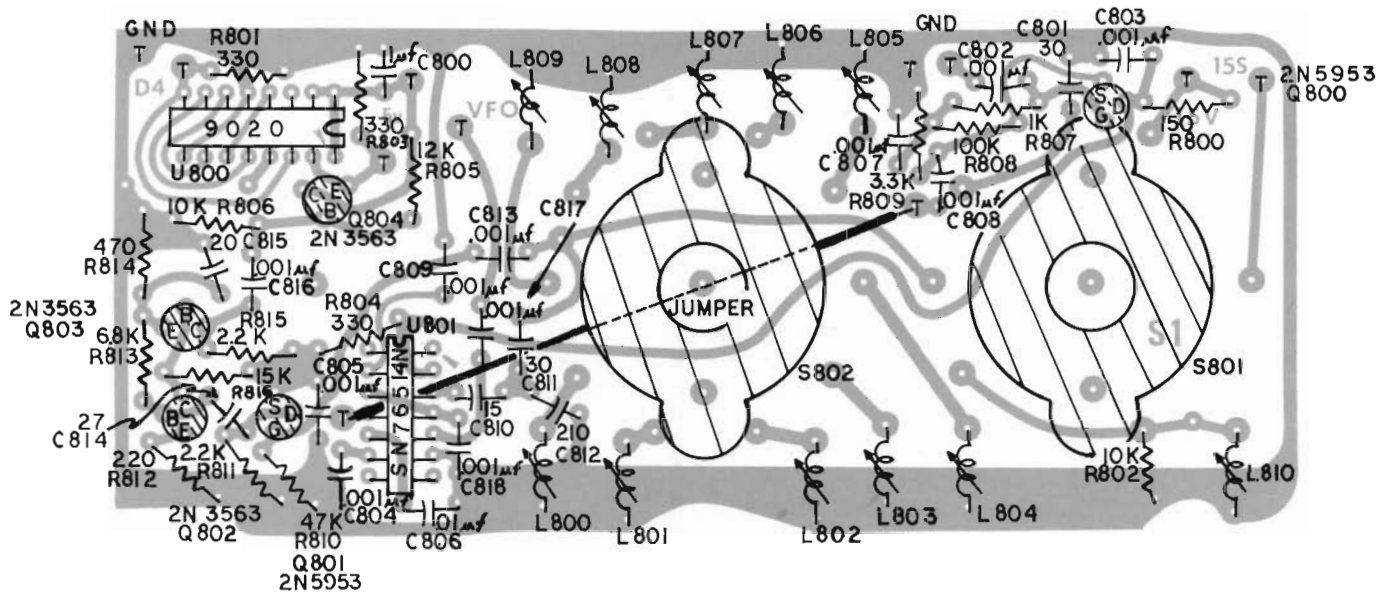


Figure 5-16. Balanced Mixer, P/N 689-800 (A8)

REF DES	DESCRIPTION
C800	Capacitor, Tantalum, 1.0 uf \pm 20%, 35V
C801	Capacitor, Ceramic Disc, .001 uf \pm 20%, Z5U
C802	Capacitor, Mica, 30 pf \pm 2%, DM-15
C803	Capacitor, Ceramic Disc, .001 uf \pm 20%, Z5U
C804	Capacitor, Ceramic Disc, .001 uf \pm 20%, Z5U
C805	Capacitor, Ceramic Disc, .001 uf \pm 20%, Z5U
C806	Capacitor, Ceramic Disc, .01 uf \pm 80 -20%, 25V
C807	Capacitor, Ceramic Disc, .001 uf \pm 20%, Z5U
C808	Capacitor, Ceramic Disc, .001 uf \pm 20%, Z5U
C809	Capacitor, Ceramic Disc, .001 uf \pm 20%, Z5U
C810	Capacitor, Ceramic Disc, NPO, 15 pf \pm 5%,
C811	Capacitor, Mica, 30 pf \pm 2%, DM-15
C812	Capacitor, Mica, 210 pf \pm 5%, DM-15
C813	Capacitor, Ceramic Disc, .001 uf \pm 20%, Z5U
C814	Capacitor, Ceramic Disc, NPO, 27 pf \pm 5%,
C815	Capacitor, Ceramic Disc, 20 pf \pm 5%
C816	Capacitor, Ceramic Disc, .001 uf \pm 20%, Z5U
C817	Capacitor, Ceramic Disc, .001 uf \pm 20%, Z5U
C818	Capacitor, Ceramic Disc, .001 uf \pm 20%, Z5U

Figure 5-16. Parts List

REF DES	DESCRIPTION
L800	Inductor, Variable (R. L. Drake A-2505-L-4)
L801	Inductor, Variable (R. L. Drake A-2505-L-4)
L802	Inductor, Variable (R. L. Drake A-2505-L-3)
L803	Inductor, Variable (R. L. Drake A-2505-L-3)
L804	Inductor, Variable (R. L. Drake A-2505-L-3)
L805	Inductor, Variable (R. L. Drake A-2505-L-2)
L806	Inductor, Variable (R. L. Drake A-2505-L-2)
L807	Inductor, Variable (R. L. Drake A-2505-L-2)
L808	Inductor, Variable (R. L. Drake A-2505-L-1)
L809	Inductor, Variable (R. L. Drake A-2505-L-1)
L810	Inductor, Variable (R. L. Drake A-2505-L-4)
U800	Integrated Circuit (Fairchild 9020)
U801	Balanced Mixer (TI SN76514N)
R800	Resistor, Carbon Comp., 150 ohm \pm 10%, 1/4 W
R801	Resistor, Carbon Comp., 330 ohm \pm 10%, 1/4 W
R802	Resistor, Carbon Comp., 10 K \pm 10%, 1/4 W
R803	Resistor, Carbon Comp., 330 ohm \pm 10%, 1/4 W
R804	Resistor, Carbon Comp., 330 ohm \pm 10%, 1/4 W
R805	Resistor, Carbon Comp., 12 K \pm 10%, 1/4 W
R806	Resistor, Carbon Comp., 10 K \pm 10%, 1/4 W
R807	Resistor, Carbon Comp., 1 K \pm 10%, 1/4 W
R808	Resistor, Carbon Comp., 100 K \pm 10%, 1/4 W
R809	Resistor, Carbon Comp., 3.3 K \pm 10%, 1/4 W
R810	Resistor, Carbon Comp., 47 K \pm 10%, 1/4 W
R811	Resistor, Carbon Comp., 2.2 K \pm 10%, 1/4 W
R812	Resistor, Carbon Comp., 22 ohm \pm 10%, 1/4 W
R813	Resistor, Carbon Comp., 6.8 K \pm 10%, 1/4 W
R814	Resistor, Carbon Comp., 470 ohm \pm 10%, 1/4 W
R815	Resistor, Carbon Comp., 2.2 K \pm 10%, 1/4 W
R816	Resistor, Carbon Comp., 15 K \pm 10%, 1/4 W
Q800	Transistor, 2N5953
Q801	Transistor, 2N5953
Q802	Transistor, 2N3563
Q803	Transistor, 2N3563
Q804	Transistor, 2N3563
S801	Switch, Rotary (R. L. Drake A-2267-DA)
S802	Switch, Rotary (R. L. Drake A-2267-DB)

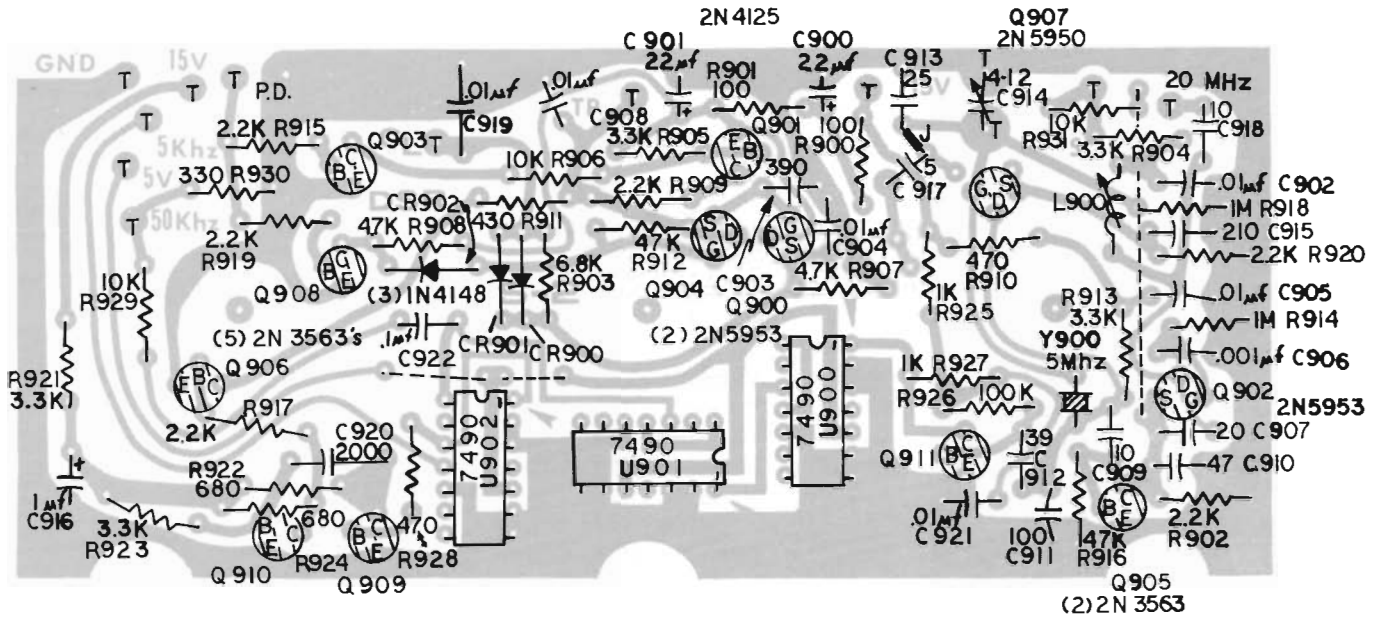


Figure 5-17. 5 MHz Standard Oscillator, P/N 689-900 (A9)

REF DES	DESCRIPTION
C900	Capacitor, Tantalum, 22 uf ± 20%, 15V
C901	Capacitor, Tantalum, 22 uf ± 20%, 15V
C902	Capacitor, Ceramic Disc, .01 uf + 80 -20%, 25V
C903	Capacitor, Mica, 390 pf ± 5%, DM-15
C904	Capacitor, Ceramic Disc, .01 uf + 80 -20%, 25V
C905	Capacitor, Ceramic Disc, .01 uf + 80 -20%, 25V
C906	Capacitor, Ceramic Disc, .001 uf ± 20%, Z5U
C907	Capacitor, Ceramic Disc, NPO, 20 pf ± 5%
C908	Capacitor, Mylar, .01 uf, 50V (Paktron MW400)
C909	Capacitor, Ceramic Disc, NPO, 10 pf ± 5%
C910	Capacitor, Ceramic Disc, NPO, 47 pf ± 5%
C911	Capacitor, Mica, 100 pf ± 5%, DM-15
C912	Capacitor, Ceramic Disc, NPO, 39 pf ± 5%
C913	Capacitor, Ceramic Disc, NPO, 25 pf ± 5%
C914	Capacitor, Variable, NPO, 4-12 pf (ERIE 3192006)
C915	Capacitor, Mica, 210 pf ± 5%, DM-15
C916	Capacitor, Tantalum, 1.0 uf ± 20%, 35V
C917	Capacitor, Ceramic Disc, NPO, 5 pf ± 5%
C918	Capacitor, Ceramic Disc, NPO, 10 pf ± 5%
C919	Capacitor, Ceramic Disc, .01 uf ± 20%, Z5U
C920	Capacitor, Mica, 2000 pf ± 1%, DM-19
C921	Capacitor, Ceramic Disc, .01 uf + 80 -20%, 25V
C922	Capacitor, Ceramic Disc, 0.1 uf + 80 -20%, 12V

Figure 5-17. Parts List

REF DES	DESCRIPTION
CR900	Diode, 1N4148
CR901	Diode, 1N4148
CR902	Diode, 1N4148
Y900	Crystal, 5 MHz (R. L. Drake A-2571-V)
L900	Inductor, Variable (R. L. Drake A-2505-L-3)
U900	Integrated Circuit, 7490
U901	Integrated Circuit, 7490
U902	Integrated Circuit, 7490
R900	Resistor, Carbon Comp., 100 ohm \pm 10%, 1/4 W
R901	Resistor, Carbon Comp., 100 ohm \pm 10%, 1/4 W
R902	Resistor, Carbon Comp., 2.2 K \pm 10%, 1/4 W
R903	Resistor, Carbon Comp., 6.8 K \pm 10%, 1/4 W
R904	Resistor, Carbon Comp., 3.3 K \pm 10%, 1/4 W
R905	Resistor, Carbon Comp., 3.3 K \pm 10%, 1/4 W
R906	Resistor, Carbon Comp., 10 K \pm 10%, 1/4 W
R907	Resistor, Carbon Comp., 4.7 K \pm 10%, 1/4 W
R908	Resistor, Carbon Comp., 4.7 K \pm 10%, 1/4 W
R909	Resistor, Carbon Comp., 2.2 K \pm 10%, 1/4 W
R910	Resistor, Carbon Comp., 470 ohm \pm 10%, 1/4 W
R911	Resistor, Carbon Comp., 430 ohm \pm 5%, 1/4 W
R912	Resistor, Carbon Comp., 47 K \pm 10%, 1/4 W
R913	Resistor, Carbon Comp., 3.3 K \pm 10%, 1/4 W
R914	Resistor, Carbon Comp., 1 MEG \pm 10%, 1/4 W
R915	Resistor, Carbon Comp., 2.2 K \pm 10%, 1/4 W
R916	Resistor, Carbon Comp., 47 K \pm 10%, 1/4 W
R917	Resistor, Carbon Comp., 2.2 K \pm 10%, 1/4 W
R918	Resistor, Carbon Comp., 1 MEG \pm 10%, 1/4 W
R919	Resistor, Carbon Comp., 2.2 K \pm 10%, 1/4 W
R920	Resistor, Carbon Comp., 2.2 K \pm 10%, 1/4 W
R921	Resistor, Carbon Comp., 3.3 K \pm 10%, 1/4 W
R922	Resistor, Carbon Comp., 680 ohm \pm 10%, 1/4 W
R923	Resistor, Carbon Comp., 3.3 K \pm 10%, 1/4 W
R924	Resistor, Carbon Comp., 680 ohm \pm 10%, 1/4 W
R925	Not Used
R926	Resistor, Carbon Comp., 100 K \pm 10%, 1/4 W
R927	Resistor, Carbon Comp., 1 K \pm 10%, 1/4 W
R928	Resistor, Carbon Comp., 470 ohm \pm 10%, 1/4 W
R929	Resistor, Carbon Comp., 10 K \pm 10%, 1/4 W
R930	Resistor, Carbon Comp., 330 ohm \pm 10%, 1/4 W
R931	Resistor, Carbon Comp., 10 K \pm 10%, 1/4 W
Q900	Transistor, 2N5953
Q901	Transistor, 2N4125
Q902	Transistor, 2N5953
Q903	Transistor, 2N3563
Q904	Transistor, 2N5953
Q905	Transistor, 2N3563
Q906	Transistor, 2N3563
Q907	Transistor, 2N5950
Q908	Transistor, 2N3563
Q909	Transistor, 2N3563
Q910	Transistor, 2N3563
Q911	Transistor, 2N3563

MAINTENANCE NOTES

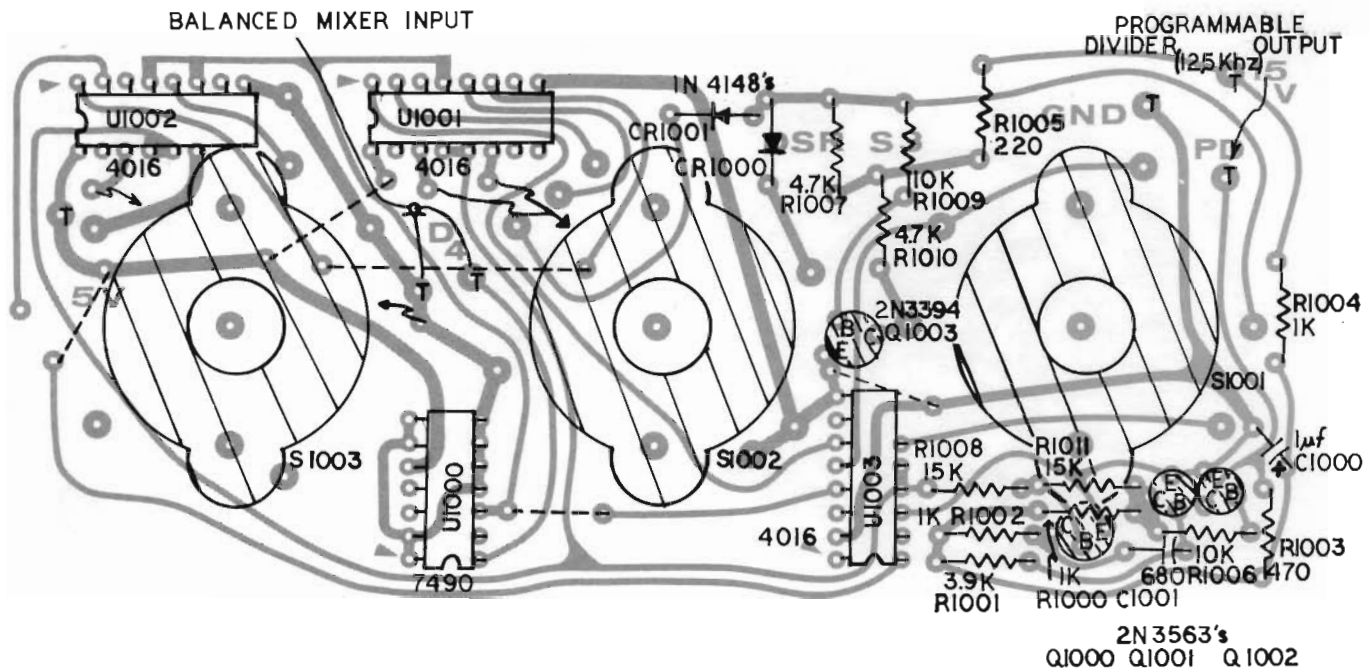


Figure 5-18. Programmable Divider, P/N 689-1000 (A10)

REF DES	DESCRIPTION
C1000	Capacitor, Tantalum, 1.0 uf ± 20%, 35V
C1001	Capacitor, Mica, 680 pf ± 5%, DM-15
CR1000	Diode, 1N4148
CR1001	Diode, 1N4148
U1000	Integrated Circuit, 7490
U1001	Integrated Circuit, (Motorola MC 4016P)
U1002	Integrated Circuit, (Motorola MC 4016P)
U1003	Integrated Circuit, (Motorola MC 4016P)
R1000	Resistor, Carbon Comp., 1 K ± 10%, 1/4 W
R1001	Resistor, Carbon Comp., 3.9 K ± 10%, 1/4 W
R1002	Resistor, Carbon Comp., 1 K ± 10%, 1/4 W
R1003	Resistor, Carbon Comp., 470 ohm ± 10%, 1/4 W
R1004	Resistor, Carbon Comp., 1 K ± 10%, 1/4 W
R1005	Resistor, Carbon Comp., 220 ohm ± 10%, 1/4 W
R1006	Resistor, Carbon Comp., 10 K ± 10%, 1/4 W
R1007	Resistor, Carbon Comp., 4.7 K ± 10%, 1/4 W
R1008	Resistor, Carbon Comp., 15 K ± 10%, 1/4 W
R1009	Resistor, Carbon Comp., 10 K ± 10%, 1/4 W
R1010	Resistor, Carbon Comp., 4.7 K ± 10%, 1/4 W
R1011	Resistor, Carbon Comp., 15 K ± 10%, 1/4 W
Q1000	Transistor, 2N3563
Q1001	Transistor, 2N3563
Q1002	Transistor, 2N3563
Q1003	Transistor, 2N3394
S1001	Switch, Rotary (R. L. Drake A-2268-DA)
S1002	Switch, Rotary (R. L. Drake A-2268-DB)
S1003	Switch, Rotary (R. L. Drake A-2268-DC)

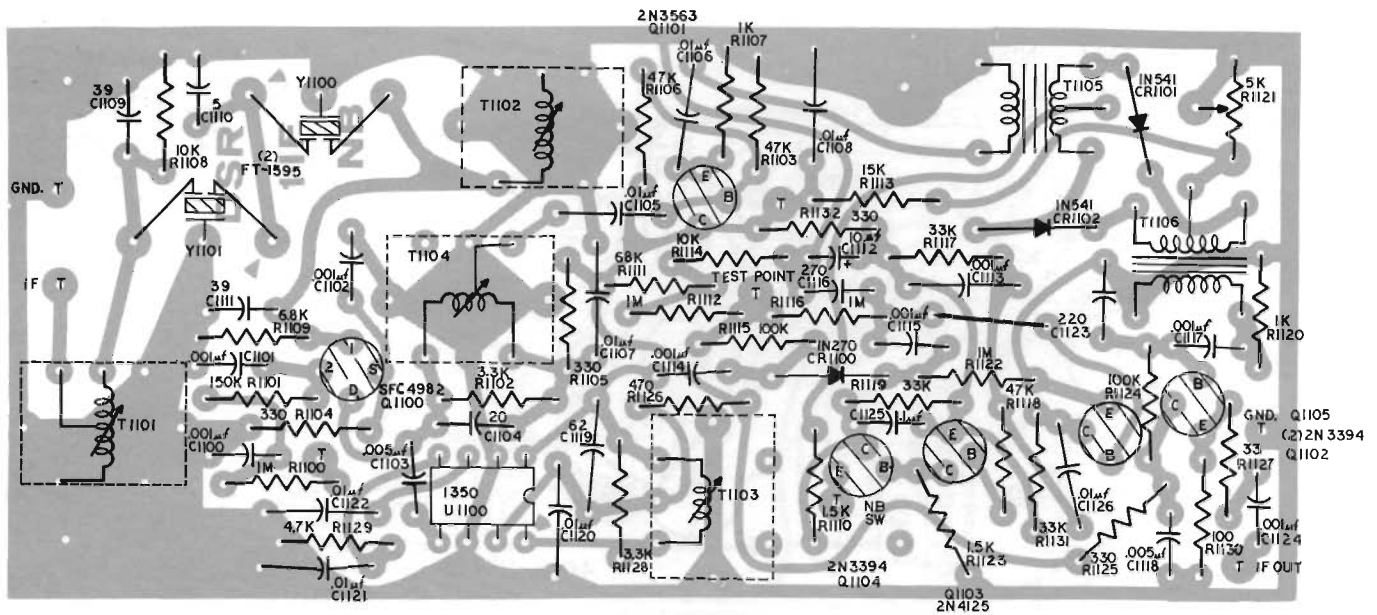


Figure 5-19. First IF and Noise Blanker, P/N 689-1100 (A11)

REF
DES

DESCRIPTION

C1100	Capacitor, Ceramic Disc, .001 uf ± 20%, Z5U
C1101	Capacitor, Ceramic Disc, .001 uf ± 20%, Z5U
C1102	Capacitor, Ceramic Disc, .001 uf ± 20%, Z5U
C1103	Capacitor, Ceramic Disc, .005 uf ± 20%, Z5U
C1104	Capacitor, Ceramic Disc, NPO, 20 pf ± 5%
C1105	Capacitor, Ceramic Disc, .01 uf ± 20%, Z5U
C1106	Capacitor, Ceramic Disc, .01 uf ± 20%, Z5U
C1107	Capacitor, Ceramic Disc, .01 uf ± 20%, Z5U
C1108	Capacitor, Ceramic Disc, .01 uf ± 20%, Z5U
C1109	Capacitor, Ceramic Disc, NPO, 39 pf ± 5%
C1110	Capacitor, Ceramic Disc, NPO, 5 pf ± 5%
C1111	Capacitor, Ceramic Disc, NPO, 39 pf ± 5%
C1112	Capacitor, Tantalum, 10 uf ± 20%, 35V
C1113	Capacitor, Ceramic Disc, .001 uf ± 20%, Z5U
C1114	Capacitor, Ceramic Disc, .001 uf ± 20%, Z5U
C1115	Capacitor, Ceramic Disc, .001 uf ± 20%, Z5U
C1116	Capacitor, Mica, 270 pf ± 5%, DM-15
C1117	Capacitor, Ceramic Disc, .001 uf ± 20%, Z5U
C1118	Capacitor, Ceramic Disc, .005 uf ± 20%, Z5U
C1119	Capacitor, Ceramic Disc, NPO, 62 pf ± 5%
C1120	Capacitor, Ceramic Disc, .01 uf ± 20%, Z5U
C1121	Capacitor, Ceramic Disc, .01 uf ± 20%, Z5U
C1122	Capacitor, Ceramic Disc, .01 uf ± 20%, Z5U
C1123	Capacitor, Ceramic Disc, .01 uf ± 20%, Z5U
C1124	Capacitor, Mica, 220 pf ± 5%, DM-15
C1125	Capacitor, Ceramic Disc, .001 uf ± 20%, Z5U
C1126	Capacitor, Ceramic Disc, .1 uf + 80 -20%, 12V
	Capacitor, Ceramic Disc, .01 uf ± 20%, Z5U

Figure 5-19. Parts List

REF DES	DESCRIPTION
CR1100	Diode, 1N270
CR1101	Diode, 1N541
CR1102	Diode, 1N541
Q1100	Transistor, (TI SFC4982)
Q1101	Transistor, 2N3563
Q1102	Transistor, 2N3394
Q1103	Transistor, 2N4125
Q1104	Transistor, 2N3394
Q1105	Transistor, 2N3394
R1100	Resistor, Carbon Comp., 6.8 MEG \pm 10%, 1/4 W
R1101	Resistor, Carbon Comp., 150 K \pm 10%, 1/4 W
R1102	Resistor, Carbon Comp., 3.3 K \pm 10%, 1/4 W
R1103	Resistor, Carbon Comp., 47 K \pm 10%, 1/4 W
R1104	Resistor, Carbon Comp., 330 ohm \pm 10%, 1/4 W
R1105	Resistor, Carbon Comp., 330 ohm \pm 10%, 1/4 W
R1106	Resistor, Carbon Comp., 47 K \pm 10%, 1/4 W
R1107	Resistor, Carbon Comp., 1 K \pm 10%, 1/4 W
R1108	Resistor, Carbon Comp., 10 K \pm 10%, 1/4 W
R1109	Resistor, Carbon Comp., 6.8 K \pm 10%, 1/4 W
R1110	Resistor, Carbon Comp., 1.5 K \pm 10%, 1/4 W
R1111	Resistor, Carbon Comp., 68 K \pm 10%, 1/4 W
R1112	Resistor, Carbon Comp., 1 MEG \pm 10%, 1/4 W
R1113	Resistor, Carbon Comp., 15 K \pm 10%, 1/4 W
R1114	Resistor, Carbon Comp., 10 K \pm 10%, 1/4 W
R1115	Resistor, Carbon Comp., 100 K \pm 10%, 1/4 W
R1116	Resistor, Carbon Comp., 1 MEG \pm 10%, 1/4 W
R1117	Resistor, Carbon Comp., 33 K \pm 10%, 1/4 W
R1118	Resistor, Carbon Comp., 47 K \pm 10%, 1/4 W
R1119	Resistor, Carbon Comp., 33 K \pm 10%, 1/4 W
R1120	Resistor, Carbon Comp., 1 K \pm 10%, 1/4 W
R1121	Resistor, Variable, 5 K (CTS RL-7153)
R1122	Resistor, Carbon Comp., 1 MEG \pm 10%, 1/4 W
R1123	Resistor, Carbon Comp., 1.5 K \pm 10%, 1/4 W
R1124	Resistor, Carbon Comp., 100 K \pm 10%, 1/4 W
R1125	Resistor, Carbon Comp., 330 ohm \pm 10%, 1/4 W
R1126	Resistor, Carbon Comp., 470 ohm \pm 10%, 1/4 W
R1127	Resistor, Carbon Comp., 33 ohm \pm 10%, 1/4 W
R1128	Resistor, Carbon Comp., 3.3 K \pm 10%, 1/4 W
R1129	Resistor, Carbon Comp., 4.7 K \pm 1/4 W
R1130	Resistor, Carbon Comp., 100 ohm \pm 10%, 1/4 W
R1131	Resistor, Carbon Comp., 33 K \pm 10%, 1/4 W
R1132	Resistor, Carbon Comp., 330 ohm \pm 10%, 1/4 W
T1101	Transformer (R. L. Drake B-2460-E-1)
T1102	Transformer (R. L. Drake B-2460-E-2)
T1103	Transformer (R. L. Drake B-2460-E-3)
T1104	Transformer (R. L. Drake B-2460-E-4)
T1105	Transformer (R. L. Drake A-2467-E)
T1106	Transformer (R. L. Drake A-2467-E)
U1100	Integrated Circuit (Motorola MC1350P)
Y1100	Crystal, Monolithic Filter (Piezo TF-1595)
Y1101	Crystal, Monolithic Filter (Piezo TF-1595)

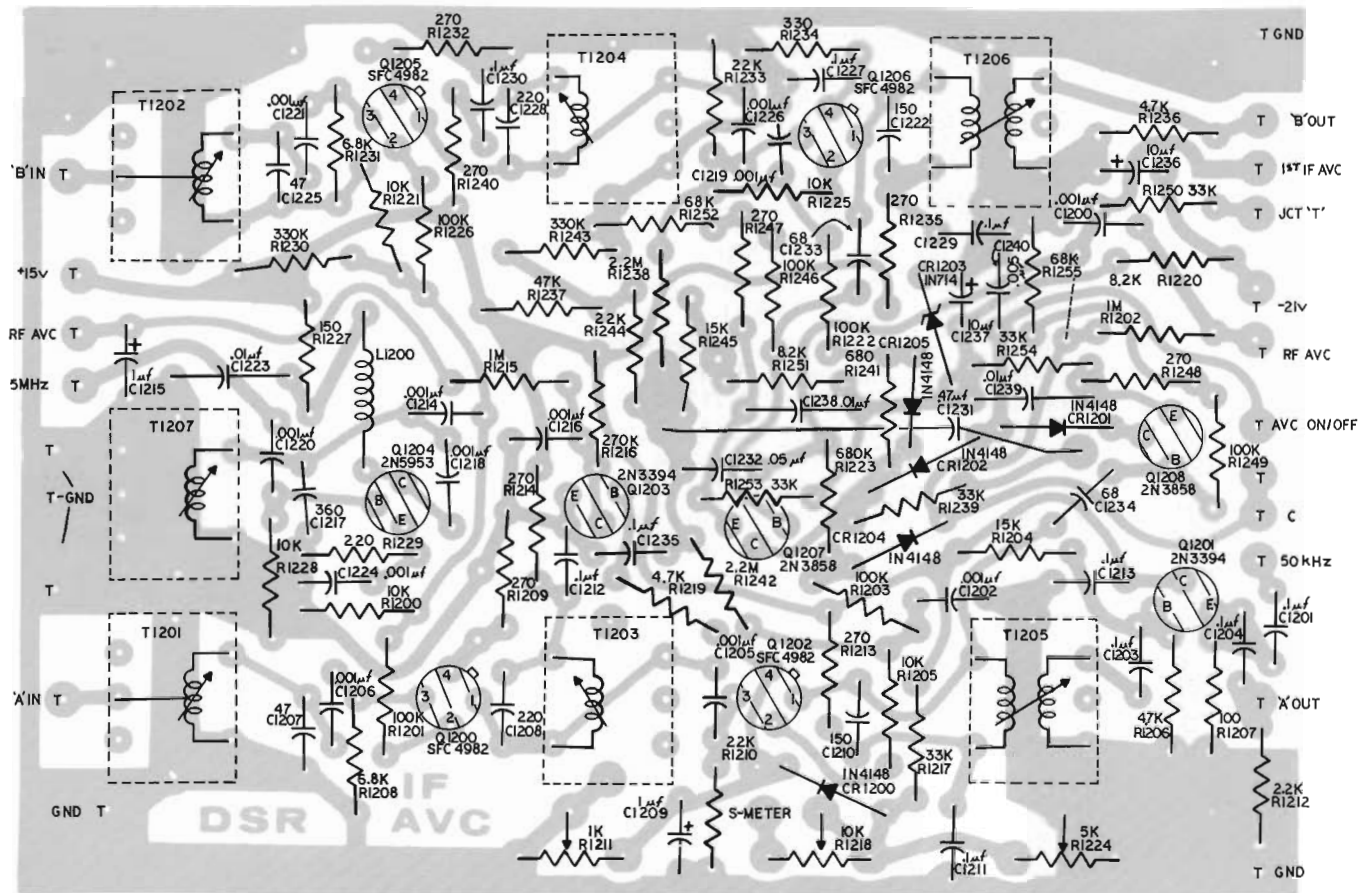


Figure 5-20. Second IF and AVC, P/N 689-1200 (A12)

REF DES	DESCRIPTION
------------	-------------

C1200	Capacitor, Ceramic Disc, .001 uf ± 20%, Z5U
C1201	Capacitor, Ceramic Disc, .1 uf + 80 -20%, 12V
C1202	Capacitor, Ceramic Disc, .001 uf ± 20%, Z5U
C1203	Capacitor, Ceramic Disc, .1 uf + 80 -20%, 12V
C1204	Capacitor, Ceramic Disc, .1 uf + 80 -20%, 12V
C1205	Capacitor, Ceramic Disc, .001 uf ± 20%, Z5U
C1206	Capacitor, Ceramic Disc, .001 uf ± 20%, Z5U
C1207	Capacitor, Ceramic Disc, NPO, 47 pf ± 5%
C1208	Capacitor, Mica, 220 pf ± 5%, DM-15
C1209	Capacitor, Tantalum, 1.0 uf ± 20%, 35V
C1210	Capacitor, Mica, 150 pf ± 5%, DM-15
C1211	Capacitor, Ceramic Disc, .1 uf + 80 -20%, 12V
C1212	Capacitor, Ceramic Disc, .1 uf + 80 -20%, 12V
C1213	Capacitor, Ceramic Disc, .1 uf + 80 -20%, 12V
C1214	Capacitor, Ceramic Disc, .001 uf ± 20%, Z5U
C1215	Capacitor, Tantalum, 1.0 uf ± 20%, 35V
C1216	Capacitor, Ceramic Disc, .001 uf ± 20%, Z5U
C1217	Capacitor, Mica, 360 pf ± 5%, DM-15

Figure 5-20. Parts List

REF DES	DESCRIPTION
C1218	Capacitor, Ceramic Disc, .001 uf \pm 20%, Z5U
C1219	Capacitor, Ceramic Disc, .001 uf \pm 20%, Z5U
C1220	Capacitor, Ceramic Disc, .001 uf \pm 20%, Z5U
C1221	Capacitor, Ceramic Disc, .001 uf \pm 20%, Z5U
C1222	Capacitor, Mica, 150 pf \pm 5%, DM-15
C1223	Capacitor, Ceramic Disc, .01 uf \pm 20%, Z5U
C1224	Capacitor, Ceramic Disc, .001 uf \pm 20%, Z5U
C1225	Capacitor, Ceramic Disc, NPO, 47 pf \pm 5%
C1226	Capacitor, Ceramic Disc, .001 uf \pm 20%, Z5U
C1227	Capacitor, Ceramic Disc, .1 uf + 80 -20%, 12V
C1228	Capacitor, Mica, 220 pf \pm 5%, DM-15
C1229	Capacitor, Ceramic Disc, .1 uf + 80 -20%, 12V
C1230	Capacitor, Ceramic Disc, .1 uf + 80 -20%, 12V
C1231	Capacitor, Mylar, .47 uf \pm 10%, 80V
C1232	Capacitor, Ceramic Disc, .05 +80 -20%, 25V
C1233	Capacitor, Mica, 68 pf \pm 5%, DM-15
C1234	Capacitor, Mica, 68 pf \pm 5%, DM-15
C1235	Capacitor, Ceramic Disc, .1 uf + 80 -20%, 12V
C1236	Capacitor, Tantalum, 10 uf \pm 20%, 35V
C1237	Capacitor, Tantalum, 10 uf \pm 20%, 35V
C1238	Capacitor, Ceramic Disc, .01 uf \pm 20%, Z5U
C1239	Capacitor, Ceramic Disc, .01 uf \pm 20%, Z5U
C1240	Capacitor, Ceramic Disc, .005 uf \pm 20%, Z5U
R1200	Resistor, Carbon Comp., 10 K \pm 10%, 1/4 W
R1201	Resistor, Carbon Comp., 100 K \pm 10%, 1/4 W
R1202	Resistor, Carbon Comp., 1 MEG \pm 10%, 1/4 W
R1203	Resistor, Carbon Comp., 100 K \pm 10%, 1/4 W
R1204	Resistor, Carbon Comp., 15 K \pm 10%, 1/4 W
R1205	Resistor, Carbon Comp., 10 K \pm 10%, 1/4 W
R1206	Resistor, Carbon Comp., 4.7 K \pm 10%, 1/4 W
R1207	Resistor, Carbon Comp., 100 ohm \pm 10%, 1/4 W
R1208	Resistor, Carbon Comp., 6.8 K \pm 10%, 1/4 W
R1209	Resistor, Carbon Comp., 270 ohm \pm 10%, 1/4 W
R1210	Resistor, Carbon Comp., 22 K \pm 10%, 1/4 W
R1211	Resistor, Variable, Carbon, 1 K (CTS RA3643)
R1212	Resistor, Carbon Comp., 2.2 K \pm 10%, 1/4 W
R1213	Resistor, Carbon Comp., 270 ohm \pm 10%, 1/4 W
R1214	Resistor, Carbon Comp., 270 ohm \pm 10%, 1/4 W
R1215	Resistor, Carbon Comp., 1 MEG \pm 10%, 1/4 W
R1216	Resistor, Carbon Comp., 270 K \pm 10%, 1/4 W
R1217	Resistor, Carbon Comp., 33 K \pm 10%, 1/4 W
R1218	Resistor, Variable, Carbon 10 K (CTS SA2999)
R1219	Resistor, Carbon Comp., 4.7 K \pm 10%, 1/4 W
R1220	Resistor, Carbon Comp., 8.2 K \pm 10%, 1/4 W
R1221	Resistor, Carbon Comp., 10 K \pm 10%, 1/4 W
R1222	Resistor, Carbon Comp., 100 K \pm 10%, 1/4 W
R1223	Resistor, Carbon Comp., 680 K \pm 10%, 1/4 W
R1224	Resistor, Variable, Carbon, 5 K (CTS RL7153)
R1225	Resistor, Carbon Comp., 10 K \pm 10%, 1/4 W
R1226	Resistor, Carbon Comp., 100 K \pm 10%, 1/4 W
R1227	Resistor, Carbon Comp., 150 ohm \pm 10%, 1/4 W

Figure 5-20. Parts List (continued)

REF DES	DESCRIPTION
R1228	Resistor, Carbon Comp., 10 K \pm 10%, 1/4 W
R1229	Resistor, Carbon Comp., 220 ohm \pm 10%, 1/4 W
R1230	Resistor, Carbon Comp., 330 K \pm 10%, 1/4 W
R1231	Resistor, Carbon Comp., 6.8 K \pm 10%, 1/4 W
R1232	Resistor, Carbon Comp., 270 ohm \pm 10%, 1/4 W
R1233	Resistor, Carbon Comp., 22 K \pm 10%, 1/4 W
R1234	Resistor, Carbon Comp., 330 ohm \pm 10%, 1/4 W
R1235	Resistor, Carbon Comp., 270 ohm \pm 10%, 1/4 W
R1236	Resistor, Carbon Comp., 4.7 K \pm 10%, 1/4 W
R1237	Resistor, Carbon Comp., 47 K \pm 10%, 1/4 W
R1238	Resistor, Carbon Comp., 2.2 MEG \pm 10%, 1/4 W
R1239	Resistor, Carbon Comp., 33 K \pm 10%, 1/4 W
R1240	Resistor, Carbon Comp., 270 ohm \pm 10%, 1/4 W
R1241	Resistor, Carbon Comp., 680 K \pm 10%, 1/4 W
R1242	Resistor, Carbon Comp., 2.2 MEG \pm 10%, 1/4 W
R1243	Resistor, Carbon Comp., 330 K \pm 10%, 1/4 W
R1244	Resistor, Carbon Comp., 22 K \pm 10%, 1/4 W
R1245	Resistor, Carbon Comp., 15 K \pm 10%, 1/4 W
R1246	Resistor, Carbon Comp., 100 K \pm 10%, 1/4 W
R1247	Resistor, Carbon Comp., 270 ohm \pm 10%, 1/4 W
R1248	Resistor, Carbon Comp., 270 ohm \pm 10%, 1/4 W
R1249	Resistor, Carbon Comp., 100 K \pm 10%, 1/4 W
R1250	Resistor, Carbon Comp., 33 K \pm 10%, 1/4 W
R1251	Resistor, Carbon Comp., 8.2 K \pm 10%, 1/4 W
R1252	Resistor, Carbon Comp., 68 K \pm 10%, 1/4 W
R1253	Resistor, Carbon Comp., 33 K \pm 10%, 1/4 W
R1254	Resistor, Carbon Comp., 33 K \pm 10%, 1/4 W
R1255	Resistor, Carbon Comp., 68 K \pm 10%, 1/4 W
Q1200	Transistor, (TI SFC4982)
Q1201	Transistor, 2N3394
Q1202	Transistor, (TI SFC4982)
Q1203	Transistor, 2N3394
Q1204	Transistor, 2N5953
Q1205	Transistor, (TI SFC4982)
Q1206	Transistor, (TI SFC4982)
Q1207	Transistor, 2N3858
Q1208	Transistor, 2N3858
CR1200	Diode, 1N4148
CR1201	Diode, 1N4148
CR1202	Diode, 1N4148
CR1203	Diode, Zener, 1N714
CR1204	Diode, 1N4148
CR1205	Diode, 1N4148
T1201	Transformer, IF (R. L. Drake B-2460-E-1)
T1202	Transformer, IF (R. L. Drake B-2460-E-1)
T1203	Transformer, IF (R. L. Drake B-2462-E-1)
T1204	Transformer, IF (R. L. Drake B-2462-E-1)
T1205	Transformer, IF (R. L. Drake B-2462-E-2)
T1206	Transformer, IF (R. L. Drake B-2462-E-2)
T1207	Transformer, IF (R. L. Drake B-2460-E-6)
L1200	Inductor, Fixed Coil (R. L. Drake A-2464-L-1)

MAINTENANCE NOTES

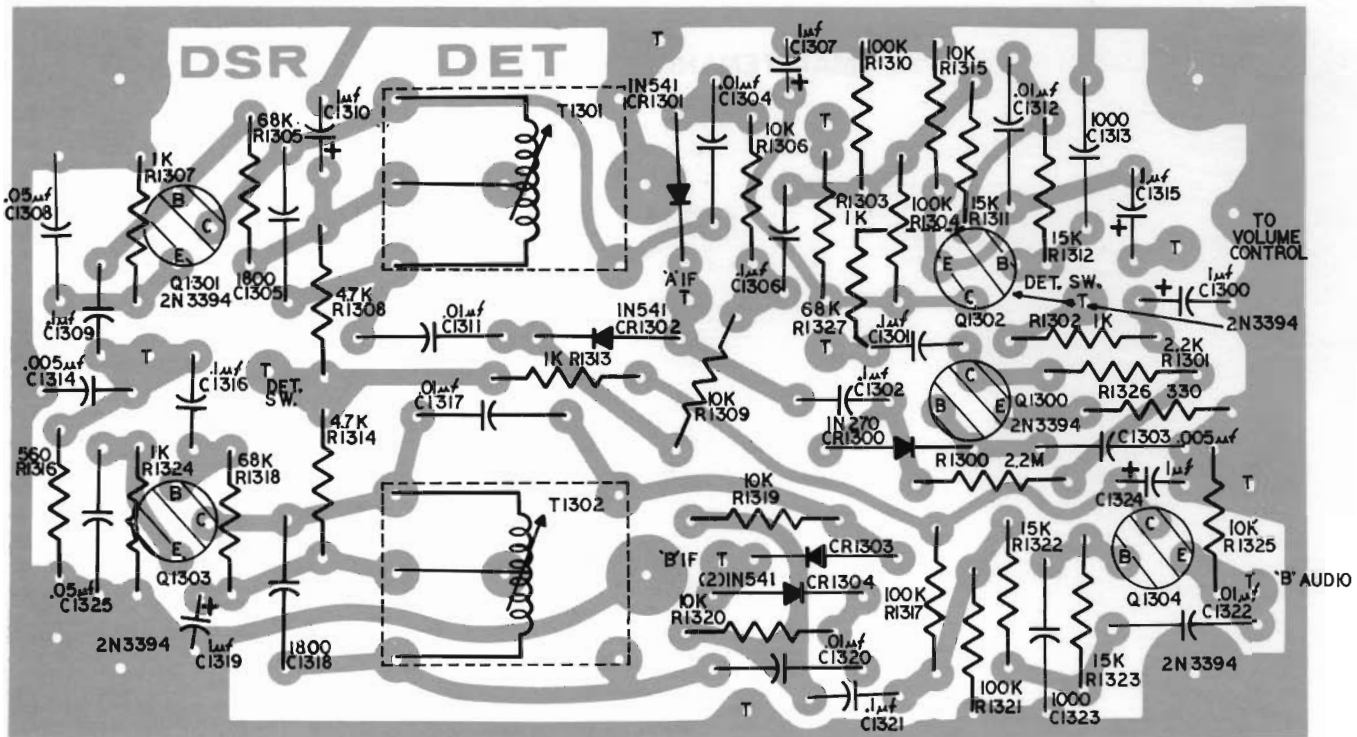


Figure 5-21. Detector, P/N 689-1300 (A13)

REF DES	DESCRIPTION
------------	-------------

C1300	Capacitor, Tantalum, 1.0 uf ± 20%, 35V
C1301	Capacitor, Ceramic Disc, .1 uf + 80 -20%, 12V
C1302	Capacitor, Ceramic Disc, .1 uf + 80 -20%, 12V
C1303	Capacitor, Ceramic Disc, .005 uf ± 20%, Z5U
C1304	Capacitor, Ceramic Disc, .01 uf ± 20%, Z5U
C1305	Capacitor, Mica, 1800 pf ± 2%, DM-20
C1306	Capacitor, Ceramic Disc, .1 uf + 80 -20%, 12V
C1307	Capacitor, Tantalum, 1.0 uf ± 20%, 35V
C1308	Capacitor, Ceramic Disc, .05 uf + 80 -20%, 100V
C1309	Capacitor, Ceramic Disc, .1 uf + 80 -20%, 12V
C1310	Capacitor, Tantalum, 1.0 uf ± 20%, 35V
C1311	Capacitor, Ceramic Disc, .01 uf ± 20%, Z5U
C1312	Capacitor, Ceramic Disc, .01 uf ± 20%, Z5U
C1313	Capacitor, Mica, 1000 pf ± 2%, DM-20
C1314	Capacitor, Ceramic Disc, .005 uf + 80 -20%, 12V
C1315	Capacitor, Ceramic Disc, 1.0 uf + 20%, 35V
C1316	Capacitor, Ceramic Disc, .1 uf + 80 -20%, 12V
C1317	Capacitor, Ceramic Disc, .01 uf ± 20%, Z5U
C1318	Capacitor, Mica, 1800 pf ± 2%, DM-20
C1319	Capacitor, Tantalum, 1.0 uf ± 20%, 35V
C1320	Capacitor, Ceramic Disc, .01 uf ± 20%, Z5U
C1321	Capacitor, Ceramic Disc, .1 uf + 80 -20%, 12V
C1322	Capacitor, Ceramic Disc, .01 uf ± 20%, Z5U
C1323	Capacitor, Mica, 1000 pf ± 2%, DM-20

Figure 5-21. Parts List

REF DES	DESCRIPTION
C1324	Capacitor, Tantalum, 1 uf \pm 20%, 35V
C1325	Capacitor, Ceramic Disc, .05 uf + 80 -20%, 100V
CR1300	Diode, 1N270
CR1301	Diode, 1N541
CR1302	Diode, 1N541
CR1303	Diode, 1N541
CR1304	Diode, 1N541
R1300	Resistor, Carbon Comp., 2.2 MEG \pm 10%, 1/4 W
R1301	Resistor, Carbon Comp., 2.2 K \pm 10%, 1/4 W
R1302	Resistor, Carbon Comp., 1.0 K \pm 10%, 1/4 W
R1303	Resistor, Carbon Comp., 1.0 K \pm 10%, 1/4 W
R1304	Resistor, Carbon Comp., 100 K \pm 10%, 1/4 W
R1305	Resistor, Carbon Comp., 68 K \pm 10%, 1/4 W
R1306	Resistor, Carbon Comp., 10 K \pm 10%, 1/4 W
R1307	Resistor, Carbon Comp., 1 K \pm 10%, 1/4 W
R1308	Resistor, Carbon Comp., 4.7 K \pm 10%, 1/4 W
R1309	Resistor, Carbon Comp., 10 K \pm 10%, 1/4 W
R1310	Resistor, Carbon Comp., 100 K \pm 10%, 1/4 W
R1311	Resistor, Carbon Comp., 15 K \pm 10%, 1/4 W
R1312	Resistor, Carbon Comp., 15 K \pm 10%, 1/4 W
R1313	Resistor, Carbon Comp., 1.0 K \pm 10%, 1/4 W
R1314	Resistor, Carbon Comp., 4.7 K \pm 10%, 1/4 W
R1315	Resistor, Carbon Comp., 10.0 K \pm 10%, 1/4 W
R1316	Resistor, Carbon Comp., 560 ohm \pm 10%, 1/4 W
R1317	Resistor, Carbon Comp., 100 K \pm 10%, 1/4 W
R1318	Resistor, Carbon Comp., 68 K \pm 10%, 1/4 W
R1319	Resistor, Carbon Comp., 10 K \pm 10%, 1/4 W
R1320	Resistor, Carbon Comp., 10 K \pm 10%, 1/4 W
R1321	Resistor, Carbon Comp., 100 K \pm 10%, 1/4 W
R1322	Resistor, Carbon Comp., 15 K \pm 10%, 1/4 W
R1323	Resistor, Carbon Comp., 15 K \pm 10%, 1/4 W
R1324	Resistor, Carbon Comp., 1.0 K \pm 10%, 1/4 W
R1325	Resistor, Carbon Comp., 10 K \pm 10%, 1/4 W
R1326	Resistor, Carbon Comp., 330 ohm \pm 10%, 1/4 W
R1327	Resistor, Carbon Comp., 68 K \pm 10%, 1/4 W
Q1300	Transistor, 2N3394
Q1301	Transistor, 2N3394
Q1302	Transistor, 2N3394
Q1303	Transistor, 2N3394
Q1304	Transistor, 2N3394
T1301	Transformer, IF (R. L. Drake B-2466-E)
T1302	Transformer, IF (R. L. Drake B-2466-E)

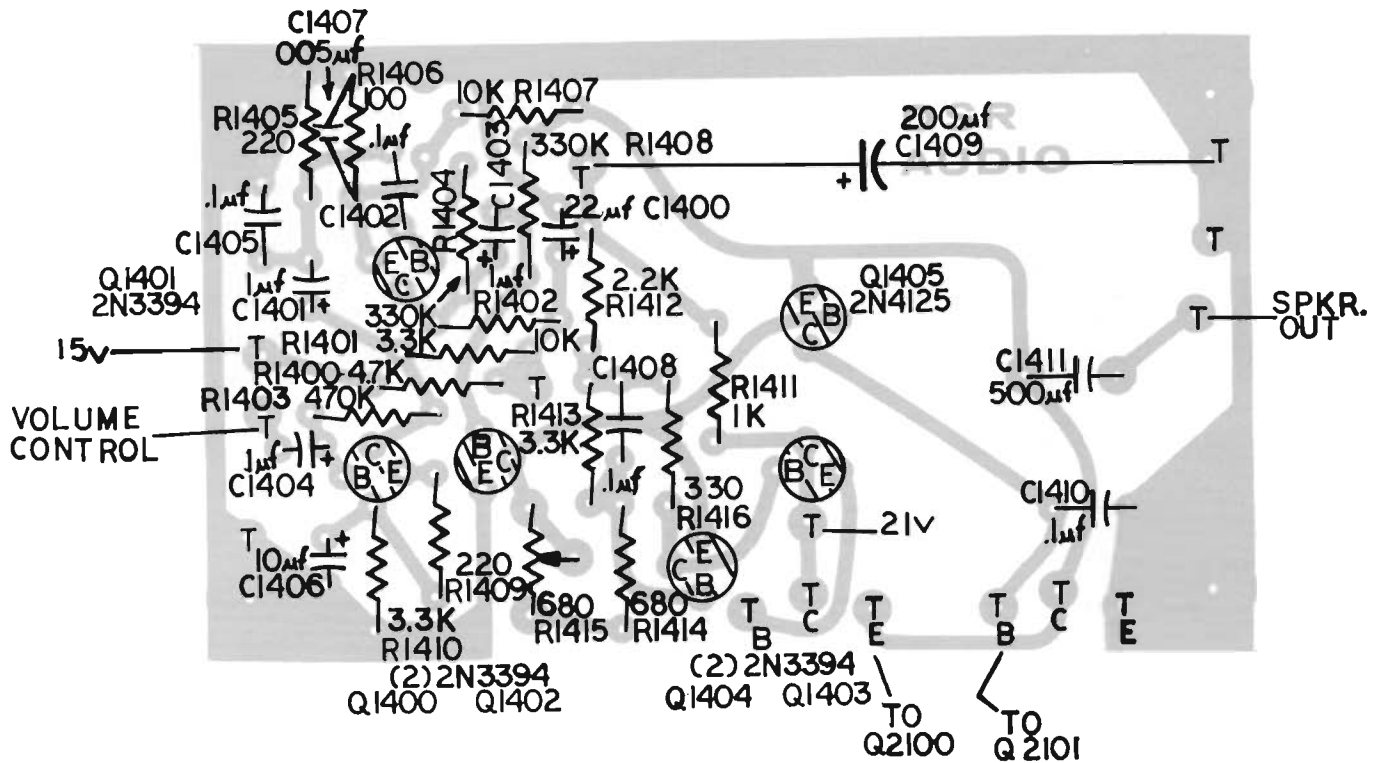


Figure 5-22. Audio Amplifier, P/N 689-1400 (A14)

REF DES	DESCRIPTION
C1400	Capacitor, Tantalum, 22 uf ± 20%, 15V
C1401	Capacitor, Tantalum, 1.0 uf ± 20%, 35V
C1402	Capacitor, Ceramic Disc, .1 uf + 80 -20%, 12V
C1403	Capacitor, Tantalum, 1.0 uf ± 20%, 35V
C1404	Capacitor, Tantalum, 1.0 uf ± 20%, 35V
C1405	Capacitor, Ceramic, .1 uf + 80 -20%, 12V
C1406	Capacitor, Tantalum, 10 uf ± 20%, 35V
C1407	Capacitor, Ceramic Disc, .005 uf ± 20%, Z5U
C1408	Capacitor, Ceramic Disc, .1 uf + 80 -20%, 12V
C1409	Capacitor, Tubular, Electrolytic, 200 uf, 25V
C1410	Capacitor, Ceramic, .1 uf + 80 -20%, 12V
C1411	Capacitor, Tubular, Electrolytic, 500 uf, 25V

Figure 5-22. Parts List

REF DES	DESCRIPTION
R1400	Resistor, Carbon Comp., 4.7 K \pm 10%, 1/4 W
R1401	Resistor, Carbon Comp., 3.3 K \pm 10%, 1/4 W
R1402	Resistor, Carbon Comp., 10 K \pm 10%, 1/4 W
R1403	Resistor, Carbon Comp., 470 K \pm 10%, 1/4 W
R1404	Resistor, Carbon Comp., 330 K \pm 10%, 1/4 W
R1405	Resistor, Carbon Comp., 220 ohm \pm 10%, 1/4 W
R1406	Resistor, Carbon Comp., 100 ohm \pm 10%, 1/4 W
R1407	Resistor, Carbon Comp., 10 K \pm 10%, 1/4 W
R1408	Resistor, Carbon Comp., 330 K \pm 10%, 1/4 W
R1409	Resistor, Carbon Comp., 390 ohm \pm 10%, 1/4 W
R1410	Resistor, Carbon Comp., 3.3 K \pm 10%, 1/4 W
R1411	Resistor, Carbon Comp., 1 K \pm 10%, 1/4 W
R1412	Resistor, Carbon Comp., 2.2 K \pm 10%, 1/4 W
R1413	Resistor, Carbon Comp., 3.3 K \pm 10%, 1/4 W
R1414	Resistor, Carbon Comp., 680 ohm \pm 10%, 1/4 W
R1415	Resistor, Variable, 1 K (CTS PA3643)
R1416	Resistor, Carbon Comp., 330 ohm \pm 10%, 1/4 W
Q1400	Transistor, 2N3394
Q1401	Transistor, 2N3394
Q1402	Transistor, 2N3394
Q1403	Transistor, 2N3394
Q1404	Transistor, 2N3394
Q1405	Transistor, 2N4125

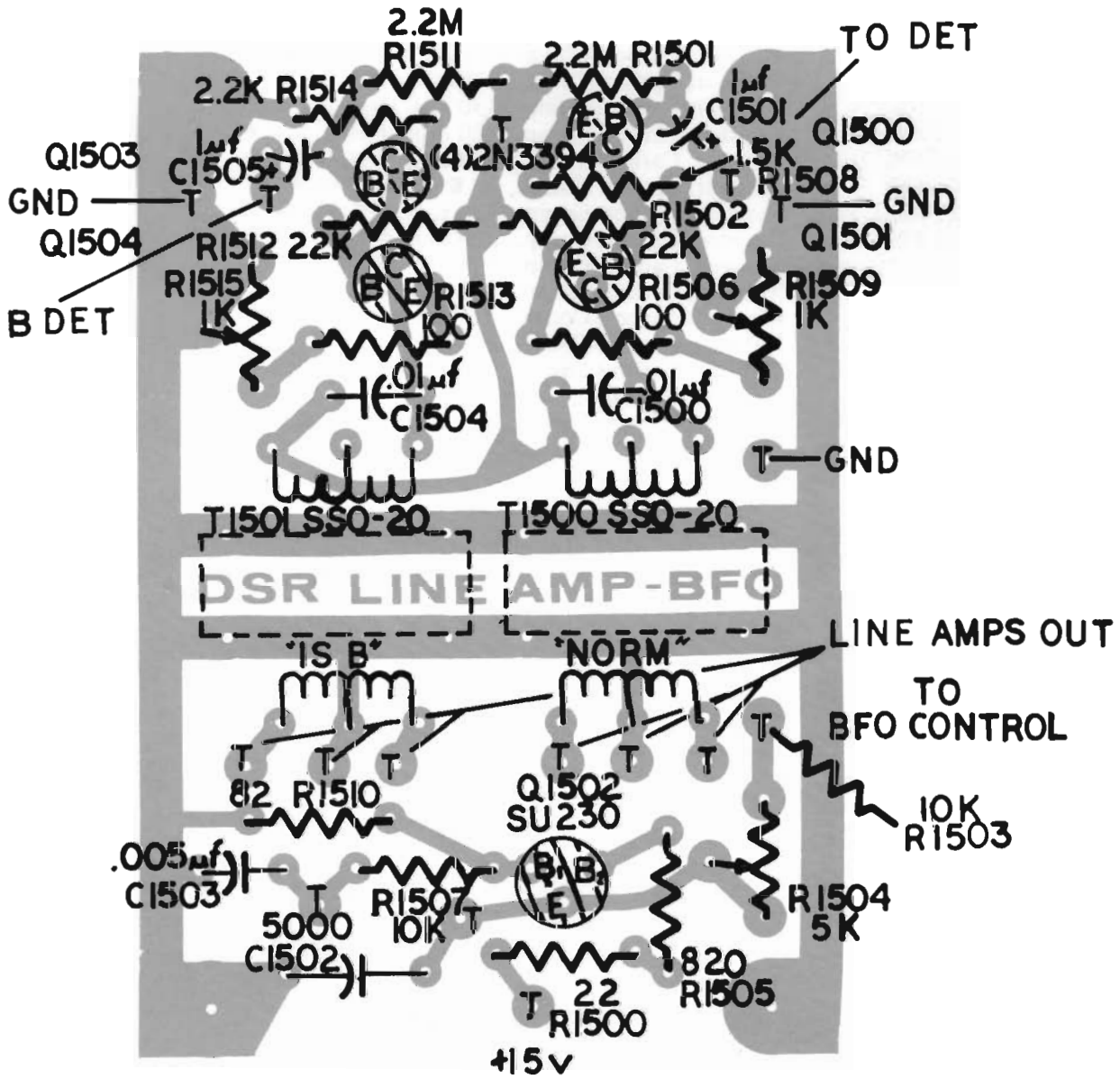


Figure 5-23. BFO and Line Amplifier, P/N 689-1500 (A15)

Figure 5-23. Parts List

REF DES	DESCRIPTION
C1500	Capacitor, Ceramic Disc, .01 uf + 80 -20%, 25V
C1501	Capacitor, Tantalum, 1.0 uf ± 20%, 35V
C1502	Capacitor, Mica, 5000 pf ± 1%, DM-20
C1503	Capacitor, Ceramic, .005 uf ± 20%, Z5U
C1504	Capacitor, Ceramic, .01 uf + 80 -20%, 25V
C1505	Capacitor, Tantalum, 1.0 uf + 20%, 35V
R1500	Resistor, Carbon Comp., 22 ohm ± 10%, 1/4 W
R1501	Resistor, Carbon Comp., 2.2 MEG ± 10%, 1/4 W
R1502	Resistor, Carbon Comp., 22 K ± 10%, 1/4 W
R1503	Resistor, Carbon Comp., 10 K ± 10%, 1/2 W
R1504	Resistor, Variable, 5 K (CTS RL7153)
R1505	Resistor, Carbon Comp., 820 ohm ± 10%, 1/4 W
R1506	Resistor, Carbon Comp., 100 ohm ± 10%, 1/4 W
R1507	Resistor, Carbon Comp., 10 K ± 10%, 1/4 W
R1508	Resistor, Carbon Comp., 1.5 K ± 10%, 1/4 W
R1509	Resistor, Variable, 1 K (CTS RA3643)
R1510	Resistor, Carbon Comp., 82 ohm ± 10%, 1/4 W
R1511	Resistor, Carbon Comp., 2.2 MEG ± 10%, 1/4 W
R1512	Resistor, Carbon Comp., 22 K ± 10%, 1/4 W
R1513	Resistor, Carbon Comp., 100 ohm ± 10%, 1/4 W
R1514	Resistor, Carbon Comp., 2.2 K ± 10%, 1/4 W
R1515	Resistor, Variable, 1 K (CTS RA3643)
T1500	Transformer, Audio, (UTC SSO-20)
T1501	Transformer, Audio, (UTC SSO-20)
Q1500	Transistor, 2N3394
Q1501	Transistor, 2N3394
Q1502	Transistor, (Motorola SU230)
Q1503	Transistor, 2N3394
Q1504	Transistor, 2N3394

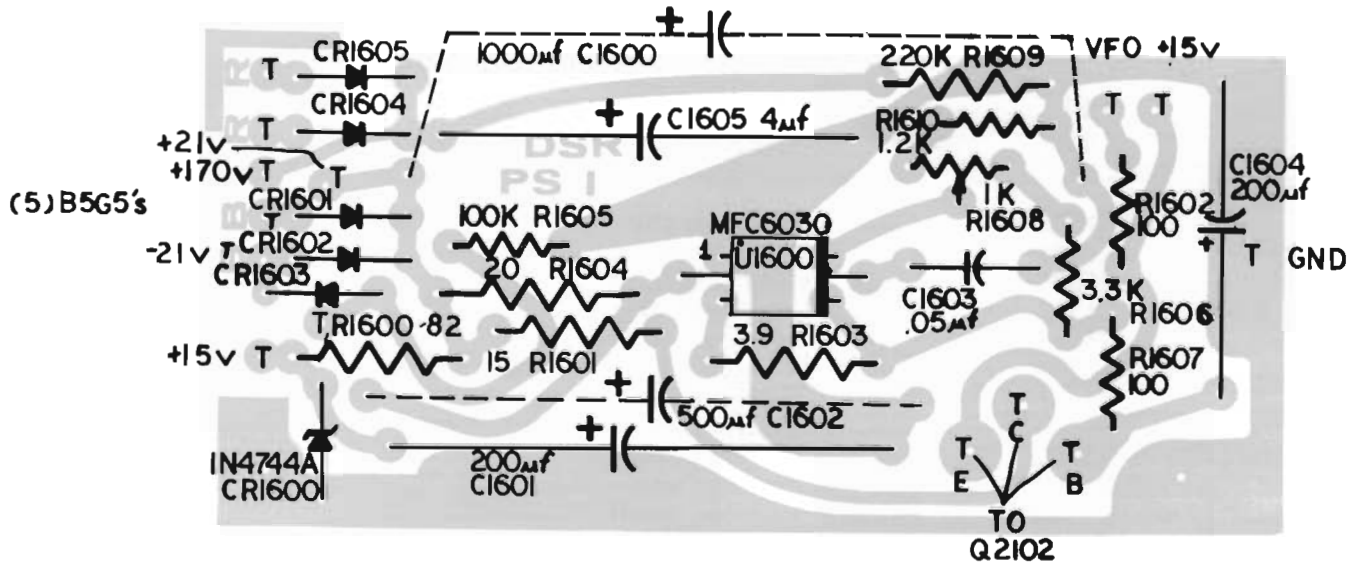


Figure 5-24. Power Supply Board No. 1, P/N 689-1600-1 (A16-1)

REF DES	DESCRIPTION
------------	-------------

C1600	Capacitor, Electrolytic, 1000 uf, 25V
C1601	Capacitor, Electrolytic, 200 uf, 25V
C1602	Capacitor, Electrolytic, 500 uf, 25V
C1603	Capacitor, Ceramic Disc, .05 uf, 100V, Z5U
C1604	Capacitor, Electrolytic, 200 uf, 15V
C1605	Capacitor, Electrolytic, 4 uf, 250VDC
CR1600	Diode, Zener, 1N4744A
CR1601	Diode, 1.1 A, 600 PIV (EDAL B5G5)
CR1602	Diode, 1.1 A, 600 PIV (EDAL B5G5)
CR1603	Diode, 1.1 A, 600 PIV (EDAL B5G5)
CR1604	Diode, 1.1 A, 600 PIV (EDAL B5G5)
CR1605	Diode, 1.1 A, 600 PIV (EDAL B5G5)
U1600	Integrated Circuit (Motorola MC 6030)
R1600	Resistor, Carbon Comp., 82 ohm \pm 10%, 1 W
R1601	Resistor, Carbon Comp., 15 ohm \pm 10%, 1/2 W
R1602	Resistor, Carbon Comp., 100 ohm \pm 10%, 1/4 W
R1603	Resistor, Carbon Comp., 3.9 ohm \pm 5%, 1/2 W
R1604	Resistor, Carbon Comp., 20 ohm \pm 5%, 1 W
R1605	Resistor, Carbon Comp., 100 K \pm 10%, 1/2 W
R1606	Resistor, Carbon Comp., 3.3 K \pm 10%, 1/4 W
R1607	Resistor, Carbon Comp., 100 ohm \pm 10%, 1/4 W
R1608	Resistor, Variable, 1 K (CTS PA3643)
R1609	Resistor, Carbon Comp., 220 K \pm 10%, 1/2 W
R1610	Resistor, Carbon Comp., 1.2 K \pm 10%, 1/4 W

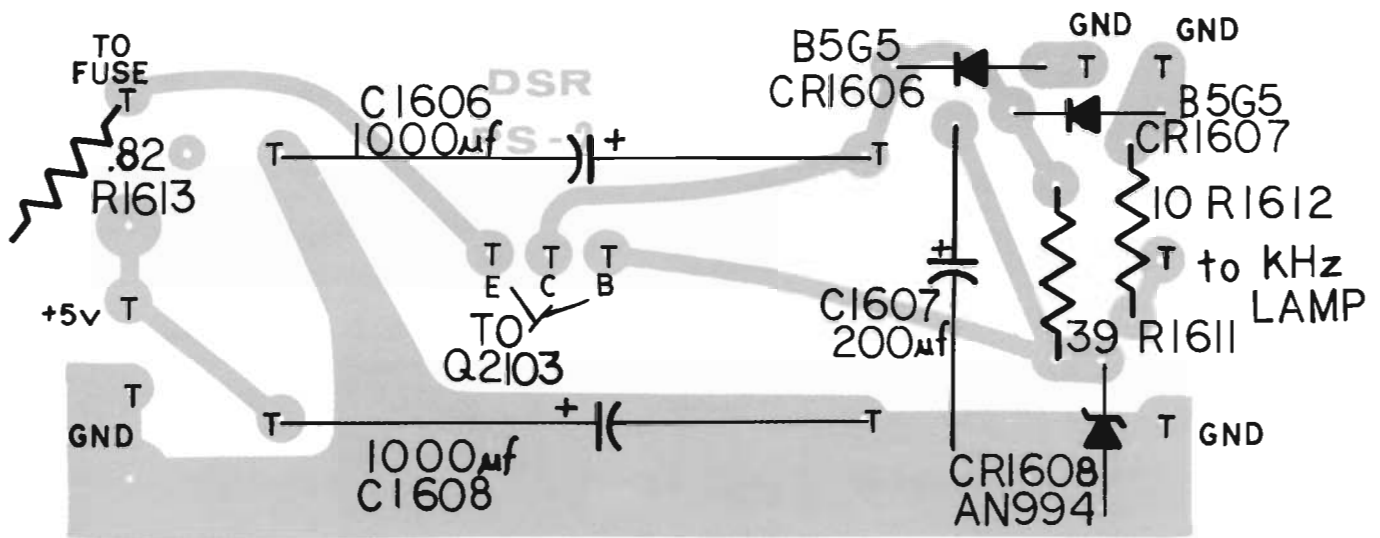


Figure 5-25. Power Supply Board No. 2, P/N 689-1600-2 (A16-2)

REF DES	DESCRIPTION
C1606	Capacitor, Electrolytic, 1000 uf, 15V
C1607	Capacitor, Electrolytic, 200 uf, 15V
C1608	Capacitor, Electrolytic, 1000 uf, 15V
CR1606	Diode, 1.1 A, 600 PIV (EDAL Industries, B5G5)
CR1607	Diode, 1.1 A, 600 PIV (EDAL Industries, B5G5)
CR1608	Diode, Zener, 6.5V, 1W, 5%, (TRW, AN994)
R1611	Resistor, Carbon Comp., 68 ohm \pm 10%, 1/2 W
R1612	Resistor, Carbon Comp., 10 ohm \pm 10%, 1/2 W
R1613	Resistor, Wire Wound, 0.82 ohm \pm 10%, 2 W

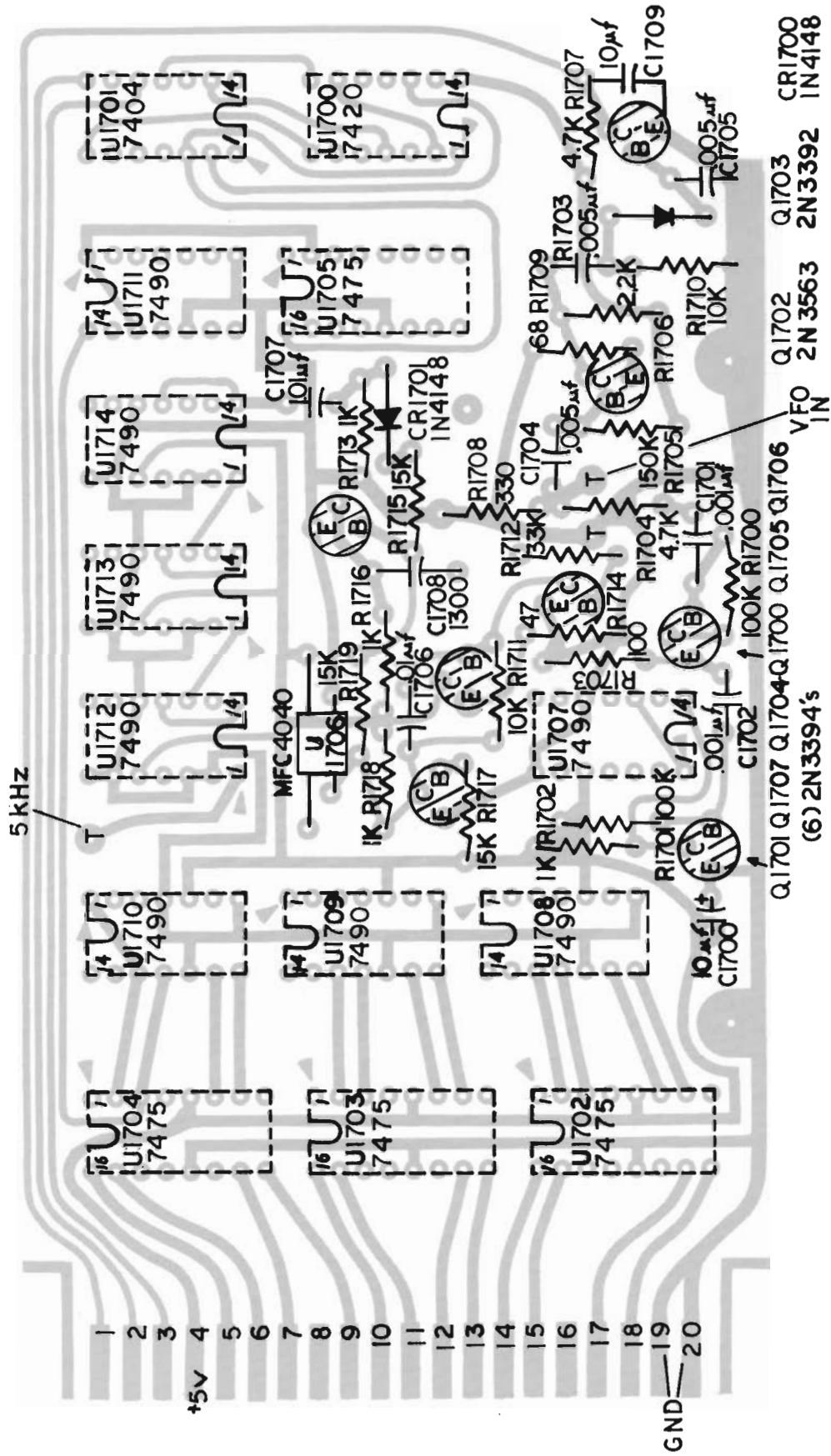


Figure 5-26. Counter No. 2, P/N 689-1700 (A17)

Figure 5-26. Parts List

REF DES	DESCRIPTION
C1700	Capacitor, Tantalum, 10 uf \pm 20%, 35V
C1701	Capacitor, Ceramic Disc, .001 uf \pm 20%, Z5U
C1702	Capacitor, Ceramic Disc, .001 uf \pm 20%, Z5U
C1703	Capacitor, Ceramic Disc, .005 uf \pm 20%, Z5U
C1704	Capacitor, Ceramic Disc, .005 uf \pm 20%, Z5U
C1705	Capacitor, Ceramic Disc, .005 uf \pm 20%, Z5U
C1706	Capacitor, Ceramic Disc, .01 uf + 80 -20%, 25V
C1707	Capacitor, Ceramic Disc, .01 uf + 80 -20%, 25V
C1708	Capacitor, Mica, 1300 pf \pm 2%, DM-20
C1709	Capacitor, Tantalum, 10 uf \pm 20%, 35V
CR1700	Diode, 1N4148
CR1701	Diode, 1N4148
U1700	Integrated Circuit, 7420
U1701	Integrated Circuit, 7404
U1702	Integrated Circuit, 7475
U1703	Integrated Circuit, 7475
U1704	Integrated Circuit, 7475
U1705	Integrated Circuit, 7475
U1706	Integrated Circuit, (Motorola MFC4040)
U1707	Integrated Circuit, 7490
U1708	Integrated Circuit, 7490
U1709	Integrated Circuit, 7490
U1710	Integrated Circuit, 7490
U1711	Integrated Circuit, 7490
U1712	Integrated Circuit, 7490
U1713	Integrated Circuit, 7490
U1714	Integrated Circuit, 7490
R1700	Resistor, Carbon Comp., 100 K \pm 10%, 1/4 W
R1701	Resistor, Carbon Comp., 100 K \pm 10%, 1/4 W
R1702	Resistor, Carbon Comp., 1 K \pm 10%, 1/4 W
R1703	Resistor, Carbon Comp., 100 ohm \pm 10%, 1/4 W
R1704	Resistor, Carbon Comp., 4.7 K \pm 10%, 1/4 W
R1705	Resistor, Carbon Comp., 150 K \pm 10%, 1/4 W
R1706	Resistor, Carbon Comp., 2.2 K \pm 10%, 1/4 W
R1707	Resistor, Carbon Comp., 4.7 K \pm 10%, 1/4 W
R1708	Resistor, Carbon Comp., 330 ohm \pm 10%, 1/4 W
R1709	Resistor, Carbon Comp., 68 ohm \pm 10%, 1/4 W
R1710	Resistor, Carbon Comp., 10 K \pm 10%, 1/4 W
R1711	Resistor, Carbon Comp., 10 K \pm 10%, 1/4 W
R1712	Resistor, Carbon Comp., 33 K \pm 10%, 1/4 W
R1713	Resistor, Carbon Comp., 1 K \pm 10%, 1/4 W
R1714	Resistor, Carbon Comp., 47 ohm \pm 10%, 1/4 W
R1715	Resistor, Carbon Comp., 15 K \pm 10%, 1/4 W
R1716	Resistor, Carbon Comp., 1 K \pm 10%, 1/4 W
R1717	Resistor, Carbon Comp., 15 K \pm 10%, 1/4 W
R1718	Resistor, Carbon Comp., 1 K \pm 10%, 1/4 W
R1719	Resistor, Carbon Comp., 15 K \pm 10%, 1/4 W
Q1700	Transistor, 2N3394
Q1701	Transistor, 2N3394
Q1702	Transistor, 2N3563
Q1703	Transistor, 2N3392
Q1704	Transistor, 2N3394
Q1705	Transistor, 2N3394
Q1706	Transistor, 2N3394
Q1707	Transistor, 2N3394

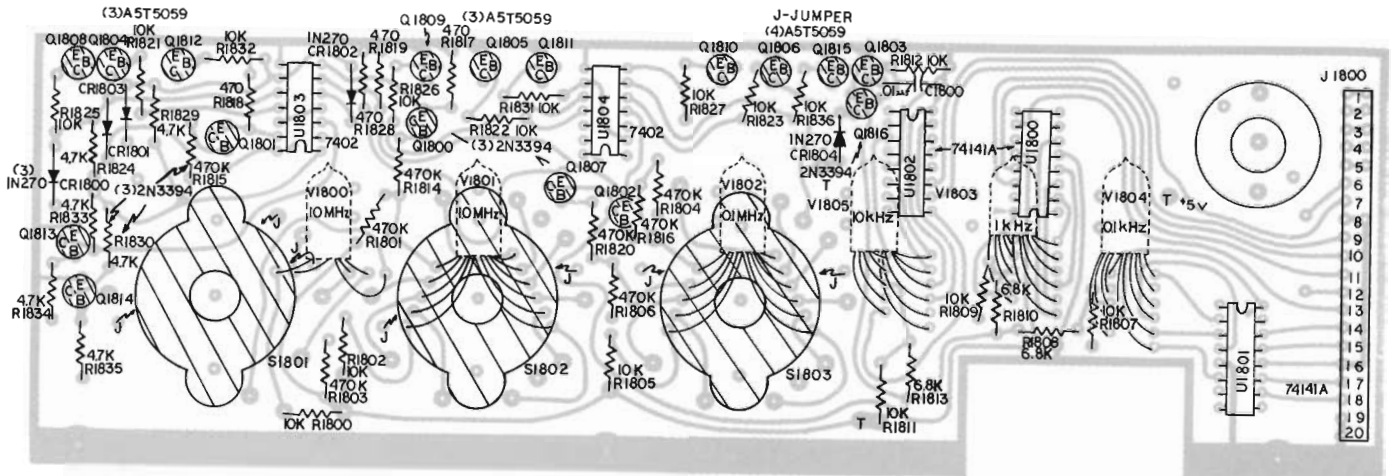


Figure 5-27. Counter No. 1, P/N 689-1800 (A18)

REF	DESCRIPTION
-----	-------------

DES	DESCRIPTION
C1800	Capacitor, Ceramic Disc, .01 uf ± 20%, Z5U
CR1800	Diode, 1N270
CR1801	Diode, 1N270
CR1802	Diode, 1N270
CR1803	Diode, 1N270
CR1804	Diode, 1N270
U1800	Integrated Circuit, 74141A
U1801	Integrated Circuit, 74141A
U1802	Integrated Circuit, 74141A
U1803	Integrated Circuit, 7402
U1804	Integrated Circuit, 7402
R1800	Resistor, Carbon Comp., 10 K ± 10%, 1/4 W
R1801	Resistor, Carbon Comp., 470 K ± 10%, 1/4 W
R1802	Resistor, Carbon Comp., 10 K ± 10%, 1/4 W
R1803	Resistor, Carbon Comp., 470 K ± 10%, 1/4 W
R1804	Resistor, Carbon Comp., 470 K ± 10%, 1/4 W
R1805	Resistor, Carbon Comp., 10 K ± 10%, 1/4 W
R1806	Resistor, Carbon Comp., 470 K ± 10%, 1/4 W
R1807	Resistor, Carbon Comp., 10 K ± 10%, 1/4 W
R1808	Resistor, Carbon Comp., 6.8 K ± 10%, 1/4 W
R1809	Resistor, Carbon Comp., 10 K ± 10%, 1/4 W
R1810	Resistor, Carbon Comp., 6.8 K ± 10%, 1/4 W
R1811	Resistor, Carbon Comp., 10 K ± 10%, 1/4 W
R1812	Resistor, Carbon Comp., 10 K ± 10%, 1/4 W
R1813	Resistor, Carbon Comp., 6.8 K ± 10%, 1/4 W
R1814	Resistor, Carbon Comp., 470 K ± 10%, 1/4 W
R1815	Resistor, Carbon Comp., 470 K ± 10%, 1/4 W
R1816	Resistor, Carbon Comp., 470 K ± 10%, 1/4 W
R1817	Resistor, Carbon Comp., 470 ohm ± 10%, 1/4 W
R1818	Resistor, Carbon Comp., 470 ohm ± 10%, 1/4 W
R1819	Resistor, Carbon Comp., 470 ohm ± 10%, 1/4 W
R1820	Resistor, Carbon Comp., 470 K ± 10%, 1/4 W
R1821	Resistor, Carbon Comp., 10 K ± 10%, 1/4 W

Figure 5-27. Parts List

REF DES	DESCRIPTION
R1822	Resistor, Carbon Comp., 10 K \pm 10%, 1/4 W
R1823	Resistor, Carbon Comp., 10 K \pm 10%, 1/4 W
R1824	Resistor, Carbon Comp., 4.7 K \pm 10%, 1/4 W
R1825	Resistor, Carbon Comp., 10 K \pm 10%, 1/4 W
R1826	Resistor, Carbon Comp., 10 K \pm 10%, 1/4 W
R1827	Resistor, Carbon Comp., 10 K \pm 10%, 1/4 W
R1828	Resistor, Carbon Comp., 470 K \pm 10%, 1/4 W
R1829	Resistor, Carbon Comp., 4.7 K \pm 10%, 1/4 W
R1830	Resistor, Carbon Comp., 4.7 K \pm 10%, 1/4 W
R1831	Resistor, Carbon Comp., 10 K \pm 10%, 1/4 W
R1832	Resistor, Carbon Comp., 10 K \pm 10%, 1/4 W
R1833	Resistor, Carbon Comp., 4.7 K \pm 10%, 1/4 W
R1834	Resistor, Carbon Comp., 4.7 K \pm 10%, 1/4 W
R1835	Resistor, Carbon Comp., 4.7 K \pm 10%, 1/4 W
R1836	Resistor, Carbon Comp., 10 K \pm 10%, 1/4 W
Q1800	Transistor, 2N3394
Q1801	Transistor, 2N3394
Q1802	Transistor, 2N3394
Q1803	Transistor, (TI AT5059)
Q1804	Transistor, (TI AT5059)
Q1805	Transistor, (TI AT5059)
Q1806	Transistor, (TI AT5059)
Q1807	Transistor, 2N3394
Q1808	Transistor, (TI AT5059)
Q1809	Transistor, (TI AT5059)
Q1810	Transistor, (TI AT5059)
Q1811	Transistor, (TI AT5059)
Q1812	Transistor, (TI AT5059)
Q1813	Transistor, 2N3394
Q1814	Transistor, 2N3394
Q1815	Transistor, (TI AT5059)
Q1816	Transistor, 2N3394
V1800	Tube, Readout (Burroughs B5870)
V1801	Tube, Readout (Burroughs B5870)
V1802	Tube, Readout (Burroughs B5870)
V1803	Tube, Readout (Burroughs B5870)
V1804	Tube, Readout (Burroughs B5870)
V1805	Tube, Readout (Burroughs B5870)
J1800	Connector (Elco 00-6313-020-699-004)
S1801	Switch, Rotary (R. L. Drake A-2293-D)
S1802	Switch, Rotary (R. L. Drake A-2295-D)
S1803	Switch, Rotary (R. L. Drake A-2295-D)

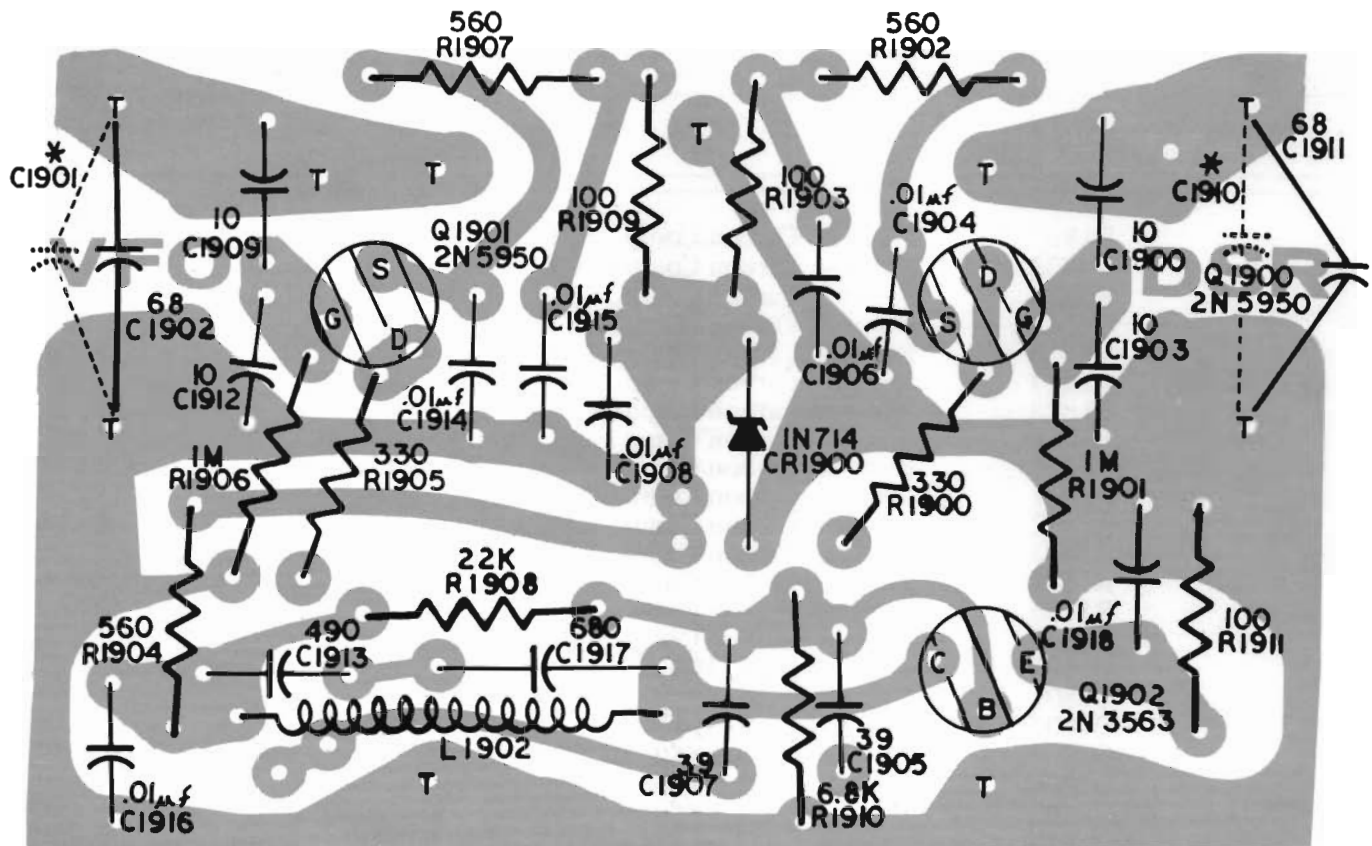


Figure 5-28. Variable Frequency Oscillator, P/N 689-1900 (A19)

REF DES	DESCRIPTION
C1900	Capacitor, Ceramic Disc, NPO, 10 pf \pm 5%
C1901	Capacitor, Ceramic Disc (Selected in production)
C1902	Capacitor, Tubular, NPO, 68 pf \pm 2%
C1903	Capacitor, Ceramic Disc, NPO, 10 pf \pm 5%
C1904	Capacitor, Ceramic Disc, .01 uf + 80 -20%, 25V
C1905	Capacitor, Ceramic Disc, NPO, 39 pf \pm 5%
C1906	Capacitor, Ceramic Disc, .01 uf + 80 -20%, 25V
C1907	Capacitor, Ceramic Disc, NPO, 39 pf \pm 5%
C1908	Capacitor, Ceramic Disc, .01 uf + 80 -20%, 25V
C1909	Capacitor, Ceramic Disc, NPO, 10 pf \pm 5%
C1910	Capacitor, Ceramic Disc (Selected in production)
C1911	Capacitor, Tubular, NPO, 68 pf \pm 2%
C1912	Capacitor, Ceramic Disc, NPO, 10 pf \pm 5%
C1913	Capacitor, Mica, 490 pf \pm 5%, DM-15
C1914	Capacitor, Ceramic Disc, .01 uf + 80 -20%, 25V
C1915	Capacitor, Ceramic Disc, .01 uf + 80 -20%, 25V
C1916	Capacitor, Ceramic Disc, .01 uf + 80 -20%, 25V
C1917	Capacitor, Mica, 680 pf \pm 5%, DM-15
C1918	Capacitor, Ceramic Disc, .01 uf + 80 -20%, 25V
C1919	Capacitor, Air Variable, 2 Section (Not Shown) (R. L. Drake A-1942-C)
C1920	Capacitor, Tubular (Selected in production)
C1921	Capacitor, Tubular (Selected in production)

Figure 5-28. Parts List

REF DES	DESCRIPTION
CR1900	Diode, 1N714
L1900	Inductor, Variable (Not Shown) (R. L. Drake B-2469-L)
L1901	Inductor, Variable (Not Shown) (R. L. Drake B-2469-L)
L1902	Inductor, Fixed (R. L. Drake A-2463-L)
Q1900	Transistor, 2N5950
Q1901	Transistor, 2N5950
Q1902	Transistor, 2N3563
R1900	Resistor, Carbon Comp., 330 ohm \pm 10%, 1/4 W
R1901	Resistor, Carbon Comp., 1 MEG \pm 10%, 1/4 W
R1902	Resistor, Carbon Comp., 560 ohm \pm 10%, 1/4 W
R1903	Resistor, Carbon Comp., 100 ohm \pm 10%, 1/4 W
R1904	Resistor, Carbon Comp., 560 ohm \pm 10%, 1/4 W
R1905	Resistor, Carbon Comp., 330 ohm \pm 10%, 1/4 W
R1906	Resistor, Carbon Comp., 1 MEG \pm 10%, 1/4 W
R1907	Resistor, Carbon Comp., 560 ohm \pm 10%, 1/4 W
R1908	Resistor, Carbon Comp., 22 K \pm 10%, 1/4 W
R1909	Resistor, Carbon Comp., 100 ohm \pm 10%, 1/4 W
R1910	Resistor, Carbon Comp., 6.8 K \pm 10%, 1/4 W
R1911	Resistor, Carbon Comp., 100 ohm \pm 10%, 1/4 W
R1912	Resistor, Carbon Comp., (Not Shown) 220 ohm \pm 10%, 1/4 W
R1913	Resistor, Carbon Comp., (Not Shown) 220 ohm \pm 10%, 1/4 W
S1900	Switch Rotary (Not Shown) (R. L. Drake A-2259-D)

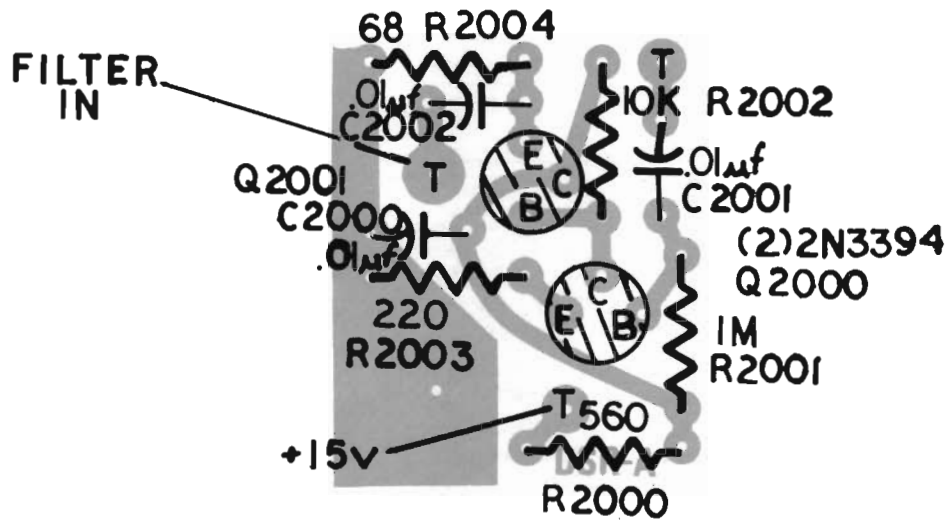
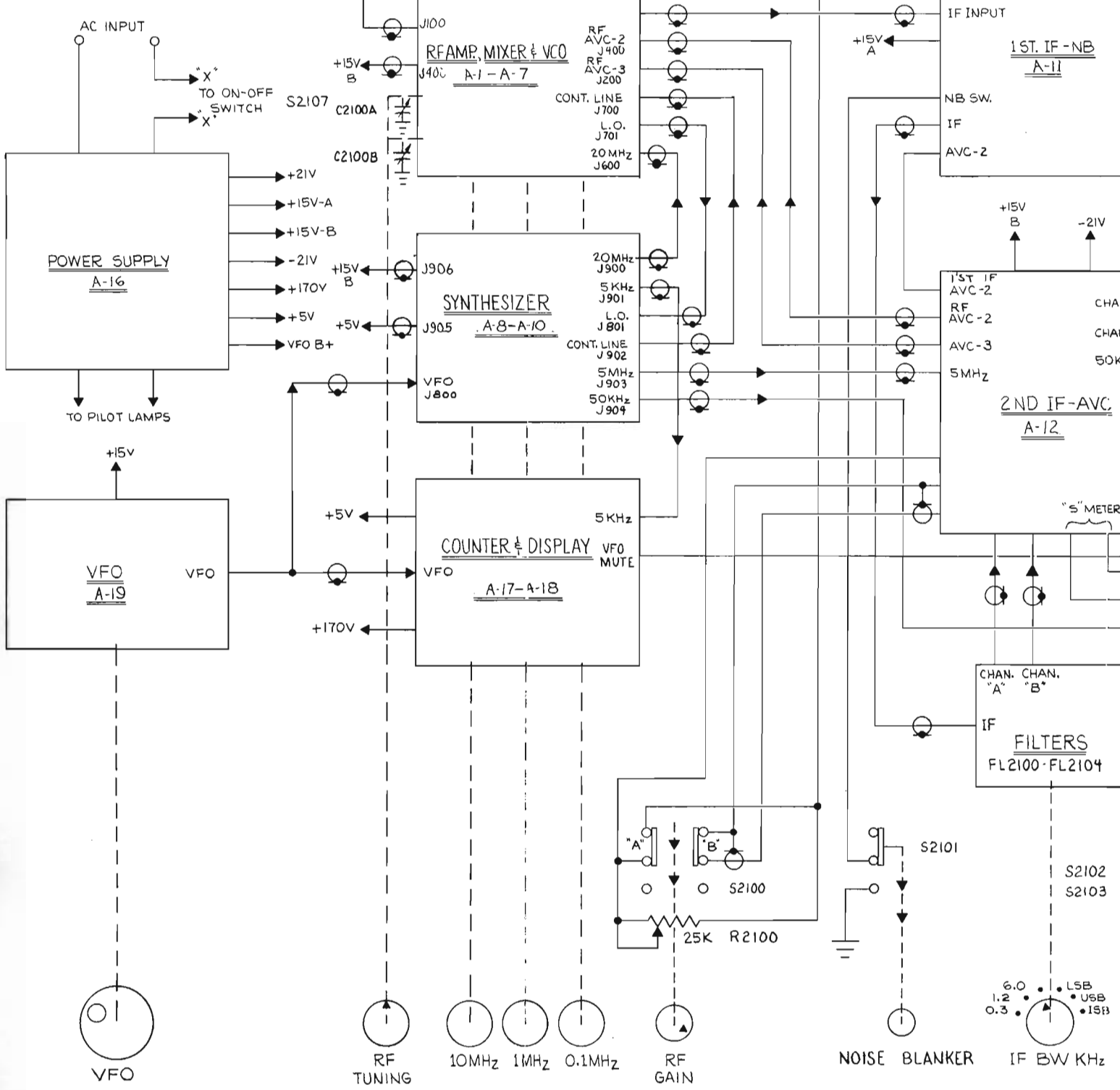


Figure 5-29. Filter Amplifier, P/N 689-2000 (A20)

REF DES	DESCRIPTION
C2000	Capacitor, Ceramic Disc, 0.01 uf + 80 -20%, 25WVDC
C2001	Capacitor, Ceramic Disc, 0.01 uf + 80 -20%, 25WVDC
C2002	Capacitor, Ceramic Disc, 0.01 uf + 80 -20%, 25WVDC
R2000	Resistor, Carbon Comp., 560 ohm \pm 10%, 1/4 W
R2001	Resistor, Carbon Comp., 1 MEG \pm 10%, 1/4 W
R2002	Resistor, Carbon Comp., 10 K \pm 10%, 1/4 W
R2003	Resistor, Carbon Comp., 220 ohm \pm 10%, 1/4 W
R2004	Resistor, Carbon Comp., 68 ohm \pm 10%, 1/4 W
Q2000	Transistor, 2N3394
Q2001	Transistor, 2N3394



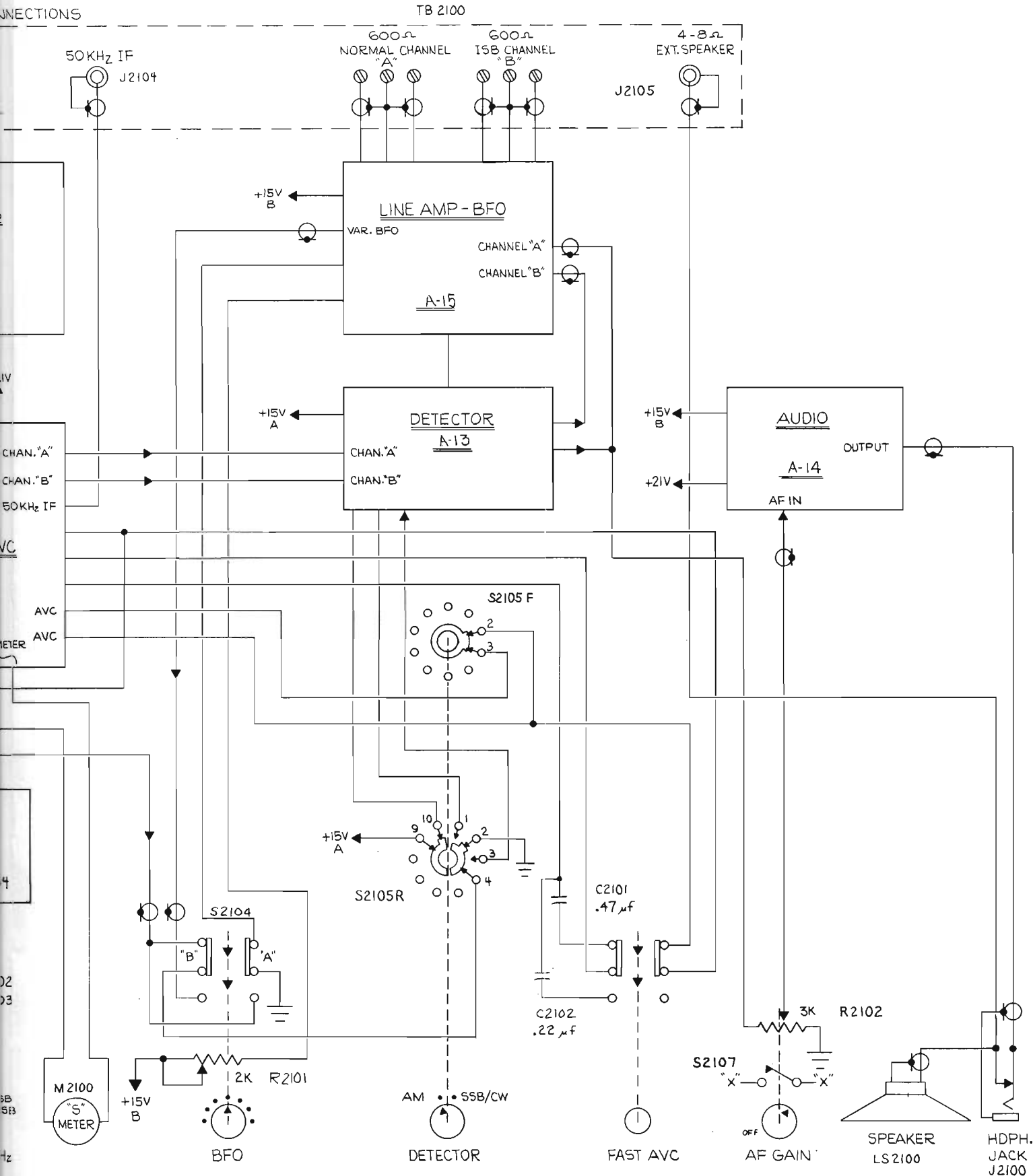
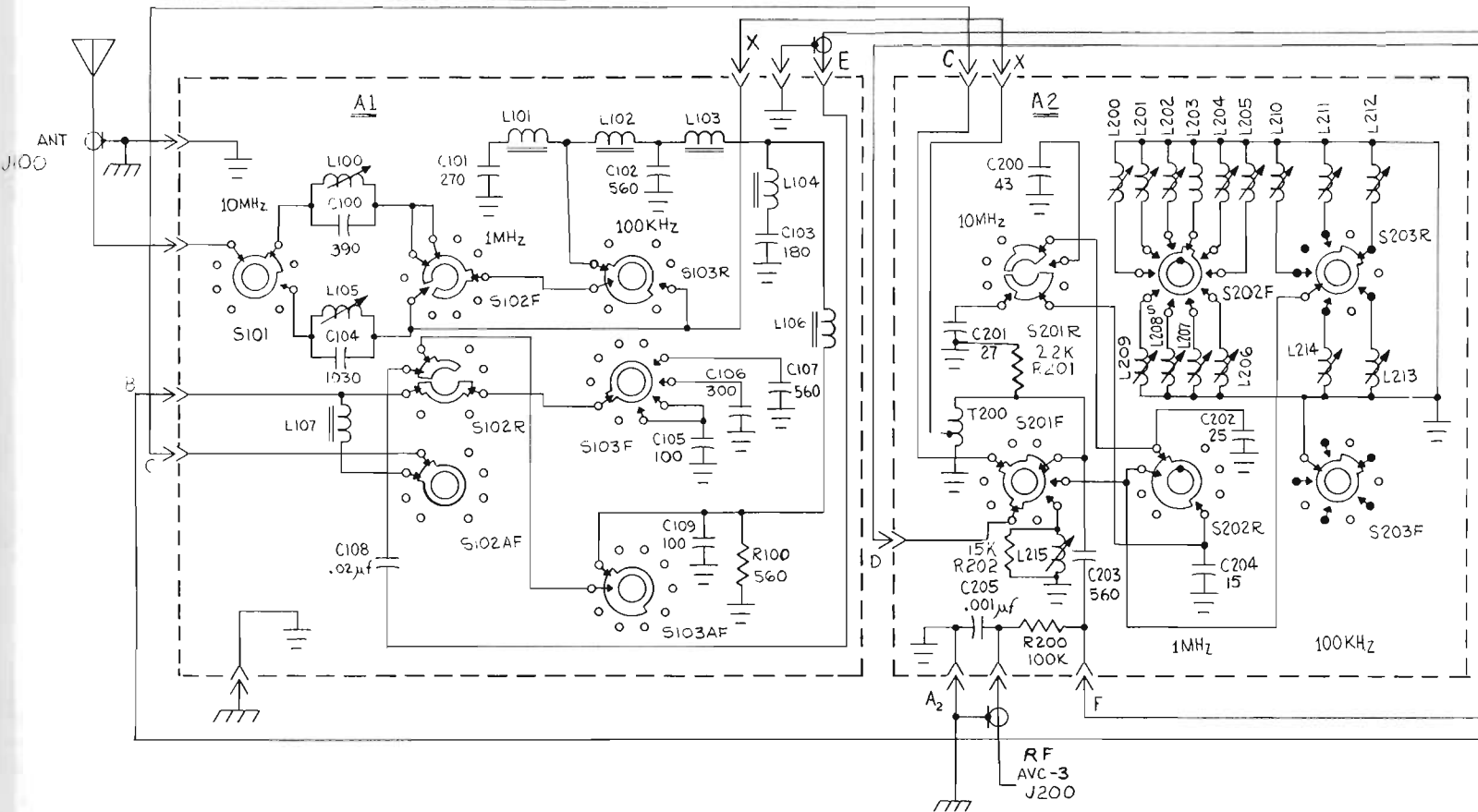


Figure 5-30. System Block Diagram

ANT - 0-1MHz INPUT

10-30MHz INPUT

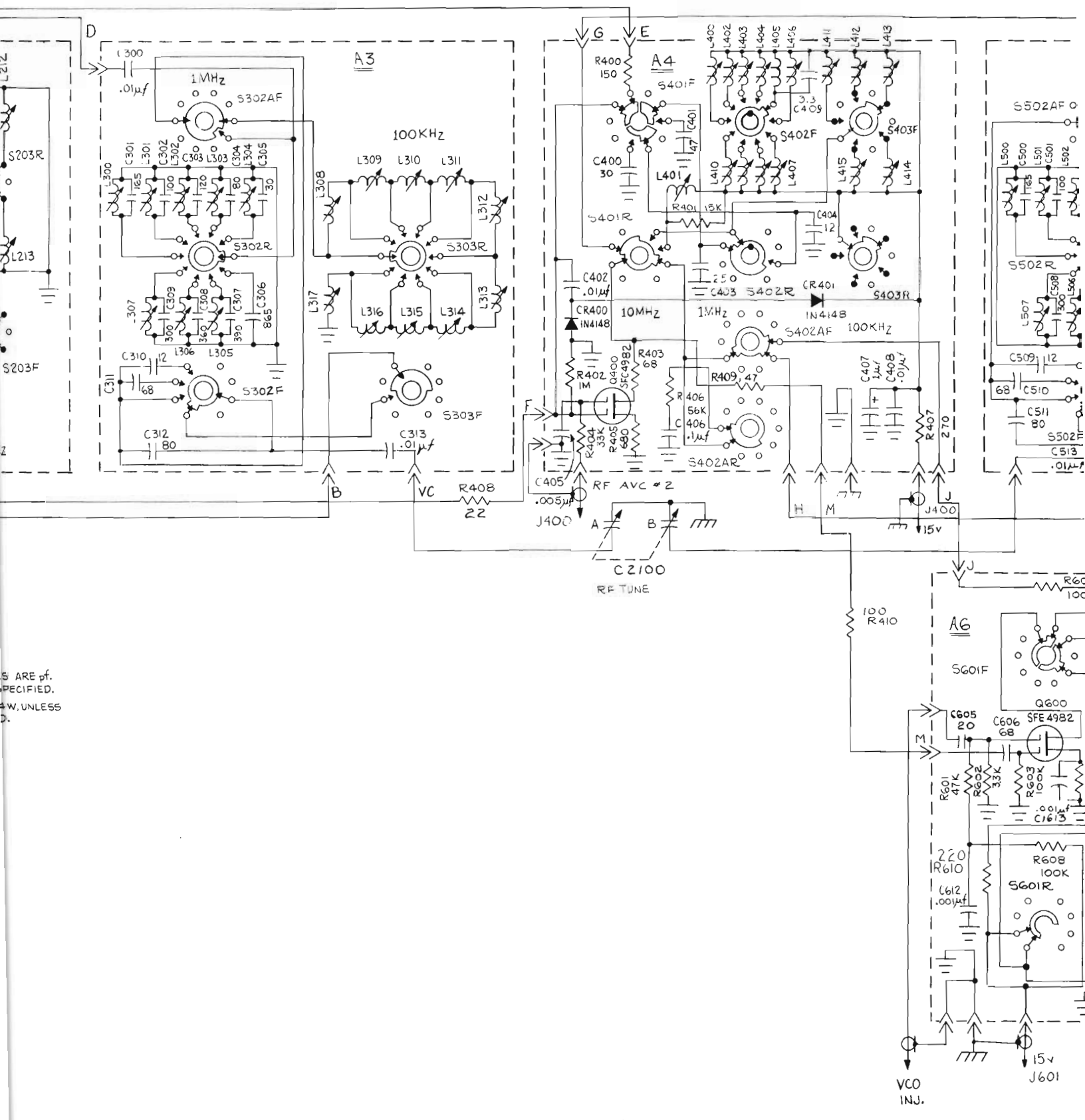


NOTE:

- 1) ALL CAPACITOR VALUES ARE pf. UNLESS OTHERWISE SPECIFIED.
- 2) ALL RESISTORS ARE 1/4W, UNLESS OTHERWISE SPECIFIED.

1-10MHz INPUT

10-30 MHz OUTPUT - RFAMP



RESISTORS ARE OF THE 5% TOLERANCE UNLESS OTHERWISE SPECIFIED.

Figure 5-31.

10-30 MHz OUTPUT - RF AMP

1-10 MHz OUTPUT

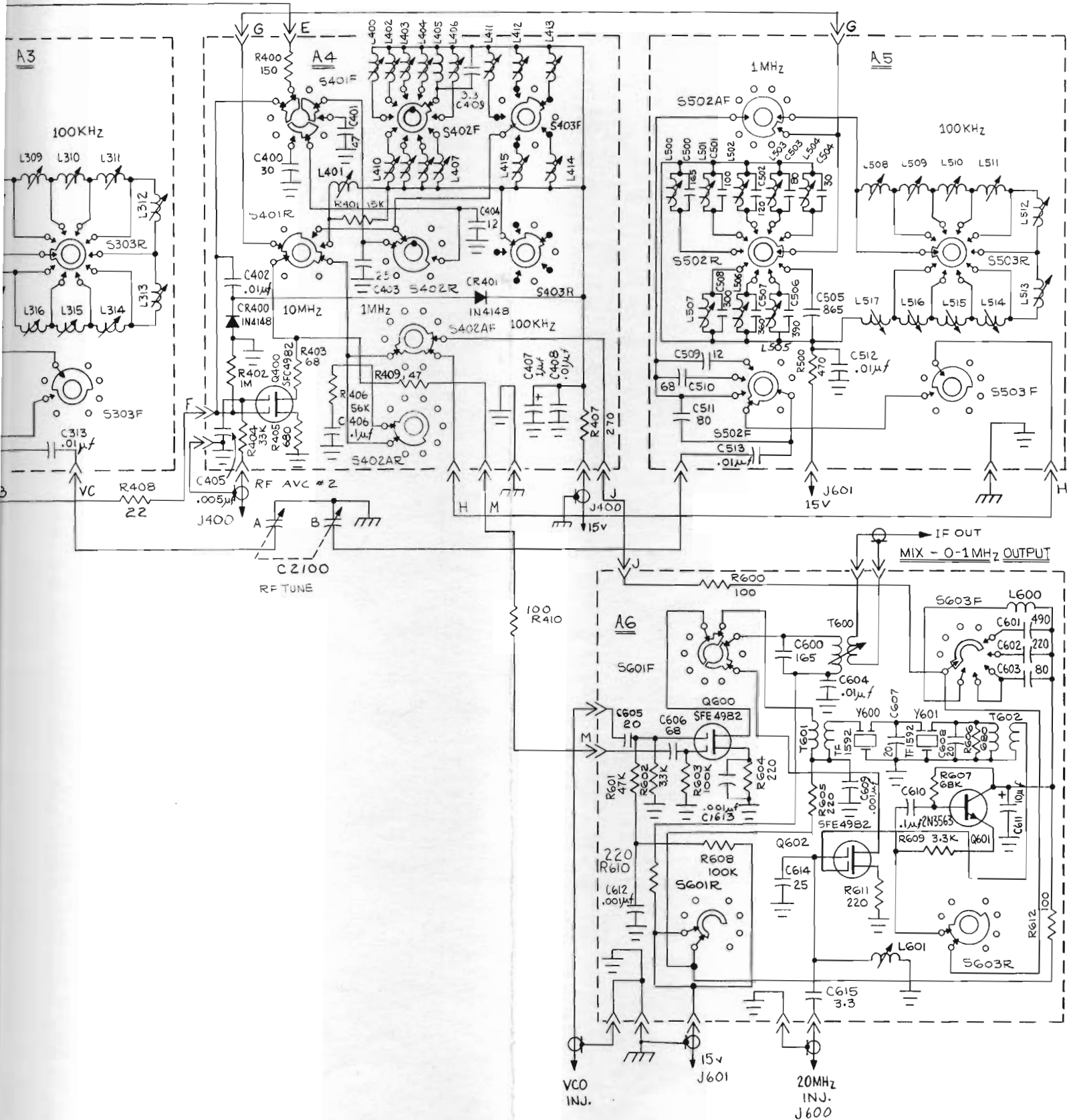
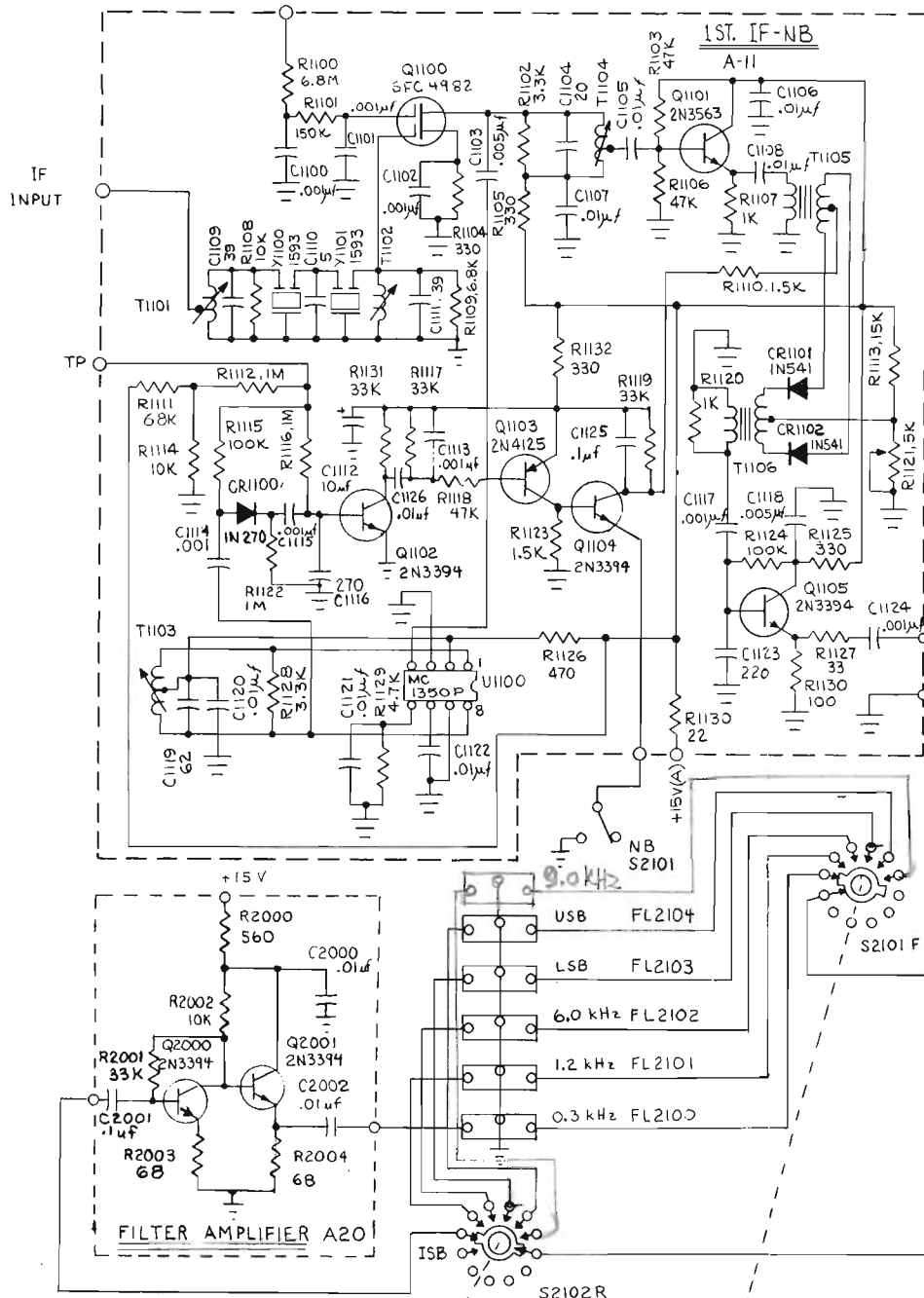


Figure 5-31. RF Amplifier and Mixer Schematic

1st IF AVC #2



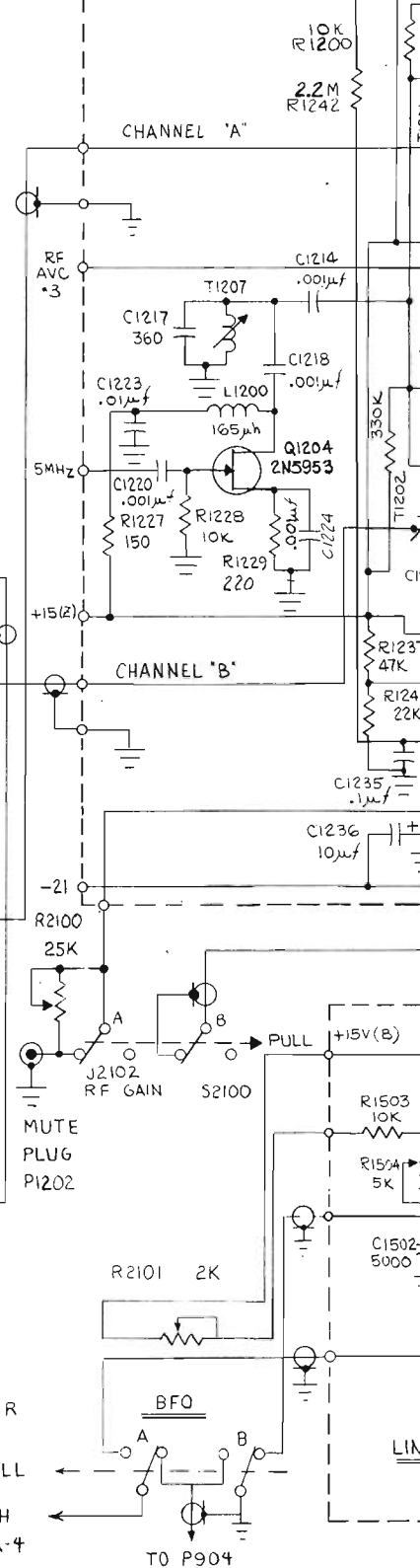
NOTES:

- 1) ALL CAPACITOR VALUES ARE pf UNLESS OTHERWISE NOTED.
- 2) ALL RESISTORS ARE 1/4 W UNLESS OTHERWISE NOTED.

IF / BW

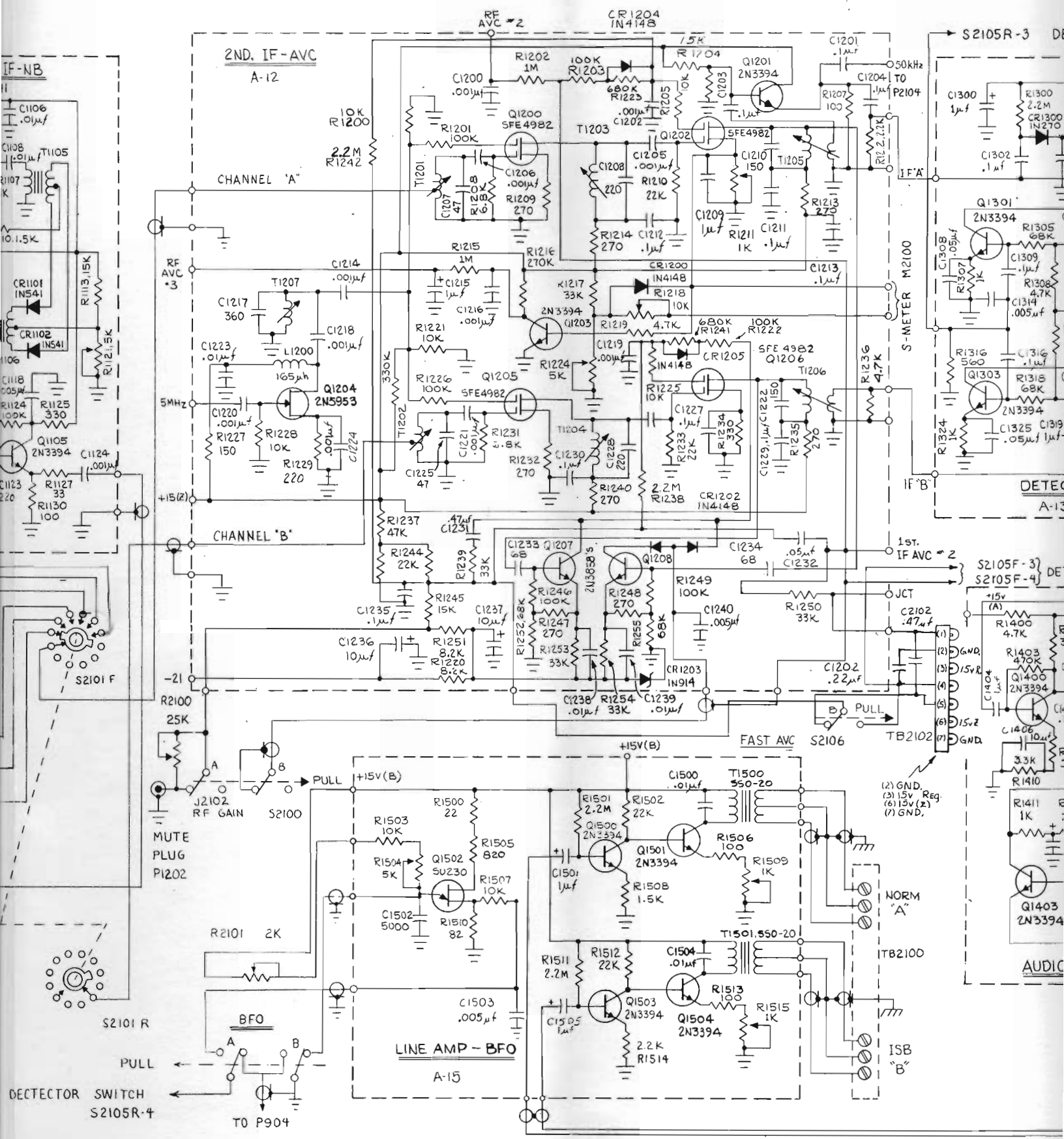
2ND. IF-AVC

A-12



TO DETECTOR SWITCH S2105R-4

TO P904



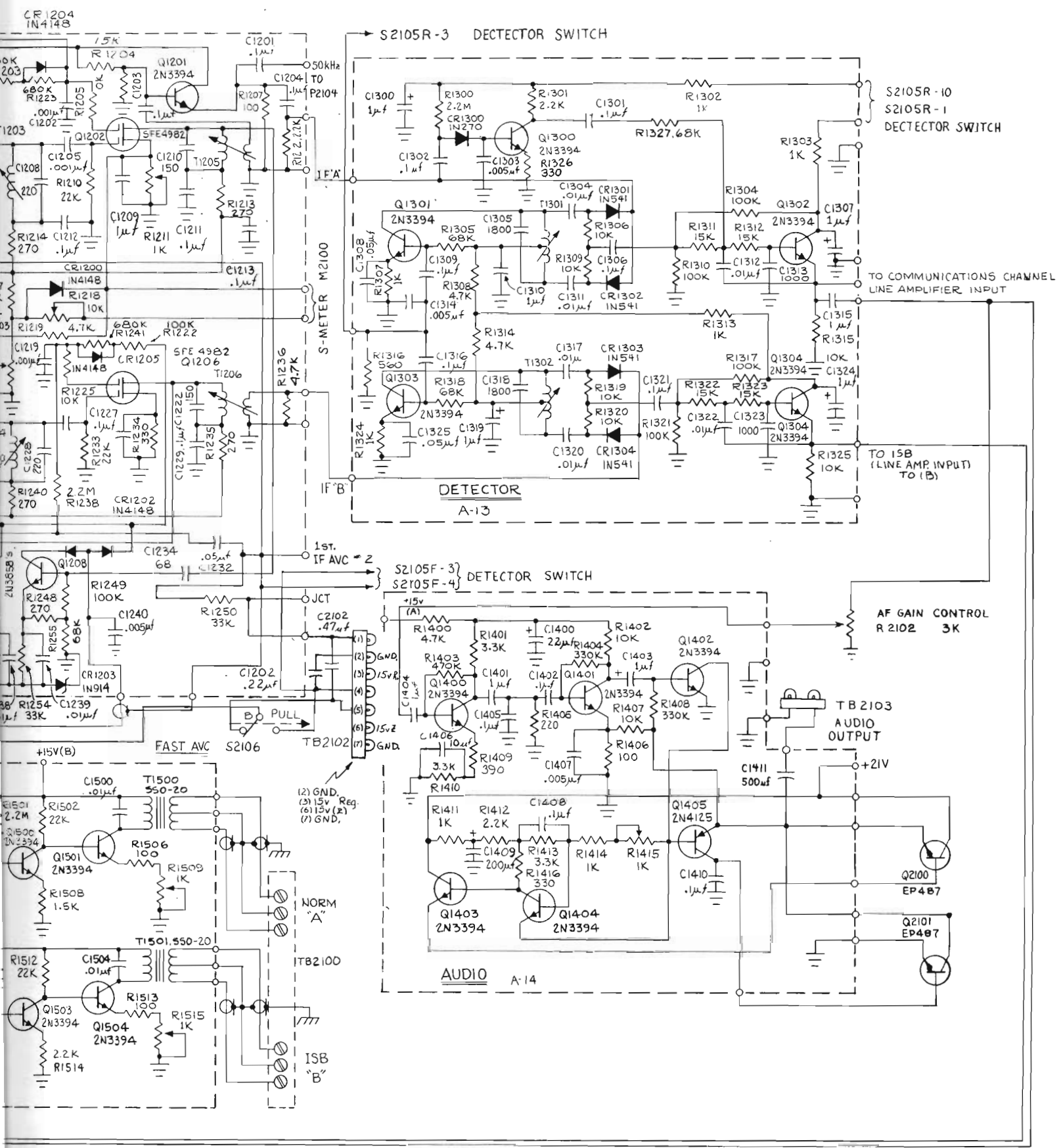
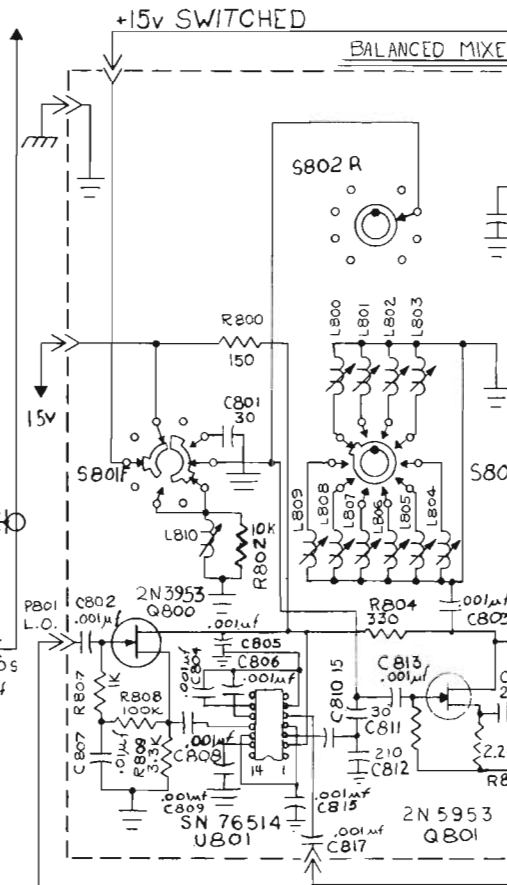
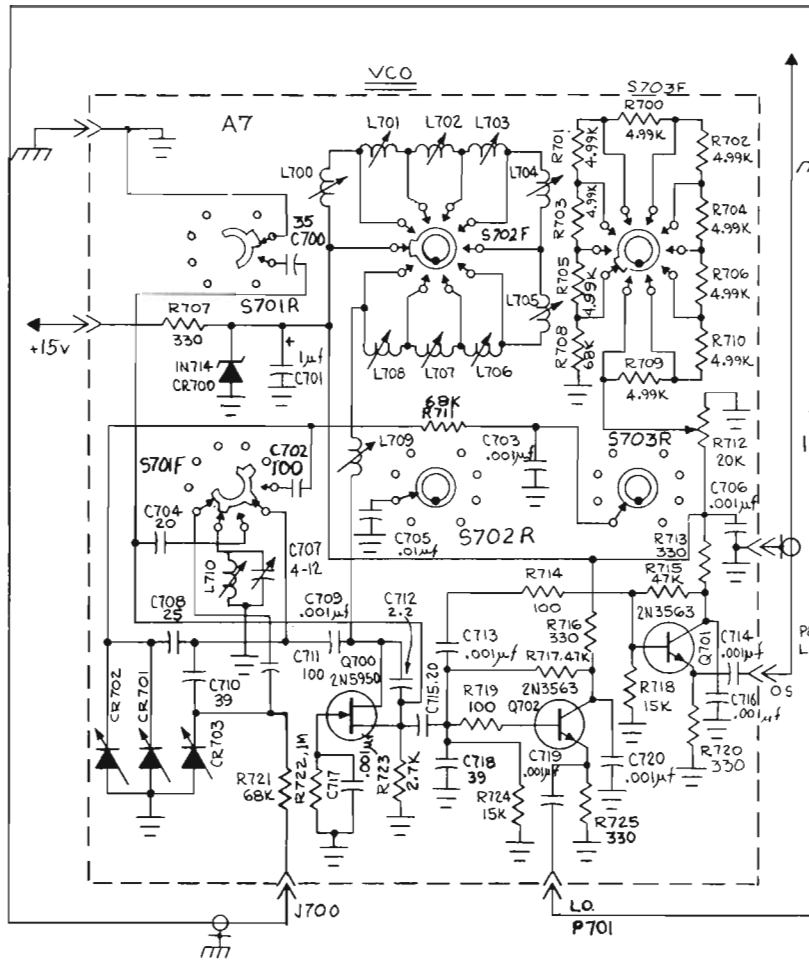
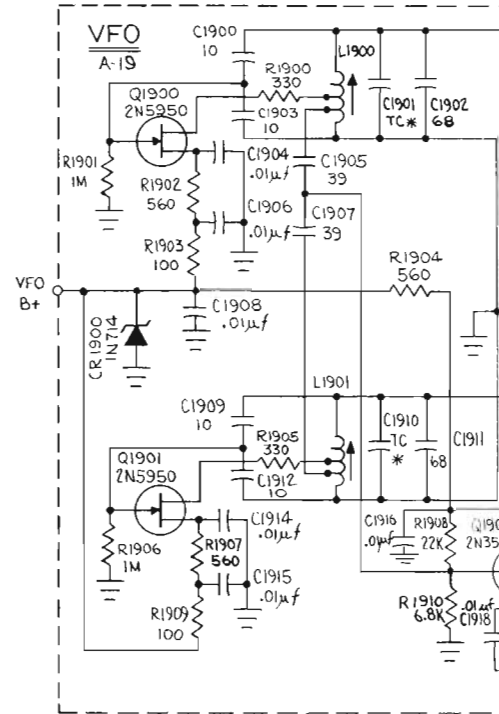
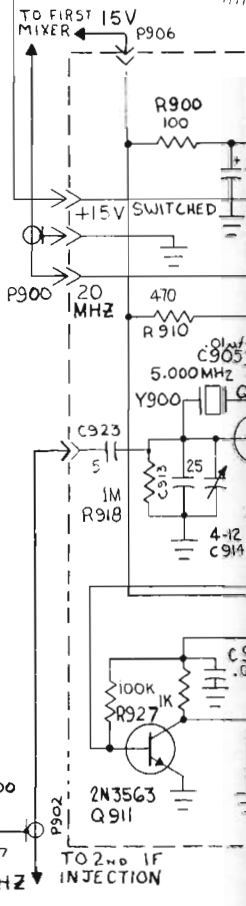
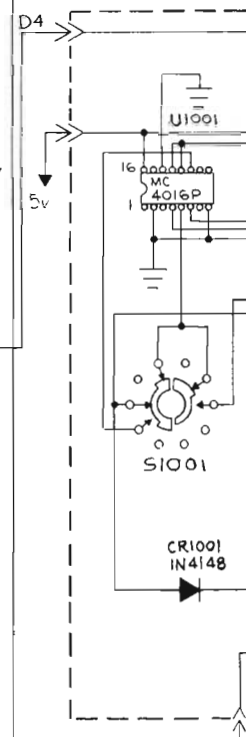
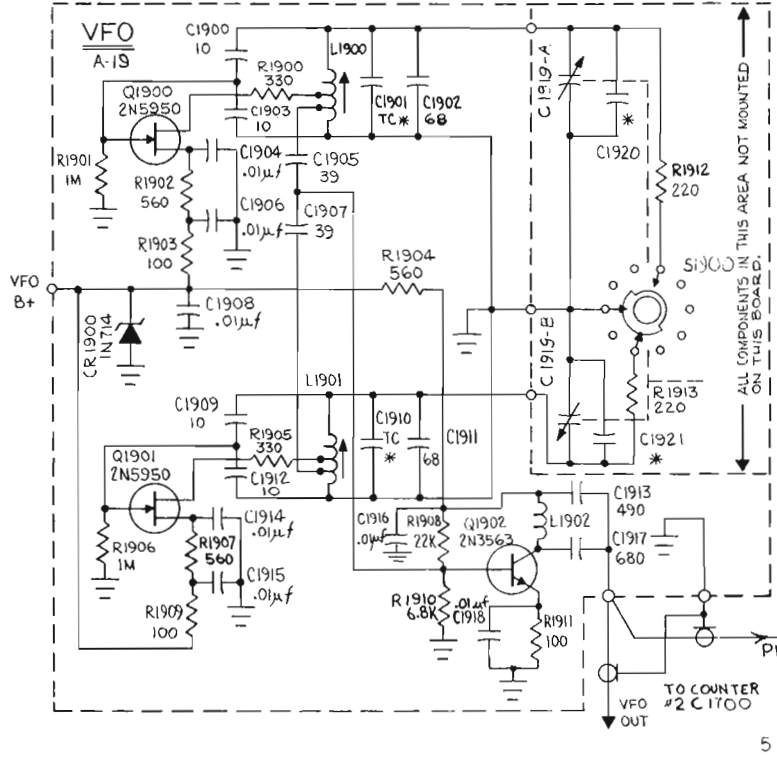
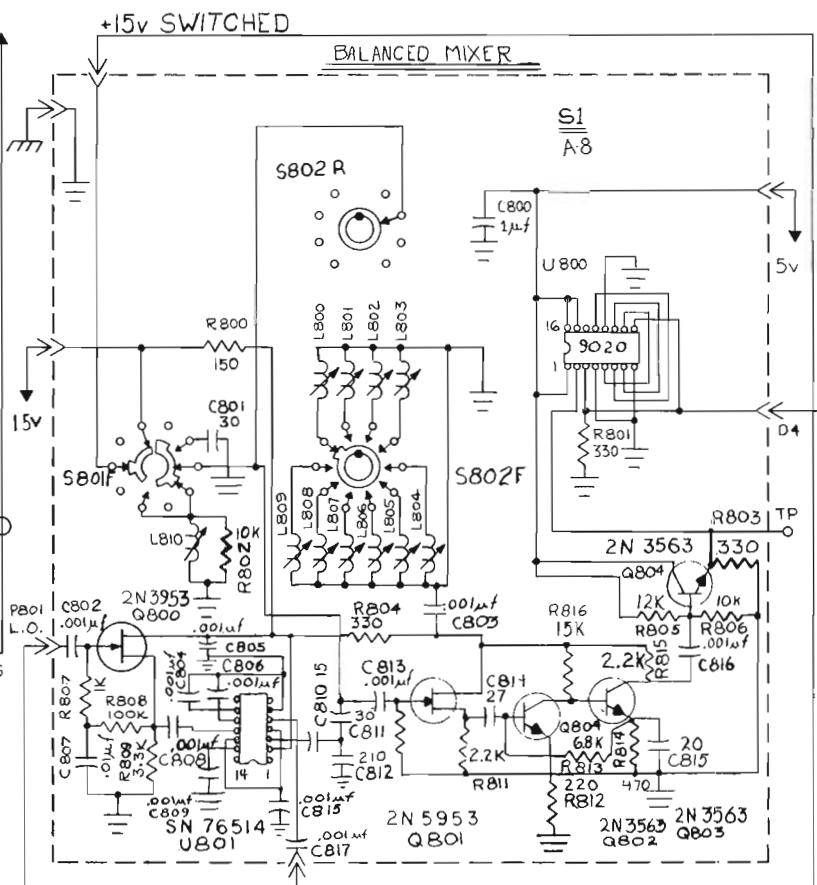
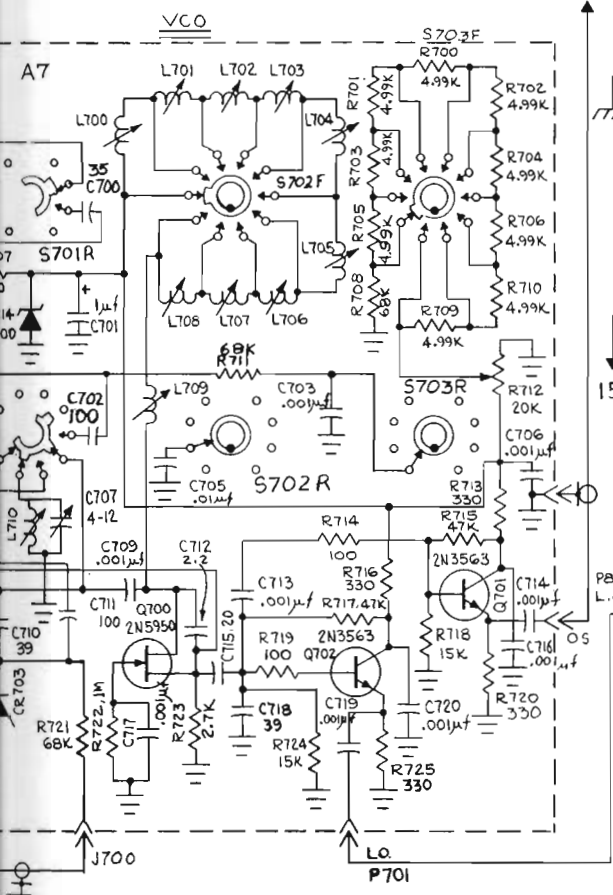


Figure 5-32. IF Amplifier, AVC, Detector and Audio Amplifier Schematic



- NOTES:**
1. ALL CAPACITOR VALUES ARE pF, UNLESS OTHERWISE SPECIFIED.
 2. ALL RESISTORS ARE 1/4 W, UNLESS OTHERWISE SPECIFIED.
 3. * DENOTES VALUES SELECTED IN PRODUCTION.





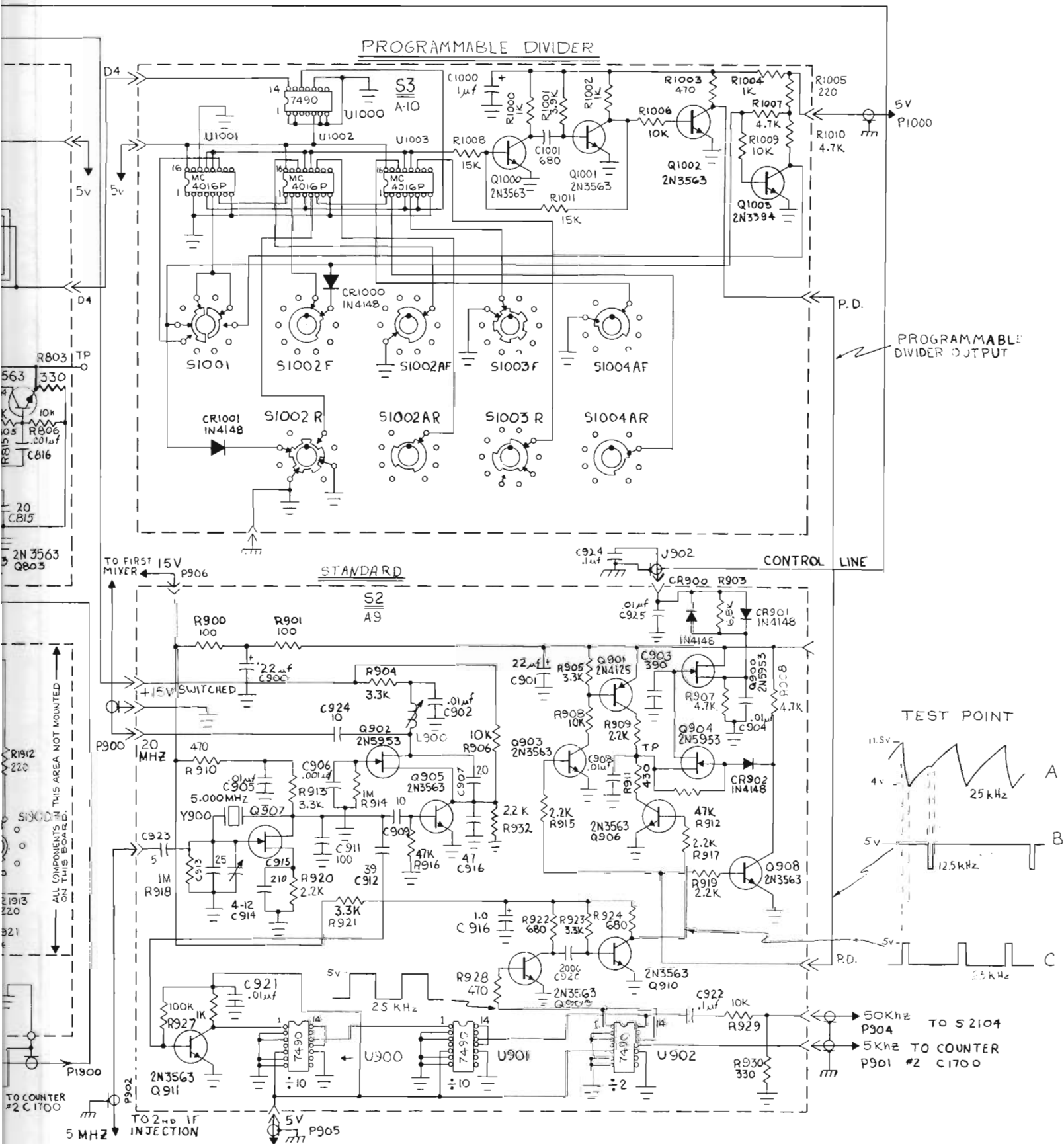
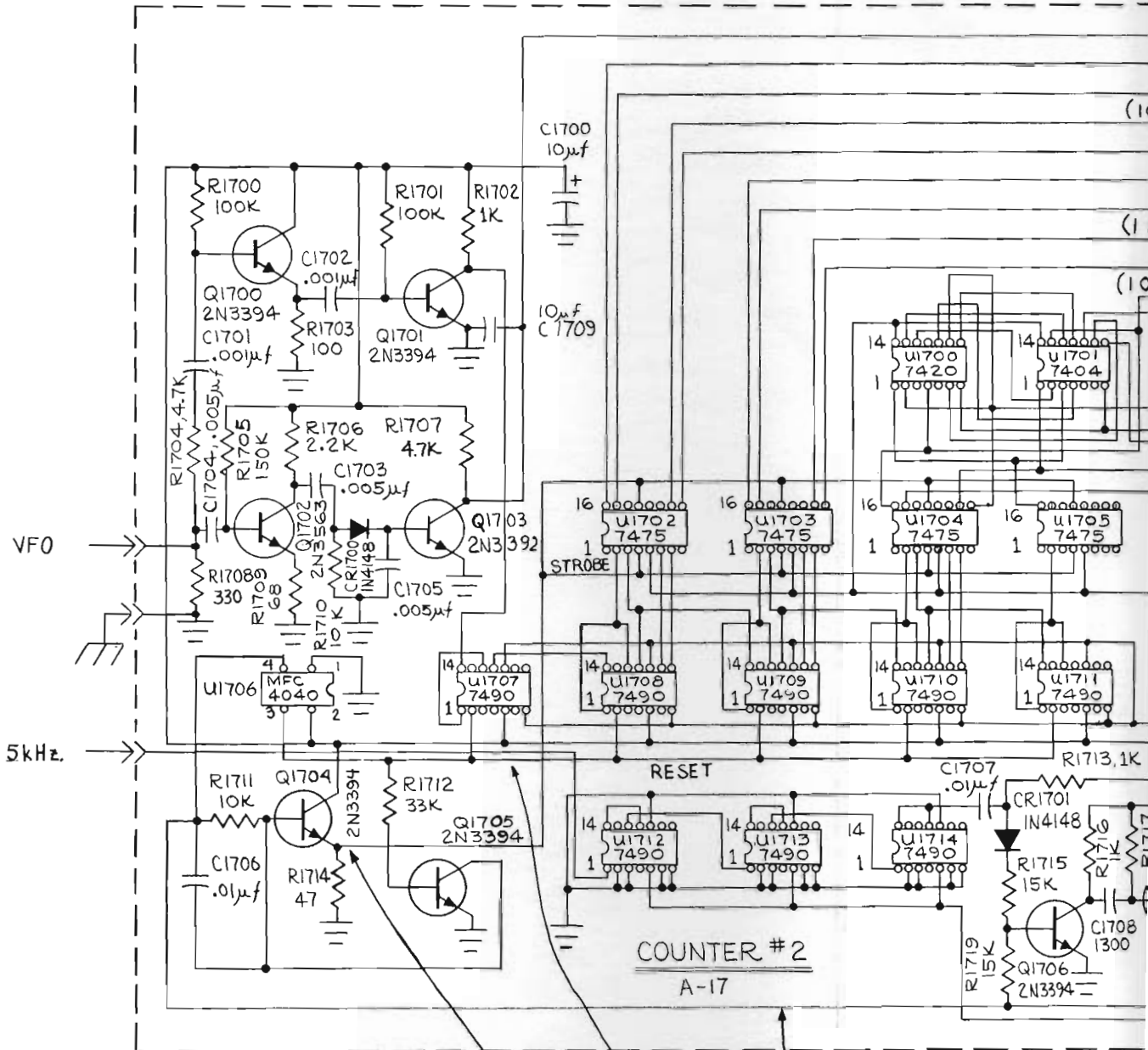
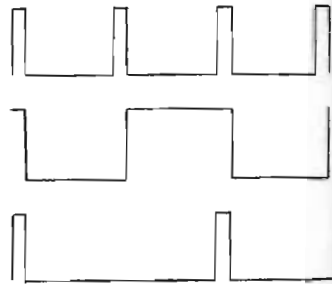


Figure 5-33. Synthesizer, VFO and VCO Schematic

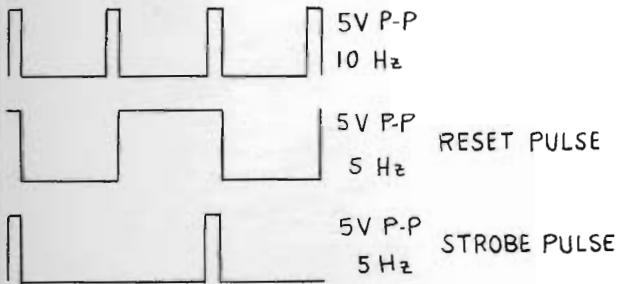
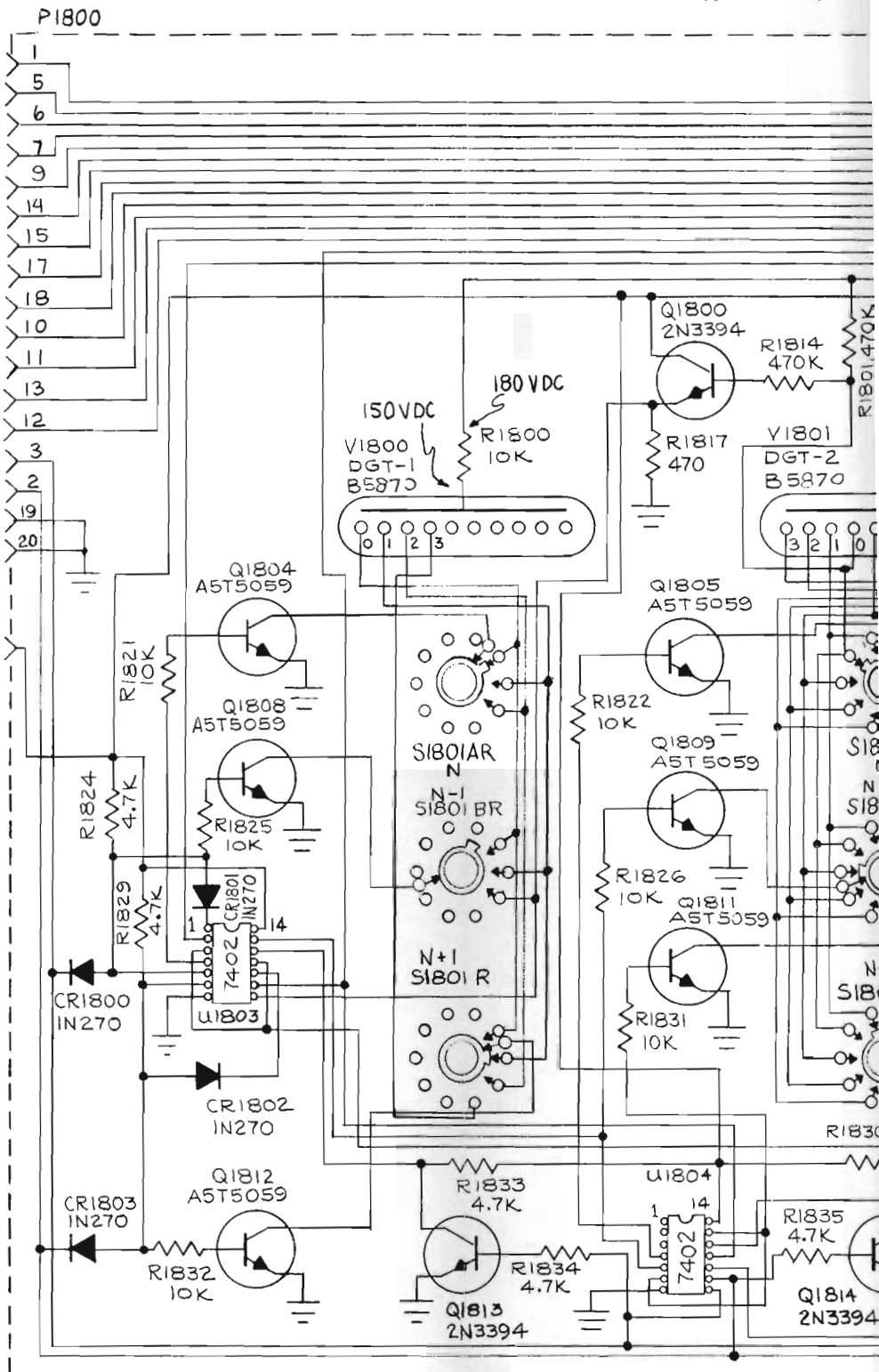
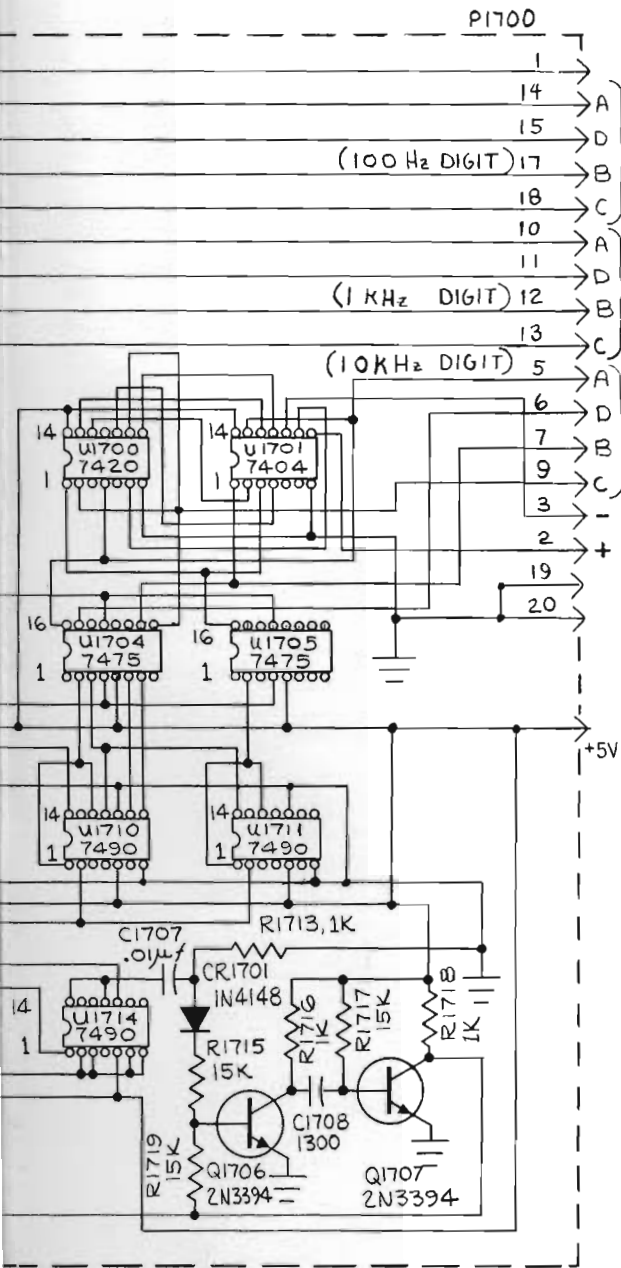


NOTES:

- 1) ALL CAPACITOR VALUES ARE pf UNLESS OTHERWISE NOTED.
- 2) ALL RESISTORS ARE 1/4 WATT UNLESS OTHERWISE NOTED.
- 3) LONG CONTACT ON SWITCHES ARE ON FRONT WAFERS.



+180V ←



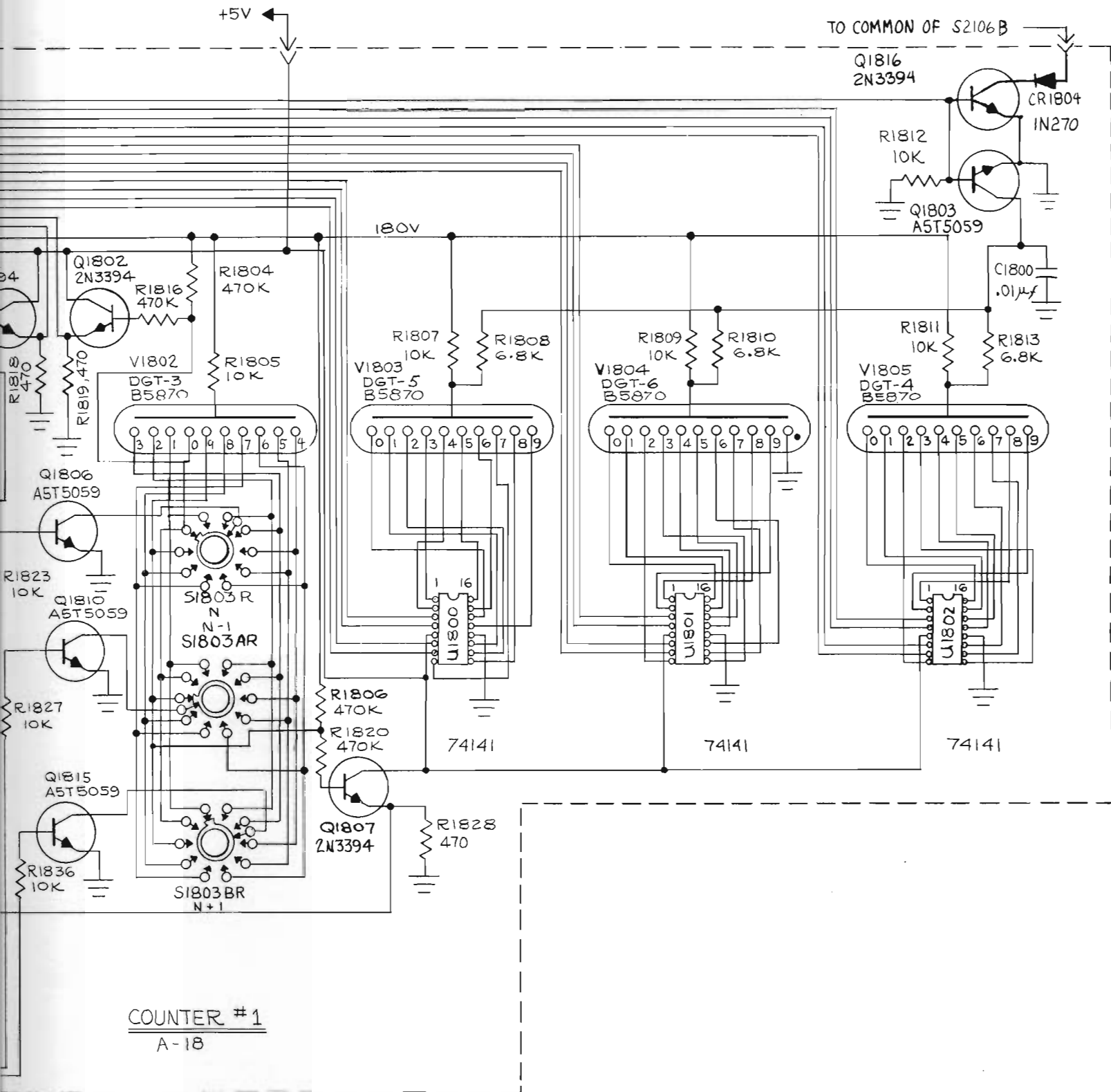
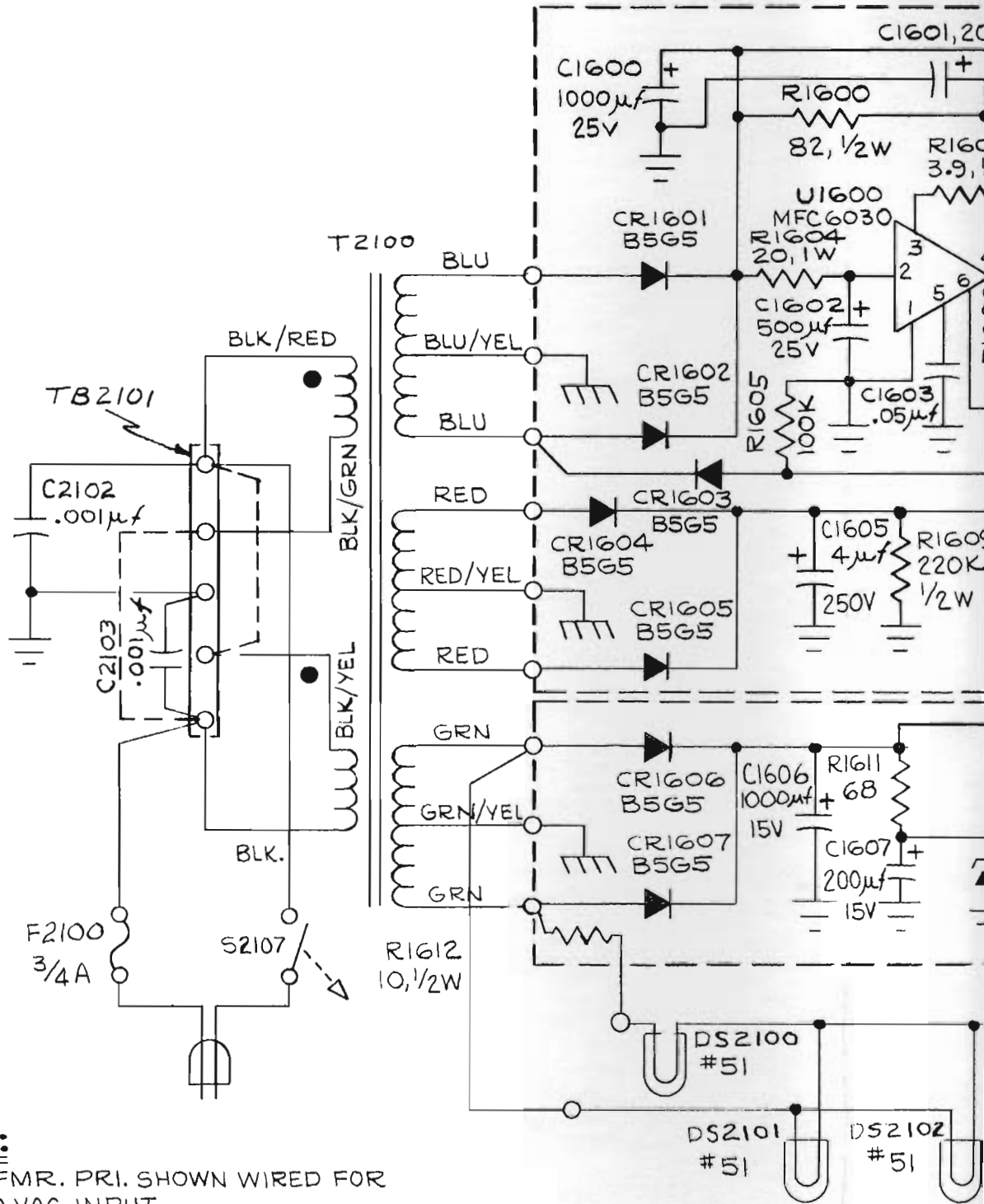
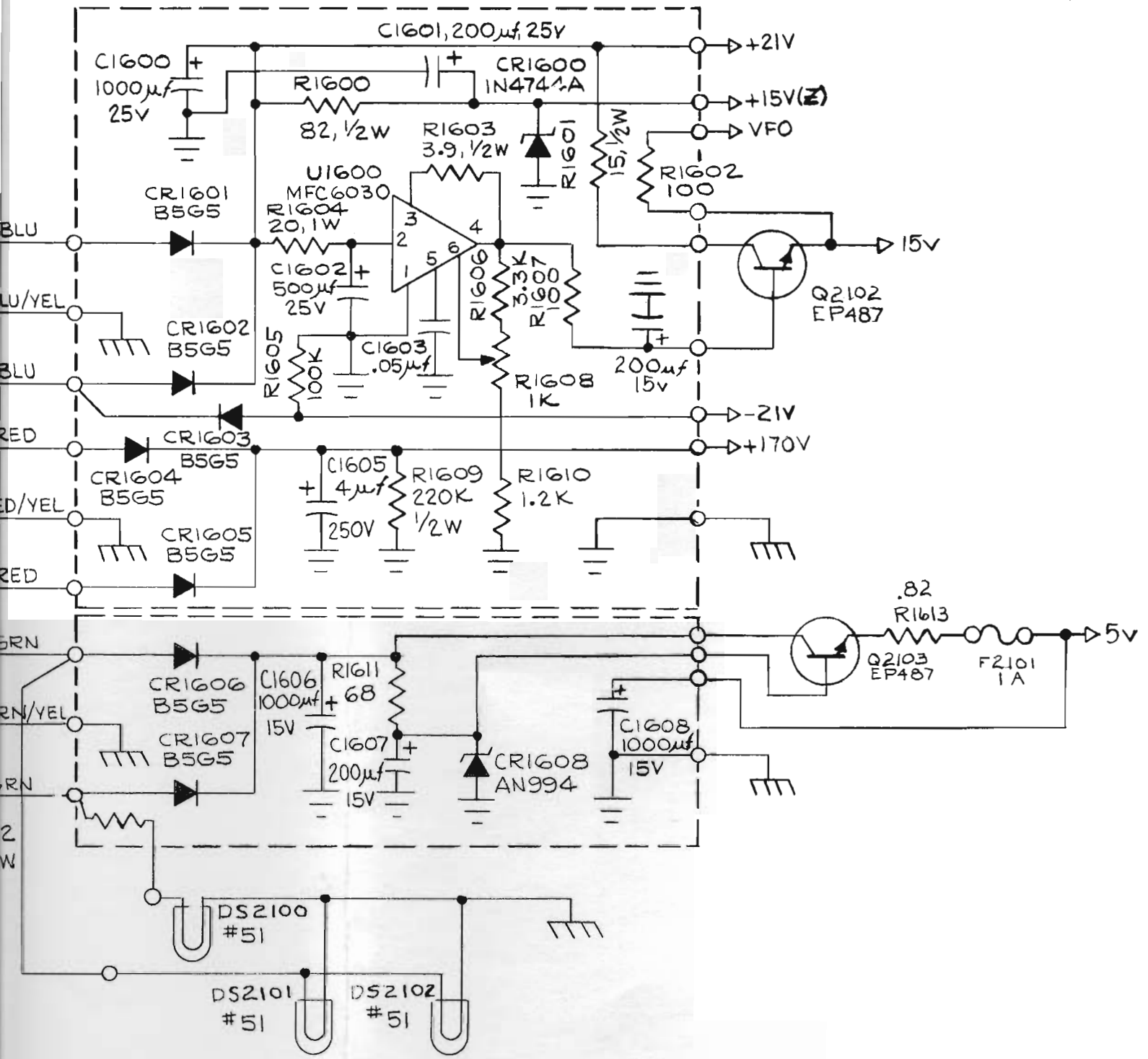


Figure 5-34. Counter Schematic



NOTES:

- 1) X-FMR. PRI. SHOWN WIRED FOR 120 VAC INPUT.
- 2) FOR 240 VAC INPUT, PLACE THE TWO (2) JUMPERS (DASHED LINES) ON PRIMARY TERM. STRIP, BETWEEN THE BLK/GRN AND BLK/YEL XFMR. PRIMARY LEADS.
- 3) C2102 AND C2103 ARE MOUNTED ON TERMINAL STRIP.



PRIMARY
 BRN
 DS.

Figure 5-35. Power Supply Schematic

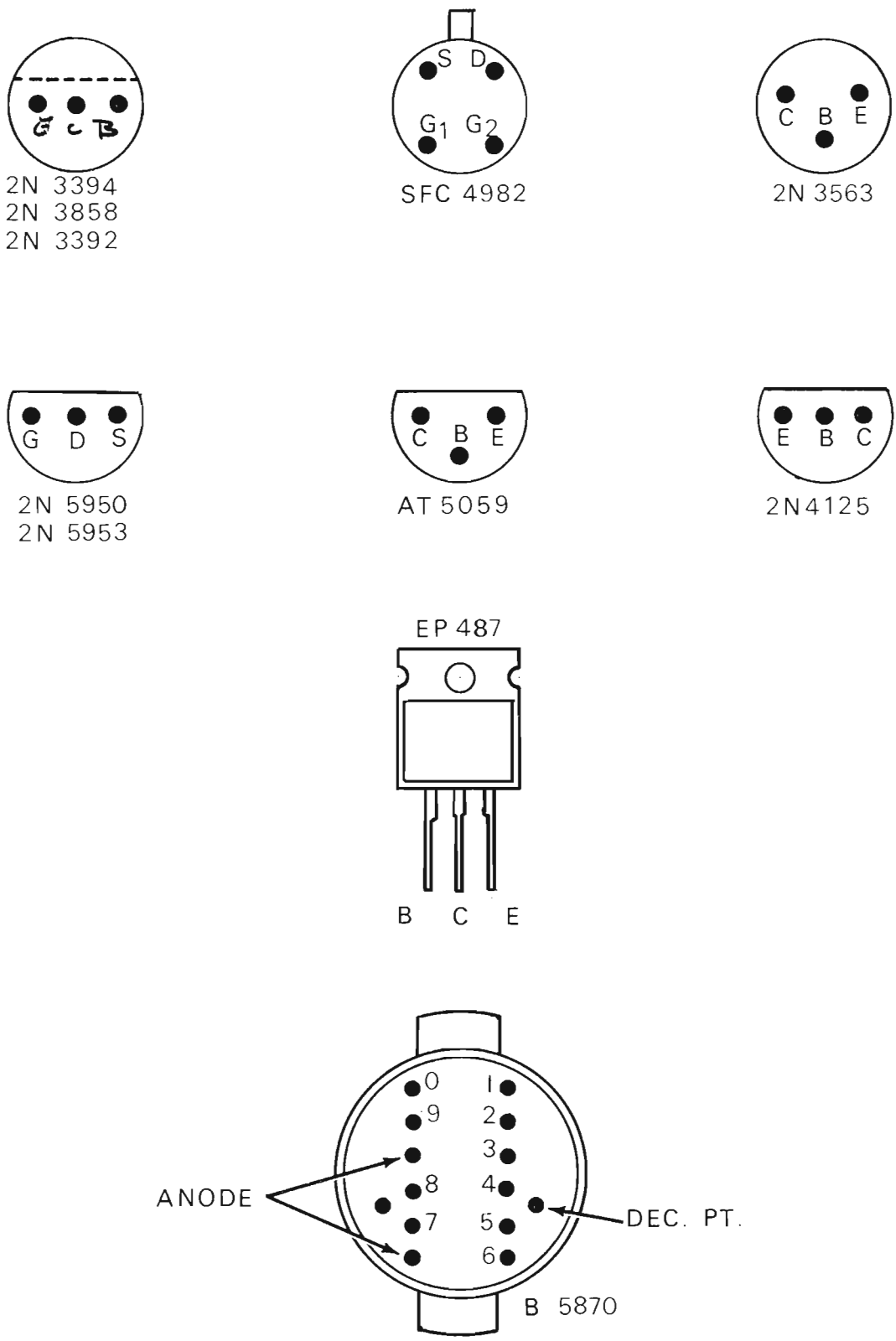


Figure 5-36. Transistor and Readout Indicator Lead Identification

R. L. Drake Company makes radio communications equipment to satisfy the needs of the most discriminating user. There's at least one item of Drake gear just right for you . . .

TRY IT...

We're sure

YOU'LL LIKE IT!



R. L. DRAKE COMPANY

540 Richard St., Miamisburg, Ohio 45342
Phone: (513) 866-2421 Telex: 288-017



