PUBLICATION NUMBER: 10007-0050
AUGUST 198

HARRIS

RF COMMUNICATIONS

RF-2301/RF-2301A

HF TACTICAL TRANSCEIVER SYNTHESIZED 1.6 TO 30 MHZ

HARRIS

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AUGUST 1987

RF-2301/RF-2301A

HF TACTICAL TRANSCEIVER SYNTHESIZED 1.6 TO 30 MHZ

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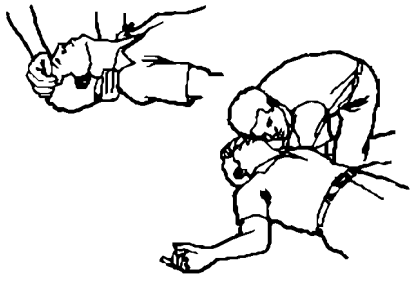
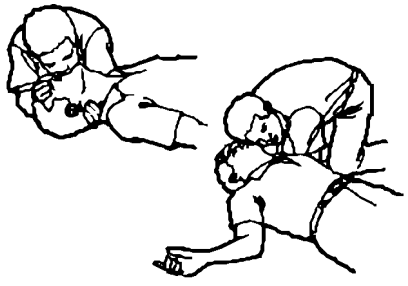
Equipment manufactured by Harris Corporation, RF Communications Division meets stringent quality and safety standards. However, high voltages are present in many radio products, and only a skilled technician should attempt to remove outer covers and make adjustments or repairs. All personnel who operate and maintain the equipment should be familiar with this page as a safety preparedness measure. Although this procedure is reproduced as a service to the personnel involved with this equipment, Harris Corporation assumes no liability regarding any injuries incurred during the operation and repair of such equipment, or the administration of this suggested procedure.

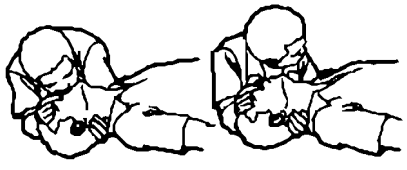
ELECTRICAL SHOCK: EMERGENCY PROCEDURE

The victim will appear unconscious and may not be breathing. If the victim is still in contact with the voltage source, disconnect the power source in a manner safe to you, or remove the victim from the source with an insulated aid (wooden pole or rope). Next, determine if the victim is breathing and has a pulse. If there is a pulse but no breathing, administer artificial respiration. If there is no pulse and no breathing, perform CPR (if you have been trained to do so). If you have not been trained to perform CPR, administer artificial respiration anyway. Never give fluids to an unconscious person.

WHEN BREATHING STOPS







FIRST, send someone to get a **DOCTOR**.
THEN, administer first aid to restore breathing (artificial respiration):

1 IF A VICTIM APPEARS TO BE UNCONSCIOUS

TAP VICTIM ON THE SHOULDER AND SHOUT, "ARE YOU OKAY?"

2 IF THERE IS NO RESPONSE

TILT THE VICTIM'S HEAD, CHIN POINTING UP. Place one hand under the victim's neck and gently lift. At the same time, push with the other hand on the victim's forehead. This will move the tongue away from the back of the throat to open the airway.

IMMEDIATELY LOOK, LISTEN, AND FEEL FOR AIR.

While maintaining the backward head tilt position, place your cheek and ear close to the victim's mouth and nose. Look for the chest to rise and fall while you listen and feel for the return of air. Check for about five seconds.

3 IF THE VICTIM IS NOT BREATHING

GIVE FOUR QUICK BREATHS.

Maintain the backward head tilt, pinch the victim's nose with the hand that is on the victim's forehead to prevent leakage of air, open your mouth wide, take a deep breath, seal your mouth around the victim's mouth, and blow into the victim's mouth with four quick but full breaths just as fast as you can. When blowing, use only enough time between breaths to lift your head slightly for better inhalation.

If you do not get an air exchange when you blow, it may help to reposition the head and try again.

AGAIN, LOOK, LISTEN, AND FEEL FOR AIR EXCHANGE.

4 IF THERE IS STILL NO BREATHING

CHANGE RATE TO ONE BREATH EVERY FIVE SECONDS.

For more information about these and other life-saving techniques, contact your Red Cross chapter for training

"When Breathing Stops" reproduced with permission from an American Red Cross Poster.

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ABOUT THIS MANUAL

This manual provides complete user information for the RF-2301/RF-2301A transceiver. The set incorporates two major elements: the RF-2301/RF-2301A transceiver and the RF-2360 power supply. The manual is divided into two color tabulated sections that provide information on these units.

SECTION	TAB COLOR	INFORMATION
I	Blue	Introduction Installation Operation Functional Descriptions Maintenance Summarized Maintenance Adjustments
II	White	1A1A1 PA Filter No. 1 1A1A2 PA Filter No. 2 1A1A3 PA Control PWB 1A1A4 IF/Audio PWB 1A1A5 Processor PWB 1A1A6 Mixer PWB 1A1A7 Memory PWB 1A1A8 LO No. 2 PWB 1A1A9 Frequency Standard PWB 1A1A10 LO No. 1 PWB 1A1A11 Interconnecting PWB 1A2A1 Frequency Select PWB 1A2A2 Interface PWB 1A2A3 Display PWB 1A3A1 RF Amplifier 1A3A2 Interface Connector Assembly 1A4 12/24 Vdc Power Supply RF-2360 Power Supply

RF-2301/A SPECIFICATIONS

General

Frequency Range	1.6 to 30 MHz in 100 Hz steps. Fine tuning of ±240 Hz in 15 Hz steps.
Number of Channels	15 Channels (Simplex or Half-Duplex Intermixed) (Field Programmable)
Frequency Stability	±1 part in 10^8 (TCXO) (Temperature Compensated Crystal Oscillator)
Modes of Operation	LSB, USB, AME, and CW (FSK and FAX with external modems)
Power Input	13.8 Vdc ±10%. RF-2360 Power Supply enables 26 Vdc ±15% operation in addition to 115/230 Vac ± 20%, 50/60 Hz.
Load Impedance	50 ohms, nominal
Temperature Range	-30° to +50°C
Humidity	95% @ 50°C
Shock/Vibration	MIL-STD-810C (with Shock Mount)
Weather	MIL-STD-108E Splashproof
Size	RF-2301 Transceiver: 5.2H × 16.3W × 17.0D inches (13.2H × 41.4W × 43.2D cm) RF-2360 Power Supply: 2.5H × 16.3W × 17.0D inches (6.4H × 41.4W × 43.2D cm)
Weight	RF-2301: 35 pounds (16 kg) RF-2360: 21 pounds (9.5 kg)

Receiver

Sensitivity	SSB: 0.7 μv for 10 dB $\frac{S+N}{N}$ AM: 3.0 μv for 10 dB $\frac{S+N}{N}$ for 30% Modulation
Audio Output	4 watts to internal speaker
Selectivity	SSB: 350 to 3150 Hz at 6 dB AM: 6 kHz bandwidth at 6 dB
Image and IF Rejection	Greater than 70 dB
AGC	Fast attack, slow release, threshold internally adjustable, 3 μv typical. Less than 10 dB change for 100 dB rf input variation (3.0 uv to 0.3V). FSK mode, fast attack and decay.
Intermodulation Distortion	In-Band Third Order: -30 dB or better for two equal 0.1 v signals falling within SSB filter
External Spurious Response	Greater than -70 dB
Squelch	Syllabic rate type with adjustable threshold, 0.5 μv to 10 μv typical

Transmitter

Power Output	SSB: 125 watts PEP/AVERAGE AME: 40 watts carrier nominal CW and FSK: 125 watts AVERAGE with RF-2360 Power Supply
Protective Circuitry	Full thermal power cutback control plus protection from mismatch including open or shorted antenna
Carrier Suppression	40 dB below PEP
Undesired Sideband Suppression	50 dB at 1 kHz
Harmonic Suppression	45 dB below PEP
Audio Input	Either carbon or dynamic microphone, 600 ohm input also provided
Intermodulation Distortion	33 dB below PEP
Hum and Noise	50 dB below PEP

Specifications subject to change without notice.

PART I

INTRODUCTION

1.1 SCOPE

This instruction manual describes and supports the RF-2301 Tactical Transceiver and associated equipment and accessories. The unit is shown in a typical operating configuration in Figure 1-1, associated with the RF-281 Antenna Coupler and RF-2380 Audio Control Unit. The RF-281 and RF-2380 are not described in detail in this instruction manual, as each companion and/or accessory unit is supported by its own manual. Table 1-1 is a list of specifications for the RF-2301 Transceiver.

The RF-2301 and RF-2301A transceivers are identical except for color. The RF-2301 is gray in color whereas the RF-2301A is olive-drab in color. This also applies to the RF-281, RF-2380, and RF-2360.

A list of accessories and optional equipment is shown in Table 1-2 and Table 1-3, along with the title and number of the corresponding instruction manual. These manuals should be consulted if more specific information is required than that presented within this manual. The following units are generally described within this instruction manual:

RF-2360 Power Supply
RF-281 Antenna Coupler
RF-2310 Shock Mount for RF-2301
Interface Cables (RF-2301)

For more specific information concerning optional and accessory equipment, refer to paragraph 1.4, 'Accessories and Spares', and paragraph 1.5, 'Optional Equipment'.

1.2 DESCRIPTION

The following paragraphs describe the general characteristics and capabilities of the RF-2301 Transceiver, RF-2360 Power Supply, and RF-281 Automatic Antenna Coupler. Further descriptions in greater detail are presented in subsequent sections of this instruction manual.

1.2.1 RF-2301 Transceiver

The RF-2301 Tactical Transceiver is is single-sideband radio set providing USB, LSB, AM, CW, and data transmission and reception within the 1.6 to 30 MHz HF band. The unit is fully synthesized and will operate in the simplex mode. Additionally, the RF-2301 may be fully programmed for up to 15 simplex or half-duplex channels. The all solid-state PA will deliver 125 watts PEP/AVG into a 50 ohm load. All tuning functions, including antenna matching with the RF-281 Antenna Coupler, are performed automatically, and the entire system may be controlled with the RF-2370 or RF-2380 Remote Control Units.

Each major assembly within the transceiver is designed to be quickly and easily removed from the unit, thus permitting rapid replacement and/or repair of defective assemblies. The majority of assemblies plug directly into the IA1A11 Interconnecting PWB in the transceiver card cage, and may be serviced directly in the RF-2301 through the use of the supplied Card Extender Board. Figure 1-2 shows the method of disassembly of the RF-2301, illu-

Figure 1-1. RF-2301A with (Optional) RF-281A Antenna Coupler and (Optional) RF-2308A Audio Control Unit

strating the removable front and rear panels with relation to the card cage and other assemblies

The RF-2301 has been designed to interface with a wide variety of external accessory devices, making it especially well-suited for systems applications. Remote control, automatic operation, and simplicity of design all make the RF-2301 an ideal choice for network use. Table 1-3 presents a listing of recommended optional equipment for the RF-2301 for all common HF mobile, fixed, and shipboard applications.

The RF-2301 has been designed for use in both mobile and fixed site applications. A wide variety of options are available to meet virtually any communications requirement including teletype, CW, telephone patching, and facsimile transmission and reception. A more complete explanation of optional equipment and accessories is included in Figure 2-1, which depicts several typical operational configurations using the RF-281 and associated equipment.

The RF-2301 frequency synthesizer covers the 1.6 to 30 MHz band in 100 Hz increments for rapid and simple selection of the operating frequency. In addition, a fine tuning control for exact matching of receive frequencies is provided. This feature is especially important in radio teletype operation, where precise matching of frequencies is required for narrow shift FSK operation. The fine tuning control will vary the selected frequency ±240 Hz in thirty-two 15 Hz steps, permitting the operator to exactly tune the RF-2301 to the required operating frequency.

The RF-2301 is intended for use with the RF-281 Antenna Coupler, but may be used by itself provided that a constant 50 ohm resistive load antenna is connected to the RF input/output connector. For further information regarding operational configurations and external interface requirements, refer to Part II, "Interconnection and Interfacing Requirements".

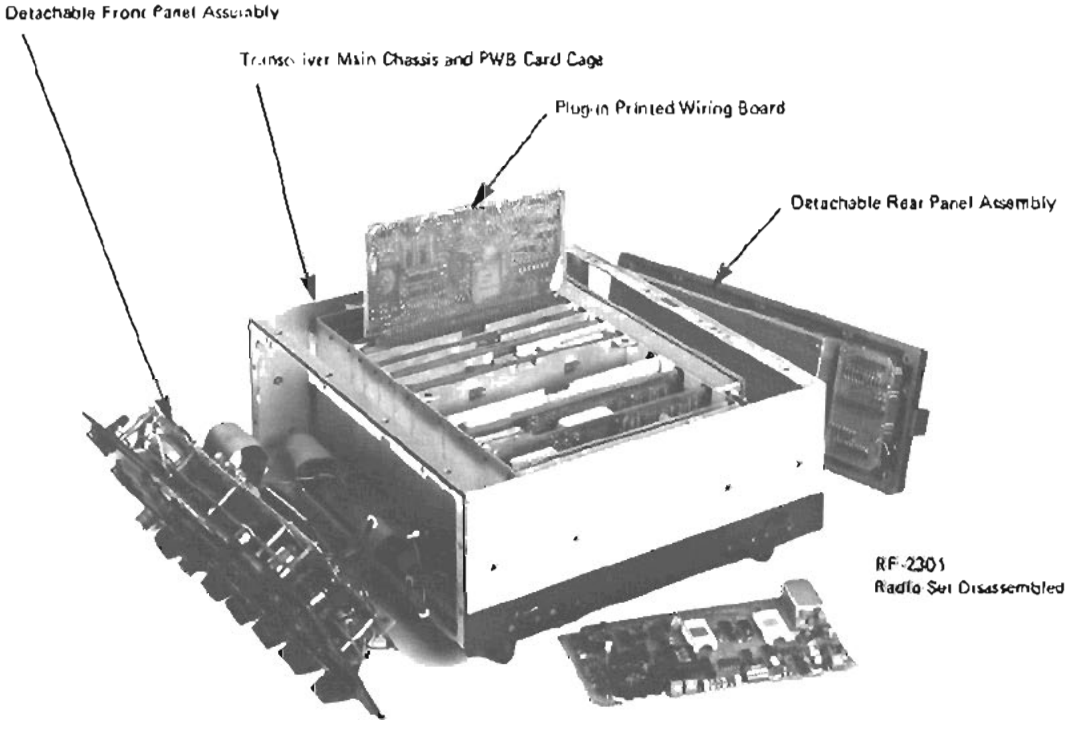


Figure 1-2. RF-2301 Transceiver Method of Disassembly

Figure 1-3. RF-2301/A Tactical Transceiver Shown with RF-2360A Power Supply and RF-2310 Shock Mount

The RF-2301 is fully programmable via the front panel controls, and may be reprogrammed at any time. All programming information for frequency and mode is stored in a non-volatile Electrically Alterable Read Only Memory (EAROM). This memory is independent of the transceiver Power Supply, and will retain the information thus stored for an indefinite period of time. Up to 15 sets of channel, frequency, and mode information may be programmed into the RF-2301 memory, each of which is displayed on the front panel LED numerical readout.

Designed for quick disassembly and reassembly Figure 1-2), the RF-2301 modular circuit card cage permits quick repair and short down times in the field.

Since the RF-2301 is fully synthesized, adding new frequencies does not mean adding crystals, as is the case with conventional single-frequency channelized radios. All internal operating frequencies are derived from a single temperature compensated cyrstal oscillator (TCXO) having a stability of ± 1 part in 10^6 over the specified temperature range (-30^{o} to $+50^{o}$C).

Primary power is obtained from a conventional +13.8 Vdc battery source, or from +24 Vdc or 115/230 Vac with optional RF-2360 Power Supply.

The RF-2301 may be operated at full output power in all standard operating modes, and in continuous key-down operation with optional RF-2360 Power Supply. The standard operating modes are LSB (Lower Sideband), USB (Upper Sideband), AME (Compatible AM), and CW (Continuous Wave). The unit can be operated in the AFSK mode with an external modem. When using the unit for continuous duty applications, especially those employing high average power levels, the optional RF-2360 Power Supply should be included as part of the RF-2301 system, since the RF-2360 provides fan cooling needed for the transceiver.

The RF-2301 may be remotely controlled over multi-conductor control cables for distances up to 250 feet (76 meters). Remote control capability is provided using either the RF-2370 Remote Control Unit or the RF-2380 Remote Audio Control Unit. For further information regarding remote control operation, refer to paragraph 1.5, "Optional Equipment".

1.2.2 RF-281 Automatic Antenna Coupler

The RF-281 Automatic Antenna Coupler is designed to automatically match the RF-2301 Transceiver to a variety of whip and long wire antennas over the freqeuncy range of 1.6 to 30 MHz. Operation, including network tuning and monitoring, is fully automatic. Tuning time is typically six to eight seconds. The RF-281 is designed for continuous operation under the most severe electrical and environmental conditions. It is intended for vehicular, transportable, shipboard, and fixed station applications. Automatic sensing circuitry protects the RF-281 from defective antennas or any internal malfunctions. The RF-281 provides tactical security by permitting remote location of the antenna up to 250 feet (76 meters) from the RF-2301.

The RF-281 is designed to directly interface with the RF-2301, eliminating the necessity of additional control units and interfaces. All tuning information is derived directly from the RF signal of the associated transmitter, and is monitored via the RF-2301 'Tune/Fault' indicator located on the RF-2301 front panel. Thus, it is not necessary to perform any modifications or additional programming to the RF-281 when reprogramming the RF-2301 transceiver. All tuning of the RF-281 is accomplished by an internal phase discriminator and 'R' detector, which senses the resistive and reactive components of the system, providing an analog control signal to the RF-281 servo control system, which in turn operates the RF-281 variable tuning elements. This approach to antenna coupler design allows the RF-281 to function equally well in either channelized or synthesized modes of operation.

For more specific information regarding the RF-281 Antenna Coupler, refer to instruction manual number 1960-0009E, "RF-281 Automatic Antenna Coupler", and to Part VIII of this instruction manual.

1.2.3 RF-2360 Power Supply

The RF-2360 Power Supply is specifically designed to interface directly with the RF-2301 Transceiver, and is additionally designed to be physically mounted to the transceiver base. This combination provides a high degree of versatility and transportability. The RF-2360 is supplied with all necessary interconnecting cables and connectors to permit operation from either dc or ac primary power sources.

Since the RF-2360 may be operated from several power sources, it is especially well-suited to stations which have emergency back-up power or dc stand-by power systems. All interconnections to and from the power supply are made at the rear of the unit. An automatically-activated internal fan permits continuous duty operation of the RF-2301 over the entire -30° to $+50^{\circ}$ temperature range. Temperature sensing is derived both from the power supply heatsink and the RF-2301 PA heatsink.

The RF-2360 may be operated from a +24 Vdc primary power source with as much as ±15% variation in supply voltage with no degradation in performance in the RF-2301, or from a 115/230 Vac primary power source with as much as ±20% variation in line voltage. Ac requirements are 50 or 60 Hz single phase power. Power consumption in CW continuous key-down operation is typically 440 watts at 24 Vdc, and 400 watts at 115/230 Vac.

The RF-2360 contains a sophisticated switching regulator that provides current on a demand basis. This regulator will nominally provide a power consumption efficiency of 70%, while maintaining regulation to within ±5% of rated output. In order to improve efficiency and reduce heat dissipation, the supply output is reduced to +11.8 Vdc during continuous duty use. For further information regarding the RF-2360 Power Supply, refer to Part VII "RF-2360 Power Supply".

1.3 TECHNICAL SPECIFICATIONS

The following technical specifications are applicable to the RF-2301 Transceiver at the time of this publication. All specifications are subject to change without prior notice, and are applicable to both the RF-2301 and RF-2301A. These specifications have been reproduced on the inside front cover of this manual for quick reference during troubleshooting and testing of the unit.

Table 1-1. RF-2301 Transceiver Technical Specifications

FREQUENCY RANGE	1.6 to 30 MHz in 100 Hz steps. Fine tuning of ±240 Hz in 15 Hz steps in all modes.
CHANNELS	15 Channels, simplex or half-duplex intermixed, all field programmable.
FREQUENCY STABILITY	±1 part in 10^6 (TCXO - Temperature Compensated Crystal Oscillator standard)
OPERATING MODES	LSB, USB, AME, and CW (FSK and FAX modes with externally connected modems)
POWER INPUT	13.8 Vdc ±10% standard; RF-2360 Power Supply enables 24 Vdc operation in addition to 115/230 Vac ±20% at 50/60 Hz single phase primary power.
LOAD IMPEDANCE	50 ohms nominal
TEMPERATURE RANGE	-30°C to +50°C
HUMIDITY	95% at 50°C
SHOCK/VIBRATION	MIL-STD-810C (with RF-2310 Shock Mount)
WEATHER	MIL-STD-108E (Splashproof)
SIZE	RF-2301 Transceive: 5.4"H x 17.0"Wx18.0"D (13.7 cm x 43.2 cm x 45.7 cm) RF-2360 Power Supply: 2.5"H x 16.9"W x 17.0"D (6.4 cm x 42.9 cm x 43.2 cm)
WEIGHT	RF-2301: 35 lbs (16 kg) RF-2360: 21 lbs (9.5 kg)
COLOR	RF-2301: Gray RF-2301A: Olive Drab

Table 1-1. RF-2301 Transceiver Technical Specifications (Continued)

RECEIVER SPECIFICATIONS	
SENSITIVITY	SSB: .7 uV for 10 dB S+N/N AME: 3.0 uV for 10 dB S+N/N at 30% modulation
AUDIO OUTPUT	4 watts to internal speaker
SELECTIVITY	SSB: 350 to 3150 Hz at 6 dB AM: 6 KHz at 6 dB
IMAGE/IF REJECTION	Greater than 70 dB
AGC	Fast attack, slow release, threshold internally adjustable: 3 uV typical. Less than 10 dB change for 100 dB RF input variation (3.0 uV to .3V). FSK mode: fast attack and decay.
IM DISTORTION	In-band Third Order: -30 dB or better for two equal .1V signals falling within SSB filter.
EXT SPURIOUS REPONSE	Greater than -70 dB
SQUELCH	Syllabic rate type with adjustable threshold, 0.5 uV to 10 uV typically.
TRANSMITTER SPECIFICATIONS	
RF POWER OUTPUT	SSB: 125 watts PEP (typ. 30 to 40W AVG. PWR for Voice) AM: 40 watts carrier nominal CW/FSK: 125 watts average with RF-2360 Power Supply
PROTECTIVE CIRCUITRY	Full thermal power cutback control, plus protection from mismatch including open or shorted antenna.
CARRIER SUPPRESSION	40 dB below PEP
SIDEBAND SUPPRESSION	50 dB at 1 KHz
HARMONIC SUPPRESSION	45 dB below PEP
AUDIO INPUT	Either carbon or dynamic microphone, 600 ohm input also provided via external interface connector.
IM DISTORTION	33 dB below PEP
HUM AND NOISE	50 dB below PEP

1.4 ACCESSORIES AND SPARES

The RF-2301 is provided with a complete set of accessories and user spare parts for most normal applications. Table 1-2 below is a list of accessories and spare parts provided as standard ancillary items with the RF-2301 transceiver. These items are contained in the supplied plastic container. Please refer to the listed Harris part numbers when re-ordering ancillary items.

Table 1-2. Accessories and Spares Supplied

QUANTITY	PART NUMBER	DESCRIPTION
1	10007-0050	Instruction Manual
1	919-5000	Dynamic microphone with coil cable and connector
1	6628-0080	Card Extender Assembly
1	Z80-0001-000	Adjustment Tool
5	F-0016	Fuse, 6A at 250V quick acting
5	F-0013	Fuse, 3A at 250V quick acting
1	J-0002	Plug, coaxial; UHF type
1	MS3106A24-12S	5 pin connector (DC Power)
1	MS3116F14-19P	19 pin connector (Coupler Control)
1	MS3116F16-26P	26 pin connector (Audio Remote)
1	MS3116F24-61P	61 pin connector (Remote Control)
2	P-0027	Plug, phone type, 2 conductor
1	MS3057-16B	Cable clamp
1	AN3420-8A	Sleeve, small
1	AN3420-16A	Sleeve, large
1	X-0728	Fuse Holder (In-Line) for DC Powercable
5	F-0107	Fuse, 40A
20 ft.	W-1788	Cable, Duplex Primary, #8 AWG, 2 COND.
1	P15-3145-000	Tube of RTV Sealant
2	MP-3553	Insulating Boot for X-0728

1.5 OPTIONAL EQUIPMENT

The RF-2301 is compatible with a wide range of optional equipment to conform to most requirements, making the RF-2301 an ideal choice for systems use. The following table presents a list of available accessories and options for use with the RF-2301 Tactical Transceiver. Please note that this list presents only those items specifically recommended for use with the RF-2301, and does not include any available companion units for special applications. For further information concerning optional equipment and accessories, contact Harris Corporation RF Communications Division for price quotations and assistance in selecting equipment that is compatible with the RF-2301.

Table 1-3. Optional Equipment

PART NUMBER	DESCRIPTION	MANUAL NUMBER
RF-2360	Heavy Duty Power Supply	10007-0050
RF-2310	Shock Mount for RF-2301 (mobile)	
RF-2341	Rack Mount for RF-2301/RF-2360	
RF-2342	Rack Mount for RF-2301 (fixed)	
RF-281	Automatic Antenna Coupler	1960-0009
RF-2306	CW Filter Option	
RF-2307	Narrowband SSB Filter	
RF-3012/3016	CW Hand Keys	
RF-3017	Dynamic Field Handset	
RF-3013	Field Handset	
RF-3014	Operator Headset	
RF-294 (1 thru 8)	Radio Intercom Set	
RF-518	Dual Headset	
RF-2370	Channelized Remote Control Unit	10007-5014
RF-2380	Audio Control Unit	10007-4050
MIL-3300	FSK Keyer/Converter (teletype)	7709-0510
RF-3001-2	Operator Headset - single earpiece	
RF-3003	Operator Headset - dual earpiece	
SB A75	75 Foot Long Wire Antenna	PM-0036
SB-A150	150 Foot Long Wire Antenna	PM-0036A
SB-AD	Doublet Antenna Kit	PM-0036B
RF-334	Doublet Antenna Kit	
SB-V (9,16,35)	Vertical Whip Antennas	
RF-1912	Transmitting Dipole Antenna	6906-2052A
RF-1930	24 Foot Fiberglass Whip Antenna	6906-2050
RF-901A	Telephone Patch	PM-0758E
RF-2301/RSK	Running Spares Kit for RF-2301	
RF-2301/SBK	Site Spares Kit for RF-2301	
RF-2301/ARK	Assembly Repair Kit for RF-2301	
RF-2301/MRK	Maintenance Repair Kit for RF-2301	
RF-3370	Teletype FSK Keyer/Converter	7709-2010
RF-3351	Time Diversity Modem	3351-0000

PART II

INSTALLATION AND INTERFACE INFORMATION

2.1 UNPACKING AND INSPECTION

Carefully remove the contents of each container, being certain not to discard small items with packing material. Check off units on the packing list as they are unpacked. Each unit should be inspected carefully for any physical damage prior to installation. If any damage exists, save packing material and containers to substantiate your claim with the transportation agency. If it is known that any units might be reshipped in the future, save the container and packing material for this purpose. Immediately notify Harris Corporation RF Communications Division of any damage to equipment received for prompt repair and/or replacement of damaged units.

2.2 PRIMARY POWER REQUIREMENTS/MOUNTING DETAILS

The RF-2301 transceiver is designed to operate from a +13.8 Vdc power source, requiring a maximum current of 30A (396W) in CW. If used in conjunction with the RF-2360 power supply, the unit may be operated on either 24 Vdc or 115/230 Vac. Choose the applicable power cable/connector assembly (supplied with RF-2301 or RF-2360), connect to appropriate power input connector (see 1A1A11, Figure 2 "RF-2301 Main Frame Schematic Diagram") and connect the other end of the cable to the correct power source. It is recommended that all ac power connections be terminated through an approved ac switch-box or circuit breaker. Do not attempt to utilize any form of ac power other than single phase 50/60 Hz power, as damage to the transceiver and/or power supply will result.

The RF-2301 may be used by itself in conjunction with a 13.2 Vdc primary power source. Normally, a heavy duty battery and vehicle alternator are satisfactory for this purpose. For fixed station applications, the RF-2360 is recommended. Figure 2-1 below illustrates the three basic primary power configurations used with the RF-2301. For additional information on primary power connections and terminations, refer to paragraph 2.7 of this section.

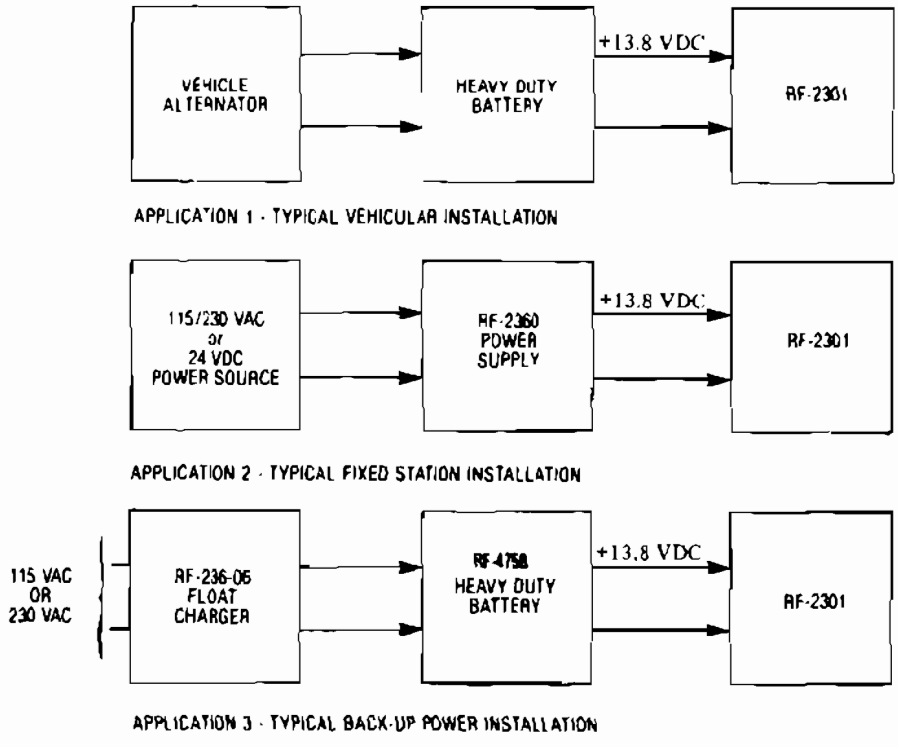


Figure 2-1. RF-2301 Primary Power Applications

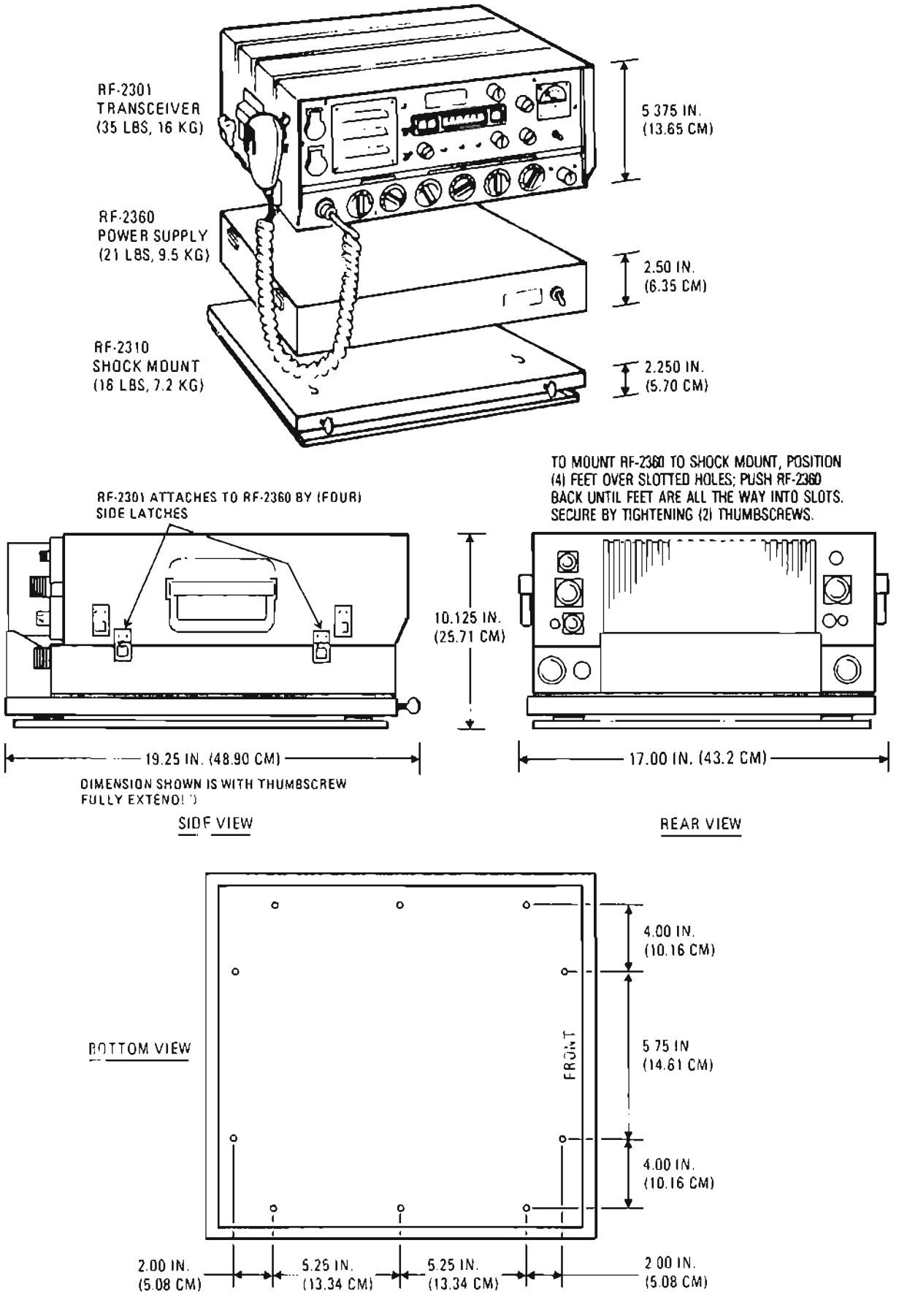


Figure 2-2. RF-2310 Dimension/Outline Drawing (Installation)

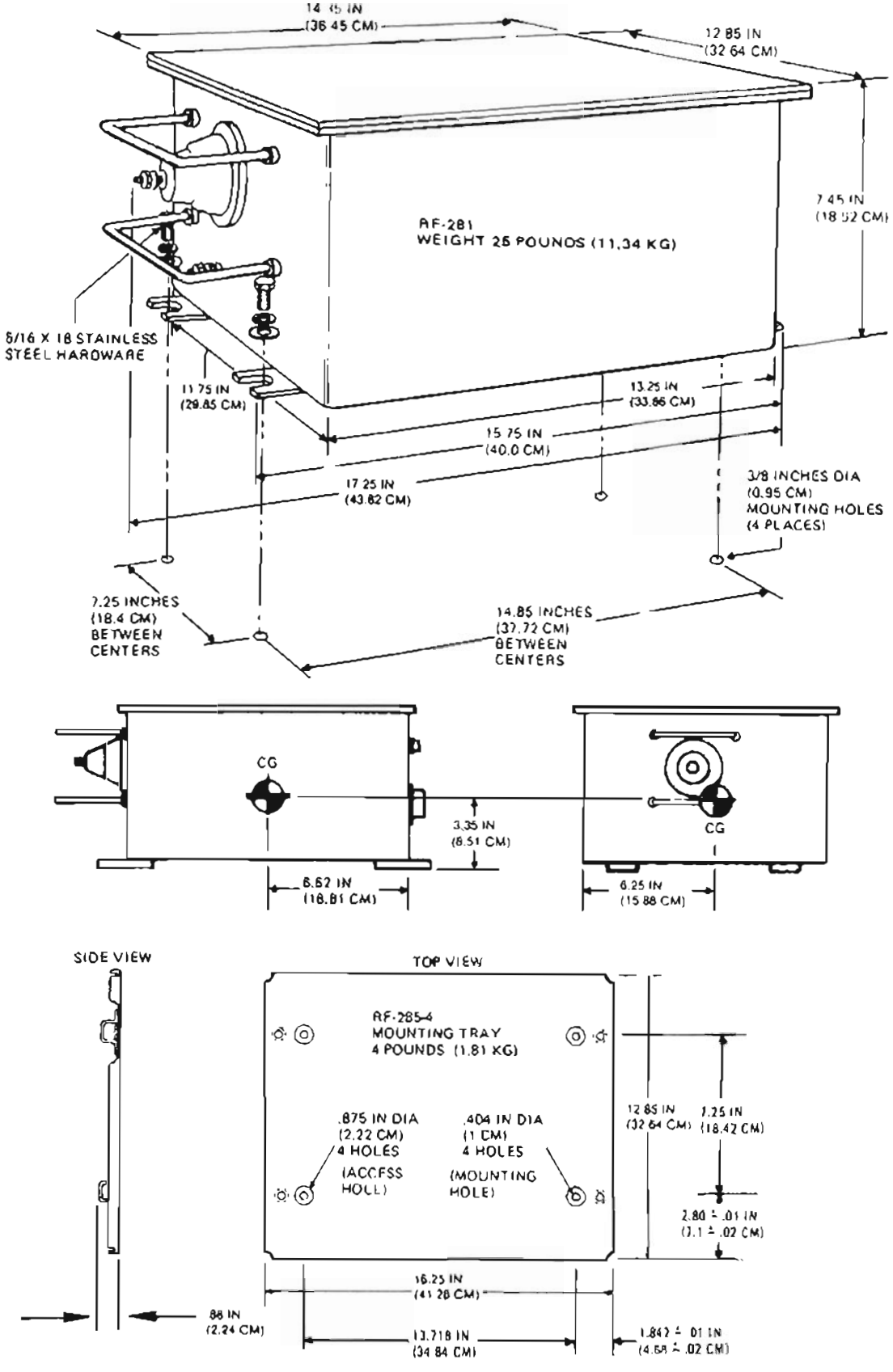


Figure 2-3. RF-281 Dimension/Outline Drawing (Installation)

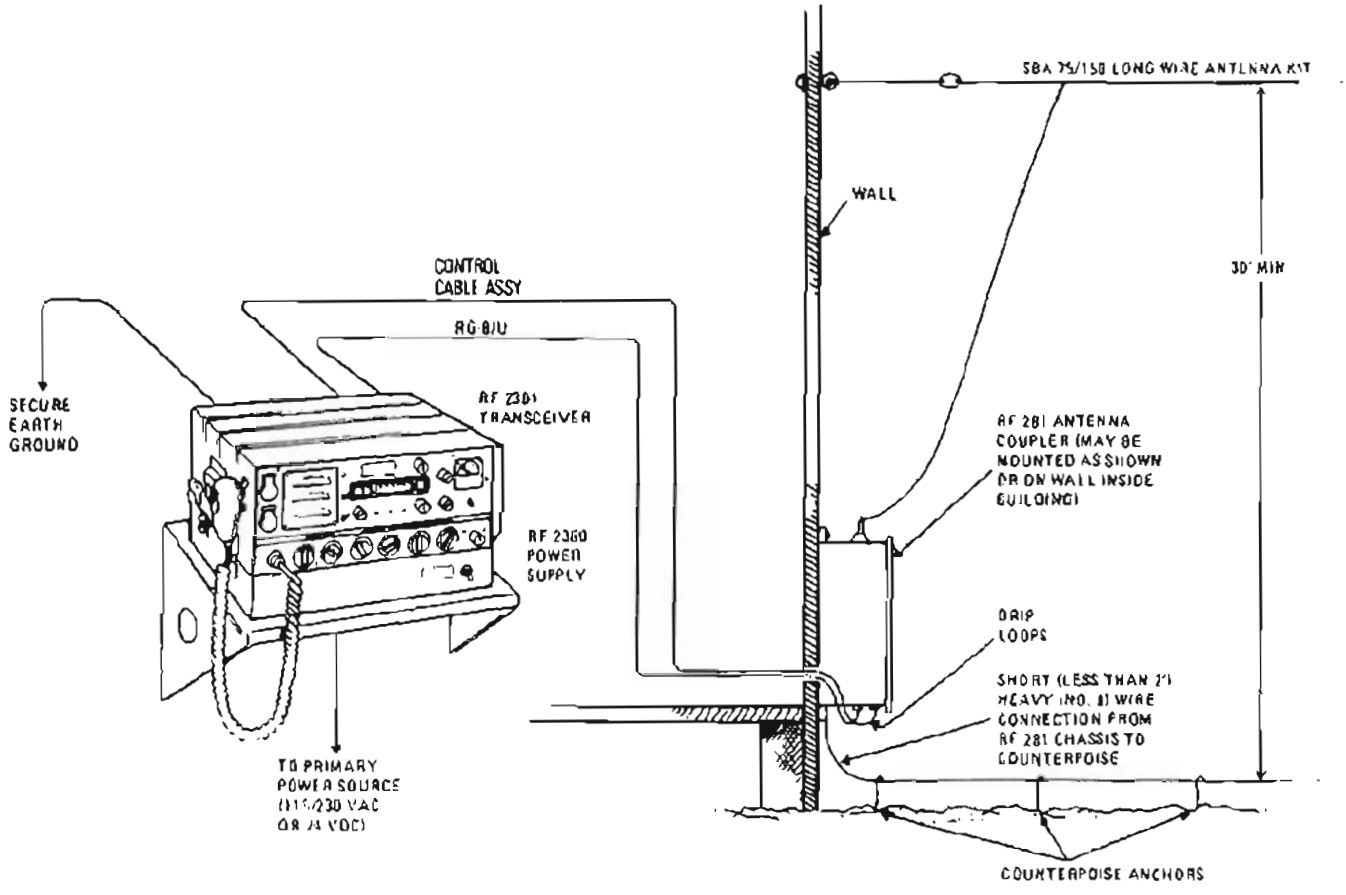


Figure 2-4. Typical Fixed Site Installation

CAUTION: Some ac power receptacles are not identified as being polarized. Before connecting the ac power cable, check power source with an ac voltmeter to determine which lead is neutral. The neutral lead will measure zero volts ac with respect to the ac (earth) ground. The white lead of the ac power cable must be connected to this neutral lead. Failure to do so can result in damage to the equipment, and present a shock hazard to operating personnel.

Do not install the RF-2301 on any metal or conductive surface which is not specifically connected to ground potential, as this may produce a hazardous operating condition in the event of electrical failure or a lightning strike. Additionally, the performance of the transceiver may suffer as a result of improper grounding. Although a non-conductive surface is satisfactory for most applications, optimum transceiver performance will be obtained by physically attaching the transceiver to a grounded, conductive surface, using the rear panel ground terminal for this purpose.

2.3 FIXED SITE SELECTION

Station efficiency depends largely on the environment in which the operator has to work. If possible, a comfortable, well-lighted and well-ventilated operating position should be provided. Avoid placing the transceiver in a busy or congested area, or in a location subject to excessive noise levels.

There are no restrictions in installing the RF-2301 with regards to placement and position. However, there are several points to be considered which, if taken under consideration prior to installation of the transceiver, will result in greater long-term efficiency of the station. Some of these points are.

- Ease of operation and functional grouping of controls and units.
- Power, control, and other equipment interfaces.
- Proximity to antenna and secure ground.
- Environmental considerations for equipment and operator.

The antenna coupler should be located within 250 feet (76 meters) of the RF-2301 to prevent RF coaxial cable losses from degrading system performance. In addition, this will prevent any possible mistuning of the antenna coupler resulting from higher VSWR due to excessive length of coaxial cable and will improve receiver performance as well.

2.4 MOBILE INSTALLATION/VEHICULAR MOUNTING

As a tactical transceiver, the RF-2301 is specifically designed for mobile applications, and is well-suited to both military and commercial vehicles. It is recommended that for all vehicular and/or mobile applications, the RF-2301 transceiver be used in conjunction with the RF-2310 Shock Mount to prevent possible damage to the unit resulting from excessive shock and vibration. The transceiver should not be installed in a compartment or sealed bulkhead unless adequate ventilation and air circulation is provided. Unless a transportable erectable antenna is used with the RF-2301, a nine or sixteen foot whip antenna is normally used for mobile applications, in conjunction with the RF-281 Automatic Antenna Coupler. Of primary importance in vehicular applications is the length of lead between the antenna and coupler. This lead becomes part of the antenna and radiates RF during transmission. This lead must be insulated (inner conductor and insulation from RG-8/U coaxial cable) and its length should not exceed 2.5 feet (70 cm) under any circumstances. Also of primary importance is the primary power and grounding system integrity. Transceiver, antenna coupler, and antenna must all be connected to the same ground potential on an electrically-conductive surface. Proper grounding procedures for fixed, vehicular, and shipboard installations are discussed in the following paragraphs. Figure 2-5 shows a typical mobile installation.

2.5 GROUNDING SYSTEMS

For efficient operation of the transceiver, a good and secure ground is essential. The following paragraphs discuss various techniques for specific types of installations and the required ground system for each.

2.5.1 Mobile Grounding

All ground cables should be as short as possible, ideally less than 12 inches (30 cm). Paint, grease, rust, etc. must be scraped away so that only bare metal is visible at grounding points. Use the chassis frame or a welded steel body panel for the grounding point. Never ground to trim or hinged panels (door, hood, etc.) or to surfaces which are removed from the chassis (dash, seats, etc.). Ground cables should be fabricated from tinned, braided copper of the correct length. Insure that a clean metal surface is presented to the RF-281 Antenna Coupler, as this surface is grounded to the coupler when mounted. Ground terminals are provided on the transceiver and antenna coupler, and should be used for this purpose. Position ground strap to the transceiver such that shock mount action is not inhibited.

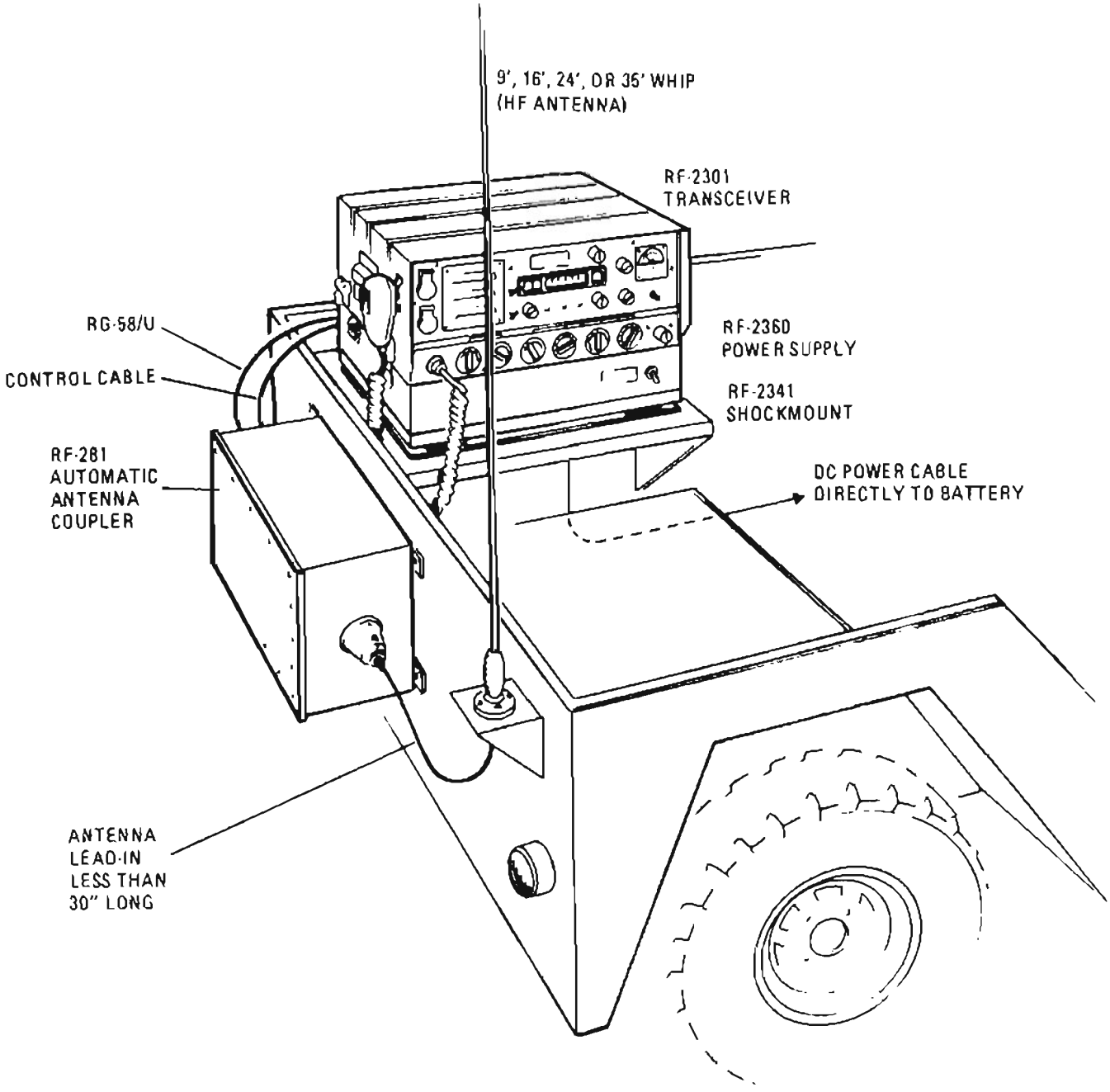


Figure 2-5. Typical Mobile Installation

It cannot be emphasized too strongly how important the ground system is to a mobile application of the RF-2301, or for that matter any HF transceiver. Failure to insure a secure integral ground can result in severely degraded transmitter performance, RFI (Radio Frequency Interference), severe pick-up of ignition transients from the engine, and pose a lethal threat to operating personnel.

2.5.2 Shipboard Grounding

For shipboard applications, the same basic grounding rules for Mobile installations are applicable. However, a shipboard installation other than upon a ship constructed of non-conductive materials must be made with a special grounding system. Normally, a steel bulkhead is a satisfactory mounting and grounding surface. However, it may be necessary to run a special ground line from the water to the transceiver. This is accomplished in a variety of ways, the most common method being the installation of lead or chemically-treated copper or brass plate(s) to the underside of the ship, and then connected to a solid conductor (No. 12 AWG or larger) wire run the shortest possible distance to the transceiver, antenna coupler, and antenna. DO NOT connect the transceiver ground to any instrumentation grounds that might exist (such as depth or radar transducer ground) as this may cause noticeable interaction between the RF-2301 and such equipment. Any special ground system installed must be terminated at the primary power (dc) ground, preferrably directly at the battery terminal labeled (-). This will reduce ignition noise pickup and prevent any possible ground loops.

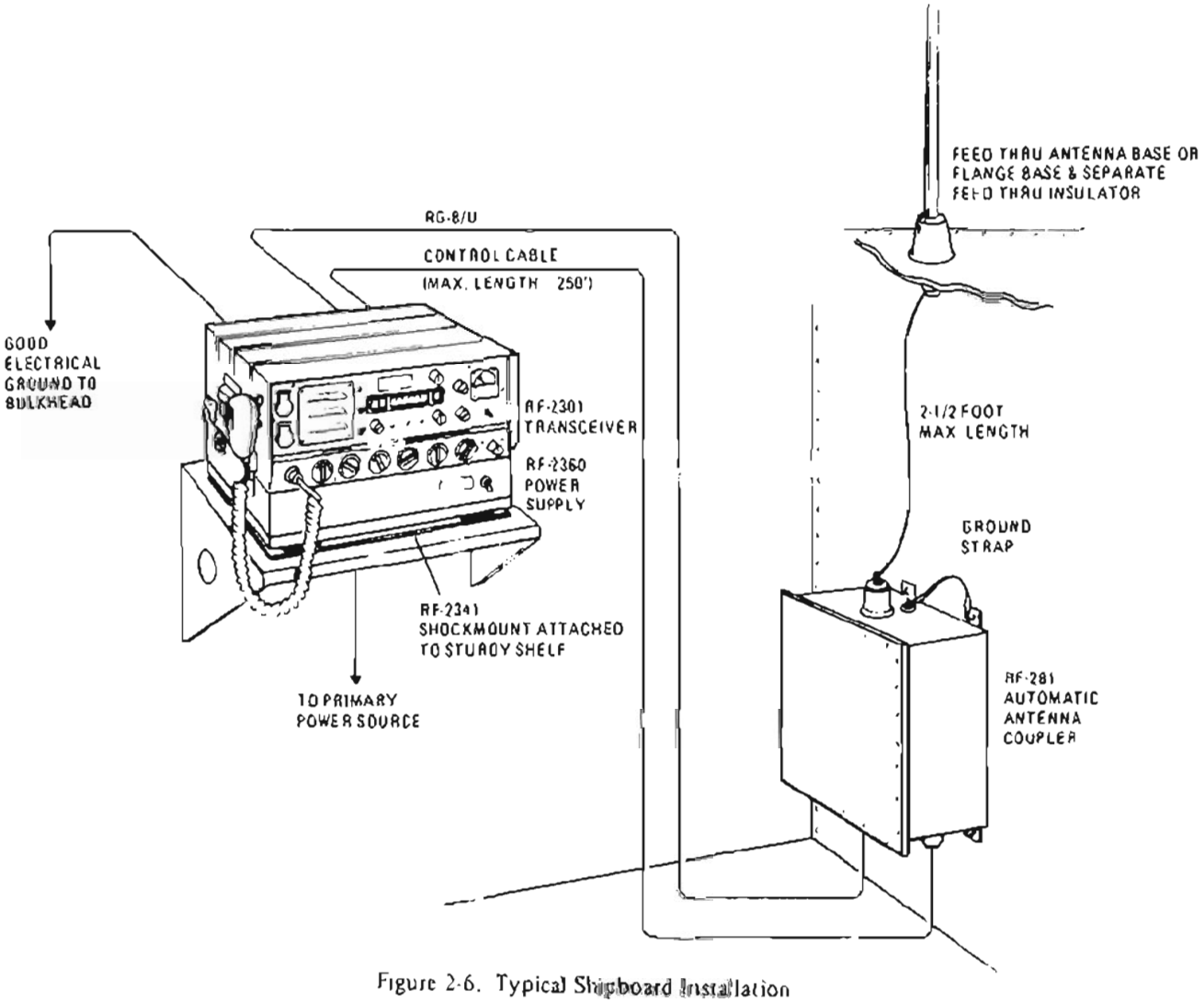


Figure 2-6. Typical Shipboard Installation

2.5.3 Fixed Station Grounding

The transceiver ground terminal must be connected to a grounded pipe (such as cold water pipe), preferrably where the pipe enters the ground, or a steel or copper rod driven six to ten feet into the soil. In situations where the water table is far below the surface (such as desert or mountainous terrain) it may be necessary to create an artificial ground system by burying steel or copper plates six to ten feet below the surface, and connected together directly below the transceiver location. In all cases, such grounds must be connected to both transceiver and antenna coupler using at least No. 8 copper cable directly from the ground point. Do not daisy-chain ground connections, as voltage differentials will develop over long distances. Any artificial ground system must additionally be connected to the primary power source ground to prevent generation of RFI and high-voltage electromagnetic fields around the equipment.

2.6 ANTENNA REQUIREMENTS

The RF-2301 (when used with RF-281 Automatic Antenna Coupler) is designed to accept a wide variety of antenna styles and configurations. Most of these antenna types are available as RF-2301 optional equipment, although there exist a broad range of antenna types and configurations to which the RF-2301 is well-suited. Some typical antenna types and configurations are shown in Figure 2-7. Although an in-depth analysis of antenna operation and use would be far too lengthy to be included within this manual, the following paragraphs outline those aspects of antenna selection, installation, grounding, operation, and maintenance which are common to virtually all applications of HF radio transmission equipment.

2.6.1 General Information

For installations where the antenna may be installed in any of several locations, select both antenna and site carefully. There are many factors which will contribute to the performance of the system which lie outside of the equipment used. For example, radio signals are absorbed and reflected by nearby obstructions such as hills, trees, buildings, and power lines. Avoid all such obstructions, especially if they fall within a direct line with the desired direction of transmission. Some antennas are more directional than others (such as the doublet, long wire, and mini-loop) and should be erected perpindicular to the desired direction of traffic. Other antennas (such as the whip and rhombic types) are omnidirectional and are therefore less susceptable to environmental interference and do not require directional adjustment. These antennas, however, are less selective than directional types, and are typically more susceptable to RFI than the directional types. As a general rule, best HF performance is obtained from an antenna that is on top of a hill, over water, on a level plain with no obstructions, or in a location that intersects the contact point of the distant station's radio propagation path.

The following paragraphs discuss the various antenna types and their respective electrical and RF characteristics.

2.6.2 Doublet Antennas

There are three (3) basic types of doublet antennas: the Horizontal doublet, the Inverted-V, and the Slant wire doublet. All three types have two legs (elements) of equal length with one element connected to the center conductor and the other connected to the shield of the coaxial lead-in cable. The two elements have a combined length of one half of an electrical wavelength of the operating frequency (1/4 wavelength for each element). The inverted V and slant wire doublets are useful if the antenna site prohibits placement of the two supports required for the horizontal doublet, or if the supports cannot be located so that the antenna is not perpindicular to the transmission path.

All doublet antennas are directional and provide better propagation from directions perpindicular to the antenna. Figure shows the three types of doublet antennas in typical installations. The length of each element can be determined by the use of one of the following formulas:

HORIZONTAL AND SLANTED DOUBLET

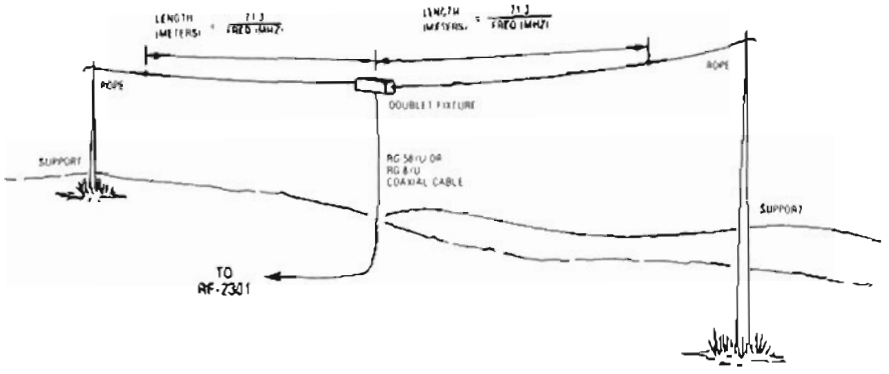
$$\text{Length of each element in feet} = \frac{234}{\text{Frequency (MHz)}}$$

$$\text{Length of each element in meters} = \frac{71.3}{\text{Frequency (MHz)}}$$

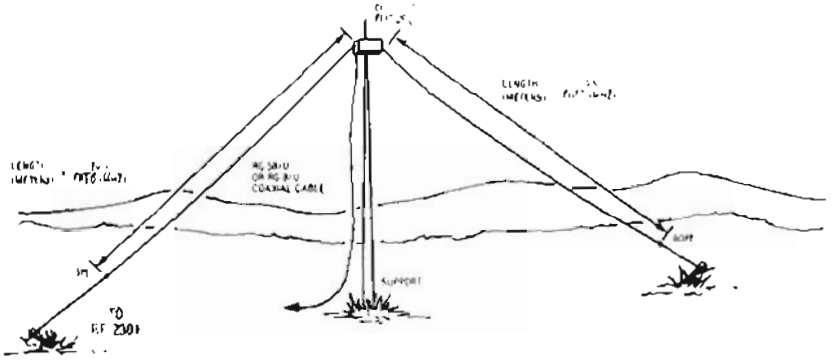
INVERTED V DOUBLET

$$\text{Length of each element in feet} = \frac{245}{\text{Frequency (MHz)}}$$

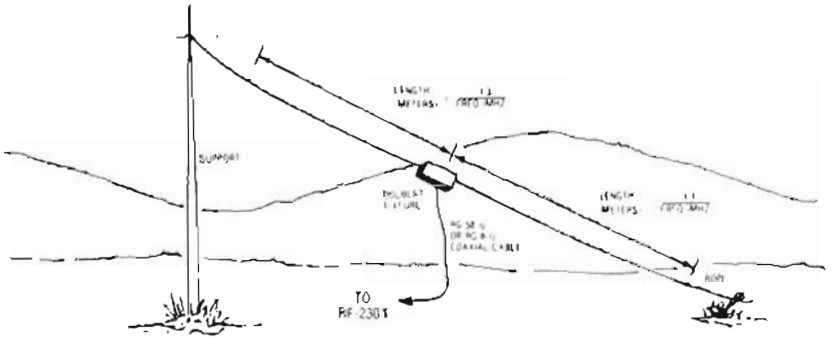
$$\text{Length of each element in meters} = \frac{74.5}{\text{Frequency (MHz)}}$$



A HORIZONTAL DOUBLET



B INVERTED V-DOUBLET



C SLANT WIRE DOUBLET

Figure 2-7. Antenna Types and Determination of Leg Lengths

Supporting pole height should be one-half of one wavelength for the horizontal and slanted doublet, and 1/2 of the total antenna length for the inverted V doublet. These three types of antennas may be constructed with the RF-334 Doublet Kit. To assemble the antenna from this kit, proceed as follows:

A. Unreel the required length of metal tape from the reel. Meter markers are provided on the tape and the table for conversion of meters to frequency is marked on the reel assembly. The length of each element can also be determined by use of the formulas shown in the preceeding paragraphs. Allow proportionate additional lengths for other frequencies to be used. The antenna elements must be very close to the correct resonant lengths to provide proper operation.

B. Secure the tape to the reel assembly using the wing nuts located on the top of the assembly.

C. Unreel the coaxial cable and connect one end to the connector on the reel assembly. Connect the other end to the RF-2301 transceiver (or RF-281 Antenna Coupler if used).

D. Tie ends (and reel assembly, if necessary) to the antenna supports and stakes using the attached rope. When tying the ends to trees, be sure to allow some slack to permit movement of the trees in the wind.

E. Position the transceiver (or antenna coupler) such that the coaxial cable does not hang near either of the antenna elements. If the coaxial cable is run parallel to one of the elements, some detuning of the antenna will occur due to phase cancellation. The best routing of the cable is perpindicular to and vertical from the antenna.

2.6.3 Onmidirectional Antennas

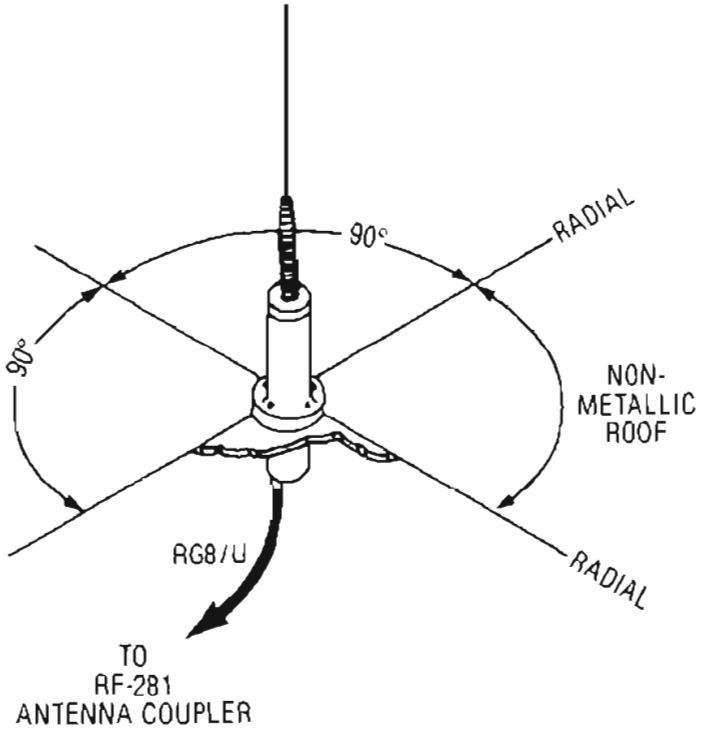
The whip antenna is the most common of the omnidirectional antennas, having low cost, high reliability, and simplicity as features making it useful in both fixed and mobile applications. Vehicular installations generally employ 9, 16, or 35 foot whips. On small vehicles, such as a jeep, a 16 foot whip is recommended. On larger vehicles or when greater efficiency is desired, a 35 foot whip should be used. Instructions for the installation of the SBV16 through SBV35 series Whip Antenna Kits are included with the kits. Figure 2-7 shows several typical whip antenna installations and associated aspects of mounting and use.

Since whip antennas have a complex characteristic resonance pattern, an antenna coupler is recommended for proper operation. The connection from the antenna base to the antenna insulator on the coupler should be made with insulated cable, such as the inner conductor from RG-8/U coaxial cable. All connections must be secure. If the antenna will be subject to movement, it should be supported in a few places by high voltage standoff insulators of the material and type used on the coupler. The type of insulator used on the coupler is recommended for installations where the antenna lead must pass through a bulkhead or wall to reach the antenna. Extended lengths (up to 250 feet, if necessary) of RG-8/U cable may be used between coupler and transceiver, however, the lead between the coupler and the antenna acts as part of the antenna itself, radiates RF energy, and is a source of inefficiency. It can also cause mistuning of the antenna coupler. The importance of having the antenna coupler as close as possible to the antenna can not be over-emphasized. This is also true for the antenna ground wire, as any length of lead between the coupler and a good electrical ground also acts as part of the antenna. In addition to resulting in poor operation of the antenna system, a long ground lead may result in generation of an RF voltage differential on the coupler chassis, causing improper operation and presenting a shock hazard to operating personnel.

For optimum whip antenna performance, a counterpoise is required. For a whip, the counterpoise is made up of at least four radials (sixteen nominal) which extend out and away from the antenna base. The radials must be at least one-quarter wavelength long (preferrably one-half wavelength) at the lowest operating frequency. The radials should be connected together at the hub and directly connected to the antenna coupler ground terminal. These radials should be of heavy wire (No. 10 AWG) extended their full length in a symetrical pattern, and should be anchored in several places. A counterpoise is recommended for all applications of a whip antenna in which the antenna will be erected in a location where a good and secure earth ground is not accessable, such as rooftop, desert, and some mobile applications.

2.7 INTERCONNECTION AND INTERFACE REQUIREMENTS

Interconnection requirements for a basic RF-2301 system (consisting of RF-2301, RF-281 Automatic Antenna Coupler, RF 2360 Power Supply, and SB-V16 Antenna) are shown in Figure 2-4. Figure 2-11 gives RF-2301 to RF-281 Control Cable detail. The system-oriented design of the RF-2301 family permits a wide variety of interface options (RTTY, FAX, and voice terminals, scramblers, linear amplifiers and remote control options, etc.) for use with the RF-2301 in both individual and systems applications.



NOTES:

1. MINIMUM RADIAL LENGTH (FT.) = $\frac{234}{\text{Lowest Freq. in MHz}}$
2. SECURE RADIALS TO ROOF
3. MAKE GOOD ELECTRICAL CONNECTION BETWEEN EACH RADIAL AND COUPLER GROUND
4. RADIALS ARE NO. 10 COPPER WIRE

Figure 2-8. Whip Antenna Counterpoise Detail

Figures 2-4, 2-5, 2-6 and show three typical applications of the RF-2301 transceiver as used in Mobile, Fixed, and Shipboard applications. Each component of the RF-2301 system is shown with respect to its relationship to the other system components, interface cable connection points and part numbers, connector identification and purpose, and function of each interface within the system. It should be noted that these three illustrations are only examples of possible system configurations, and that many other possibilities exist with additional equipment.

Interconnection of the RF-2301 is accomplished at the rear panel of the unit. The simplified design layout of the connectors and the connectors themselves provide easy access and functional grouping of the most frequently used external equipment options. The rear panel consists of a dc power connector, rf input/output, antenna coupler control connector, remote control connector, and an audio remote connector. Additionally, the rear panel contains the primary dc and antenna coupler power fuses, as well as a heavy-duty radio ground terminal. All connectors are environmentally protected, and are marked internally for ease of locating RF-2301 functional interconnection points.

The RF-2301 will interface directly with a number of standard Harris products, such as the MIL-3300 FSK Keyer/Converter shown in Figure 2-9. For additional information concerning interface and system applications of the RF-2301, contact Harris Corporation RF Communications Division, Systems Engineering Department, 1680 University Avenue, Rochester, New York 14610.

Figure 2-9. RF-2301 Transceiver/RF-2310 Shock Mount with MIL-3300 Keyer/Converter

2.7.1 Interface Cables

Normally, there are three (3) interface cables required for operation of the RF-2301 transceiver, these being: (1) Primary Power cable, (2) Antenna Coaxial cable, and (3) Antenna Coupler Control cable. The relative positions of these cables and their recommended placement in a jeep are shown in Figure 2-10 below. Additional cables for remote control, etc., may be added as required.

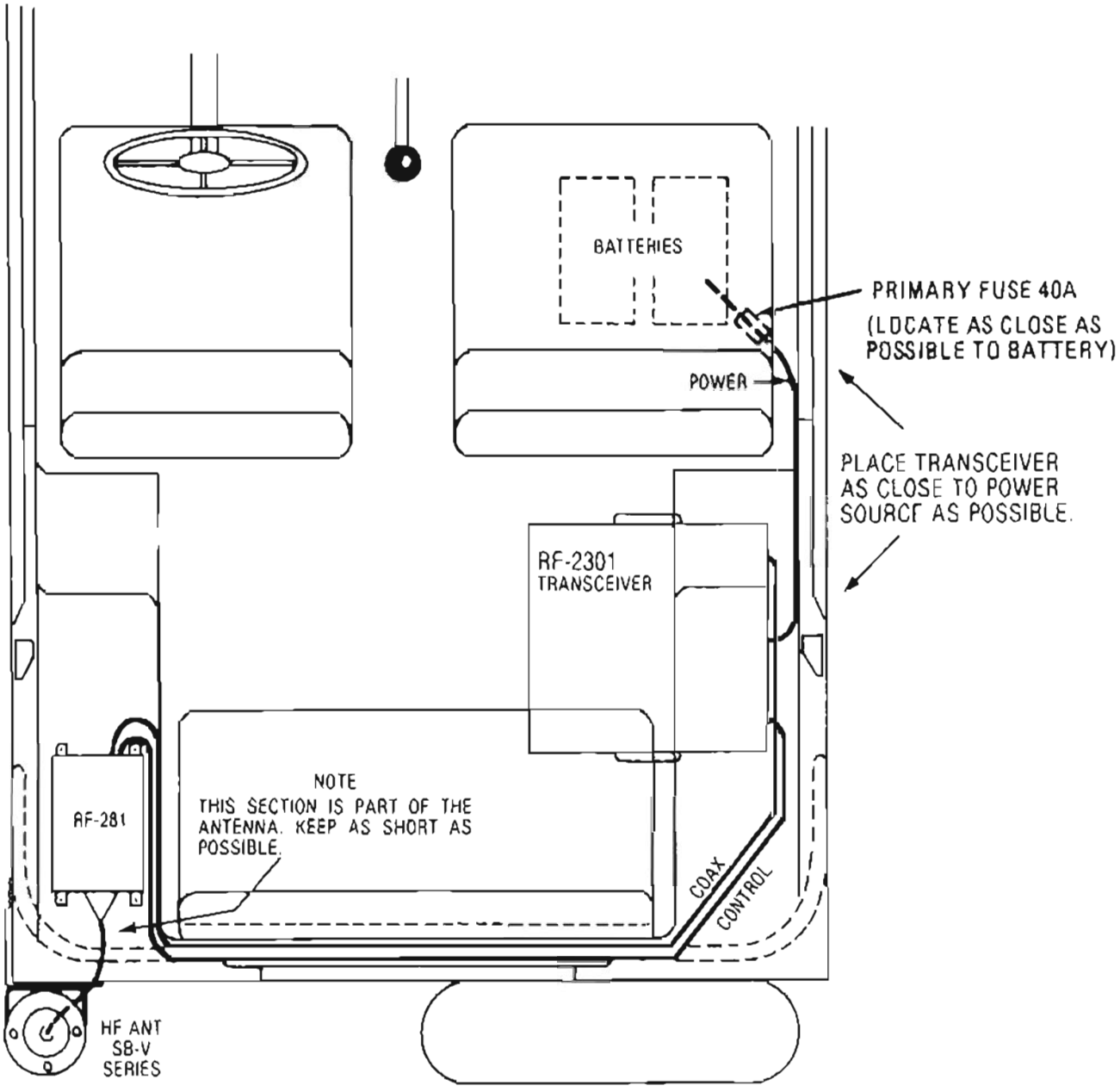


Figure 2-10. Recommended Mobil Installation Positioning

2.7.2 Connector Information

The following pages present information and data pertaining to the various connectors found at the rear panel of the RF-2301 transceiver. The specific functions of each connector are presented in Table 2-1, and theindividual functions of each connector pin are presented in Table 2-2 . Note that all five (5) connector mates are contained in the RF-2301 ancillary package. Table 2-3 shows primary power connections for the RF-2360 Power Supply.

Table 2-1. RF-2301 Interface Connectors

CONNECTOR	DESCRIPTION OF FUNCTION OF CONNECTOR	MATING CONNECTOR
COUPLER CONTROL	Provides primary dc power to antenna coupler, interfaces transceiver with coupler control and supervisory signals for automatic operation.	MS3116F14-19P
AUDIO REMOTE	Provides all audio inputs and outputs for external processing devices, provides dc power outputs, mute control, squelch control, and microphone enable and keyline signals.	MS3116F16-26P
REMOTE	Provides all bidirectional digital control and monitoring lines for frequency, channel, mode, fine tune, and others for channelized remote control of the RF-2301. Also provided are analog control signals (VSWR Reference, ALC, ACC, etc.) and special functions such as CW key and low power select. Additionally, several functions contained in the AUDIO REMOTE and COUPLER CONTROL connectors are also contained in the REMOTE connector. The REMOTE connector is intended for use with the RF-2370 Remote Control Unit.	MS3116F24-61P
RF IN/OUT	UHF type connector for antenna connection.	J-0002
POWER	Permits connection of external +13.8 Vdc power sources, or connects to RF-2360 if used.	MS3106A24-12S

Table 2-2. RF-2301 Rear Panel Connectors and Functions

RF-2301 CONNECTOR	PIN	DESCRIPTION OF FUNCTION	RF-281 CONNECTOR PIN	ORIGINATES AT:	WIRE COLOR
COUPLER CONTROL J1	A	Coupler Fault	E	Coupler	Blue
	B	Coupler Rechannel	K	Transceiver	Brown
	C	Spare		.....	
	D	Ground	D	.....	Shield & Black
	E	Keyline	H	Bidirectional	Violet
	F	Coupler Bypass	M	Transceiver	Green
	G	Coupler +24 Vdc (See Note III below)	F	Transceiver	Orange
	H	Spare		.....	
	J	Spare		.....	
	K	Coupler Keyline Disable	G	Coupler	Gray
	L	Spare		.....	
	M	Tune Power Request	J	Coupler	White
	N	Spare			
	P	Spare			
	R	Spare			
	S	Spare			
	T	Spare			
	U	Spare			
	V	Spare			

NOTE

RF-281 cable fabrication instructions are contained in the RF-281 Automatic Antenna Coupler Manual (Publication No. 1960-0009), Installation Section, paragraph 2.6.

Table 2-2. RF-2301 Rear Panel Connectors and Functions (Continued)

CONNECTOR	PIN	DESCRIPTION OF SIGNAL OR FUNCTION	ORIGINATES AT:
REMOTE AUDIO J2	A	600 Ohm TX Audio Input - 0 dBm	Ext. Source
	B	Speaker	
	C	+24 Vdc Output	Transceiver
	D	Spare	
	E	Tune/Fault	Transceiver
	F	Bypass Relay	Transceiver
	G	Squelch Bypass	Transceiver
	H	600 Ohm RX Audio Output - 0 dBm → +10 dBm	Transceiver
	J	Ext. Bypass	Transceiver
	K	Ground	
	L	Mute	Ext. Source
	M	Keyline	Ext. Source
	N	+13.8 Vdc	Transceiver
	P	ACC	Transceiver
	R	Spare	
	S	Spare	
	T	Speaker Gnd.	
	V	Spare	
	W	Spare	
	X	600 Ohm RX Audio Output - 0 dBm → +10 dBm	Transceiver
	Y	Spare	
	Z	Microphone Enable	Transceiver
	$\overline{A}$	600 Ohm TX Audio Input - 0 dBm	Ext. Source
	$\overline{B}$	Spare	
	$\overline{C}$	Spare	
REMOTE J3	A	10 KHz - 2^1	Bidirectional
	B	1 MHz - 2^2	Bidirectional
	C	10 KHz - 2^2	Bidirectional
	D	Ground	
	E	+24 Vdc Output	Transceiver
	F	+24 Vdc Output	Transceiver
	G	+13.8 Vdc Switched	Transceiver
	H	CH - 2^0	Bidirectional
	J	External ACC Input	Ext. Source
	K	Remote	Ext. Source
	L	600 Ohm RX Audio Output - 0 dBm	Transceiver
	M	CH - 2^3	Bidirectional
	N	Automatic Level Control (ALC)	Transceiver
	P	600 Ohm TX Audio Input - 0 dBm	Ext. Source
	R	1 MHz - 2^1	Bidirectional
	S	600 Ohm TX Audio Input - 0 dBm	Ext. Source
	T	Microphone Enable	Transceiver
	U	XMIT Inhibit	Transceiver
	V	CH - 2^2	Bidirectional
	W	Keyline Disable	Transceiver
	X	100 Hz - 2^0	Bidirectional
	Y	100 Hz - 2^3	Bidirectional
	Z	100 KHz - 2^3	Bidirectional

Table 2-2. RF 2301 Rear Panel Connectors and Functions (Continued)

CONNECTOR	PIN	DESCRIPTION OF SIGNAL OR FUNCTION	ORIGINATES AT:
REMOTE J3	$\overline{A}$	100 KHz - 2^2	Bidirectional
	$\overline{B}$	10 KHz - 2^0	Bidirectional
	$\overline{C}$	10 KHz - 2^3	Bidirectional
	$\overline{D}$	1 KHz - 2^1	Bidirectional
	$\overline{E}$	Ground	
	$\overline{F}$	$\overline{\text{Clarifier Up/Down}}$	Ext. Source
	$\overline{G}$	+13.8 Vdc Switched	Transceiver
	$\overline{H}$	REF PWR IND	Transceiver
	$\overline{I}$	+10R (Receive)	Transceiver
	$\overline{J}$	Mode - 2^2	Bidirectional
	$\overline{K}$	FSK TC	Transceiver
	$\overline{M}$	Low Power Select	Transceiver
	$\overline{N}$	VSWR Control	Transceiver
	$\overline{P}$	CW Key	Transceiver
	$\overline{Q}$	100 KHz - 2^1	Bidirectional
	$\overline{R}$	TX Light	Transceiver
	$\overline{S}$	CH - 2^1	Bidirectional
	$\overline{T}$	100 KHz - 2^0	Bidirectional
	$\overline{U}$	10 MHz - 2^0	Bidirectional
	$\overline{V}$	1 KHz - 2^2	Bidirectional
	$\overline{W}$	1 KHz - 2^0	Bidirectional
	$\overline{X}$	$\overline{\text{Clarifier Up}}$	Ext. Source
	$\overline{Y}$	Down Signal	Transceiver
	$\overline{Z}$	Coupler Bypass	Transceiver
	AA	Mode - 2^1	Bidirectional
	BB	$\overline{\text{Tune/Fault}}$	Transceiver
	CC	Keyline	Ext. Source
	DD	1 MHz - 2^3	Bidirectional
	EE	Mute	Ext. Source
	FF	600 Ohm RX Audio Output - 0 dBm	Transceiver
	GG	100 Hz - 2^2	Bidirectional
	HH	1 KHz - 2^3	Bidirectional
	JJ	Up Signal	Transceiver
	KK	High/Lo Out	Ext. Source
	LL	Mode - 2^0	Bidirectional
	MM	10 MHz - 2^1	Bidirectional
	NN	100 Hz - 2^1	Bidirectional
	PP	1 MHz - 2^0	Bidirectional
RF IN/OUT J4	Center cond.	RF Signal Input/Output	Antenna/Transceiver
	shield	Ground	Transceiver Chassis

Table 2-2. RF 2301 Rear Panel Connectors and Functions (Continued)

CONNECTOR	PIN	DESCRIPTION OF SIGNAL OR FUNCTION	ORIGINATED AT:
POWER J5	A	+13.8 Vdc Primary Power Input	Ext. Source
	B	+24 Vdc Input	RF-2360
	C	Ground	Ext. Source
	D	Reduced Voltage Control	RF-2301
	E	Fan Control	RF-2301

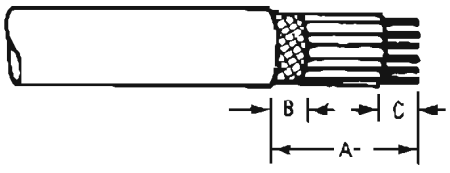
Table 2-3. RF-2360 Primary Power Connections

CONNECTOR	PIN	DESCRIPTION OF SIGNAL OR FUNCTION	ORIGINATED AT:
J1 13.8 Vdc Output	A	+13.8 Vdc Output to RF-2301	RF-2360
	B	+24V Output to RF-2301	RF-2360
	C	Gnd.	Bidirectional
	D	Reduced Voltage Control	RF-2301
	E	Fan Control	RF-2301
J2 115/230 VAC Input	A	115 VAC Hot/230 VAC	Ext. Source
	B	Spare	
	C	Spare	
	D	115 VAC Neutral/230 VAC	Ext. Source
	E	Ground	Ext. Source
	F	Spare	
	G	Spare	
J3 +24 Vdc Input	A	+24 Vdc Input	Ext. Source
	B	Gnd.	Ext. Source
	C, D	DC Interlock – Connect these two pins together using #8-12 AWG wire. This is a series interlock in the main +13.8 Vdc output located before the output filter.	J3
	E, F	AC Interlock connect these two pins together using any convenient small wire size. This interlock shuts off the AC switching circuitry when the DC input plug is installed.	J3
	G	Spare	

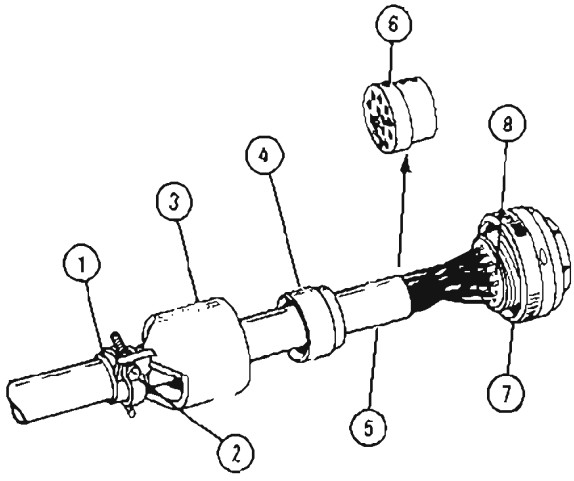
Table 2-4. RF-2360 Cable and Mating Connector Information

ITEM	PART NO.	DESCRIPTION	NOTES
Mate for J1	MS3106A24-12P MS3057-16B MS3420-16A	Connector, 5 Pin Cable Clamp Sleeve	A complete cable assy to connect the +13.8 Vdc between the RF-2360 and the RF-2301 is supplied in the ancillary kit. Order RFC P/N 10007-2021.
Mate for J2	MS3108E16S-1S MS3057-8A with Bushing	Connector, 7 Pin Cable Clamp	Complete cable supplied in ancillary kit. Order RFC P/N 10007-2006.
Mate for J3	MS3106A24-10S MS3057-16B AN3420-8A AN3420-16A	Connector, 7 Pin Cable Clamp Sleeve Sleeve	
24 Vdc Input Cable	RF COMM P/N W-1788	2 ea. #8 AWG conductors	20 ft. supplied in RF-2301 ancillary kit.

A. STRIP THE CABLE (5) TO THE FOLLOWING DIMENSIONS.



A (OUTER JACKET) – 1"
B (SHIELD) = 1/4"
C (WIRE CONDUCTORS) – 3/16"



B COMB THE EXPOSED BRAID AND TWIST THE STRANDS TOGETHER TO FORM A CONDUCTOR. SOLDER 3/4" LENGTH OF BLACK WIRE TO THE BRAID. INSTALL HEAT SHRINKABLE TUBING OVER THE CONNECTION (IF AVAILABLE) AND SHRINK.

C COVER THE END OF THE OUTER JACKET AND THE EXPOSED SHIELD WITH LARGE DIAMETER HEAT SHRINKABLE TUBING (IF AVAILABLE) AND SHRINK INTO PLACE.

D. TWIST AND TIN THE WIRE CONDUCTOR ENDS

E INSTALL THE FOLLOWING ITEMS REQUIRED FOR PROPER CONNECTOR ASSEMBLY OVER THE END OF THE CABLE AND SLIDE THEM UP THE CABLE, OUT OF THE WAY.

(1) RUBBER BUSHING (FOR CABLE CLAMP)

(2) & (3) CABLE CLAMP, RELATED HARDWARE, AND CONNECTOR HOUSING

(4) NYLON RETAINER RING (ORIENT WITH THE SMALLER DIAMETER END FACING THE CABLE END)

NOTE

THE RUBBER GLAND (6) THAT IS SUPPLIED WITH THE CONNECTOR IS NOT REQUIRED FOR THIS APPLICATION AND SHOULD BE REMOVED AND DISCARDED

F BACKFILL THE CONNECTOR WIRE RETENTION SOLDER CUPS (8) WITH SOLDER.

G IF AVAILABLE, IT IS PREFERRED THAT HEAT SHRINKABLE TUBING BE INSTALLED OVER EACH WIRE CONDUCTOR AND SHRUNK AFTER SOLDERING THE WIRE TO THE CUP.

H SOLDER THE WIRES TO THE APPROPRIATE CONNECTOR PIN (8) PER TABLE 2-2. SHRINK THE TUBING.

I. SEAT THE NYLON RETAINING RING (4) FIRMLY AGAINST THE REAR OF THE CONNECTOR (7).

J FILL THE CAVITY WITH RTV SEALANT TO A LEVEL JUST ABOVE THE INDIVIDUAL WIRE INSULATION.

K JOIN THE CONNECTOR HOUSING (3) TO THE CONNECTOR (7) AND TIGHTEN.

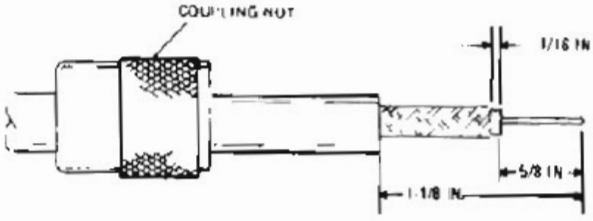
L INSERT THE RUBBER BUSHING (1) BETWEEN THE OUTER JACKET OF THE CABLE AND THE CABLE CLAMP (2). TIGHTEN THE CABLE CLAMP HARDWARE.

IMPORTANT

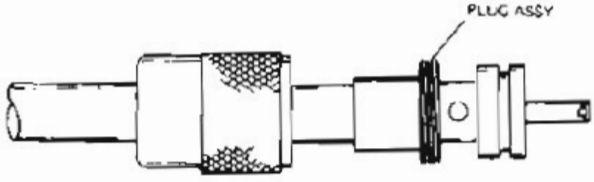
THE CABLE CLAMP MUST BE AGAINST THE OUTER JACKET OF THE CABLE ONLY. DAMAGE WILL OCCUR IF THE CLAMP IS TIGHTENED AGAINST THE WIRE CONDUCTORS.

Figure 2-11. RF-2301 Rear Panel Connectors J1, J2, and J3 Fabrication Instructions

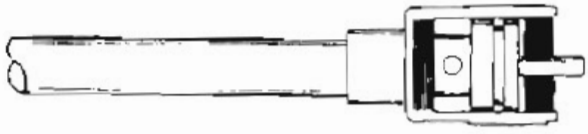
PL-259 Connector Assembly



Cut cable end square. Slide coupling nut on cable. Trim cable to dimensions shown. Tin braid and center conductor.



Screw plug assembly on cable. Solder braid through holes. To avoid deforming dielectric, use minimum heat required to produce good bond. Solder center conductor.

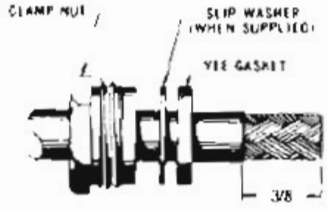


Complete assembly by screwing coupling nut over plug assembly. Check assembly by checking for shorts and continuity to other end of cable using ohmmeter.

UG-21D/U Connector Assembly

STEP

1



Cut cable end square, place clamp-nut, slip washer (when supplied), and gasket over jacket. Remove ¾" of vinyl jacket.

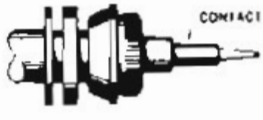
2

Place braid clamp over braid against jacket cut. Comb out copper braid as shown.

3

Fold braid back over braid clamp and trim as shown. Cut off dielectric 3/16" from end. Tin center conductor.

4



Solder contact to center conductor. Avoid use of excessive heat. See that end of dielectric is clean. Contact must be flush against dielectric. Outside of contact must be free of solder.

5

Thread assembly into connector, and lock securely. Vee gasket must be split by braid clamp.

After connector has been threaded onto RF-261 Coupler (J1), wrap connector with several layers of plastic electrical tape (supplied with RF-261 accessory kit) as close to the coupler case as possible. This protects against corrosion of mating threads in wet or humid environments.

Figure 2-12. Coaxial Cable Fabrication

PART III

OPERATION

3.1 GENERAL INFORMATION

This section presents information pertaining specifically to the operation of the RF-2301 transceiver. The information in this section is presented in three parts: Initial control settings and programming instructions, turn on and initial tests, and operational procedures. All routine RF-2301 system operations can be performed at the transceiver front panel. Once the RF-2301 has been programmed, selecting the desired operating channel would normally be the only routine operator requirement.

Prior to attempting to operate the RF-2301, verify all system interconnections, especially the RF power output connector and primary power connector. Be certain that the antenna coupler has been connected properly to an antenna designed for use in the 1.6 - 30 MHz frequency range, and that the transceiver and associated units have been installed in accordance with the information presented in the Installation section. All primary operating voltages should be measured with a meter before interconnecting to the RF-2301.

CAUTION: Prior to connecting the RF-2360 Power Supply to an ac primary power source, verify that the 115/230 Vac switch has been set to the correct ac line voltage; for 26 Vdc operation, verify that all interlocks have been properly installed (refer to Part VII, 'RF-2360 Schematic Diagram').

3.2 CONTROLS AND INDICATORS

The various front panel controls and indicators of the RF-2301 are shown in Figure 3-1 below. Each control and indicator is described in further detail in Table 3-1. Additionally, the individual symbols used in the transceiver LED readout to indicate the selected operating mode are described in Table 3-2. These two tables should be referred to when interpreting Figure 3-1. Rear panel connector information may be obtained by referring to Part II, 'Installation', paragraph 2.7.2.

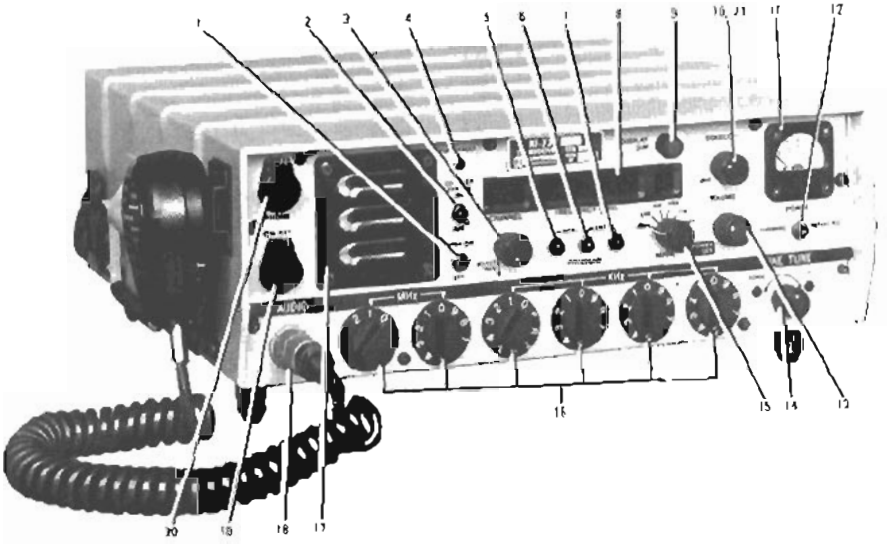


Figure 3-1 RF-2301/A Transceiver Control and Indicator Locations

Table 3-1. RF-2301 Operating Controls, Indicators, and Connectors

NO.	DESCRIPTION	FUNCTION
1	SPKR ON/OFF Switch	When the switch is placed in the 'SPKR ON' position, the front panel speaker will be activated. Placing the switch in the 'SPKR OFF' position will disable the speaker. Received audio signals are always present at the PHONES jack and 600 ohm output regardless of switch position.
2	COUPLER BYPASS ON/OFF Switch	If the programmed receive and transmit frequencies are not the same, the antenna coupler may cause attenuation of the received signal. If this occurs, set the 'COUPLER BYPASS' switch to the ON position. This will automatically bypass the antenna coupler when the transceiver is in the receive mode; thus restoring the attenuated signal.
3	CHANNEL/SELECT FREQ Switch	This control is used to select any one of fifteen possible pre-programmed channels, or to select manual operation of the transceiver frequency and mode selector switches.
4	TUNE/FAULT Indicator	Illuminates under any of the following circumstances. 1. During antenna coupler tuning cycle (steady 'on'). 2. Internal 'FAULT' condition in RF-2301 (steady 'on'). 3. Antenna coupler tuning time beyond 45 seconds (flashing).
5	RCV PROGRAM Switch	When used in conjunction with the channel select switch and the PROGRAM switch, the RCV PROGRAM switch is used to program the transceiver frequency and mode for the specified receive channel. For further information, see paragraph 3.3, RF-2301 Programming Instructions.
6	PROGRAM Switch	When used in conjunction with the RCV and XMT PROGRAM switches, the PROGRAM switch enters into memory the frequency, mode, and channel information selected on the front panel controls. For further information, see paragraph 3.3, RF-2301 Programming Instructions.
7	XMT PROGRAM Switch	When used in conjunction with the CHANNEL SELECT FREQUENCY switch and the PROGRAM switch, the XMT PROGRAM switch is used to program the transceiver frequency and mode for the specified transmit channel. For further information, see paragraph 3.3, RF-2301 Programming Instructions.
8	Channel-Frequency (MHz) – Mode Display	This LED alpha-numeric display presents (from left to right) channel number, frequency in MHz (alternating between receive and transmit frequencies if so selected), and the radio mode selected. See Table 3-2, Mode Readout Interpretation.

Table 3-1. RF-2301 Operating Controls, Indicators, and Connectors (Continued)

NO.	DESCRIPTION	FUNCTION
9	DISPLAY DIM Control	Adjusts brightness of the LED displays to a level that is appropriate for the surrounding environment. Rotating the control in a clockwise direction will increase the LED intensity, and will dim in the opposite direction. This control also adjusts the brightness of the POWER meter light and the UP and DOWN indicator lights associated with the FINE TUNE control.
10	SQUELCH Control	The SQUELCH control sets the threshold of the voice detection circuit. Clockwise rotation of this control will increase the threshold level to a level of >10 uV, and counterclockwise rotation to a minimum of 0.5 uV.
11	POWER Meter	In the receive mode, the meter indicates received signal strength in "S" units (see paragraph 3.4 for further details). When transmitting, the meter indicates forward or reflected RF power output in watts, as selected by the POWER FORWARD/REFLECTED switch.
12	FORWARD/REFLECTED Switch	In the FORWARD position, the meter indicates the amount of transmitted RF power in watts. In the REFLECTED position, the meter will indicate the RF power being reflected back from the antenna system. Note that the switch is spring-loaded to rest in the FORWARD position
13	VOLUME/POWER OFF Control	Applies dc power to transceiver and adjusts receive audio level. Note that this control has no effect on the 600 ohm audio outputs available at the rear panel interface connectors.
14	FINE TUNE DOWN/UP Control	Displacing the spring-loaded FINE TUNE control will slowly 'step' the frequency up or down in 15 Hz steps within a ± 240 Hz range. Releasing the control to its rest position stops the stepping action and maintains the selected "tune" condition. Turning on the transceiver or changing frequency or channel will automatically reset the control to zero (both DOWN and UP lights off). The DOWN and UP lights indicate the direction of frequency shift. The FINE TUNE control is operational in receive mode only.
15	MODE Switch	This control can be used to select the desired operating mode of the transceiver (USB, LSB, AM, FSK, CW, and RMT) The MODE switch will only operate if the CHANNEL switch is placed in the SELECT FREQ position, or if used to program or re-program a selected channel (see paragraph 3.3, RF-2301 Programming Instructions). The selected mode is displayed in the "window" just above the MODE switch (see Table 3-2, Mode Readout Interpretation).

Table 3-1. RF-2301 Operating Controls, Indicators, and Connectors (Continued)

NO.	DESCRIPTION	FUNCTION
16	MHz/KHz Select Switches	The six (6) switches are used to select the transceiver operating frequency for transmit and receive conditions. The switches operate in increments of: 10 MHz, 1 MHz, 100 KHz, 10 KHz, 1 KHz, and 100 Hz from left to right respectively. For example, to operate the transceiver on a frequency of 12.3456 MHz, set the six switches, left to right, 1, 2, 3, 4, 5, 6. Note: For non-channelized applications the RF-2301 operates only in the simplex mode.
17	Speaker	Reproduces receiver audio output.
18	AUDIO Connector	Connector for local handset (RF-3013), Headset with Boom microphone (RF-3014), or supplied microphone.
19	CW KEY Jack	Connector for hand key used to initiate CW transmission.
20	PHONE Jack	Connector for headphones to monitor received audio signals.
21	RF GAIN	The RF Gain Control allows manual adjustment of the receiver gain. The receiver's gain will be controlled by the manual gain or the AGC. This is dependent upon whether the largest attenuation is produced by the manual gain or by the AGC.

Table 3-2. Mode Readout Interpretation

MODE Switch Position	Display Indicates	Description of Selected Mode
USB	U	Upper Sideband
LSB	L	Lower Sideband
AM	A	Amplitude Modulation
FSK	F	Frequency Shift Keying
CW	C	Continuous Wave
RMT	(-).	Remote Operation ***

*** Display will indicate selected mode when used with Remote Control Unit, or will show a (-) when no remote is connected.

3.2.1 Initial Control Settings

Table 3-3 below presents the correct control settings for initial turn-on of the RF-2301. Note that these settings may vary after the unit has been initially tested and is ready for in-service operation.

After the unit's controls have been positioned according to Table 3-3, proceed with the turn-on tests in paragraph 3.3.2, 'Turn On/Initial Tests'.

CAUTION: Observe ac line polarity when connecting to power supply, in particular the 115 Vac line to NEUTRAL line polarity. Reversal of these two lines will cause the circuit breaker to trip when activated. The RF-2360 is not polarity-sensitive when used in 230 Vac Line-to-Line or Line-to-Neutral systems. Before connecting to ac power line, check the position of the 115/230 switch, located under the bottom cover of the supply case. Always remove ac line cord before connecting +24 Vdc to the RF-2360. Observing these points will prevent possible damage to equipment, or injury to operating personnel.

WARNING: *Voltages dangerous to life exist within the RF-2360 Power Supply. Exercise extreme caution when servicing energized power supply.*

3.2.2 Turn On/Initial Tests

The following turn-on and tuning procedure is applicable to the RF-2301 and RF-281 Automatic Antenna Coupler.

NOTE: *All RF-2360 Power Supplies are shipped from the factory with the line voltage selector in the 230 Vac position. See label on rear of power supply for information to set voltage selector switch for users line voltage.*

1) Select desired Mode and Frequency by moving appropriate selector switches to the desired positions. Do not select a frequency less than 1.6000 MHz.

2) If transceiver is used with RF-2360 Power Supply, set POWER ON/OFF switch of Power Supply to the ON position.

3) Rotate transceiver VOLUME/POWER OFF control clockwise from POWER OFF position to apply power to the transceiver. Upon activation of the transceiver, note that the POWER meter lamp is illuminated, that all mode, frequency, and channel information is displayed in LED readout, and that received audio is heard in speaker when VOLUME control is advanced.

CAUTION: If there is any reason to doubt that transceiver is functioning properly, stop here, turn power off, and determine nature of fault before proceeding to the next step.

Table 3-3. Initial Control Settings

NO.	CONTROL	POSITION
13	VOLUME /POWER OFF Control	POWER OFF
10	SQUELCH Control	OFF
1	SPKR ON/OFF Switch	ON
2	COUPLER BYPASS ON/OFF Switch	OFF
3	CHANNEL/SELECT FREQ Switch	SELECT FREQ
9	DISPLAY DIM Control	Fully Clockwise
16	KHZ/MHZ SELECT Switches	Set to any desired frequency between 1.6 and 29.999 MHz
15	MODE Switch	Any position except REMOTE
21	RF Gain	Fully Clockwise

3.2.1 Initial Control Settings

Table 3-3 below presents the correct control settings for initial turn-on of the RF-2301. Note that these settings may vary after the unit has been initially tested and is ready for in-service operation.

After the unit's controls have been positioned according to Table 3-3, proceed with the turn-on tests in paragraph 3.3.2, 'Turn On/Initial Tests'.

CAUTION: Observe ac line polarity when connecting to power supply, in particular the 115 Vac line to NEUTRAL line polarity. Reversal of these two lines will cause the circuit breaker to trip when activated. The RF-2360 is not polarity-sensitive when used in 230 Vac Line-to-Line or Line-to-Neutral systems. Before connecting to ac power line, check the position of the 115/230 switch, located under the bottom cover of the supply case. Always remove ac line cord before connecting +24 Vdc to the RF-2360. Observing these points will prevent possible damage to equipment, or injury to operating personnel.

WARNING: *Voltages dangerous to life exist within the RF-2360 Power Supply. Exercise extreme caution when servicing energized power supply.*

3.2.2 Turn On/Initial Tests

The following turn-on and tuning procedure is applicable to the RF-2301 and RF-281 Automatic Antenna Coupler.

NOTE: *All RF-2360 Power Supplies are shipped from the factory with the line voltage selector in the 230 Vac position. See label on rear of power supply for information to set voltage selector switch for users line voltage.*

1) Select desired Mode and Frequency by moving appropriate selector switches to the desired positions. Do not select a frequency less than 1.6000 MHz.

2) If transceiver is used with RF-2360 Power Supply, set POWER ON/OFF switch of Power Supply to the ON position.

3) Rotate transceiver VOLUME/POWER OFF control clockwise from POWER OFF position to apply power to the transceiver. Upon activation of the transceiver, note that the POWER meter lamp is illuminated, that all mode, frequency, and channel information is displayed in LED readout, and that received audio is heard in speaker when VOLUME control is advanced.

CAUTION: If there is any reason to doubt that transceiver is functioning properly, stop here, turn power off, and determine nature of fault before proceeding to the next step.

Table 3-3. Initial Control Settings

NO.	CONTROL	POSITION
13	VOLUME /POWER OFF Control	POWER OFF
10	SQUELCH Control	OFF
1	SPKR ON/OFF Switch	ON
2	COUPLER BYPASS ON/OFF Switch	OFF
3	CHANNEL/SELECT FREQ Switch	SELECT FREQ
9	DISPLAY DIM Control	Fully Clockwise
16	KHZ/MHZ SELECT Switches	Set to any desired frequency between 1.6 and 29.999 MHz
15	MODE Switch	Any position except REMOTE
21	RF Gain	Fully Clockwise

4) Connect supplied microphone (See Table 1-2, Accessories and Spares Supplied) to AUDIO connector on front panel. Momentarily depress switch on microphone to initiate coupler tuning process.

5) Verify POWER meter indicates approximately 40 watts output power, and that the TUNE/FAULT indicator is illuminated. This indicates the RF-2301 RF amplifier is applying power to the RF-281 coupler, and the coupler is tuning. POWER meter may show changes in output level as the coupler tunes to the transmitted frequency. Note that REVERSE power cannot be measured while the RF-281 coupler is tuning.

6) The coupler tuning cycle is completed when the TUNE/FAULT indicator extinguishes, and the RF-2301 returns to receive condition. If the receive frequency is different than the transmit frequency by 10% or greater, it may be necessary to use the COUPLER BYPASS switch when in receive mode.

7) The RF-2301 may now be operated in either simplex or half-duplex modes. The unit may be programmed at this point if no previous programming was performed. Note that all programming information is stored indefinitely in the RF-2301's EAROM storage circuits, and that it is not necessary to reprogram the unit each time power is reapplied.

8) Whenever a frequency change is effected of more than 10 KHz, the RF-281 will retune. This is also true whenever a new channel is selected, or when power is first applied. It may become necessary to repeat the tuning procedure outlined in steps 4-7 above. The RF 281 Antenna Coupler will tune to the transmit frequency in 15 seconds. A tuning cycle of greater than approximately 45 seconds will generate a fault condition.

9) If a malfunction occurs during the tuning procedure (i.e., the TUNE/FAULT indicator remains illuminated for more than one minute, or begins to flash), set the VOLUME/POWER OFF control to the POWER OFF position for at least five seconds. Repeat steps 1-8 of this procedure to determine if condition is corrected.

10) If malfunction is still present, refer to Part V, 'Maintenance', paragraph 5.2 for information regarding identification and isolation of fault conditions. There are several malfunctions for which the TUNE/FAULT indicator will illuminate, both within the RF-2301 and the RF-281. A careful analysis of the transceiver is necessary to isolate and correct faults indicated on the TUNE/FAULT indicator.

3.3 PROGRAMMING INFORMATION

The following lists all steps required to program the RF-2301 for channelized operation form the front panel:

1) Place all front panel controls to positions shown in Table 3-3.

2) Select the desired frequency by setting the six selector switches to the frequency in MHz.

NOTE: *The frequency will be displayed on the LED readout when the CHANNEL/SELECT FREQ switch is in the SELECT FREQ position.*

3) Select desired operating mode by setting MODE switch to desired position on front panel. Code designating selected mode is displayed in the LED readout as shown in Table 3-2.

4) Set CHANNEL/SELECT FREQ switch to desired position. Channel number will be displayed in LED readout directly above CHANNEL/SELECT FREQ switch.

3.3.1 Transmit Programming

After completing the above four steps simultaneously depress the XMT PROGRAM switch and the PROGRAM switch. The LED readout will momentarily go blank. When the transceiver is keyed, the transmit frequency will be displayed on the LED readout. Note that only the transmit frequency has been programmed up to this point.

3.3.2 Receive Programming

The receive programming procedure is identical to the transmit programming procedure except the RCV PROGRAM switch is depressed. The RF-2301 has now been programmed for both receive and transmit information. The selected receive frequency will be displayed when the transceiver is unkeyed.

3.3.3 Optional Programming

The RF-2301 Transceiver contains an additional set of programming switches for the purpose of adding special programming instructions to any of the fifteen programmable channels. The switches are internal to the RF-2301, and are located on the 1A1A7 Memory PWB Assembly at the top of the card.

The OP1, OP2 and OP3 switches are not used. However, the RX and HOP switches are functional and may be used to program the RF-2301 as follows:

RX – Receive-only operation for selected channels.

HOP – Spur-evasion system for both transmit and receive.

The following paragraphs describe the function and use of these switches. For additional information regarding RX and HOP operation and functional description, see Part VI, Unit Instructions, sections 1A1A7, 1A1A8, and 1A1A10.

3.4 RX ONLY PROGRAMMING

The RX selector switch is used for the purpose of designating a particular channel as a 'Receive-Only' channel. This means the transceiver will function only as a receiver when a channel with RX programming has been selected. Note also that the RX function is potentially active when the transceiver is used in the synthesized (select frequency) mode of operation.

The only requirement for programming a channel for RX operation is to place the RX switch in the up position (away from the label) when programming the transceiver channel receive frequency. Thus, when the front panel 'PROGRAM' switch is depressed, the RX function is also programmed along with the channel, mode, and frequency information already selected.

Since the RX switch is potentially active when operating in the synthesized mode, ensure the switch is not left in the ON position after programming is accomplished. Attempting to transmit in the synthesized mode with the RX switch in the ON position will inhibit the transmitter when the unit is keyed.

3.5 HOP PROGRAMMING

The RF-2301 Transceiver local oscillators are digitally controlled, thus providing frequency accuracy and automatic tuning operation. However, this approach does not necessarily minimize spurious responses being encountered on some channel frequencies that coincidentally correspond to a product of two frequencies used for injection. Spurious responses may be encountered in both receive and transmit operation, and may take the form of an audible whistle or tone present in the received signal, or an undesired modulation component in the transmit signal, causing high residual output in sideband modes.

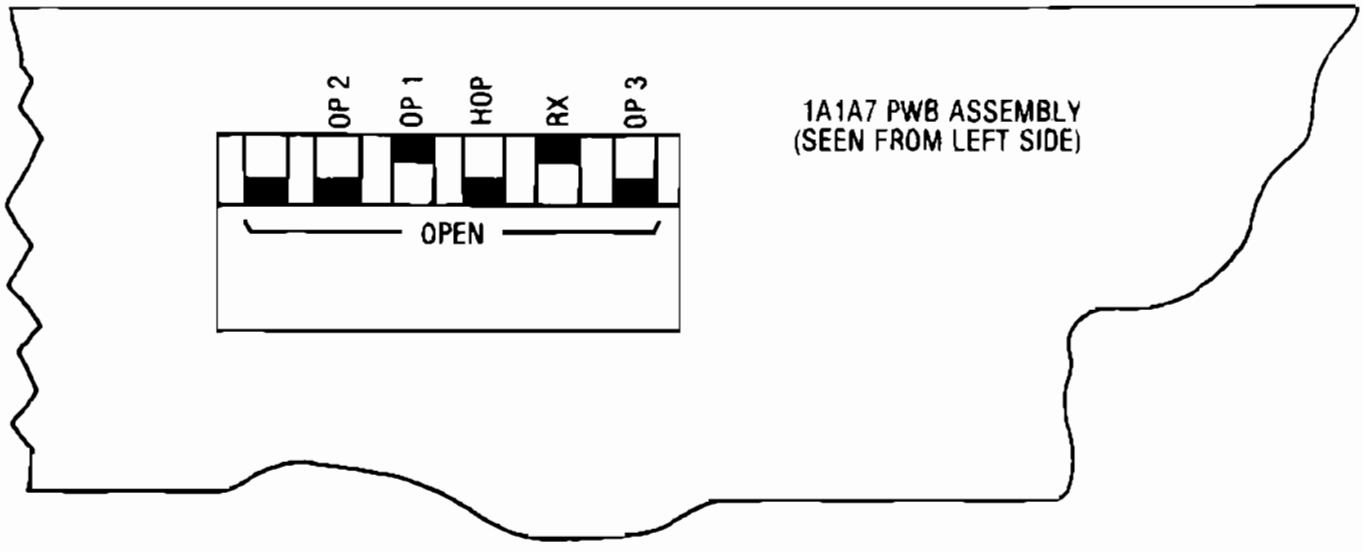


Figure 3.2 Option Switches (Part of 1A1A7PWB)

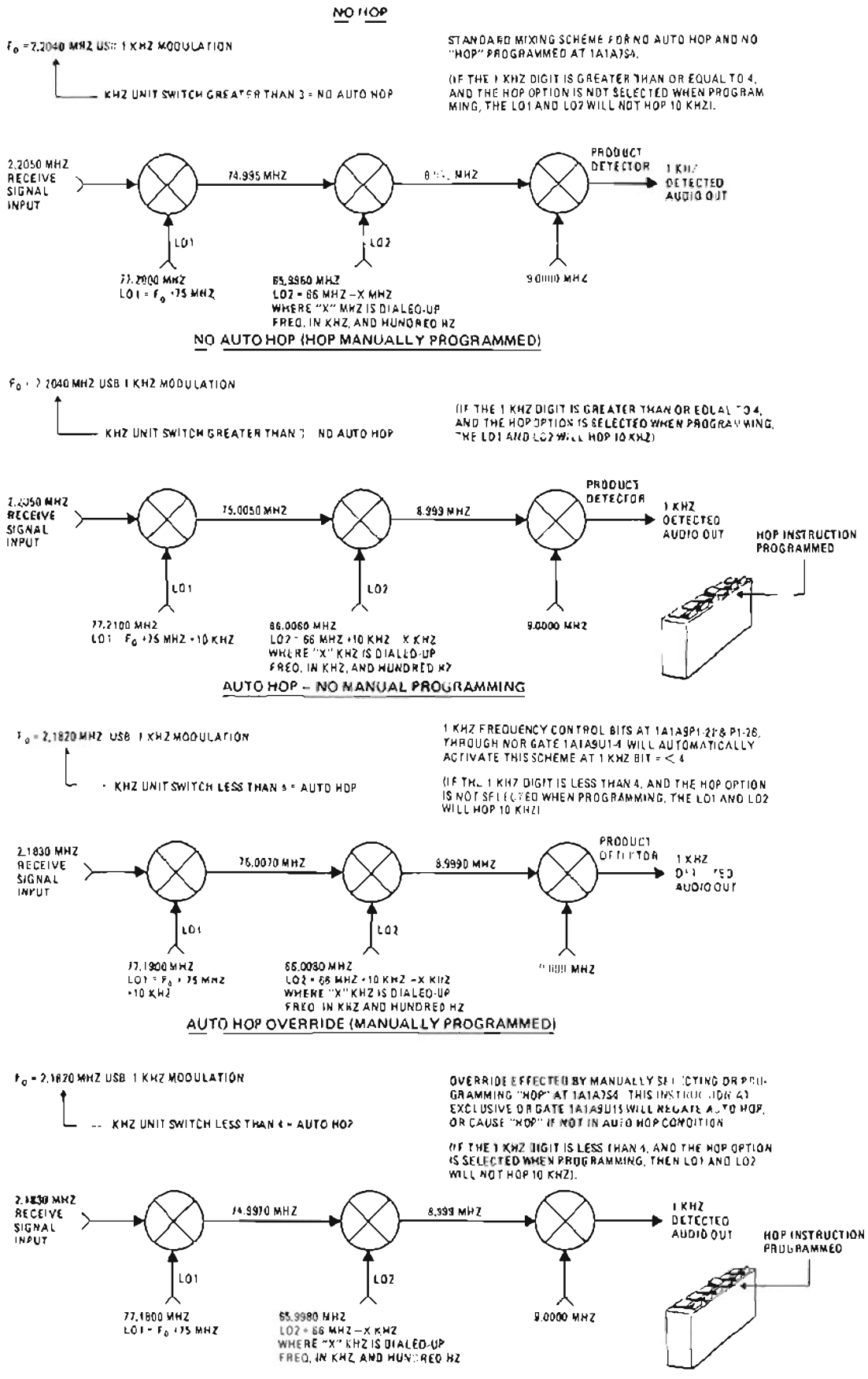


Figure 3-3. HOP Functional Operation

The HOP spur-evasion system, however, is designed specifically to avoid and reduce coincidental spurs for both transmit and receive operation, even if different frequencies have been programmed for each. This is accomplished by shifting the LO No. 1 and LO No. 2 injection signals by 10 KHz to avoid encountering known spurs. It should be noted, however, that improper use of HOP can also cause spurious responses to be encountered.

Use HOP programming for the following conditions:

1) If an obvious spur is present on a programmed receive channel.

2) If the transceiver shows a high residual output in USB or LSB modes.

NOTE: *High residual output is SSB mode may indicate a problem within the RF-2301; for further information refer to Part V, 'Maintenance', paragraph 5.7, 'Troubleshooting'.*

Programming the RF-2301 for HOP operation consists of moving the 'HOP' selector switch on the 1A1A7 PWB assembly to the upwards (away from the OPEN label on the switch) position while programming the channel frequency and mode information. The RF-2301 may be programmed for receive-HOP, transmit-HOP, or both transmit and receive HOP. Since the HOP switch is potentially active in the synthesized mode of operation, care should be taken to insure that the switch is turned off after programming has been accomplished.

3.6 OPERATION WITHOUT RF-281 ANTENNA COUPLER

Use of the RF-2301 is not necessarily limited to use strictly with an HF Antenna Coupler. If a resonant-type antenna is used with the RF-2301, then the following general test/tuning procedure should be followed.

1) Set frequency selector switches at the antenna resonant frequency (±1.5%).

2) Set MODE selector switch to the AM position.

3) Depress and hold microphone switch. Note indication of about 40 watts on POWER meter (±10 watts). Release microphone switch.

4) Move FORWARD/REFLECTED switch to the REFLECTED position and hold. Depress microphone switch and note indication on meter.

5) If meter indication in step (4) was more than 10% of the indication in step (3), then there is a problem present within the antenna system (see Part V (Maintenance, Troubleshooting Chart). If less than 10%, system is ready for use.

3.7 SPECIAL OPERATOR INFORMATION

Radio operators are frequently asked to provide the distant station with signal strength reports. The front panel 'S' meter provides the operator with this data. Table 3-4 below gives the correlation between 'S' units and the approximate signal strength at the antenna in uV. Section 1A1A4 provides additional information about the AGC circuits and associated meter driver and VSWR bridge.

Note that the POWER meter will indicate RF power output in watts when the unit is keyed, and will indicate received signal strength when the unit is in the receive mode. Moving the FWD/REF switch to the REF position when in receive mode will have no effect on the operation of the meter.

The frequency accuracy of the transceiver may best be checked by receiving the AM time signals transmitted by a Frequency Standard Station, such as WWV, WWVH, or CHU. When the transceiver is tuned to their known frequency on LSB or USB modes, a zero-beat or near zero-beat condition will occur (for further information concerning technical operational aspects of the RF-2301, refer to Part V, Maintenance paragraph 5.6). Clarifier operation should cause the zero-beat condition to shift proportionately to the frequency deviation.

Table 3-4. Signal Strength VS 'S' Meter Calibration

'S' METER INDICATION	APPROXIMATE SIGNAL AT THE ANTENNA
S3	3.6 uV
S4	5.0 uV
S5	7.3 uV
S6	11.5 uV
S7	21.0 uV
S8	42.0 uV
S9	100.0 uV
S9 + 30	31.6 mV
S9 + 60	100 mV

3.8 RF-2301 OPERATION WITH MIL-3300 FSK KEYER/CONVERTER

Consult the MIL-3300 Instruction Manual for information concerning operation of the RF-2301- with the MIL-3300 FSK Keyer/Converter.

PART IV

FUNCTIONAL DESCRIPTION

4.1 GENERAL INFORMATION

The information presented in this section describes the major functions of the RF-2301 transceiver, RF-281 Automatic Antenna Coupler, and the RF-2360 Power Supply. Individual descriptions of each RF-2301 assembly may be found in the seventeen Unit Instruction sections, compiled in tabular form in Part VI. Specific information for each subassembly may be referenced by consulting the individual Table of Contents on the overleaf of each section. Each section consists of a general description of the subassembly, a functional description, and recommended maintenance information. This may also include alignment and testing of the subassembly for repair purposes. All technical descriptions are supported by appropriate and informative illustrations to expedite repair, and all information presented relates back to the RF-2301 system for reference during alignment procedures.

4.2 RF-2301 FUNCTIONAL DESCRIPTION

Figure 4-1 shows the system elements which comprise the RF-2301 Transceiver in block form, indicating the function, interconnection points, and frequencies of the various elements and their respective signals. For specific information concerning the functional aspects of each individual elements, consult Part VI, 'Unit Instructions'.

The following paragraphs provide a summary and overview of the major component elements contained within the RF-2301, and the most important signal inter-relationships. Further information pertaining to any one particular element may be obtained in subsequent sections of this chapter. The RF-2301 Block Diagram, Figure 4-1 should be consulted while reading the following paragraphs.

4.2.1 PA Filters

PA Filter NO. 1 (1A1A1) works in conjunction with PA Filter NO. 2 (1A1A2) to perform the receive mode preselector function, and in the transmit mode to filter the RF power amplifier output signal. PA Filter NO. 1 contains three of the six eliptical low/high pass filters required to perform these functions. All transmit signals are routed through the VSWR assembly on the 1A1A1 PWB. This feedback information is used in the development of ACC and ALC power control signals. The desired eliptical filter is selected automatically by relay control ground signals from the 1A1A3 PA Control PWB. In the transmit mode, the selected filter will reduce harmonic output to typically better than -45 dB. In the receive mode, these same filters pass the RF signal, allowing the signal to be introduced directly to the high-dynamic-range input mixer on the 1A1A6 Mixer PWB.

PA Filter NO. 2 is similar to PA Filter NO. 1 with the exception that there is no VSWR assembly, which is common to both filter PWB's.

4.2.2 Mixer

The 1A1A6 Mixer PWB performs all of the major frequency conversions for the RF-2301 transceiver. In the transmit signal path, the double sideband 9 MHz input from the balanced modulator on the 1A1A5 Processor PWB is selectively filtered to eliminate the unwanted sideband. Two further conversions translate the 9 MHz signal, first to a 75 MHz intermediate frequency, then to the final selected operating frequency. The final operating frequency is determined by the difference in frequency between LO No. 1 (1A1A10) and LO No. 2 (1A1A8). Conversely, receive signals from the PA Filter(s) are translated from the selected operating frequency, up to 75 MHz (first IF), then to 9 MHz (second IF), and then filtered before routing to the IF/Audio PWB (1A1A4) as a 9 MHz IF signal. The signal is then detected and translated into useable audio intelligence by the product or envelope detector.

The Mixer PWB also contains the necessary circuitry to vary the transmit RF drive level over a 30 dB range, controlled via the ALC voltage. The AM carrier signal from the 1A1A5 Processor is also recombined in the mixer circuits. The Mixer PWB additionally contains the receiver protection circuits, which protect the transceiver in the event of excessive signal input levels.

4.2.3 IF/Audio

The IF/Audio board accepts the 9 MHz IF output from the mixer assembly and performes the final detector function to translate the intermediate frequency signal into the intelligeable audio. This process involves two discrete, but not simultaneous detector functions: a product detector is operative in the USB, LSB, CW, and FSK modes, and an envelope detector is operative in the AM mode. Two separate audio outputs are provided: a 600 ohm line audio output, and a front panel phones/speaker output.

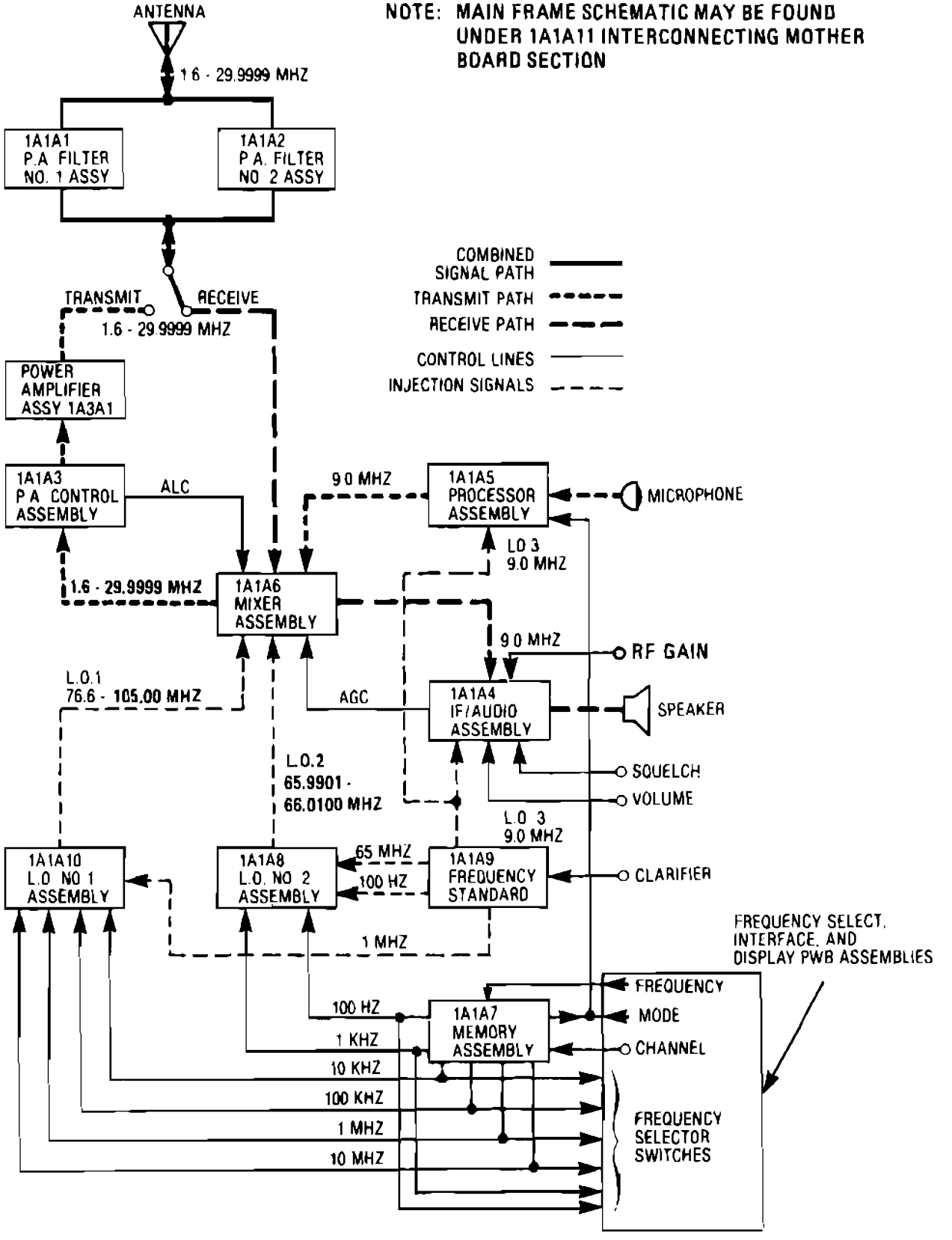


Figure 4-1. RF-2301 Transceiver Functional Block Diagram

Mute, squelch, and audio enable/disable control is also effected through the IF/Audio board via Logic Level control and discrete transistor switches. The 600 ohm output is affected only by the MUTE signal; the front panel speaker, however, is controlled by all three. Squelch control is derived from a pulse width discriminator which is fed from a reference comparator, the other side of which compares the proportional amplitude of 10-20 Hz iterations of the received audio to a constant and predetermined dc voltage, set by the front panel SQUELCH control.

AGC voltages are developed on the IF/Audio board for RF input levels of 3 uV or greater. In the AM mode, the AGC signal is derived from the carrier. In all other modes, AGC is derived directly from the detected audio. AGC is automatically compensated for derivation source (carrier of SSB) and time constant. Fast attack/fast decay is used for typical AM and FSK signals. Fast attack/slow decay is used for sideband and CW modes. A delayed AGC voltage from the IF/Audio board controls front end gain, which is nominally set to an AGC voltage of 3.9V by a zener reference diode.

4.2.4 Processor

The Processor PWB functions in the transmit signal path to translate audio signals to a 9 MHz frequency for use at the 1A1A6 Mixer PWB. The Processor board will select any one of four possible signal inputs as the modulation source (600 ohm audio, dynamic microphone, carbon microphone, or CW key) at the first transmit mixer to produce the desired DSB, AM or CW output. The desired modulation source is selected by electronic switching in response to operator inputs and logic control elements.

ACC (Automatic Carrier Control) is effected on the Processor board in response to control, inputs developed at the PA Control Board from the VSWR bridge. A complete family of mode-related control functions are generated on the Processor board in response to 3-bit mode control inputs from the front panel, and as modified by related inhibit, enable, and other logic functions. Thus, audio, control, and switching functions relating to mode of operation, keyline operation, source selection, and carrier generation are controlled and/or generated on the 1A1A5 Processor board.

4.2.5 RF Power Amplifier

The all solid-state amplifier accepts the +14 dBm RF drive input from the 1A1A3 PA Control PWB, providing a nominal 37.5 dB of amplification to produce the final RF POWER output to the PA filters and the antenna system. Receive and transmit paths are controlled by relay K2 to route the PA Filters directly to the Mixer (1A1A6) in the receive mode, and to the output of the RF Power Amplifier in the transmit mode. A control voltage analogous to total power amplifier current drain is also generated on this assembly and is used to generate the current limit control signal on the 1A1A3 PA Control PWB.

4.2.6 Frequency Synthesizer

The complete frequency synthesizer consists of three assemblies; the 1A1A8 L.O. No. 2, 1A1A9 Frequency Standard, and 1A1A10 L.O. No. 1 assemblies. The Frequency Standard contains the master reference oscillator (TCXO A2), and circuitry to provide the 9 MHz carrier injection signal, the L.O. No. 1 and L.O. No. 2 reference signals, and the FINE TUNE control circuitry.

L.O. No. 1 generates the F_0 +75 MHz signal required at the 1A1A6 Mixer to perform the final transmit mixer down-conversion to the F_0, and in the receive mode to perform the first up-conversion to the 75 MHz IF. The F_0 +75 MHz output can be any discrete frequency (in 10 KHz increments) between 75.0000 MHz and 104.9900 MHz. The output frequency is synthesized from a single 1 MHz signal input. Synthesizer control is exercised automatically in response to BCD frequency control inputs from the Memory Board (1A1A7).

L.O. No. 2 generates the 66 MHz injection signal used at the 1A1A6 Mixer to convert the 9 MHz transmit input signal to the 75 MHz Intermediate Frequency (IF), or (if in the receive mode) to convert the 75 MHz First IF to the 9 MHz Second IF. The L.O. No. 2 assembly uses 100 Hz and 1 KHz BCD input information to effect its function.

BPF (Band Pass Filters) Select Control signals are also generated on the L.O. No. 2 assembly. This function is also accomplished automatically in response to BCD frequency control inputs. This section also incorporates a priority encoder system to automatically select 'RX only' mode in response to control inputs.

All operating frequencies are synthesized from a single standard. This TCXO (Temperature Compensated Crystal Oscillator) is mounted in a protected environment on the Frequency Standard PWB assembly, and is stable to 1 part per million ($\pm 1/10^6$) over the entire specified temperature range of -30° to $+50^{\circ}$C. Because the TCXO employs temperature compensated circuit devices, it does not require a temperature controlled operating environment.

4.2.7 12/24 Vdc Power Supply

The 1A4 Power Supply assembly provides +24 Vdc for operation of the RF-281 Automatic Antenna Coupler and other acessory units. Consisting of two subassemblies, the 1A4A1 Bracket assembly and the 1A4A2 Power Supply/

Regulator assembly, the supply is designed to operate from a +13.8 Vdc power source. The 1A4 assembly is optional and need not be included in the transceiver when the RF-2360 is used with the RF-2301.

The purpose of the 1A4 power supply is to convert +13.8 Vdc to 28 Vdc. This is accomplished via a multivibrator/ power converter circuit, which converts the +13.8 Vdc input into a high-frequency ac signal, which is then fed to a switching regulator circuit. This circuit, consisting of a regulating pulse-width modulator and associated components, processes the signal through synchronized switching action. Current demand of the supply is proportional to the pulse-width of the modulator. This composite signal is then fed to a series of filters and current limit control circuits to provide the necessary 28 Vdc to operate many of the RF-2301 Acessories, as well as the RF-281 Antenna Coupler.

When the RF-2301 is used in conjunction with the RF-2360 Power Supply, the 1A4 assembly need not be used in the transceiver. However, the same basic type of regulating pulse-width modulator and switching regulator circuit is used by the RF-2360. Further information may be obtained by consulting paragraph 5.9, 'Integrated Circuit Data and Details', under 'SG2524 Regulating Pulse Width Modulator'.

4.3 RF-2360 POWER SUPPLY

The RF-2360 Power Supply is used in conjunction with the RF-2301 for continuous duty applications. The purpose of the RF-2360 is to convert 24 Vdc or 115/230 Vac into the required 13.8 and +24 Vdc operating voltages to power the RF-2301 and associated components.

Conversion of primary ac and dc voltages is achieved through a solid-state switching regulator and regulating pulse-width modulator. Switching action is controlled by the pulse-width modulator, which regulates the final output voltages. The supply outputs are +13.8 Vdc at up to 36A and +24 Vdc at up to 3A.

The RF-2360 contains all necessary circuitry to permit on-the-spot conversion of primary power sources, either through the use of alternative connectors or internal selector switches. Additionally, internal thermistor circuits function to detect excessive heat and consequently activate the internal fan. The unit will also respond to a control signal from the RF-2301, indicating excessive heat within the unit. The fan serves to cool the RF-2301 heat sink fins.

Both current limit and voltage parameters are internally adjustable via potentiometers located on the power/ regulator PWB. Current limiting action is nominally set at the factory to a threshold of 36A. Low voltage adjustment is set to approximately 11.8 Vdc, and high voltage adjustment is set to approximately 13.8 Vdc. Placing the RF-2301 in either the FSK or CW modes will automatically cause the RF-2360 to reduce it's +13.8 Vdc output to about 11.8 Vdc. This is to improve the overall efficiency of the supply and 1A3 Power Amplifier when used for data transmission.

4.4 RF-281 AUTOMATIC ANTENNA COUPLER

The optional RF-281 Antenna Coupler matches the output of the RF-2301 with a variety of antenna types and configurations. Automatic tuning is accomplished by an internal discriminator, which operates the tuning control circuitry. All tuning information is derived directly from the transceiver RF output.

When the antenna has been properly tuned or matched by the reactive elements in the RF-281, the coupler will present a purely resistive 50 ohm load to the RF-2301 RF output. Retuning of the coupler is achieved by a 'rechannel' pulse from the RF-2301, which sends this pulse whenever the selected frequency is altered by more than 10 KHz.

The control logic circuitry monitors keyline, transmitter rechanneling, RF power level, and antenna conditions to make the appropriate sequence of responses required to perform automatic operation. A Phase Discriminator drives the capacitive element, and an 'R' Discrimmator drives the inductive elements.

All interconnections are made via a single coupler control cable, which provides +24 Vdc operating power, keyline, and other control and monitoring signals. The unit may be placed up to 250 feet from the transceiver.

For additional information concerning the RF-281 Antenna Coupler, refer to the instruction manual supplied with the unit.

PART V

MAINTENANCE

5.1 GENERAL INFORMATION

This section contains procedures for routine maintenance and overall performance tests to establish proper operation of the RF-2301. Also included in this section are removal and replacement procedures for each assembly, suggested methods of troubleshooting and general repair practices, and a step-by-step transceiver alignment procedure. Although the RF-2301 is aligned and thoroughly tested at the factory, replacement of some PWB's will necessitate the realignment of the transceiver. Specific alignment procedures for each assembly are included in the indexed Unit Instructions section, Part VI. Refer to the indexed sections for information pertaining to the assembly in question.

5.2 OPERATIONAL TESTING

5.2.1 GENERAL INFORMATION

To determine the operating condition of the RF-2301 transceiver, perform the receiver and transmitter operational tests outlined in the following paragraphs. By comparing the data obtained from these tests to the specified data, it will be possible to determine if a problem exists. Upon completion of the operational tests, refer to paragraph 5.7, Troubleshooting and paragraph 5.8, Alignment/Test Point Information for information concerning localization of detected problems.

5.2.2 RECOMMENDED TEST ENVIRONMENT

Ambient Temperature	25° C ± 5° (77° F ± 9° F)
AC Line Voltage	115/230 VAC @50/60 Hz ± 10%
Relative Humidity	Less than 60%

5.2.3 TEST EQUIPMENT

This paragraph lists recommended test equipment items. In each case, equivalent items may be substituted.

RF VOLTMETER HP-410C
including Sampling Tee connector
AUDIO VOLTMETER ..... HP-400F (to +20 dBm)
or
DISTORTION ANALYZER .....
HP-334A with voltmeter function
50 OHM LOAD ..... Sierra Division Model 662A-30, feedthrough type
RF SIGNAL GENERATOR ..... HP-8640 (to 600 MHz)
FREQUENCY COUNTER ..... Heath/Schlumburger Model SM-110A (1 part in 10^8)
FREQUENCY STANDARD ..... For use with frequency counter; better than 1 part in 10^7
INTERFACE CABLES ..... 50 ohm coaxial cable w/ mating connectors, shielded audio cables w/ appropriate connectors and/or alligator clips.

5.2.4 PRELIMINARY PROCEDURES

Before proceeding with either the receiver or transmitter tests, it is necessary to establish that the RF-2301 and RF-2360 are functional and prepared for testing. The following preliminary test procedure should be observed:

1) Before connecting to AC power line, verify correct primary operating voltage.

CAUTION

Observe AC line polarity when connecting to power supply, in particular the 115 VAC line to NEUTRAL line polarity. Reversal of these two lines will cause the circuit breaker to trip when activated. The RF-2360 is not polarity-sensitive when used in 230 VAC line-to-line or line-to-neutral systems. Before connecting to AC power line, check the position of the 115/230 switch, located under the bottom cover of the supply case. Always remove AC line cord before connecting +24 VDC to the RF-2360. Observing these points will prevent possible damage to equipment, or injury to operating personnel.

WARNING

High voltages exist within the RF-2360 which, when contacted under certain circumstances, can cause serious injury or death. Exercise caution when servicing interior of power supply when energized.

2) Check integrity of all audio and RF interface cables and connectors. Test each cable before including in any test setup.

3) Insure that all test equipment used is in good working order and properly calibrated. Perform any recommended manufacturer's tests for establishing accurate calibration of the equipment.

4) In the course of the tests, the option is made of utilizing the 10007-0610 Interface Test Fixture Assembly. In the event that both the test fixture and specified test equipment used in its place are not available, a substitute assembly may be fabricated utilizing the information presented in Figure 5-1.

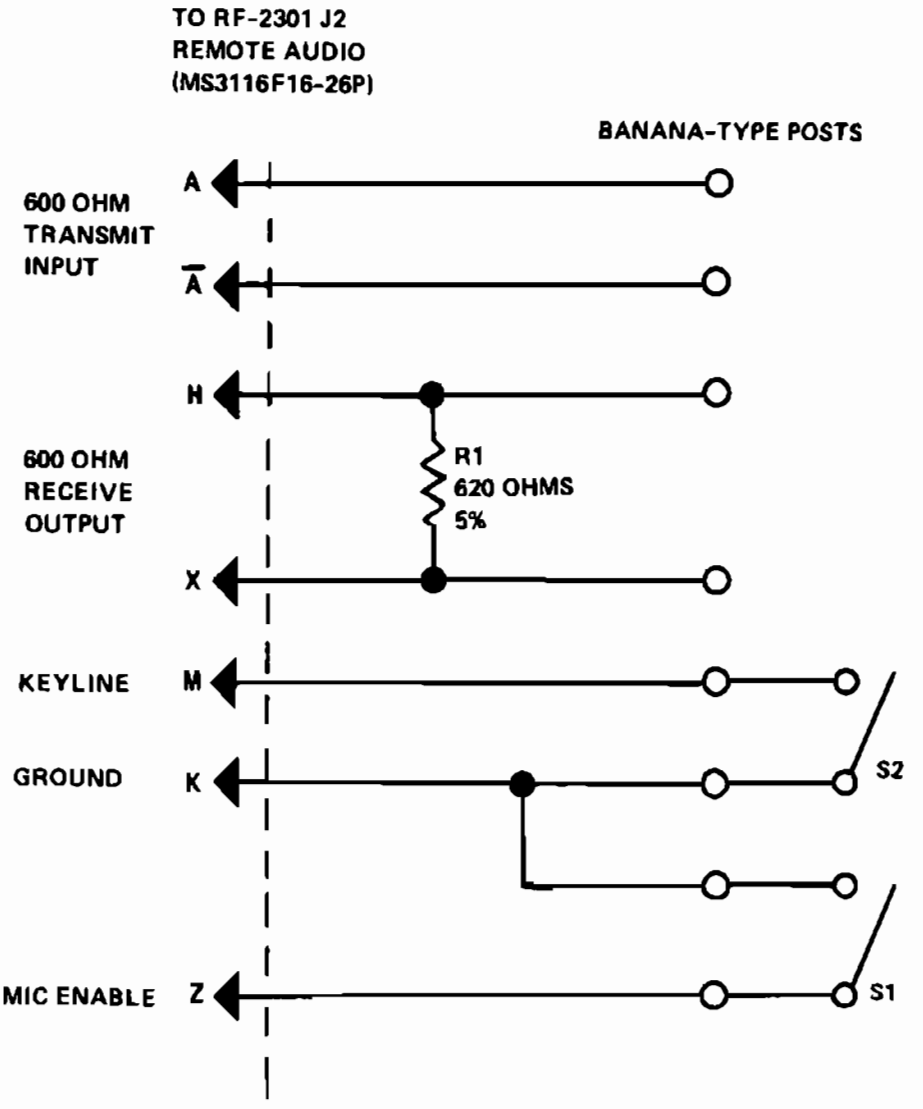


Figure 5-1. Interface Test Fixture Assembly Schematic Diagram

A 10 conductor shielded cable (such as RF part number W-0956 or equivalent) should be used to interconnect the transceiver (J2) with the test points. Resistor R1 should be ¼ watt or greater. A fully assembled and tested assembly is available from Harris/RF Communications (order part number 10007-0610).

5.2.5 RECEIVER OPERATION TEST

The following test will determine the operational condition of the receiver portion of the RF-2301 transceiver. Refer to paragraph 5.6.6 for transmitter testing information.

1) Interconnect the RF-2301/RF-2360 with the designated test equipment as shown in Figure 5-2.

2) Set the RF-2301 front panel controls to the following positions:

FREQUENCY SELECTOR SWITCHES ..... 2.5000 MHz
MODE SWITCH ..... USB position
CHANNEL SWITCH ..... SELECT FREQ position
SQUELCH CONTROL ..... OFF position
DISPLAY DIM CONTROL ..... Fully CW (maximum intensity)
VOLUME CONTROL ..... OFF position
COUPLER BYPASS ..... OFF position
SPEAKER SWITCH ..... ON position
RF GAIN CONTROL ..... Fully cw

3) Energize the RF-2301 and RF-2360. Set VOLUME control to a convenient level.

4) Set the signal generator frequency at 2.5010 MHz at an output level of 0 uV (minimum output level). Set audio voltmeter to 0 dBm range. Note voltmeter indication (noise).

5) Adjust signal generator output level to 0.7 uV. Fine tune generator frequency for peak indication on audio voltmeter. Voltmeter should read typically 10 dB higher than the noise level indication noted in step 4.

6) Move the FINE TUNE control towards the UP and DOWN detents. Pitch (frequency) of the tone heard in the speaker should increase and decrease accordingly. Moving the 100 Hz frequency selector switch should produce a similar effect.

7) Move MODE switch to LSB position; repeat steps 4 through 6.

8) Set signal generator frequency to 2.5000 MHz, and adjust output level to minimum (0 uV). Set generator output mode to AM position modulated by a 1 KHz tone @ 30% modulation intensity. Move RF-2301 MODE control to AM position.

9) Set signal generator level to 3.0 uV. A 1 KHz tone should be heard from the RF-2301 speaker. Note audio voltmeter indication.

10) Remove the 1 kHz modulation component from the signal generator output. Audio voltmeter should indicate a level typically 10 dB lower than with modulation applied.

11) Reapply the modulation component to the signal generator output. Note the indication on the audio voltmeter. Increase the signal generator output level to 300 mV (300,000 uV). Observe that the total change in audio voltmeter indication is 10 dB or less. This indicates proper AGC adjustment for AM mode.

12) Select USB mode and apply input signal at 10 uv level at a frequency of 2.5010 MHz. Note audio output level. Increase signal generator output level to

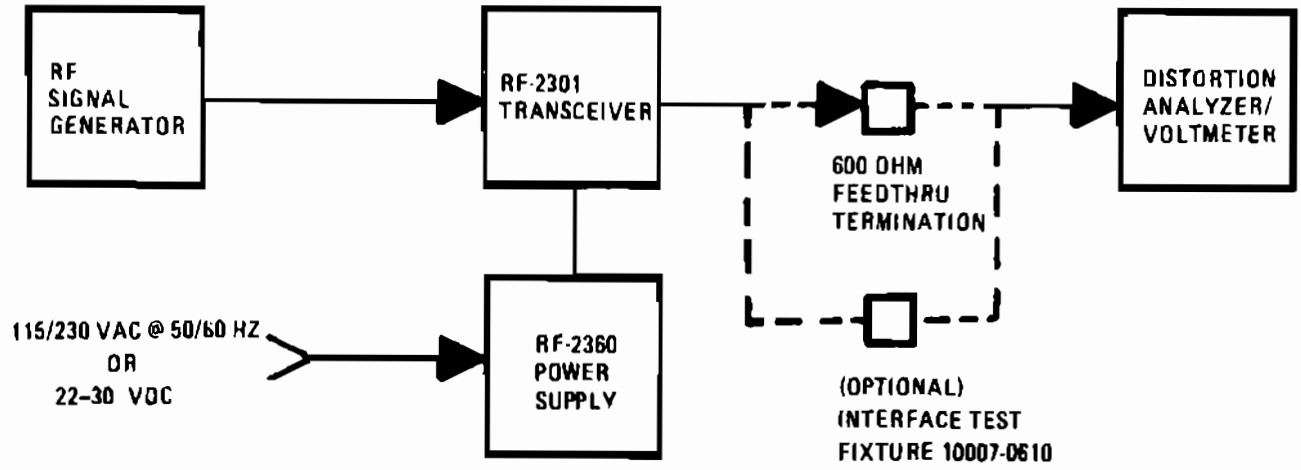


Figure 5-2. Receiver Operational Test Setup

100,000 uv (.1v) and measure rise in audio output level. The rise should typically be less than 10 dB.

This completes the receiver portion of the operation tests. Correlation of the test results with the most likely defective subassemblies is indicated in table 5-1. Additional troubleshooting information is presented in paragraphs 5.7 and 5.8.

5.2.6 TRANSMITTER TESTING

The following test will determine the operational condition of the transmitter portion of the RF-2301 transceiver.

1) Interconnect the RF-2301/RF-2360 with the designated test equipment at the locations shown in Figure 5-3.

2) Set the RF-2301 front panel controls to the following positions:

FREQUENCY SELECTOR SWITCHES ..... 2.5000 MHz
MODE SWITCH ..... AM position
CHANNEL SWITCH ..... SELECT FREQ position
SQUELCH CONTROL ..... OFF position
DISPLAY DIM CONTROL ..... Fully CW (maximum intensity)
VOLUME CONTROL ..... OFF position
COUPLER BYPASS ..... OFF position
SPEAKER SWITCH ..... ON position

3) Energize the RF-2301 and RF2360. Observe 2.5000 MHz indicated on display.

4) Depress remote key switch; transmitter should key, and selected frequency should be displayed on frequency counter. Adjust counter sensitivity as necessary to obtain an accurate and stable indication. Frequency should be within 1 part in 106 of the selected frequency. AM carrier level should be between 35 and 50 volts RMS (25-50 watts).

5) Move frequency selector switches while transmitter is keyed. Note that all frequencies selected are displayed on frequency counter within 1 part in 10^6 of the selected frequency (example: acceptable deviation for 27.4362 MHz would be 27.4 Hz).

6) Rotate FINE TUNE control (either UP or DOWN) while transmitter is keyed. The displayed and transmitted frequency should not be affected by the FINE TUNE control.

Table 5-1. Receiver Test Analysis

Problem Detected In Step:	Most Likely Causes:
2	1A2A1 Frequency Select Assembly 1A1A7 Memory Assembly
5	1A1A4 IF/Audio Assembly 1A1A6 Mixer Assembly
6	1A1A9 Frequency Standard Assembly 1A2A1 Frequency Select Assembly
7	1A1A4 IF/Audio Assembly 1A1A6 Mixer Assembly
9	1A1A4 IF/Audio Assembly 1A1A6 Mixer Assembly
10	1A1A4 IF/Audio Assembly 1A1A6 Mixer Assembly
11	1A1A4 IF/Audio Assembly 1A1A6 Mixer Assembly

Table 5-2. Relationship of RF Signal Input Level And Typical AGC Voltage

RF Input Level (In uV)	AGC Voltage (in Vdc) ±10%
0.0	0.36
0.39	0.36
0.78	0.36
1.00	0.36
1.50	0.36
2.00	0.36
2.50	0.36
3.00	0.63
3.50	1.12
4.00	1.44
6.00	2.09
8.00	2.41
10.00	2.64
30.00	3.28
100	3.70
300	4.02
1,000	4.32
3,000	4.58
10,000	4.90
30,000	5.40
100,000	6.25
300,000	7.40
1,000,000	7.65
1,500,000	7.75

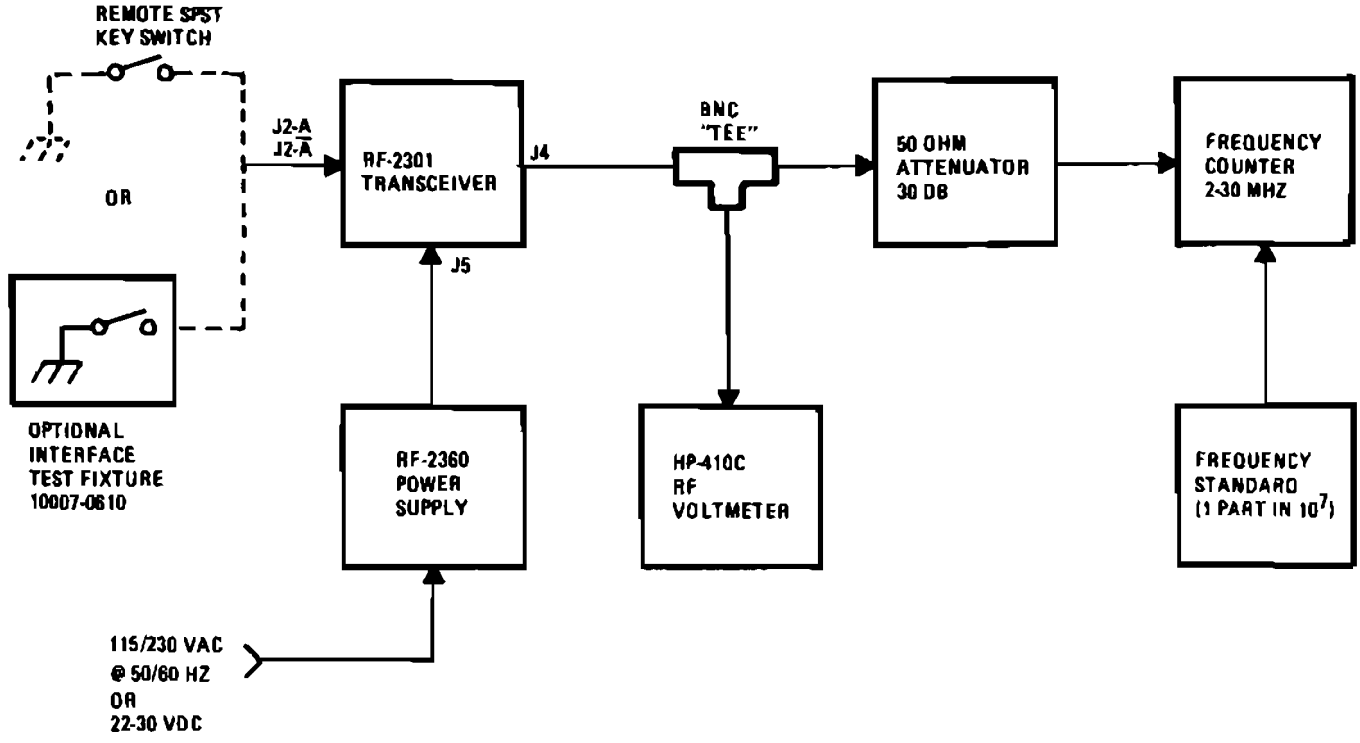


Figure 5-3. Transmitter Operational Test Setup

7) Set RF-2301 MODE switch to CW position. Connect CW key to front panel jack and key transmitter. RF output level should be indicated on RF voltmeter. The voltmeter should indicate between 70.7 and 80.7 VAC (100-130 watts) Repeat for several different frequencies.

8) Connect supplied microphone (Harris part number 919-5000) to the front panel AUDIO connector. Depress the microphone keyswitch and speak (don't shout) into microphone for an extended interval. Note that both front panel meter and RF voltmeter indicate RF power output (note: power output may be less than in step 7 due to variations in voice qualities and intensity).

This completes the transmitter portion of the operational tests. Correlation of the test results with the most likely defective subassemblies is indicated in Table 5-3. Additional troubleshoting information is presented in paragraphs 5.7 and 5.8.

Table 5-4 is provided to allow cross referencing between test equipment that may be calibrated in millivolts RMS, or dBm (1 milliwatt reference into 50 ohm load).

Table 5-3. Transmitter Test Analysis

Problem Detected in Step:	Most Likely Causes:
3	1A1A7 Memory Assembly 1A2A2 Interface Assembly 1A2A3 Display Assembly
4	1A1A5 Processor Assembly 1A1A9 Frequency Standard 1A1A8/ 1A1A10 Local Oscillators
6	1A1A9 Frequency Standard
7	1A3A1 PA Assembly 1A1A1/ 1A1A2 PA Filters 1A1A3 PA Control Assembly 1A1A5 Processor Assembly 1A1A6 Mixer Assembly
8	1A1A5 Processor Assembly

Table 5-4. Conversion of DBM to Volts RMS Across 50 Ohms

(Based on 0 dBm = 1 milliwatt)

(NEGATIVE DBM)			(POSITIVE DBM)
VOLTS	MILLIVOLTS	DBM	VOLTS
0.224	224	0	0.224
0.199	199	1	0.251
0.178	178	2	0.282
0.158	158	3	0.316
0.141	141	4	0.354
0.126	126	5	0.398
0.112	112	6	0.446
	99.9	7	0.501
	89.0	8	0.562
	79.3	9	0.630
	70.7	10	0.707
	63.0	11	0.793
	56.2	12	0.890
	50.1	13	0.999
	44.6	14	1.12
	39.8	15	1.26
	35.4	16	1.41
	31.6	17	1.58
	28.2	18	1.78
	25.1	19	1.99
	22.4	20	2.24
	19.9	21	2.51
	17.8	22	2.82
	15.8	23	3.16
	14.1	24	3.54
	12.6	25	3.98
	12.0	25.4	– –
	11.2	26	4.46
	10.0	27	5.01
	8.90	28	5.62
	7.93	29	6.30
	7.07	30	7.07
	3.98	35	12.6
	2.24	40	22.4
	1.26	45	39.8
	0.707	50	70.7

5.3 FAULT ISOLATION

The first step in troubleshooting is recognition of the symptoms based on a working knowledge of the unit's electrical characteristics. Not all equipment failures are the result of defective components. Often repairs are as simple as cleaning dirty contacts or pushing a PWB completely into its slot. It is important that symptoms be classified as one of the following:

- Total Failure
- Degraded Performance
- Improper Performance

Generally, each class of fault has a recognizable set of circumstances that support analysis of the equipment or subassembly being evaluated. The following presents a

general list of circumstances which typically accompany each type of failure, and thus permit recognition and localization of the problem area.

Total Failure

Total failure is nearly always accompanied by blown fuses, primary power failure, electrical short circuits, or failure of one or more unit subassemblies. If total failure has occurred, do not reconnect the transceiver to the primary power source until the problem has been localized. Attempting to troubleshoot a transceiver that has experienced total failure by allowing the unit to remain energized could cause even more damage to the unit. Generally, total failure is not the result of component failure unless the component in question can easily be identified as a key component upon which all of the other subassemblies rely. This may take the form of primary power series components, interface cables, or other series components in line with essential control or operating signals.

Degraded Performance

This type of problem is usually the most difficult to deal with because of the number of possibilities. Every electrical connection, component, interface, and wire may be suspect. Therefore, localization is the first step. Analysis of the symptoms will only be valid if each and every subassembly is checked one by one. Hence, the best method of approaching localization is to follow these generally-accepted techniques for recognition:

1) By referring to the transceiver block diagram, determine the nature of the symptom in relation to those subassemblies which, in some direct way, contribute to the function in question. This will automatically rule out 90% of the possible components by direct association. For example, if the transceiver failed to produce any rf output but the receiver was still functional, one would tend not to suspect the majority of the unit, but would rather directly suspect the PA Control or Power Amplifier assembly. Also, since there may not be any defect at all, one might also suspect that the RX (Receive-Only) switch on the 1A1A7 Memory PWB might be turned on, thus inhibiting the transmitter.

2) By referring to the indexed information in Part IV, carefully check the suspected subassembly. If no one subassembly is suspected in particular, then check the basic operational parameters of the unit. Some of these are:

   –Primary power available and correctly installed.

   – All PWB assemblies are seated properly in their respective connectors.

   – Specific operational mode affected (i.e., transmit/receive/emission mode).

   – All operator controls functional and performing properly.

3) If it does not seem to be possible to localize the fault, it will be necessary to perform the test in paragraph 5.2 of this chapter. This, in conjunction with the troubleshooting chart listed in Table 5-5 will assist in localizing the fault to the subassembly level.

4) After localization, refer to the indexed sections in Part VI for specific tests.

Table 5-5. RF-2301 Fault Conditions and Interpretation

SYMPTOM INDICATED	FAULT DETECTED	EXPLANATION AND SUGGESTED REPAIR
Indicator flashes continuously	Antenna Coupler	Antenna Coupler will send a 'Key/Fault' signal to the RF-2301, if, after approximately 60 seconds, the coupler fails to tune. Check RF-281. (Refer to separate manual).
Indicator stays on indefinitely	Two possible faults	
	(1) PA Fault	Excessive current initiates FAULT condition. Check 1A3A1 assembly.
	(2) Synthesizer Fault	Either synthesizer out of lock (off frequency) or no output. Check LED on 1A1A9 PWB.

5) Generally speaking, direct substitution of assemblies to pin point the cause of trouble is not recommended. Damage to the substituted assembly may result from being placed in a defective circuit.

Improper Performance

Improper performance is often the result of environmental effects, such as corroded connector contacts, old coaxial cables, dirty card-edge fingers, or mechanical problems such as dust and dirt affecting potentiometer and switch operation. The same basic rules of troubleshooting for degraded performance apply, with the exception that all external interconnections and equipment should be checked first unless it becomes obvious by inspection where the fault lies.

If the problem at any time is localized specifically to the transceiver, the next step is to determine the logical causes of the trouble. A check of operation in different modes and at different frequencies will often pin point the problem. Use of internal signals to pin point the problem is the next step, using such signals as AGC to measure receiver gain or ALC to measure transmitter gain.

The quickest and most convenient method of confirming input or output levels at a suspected assembly is to temporarily remove it from the chassis and, if necessary, place the assembly on an extender card for testing convenience.

Figure 5-4 shows an RF-2301 Card Extender as supplied with the Ancillary Kit. Use the PWB extraction tool located at the top of the PA assembly to remove plug-in PWB assemblies.

CAUTION

Always turn the transceiver off before removing assemblies.

If the TUNE/FAULT indicator has been activated, then the fault may be easily located by referring to Table 5-5, for possible FAULT conditions.

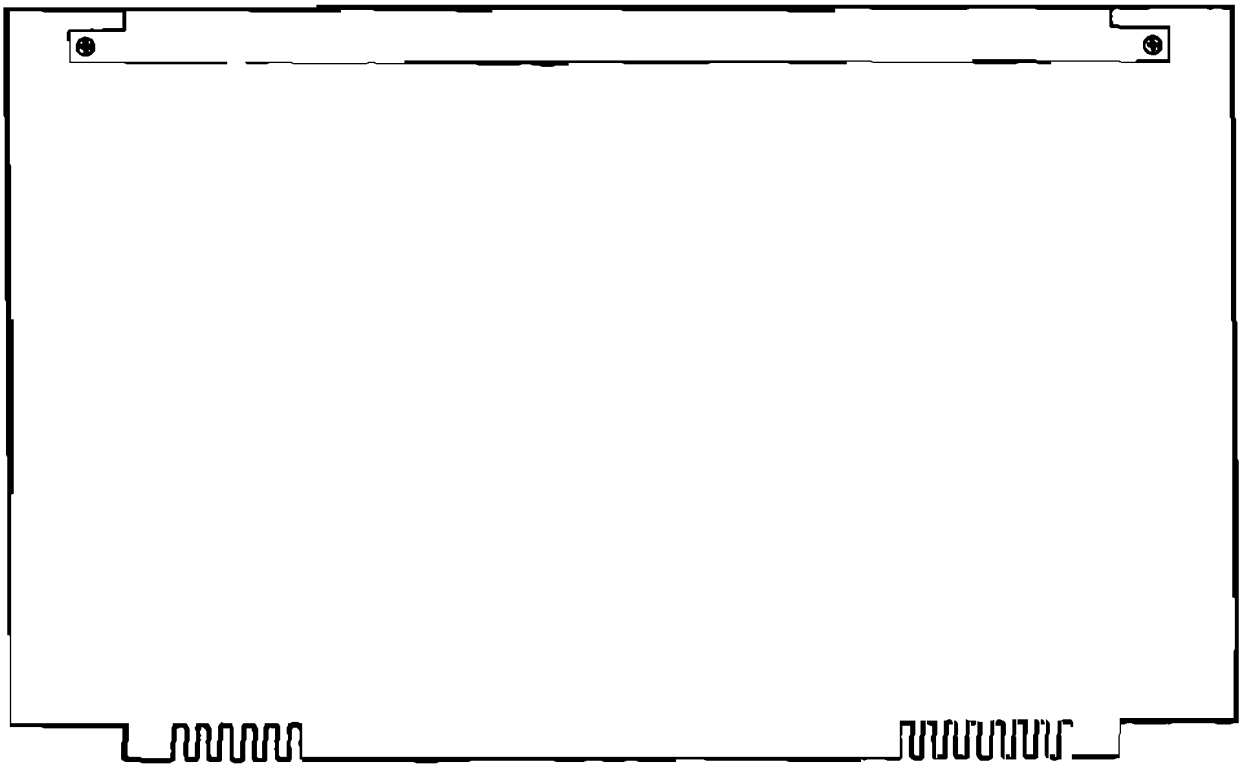


Figure 5-4. RF-2301 Card Extender

5.4 METHOD OF DISASSEMBLY

Figure 5-5 illustrates the method of disassembly of the RF-2301, as well as the locations of the individual assemblies and subassemblies comprising the transceiver. The 1A3 Power Amplifier Assembly is removed from the transceiver by unscrewing the thirteen retaining fasteners attaching the assembly to the rear of the transceiver chassis. The 1A2 Front Panel Assembly is removed from the transceiver by unscrewing the nine retaining screws (No. 6-32 Hex) from the front panel. In each case, it is necessary to remove the transceiver top cover, as the cover forms a lip which helps to hold the assemblies in place. The 1A4 Power Supply Assembly is removed easily from the card cage by rotating the two 1/4-turn fasteners approximately one-quarter turn until the assembly is free, and then lifting the assembly from the chassis. Table 5-6 lists the various RF-2301 functional elements (assemblies) with respect to their locations within the transceiver.

Table 5-6. RF-2301 Location of Functional Elements

Reference Designation	Description of Assembly	Assembly Part Number	Location of Assembly
1A1A1	PA Filter No. 1 PWB	6628-0400	Card Cage
1A1A2	PA Filter No. 2 PWB	6628-0450	Card Cage
1A1A3	PA Control PWB	6628-0500	Card Cage
1A1A4	IF/Audio	6628-0590	Card Cage
1A1A5	Processor PWB	6628-0600	Card Cage
1A1A6	Mixer PWB	6628-0650-04	Card Cage
1A1A7	Memory PWB	10007-1120	Card Cage
1A1A8	L.O. No. 2 PWB	6628-0800	Card Cage
1A1A9	Frequency Standard PWB	6628-0880	Card Cage
1A1A10	L.O. No. 1 PWB	6628-0900	Card Cage
1A1A11	Interconnecting PWB	10007-1100	Card Cage
1A2A1	Frequency Select PWB	10007-1060	Front Panel
1A2A2	Front Panel Interface PWB	10007-0220	Front Panel
1A2A3	Display PWB	10007-0230	Front Panel
1A3A1	RF Power Amplifier Assembly	6628-1150	Rear Panel
1A3A2	Interface Connector Assembly	10007-1020	Rear Panel
1A4	Power Supply/Bracket Assembly	10007-0900	(Located at rear of Card Cage)

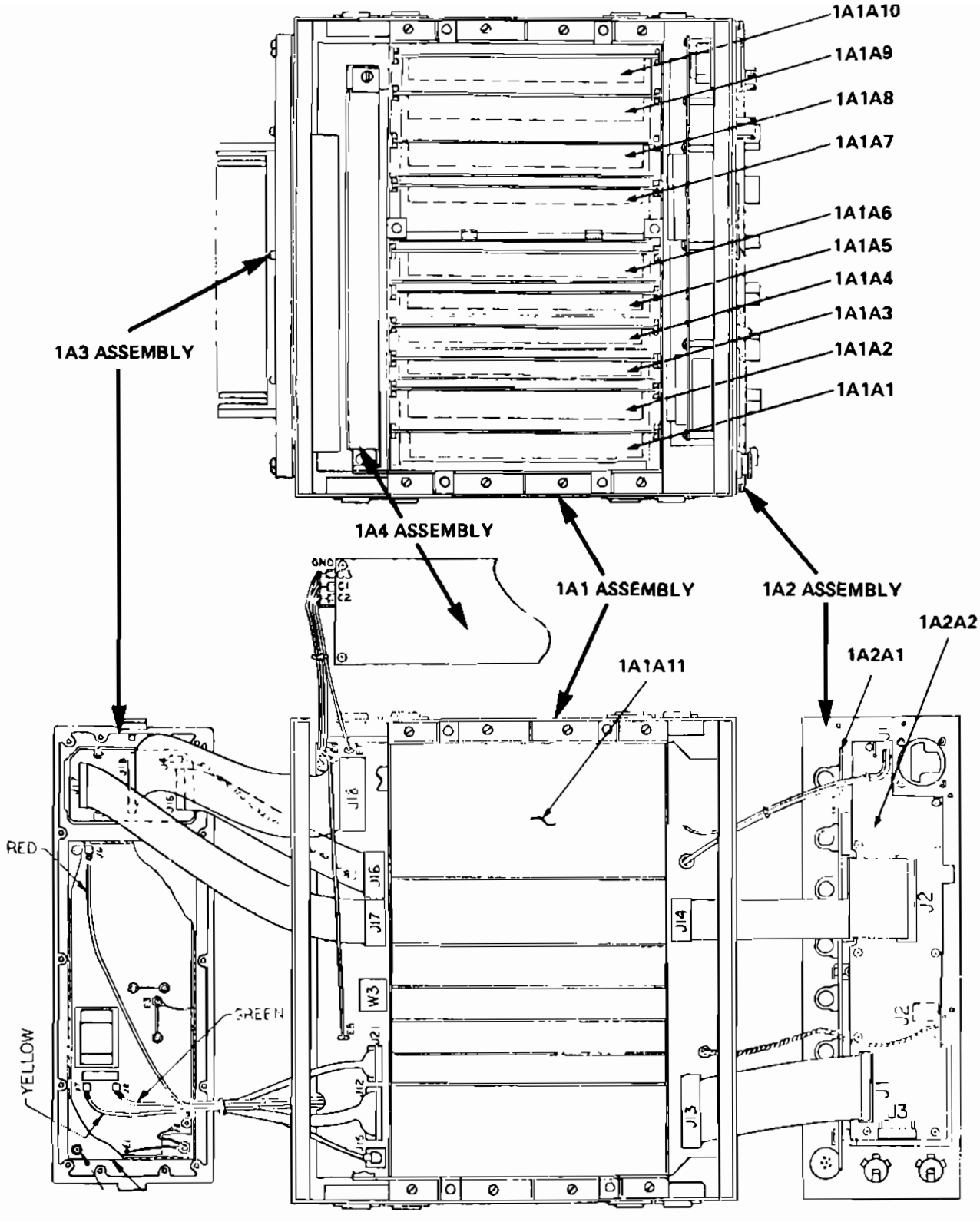


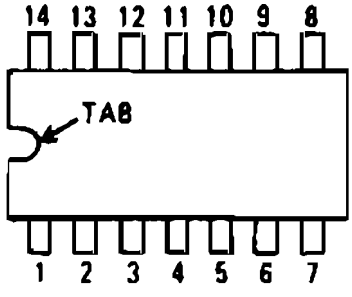
Figure 5-5. RF-2301 Disassembly Method

5.5 PW BOARD REPAIRS

The following general rules and techniques are useful in servicing the printed wiring boards of the RF-2301.

- When replacing components on printed wiring boards, clip the mounting leads first with a suitable pair of diagonal cutters and remove the component. This is especially helpful on multilead components such as integrated circuits. The individual leads are then removed from the PWB with a low wattage iron. Replace component, do not use again.

- Before removing an integrated circuit from a PWB, note orientation of the pin locating tab and insure the replacement component is reinstalled in exactly the same way.



- Because of the double-sided construction used on PW boards, a component lead may be soldered to land areas on the top and bottom of the PWB. Consequently, when a component lead is removed, the replacement component should be resoldered the same way. Note that excessive heat can damage the plated-through holes and possible the component itself.

- Overheating a printed circuit conductor may cause the copper to pull loose from the board. Apply only the minimum amount of heat necessary for component removal or replacement. The use of a soldering iron in the 25 to 40 watt range is recommended.

- A solder sucker (de-soldering vacuum-tool) is very useful for removing multi-lead components which cannot be readily cut loose with diagonal cutters, or which are only to be temporarily removed. This type of tool also minimizes PWB damage and will not easily overheat the component.

- A convenient device to use in place of a solder-sucker is a roll of Solder-Wick, manufactured by Solder Removal Co., Covina, California. This full-saturated copper-braid is often more effective than a solder-sucker for removing solder from PW boards. However, care must be exercised when using solder braid not to overheat the component. The braid should ideally be placed directly on the solder itself as close to the component lead as possible without actually touching it. Always use the flat edge of the iron when using braid, as this speeds the heating process.

- Never attempt to perform any of the above techniques while the PWB is still installed in the transceiver. Remove the board from the card cage and place it on a flat work surface before attempting to solder.

5.6 GENERAL REPAIR AND DIAGNOSTIC TECHNIQUES

The following paragraphs present suggested methods of handling integrated circuits, methods of conversion of measurement units used throughout this manual, and interpretation of basic logic elements in schematic form for reference during repair and analysis of the RF-2301. For specific troubleshooting information, see paragraph 5.7.

5.6.1 MOSFET Replacement

When handling and replacing MOSFET (Metal-Oxide Substrate Field-Effect Transistor) devices, the following three (3) steps should be performed:

1) Remove new MOSFET from package. The four leads will be connected together with a small ferrule or wire to prevent static voltage differences from developing between the gate and substrate terminals. If the ferrule is present, wrap several turns of small solid wire around the leads and then remove the ferrule.

2) Position the four leads and carefully install the MOSFET on the PWB.

3) Remove the jumper(s) only after the leads have been soldered.

5.6.2 CMOS Handling and Replacement

All CMOS (Complementary Offset Symmetry Metal-Oxide Semiconductor) devices have diode input protection against adverse electrical environments such as static electricity.

Although devices contrain circuitry to protect inputs against damage due to high voltages or electrical fields, precautions should be taken to avoid application of any voltage higher than maximum rated voltages.

Unfortunately, severe electrical conditions can develop during the process of handling. For example, static voltages generated by a person walking across a common waxed floor have been measured in the 4 to 15 KV range. This depends to a great extent upon the humidity, surface conditions, friction, and other factors. These static voltages are potentially disasterous when discharged into a CMOS input, considering the energy stored in the human body at these voltage levels.

Present CMOS gate protection structures can generally protect against overvoltages. However, these same structures will break down under severe conditions such as described above. Following are some suggested handling procedures for CMOS devices, many of which apply to most semiconductors.

1) All CMOS devices should be stored or transported in materials that are somewhat conductive. CMOS devices must never be inserted into conventional plastic packing material or plastic trays.

2) Avoid contact with the leads of the device. The component should always be handled very carefully by the ends or the side opposite the leads.

3) Avoid contact between PWB circuits or component leads and synthetic clothing while handling static sensitive devices or assemblies containing them.

4) Do not insert or remove CMOS devices from test sockets with power applied. Check all power supplies to be used for testing CMOS devices to be certain that the voltage is correct, and that no transients are present.

5) When lead straightening or hand soldering is necessary, provide additional ground straps for the equipment and tools used. Never use a soldering gun.

6) Never exceed the maximum rated voltages for each type of device as listed on the data sheets in Part VII, "Integrated Circuits and Mini-Modules".

7) Double check test equipment setup for correct polarity of voltage before conducting any tests. Reversed polarity is usually fatal to most CMOS devices.

8) All unused device inputs should be connected to V_{DD} or V_{SS} according to the data sheet for that particular device.

When replacing CMOS devices in a PWB, it is recommended that the same procedures for replacing MOSFET devices be followed (see paragraph 5.6.1). In general, once a CMOS device has been re-installed there exists little possibility of damaging the device due to static voltages. However, care should be exercised nevertheless to insure that all interfaces to/from the assembly are referenced to the same ground point as the assembly.

5.6.3 Conversion of Measurement Units

RF power levels in this manual are stated in dBm, or decibels with respect to 1 milliwatt. For example, +6 dBm means '6 dB more than 1 milliwatt' or 4 mW. Similarly, -6 dBm means '6 dB less than 1 milliwatt' or .25 mW. Note that all values relate specifically to the impedance against which 1 milliwatt is referenced, in this case 50 ohms. Thus, every value of dBm corresponds to a particular amount of power. If the impedance into which this power is dissipated is known, then the corresponding voltage and current can be determined. Conversely, if the impedance and voltage are known, then the power in dB can also be determined. Most test measurement equipment are scaled in both V and dB. Table 5-3 lists 50-ohm voltage equivalents for many dBm power levels. Note that the negative values of dBm vs. voltage are read in the lefthand columns, whereas positive values of dBm are read in the righthand column. For example, -6 dBm equals .112V (112 mV) across 50 ohms, while +6 dBm equals .446V. Similarly, -20 dBm equals 22.4 mV while +20 dBm equals 2.24 volts across 50 ohms.

5.6.4 Logic Interpretation

Many counting and control functions in the RF-2301 are implemented through the use of digital information circuits. The basic circuits and elements (gates, flip-flops, etc.) are binary in nature; that is, the output of each type of device can lie only in one of two permissible areas.

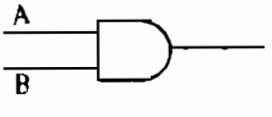
The two possible states of each element are called 'logical 1' and 'logical 0'. The assignment of voltage levels to these states is arbitrary, however, in this technical manual, positive logic is standardized, which means that the two logical states are defined as shown:

		TTL	CMOS
logical 1:	Normally more than	2.4V	7.0V
logical 0.	Normally less than	1.0V	3.0V

The following paragraphs generally describe the basic digital logic elements which comprise virtually all digital integrated circuits. Further information may be obtained on the parametric operation of any one integrated circuit by referring to paragraph 5.9, 'Integrated Circuit Data and Details'.

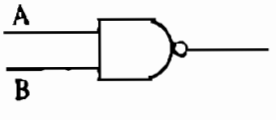
Note: *Logic '1' = +10V and Logic '0' = 0V. Frequency control lines are positive true input (add activating levels).*

A gate is a circuit element whose output level depends on the states of all of the inputs in a specific and particular pattern.



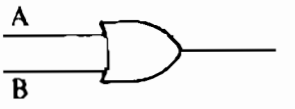
INPUTS		OUTPUT
A	B	
0	0	0
1	0	0
0	1	0
1	1	1

For an AND gate, the output is 1 if and only all inputs are 1. The output is 0 if any or all inputs are 0. A truth table that lists all possibilities for a two input AND is shown above.



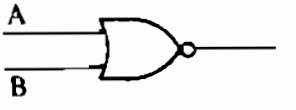
INPUTS		OUTPUT
A	B	
0	0	1
1	0	1
0	1	1
1	1	0

The outputs of the NAND gate are the opposite of the AND gate.



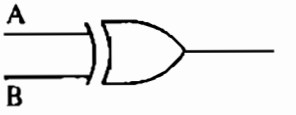
INPUTS		OUTPUT
A	B	
0	0	0
1	0	1
0	1	1
1	1	1

The output of the OR gate is 1 if any (or all) inputs are 1.



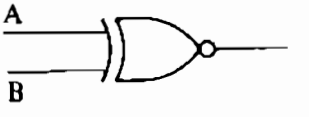
INPUTS		OUTPUT
A	B	
0	0	1
1	0	0
0	1	0
1	1	0

The outputs of the NOR gate are the opposite of the OR gate.



INPUTS		OUTPUT
A	B	
0	0	0
0	1	1
1	0	1
1	1	0

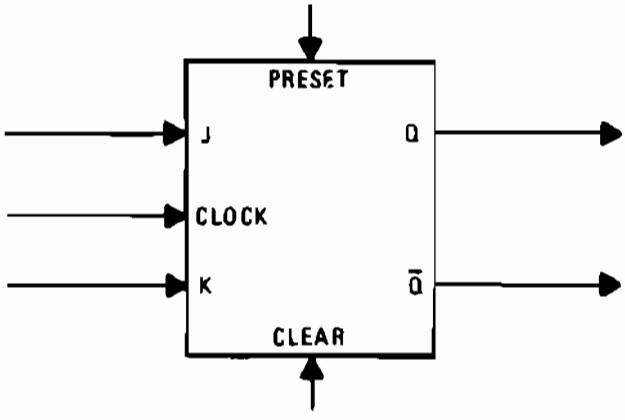
The output of the exclusive OR gate will be 1 only if one or the other of the inputs are high, but not for both



INPUTS		OUTPUT
A	B	
0	0	1
0	1	0
1	0	0
1	1	1

The outputs of the exclusive NOR gate are opposite of the exclusive OR gate.

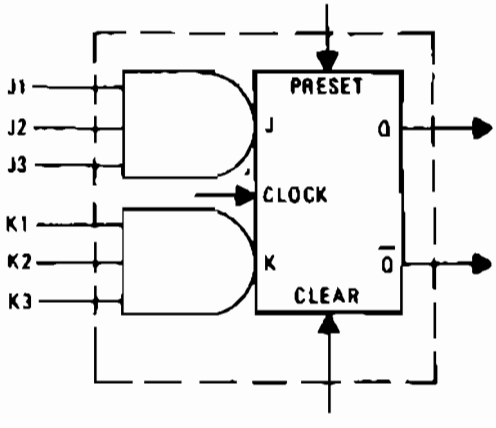
A flip-flop has memory, i.e., it stores a logic state. The logical symbol of the binary storage element called a JK flip-flop (abbreviated FF) is shown below. The state of the FF is referred to by the condition of the Q output. For example, if the Q output is high, the FF is set. FF has a 1 output. The Q output is always at the opposite level of the $\overline{Q}$ output.



The state of the FF can be changed in two ways: by means of the CLOCK input or by means of PRESET and CLEAR inputs. The effect of an applied clock pulse on the state of an FF depends upon the J and K inputs. The J input must be high for an applied clock pulse to cause a 1 output; similarly, the K input must be high and a clock pulse applied to cause a 0 output. If both J and K are kept high, the FF toggles (changes state) on each applied clock pulse.

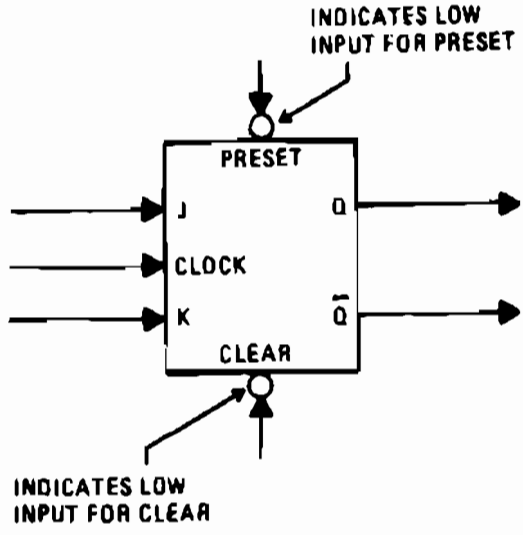
The PRESET and CLEAR inputs operate independently of the clock. A high level input to PRESET drives the FF to 1 (if it is not already at 1) while a high level input to CLEAR drives the FF to 0 (if it is not already at 0).

There are many variations of the basic JK flip-flop. For example, a circuit may have several J and K inputs.



Because of the AND gates, all J's or K's must be high in order to toggle with an applied clock pulse.

Some circuits PRESET or CLEAR with a low level input instead of a high level. This is indicated by a "circle" at the appropriate input terminal.



Digital Control lines used in the RF-2301 system, whether tri-state bus, open collector bus, or direct logic driven, all respond to 10V CMOS levels. Zero and 1 logic level references are commonly used to describe these HI and LO logic levels are as follows:

- 1 = HI = Nominally 7 through 10 Vdc
- 0 = LOW = Nominally 0 through 1.4 Vdc

5.7 TROUBLESHOOTING

The following information is presented as a guide to diagnosing and localizing detected problems within the RF-2301 transceiver. Table 5-7 below lists a number of possible symptoms, possible causes, and points to check. For individual subassembly maintenance information, refer to the indexed Unit Instructions section for the subassembly in question.

5.8 ALIGNMENT PROCEDURE/TEST POINT INFORMATION

The RF-2301 Transceiver is aligned at the factory and thoroughly tested prior to shipment to insure operation compatible with the published specifications (see paragraph 1.3). However, when replacing or repairing certain assemblies within the transceiver, it may become necessary to realign the transceiver. In these cases, the following procedure should be observed:

Table 5-7. Troubleshooting Information

Symptom or Malfunction	Possible Cause	Check:
Transceiver will not operate (dead)	1. Power Supply malfunction 2. Transceiver malfunction	1. Supply and all cables. 2. All fuses, input voltage, 1A3A1 TP2, 1A1A7 TP6 and TP1 (see paragraph 5.8).
Poor receiver sensitivity.	1. 1A1A6 Mixer PWB 2. 1A1A4 IF/Audio PWB 3. Defective antenna or cable.	1. LO injection levels, PA Filters switching, and RF section. 2. Antenna system/connectors
Poor receiver selectivity.	1. 1A1A6 AM or SSB filter. 2. Improper bandpass filter selection.	1. 1A1A6 PWB filter switching 2. 1A1A1 and 1A1A2 PWB's
High audio output distortion	1. 1A1A4 IF/Audio PWB. 2. Monitor level misadjusted.	1. 1A1A4 Maintenance section. 2. R54 on 1A1A4 assembly.
Transmitter will not operate, but receiver operates OK.	1. 1A1A5 malfunction. 2. RX ONLY switch set to ON position (1A1A7 PWB).	1. Proper codes and keyline enable functions. 2. Check 1A1A7 option switches.
Low RF output level.	1. Defective 1A3A1 assembly 2. Defective PA Control PWB.	1. 1A3A1 maintenance section. 2. 1A1A3 maintenance section, particularly ALC, overcurrent, VSWR, overtemp, or over dc voltage cutback.
Poor or no carrier suppression in SSB modes	1. FL1-FL2 on Mixer PWB. 2. U11 on processor PWB	1. 1A1A6 maintenance section. 2. 1A1A5 maintenance section
Transmitter will not tune antenna coupler (flashing FAULT indication)	1. RF-281 Antenna Coupler malfunction 2. 1A1A5 Processor PWB. 3. Antenna System.	1. Tune Power Request line and transmitter keyline(s). 2. TP4 and TP7 (low RF power out) 3. Possible short or open condition
Improper squelch or mute operation	1. 1A1A4 IF/PWB. 2. 1A1A5 Processor PWB.	1. Squelch Adjustment 2. 1A1A5 maintenance section.

1. Perform the test presented in paragraph 3.2.2, "Turn On Initial Tests" on page 3-5

2. If a specific problem has been detected, refer to the troubleshooting information presented in the preceding paragraph.

3. Check all assembly test points as shown in Table 5-8 below.

4. Upon determining that a particular parameter listed in Table 5-8 is not observed, refer to the indexed Unit Instructions section for alignment information concerning the subassembly in question.

5. If it does not seem possible to localize the faulty assembly, refer to paragraph 5.2 for suggestions concerning fault identification and isolation.

Table 5-8. Test Point Locations and Functions

ASSEMBLY	TEST POINT	DESCRIPTION/SIGNAL OBSERVED	COLOR
1A1A3	TP1	ALC (1.4-9.5 Vdc, 1.4V = max pwr reduction)	Brown
PA Control	TP2	Current Cutback test (1.7V = cutback)	Red
	TP3	Overvoltage Cutback control line (6.4 V = cutback)	Orange
	TP4	Thermal Cutback test (1.7V = cutback)	Yellow
	TP5	Keyline Enable control line (0.7V = Disable)	Green
1A1A4	TP0	AGC Control Voltage	Black
IF Audio	TP1	9 MHz Input (0.5 uV to 71 mV RMS)	Brown
	TP2	AGC test (0.34 to 8.0 Vdc)	Red
	TP3	IF Output (57 mV RMS 1 mV RF Input @ 9 MHz)	Orange
	TP4	Detected Audio (1 mV RF input = 110 mV RMS)	Yellow
	TP5	VF Filter Output (250 mV RMS 1 mV RF input)	Green
	TP6	600 Ohm Audio (0 to +10 dBm 1 mV RF input)	Blue
	TP7	Squelch Audio Output (225 mV RMS 1 mV RF input)	Violet
	TP8	Syllabic Detector Output (5 Vdc ± 1.5 V @ 16 Hz)	Grey
	TP9	Squelch Control Voltage Ref. (±1.5 Vac)	White
	TP10	Hang Time Threshold Voltage (5.4 V typ.)	Black
1A1A5	TP1	9 MHz Mixer Input Level (+7 dBm)	Brown
Processor	TP2	Mixer Audio Input Level (44 mV RMS)	Red
	TP3	ACC Control Level (0 to 8.5 Vdc)	Orange
	TP4	AM PCS Level to Mixer (11 dBm to 27 dBm)	Yellow
	TP5	600 ohm Transmit audio (120 mV RMS 0 dBm)	Green
	TP6	CW Enable condition (9 Vdc)	Blue
	TP7	AM Enable (9 Vdc transmit)	Violet
	TP8	Mic Clipper Output (.25-.30V P-P @ 1 KHz	Grey
1A1A6	TP1	ALC (1.4-9.5 Vdc; 1.4V = max pwr reduction)	Brown
Mixer	TP2	SSB AM Filter Input Output (switched)	Red
	TP3	Not Used	Orange
	TP4	1st Mixer Input (14 dBm in tramsit mode)	Yellow
	TP5	2nd Mixer Input (16 dBm in transmit mode)	Green
	TP6	2nd Mixer bias adj. (aprox. 1.8 Vdc)	Blue
	TP7	RF Input Output (20 dBm in transmit mode)	Violet
1A1A7	TP1	24 VDC	Brown
Memory	TP2	Rechannel Pulse (+10 V) 1 KHz	Red
Assembly	TP3	Rechannel Pulse (+10 V) Channel program pwr up	Orange
	TP4	3.33 Hz Programming sequence clock	Yellow
	TP5	0 Vdc = Transmit Data, 10 Vdc = Receive Data	Green
	TP6	Regulated +10 Vdc output	Blue
	TP7	Chip Select line (Freq. mode = 0V, Ch. mode = 10V)	Violet
	TP8	Represents C1 bit of control mode input to EAROM	Grey
	TP9	Blank line momentary +10V when programming	White
	TP10	Represents C2 bit of control mode input to EAROM	Black
1A1A8 L.O. #2	TP1	Normal operating voltage range = 2.75 ~ 7.6 VDC	Brown
1A1A10	TP1	Loop Filter Output – Normal range is 1.5 – 6.5 VDC	
L.O. #1		for freq between 1.6 and 9.90 MHz and 1 – 6.5 VDC	Brown
		and freq between 10.00 and 29.90 MHz	
1A2A2	TP1	Coupler Fault (+10 Vdc = coupler fault)	Brown
Interface	TP2	Indication of AGC Receive (no signal = 0 Vdc)	Red
Assembly	TP3	Indication of reflected power (5.5V open circuit)	Orange
	TP4	Synthesizer Fault (normal condition = 0 Vdc)	Yellow
	TP5	PA Fault (normal condition = 0 Vdc)	Green
	TP6	Forward Power (+6.5 Vdc @ 125 watts output)	Blue
	TP7	Mode (Freq mode = 0 Vdc, Channel mode = 10 Vdc)	Violet
	TP8	DIM control voltage (2.6 to 8.0 Vdc)	Grey
1A3A1	TP1	Final Test Output (11.5 Vdc @ 125 watts)	Brown
RF Amplifier	TP2	B+ Test output (13.8 Vdc)	Red
	TP3	Pre-Driver Output (5.7 Vdc @ 125 watts)	Orange
	TP4	Driver Output (11.8 Vdc @ 125 watts)	Yellow
	TP5	Pre-Driver Bias (.3 Vdc keyed, no modulation)	Green
	TP6	Keyline (0 Vdc = keyed condition)	Blue

5.9 LIST OF MANUFACTURERS

Table 5-9. List of Manufacturers

CODE NUMBER	MANUFACTURER'S NAME AND ADDRESS
14304	RF Communications Division Harris Corp. 1680 University Avenue Rochester, NY 14610
81349	Government Bureau of Military Specifications, Promulgated by Standardization Division, Directorate of Logistic Services DSA

5.10 INTEGRATED CIRCUIT DATA AND DETAILS

The following is a quick reference index of complex integrated devices used in the RF-2301 transceiver. Supplementary data may be obtained by referring to the individual assembly index in Part IV, 'Functional Description'.

When replacing integrated circuits, other manufacturer's devices of the same generic number may be used. However, devices from Harris Corporation, RF Communications Division, are preferred because each has been pre-screened for higher reliability. This is especially true of CMOS devices, which require special handling and packaging.

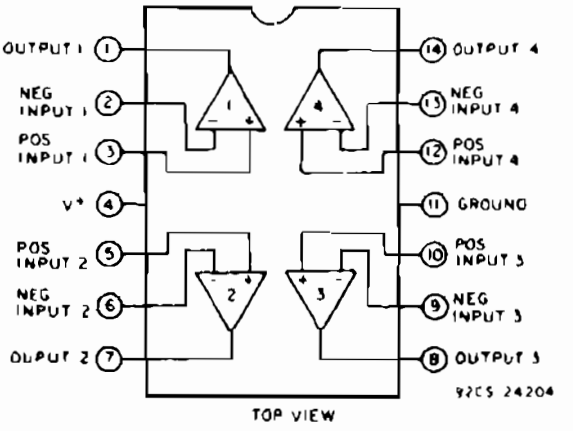
Table 5-10. Integrated Circuit Index

Type	Function	Page
CA324	Quad Operational Amplifiers	5-19
CA55	Timer	5-20
CA810Q	7-Watt Audio Power Amplifier	5-21
CA3028AS	Differential/Cascode Amplifier	5-22
CA-3081	Common Emitter NPN Transistor Array	5-23
CA3096AE	N-P-N/P-N-P Transistor Array IC	5-24
CA3130AS	Operational Amplifier	5-25
CD4001AE	Quad 2-Input NOR Gates	5-26
CD4008AE	4-Bit Full Adder	5-27
CD4010	Hex Buffers/Converters	5-28
CD4011AE	Quad 2-Input NAND Gate	5-29
CD4012A	NAND Gates	5-30
CD4017AE	Decade Counter	5-31
CD4023E	Triple 3-Input NAND Gates	5-32
CD4023B	Triple 3-Input NAND Gates	5-33
CD4024AE	7-Stage Binary Counter	5-34
CD4025B	Triple 3-Input NOR Gates	5-35
CD4027A	Dual J-K Master-Slave Flip-Flop	5-36
CD4028AE	BCD-to-Decimal Decoder	5-37
CD4029A	Presettable Up/Down Counter	5-38
CD4030AE	Quad Exclusive OR Gate	5-39
CD4040A	12-Stage Ripple-Carry Binary Counter/Divider	5-40
CD4042AE	Quad Clocked "D" Latch	5-41
CD4046A	Micropower Phase-Locked Loop	5-42
CD4051BE	8 to 1 Multiplexer	5-44
CD4053	Triple 2-Channel Multiplexer	5-45
CD4060AE	14-Stage Ripple-Carry Binary Counter/Divider and Osc	5-46
CD4066AE	Quad Bilateral Switch	5-47
CD4068	8-Input NAND Gate	5-48
CD4070B	Quad Exclusive-OR Gates	5-49
CD4069BE	Hex Inverter	5-50
CD4071B	Quad 2-Input OR Gates	5-51
CD4073	AND Gates	5-52
CD4075BE	Triple 3-Input OR Gate	5-53
CD4077BE	Quad Exclusive NOR Gates	5-54
CD4081BE	Quad 2-Input AND Gate	5-55
CD4082	Dual 4-Input AND Gate	5-56
CD4096B	Gated J-K Master-Slave Flip-Flop	5-57
CD4097	CMOS Differential 8-Channel Multiplexer	5-58
CD4518B	Dual BCD Up-Counter	5-60
CD4532B	8-Bit Priority Encoder	5-61
ER2051	512 Bit Electrically Alterable Read Only Memory	5-62
FCS11C90	650 MHZ ÷ 10/11 Prescaler	5-64
LM317T	Adjustable Output Voltage Regulator	5-65
MC1350	IF Amplifier	5-66
MC1723CL	Monolithic Voltage Regulator	5-67
MC3340P	Electronic Attenuator	5-68
LM386N-1	1/4 Watt Audio Amplifier	5-69
MC4044P	Phase Detector TTL	5-70
MC7805CT	Positive 5 Volt Regulator	5-71
MM80C97	Hex Tri-Stage Non-Inverting Buffers	5-72
SN74LS00	Quadruple 2-Input Positive NAND Gates TTL	5-73
SN74LS27	Triple 3-Input Positive NOR Gate TTL	5-74
SN74LS163	Synchronous 4-Bit Binary Counter TTL	5-75
SN74LS190	Synchronous Up/Down BCD Counter TTL	5-76
SN7470	AND Gated J-K Flip-Flop TTL	5-77
SN78L05	Three Terminal Positive Fixed Voltage Regulator	5-78
6628-0666	Balanced Mixer	5-79
10007-0241	PROM, Display Decoder	5-80

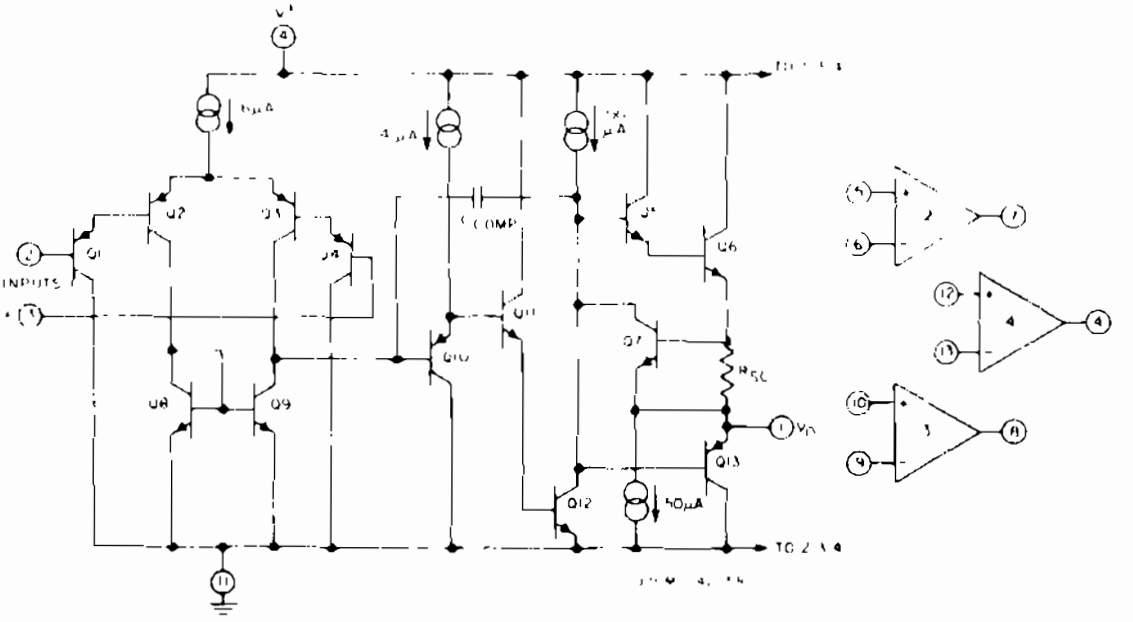
CA324 OR LM324

QUAD OPERATIONAL AMPLIFIERS
BIPOLAR LINEAR

This device consists of four independent, high-gain operational amplifiers on a single monolithic substrate. An on-chip capacitor in each amplifier provides frequency compensation for unity gain. A functional diagram of the complete device and a schematic diagram representative of all four amplifiers is shown below. These devices will operate from single or dual supplies, and the differential voltage range is equal to the power supply voltage.



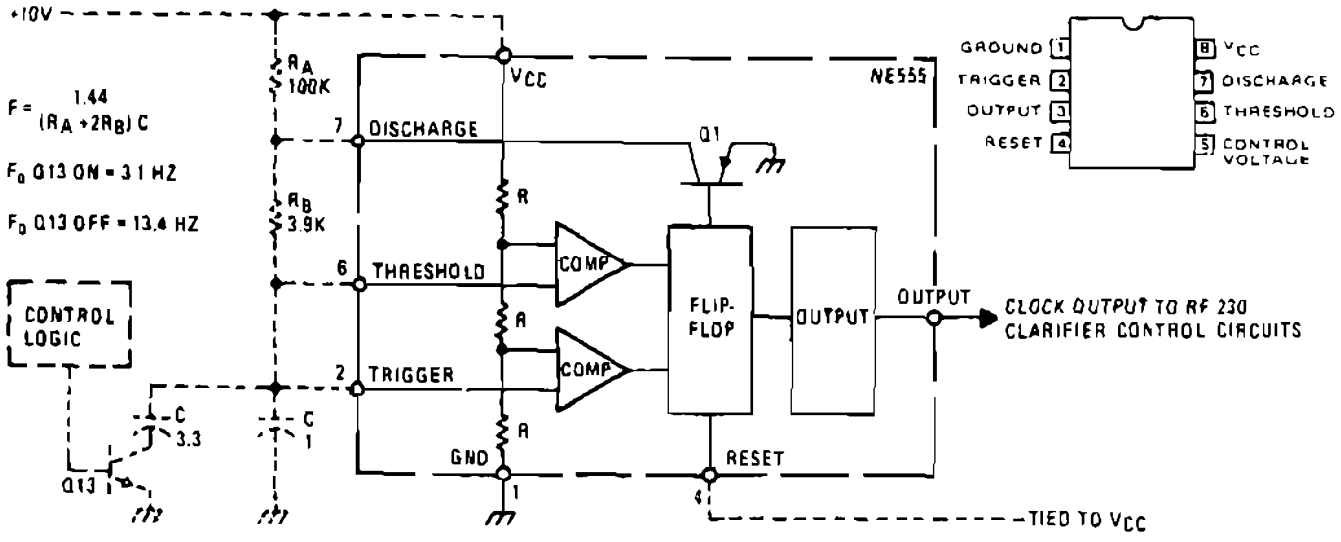
Functional diagram.



Schematic diagram—one of four operational amplifiers.

CA555
TIMER

The CA555 Timer consists of two voltage comparators, a bistable flip-flop, a discharge transistor, and a resistor divider network. This device is used as an "Astable" (free running) oscillator in the RF-230 (1A1A10U6). The block diagram below demonstrates this application.



The resistive divider network is used to set the comparator levels. Since all three resistors are of equal value, the threshold comparator is referenced internally at 2/3 of supply voltage level and the trigger comparator is referenced at 1/3 of supply voltage. The outputs of the comparators are tied to the bistable flip-flop. When the trigger voltage is moved below 1/3 of the supply, the comparator changes state and sets the flip-flop driving the output to a high state. The threshold pin normally monitors the capacitor voltage of the RC timing network. When the capacitor voltage exceeds 2/3 of the supply, the threshold comparator resets the flip-flop which in turn drives the output to a low state. When the output is in a low state, the discharge transistor is "on", hereby discharging the external timing capacitor. Once the capacitor is discharged, the timer will await another trigger pulse, the timing cycle having been completed. By proper selection of external components, oscillating frequencies from one cycle per half hour to 500 kHz can be realized.

In the Astable mode, the trigger is tied to the threshold pin. At power up, the capacitor is discharged, holding the trigger low. This triggers the timer, which establishes the capacitor charge path thru R_A and R_B. When the capacitor reaches the threshold level of 2/3 Vcc, the output drops low and the discharge transistor turns on.

The timing capacitor now discharges thru R_B thru Q1. When the capacitor voltage drops to 1/3 Vcc, the trigger comparator trips, automatically retriggering the timer, creating an oscillator whose frequency is given by:

$$f = \frac{1.49}{(R_A + 2R_B)\,C}$$

There are three significant times; T1, T2, and T_T. Time 1 (T1) is the time that the output is HIGH and can be calculated as follows:

$$T1 = 0.693\,(R_Z + R_B)\,C$$

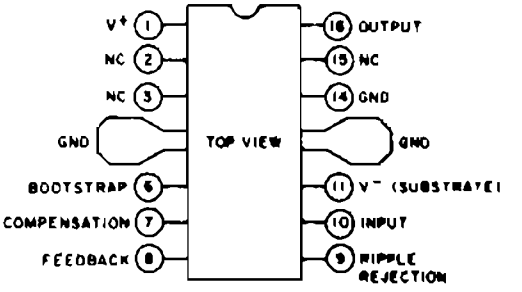
Time T2 is the time that the output is low, and can be calculated as follows:

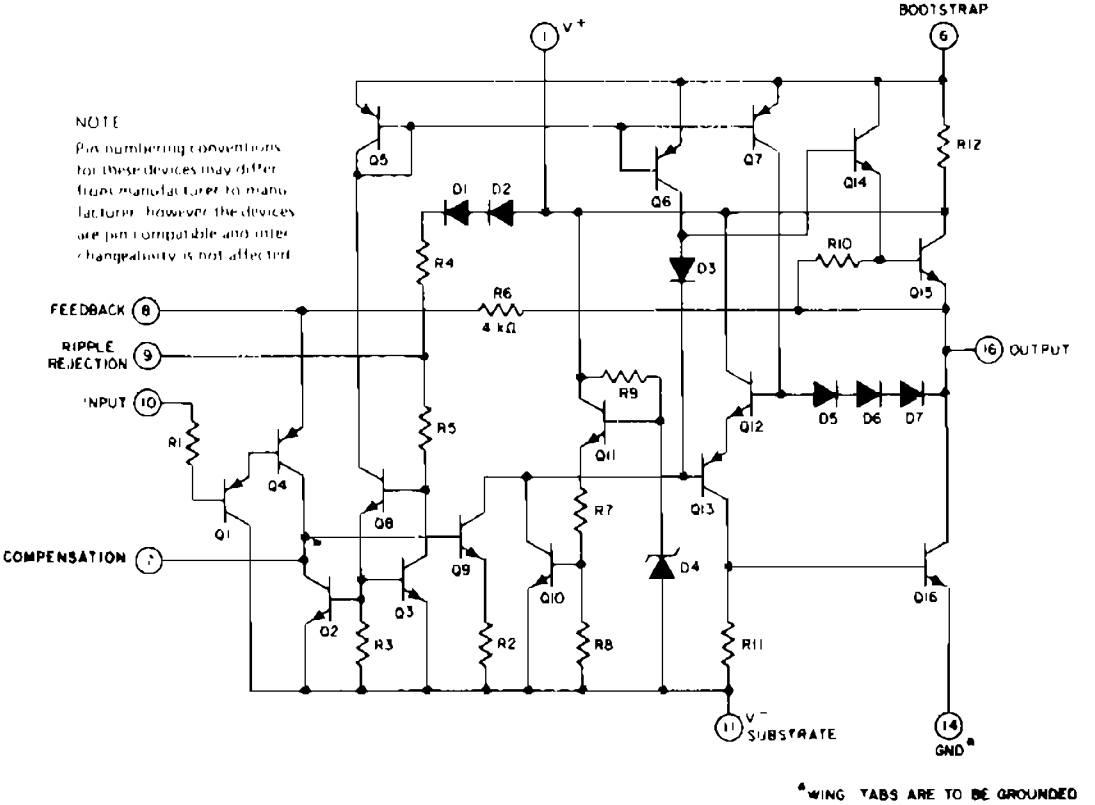
$$T2 = 0.693\,(R_B)\,C$$

Total time (T_T) is derived by simply adding T1 + T2.

CA 810Q OR TB A810S
7-WATT AUDIO POWER AMPLIFIER
BIPOLAR LINEAR

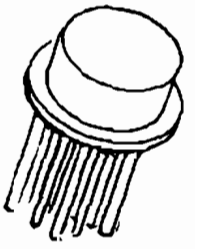
The CA810Q is a monolithic audio amplifier designed specifically for 12V battery supply operation. The amplifier will operate with supply voltages of from 4 to 20 V with very low harmonic or crossover distortion. The maximum repetitive peak output current is 2.5A. An integral thermal limiting circuit shuts the device down in case of output or temperature overloads.



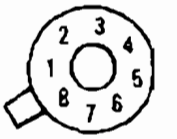


CA 3028AS
DIFFERENTIAL/CASCADE AMPLIFIER
BIPOLAR LINEAR

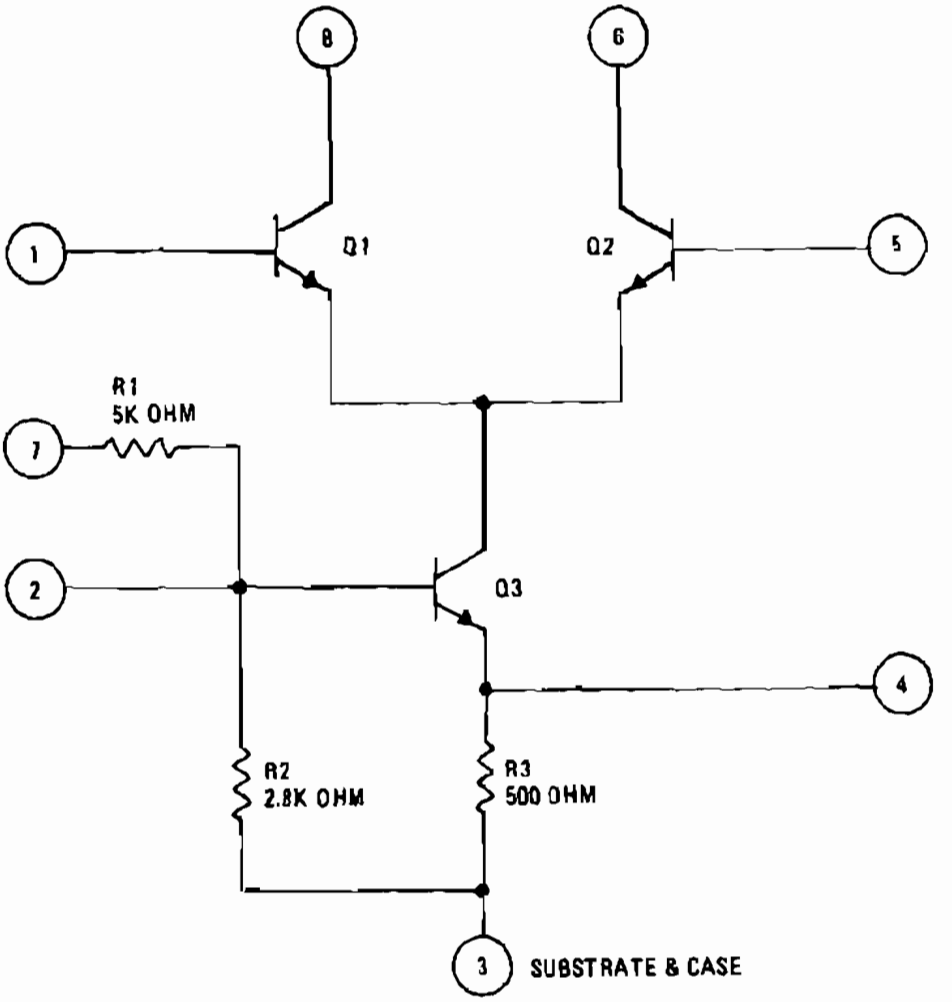
The CA 3028 is controlled for input offset voltage, input offset current, and input bias current. The device has a controlled constant current source for balanced differential amplifier operation.



TO5 PACKAGE



BASE DIAGRAM



CA3081, CA3082 Types

General-Purpose High-Current N-P-N Transistor Arrays

CA3081–Common-Emitter Array **CA3082–Common-Collector Array**

Directly Drive 7-Segment Incandescent Displays and Light-Emitting-Diode (LED) Displays

Features

- 7 transistors permit a wide range of applications in either a common-emitter (CA3081) or common-collector (CA3082) configuration
- High I_C: 100 mA max. ■ Low $V_{CE\ sat}$ (at 50 mA): 0.4 V typ.

Applications

- Drivers for:
  - Incandescent display devices (e.g. RCA NUMITRON DR2000 Series and lamps)
  - LED (e.g. RCA-SG1002 GaAs High-Efficiency Emitting Diode)
  - Relay control
  - Thyristor firing

RCA-CA3081* and CA3082* consist of seven high-current (to 100 mA) silicon n-p-n transistors on a common monolithic substrate. The CA3081 is connected in a common emitter configuration and the CA3082 is connected in a common-collector configuration.

The CA3081 and CA3082 are capable of directly driving seven-segment displays, such as the RCA NUMITRON devices (DR2000 and DR2010), and light-emitting diode (LED) displays. These types are also well-suited for a variety of other driver applications, including relay control and thyristor firing.

The CA3081 and CA3082 are supplied in a 16-lead dual-in-line plastic package, and the CA3081F and CA3082F in a 16-lead dual-in-line frit-seal ceramic package, which includes a separate substrate connection for maximum flexibility in circuit design.

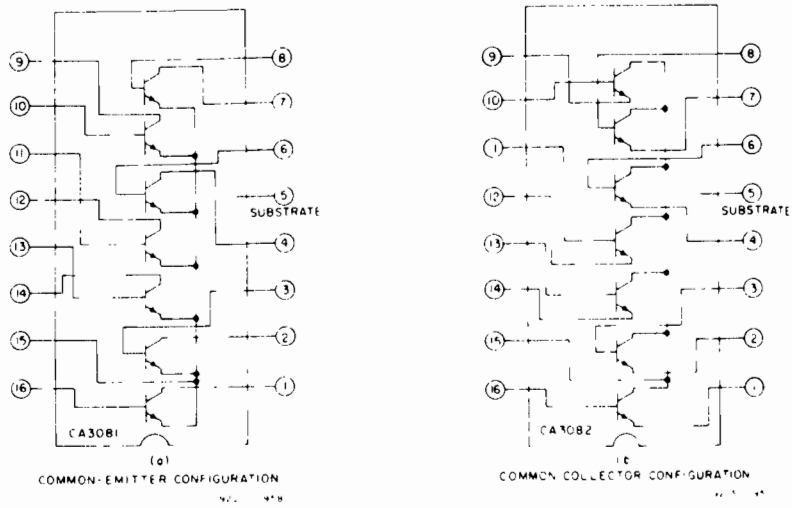


Fig 1 Functional diagrams of types CA3081 and CA3082

TYPICAL STATIC CHARACTERISTICS FOR EACH TRANSISTOR OF TYPES CA3081 AND CA3082

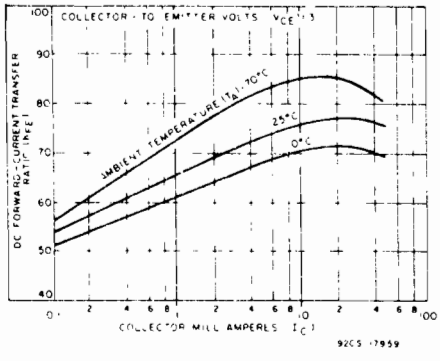


Fig 2–h_{FE} vs. I_C

MAXIMUM RATINGS, Absolute-Maximum Values at T_A = 25°C

Power Dissipation		
Any one transistor	500	mW
Total package	750	mW
Above 55°C	Derate linearly 6.67	mW/°C
Ambient Temperature Range		
Operating	−55 to +125	°C
Storage	−65 to +150	°C
Lead Temperature (During Soldering)		
At distance 1/16" ±1/32" (1.59 mm ±0.79 mm) from case for 10 seconds max.	265	°C
The following ratings apply for each transistor in the device		
Collector to Emitter Voltage (V_{CEO})	16	V
Collector to Base Voltage (V_{CBO})	20	V
Collector to Substrate Voltage (V_{CIO})■	20	V
Emitter to Base Voltage (V_{EBO})	5	V
Collector Current (I_C)	100	mA
Base Current (I_B)	20	mA

■ The collector of each transistor of the CA3081 and CA3082 is isolated from the substrate by an integral diode. The substrate must be connected to a voltage which is more negative than any collector voltage in order to maintain isolation between transistors and provide normal transistor action. To avoid undesired coupling between transistors the substrate terminal (5) should be maintained at either DC or signal (AC) ground. A suitable bypass capacitor can be used to establish a signal ground.

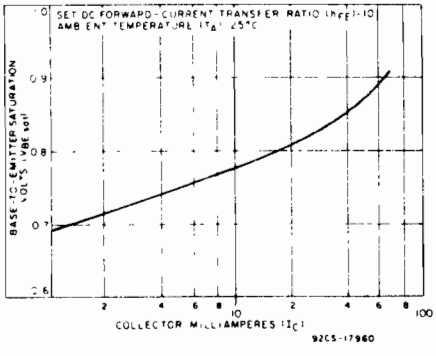


Fig.3–V_{BEsat} vs I_C

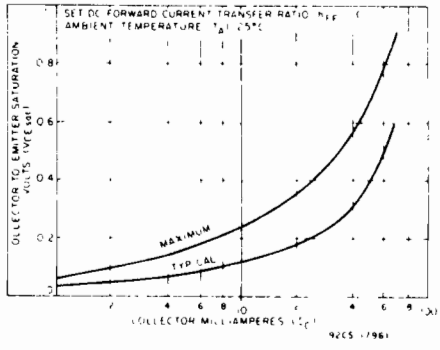


Fig.4–V_{CEsat} vs I_C at T_A = 25°C

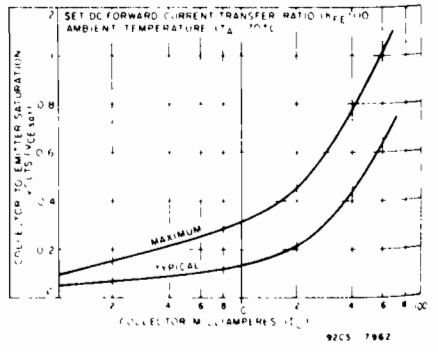
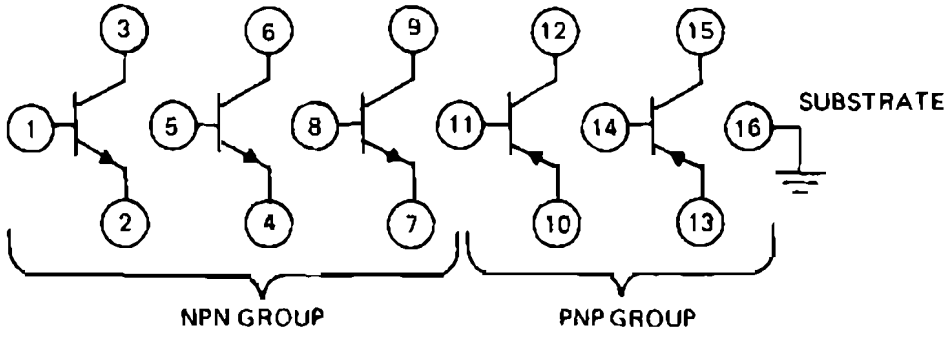
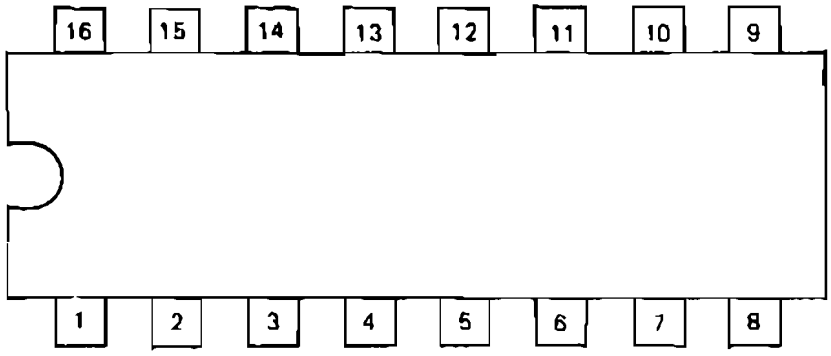


Fig 5 V_{CEsat} vs I_C at T_A = 70°C

CA3096AE
N-P-N/P-N-P TRANSISTOR ARRAY IC
BIPOLAR LINEAR

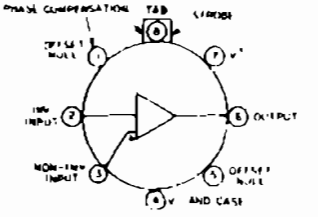


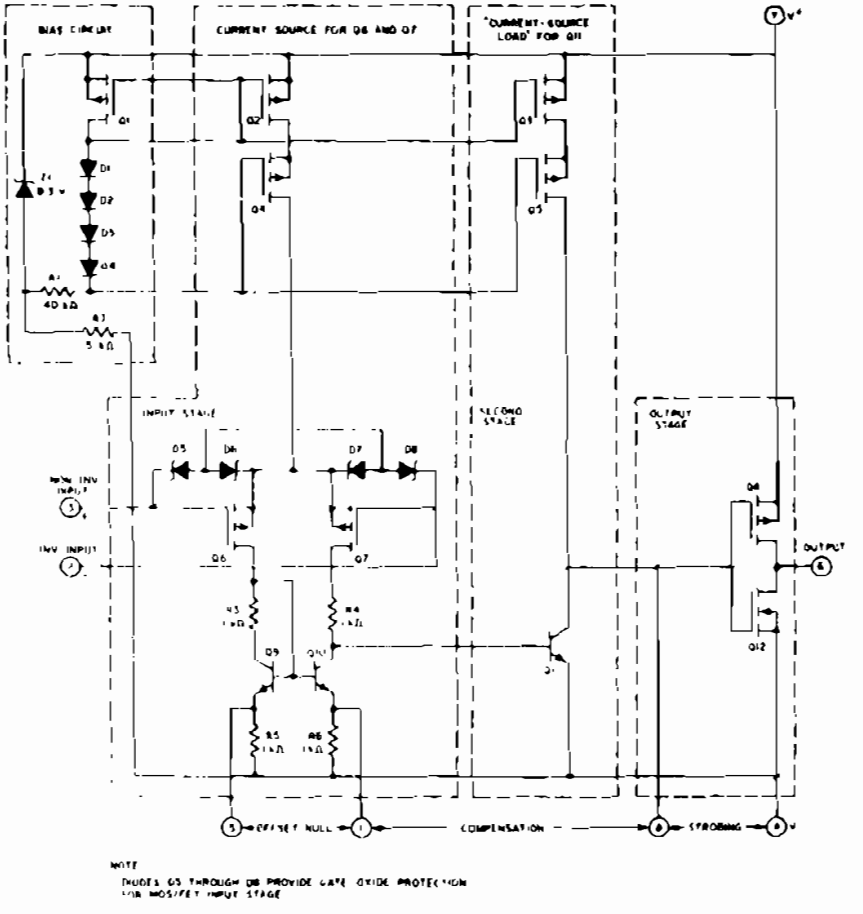


The CA3096AE is a general-purpose high voltage silicon transistor array. The array consists of five independent transistors on a common substrate. Two of the transistors are p-n-p, and three are n-p-n, as shown above. As IC1 on the Power Amplifier, the array is configured as a "sense" amplifier. Load current flowing through R56, the "sensing" element, generates a control voltage at pins 5 and 6 of IC1 This voltage is compared with a threshold reference voltage established by R49, and generates a control voltage at pin 12 of IC1. This 0-12 Vdc (approx.) control voltage can effect a 20 dB change in input drive level to the amplifier to reduce high operating currents to a desired safe level.

CA3130AS OPERATIONAL AMPLIFIER
CMOS LINEAR

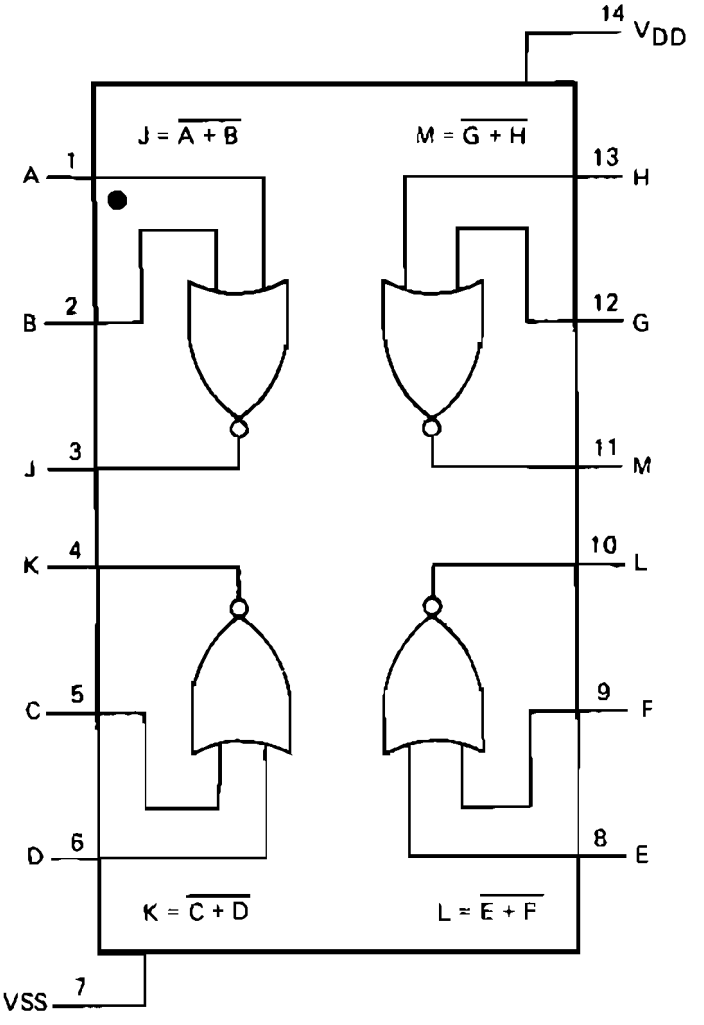
The CA3130 is an integrated-circuit operational amplifier on a monolithic chip. Gate-protected PMOS Transistors are used in the input and provide very high input impedance and common-mode input-voltage down to 0.5V below the negative supply terminal. A complimentary-symmetry MOS (COS/MOS) transistor pair at the output provides for output swings to within millivolts of either supply voltage. The device is shown schematically, and functionally below.

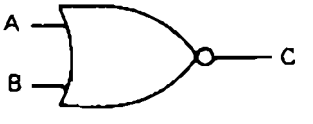




NOTE:
DIODES D5 THROUGH D8 PROVIDE GATE OXIDE PROTECTION FOR MOSFET INPUT STAGE

CD4001AE
QUAD 2-INPUT NOR GATES
CMOS DIGITAL



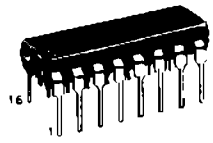


NOR TRUTH TABLE

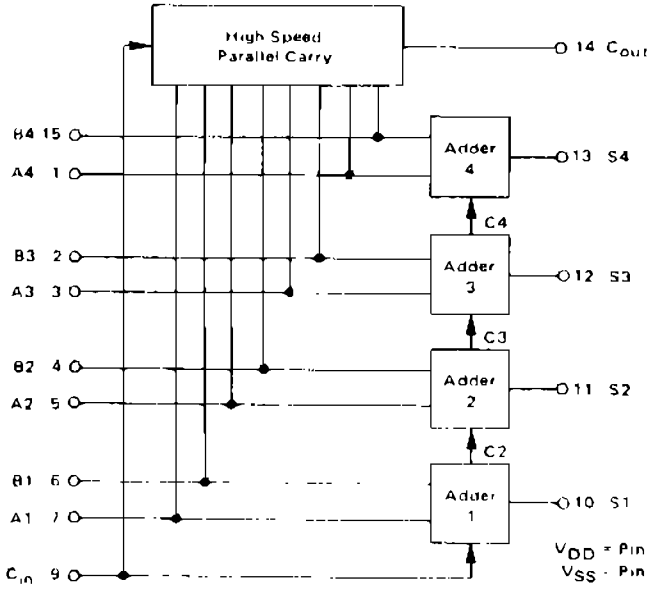
A	B	C
0	0	1
0	1	0
1	0	0
1	1	0

CD4008AE
4-BIT FULL ADDER
CMOS DIGITAL

The CD4008 consists of four full-adder stages as shown below. Inputs include the four sets of bits to be added, A1 to A4 and B1 to B4, in addition to the "Carry In" bit from a previous section. Outputs include the four sum bits, S1 and S4, in addition to the high speed "parallel-carry-out", which may be used at a succeeding CD4008 as shown in the typical application diagram.



BLOCK DIAGRAM

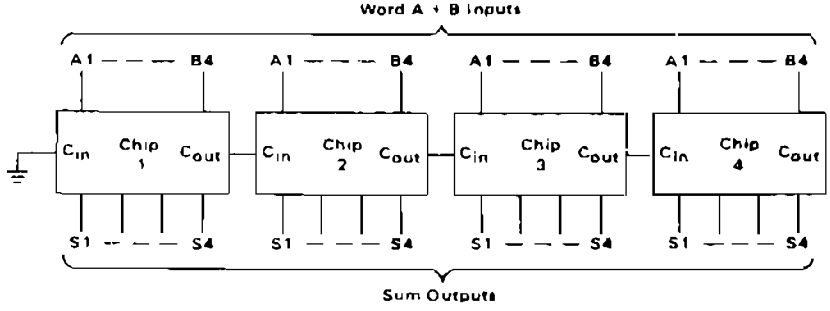


TRUTH TABLE
(One Stage)

C_{in}	B	A	C_{out}	S
0	0	0	0	0
0	0	1	0	1
0	1	0	0	1
0	1	1	1	0
1	0	0	0	1
1	0	1	1	0
1	1	0	1	0
1	1	1	1	1

TYPICAL APPLICATION

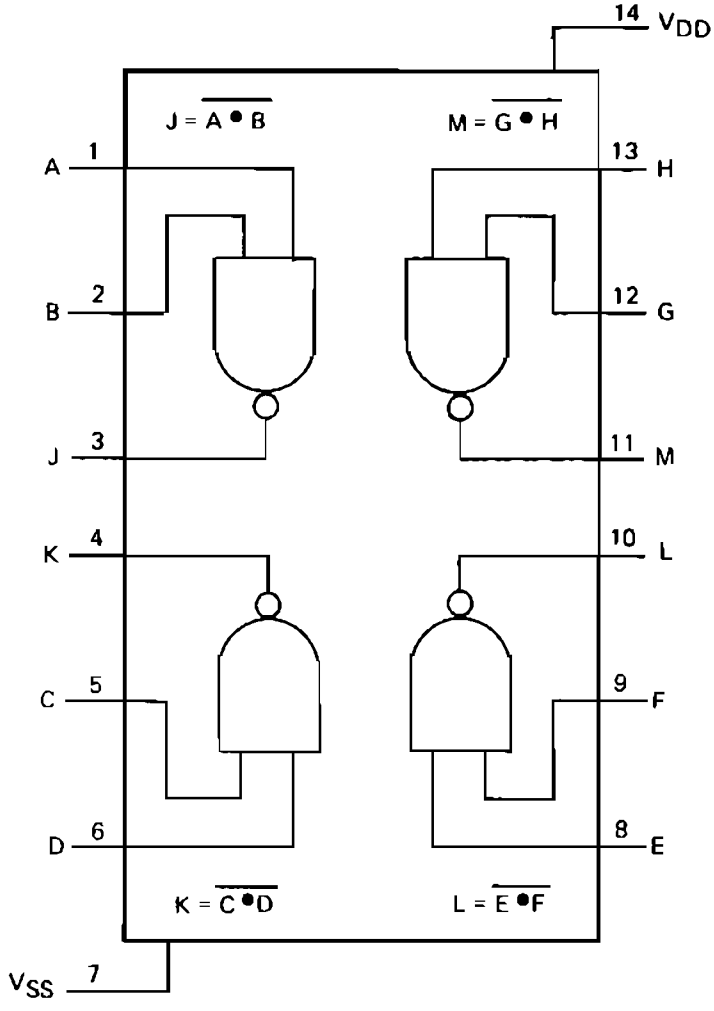
USING THE MC14008B IN A 16-BIT ADDER CONFIGURATION

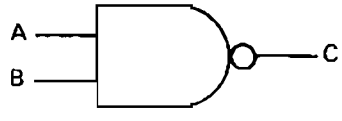


CD4011AE

QUAD 2 INPUT NAND GATE

CMOS DIGITAL

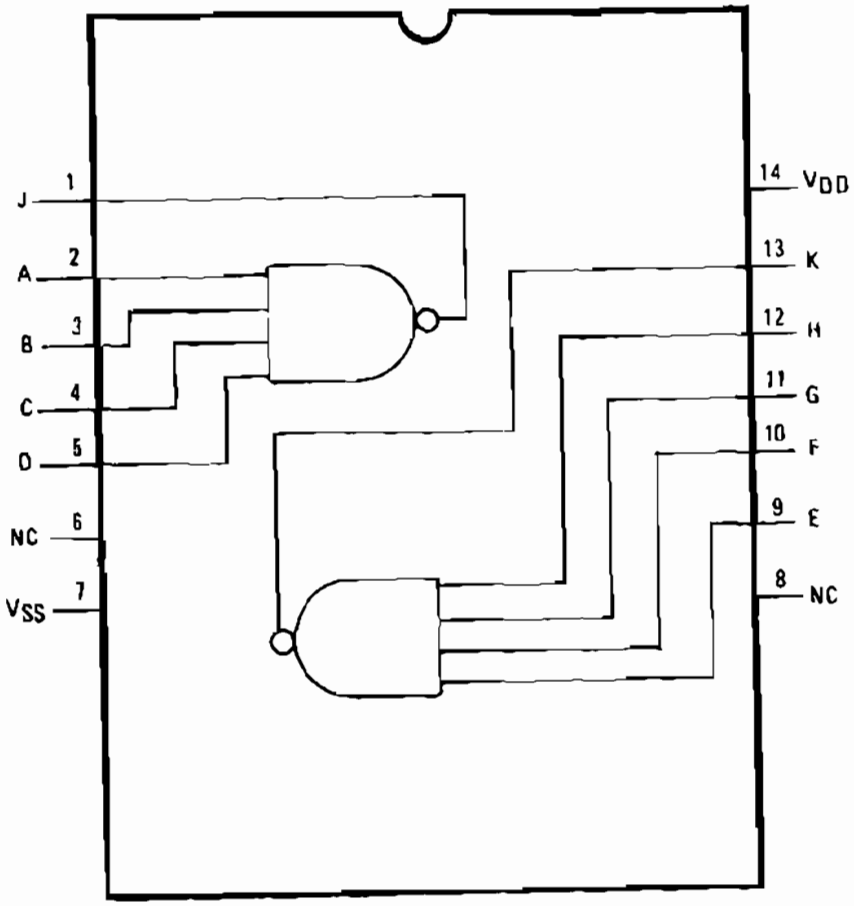




NAND TRUTH TABLE

A	B	C
0	0	1
0	1	1
1	0	1
1	1	0

CD 4012A
NAND GATES
CMOS DIGITAL



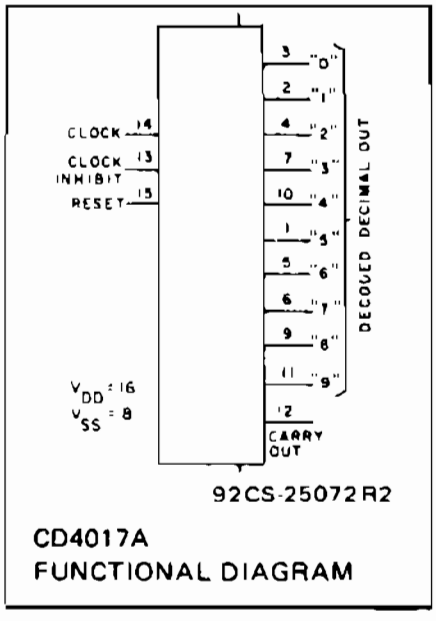
$J = \overline{A \cdot B \cdot C \cdot D}$

$K = \overline{E \cdot F \cdot G \cdot H}$

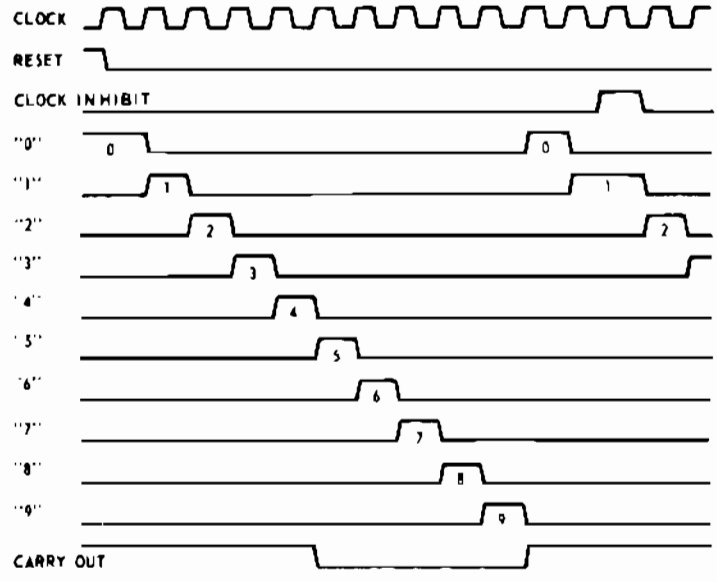
A	B	C	D	J
0	0	0	0	1
0	0	0	1	1
0	0	1	0	1
0	0	1	1	1
0	1	0	0	1
0	1	0	1	1
0	1	1	0	1
0	1	1	1	1
1	0	0	0	1
1	0	0	1	1
1	0	1	0	1
1	0	1	1	1
1	1	0	0	1
1	1	0	1	1
1	1	1	0	1
1	1	1	1	0

CD4017AE
DECADE COUNTER
CMOS DIGITAL

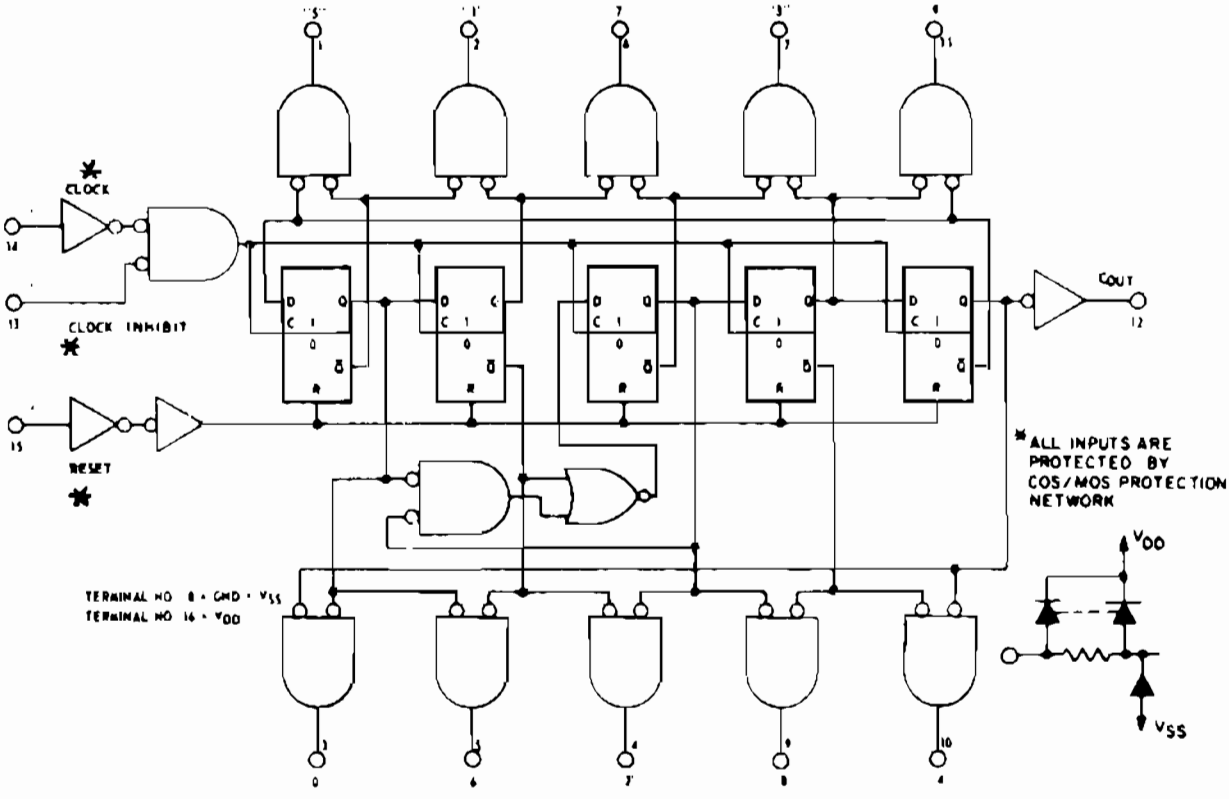
Consists of a 5-stage Decade Counter and an output decoder which converts the binary code to a decimal number. Inputs include a CLOCK, a RESET, and a CLOCK INHIBIT signal. The decade counter is advanced one count at the positive clock signal transition if the CLOCK INHIBIT signal is low. A high RESET signal clears the decade counter to its zero count. The 10 decoded outputs are normally low and go high only at their respective decimal time slot. Each decoded output remains high for one full clock cycle. A CARRY OUT (C_{OUT}) signal completes one cycle every 10 clock input cycles and is used to clock the succeeding decade directly, if in a multi-decade chain.



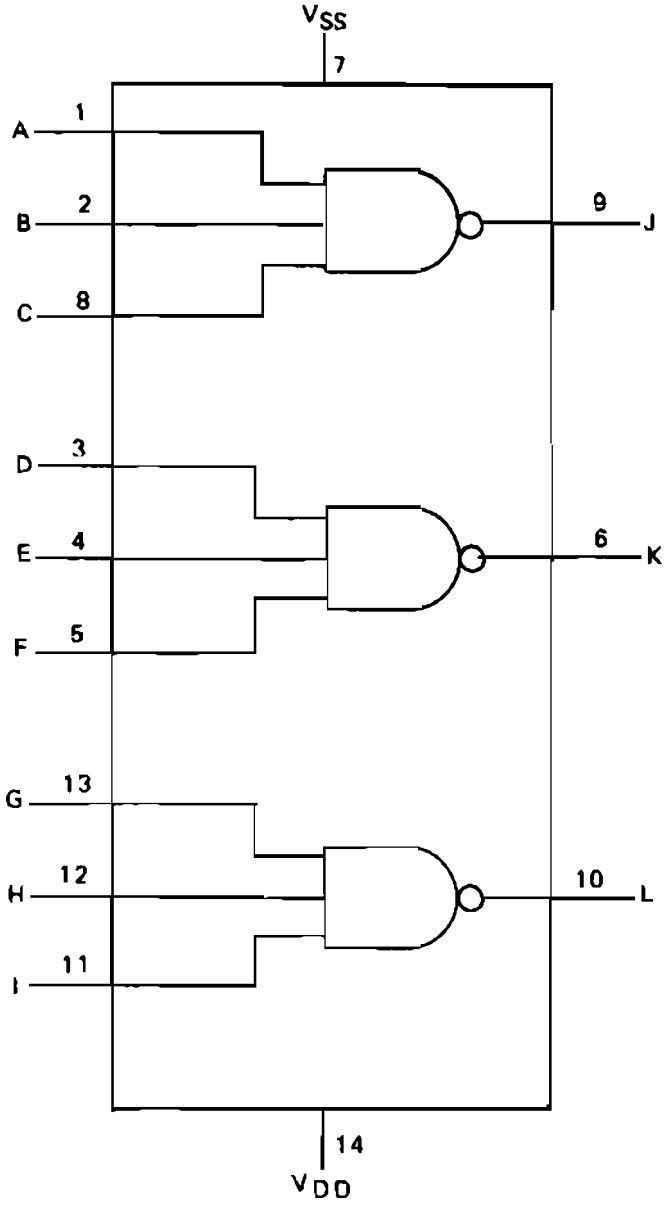
CD4017A
FUNCTIONAL DIAGRAM

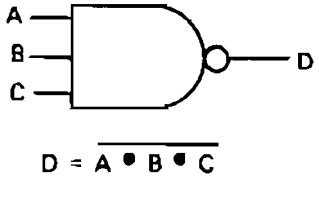


Timing diagram.



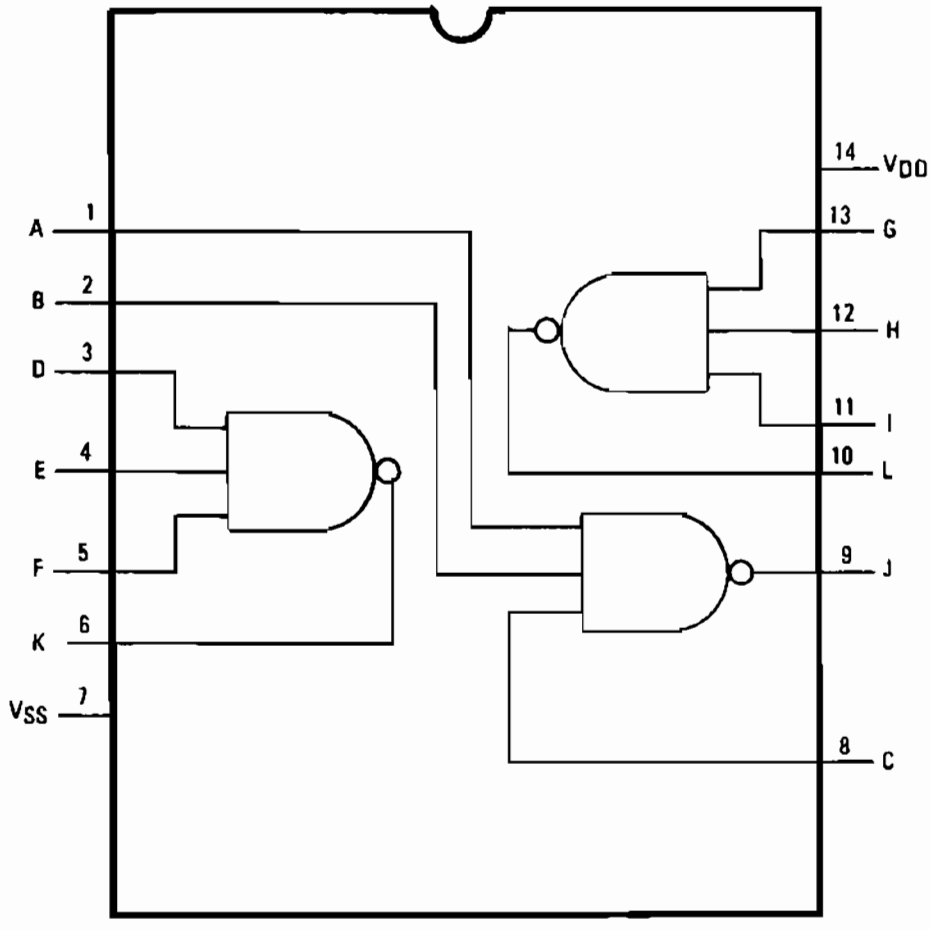
CD4023E
TRIPLE 3-INPUT NAND GATES
CMOS DIGITAL

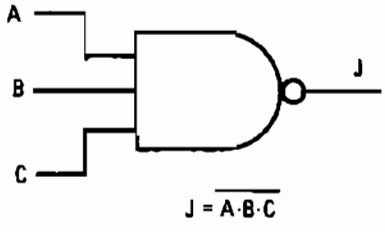




A	B	C	D
0	0	0	1
0	0	1	1
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	0

CD 4023B
TRIPLE 3-INPUT NAND GATES
CMOS DIGITAL



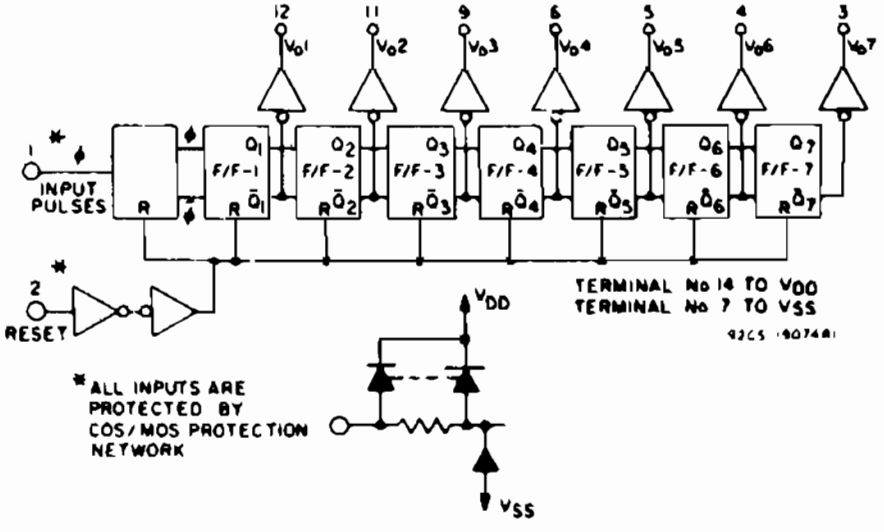


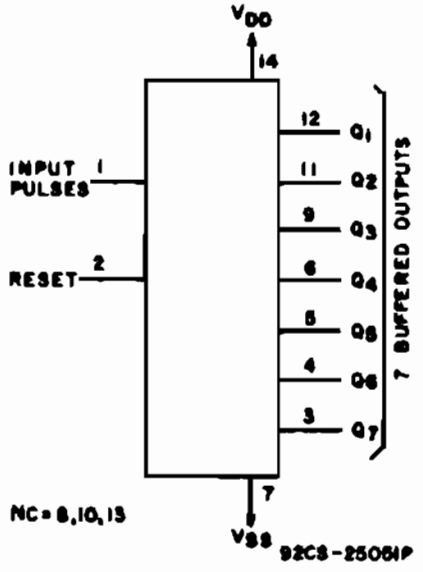
$J = \overline{A \cdot B \cdot C}$

A	B	C	J
0	0	0	1
0	0	1	1
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	0

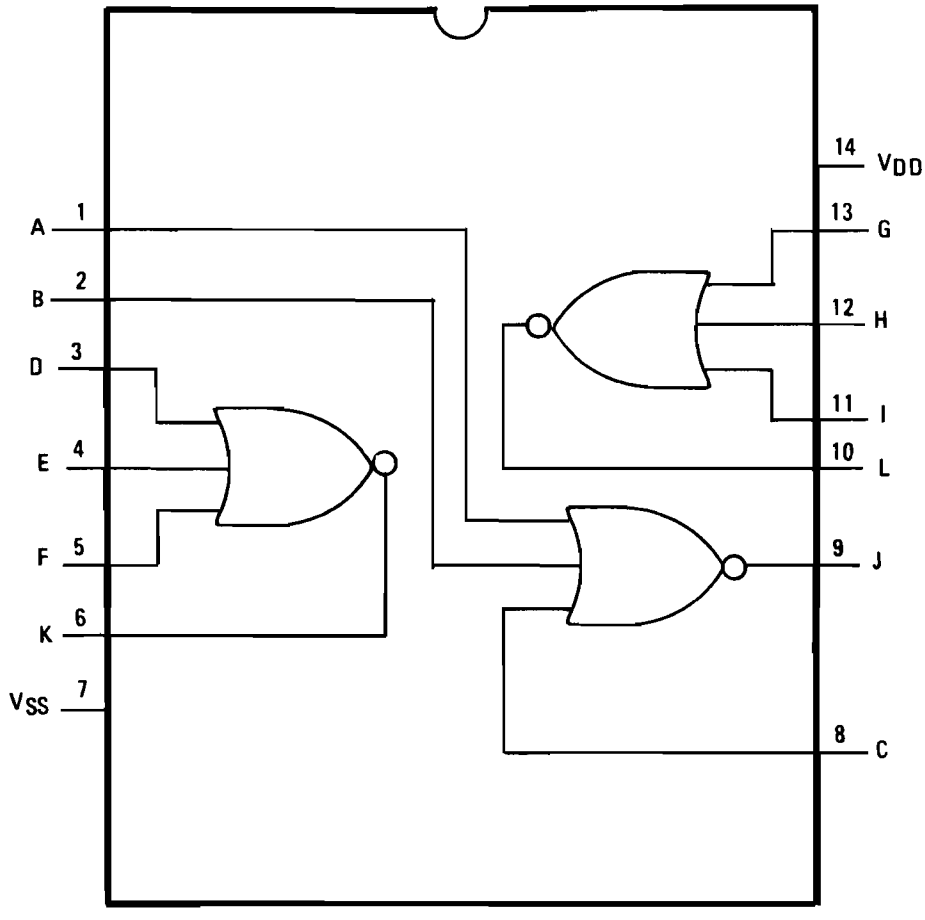
CD4024AE
7-STAGE BINARY COUNTER
CMOS DIGITAL

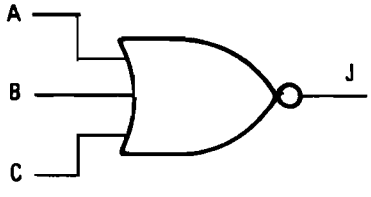
The RCA-CD4024A consists of an INPUT PULSE shaping circuit, RESET line driver circuitry, and seven binary counter stages. The counter is reset to "zero" by a high level on the RESET input. Each counter stage is a static master-slave flip-flop. The counter state is advanced one count on the negative-going transition of each INPUT PULSE.





CD 4025 B
TRIPLE 3-INPUT NOR GATES
CMOS DIGITAL





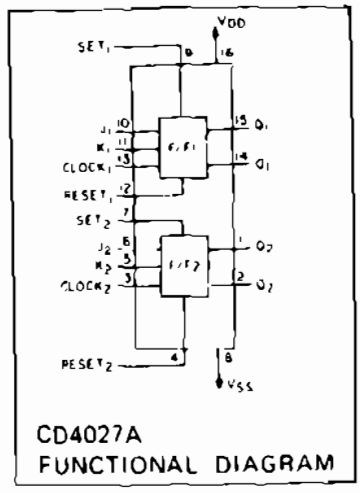
$J = \overline{A + B + C}$

A	B	C	J
0	0	0	1
0	0	1	0
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	0

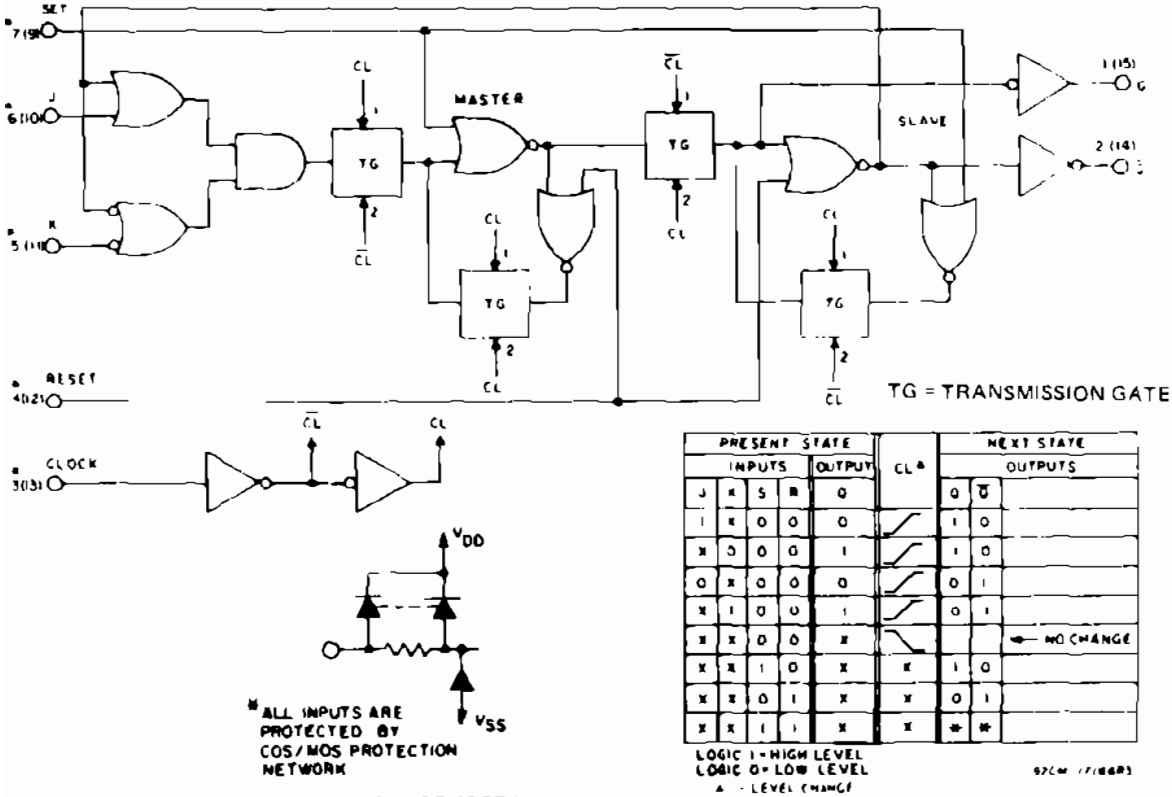
CD4027A
DUAL J-K MASTER-SLAVE FLIP-FLOP
CMOS DIGITAL

The RCA-CD4027A is a single monolithic chip integrated circuit containing two identical complementary-symmetry J-K master-slave flip-flops. Each flip-flop has provisions for individual J, K, Set, Reset, and Clock input signals. Buffered Q and Q signals are provided as outputs.

The CD4027A is useful in performing control, register, and toggle functions. Logic levels present at the J and K inputs along with internal self-steering control the state of each flip-flop; changes in the flip-flop state are synchronous with the positive-going transition of the clock pulse. Set and reset functions are independent of the clock and are initiated when a high level signal is present at either the Set or Reset input.



CD4027A
FUNCTIONAL DIAGRAM



PRESENT STATE					CL▲	NEXT STATE	
INPUTS				OUTPUT		OUTPUTS	
J	K	S	R	Q		Q	$\bar{Q}$
1	X	0	0	0	↑	1	0
X	0	0	0	1	↑	1	0
0	X	0	0	0	↑	0	1
X	1	0	0	1	↑	0	1
X	X	0	0	X			← NO CHANGE
X	X	1	0	X	X	1	0
X	X	0	1	X	X	0	1
X	X	1	1	X	X	*	*

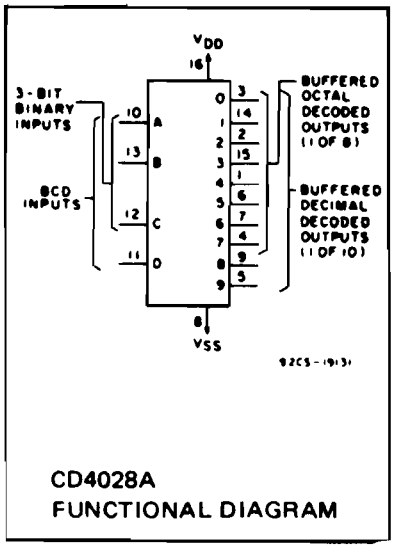
LOGIC 1 = HIGH LEVEL
LOGIC 0 = LOW LEVEL
▲ = LEVEL CHANGE
X = DON'T CARE

Logic diagram & truth table for CD4027A (one of two identical J-K flip flops).

CD4028AE

BCD-TO-DECIMAL DECODER
CMOS DIGITAL

A BCD code applied to the four inputs, A to D, results in a high level at the selected one of ten decimal decoded outputs. Similarly, a 3-bit binary code applied to inputs A to C is decoded to octal at outputs 0 to 7. A high level at the D input inhibits octal decoding and causes outputs o to 7 to go low.

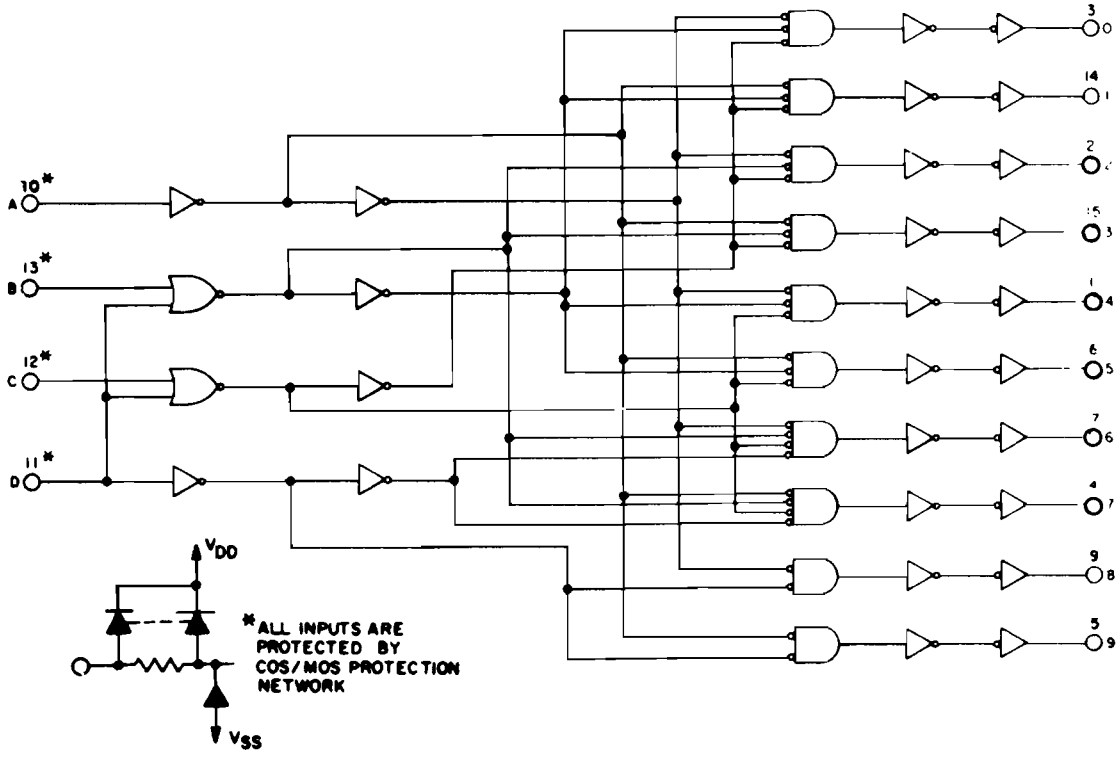


CD4028A
FUNCTIONAL DIAGRAM

TRUTH TABLE

D	C	B	A	0	1	2	3	4	5	6	7	8	9	
0	0	0	0	1	0	0	0	0	0	0	0	0	0	*
0	0	0	1	0	1	0	0	0	0	0	0	0	0	
0	0	1	0	0	0	1	0	0	0	0	0	0	0	
0	0	1	1	0	0	0	1	0	0	0	0	0	0	
0	1	0	0	0	0	0	0	1	0	0	0	0	0	
0	1	0	1	0	0	0	0	0	1	0	0	0	0	
0	1	1	0	0	0	0	0	0	0	1	0	0	0	
0	1	1	1	0	0	0	0	0	0	0	1	0	0	
1	0	0	0	0	0	0	0	0	0	0	0	1	0	
1	0	0	1	0	0	0	0	0	0	0	0	0	1	
1	0	1	0	0	0	0	0	0	0	0	0	1	0	*
1	0	1	1	0	0	0	0	0	0	0	0	0	1	
1	1	0	0	0	0	0	0	0	0	0	0	1	0	
1	1	0	1	0	0	0	0	0	0	0	0	0	1	
1	1	1	0	0	0	0	0	0	0	0	0	1	0	
1	1	1	1	0	0	0	0	0	0	0	0	0	1	

* WHERE 1 = HIGH LEVEL
0 = LOW LEVEL



Logic diagram.

CD-4029A
PRESETTABLE UP/DOWN COUNTER
CMOS DIGITAL

Binary or BCD-Decade

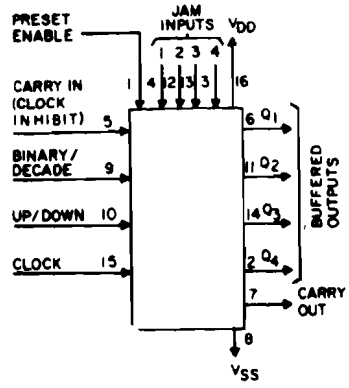
The RCA-CD4029A consists of a four-stage binary or BCD-decade up/down counter with provisions for look-ahead carry in both counting modes. The inputs consist of a single CLOCK, CARRY-IN (CLOCK INHIBIT), BINARY/DECADE, UP/DOWN, PRESET ENABLE, and four individual JAM signals and a CARRY OUT signal are provided as outputs.

A high PRESET ENABLE signal allows information on the JAM INPUTS to preset the counter to any state asynchronously with the clock. A low on each JAM line, when the PRESET-ENABLE signal is high, resets the counter to its zero count. The count is advanced one count at the positive transition of the clock when the CARRY-IN and PRESET ENABLE signals are low. Advancement is inhibited when the CARRY-IN or PRESET ENABLE signals are high. The CARRY-OUT signal is normally high and goes low when the counter reaches its maximum count in the UP mode or the minimum count in the DOWN mode provided the CARRY-IN signal is low. The CARRY-IN signal in the low state can thus be considered a CLOCK INHIBIT. The CARRY-IN terminal must be connected to V_{SS} when not in use.

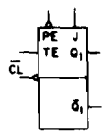
Binary counting is accomplished when the BINARY/DECADE input is high; the counter counts in the decade mode when the BINARY/DECADE input is low. The counter counts Up when the UP/DOWN INPUT is low. Multiple packages can be connected in either a parallel-clocking or a ripple- clocking arrangement.

Parallel clocking provides synchronous control and hence faster response from all counting outputs. Ripple-clocking allows for longer clock input rise and fall times.

CD4029A Functional Diagram



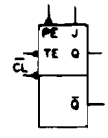
* TRUTH TABLE FOR F-F No 1



CLOCK	TE	PE	J	Q	$\bar{Q}$
X	X	0	0	0	1
↓	1	1	X	$\bar{Q}$	Q
X	X	0	1	1	Q
↓	0	1	X	Q	$\bar{Q}$ NC
↑	X	1	X	Q	$\bar{Q}$ NC

NC - NO CHANGE TE - TOGGLE ENABLE

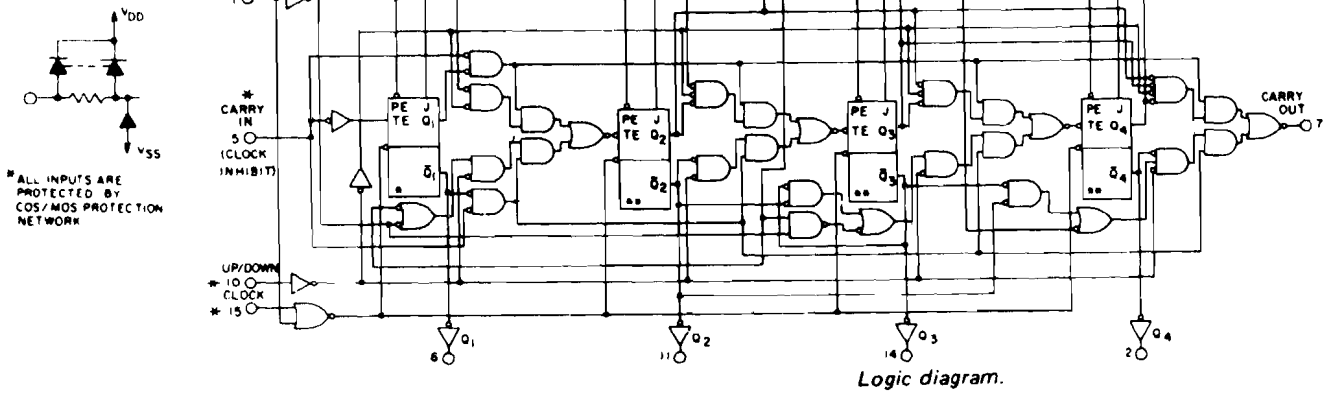
** TRUTH TABLE FOR F-F'S 2,3,4



CLOCK	TE	PE	J	Q	$\bar{Q}$
X	X	0	0	0	1
↓	0	1	X	$\bar{Q}$	Q
X	X	0	1	1	0
↓	1	1	X	Q	$\bar{Q}$ NC
↑	X	1	X	Q	$\bar{Q}$ NC

X - DON'T CARE

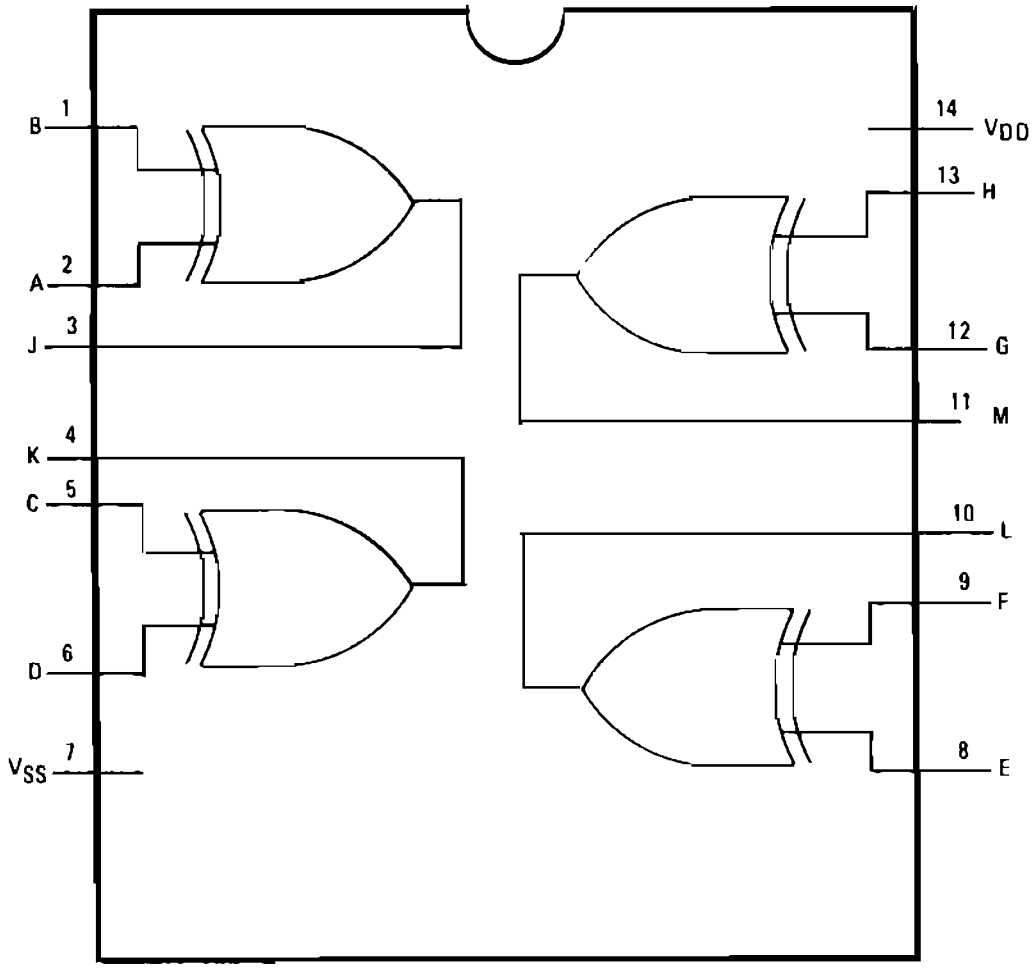
CONTROL INPUT	LOGIC LEVEL	ACTION
BIN/DEC (B/D)	1	BINARY COUNT
	0	DECADE COUNT
UP/DOWN (U/D)	1	UP COUNT
	0	DOWN COUNT
PRESET ENABLE (PE)	1	JAM IN
	0	NO JAM
CARRY IN (CI) (CLOCK INHIBIT)	1	NO COUNTER ADVANCE AT POS CLOCK TRANSITION
	0	ADVANCE COUNTER AT POS CLOCK TRANSITION



Logic diagram.

CD4030AE
QUAD EXCLUSIVE OR GATE
CMOS DIGITAL

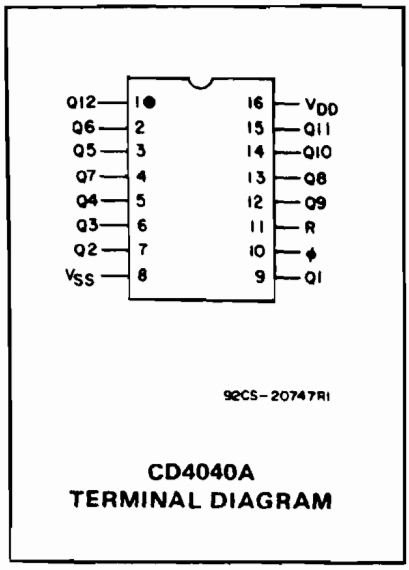
The CD4030AE consists of four independent Exclusive-OR gates on a single monolithic chip. Each Exclusive-OR gate consists of four n-channel, and four p-channel enhancement type transistors.



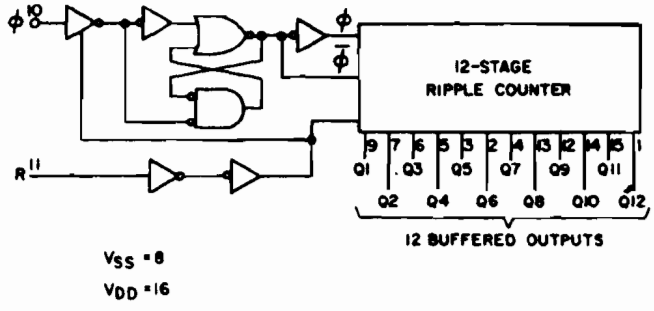
A	B	J
0	0	0
1	0	1
0	1	1
1	1	0

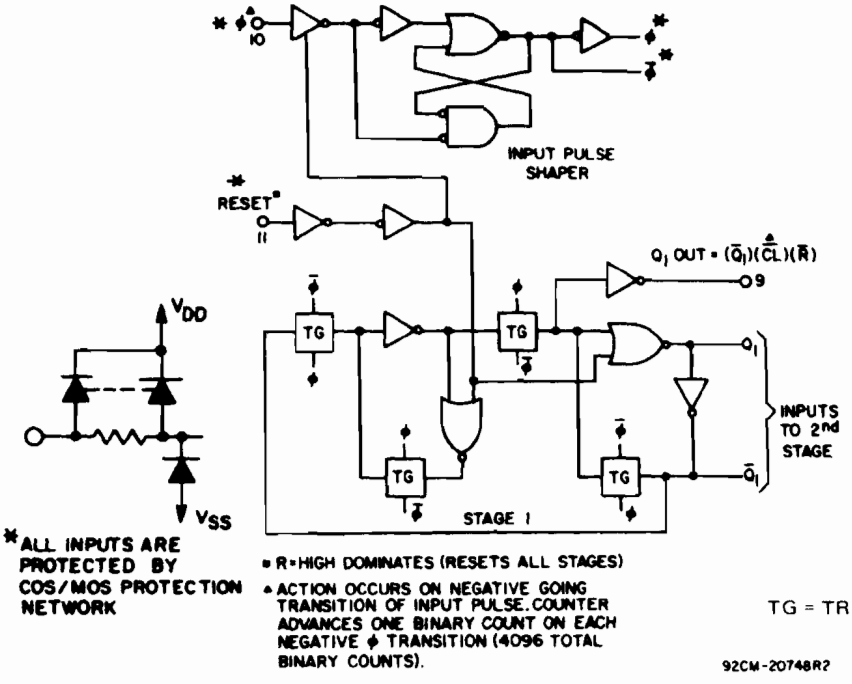
CD4040A
12-STAGE RIPPLE-CARRY BINARY COUNTER/DIVIDER
CMOS DIGITAL

The RCA-CD4040A consists of an input-pulse-shaping circuit and 12 ripple-carry binary counter stages. Resetting the counter to the all-0's state is accomplished by a high-level on the reset line. A master-slave flip-flop configuration is utilized for each counter stage. The state of the counter is advanced one step in binary order on the negative-going transition of the input pulse. All inputs and outputs are fully buffered.



CD4040A
TERMINAL DIAGRAM

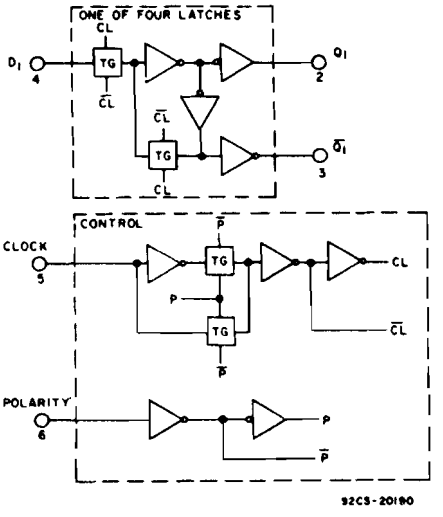




Logic diagram of CD4040A input pulse shaper and 1 of 12 stages.

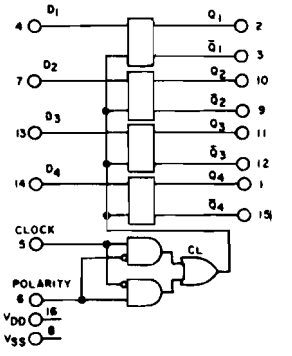
CD4042AE
QUAD CLOCKED "D" LATCH
CMOS DIGITAL

The CD4042 contains four latch circuits, each strobed by a common clock. Complementary buffered outputs are available from each circuit. Information present at the data output is transferred to the Q and Q during the CLOCK level which is programmed by the POLARITY input. For POLARITY = 0, the transfer occurs during the 0 CLOCK level, and for POLARITY = 1, the transfer occurs during the 1 CLOCK level. The outputs follow the data inputs providing the CLOCK and POLARITY levels are present. When a CLOCK transition occurs (positive for POLARITY = 0 and negative for POLARITY = 1) the information present at the input during the CLOCK transition is retained at the outputs until an opposite CLOCK transition occurs. Functional and Logic diagrams are shown below.



CLOCK	POLARITY	Q
0	0	D
⌐	0	LATCH
1	1	D
⌐	1	LATCH

Logic block diagram & truth table.



FUNCTIONAL DIAGRAM

TG = TRANSMISSION GATE

CD4046A
MICROPOWER PHASE-LOCKED LOOP CMOS DIGITAL

The CD4046A COS/MOS Micropower Phase-Locked Loop (PLL) consists of a low-power, linear voltage-controlled oscillator (VCO) and two different phase comparators having a common signal-input amplifier and a common comparator input. A 5.2V zener diode is provided for supply regulation if necessary.

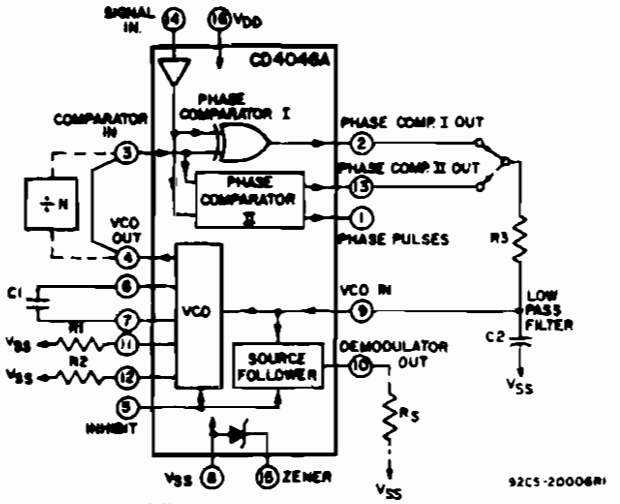


Fig. 1 – COS/MOS phase-locked loop block diagram.

VCO Section

The VCO requires one external capacitor C1 and one or two external resistors (R1 or R1 and R2). Resistor R1 and capacitor C1 determine the frequency range of the VCO and resistor R2 enables the VCO to have a frequency offset. A logic 0 on the INHIBIT input "enables" the VCO and the source follower, while a logic 1 "turns off" both to minimize stand-by power consumption.

Phase Comparators

The phase-comparator signal input (terminal 14) can be direct-coupled provided the signal swing is within COS/MOS logic levels (logic "0" $\leq$ 30% ($V_{DD} - V_{SS}$), logic "1" $\geq$ 70% ($V_{DD} - V_{SS}$)). For smaller swings the signal must be capacitively coupled to the self-biasing amplifier at the signal input.

Phase comparator I is an exclusive-OR network; it operates analagously to an overdriven balanced mixer. To maximize the lock range, the signal- and comparator-input frequencies must have a 50% duty cycle With no signal or noise on the signal input, this phase comparator has an average output voltage equal to $V_{DD}/2$. The low-pass filter connected to the output of phase comparator I supplies the average voltage to the VCO input, and causes the VCO to oscillate at the center frequency (f_o)

The frequency range of input signals on which the PLL will lock if it was initially out of lock is defined as the frequency capture range ($2f_c$).

The frequency range of input signals on which the loop will stay locked if it was initially in lock is defined as the frequency lock range ($2f_L$). The capture range is $\leq$ the lock range.

With phase comparator I the range of frequencies over which the PLL can acquire lock (capture range) is dependent on the low-pass-filter characteristics, and can be made as large as the lock range. Phase-comparator I enables a PLL system to remain in lock in spite of high amounts of noise in the input signal.

One characteristic of this type of phase comparator is that it may lock onto input frequencies that are close to harmonics of the VCO center-frequency. A second characteristic is that the phase angle between the signal and the comparator input varies between 0° and 180°, and is 90° at the center frequency. Fig. 2 shows the typical, triangular, phase-to-output response characteristic of phase comparator I. Typical waveforms for a COS/MOS phase-locked-loop employing phase comparator I in locked condition of f_o is shown in Fig. 3.

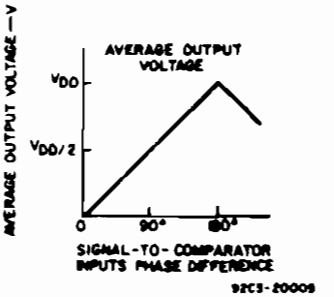


Fig. 2 – Phase-comparator I characteristics at low-pass filter output.

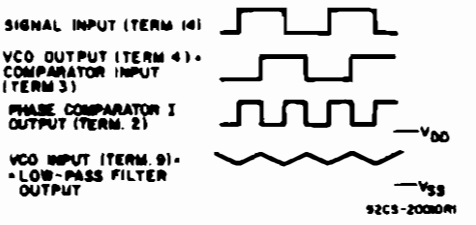


Fig. 3 – Typical waveforms for COS/MOS phase-locked loop employing phase comparator I in locked condition of f_o.

Phase-comparator II is an edge-controlled digital memory network. It consists if four flip-flop stages, control gating, and a three-state output circuit comprising p- and n-type drivers having a common output mode. When the p-MOS or n-MOS drivers are ON they pull the output up to V_{DD} or down to V_{SS}, respectively. This type of phase comparator acts only on the positive edges of the signal and comparator inputs. The duty cycles of the signal and comparator inputs are not important since positive transitions control the PLL system utilizing this type of comparator. If the signal-input frequency is higher than the comparator-input frequency, the p-type output driver is maintained ON most of the time, and both the n and p drivers OFF (3 state) the remainder of the time. If the signal-input frequency is lower than the comparator-input frequency, the n- type output driver is maintained ON most of the time, and both the n and p drivers OFF (3 state) the remainder of the time. If the signal- and comparator-input frequencies are the same, but the signal input lags the comparator input in phase, the n-type output driver is maintained ON for a time corresponding to the phase difference. If the signal- and comparator-input frequencies are the same, but the comparator input lags the signal in phase, the p-type output driver is maintained ON for a time corresponding to the phase difference. Subsequently, the capacitor voltage of the low-pass filter connected to this phase comparator is adjusted until the signal and comparator inputs are equal in both phase and frequency. At this stable point both p- and n-type output drivers remain OFF and thus the phase comparator output becomes an open circuit and holds the voltage on the capacitor of the low-pass filter constant.

Moreover the signal at the "phase pulses" output is a high level which can be used for indicating a locked condition. Thus, for phase comparator II, no phase difference exists between signal and comparator input over the full VCO frequency range. Moreover, the power dissipation due to the lowpass filter is reduced when this type of phase comparator is used because both the p- and n-type output drivers are OFF for most of the signal input cycle. It should be noted that the PLL lock range for this type of phase comparator is equal to the capture range, independent of the low-pass filter. With no signal present at the signal input, the VCO is adjusted to its lowest frequency for phase comparator II. Fig. 4 shows typical waveforms for a COS/MOS PLL employing phase comparator II in a locked condition.

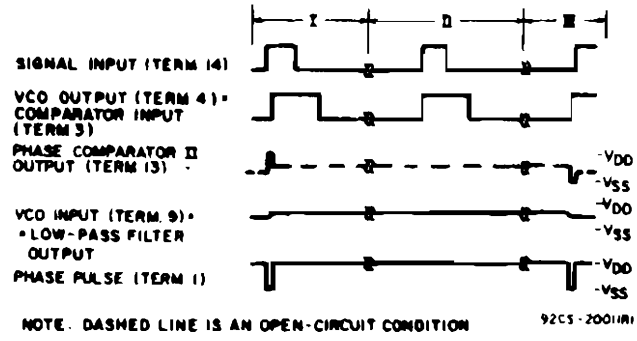
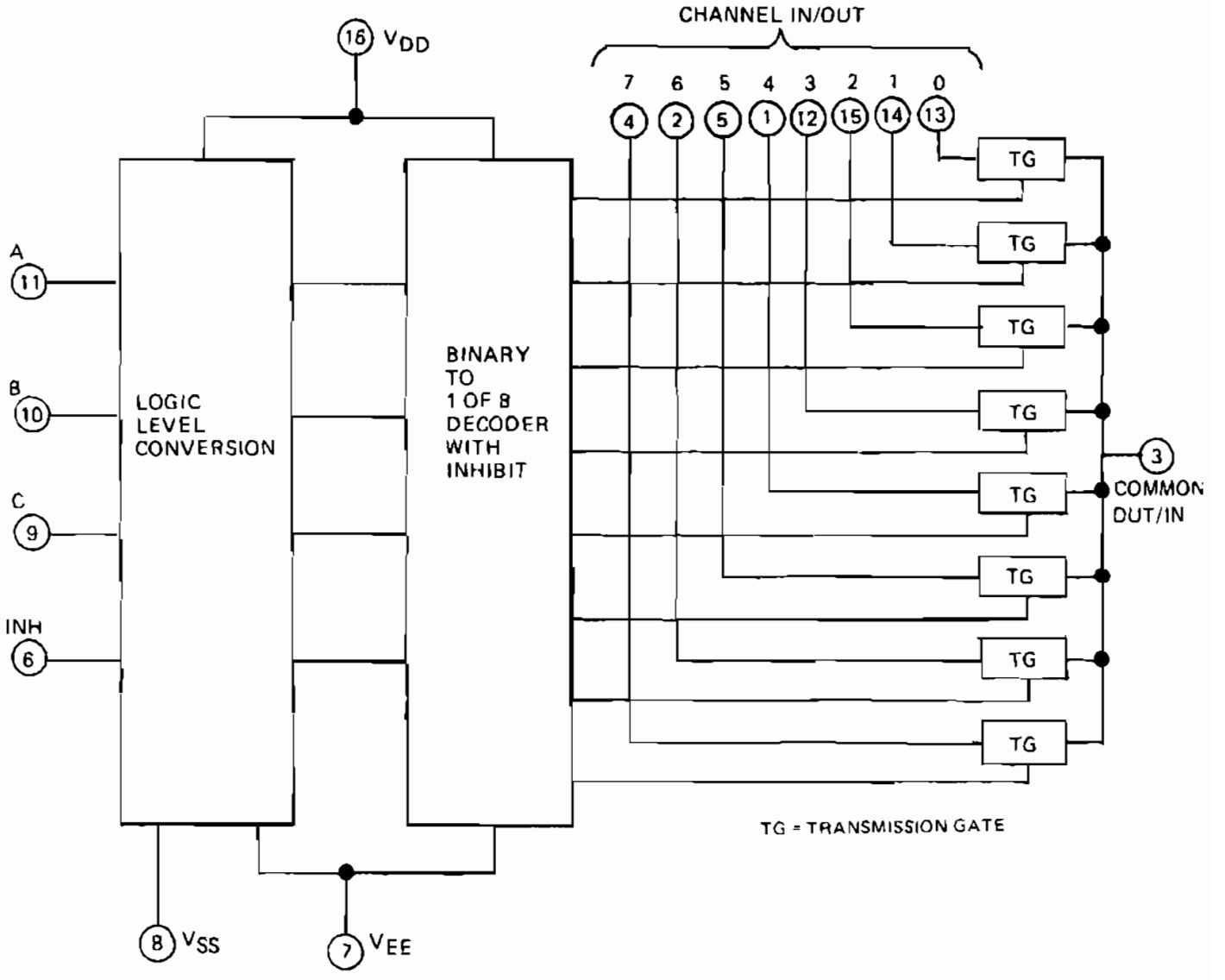


Fig.4 – Typical waveforms for COS/MOS phase-locked loop employing phase comparator II in locked condition.

CD4051BE
8 TO 1 MULTIPLEXER
CMOS DIGITAL

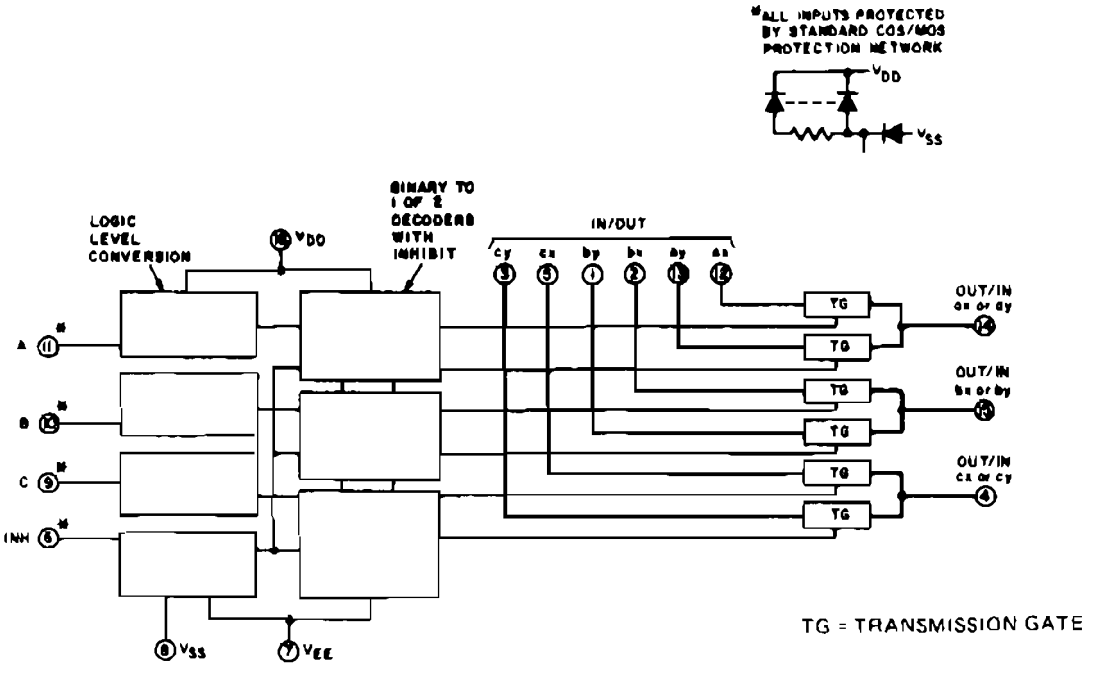
The CD4051BE is a single 8-channel multiplexer having three binary control inputs; A, B, and C; and an inhibit input. The three binary signals select 1 of 8 channels to be turned ON, and connect one of the 8 inputs to the output. When a logic "1" is present at the inhibit input, all channels are OFF.



CD4051 FUNCTIONAL DIAGRAM

CD4053
TRIPLE 2-CHANNEL MULTIPLEXER
CMOS DIGITAL

The CD4053 is a triple 2-channel multiplexer having three separate digital control inputs, A, B, and C, and an inhibit input. Each control input selects one of a pair of channels which are connected in a single-pole double-throw configuration.



Functional diagram of CD4053.

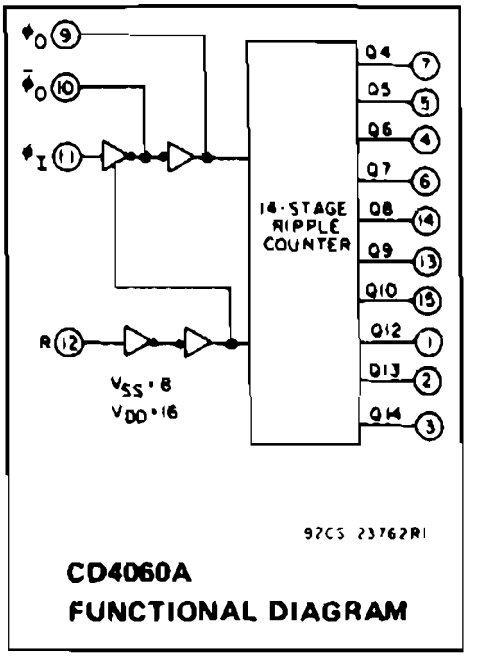
When a logic "1" is present at the inhibit input terminal (pin 6), all channels are OFF.

CD4060AE

14-STAGE RIPPLE-CARRY BINARY COUNTER/DIVIDER AND OSC

CMOS DIGITAL

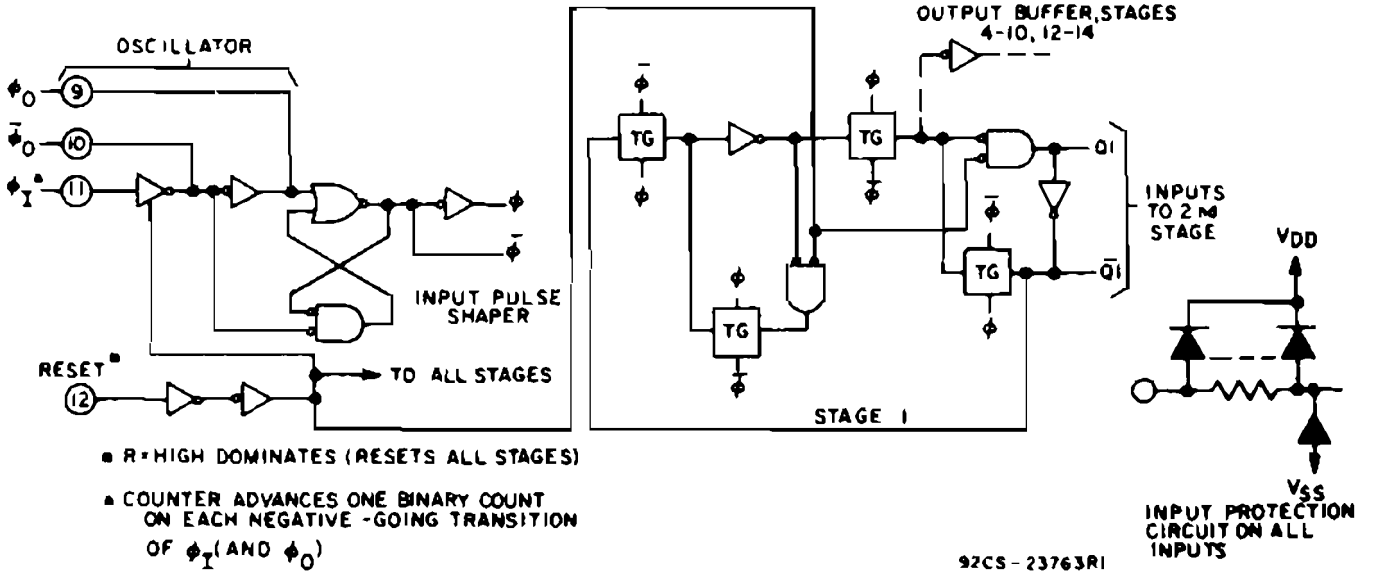
Consists of an oscillator section as shown below, and 14 ripple-carry binary counter stages. . . only one is shown for simplicity. The RESET input resets the counter to the all zeros state and disables the oscillator. A high level accomplishes the RESET function. All counter stages are master-slave flip-flops. The state of the counter is advanced one step in binary order on the negative transition of $\emptyset_I$ ($\emptyset_O$). A 4-MHZ osc operating frequency in typical with V_{DD}-V_{SS} = 10V.



CD4060A
FUNCTIONAL DIAGRAM

$V_{DD} - V_{SS}$ = 10V

TG = TRANSMISSION GATE



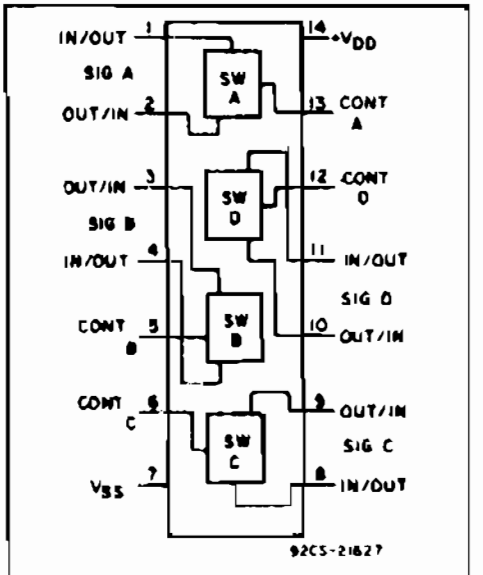
* R = HIGH DOMINATES (RESETS ALL STAGES)

▲ COUNTER ADVANCES ONE BINARY COUNT ON EACH NEGATIVE-GOING TRANSITION OF ϕ_I (AND ϕ_O)

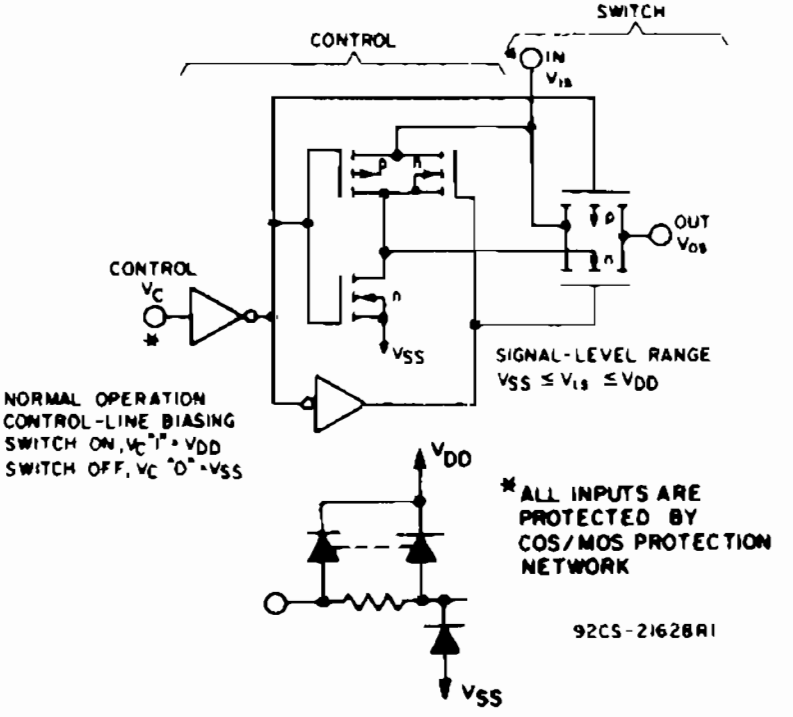
Logic diagram of CD4060A oscillator, pulse shaper, and 1 of 14 counter stages.

CD4066AE
QUAD BILATERAL SWITCH
CMOS DIGITAL

The CD4066A is a quad bilateral switch for the transmission or multiplexing of analog or digital signals. It is pin-for-pin compatible with the CD4016, but exhibits a lower ON resistance. The CD4066A consists of four independent bilateral switches. A single control signal is required per switch. Both the p and the n device in a given switch are biased ON or OFF simultaneously by the control signal. As shown in Figure 1, the well of the n-channel device on each switch is either tied to the input when the switch is ON or to V_{SS} when the switch is OFF. This configuration eliminates the variation of the switch-transistor threshold voltage with input signal, and thus keeps the ON resistance low over the full operating-signal range.



CD4066A
FUNCTIONAL DIAGRAM

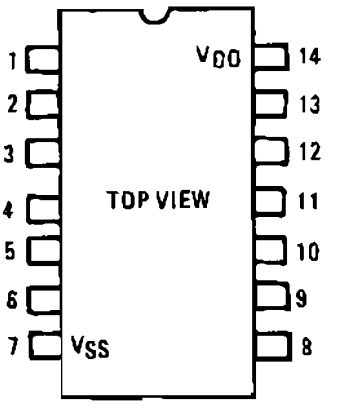


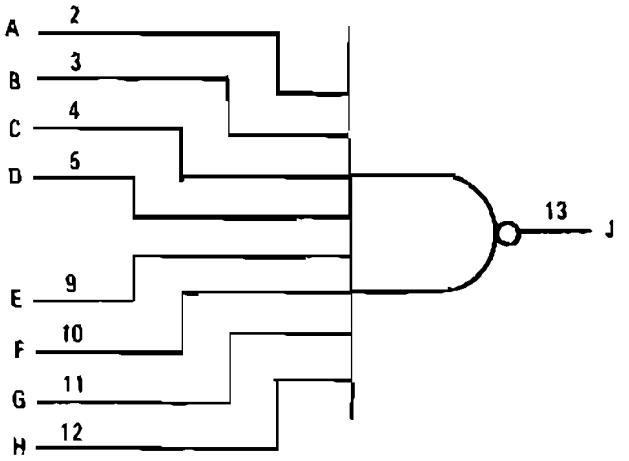
Schematic diagram of 1 of 4 identical switches and its associated control circuitry.

CD 4068
8-INPUT NAND GATE
CMOS DIGITAL

Provides an 8-input positive logic NAND function.

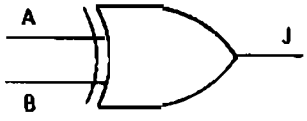
1 = INTERNAL CONNECTION, DO NOT USE
6 = NO CONNECTION
7 = V_{SS}
8 = NO CONNECTION
14 = V_{DD}



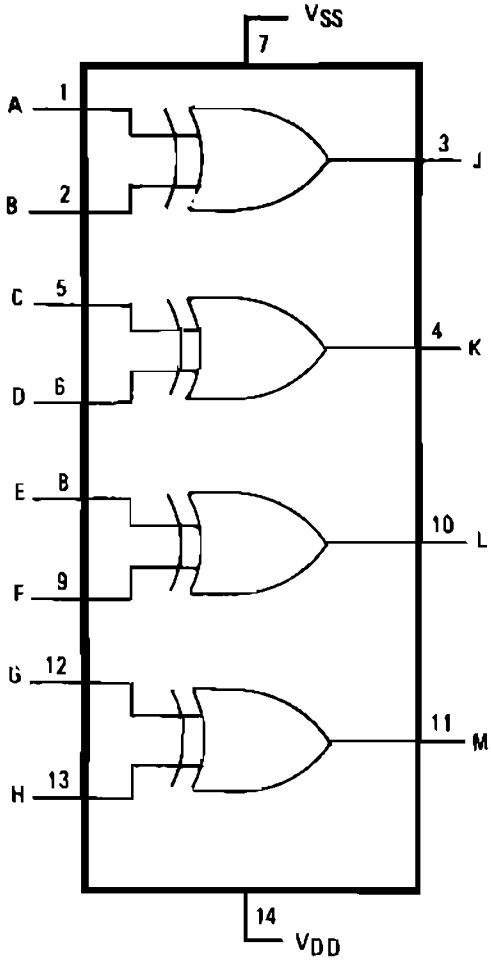


$J = \overline{A \cdot B \cdot C \cdot D \cdot E \cdot F \cdot G \cdot H}$

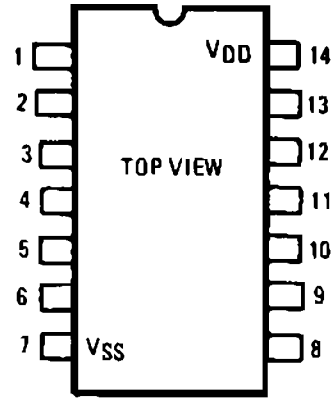
CD 4070B
QUAD EXCLUSIVE-OR GATES
CMOS DIGITAL



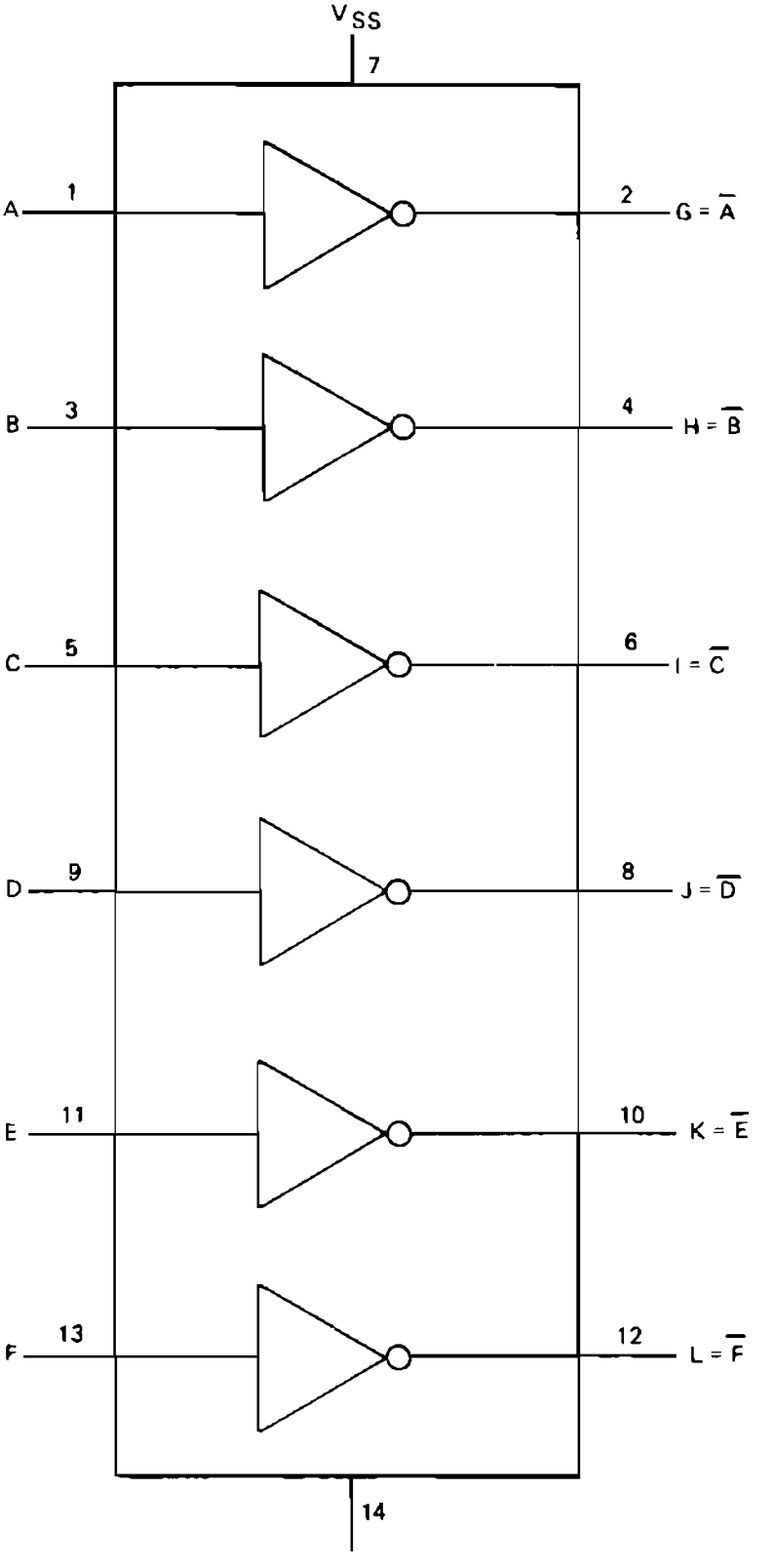
A	B	J
0	0	0
0	1	1
1	0	1
1	1	0



FUNCTIONAL DIAGRAM

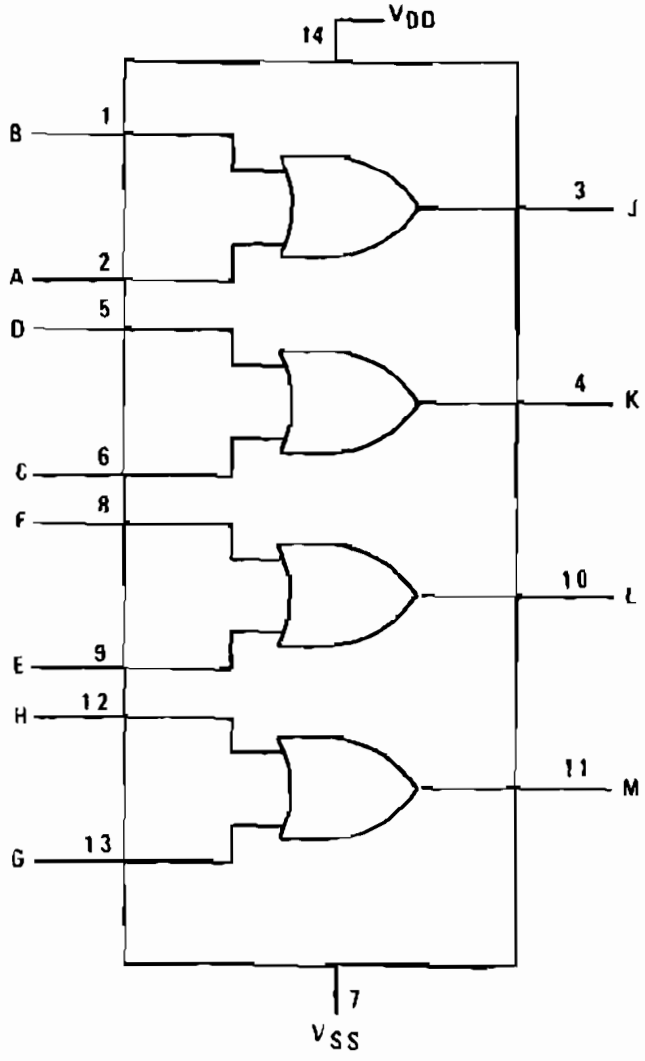


CD4069BE
HEX INVERTER
CMOS DIGITAL



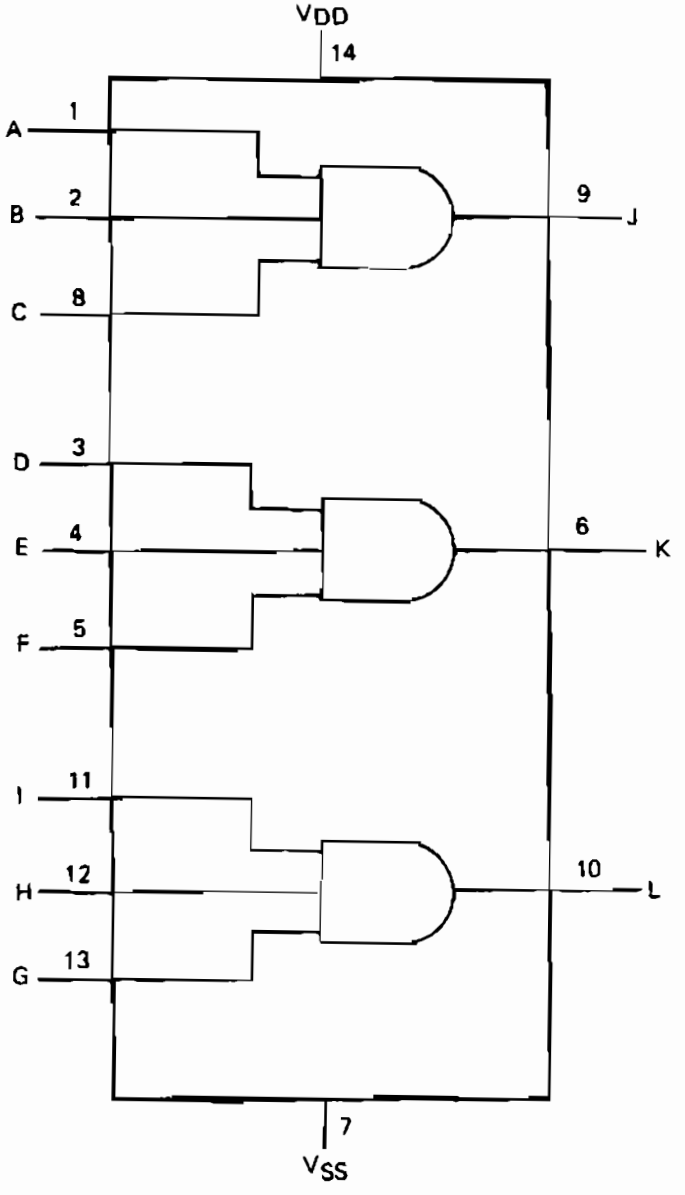
CD4071B
QUAD 2-INPUT OR GATES
CMOS DIGITAL

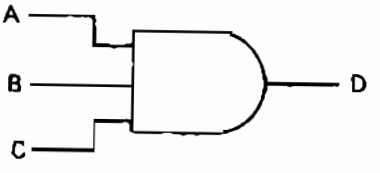
The CD4071B provides four positive logic OR functions on one chip as shown below.



A	B	J
0	0	0
0	1	1
1	0	1
1	1	1

CD4073
AND GATES
CMOS DIGITAL

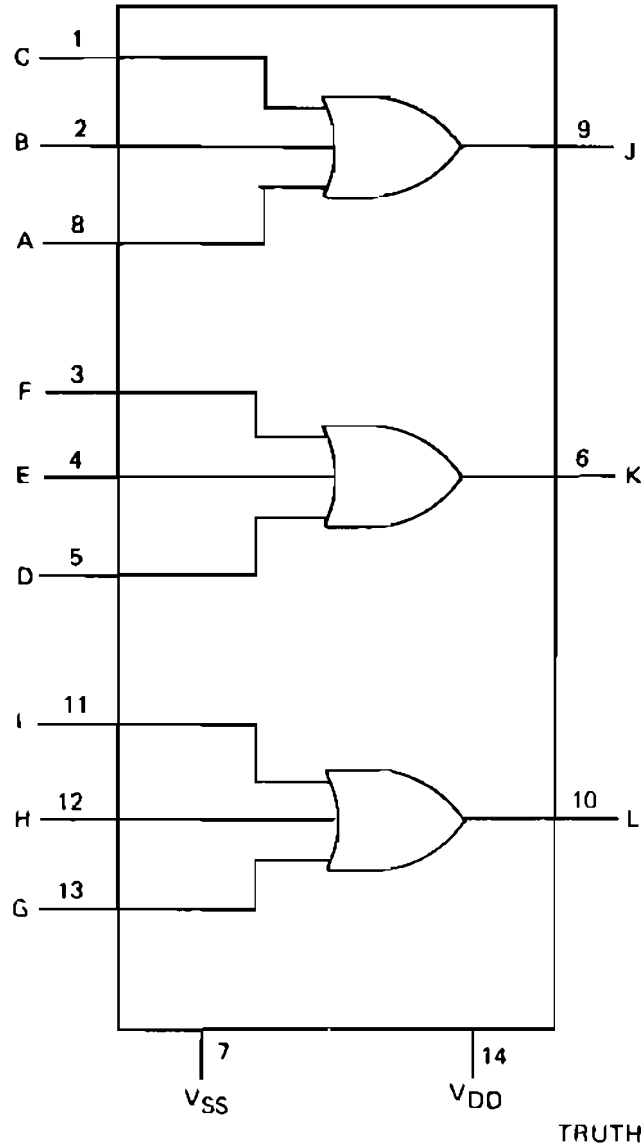


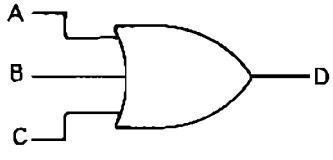


$D = A \bullet B \bullet C$

A	B	C	D
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	1

CD4075BE
TRIPLE 3-INPUT OR GATE
CMOS DIGITAL



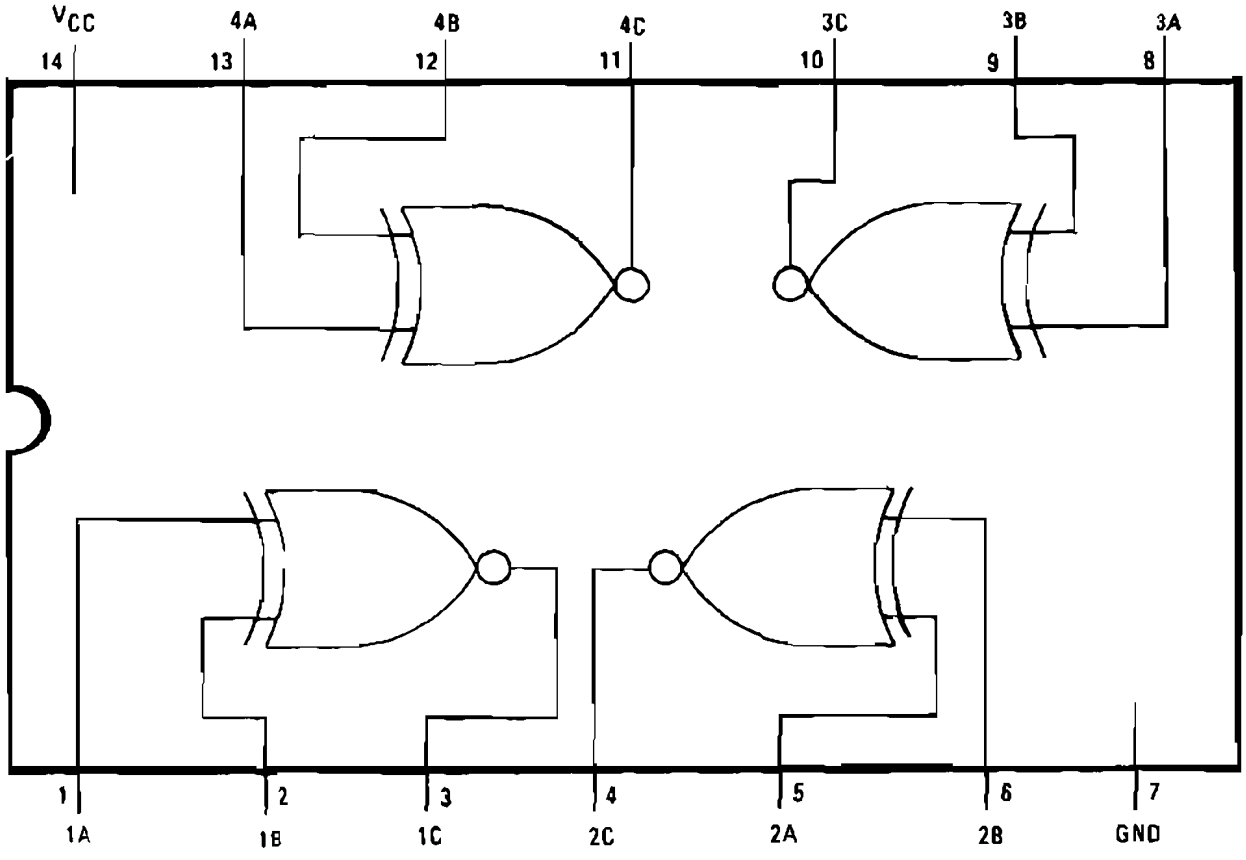


TRUTH TABLE

A	B	C	D
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	1

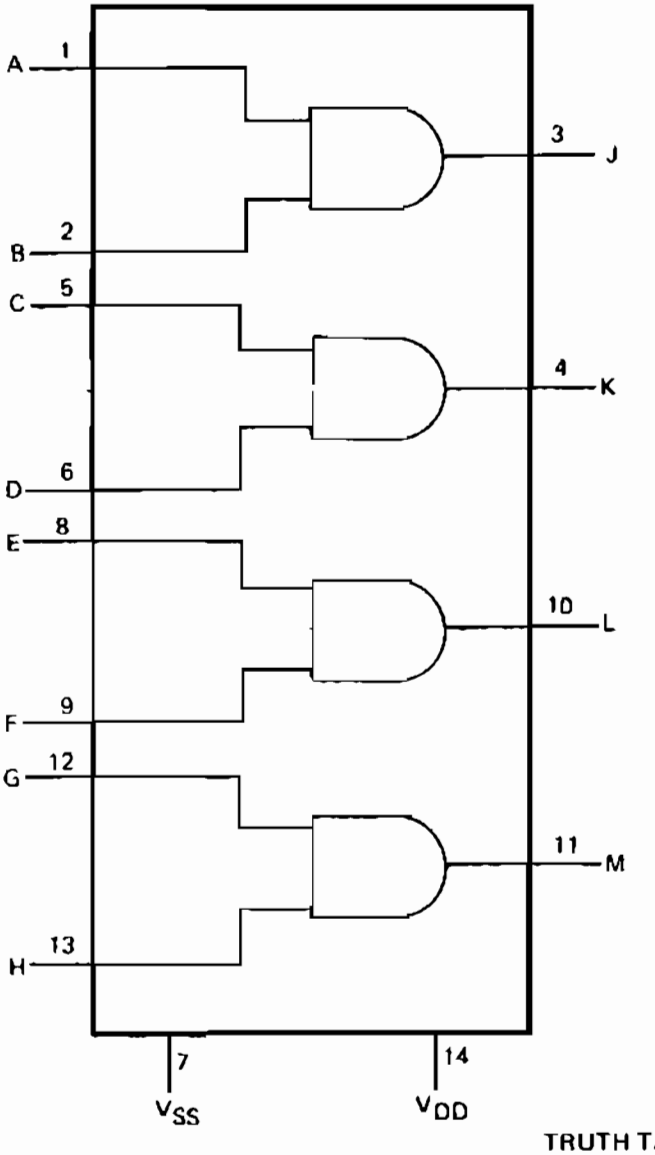
CD4077BE
QUAD EXCLUSIVE NOR GATES
CMOS DIGITAL

The CD4077BE contains four independent Exclusive-NOR gates. This device is similar to the CD4030, but has greater output sourcing capability and higher input impedance.



A	B	C
0	0	1
0	1	0
1	0	0
1	1	1

CD4081BE
QUAD 2-INPUT AND GATE
CMOS DIGITAL



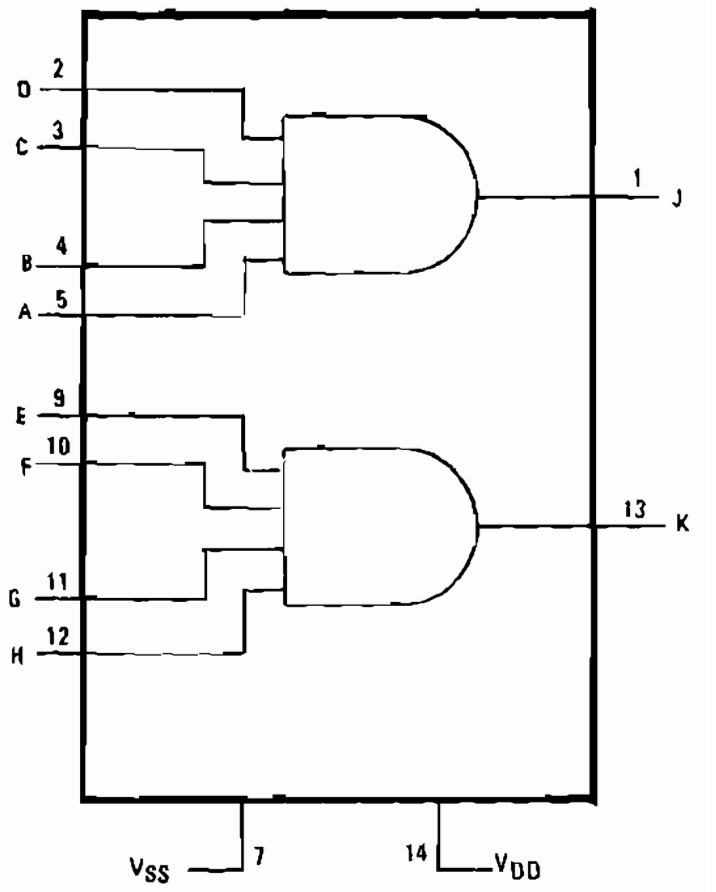
TRUTH TABLE

A	B	C
0	0	0
0	1	0
1	0	0
1	1	1

CD4082
DUAL 4-INPUT AND GATE
CMOS DIGITAL

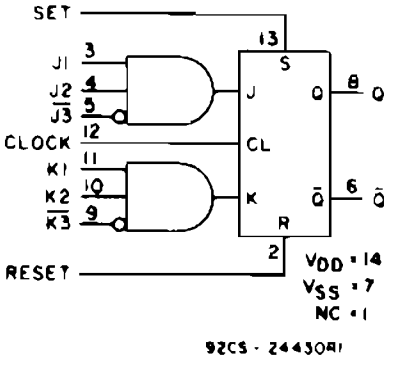
The CD4082 provides two 4-Input AND functions on one chip as shown below.

A	B	C	D	J
0	0	0	0	0
0	0	0	1	0
0	0	1	0	0
0	0	1	1	0
0	1	0	0	0
0	1	0	1	0
0	1	1	0	0
0	1	1	1	0
1	0	0	0	0
1	0	0	1	0
1	0	1	0	0
1	0	1	1	0
1	1	0	0	0
1	1	0	1	0
1	1	1	0	0
1	1	1	1	1



CD4096B
GATED J-K MASTER-SLAVE FLIP-FLOP
CMOS DIGITAL

The CD4096 employs inverting and non-inverting J and K inputs. There are three AND gated J inputs, and three AND gated K inputs as shown in the functional diagram below. The J1 and J2, and the K1 and K2 inputs are non-inverting; the J3 and K3 inputs are inverting. The gated J-K inputs control transfer of information into the master section during clocked operation. Information on the J-K inputs is transferred to the Q and $\overline{Q}$ outputs on the positive edge of the clock pulse. SET and RESET inputs (active high) provide for asynchronous operation.



CD4096B
Functional Diagram

TRUTH TABLES
SYNCHRONOUS OPERATION (S=0 R=0)

Inputs Before Positive Clock Transition		Outputs After Positive Clock Transition	
J*	K*	Q	$\overline{Q}$
0	0	No Change	
0	1	0	1
1	0	1	0
1	1	Toggles	

For CD4096B
$J = J1 \cdot J2 \cdot \overline{J3}$
$K = K1 \cdot K2 \cdot \overline{K3}$

ASYNCHRONOUS OPERATION
(J and K - DON'T CARE)

S	R	Q	$\overline{Q}$
0	0	No Change	
0	1	0	1
1	0	1	0
1	1	0	0

0 = V_{SS}, 1 = V_{DD}

COS/MOS Analog Multiplexers/Demultiplexers

High-Voltage Types (20-Volt Rating)

CD4067B – Single 16-Channel Multiplexer/Demultiplexer

CD4097B – Differential 8-Channel Multiplexer/Demultiplexer

The RCA-CD4067B and CD4097B COS/MOS analog multiplexers/demultiplexers* are digitally controlled analog switches having low ON impedance, low OFF leakage current, and internal address decoding. In addition, the ON resistance is relatively constant over the full input-signal range.

The CD4067B is a 16-channel multiplexer with four binary control inputs, A,B,C,D, and an inhibit input, arranged so that any combination of the inputs selects one switch.

The CD4097B is a differential 8-channel multiplexer having three binary control inputs A, B, C, and an inhibit input. The inputs permit selection of one of eight pairs of switches.

A logic "1" present at the inhibit input turns all channels off.

The CD4067 and CD4097 are supplied in 24-lead dual-in-line welded-seal ceramic packages (D suffix), 24-lead dual-in-line frit-seal ceramic packages (F suffix), 24-lead dual-in-line plastic packages (E suffix), and in chip form (H suffix).

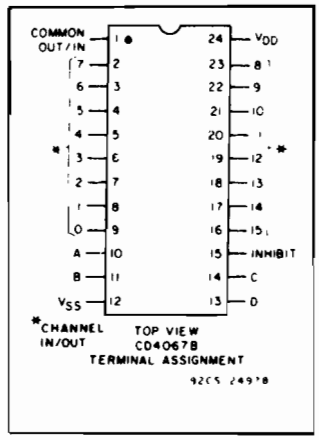
*When these devices are used as demultiplexers, the channel in/out terminals are the outputs and the common out/in terminals are the inputs.

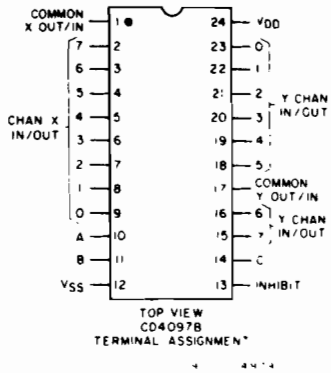
Features:

- **Low ON resistance: 125 Ω (typ.) over 15 V_{p-p} signal-input range for $V_{DD}-V_{SS}=15$ V**
- **High OFF resistance: channel leakage of ±10 pA (typ.) @ $V_{DD}-V_{SS}=10$ V**
- **Matched switch characteristics: $R_{ON}=5$ Ω (typ.) for $V_{DD}-V_{SS}=15$ V**
- **Very low quiescent power dissipation under all digital-control input and supply conditions: 0.2 μW (typ.) @ $V_{DD}-V_{SS}=10$ V**
- **Binary address decoding on chip**
- **5-V, 10-V, and 15-V parametric ratings**
- **100% tested for quiescent current at 20 V**
- **Standardized symmetrical output characteristics**
- **Maximum input current of 1 μA at 18 V over full package temperature range; 100 nA at 18 V and 25°C**
- **Meets all requirements of JEDEC Tentative Standard No. 13A, "Standard Specifications for Description of 'B' Series CMOS Devices"**

Applications:

- **Analog and digital multiplexing and demultiplexing**
- **A/D and D/A conversion**
- **Signal gating**





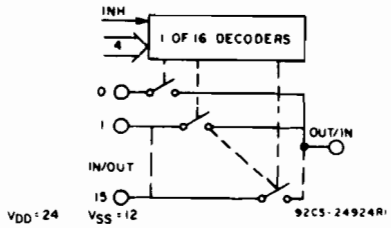


Fig. 1 – CD4067 functional diagram.

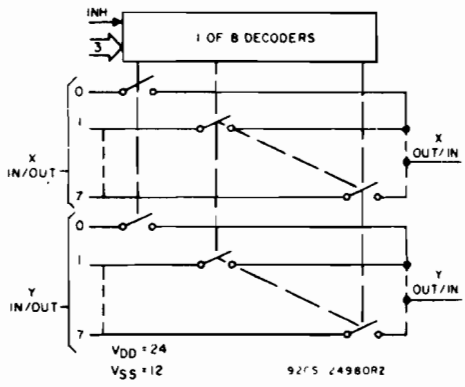


Fig. 2–CD4097 functional diagram.

Recommended Operating Conditions at T_A = 25°C (Unless Otherwise Specified)

For maximum reliability, nominal operating conditions should be selected so that operation is always within the following ranges. Values shown apply to all types except as noted.

Characteristic	Min.	Max.	Units
Supply-Voltage Range (T_A=Full Package Temp. Range)	3	18	V
Multiplexer Switch Input Current Capability	–	25	mA
Output Load Resistance	100	–	Ω

NOTE:

In certain applications, the external load-resistor current may include both V_{DD} and signal-line components. To avoid drawing V_{DD} current when switch current flows into the transmission gate inputs, the voltage drop across the bidirectional switch must not exceed 0.8 volt (calculated from R_{ON} values shown in ELECTRICAL CHARACTERISTICS CHART). No V_{DD} current will flow through R_L if the switch current flows into terminal 1 on the CD4067 terminals 1 and 17 on the CD4097

CD4067 TRUTH TABLE

A	B	C	D	Inh	Selected Channel
X	X	X	X	1	None
0	0	0	0	0	0
1	0	0	0	0	1
0	1	0	0	0	2
1	1	0	0	0	3
0	0	1	0	0	4
1	0	1	0	0	5
0	1	1	0	0	6
1	1	1	0	0	7
0	0	0	1	0	8
1	0	0	1	0	9
0	1	0	1	0	10
1	1	0	1	0	11
0	0	1	1	0	12
1	0	1	1	0	13
0	1	1	1	0	14
1	1	1	1	0	15

CD4097 TRUTH TABLE

A	B	C	Inh	Selected Channel
X	X	X	1	None
0	0	0	0	0X, 0Y
1	0	0	0	1X, 1Y
0	1	0	0	2X, 2Y
1	1	0	0	3X, 3Y
0	0	1	0	4X, 4Y
1	0	1	0	5X, 5Y
0	1	1	0	6X, 6Y
1	1	1	0	7X, 7Y

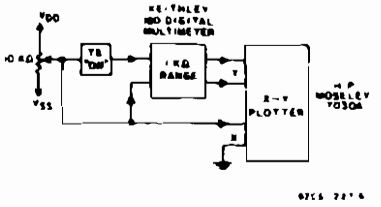


Fig. 13–Channel ON resistance measurement circuit

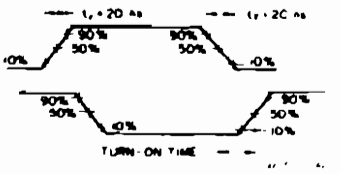


Fig. 14–Propagation delay waveform channel being turned ON (R_L = 10 KΩ, C_L = 50 pF).

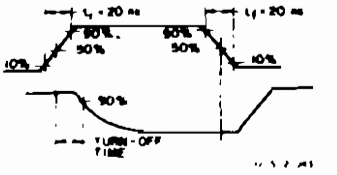


Fig. 15–Propagation delay waveform, channel being turned OFF (R_L = 300 Ω, C_L = 50 pF)

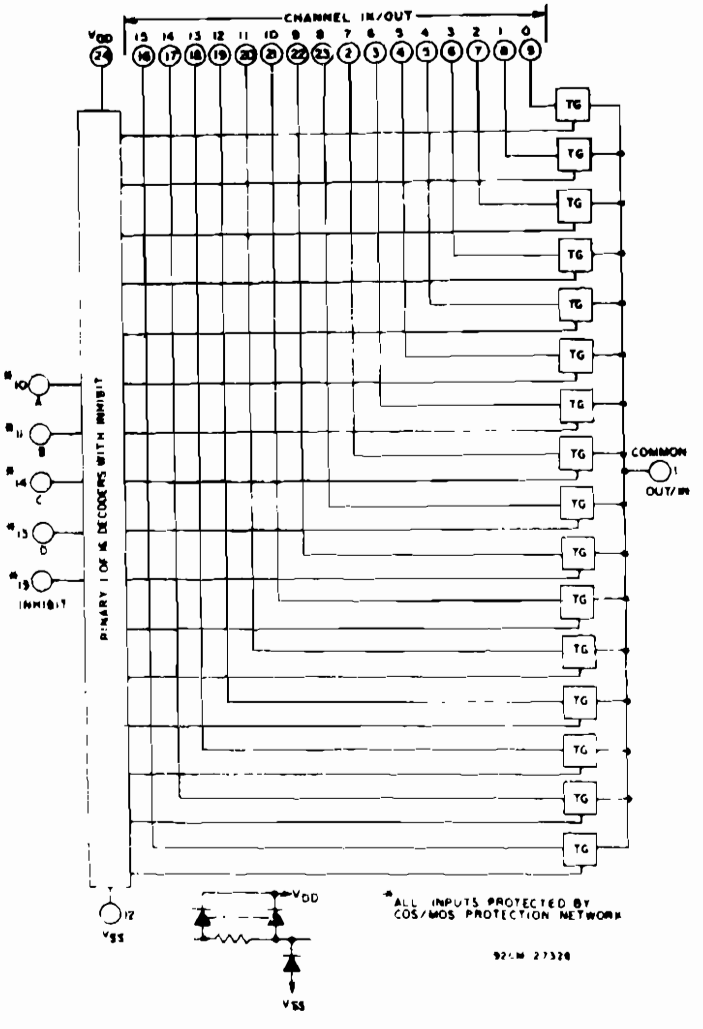


Fig. 16–CD4067 logic diagram

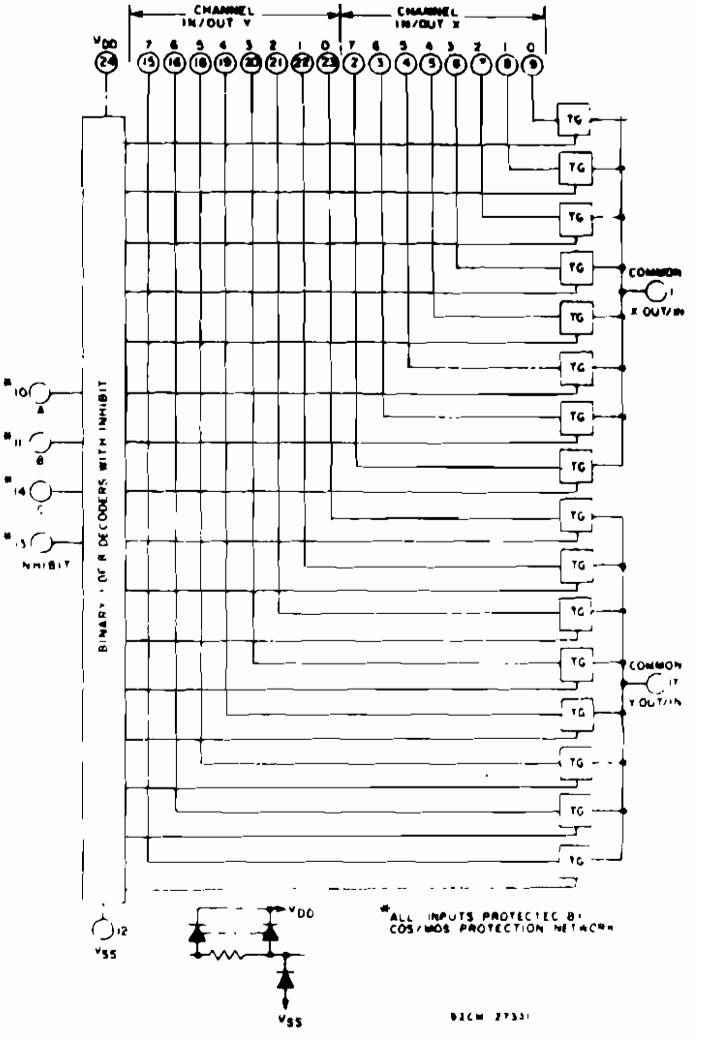


Fig. 17–CD4097 logic diagram

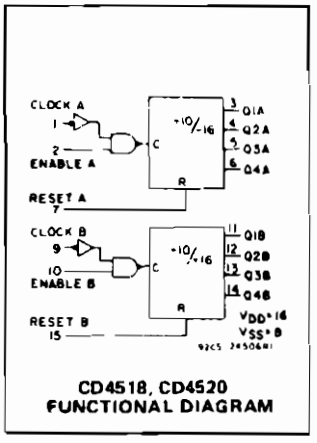
CD4518B
DUAL BCD UP-COUNTER
CMOS DIGITAL

The CD4518B is a dual BCC Up-Counter consisting of two identical, internally synchronous 4 stage counters. The counter stages are D type flip-flops having interchangeable CLOCK and ENABLE lines for incrementing on either the positive-going or the negative-going transition. If the ENABLE unit is held high, the counter advances on each positive going clock transition. Cascading can be effected in the ripple mode by connecting Q4 to the ENABLE input of the subsequent counter, while the CLOCK input of the latter is held low.

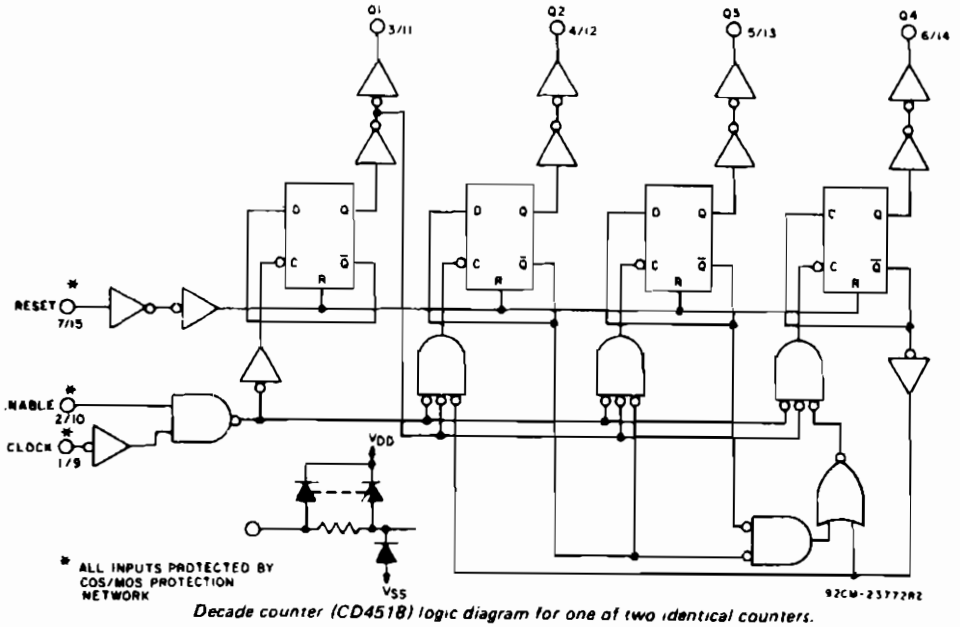
TRUTH TABLE

CLOCK	ENABLE	RESET	ACTION
⌐	1	0	Increment Counter
0	¬	0	Increment Counter
¬	X	0	No Change
X	⌐	0	No Change
⌐	0	0	No Change
1	¬	0	No Change
X	X	1	Q1 thru Q4 = 0

X = Don't Care 1 ≡ High State 0 ≡ Low State



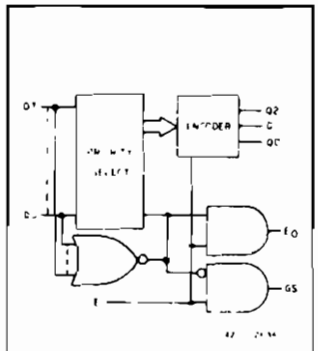
CD4518, CD4520
FUNCTIONAL DIAGRAM



Decade counter (CD4518) logic diagram for one of two identical counters.

CD4532B
8-BIT PRIORITY ENCODER
CMOS DIGITAL

The CD4532 consists of combinational logic that encodes the highest priority input (D7-D0) to a 3 bit binary code. The eight inputs, D7 through D0, each have an assigned priority; D7 is the highest priority and D0 is the lowest. The priority encoder is inhibited when the chip-enable input E_I is low. When E_I is high, the binary representation of the highest-priority input appears on output lines Q2-Q0, and the group select line GS is high to indicate that priority inputs are present. The enable-out (E_O) is high when no priority inputs are present. If any one input is high, E_O is low and all cascaded lower-order stages are disabled.



CD4532 Functional Diagram

TRUTH TABLE

Input									Output				
E_I	D7	D6	D5	D4	D3	D2	D1	D0	GS	Q2	Q1	Q0	E_O
0	X	X	X	X	X	X	X	X	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0	0	0	0	1
1	1	X	X	X	X	X	X	X	1	1	1	1	0
1	0	1	X	X	X	X	X	X	1	1	1	0	0
1	0	0	1	X	X	X	X	X	1	1	0	1	0
1	0	0	0	1	X	X	X	X	1	1	0	0	0
1	0	0	0	0	1	X	X	X	1	0	1	1	0
1	0	0	0	0	0	1	X	X	1	0	1	0	0
1	0	0	0	0	0	0	1	X	1	0	0	1	0
1	0	0	0	0	0	0	0	1	1	0	0	0	0

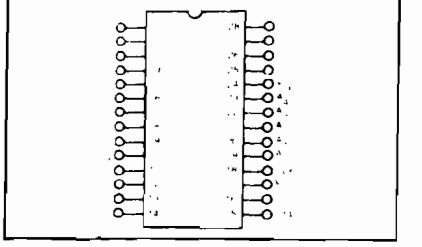
X - Don't Care Logic 1 High Logic 0 Low

ER2051
512 BIT ELECTRICALLY ALTERABLE READ ONLY MEMORY

- 32 Word x 16 Bits/Word Organization
- 5-Bit Parallel Binary Addressing
- Electrically reprogrammable
- 4.0 μsec Word Read Access Time
- 40 msec Word Erase Time
- 40 msec Word Write Time
- Minimum Data Retention — 2 x 10^{11} Read Cycles/Word Before Refresh
- Three-State Outputs
- 28 Pin Ceramic Dual In-Line Package
- Unpowered, Nonvolatile Data Storage — 10 Years at 70 C
- Chip-Select, Control, Address, and Data Inputs TTL Compatible

STANDARD 28 PIN SIDE BRAZE DIP
(1.4 x 0.6 IN.)

PIN CONFIGURATION



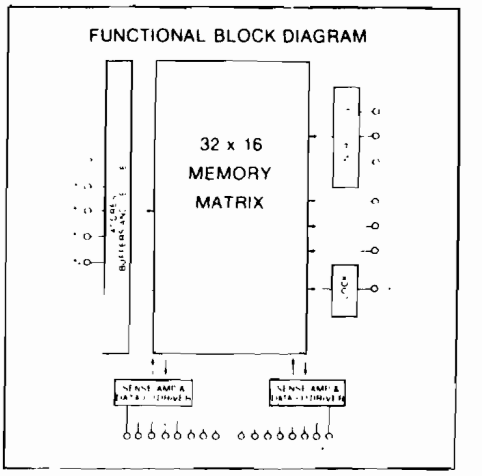
The NCR 2051 is a fully decoded, 32 x 16-bit electrically erasable and reprogrammable ROM utilizing second-generation NCR MNOS epitaxial processing technology.

Data is stored by applying negative writing pulses that selectively tunnel charge into the oxide-nitride interface at the gate insulator of the MNOS memory transistors. When the writing voltage is removed, the charge trapped at the interface is manifested as a negative shift in the threshold voltage of the selected memory transistor.

Stored data may be accessed a minimum of 2 x 10^{11} times before refresh is necessary, and is nonvolatile in the unpowered state in excess of 10 years. Although the NCR 2051 is not intended for use as a read/write memory, data can be erased and rewritten up to a maximum of 10^6 times.

All reading, writing, and erasing is accomplished through the use of internal voltage shifting. Hence, high voltage switching and its associated logic are not required for operation.

FUNCTIONAL BLOCK DIAGRAM



PIN FUNCTIONS

A_0-A_4	5-Bit Word Address
D_0-D_{15}	Data input and output pins
CS	Chip Select. Chip selected at logic 1. When chip select is at logic "0" outputs are open circuit, read, write and erase are disabled. Power is reduced.
C1, C2	Mode Control Inputs C1 C2 1 1 Hold Mode — output data from previous read operation stored at output pins 0 1 Erase Mode — stored data is erased at addressed location 1 0 Read Mode — addressed data read after clock pulse. Output data retained at output pins until next read operation 0 0 Write Mode — input data written at addressed location. Clock not required Note: Care must be exercised to ensure that CS is held at logic "0" during power up or power down to protect all addresses from spurious write or erase inputs.
CLK	Clock Input. Pulse to logic "1" for read operation
V_{SS}	Substrate supply. Normally at +5 volts
V_{GI}	Ground Input
V_{GG}	Power Supply Input. Normally at -28 volts

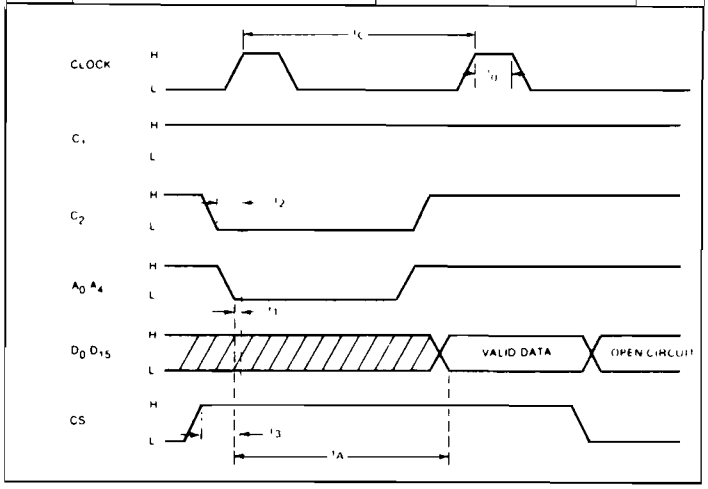
ABSOLUTE MAXIMUM RATINGS*

All inputs or outputs relative to V_{SS}	+0.3V to -30V
Operating ambient temperature	0 C to +70 C
Storage temperature	-65 C to +150 C
Soldering temperature of leads (10 seconds)	+300 C

*Exceeding these ratings could cause permanent damage. Functional operation of this device at these conditions is not implied—operating ranges are specified below.

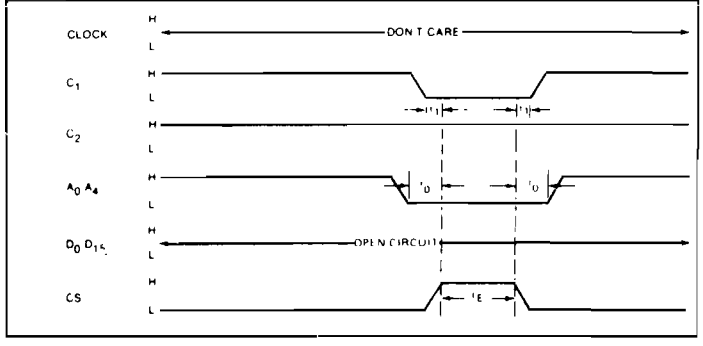
READ CYCLE CHARACTERISTICS T_A 0°C to 70°C

Symbol	Parameter	Min	Typ	Max	Unit
t_D	Clock pulse width	20		20	μsec
t_C	Cycle time (t_O 20 μsec)	40			μsec
t_A	Access time (t_O 20 μsec)			40	μsec
t_1	Address - clock separation	0			nsec
t_2	Select - clock separation	0			nsec
t_3	Mode - clock separation	0			nsec
t_{rc}	Input Rise Time	0		100	nsec
t_f	Input Fall Time	0		100	nsec



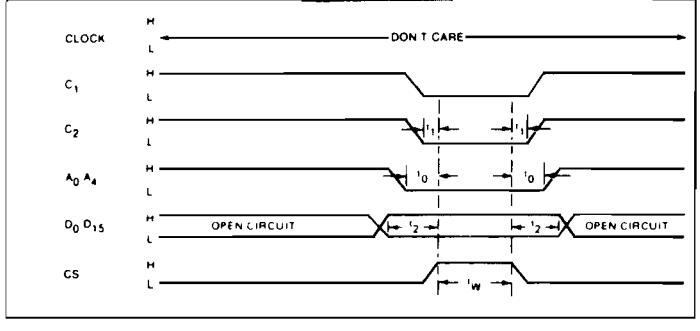
ERASE CYCLE CHARACTERISTICS, T_A 0°C TO 70°C

Symbol	Parameter	Min	Typ	Max	Unit
t_E	V_{GG} Erase pulse width	40		200	msec
t_0	Address Select - Erase Delay	0			nsec
t_3	Mode Select - Erase Delay	0			nsec



WRITE CYCLE CHARACTERISTICS, T_A = 0°C TO 70°C

Symbol	Parameter	Min	Typ	Max	Unit
t_W	Write pulse width	40		200	msec
t_0	Address Select - Write Delay	0			nsec
t_1	Mode Select - Write Delay	0			nsec
t_2	Data Set - Write Delay	0			nsec



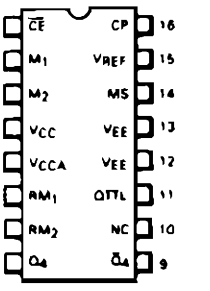
RECOMMENDED OPERATING CONDITIONS, T_A 0°C TO 70°C

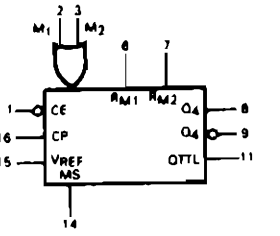
Symbol	Parameter	Power Supply Requirements: TTL Erase Min	Erase Typ	Erase Max	CMOS Erase Min	Erase Typ	Erase Max	Write Min	Write Typ	Write Max	Read Min	Read Typ	Read Max
V_{DD}		4.75	5	5.25	4.5	5	5.5	4.5	5	5.5	4.5	5	5.5
V_{SS}			0			0			0			0	
V_{GG}		23.5	24	24.5	23.5	24	24.5	23.5	24	24.5	23.5	24	24.5
V_{CC1H} V_{CC2H}	* Clock high	V_{SS} -1.5	V_{SS}	V_{SS} +1.5	V_{SS} -1.5	V_{SS}	V_{SS} +1.5	V_{SS} -1.5	V_{SS}	V_{SS} +1.5	V_{SS} -1.5	V_{SS}	V_{SS} +1.5
t_{CKL}	Clock input rise			100			100			100			100
V_{C1H} V_{C2H}	Middle-clock high	V_{SS} +3.5	V_{SS} +4	V_{SS} +4.5	V_{SS} +3.5	V_{SS} +4	V_{SS} +4.5	V_{SS} +3.5	V_{SS} +4	V_{SS} +4.5	V_{SS} +3.5	V_{SS} +4	V_{SS} +4.5
V_{C1L} V_{C2L}	Middle-clock low	V_{SS} -1.5	V_{SS} -1	V_{SS} -0.5	V_{SS} -1.5	V_{SS} -1	V_{SS} -0.5	V_{SS} -1.5	V_{SS} -1	V_{SS} -0.5	V_{SS} -1.5	V_{SS} -1	V_{SS} -0.5
V_{GSH}	Chip-select high	V_{SS} +3.5	V_{SS} +4	V_{SS} +4.5	V_{SS} +3.5	V_{SS} +4	V_{SS} +4.5	V_{SS} +3.5	V_{SS} +4	V_{SS} +4.5	V_{SS} +3.5	V_{SS} +4	V_{SS} +4.5
V_{GSL}	Chip-select low	V_{SS} -1.5	V_{SS} -1	V_{SS} -0.5	V_{SS} -1.5	V_{SS} -1	V_{SS} -0.5	V_{SS} -1.5	V_{SS} -1	V_{SS} -0.5	V_{SS} -1.5	V_{SS} -1	V_{SS} -0.5
V_{AH}	Word address high	V_{SS} +3.5	V_{SS} +4	V_{SS} +4.5	V_{SS} +3.5	V_{SS} +4	V_{SS} +4.5	V_{SS} +3.5	V_{SS} +4	V_{SS} +4.5	V_{SS} +3.5	V_{SS} +4	V_{SS} +4.5
V_{AL}	Word address low	V_{SS} -1.5	V_{SS} -1	V_{SS} -0.5	V_{SS} -1.5	V_{SS} -1	V_{SS} -0.5	V_{SS} -1.5	V_{SS} -1	V_{SS} -0.5	V_{SS} -1.5	V_{SS} -1	V_{SS} -0.5
V_{DH}	Data-in high	V_{SS} +3.5	V_{SS} +4	V_{SS} +4.5	V_{SS} +3.5	V_{SS} +4	V_{SS} +4.5	V_{SS} +3.5	V_{SS} +4	V_{SS} +4.5	V_{SS} +3.5	V_{SS} +4	V_{SS} +4.5
V_{DL}	Data-in low	V_{SS} -1.5	V_{SS} -1	V_{SS} -0.5	V_{SS} -1.5	V_{SS} -1	V_{SS} -0.5	V_{SS} -1.5	V_{SS} -1	V_{SS} -0.5	V_{SS} -1.5	V_{SS} -1	V_{SS} -0.5

STATIC ELECTRICAL CHARACTERISTICS, T_A = 0°C TO 70°C NO EXTERNAL LOADS EXCEPT AS NOTED

Symbol	Parameter	Conditions: All Pins at V_{SS} Unless Noted	Min	Typ	Max	Unit
I_{IN}	Input leakage current (Pins 18-23 [9-12])	V_{IN} V_{SS} -15V			10	μA
I_{OUT}	Output leakage current	V_{OUT} V_{SS} -15V V_{CS} LOW V_{GG} V_{SS} -34V			1.0	μA
H	V_{GG} supply current	V_{GG} V_{SS} -34V		10	12	mA
		Outputs Open				
I_{PS}	V_{GG} supply current	V_{GG} V_{SS} -34V		7	8	mA
		Outputs Open				
I_{OH}	Data output high current	V_{OH} 2.4V	-1.0			mA
I_{OL}	Data output low current	V_{OL} 0.4V	-1.6			mA
V_{OH}	Data output high voltage	C_L 100 pf	V_{SS} -1.5			V
V_{OL}	Data output low voltage	C_L 100 pf			0.4	V
t_S	Chip set up	Following minimum write conditions	10		6	Years

FCS 11C90
650 MHZ ÷ 10/11 PRESCALER
ECL (EMITTER COUPLED LOGIC)





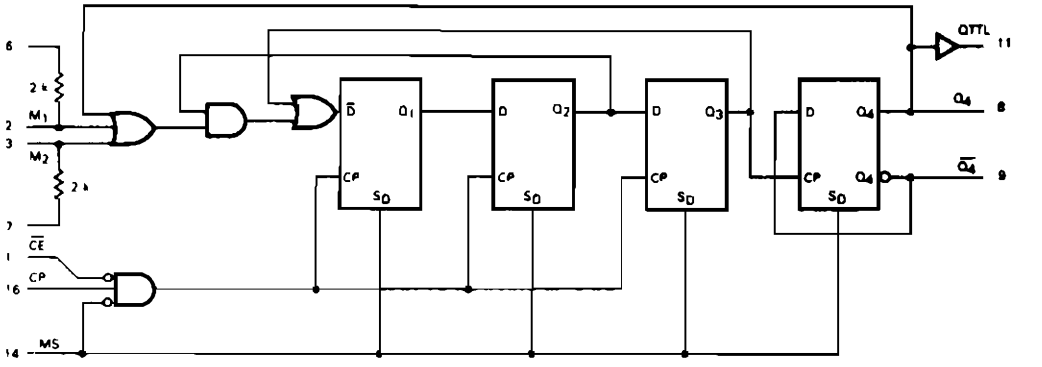
GENERAL DESCRIPTION The 11C90 is a high speed prescaler designed specifically for communication and instrumentation applications. It will divide by either 10 or 11 over a frequency range from dc to typically 650 MHz. The division ratio is controlled by the mode control. The divide by 10 or 11 capability allows the use of pulse swallowing techniques to control high speed counting modulos by lower speed circuits. The 11C90 may be used with either ECL or TTL power supplies.

In addition to the ECL outputs $\overline{Q}_4$ and Q_4, the 11C90 contains an ECL-to-TTL converter and a TTL output. The TTL output operates from the same V_{CC} and V_{EE} levels as the counter, but a separate pin is used for the TTL circuit V_{EE}. This minimizes noise coupling when the TTL output switches and also allows power consumption to be reduced by leaving the separate V_{EE} pin open if the TTL output is not used.

To facilitate capacitive coupling of the clock signal, a 400 Ω resistor (V_{REF}) is connected internally to the V_{BB} reference. Connecting this resistor to the Clock Pulse input (CP) automatically centers the input signal about the switching threshold. Maximum frequency operation is achieved with a 50% duty cycle.

Each of the Mode Control inputs is connected to an internal 2 k resistor with the other end uncommitted (RM_1 and RM_2). An M input can be driven from a TTL circuit operating from the same V_{CC} by connecting the free end of the associated 2 k resistor to V_{CCA}. When an M input is driven from an ECL circuit, the 2 k resistor can be left open or, if required, can be connected to V_{EE} to act as a pull-down resistor. The device is packaged in a hermetic 16 pin ceramic Dual In-line package. It is available in commercial and military temperature ranges.

LOGIC DIAGRAM



FUNCTIONAL DESCRIPTION – The 11C90 contains four ECL flip-flops, an ECL to TTL converter and a Schottky TTL output buffer with an active pull-up. Three of the flip-flops operate as a synchronous shift counter driving the fourth flip-flop operating as an asynchronous toggle. The internal feedback logic is such that the TTL output and the Q_4 ECL output are HIGH for six clock periods and LOW for five clock periods. The Mode Control (M) inputs can modify the feedback to make the output HIGH for five clock periods and LOW for five clock periods, as indicated in the Count Sequence Table.

The feedback logic is such that at the instant the output goes HIGH, the circuit is already committed as to whether the output period will be 10 or 11 clock periods long. This means that subsequent changes in an M input signal, including decoding spikes, will have no effect on the current output period. The only timing restriction for an M input signal is that it be in the desired state at least a set-up time before the clock that follows the HHLL state shown in the table. The allowable propagation delay through external logic to an M input is maximized by designing it to use the positive transition of the 11C90 output as its active edge. This gives an allowable delay of ten clock periods, minus the CP to Q delay of the 11C90 and the M to CP set-up time. If the external logic uses the negative output transition as its active edge, the allowable delay is reduced to five clock periods minus the aforementioned delay and set-up time.

COUNT SEQUENCE TABLE

	Q_1	Q_2	Q_3	Q_4(QTTL)	
	H	H	H	H	11
10	L	H	H	H	
	L	L	H	H	
	L	L	L	H	
	H	L	L	H	
	H	H	L	H	
	L	H	H	L	
	L	L	H	L	
	L	L	L	L	
	H	L	L	L	
	H	H	L	L	

Note: A HIGH on MS forces all Qs HIGH.

OPERATING MODE TABLE

INPUTS				OUTPUT RESPONSE
MS	$\overline{CE}$	M_1	M_2	
H	X	X	X	Set HIGH
L	H	X	X	Hold
L	L	L	L	– 11
L	L	H	X	– 10
L	L	X	H	÷ 10

X = Immaterial

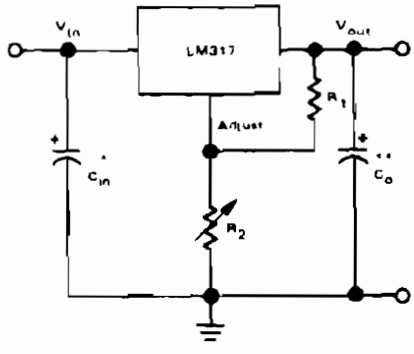
PIN NAMES

$\overline{CE}$	Count Enable Input (Active LOW)
CP	Clock Pulse Input
M_n	Count Modulus Control Input
MS	Asynchronous Master Set Input
Q_4, $\overline{Q}_4$	Complementary ECL Outputs
QTTL	TTL Output
RM_n	2 k Resistor to M_n
V_{REF}	400 Ω Resistor to V_{BB}

LM317T
ADJUSTABLE OUTPUT VOLTAGE REGULATOR
BIPOLAR LINEAR

The LM317 is an adjustable 3-terminal positive voltage regulator capable of supplying 1.5A over an output range of 1.2V to 37V. Internal current limiting, thermal shutdown, and safe area compensation make the regulator almost blow-out proof.

STANDARD APPLICATION

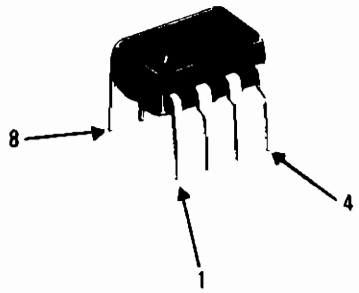


* - C_{in} is required if regulator is located an appreciable distance from power supply filter

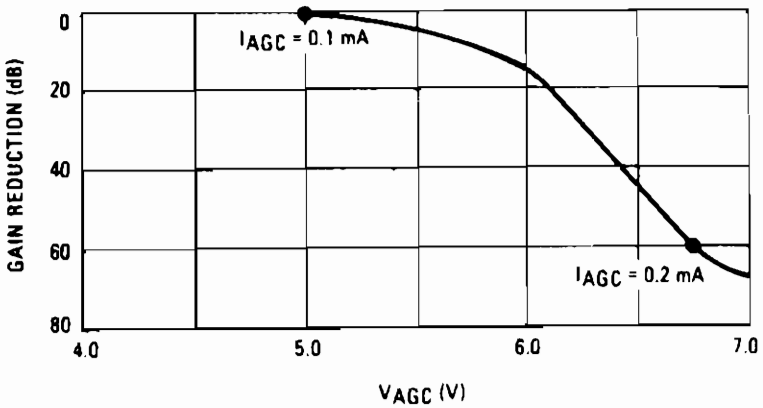
** C_o is not needed for stability, however it does improve transient response

MC 1350
IF AMPLIFIER
BIPOLAR LINEAR

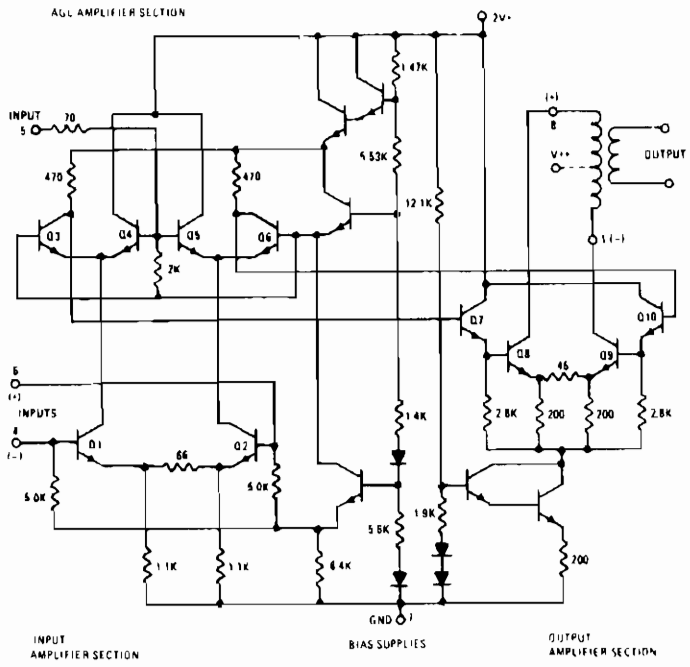
This monolithic silicon integrated circuit is used as AR1 on the 1A1A4 IF Audio Board. The device is shown schematically below. The 9 MHz IF input is at pin 4, where internal input amplifiers (Q1 and Q2) operate at constant emitter currents to hold input impedance constant regardless of AGC action. Delay AGC is fed to pin 5. AGC action occurs as a result of increasing voltage on the base of Q4 and Q5 causing these transistors to conduct more heavily, and thereby shunting current from interstage amplifiers Q3 and Q6. The output amplifiers are supplied from an active current source to maintain quiescent bias . . . thereby holding output admittance nearly constant. A gain reduction graph is included for the device.



TYPICAL GAIN REDUCTION

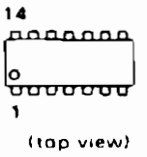


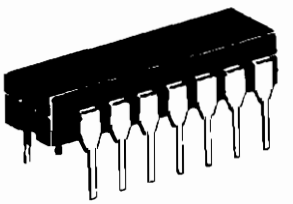
CIRCUIT SCHEMATIC

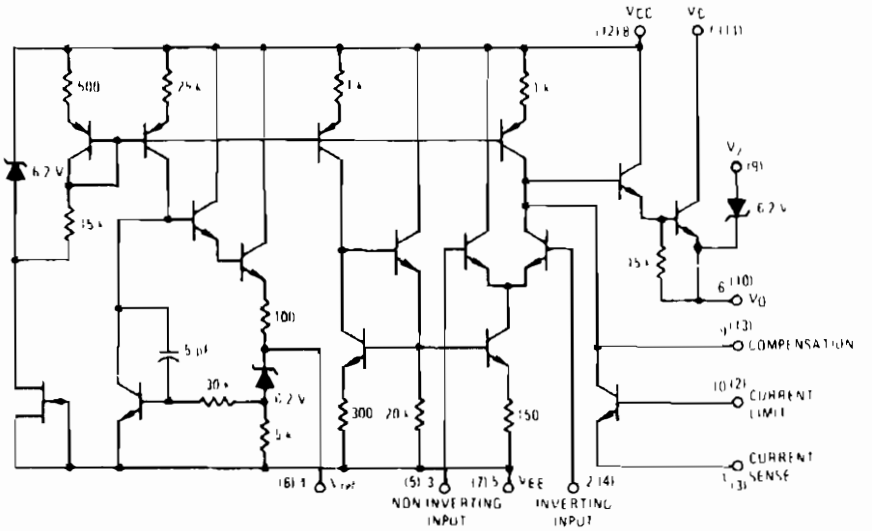


MC1723CL
MONOLITHIC VOLTAGE REGULATOR
BIPOLAR LINEAR

The MC1723CL is a positive or negative voltage regulator designed to deliver load currents to 150 mAdc. This regulator is used as U1, in a positive regulator configuration, to produce a regulated +10 Vdc on the 1A1A10 Frequency Standard PC Board.





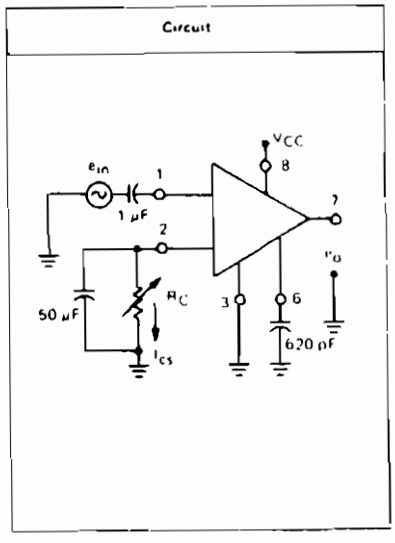


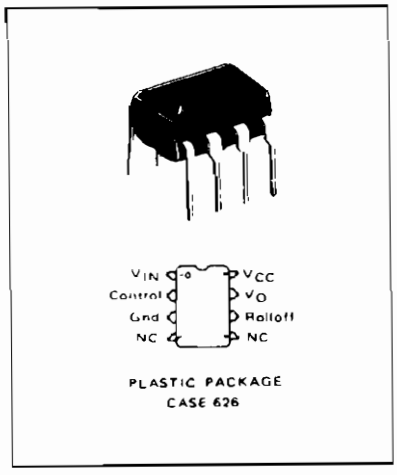
PIN NUMBERS ADJACENT TO TERMINALS ARE FOR THE METAL AND CERAMIC FLAT PACKAGE
PIN NUMBERS IN PARENTHESIS ARE FOR THE CERAMIC DUAL IN-LINE PACKAGE

MC3340P
ELECTRONIC ATTENUATOR
BIPOLAR LINEAR

ELECTRICAL CHARACTERISTICS

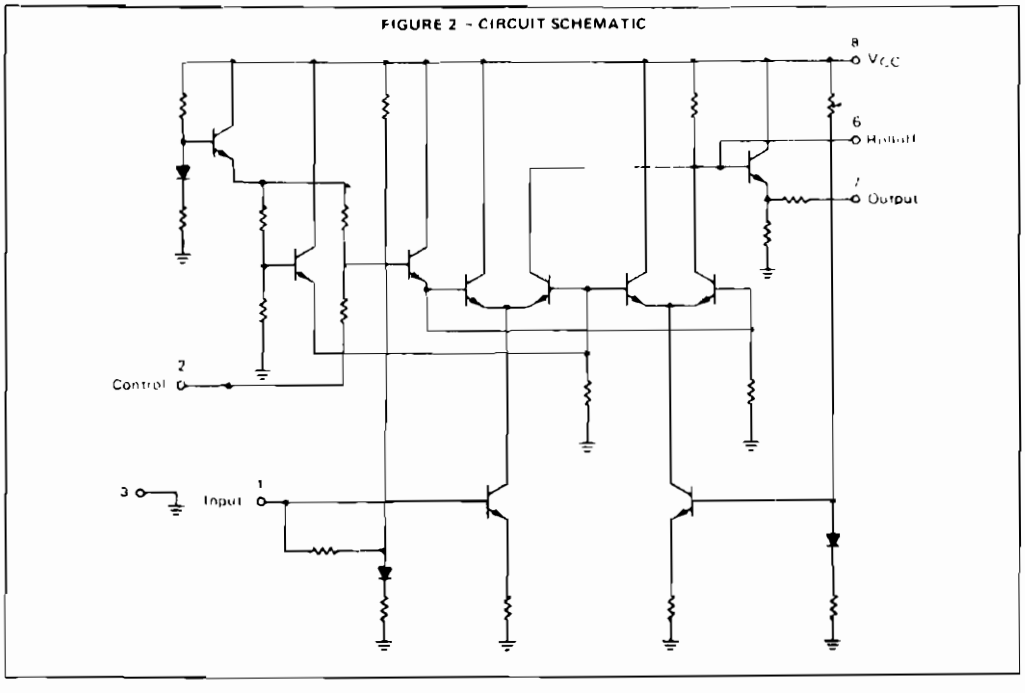
(e_{in} = 100mV(RMS), f = 1.0 kHz
R1 = 0, V_{CC} = 16 Vdc)





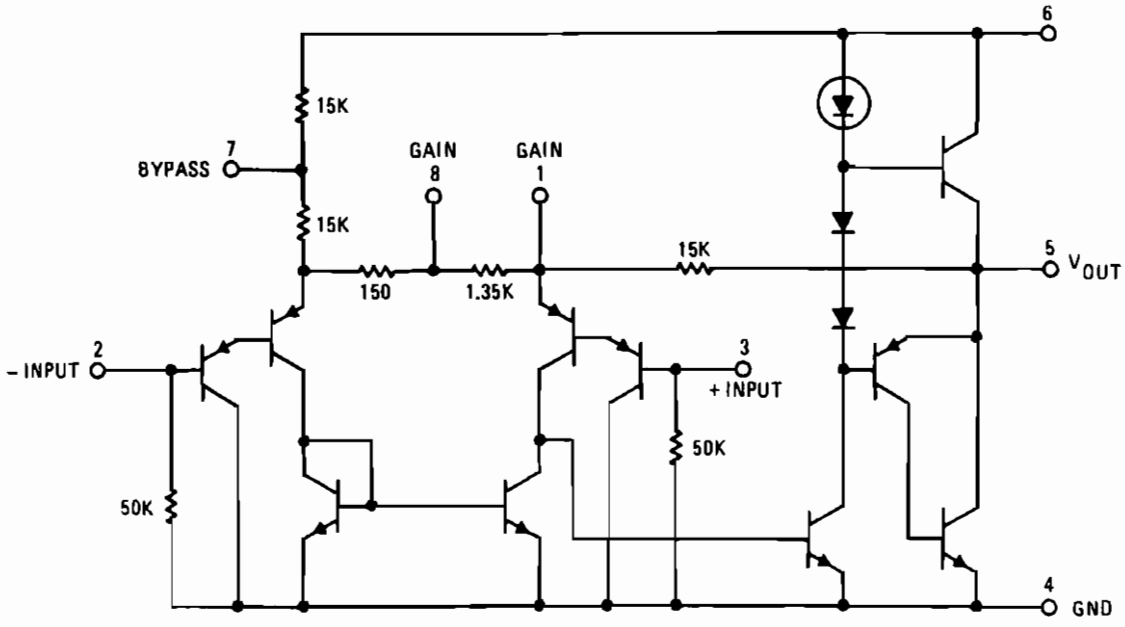
This device is used as U6 on the 1A1A5 Processor Board, and functions as a switch. A 1 kHz input signal is controlled (switched) by the cw key input to effect smooth cw keying.

FIGURE 2 - CIRCUIT SCHEMATIC



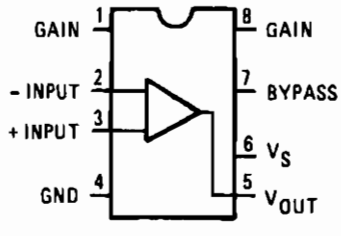
LM386N-1
1/4 WATT AUDIO AMPLIFIER
BIPOLAR LINEAR

The LM386 Audio Amplifier is used as AR3 on the IF/Audio PWB (6628-0590) as a 600 ohm audio line driver. The input to pin 1 in adjusted by R54 on the IF/Audio PWB. The device is shown schematically below.

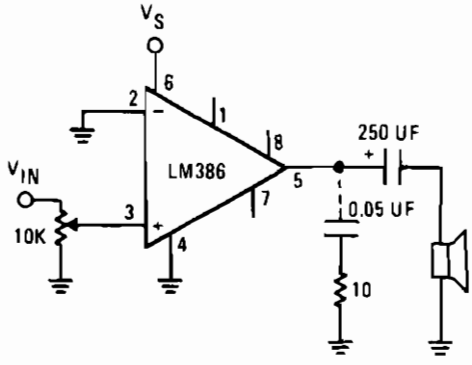


EQUIVALENT SCHEMATIC AND CONNECTION DIAGRAM

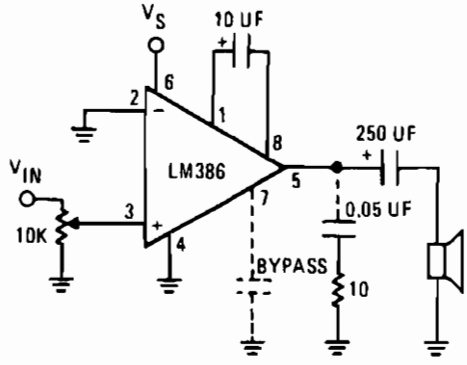
DUAL-IN-LINE PACKAGE



AMPLIFIER WITH GAIN = 20
MINIMUM PARTS



AMPLIFIER WITH GAIN = 200



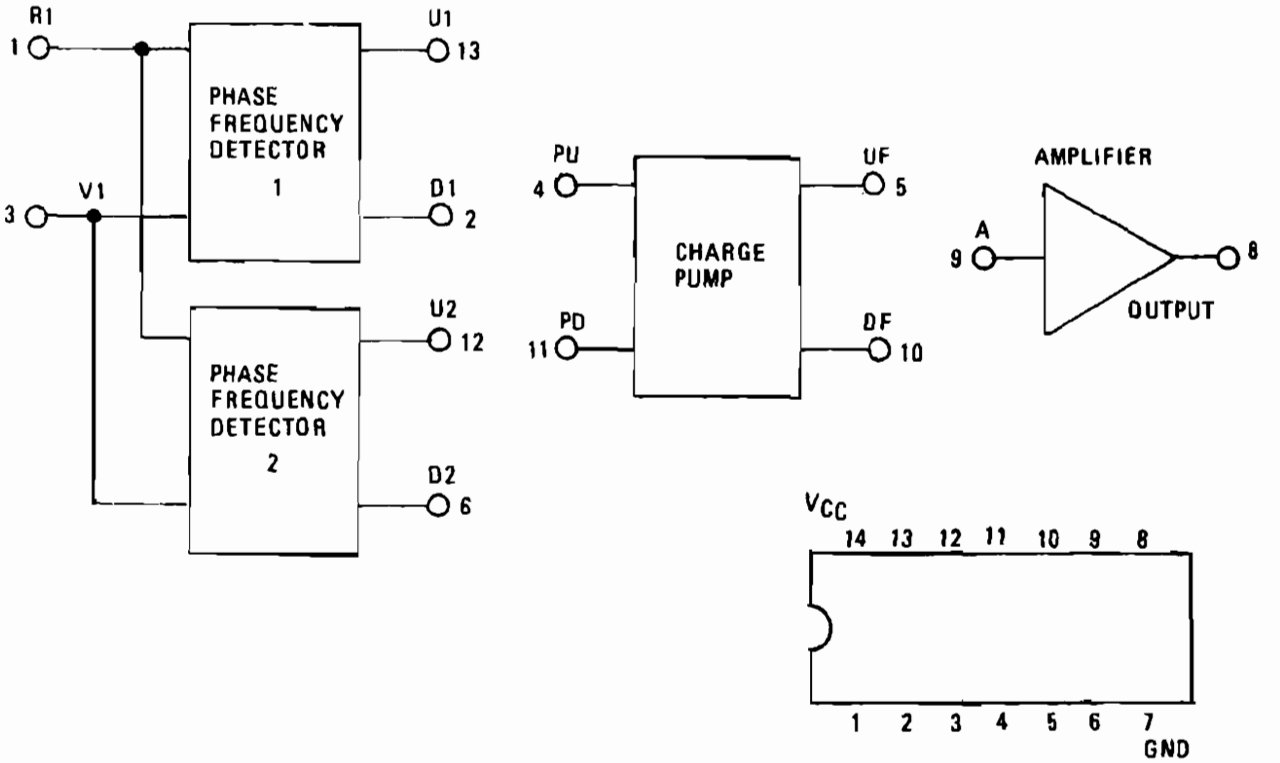
MC4044P

PHASE DETECTOR TTL, BIPOLAR DIGITAL

The MC4044 contains two digital phase detectors and a charge pump circuit which converts MTTL inputs to a dc voltage level. The two phase detectors have common inputs as shown below. Phase frequency detector 1 is locked in (both outputs high) when the negative transitions of the variable input (V1) and reference input (R1) are equal in frequency and phase. If the variable input is lower in frequency or lags in phase, the U1 (up) output goes low; conversely the D1 (down) output goes low when the variable input is higher in frequency or leads the reference input in phase. Duty cycles of the variable and reference inputs are not important because negative transitions control operation.

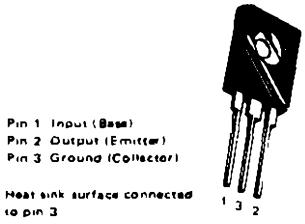
Phase detector 2 is locked in when the variable input phase lags the reference by 90° (indicated by U2 and D2 outputs alternately going low with equal pulse widths). If the variable input phase lags by more than 90°, U2 will remain low longer than D2, and, conversely, if the variable input phase lags the reference phase by less than 90°, D2 remains low longer. The variable and reference inputs must have 50% duty cycles.

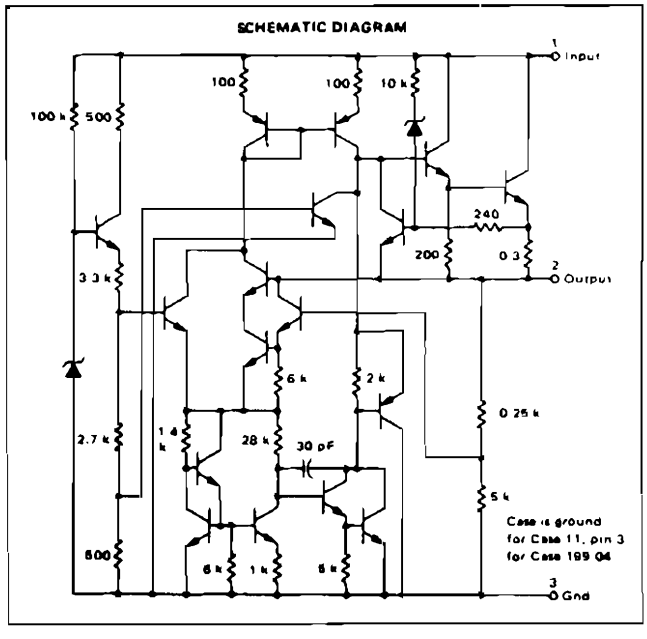
The charge pump accepts the phase detector outputs (U1 or U2 applied to PU, and D1 or D2 applied to PD) and converts them to fixed amplitude positive and negative pulses at the UF and DF outputs respectively. These pulses are applied to a lag-lead sensitive filter (using external components) and the integral amplifier. The filter provides a dc voltage proportional to the phase error.



MC7805CT
POSITIVE 5 VOLT REGULATOR
BIPOLAR LINEAR

The MC7805CP is a three terminal positive 5 volt regulator as shown in the accompanying diagrams. A circuit diagram of the monolithic integrated fixed regulator circuit is shown below also. The regulator employs internal current limiting, thermal shutdown, and safe area compensation and is, as a consequence, essentially blow-out proof.

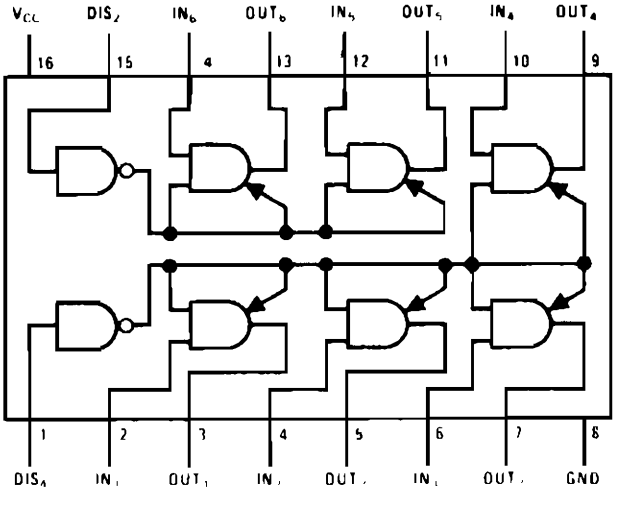




MM80C97

HEX TRI-STATE NON-INVERTING BUFFERS
CMOS DIGITAL

Each device converts CMOS or TTL outputs to Tri-state, with no logic inversion. The MM80C97 has two tri-state controls, one for two buffers, and one for the other four.



TOP VIEW

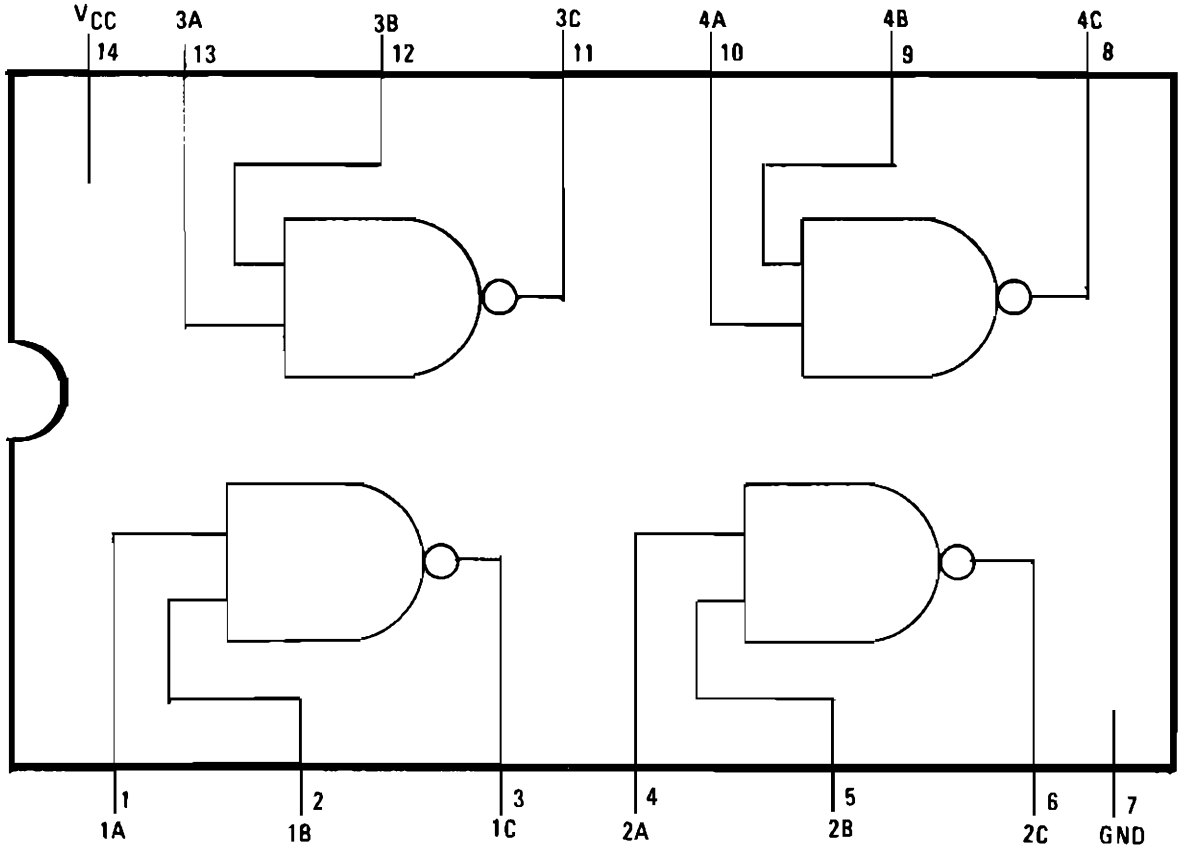
MM80C97

MM80C97

DISABLE INPUT		INPUT	OUTPUT
DIS_4	DIS_2		
0	0	0	0
0	0	1	1
X	1	X	HZ*
1	X	X	HZ**

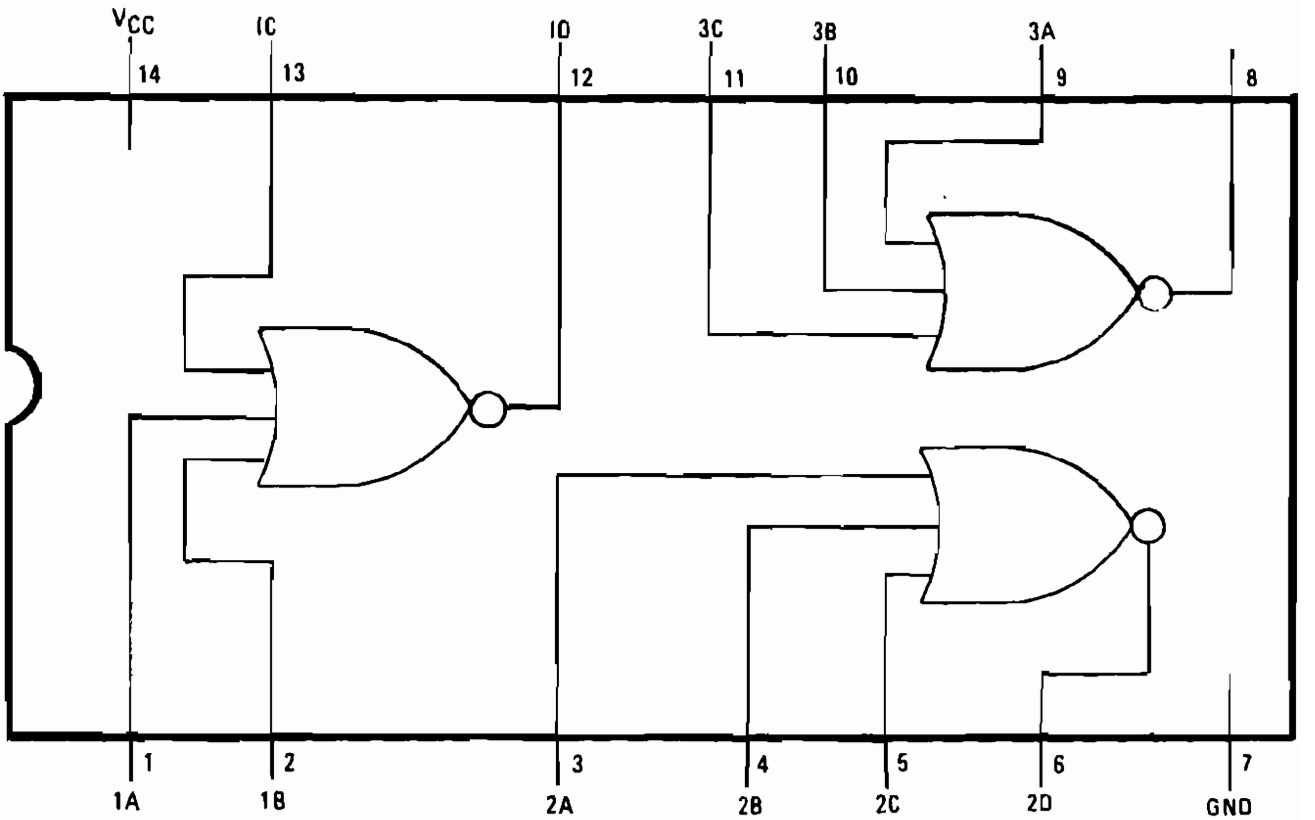
*Output 5 6 only
**Output 1 4 only
X Irrelevant

SN74LS00
QUADRUPLE 2-INPUT POSITIVE NAND GATES TTL
BIPOLAR DIGITAL



A	B	C
0	0	1
0	1	1
1	0	1
1	1	0

SN74LS27
TRIPLE 3-INPUT POSITIVE-NOR GATE TTL
BIPOLAR DIGITAL



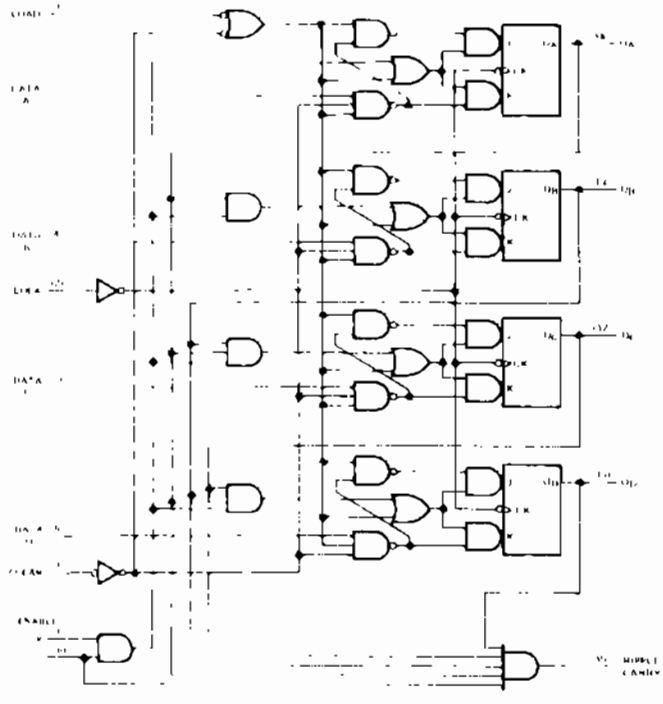
A	B	C	D
0	0	0	1
0	0	1	0
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	0

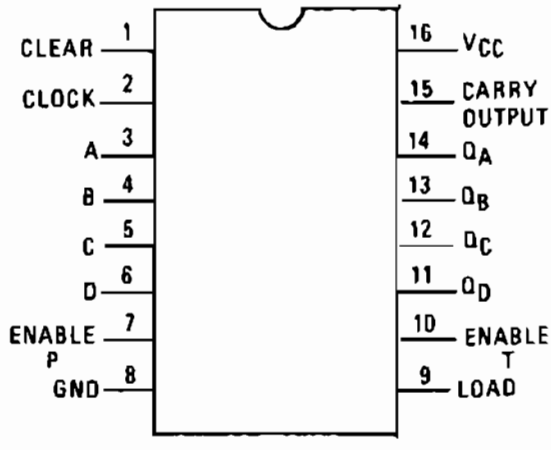
SN74LS163

SYNCHRONOUS 4-BIT BINARY COUNTER TTL BIPOLAR DIGITAL

All flip-flops are clocked simultaneously to provide synchronous operation. Outputs change coincident with each other when so instructed by the count-enable inputs and internal gating. The buffered clock input triggers the four J-K master-slave flip-flops on the positive going edge of the input waveform. A low level at the load input disables the counter and causes the outputs to agree with setup data after the next clock pulse regardless of enable input levels. The clear function is synchronous and a low level at the clear input sets all four flip-flops outputs low after the next clock input regardless of enable levels.

Carry look-ahead circuitry provides for cascading counters for n-bit synchronous applications. The two count enable inputs (P & T) must be high to count, and, input T is fed forward to enable the carry output. The carry output thus enabled will produce a positive output pulse with a duration approximately equal to the positive portion of Q_A. This positive overflow carry pulse can be used to enable successive stages.



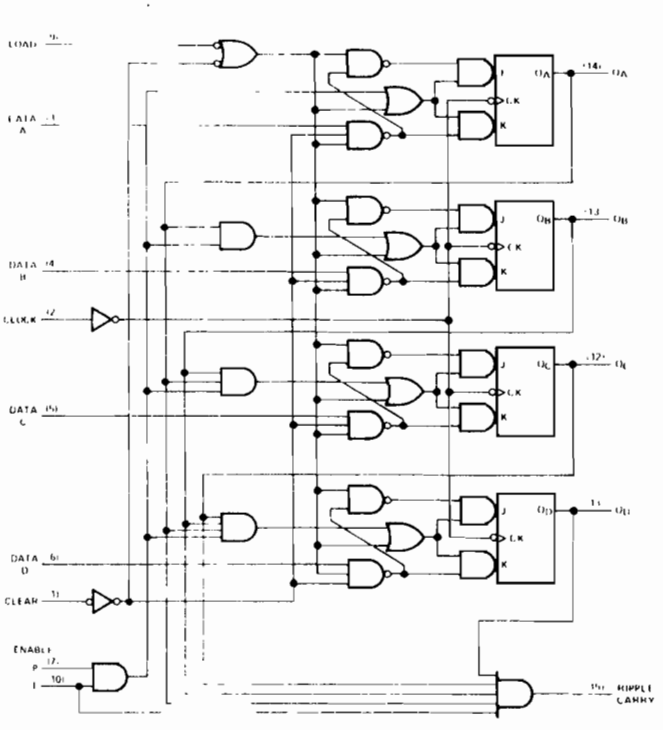


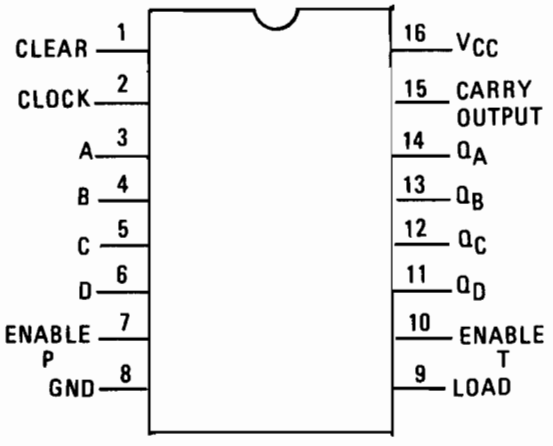
SN74LS163

SYNCHRONOUS 4-BIT BINARY COUNTER TTL BIPOLAR DIGITAL

All flip-flops are clocked simultaneously to provide synchronous operation. Outputs change coincident with each other when so instructed by the count-enable inputs and internal gating. The buffered clock input triggers the four J-K master-slave flip-flops on the positive going edge of the input waveform. A low level at the load input disables the counter and causes the outputs to agree with setup data after the next clock pulse regardless of enable input levels. The clear function is synchronous and a low level at the clear input sets all four flip-flops outputs low after the next clock input regardless of enable levels.

Carry look-ahead circuitry provides for cascading counters for n-bit synchronous applications. The two count enable inputs (P & T) must be high to count, and, input T is fed forward to enable the carry output. The carry output thus enabled will produce a positive output pulse with a duration approximately equal to the positive portion of Q_A. This positive overflow carry pulse can be used to enable successive stages.

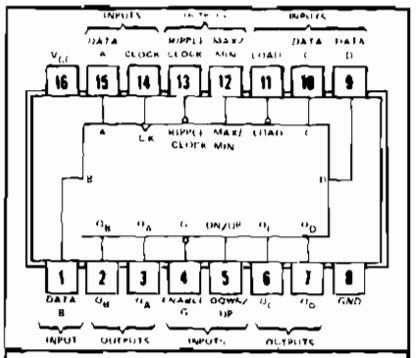




74LS190

SYNCHRONOUS UP/DOWN BCD COUNTER TTL
BIPOLAR DIGITAL

The outputs of the four master-slave flip-flops are triggered on a low-to-high level transition of the clock input if the enable input is low. A high at the enable input inhibits counting. The direction of the count is determined by level of the down/up input. When low, the counter counts up, and when high, it counts down. The counter can be programmed by placing a low on the load input and entering the desired data at the data inputs. The output will change to agree with the data inputs independently of the clock input level.

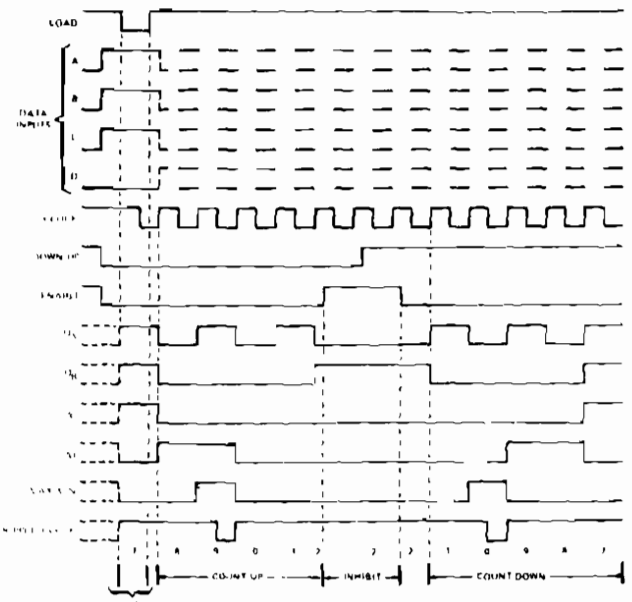


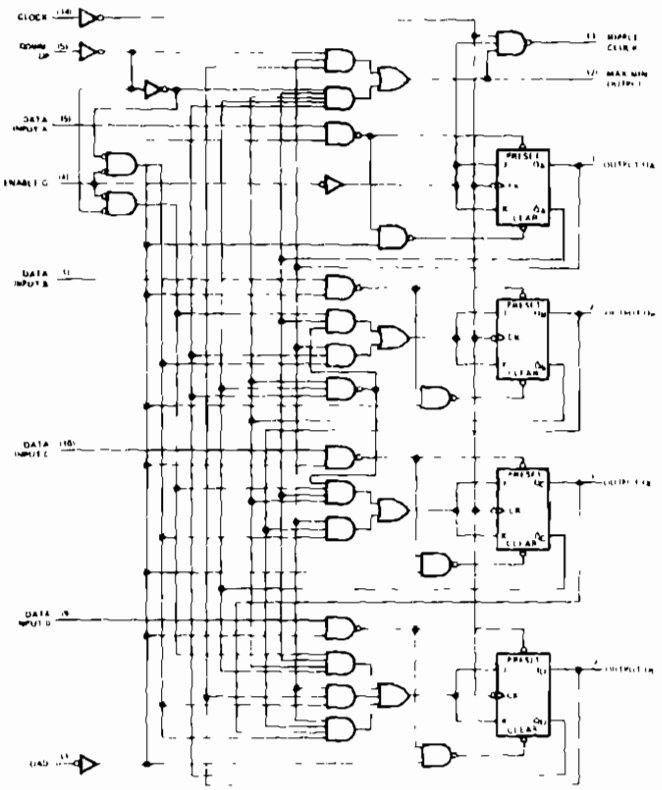
asynchronous inputs: Low input to load sets Q_A=A, Q_B = B, Q_C = C, and Q_D = D

typical load, count, and inhibit sequences

Illustrated below is the following sequence

1. Load (preset) to BCD seven
2. Count up to eight, nine (maximum), zero, one, and two
3. Inhibit
4. Count down to one, zero (minimum), nine, eight, and seven

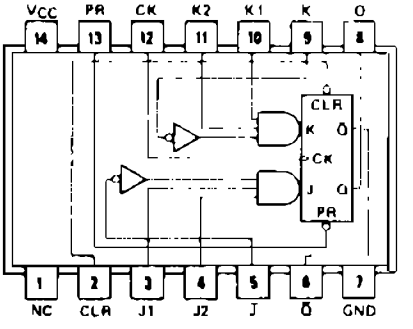




SN7470

AND GATED J-K FLIP-FLOP TTL, BIPOLAR DIGITAL

The MC7470 is an AND Gated positive-edge-triggered flip-flop with PRESET and CLEAR.



FUNCTION TABLE

INPUTS					OUTPUTS	
PRESET	CLEAR	CLOCK	J	K	Q	$\bar{Q}$
L	H	X	X	X	H	L
H	L	X	X	X	L	H
L	L	X	X	X	H*	H*
H	H	↓	L	L	Q_0	Q_0
H	H	↑	H	L	H	L
H	H	↑	L	H	L	H
H	H	↑	H	H	TOGGLE	
H	H	L	X	X	Q_0	Q_0

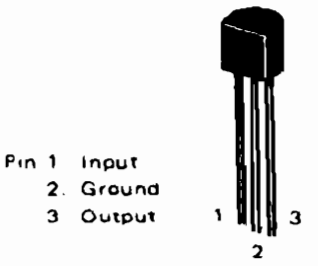
positive logic: J = J1·J2·J

K = K1·K2·K

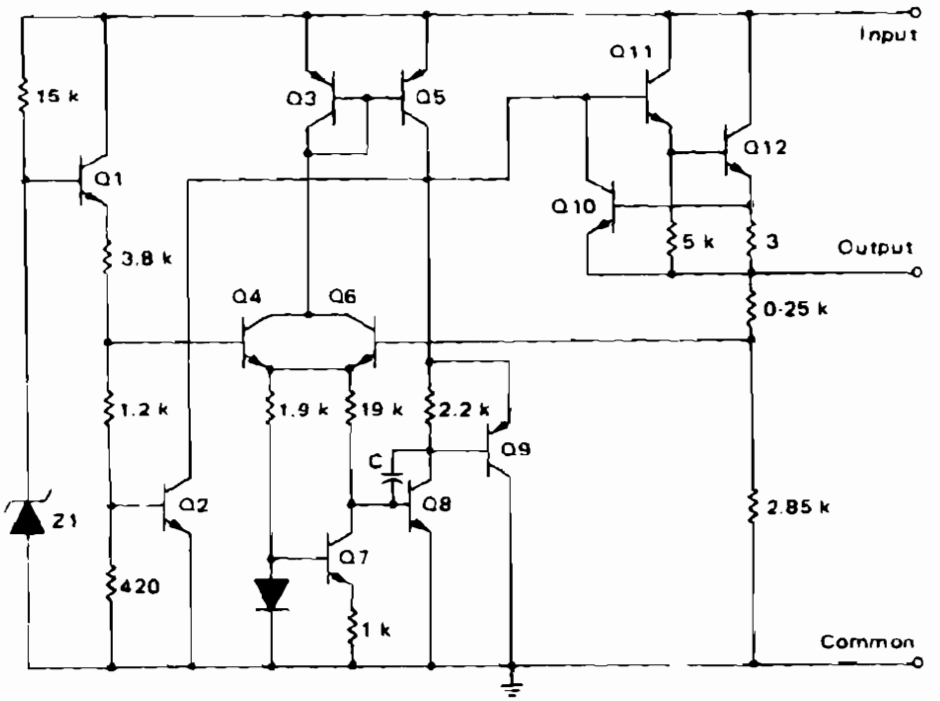
If inputs J and K are not used, they must be grounded

78L05
THREE TERMINAL POSITIVE FIXED VOLTAGE REGULATOR
5V ±5%

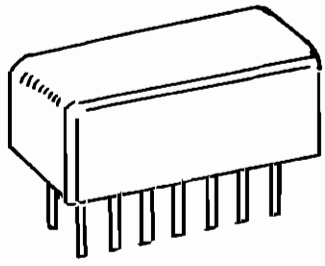
Provides a regulated 5 Vdc at up to 100 mA. This regulator incorporates internal current limiting and thermal shutdown.



REPRESENTATIVE CIRCUIT SCHEMATIC

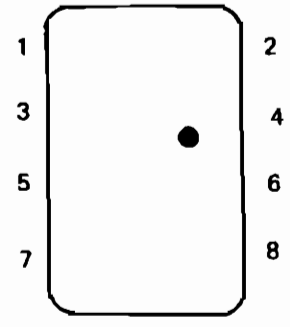


6628-0666
BALANCED MIXER



SPECIFICATIONS:

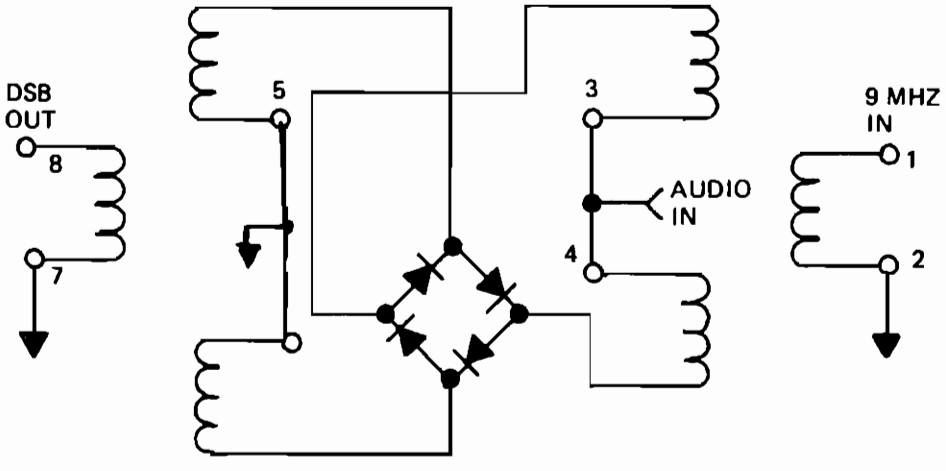
Polarity:	Positive with LO and RF in phase
DC Offset:	1 MV TYP
Attenuation:	3DB TYP for 10 MA IF current
IDB Compression Point:	+3 DBM Min
Power Input:	300 MW Max
IF Port Current:	50 MA Max
3rd Order Intercept:	+14 DBM TYP
Temperature Ranges:	
Operating:	-55°C to +100°C
Storage:	-55°C to +125



FREQUENCY RANGE		CONVERSION LOSS	ISOLATION (DB) L-F	L-X	R-X
0.5	100 MHZ	5.5DB TYP, 7DB MAX	*52	35	30
100	300 MHZ	5.5DB TYP, 7DB MAX	35	30	20
300	500 MHZ	6.5DB TYP, 8DB MAX	30	20	15

*Min.

All specifications are met using +7 DBM LO and 0 DBM RF (MAX)



PIN CONNECTIONS:

LO PIN 8	LO RETURN PIN 7
RF PIN 1	RF RETURN PIN 2
IF PIN 3 & 4*	IF RETURN PIN 5 & 6*

* Must be externally tied together.

PROM, DISPLAY DECODER

1. DESCRIPTION: Programmable read-only-memory; programmed.

2. PHYSICAL REQUIREMENTS: Part is identical to part number 125-0006-000 programmable read-only-memory (unprogrammed).

3. PROGRAM REQUIREMENTS:

ADDRESS (DECIMAL)	ADDRESS (HEX)	OUTPUT (HEX)	ADDRESS (DECIMAL)	ADDRESS (HEX)	OUTPUT (HEX)
0	00	3F	41	29	00
1	01	06	42	2A	00
2	02	5B	43	2B	00
3	03	4F	44	2C	00
4	04	66	45	2D	00
5	05	6D	46	2E	00
6	06	7C	47	2F	00
7	07	07	48	30	00
8	08	7F	49	31	00
9	09	67	50	32	00
10	0A	00	51	33	00
11	0B	00	52	34	00
12	0C	00	53	35	00
13	0D	00	54	36	00
14	0E	00	55	37	00
15	0F	00	56	38	00
16	10	00	57	39	00
17	11	06	58	3A	00
18	12	5B	59	3B	00
19	13	4F	60	3C	00
20	14	66	61	3D	00
21	15	6D	62	3E	00
22	16	7C	63	3F	00
23	17	07	64	40	00
24	18	7F	65	41	06
25	19	67	66	42	5B
26	1A	BF	67	43	00
27	1B	86	68	44	00
28	1C	DB	69	45	00
29	1D	CF	70	46	00
30	1E	E6	71	47	00
31	1F	ED	72	48	00
32	20	00	73	49	00
33	21	3E	74	4A	00
34	22	38	75	4B	00
35	23	77	76	4C	00
36	24	71	77	4D	00
37	25	39	78	4E	00
38	26	73	79	4F	00
39	27	40	80	50	00
40	28	00	81	51	00

PROM, DISPLAY DECODER (CONT.)

ADDRESS (DECIMAL)	ADDRESS (HEX)	OUTPUT (HEX)	ADDRESS (DECIMAL)	ADDRESS (HEX)	OUTPUT (HEX)
82	52	00	129	81	00
83	53	00	130	82	00
84	54	00	131	83	00
85	55	00	132	84	00
86	56	00	133	85	00
87	57	00	134	86	00
88	58	00	135	87	00
89	59	00	136	88	00
90	5A	00	137	89	00
91	5B	00	138	8A	00
92	5C	00	139	8B	00
93	5D	00	140	8C	00
94	5E	00	141	8D	00
95	5F	00	142	8E	00
96	60	00	143	8F	00
97	61	00	144	90	00
98	62	00	145	91	00
99	63	00	146	92	00
100	64	00	147	93	00
101	65	00	148	94	00
102	66	00	149	95	00
103	67	00	150	96	00
104	68	00	151	97	00
105	69	00	152	98	00
106	6A	00	153	99	00
107	6B	00	154	9A	00
108	6C	00	155	9B	00
109	6D	00	156	9C	00
110	6E	00	157	9D	00
111	6F	00	158	9E	00
112	70	00	159	9F	00
113	71	00	160	A0	00
114	72	00	161	A1	00
115	73	00	162	A2	00
116	74	00	163	A3	00
117	75	00	164	A4	00
118	76	00	165	A5	00
119	77	00	166	A6	00
120	78	00	167	A7	00
121	79	00	168	A8	00
122	7A	00	169	A9	00
123	7B	00	170	AA	00
124	7C	00	171	AB	00
125	7D	00	172	AC	00
126	7E	00	173	AD	00
127	7F	00	174	AE	00
128	80	00	175	AF	00

PROM, DISPLAY DECODER (CONT.)

ADDRESS (DECIMAL)	ADDRESS (HEX)	OUTPUT (HEX)	ADDRESS (DECIMAL)	ADDRESS (HEX)	OUTPUT (HEX)
176	B0	00	223	DF	00
177	B1	00	224	E0	00
178	B2	00	225	E1	00
179	B3	00	226	E2	00
180	B4	00	227	E3	00
181	B5	00	228	E4	00
182	B6	00	229	E5	00
183	B7	00	230	E6	00
184	B8	00	231	E7	00
185	B9	00	232	E8	00
186	BA	00	233	E9	00
187	BB	00	234	EA	00
188	BC	00	235	EB	00
189	BD	00	236	EC	00
190	BE	00	237	ED	00
191	BF	00	238	EE	00
192	C0	00	239	EF	00
193	C1	00	240	F0	00
194	C2	00	241	F1	00
195	C3	00	242	F2	00
196	C4	00	243	F3	00
197	C5	00	244	F4	00
198	C6	00	245	F5	00
199	C7	00	246	F6	00
200	C8	00	247	F7	00
201	C9	00	248	F8	00
202	CA	00	249	F9	00
203	CB	00	250	FA	00
204	CC	00	251	FB	00
205	CD	00	252	FC	00
206	CE	00	253	FD	00
207	CF	00	254	FE	00
208	D0	00	255	FF	00
209	D1	00			
210	D2	00			
211	D3	00			
212	D4	00			
213	D5	00			
214	D6	00			
215	D7	00			
216	D8	00			
217	D9	00			
218	DA	00			
219	DB	00			
220	DC	00			
221	DD	00			
222	DE	00			

PART VI

SUMMARIZED MAINTENANCE ADJUSTMENTS

Before deciding that the radio needs adjustment, first:

- Recheck equipment setup and cable connections
- Carefully repeat operator procedures
- Check the primary source of power

Then refer to this section for a summary of radio alignment and performance adjustments.

When troubleshooting, first determine the nature of the problem as clearly as possible. Think through each step when attempting adjustments. Read all instructions with care.

6.1 INTRODUCTION

This section summarizes important radio adjustments and measurements that may be required in the field. Use this section when troubleshooting, when verifying radio performance to specifications, or when necessary to modify the RF-2301 Transceiver to accommodate specific units of peripheral equipment.

This section describes several radio adjustments in summary form. For detailed information on any of these adjustments -- theory of operation, test equipment setup, and step-by-step procedures -- refer to the maintenance paragraphs in individual Unit Instruction tab sections for each assembly.

Before making any adjustment, refer to the appropriate Maintenance section of this manual. Lack of attention to proper adjustment procedures or the unintended effects of adjustments can cause reduced performance.

6.2 POWER SUPPLY AND FRONT PANEL METER ADJUSTMENTS

Figure 1 shows potentiometer locations for these front panel meter measurements and adjustments:

- Reflected Power Adjust
- S-Meter Adjust
- Forward Power Adjust

This figure also shows potentiometer locations for these power supply adjustments:

- -24 Vdc Adjust
- Regulator Current Adjust
- +10 Vdc Adjust

6.3 TRANSMITTER ADJUSTMENTS

Figure 2 shows potentiometer locations for transmitter operation adjustments:

NOTE

Prior to performing transmit adjustments ensure transceiver is connected to a 50 ohm, 150W load.

- 1 kHz Level Adjust
- CW Sidetone Output Level Adjust
- AM Carrier Power Adjust
- PCS Carrier Power Adjust
- 600-Ohm Audio Input Level Adjust
- 600-Ohm Monitor Level Adjust
- Microphone Level Adjust

Figure 3 shows potentiometer locations for transmitter output power and protection adjustments:

- Temperature Cutback Adjust
- Overvoltage Threshold Adjust
- Output Power Adjust

6.4 RECEIVER ADJUSTMENTS

Figure 4 shows potentiometer locations for receiver operation adjustments:

- 600-Ohm Audio Line Level Adjust
- AM AGC Threshold Adjust
- AM AGC Gain Adjust
- Squelch Gain Adjust
- Hang Threshold Adjust
- SSB AGC Threshold Adjust

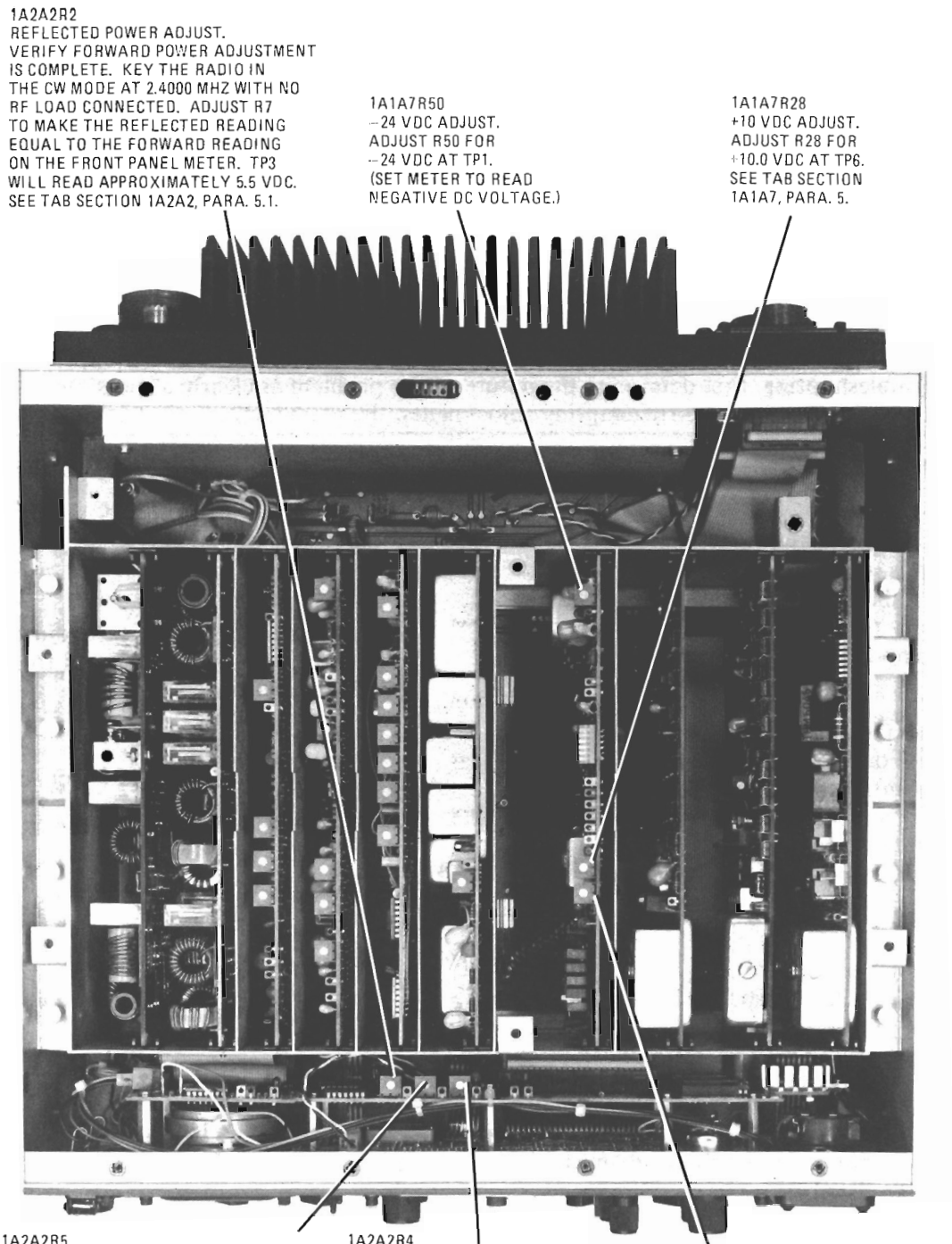


Figure 6-1. Power Supply and Front Panel Meter Adjustments

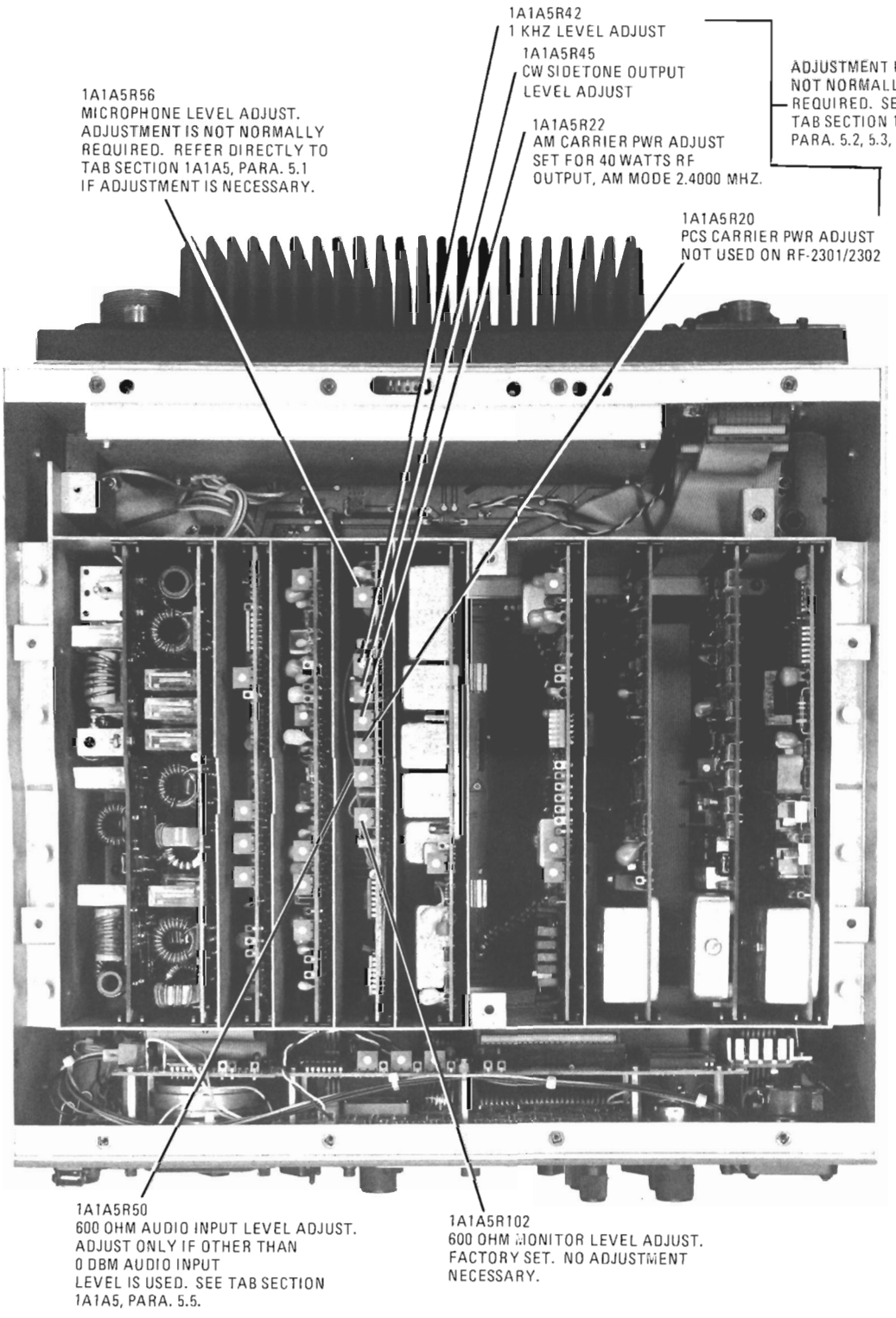


Figure 6-2. Transmitter Operation Adjustments

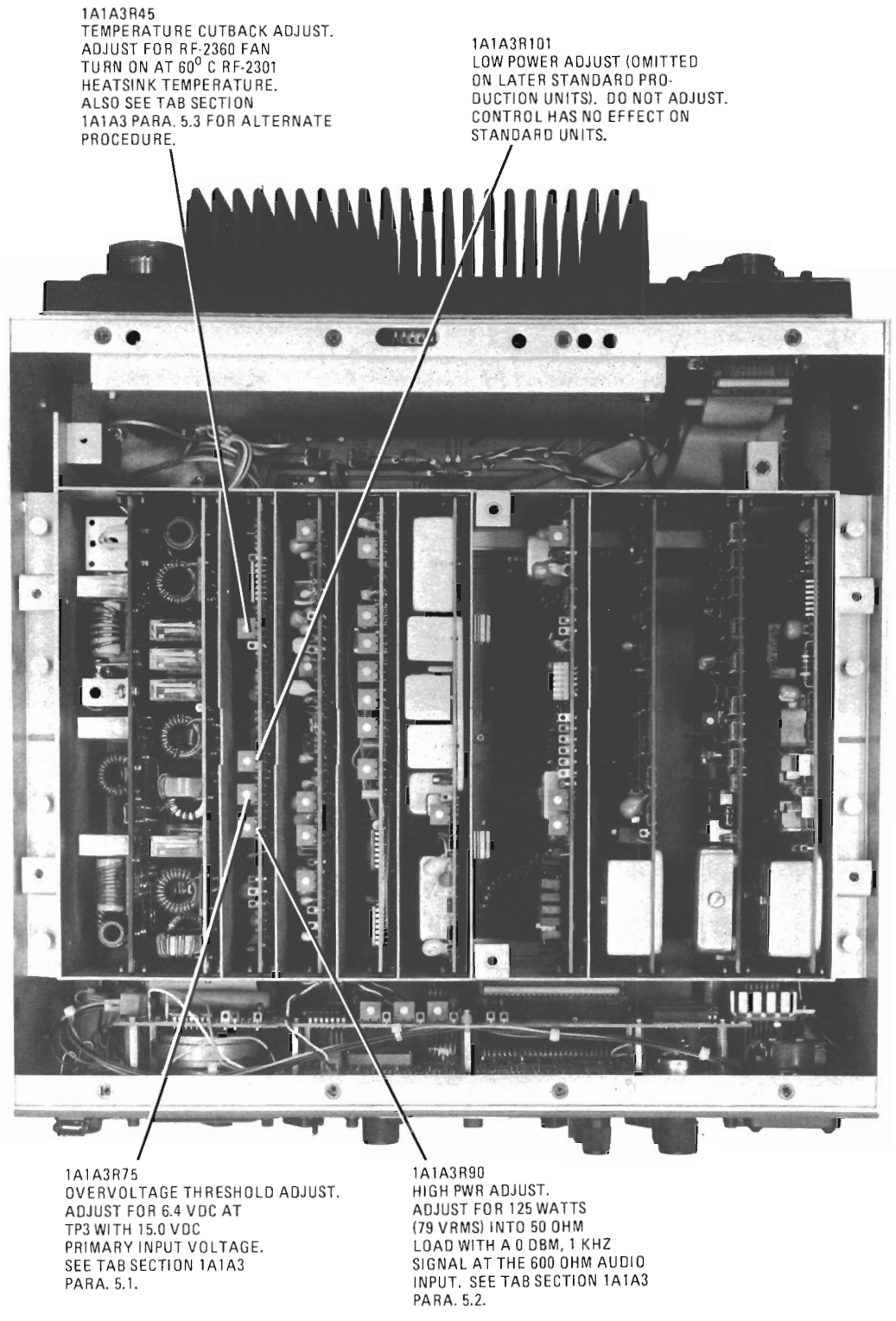


Figure 6-3. Transmitter Output Power and Protection Adjustments

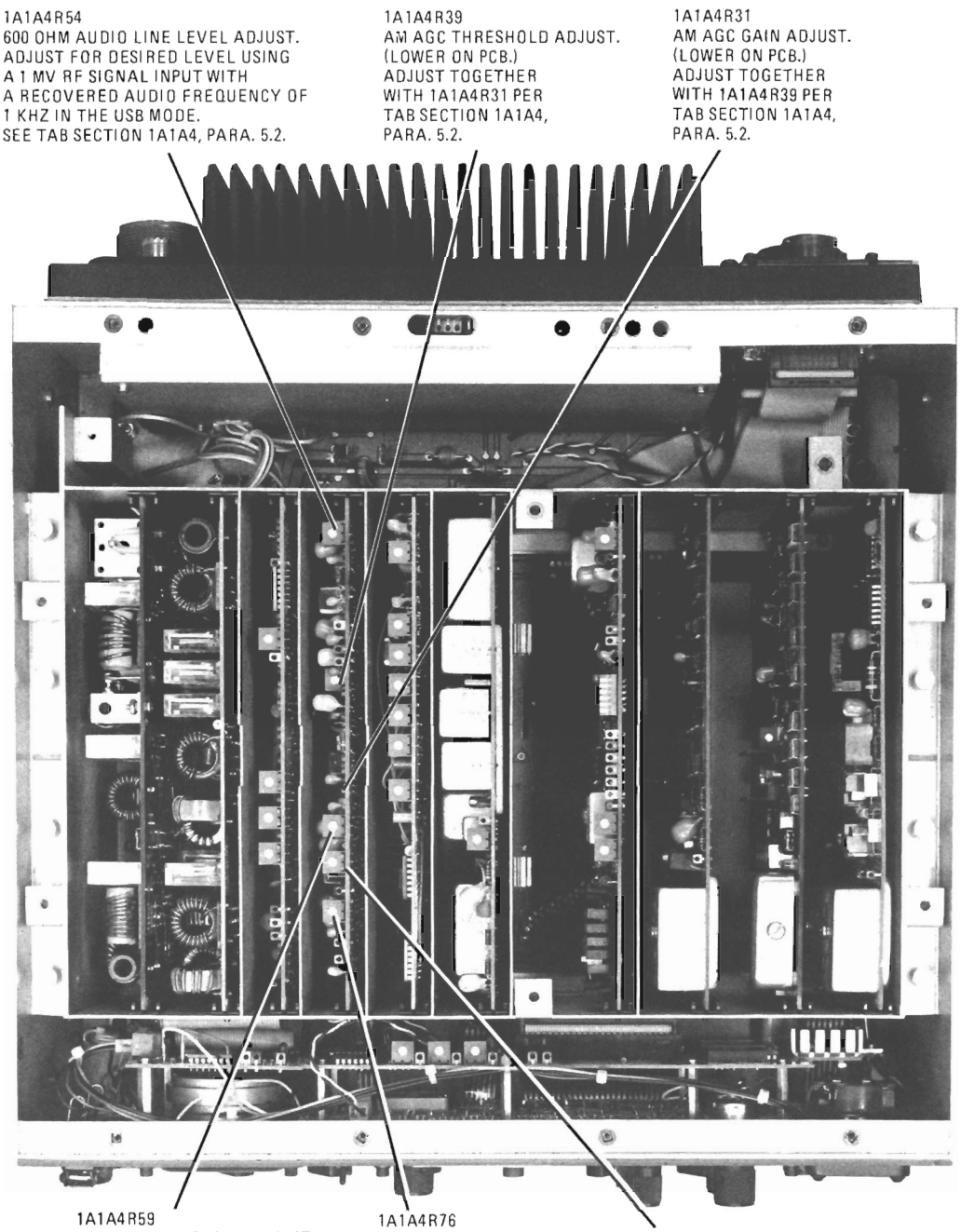


Figure 6-4. Receiver Operation Adjustments

PART VII

UNIT INSTRUCTIONS

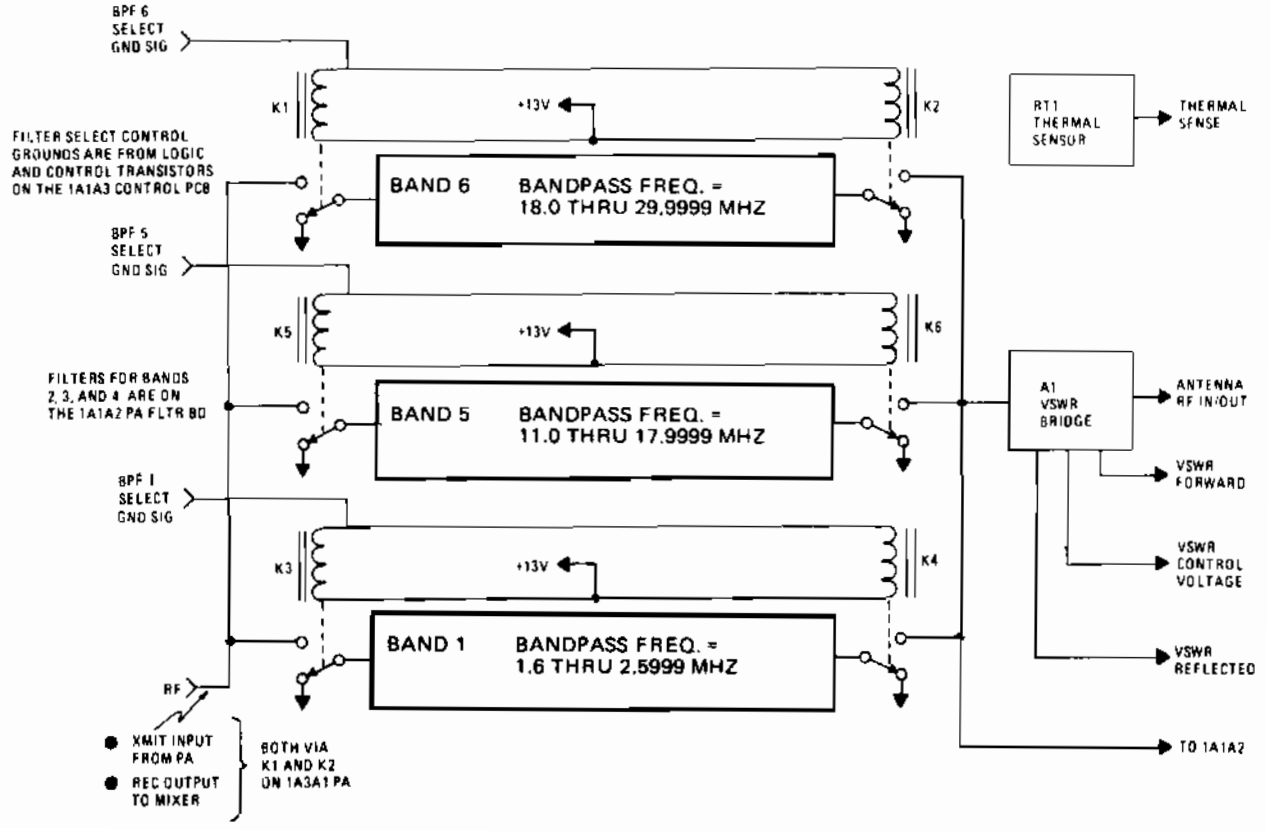
The following sections provide information relating to the various assemblies contained within the RF-2301 transceiver. The sections are indexed and labeled with their respective nomenclature. The following assemblies are described in the indexed sections:

1A1A1	PA FILTER #1
1A1A2	PA FILTER #2
1A1A3	PA CONTROL BOARD
1A1A4	IF/AUDIO BOARD
1A1A5	PROCESSOR BOARD
1A1A6	MIXER BOARD
1A1A7	MEMORY BOARD
1A1A8	L.O. #2
1A1A9	FREQUENCY STANDARD
1A1A10	L.O. #1
1A1A11	INTERCONNECTING BOARD
1A2A1	FREQUENCY SELECT BOARD
1A2A2	INTERFACE BOARD
1A2A3	DISPLAY BOARD
1A3A1	RF AMPLIFIER
1A3A2	INTERFACE CONNECTOR ASSEMBLY
1A4	12/24 VDC POWER SUPPLY

UNIT INSTRUCTIONS

PA FILTER NO.1

1A1A1



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1. GENERAL DESCRIPTION

PA Filter No. 1 works with PA Filter No. 2 to perform the receive mode preselector function, and in the transmit mode to filter the power amplifier output. PA Filter No. 1 contains three of the six eliptical low/high pass filters required to perform these functions. Input or output signals are all routed through the VSWR assembly on the 1A1A1 board. The desired eliptical filter is selected automatically by relay control ground signals from the 1A1A3 PA Control Board. In the transmit mode the filter selected will reduce harmonic output to typically better than −50 dB. In the receive mode, these same filters maintain input losses at such a low level that the signal can be introduced directly to the high dynamic range input mixer on the 1A1A6 Mixer Board. Figure 1 is included to demonstrate spectral relationships, and is not intended to show exact filter response curves.

2. TECHNICAL CHARACTERISTICS

Power Requirements:
+13.8V from front panel for band select relays.

Signal Inputs:
PA Output power in transmit mode, typically 125W (or higher to allow for losses).
Receive RF Input, (0.7 uV for 10 dB S+N/N).

Control Inputs:
Control ground signals to band select relay from PA Control PC Board, 1A1A3.
VSWR Control

Control Outputs:
Thermal Output
VSWR Forward
VSWR Reflected

Filter Types (Cascaded)
5 Pole Chebyshev High Pass
5 Pole Elliptical Low Pass

Power Handling Capability:
150 Watts average.

Operating Temperature Range:
−30°C to +60°C

3. SEMICONDUCTOR COMPLEMENT

REF. DESIG.	TYPE	FUNCTION
CR1–CR3	1N4004	Diode
A1CR1–A1CR2	5082-2800	Diode, Hot Carrier

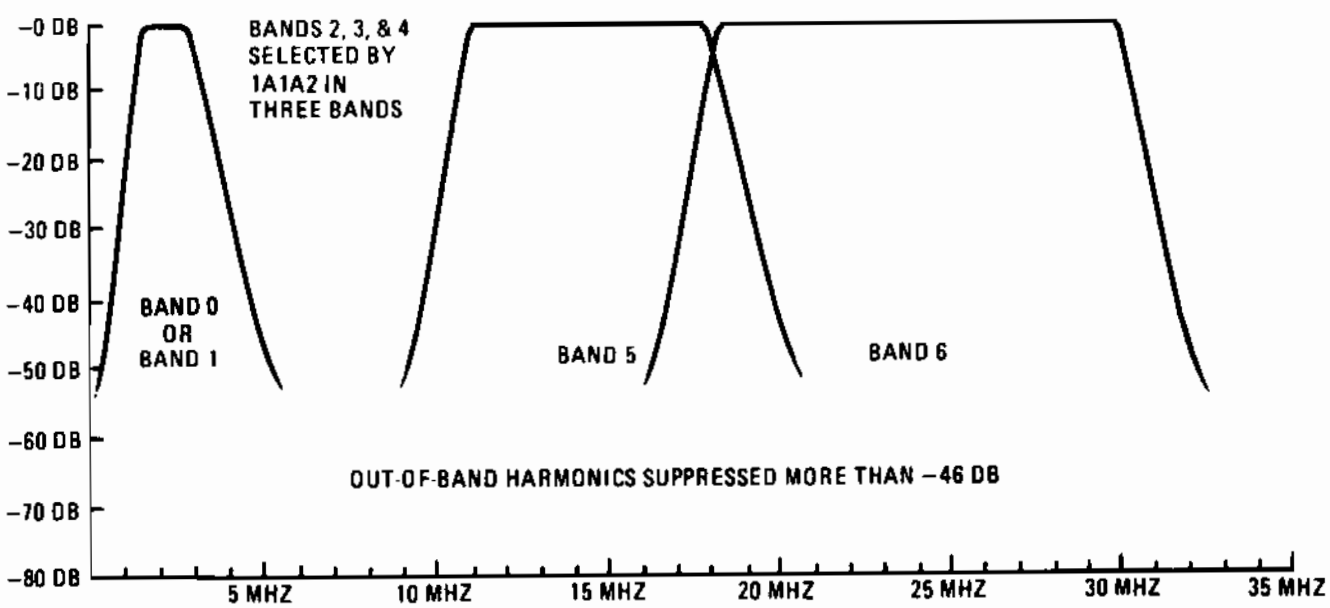


Figure 1. Spectral Band Relationship

4. CIRCUIT DESCRIPTION

Band pass filter select information is decoded on the 1A1A3 PA Control PC Board, and translated to BPF (Band Pass Frequency) select control signals. These control signals are in the form of relay control grounds (minus the drop across the control transistor on the PA Control PC Board). For example, a channel selection that would result in an operating frequency of 1.7 MHz would apply a relay control ground at pin 30. The +13.8V operating voltage present at the hot side of K3 and K4 would now have a path to ground thru Q8 on the PA Control PC Board, K3 and K4 would energize and the 1.6 – 2.599 MHz frequency select elliptical filter elements would be placed in the signal path.

At the antenna side of the filter, VSWR bridge A1 is also placed in the circuit. Pin 42 at the output connects to the RF IN/OUT connector at the rear of the radio. CR2 and CR1 in the VSWR bridge sense and detect forward and reflected power through L3 and provide corresponding control voltage outputs as shown in figure 2, a simplified diagram demonstrating the VSWR output functions. The reflected (REF) output is used to generate a metering voltage thru buffer amplifier Q17 on the PA Control PC Board. The forward power is also brought out for metering through buffer Q15, as well as to provide for ACC (Automatic Carrier Control) sensing. Together the reflected and forward power outputs are combined to provide automatic level control (ALC) of the output power. AR2 provides additional weighting for reflected power signal to allow protection of the power amplifier when operating into mismatched loads. The RT1 thermal sensor output (THERM OUT) at pin 33 connects to the VSWR TEMP CONTROL circuit as shown to produce constant power output in response to ambient temperature changes. The LOW POWER SELECT function is also shown in this simplified diagram because it operates thru this circuit on the PA Control PC Board to effect HI-LO power control. A logic "0" at pin 21 on the PA Control PC Board Q21 base on to reduce output power to 25 watts.

5. MAINTENANCE

Bandpass filter performance can be measured against the following specifications:

Cut off Frequencies:
Band 0/Band 1 1.6 2.6 MHz
Band 5 11.0 - 18.0 MHz
Band 6 18.0 – 30.0 MHz

Input VSWR:
Low Pass: 1.353:1 maximum
High Pass: 1.105:1 maximum
Combined: 1.495:1 maximum

Insertion Loss:
0.5 dB maximum

Stopband Attenuation:
2nd harmonic – 15 dB minimum
All other harmonic – 35 dB minimum

Temperature Range:
$-30^{\circ}C$ to $+60^{\circ}C$

5.1 VSWR Bridge Adjustment Procedure

For this procedure, use the test equipment and basic setup shown in figure 3 of the 1A1A3 Unit Instructions section.

1. Remove 1A1A1 PA Filter No. 1 PWB Assembly. Tape off pins 39 and 40. Reinstall the PWB on an extender card.
2. With the unit set to 2.4000 MHz, USB turn the 600 ohm audio input all the way down.
3. Key the unit and slowly increase the audio input level until the RF output reaches 125 watts (79 Vrms).

   CAUTION

   The ALC has been disabled for this procedure. Damage to the PA Assembly can occur if the specified output power is exceeded. Continuously monitor the RF output and adjust the audio input as necessary to insure safe RF output level.
4. Install a VOM at pin 39 and adjust C1 on the VSWR Bridge Assembly for a DC voltage null.
5. Disconnect the 50 ohm load from the rear panel antenna jack and note the VOM reading.
6. Install the VOM at pin 40 and adjust C2 on the VSWR Bridge Assembly for the same reading as noted in the previous step.

7. Repeat steps 4-6 as some adjustment interaction occurs.

8. Unkey. Remove the tape from pins 39 and 40. Reinstall the assembly into the card cage. Reconnect the 50 ohm load.

9. Adjust ALC High Power potentiometer R90 per paragraph 5.2 in Tab Section 1A1A3 PA Control.

10. Reconfigure for normal operation.

6. PARTS LIST

Parts list information is given in table 1. All parts are identified in figure 3, the 1A1A1 Component Location Diagram. Complete manufacturers code data is given in the general information section of this under maintenance.

7. SCHEMATICS

Figure 4 is a complete schematic diagram of the assembly.

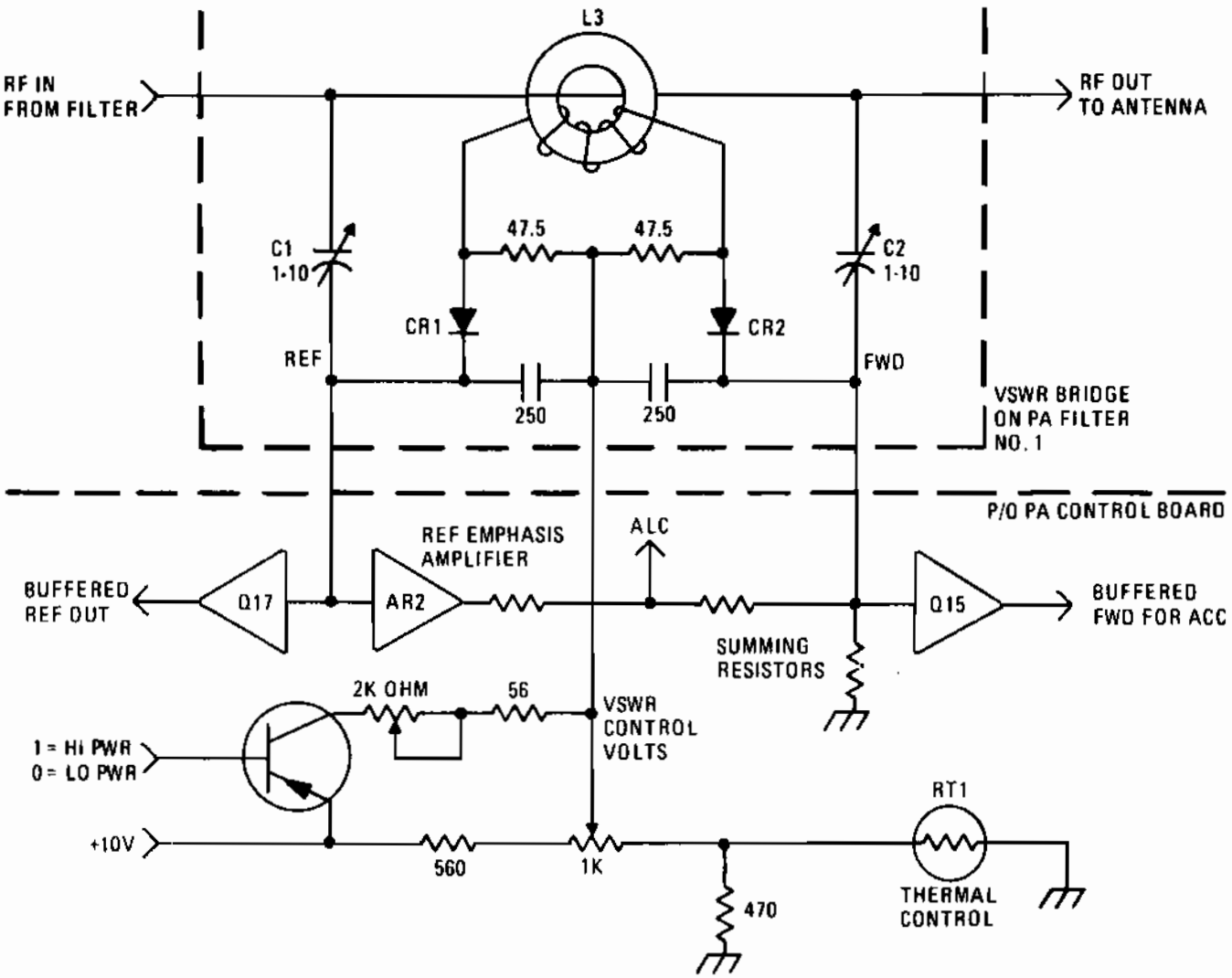


Figure 2. VSWR Functions

Table 1. 1A1A1 Maintenance Parts List (PL 6628-0400)

Ref. Desig.	Name & Description	Mfr. Code	Part Number
1A1A1	PA Filter No. 1 PW Board Assembly	14304	6628-0400
C1	Capacitor, Fixed, Ceramic, 75 pF ±2%, 1000V	14304	C-6918
C2	Capacitor, Fixed, Ceramic, 62 pF ±2%, 1000V	14304	C-6916
C3	Capacitor, Fixed, 470 pF ±5%, 500V	14304	C11-0004-010
C4	Capacitor, Fixed, Ceramic, 68 pF ±2%, 1000V	14304	C-6917
C5	Capacitor, Fixed, Ceramic, 75 pF ±2%, 1000V	14304	C-6918
C8-C18	Not Used		
C19	Capacitor, Fixed, Ceramic, .01 uF ±20%, 50V	81349	M39014/02-1378
C20	Capacitor, Fixed, Ceramic, .1 uF ±20%, 50V	14304	M39014/02-1391
C21, C22	Capacitor, Fixed, Ceramic, .01 uF ±20%, 50V	81349	M39014/02-1378
C23, C24	Capacitor, Fixed, Mica, 560 pF ±2%, 300V	14304	C-2499
C25,C26	Capacitor, Fixed, Mica, 130 pF ±2%, 500V	14304	C-2482
C27-C29	Capacitor, Fixed, Mica, 430 pF ±2%, 500V	14304	C-2495
C30	Capacitor, Fixed, Mica, 470 pF ±2%, 500V	14304	C-2496
C31	Capacitor, Fixed, Mica, 360 pF ±2%, 500V	14304	C-2493
C32	Capacitor, Fixed, Mica, 430 pF ±2%, 500V	14304	C-2495
C33	Capacitor, Fixed, Mica, 360 pF ±2%, 500V	14304	C-2493
C34	Capacitor, Fixed, Mica, 430 pF ±2%, 500V	14304	C-2495
C35,C36	Capacitor, Fixed, Ceramic, .01 uF ±20%, 50V	81349	M39014/02-1378
C37,C38	Capacitor, Fixed, Ceramic, 82 pF ±2%, 1000V	14304	C-6919
C39	Capacitor, Fixed, Ceramic, 18 pF, ±2%, 1000V	14304	C-5193
C40	Capacitor, Fixed, Ceramic, 20 pF, ±2%, 1000V	14304	C-5194
C41	Capacitor, Fixed, Ceramic, 62 pF, ±2%, 1000V	14304	C-6916
C42-C44	Capacitor, Fixed, Ceramic, 68 pF, ±2%, 1000V	14304	C-6917
C45	Capacitor, Fixed, Ceramic, 56 pF, ±2%, 1000V	14304	C-6915
C46	Capacitor, Fixed, Ceramic, 62 pF, ±2%, 1000V	14304	C-6916
C47	Capacitor, Fixed, Ceramic, 56 pF, ±2%, 1000V	14304	C-6915
C48	Capacitor, Fixed, Ceramic, 62 pF, ±2%, 1000V	14304	C-6916
C49	Capacitor, Fixed, Ceramic, 56 pF, ±2%, 1000V	14304	C-6915
C50	Capacitor, Fixed, Ceramic, 62 pF, ±2%, 1000V	14304	C-6916
C51, C52	Capacitor, Fixed, Ceramic, 75 pF, ±2%, 1000V	14304	C-6918
C53	Capacitor, Fixed, Ceramic, 62 pF, ±2%, 1000V	14304	C-6916
C54	Capacitor, Fixed, Ceramic, 56 pF, ±2%, 1000V	14304	C-6915
C55,C56	Not Used		
C57,C58	Capacitor, Fixed, Ceramic, .001 uF, ±10%, 500V	14304	C-3513
C59	Capacitor, Fixed, Ceramic, .1 uF, ±2%, 50V	14304	C-6370
C60-C63	Not Used		
C64,C65	Capacitor, Fixed, Ceramic, .01 uF ±20%, 50V	81349	M39014/02-1378
C66	Capacitor, Fixed, Ceramic, .01 uF, 10%	81349	M39014/02-1218
CR1-CR3	Diode, Rectifier, 1N4004	14304	CR-0725
JMP1	Jumper, Circuit	14304	MP-1142
K1-K6	Relay, SPDT, 12V	14304	6628-0405
L1	Inductor, Air Core, .25 uH	14304	6628-0427
L2	Inductor, Assembly, 1.64 uH	14304	6628-0410
L3	Inductor, Air Core, .12 uH	14304	6628-0428
L4	Inductor, Air Core, .25 uH	14304	6628-0427
L5	Not Used		

Table 1. 1A1A1 Maintenance Parts List (PL 6628-0400) (Cont.)

Ref. Desig.	Name & Description	Mfr. Code	Part Number
L6	Inductor, Toroid, 3.202 uH	14304	6628-0420
L7	Inductor, Toroid, 2.481 uH	14304	6628-0421
L8	Inductor, Air Core, 0.5080 uH	14304	6628-0422
L9	Inductor Air Core, 0.3549 uH	14304	6628-0423
L10	Inductor, Toroid, 0.8352 uH	14304	6628-0424
L11	Inductor, Air Core, 0.4389 uH	14304	6628-0425
L12	Inductor, Air Core, 0.7129 uH	14304	6628-0426
L13-L17	Not Used		
L18	Choke, RF, 470 uH ±10%	14304	L-0648
R1	Resistor, Fixed, Composition, 180K ±5%, 1/4W	Mil Type	RCR07G184JM
RT1	Thermistor, 50K, ±10%	14304	R-4280

Table 2. 1A1A1A1 Maintenance Parts List (PL 6628-0440)

Ref. Desig.	Name & Description	Mfr. Code	Part Number
1A1A1A1	VSWR Bridge Assembly	14304	6628-0440
1A1A1A1A1	VSWR Bridge Partition Subassembly	14304	6628-0441
C1,C2	Not Used		
C3,C4	Capacitor, Fixed, Silver Mica, 250 pF, 350V	14304	C-6673
C5,C6	Capacitor, Fixed, 15 pF, 1 KV	14304	C-4743
CR1,CR2	Diode, Hot Carrier	14304	CR-0403
L1,L2	Inductor, RF, 1 mH	14304	L-0652
L3	Inductor, Toroid	14304	919-2759
R1,R2	Resistor, Fixed, Composition, 47.5 ohm, 1%, 1/4W	14304	R-3745
1A1A1A1A2	VSWR Bridge Capacitor Subassembly	14304	6628-0442
C1,C2	Capacitor, Variable, 1-10 pF	14304	C-2175

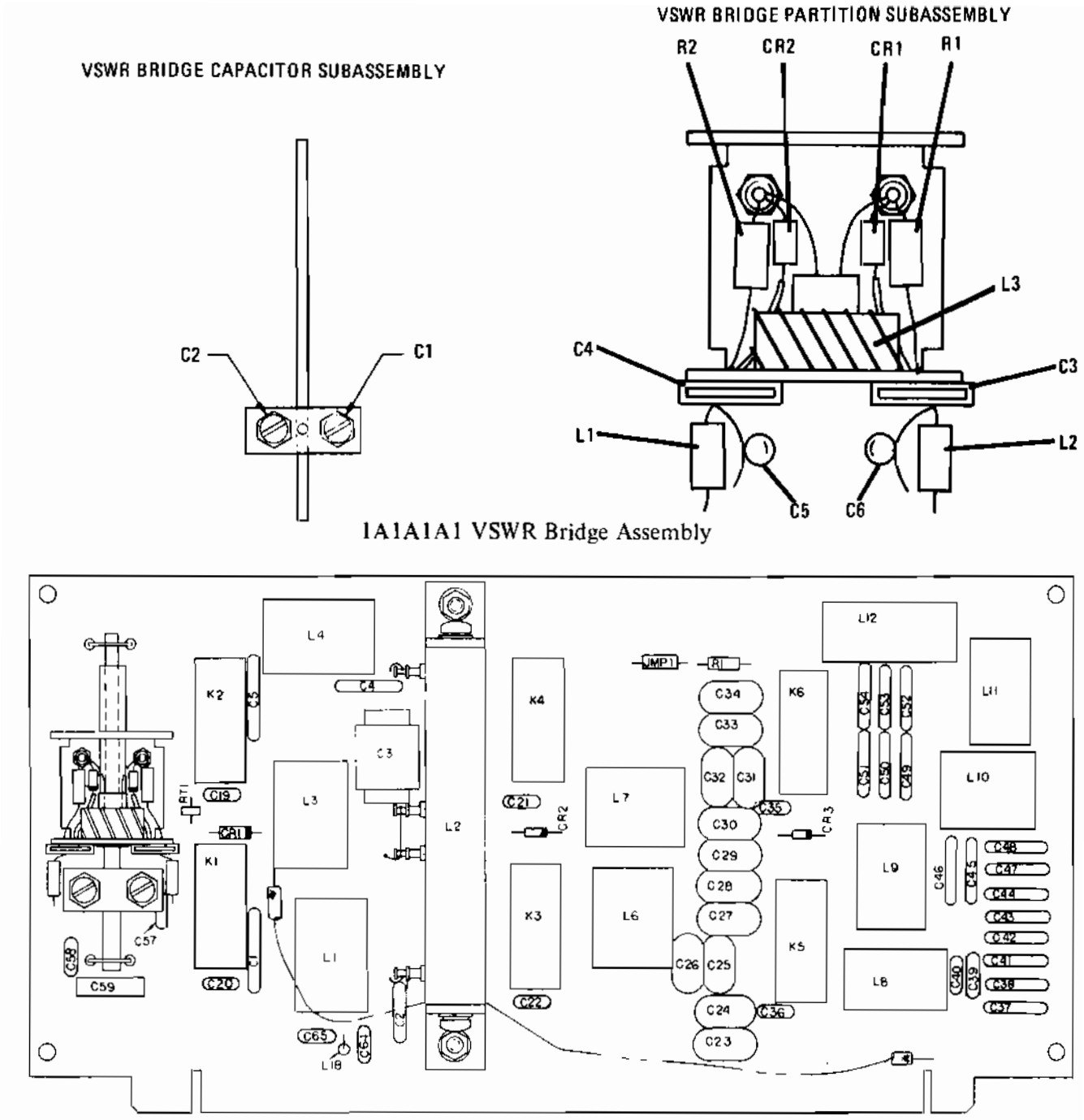


Figure 3. 1A1A1 PA Filter Component Locations

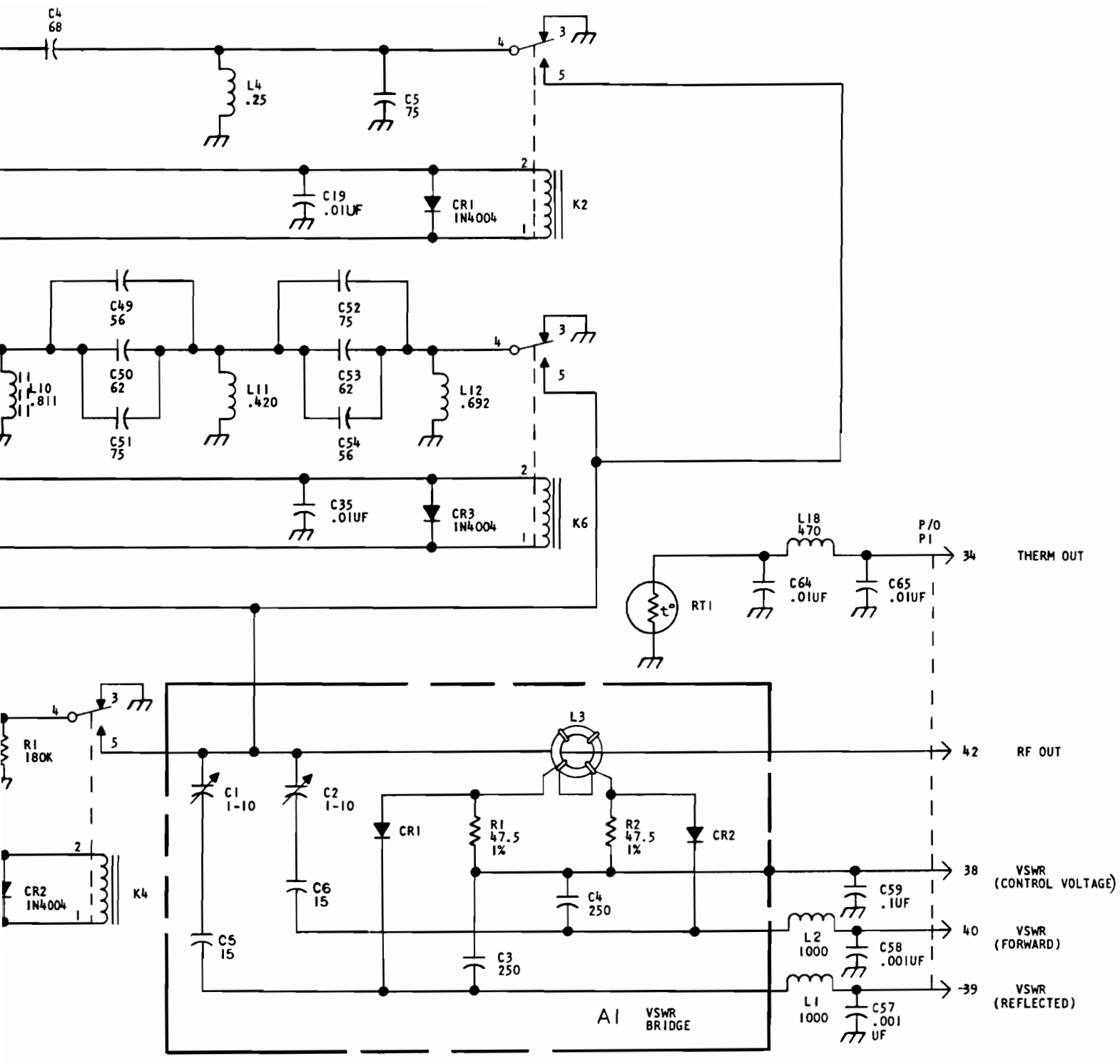
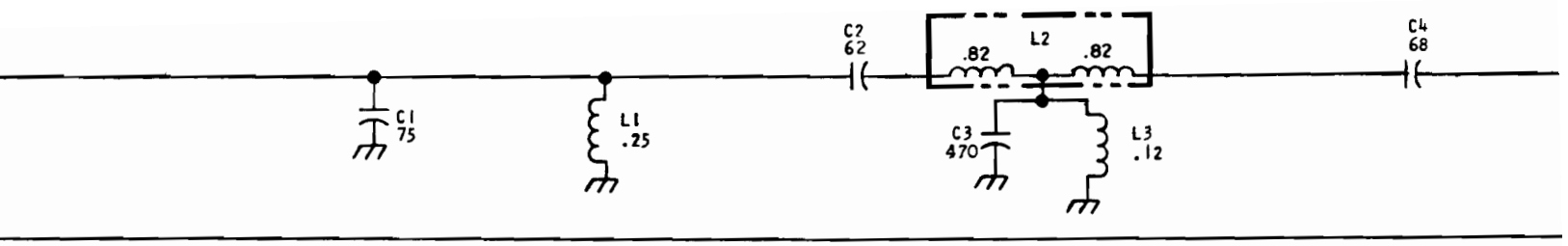


Figure 4. 1A1A1 PA Filter Schematic Diagram (6628-9040)



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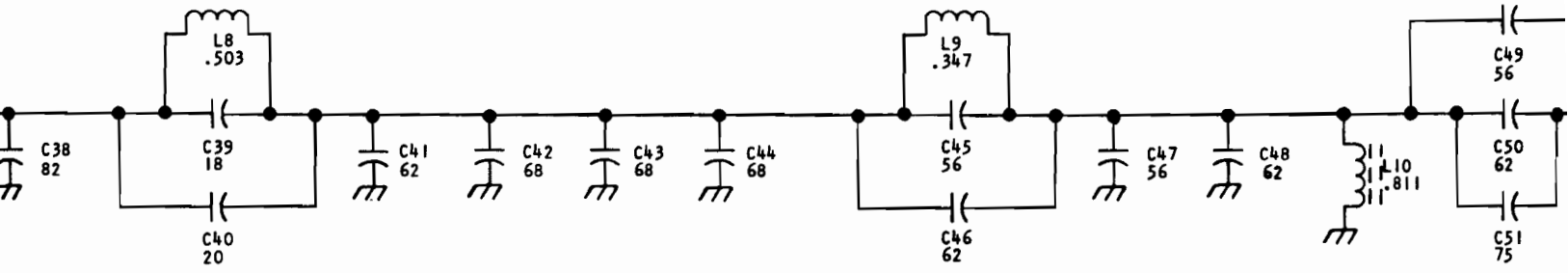
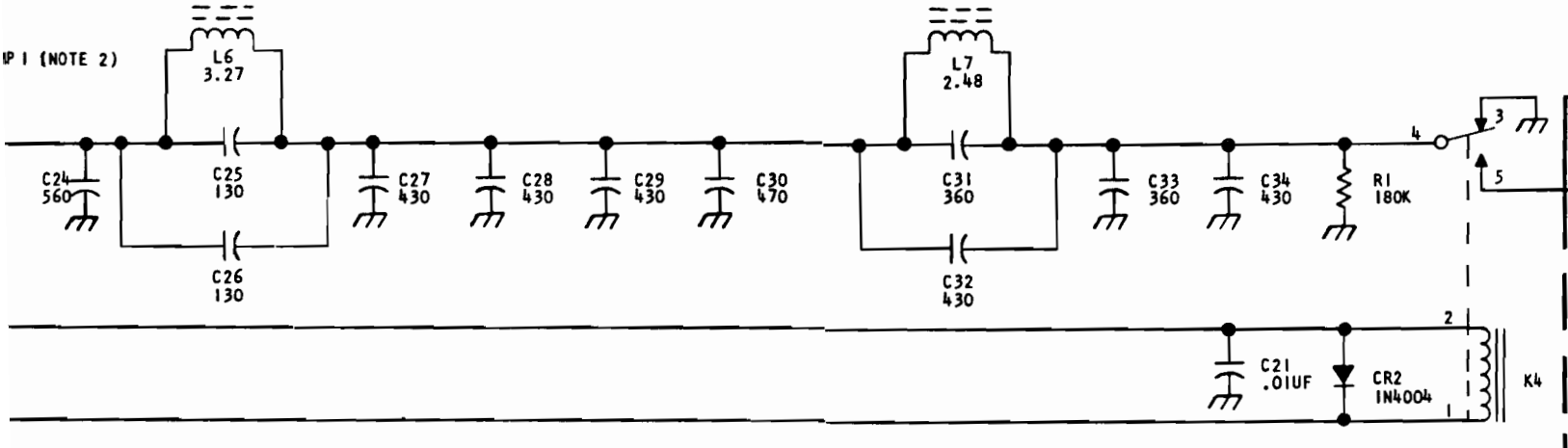
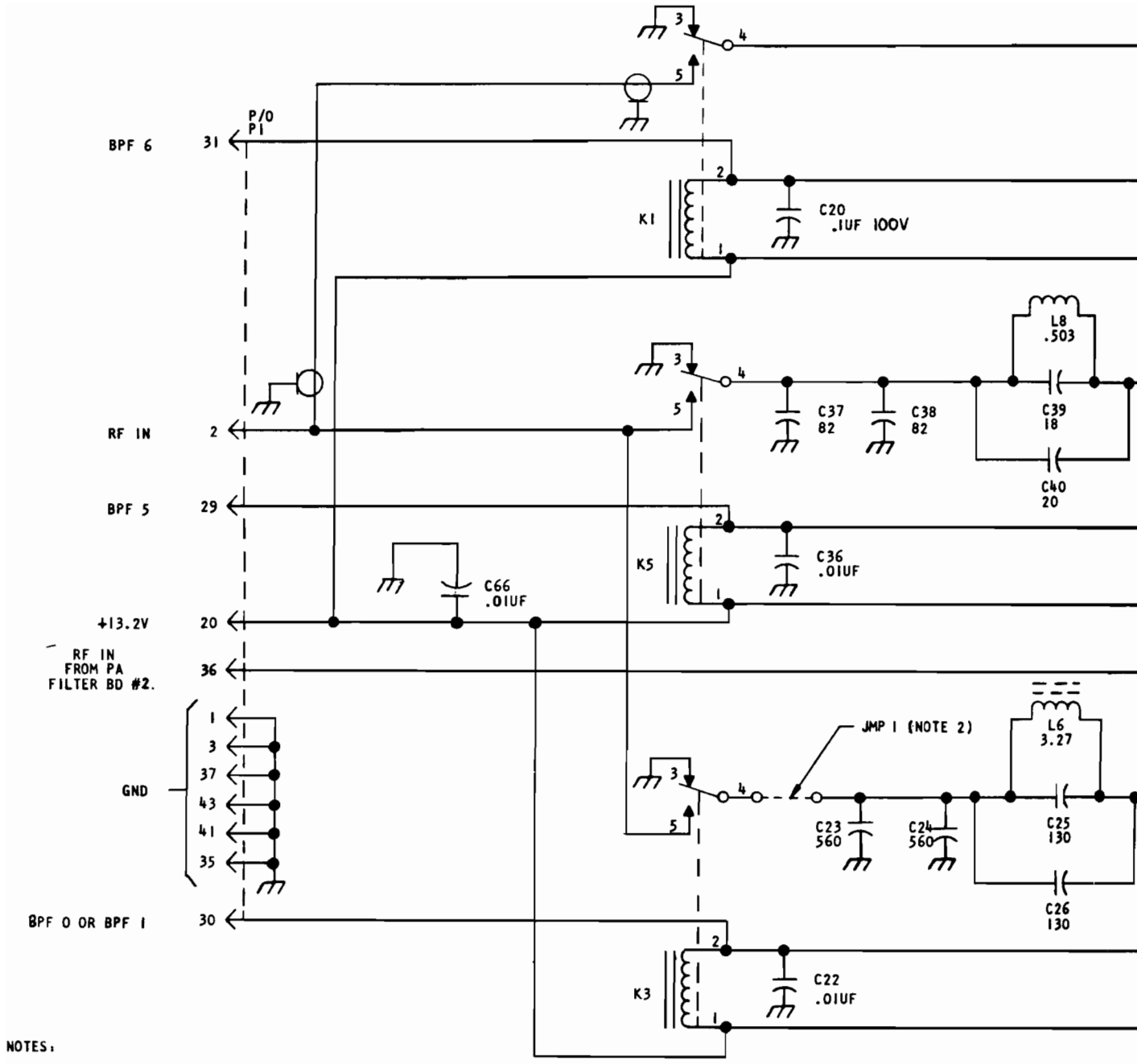


IP I (NOTE 2)





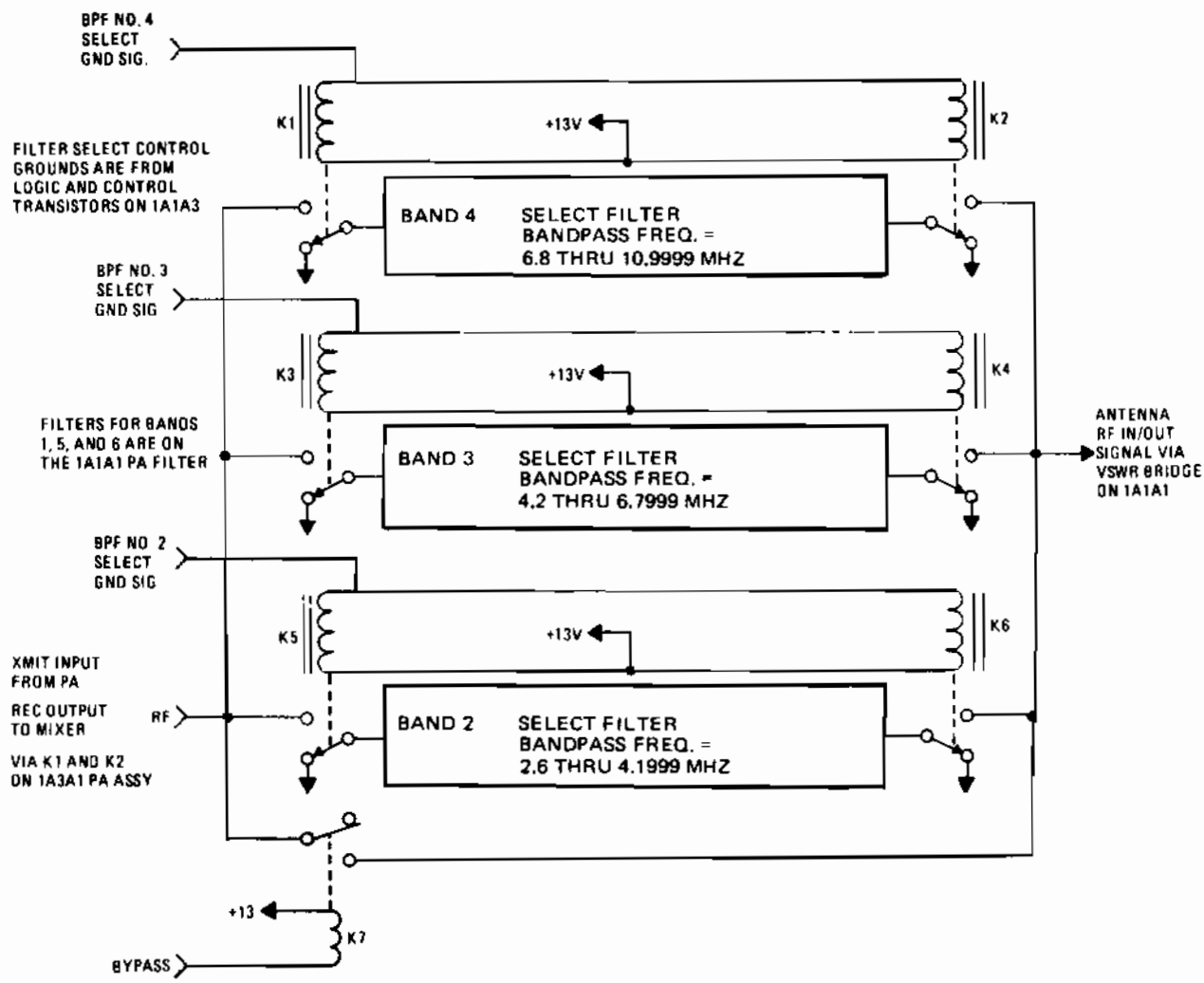
NOTES:

1. UNLESS OTHERWISE SPECIFIED:
   A. ALL CAPACITORS ARE IN PICOFARADS.
   B. ALL COILS ARE IN MICROHENRIES.
   C. ALL RESISTORS ARE IN OHMS, 1/4W, ± 5%.
2. JMP 1 USED WITH RF-230 ONLY.

UNIT INSTRUCTIONS

PA FILTER NO.2

1A1A2



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1. GENERAL DESCRIPTION

PA Filter No. 2 works with PA Filter No. 1 to perform the receive mode preselector function and in the transmit mode to filter the power amplifier output. PA Filter No. 2 contains three of the six eliptical low pass filters required to perform these functions. Unlike PA Filter No. 1, there is no VSWR assembly on the PA Filter No. 2 PC Board. The VSWR assembly on PA Filter No. 1 is used by both the 1A1A1 and 1A1A2 assemblies. The desired filter is selected automatically by relay control ground signals from the 1A1A3 PA Control Board. In the transmit mode, the selected filter will reduce harmonic output to typically better than −50 dB. Figure 1 is included to demonstrate spectral relationships and is not intended to show exact filter response curves. In the transmit mode the filter selected will reduce harmonic output to typically better than - 50 dB. In the receive mode, these same filters maintain input losses at such a low level that the signal can be introduced directly to the high dynamic range input mixer on the 1A1A6 Mixer Board.

2. TECHNICAL CHARACTERISTICS

Power Requirements:
+13.8 Vdc from front panel for band select relays.

Signal Inputs:
PA Output power in transmit mode. Typically 125W (or higher to allow for losses).
Receive RF Input (0.7 uV for 10 dB S+N/N).

Control Inputs:
Control ground signals to band select relays from PA Control PC Board.

Filter Types (Cascaded):
5 pole Chebyshev high pass
5 pole Elliptical low pass

Cutoff Frequencies:
Band 2 2.6 – 4.199 MHz
Band 3 4.2 – 6.799 MHz
Band 4 6.8 – 10.999 MHz

Input VSWR:
High pass 1.105:1 maximum
Low pass 1.353:1 maximum
Combined 1.495:1 maximum

Insertion Loss:
0.5 dB maximum

Stop Band Attenuation:
2nd Harmonic - 15 dB minimum
All others --35 dB minimum

Power Handling Capability:
150 watts average

Operating Temperature Range:
- 30°C to +60°C

3. SEMICONDUCTOR COMPLEMENT

REF. DESIG.	TYPE	FUNCTION
CR1 CR4	1N4004	Diode

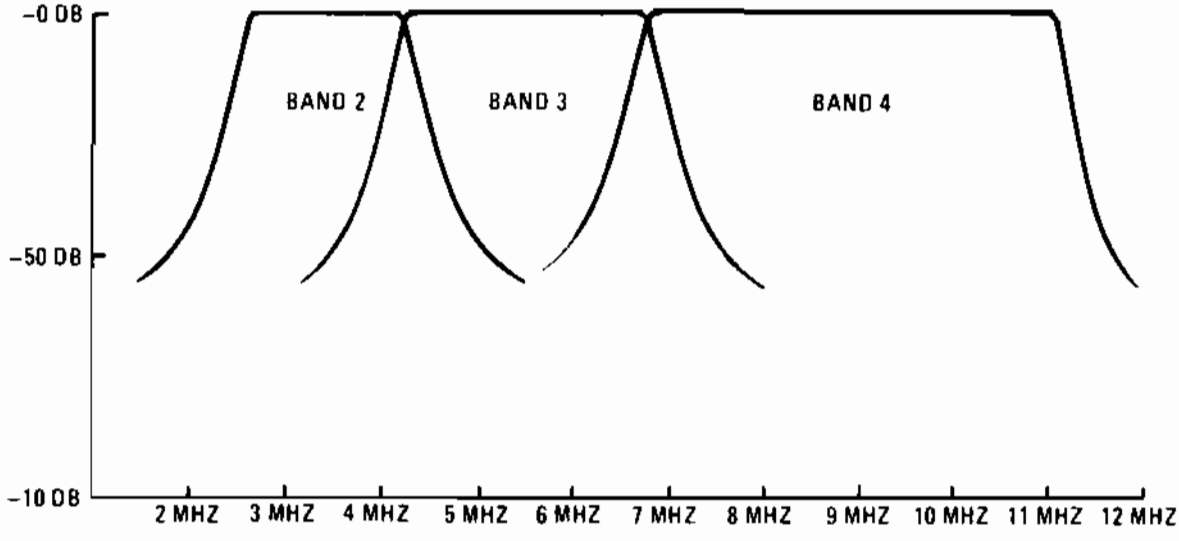


Figure 1. Spectral Band Relationship

4. CIRCUIT DESCRIPTION

Channel frequency information is decoded on the 1A1A3 PA Control PC Board, and translated to BPF (Band Pass Frequency) select control signals. These control signals are in the form of relay control grounds (minus the diode drop of the control transistor on the PA Control PC Board. Assuming a band 2 activation signal (from 1A1A3Q3), band 2 select relays K5 and K6 would be energized and the corresponding filter elements would be placed in the circuit.

Figure 2 shows a typical filter section, and identifies both the high pass filter elements and the low pass filter elements. This same basic configurations is used for bands 2 through 6. Band 1 uses only the low pass filter section because of its position at the low end of the spectrum.

5. MAINTENANCE

There are no maintenance adjustments on assembly 1A1A2. When making RF input and output measurements, recall that input and output impedances are 50 ohms.

6. PARTS LIST

Parts list information is given in table 1. All parts are identified in figure 3, the 1A1A2 Component Location Diagram. Complete manufacturers code data is given in the general information section of this manual under maintenance.

7. SCHEMATICS

Figure 4 is a complete schematic diagram of the assembly.

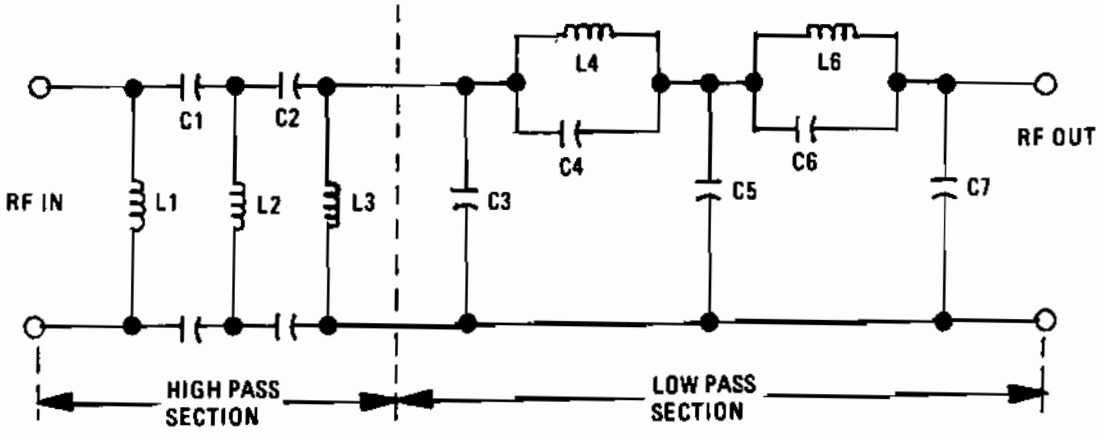


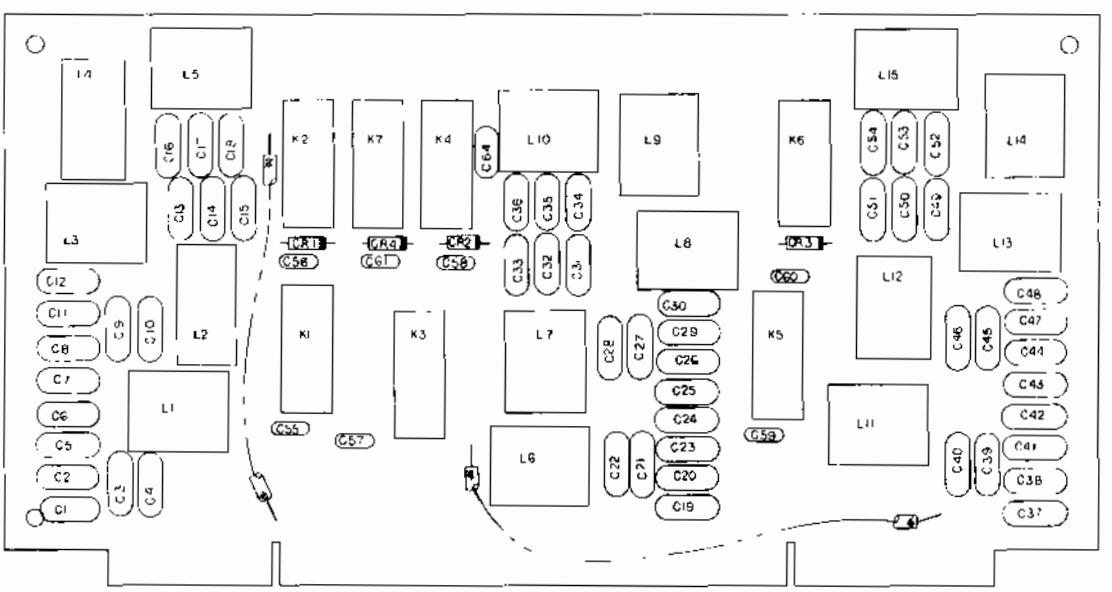
Figure 2. Typical Filter Section

Table 1. 1A1A2 Maintenance Parts List

Ref. Desig.	Name & Description	Mfr. Code	Part Number
1A1A2	PA Filter No. 2 PW Board Assembly	14304	6628-0450
C1	Capacitor, Fixed, Mica, 130 pF ±2%, 500V	14304	C-2482
C2	Capacitor, Fixed, Mica, 150 pF ±2%, 500V	14304	C-2483
C3,C4	Capacitor, Fixed, Mica, 30 pF ±2%, 500V	14304	C-2465
C5-C7	Capacitor, Fixed, Mica, 110 pF ±2%, 500V	14304	C-2480
C8-C12	Capacitor, Fixed, Mica, 100 pF ±2%, 500V	14304	C-2479
C13-C18	Capacitor, Fixed, Mica, 110 pF ±2%, 500V	14304	C-2480
C19	Capacitor, Fixed, Mica, 200 pF ±2%, 500V	14304	C-2486
C20	Capacitor, Fixed, Mica, 220 pF ±2%, 500V	14304	C-2487
C21	Capacitor, Fixed, Mica, 51 pF ±2%, 500V	14304	C-2472
C22	Capacitor, Fixed, Mica, 43 pF ±2%, 500V	14304	C-2469
C23,C24	Capacitor, Fixed, Mica, 150 pF ±2%, 500V	14304	C-2483
C25,C26	Capacitor, Fixed, Mica, 180 pF ±2%, 500V	14304	C-2485
C27-C30	Capacitor, Fixed, Mica, 150 pF ±2%, 500V	14304	C-2483
C31	Capacitor, Fixed, Mica, 180 pF ±2%, 500V	14304	C-2485
C32,C33	Capacitor, Fixed, Mica, 200 pF ±2%, 500V	14304	C-2486
C34	Capacitor, Fixed, Mica, 180 pF ±2%, 500V	14304	C-2485
C35,C36	Capacitor, Fixed, Mica, 200 pF ±2%, 500V	14304	C-2486
C37	Capacitor, Fixed, Mica, 330 pF ±2%, 500V	14304	C-2492
C38	Capacitor, Fixed, Mica, 360 pF ±2%, 500V	14304	C-2493
C39	Capacitor, Fixed, Mica, 75 pF ±2%, 500V	14304	C-2476
C40	Capacitor, Fixed, Mica, 82 pF ±2%, 500V	14304	C-2477
C41,C42	Capacitor, Fixed, Mica, 250 pF ±2%, 500V	14304	C-2489
C43,C44	Capacitor, Fixed, Mica, 300 pF ±2%, 500V	14304	C-2491
C45-C50	Capacitor, Fixed, Mica, 250 pF ±2%, 500V	14304	C-2489
C51	Capacitor, Fixed, Mica, 330 pF ±2%, 500V	14304	C-2492
C52,C53	Capacitor, Fixed, Mica, 250 pF ±2%, 500V	14304	C-2489
C54	Capacitor, Fixed, Mica, 330 pF ±2%, 500V	14304	C-2492
C55-C61	Capacitor, Fixed, Ceramic, .01 uF ±20%, 50V	81349	M39014/02-1378
C64	Capacitor, Ceramic, 0.1 uF	14304	C-3202
CR1-CR4	Diode, Rectifier, 1N4004	14304	CR-0725
K1-K7	Relay, SPDT, 12V	14304	6628-0405
L1	Inductor, Toroid, .795 uH	14304	6628-0465
L2	Inductor, Air Core, .576 uH	14304	6628-0466
L3	Inductor, Toroid, 1.268 uH	14304	6628-0467
L4	Inductor, Air Core, .729 uH	14304	6628-0468
L5	Inductor, Toroid, 1.418 uH	14304	6628-0469
L6	Inductor, Toroid, 1.358 uH	14304	6628-0470
L7	Inductor, Toroid, .915 uH	14304	6628-0471
L8	Inductor, Toroid, 1.650 uH	14304	6628-0472
L9	Inductor, Toroid, .904 uH	14304	6628-0473
L10	Inductor, Toroid, 1.572 uH	14304	6628-0474
L11	Inductor, Toroid, 1.996 uH	14304	6628-0475
L12	Inductor, Toroid, 1.500 uH	14304	6628-0476
L13	Inductor, Toroid, 3.649 uH	14304	6628-0477

Table 1. 1A1A2 Maintenance Parts List (Continued)

Ref. Desig.	Name & Description	Mfr. Code	Part Number
L14	Inductor, Totoid, 1.895 uH	14304	6628-0478
L15	Inductor, Toroid, 3.521 uH	14304	6628-0479



NOTES:

1. PREFIX ALL DESIGNATORS WITH 1A1A1 FOR COMPLETE REFERENCE.

Figure 3. 1A1A2 PA Filter No. 2 Component Locations

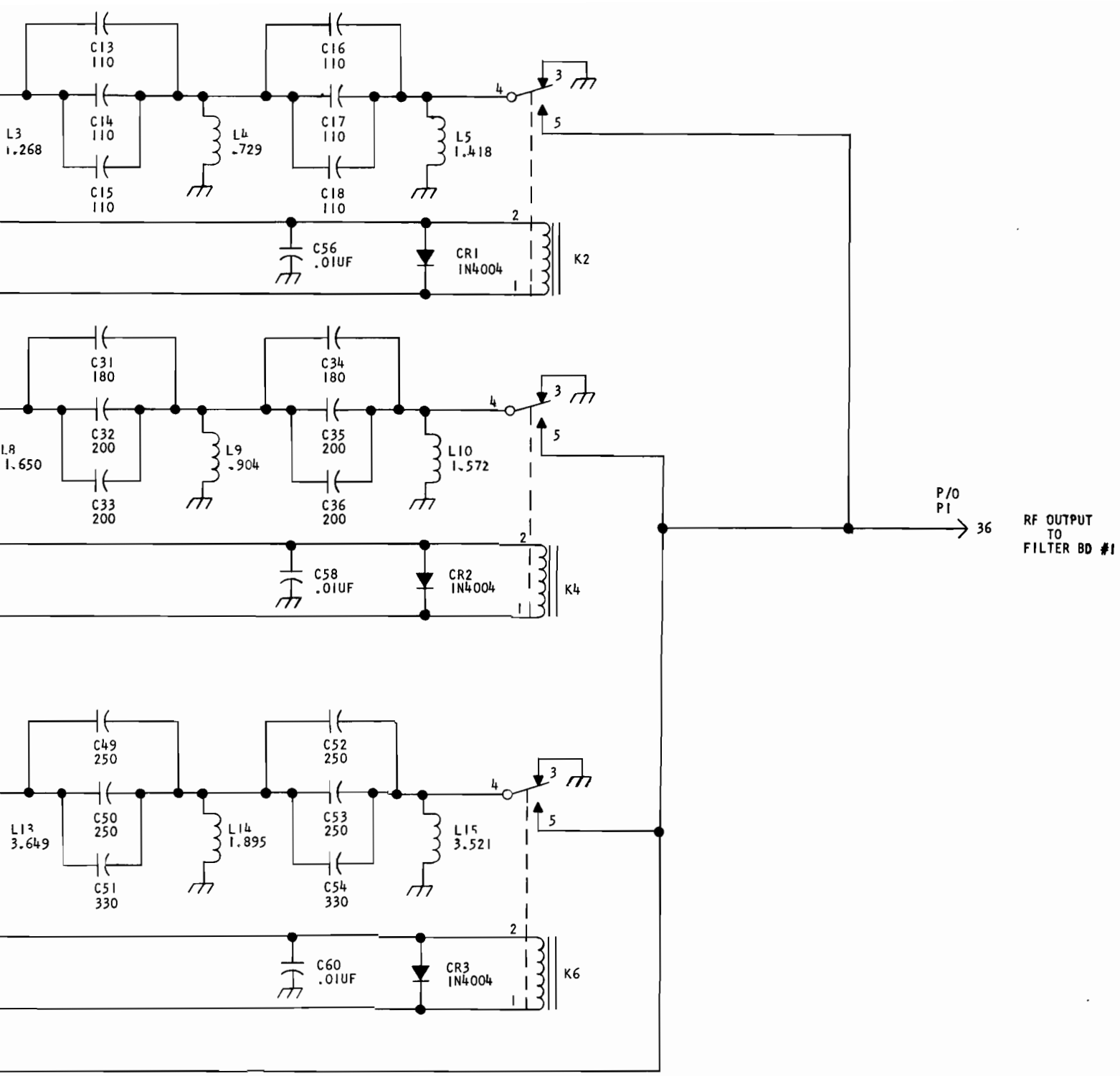
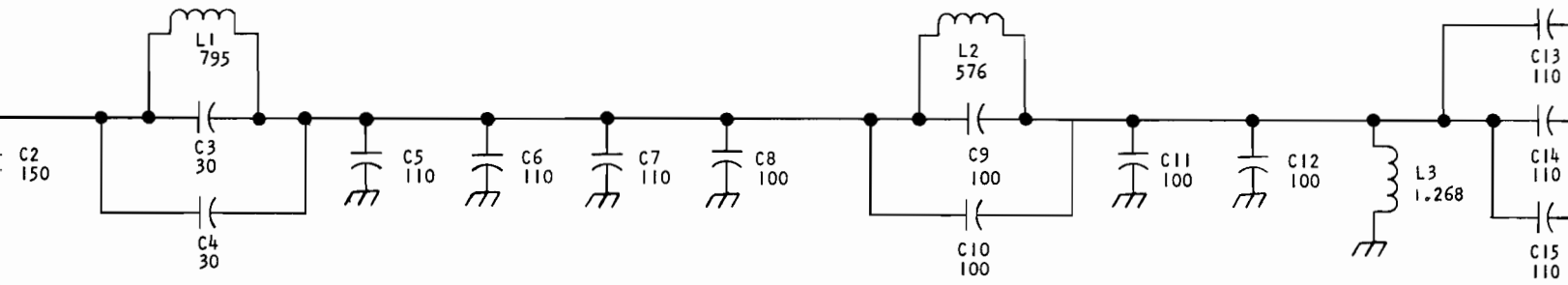
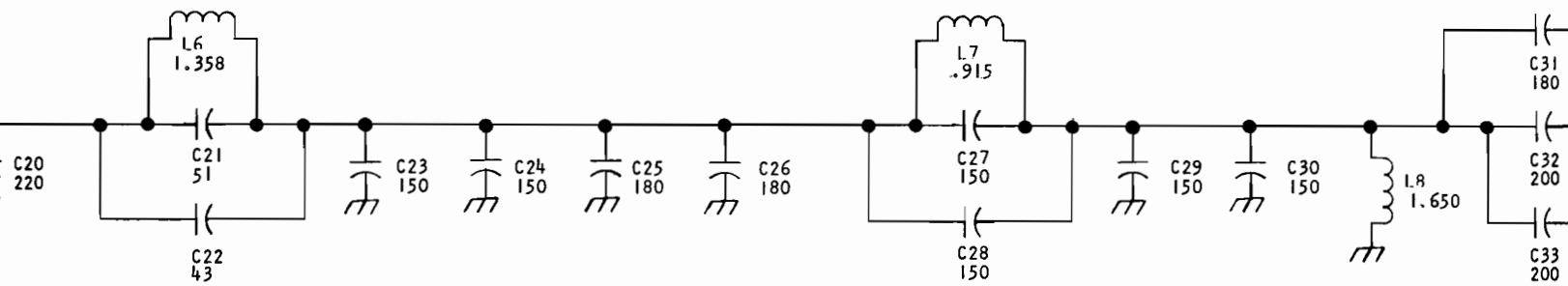
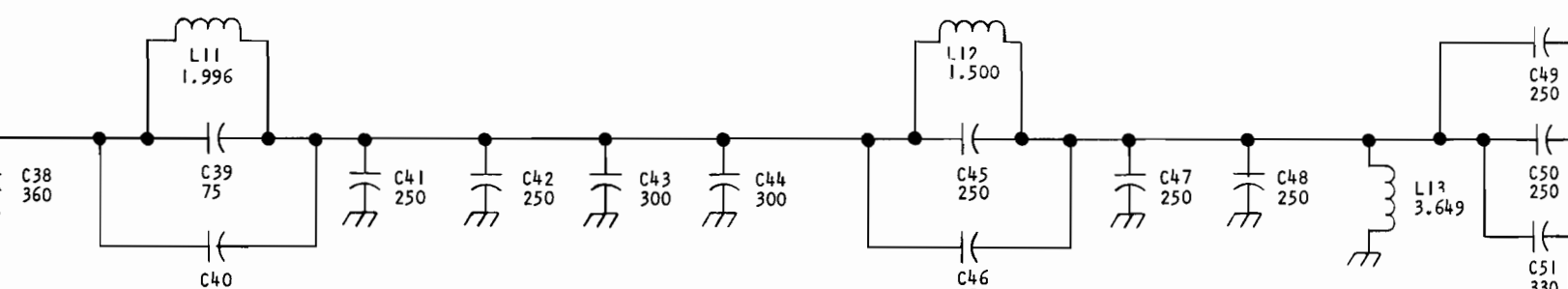
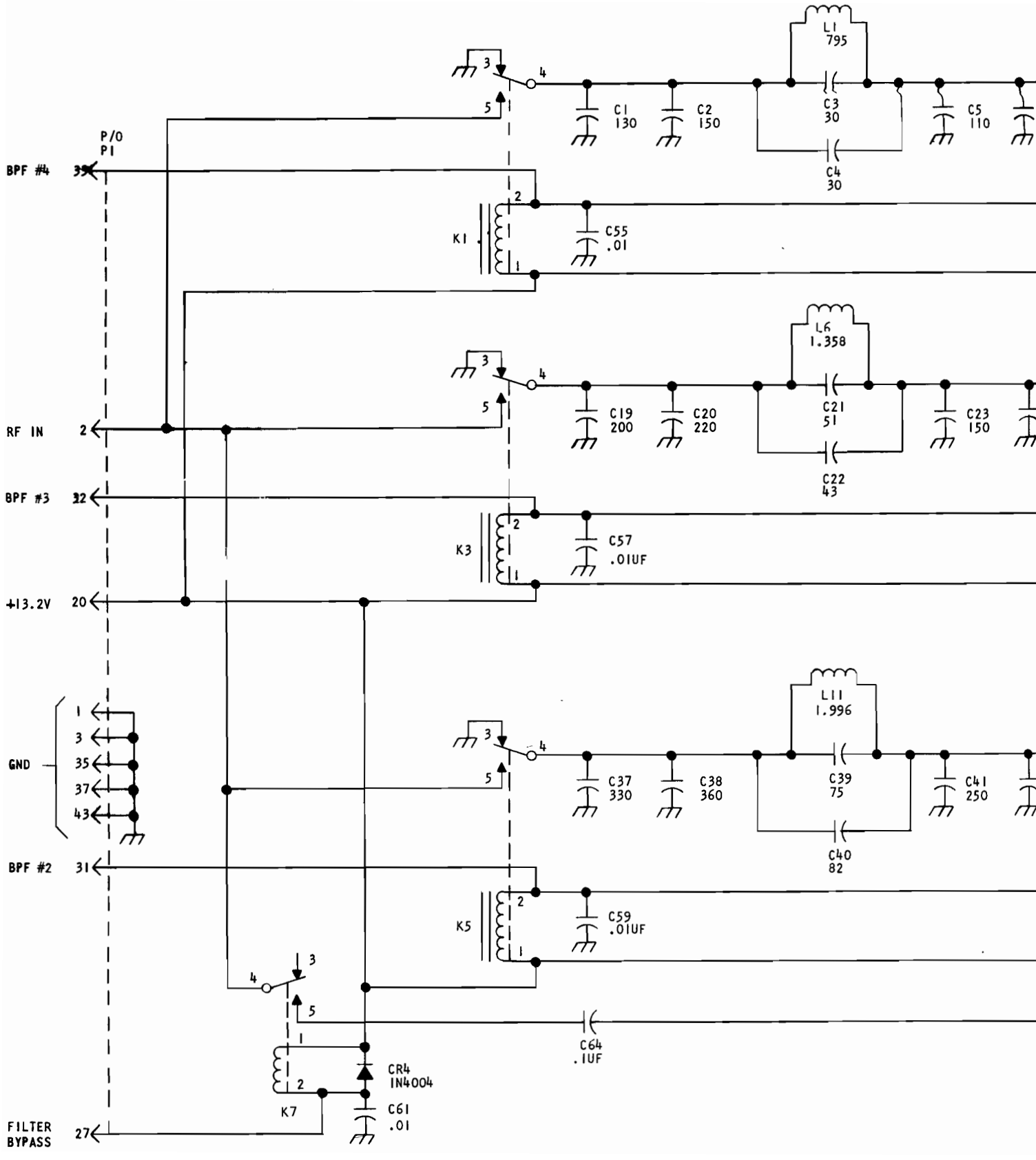


Figure 4. 1A1A2 PA Filter No. 2 Schematic Diagram (6628-9045)


L1
795
C2
150
C3
30
C4
30
C5
110
C6
110
C7
110
C8
100
L2
576
C9
100
C10
100
C11
100
C12
100
L3
1.268
C13
110
C14
110
C15
110

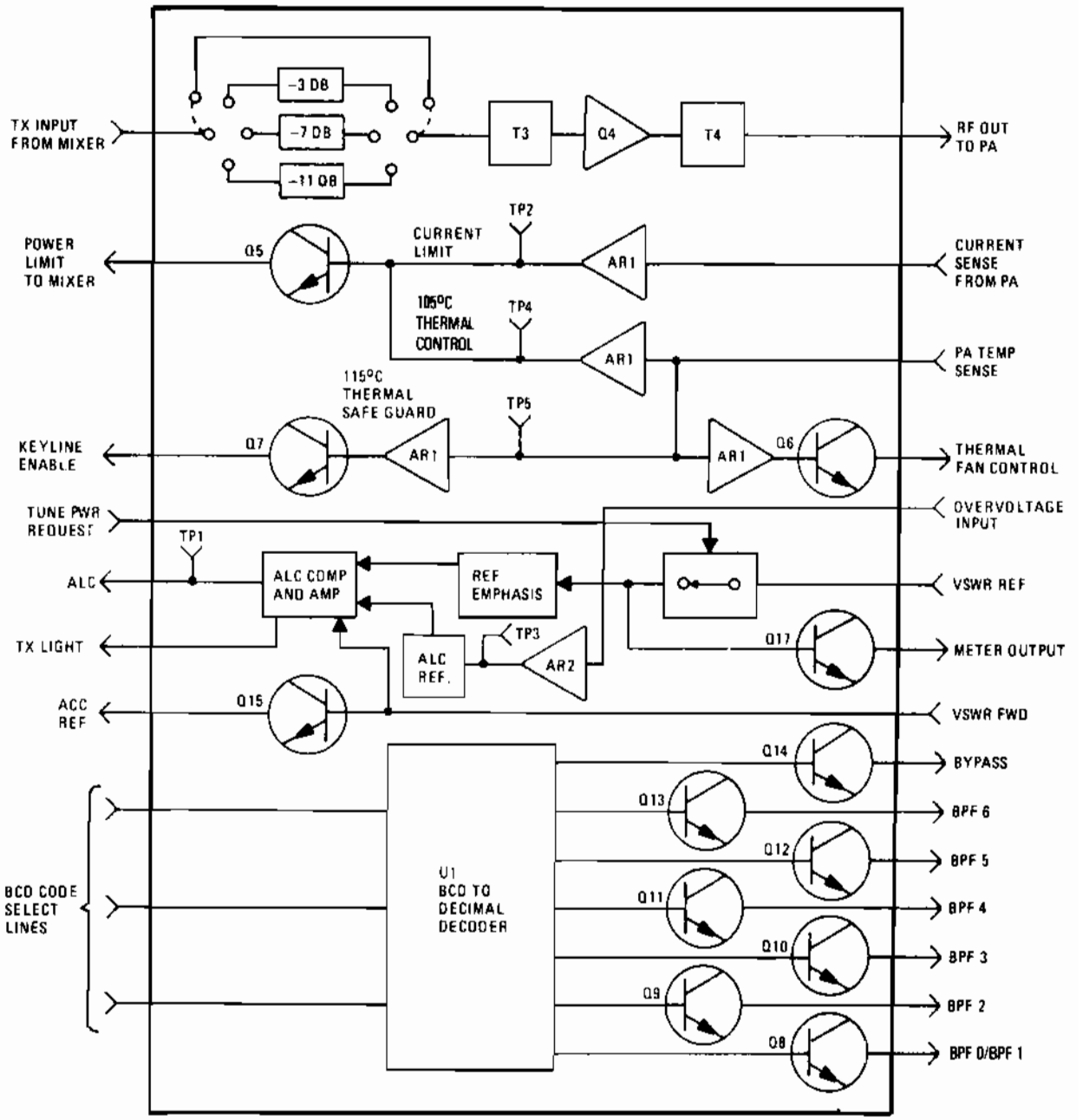

L6
1.358
C20
220
C21
51
C22
43
C23
150
C24
150
C25
180
C26
180
L7
.915
C27
150
C28
150
C29
150
C30
150
L8
1.650
C31
180
C32
200
C33
200


L11
1.996
C38
360
C39
75
C40
82
C41
250
C42
250
C43
300
C44
300
L12
1.500
C45
250
C46
250
C47
250
C48
250
L13
3.649
C49
250
C50
250
C51
330


P/O
P1
BPF #4
39
RF IN
2
BPF #3
32
+13.2V
20
GND
1
3
35
37
43
BPF #2
31
FILTER
BYPASS
27
L1
795
C1
130
C2
150
C3
30
C4
30
C5
110
K1
C55
.01
L6
1.358
C19
200
C20
220
C21
51
C22
43
C23
150
K3
C57
.01UF
L11
1.996
C37
330
C38
360
C39
75
C40
82
C41
250
K5
C59
.01UF
C64
.1UF
CR4
IN4004
K7
C61
.01

PA CONTROL BOARD

1A1A3



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1. GENERAL DESCRIPTION

The 1A1A3 PA Control PC Board functions as an interface between the 1A3A1 Power Amplifier PC Board and other elements of the RF-2301 Transceiver. Four distinct functions are performed by the control board; three of these are control functions and one is an active signal processing function.

The three control functions are:

- Band Pass Filter Selection
- ACC/ALC Control Voltage Development
- Current Limit Control

The transmit signal is amplified through the active signal path to the level required to drive the Power Amplifier Assembly.

2. TECHNICAL CHARACTERISTICS

Power Requirements:
+10 Vdc
+10 Vdc Xmit (+10T)
+13.8 Vdc

Signal Inputs:
+5 dBm (nominal) Xmit Fo from mixer

Signal Outputs:
+15 dBm (Nominal) Xmit F0 to Power Amplifier

Control Inputs:
BPF Binary Coded Inputs from LO2 (3)
Current Cutback control voltage from PA
Thermal control voltage from PA
High/Low Power Level Select (optional)
VSWR, (Forward and Reflected) analog voltages

Control Outputs:
Current Control to PIN diode on mixer
BPF Select Control Lines (6)
Bypass Control Line
ALC
ACC
VSWR Reference Control Volts
ACC Reference Control Volts
Keyline Enable

3. SEMICONDUCTOR COMPLEMENT

REF. DESIG.	TYPE	FUNCTION
AR1, AR2	CA324	Quad Operational Amplifier
CR6, CR7	1N4004	Diode
CR8, CR9	1N4454	Diode
CR11-CR16	1N4004	Diode
CR17-CR18	1N4454	Diode
CR19	1N4004	Diode
Q4	PT5701	Transistor, NPN
Q5-Q7	2N4124	Transistor, NPN
Q8-Q17	MPS-A13	Transistor, NPN Darlington Pair
Q18	2N4124	Transistor, NPN
Q19, Q20	2N3644	Transistor, PNP
Q21	2N4126	Transistor, PNP
U1	CD4028AE	BCD-To-Decimal Decoder
VR1, VR2	1N5232B	Diode, Zener, 5.6V

4. CIRCUIT DESCRIPTION

Refer to figure 1, the PA Control PC Board Simplified Diagram, and to the schematic diagram at the end of this section for the following discussion.

4.1 Transmit Active Signal Path

RF input from the 1A1A6 Mixer enters the 1A1A3 Control PC Board at a nominal level of +5 dBm. Several factors can affect overall system gain, especially variations in device parameters. In this configuration, the 1.6 – 29.9999 MHz (fo) RF input signal would be fed through the 50 ohm broad band input at T3, amplified approximately 10 dB by Q4, and fed to the 50 ohm output at T4 and P1-6. The +15 dBm output should be adequate to drive the 1A3A1 Power Amplifier Assembly to a full rated output of 125 watts. If the total system gain is significantly high (see system setup procedure in maintenance section), it may be necessary to use a "T" pad option to reduce overall system gain.

4.2 Band Pass Filter Selections

BPF (Band Pass Filter) selections on the Power Amplifier Assembly are controlled by BCD-to-Decimal Decoder U1 and associated circuitry. BCD 2^0, 2^1, and 2^2 control information from the LO2 assembly is decoded as shown in table 1.

Selecting a desired operating channel will automatically cause one of the input codes shown to appear at pins P1-11, -12, and -13 of the PA Control PC Board. U1 constantly monitors these lines and will instantly decode any change and produce a logic "1" only at the corresponding decimal output. This "high" output will turn on the corresponding NPN control transistor and provide a ground path for the related bandpass filter select relays in either the 1A1A1 (PA Filter No. 1), or 1A1A2 (PA Filter No. 2) assembly.

4.3 RF Power Control

> **NOTE** – The ALC Hi/Lo Power Select is not used in standard units. In later units the Low Power Adjust portion of the circuit has been omitted.

The ACC and VSWR control reference voltage is established by 1K pot R90. The ALC RF power control is adjusted to limit RF power output to the antenna to 125 watts (with normal audio drive level at the modulation input).

4.4 ACC/ALC Control Voltage Development

ACC, ALC, and the TX Lamp are controlled by "weighted" information from the VSWR sensor in PA Filter No. 1. The information is weighted in that the Reflected Power analog voltage is amplified by AR2 before it is summed with the Forward Power analog voltage to produce the ALC and ACC control voltages. Two conditions affect the presence of the REF PWR voltage: (1) TUNE PWR Request logic line at P1-26, and (2) The 1.4 V threshold established by the diode drops of CR17 and CR18. With the Request line low, Q18 is biased off, K1 is deenergized, and the VSWR REF signal path is opened. This prevents any tendency the weighted reference voltage might have to cause a power reduction during low power tuning operations. The diode drops establish threshold during normal operation allowing for automatic amplifier protection when the VSWR exceeds 1.3:1.

The summed and weighted ALC control voltage output from the R65/R63 junction is compared against a reference voltage at AR2. This reference is determined by VR1, VR2 and divider R84 and R85 and is nominally 7.1 V. If the +13.8 V input increases, however, the input voltage established at overvoltage adjust control R75 will also increase. Because AR2 is operated as a saturated operational amplifier, the +8 V output (measured at TP3) will decrease thereby lowering the output voltage at the R84/R85 voltage divider. This means the ALC voltage at J5-14 will decrease, resulting in a power output reduction. R75 is adjusted at the factory

TABLE 1. BPF SELECT CONDITIONS

Frequency	Input Code C	B	A	Decoded Output	Output Condition
DEFAULT	0	0	0	U1-3 = 1	Q8 ON, P1-30 LOW
1.6 - 2.599 MHz	0	0	1	U1-14 = 1	Q8 ON, P1-30 LOW
2.6 - 4.199 MHz	0	1	0	U1-2 = 1	Q9 ON, P1-32 LOW
4.2 - 6.799 MHz	0	1	1	U1-15 = 1	Q10 ON, P1-33 LOW
6.8 - 10.999 MHz	1	0	0	U1-1 = 1	Q11 ON, P1-34 LOW
11.0 - 17.999 MHz	1	0	1	U1-6 = 1	Q12 ON, P1-29 LOW
18.0 - 29.999 MHz	1	1	0	U1-7 = 1	Q13 ON, P1-31 LOW
BYPASS	1	1	1	U1-4 = 1	Q14 ON, P1-28 LOW

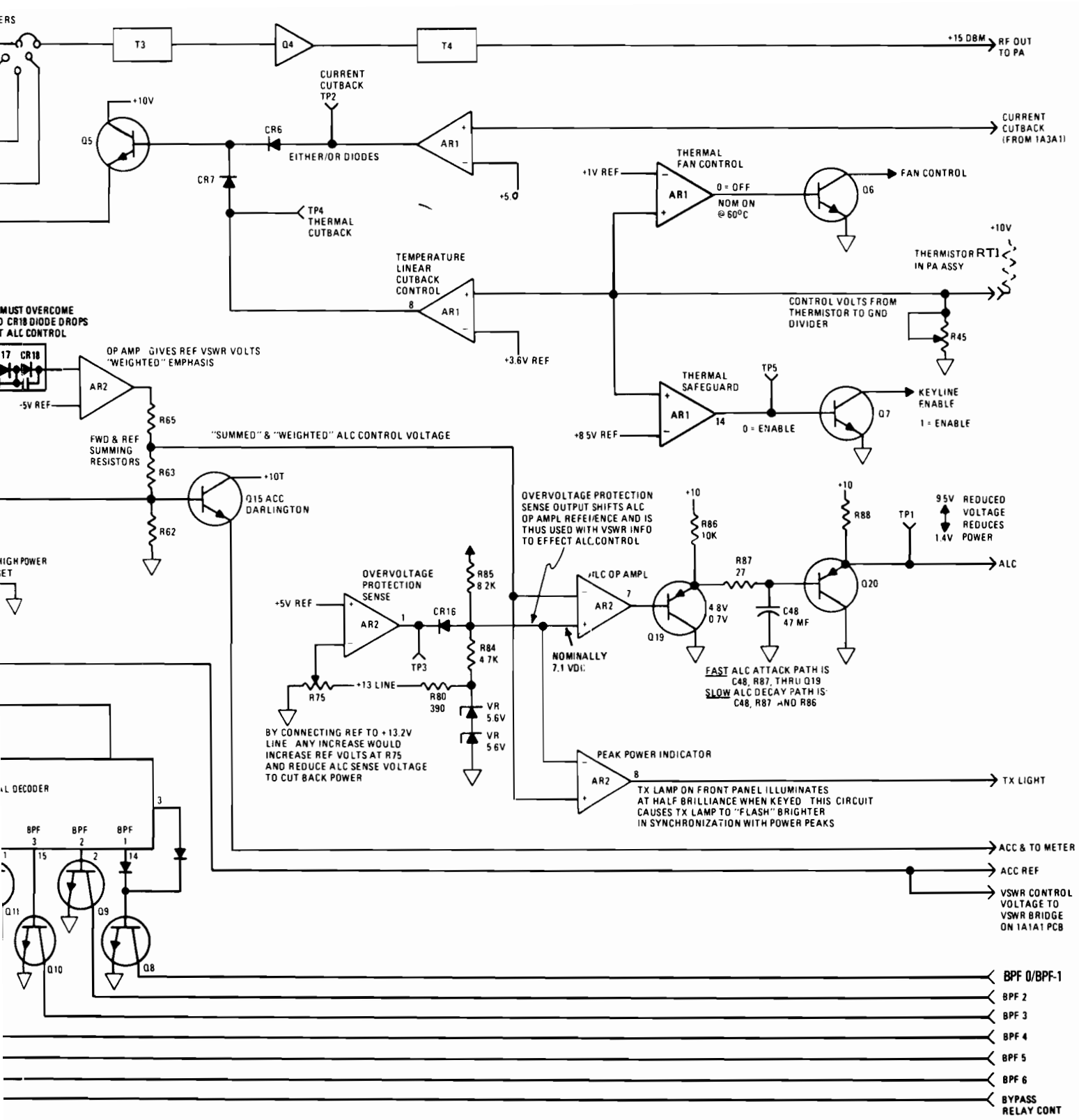
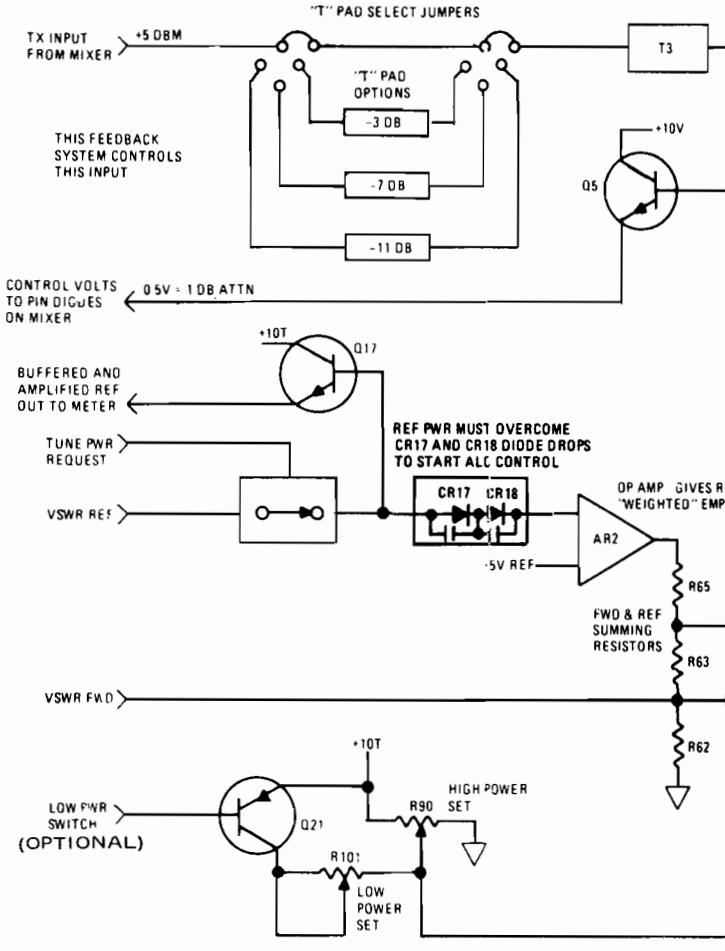
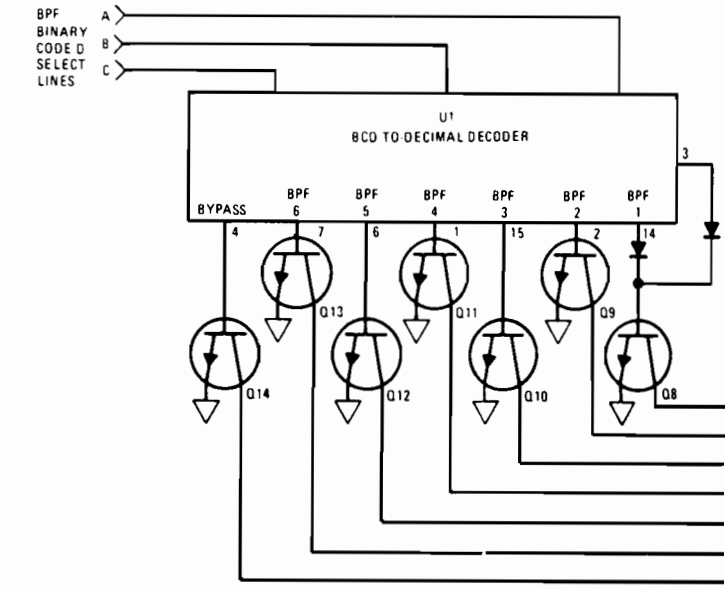


Figure 1. 1A1A3, PA Control PC Board Simplified Diagram

BCD CODE INPUT A	B	C	BPF SELECTED	HIGH U1 OUTPUT	LOW BPF SELECT PIN
0	0	0	BPF 1	U1-3="1"	P1-30
1	0	0	BPF 1	U1 14="1"	P1-30
0	1	0	BPF 2	U1-2="1"	P1-32
1	1	0	BPF 3	U1 15="1"	P1-33
0	0	1	BPF 4	U1-1="1"	P1-34
1	0	1	BPF 5	U1-6="1"	P1-29
0	1	1	BPF 6	U1 7="1"	P1-31
1	1	1	BYPASS	U1-4="1"	P1-28

TEST POINTS	FUNCTIONAL TITLE	RELATED INFORMATION
TP1	ALC OUT	14 – 9.5V 1.4V = MAX PWR REDUCTION
TP2	CURRENT CUTBACK	≈> 1.7V = CUTBACK
TP3	OVERVOLTS CUTBACK	6.4V INITIATES POWER CUTBACK
TP4	THERMAL CUTBACK	≈> 1.7V = CUTBACK
TP5	KEYLINE ENABLE	LOGIC 0 = DISABLE





so that with 15 Vdc on the +13.8 Vdc input line, the voltage at TP3 will decrease to +6.4 Vdc. The ALC output voltage, measurable at TP1, would decrease to call for a power reduction at control FET Q11 on the Mixer board. R47 on the 1A1A6 Mixer is adjusted so that a decrease in ALC output voltage at P1-14 (TP1), of from typically +8.5 Vdc to +1.4 Vdc will cause a 30 dB reduction in power output. Q19 and Q20 also function to "shape" ALC characteristics. A fast attack path is provided through C48, R87, and Q19. A slow ALC decay characteristic is achieved through the C48, R87, and R86.

4.5 Power Limit Control

Power Limit Control is effected by controlling the bias on pin diode CR30 at the 1A1A6 Mixer output. This control voltage is developed on the PA Control Board from two inputs from the 1A3-A1 Power Amplifier. These two inputs are: (1) A current sense input, and (2) A thermal sense input. The current sense input monitors the voltage drop across a .005 ohm resistor in the +13.2 Vdc supply line to the PA, and the thermal sense voltage is developed across a thermistor in the PA.

The current cutback sense voltage enters the PA Control Board at P1-10, and is compared in AR1 against a fixed 5.0V reference voltage established by R28 and R29 accross the +10T line. This AR1 output is measurable at TP2. When the control threshold is reached, the AR1-1 output will be a linear function of the current cutback input. Similarly, the thermal sense input at P1-42 is compared against a +3.6 Vdc reference, and the AR1-8 output varies linearly with the thermal sense input. Both inputs operate through "either/or" control diodes CR6 and CR7 to control Q5 base bias, and as a consequence, the control voltage output at P1-36 to the pin diodes on the mixer board.

The thermal input is also used to effect fan control through the AR1-7 output, and the Keyline Enable function through the AR1-14 output. Keyline Enable can be measured at TP5. A positive output at AR1-14 will bias Q7 and provide an disabling ground through this NPN Transistor. A +60°C thermistor temperature will normally cause the AR1-7 output to switch from "0" to "1" and turn on the cooling fan (optional) through Q6. At +115°C the unit fail safes and grounds the keyline enable thru Q7, shutting off transmitter until the unit cools.

R45 establishes the reference level for all of these functions and has been setup as shown in figure 2. By substituting a 5K 1% resistor for the thermistor circuit on the PA, the AR1-10 input established by R45 can be varied between 1.5 and 2.75 Vdc. With the setup conditions shown R45 is adjusted to the point that produces a +0.5 Vdc output at P1-36.

5. MAINTENANCE

Significant signal and control inputs and outputs to the 1A1A3 PA Control Board are shown in figure 1 and are described in the text. By installing the 1A1A3 Assembly on an extender card, all circuit elements are accessible for test or adjustment. Setup and adjustment procedures follow.

CAUTION

Always remove primary power (select POWER OFF at front panel) when removing or installing plug-in assemblies to prevent accidental damage.

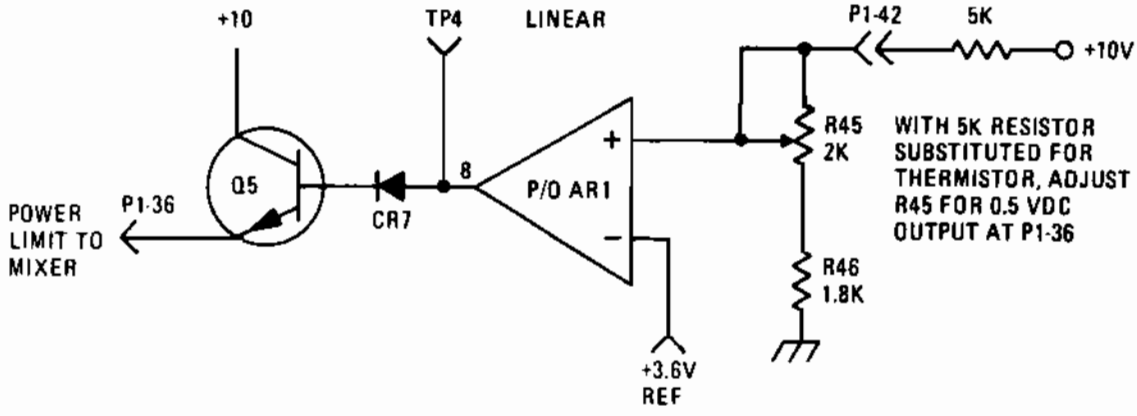


Figure 2. R45 Setup Condition

5.1 R75, Overvoltage Sense Threshold Adjustment

a. Remove power (select POWER OFF at the front panel).

b. Remove RF-2301 top and card cage cover.

c. Remove 1A1A3 PC Board Assembly using board extractor and reinstall using extender card.

d. Verify 13.8 Vdc primary power input to radio.

Note

It is important to verify this voltage at the radio as I^2R losses in the power cable could cause inconsistent results.

e. Install VOM at TP3 and note approximate +8 Vdc output.

f. Increase primary power to +15 Vdc and adjust R75 for +6.4 Vdc indication at TP3.

g. This completes R75 overvoltage sense threshold adjustment. Reconfigure for normal operation or subsequent tests as necessary.

5.2 R90, ALC RF Power Adjustment

Note

Verify that the Overcurrent Setup Adjustment (R49 on 1A3A1 PA Assembly) has been completed before proceeding with ALC High adjustment.

To adjust R90, proceed as follows:

a. Configure for test as shown in figure 3, and reposition R90 to full cw (low power) position. Select frequency of 2.4 MHz and USB mode.

b. With 0 dBm, 1 kHz signal at 600 ohm audio input, increase R90 until wattmeter indicates 125 watts output.

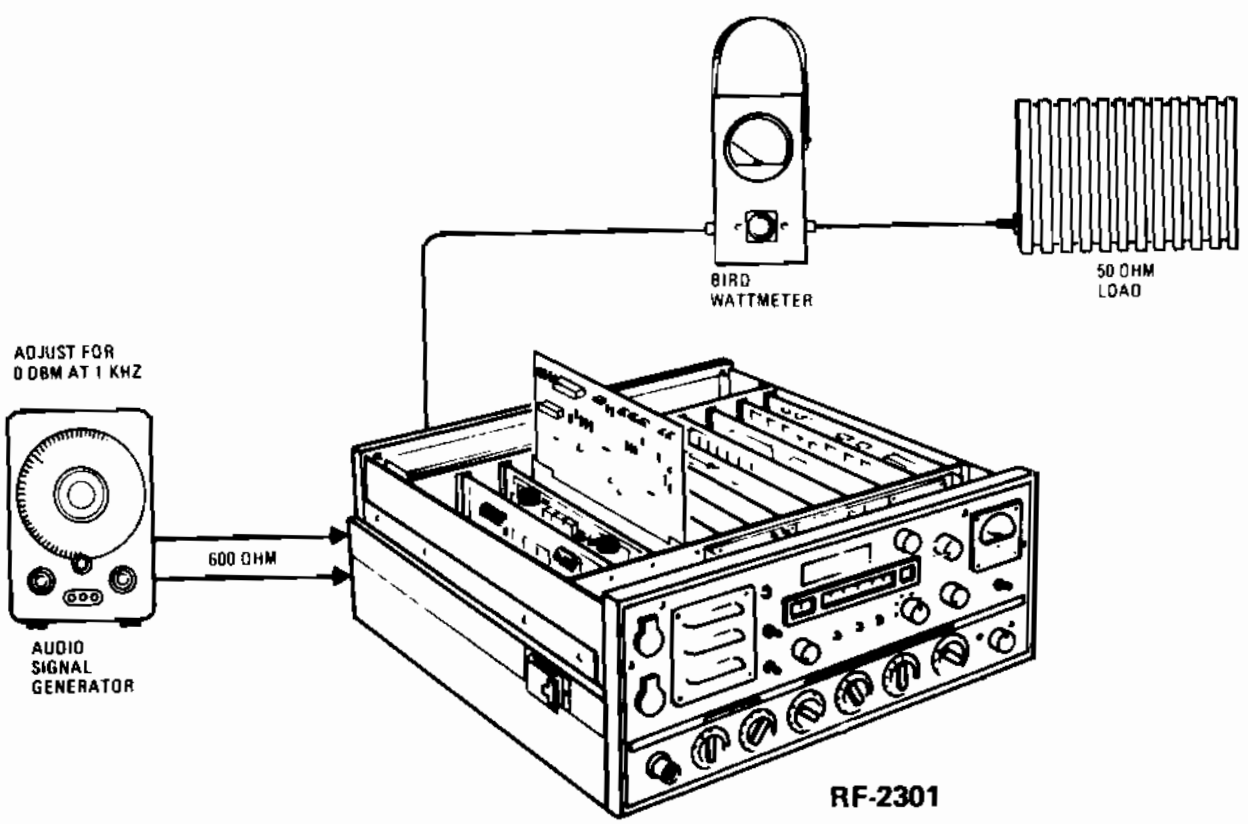


Figure 3. ALC High/Low Test Setup

c. Low Power Select is not used in standard units. Therefore, adjustment of R101 has no effect. R101 has been omitted in later units.

d. This completes RF Power Adjustment, configure for normal operation.

5.3 R45 Temperature Cutback Control Reference Adjustment

Perform the following procedure to adjust the R45 Temperature Cutback Control Reference.

a. Remove 1A1A3 PA Control Board and insulate pin P1-42 with tape. Place the board in the extender card.

b. Solder a 5K, 1/2 W resistor to the trace going to pin P1-42. (It is important to keep solder away from the connector contacts.) Solder a wire to the free end of the resistor. Connect the other end of the wire to 1A1A7 Memory PWB, TP6.

c. Connect VOM at 1A1A3, P1-36. Adjust R45 for 0.5V indication on VOM.

d. Unsolder resistor and wire, remove from extender card. Remove the insulation from pin P1-42 and return the board to its normal position in the card cage.

e. The adjustment is now complete.

5.4 1A1A3 Input/Output Summary

Figure 4 summarizes all 1A1A3 inputs and outputs and locates all test and adjustment points.

6. PARTS LIST

Table 2 lists all 1A1A3 maintenance parts. These parts can be identified on Figure 5.

7. SCHEMATICS

Figure 6 is a complete schematic diagram of the 1A1A3 Assembly.

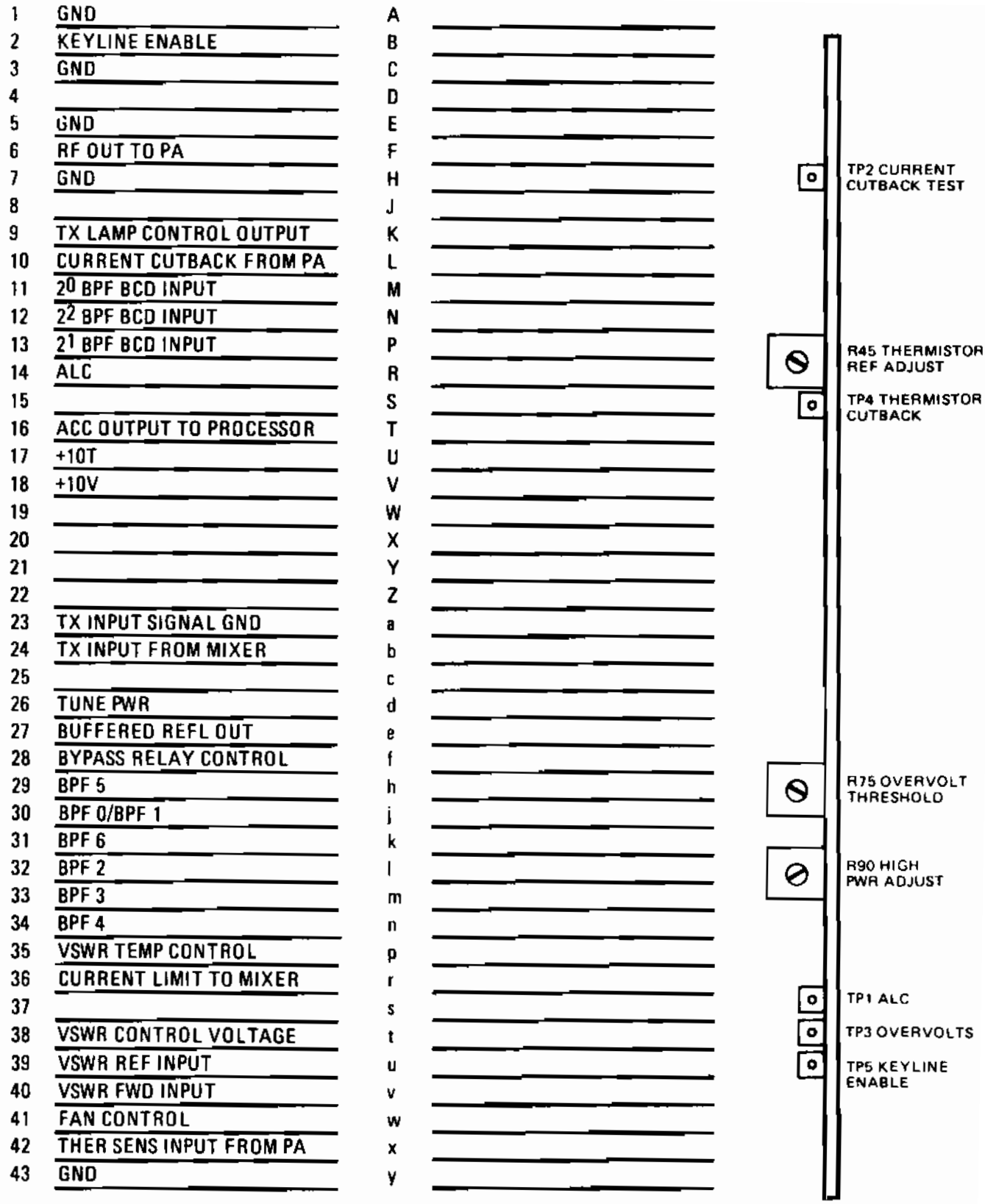


Figure 4. 1A1A3 Input/Output Summary

Table 2. 1A1A3 Maintenance Parts List

Ref. Desig.	Name & Description	Mfr. Code	Part Number
1A1A3	Control/Protection PW Board Assembly	14304	6628-0500
AR1,AR2	Integrated Circuit, Quad Operational Amplifier, CA324E	14304	IC-0359
C1,C2	Capacitor, Fixed, Ceramic, .1 uF +80-20%, 50V	14304	C-3202
C3-C14	Not Used		
C15	Capacitor, Fixed, Mica, 100 pF ±5%, 500V	14304	C-0126
C16,C17	Capacitor, Fixed, Ceramic, .1 uF +80-20%, 50V	14304	C-3202
C18	Capacitor, Fixed, Ceramic, .01 uF ±20%, 50V	14304	C-4952
C19	Capacitor, Fixed, Ceramic, .47 uF ±20%, 50V	14304	C-6374
C20	Capacitor, Fixed, Ceramic, .01 uF ±20%, 50V	14304	C-4952
C21	Capacitor, Fixed, Ceramic, .1 uF +80-20%, 50V	14304	C-3202
C22	Capacitor, Fixed, Mica, 47 pF ±5%, 500V	14304	C-0117
C23	Capacitor, Fixed, Ceramic, .1 uF +80-20%, 50V	14304	C-3202
C24	Not Used		
C25	Capacitor, Fixed, Tantalum, 150 uF ±10%, 15V	14304	C-3106
C26-C47	Capacitor, Fixed, Ceramic, .01 uF ±20%, 50V	14304	C-4952
C48	Capacitor, Fixed, Tantalum, 47 uF ±20%, 20V	14304	C-6452
C49-C53	Capacitor, Fixed, Ceramic, .01 uF ±20%, 50V	14304	C-4952
C54	Capacitor, Fixed, Tantalum, 2.2 uF ±20%, 50V	14304	C-6408
C55	Capacitor, Fixed, Ceramic, .01 uF ±20%, 50V	14304	C-4952
C56	Capacitor, Ceramic, .01 uF	14304	C11-0005-103
CR1-CR5	Not Used		
CR6,CR7	Diode, Rectifier, 1N4004	14304	CR-0725
CR8,CR9	Diode, Signal, 1N4454	14304	CR-0705
CR10	Not Used		
CR11-CR14	Diode, Rectifier, 1N4004	14304	CR-0725
CR15	Not Used		
CR16	Diode, Rectifier, 1N4004	14304	CR-0725
CR17,CR18	Diode, Signal, 1N4454	14304	CR-0705
CR19	Diode, Rectifier, 1N4004	14304	CR-0725
CR20	Diode, Germanium, 1N277	14304	CR-0065
CR22	Diode, Silicon, 1N4454	14304	1N4454
JMP1-JMP5	Jumper, Circuit	14304	MP-1142
K1	Relay, SPST, 12V	14304	K-0095
L1	Choke, RF, 3.9 uH 10%	14304	L-0623
L2-L6	Not Used		
L7	Choke, RF, 10 uH ±10%	14304	L-0628
L8	Choke, RF, 1 uH ±10%	14304	L-0616
L9	Choke, RF, 56 uH ±10%	14304	L-0637
L10-L16	Choke, RF, 22 uH ±10%	14304	L-0058
Q1-Q3	Not Used		
Q4	Transistor, NPN, PT5701	14304	Q-0405
Q5-Q7	Transistor, NPN, 2N4124	14304	Q-0385
Q8-Q15	Transistor, NPN, Darlington, MPS-A13	14304	Q-0076
Q16	Not Used		
Q17	Transistor, NPN, Darlington, MPS-A13	14304	Q-0076
Q18	Transistor, NPN, 2N4124	14304	Q-0385
Q19,Q20	Transistor, PNP, 2N3644	14304	Q-0415
Q21	Transistor, 2N4126	14304	2N4126
Q22	Transistor, 2N2222A	14304	2N2222

Table 2. 1A1A3 Maintenance Parts List (Continued)

Ref. Desig.	Name & Description	Mfr. Code	Part Number
R1-R9	Not Used		
R10,R11	Resistor, Fixed, Composition, 8.2 ohms ±5%, 1/4W	81349	RCR07G8R2JM
R12	Resistor, Fixed, Composition, 150 ohm ±5%, 1/4W	81349	RCR07G151JM
R13,R14	Resistor, Fixed, Composition, 18 ohm ±5%, 1/4W	81349	RCR07G180JM
R15	Resistor, Fixed, Composition, 56 ohm ±5%, 1/4W	81349	RCR07G560JM
R16,R17	Resistor, Fixed, Composition, 27 ohm ±5%, 1/4W	81349	RCR07G270JM
R18	Resistor, Fixed, Composition, 30 ohm ±5%, 1/4W	81349	RCR07G300JM
R19,R20	Resistor, Fixed, Composition, 5.6 ohm ±5%, 1/4W	81349	RCR07G5R6JM
R21	Resistor, Fixed, Composition, 220 ohm ±5%, 1/4W	81349	RCR07G221JM
R22	Resistor, Fixed, Composition, 150 ohm ±5%, 2W	81349	RCR42G151JM
R23	Resistor, Fixed, Composition, 33 ohm ±5%, 1/4W	81349	RCR07G330JM
R24	Resistor, Fixed, Composition, 10 ohm ±5%, 1/4W	81349	RCR07G100JM
R25	Resistor, Fixed, Composition, 150 ohm ±5%, 1/4W	81349	RCR07G151JM
R26	Resistor, Fixed, Composition, 180 ohm ±5%, 1/4W	81349	RCR07G181JM
R27	Resistor, Fixed, Composition, 4.7K ±5%, 1/4W	81349	RCR07G472JM
R28	Resistor, Fixed, Composition, 1K ±5%, 1/4W	81349	RCR07G102JM
R29	Resistor, Fixed, Composition, 1.2K ±5%, 1/4W	81349	RCR07G122JM
R30	Resistor, Fixed, Composition, 10K ±5%, 1/4W	81349	RCR07G103JM
R31	Resistor, Fixed, Composition, 1K ±5%, 1/4W	81349	RCR07G102JM
R32	Resistor, Fixed, Composition, 10K ±5%, 1/4W	81349	RCR07G103JM
R33	Resistor, Fixed, Composition, 1 Meg ±5%, 1/4W	81349	RCR07G105JM
R34	Resistor, Fixed, Composition, 10K ±5%, 1/4W	81349	RCR07G103JM
R35	Resistor, Fixed, Composition, 470 ohm ±5%, 1/4W	81349	RCR07G471JM
R36	Resistor, Fixed, Composition, 4.7K ±5%, 1/4W	81349	RCR07G472JM
R37	Resistor, Fixed, Film, 6.81K ±1%, 1/8W	81349	RN55D6811F
R38	Resistor, Fixed, Film, 4.75K ±1%, 1/8W	81349	RN55D4751F
R39	Resistor, Fixed, Film, 47.5K ±1%, 1/8W	81349	RN55D4752F
R40	Resistor, Fixed, Film, 3.92K ±1%, 1/8W	81349	RN55D3921F
R41	Resistor, Fixed, Film, 82.5K ±1%, 1/8W	81349	RN55D8252F
R42	Resistor, Fixed, Composition, 330 ohm ±5%, 1/4W	81349	RCR07G331JM
R43	Resistor, Fixed, Composition, 1.2K ±5%, 1/4W	81349	RCR07G122JM
R44	Resistor, Fixed, Film, 2.49K ±1%, 1/8W	81349	RN55D2491F
R45	Resistor, Variable, 2K	14304	R-2226
R46	Resistor, Fixed, Film, 1.82K ±1%, 1/8W	81349	RN55D1821F
R47	Resistor, Fixed, Film, 15.4K ±1%, 1/8W	81349	RN55D1542F
R48	Resistor, Fixed, Film, 82.5K ±1%, 1/8W	81349	RN55D8252F
R49	Resistor, Fixed, Composition, 3.3K ±5%, 1/4W	81349	RCR07G332JM
R50	Resistor, Fixed, Composition, 47K ±5%, 1/4W	81349	RCR07G473JM
R51-R53	Resistor, Fixed, Composition, 220K ±5%, 1/4W	81349	RCR07G224JM
R54	Resistor, Fixed, Composition, 47K ±5%, 1/4W	81349	RCR07G473JM

Table 2. 1A1A3 Maintenance Parts List (Continued)

Ref. Desig.	Name & Description	Mfr. Code	Part Number
R55	Resistor, Fixed, Composition, 100K ±5%, 1/4W	81349	RCR07G104JM
R56-R63	Resistor, Fixed, Composition, 47K ±5%, 1/4W	81349	RCR07G473JM
R64	Not Used		
R65	Resistor, Fixed, Composition, 47K ±5%, 1/4W	81349	RCR07G473JM
R66	Resistor, Fixed, Composition, 1.8K ±5%, 1/4W	81349	RCR07G182JM
R67	Resistor, Fixed, Composition, 15K ±5%, 1/4W	81349	RCR07G153JM
R68	Resistor, Fixed, Composition, 390 ohms ±5%, 1/4W	81349	RCR07G391JM
R69,R70	Resistor, Fixed, Composition, 330 ohm ±5%, 1/4W	81349	RCR07G331JM
R71	Resistor, Fixed, Composition, 470 ohm ±5%, 1/4W	81349	RCR07G471JM
R72	Resistor, Fixed, Composition, 220 ohm ±5%, 1/4W	81349	RCR07G221JM
R73	Resistor, Fixed, Composition, 10K ±5%, 1/4W	81349	RCR07G103JM
R74	Resistor, Fixed, Composition, 2.7K ±5%, 1/4W	81349	RCR07G272JM
R75	Resistor, Variable, 5K	14304	R-2227
R76	Resistor, Fixed, Composition, 6.8K ±5%, 1/4W	81349	RCR07G682JM
R77	Resistor, Fixed, Composition, 10K ±5%, 1/4W	81349	RCR07G103JM
R78	Resistor, Fixed, Composition, 15K ±5%, 1/4W	81349	RCR07G153JM
R79	Resistor, Fixed, Composition, 1.8K ±5%, 1/4W	81349	RCR07G182JM
R80	Resistor, Fixed, Composition, 390 ohm ±5%,	81349	RCR07G391JM
R81	Resistor, Fixed, Composition, 10 Meg ±5%, 1/4W	81349	RCR07G106JM
R82	Not Used		
R83	Resistor, Fixed, Composition, 1.8K ±5%, 1/4W	81349	RCR07G182JM
R84	Resistor, Fixed, Film, 4.75K, 1%, 1/8W	81349	RN55D4751F
R85	Resistor, Fixed, Film, 8.25K 1%, 1/8W	81349	RN55D8251F
R86	Resistor, Fixed, Composition, 10K ±5%, 1/4W	81349	RCR07G103JM
R87	Resistor, Fixed, Composition, 27 ohm ±5%, 1/4W	81349	RCR07G270JM
R88,R89	Resistor, Fixed, Composition, 560 ohm ±5%, 1/4W	81349	RCR07G561JM
R90	Resistor, Variable, 1K	14304	R-2225
R91	Resistor, Fixed, Composition, 470 ohm ±5%, 1/4W	81349	RCR07G471JM
R92	Resistor, Fixed, Composition, 22K ±5%, 1/4W	81349	RCR07G223JM
R93	Resistor, Fixed, Composition, 4.3K ±5%, 1/4W	81349	RCR07G432JM
R94	Resistor, Fixed, Composition, 100K ±5%, 1/4W	81349	RCR07G104JM
R95,R96	Resistor, Fixed, Film, 1K, 1%, 1/8W	81349	RN55D1001F
R97	Resistor, Fixed, Composition, 10K ±5%, 1/4W	81349	RCR07G103JM
R98,R99	Resistor, Fixed, Film, 1K, 1/8W	81349	RN55D1001F
R100	Resistor, Fixed, Comp, 56 ohms, 5%, 1/4W	81349	RCR07G560JM
R101	Potentiometer, Carmet, 2K	14304	R-2226
R102	Resistor, Fixed, Composition, 10K, 5%, 1/4W	81349	RCR07G103JM
R103	Resistor, Fixed, Composition, 1K, 5%, 1/4W	81349	RCR07G102JM
R104,R105	Resistor, Fixed, Composition, 10K, 5%, 1/4W	81349	RCR07G103JM
R106	Resistor, Fixed, Composition, 1K, 5%, 1/4W	81349	RCR07G102JM
R107	Resistor, Fixed, Composition, 33K, 5%, 1/4W	81349	RCR07G333JM
TP1	Test Point, Brown	14304	J-0392
TP2	Test Point, Red	14304	J-0387

Table 2. 1A1A3 Maintenance Parts List (Continued)

Ref. Desig.	Name & Description	Mfr. Code	Part Number
TP3	Test Point, Orange	14304	J-0390
TP4	Test Point, Yellow	14304	J-0391
TP5	Test Point, Green	14304	J-0389
T1,T2	Not Used		
T3	Transformer	14304	919-1280
T4	Transformer	14304	6628-1178
U1	Integrated Circuit, BCD-to-Decimal Decoder, CD4028AE	14304	IC-0257
VR1, VR2	Diode Zener, 5.6V ±5%	14304	CR-0265

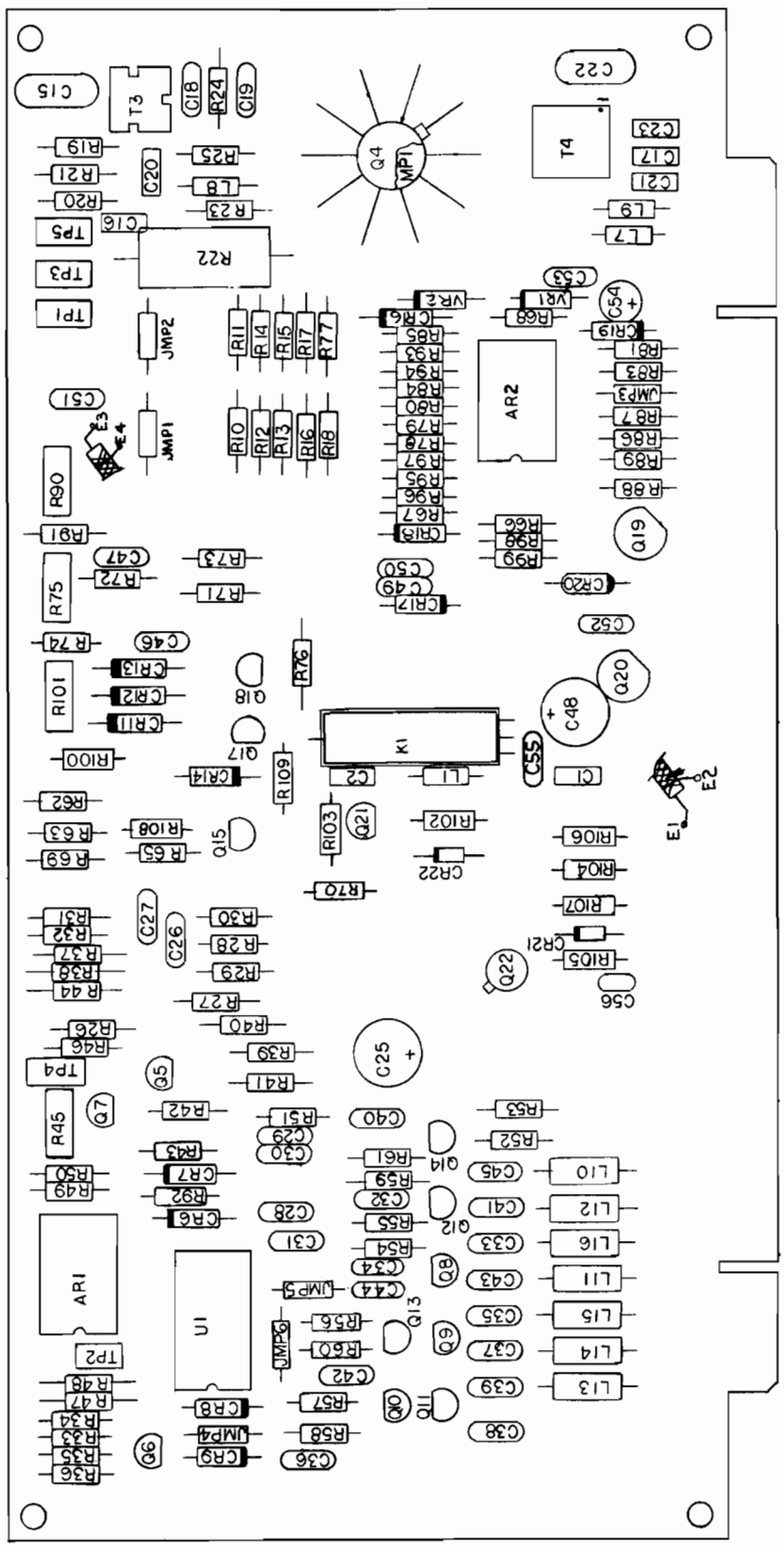
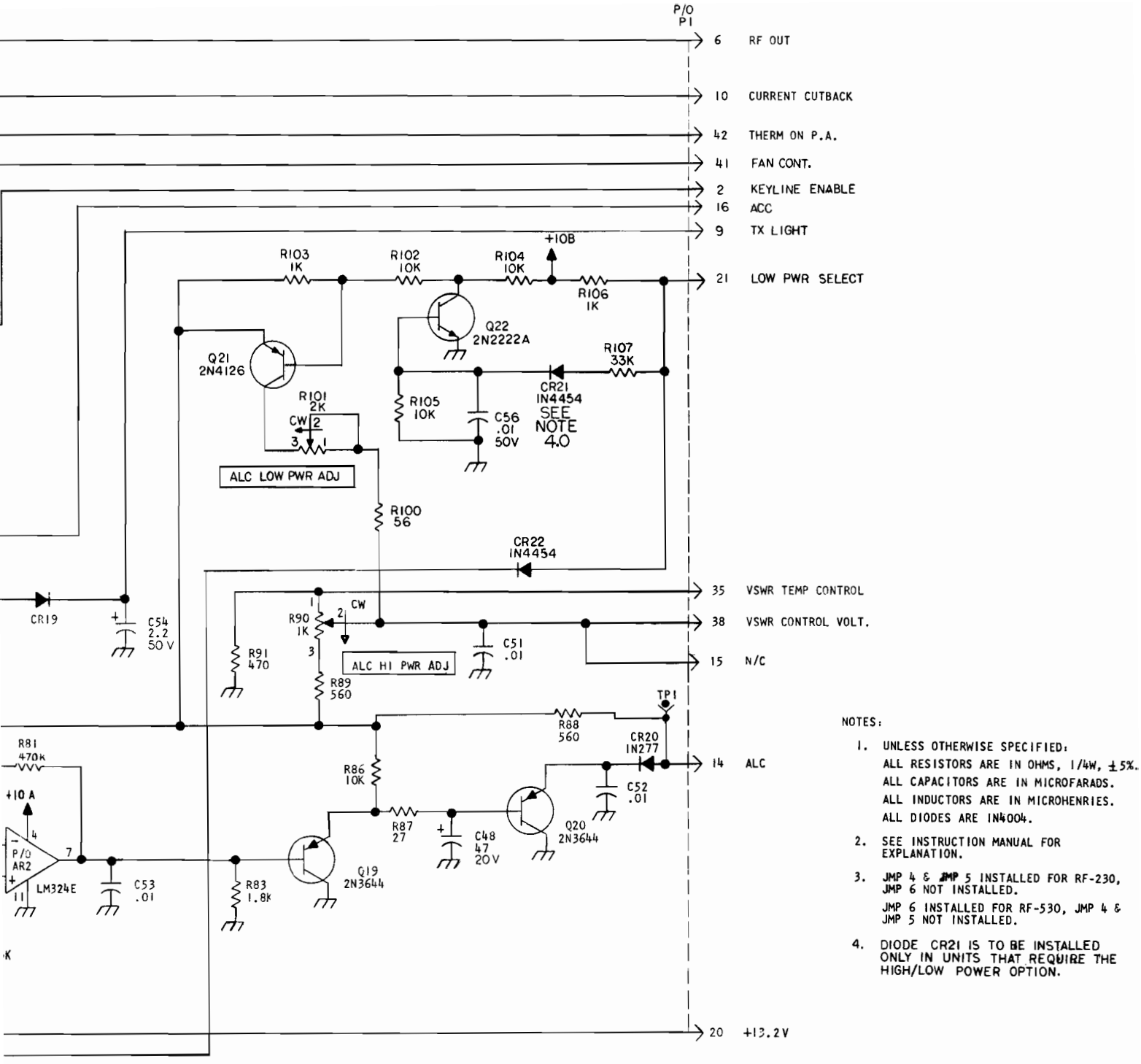


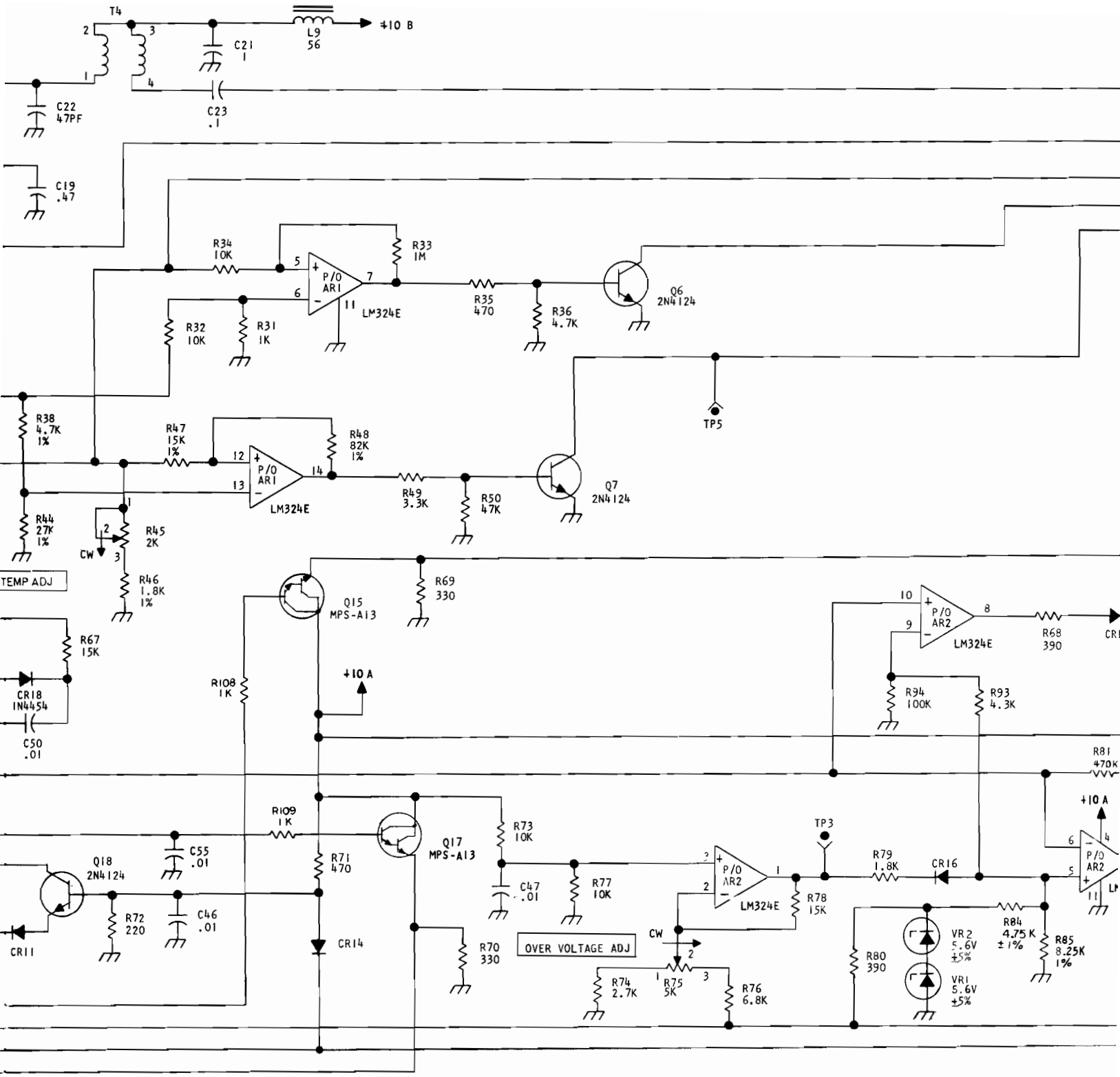
Figure 5. 1A1A3 PA Control Component Locations



NOTES:

1. UNLESS OTHERWISE SPECIFIED:
   ALL RESISTORS ARE IN OHMS, 1/4W, ±5%.
   ALL CAPACITORS ARE IN MICROFARADS.
   ALL INDUCTORS ARE IN MICROHENRIES.
   ALL DIODES ARE IN4004.
2. SEE INSTRUCTION MANUAL FOR EXPLANATION.
3. JMP 4 & JMP 5 INSTALLED FOR RF-230, JMP 6 NOT INSTALLED.
   JMP 6 INSTALLED FOR RF-530, JMP 4 & JMP 5 NOT INSTALLED.
4. DIODE CR21 IS TO BE INSTALLED ONLY IN UNITS THAT REQUIRE THE HIGH/LOW POWER OPTION.

Figure 6. 1A1A3 PA Control Schematic Diagram, 6628-9050


T4
L9
56
+10 B
C21
1
C22
47PF
C23
.1
C19
.47
R34
10K
R33
1M
P/O
AR1
LM324E
R35
470
R36
4.7K
Q6
2N4124
R32
10K
R31
1K
TP5
R38
4.7K
1%
R47
15K
1%
R48
82K
1%
R49
3.3K
R50
47K
Q7
2N4124
R44
27K
1%
R45
2K
CW
R46
1.8K
1%
TEMP ADJ
Q15
MPS-A13
R69
330
R67
15K
CR18
IN4454
C50
.01
R108
1K
+10 A
P/O
AR2
LM324E
R68
390
R94
100K
R93
4.3K
R81
470K
R109
1K
C55
.01
Q18
2N4124
R72
220
C46
.01
CR11
R71
470
CR14
Q17
MPS-A13
R73
10K
C47
.01
R77
10K
R70
330
OVER VOLTAGE ADJ
R74
2.7K
R75
5K
R76
6.8K
TP3
R79
1.8K
CR16
R78
15K
R80
390
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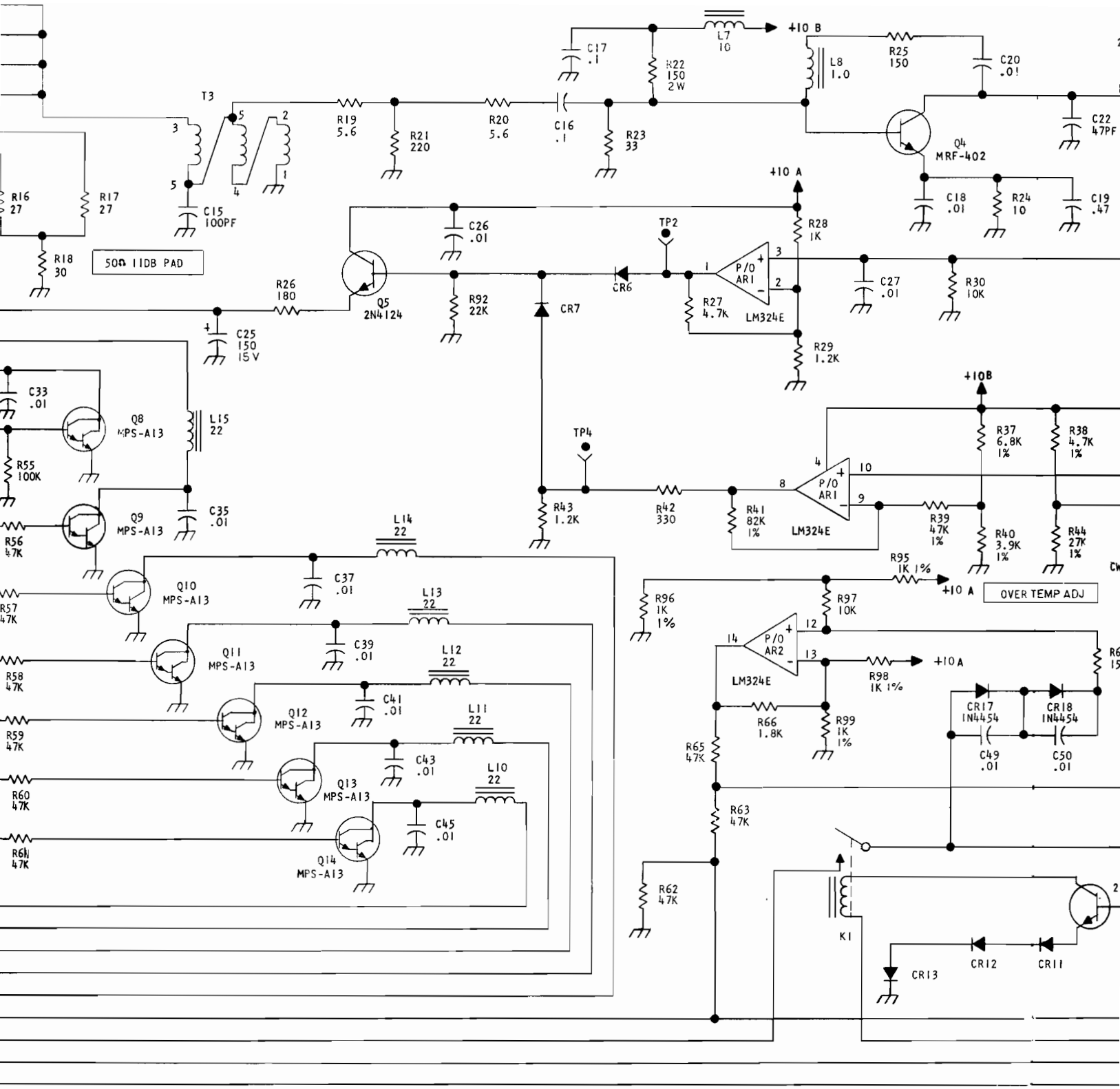
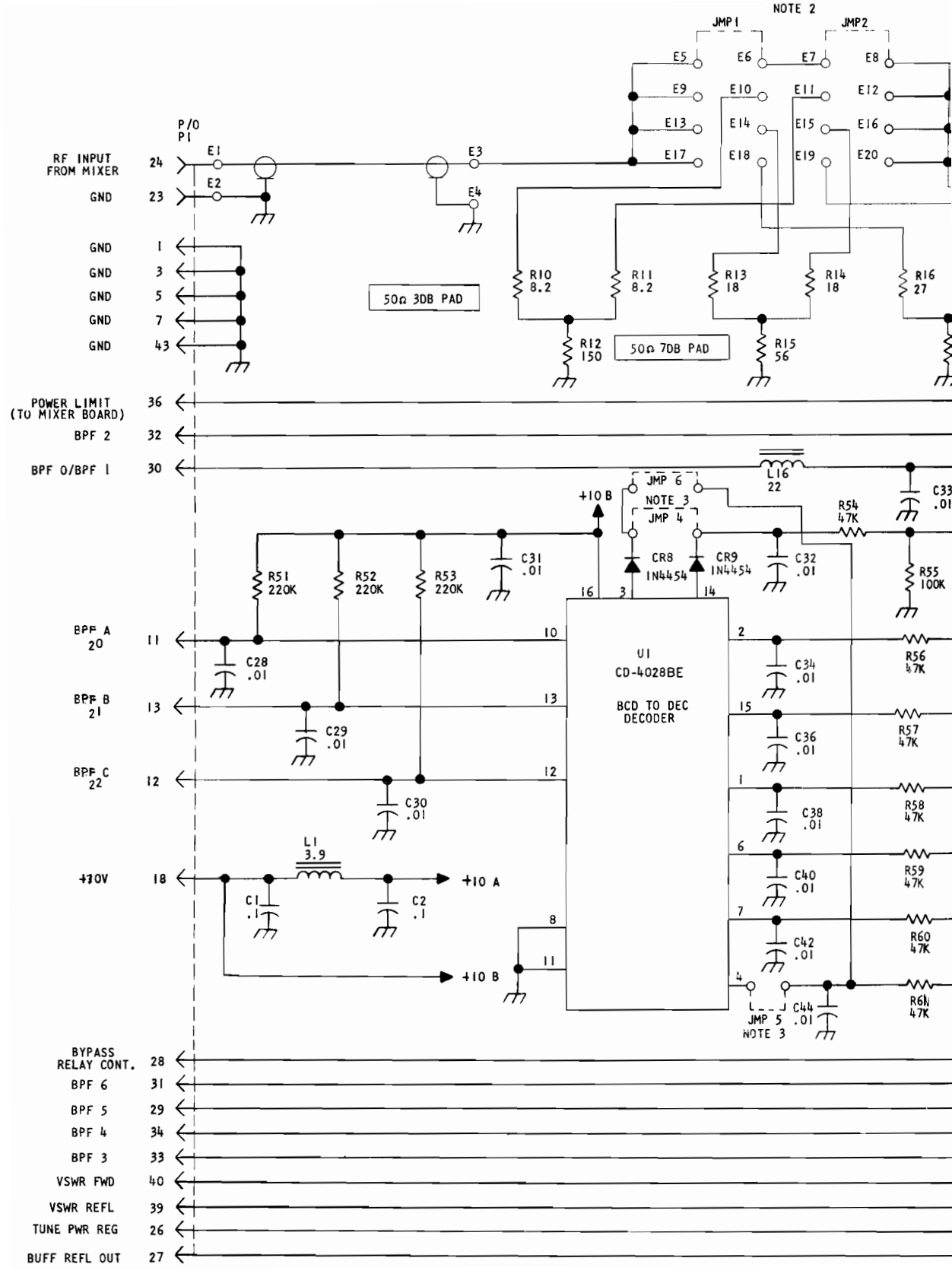
VR1
5.6V
±5%
R84
4.75K
±1%
R85
8.25K
1%

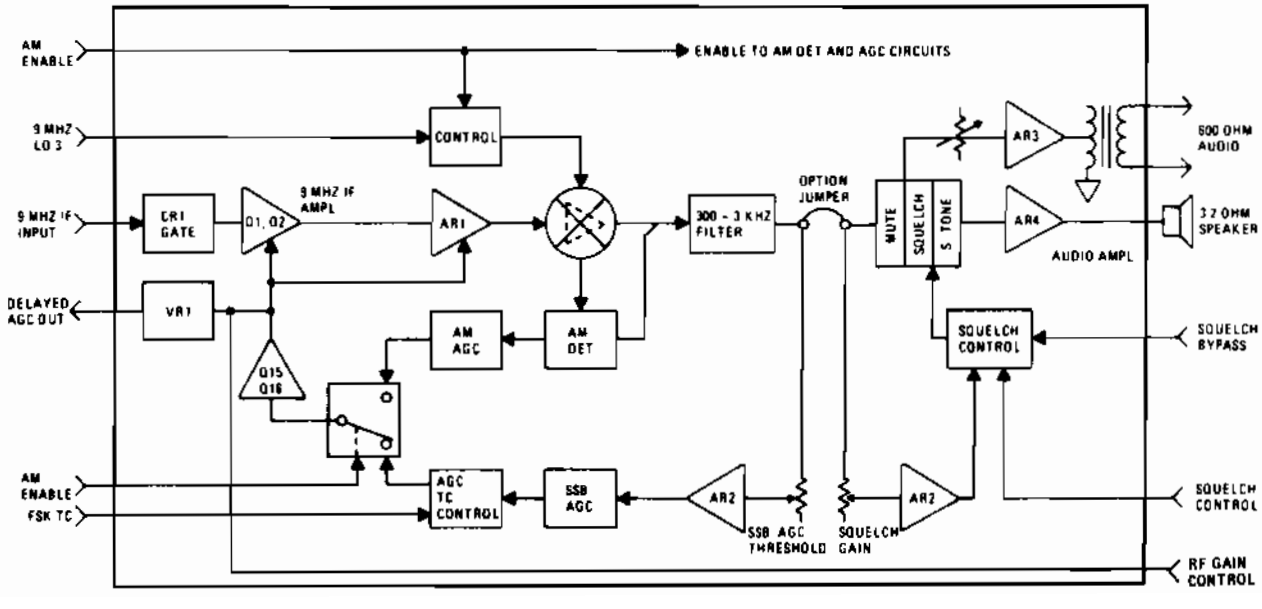

T3
R16 27
R17 27
R18 30
50Ω 11DB PAD
C15 100PF
R19 5.6
R21 220
R20 5.6
C16 .1
C17 .1
R22 150 2W
R23 33
L7 10
+10 B
L8 1.0
R25 150
C20 .01
C22 47PF
Q4 MRF-402
C18 .01
R24 10
C19 .47
+10 A
R28 1K
C26 .01
TP2
R26 180
Q5 2N4124
R92 22K
CR6
CR7
P/O AR1
LM324E
R27 4.7K
C27 .01
R30 10K
R29 1.2K
C25 150 15V
C33 .01
Q8 MPS-A13
L15 22
R55 100K
Q9 MPS-A13
C35 .01
R56 47K
TP4
R43 1.2K
R42 330
R41 82K 1%
+10B
R37 6.8K 1%
R38 4.7K 1%
R39 47K 1%
R40 3.9K 1%
R44 27K 1%
L14 22
C37 .01
Q10 MPS-A13
R57 47K
L13 22
C39 .01
Q11 MPS-A13
R58 47K
L12 22
C41 .01
Q12 MPS-A13
R59 47K
L11 22
C43 .01
Q13 MPS-A13
R60 47K
L10 22
C45 .01
Q14 MPS-A13
R61 47K
R95 1K 1%
R96 1K 1%
R97 10K
+10 A
OVER TEMP ADJ
P/O AR2
LM324E
R98 1K 1%
R66 1.8K
R99 1K 1%
R65 47K
R63 47K
R62 47K
CR17 IN4454
CR18 IN4454
C49 .01
C50 .01
K1
CR12
CR11
CR13


NOTE 2
JMP1
JMP2
P/O P1
RF INPUT FROM MIXER 24
GND 23
GND 1
GND 3
GND 5
GND 7
GND 43
E1
E2
E3
E4
E5
E6
E7
E8
E9
E10
E11
E12
E13
E14
E15
E16
E17
E18
E19
E20
50Ω 3DB PAD
50Ω 7DB PAD
R10 8.2
R11 8.2
R12 150
R13 18
R14 18
R15 56
R16 27
POWER LIMIT (TO MIXER BOARD) 36
BPF 2 32
BPF 0/BPF 1 30
L16 22
JMP 6
NOTE 3
JMP 4
+10 B
R54 47K
C33 .01
R51 220K
R52 220K
R53 220K
C31 .01
CR8 IN4454
CR9 IN4454
C32 .01
R55 100K
BPF A 20 11
BPF B 21 13
BPF C 22 12
C28 .01
C29 .01
C30 .01
U1
CD-4028BE
BCD TO DEC DECODER
C34 .01
R56 47K
C36 .01
R57 47K
C38 .01
R58 47K
C40 .01
R59 47K
C42 .01
R60 47K
C44 .01
JMP 5
NOTE 3
L1 3.9
+10V 18
C1 .1
C2 .1
+10 A
+10 B
BYPASS RELAY CONT. 28
BPF 6 31
BPF 5 29
BPF 4 34
BPF 3 33
VSWR FWD 40
VSWR REFL 39
TUNE PWR REG 26
BUFF REFL OUT 27

UNIT INSTRUCTIONS

IF AUDIO BOARD

1A1A4



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1. GENERAL DESCRIPTION

The IF Audio Board accepts the 9 MHz 2nd IF Out put from the mixer assembly and performs the final detector function to translate the intermediate frequency signal into useable intelligence. This process involves two discrete, but not simultaneous, detector functions: a product detector is operative in the single sideband, CW, and AFSK mode, and an envelope detector is operative in the AM mode. Two separate audio outputs are provided: a 600 ohm line audio output, and a conventional front panel speaker output.

Mute, squelch, and speaker enable control is also effected through the Audio IF Board via Logic Level control and J-FET transistors Q17, Q18, Q20, and Q21. These transistors have been shown as simple SPST switches on logic diagrams for simplicity. The 600 ohm audio output is affected only by the MUTE signal; the front panel speaker is controlled by all three signals (MUTE, SQUELCH, SPEAKER ENABLE).

Squelch and AGC control voltages are also developed and used on the Audio IF Board. AGC is also automatically controlled for derivation source (carrier or SSB) and time constant. Fast attack, fast decay is used for typical AM and AFSK signals, and fast attack slow decay for sideband and for CW. A delayed AGC voltage from the Audio IF Board controls front end gain.

Manual RF Gain Control is affected through the IF/ Audio Board by manually controlling AGC voltage at the front panel.

2. TECHNICAL CHARACTERISTICS

Power Requirements:
- 13.8 Vdc for Speaker Audio Amplifier
- +10V R (Present in Receive Mode Only)
- +10V

Control Inputs:

FSK	1 = FSK TC
MUTE	1 = No Muting
AM Enable	1 = Disabled
Squelch Bypass	1 = Bypass
Squelch Control Arm	Linear
Volume Control Arm	Modified Log
Sidetone Enable	1 = Enable

Control Outputs:

Delayed AGC Out	0 – 6V

Signal Inputs:
- 9 MHz IF Input from Mixer 1A1A6
- L.O. 3 in from frequency standard (9 MHz)
- Sidetone Input from Processor 1A1A5
- 600 ohm Monitor from Processor 1A1A5
- (Receive Audio from options)

Signal Outputs
- 600 ohm Receive Out
- Speaker Audio Out, 3.2 ohms

3. SEMICONDUCTOR COMPLEMENT

REF. DESIG.	TYPE	DESCRIPTION
AR1	MC1350P	IF Amplifier
AR2	CA324E	Quad Operational Amplifier
AR3	LM386N-1	1/4 Watt Audio Amplifier
AR4	CA810	Speaker Audio Power Ampl.
AR5, AR6	CA324E	Quad Operational Amplifier
CR1	1N4454	Diode
CR2	HP3080	PIN Diode
CR3, CR4	1N4454	Diode
CR5	MPN3401	PIN Diode
CR6-CR21	1N4454	Diode
Q1	2N4126	Transistor, PNP
Q2	2N5179	Transistor, NPN
Q3-Q5	2N3563	Transistor, NPN
Q6-Q8	2N4126	Transistor, PNP
Q9-Q12	2N4124	Transistor, NPN
Q13	2N4126	Transistor, PNP
Q14, Q15	2N4124	Transistor, NPN
Q16	2N3644	Transistor, PNP
Q17-Q21	2N4392	Transistor, JFET
VR1	1N5228	Diode, Zener, 3.9V

4. CIRCUIT DESCRIPTION

Refer to figures 1 and 2 for the following discussions. The 9 MHz IF Input to the Audio IF Board can be measured at TP1. Typical levels are given for all test points on figure 1. IF input to the board is controlled by gate diode CR1. With +10R present at P1-19, CR1 is forward biased, and input amplifiers Q1 and Q2 are active. Note that +10R is used as B+ for all active elements in the IF Amplifier and detector circuits; as a consequence, in the transmit mode, operating potential is removed.

AR1 is a monolithic silicon integrated circuit. The 9 MHz IF input is at pin 4, where internal amplifiers operate at constant emitter currents to hold input impedance constant regardless of AGC action. AGC is fed to pin 5. Increasing the AGC voltage from 5 to 6.75 volts at this point can cause a gain reduction of 60 dB. Again, refer to figure 1 for typical levels. 9 MHz IF section performance can be measured using relative measurements at the input (TP1) and at the IF output (TP3). The AR1

output at pins 1 and 8 terminates in 9 MHz adjustable IF Transformer T1. This Transformer is adjusted for peak output at 9 MHz.

Q3, Q4, and Q5 function as a product detector in SSB, and as an amplifier in AM. In either case, the detected audio can be measured at TP4. Q8 and CR7 perform the envelope detector function in the AM mode. The AM Enable input at P1-22 turns on Q6 and biases on PIN diode CR3 to ground the LO3 input signal for the AM mode. With the LO3 input grounded, Q4 has only one input signal. The 9 MHz IF input, and as a consequence, Q4 functions only as an amplifier to drive the AM detector. Q9 buffers the detected AM output fed to comparator AR6 for carrier derived AGC development. R39 establishes the carrier derived AGC threshold.

Both the AM and SSB signal paths are common at TP4 where the signal is fed to 300 – 3000 Hz filter Q12 and Q13. This filtered output is measurable at TP5. The detected and filtered audio is jumpered directly to J-FET transistor switch Q21. The logic level control inputs at P1-21 effect MUTE control at this point. A logic "1" closes the switch section and the audio is fed via line level adjust potentiometer R54 to an integrated circuit 1/4 watt audio amplifier. This amplifier drives T9, the 600 ohm line audio output transformer. R54 would normally be adjusted to produce a nominal 10 dBm output to a 600 ohm line, or as per customer requirements.

J-FET transistors switches Q17, Q18, Q19, and Q21 are used to provide squelch and sidetone enable logic level controlled functions. With a logic"0" at Q18, audio is "squelched", and with a logic "0" at Q19, audio is disabled. Note that R128, a 18K resistor, bypasses the squelch switch section. This bypass provides a low level audio "presence" when the radio is squelched.

The squelch threshold is established by varying R76, the squelch gain control at the inverting input of AR2-9. The non-inverting input is tied to a fixed +5V reference developed by divider R62 and R63. The squelch amplifier output is fed to AR5-10 (see TP7). The squelch circuit uses a sylabic rate detector, that recognizes the 16–25 rate characteristic of human speech, so that squelch action is not solely a function of signal amplituted. This system of speech pattern recognition results in a very high noise immunity in the squelch system. Random and periodic noise, or constant tones are rectified and averaged to a steady dc level – which is blocked by R56. Detected and filtered sylabic rate elements reference at AR6 to effect squelch control.

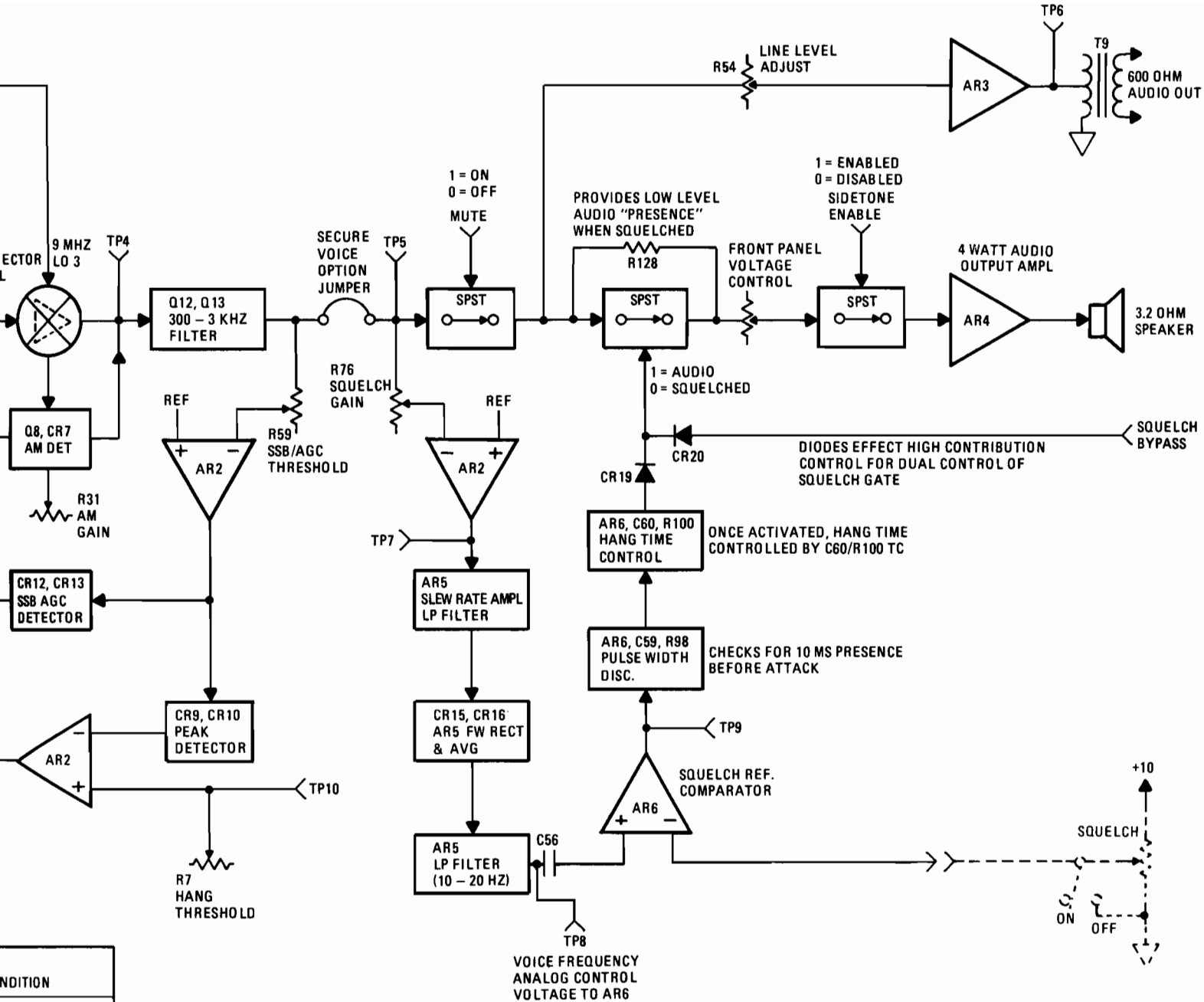
AR6, CR17, C59, and R98 are configured as a pulse width discriminator. This circuit forces a presence greater than 10 ms before it is activated. Hang time control is accomplished by the time constant of C60/R100 at the AR6-14 output. CR19 and CR20 function as high contribution diodes at the squelch control gate to accomodate certain options.

The SSB AGC Threshold is established by R59 and represents a sample of the receive audio at this point. This level is used to develop and control SSB AGC; the R59 sample is amplified by AR2, and the output at pin 7 is fed through J-fet Transistor Switch Q20 for logic control by the AM ENABLE signal. The output of Q20 is fed via C46 to peak rectifiers CR12 and CR13. This voltage is filtered by C47 and either R66 or R67. With Q14 on, R67 is effectively substituted for R66. Because R67 is only 10k ohms, as compared with the relatively much higher 2.2 megohm value of R66, the AGC time constant is shortened considerably. Q14 can be turned on by logic "1" at the P1-16 FSK-TC input, or by a positive signal from Hang-time Control Comparator AR2-14. R70 establishes the internal hang-time reference which is compared with the AGC sample from C45. This AGC sample is peak-rectified by CR9 and CR10. The AR2-1 AGC output is fed to Dc Amplifiers Q15/Q16. The AGC output at the collector of Q16 controls IF Amplifier AR1 and controls Q2 via pin diode CR2. Delayed AGC is fed to the RF section via VR1. AGC voltage must exceed 3.1 V to overcome VR1 and effect control at the RF section. AGC can be measured at TP2.

Manual RF Gain Control is effected by manually controlling the dc voltage at TP2. A variable dc voltage is developed in the RF Gain Control potentiometer located on the front panel assembly. The dc voltage is diode "ORed" into the AGC test circuit line that enters the IF/Audio board via P1-34. The OR action allows the higher control voltage, coming from either AGC circuitry or the Manual RF Gain Control, to have priority and control the receiver gain.

5. MAINTENANCE

Figure 1 gives typical test point information. Figure 3 summarizes all card edge inputs and outputs, and also locates all adjustment points. Figure 4 is a complete component location diagram that locates

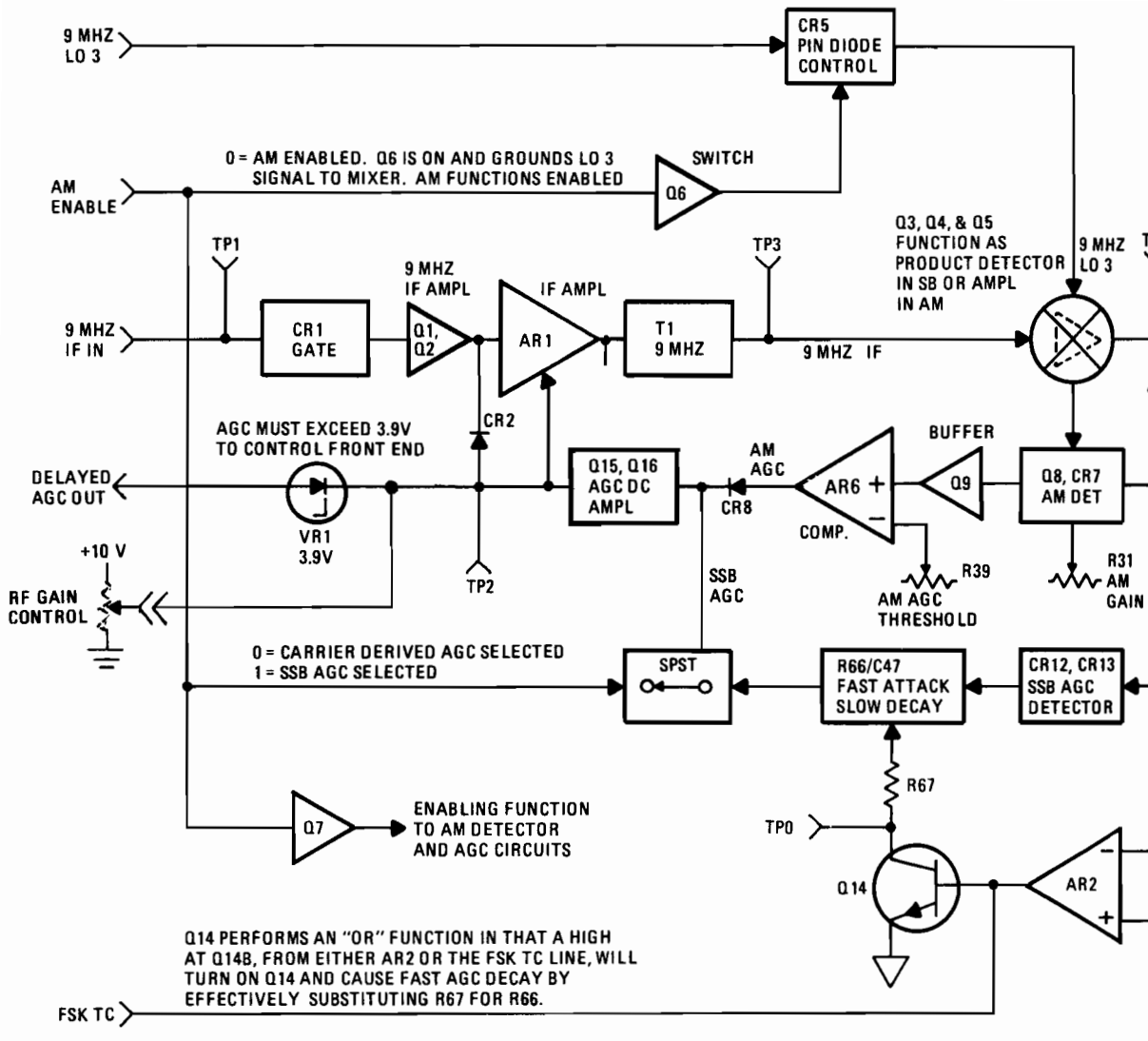


NDITION
ECEIVE
71 MV RMS
IN
IN
IN
IN
IN
IN
ILY

FUNCTION	PIN	MEASURE	FOR CONDITION
LO 3 IN	15	0 DBM	ALL
FSK TC	16	HI = FSK	LO = ALL OTHER
AM ENABLE	22	LO	AM
MUTE CONTROL	21	LO	1A1A5 PULLED
SQ BYPASS	23	NO VOLTAGE	NORM W/O SQUELCH BYPASS
SIDETONE IN	25	200 mV MIN/28 VDC MAX.	CW XMIT AND KEYED
SIDETONE ENABLE	38	HI	REC/CW OR 600 OHM XMIT
SPKR OUT (3.2 OHM)	32	3.58 VRMS MAX	REC 1000 uV IN

230-5

Figure 1. 1A1A4 IF Audio Board, Simplified Diagram



TEST POINT	FUNCTION	MEASURE	FOR CONDITION
TP1	9 MHZ IN	0.5uV TO 71 mVRMS	TYPICAL RECEIVE
TP2	AGC OUT	0.34 TO 8.0 VDC	0.5 UV TO 71 MV RMS
TP3	9 MHZ IF OUT	57 mVRMS @ 9 MHZ	1000 uV IN
TP4	DETECTED AUDIO	110 mVRMS	1000 uV RF IN
TP5	VF FILTER OUT	950 mVRMS	1000 uV RF IN
TP6	LINE AUDIO OUT	0 TO +10 DBM	1000 uV RF IN
TP7	SQ AMPL OUT	225 MV RMS	1000 uV RF IN
TP8	SQ DC CONTROL VOLTS	5 VDC + (±1.5V AUDIO 16 HZ)	1000 uV RF IN
TP9	SQ REF COMP. OUT	5 VDC WITH ±3V AUDIO	1000 uV RF IN
TP10	AGC HANG REF.	5.1 TO 5.6 VDC 5.4 TYP.	REC SSB
TP0	AGC FAST/SLOW CONDITION	2.84V OR 0.02V	0.02 FSK ONLY

all test points. Several test points on the Audio IF Board are only accessible with the board mounted on an extender card. T1 and Z1 can only be tuned with the board on an extender card, however, this level of adjustment should never by necessary unless reactive components in the related circuits are changed. The following adjustments should only be made as required.

Audio IF Board setup adjustments can be made in the radio, with the assembly on an extender card.

These setup adjustments presuppose an otherwise operational radio, and that all 1A1A6 Mixer adjustments have been made (Tune LP Filter, LO 1, 75 MHz Matching Network, L6, and 2nd Receive Mixer Bias Adjustment).

5.1 Test Equipment

Figure 2 demonstrates test equipment typically required to make all 1A1A4 maintenance or setup adjustments.

5.2 1A1A4 Setup/Adjustment Procedure

Perform the following procedure to adjust the 1A1A4 IF/Audio PWB.

a. Assemble required test equipment setup for test as shown in Figure 2, with RF Signal Generator connected to RF-2301 input, and measuring equipment available for use as directed.

b. Install 1A1A4 on extender card.

CAUTION

Always select POWER OFF when removing or installing subassemblies to prevent possible damage to equipment. A PCB Extractor is included with the RF-2301.

c. Set Transceiver frequency to 3.9876 MHz USB mode, Squelch Control OFF, and RF Gain Control fully cw. Tune Signal Generator to Transceiver receive frequency and adjust genera-

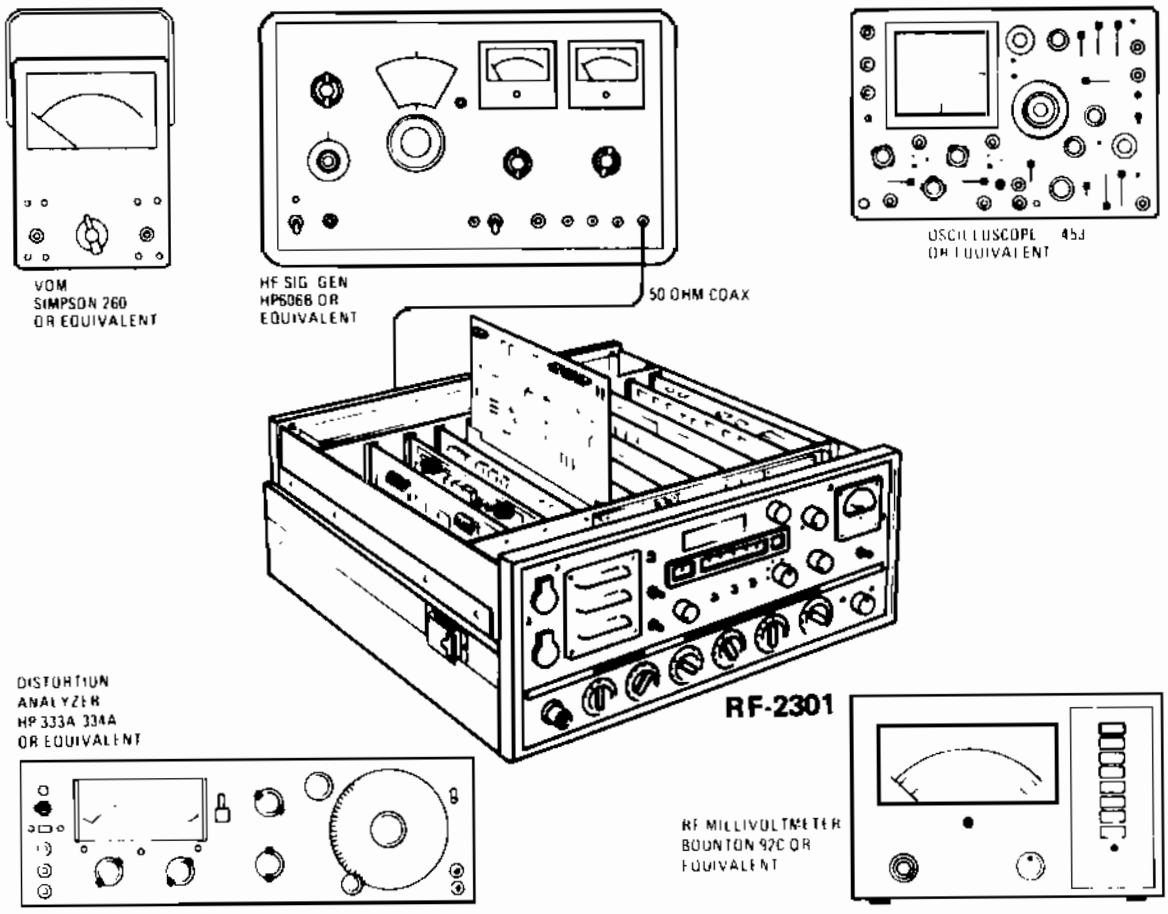


Figure 2. 1A1A4 Test/Setup

tor output to 2.0 uV. Fine tune signal generator for maximum audio output across 3.2 ohm speaker or the 600 ohm audio line output using audio VM or oscilloscope. Use USB receive mode.

d. Adjust volume control for 0.2V rms.

e. Locate T1 on Audio IF Board and tune for peak indication at audio output.

f. Increase signal generator level to 3 uV.

g. Connect dc VM to TP2 and adjust R59, (SSB AGC Threshold) to 1 ±0.1 Vdc. The AGC voltage at TP2 will vary from approximately 0.34 Vdc, for a no-AGC condition, to approximately 9 Vdc, for a full AGC condition. The AGC Threshold should thus be set for approximately 1.0 Vdc with a 3 uV RF input.

h. Adjust signal generator output level to 1 mV. Note AGC level at TP2. Momentarily disconnect RF input and note AGC hang time. Adjust AGC Hang Theshold Control R70 for desired hang time (1 second).

i. Select AM mode at RF-2301 front panel and adjust signal generator to the receive frequency. Modulate 30% @ 1 kHz and adjust generator output level to 4.5 uV.

u. Adjust Z1 for maximum output at speaker.

k. Adjust R31 and R39 (see figure 3) fully ccw.

l. Adjust R39 for a minimum VOM indiction of approximately 0.35 Vdc at TP2.

m. Adjust R31 for a VOM indication of 1 ± 0.1 Vdc at TP2.

n. Select USB mode. Using 100 mV signal level from signal generator, with a recovered audio frequency of approximately 1 kHz, adjust Squelch Gain Control R76 for 600 mV peak-to-peak at Squelch Amplifier Output Test Point TP7.

o. Adjust signal generator output to 1 mV. Using audio VTVM across 600 ohm receive line output, adjust 600 ohm Audio Line Level Adjust Control R54 for 0 dBm output level (or to other level as desired).

p. Disconnect all test equipment. The adjustment procedure is now complete.

6. PARTS LIST

Table 1 lists all 1A1A4 Maintenance Parts. All of these components can be identified in Figure 4. Refer to the General Information for list of manufacturers.

7. SCHEMATIC

Figure 5 is a complete schematic diagram of the 1A1A4 assembly.

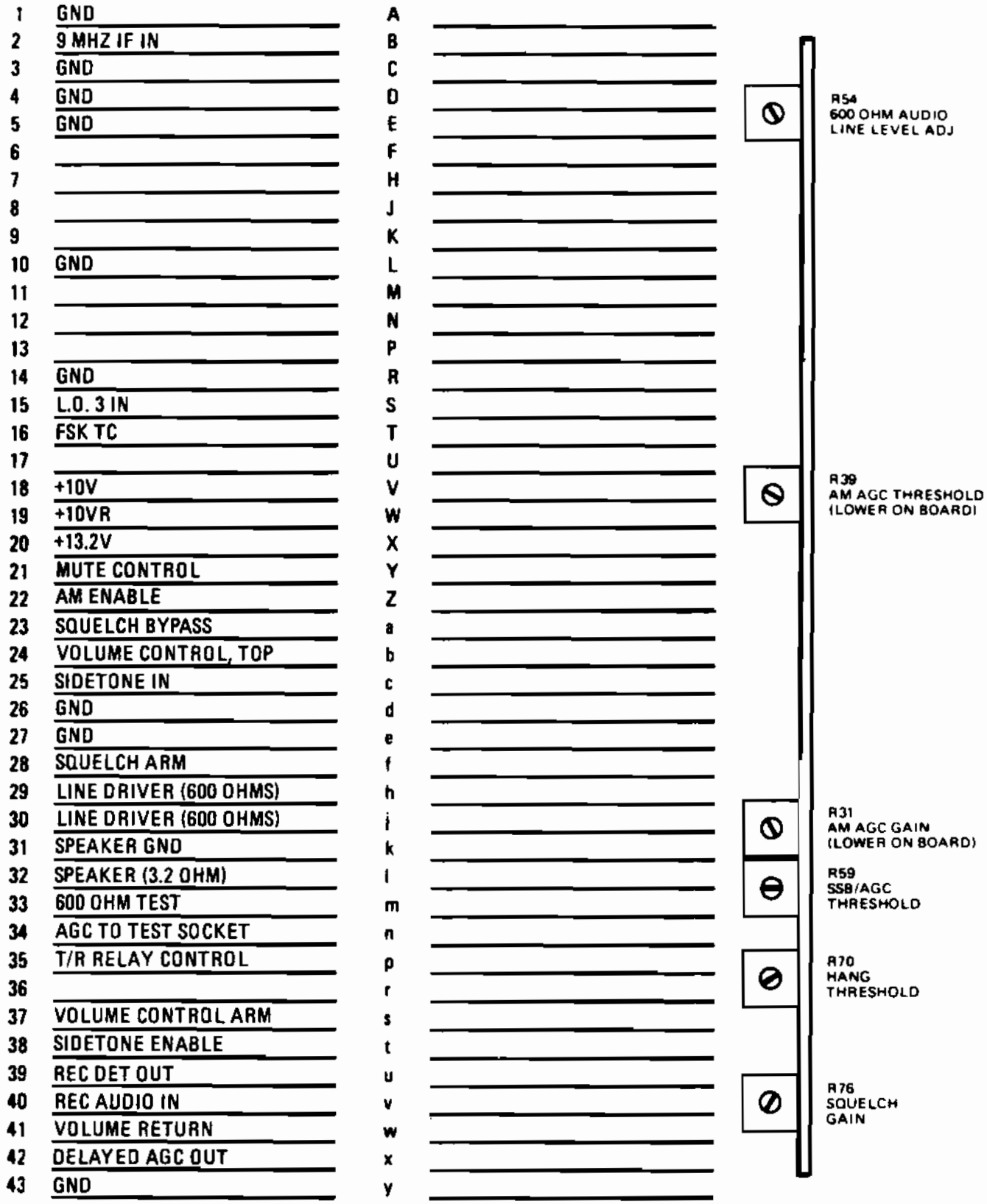


Figure 3. 1A1A4 Input/Output Summary

Table 1. 1A1A4 Maintenance Parts List (PL 6628-0590)

Ref. Desig.	Name & Description	Mfr. Code	Part Number
1A1A4	IF/Audio PWB Assembly	14304	6628-0590
AR1	Integrated Circuit, IF/RF Amplifier	14304	IC-0056
AR2	Integrated Circuit, Quad Operational Amplifier	14304	IC-0359
AR3	Integrated Circuit, 1/4 W Audio Amplifier	14304	I32-0003-001
AR4	Integrated Circuit, 7 W Audio Power Amplifier	14304	IC-0410
AR5	Integrated Circuit, Quad Operational Amplifier	14304	IC-0359
AR6	Integrated Circuit, Quad Operational Amplifier	14304	IC-0359
C1	Capacitor, Tantalum, 6.8 uF, 35 V	14304	C-3102
C2	Capacitor, Ceramic, 0.01 uF	14304	C-4952
C3	Capacitor, Ceramic, 0.01 uF	14304	C-4952
C4	Capacitor, Ceramic, 0.1 uF	14304	C-3202
C5	Capacitor, Tantalum, 6.8 uF, 35 V	14304	C-3102
C6	Capacitor, Ceramic, .01 uF	14304	C-4952
C7	Capacitor, Tantalum, 6.8 uF, 35 V	14304	C-3102
C8	Capacitor, Ceramic, .001 uF	14304	C-3513
C9	Capacitor, Ceramic, .01 uF	14304	C-4952
C10	Capacitor, Ceramic, .01 uF	14304	C-4952
C11	Capacitor, Ceramic, .01 uF	14304	C-4952
C12	Capacitor, Ceramic,	14304	C-3102
C13	Capacitor, Ceramic, .01 uF	14304	C-4952
C14	Capacitor, Ceramic, .01 uF	14304	C-4952
C15	Capacitor, Ceramic, .01 uF	14304	C-4952
C16	Capacitor, Ceramic, .01 uF	14304	C-4952
C17	Capacitor, Ceramic, .01 uF	14304	C-4952
C18	Capacitor, Tanatlum, 100 uF, 20 V	14304	C-6454
C19	Capacitor, Ceramic, .01 uF	14304	C-4952
C20	Capacitor, Tantalum, 6.8 uF, 35 V	14304	C-3102
C21	Capacitor, Ceramic, .01 uF	14304	C-4952
C22	Capacitor, Ceramic, .001 uF	14304	C-3513
C23	Capacitor, Ceramic, .01 uF	14304	C-4952
C24	Capacitor, Ceramic, .001 uF	14304	C-3513
C25	Capacitor, Ceramic, .001 uF	14304	C-3513
C26	Capacitor, Tantalum, 4.7 uF, 20 V	14304	C-6446
C27	Not Used		
C28	Capacitor, Mylar, 5%, .0047 uF	14304	C-0961
C29	Not Used		
C30	Capacitor, Tantalum, .15 uF, 20 V	14304	C-6449
C31	Capacitor, Tantalum, 6.8 uF, 35 V	14304	C-3102
C32	Capacitor, Tantalum, 6.8 uF, 35 V	14304	C-3102
C33	Capacitor, Tantalum, 33 uF, 35 V	14304	C-6430
C34	Capacitor, Tantalum, 33 uF, 35 V	14304	C-6430
C35	Capacitor, Ceramic, .01 uF	14304	C-4952
C36	Capacitor, Mica, 1500 pF	14304	C-0156
C37	Capacitor, Tantalum, 2.2 uF, 35 V	14304	C25-0002-109
C38	Capacitor, Tantalum, 33 uF, 35 V	14304	C-6430
C39	Capacitor, Electrolytic, 470 uF, 25 V	14304	C-1419
C40	Capacitor, Tantalum, .1 uF, 20 V	14304	C-6442
C41	Capacitor, Ceramic, .001 uF, 50V	14304	C1[illegible]-0005-102
C42	Capacitor, Tantalum, 2.2 uF, 20V	14304	C-6444

Table 1. 1A1A4 Maintenance Parts List (PL 6628-0590) (Cont.)

Ref. Desig.	Name & Description	Mfr. Code	Part Number
C43	Capacitor, Tantalum, 22 uF, 25 V	14304	C-6439
C44	Capacitor, Tantalum, .47 uF, 35 V	14304	C-6419
C45	Capacitor, Tantalum, 100 uF, 20 V	14304	C-6454
C46	Capacitor, Tantalum, 100 uF, 20 V	14304	C-6454
C47	Capacitor, Tantalum, 22 uF, 25 V	14304	C-6439
C48	Capacitor, Tantalum, 22 uF, 25 V	14304	C-6439
C49	Capacitor, Tantalum, 4.7 uF, 20 V	14304	C-6446
C50	Capacitor, Tantalum, 6.8 uF, 35 V	14304	C-3102
C51	Capacitor, Ceramic, .1 uF	14304	C-3202
C52	Capacitor, Tantalum, .22 uF, 35 V	14304	C-6417
C53	Capacitor, Tantalum, 100 uF, 20 V	14304	C-6454
C54	Capacitor, Tantalum, 4.7 uF, 20 V	14304	C-6446
C55	Capacitor, Tantalum, .47 uF, 35 V	14304	C-6419
C56	Capacitor, Tantalum, 4.7 uF, 20 V	14304	C-6446
C57	Capacitor, Tantalum, 150 uF, 15 V	14304	C-4976
C58	Capacitor, Ceramic, .01 uF	14304	C-4952
C59	Capacitor, Tantalum, .1 uF, 35 V	14304	C-6415
C60	Capacitor, Tantalum, 22 uF, 35 V	14304	C-6439
C61	Capacitor, Tantalum, .47 uF, 35 V	14304	C-6419
C62	Capacitor, Electrolytic, 470 uF, 25 V	14304	C-1419
C63	Capacitor, Ceramic, .0047 uF	81349	CK06BX472M
C64	Capacitor, Tantalum, 6.8 uF, 35 V	14304	C-3102
C65	Capacitor, Tantalum, 6.8 uF, 35 V	14304	C-3102
C66	Capacitor, Tantalum, 6.8 uF, 35 V	14304	C-3102
C67	Capacitor, Tantalum, 6.8 uF, 35 V	14304	C-3102
C68	Capacitor, Ceramic, .01 uF	14304	C-4952
C69	Capacitor, Ceramic, .01 uF	14304	C-4952
C70	Capacitor, Tantalum, 4.7 uF, 20 V	14304	C-6446
C71	Capacitor, Tantalum, 4.7 uF, 20 V	14304	C-6446
C72	Capacitor, Tantalum, 6.8 uF, 20 V	14304	C-6447
C73	Capacitor, Ceramic, .01 uF	14304	C-4952
C74	Capacitor, Tantalum, 6.8 uF, 35 V	14304	C-3102
C75	Not Used		
C76	Capacitor, Ceramic, .01 uF	14304	C-4952
C77	Capacitor, Tantalum, 6.8 uF, 35 V	14304	C-3102
C78	Capacitor, Tantalum, .47 uF, 35 V	14304	C-6419
C79	Capacitor, Tantalum, .47 uF, 35 V	14304	C-6419
C80	Capacitor, Tantalum, 15 uF, 20 V	14304	C-3103
C81	Capacitor, Tantalum, 6.8 uF, 35 V	14304	C-3102
C82	Capacitor, Tantalum, 15 uF, 20 V	14304	C-3103
C83	Capacitor, Ceramic, .01 uF	14304	C-4952
C84	Capacitor, Tantalum, 22 uF, 25 V	14304	C-6439
C85	Capacitor, Ceramic, .047 uF, 50 V	14304	C11-0005-473
C86	Capacitor, Ceramic, .01 uF	14304	CK06BX103M
CR1	Diode, 1N4454	14304	CR-0705
CR2	Diode Pin	14304	CR-0294
CR3, CR4	Diode, 1N4454	14304	CR-0705
CR5	Diode Pin	14304	CR-0746
CR6	Diode 1N4454	14304	CR-0705
CR7	Diode 1N4454	14304	CR-0705

Table 1. 1A1A4 Maintenance Parts List (PL 6628-0590) (Cont.)

Ref. Desig.	Name & Description	Mfr. Code	Part Number
CR8	Diode 1N4454	14304	CR-0705
CR9	Diode 1N4454	14304	CR-0705
CR10	Diode 1N4454	14304	CR-0705
CR11	Diode 1N4454	14304	CR-0705
CR12	Diode 1N4454	14304	CR-0705
CR13	Diode 1N4454	14304	CR-0705
CR14	Not Used		
CR15	Diode 1N4454	14304	CR-0705
CR16	Diode 1N4454	14304	CR-0705
CR17	Diode 1N4454	14304	CR-0705
CR18	Diode 1N4454	14304	CR-0705
CR19	Diode 1N4454	14304	CR-0705
CR20	Diode 1N4454	14304	CR-0705
CR21	Diode 1N4454	14304	CR-0705
CR22	Diode 1N4004	14304	CR-0725
CR23	Diode 30S10	14304	CR-0034
CR24	Diode 1N4454	14304	CR-0705
CR25	Not Used		
CR26	Diode 1N4004	14304	CR-0725
CR27	Diode 1N4004	14304	CR-0725
CR28	Diode 1N4004	14304	CR-0725
CR29	Diode 1N4454	14304	CR-0705
CR30	Diode 1N4454	14304	CR-0705
JMP1	Not Used		
JMP2-JMP4	Jumper	14304	MP-1142
L1	Choke, 47 uH	14304	L-0636
L2	Choke, 100 uH	14304	L-0640
L3	Choke, 100 uH	14304	L-0640
L4	Choke, 100 uH	14304	L-0640
L5	Inductor, Toroid, 2.8 mH	14304	6628-0573
L6	Choke, 100 uH	14304	L-0640
L7	Choke, 470 uH	14304	L-0648
L8	Choke, 100 uH	14304	L-0640
Q1	Transistor, PNP 2N4126	14304	Q-0386
Q2	Transistor, NPN, 2N5179	14304	Q-0390
Q3	Transistor, NPN, 2N3563	14304	Q-0309
Q4	Transistor, NPN, 2N3563	14304	Q-0309
Q5	Transistor, NPN, 2N3563	14304	Q-0309
Q6	Transistor, PNP, 2N4126	14304	Q-0386
Q7	Transistor, PNP, 2N4126	14304	Q-0386
Q8	Transistor, PNP, 2N4126	14304	Q-0386
Q9	Transistor, NPN, 2N4124	14304	Q-0385
Q10, Q11	Not Used		
Q12	Transistor, NPN, 2N4124	14304	Q-0385
Q13	Transistor, PNP, 2N4126	14304	Q-0386
Q14	Transistor, NPN, 2N4124	14304	Q-0385
Q15	Transistor, NPN, 2N4124	14304	Q-0385
Q16	Transistor, PNP, 2N3644	14304	Q-0415
Q17	2N4392 JFET	14304	Q02-4392-000

Table 1. 1A1A4 Maintenance Parts List (PL 6628-0590) (Cont.)

Ref. Desig.	Name & Description	Mfr. Code	Part Number
Q18	2N4392 JFET	14304	Q02-4392-000
Q19	2N4392 JFET	14304	Q02-4392-000
Q20	2N4392 JFET	14304	Q02-4392-000
Q21	2N4392 JFET	14304	Q02-4392-000
R1	Resistor, ±5%, 1/4 W, 12K	14304	R-1275
R2	Resistor, ±5%, 1/4 W, 27K	14304	R-1283
R3	Resistor, ±5%, 1/4 W, 8.2K	14304	R-1271
R4	Resistor, ±5%, 1/4 W, 2.2K	14304	R-1257
R5	Resistor, ±5%, 1/4 W, 2.7K	14304	R-1259
R6	Resistor, ±5%, 1/4 W, 470 ohm	14304	R-1241
R7	Resistor, ±5%, 1/4 W, 22 ohm	14304	R-1209
R8	Resistor, ±5%, 1/4 W, 56 ohm	14304	R-1219
R9	Resistor, ±5%, 1/4 W, 6.8 ohm	14304	R-1364
R10	Resistor, ±5%, 1/4 W, 100 ohm	14304	R-1225
R11	Resistor, ±5%, 1/4 W, 100 ohm	14304	R-1225
R12	Resistor, ±5%, 1/4 W, 22K	14304	R-1281
R13	Resistor, ±5%, 1/4 W, 27K	14304	R-1283
R14	Resistor, ±5%, 1/4W, 10 ohm	14304	R-1201
R15	Resistor, ±5%, 1/4 W, 47K	14304	R-1289
R16	Resistor, ±5%, 1/4 W, 4.7K	14304	R-1265
R17	Resistor, ±5%, 1/4 W, 820 ohm	14304	R-1247
R18	Resistor, ±5%, 1/4W, 820 ohm	14304	R-1247
R19	Resistor, ±5%, 1/4 W, 4.7K	14304	R-1265
R20	Resistor, ±5%, 1/4 W, 82 ohm	14304	R-1223
R21	Resistor, ±5%, 1/4 W, 8.2K	14304	R-1271
R22	Resistor, ±5%, 1/4 W, 1.2K	14304	R-1251
R23	Resistor, ±5%, 1/4 W, 1.2K	14304	R-1251
R24	Resistor, ±5%, 1/4 W, 470 ohm	14304	R-1241
R25	Resistor, ±5%, 1/4 W, 100 ohm	14304	R-1225
R26	Resistor, ±5%, 1/4 W, 47K	14304	R-1289
R27	Resistor, ±5%, 1/4 W, 220 ohm	14304	R-1233
R28	Resistor, ±5%, 1/4 W, 47K	14304	R-1289
R29	Resistor, ±5%, 1/4 W, 47K	14304	R-1289
R30	Resistor, ±5%, 1/4 W, 5.6K	14304	R-1267
R31	Potentiometer, 500 ohm	14304	R-2224
R32	Resistor, ±5%, 1/4 W, 18K	14304	R-1279
R33	Resistor, ±5%, 1/4 W, 100 ohm	14304	R-1225
R34	Resistor, ±5%, 1/4 W, 4.7K	14304	R-1265
R35	Resistor, ±5%, 1/4 W, 10K	14304	R-1273
R36	Resistor, ±5%, 1/4 W, 1K	14304	R-1249
R37	Resistor, ±5%, 1/4 W, 150K	14304	R-1301
R38	Resistor, ±5%, 1/4 W, 22K	14304	R-1281
R39	Potentiometer, 10K	14304	R-2228
R40	Resistor, ±5%, 1/4 W, 150K	14304	R-1301
R41	Resistor, ±5%, 1/4 W, 7.5K	14304	R-1270
R42	Resistor, ±5%, 1/4 W, 3.9K	14304	R-1263
R43	Resistor, ±5%, 1/4 W, 10K	14304	R-1273

Table 1. 1A1A4 Maintenance Parts List (PL 6628-0590) (Cont.)

Ref. Desig.	Name & Description	Mfr. Code	Part Number
R44	Resistor, ±5%, 1/4 W, 2.2K	14304	R-1257
R45	Resistor, ±5%, 1/4 W, 4.7K	14304	R-1265
R46	Resistor, ±5%, 1/4 W, 1K	14304	R-1249
R47	Resistor, ±5%, 1/4 W, 470 ohm	14304	R-1241
R48	Resistor, ±5%, 1/4 W, 47K	14304	R-1289
R49	Resistor, ±5%, 1/4 W, 18K	14304	R-1279
R50	Resistor, ±5%, 1/4 W, 220K	14304	R-1305
R51	Resistor, ±5%, 1/4 W, 47 ohm	14304	R-1217
R52	Resistor, ±5%, 1/2 W, 1 ohm	14304	R-1567
R53	Resistor, ±5%, 1/4 W, 100 ohm	14304	R-1225
R54	Potentiometer, 10K	14304	R-2228
R55	Resistor, ±5%, 100 ohm	14304	R-1225
R56	Resistor, ±5%, 9.1K	14304	R-1272
R57	Resistor, ±5%, 10 ohm	14304	R-1201
R58	Resistor, ±5%, 10 ohm	14304	R-1201
R59	Potentiometer, 20K	14304	R-2229
R60	Resistor, ±5%, 1/4W, 1K	14304	R-1249
R61	Resistor, ±5%, 1/4 W, 39K	14304	R-1287
R62	Resistor, ±5%, 1/4 W, 10K	14304	R-1273
R63	Resistor, ±5%, 1/4 W, 10K	14304	R-1273
R64	Resistor, ±5%, 1/4 W, 560 ohm	14304	R-1243
R65	Resistor, ±5%, 1/4 W, 1.2K	14304	R-1251
R66	Resistor, ±5%, 1/4 W, 2.2 Meg	14304	R-1329
R67	Resistor, ±5%, 1/4 W, 10K	14304	R-1273
R68	Resistor, ±5%, 1/4 W, 150K	14304	R-1301
R69	Resistor, ±5%, 1/4 W, 8.2K	14304	R-1271
R70	Potentiometer, 2K	14304	R-2226
R71	Resistor, ±5%, 1/4 W, 10K	14304	R-1273
R72	Resistor, ±5%, 1/4 W, 47K	14304	R-1289
R73	Resistor, ±5%, 1/4 W, 2.2K	14304	R-1257
R74	Resistor, ±5%, 1/4 W, 10K	14304	R-1273
R75	Resistor, ±5%, 1/4 W, 39K	14304	R-1287
R76	Potentiometer, 1K	14304	R-2225
R77	Resistor, ±5%, 1/4 W, 5.6K	14304	R-1267
R78	Resistor, ±5%, 1/4 W, 100 ohm	14304	R-1225
R79	Resistor, ±5%, 1/4 W, 10K	14304	R-1273
R80	Resistor, ±5%, 1/4 W, 10K	14304	R-1273
R81	Resistor, ±5%, 1/4 W, 10K	14304	R-1273
R82	Resistor, ±5%, 1/4 W, 6.8K	14304	R-1269
R83	Resistor, ±5%, 1/4 W, 20K	14304	R-1280
R84	Resistor, ±5%, 1/4 W, 10K	14304	R-1273
R85	Resistor, ±5%, 1/4 W, 20K	14304	R-1280
R86	Resistor, ±5%, 1/4 W, 6.8K	14304	R-1269
R87	Resistor, ±5%, 1/4 W, 2K	14304	R-1256
R88	Resistor, ±5%, 1/4 W, 1.5K	14304	R-1253
R89	Resistor, ±5%, 1/4 W, 270 ohm	14304	R-1235
R90	Resistor, ±5%, 1/4 W, 6.8K	14304	R-1269
R91	Resistor, ±5%, 1/4 W, 39K	14304	R-1287

Table 1. 1A1A4 Maintenance Parts List (PL 6628-0590) (Cont.)

Ref. Desig.	Name & Description	Mfr. Code	Part Number
R92	Resistor, ±5%, 1/4 W, 100 ohm	14304	R-1225
R93	Resistor, ±5%, 1/4 W, 100K	14304	R-1297
R94	Resistor, ±1%, 1/8 W, 4.64K	14304	R-7358
R95	Resistor, ±1%, 1/8 W, 4.02K	14304	R-7335
R96	Resistor, ±5%, 1/4 W, 10K	14304	R-1273
R97	Resistor, ±5%, 1/4 W, 10K	14304	R-1273
R98	Resistor, ±5%, 1/4 W, 120K	14304	R-1299
R99	Resistor, ±5%, 1/4 W, 10K	14304	R-1273
R100	Resistor, ±5%, 1/4 W, 120K	14304	R-1299
R101	Resistor, ±5%, 1/4 W, 10K	14304	R-1273
R102	Resistor, ±5%, 1/4 W, 4.7K	14304	R-1265
R103	Resistor, ±5%, 1/4 W, 1 Meg	14304	R-1321
R104	Resistor, ±5%, 1/4W, 10K	14304	R-1273
R105	Resistor, ±5%, 1/4 W, 47K	14304	R-1289
R106	Not Used		
R107	Resistor, ±5%, 1/4 W, 2.2K	14304	R-1257
R108	Resistor, ±5%, 1/4 W, 100 ohm	14304	R-1225
R109	Resistor, ±5%, 1/4 W, 220 ohm	14304	R-1233
R110	Not Used		
R111	Resistor, ±5%, 1/4 W, 10K	14304	R-1273
R112	Resistor, ±5%, 1/4 W, 2.2K	14304	R-1257
R113	Resistor, ±1%, 1/8 W, 47.5K	14304	R-7328
R114	Resistor, ±5%, 1/4 W, 150 ohm	14304	R-1229
R115	Resistor, ±5%, 1/4 W, 1K	14304	R-1249
R116	Not Used		
R117	Resistor, ±5%, 1/4 W, 10K	14304	R-1273
R118	Resistor, ±5%, 1/4 W, 1K	14304	R-1249
R119	Resistor, ±5%, 1/4 W, 4.7K	14304	R-1265
R120	Resistor, ±5%, 1/4 W, 2.7K	14304	R-1259
R121	Resistor, ±5%, 1/4 W, 4.7K	14304	R-1265
R122	Resistor, ±5%, 1/4 W, 10K	14304	R-1273
R123	Not Used		
R124	Not Used		
R125	Not Used		
R126	Resistor, ±1%, 1/8 W, 1K	14304	R-7270
R127	Resistor, ±5%, 1/4 W, 10K	14304	R-1273
R128	Resistor, ±5%, 1/4 W, 18K	14304	R-1279
R129	Resistor, ±5%, 1/4 W, 100K	14304	R-1297
R130	Resistor, ±1%, 1/8 W, 1K	14304	R-7270
R131	Resistor, ±5%, 1/4W, 330 ohm	14304	R-1237
R132	Resistor, ±5%, 1/4W, 2.2K	14304	R-1257
R133	Not Used		
R134	Not Used		
R135	Not Used		
R136	Resistor, ±5%, 1/4 W, 100 ohm	14304	R-1225
R137	Resistor, ±5%, 1/4 W, 100 ohm	14304	R-1225
R138	Resistor, ±5%, 1/4 W, 1 Meg	14304	R-1321
R139	Resistor, ±5%, 1/4 W, 220K	14304	R-1305

Table 1. 1A1A4 Maintenance Parts List (PL 6628-0590) (Cont.)

Ref. Desig.	Name & Description	Mfr. Code	Part Number
R140	Resistor, ±5%, 1/4 W, 47K	14304	R-1289
R141	Resistor, ±5%, 1/4 W, 220K	14304	R-1305
R142	Resistor, ±5%, 1/4W, 1K	14304	R-1249
R143	Resistor, ±5%, 1/4W, 6.8K	14304	R-1269
T1	Transformer, 9 MHz	14304	6628-0570
T2	Not Used		
T3	Transformer, 600 ohm, Audio	14304	6628-0572
TP0	Test Point, Black	14304	J-0388
TP1	Test Point, Brown	14304	J-0071
TP2	Test Point, Red	14304	J-0387
TP3	Test Point, Orange	14304	J-0069
TP4	Test Point, Yellow	14304	J-0070
TP5	Test Point, Green	14304	J-0389
TP6	Test Point, Blue	14304	J-0072
TP7	Test Point, Violet	14304	J-0394
TP8	Test Point, Grey	14304	J-0395
TP9	Test Point, White	14304	J-0386
TP10	Test Point, Black	14304	J-0067
VR1	Diode, Zener, 3.9V, 10%, 1N5228	14304	CR-0207
Z1	Transformer, 9 MHz IF	14304	919-1319

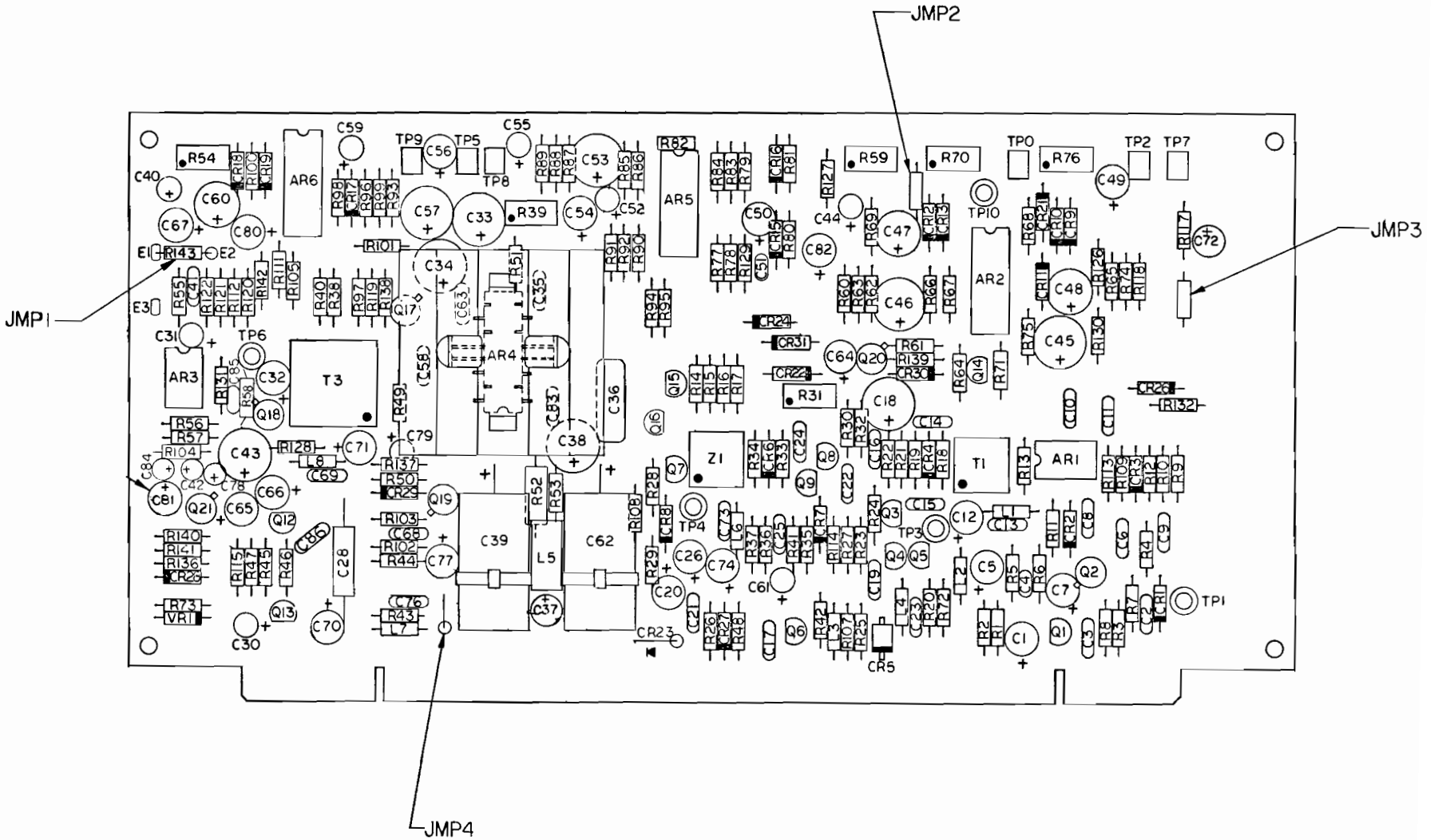


Figure 4. 1A1A4 IF/Audio Board Component Locations (6628-0590)

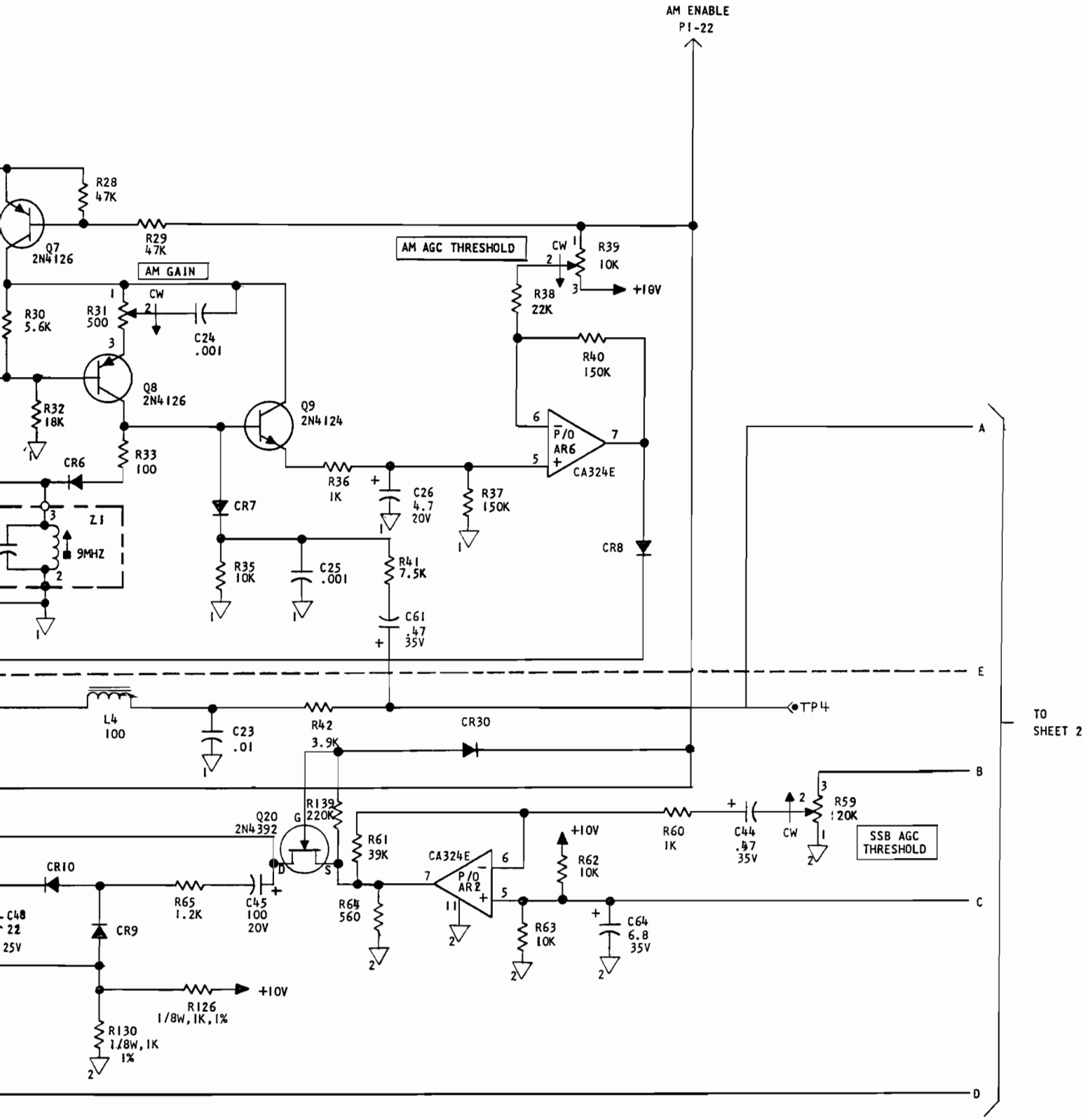
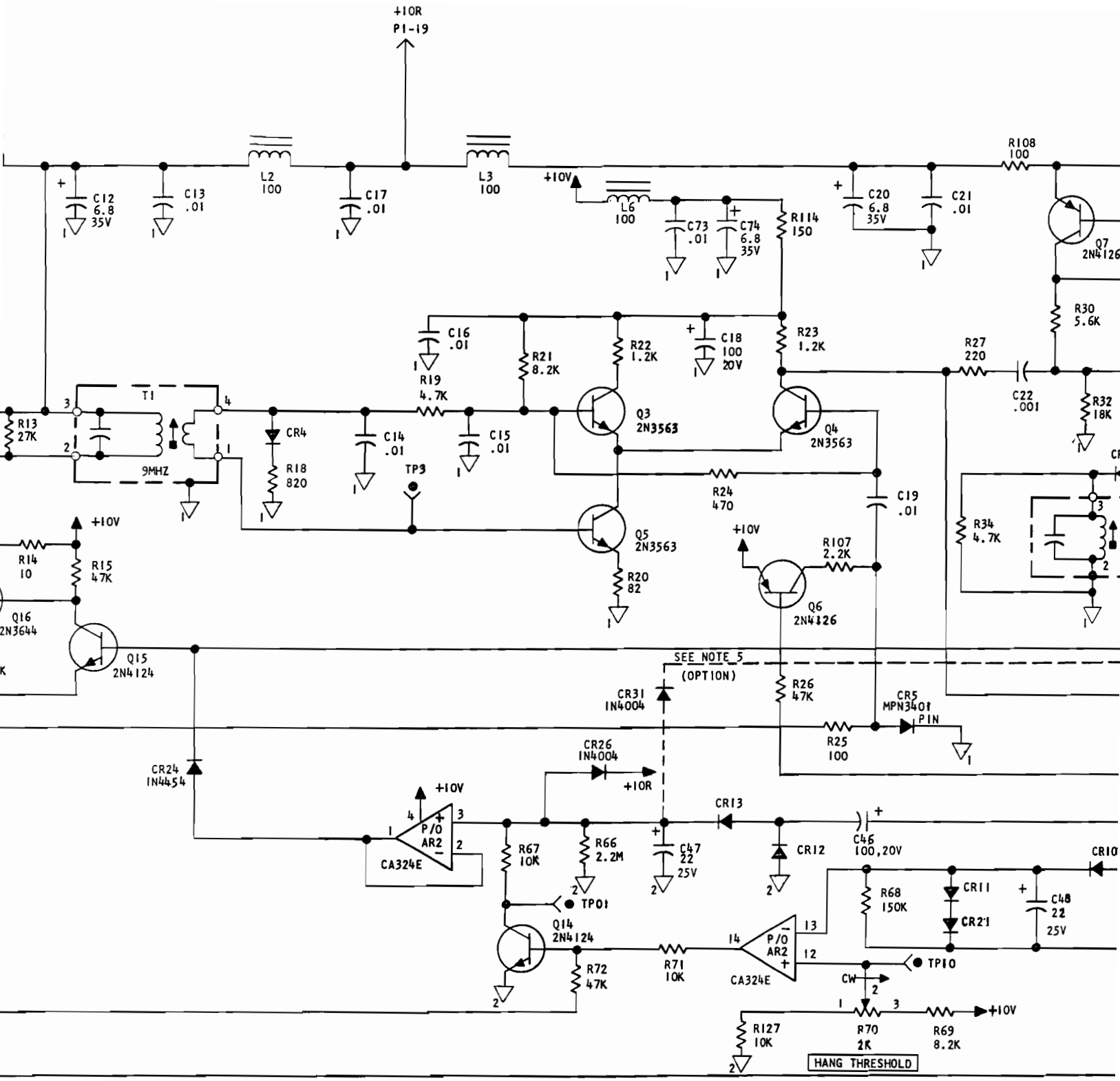


Figure 5. 1A1A4 Schematic Diagram (6628-9059)
(Sheet 1 of 2)


+10R
P1-19
C12 6.8 35V
C13 .01
L2 100
C17 .01
L3 100
+10V
L6 100
C73 .01
C74 6.8 35V
R114 150
C20 6.8 35V
C21 .01
R108 100
Q7 2N4126
R30 5.6K
C16 .01
R19 4.7K
R21 8.2K
R22 1.2K
C18 100 20V
R23 1.2K
R27 220
C22 .001
R32 18K
T1
9MHZ
R13 27K
CR4
R18 820
C14 .01
C15 .01
TP3
Q3 2N3563
Q4 2N3563
R24 470
C19 .01
Q5 2N3563
R20 82
+10V
R14 10
R15 47K
Q16 2N3644
Q15 2N4124
+10V
R107 2.2K
Q6 2N4126
R34 4.7K
SEE NOTE 5
(OPTION)
CR31 IN4004
R26 47K
CR5 MPN3401 PIN
R25 100
CR24 IN4454
CR26 IN4004
+10R
+10V
P/O AR2
CA324E
CR13
C46 100,20V
R67 10K
R66 2.2M
C47 22 25V
CR12
TP01
R68 150K
CR11
CR21
C48 22 25V
Q14 2N4124
R72 47K
R71 10K
P/O AR2
CA324E
TP10
CW
R127 10K
R70 2K
R69 8.2K
+10V
HANG THRESHOLD

ISE SPECIFIED:

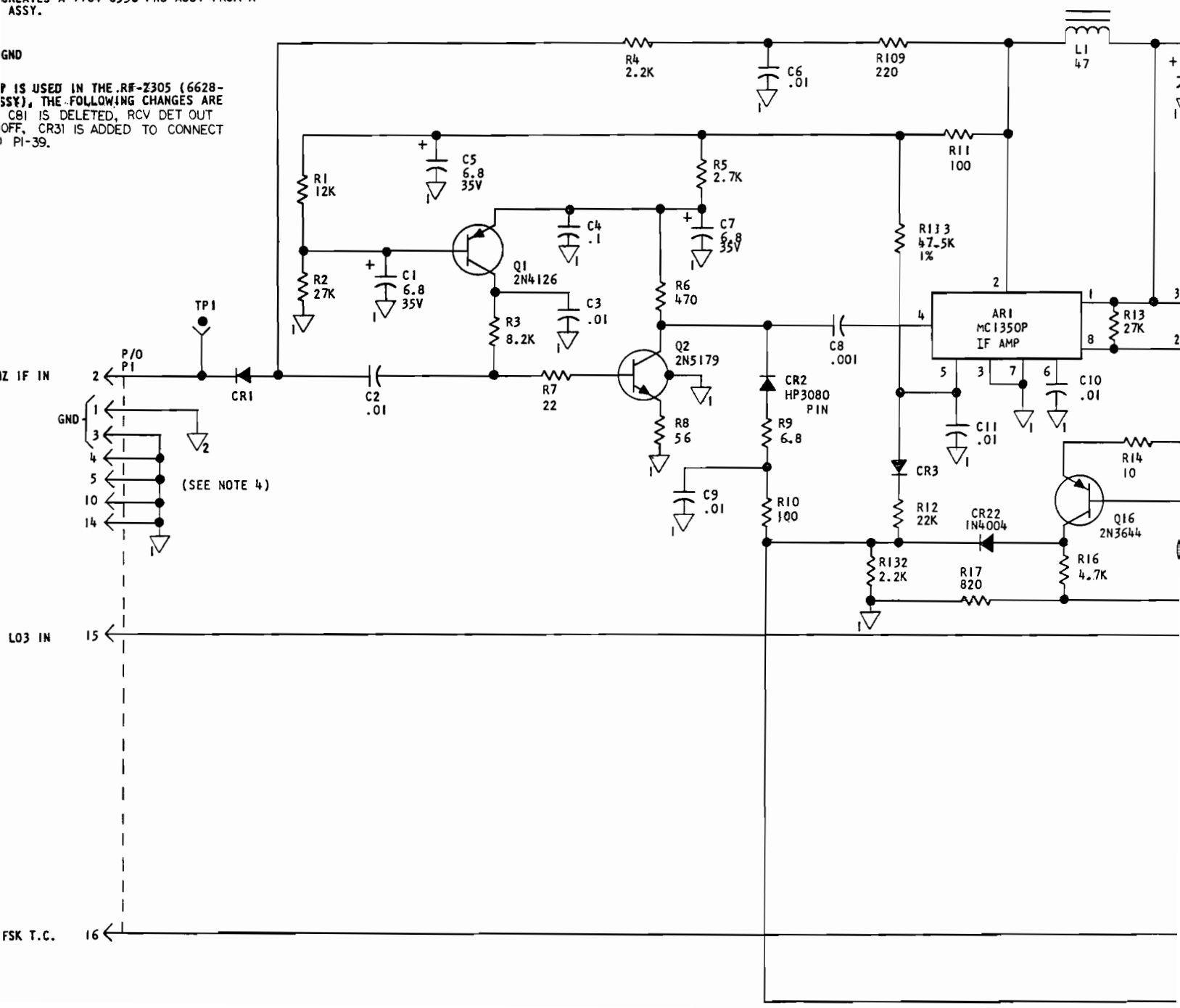
ARE IN OHMS, 1/4W, ±5%.
S ARE IN MICROFARADS.
ARE IN MICROHENRIES.
E IN4454.

OP AMP.

MALLY INSTALLED BETWEEN E1 AND E2.
BETWEEN E1 AND E3 RESULTS IN 600
RESPONDING TO SQUELCH. THIS OPTIONAL
CREATES A 7704-0590 PWB ASSY FROM A
ASSY.

GND

P IS USED IN THE RF-Z305 (6628-
55X), THE FOLLOWING CHANGES ARE
C81 IS DELETED, RCV DET OUT
OFF, CR31 IS ADDED TO CONNECT
P1-39.



NOTES:

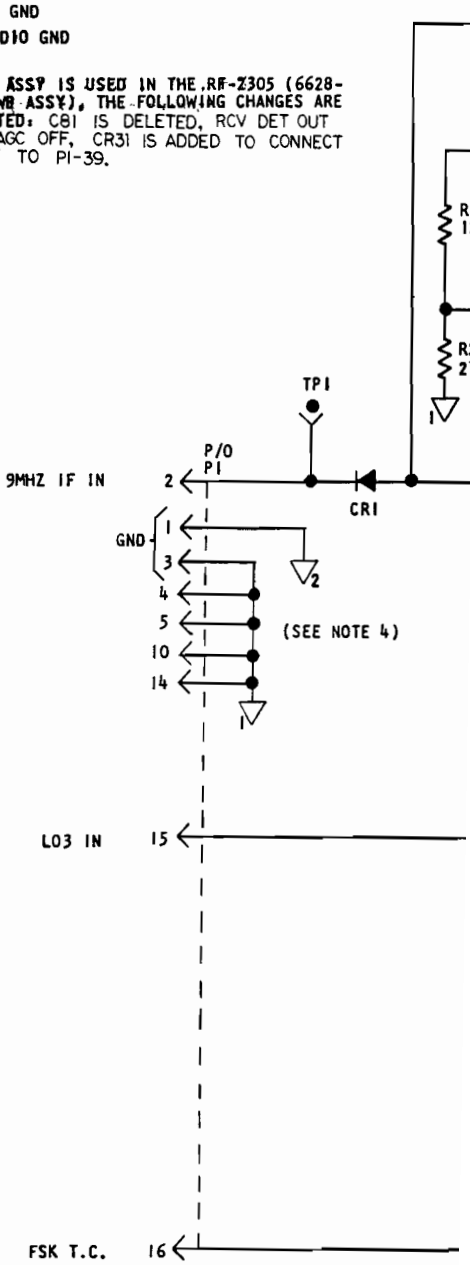
1. UNLESS OTHERWISE SPECIFIED:
   ALL RESISTORS ARE IN OHMS, 1/4W, ±5%.
   ALL CAPACITORS ARE IN MICROFARADS.
   ALL INDUCTORS ARE IN MICROHENRIES.
   ALL DIODES ARE IN4454.
   K = X1000
   M = X1000000

2. AR2 IS A QUAD OP AMP.

3. RESISTOR IS NORMALLY INSTALLED BETWEEN E1 AND E2. R143 INSTALLED BETWEEN E1 AND E3 RESULTS IN 600 OHM RCV LINE RESPONDING TO SQUELCH. THIS OPTIONAL MODIFICATION CREATES A 7704-0590 PWB ASSY FROM A 6628-0590 PWB ASSY.

4. ▽1 = RF GND
   ▽2 = AUDIO GND

5. WHEN THIS ASSY IS USED IN THE RF-2305 (6628-0590-06 PWB ASSY), THE FOLLOWING CHANGES ARE INCORPORATED: C81 IS DELETED, RCV DET OUT BECOMES AGC OFF, CR31 IS ADDED TO CONNECT FROM C47 TO P1-39.



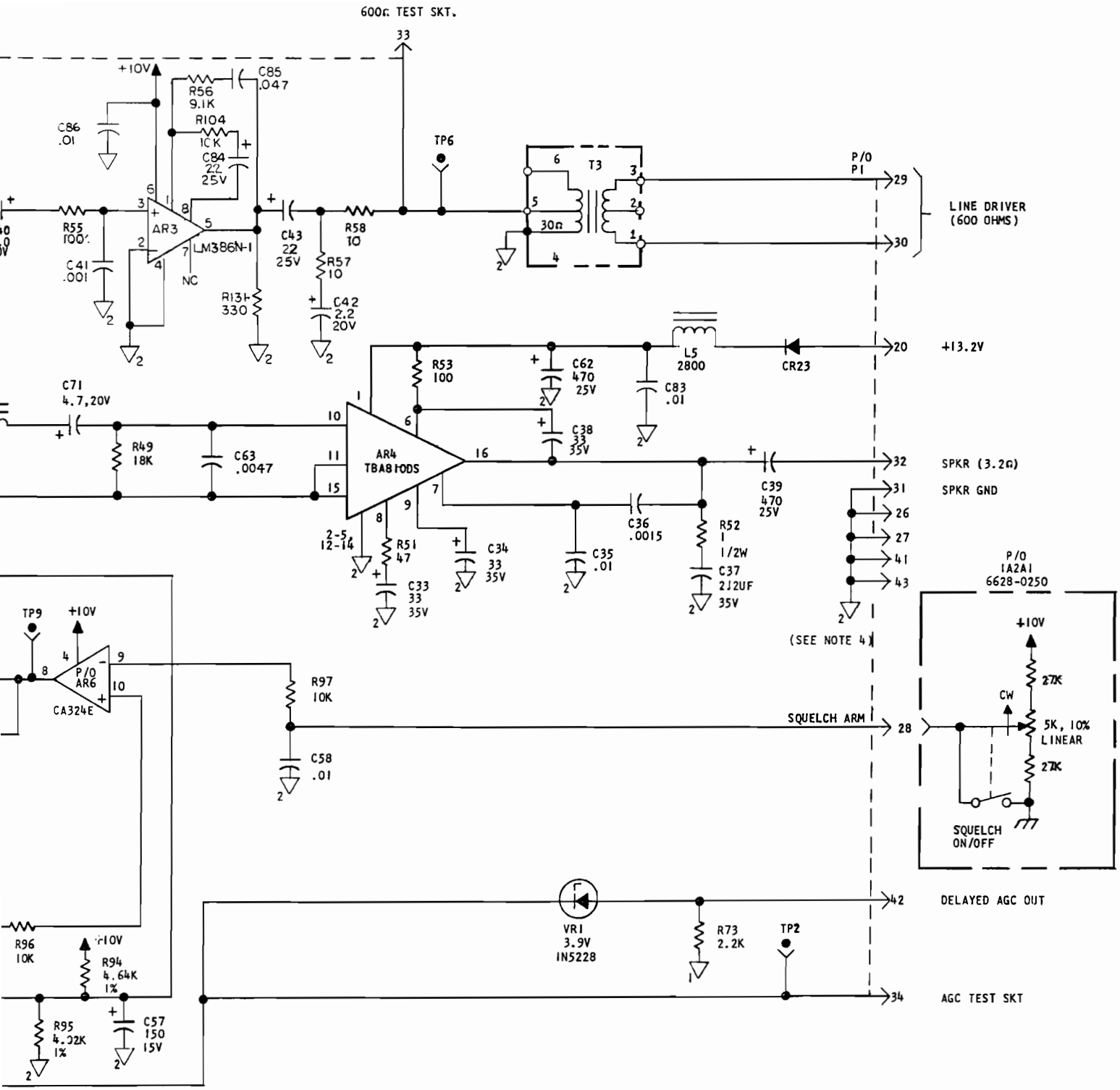
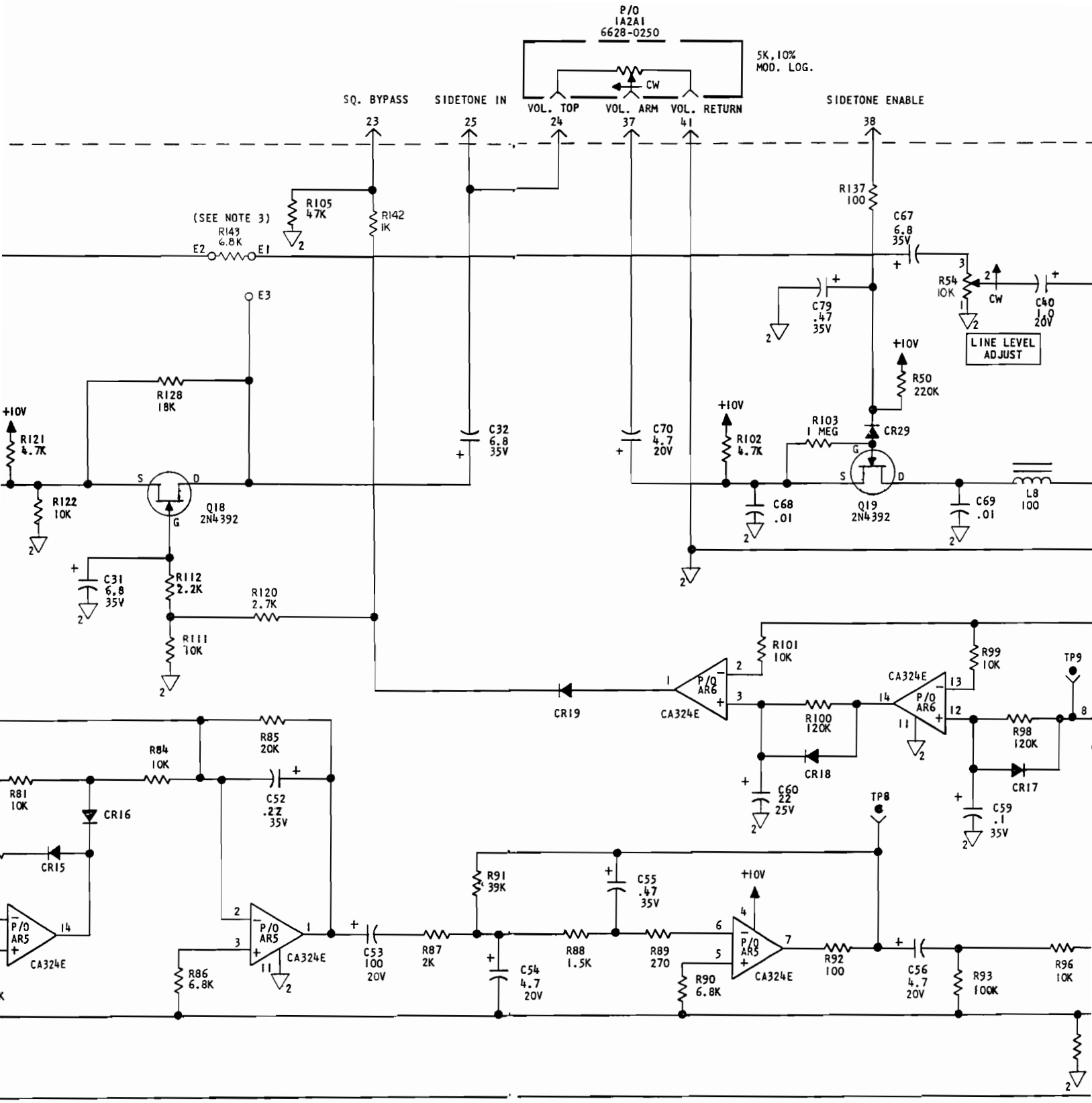
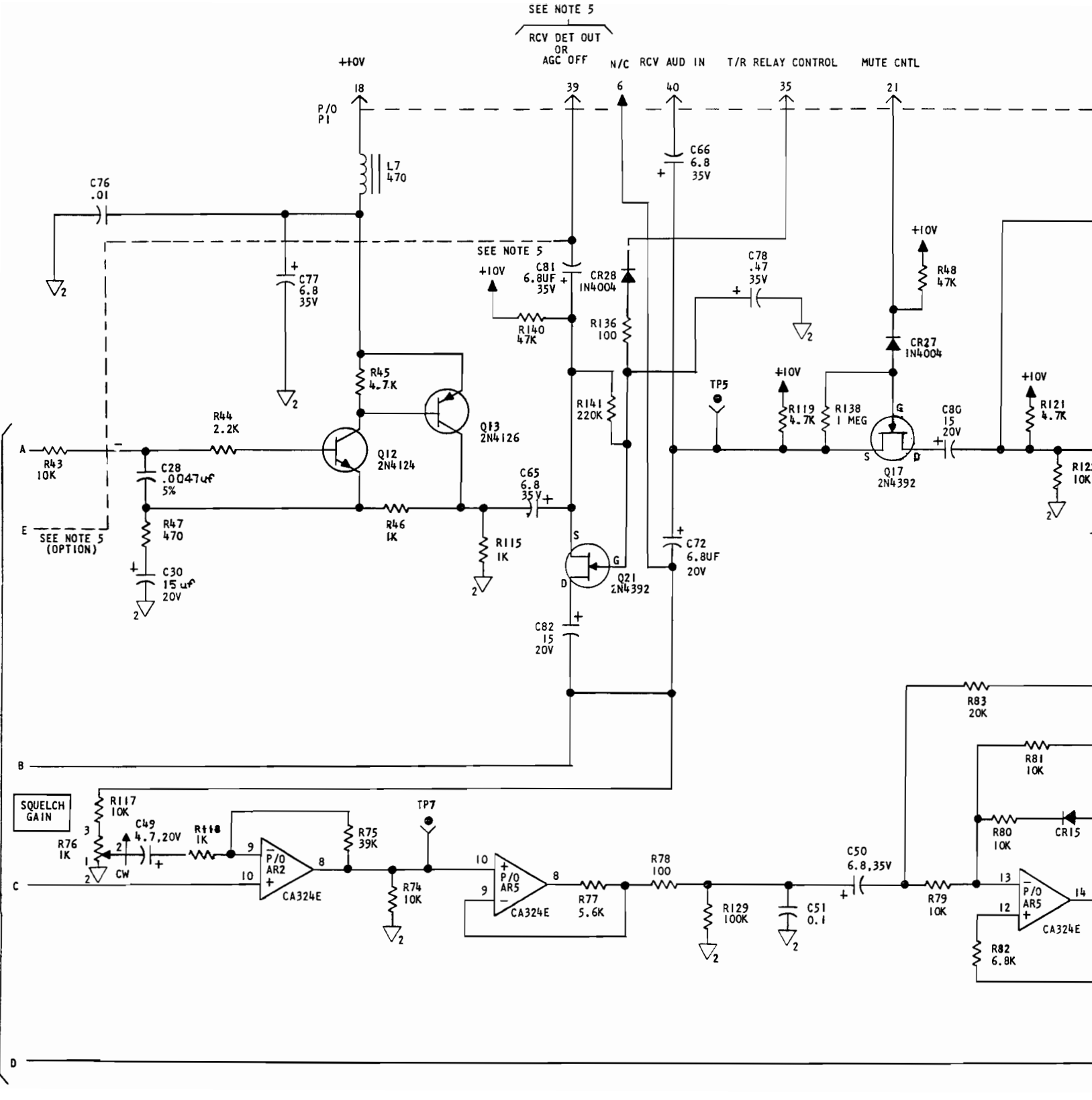
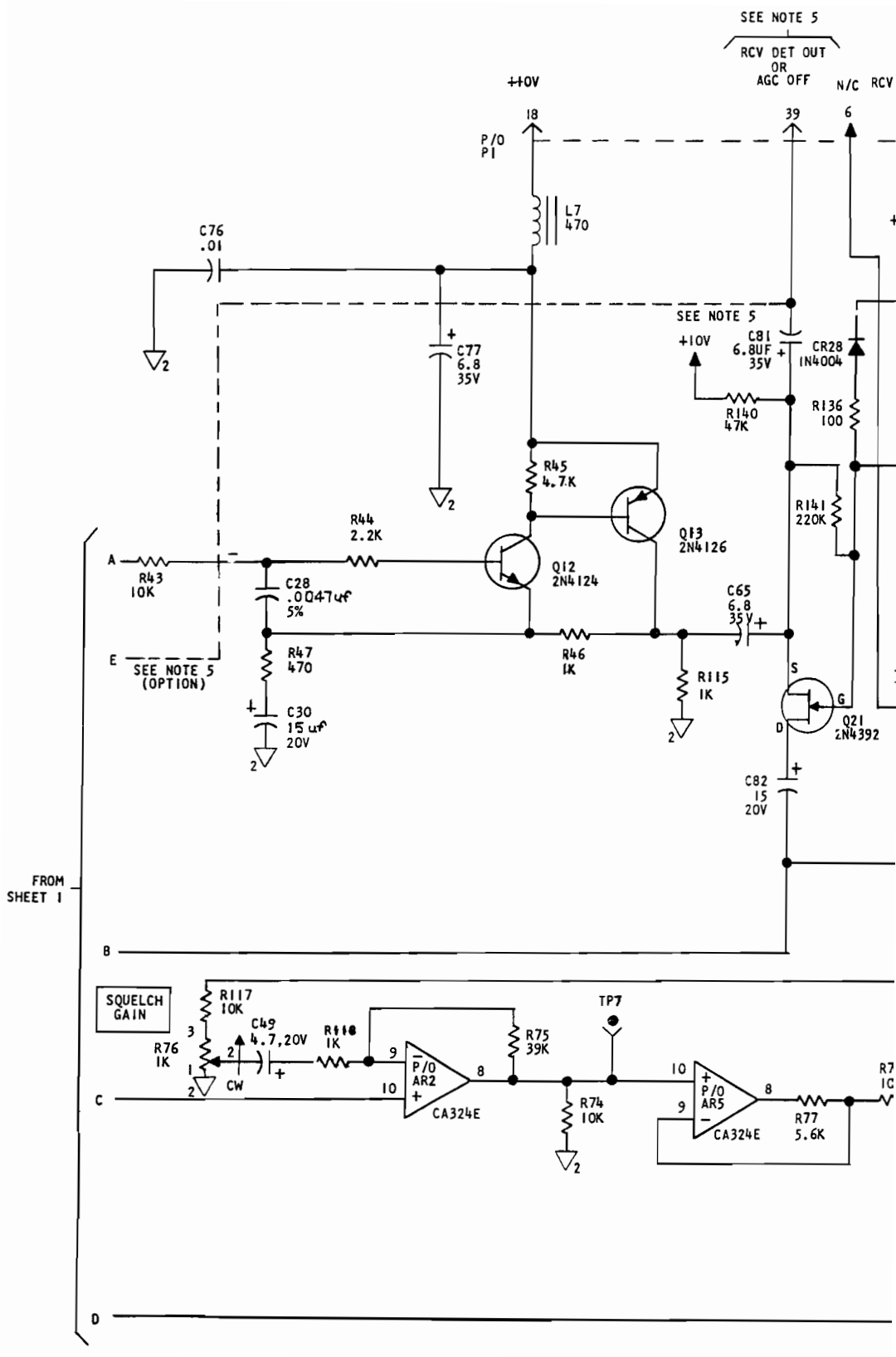


Figure 5. 1A1A4 Schematic Diagram (6628-9059)
(Sheet 2 of 2)

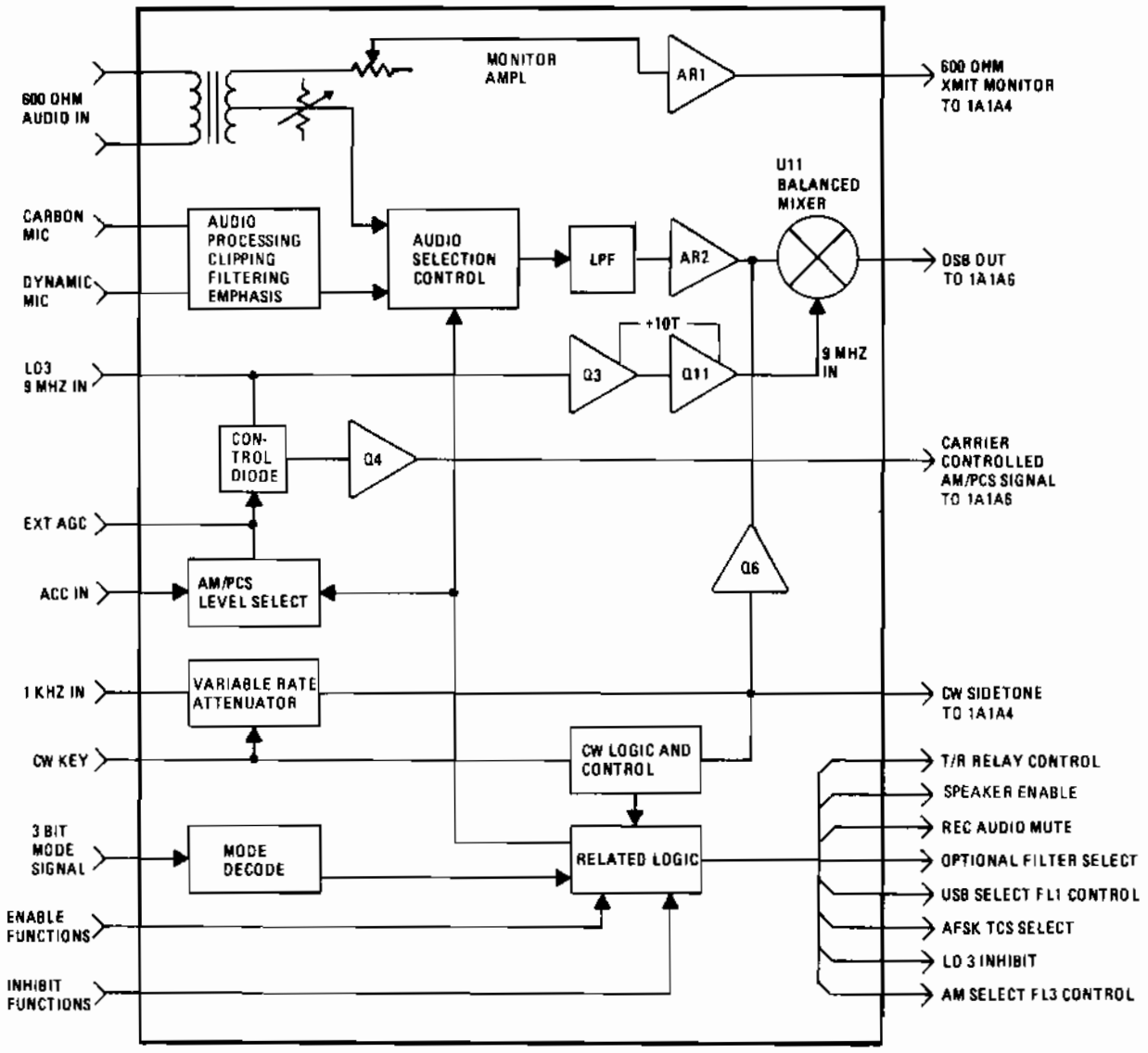

P/O
1A2A1
6628-0250
5K, 10%
MOD. LOG.
CW
SQ. BYPASS
SIDETONE IN
VOL. TOP
VOL. ARM
VOL. RETURN
SIDETONE ENABLE
23
25
24
37
41
38
R105
47K
R142
1K
(SEE NOTE 3)
R143
6.8K
E2
E1
E3
R137
100
C67
6.8
35V
R54
10K
CW
C40
1.0
20V
LINE LEVEL
ADJUST
C79
.47
35V
+10V
R50
220K
R128
18K
+10V
R121
4.7K
C32
6.8
35V
C70
4.7
20V
+10V
R102
4.7K
R103
1 MEG
CR29
S
D
G
Q18
2N4392
Q19
2N4392
R122
10K
C68
.01
C69
.01
L8
100
C31
6.8
35V
R112
2.2K
R120
2.7K
R111
10K
R101
10K
R99
10K
TP9
CR19
P/O
AR6
CA324E
R100
120K
R98
120K
CR18
CR17
C60
22
25V
C59
.1
35V
R84
10K
R85
20K
R81
10K
CR16
C52
.22
35V
CR15
TP8
R91
39K
C55
.47
35V
+10V
P/O
AR5
CA324E
R86
6.8K
C53
100
20V
R87
2K
C54
4.7
20V
R88
1.5K
R89
270
R90
6.8K
R92
100
C56
4.7
20V
R93
100K
R96
10K


SEE NOTE 5
RCV DET OUT OR AGC OFF
+10V
N/C
RCV AUD IN
T/R RELAY CONTROL
MUTE CNTL
18
39
6
40
35
21
P/O P1
L7 470
C66 6.8 35V
C76 .01
C77 6.8 35V
SEE NOTE 5
+10V
C81 6.8UF 35V
CR28 1N4004
C78 .47 35V
R140 47K
R136 100
R48 47K
CR27 1N4004
R45 4.7K
Q13 2N4126
R44 2.2K
Q12 2N4124
TP5
R119 4.7K
R138 1 MEG
C80 15 20V
R121 4.7K
R141 220K
A
R43 10K
C28 .0047uf 5%
C65 6.8 35V
Q17 2N4392
E
SEE NOTE 5 (OPTION)
R47 470
C30 15 uf 20V
R46 1K
R115 1K
C72 6.8UF 20V
Q21 2N4392
C82 15 20V
B
R83 20K
R81 10K
SQUELCH GAIN
R117 10K
R76 1K
CW
C49 4.7,20V
R118 1K
R75 39K
TP7
P/O AR2
CA324E
R74 10K
P/O AR5
CA324E
R77 5.6K
R78 100
R129 100K
C51 0.1
C50 6.8,35V
R79 10K
R80 10K
CR15
P/O AR5
CA324E
R82 6.8K
C
D


SEE NOTE 5
RCV DET OUT
OR
AGC OFF
+10V
N/C
RCV
18
39
6
P/O
P1
L7
470
C76
.01
C77
6.8
35V
SEE NOTE 5
+10V
C81
6.8UF
35V
CR28
IN4004
R140
47K
R136
100
R45
4.7K
R44
2.2K
Q13
2N4126
R141
220K
A
R43
10K
C28
.0047uf
5%
Q12
2N4124
C65
6.8
35V
E
SEE NOTE 5
(OPTION)
R47
470
C30
15 uf
20V
R46
1K
R115
1K
S
G
D
Q21
2N4392
C82
15
20V
FROM
SHEET 1
B
SQUELCH
GAIN
R117
10K
R76
1K
C49
4.7,20V
R118
1K
CW
TP7
R75
39K
P/O
AR2
CA324E
R74
10K
P/O
AR5
CA324E
R77
5.6K
C
D

PROCESSOR BOARD

1A1A5



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1. GENERAL DESCRIPTION

The Processor PC Board functions in the transmit signal path to translate audio or other intelligence inputs to a 9 MHz IF frequency for use at the 1A1A6 Mixer. The Processor board will select any one of these four intelligence inputs as the modulation source at the 1st transmit mixer to produce the desired DSB output. The desired modulation source (600 ohm audio, dynamic mic, carbon mic, or cw) is selected by electronic switching in response to operator inputs and logic control elements.

ACC (Automatic Carrier Control) is effected on the Processor board in response to control inputs developed at the PA Control Board from VSWR and other information. A complete family of mode related control functions are generated on the Processor board in response to 3-bit mode control inputs from the front panel, as modified by related inhibit, enable, or other logic functions. These significant input and output functions are shown in abbreviated form on the cover to this section, and in increased detail in figure 3, the simplified overall block diagram of the 1A1A5 assembly.

2. TECHNICAL CHARACTERISTICS

Power Requirements:
- +10V
- +10R
- +10T

Signal Inputs:
- LO3 9 MHz input
- 1 kHz
- 600 ohm line audio input
- Carbon or dynamic mic input from front panel

Signal Outputs:
- DSB output to 1A1A6
- 600 ohm transmit monitor to 1A1A4
- AM/PCS injection output to 1A1A6

Control Inputs
- Transmit inhibit
- ACC control inputs from 1A1A3
- Mic keyline
- CW key
- Keyline enable
- 3-bit mode control
- Tune power receive

Control Inputs (continued):
- Mic enable
- RF-281 keyline enable

Control Outputs:

FL1 filter control	0 = select
FL2 filter control	0 = select
FL3 filter control	0 = select
LO3 inhibit	0 = LO inhibited
T/R relay control	0 = Transmit
FSK TC select	1 = FSK TC select
Speaker enable	1 = SPEAKER ON
AM enable	0 = AM enable
Mute control	0 = mute

3. SEMICONDUCTOR COMPLEMENT

REF. DESIG.	TYPE	FUNCTION
AR1, AR2	CA324E	Quad Operational Amplifier
CR1	1N4454	Diode
CR2	HP3080	Diode, Pin
CR3, CR4	1N4454	Diode
CR5	1N277	Diode
CR6	1N4454	Diode
CR7	1N277	Diode
CR8	MPN3401	Diode
CR9	1N4454	Diode
CR10	MSD6150	Dual schottky diode
CR11, CR12	1N4454	Diode
CR13	1N4004	Diode
CR14	1N4454	Diode
Q1, Q2	2N4126	Transistor, PNP
Q3, Q4	2N3563	Transistor, NPN
Q5	2N4126	Transistor, PNP
Q6, Q7	2N4124	Transistor, NPN
Q8	2N4921	Transistor, NPN
Q9, Q10	2N4124	Transistor, NPN
Q11	2N3563	Transistor, NPN
U1	CD4011AE	Quad 2-Input NAND gates
U2	CD4069BE	Hex inverter
U3	CD4001AE	Quad 2-Input NOR gates
U4	CD4028AE	BCD-to-Decimal decoder
U5	CD4053A2	Triple 2-Channel Multiplexer
U6	MC3340D	Electronic Attenuator (sw)
U7, U8	Not used	
U9	CD4073BE	Triple 3-Input AND gates
U10	CA4023AE	Triple 3-Input NAND gates
U11	6628-0666	Double balanced mixer

4. CIRCUIT DESCRIPTION

The 1A1A5 PC Board Assembly performs several initial transmitter signal path processing and control

functions. The introductory block diagram on the cover of this section summarizes these functions and shows most significant relationships. Figure 3 is a detailed block diagram showing all significant logic and control elements, and includes all signal inputs and outputs.

4.1 Transmit Audio - to - 9 MHz IF

U11 constitutes the primary 1A1A5 signal processing element. Detailed information on this balanced mixer is given in the General Information Section of this manual under Maintenance. Figure 1 is a schematic diagram of the mixer and provides sufficient information for our purpose here. With a pure, 9 MHz signal input at pins 1 and 2, there will be almost no output at pins 7 and 8. The carrier is essentially cancelled, or "balanced out" by the electrical symmetry of the mixer. As a consequence, in the single sideband mode, with no modulation input, there should be zero power out.

With an audio input to the mixer, sidebands are produced above and below the 9 MHz carrier as a function of the modulating voltage. A pure 1000 Hz audio input would produce two separate sidebands with one displaced 1 kHz above the 9 MHz carrier frequency, and one displaced 1 kHz below the 9 MHz carrier frequency. If the modulating audio were a complex voice signal, the upper and lower sideband energy would be displaced evenly above and below as a function of the modulating voltage. If the complex DSB output at P1-7 were observed on a spectrum analyzer, it would appear similar to that shown in figure 3.

The 9 MHz LO3 carrier signal is generated at 1A1-A10. The modulating audio can originate from either a carbon mic, dynamic mic, 600 ohm audio input, or 1 kHz CW tone. If a carbon mic is used, dc operating potential is obtained through R48 to +10T with developed audio coupled via C25 and C27 to the filter/amplifier and audio processing circuits of AR2.

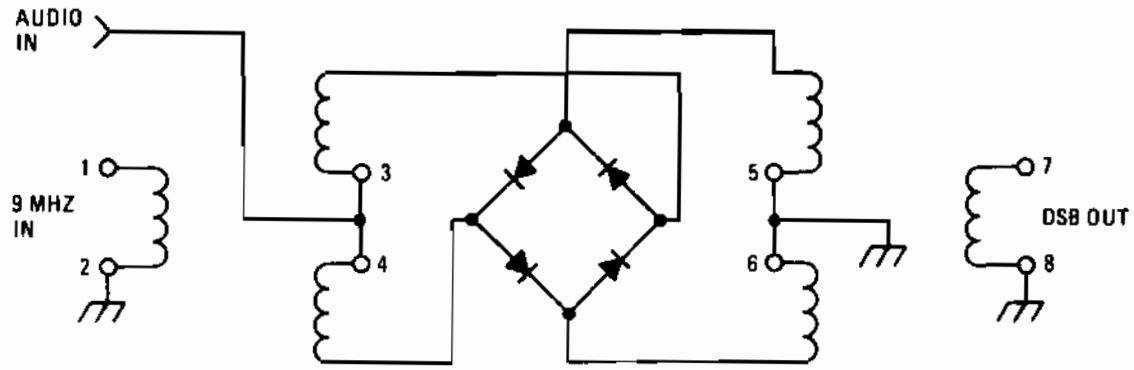


Figure 1. U11 Mixer Schematic

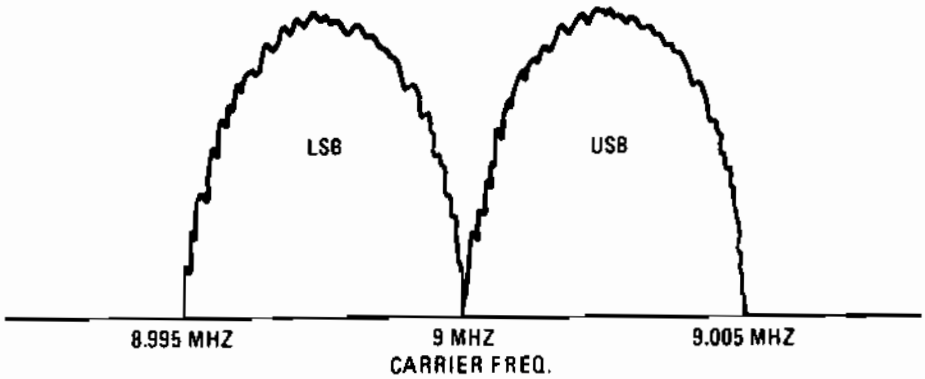


Figure 2. Processor DSB Output

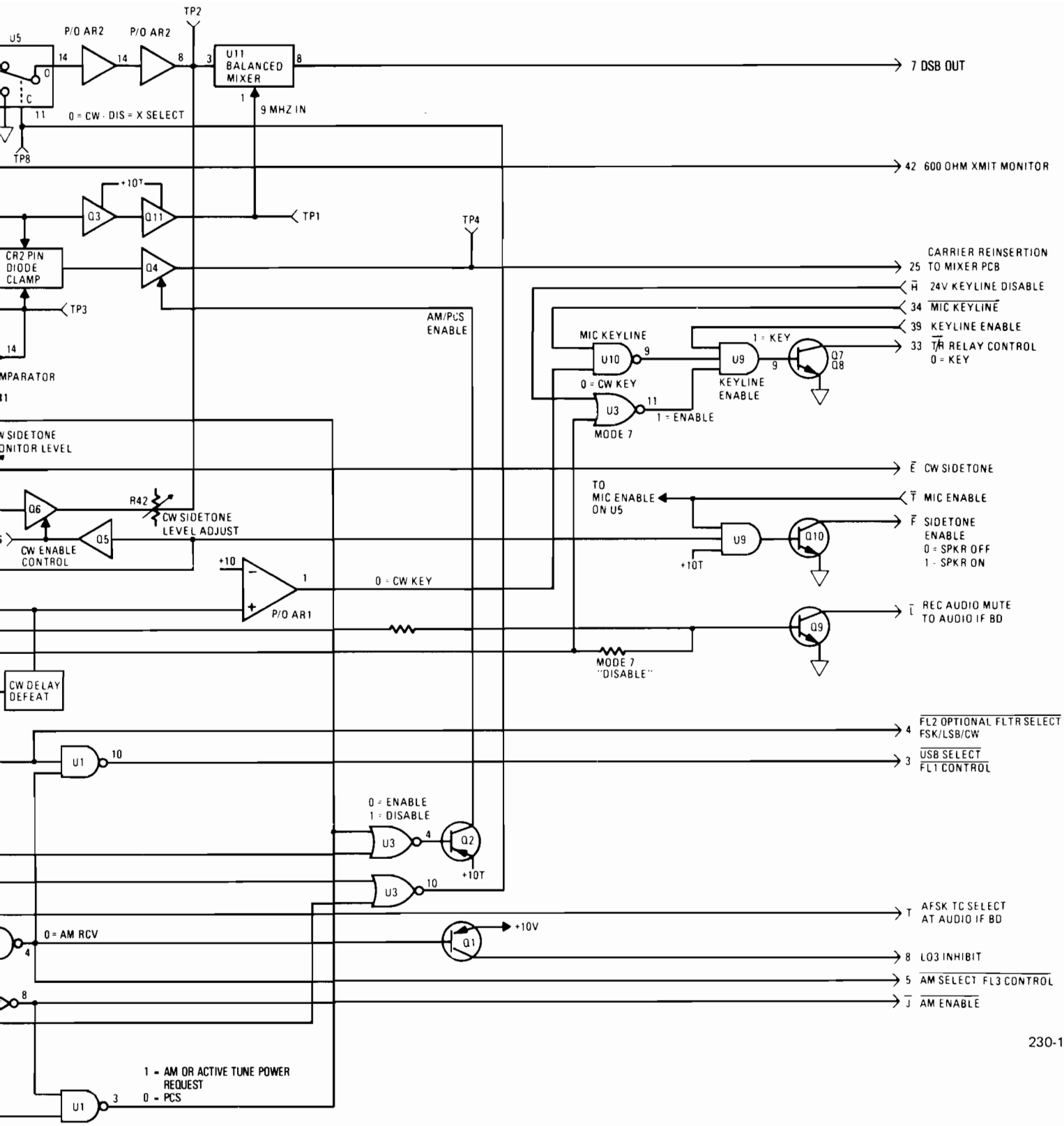
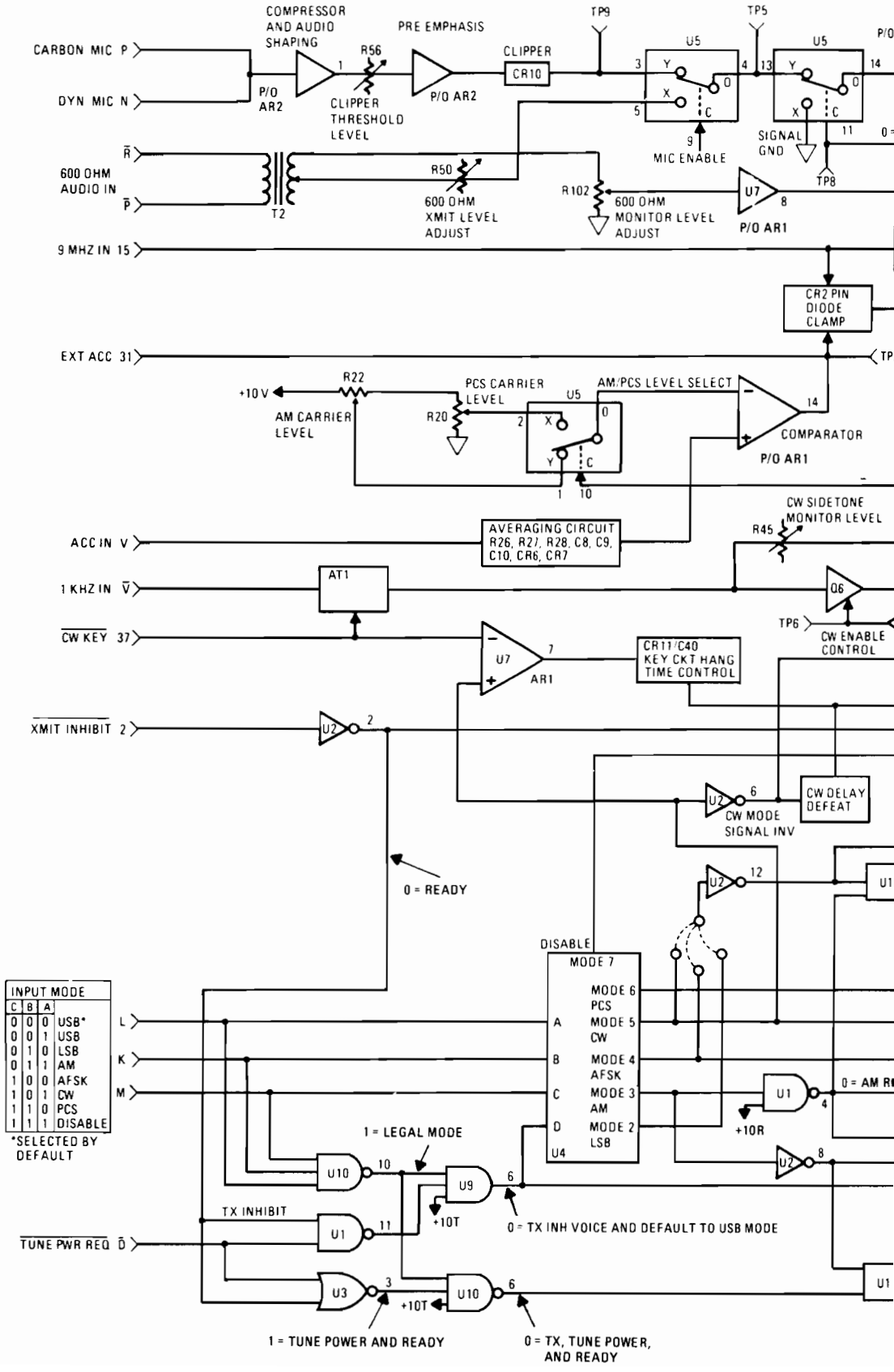


Figure 3. 1A1A5 Processor Board Simplified Diagram

	MEASURE WITH
	HI Z RFVM
	HI Z ACVM
	VOM
PCS	HI Z RFVM
	HI Z ACVM
	VOM
S)	VOM
DIS)	VOM
	SCOPE

ADJUST FOR
rier output
rier output
k-to-peak at TP2
k-to-peak at 1A1A4TP5
k-to-peak at TP2
to-peak clipping threshold h 12 mVRMS input
k-to-peak at 1A1A4TP5 (XMIT 1 kHz with 0 dBm input)



TEST POINT	FUNCTION	TYPICAL DATA	MEASURE WITH
TP1	9 MHZ MIXER INPUT LEVEL	+7 dBm	HI Z RFVM
TP2	MIXER AUDIO INPUT LEVEL	54 mV rms	HI Z ACVM
TP3	ACC CONTROL LEVEL	0 to 8.5 Vdc	VOM
TP4	AM/PCS LEVEL TO MIXER	−11 AM/−27 dBm PCS	HI Z RFVM
TP5	600 OHM XMIT (with 0 dBm in)	120 mV rms	HI Z ACVM
TP6	CW ENABLE CONDITION	9 Vdc (CW)	VOM
TP7	AM/PCS ENABLE (XMIT)	9 Vdc (AM or PCS)	VOM
TP8	CW OR DISABLE MODULATION SELECT	9 Vdc (Xmit, $\overline{CW}/\overline{DIS}$)	VOM
TP9	MIC CLIPPER OUTPUT (@ 1 kHz)	0.50V P-P	SCOPE

CONTROL	FUNCTIONAL TITLE	ADJUST FOR
R20	PCS CARRIER LEVEL	3.1 Watts carrier output
R22	AM CARRIER LEVEL	40 Watts carrier output
R42	CW SIDETONE LEVEL	150 mV peak-to-peak at TP2
R45	CW SIDETONE MONITOR	600 mV peak-to-peak at 1A1A4TP5
R50	600 OHM XMIT LEVEL @ 1 kHz, 0 dBm input	150 mV peak-to-peak at TP2
R56	CLIPPER LEVEL	0.50V peak-to-peak clipping threshold @1 kHz with 12 mVRMS input
R102	600 OHM XMIT MONITOR LEVEL	600 mV peak-to-peak at 1A1A4TP5 (X 600 OHM @ 1 kHz with 0 dBm input)

TEST POINT	FUNCTION	TYPICAL DATA	MEASURE WITH
TP1	9 MHZ MIXER INPUT LEVEL	+7 dBm	HI Z RFVM
TP2	MIXER AUDIO INPUT LEVEL	54 mV rms	HI Z ACVM
TP3	ACC CONTROL LEVEL	0 to 8.5 Vdc	VOM
TP4	AM/PCS LEVEL TO MIXER	–11 AM/–27 dBm PCS	HI Z RFVM
TP5	600 OHM XMIT (with 0 dBm in)	120 mV rms	HI Z ACVM
TP6	CW ENABLE CONDITION	9 Vdc (CW)	VOM
TP7	AM/PCS ENABLE (XMIT)	9 Vdc (AM or PCS)	VOM
TP8	CW OR DISABLE MODULATION SELECT	9 Vdc (Xmit, $\overline{CW}/\overline{DIS}$)	VOM
TP9	MIC CLIPPER OUTPUT (@ 1 kHz)	0.50V P-P	SCOPE

CONTROL	FUNCTIONAL TITLE	ADJUST FOR
R20	PCS CARRIER LEVEL	3.1 Watts carrier output
R22	AM CARRIER LEVEL	40 Watts carrier output
R42	CW SIDETONE LEVEL	150 mV peak-to-peak at TP2
R45	CW SIDETONE MONITOR	600 mV peak-to-peak at 1A1A4TP5
R50	600 OHM XMIT LEVEL @ 1 kHz, 0 dBm input	150 mV peak-to-peak at TP2
R56	CLIPPER LEVEL	0.50V peak-to-peak clipping threshold @ 1 kHz with 12 mVRMS input
R102	600 OHM XMIT MONITOR LEVEL	600 mV peak-to-peak at 1A1A4TP5 (XMIT 600 OHM @ 1 kHz with 0 dBm input)

If a dynamic mic is used, no power source is required, and the voice generated signal energy is coupled through L3 to C27 where it shares a common signal path with the carbon mic input. R56 at the AR2-1 output establishes the microphone level threshold. This threshold is normally adjusted to 0.59V (peak-to-peak) at TP8, with a 1 kHz, 5 mV, (200 ohm source) input at P1-N, USB, Keydown. These clipper amplifier, and emphasis circuits provides maximum talk power output.

The microphone output from the speech processing network is routed through an element of quad bilateral switch U5, for control. With a logic "1" at pin 9, the microphone output is selected. With a logic "0" at pin 9 the 600 ohm audio input from T2 is selected. R50 adjusts the 600 ohm line level. With a 0 dBm input at P1-$\overline{R}$ and P1-$\overline{P}$, R50 is adjusted for a nominal 126 mV (peak-to-peak) level at TP2. The selected audio output at U5-4 is not fed directly to the mixer audio input, but is fed back to another section of quad bilateral switch U5 at the pin 13 "Y" input. With a logic "1" at U5-11, the "Y" input is selected and fed through low pass filter and amplifier AR2. Note that the "X" input at U5-12 is simply the op ampl. reference, and as a consequence, with a logic "0" control input at pin U5-11, the "X" input is selected, and the audio input to the mixer is effectively locked out. This logic level is derived from the mode control logic. Either a "CW", or a "DISABLE" mode control condition would cause the logic line to go low and disable the audio inputs.

4.2 CW Signal Development

With CW selected, normal audio input to the balanced mixer via low pass filter and amplifier AR2 is shut off, and the CW input is "enabled". The CW modulation input is actually a "keyed", and "shaped" 1000 Hz note from the 1A1A9 Frequency Standard PC Board. Keying and shaping is accomplished on the Processor by variable rate attenuator U6. A CW key ground signal from an external hand key would cause P1-37 to go low and effect a "shaped" turn on of U6. Using a variable rate attenuator to control the 1 kHz cw signal produces literally ideal wave-shape characteristics. Key clicks and other undesirable by-products that detract from cw "readability" are completely eliminated in this system. The "shaped" 1 kHz cw note is amplified by U6 (which is enabled by Q5 as a result of the inverted cw mode select signal through U2), level controlled by R42, and applied as the modulating audio input to balanced mixer U11. CW transmission is thus effected as sideband intelligence, and will appear in the frequency spectrum displaced 1 kHz above the carrier frequency at the transmitter output. For ease of operation a sidetone is taken off Q6 and through level control R45 is injected into the speaker/volume control.

4.3 AM Carrier Level Control

AM Carrier Level Control is effected through an element of quad bilateral switch U5. A logic "1" at the U5-10 control input will select the AM reference level established by R22. This control voltage is used at U7-13 to establish the desired AM carrier level. An ACC (Automatic Carrier Control) input from the Control PC Board functions to maintain the desired level. If the carrier output should tend to increase, this increase would cause an increased ACC control voltage input at P1-V, which after processing in an averaging circuit, is applied to the non-inverting input of U7 at pin 12. An increasing ACC input will thus cause an increasing control voltage output at U7-14 (TP3) and increase the current through CR2. This diode attenuator control would tend to reduce the AM output through Q4 to correct for the increase sensed at the output. The AM output to the 1A1A6 Mixer is thus a precise, level controlled, 9 MHz signal that bypasses the balanced mixer to provide the desired level of carrier re-insertion.

4.4 Mode Control

Mode control information enters the Processor PC Board in a 3-bit code, is applied to the A, B, and C inputs of BCD-to-Decimal decoder U4 and produces a mode-related one of seven output. The input code-to-mode relationship is shown in the table accompanying figure 3.

4.4.1 USB Select

USB is selected by default in that there is no U4 output pin for this function - whenever another mode is not selected, USB is automatically selected by "default". USB select is controlled by a low logic level output from U1-10, USB = $\overline{AM}+\overline{FSK}+\overline{LSB}+\overline{CW}$. Transmit audio would also be enabled by a logic "1" at U5-11 in the USB mode.

4.4.2 LSB/FSK/CW Select

Decoded control outputs for these modes terminate in a jumper select system. The jumper can be

used to complete only one of these three options. If the system was purchased to include LSB, and a LSB filter was installed in the optional filter position (FL2) on the Mixer PC Board, then the jumper would be installed to pick-off the LSB select signal from U4-2. Inverter U2 would translate the decoded LSB select "1" output from U4-2, to the desired low logic level FL2 select "0" output at P1-4. If the system was purchased for FSK or CW operation, then obviously the corresponding jumper would be installed. Whichever of these modes is not selected by a jumper, the system defaults to USB.

4.4.3 AM Select

The AM mode select high output at U4-3 is inverted by U2 to produce a low AM Enable output at P1-J for use at the IF Audio PC Board; and this same inverted signal is used at U1 to generate the AM Carrier Level Select Signal at U5-10. The AM Mode Select Signal is used with +10R to generate the FL3 select signal and the LO3 Inhibit Signal. In the receive mode (+10R), an LO3 Inhibit Signal is generated at U1-4. The two high inputs to NAND gate U1 produce a low output to bias ON PNP transistor Q1. With Q1 ON a high LO3 Inhibit voltage will be present at P1-8. The low U1-4 output is used directly at P1-5 as the FL3 select signal. Note USB filter is used for AM transmit.

4.4.4 PCS Select

The PCS level select function is accomplished by the $\overline{AM}$ condition at U5-10. The PCS Mode Select high logic level is used at NOR Gate U3 to produce a low at the output, bias ON Q2 and enable Q4 to produce the PCS carrier output to the mixer.

4.4.5 Disable

When U4 decodes a decimal 7 output, U4-4 goes high, biases ON Q9, and produces a low P1-I MUTE control condition to the IF Audio PC Board. The same U4-4 high condition at NOR gate U3-13 produces a disable condition at the U9-1 T/R Relay control gate input to disable the transmitter.

4.4.6 Pre-emptive Control Line Functions

TPR (Tune Power Request) and TXI (Transmit Inhibit) control inputs at U1-13 and U1-12 are tied to pull-up resistors to produce a constant "0" output at U1-11. If either of these lines go low, the U1-11 output state would change to a "1" condition, and when "anded" with the +10T Logic input at U9-4, requires only a "1" input at U9-5 to produce a disable output at U9-6. U10-10 will produce a "1" output for any mode control input other than the disable code (which would in itself disable the radio), and as a consequence, if either the TPR or the TXI control lines go low, the normal mode control circuitry is disabled. In addition, the TPR signal thru U3-3 would automatically select the following:

- Transmit Audio Off
- AM Injection Amplifiers On
- AM Carrier Level Selected
- USB Filter On

If the TXI control line goes low, the following conditions will be automatically selected:

- Audio Mute (Receive)
- AM/PCS Disabled
- USB Filter Selected
- TX Audio Off

5. MAINTENANCE

All of the adjustments indicated in this paragraph have been made at the factory prior to shipment. It should not be necessary to repeat any of these adjustments unless component failure is experienced, or unless readjustment becomes necessary for some other specific reason. All of these adjustments could be made without removing the board from the unit, however, removing the PC Board and reinstalling it on the extender card as shown in figure 4 will normally facilitate maintenance and adjustment by making all test points readily available. These adjustments can all be made using the test equipment shown or the electrical equivalents. Figure 5 summarizes 1A1A5 Inputs/Outputs and locates significant adjustment points.

CAUTION

Always remove power when removing or reinstalling subassemblies.

5.1 R56, Microphone Level Adjustment

This procedure establishes the clipper threshold to a level just below the nominal TP9 signal level.

a. Connect Audio Signal Generator to 200 ohm dynamic mic input at P1-N, and adjust input to 12 mV rms at 1 kHz.

b. Connect the oscilloscope to monitor the 1 kHz audio input waveshape at TP9 (Clipper CR-10 output).

c. Terminate antenna output connector (J1) in 50 ohm dummy load, select USB mode, and complete mic keyline to ground at P1-34.

d. Adjust R56 for clipping threshold observed on the oscilloscope as the point where the peak of the wave just starts to flatten. (This is approximately 0.5V peak-to-peak.)

e. Verify 150 mV peak-to-peak at TP2.

f. This completes adjustment. Reconfigure for normal operation or proceed to next step.

5.2 R42, CW Sidetone Level Adjustment

This adjustment establishes cw modulation level. Terminate antenna output connector J1 in 50 ohm dummy load.

a. Select or verify cw mode and complete cw key circuit to ground either at P1-37, or at cw key connection at front of radio.

b. Verify 1 kHz 280 mV rms input at P1-$\overline{V}$.

c. Adjust R42 for 150 mV peak-to-peak at TP2.

d. This completes adjustment. Reconfigure for normal operation or proceed to next step.

5.3 R45 CW Sidetone Monitor Adjustment

This adjustment establishes nominal cw sidetone monitor level.

a. Setup for test as for paragraph 5.2 and verify paragraph 5.2 complete.

b. Adjust R45 for 600 mV peak-to-peak at 1A1A4TP5.

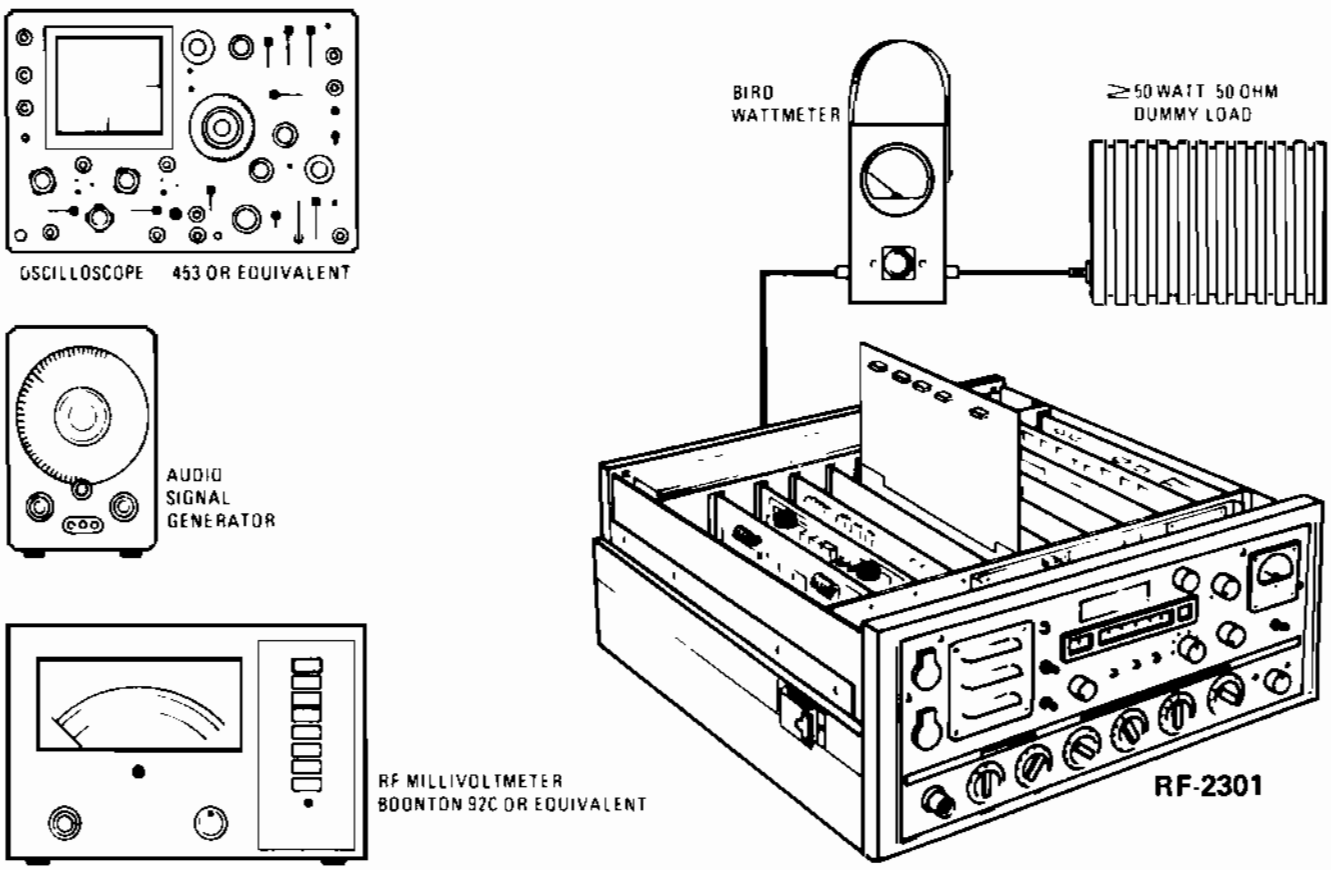


Figure 4. Typical 1A1A5 Test Elements

c. This completes adjustment. Reconfigure for normal operation or proceed to next step.

5.4 R22 AM Carrier Level Adjustment

This adjustment establishes the normal no-modulation AM carrier level at 40 watts.

a. Connect antenna output at J1 through Bird Wattmeter to 50 ohm dummy load. Position wattmeter slug to measure forward power.

b. Select or verify AM Mode at RF-2301.

c. Disconnect front panel mic and verify no audio input at 600 ohm transmit audio input – this step verifies no-modulation condition for test.

d. Ground P1-34 on Processor PC Board or use front panel CW key to key transmitter.

e. Adjust R22 for 40 watts (carrier output) at Bird Wattmeter.

f. This completes adjustment. Reconfigure for normal operation, or as desired.

5.5 R50/R102 600 Ohm Transmit Audio Adjustment.

a. Connect Audio Signal Generator to 600 Ohm Transmit Audio input at P1-$\overline{P}$ and P1-$\overline{R}$ and adjust for 0 dBm (0.78V rms) at 1 kHz. This input can also be made at normal system 600 ohm audio input if more convenient.

Connect P1, pin t to ground. This will enable the 600 ohm input line.

b. Select USB mode and key transmitter.

c. Adjust R50 for 150 mV peak-to-peak at TP2.

d. Adjust R102 for 600 mV peak-to-peak at 1A1A4TP5.

e. This completes adjustment. Reconfigure for normal operation.

6. PARTS LISTS

Table 1 lists all 1A1A5 Maintenance Parts. All of these components can be identified in figure 6.

7. SCHEMATIC

Figure 7 is a complete schematic diagram of the 1A1A5 assembly.

1	GND	A	GND
2	XMIT INHIBIT FROM 1A1A12	B	GND
3	FL1 USB FILTER CONTROL TO 1A1A6	C	GND
4	FL2 OPT. FILTER CONTROL TO 1A1A6	D	GND
5	FL3 AM FILTER CONTROL TO 1A1A6	E	GND
6	GND (DSB OUT SIGNAL GND)	F	GND
7	DSB OUT TO 1A1A6	H	DSB OUT TO 1A1A6
8	LO3 INHIBIT TO 1A1A10	J	GND
9		K	MODE B IN FROM 1A1A12
10		L	MODE A IN FROM 1A1A12
11		M	MODE C IN FROM 1A1A12
12	GND	N	DYN MIC FROM 1A2A1
13	GND	P	CARBON MIC FROM 1A2A1
14	GND	R	GND
15	LO3 9 MHZ IN FROM 1A1A10	S	
16		T	FSK TC SELECT TO 1A1A4
17		U	ACC REF FROM 1A1A3
18		V	ACC FROM 1A1A3
19	GND	W	
20	+10T	X	
21	+10V	Y	
22	+10R	Z	
23		a	
24	GND	b	
25	AM/PCS INJECTION OUT TO 1A1A6	c	GND
26	GND	d	TUNE PWR REQUIRED FROM 1J4
27	GND	e	SIDETONE OUT TO 1A1A4
28	GND	f	SPEAKER ENABLE TO 1A1A4
29	GND	h	RF-281 KEYLINE DISABLE
30	GND	j	AM ENABLE TO 1A1A4
31	EXT ACC FROM 1J3	k	
32		l	MUTE CONTROL TO 1A1A4
33	T/R RELAY CONTROL TO 1A1A12	m	
34	MIC KEYLINE FROM 1A2A1	n	
35		p	600 OHM IN FROM 1J4
36		r	600 OHM IN FROM 1J4
37	CW KEY FROM 1TB1	s	
38		t	MIC ENABLE
39	KEYLINE ENABLE	u	
40		v	1 KHZ FROM 1A1A10
41		w	
42	600 OHM XMIT MONITOR TO 1A1A4	x	
43	GND	y	

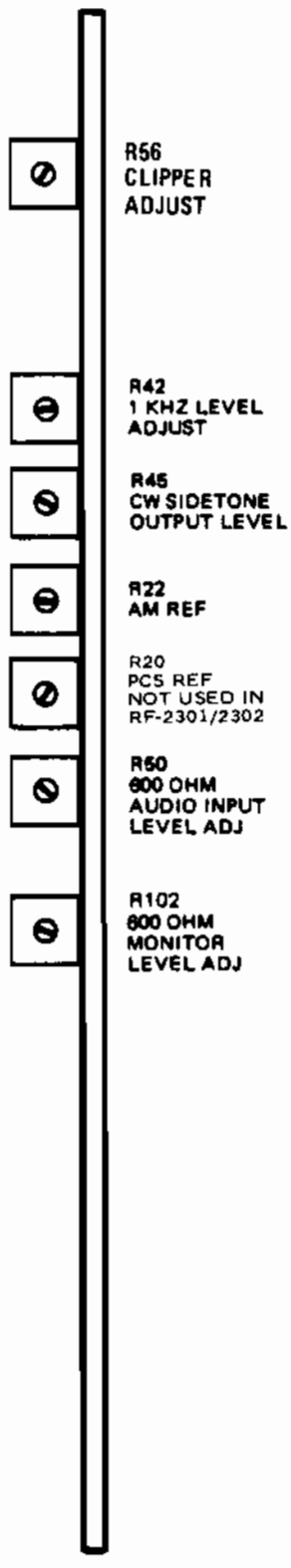


Figure 5. 1A1A5 Input/Output Summary

Table 1. 1A1A5 Maintenance Parts List

Ref. Desig.	Name & Description	Mfr. Code	Part Number
1A1A5	Processor PWB Assembly	14304	6628-0600
AR1,AR2	Integrated Circuit, Quad Operational Amplifier, CA324E	14304	IC-0359
AT1	Integrated Circuit, Electronic Attenuator, MC3340P	14304	IC-0171
C1, C2	Capacitor, Fixed, Ceramic, .1 uF +80-20%, 50 V	14304	C-3202
C3	Capacitor, Fixed, Ceramic, .01 uF ±20%, 50V	14304	C-4952
C4, C5	Capacitor, Fixed, Ceramic, .1 uF +80-20%, 50V	14304	C-3202
C6-C8	Capacitor, Fixed, Ceramic, .01 uF ±20%, 50V	14304	C-4952
C9, C10	Capacitor, Fixed, Tantalum, 15 uF ±10%, 20V	14304	C-3103
C11	Capacitor, Fixed, Ceramic, .01 uF ±20%, 50V	14304	C-4952
C12	Capacitor, Fixed, Tantalum, 6.8 uF ±10%, 35V	14304	C-3102
C13-C15	Capacitor, Fixed, Ceramic, .01 uF ±20%, 50V	14304	C-4952
C16	Capacitor, Fixed, Ceramic, .1 uF +80-20%, 50V	14304	C-3202
C17-C19	Capacitor, Fixed, Ceramic, .01 uF ±20%, 50V	14304	C-4952
C20	Capacitor, Fixed, Ceramic, .1 uF +80-20%, 50 V	14304	C-3202
C21	Capacitor, Fixed, Tantalum, 6.8 uF ±20%, 35V	14304	C-3102
C22	Capacitor, Fixed, Ceramic, .01 uF ±20%, 50V	14304	C-4952
C23	Capacitor, Fixed, Tantalum, 6.8 uF ±10%, 35V	14304	C-3102
C24	Capacitor, Fixed, Tantalum, 2.2 uF ±20%, 20V	14304	C-6444
C25	Capacitor, Fixed, Tantalum, 15 uF ±10%, 20V	14304	C-3103
C26	Capacitor, Fixed, Ceramic, .001 uF ±10%, 500V	14304	C-3513
C27	Capacitor, Fixed, Tantalum, .47 uF ±20%, 35V	14304	C-6419
C28	Capacitor, Fixed, Ceramic, .01 uF ±20%, 50V	14304	C-4952
C29	Capacitor, Fixed, Ceramic, .01 uF ±20%	14304	C11-0008-103
C30	Capacitor, Fixed, Tantalum, 1 uF ±20%, 35V	14304	C-3100
C31	Capacitor, Fixed, Tantalum, 2.2 uF ±20%, 20V	14304	C-6444
C32,C33	Capacitor, Fixed, Ceramic, 150 pF ±10%, 500V	14304	C-3502
C34	Capacitor, Fixed, Tantalum, 2.2 uF ±20%, 20V	14304	C-6444
C35	Capacitor, Fixed, Ceramic, .1 uF +80-20%, 50V	14304	C-3202
C36	Capacitor, Fixed, Ceramic, .033 uF ±10%, 100V	14304	C11-0008-333
C37	Capaictor, Fixed, Ceramic, .01 uF ±10%, 100V	14304	C11-0008-103
C38	Capacitor, Fixed, Tantalum, 2.2 uF ±10%, 20V	14304	C-6444
C39	Capacitor, Fixed, Tantalum, 22 uF ±20%, 25V	14304	C-6439
C40	Capacitor, Fixed, Tantalum, 10 uF ±20%, 20V	14304	C-6448
C41	Capacitor, Fixed, Tantalum, .33 uF ±20%, 35V	14304	C-6418
C42	Capacitor, Fixed, Ceramic, .1 uF +80-20%, 50V	14304	C-3202
C43	Capacitor, Fixed, Tantalum, 6.8 uF ±10%, 35V	14304	C-3102
C44	Capacitor, Fixed, Ceramic, .1 uF +80-20%	14304	C11-0005-104
C45	Capacitor, Fixed, Ceramic, .01 uF ±20%, 50V	14304	C-4952
CR1	Diode, Signal, 1N4454	14304	CR-0705
CR2	Diode, Pin, HP-3080	14304	CR-0294
CR3, CR4	Diode, Signal, 1N4454	14304	CR-0705
CR5	Diode, Signal, 1N277	14304	CR-0065
CR6	Diode, Signal, 1N4454	14304	CR-0705
CR7	Diode, Signal, 1N277	14304	CR-0065
CR8	Diode, Pin, MPN3401	14304	CR-0746
CR9	Diode, Signal, 1N4454	14304	CR-0705
CR10	Diode, Twin, Common Anode	14304	CR-0038

Table 1. 1A1A5 Maintenance Parts List (Continued)

Ref. Desig.	Name & Description	Mfr. Code	Part Number
CR11,CR12	Diode, Signal, 1N4454	14304	CR-0705
CR13	Diode, Rectifier, 1N4004	14304	CR-0725
CR14	Diode, Signal, 1N4454	14304	CR-0705
CR15 to CR17	Diode, Rectifier, 1N4004	14304	CR-0725
JMP1-JMP11	Jumper, Circuit	14304	MP-1142
L1,L2	Choke, RF, 56 uH	14304	L-0637
L3	Choke, RF, 1 mH	14304	L-0050
L4	Choke, RF, 100 uH	14304	L-0640
Q1, Q2	Transistor, PNP, 2N4126	14304	Q-0386
Q3, Q4	Transistor, NPN, 2N3563	14304	Q-0309
Q5	Transistor, PNP, 2N4126	14304	Q-0386
Q6, Q7	Transistor, PNP, 2N4124	14304	Q-0385
Q8	Transitor, NPN, 2N4921	14304	Q-0334
Q9, Q10	Transistor, NPN, 2N4124	14304	Q-0385
Q11	Transistor, NPN, 2N3563	14304	Q-0309
R1	Resistor, Fixed, Composition, 1K ±5%, 1/4W	81349	RCR07G102JM
R2	Resistor, Fixed, Composition, 100K ±5%, 1/4W	81349	RCR07G104JM
R3	Resistor, Fixed, Composition, 39K ±5%, 1/4W	81349	RCR07G393JM
R4	Resistor, Fixed, Composition, 1K ±5%, 1/4W	81349	RCR07G102JM
R5 to R7	Resistor, Fixed, Composition, 10K ±5%, 1/4W	81349	RCR07G103JM
R8, R9	Resistor, Fixed, Composition, 1K ±5%, 1/4W	81349	RCR07G102JM
R10	Resistor, Fixed, Composition, 39K ±5%, 1/4W	81349	RCR07G393JM
R11	Resistor, Fixed, Composition, 100K ±5%, 1/4W	81349	RCR07G104JM
R12	Resistor, Fixed, Composition, 100 Ohm ±5%, 1/4W	81349	RCR07G101JM
R13	Resistor, Fixed, Composition, 4.7K ±5%, 1/4W	81349	RCR07G472JM
R14	Resistor, Fixed, Composition, 1K ±5%, 1/4W	81349	RCR07G102JM
R15	Resistor, Fixed, Composition, 4.7K ±5%, 1/4W	81349	RCR07G472JM
R16	Resistor, Fixed, Composition, 1K ±5%, 1/4W	81349	RCR07G102JM
R17	Resistor, Fixed, Composition, 220 ohm ±5%, 1/4W	81349	RCR07G221JM
R18	Resistor, Fixed, Composition, 220K ±5%, 1/4W	81349	RCR07G224JM
R19	Resistor, Fixed, Composition, 10K ±5%, 1/4W	81349	RCR07G103JM
R20	Resistor, Variable, 5K	14304	R-2227
R21	Not Used		
R22	Resistor, Variable, 10K	14304	R-2228
R23	Resistor, Fixed, Composition, 100K ±5%, 1/4W	81349	RCR07G104JM
R24	Resistor, Fixed, Composition, 180K ±5%, 1/4W	81349	RCR07G184JM
R25	Resistor, Fixed, Composition, 1.5K ±5%, 1/4W	81349	RCR07G152JM
R26	Resistor, Fixed, Composition, 33K ±5%, 1/4W	81349	RCR07G333JM
R27, R28	Resistor, Fixed, Composition, 2.7K ±5%, 1/4W	81349	RCR07G272JM
R29	Not Used		
R30	Resistor, Fixed, Composition, 820 Ohm ±5%, 1/4W	81349	RCR07G821JM

Table 1. 1A1A5 Maintenance Parts List (Continued)

Ref. Desig.	Name & Description	Mfr. Code	Part Number
R31	Resistor, Fixed, Composition, 470 Ohm ±5%, 1/4W	81349	RCR07G471JM
R32	Resistor, Fixed, Composition, 270 Ohm ±5%, 1/4W	81349	RCR07G271JM
R33	Resistor, Fixed, Composition, 160 Ohm ±5%, 1/4W	81349	RCR07G161JM
R34	Resistor, Fixed, Composition, 1.8K ±5%, 1/4W	81349	RCR07G182JM
R35	Resistor, Fixed, Composition, 39K ±5%, 1/4W	81349	RCR07G393JM
R36	Resistor, Fixed, Composition, 100K ±5%, 1/4W	81349	RCR07G104JM
R37	Resistor, Fixed, Composition, 6.8K ±5%, 1/4W	81349	RCR07G682JM
R38	Resistor, Fixed, Composition, 3.9K ±5%, 1/4W	81349	RCR07G392JM
R39	Resistor, Fixed, Composition, 12K ±5%, 1/4W	81349	RCR07G123JM
R40	Resistor, Fixed, Composition, 5.6K ±5%, 1/4W	81349	RCR07G562JM
R41	Resistor, Fixed, Composition, 680 ±5%, 1/4W	81349	RCR07G681JM
R42	Resistor, Variable, 500 Ohm	14304	R-2224
R43	Resistor, Fixed, Composition, 330 Ohm ±5%, 1/4W	81349	RCR07G331JM
R44	Resistor, Fixed, Composition, 51 Ohm ±5%, 1/4W	81349	RCR07G510JM
R45	Resistor, Variable, 5K	14304	R-2227
R46	Resistor, Fixed, Composition, 1K ±5%, 1/4W	81349	RCR07G102JM
R47	Not Used		
R48	Resistor, Fixed, Composition, 4.7K ±5%, 1/4W	81349	RCR07G472JM
R49	Resistor, Fixed, Composition, 510 Ohm ±5%, 1/4W	81349	RCR07G511JM
R50	Resistor, Variable, 100 Ohm	14304	R-2222
R51	Not Used		
R52, R53	Resistor, Fixed, Composition, 47K ±5%, 1/4W	81349	RCR07G473JM
R54	Resistor, Fixed, Composition, 3.3K ±5%, 1/4W	81349	RCR07G332JM
R55	Resistor, Fixed, Composition, 75K ±5%, 1/4W	81349	RCR07G753JM
R56	Resistor, Variable, 5K	14304	R-2227
R57	Resistor, Fixed, Composition, 3.9K ±5%, 1/4W	81349	RCR07G392JM
R58, R59	Resistor, Fixed, Composition, 100K ±5%, 1/4W	81349	RCR07G104JM
R60	Resistor, Fixed, Composition, 27K ±5%, 1/4W	81349	RCR07G273JM
R61, R62	Resistor, Fixed, Composition, 3.3K ±5%, 1/4W	81349	RCR07G332JM
R63	Resistor, Fixed, Composition, 47K ±5%, 1/4W	81349	RCR07G473JM
R64	Resistor, Fixed, Composition, 3.3K ±5%, 1/4W	81349	RCR07G332JM
R65	Resistor, Fixed, Composition, 68K ±5%, 1/4W	81349	RCR07G683JM
R66, R67	Resistor, Fixed, Composition, 2.4K ±5%, 1/4W	81349	RCR07G242JM
R68	Resistor, Fixed, Composition, 4.7K ±5%, 1/4W	81349	RCR07G472JM
R69	Resistor, Fixed, Composition, 560 Ohm ±5%, 1/4W	81349	RCR07G561JM
R70	Resistor, Fixed, Composition, 22K ±5%, 1/4W	81349	RCR07G223JM
R71	Resistor, Fixed, Composition, 470 Ohm ±5%, 1/4W	81349	RCR07G471JM
R72	Resistor, Fixed, Composition, 33K ±5%, 1/4W	81349	RCR07G333JM
R73	Resistor, Fixed, Composition, 390 Ohm ±5%, 1/4W	81349	RCR07G391JM
R74, R75	Resistor, Fixed, Composition, 1K ±5%, 1/4W	81349	RCR07G102JM

Table 1. 1A1A5 Maintenance Parts List (Continued)

Ref. Desig.	Name & Description	Mfr. Code	Part Number
R75	Resistor, Fixed, Composition, 20K ±5%, 1/4W	81349	RCR07G203JM
R76, R77	Resistor, Fixed, Composition, 47K ±5%, 1/4W	81349	RCR07G473JM
R78	Resistor, Fixed, Composition, 20K ±5%, 1/4W	81349	RCR07G203JM
R79, R80	Resistor, Fixed, Composition, 47K ±5%, 1/4W	81349	RCR07G473JM
R81	Resistor, Fixed, Composition, 150K ±5%, 1/4W	81349	RCR07G154JM
R82	Not Used		
R83	Resistor, Fixed, Composition, 33K ±5%, 1/4W	81349	RCR07G333JM
R84	Resistor, Fixed, Composition, 27K ±5%, 1/4W	81349	RCR07G273JM
R85	Resistor, Fixed, Composition, 47K ±5%, 1/4W	81349	RCR07G473JM
R86	Resistor, Fixed, Composition, 330 Ohm ±5%, 1/4W	81349	RCR07G331JM
R87	Resistor, Fixed, Composition, 47K ±5%, 1/4W	81349	RCR07G473JM
R88	Resistor, Fixed, Composition, 390K ±5%, 1/4W	81349	RCR07G394JM
R89	Resistor, Fixed, Composition, 47K ±5%, 1/4W	81349	RCR07G473JM
R90	Resistor, Fixed, Composition, 100 Ohm ±5%, 1/4W	81349	RCR07G101JM
R91, R92	Resistor, Fixed, Composition, 47K ±5%, 1/4W	81349	RCR07G473JM
R93	Resistor, Fixed, Composition, 10K ±5%, 1/4W	81349	RCR07G103JM
R94	Resistor, Fixed, Composition, 12K ±5%, 1/4W	81349	RCR07G123JM
R95 to R100	Resistor, Fixed, Composition, 100K ±5%, 1/4W	81349	RCR07G104JM
R101	Not Used		
R102	Resistor, Variable, 10K	14304	R-2228
R103	Resistor, Fixed, Composition, 15K ±5%, 1/4W	81349	RCR07G153JM
R104	Not Used		
R105	Resistor, Fixed, Composition, 150K ±5%, 1/4W	81349	RCR07G154JM
R106	Resistor, Fixed, Composition, 470 Ohm ±5%, 1/4W	81349	RCR07G471JM
R107	Resistor, Fixed, Composition, 2.2K ±5%, 1/4W	81349	RCR07G222JM
R108	Resistor, Fixed, Composition, 1K ±5%, 1/4W	81349	RCR07G102JM
R109	Resistor, Fixed, Composition, 56 Ohm ±5%, 1/4W	81349	RCR07G560JM
R110	Resistor, Fixed, Composition, 30 Ohm ±5%, 1/4W	81349	RCR07G300JM
R111	Resistor, Fixed, Composition, 39 Ohm ±5%, 1/4W	81349	RCR07G390JM
R112	Resistor, Fixed, Composition, 270 Ohm ±5%, 1/4W	81349	RCR07G271JM
R113	Resistor, Fixed, Composition, 51 Ohm ±5%, 1/4W	81349	RCR07G510JM
R114	Resistor, Fixed, Composition, 22K ±5%, 1/4W	81349	RCR07G510JM
T1	Not Used		
T2	Transformer, 600 ohm, Audio	14304	6628-0572
TP1	Test Point, Brown	14304	J-0071
TP2	Test Point, Red	14304	J-0066
TP3	Test Point, Orange	14304	J-0069
TP4	Test Point, Yellow	14304	J-0070
TP5	Test Point, Green	14304	J-0068
TP6	Test Point, Blue	14304	J-0072
TP7	Test Point, Violet	14304	J-0073

Table 1. 1A1A5 Maintenance Parts List (Continued)

Ref. Desig.	Name & Description	Mfr. Code	Part Number
TP8	Test Point, Gray	14304	J-0074
TP9	Test Point, White	14304	J-0065
U1	Integrated Circuit, Quad 2-Input NAND Gate, CD4011AE	14304	IC-0136
U2	Integrated Circuit, Hex Inverter, CD4069BE	14304	IC-0387
U3	Integrated Circuit, Quad 2-Input NOR Gate, CD4001AE	14304	IC-0135
U4	Integrated Circuit, BDC-to-Decimal Decode, CD4028AE	14304	IC-0257
U5	Integrated Circuit, Triple 2-Channel Multiplexer, CD4053BE	14304	IC-0384
U6-U8	Not Used		
U9	Integrated Circuit, Triple 3-Input AND Gate, CD4073BE	14304	IC-0390
U10	Integrated Circuit, Triple 3-Input NAND Gate, CD4023AE	14304	IC-0142
U11	Mixer, Doubly Balanced	14304	6628-0666

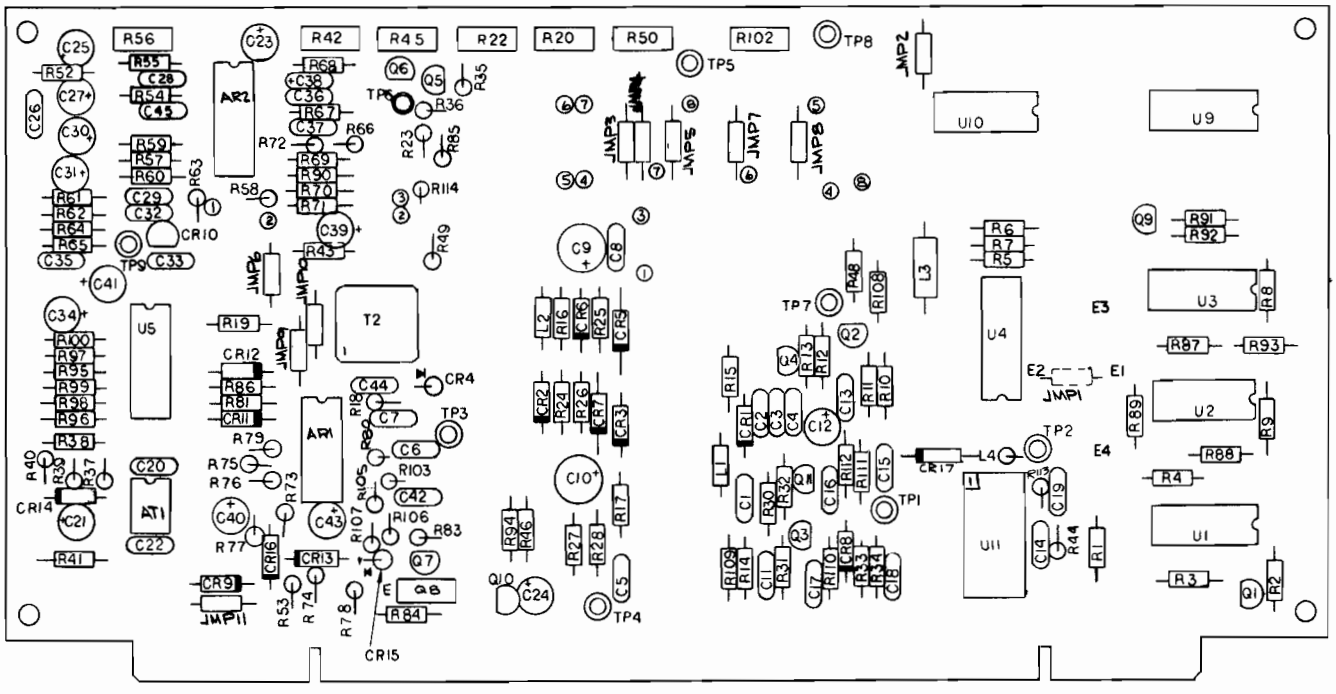
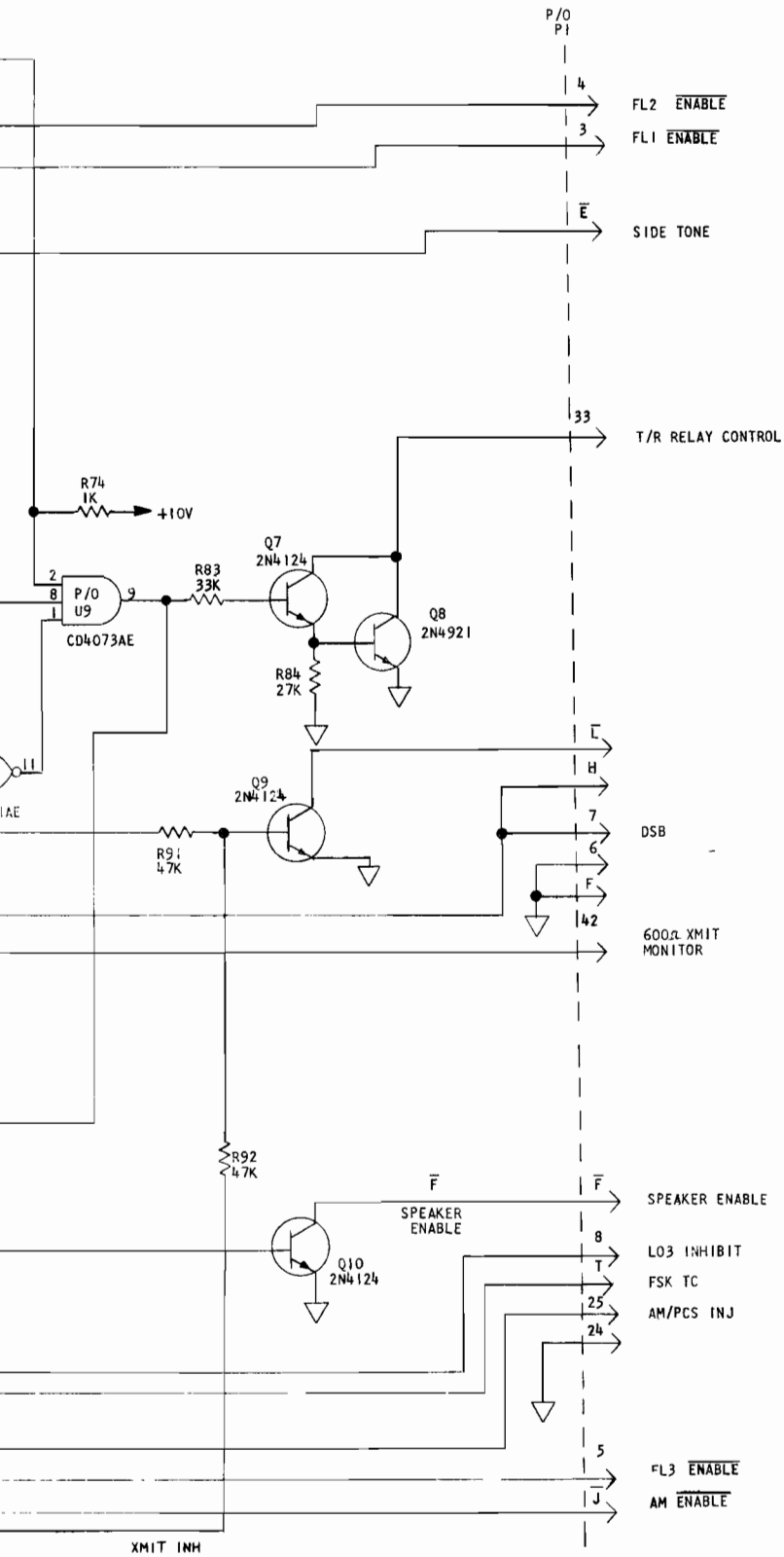


Figure 6. 1A1A5 Component Locations



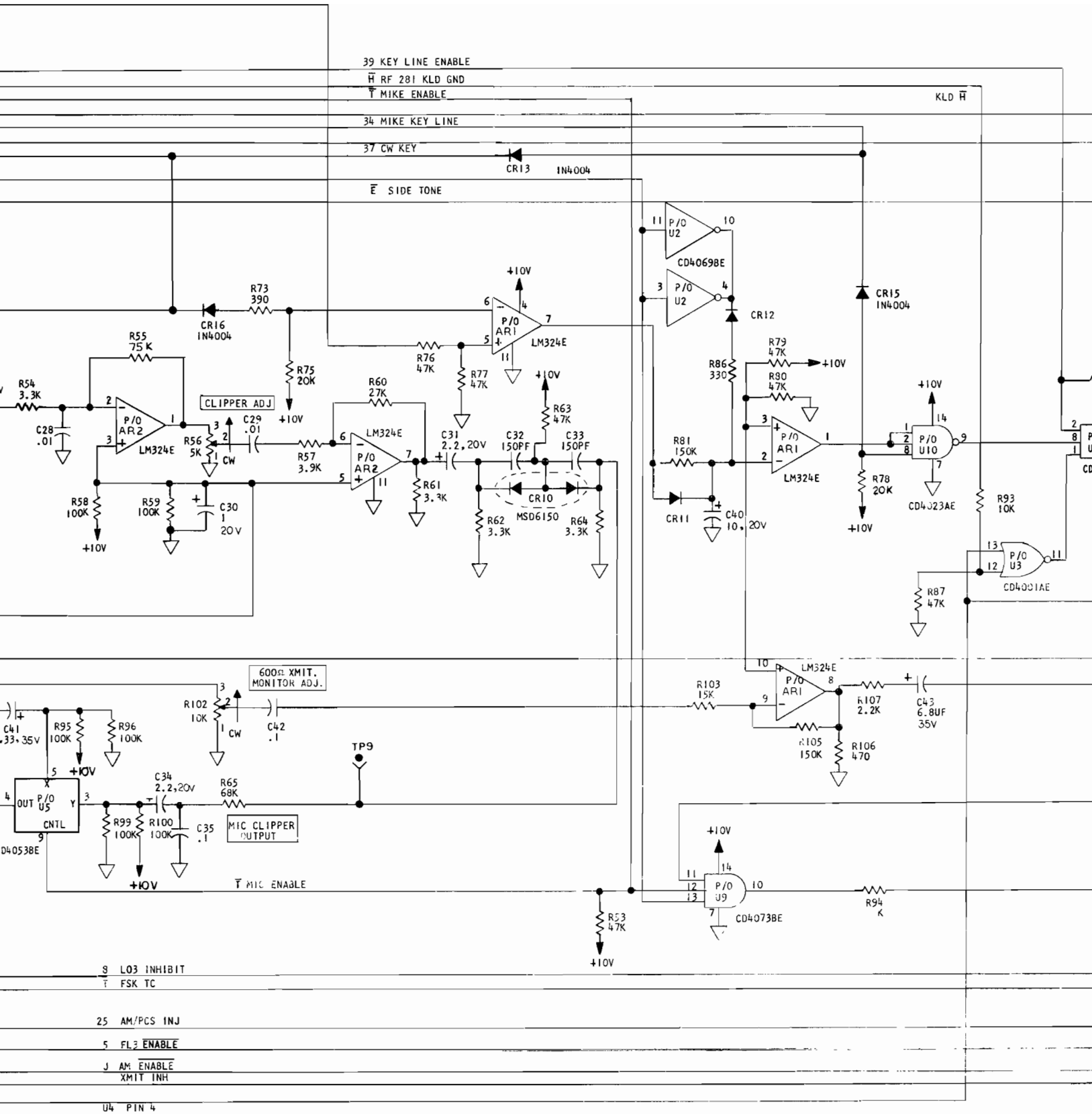
NOTES:

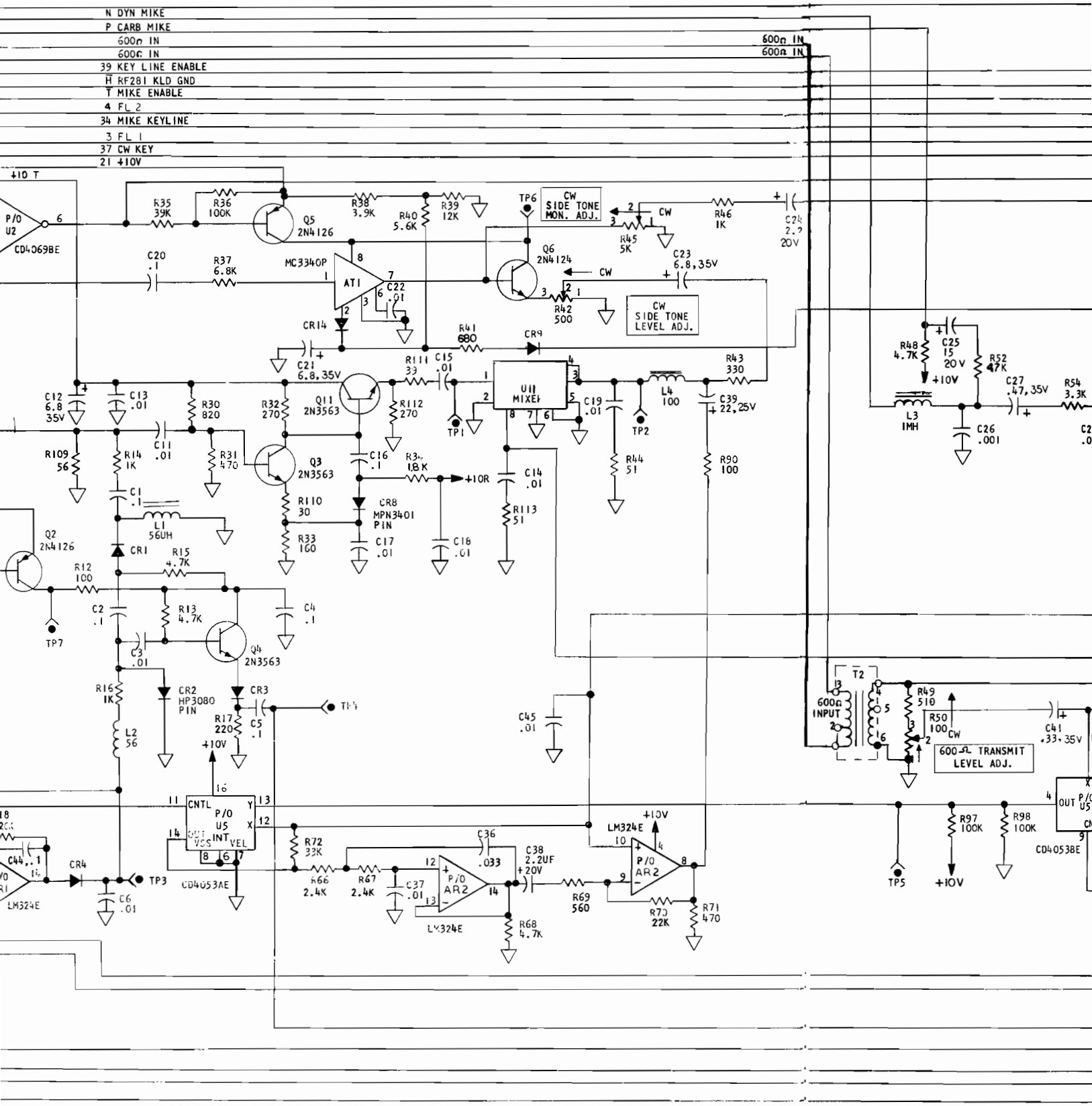
1. UNLESS OTHERWISE SPECIFIED:
   ALL RESISTORS ARE IN OHMS, 1/4W, ±5%.
   ALL CAPACITORS ARE IN MICROFARADS.
   ALL INDUCTORS ARE IN MICROHENRIES; ALL DIODES ARE IN4454.
2. R20 IS PCS CARRIER ADJ.
   R22 IS AM CARRIER ADJ.
3. U5, CD4053BE IS A TRIPLE 2 CHANNEL MUX.
   AT1, MC3340P IS AN ELECTRONIC ATTENUATOR.
4. A. JUMPER IS NORMALLY INSTALLED BETWEEN E1 AND E2 EXCEPT FOR RF-230M.
   B. JUMPER IS INSTALLED BETWEEN E1 AND E3 WHEN CW FILTER IS INSTALLED AS FL-2.
   C. JUMPER IS INSTALLED BETWEEN E1 AND E4 WHEN NARROWBAND FSK FILTER IS INSTALLED AS FL-2.

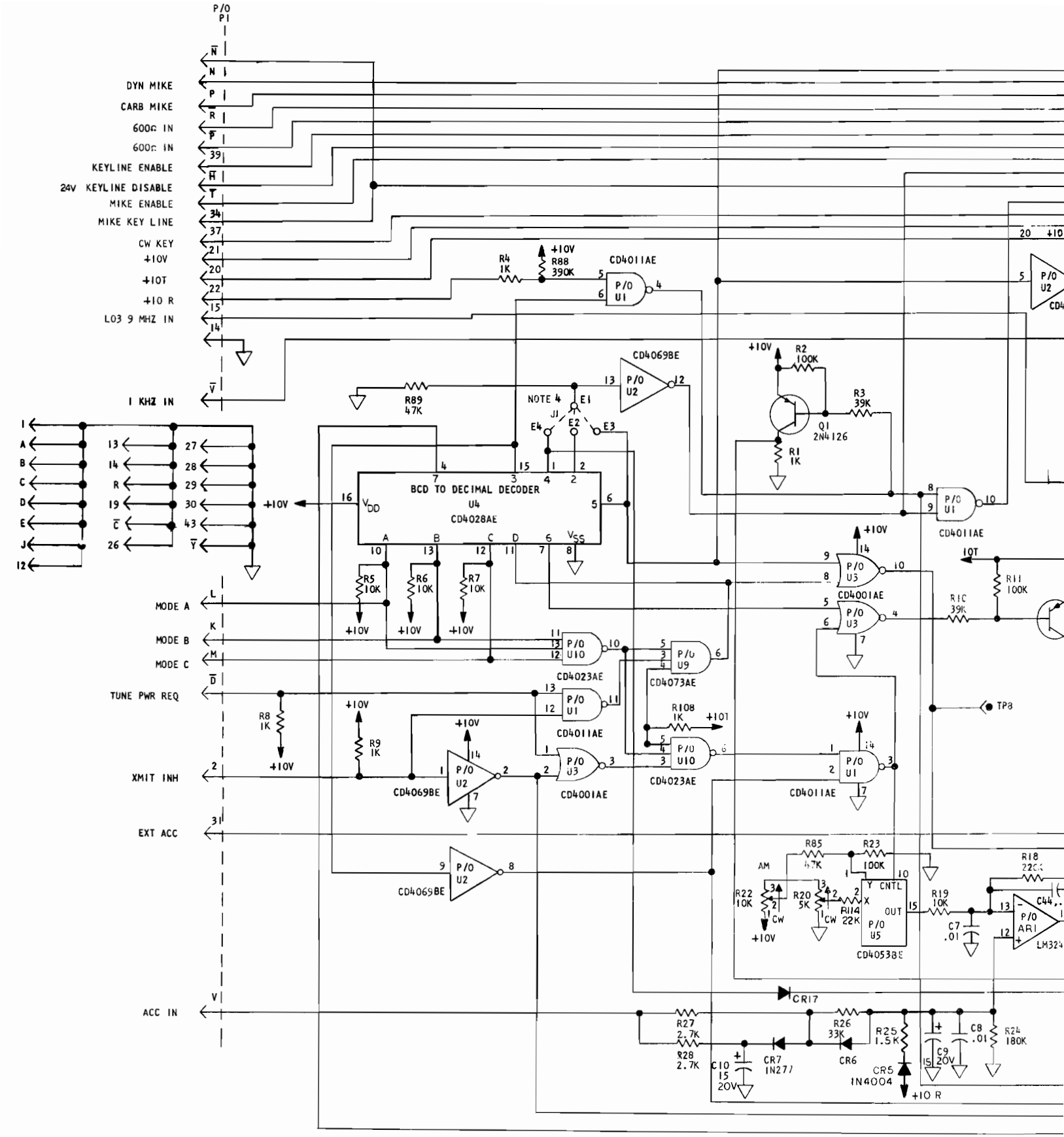
TRUTH TABLE

MODE	C	B	A
USB	0	0	1
LSB	0	1	0
AM	0	1	1
AFSK	1	0	0
CW	1	0	1
PCS	1	1	0
INHIBIT	1	1	1

Figure 7. 1A1A5 Processor PC Board Schematic Diagram, 6628-9060


39 KEY LINE ENABLE
H RF 281 KLD GND
T MIKE ENABLE
KLD H
34 MIKE KEY LINE
37 CW KEY
CR13 IN4004
E SIDE TONE
CR16 IN4004
R73 390
R75 20K
R55 75K
R54 3.3K
C28 .01
CLIPPER ADJ
R56 5K CW
C29 .01
R57 3.9K
R58 100K
R59 100K
C30 1 20V
+10V
LM324E
P/O AR2
R60 27K
C31 2.2,20V
C32 150PF
C33 150PF
R63 47K
R76 47K
R77 47K
R61 3.3K
R62 3.3K
R64 3.3K
CR10 MSD6150
P/O AR1
CD4069BE
P/O U2
CR12
CR15 IN4004
R79 47K
R80 47K
R86 330
R81 150K
CR11
C40 10, 20V
R78 20K
P/O U10
CD4023AE
R93 10K
P/O U3
CD4001AE
R87 47K
600Ω XMIT. MONITOR ADJ.
R102 10K CW
C42 .1
C41 .33, 35V
R95 100K
R96 100K
TP9
R103 15K
R107 2.2K
C43 6.8UF 35V
R105 150K
R106 470
C34 2.2,20V
R65 68K
MIC CLIPPER OUTPUT
R99 100K
R100 100K
C35 .1
P/O U5 CNTL
CD4053BE
T MIC ENABLE
P/O U9
CD4073BE
R94 K
R53 47K
8 LO3 INHIBIT
T FSK TC
25 AM/PCS INJ
5 FL3 ENABLE
J AM ENABLE
XMIT INH
U4 PIN 4

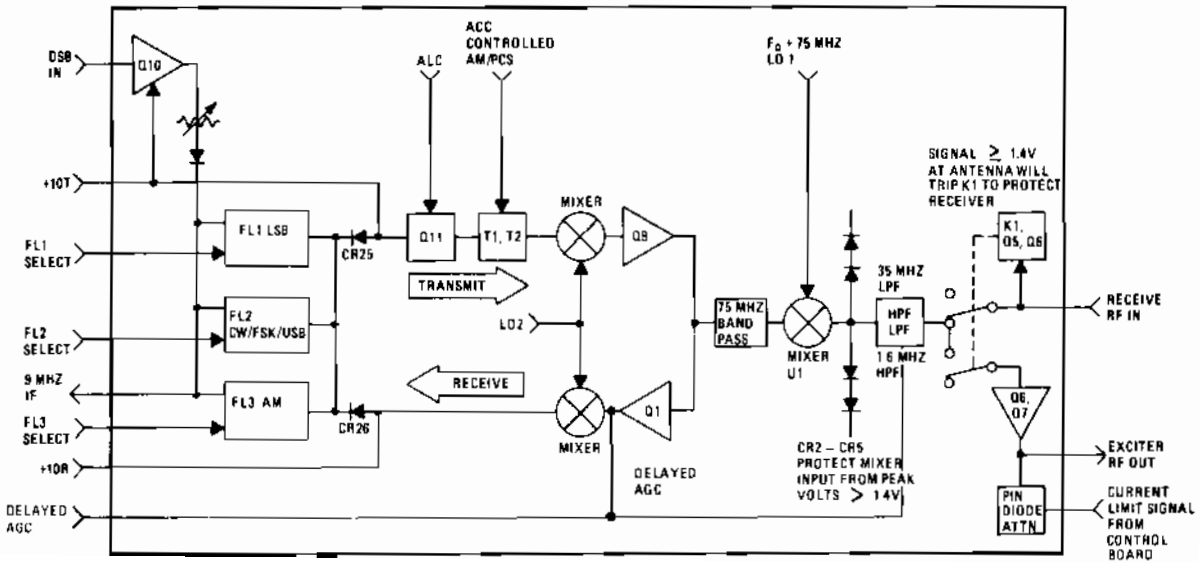

N DYN MIKE
P CARB MIKE
600Ω IN
600Ω IN
39 KEY LINE ENABLE
H RF281 KLD GND
T MIKE ENABLE
4 FL 2
34 MIKE KEYLINE
3 FL 1
37 CW KEY
21 +10V
600Ω IN
600Ω IN
+10 T
P/O U2 CD4069BE
R35 39K
R36 100K
Q5 2N4126
R38 3.9K
R40 5.6K
R39 12K
TP6
CW SIDE TONE MON. ADJ.
R45 5K
R46 1K
C24 2.2 20V
C20 .1
R37 6.8K
MC3340P
AT1
C22 .01
Q6 2N4124
C23 6.8,35V
R42 500
CW SIDE TONE LEVEL ADJ.
CR14
R41 680
CR9
C21 6.8,35V
R111 33
C15 .01
U11 MIXER
R43 330
L4 100
C39 22,25V
R48 4.7K
C25 15 20V
R52 47K
+10V
C27 .47,35V
R54 3.3K
L3 1MH
C26 .001
C12 6.8 35V
C13 .01
R30 820
R32 270
Q11 2N3563
R112 270
TP1
TP2
C19 .01
R44 51
R90 100
R109 56
R14 1K
C11 .01
R31 470
Q3 2N3563
C16 .1
R34 1.8K
+10R
C14 .01
R113 51
R110 30
CR8 MPN3401 PIN
C17 .01
C18 .01
R33 160
L1 56UH
Q2 2N4126
CR1
R15 4.7K
R12 100
C2 .1
R13 4.7K
C4 .1
TP7
C3 .01
Q4 2N3563
R16 1K
CR2 HP3080 PIN
CR3
TP4
R17 220
C5 .1
L2 56
+10V
C45 .01
T2
600Ω INPUT
R49 510
R50 100 CW
C41 .33,35V
600Ω TRANSMIT LEVEL ADJ.
CNTL
P/O U5 INT
VEL
CD4053AE
R72 33K
C36 .033
C38 2.2UF +20V
LM324E
+10V
R97 100K
R98 100K
CD4053BE
C44 .1
CR4
TP3
LM324E
C6 .01
R66 2.4K
R67 2.4K
C37 .01
P/O AR2
LM324E
R68 4.7K
R69 560
R70 22K
R71 470
TP5
+10V


P/O P1
DYN MIKE
CARB MIKE
600Ω IN
600Ω IN
KEYLINE ENABLE
24V KEYLINE DISABLE
MIKE ENABLE
MIKE KEY LINE
CW KEY
+10V
+10T
+10 R
L03 9 MHZ IN
1 KHZ IN
MODE A
MODE B
MODE C
TUNE PWR REQ
XMIT INH
EXT ACC
ACC IN
+10V
+10T
+10 R
R4 1K
R88 390K
CD4011AE
P/O U1
R89 47K
CD4069BE
P/O U2
NOTE 4
J1
E1
E2
E3
E4
R2 100K
R3 39K
Q1 2N4126
R1 1K
BCD TO DECIMAL DECODER
U4
CD4028AE
R5 10K
R6 10K
R7 10K
R8 1K
R9 1K
CD4023AE
P/O U10
CD4073AE
P/O U9
CD4001AE
P/O U3
R108 1K
R11 100K
R10 39K
TP8
R85 47K
R23 100K
R22 10K
R20 5K
R114 22K
CW
AM
CD4053BE
P/O U5
CNTL
OUT
R19 10K
C7 .01
P/O AR1
LM324
C44
R18 22K
CR17
R27 2.7K
R28 2.7K
C10 15 20V
CR7 IN277
R26 33K
CR6
R25 1.5K
CR5 IN4004
C9 20V
C8 .01
R24 180K

UNIT INSTRUCTIONS

MIXER BOARD

1A1A6



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1. GENERAL INFORMATION

The 1A1A6 Mixer PC Board performs all of the major frequency conversion functions accomplished within the RF-2301. In the transmit signal path, the double sideband 9 MHz input from the balanced modulator on the Processor PCB is selectively filtered to eliminate the unwanted sideband, and two frequency conversion functions translate the 9 MHz input first to a 75 MHz intermediate frequency, and then to the final operating frequency. Conversely, receive signals from the PA Filter are translated from the operating frequency, up to the 75 MHz 1st IF, then to the 9 MHz 2nd IF, and filtered before routing to the Audio IF PC Board as a 9 MHz IF signal.

In addition, the ALC control voltage input provides a 30 dB control range for transmit signal Automatic Level Control, and the automatically level controlled AM/PCS input from the Processor is recombined in the 9 MHz path on this board. Power limit control information from the Power Amplifier controls the final operating frequency RF Output to the PA Control Board. Receiver protection is also incorporated at this point to automatically react in the presence of excessive signal input voltages. Delayed AGC input from the Audio IF Board provides up to 36 dB attenuation with 1V at the antenna.

2. TECHNICAL CHARACTERISTICS

Power Requirements:

+13.8 Vdc	P1-20
+10T	P1-17
+10R	P1-W

Signal Inputs:

REC RF	P1-42	0.5 uV @ fo
LO1	P1-M	+7 dBm
LO2	P1-Z	+7 dBm
DSB IN	P1-J	9 MHz –20 dBm

Signal Outputs:

EXCITER RF OUT	P1-38	Xmit fo at +5 dBm
9 MHz IF	P1-B	Receiver IF Signal

Control Inputs:

ALC	P1-16	+1.5 8 Vdc from 1A1A3
DELAYED AGC	P1-35	0 – 6 Vdc from 1A1A4
CURRENT LIMIT	P1-36	0 – 0.7 Vdc from 1A1A3

Control Inputs (continued):

FL1 SELECT	P1-D	+0.7V = Select
FL2 SELECT	P1-L	+0.7V = Select
FL3 SELECT	P1-F	+0.7V = Select

3. SEMICONDUCTOR COMPLEMENT

REF. DESIG.	TYPE	DESCRIPTION
CR1	5082-3080	Diode, PIN
CR2 -CR5	1N4933	Diode, Signal
CR6, CR7	MPN3401	Diode, Pin
CR8	5082-3080	Diode, Pin
CR9–CR22	1N4454	Diode, Signal
CR23	MPN3401	Diode, Pin
CR24–CR26	1N4454	Diode, Signal
CR27	1N4004	Diode, Rectifier
CR28, CR29	1N4454	Diode, Signal
CR30	5082-3080	Diode, Pin
CR31	1N4004	Diode, Rectifier
Q1	2N5486	Transistor, NPN
Q2	3N187	Transistor, Dual Gate
Q3, Q4	2N4124	Transistor, NPN
Q5	MPS-A13	Transistor NPN Darlington Pair
Q6	2N5179	Transistor, NPN
Q7	2N3866	Transistor, NPN
Q8	2N4124	Transistor, NPN
Q9	2N5179	Transistor, NPN
Q10	2N4126	Transistor, PNP
Q11	3N187	Transistor, Dual Gate
Q12- Q15	2N4124	Transistor, NPN
U1, U2	6628-0666	Mixer, Doubly Balanced

4. CIRCUIT DESCRIPTION

Figure 2 and 3 are detailed diagrams showing all active mixer board elements and related inputs and outputs. Several other drawings are included, in addition to the complete schematic at the end of the section, as an aide to understanding transmit and receive signal paths and related components.

The Mixer PC Board performs two frequency conversion functions in both the transmit and the receive operating modes. In the transmit mode, the 9 MHz double sideband input from the Processor PC Board is filtered to select the desired spectral element, and converted in two mixing steps to the desired operating frequency. In the receive mode, the operating frequency signal input from the antenna, via filter elements in 1A1A1 or 1A1A2, is filtered and processed down in two mixing steps to a 9 MHz IF output frequency for final detection

at the Audio IF PC Board. Each of these functions will be traced in detail in subsequent paragraphs; the transmit signal path will be discussed first.

4.1 Transmit Function

This discussion will presuppose that the RF-2301 is keyed, and that a transmit audio signal is present at a level sufficient to produce full rated output. With these conditions, a nominal - 20 dBm signal level would be present at P1-J, the DSB input from the Processor PC Board.

The DSB input signal is fed via C54 to the base of Q10. R44 in the Q10 emitter circuit controls the gain of this stage, and is adjusted to provide the desired --14 dBm drive level at TP4, the input to the first mixer. This adjustment must be made with R47 and the ALC system set for maximum gain.

The desired filter, FL1, FL2 or FL3, is selected by a low logic level on the appropriate filter select control line. As an example, to select FL1, a low logic level at P1-D (from 1A1A5) would bias Q3 and Q4 OFF. With Q3 and Q4 OFF, CR9 and CR10 would be forward biased and the signal path through FL1 would be complete. Note also that Q12, Q13, Q14, and Q15 would be biased ON by the high logic levels at P1-E and P1-F. With these control transistors ON, the voltages at their collectors would drop to approximately 0.7 Vdc and the signal diodes controlling FL2 and FL3 would be turned OFF. In addition, Q12 through Q14 would provide a low impedance signal path to ground for the FL2 and FL3 input and output circuits.

Because of the frequency mixing scheme used in the RF-2301, the LSB filter is actually used to select the upper sideband. This means that passing the DSB input through FL1 (designated LSB Filter) will actually select the lower sideband at this point, however, because of the mixing scheme, at the 2nd mixer output this sideband will actually appear in the operating frequency output spectrum as the upper sideband. Conversely, if the radio were a LSB radio, a USB filter would be installed in the optional filter position (FL2), and with this filter selected, the actual output information would be in lower sideband. Figure 1 shows FL1, FL2, and FL3 response curves to demonstrate spectral relationships at this point.

There are two signal paths at the filter output (with respect to the transmit signal); one is through CR25 and one is through CR26. These signal diodes function as transmit and receive mode gates. In the transmit mode, CR25 is forward biased by +10T through R39 and L23. CR26 is forward biased in the receive mode by +10R through R53.

The transmit output thru CR25 and C49 to Q11 is a 9 MHz signal containing only the selected sideband (or other information). This stage is ALC-controlled and has a 25 dB gain control range. This means that the signal level at TP4, the mixer input,

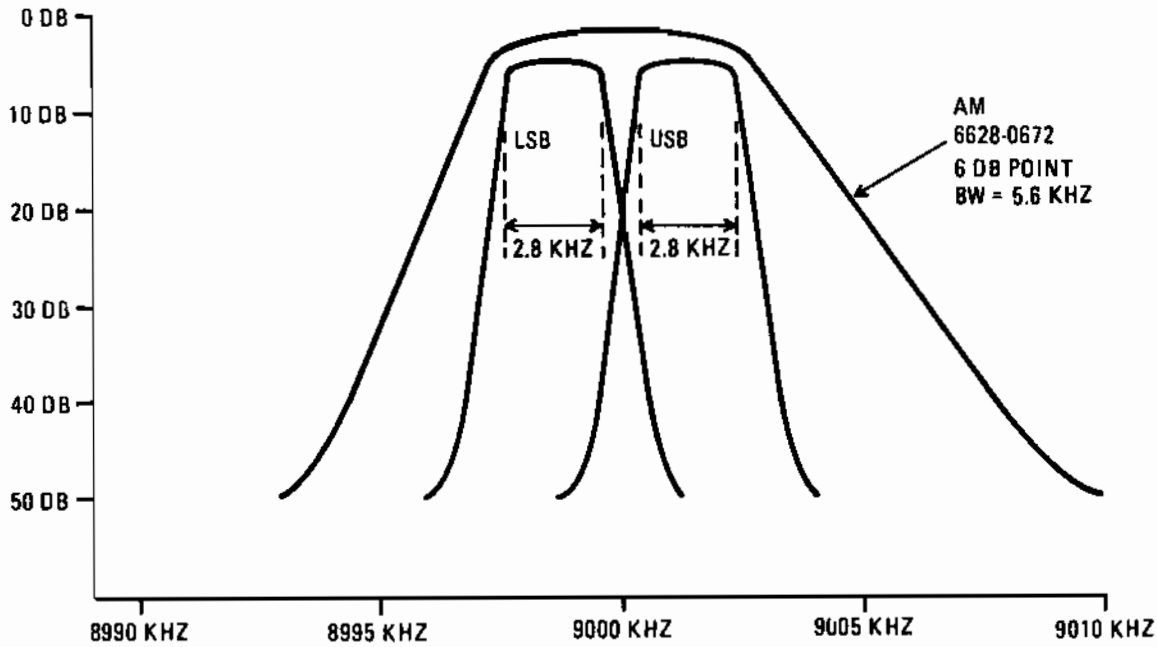


Figure 1. FL1, FL2, and FL3 Spectral Relationships

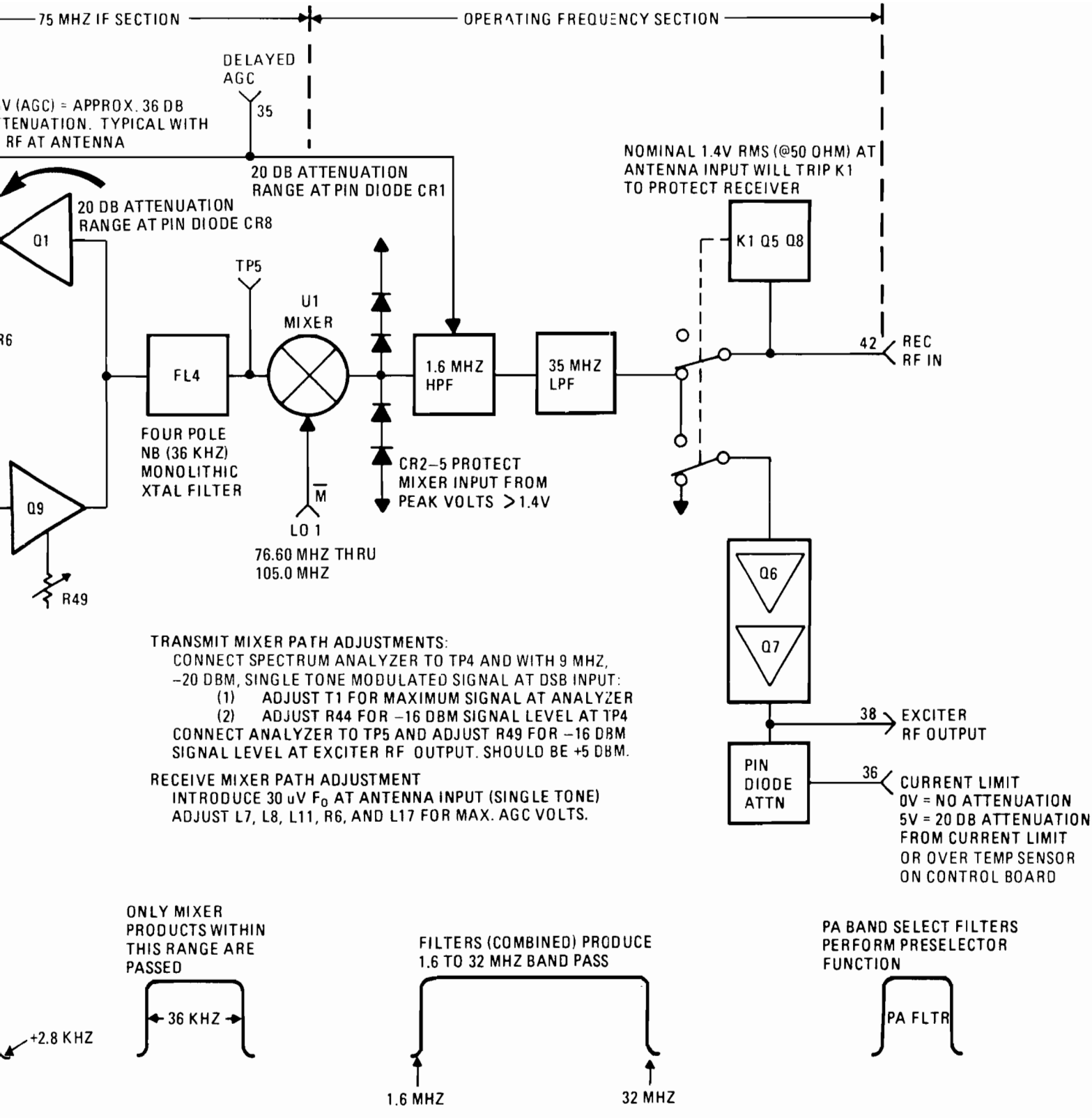
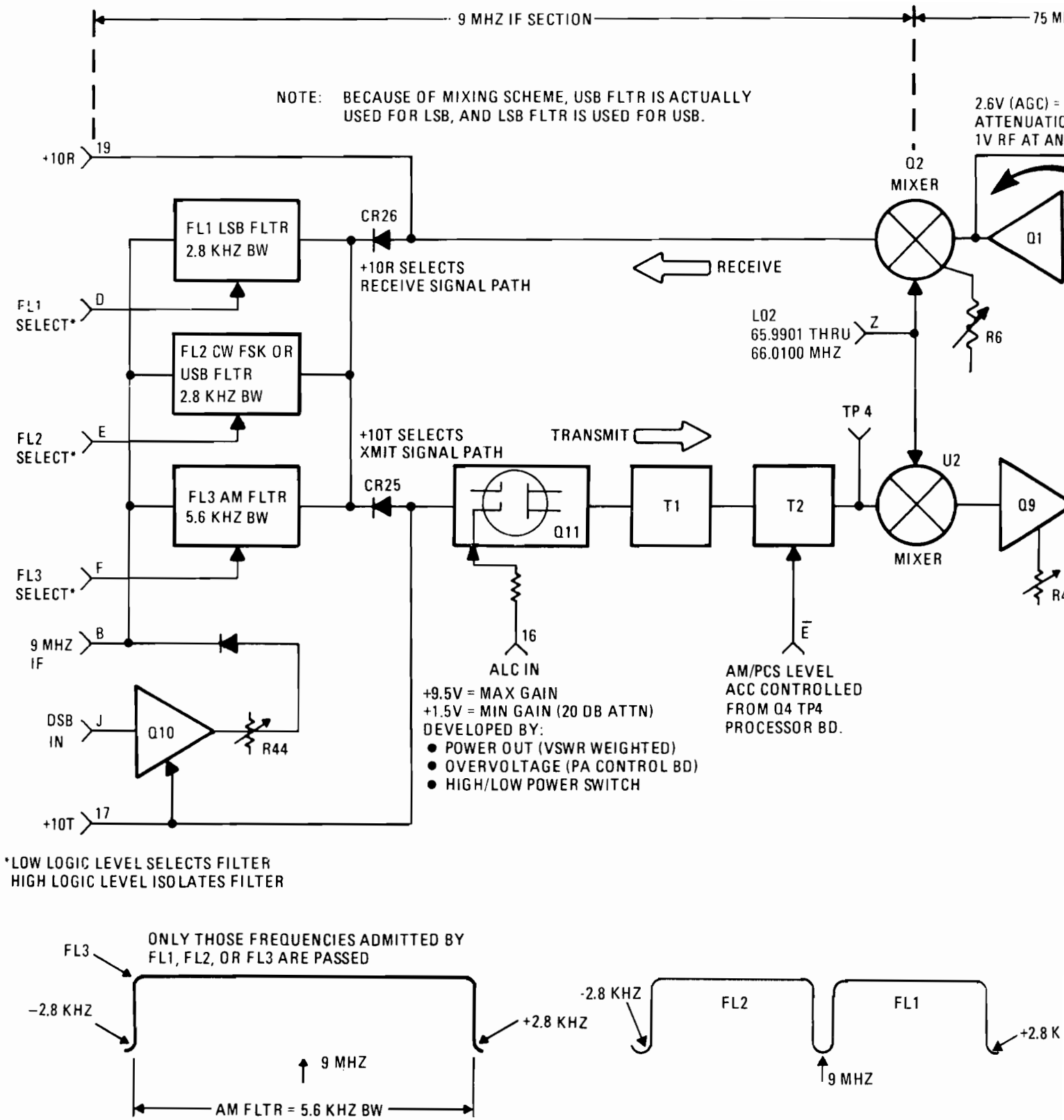


Figure 2. 1A1A6 Mixer Board, Functional Diagram


9 MHZ IF SECTION
75 M
NOTE: BECAUSE OF MIXING SCHEME, USB FLTR IS ACTUALLY USED FOR LSB, AND LSB FLTR IS USED FOR USB.
2.6V (AGC) =
ATTENUATIO
1V RF AT AN
+10R
19
Q2
MIXER
Q1
FL1 LSB FLTR
2.8 KHZ BW
CR26
+10R SELECTS
RECEIVE SIGNAL PATH
RECEIVE
FL1
SELECT*
D
LO2
65.9901 THRU
66.0100 MHZ
Z
R6
FL2 CW FSK OR
USB FLTR
2.8 KHZ BW
FL2
SELECT*
E
+10T SELECTS
XMIT SIGNAL PATH
TRANSMIT
TP 4
U2
FL3 AM FLTR
5.6 KHZ BW
CR25
Q11
T1
T2
Q9
MIXER
FL3
SELECT*
F
9 MHZ
IF
B
DSB
IN
J
Q10
R44
16
ALC IN
+9.5V = MAX GAIN
+1.5V = MIN GAIN (20 DB ATTN)
DEVELOPED BY:
• POWER OUT (VSWR WEIGHTED)
• OVERVOLTAGE (PA CONTROL BD)
• HIGH/LOW POWER SWITCH
Ē
AM/PCS LEVEL
ACC CONTROLLED
FROM Q4 TP4
PROCESSOR BD.
+10T
17
*LOW LOGIC LEVEL SELECTS FILTER
HIGH LOGIC LEVEL ISOLATES FILTER

FL3
ONLY THOSE FREQUENCIES ADMITTED BY
FL1, FL2, OR FL3 ARE PASSED
-2.8 KHZ
+2.8 KHZ
9 MHZ
AM FLTR = 5.6 KHZ BW
-2.8 KHZ
FL2
FL1
+2.8 K
9 MHZ

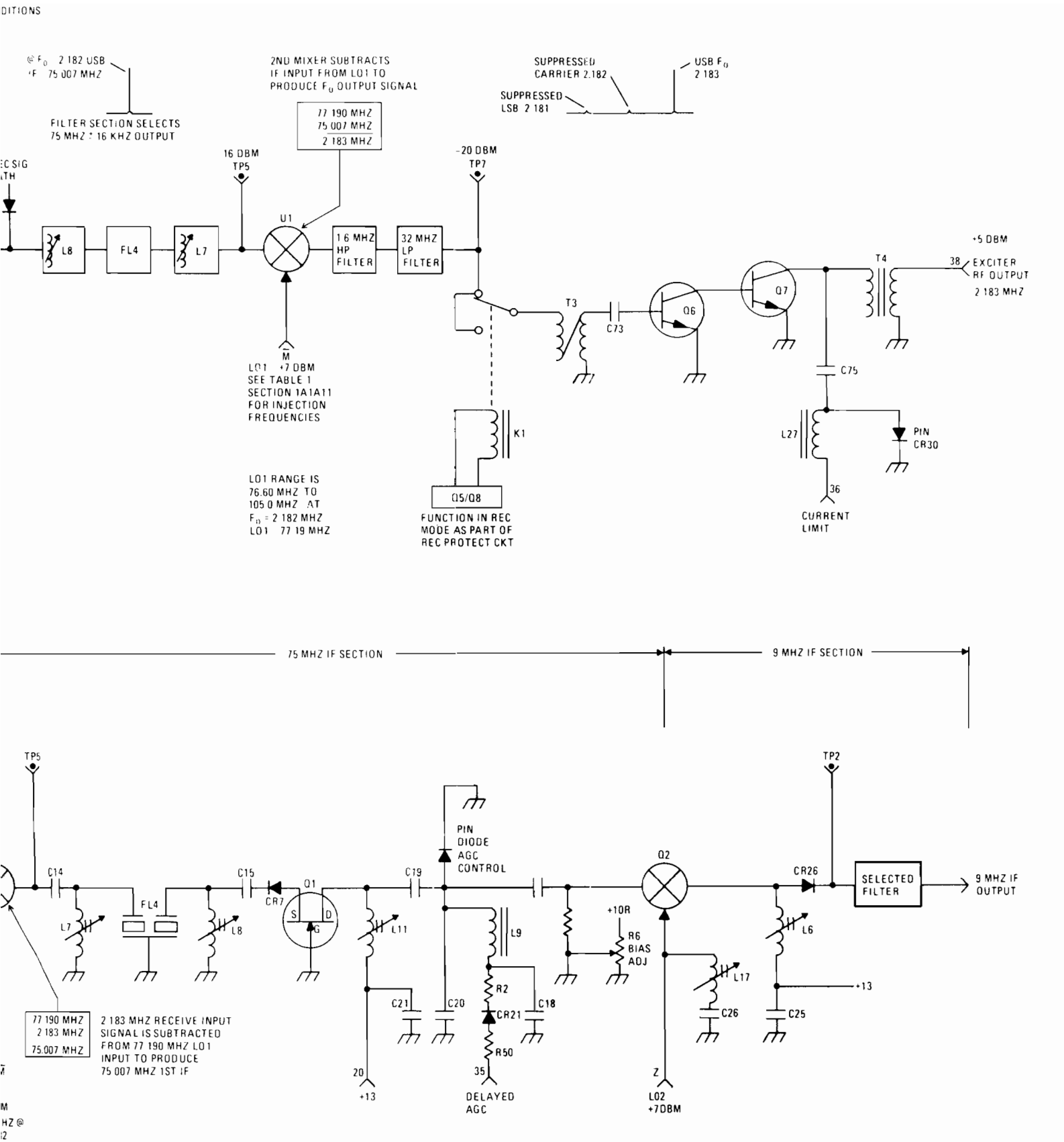
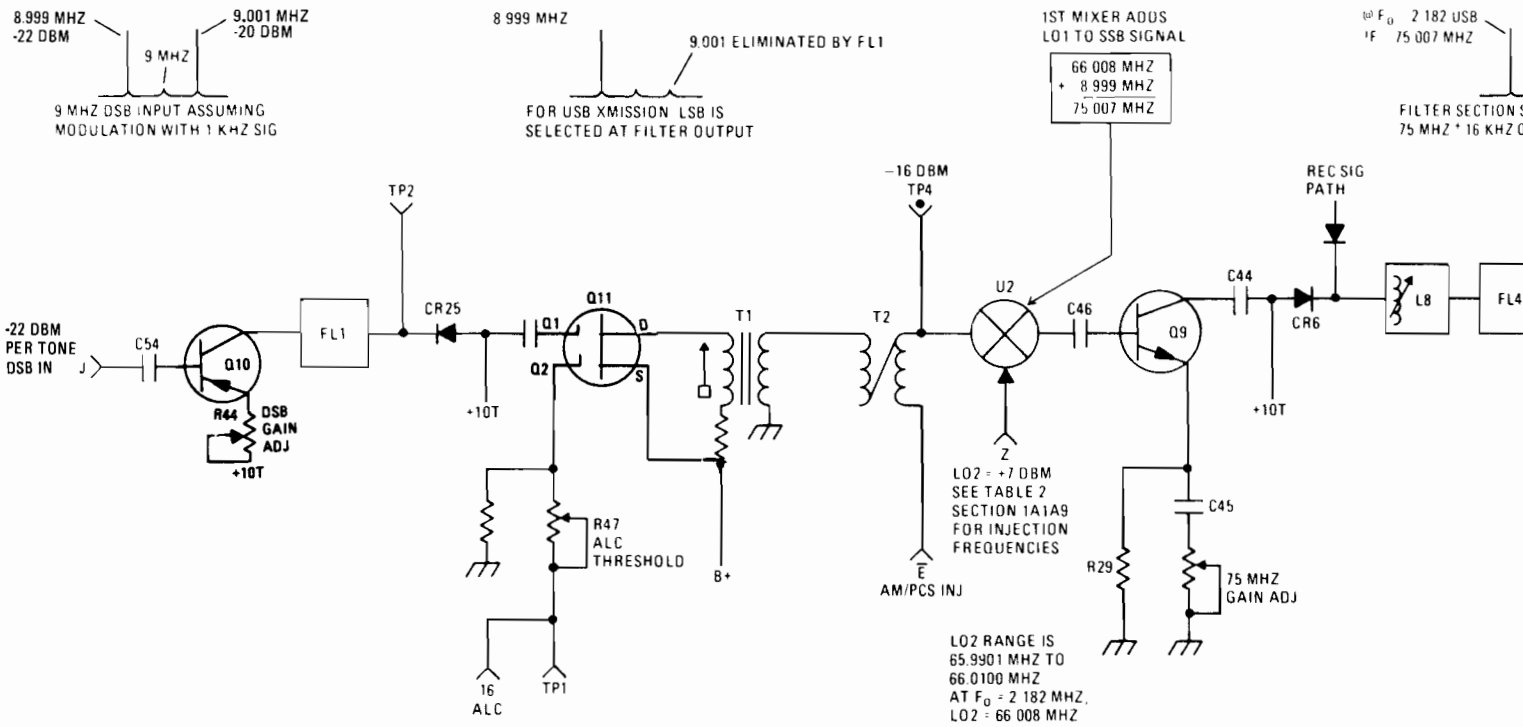


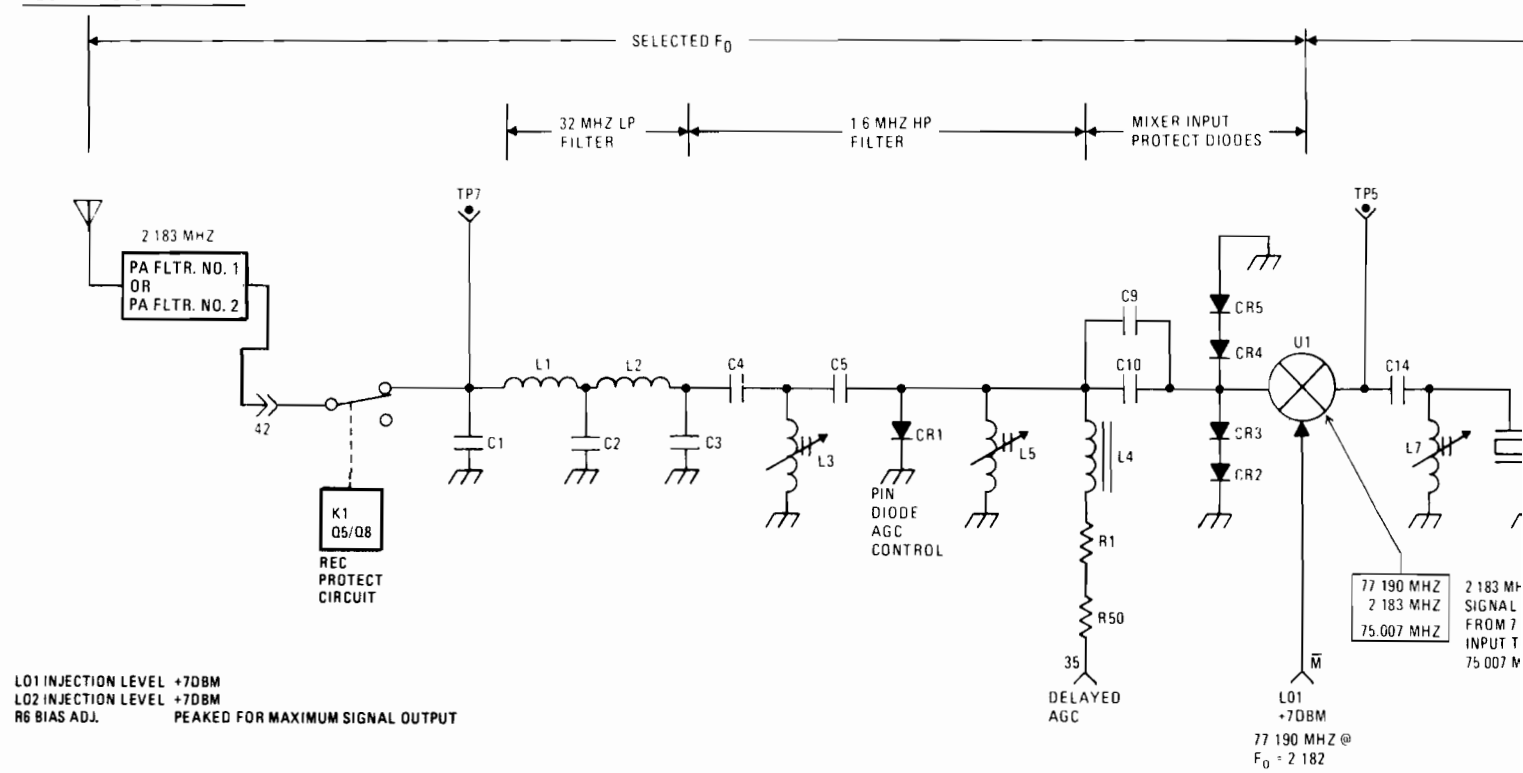
Figure 3. 1A1A6 Transmit and Receive, Mixer Signal Path Detail

TRANSMIT SIGNAL PATH

THIS MIXING SCHEME DEMONSTRATION PRESUPPOSES USB MODE SELECTION 2 182 MHZ F_0, AND MODULATION WITH 1 KHZ LEVELS IN DBM ARE TYPICAL UNDER THESE CONDITIONS



RECEIVE SIGNAL PATH



LO1 INJECTION LEVEL +7DBM
LO2 INJECTION LEVEL +7DBM
R6 BIAS ADJ. PEAKED FOR MAXIMUM SIGNAL OUTPUT

can be changed from a nominal −16 dBm level with +9V at pin 16 of the PCB, to a level of −41 dBm with +1.5V at the ALC control input. This ALC control voltage is developed on the 1A1A3 PA Control PC Board in response to VSWR, overvoltage, and High/Low Power Control inputs.

T1 tunes the 9 MHz Q11 output to the mixer and is peaked for maximum signal level at this point. When properly setup, the signal level at TP4 should be approximately −14 dBm.

Assuming the transmit audio input to be a pure 1 kHz tone, the signal input to U2 at pins 3 and 4 would be 8.999 MHz (with FL1 selected). The LO2 input at U2-8 would be 66.008 MHz (see table 1 section 1A1A9. The desired mixer product is the additive component, or 75.00 MHz. Note that the signal still appears in the LSB position with respect to the suppressed carrier at this point. The mixer output at pin 1 is coupled to Q9 base by C46. Q9 amplifies this 75 MHz output and provides an adjustable level at the 2nd mixer input. L7 and L8 are tuned in the receive mode, and together with 4 pole crystal filter FL4, they discriminate very sharply against out-of-band signals as shown in figure 4. Note that if LSB operation were used, that the 66.008 MHz +9.001 MHz mixer output (75.009 MHz) would still be within the band pass of this filter.

The 75 MHz (actually 75.007 MHz in our example) input at U1 pins 3 and 4 is mixed with the LO1 input to produce the final output frequency. The LO1 input at U1-8 is at a frequency of 77.19 MHz, (Again assuming F_O = 2.182 MHz and no manual HOP switching or programming). In a subtractive mixing process with 75.007 MHz, this would produce an actual USB output frequency of 2.183 MHz. This mixing scheme is used to provide maximum suppression of spurious radiation.

CR2 – CR5 function in the receive mode to protect the mixer input. The high and low pass filter sections are tuned in the receive mode and function in the transmit mode to suppress undesired energy elements. K1 contacts are normally closed. K1 can be energized only in the receive mode (see +10R at Q5), and functions as a high input signal level receiver protection device. In the transmit mode the high and low pass filtered mixer output is routed via a 5.5 dB attenuator circuit to broad band amplifier Q6 and Q7. The Q7 output is level controlled by pin diode CR30 at the output. With 0 volts at the P1-36 current limit input, CR30 is OFF and will not attenuate the output signal. With +5V at this same point, CR30 will be full ON and attenuate the output signal 20 dB to protect the output. The transmit signal path output is via T4 and P1-38 to the PA Control PC Board. The nominal output level is +5 dBm at full rated output.

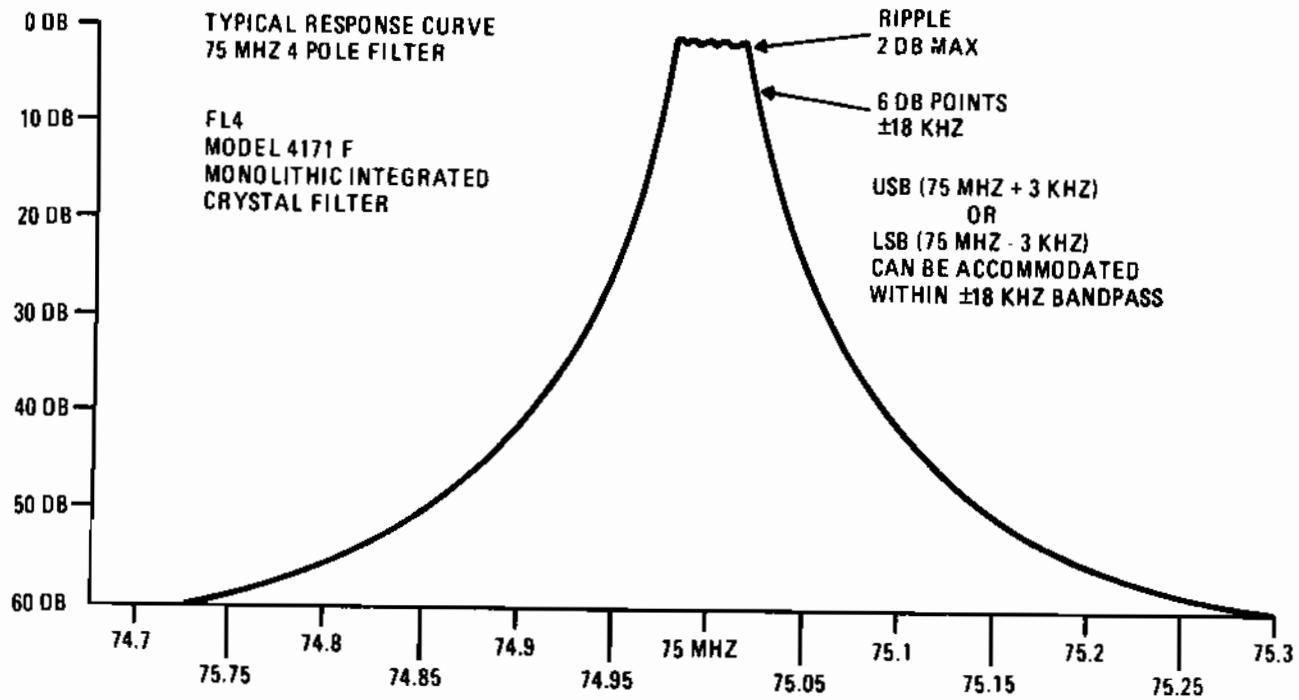


Figure 4. FL4 Band Pass Characteristics

4.2 Receive Function

The receive signal enters the Mixer PC Board at P1-42, as shown in figure 3. This input is directly from the antenna/antenna coupler system, and the band selected PA Filter in the RF-230. There are no active circuit elements that precede introduction of the signal at this point. By maintaining very low losses in these circuits, the need for an RF preamplifier has been eliminated. This system provides excellent dynamic range and eliminates the need for tracked tuned circuits at the input.

In the receive mode, K1 is normally energized by +10R through R65. This voltage biases Q8 on and completes the K1 ground path. However, if Q5 is ON, the bias at Q8 base will be pulled down to approximately 0.3 Vdc, Q8 will be "switched" OFF, and K1 will open. A receive signal sample is coupled via C70 to the detector circuit at the base of Q5. Any RF input signal that exceeds a nominal value of 1.4V rms will automatically de-energize K1 to protect the receiver input.

Normally, the receive signal is routed from P1-42, through the closed contacts of K1, and to the high and low pass filter sections that precede the input mixer. The low pass filter section is fixed tuned. L3 and L5 in the high pass filter section are adjusted at 0.8836 MHz and 1.2338 MHz respectively to produce the typical response curve shown in figure 5.

Diodes CR2 thru CR5 at the mixer input also serve to protect the device from high signal level inputs. Any input that tries to exceed the two diode drops (2 x 0.7V = 1.4V) would be clamped at 1.4V.

Delayed AGC is also used to control RF input signal levels thru Pin diode CR1. This "delayed" AGC voltage will not be present until the AGC level from the Audio IF board exceeds 3.9 Vdc. CR1 exercises a 20 dB control range when activated.

U1 is a double balanced diode mixer having an intercept point of +12 dBm. This wide range mixer in combination with the delayed AGC controlled Pin diode attenuator preceding it, provide a signal input capability of more than a volt without degradation. This type mixer also provides outstanding IM (Inter-Modulation) performance (80 dB for two 5 uV signals at fo +30 and +60 kHz).

The remainder of this receive signal path circuit description will presuppose a 2.182 MHz receive operating frequency, and further assume that the transmitted signal was modulated with a pure 1 kHz note, to produce an actual USB receive frequency of 2.183 MHz.

This 2.183 MHz receive F_O input is subtracted from the 77.190 MHz LO1 input to produce an 75.007 MHz 1st IF output to FL4. See table I in section 1A1A11 for F_O vs LO1 input detail.

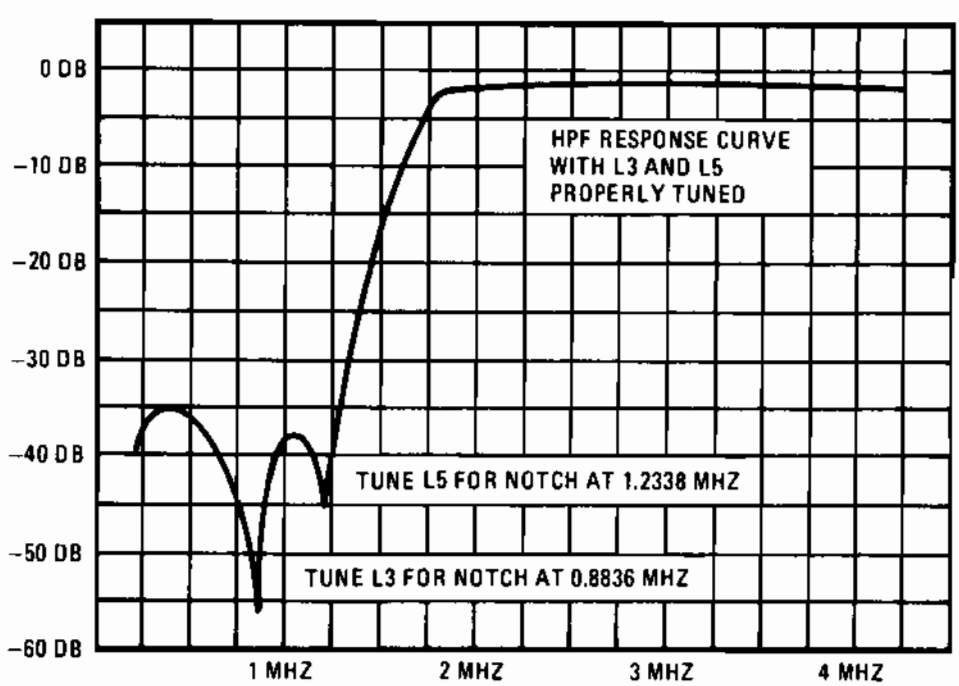


Figure 5. HPF Response Curve

Any other mixer products are sharply discriminated against by FL4 and its related tuned input and output circuits (see figure 4). L7 and L8 are tuned for optimum output at the speaker. FL4 is a four pole narrowband (36 kHz) 75 MHz monolithic crystal filter, and serves to provide a high degree of selectivity before any amplification to maintain the wide dynamic range and IM capability established by the mixer.

The filter output is coupled via CR7 in the receive mode to Q1, the first active element in the receive signal path. This low noise FET amplifier introduces approximately 12 dB of gain at this point to prevent sensitivity degradation. This output is coupled via C19 and C23 to 2nd mixer, Q2. Delayed AGC control is also introduced at this point using Pin diode CR8 for a total 36 dB dynamic control range of the AGC.

Q2, the 2nd mixer, is a dual gate MOSFET, and exhibits IM, cross modulation, and isolation characteristics markably better than bipolar transistor equivalents. L6, L11, and bias adjustment potentiometer R6, are all adjusted for optimum gain and signal-to-noise ratio performance. The 66 MHz LO2 input at Q2 can be peaked by L17 for optimum output. For a receiver frequency of 2.1820 MHz, the LO2 input to Q2, the 2nd mixer, will be 66.008 MHz (see table 2, section 1A1A9), which when mixed with the 75.007 MHz 1st IF input in a subtractive mixing process, will produce the desired 8.999 MHz 2nd IF output to the desired filter.

L6 and C25 actually function as a parallel resonant trap tuned to 9 MHz, and as a consequence present a high impedance to this frequency and serve as a low impedance path to ground for any other mixer components.

The 8.999 MHz IF frequency is routed via CR26 (which is forward biased by +10R through R53/L22) to FL1. Recall that we are assuming USB operation, and as a consequence, FL1 would be selected. As previously explained in the transmit signal path discussion, the LSB filter is used to receive USB because of the mixing scheme. The 8.999 MHz IF output will be passed by LSB filter FL1 (see figure 1), and beat with the 9 MHz carrier frequency on the Audio IF board to detect the transmitter 1 kHz audio note.

5. MAINTENANCE

The 1A1A6 Mixer PC Board can be mounted on an extender card to make all test and adjustment points accessible for maintenance. Figure 6 identifies all significant adjustments on the Mixer PC Board.

CAUTION

Always remove power when removing or installing subassemblies for maintenance.

5.1 Tuning Adjustments

It is not necessary to make any of the following tuning adjustments as part of a routine scheduled maintenance program. These adjustments have been made at the factory and should not require reaccomplishment unless components that relate to the reactive element in question are changed. Most of the circuits are tuned in the receive mode, and as a consequence, should be accomplished first. Test equipment items required for receive signal path adjustments are shown in figure 7.

5.2 High Pass Filter Adjustment

a. With the 1A1A6 PC Board mounted on an extender card as shown, connect the HF Signal Generator output to rear panel RF output connector.

b. Adjust RF Signal Generator for an unmodulated output @ .8836 MHz.

c. Have radio at a frequency of .8826 MHz USB Mode.

d. Monitor TP2 of the 1A1A4 IF Audio Board with a DVM and adjust output of Signal General for a level of just below AGC. (TP2 less than 0.4 Vdc).

e. Monitoring the line audio output with an audio voltmeter, tune L3 for the BEST NULL at this frequency.

f. Adjust Signal Generator for a frequency of 1.2338 MHz and set radio at 1.2328 MHz USB Mode.

g. It will be necessary to drop the level of Signal Generator to remain below AGC.

h. Tune L5 for the BEST NULL at this frequency, again while monitoring the line audio output with an audio voltmeter.

i. Repeat steps e and f.

j. This completes HPF adjustment. Reconfigure for normal operation or continue with adjustment procedure.

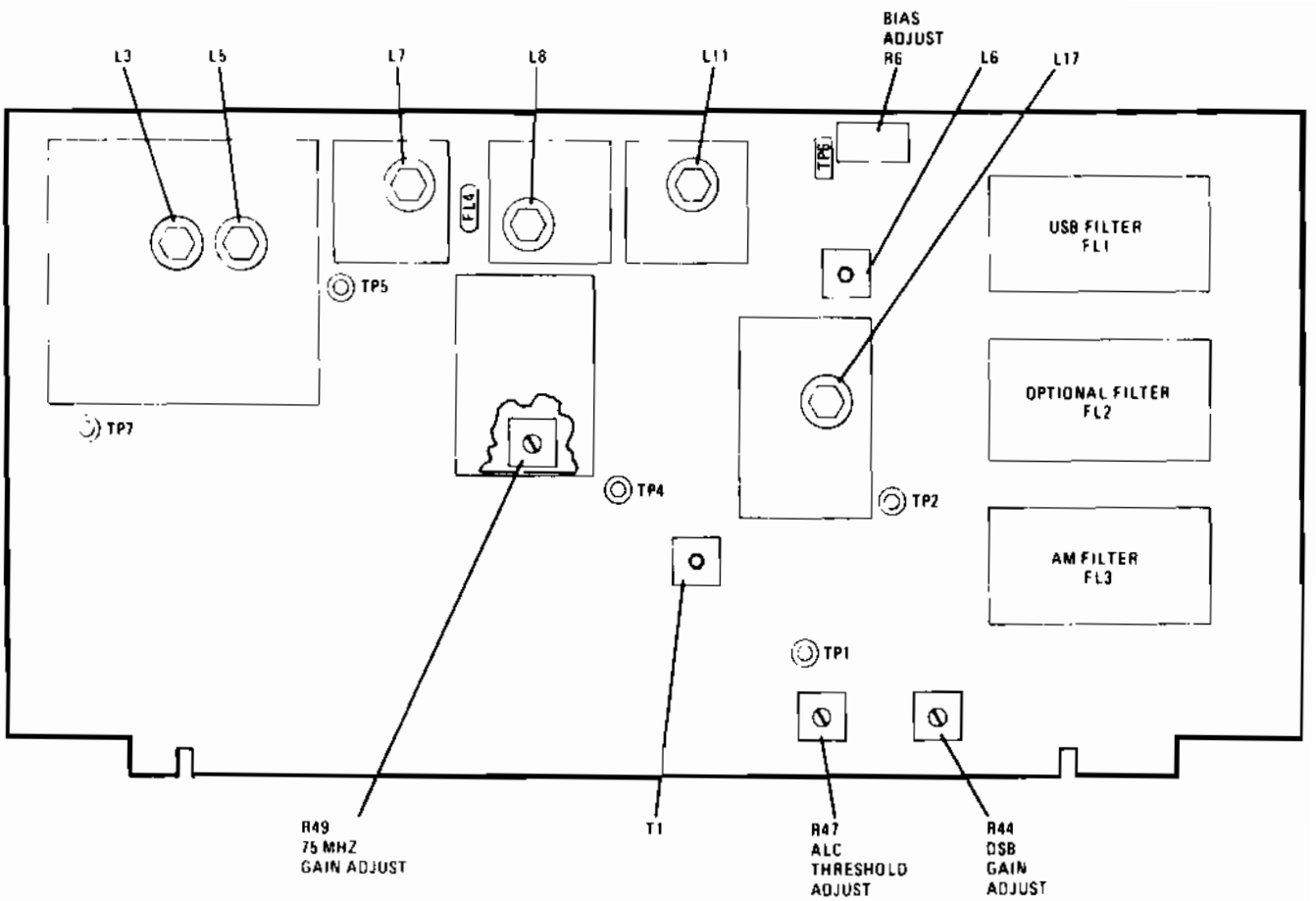


Figure 6. Mixer Adjustments and Test Points

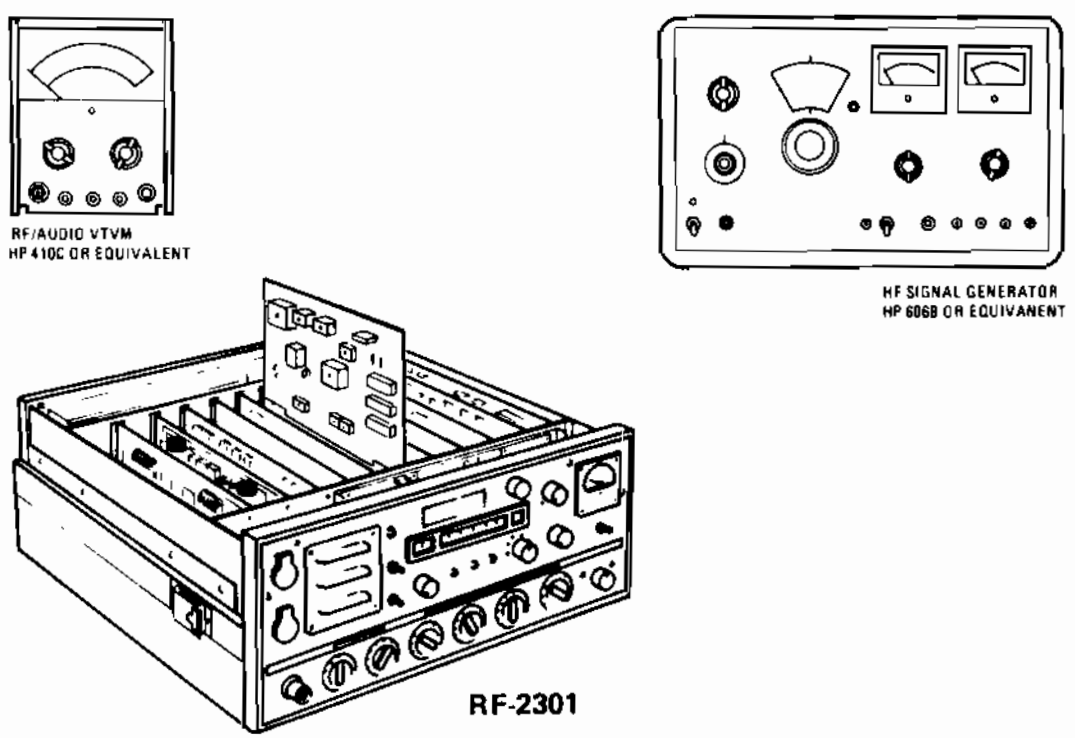


Figure 7. 1A1A6 Receive Signal Path Adjustments

5.3 Receive Tuning and Setup Adjustments

This procedure should be used for all remaining receiver tuning or setup adjustments on the mixer board.

a. At the RF-2301, select any desired frequency; use USB mode for this test.

CAUTION

Keying the transceiver while connected to a signal generator can damage the signal generator.

b. Connect the Signal Generator to J1, the RF Input connector to the RF-2301.

Note

The signal generator can also be connected to TP7 as desired.

c. Adjust the signal generator output to the receive frequency (for USB, this would be approximately 1 kHz above the selected frequency).

d. Adjust the signal generator output for an unmodulated 2 uV output.

e. Connect the audio voltmeter across the speaker terminals or at the 600 ohm output to measure audio output. Fine tune the signal generator to produce maximum audio output.

f. Adjust L6, L7, L8, L11, and L17 all for maximum receiver audio output on the voltmeter.

g. Adjust R6 (BIAS ADJ) for maximum output.

h. Measure signal to noise ratio and if necessary readjust L11 for optimum noise threshold.

i. This completes receiver adjustments on the mixer. Reconfigure for normal operation or continue with transmit adjustments.

5.4 Transmit Signal Path Adjustments

Test equipment items shown in figure 8 will normally be required to make 1A1A6 transmit signal path adjustments.

a. Connect audio signal generator to 600 ohm transmit audio input.

b. Remove the 1A1A3 P.C. board and, using masking tape, tape off pin 6 on the PCB. This in effect, prevents the Power Amplifier from receiving any input during these next tests.

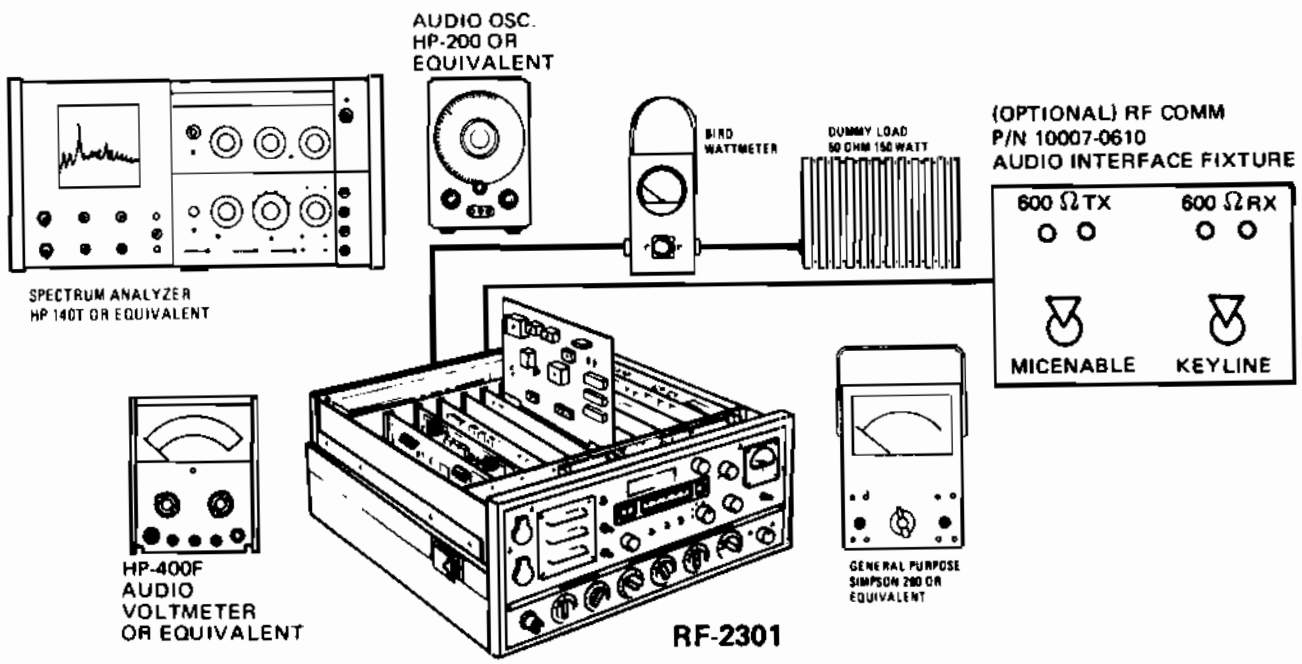


Figure 8. 1A1A6 Transmit Signal Path Adjustments

Note

For these procedures, use a convenient GND location on the PWB, not chassis ground.

c. Use audio voltmeter to adjust transmit audio drive level to 0 dBm.

d. Terminate RF-2301 output into a 50 ohm dummy load.

e. Select any desired test frequency, and USB mode at RF-2301 front panel.

f. Key transmitter and using the spectrum analyzer, verify -22 dBm per tone signal level at 1A1A6P1-J, the DSB input from the Processor PC Board. Set analyzer for 300 Hz bandwidth 2 KHz scan width and tune to 9.0000 MHz.

g. Connect the spectrum analyzer to TP4 (U2 Mixer input) and adjust R44, the DSB GAIN ADJ, for -16 dBm indication at TP4.

Note

Verify ALC gain by measuring +9.5 Vdc at P1-16. Adjust R47 to produce maximum gain (full cw).

h. Adjust T1 for peak output as measured by VTVM at TP4.

i. Readjust R44 for -16 dBm level at TP4.

j. Connect the spectrum analyzer to TP5, and adjust R49, 75 MHZ GAIN ADJUST for -16 dBm at this test point. Connect ground lead of spectrum analyzer to PWB ground.

k. Unkey transmitter.

l. Remove 1A1A3 Control PC Board and jumper +10V to 1A1A3P1-40 (from TP6 on the 1A1A7 Memory PWB), the VSWR FWD line. Leave tape previously applied to 1A1A3 pin 6. Reinsert the 1A1A3 Control PC Board.

Note

The artificial VSWR signal at this point is used to force the ALC system to a maximum gain reduction condition to adjust R47, the ALC threshold control.

m. Key transmitter and measure +1.0 to 2.0 Vdc at the P1-16 ALC input.

n. Connect the spectrum analyzer at TP4 and adjust R47 for -41 dBm (a 25 dB gain reduction from the reference level previously set up).

o. Remove the +10V connected to 1A1A3P1-40 and verify a -16 dBm level at TP4 again. If it is low, raise level at TP4 to -16 dBm by adjusting R44.

p. Unkey transmitter and remove masking tape at 1A1A3 pin 6. This completes all 1A1A6 adjustments. Reconfigure for normal operation.

5.5 1A1A6 Input/Output Summary

Figure 9 is a complete input/output summary of all 1A1A6P1 connections. Many test and adjustment points are not visible from the card edge. See figure 6 for a detail drawing of all these points.

6. PARTS LIST

Table 1 lists all 1A1A6 Maintenance Parts. These parts can be identified in figure 10. Refer to General Information Section for list of manufacturers.

7. SCHEMATIC

Figure 11 is a complete schematic diagram of the 1A1A6 Assembly.

1	GND	A	GND
2	GND	B	9 MHZ IF TO 1A1A4
3	GND	C	GND
4	GND	D	FL1 SELECT FROM 1A1A5
5	GND	E	FL2 SELECT FROM 1A1A5
6	GND	F	FL3 SELECT FROM 1A1A5
7	GND	H	GND
8	GND	J	DSB IN FROM 1A1A5
9	GND	K	GND
10		L	
11		M	
12		N	
13		P	
14	GND	R	GND
15	GND	S	GND
16	ALC FROM 1A1A3	T	
17	+10T	U	
18		V	
19		W	+10R
20	+13.2 VDC	X	
21	GND	Y	GND
22	GND	Z	LO2 FROM 1A1A9
23	GND	a	GND
24	GND	b	GND
25	GND	c	GND
26	GND	d	GND
27	GND	e	AM/PCS INJ FROM 1A1A5
28	GND	f	GND
29	GND	h	GND
30	GND	j	GND
31	GND	k	GND
32	GND	l	GND
33	GND	m	LO1 FROM 1A1A11
34	GND	n	GND
35	DELAYED AGC FROM 1A1A4	p	
36	CURRENT LIMIT FROM 1A1A3	r	
37	GND	s	GND
38	EXCITER RF OUT TO 1A1A3	t	
39	GND	u	GND
40	GND	v	GND
41	GND	w	GND
42	REC RF	x	REC RF
43	GND	y	GND

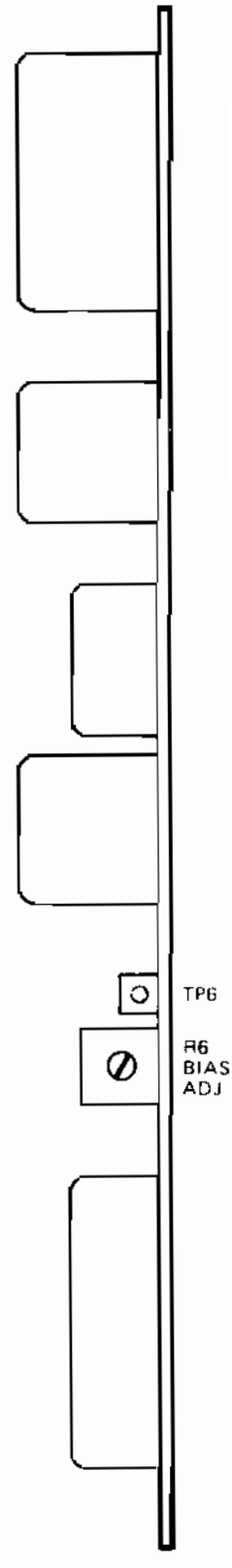


Figure 9. 1A1A6 Input/Output Summary

Table 1. 1A1A6 Maintenance Parts List

Ref. Desig.	Name & Description	Mfr. Code	Part Number
1A1A6	Mixer PW Board Assembly	14304	6628-0650-04
C1	Capacitor, Fixed, Mica, 91 pF ±5%, 500V	14304	C-0125
C2	Capacitor, Fixed, Mica, 200 pF ±5%, 500V	14304	C-0133
C3	Capacitor, Fixed, Mica, 91 pF ±5%, 500V	14304	C-0125
C4	Capacitor, Fixed, Mica, 1300 pF ±5%, 500V	14304	C-0155
C5	Capacitor, Fixed, Mica, 1110 pF ±5%, 500V	14304	C-0153
C6, C7	Not Used		
C8	Capacitor, Fixed, Mica, 5600 pF ±5%, 300V	14304	6628-0660
C9	Capacitor, Fixed, Mica, 1800 pF ±5%, 500V	14304	C-0158
C10	Capacitor, Fixed, Mica, 130 pF ±5%, 500V	14304	C-0129
C11	Capacitor, Fixed, Mica, 1800 pF ±5%, 500V	14304	C-0158
C12	Capacitor, Fixed, Ceramic, .01 uF ±20%, 50V	14304	C-4952
C13	Capacitor, Fixed, Mica, 130 pF ±5%, 500V	81349	CMR04F131J0DM
C14	Capacitor, Fixed, Ceramic, 16 pF ±5%, 1000V	14304	C-6620
C15	Capacitor, Fixed, Mica, 20 pF ±5%, 500V	81349	CMR04E200J0DM
C16	Capacitor, Fixed, Mica, 56 pF ±5%, 500V	14304	C-0120
C17	Capacitor, Fixed, Ceramic, .01 uF ±20%, 50V	14304	C-4952
C18	Capacitor, Fixed, Ceramic, .001 uF ±10%, 500V	14304	C-3513
C19	Capacitor, Fixed, Mica, 20 pF ±5%, 500V	81349	CMR04E200J0DM
C20	Capacitor, Fixed, Mica, 68 pF ±5%, 500V	14304	C-0122
C21 to C23	Capacitor, Fixed, Ceramic, .01 uF ±20%, 50V	14304	C-4952
C24	Not Used		
C25	Capacitor, Fixed, Ceramic, .01 uF ±20%, 50V	14304	C-4952
C26	Capacitor, Fixed, Ceramic, .001 uF ±10%, 500V	14304	C-3513
C27	Capacitor, Fixed, Ceramic, .01 uF ±20%, 50V	14304	C-4952
C28	Capacitor, Fixed, Ceramic, 16 pF ±5%, 1000V	14304	C-6620
C29	Capacitor, Fixed, Mica, 68 pF ±5%, 500V	14304	C-0122
C30	Capacitor, Fixed, Mica, 33 pF ±5%, 500V	14304	C-0113
C31	Capacitor, Fixed, Mica, 82 pF ±5%, 500V	14304	C-0124
C32 to C43	Capacitor, Fixed, Ceramic, .01 uF ±20%, 50V	14304	C-4952
C44	Capacitor, Fixed, Ceramic, .001 uF ±10%, 500V	14304	C-3513
C45 to C51	Capacitor, Fixed, Ceramic, .01 uF ±10%, 50V	14304	C-4952
C52, C53	Capacitor, Fixed, Ceramic, .001 uF ±10%, 500V	14304	C-3513
C54, C55	Capacitor, Fixed, Ceramic, .01 uF ±20%, 50V	14304	C-4952
C56	Not Used		
C57	Capacitor, Fixed, Tantalum, 100 uF ±10%, 20V	14304	C-6454
C58	Capacitor, Fixed, Ceramic, .1 uF +80-20%, 50V	14304	C-3202
C59	Capacitor, Fixed, Ceramic, .01 uF ±20%, 50V	14304	C-4952
C60	Capacitor, Fixed, Tantalum, 47 uF ±20%, 20V	14304	C-6452
C61	Capacitor, Fixed, Mica, 20 pF ±5%, 500V	14304	C-0108
C62	Capacitor, Fixed, Mica, 10 pF ±5%, 500V	14304	C-0104
C63	Capacitor, Fixed, Mica, 5 pF ±5%, 500V	14304	C-0103
C64 to C67	Capacitor, Fixed, Ceramic, .01 uF ±20%, 50V	14304	C-4952
C68	Capacitor, Fixed, Ceramic, .1 uF +80-20%, 50V	14304	C-3202
C69	Capacitor, Fixed, Ceramic, 10 pF ±5%, 1000V	14304	C-4741
C70	Capacitor, Fixed, Ceramic, 18 pF ±5%, 1000V	14304	C-4744
C71	Capacitor, Fixed, Tantalum, 1 uF ±20%, 20V	14304	C-6444

Table 1. 1A1A6 Maintenance Parts List (Continued)

Ref. Desig.	Name & Description	Mfr. Code	Part Number
C72	Capacitor, Fixed, Mica, 470 pF ±2%, 500V	14304	C-2496
C73	Capacitor, Fixed, Ceramic, .1 uF +80-20%, 50V	14304	C-3202
C74, C75	Capacitor, Fixed, Ceramic, .01 uF ±20%, 50V	14304	C-4952
C76	Capacitor, Fixed, Ceramic, .1 uF +80-20%, 50V	14304	C-3202
C77	Capacitor, Fixed, Mica, 43 pF ±5%, 500V	14304	C-0116
C78	Capacitor, Fixed, Mica, 820 pF ±2%, 300V	14304	C-2503
C79	Capacitor, Fixed, Ceramic, 51 pF ±5%	14304	C-0119
C80	Capacitor, Fixed, Ceramic, .01 uF ±20%	14304	C-4952
C81, C82	Capacitor, Fixed, Tantalum, 100 uF ±10%, 20V	14304	C-6454
CR1	Diode, Pin HP3080	14304	CR-0294
CR2-CR5	Rectifier, Fast Recovery, 1N5802	81349	1N5802
CR6,CR7	Diode, Pin, MPN3401	14304	CR-0746
CR8	Diode, Pin, HP3080	14304	CR-0294
CR9-CR22	Diode, Signal, 1N4454	14304	CR-0705
CR23	Diode, Pin, MPN3401	14304	CR-0746
CR24-CR26	Diode, Signal, 1N4454	14304	CR-0705
CR27	Diode, Rectifier, 1N4004	14304	CR-0725
CR28,CR29	Diode, Signal, 1N4454	14304	CR-0705
CR30	Diode, Pin, HP-3080	14304	CR-0294
CR31,CR32	Diode, Rectifier, 1N4004	14304	CR-0725
CR33	Diode, Signal, 1N4454	14304	CR-0705
*FL1	Filter, 9 MHz, LSB (For USB Operation)	14304	6628-0673
*FL2	Filter, 9 MHz, USB (For LSB Operation)	14304	10007-0621
*FL3	Filter, 9 MHz, AM	14304	6628-0672
FL4	Filter, 75 MHz	14304	6628-0671
K1	Relay, 12V, DPDT	14304	K-0118
L1, L2	Choke, RF, .33 uH	14304	L-0035
L3	Inductor, Variable, 5.1 uH	14304	L-0722
L4	Choke, RF, 470 uH	14304	L-0648
L5	Inductor, Variable, 8.3 uH	14304	L-0724
L6	Inductor, Variable, 10 uH	14304	L-0725
L7, L8	Inductor, Variable, .3 uH	14304	L-0256
L9,L10	Choke, RF, 10 uH	14304	L-0628
L11	Inductor, Variable, .3 uH	14304	L-0256
L12	Choke, RF, 10 uH	14304	L-0628
L13	Choke, RF, 220 uH	14304	L-0644
L14	Choke, RF, 56 uH	14304	L-0637
L15	Choke, RF, 22 uH	14304	L-0632
L16	Choke, RF, .47 uH	14304	L-0612
L17	Inductor, Variable, .3 uH	14304	L-0256
L18	Choke, RF, 100 uH	14304	L-0640
L19	Choke, RF, 4.7 uH	14304	L-0624
L20	Choke, RF, 56 uH	14304	L-0637
L21	Choke, RF, 8.2 uH	14304	L-0627

*See table 2.

Table 1. 1A1A6 Maintenance Parts List (Continued)

Ref. Desig.	Name & Description	Mfr. Code	Part Number
L22	Choke, RF, 220 uH	14304	L-0644
L23	Choke, RF, 15 uH	14304	L-0630
L24	Choke, RF, 100 uH	14304	L-0640
L25, L26	Choke, RF, 3.9 uH	14304	L-0623
L27	Choke, RF, 470 uH	14304	L-0648
L28	Choke, RF, 100 uH	14304	L-0640
Q1	Transistor, NPN, 2N5486	14304	Q-0376
Q2	Transistor, Dual Gate, 3N187	14304	Q03-0187-000
Q3, Q4	Transistor, NPN, 2N4124	14304	Q-0385
Q5	Transistor, NPN, Darlington, MPS-A13	14304	Q-0076
Q6	Transistor, NPN, 2N5179	14304	Q-0390
Q7	Transistor, NPN, 2N3866	14304	Q-0397
Q8	Transistor, NPN, 2N4124	14304	Q-0385
Q9	Transistor, 2N6304	14304	759-5009
Q10	Transistor, PNP, 2N4126	14304	Q-0386
Q11	Transistor, Dual Gate, 3N187	14304	Q03-0187-000
Q12 to Q15	Transistor, NPN, 2N4124	14304	Q-0385
R1	Resistor, Fixed, Composition, 120 ohm ±5%, 1/4W	81349	RCR07G121JM
R2, R3	Resistor, Fixed, Composition, 220 ohm ±5%, 1/4W	81349	RCR07G221JM
R4	Not Used		
R5	Resistor, Fixed, Composition, 47K ±5%, 1/4W	81349	RCR07G473JM
R6	Resistor, Variable, 50K	14304	R-2231
R7	Resistor, Fixed, Composition, 27K ±5%, 1/4W	81349	RCR07G273JM
R8	Not Used		
R9	Resistor, Fixed, Composition, 120K ±5%, 1/4W	81349	RCR07G124JM
R10	Resistor, Fixed, Composition, 68K ±5%, 1/4W	81349	RCR07G683JM
R11	Resistor, Fixed, Composition, 390 ohm ±5%, 1/4W	81349	RCR07G391JM
R12	Resistor, Fixed, Composition, 150 ohm ±5%, 1/4W	81349	RCR07G151JM
R13, R14	Resistor, Fixed, Composition, 820 ohm ±5%, 1/4W	81349	RCR07G821JM
R15	Resistor, Fixed, Composition, 470 ohm ±5%, 1/4W	81349	RCR07G471JM
R16	Resistor, Fixed, Composition, 680 ohm ±5%, 1/4W	81349	RCR07G681JM
R17, R18	Resistor, Fixed, Composition, 47K ±5%, 1/4W	81349	RCR07G473JM
R19	Rdsistor, Fixed, Composition, 820 ohm ±5%, 1/4W	81349	RCR07G821JM
R20	Resistor, Fixed, Composition, 680 ohm ±5%, 1/4W	81349	RCR07G681JM
R21, R22	Resistor, Fixed, Composition, 47K ±5%, 1/4W	81349	RCR07G473JM
R23	Resistor, Fixed, Composition, 820 ohm ±5%, 1/4W	81349	RCR07G821JM
R24	Resistor, Fixed, Composition, 680 ohm ±5%, 1/4W	81349	RCR07G681JM
R25, R26	Resistor, Fixed, Composition, 47K ±5%, 1/4W	81349	RCR07G473JM
R27	Resistor, Fixed, Composition, 100 ohm ±5%, 1/4W	81349	RCR07G101JM
R28	Resistor, Fixed, Composition, 330 ohm ±5%, 1/4W	81349	RCR07G331JM
R29	Resistor, Fixed, Composition, 220 ohm ±5%, 1/4W	81349	RCR07G221JM
R30, R31	Resistor, Fixed, Composition, 470 ohm ±5%, 1/4W	81349	RCR07G471JM

Table 1. 1A1A6 Maintenance Parts List (Continued)

Ref. Desig.	Name & Description	Mfr. Code	Part Number
R32	Resistor, Fixed, Composition, 2.2K ±5%, 1/4W	81349	RCR07G222JM
R33	Resistor, Fixed, Composition, 220 ohm ±5, 1/4W	81349	RCR07G221JM
R34	Resistor, Fixed, Composition, 100 ohm ±5%, 1/4W	81349	RCR07G101JM
R35	Resistor, Fixed, Composition, 3.9K ±5%, 1/4W	81349	RCR07G392JM
R36	Resistor, Fixed, Composition, 56 ohm ±5%, 1/4W	81349	RCR07G560JM
R37	Resistor, Fixed, Composition, 270 ohm ±5%, 1/4W	81349	RCR07G271JM
R38	Resistor, Fixed, Composition, 820 ohm ±5%, 1/4W	81349	RCR07G821JM
R39	Resistor, Fixed, Composition, 750 ohm ±5%, 1/4W	81349	RCR07G751JM
R40	Resistor, Fixed, Composition, 15K ±5%, 1/4W	81349	RCR07G153JM
R41	Resistor, Fixed, Composition, 5.6K ±5%, 1/4W	81349	RCR07G562JM
R42	Resistor, Fixed, Composition, 1.5K ±5%, 1/4W	81349	RCR07G152JM
R43	Resistor, Fixed, Composition, 470 ohm ±5%, 1/4W	81349	RCR07G471JM
R44	Resistor, Variable, 200 ohm	14304	R-2204
R45	Resistor, Fixed, Composition, 33K ±5%, 1/4W	81349	RCR07G333JM
R46	Resistor, Fixed, Composition, 390 ohm ±5%, 1/4W	81349	RCR07G391JM
R47	Resistor, Variable, 50K	14304	R-2212
R48	Resistor, Fixed, Composition, 4.7K ±5%, 1/4W	81349	RCR07G472JM
R49	Resistor, Variable, 100 ohm		R-2203
R50	Resistor, Fixed, Composition, 100 ohm ±5%, 1/4W	81349	RCR07G101JM
R51	Resistor, Fixed, Composition, 7.5K ±5%, 1/4W	81349	RCR07G752JM
R52	Resistor, Fixed, Composition, 910 ohm ±5%, 1/4W	81349	RCR07G911JM
R53	Resistor, Fixed, Composition, 750 ohm ±5%, 1/4W	81349	RCR07G751JM
R54	Resistor, Fixed, Composition, 820 ohm ±5%, 1/4W	81349	RCR07G821JM
R55	Not Used		
R56	Resistor, Fixed, Composition, 4.7M ±5%, 1/4W	81349	RCR07G475JM
R57	Resistor, Fixed, Composition, 2.2K ±5%, 1/4W	81349	RCR07G222JM
R58, R59	Resistor, Fixed, Composition, 15 ohm ±5%, 1/4W	81349	RCR07G150JM
R60	Resistor, Fixed, Composition, 68 ohm ±5%, 1/4W	81349	RCR07G680JM
R61, R62	Resistor, Fixed, Composition, 820 ohm ±5%, 1/4W	81349	RCR07G821JM
R63	Resistor, Fixed, Composition, 68 ohm ±5%, 1/4W	81349	RCR07G680JM
R64	Resistor, Fixed, Composition, 1K ±5%, 1/4W	81349	RCR07G102JM
R65	Resistor, Fixed, Composition, 10K ±5%, 1/4W	81349	RCR07G103JM
R66	Resistor, Fixed, Composition, 4.7 ohm ±5%, 1/4W	81349	RCR07G4R7JM
R67	Resistor, Fixed, Composition, 1.0M ±5%, 1/4W	81349	RCR07G105JM
T1	Transformer, 9 MHz	14304	919-1319
T2 to T4	Transformer, 1.5 - 80 MHz	14304	919-1280
TP1	Test Point, Brown	14304	J-0071
TP2	Test Point, Red	14304	J-0066
TP3	Not used		
TP4	Test Point, Yellow	14304	J-0070
TP5	Test Point, Green	14304	J-0068
TP6	Test Point, Blue	14304	J-0393
TP7	Test Point, Violet	14304	J-0073
U1, U2	Mixer, Doubly Balanced	14304	6628-0666

Table 2 is a listing of the various filters and filter options available for installation into the 1A1A6 Mixer PWB Assembly.

NOTE: In all standard and optional applications, FL3 part number is 6628-0672.

Table 2. 1A1A6 Mixer Board Filter Table

Applications	FL1 Part Number (USB)	FL2 Part Number (LSB)	A1A5 Jumper Installed
Standard			
RF-230	FL-0136	FL-0135	E1 to E2
RF-230M	FL-0136	None	None
RF-230MS	FL-0136	None	None
RF-2301/A	6628-0673	10007-0621	E1 to E2
Options			
*RF-267 USB/LSB Wideband Filter	6628-0661	6628-0662	E1 to E2
*RF-247 USB Wideband Filter	6628-0673	Standard FL2 as applicable	E1 to E2 as applicable
*RF-247-01 Wideband Filter - AFSK	Standard FL1 as applicable	6628-0673	E1 to E4
*RF-230-06 CW Narrowband Filter	Standard FL1 as applicable	6628-0664	E1 to E3
*RF-230-07 Narrowband Filter	Standard FL1 as applicable	6628-0663	E1 to E4

*Factory Installed Options

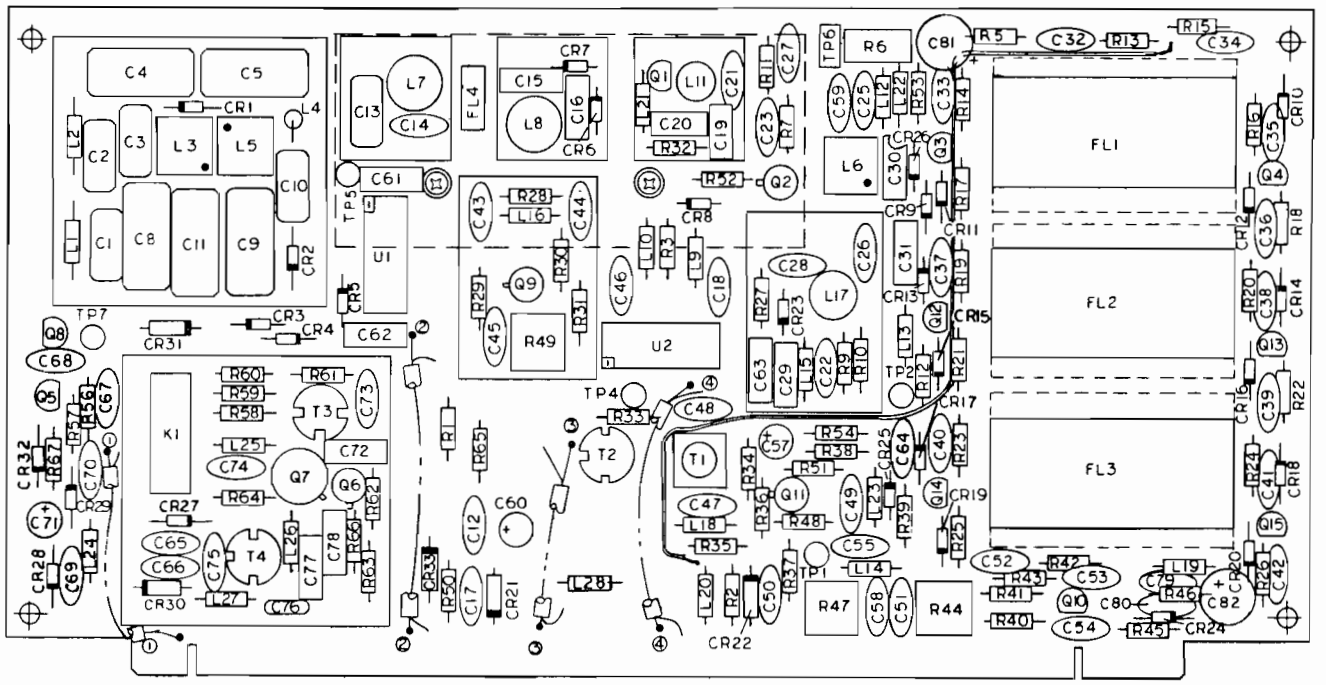
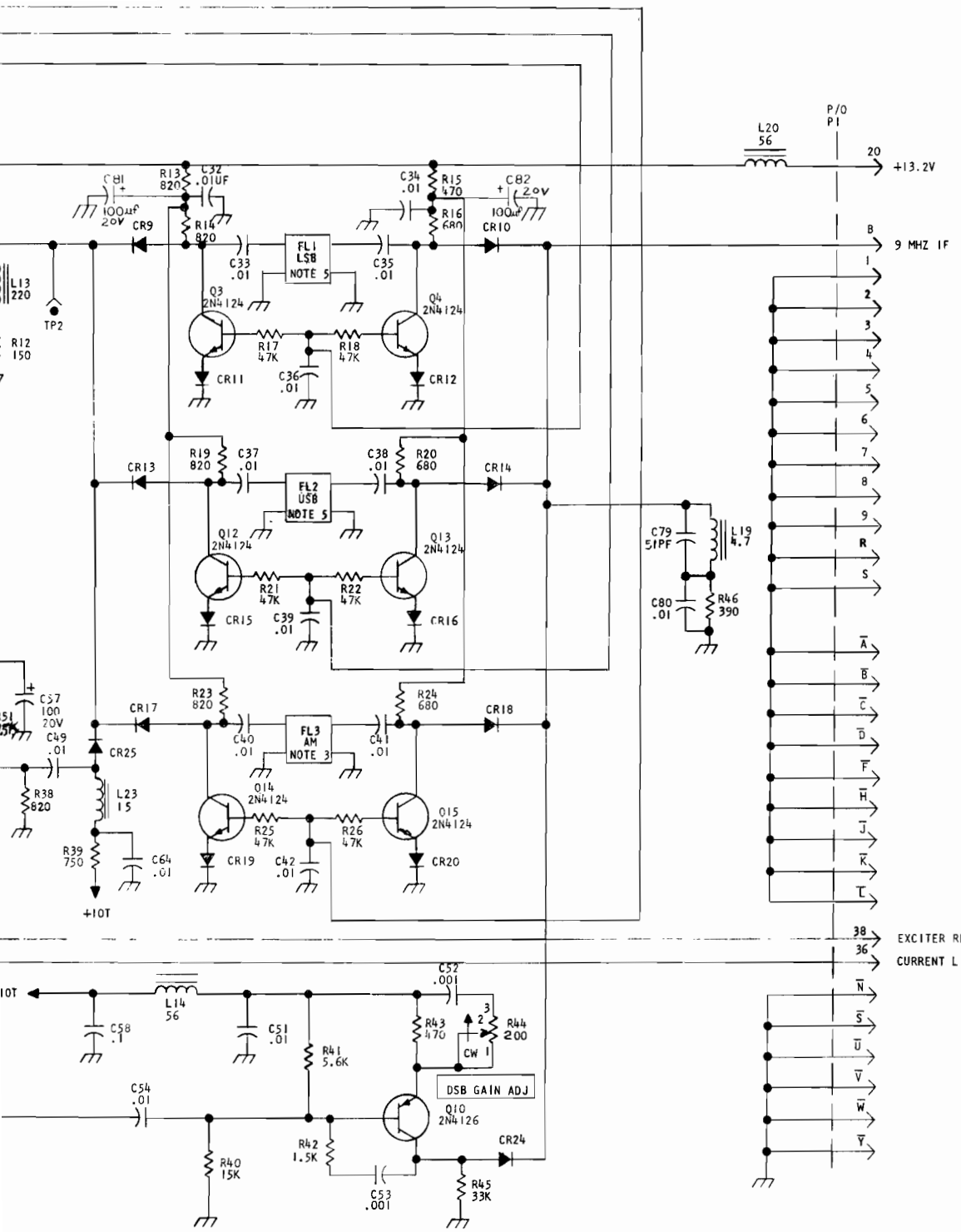


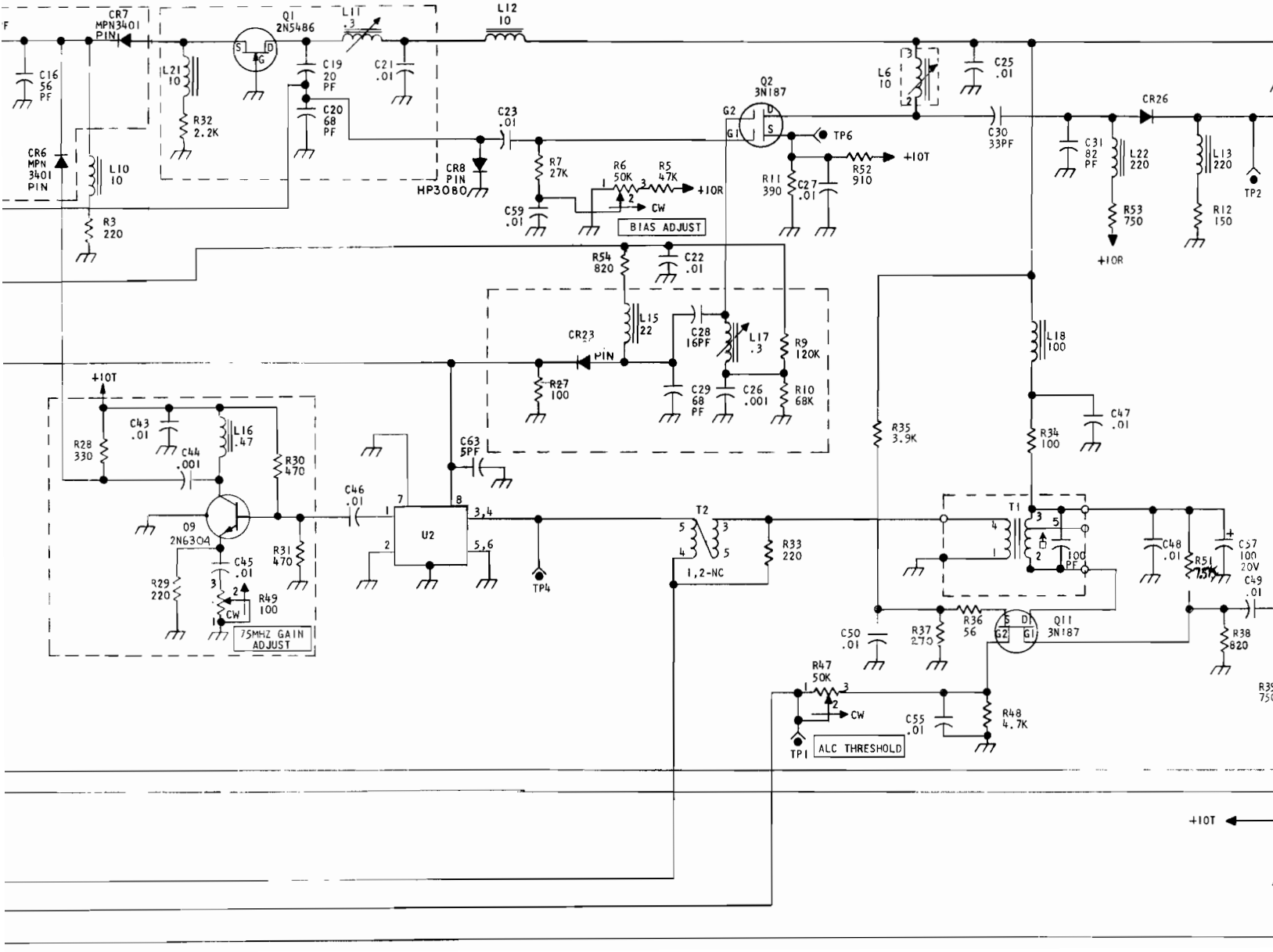
Figure 10. 1A1A6 Mixer PC Board Component Locations

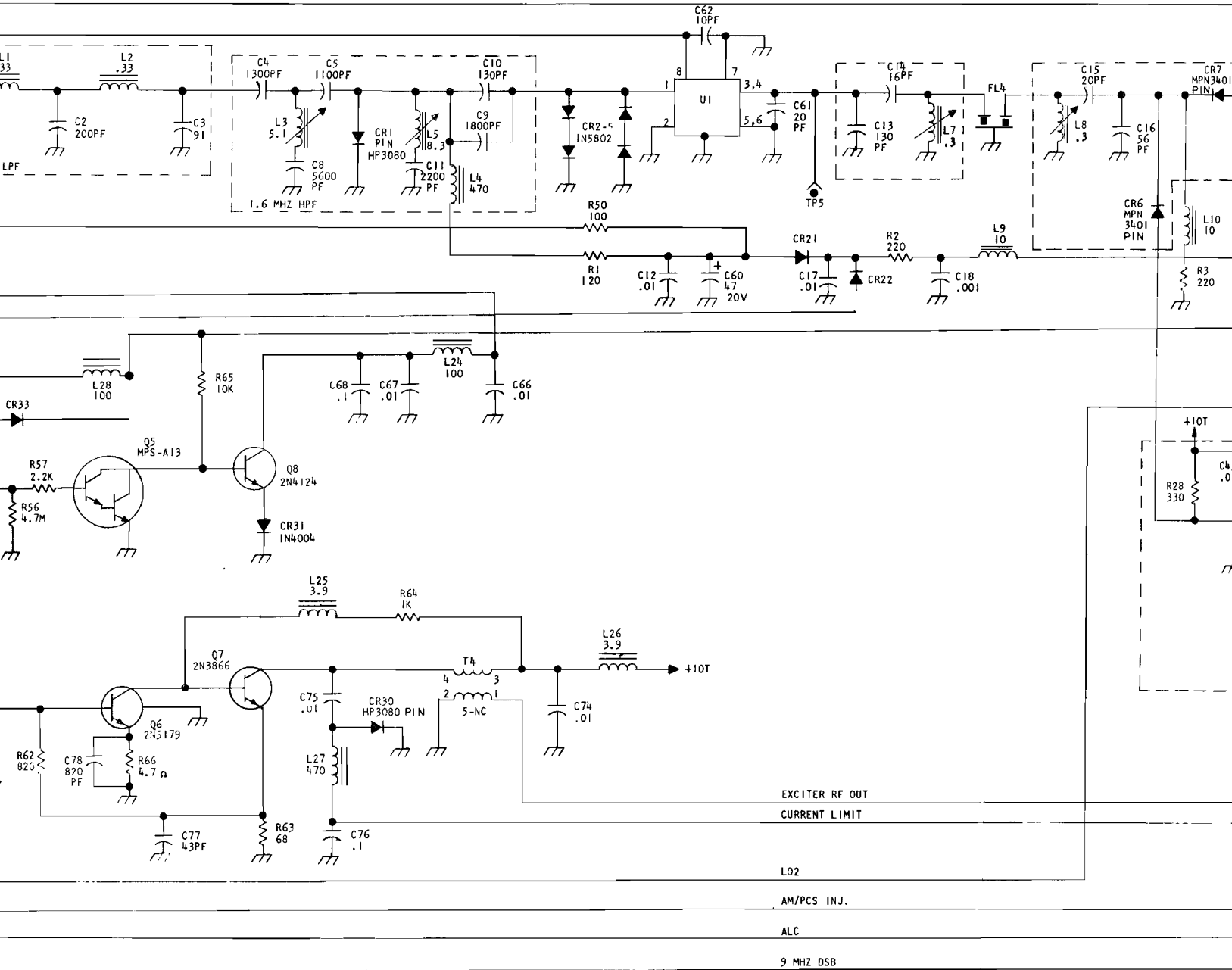


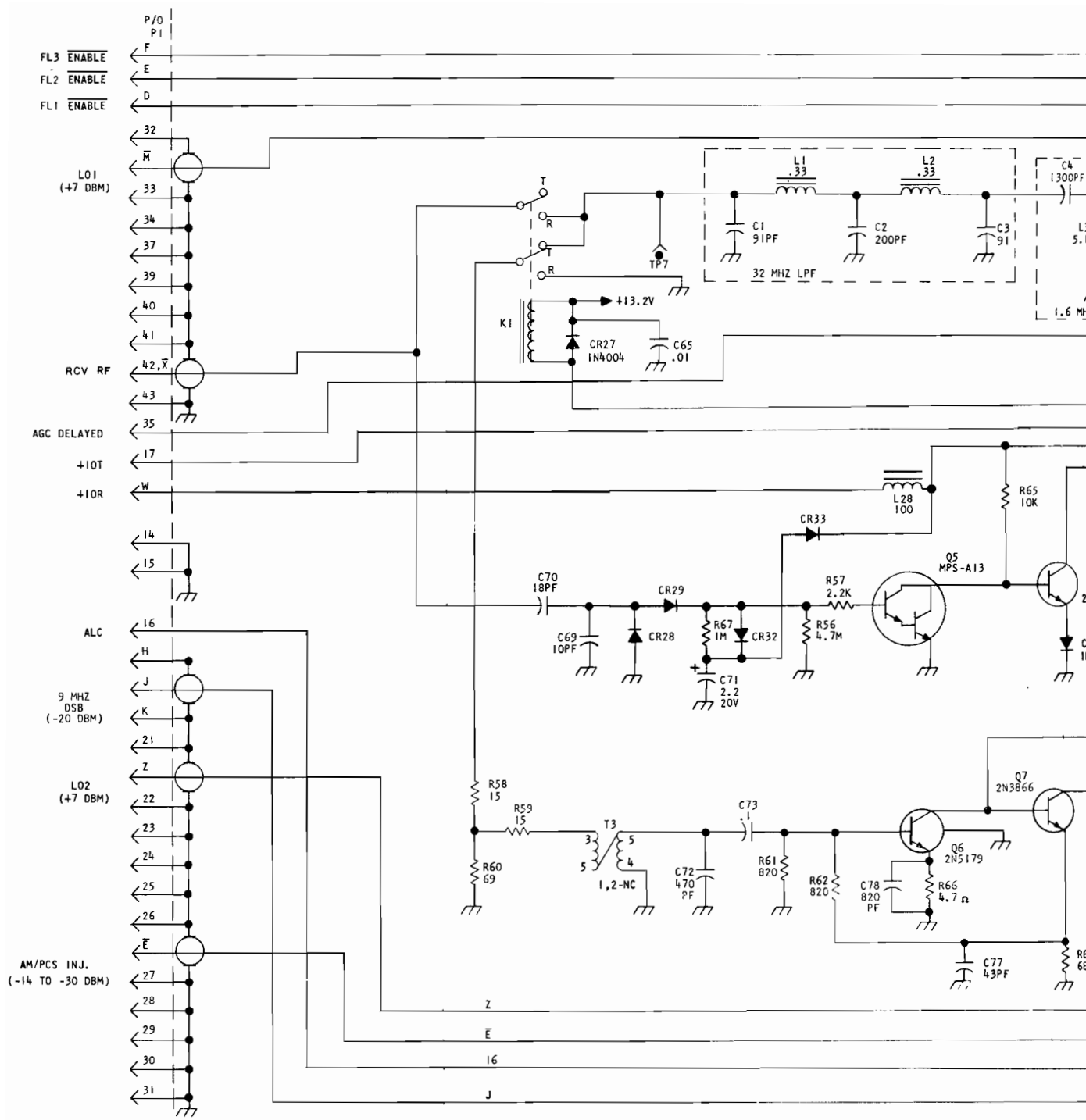
NOTES:

1. UNLESS OTHERWISE SPECIFIED:
   ALL DIODES ARE IN4454.
   ALL RESISTORS ARE IN OHMS.
   ALL CAPACITORS ARE IN MICROFARADS.
   ALL CHOKES ARE IN MICROHENRIES.
2. OPTION FILTER MAY BE ANY 9 MHZ, 400 OHM, CW, FSK, OR USB. OPTION MUST BE COORDINATED WITH J1 ON PROCESSOR BOARD (6628-0600 1A1A5).
3. AM FILTER FL3 IS USED ONLY IN RECEIVE. FL1 IS USED FOR AM TRANSMIT.
4. FL2 IS NOT INSTALLED IN RF-230M.
5. FREQUENCY MIXING SCHEMATIC REQUIRES LSB FILTER FL1 TO BE USED IN USB MODE AND USB FILTER FL2 TO BE USED IN LSB MODE.

Figure 11. 1A1A6 Mixer PC Board Schematic
Diagram (6628-9065)


CR7 MPN3401 PIN
Q1 2N5486
L11 .3
L12 10
C16 56 PF
L21 10
R32 2.2K
C19 20 PF
C20 68 PF
C21 .01
CR6 MPN 3401 PIN
L10 10
R3 220
C23 .01
CR8 PIN HP3080
R7 27K
C59 .01
R6 50K
R5 47K
+10R
CW
BIAS ADJUST
Q2 3N187
TP6
R11 390
C27 .01
R52 910
+10T
L6 10
C25 .01
C30 33PF
CR26
C31 82 PF
L22 220
R53 750
L13 220
R12 150
TP2
+10R
R54 820
C22 .01
L15 22
CR23 PIN
C28 16PF
L17 .3
R9 120K
R27 100
C29 68 PF
C26 .001
R10 68K
L18 100
R35 3.9K
R34 100
C47 .01
+10T
C43 .01
L16 .47
R28 330
C44 .001
R30 470
Q9 2N6304
R31 470
C45 .01
R29 220
R49 100
75MHZ GAIN ADJUST
C46 .01
C63 5PF
U2
TP4
T2
1,2-NC
R33 220
T1
100 PF
C48 .01
R51 7.5K
C57 100 20V
C49 .01
R38 820
Q11 3N187
R36 56
R37 270
C50 .01
R47 50K
CW
ALC THRESHOLD
TP1
C55 .01
R48 4.7K
+10T

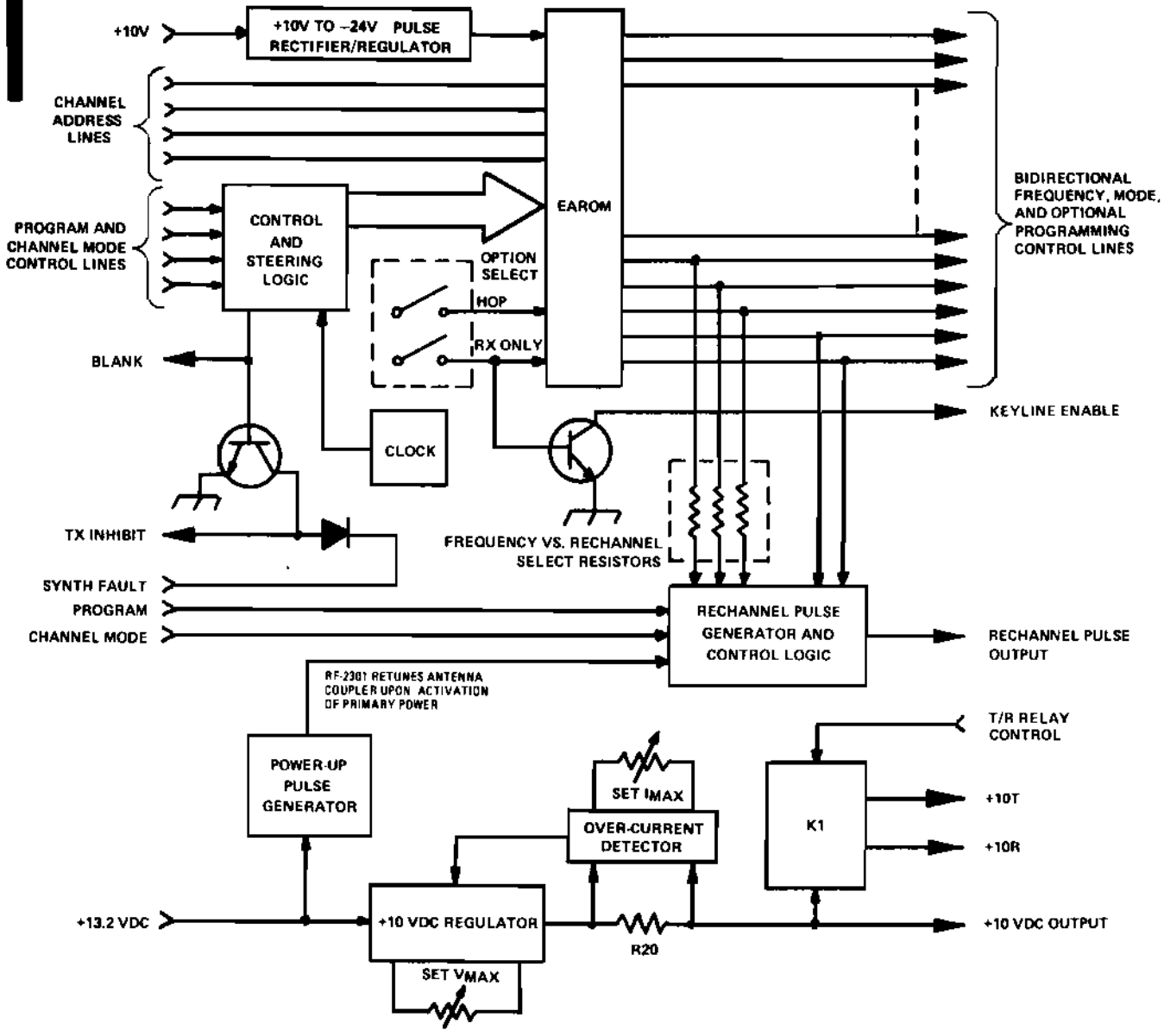

C62 10PF
L1 33
L2 .33
C2 200PF
C3 91
LPF
C4 1300PF
C5 1100PF
L3 5.1
C8 5600 PF
CR1 PIN HP3080
L5 8.3
C11 2200 PF
L4 470
1.6 MHZ HPF
C10 130PF
C9 1800PF
CR2-5 IN5802
U1
C61 20 PF
C14 16PF
C13 130 PF
L7 .3
FL4
C15 20PF
L8 .3
C16 56 PF
CR7 MPN3401 PIN
TP5
R50 100
R1 120
C12 .01
C60 47 20V
CR21
C17 .01
CR22
R2 220
C18 .001
L9 10
CR6 MPN 3401 PIN
L10 10
R3 220
L28 100
R65 10K
C68 .1
C67 .01
L24 100
C66 .01
CR33
Q5 MPS-A13
R57 2.2K
R56 4.7M
Q8 2N4124
CR31 IN4004
+10T
R28 330
L25 3.9
R64 1K
Q7 2N3866
T4
L26 3.9
+10T
C75 .01
CR30 HP3080 PIN
5-NC
C74 .01
Q6 2N5179
R62 820
C78 820 PF
R66 4.7 Ω
L27 470
EXCITER RF OUT
CURRENT LIMIT
C77 43PF
R63 68
C76 .1
LO2
AM/PCS INJ.
ALC
9 MHZ DSB


P/O P1
FL3 ENABLE
FL2 ENABLE
FL1 ENABLE
LO1 (+7 DBM)
RCV RF
AGC DELAYED
+10T
+10R
ALC
9 MHZ DSB (-20 DBM)
LO2 (+7 DBM)
AM/PCS INJ. (-14 TO -30 DBM)
L1 .33
L2 .33
C1 91PF
C2 200PF
C3 91
32 MHZ LPF
TP7
+13.2V
K1
CR27 1N4004
C65 .01
L28 100
R65 10K
CR33
Q5 MPS-A13
C70 18PF
CR29
R57 2.2K
C69 10PF
CR28
R67 1M
CR32
R56 4.7M
C71 2.2 20V
R58 15
R59 15
T3
1,2-NC
C73 .1
Q7 2N3866
Q6 2N5179
R60 69
C72 470 PF
R61 820
R62 820
C78 820 PF
R66 4.7 Ω
C77 43PF
Z
E
16
J

UNIT INSTRUCTIONS

MEMORY BOARD

1A1A7



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1 GENERAL INFORMATION

The 1A1A7 Memory Board Assembly performs electrical operations associated with RF-2301 programming, control signal generation, dc voltage regulation, and +10R and +10T voltage switching. The 1A1A7 assembly operates in conjunction with the 1A2 assemblies (A1 Frequency Select, A2 Interface, and A3 Display) to cause the frequency, mode, channel, and programming signals applied to these assemblies to be formatted and applied to Electrically Alterable Read-Only Memory (EAROM) U7/U8. Additionally, HOP and RX ONLY optional programming is exercised on the 1A1A7 assembly. The Memory Board also acts as logic control interface for optional Channelized Remote Control Unit RF-2370.

2. TECHNICAL CHARACTERISTICS

Power Inputs:

+13.8 Vdc (switched)

Power Outputs:

+10 Vdc Transmit (+10T)
+10 Vdc Receive (+10R)
+10 Vdc

Control Inputs:

Channel Mode	P1-9
Program TX	P1-10
Program RX	P1-11
Frequency Disable	P1-6
Blank (Display)	P1-H
Synthesizer Fault	P1-J
Channel - 2^0	P1-F
Channel - 2^1	P1-E
Channel - 2^2	P1-D
Channel - 2^3	P1-7
Program	

Control Outputs:

Rechannel Pulse	P1-C/3
TX Inhibit	P1-4
Keyline Enable (RX Only)	P1-B
Frequency (chan. mode)	
Mode (chan. mode)	

3. SEMICONDUCTOR COMPLEMENT

Ref. Des.	Type	Description
CR1	1N4004	Diode, Rectifier
CR2	1N4004	Diode, Rectifier
CR3	1N4454	Diode, Signal
CR4	1N4454	Diode, Signal
CR5	1N4454	Diode, Signal
CR6	1N4935	Diode, Fast Recovery
CR7	1N4454	Diode, Signal
CR8	1N4454	Diode, Signal
Q1	2N5190	Transistor, NPN
Q2	2N5986	Transistor, PNP
Q3	2N4124	Transistor, NPN
Q4	2N4124	Transistor, NPN
Q5	2N4124	Transistor, NPN
Q6	2N4124	Transistor, NPN
Q7	2N4124	Transistor, NPN
Q8	2N2905A	Transistor, PNP
Q9	2N4126	Transistor, PNP
U1	CD4077	Quad Exclusive NOR
U2	CD4077	Quad Exclusive NOR
U3	CD4001	Quad NOR Gate
U4	LM324	Voltage Comparator
U5	CD4060	14-Stage Counter
U6	CD4001	Quad NOR Gate
U7	ER2051	Read-Only Memory
U8	ER2051	Read-Only Memory
U9	80C97	Hex Tri-State Buffer
U10	CA555	Timer
U11	CD4081	Quad AND Gate
U12	CD4001	Quad NOR Gate
U13	CD4013	Dual R/D Flip-Flop
U14	CD4013	Dual R/D Flip-Flop
U15	CD4022	Decade Counter

4. FUNCTIONAL DESCRIPTION

Bidirectional Frequency, Mode, and Channel binary data is applied in parallel to U7 and U8, Electrically-Alterable Read-Only Memory (EAROM) devices. The I/O lines of

these circuits act as memory inputs when programming the fifteen channels available via the front panel CHANNEL switch/programming switches, and as outputs when selecting a preprogrammed channel via the CHANNEL switch. The state of the memories is determined according to the conditions presented at the MODE CONTROL inputs (pins 25/26), the CHIP SELECT input (pin 27), and the CLK input (pin 18). These inputs are tied in parallel, and are fed by logic circuits which are operated by the front panel PROGRAM switches (RCV, XMT, and PROGRAM). Clock oscillator U5 feeds the CLK inputs of U7 and U8 via pulse expander U6. The two MODE CONTROL inputs correspond to RF-2301 receive and transmit conditions. The CHIP SELECT input is operated by the CHANNEL MODE control input. When the front panel CHANNEL switch is moved from the SELECT FREQUENCY position to any of the fifteen channel positions, the binary memory address lines representing the channel number selected are enabled, in turn causing the data I/O lines to output the stored information corresponding to that particular channel. However, the front panel selector switch binary outputs are disabled by the FREQUENCY DISABLE control line, thus preventing two sets of data from appearing on the same control lines. When either the RCV or XMT programming switches are depressed, the memory output lines momentarily become input lines, as determined by the CHIP SELECT input(s). When this occurs, the previously-stored data corresponding to the selected channel is erased, and the frequency select switch binary output states are stored by U7/U8. This may only occur in the CHANNEL mode of operation; e.g., the programming switches will not affect the memory circuit when the CHANNEL switch is placed in the SELECT FREQUENCY position. When the I/O lines change state, due to depressing the PROGRAM switch, the Q output of U14B generates a BLANK pulse, which simultaneously inhibits the transmitter (TX INHIBIT) and momentarily causes the front panel LED display to blank, indicating that the selected frequency has been stored in place of the previoulsy-stored data. The TX INHIBIT line is also activated by a ground closure from the 1A1A9 Frequency Standard PWB, indicating a fault or out-of-lock condition of the frequency synthesizer. Also associated with the U8 I/O lines are the five Option Select switches, which drive hex tri-state buffer U9. Only the HOP and RX ONLY option switches are used in the circuit. Closing of the HOP option switch activates its corresponding tri-state buffer, the output of which is applied to pin 15 of U8 (D_{14}) and to the 1A1A8 Local Oscillator PWB via the 1A1A11 Interconnect assembly (refer to L.O. No. 2 Unit Instructions section, and to Part III, Operation, paragraph 3.5). Closing the RX ONLY option switch causes the output of its associated tri-state buffer to activate Q6, which disables the RF-2301 keyline at the 1A1A5 Processor PWB. The RX ONLY signal is also applied to the second input of U12B, which functions in the Tx programming path. When the RX ONLY switch is closed, this logic level causes a no-program condition in the TX programming path for as long as the RX ONLY switch is closed, thus insuring that the RX ONLY state is programmed into the receive portion of U7/U8 automatically. Hence, the RX ONLY switch is a functionally active switch at all times, as opposed to the HOP switch, which must be directly programmed into the EAROM's by depressing the appropriate program button (RCV or XMT). The EAROM's are powered from a separate pseudo-switching regulator and pulse rectifier circuit (L2/CR6), which delivers -24 Vdc with respect to chassis ground. +10 Vdc is applied to the emitters of Q8 and Q9, which act as series-pass regulators. The collector of Q9 feeds the comparator inputs contained in U10 (refer to Part V, 'CA555 Timer'). The resulting oscillation operates the U10 internal flip-flop, in turn feeding the output driver. The fixed pulse width output is then applied to the base of Q8, which switches +10 Vdc at the clocking rate. Interrupting the current flow through Q8/L2, and rectifying the negative pulse energy levels stored in L2 provides the necessary reverse voltage, which is then rectified by CR6 and filtered by C19/C20/L3. R50 provides an adjustable feedback source to control the U10 pulse frequency output, and consequently control the -24 Vdc output to within ±1 volt. Q7 acts as a voltage reference source for Q9, and further serves to isolate the U10 oscillator signal from the -24 Vdc output. This type of regulator results in comparatively high ripple content at the dc output; however, as this has no effect on either U7 or U8, Pi-filter C19/C20/L3 provides adequate filtering of the supply output, which may be observed at TP1.

5. MAINTENANCE

All of the adjustments indicated in this paragraph have been performed at the factory prior to shipment. It should not be necessary to repeat any of these adjustments unless component failure is experienced, or unless the entire 1A1A7 assembly is replaced with a new printed circuit board. All of the adjustments may be performed by placing the assembly on the supplied card extender board. This will facilitate maintenance and adjustment by making all test points readily available. An overview and description of all 1A1A7 test points is presented in Table 2.

The 1A1A7 assembly should be periodically checked and visually inspected for signs of dust, dirt, or component aging. The board gold-plated fingers should be cleaned with a soft brush and cleaning solution to prevent corrosion.

-24 VDC Adjustment

a. Connect a DVM to TP1 (brown color test point). Connect the (-) lead to ground.

b. Adjust R50 for -24 Vdc at TP1 (set meter to read negative DC).

10 VDC Adjustment

a. Connect DVM to TP6 (blue color test point). Connect the (-) lead to ground.

b. Adjust R28 for +10.0 Vdc at TP6 (set meter to read positive DC).

Regulator Current Adjustment

a. With assembly on card extender board, connect DVM (+) lead up to U4 pin 12 and the (-) lead to ground.

b. Adjust R22 for 8.10 Vdc ± 0.1 Vdc.

Table 2. 1A1A7 Memory Assembly Test Points

Test Point	Description of Function/Description of Signal
TP1	-24 Vdc power supply input for ER2051 (EAROM)
TP2	Rechannel pulse associated with a frequency change of 10 KHz or greater.
TP3	Rechannel pulse associated with any of the following: • A channel change • A program cycle • A power-up mode (negative pulse same as TP2)
TP4	Clock for programming sequence (3.33 Hz)
TP5	Indication of the area of memory addressed (A_4 on EAROM) • 0 Vdc = Transmit Data or Program Cycle • 10 Vdc = Receive Data
TP6	Regulated +10.0 Vdc output from regulator circuit
TP7	Chip select line; 10 Vdc = chip selected (channel mode) 0 Vdc = open circuit (frequency mode)
TP8	One bit of control mode inputs to EAROM (C_1 bit)
TP9	Blank line—blank pulse appears during PROGRAM
TP10	One bit of control mode inputs to EAROM (C_2 bit)

Table 3. 1A1A7 Memory PWB Maintenance Parts List (10007-1120)

Ref. Desig.	Name & Description	Mfr. Code	Part Number
1A1A7	Memory PWB	14304	10007-1120
C1	Capacitor, Tant., .47 uF, 35 volts	14304	C25-0001-105
C2	Capacitor, Tant., .47 uF, 35 volts	14304	C25-0001-105
C3	Capacitor, Tant., 1.0 uF, 50 volts	14304	C25-0001-007
C4	Capacitor, Mica, 470 pF	14304	C-0143
C5	Capacitor, Ceramic, 0.001 uF, 50 volts	14304	C11-0005-102
C6	Capacitor, Tant., 220 uF, 16 volts	14304	C19-0003-221
C7	Capacitor, Tant., 33 uF, 25 volts	14304	C19-0004-330
C8	Capacitor, Tant., 10 uF, 20 volts	14304	C25-0001-307
C9	Capacitor, Tant., 0.1 uF, 50 volts	14304	C25-0001-001
C10	Capacitor, Ceramic, 0.001 uF, 50 volts	14304	C11-0005-102
C11	Capacitor, Ceramic, 0.001 uF, 50 volts	14304	C11-0005-102
C12	Capacitor, Ceramic, 0.001 uF, 50 volts	14304	C11-0005-102
C13	Capacitor, Tant., 1.0 uF, 50 volts	14304	C25-0001-007
C14	Capacitor, Tant., 3.3 uF, 50 volts	14304	C25-0001-010
C15	Capacitor, Tant., 100 uF, 20 volts	14304	C25-0001-313
C16	Capacitor, Ceramic, 0.1 uF, 50 volts	14304	C11-0005-104
C17	Capacitor, Disc, 0.001 uF, 50 volts	14304	C-0001
C18	Capacitor, Disc, 0.01 uF, 150 volts	14304	C-0065
C19	Capacitor, Ceramic, .47 uF, 50 volts	14304	C11-0005-474
C20	Capacitor, Tant., 47 uF, 50 volts	14304	C25-0002-117
C21	Capacitor, Ceramic, 0.001 uF, 50 volts	14304	C11-0005-102
C22	Capacitor, Ceramic, 0.1 uF, 50 volts	14304	C11-0005-104
CR1	Diode, 1N4004	14304	1N4004
CR2	Diode, 1N4004	14304	1N4004
CR3	Diode, 1N4454	14304	1N4454
CR4	Diode, 1N4454	14304	1N4454
CR5	Diode, 1N4454	14304	1N4454
CR6	Diode, Fast Recovery, 1N4935	14304	1N4935
CR7	Diode, 1N4454	14304	1N4454
CR8 thru CR10	Diode, 1N4454	14304	1N4454
K1	Relay, DPDT, 12 Vdc	14304	K15-0007-012
L1	Inductor, 47 uH, 1/2 watt	14304	L10-0006-470
L2	Inductor, Toroidal	14304	6628-0768
L3	Inductor, 47 uH, 1/2 watt	14304	L10-0006-470
Q1	Transistor, 2N5190	14304	2N5190
Q2	Transistor, 2N5986	14304	2N5986
Q3	Transistor, 2N4124	14304	2N4124
Q4	Transistor, 2N4124	14304	2N4124
Q5	Transistor, 2N4124	14304	2N4124
Q6	Transistor, 2N4124	14304	2N4124
Q7	Transistor, 2N4124	14304	2N4124
Q8	Transistor, 2N2905A	14304	2N2905A
Q9	Transistor, 2N4126	14304	2N4126
R1	Resistor, 39K ohm, 1/4W, 5%	81349	RCR07G393JM
R2	Resistor, 39K ohm, 1/4W, 5%	81349	RCR07G393JM
R3	Not Used		

Table 3. 1A1A7 Memory PWB Maintenance Parts List (10007-1120) (Continued)

Ref. Desig.	Name & Description	Mfr. Code	Part Number
R4	Resistor, 100 ohm, 1/4W, 5%	81349	RCR07G101JM
R5	Resistor, 100 ohm, 1/4W, 5%	81349	RCR07G101JM
R6	Resistor, 39K ohm, 1/4W, 5%	81349	RCR07G393JM
R7	Resistor, 221K ohm, 1/4W, 1%	81349	RN55D2213F
R8	Resistor, 221K ohm, 1/4W, 1%	81349	RN55D2213F
R9	Resistor, 10K ohm, 1/4W, 5%	81349	RCR07G103JM
R10	Resistor, 4.7K ohm, 1/4W, 5%	81349	RCR07G472JM
R11	Resistor, 10K ohm, 1/4W, 5%	81349	RCR07G103JM
R12	Resistor, 100K ohm, 1/4W, 5%	81349	RCR07G104JM
R13	Resistor, 820 ohm, 1/4W, 5%	81349	RCR07G821JM
R14	Resistor, 150 ohm, 1/4W, 5%	81349	RCR07G151JM
R15	Resistor, 1K ohm, 1/4W, 5%	81349	RCR07G102JM
R16	Resistor, 100 ohm, 1/2W, 5%	81349	RCR20G101JM
R17	Resistor, 100 ohm, 1W, 5%	81349	RCR32G101JM
R18	Resistor, 10K ohm, 1/4W, 5%	81349	RCR07G103JM
R19	Resistor, 1K ohm, 1/4W, 5%	81349	RCR07G102JM
R20	Resistor, 0.1 ohm, 1W, 10%	14304	R-0983
R21	Resistor, 221 ohm, 1/8W, 1%	81349	RN55D2210F
R22	Resistor, Variable, 100 ohm	14304	R-2222
R23	Resistor, 909 ohm, 1/8W, 1%	81349	RN55D9090F
R24	Resistor, 7.15K ohm, 1/8W, 1%	81349	RN55D7151F
R25	Resistor, 2.7K ohm, 1/4W, 5%	81349	RCR07G272JM
R26	Resistor, 1 Meg ohm, 1/4W, 5%	81349	RCR07G105JM
R27	Resistor, 33.2K ohm, 1/8W, 1%	81349	RN55D3322F
R28	Resistor, Variable, 100 ohm	14304	R-2222
R29	Resistor, 825 ohm, 1/8W, 1%	81349	RN55D8250F
R30	Resistor, 332 ohm, 1/8W, 1%	81349	RN55D3320F
R31	Resistor, 33K ohm, 1/4W, 5%	81349	RCR07G333JM
R32	Resistor, 33K ohm, 1/4W, 5%	81349	RCR07G333JM
R33	Resistor, 33K ohm, 1/4W, 5%	81349	RCR07G333JM
R34	Resistor, 33K ohm, 1/4W, 5%	81349	RCR07G333JM
R35	Resistor, 47K ohm, 1/4W, 5%	81349	RCR07G473JM
R36	Resistor, 4.7K ohm, 1/4W, 5%	81349	RCR07G472JM
R37	Resistor, 47K ohm, 1/4W, 5%	81349	RCR07G473JM
R38	Resistor, 47K ohm, 1/4W, 5%	81349	RCR07G473JM
R39	Resistor, 33K ohm, 1/4W, 5%	81349	RCR07G333JM
R40	Resistor, 10K ohm, 1/4W, 5%	81349	RCR07G103JM
R41	Resistor, 33K ohm, 1/4W, 5%	81349	RCR07G333JM
R42	Resistor, 1 Meg ohm, 1/4W, 5%	81349	RCR07G105JM
R43	Resistor, 10K ohm, 1/4W, 5%	81349	RCR07G103JM
R44	Resistor, 33K ohm, 1/4W, 5%	81349	RCR07G333JM
R45	Resistor, 33K ohm, 1/4W, 5%	81349	RCR07G333JM
R46	Resistor, 15K ohm, 1/4W, 5%	81349	RCR07G153JM
R47	Resistor, 27K ohm, 1/4W, 5%	81349	RCR07G273JM
R48	Resistor, 2.2K ohm, 1/4W, 5%	81349	RCR07G222JM
R49	Resistor, 22K ohm, 1/4W, 5%	81349	RCR07G223JM
R50	Resistor, Variable, 200 ohm	14304	R-2223

Table 3. 1A1A7 Memory PWB Maintenance Parts List (10007-1120) (Continued)

Ref. Desig.	Name & Description	Mfr. Code	Part Number
R51	Resistor, .825 ohm, 1/8W, 1%	81349	RN55D8250F
R52	Resistor, 680 ohm, 1/4W, 5%	81349	RCR07G681JM
R53	Resistor, 330 ohm, 1/4W, 5%	81349	RCR07G331JM
R54	Resistor, 2.2K ohm, 1/4W, 5%	81349	RCR07G222JM
R55	Resistor, 2.2K ohm, 1/4W, 5%	81349	RCR07G222JM
R56	Resistor, 33K ohm, 1/4W, 5%	81349	RCR07G333JM
R57	Resistor, 33K ohm, 1/4W, 5%	81349	RCR07G333JM
R58	Resistor, 33K ohm, 1/4W, 5%	81349	RCR07G333JM
R59	Resistor, 33K ohm, 1/4W, 5%	81349	RCR07G333JM
R60	Resistor, 33K ohm, 1/4W, 5%	81349	RCR07G333JM
R61	Resistor, 33K ohm, 1/4W, 5%	81349	RCR07G333JM
R62	Resistor, 8.25K ohm, 1/8W, 1%	81349	RN55D8251F
R63	Resistor, 33K ohm, 1/4W, 5%	81349	RCR07G333JM
S1-S6	Switch, Piano DIP	14304	6628-0760
TP1	Test Point, Brown	14304	J-0392
TP2	Test Point, Red	14304	J-0387
TP3	Test Point, Orange	14304	J-0390
TP4	Test Point, Yellow	14304	J-0391
TP5	Test Point, Green	14304	J-0389
TP6	Test Point, Blue	14304	J-0393
TP7	Test Point, Violet	14304	J-0394
TP8	Test Point, Grey	14304	J-0395
TP9	Test Point, White	14304	J-0386
TP10	Test Point, Black	14304	J-0388
U1	Integrated Circuit, CD4077BE	14304	I01-0000-027
U2	Integrated Circuit, CD4077BE	14304	I01-0000-027
U3	Integrated Circuit, CD4001AE	14304	IC-0135
U4	Integrated Circuit, LM324	14304	I30-0003-000
U5	Integrated Circuit, CD4060AE	14304	IC-0385
U6	Integrated Circuit, CD4001AE	14304	IC-0135
U7	Integrated Circuit, ER2051 (EAROM)	14304	IC-0401
U8	Integrated Circuit, ER2051 (EAROM)	14304	IC-0401
U9	Integrated Circuit, MM80C97	14304	I03-0004-000
U10	Integrated Circuit, CA555CE	14304	I35-0004-000
U11	Integrated Circuit, CD4081BE	14304	I01-0000-029
U12	Integrated Circuit, CD4001AE	14304	IC-0135
U13	Integrated Circuit, CD4013AE	14304	IC-0137
U14	Integrated Circuit, CD4013AE	14304	IC-0137
U15	Integrated Circuit, CD4022AE	14304	IC-0141
VR1	Diode, Zener, 9.1 volt 1N5239	14304	1N5239A
VR2	Diode, Zener, 6.2 volt 1N753A	14304	1N753A
VR3	Diode, Zener, 3.6 volt 1N747A	14304	1N747A

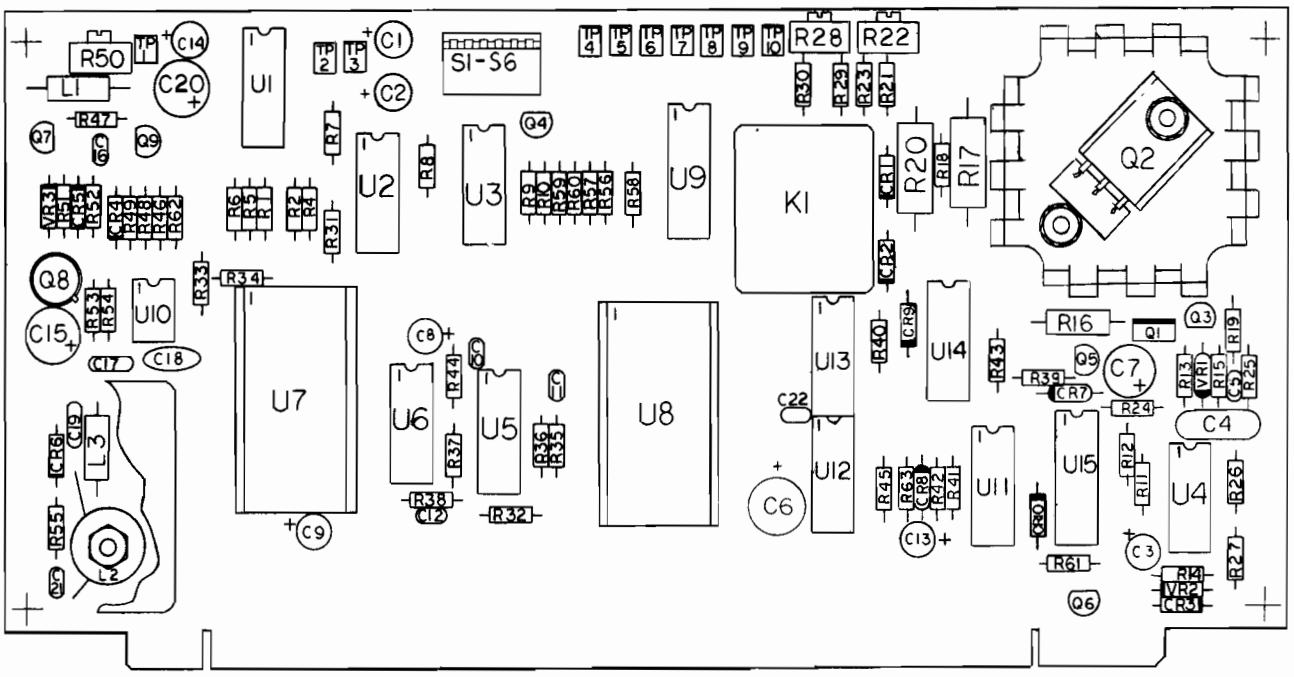


Figure 1. 1A1A7 Component Layout

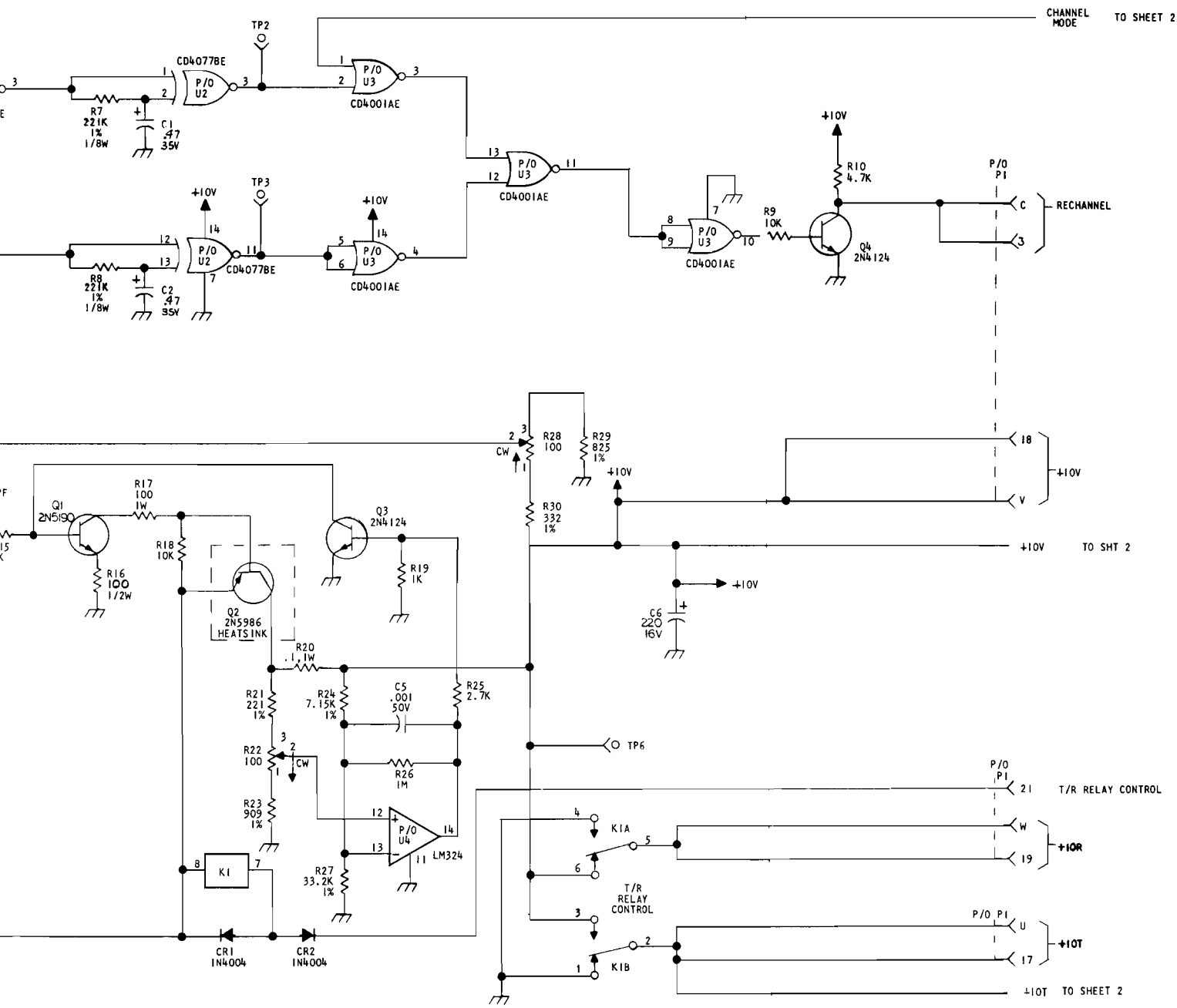
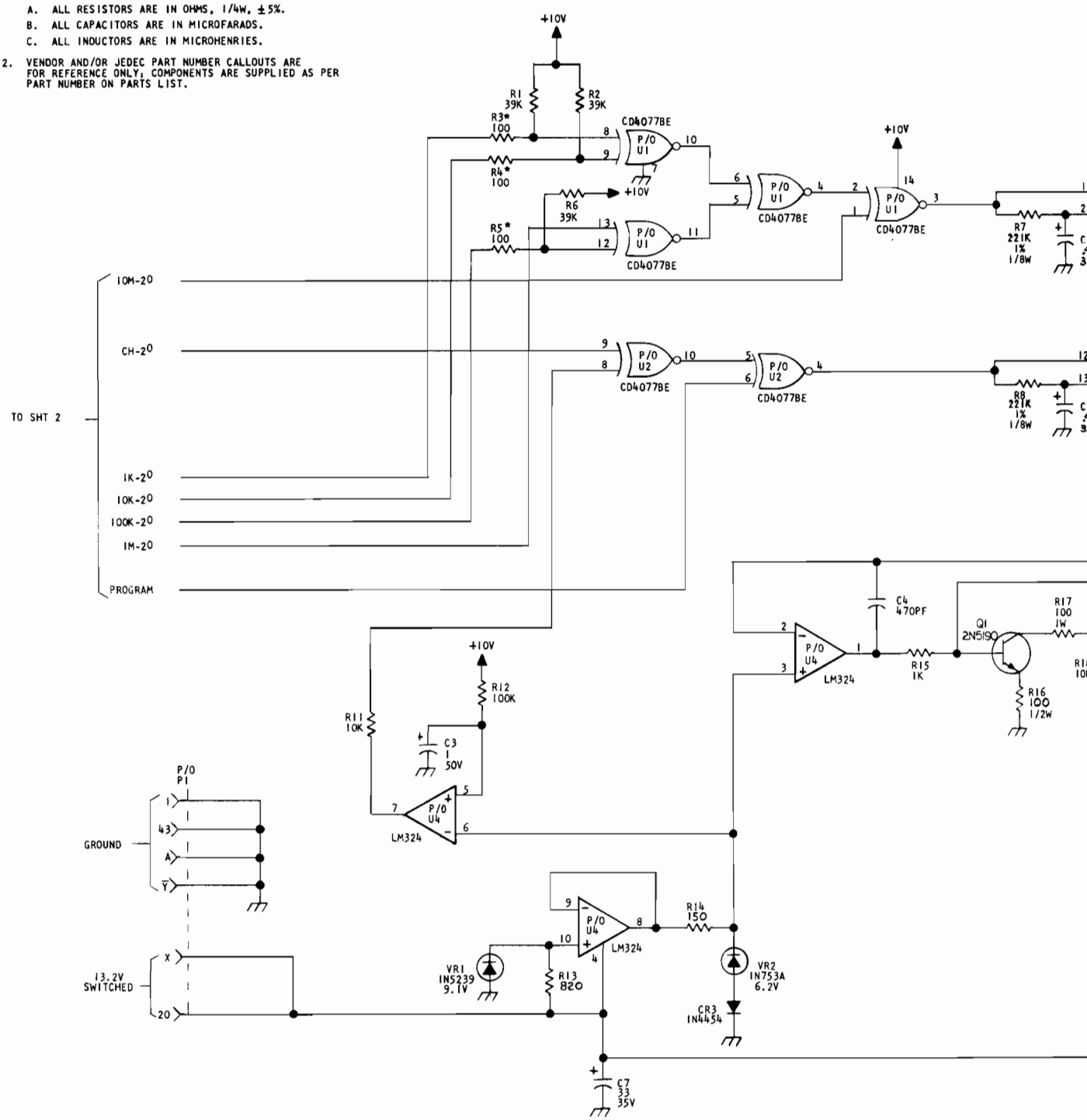


Figure 2. 1A1A7 Memory Assembly Schematic Diagram (10007-1121) (Sheet 1 of 2)

1. UNLESS OTHERWISE SPECIFIED:
   A. ALL RESISTORS ARE IN OHMS, 1/4W, ±5%.
   B. ALL CAPACITORS ARE IN MICROFARADS.
   C. ALL INDUCTORS ARE IN MICROHENRIES.

2. VENDOR AND/OR JEDEC PART NUMBER CALLOUTS ARE FOR REFERENCE ONLY; COMPONENTS ARE SUPPLIED AS PER PART NUMBER ON PARTS LIST.



* THESE RESISTORS MAY BE REMOVED AS FOLLOWS:

RECHANNEL PULSE FOR GREATER THAN:	REMOVE
900 HZ	NONE
9.9 KHZ	R3
99.9 KHZ	R3,R4
999.9 KHZ	R3,R4,R5

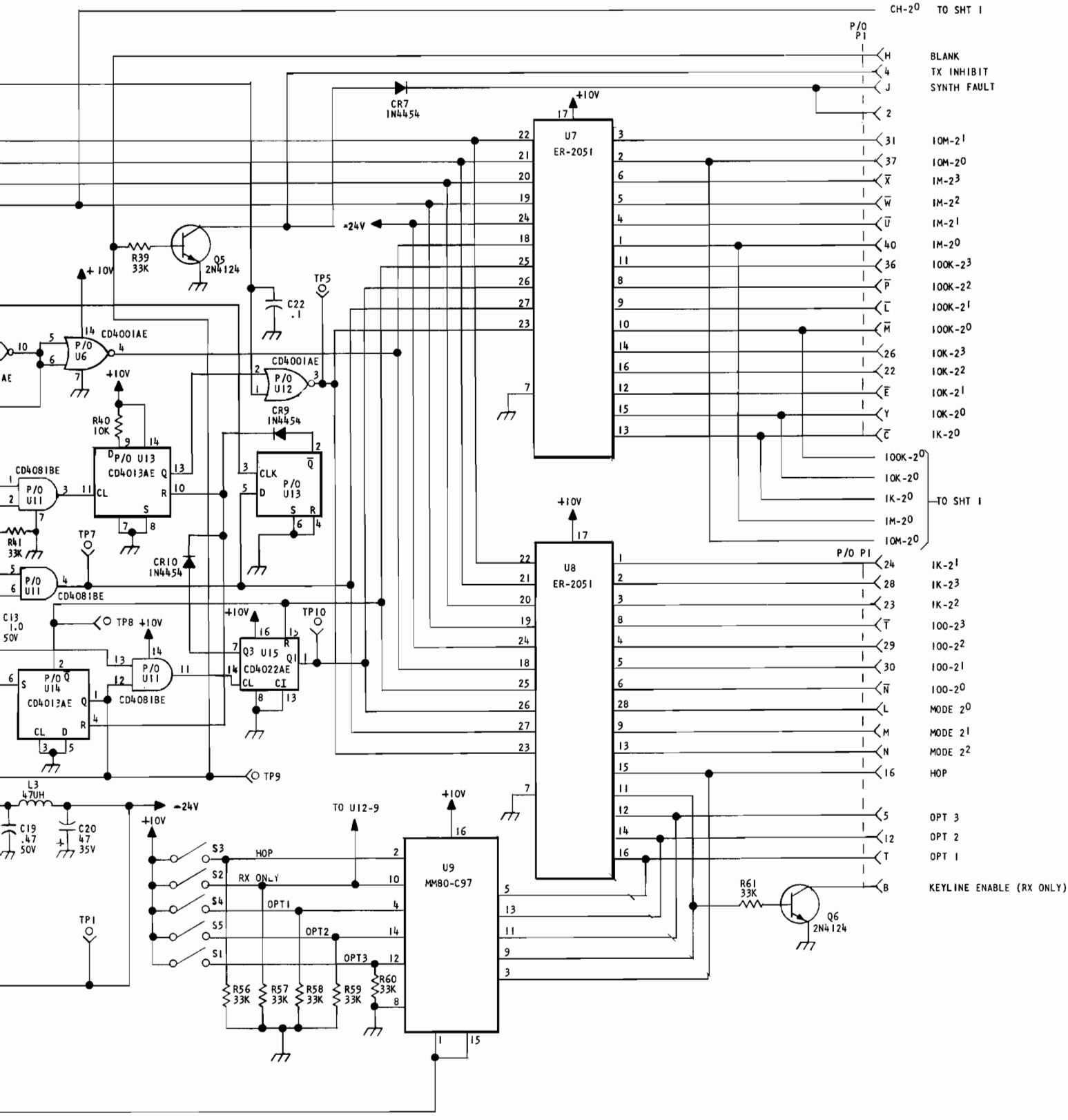
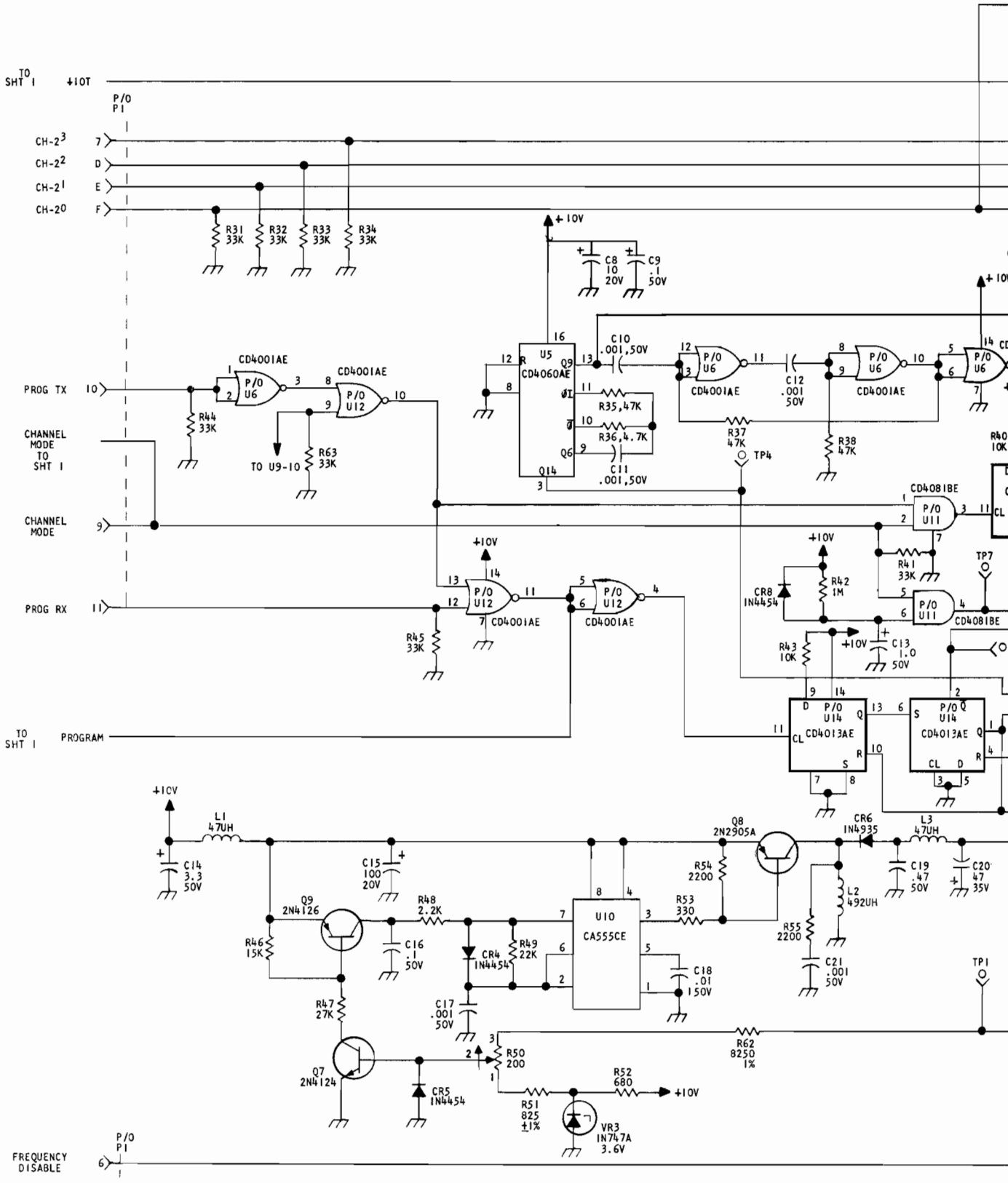


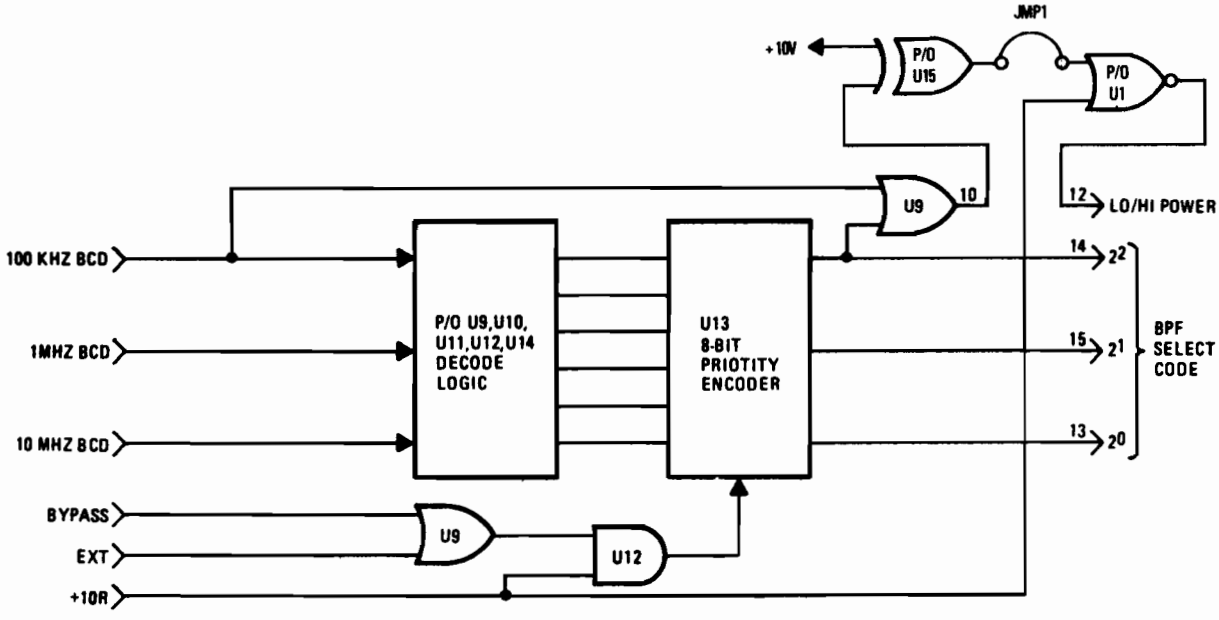
Figure 2. 1A1A7 Memory Assembly Schematic Diagram (10007-1121) (Sheet 2 of 2)

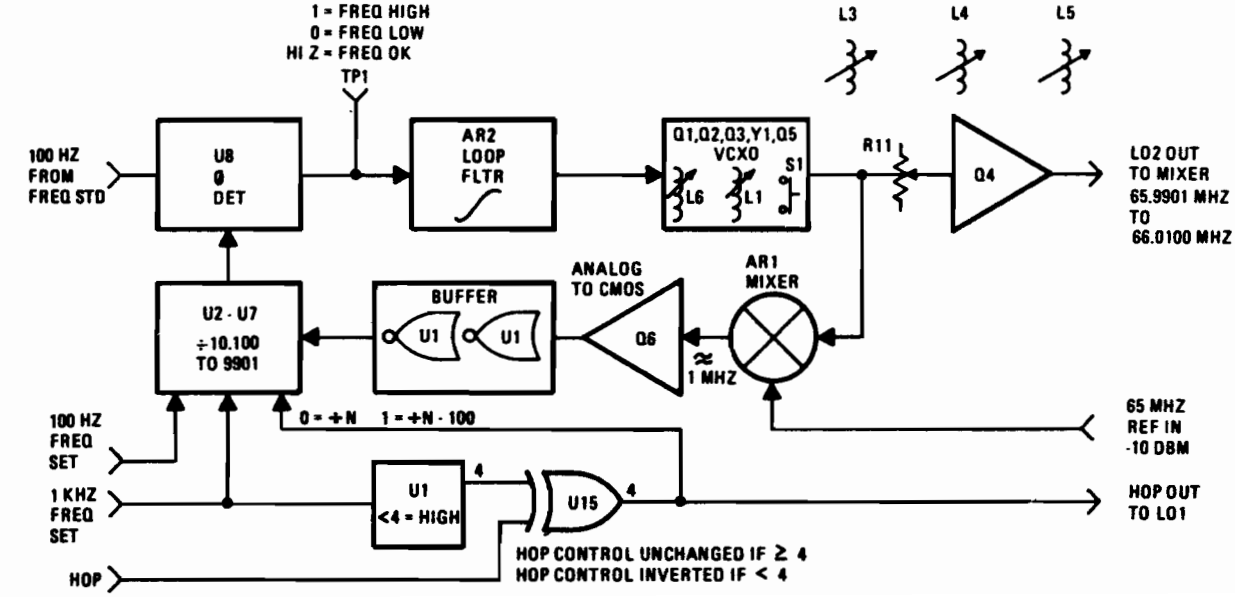

TO SHT 1
+10T
P/O P1
CH-2³
CH-2²
CH-2¹
CH-2⁰
R31 33K
R32 33K
R33 33K
R34 33K
+10V
C8 10 20V
C9 .1 50V
C10 .001,50V
U5 CD4060AE
R35,47K
R36,4.7K
C11 .001,50V
CD4001AE
P/O U6
C12 .001 50V
R37 47K
TP4
R38 47K
CD4081BE
P/O U11
R41 33K
TP7
R40 10K
PROG TX
R44 33K
P/O U12
TO U9-10
R63 33K
CHANNEL MODE TO SHT 1
CHANNEL MODE
PROG RX
R45 33K
CR8 IN4454
R42 1M
R43 10K
C13 1.0 50V
TO SHT 1
PROGRAM
P/O U14
CD4013AE
L1 47UH
C14 3.3 50V
C15 100 20V
Q8 2N2905A
CR6 IN4935
L3 47UH
C19 .47 50V
C20 47 35V
R54 2200
L2 492UH
R55 2200
C21 .001 50V
TP1
Q9 2N4126
R48 2.2K
R46 15K
C16 .1 50V
CR4 IN4454
R49 22K
U10 CA555CE
R53 330
C18 .01 150V
R47 27K
C17 .001 50V
R62 8250 1%
Q7 2N4124
R50 200
CR5 IN4454
R52 680
R51 825 ±1%
VR3 IN747A 3.6V
FREQUENCY DISABLE
P/O P1

UNIT INSTRUCTIONS

LO NO.2

1A1A8





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1. GENERAL DESCRIPTION

LO No. 2 generates the 66 MHz injection signal used at the 1A1A6 Mixer to convert the 9 MHz transmit input to the 75 MHz Intermediate Frequency, or in the receive mode, to convert the 75 MHz IF input to a 9 MHz IF. The LO No. 2 assembly uses 100 Hz and 1 kHz BCD input information. HOP (spur evasion technique) control information is also used to shift the output 10 kHz.

BPF (Band Pass Frequency) Select Control signals are also generated on the LO No. 2 assembly. This function is accomplished automatically in response to BCD frequency control inputs. This section also incorporates a priority encoder system to automatically select BYPASS mode in response to control inputs.

2. TECHNICAL CHARACTERISTICS

Power Inputs:

+10 Vdc	P1-18	
+10R	P1-19	

Signal Inputs −10 dBm :

65 MHz REF	P1-9	From 1A1A10
100 Hz REF	P1-42	From 1A1A10

Signal Outputs +7 dBm:

LO No. 2 (66 MHz)	P1-2	To 1A1A6

Control Inputs:

BPF Control Inputs	From 1A1A6/1A1A8
BYPASS Control	INT. EXT., +10R
100 Hz Freq. Control	From 1A1A7/1A1A8
1 kHz Freq. Control	From 1A1A7/1A1A8
HOP	From 1A1A7/1A1A8

Control Outputs:

BPF Select Control, 3-Bit
LO/HI Power Control
O/L (Out of Lock) = 0

3. SEMICONDUCTOR COMPLEMENT

REF. DESIG.	TYPE	DESCRIPTION
AR1	CA3028AS	Differential Cascode Ampl.
AR2	CA3130AS	Operational Amplifier
CR1		Voltage Variable Capacitance
CR2, CR3	1N4454	Diode, Signal
Q1, Q2	2N4124	Transistor, NPN
Q3	MPS2369	Transistor, NPN
Q4	2N3563	Transistor, NPN
Q5	MPS-A13	Transistor, Darlington, NPN
Q6	2N4124	Transistor, NPN
U1	CD4001AE	Quad 2-Input NOR
U2, U3	CD4029AE	Presettable Up/Down Counter
U4	CD4024AE	7 Stage Binary Counter
U5	CD4096BE	Gated J-K Master Slave Flip-Flop
U6	CD4082BE	Dual 4-Input AND Gates
U7	CD4011AE	Quad 2-Input NAND Gates
U8	CD4046AE	Phase Locked Loop
U9, U11	CD4071BE	Quad 2-Input OR Gates
U10	CD4075BE	Triple 3-Input OR Gates
U12	CD4081BE	Quad 2-Input AND Gates
U13	CD4532BE	8-Bit Priority Encoder
U14	CD4081BE	Quad 2-Input AND Gates
U15	CD4030AE	Quad Exclusive OR Gates

4. FUNCTIONAL DESCRIPTION

The two major functions performed by the LO2 PC Board are each covered by a separate schematic diagram. Figure 4 (sheet 1 of 2) is a complete schematic diagram of the BPF (Band Pass Frequency Select) function, and figure 4 (sheet 2 of 2) is a complete schematic diagram of the LO2 synthesizer function.

4.1 BPF Decoder Function

U13 is an 8-Bit Priority Encoder and functions to translate BCD frequency control elements from the Program Board to the desired band select control elements. U9 looks for a "frequency greater than 4 MHz condition", to generate LO/HI Power Control Logic. With JMP 1 installed, the output at P1-12 will be high for a frequency $>$ 4.000 MHz condition, and it will be low for any frequency $\leq$ 4.000 MHz condition. This output is not used in a standard 125 watt RF-2301 system; however, in systems employing an RF-103 1 kW Power Amplifier, this output will automatically bypass the RF-103 to meet FCC inposed reduced power requirements at frequencies below 4 MHz.

NOTE

With JMP 1 removed, the output at P1-12 will be high for frequencies 2-30 MHz.

If in the receive mode, the two BYPASS control lines are "prioritized" to pre-empt any other band control information, and to select BYPASS mode at the coupler.

U13 interprets the decode logic outputs to produce BPF Select Code outputs as shown in table 1.

TABLE 1.
INPUT FREQUENCIES VS OUTPUT CODES

Input Frequency Range (MHz)	BPF Output Codes 2^2	2^1	2^0
0.0 – 1.5999	0	0	0
1.6 – 2.5999	0	0	1
2.6 – 4.1999	0	1	0
4.2 – 6.7999	0	1	1
6.8 – 10.9999	1	0	0
11.0 – 17.9999	1	0	1
18.0 – 29.9999	1	1	0
BYPASS	1	1	1

4.2 LO2 Generation

Phase comparator U8 functions as an edge-controlled digital memory network. It consists of four flip-flop stages, control gating, and a three state output circuit comprising p and n type drivers having a common output mode. When the P-MOS or N-MOS drivers are ON they pull the output up to V_{DD} (+10V), or down to V_{SS} (gnd), respectively. This type comparator acts only on the positive edges of the signal and comparator inputs. The feedback loop signal input is at U8-14, and the reference 100 Hz input is at U8-3. The phase comparator output is at U8-13 and is measurable at TP1.

The duty cycles of the signal and comparator inputs are not important since positive transitions control the PLL system utilizing this type of comparator. If the signal-input frequency is higher than the comparator-input frequency, the p-type output driver is maintained ON most of the time, and both the n and p drivers OFF (3 state) the remainder of the time. If the signal-input frequency is lower than the comparator-input frequency, the n-type output driver is maintained ON most of the time, and both the n and p drivers OFF (3 state) the remainder of the time. If the signal-and comparator-input frequencies are the same, but the signal input lags the comparator input in phase, the n-type output driver is maintained ON for a time corresponding to the phase difference. If the signal-and comparator-input frequencies are the same, but the comparator input lags the signal in phase, the p-type output driver is maintained ON for a time corresponding to the phase difference. Subsequently, the capacitor voltage of the low-pass filter connected to this phase comparator is adjusted until the signal and comparator inputs are equal in both phase and frequency. At this stable point both p- and n-type output drivers remain OFF and thus the phase comparator output becomes an open circuit and holds the voltage on the capacitor of the low-pass filter constant.

The "phase pulses" output signal at pin 1 is a high level to indicate a locked condition and is used at the frequency standard (1A1A8) for this purpose. At pin 13, the output to the loop filter has three states: The high impedance state indicates a "locked" condition; a high logic level indicates that the frequency is too high; and a low logic level indicates that the frequency is to low. These outputs through loop filter AR2 drive voltage variable capacitor CR1 in the VCXO to correct any error. Normal phase detector operation is 2 – 8V. Therefore, 8 – 10 Vdc indicates LO2 too high in frequency 0 – 2 Vdc indicates LO2 too low in frequency.

S1 on the VCXO is used as a test/adjust switch to bypass the frequency control circuit for initial adjustment of the oscillator. With S1 closed, L6 is adjusted so that the oscillators inherent frequency is 16.5 MHz. L3, L4, and L5 are adjusted for optimum output and spurious rejection. Note that the output section is actually a times 4 multiplier, and that the output at P1-2 is actually 66 MHz. The output level at P1-2 is adjusted to +7 dBm using R11.

A sample of this 66 MHz output is picked off at the Q3 collector and fed to down mixer AR1. AR1 performs a subtractive mixing function using this 66 MHz input and the 65 MHz reference input from the Frequency Standard PC Board via P1-9. The 1 MHz mixer output is fed to Q6 via C27. Q6 functions as an analog to CMOS converter to produce a square wave output from the 1 MHz sine wave input. This output is buffered by U1 elements and closes the feedback loop driving the divide-by-N frequency control circuit. U2 provides 100 Hz frequency control information, and U3 provides 1 kHz information. Each of these frequency control elements are driven by 4-bit control lines from the program pc board.

The divide-by-N function involves three major subfunctions: presettable counters, divider control logic, and HOP control logic, the presettable

counters operate in conjunction with divider control logic to allow division of the input frequency by a number between 9901 and 10100. The actual division radio is determined as follows. U6 decodes two end states for counter U4. One of these end states is selected by U7 under control of HOP (defined as the condition that exists when U15-4 is high). In the HOP condition, U6-13 will be high and the "100" end-state is selected; If U6-1 is low, there is no HOP condition and the selected end-state will be "99".

Counters U2 and U3 each have a state of 9. There are, therefore, three signals that occur when the counters have reached the end state; which is 9999 with HOP low, or 10099 with HOP high. These three control signals are processes by U5 to reset counters U2, U3, and U4 to zero, and to allow them to count up again.

When not in the HOP condition, after U2 and U3 are preset to zero, the counters will provide an output as they read 9999, reset, and start over. Since the count starts at zero, 10,000 clock pulses are required to produce one output – which translates to a division ratio of 10,000.

The U5-6 $\overline{Q}$ output will thus always be 100 Hz as long as the LO 2 output is "on frequency", and any tendency to deviate from this "on frequency" condition will be defected by Phase Detector U8 and the appropriate correction voltage will be generated.

Let us assume an operating frequency of 2.182 MHz as a pratical review example. Referring to table 2, the "normal" LO2 output will be 66.0080 MHz, because the 2^2 and 2^3 kHz control bits at U1-5 and U1-6 respectively will cause a high at U1-4 and at U15-4. This same x.xx20 MHz frequency select control information at U2 and U3 will preset these counters with "20", and in combination with the Automatic HOP forcing signal at U15-4, will cause a total divide-by-N factor of 10080. Dividing (66.008 MHz - 65 MHz) by 10080 will produce the desired 100 Hz Phase Detector signal input. To continue the example using a frequency above the Automatic HOP control crossover point, 2.184 MHz, the LO2 output would be 65.9960 MHz. By subtracting the 65 MHz reference, we find a 0.996 MHz feedback signal to the divide-by-N circuit and a total divide-by-N factor of 9960, to produce the 100 Hz phase detector feed-back signal. An LO2 output can be derived using information presented in table 2. Remember one point, automatically or manually employing the HOP spur evasion technique will never alter the actual transmit or receive operating frequency because of the complementary mixing process action at LO1.

5. MAINTENANCE

All of the adjustments indicated in this paragraph have been made at the factory prior to shipment. It should not be necessary to repeat any of these adjustments unless component failure is experienced, or unless readjustment becomes necessary for some other specific reason. All of these adjustments can be made by removing the PC Board and reinstalling it on the extender card as shown in figure 1. This will facilitate maintenance and adjustment by making all test points readily available. These adjustments can all be made using the test equipment shown or the electrical equivalents. Figure 2 summarizes 1A1A9 Inputs/Outputs and locates significant adjustment points.

CAUTION

Always remove power when removing or reinstalling subassemblies.

5.1 L1/L6 Adjustment

L6 is tuned to establish the normal (no varactor control) resonant frequency of the VCXO at 16.5 MHz. Install the LO2 assembly on a pc board extender card (part of MRK) and connect the rf output to a dummy load to prevent unnecessary test transmissions. Procede as follows:

a. Set RF-2301 to 2.5000 MHz and verify that the HOP switch located on the 1A1A7 program board is not activated.

b. Select or verify power on at RF-2301.

c. Connect a frequency counter to the rf output connector at P1-2.

d. Close slide switch S1 (by sliding toward top of board) on 1A1A8 to disable CR1 control and adjust L6 for an rf output of 66 MHz ± .005 MHz (4 x 16.5 MHz) at P1-2.

e. Set kHz and 100 Hz programming switches to zero.

f. Open slide switch S1 (down position), and adjust L1 for a reading of 7.5 Vdc ±0.1 Vdc at TP1.

g. Set kHz and 100 Hz programming switch to 9 and verify voltage at TP1 to be 3.75 Vdc ±1.0 Vdc.

h. This completes L1/L6 adjustment. Reconfigure for normal operation or proceed with test. Make certain that S1 is left in the open (down) position for normal operation.

5.2 L3, L4, L5 Adjustment

L3, L4, and L5 are all tuned to select the 4th harmonic of the VCXO oscillator frequency, and to produce the optimum spurious attenuation simultaneous with optimum 66 MHz output.

a. Connect a spectrum analyzer to the LO2 output at P1-2.

b. With slide switch S1 in the open position, adjust L3, L4, and L5 for optimum 66 MHz output and spurious rejection.

c. Disconnect the spectrum analyzer and connect an RF Millivoltmeter at P1-2. Adjust R11 to produce a +7 dBm output at this point.

d. This completes 1A1A8 adjustments. Reconfigure for normal operation.

6. PARTS LIST

Table 3 lists all 1A1A8 Maintenance Parts. All of these components can be identified in figure 3. Refer to General Information Section for list of manufacturers.

7. SCHEMATIC

Figure 4 is a complete schematic diagram of the 1A1A8 assembly.

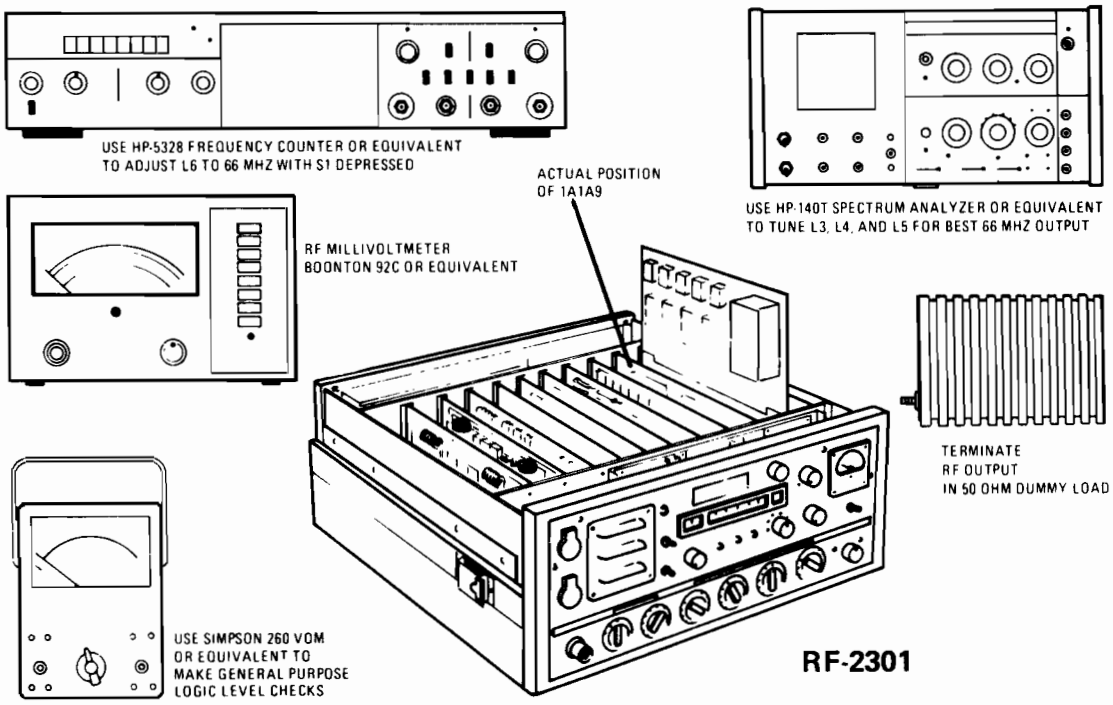


Figure 1. 1A1A8 Test Setup and Equipment

TABLE 2. LO2 OUTPUTS FOR SELECTED F_O CONDITIONS

SELECTED F_0 IN MHZ	LO2 OUTPUT (NORMAL)	DIVIDE-BY-N FACTOR	HOP CROSSOVER POINT NOTES	LO2 OUTPUT HOP SELECTED	DIVIDE-BY-N FACTOR
X.XX00	66.0100	10100		66.0000	10000
01	66.0099	10099		65.9999	9999
02	66.0098	10098	NORMAL LO2 OUT-	65.9998	9998
03	66.0097	10097	PUTS ARE AS	65.9997	9997
04	66.0096	10096	SHOWN AT LEFT.	65.9996	9996
05	66.0095	10095	IF HOP IS MAN-	65.9995	9995
06	66.0094	10094	UALLY SELECTED	65.9994	9994
07	66.0093	10093	OR PROGRAMMED,	65.9993	9993
08	66.0092	10092	LO2 OUTPUTS WILL	65.9992	9992
09	66.0091	10091	BE AS SHOWN AT	65.9991	9991
10	66.0090	10090	RIGHT.	65.9990	9990
11	66.0089	10089		65.9989	9989
12	66.0088	10088		65.9988	9988
CONTINUES IN SEQUENCE					
19	66.0081	10081	CROSSOVER CON-	65.9981	9981
20	66.0080	10080	TROL FOR "AUTO	65.9980	9980
21	66.0079	10079	HOP" EFFECTED	65.9979	9979
22	66.0078	10078	BY 2^2 AND 2^3 KHZ	65.9978	9978
23	66.0077	10077	BITS AT U1-5 AND	65.9977	9977
24	66.0076	10076	U1-6	65.9976	9976
CONTINUES IN SEQUENCE					
37	66.0063	10063	CROSSOVER	65.9963	9963
38	66.0062	10062	POINT	65.9962	9962
39	66.0061	10061	▼	65.9961	9961
40	65.9960	9960	▲	66.0060	10060
41	65.9959	9959	CROSSOVER	66.0059	10059
42	65.9958	9958	POINT	66.0058	10058
43	65.9957	9957		66.0057	10057
44	65.9956	9956	FOR FREQUENCIES	66.0056	10056
45	65.9955	9955	LESS THAN X.XX40	66.0055	10055
46	65.9954	9954	MHZ, HOP IS AUTO-	66.0054	10054
47	65.9953	9953	MATICALLY ACTI-	66.0053	10053
48	65.9952	9952	VATED.	66.0052	10052
49	65.9951	9951	MANUALLY SEL-	66.0051	10051
50	65.9950	9950	ECTING HOP WILL	66.0050	10050
51	65.9949	9949	ALWAYS CHANGE	66.0049	10049
52	65.9948	9948	LO2 OUTPUT FROM	66.0048	10048
53	65.9947	9947	THAT SHOWN AT	66.0047	10047
54	65.9946	9946	THE LEFT, TO THAT	66.0046	10046
55	65.9945	9945	SHOWN AT THE	66.0045	10045
56	65.9944	9944	RIGHT.	66.0044	10044
CONTINUES IN SEQUENCE					
97	65.9903	9903		66.0003	10003
98	65.9902	9902		66.0002	10002
X.XX99	65.9901	9901		66.0001	10001

1	GND	A	
2	LO2 OUTPUT (66 MNZ)	B	
3	GND	C	
4		D	
5		E	
6		F	
7		H	
8		J	
9	65 MHZ REF INPUT	K	
10	GND	L	
11	TP1	M	
12	LO/HI POWER	N	
13	BPF SELECT CODE 2^0	P	
14	BPF SELECT CODE 2^2	R	
15	BPF SELECT CODE 2^1	S	
16	HOP	T	HOP
17		U	
18	+10 VDC	V	
19	+10R	W	
20		X	
21	BYPASS (INT)	Y	
22	1 KHZ FREQ SELECT 2^2	Z	
23	1 KHZ FREQ SELECT 2^1	a	
24	1 KHZ FREQ SELECT 2^0	b	
25	BYPASS (EXT)	c	
26	1 KHZ FREQ SELECT 2^3	d	
27	100 HZ FREQ SELECT 2^2	e	
28	100 HZ FREQ SELECT 2^1	f	
29	10 MHZ 2^1	h	
30	100 KHZ 2^1	j	
31		k	
32	100 HZ FREQ SELECT 2^0	l	
33	100 KHZ 2^2	m	
34	100 KHZ 2^3	n	
35	10 MHZ 2^0	p	
36	100 HZ FREQ SELECT 2^3	r	
37	1 MHZ 2^1	s	
38	1 MHZ 2^0	t	
39	1 MHZ 2^2	u	
40	1 MHZ 2^3	v	
41	O/L OUT	w	
42	100 HZ REF INPUT	x	
43	GND	y	

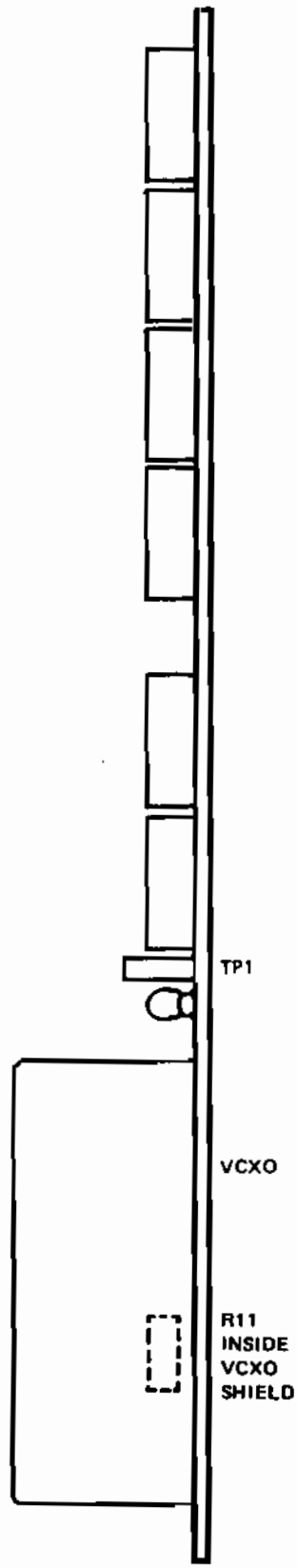


Figure 2. 1A1A8 Input/Output Summary

Table 3. 1A1A8-Maintenance Parts List

Ref. Desig.	Name & Description	Mfr. Code	Part Number
1A1A8	L.O. No. 2 PWB Assembly	14304	6628-0800
AR1	Integrated Circuit, Differential/Cascode Amplifier, CA3028AS	14304	IC-0031
AR2	Integrated Circuit, Operational Amplifier, CA3130AS	14304	IC-0376
C1	Capacitor, Fixed, Mica, 470 pF ±2%, 500V	14304	C-2496
C2	Capacitor, Fixed, Mica, 680 pF ±2%, 500V	14304	C-2501
C3	Capacitor, Fixed, Tantalum, 6.8 uF ±10%, 35V	14304	C-3102
C4	Capacitor, Fixed, Ceramic, .01 uF ±20%, 50V	14304	C11-0007-103
C5	Capacitor, Fixed, Ceramic, 33 pF ±5%, 1000V	14304	C-4750
C6	Capacitor, Fixed, Ceramic, .01 uF ±20%, 50V	14304	C11-0007-103
C7	Capacitor, Fixed, Ceramic, 10 pF ±5%, 1000V	14304	C-4741
C8	Capacitor, Fixed, Ceramic, 15 pF ±5%, 1000V	14304	C-4743
C9	Capacitor, Fixed, Mica, 75 pF ±2%, 500V	14304	C-2476
C10	Capacitor, Fixed, Ceramic, .01 uF ±20%, 50V	14304	C11-0007-103
C11	Capacitor, Fixed, Ceramic, .001 uF ±10%, 500V	14304	C-3513
C12	Capacitor, Fixed, Ceramic, 15 pF ±5%, 1000V	14304	C-4743
C13	Capacitor, Fixed, Ceramic, 39 pF ±5%, 1000V	14304	C-4751
C14	Capacitor, Fixed, Ceramic, 1 pF ±5%, 1000V	14304	C-4727
C15	Capacitor, Fixed, Ceramic, .01 uF ±20%, 50V	14304	C11-0007-103
C16	Capacitor, Fixed, Tantalum, 6.8 uF ±10%, 35V	14304	C-3102
C17	Capacitor, Fixed, Mica, 220 pF ±5%, 500V	14304	C-0134
C18	Capacitor, Fixed, Ceramic, 20 pF ±5%, 1000V	14304	C-4745
C19	Capacitor, Fixed, Ceramic, 47 pF ±5%, 1000V	14304	C-4752
C20	Capacitor, Fixed, Ceramic, .01 uF ±20%, 50V	14304	C-4952
C21	Capacitor, Fixed, Ceramic, 56 pF ±5%, 1000V	14304	C-4754
C22	Capacitor, Fixed, Mica, 120 pF ±5%, 500V	14304	C-0128
C23, C24	Capacitor, Fixed, Ceramic, .01 uF ±20%, 50V	14304	C-4952
C25	Capacitor, Fixed, Mica, 220 pF ±5%, 500V	14304	C-0134
C26	Capacitor, Fixed, Tantalum, 6.8 uF ±10%, 35V	14304	C-3102
C27	Capacitor, Fixed, Ceramic, .01 uF ±20%, 50V	14304	C-4952
C28	Capacitor, Fixed, Tantalum, 1 uF ±10%, 35V	14304	C-3100
C29	Capacitor, Fixed, Tantalum, 150 uF ±10%, 15V	14304	C-3106
C30	Capacitor, Fixed, Tantalum, 1 uF ±10%, 35V	14304	C-3100
C31	Capacitor, Fixed, Ceramic, 47 pF ±5%, 1000V	14304	C-4752
C32	Capacitor, Fixed, Ceramic, .047 uF +80-20%, 50V	14304	C-3201
C33	Capacitor, Fixed, Polycarbonate, .1 uF ±10%, 100V	14304	C-8031
C34	Capacitor, Fixed, Polycarbonate, 1 uF ±10%, 100V	14304	C-8043
C35	Capacitor, Fixed, Tantalum, 150 uF ±10%, 15V	14304	C-3106
C36, C37	Capacitor, Fixed, Ceramic, .01 uF ±10%, 50V	14304	C-4952
C38	Capacitor, Fixed, Ceramic, .001 uF ±10%, 500V	14304	C-3513
C39	Capacitor, Fixed, Tantalum, 6.8 uF ±10%, 35V	14304	C-3102
C40	Capacitor, Fixed, Ceramic, .01 uF ±20%, 50V	14304	C-4952

Table 3. 1A1A8 Maintenance Parts List (Continued)

Ref. Desig.	Name & Description	Mfr. Code	Part Number
C41 to C49	Capacitor, Fixed, Ceramic, .001 μF ±10%, 500V	14304	C-3513
C50	Capacitor, Fixed, Ceramic, .01 μF ±20%, 50V	14304	C11-0007-103
C51 to C53	Capacitor, Fixed, Ceramic, .1 μF +80-20%, 50V	14304	C-3202
C54	Capacitor, Fixed, Ceramic, .001 μF ±10%, 500V	14304	C-3513
C55	Capacitor, Fixed, Ceramic, 1.9 pF ± .5 pF, 1000V	14304	C-4730
C56	Capacitor, Fixed, Ceramic, 1.8 pF ± .5 pF, 1000V	14304	C-4730
C57	Capacitor, Tantalum, 4.7 uF, 20V	14304	C-6446
C58	Capacitor, Fixed, Ceramic, .01 uF ±20%, 50V	14304	C-4952
CR1	Diode, Hyper Abrupt	14304	10073-7118
CR2, CR3	Diode, Signal, 1N4454	14304	CR-0705
JMP1,JMP2	Jumper	14304	MP1142
L1	Inductor, Variable, 3.3 μH	14304	6628-0812
L2	Choke, RF, 10 μH ±10%	14304	L-0628
L3 to L6	Inductor, Variable, .34 μH	14304	L-0251
L7	Choke, RF, .39 μH ±10%	14304	L-0611
L8	Choke, RF, .15 μH ±10%	14304	L-0606
L9	Choke, RF, 100 μH ±10%	14304	L-0640
L10	Choke, RF, 56 μH ±10%	14304	L-0637
Q1, Q2	Transistor, NPN, 2N4124	14304	Q-0385
Q3, Q4	Transistor, NPN, 2N3563	14304	Q-0309
Q5	Transistor, NPN, Darlington, MPSA13	14304	Q-0076
Q6	Transistor, NPN, 2N4124	14304	Q-0385
R1	Resistor, Fixed, Composition, 33K ±5%, 1/4W	81349	RCR07G333JM
R2	Resistor, Fixed, Composition, 4.3K ±5%, 1/4W	81349	RCR07G432JM
R3	Resistor, Fixed, Composition, 910 ohm ±5%, 1/4W	81349	RCR07G911JM
R4	Resistor, Fixed, Composition, 3.3K ±5%, 1/4W	81349	RCR07G332JM
R5	Resistor, Fixed, Composition, 330 ohm ±5%, 1/4W	81349	RCR07G331JM
R6	Resistor, Fixed, Composition, 82 ohm ±5%, 1/4W	81349	RCR07G820JM
R7	Resistor, Fixed, Composition, 8.2K ±5%, 1/4W	81349	RCR07G822JM
R8	Resistor, Fixed, Composition, 1.8K ±5%, 1/4W	81349	RCR07G182JM
R9	Resistor, Fixed, Composition, 560 ohm ±5%, 1/4W	81349	RCR07G561JM
R10	Resistor, Fixed, Composition, 100 ohm ±5%, 1/4W	81349	RCR07G101JM
R11	Resistor, Variable, 500 ohm	14304	R-2205
R12	Resistor, Fixed, Composition, 6.8K ±5%, 1/4W	81349	RCR07G682JM
R13	Resistor, Fixed, Composition, 18K ±5%, 1/4W	81349	RCR07G183JM
R14	Resistor, Fixed, Composition, 100K ±5%, 1/4W	81349	RCR07G104JM
R15	Resistor, Fixed, Composition, 2.2K ±5%, 1/4W	81349	RCR07G222JM
R16	Resistor, Fixed, Composition, 82 ohm ±5%, 1/4W	81349	RCR07G562JM
R17	Resistor, Fixed, Composition, 5.6K ±5%, 1/4W	81349	RCR07G562JM
R18	Resistor, Fixed, Composition, 2.7K ±5%, 1/4W	81349	RCR07G272JM
R19	Resistor, Fixed, Composition, 100 ohm ±5%, 1/4W	81349	RCR07G101JM
R20	Resistor, Fixed, Composition, 220 ohm ±5%, 1/4W	81349	RCR07G221JM
R21	Resistor, Fixed, Composition, 2.2K ±5%, 1/4W	81349	RCR07G222JM
R22	Resistor, Fixed, Composition, 68K ±5%, 1/4W	81349	RCR07G683JM
R23	Resistor, Fixed, Composition, 12K ±5%, 1/4W	81349	RCR07G123JM
R24	Resistor, Fixed, Composition, 470 ohm ±5%, 1/4W	81349	RCR07G471JM
R25	Resistor, Fixed, Composition, 100 ohm ±5%, 1/4W	81349	RCR07G101JM
R26, R27	Resistor, Fixed, Composition, 27K ±5%, 1/4W	81349	RCR07G273JM
R28	Resistor, Fixed, Composition, 33K ±5%, 1/4W	81349	RCR07G333JM

Table 3. 1A1A8 Maintenance Parts List (Continued)

Ref. Desig.	Name & Description	Mfr. Code	Part Number
R29	Resistor, Fixed, Composition, 18K ±5%, 1/4W	81349	RCR07G183JM
R30	Not Used		
R31	Resistor, Fixed, Composition, 10K ±5%, 1/4W	81349	RCR07G103JM
R32	Resistor, Fixed, Composition, 100 ohm ±5%, 1/4W	81349	RCR07G101JM
R33	Resistor, Fixed, Composition, 10K ±5%, 1/4W	81349	RCR07G103JM
R34	Resistor, Fixed, Composition, 1K ±5%, 1/4W	81349	RCR07G102JM
R35, R36	Resistor, Fixed, Composition, 100K ±5%, 1/4W	81349	RCR07G104JM
R37	Resistor, Fixed, Composition, 1K ±5%, 1/4W	81349	RCR07G102JM
R38	Resistor, Fixed, Composition, 100 ohm ±5%, 1/4W	81349	RCR07G101JM
R39 to R46	Resistor, Fixed, Composition, 100K ±5%, 1/4W	81349	RCR07G104JM
R47 to R58	Resistor, Fixed, Composition, 1K ±5%, 1/4W	81349	RCR07G102JM
R59 to R67	Resistor, Fixed, Composition, 100K ±5%, 1/4W	81349	RCR07G104JM
R68	Resistor, Fixed, Composition, 220K ±5%, 1/4W	81349	RCR07G224JM
R69, R70	Resistor, Fixed, Composition, 100K ±5%, 1/4W	81349	RCR07G104JM
R71 to R82	Resistor, Fixed, Composition, 2.7K ±5%, 1/4W	81349	RCR07G272JM
R83	Resistor, Fixed, Composition, 1K ±5%, 1/4W	81349	RCR 07G102JM
R84	Resistor, Fixed, Composition, 100K ±5%, 1/4W	81349	RCR07G104JM
R85	Resistor, Fixed, Composition, 100 ohm ±5%, 1/4W	81349	RCR07G101JM
R86	Resistor, Fixed, Composition, 47K ±5%, 1/4W	81349	RCR07G473JM
S1	Switch, SPST	14304	S-0130
TP1	Test Point, Brown	14304	J-0392
U1	Integrated Circuit, Quad 2-Input NOR Gate, CD4001AE	14304	IC-0135
U2, U3	Integrated Circuit, Presettable UP/DOWN Counter CD4029AE	14304	IC-0090
U4	Integrated Circuit, 7-Stage Binary Counter, CD4024AE	14304	IC-0243
U5	Integrated Circuit, Gated J-K Master Slave Flip-Flop, CD4096BE	14304	IC-0395
U6	Integrated Circuit, Dual 4-Input AND Gate, CD4082BE	14304	IC-0394
U7	Integrated Circuit, Quad 2-Input NAND Gate, CD4011AE	14304	IC-0136
U8	Integrated Circuit, Micropower Phase-Locked Loop, CD4046AE	14304	IC-0383
U9	Integrated Circuit, Quad 2-Input OR Gate, CD4071BE	14304	IC-0389
U10	Integrated Circuit, Triple 3-Input OR Gate, CD4075BE	14304	IC-0391
U11	Integrated Circuit, Quad 2-Input OR Gate, CD4071BE	14304	IC-0389
U12	Integrated Circuit, Quad 2-Input AND Gate, CD4081BE	14304	IC-0393
U13	Integrated Circuit, 8-Bit Priority Encoder, CD4532BE	14304	IC-0397

Table 3. 1A1A8 Maintenance Parts List (Continued)

Ref. Desig.	Name & Description	Mfr. Code	Part Number
U14	Integrated Circuit, Quad 2-Input AND Gate, CD4081BE	14304	IC-0393
U15	Integrated Circuit, Quad Exclusive OR Gate, CD4030AE	14304	IC-0244
Y1	Crystal, VCXO, 16.5000 MHz	14304	6628-0810

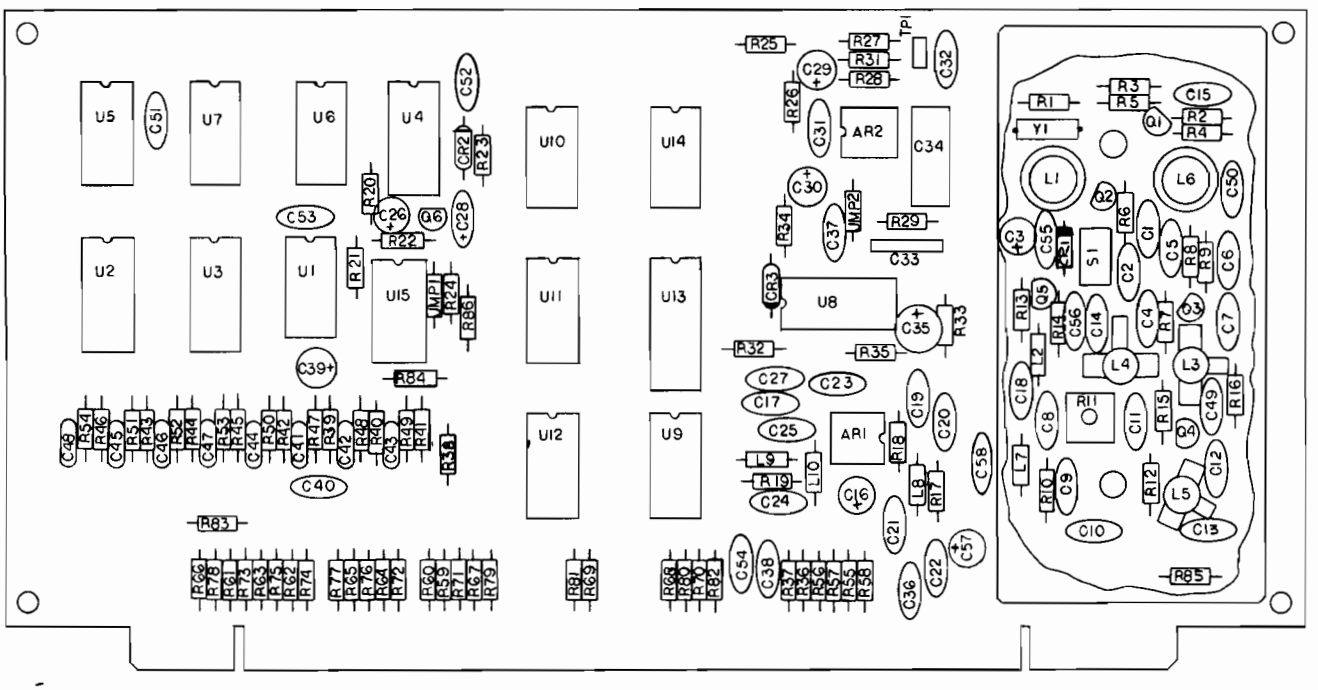
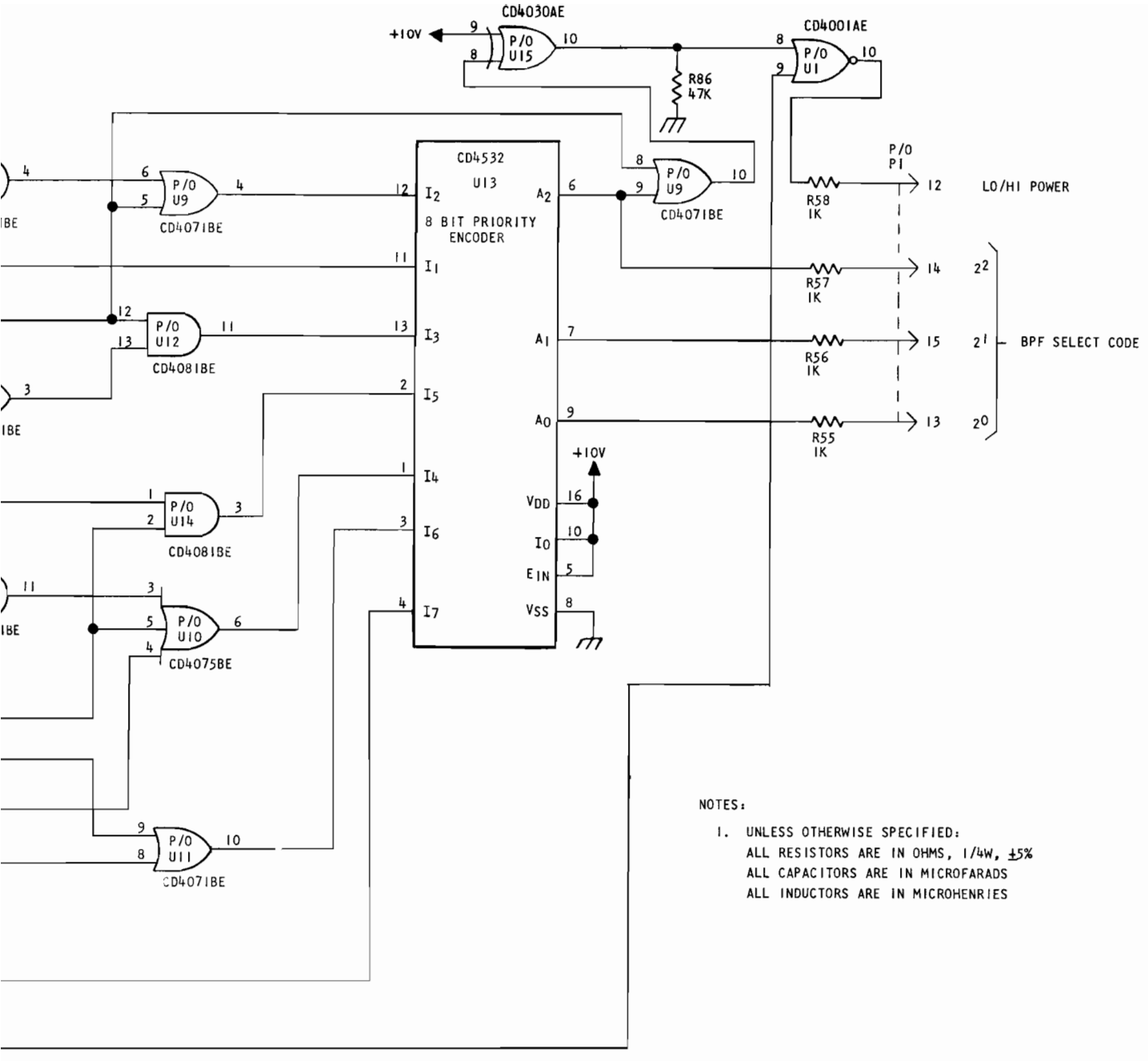


Figure 3. 1A1A8 Component Locations



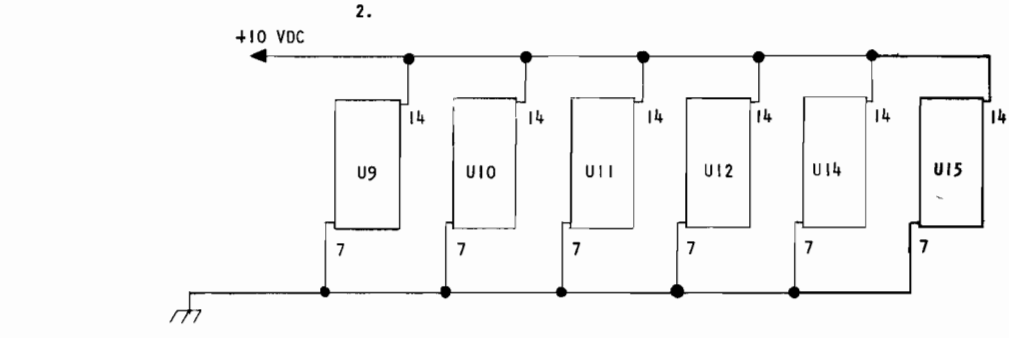
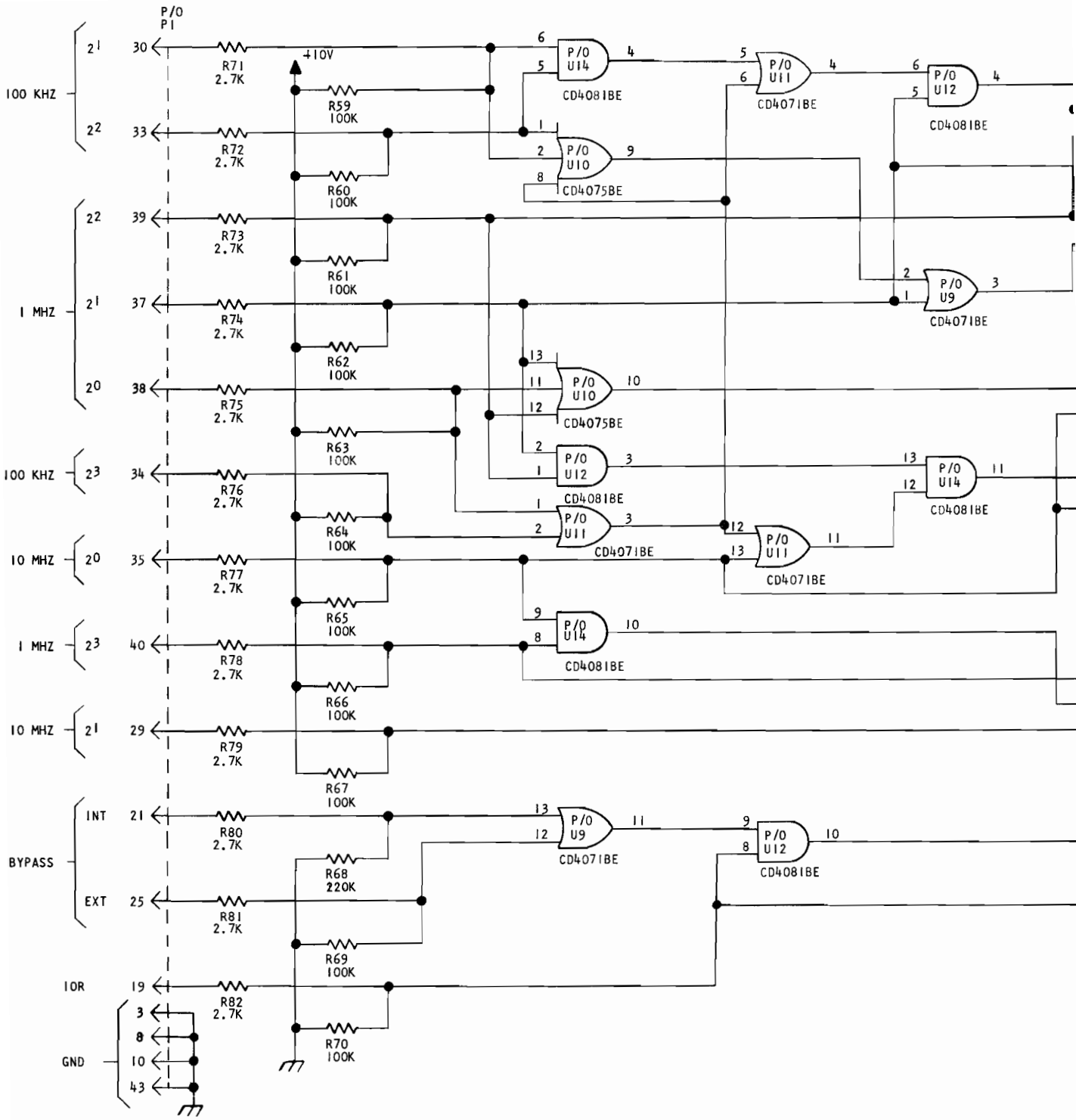


Figure 4. 1A1A8 LO No. 2 PC Board Schematic Diagram (6628-9080) (Sheet 1 of 2)


P/O P1
100 KHZ
1 MHZ
100 KHZ
10 MHZ
1 MHZ
10 MHZ
BYPASS
INT
EXT
IOR
GND
+10V
R71 2.7K
R72 2.7K
R73 2.7K
R74 2.7K
R75 2.7K
R76 2.7K
R77 2.7K
R78 2.7K
R79 2.7K
R80 2.7K
R81 2.7K
R82 2.7K
R59 100K
R60 100K
R61 100K
R62 100K
R63 100K
R64 100K
R65 100K
R66 100K
R67 100K
R68 220K
R69 100K
R70 100K
P/O U14
CD4081BE
P/O U11
CD4071BE
P/O U12
CD4081BE
P/O U10
CD4075BE
P/O U9
CD4071BE
P/O U10
CD4075BE
P/O U12
CD4081BE
P/O U14
CD4081BE
P/O U11
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P/O U12
CD4081BE

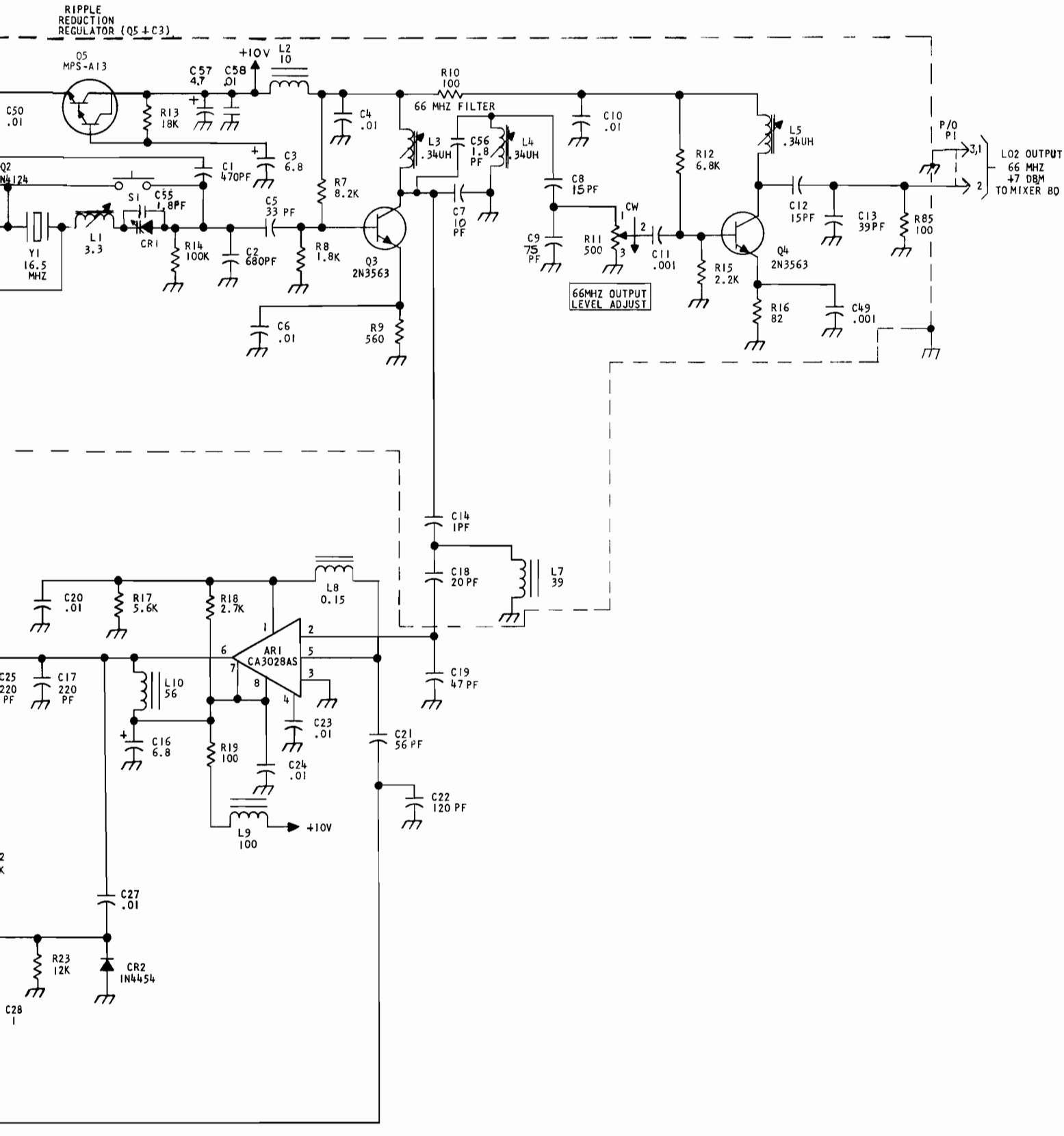
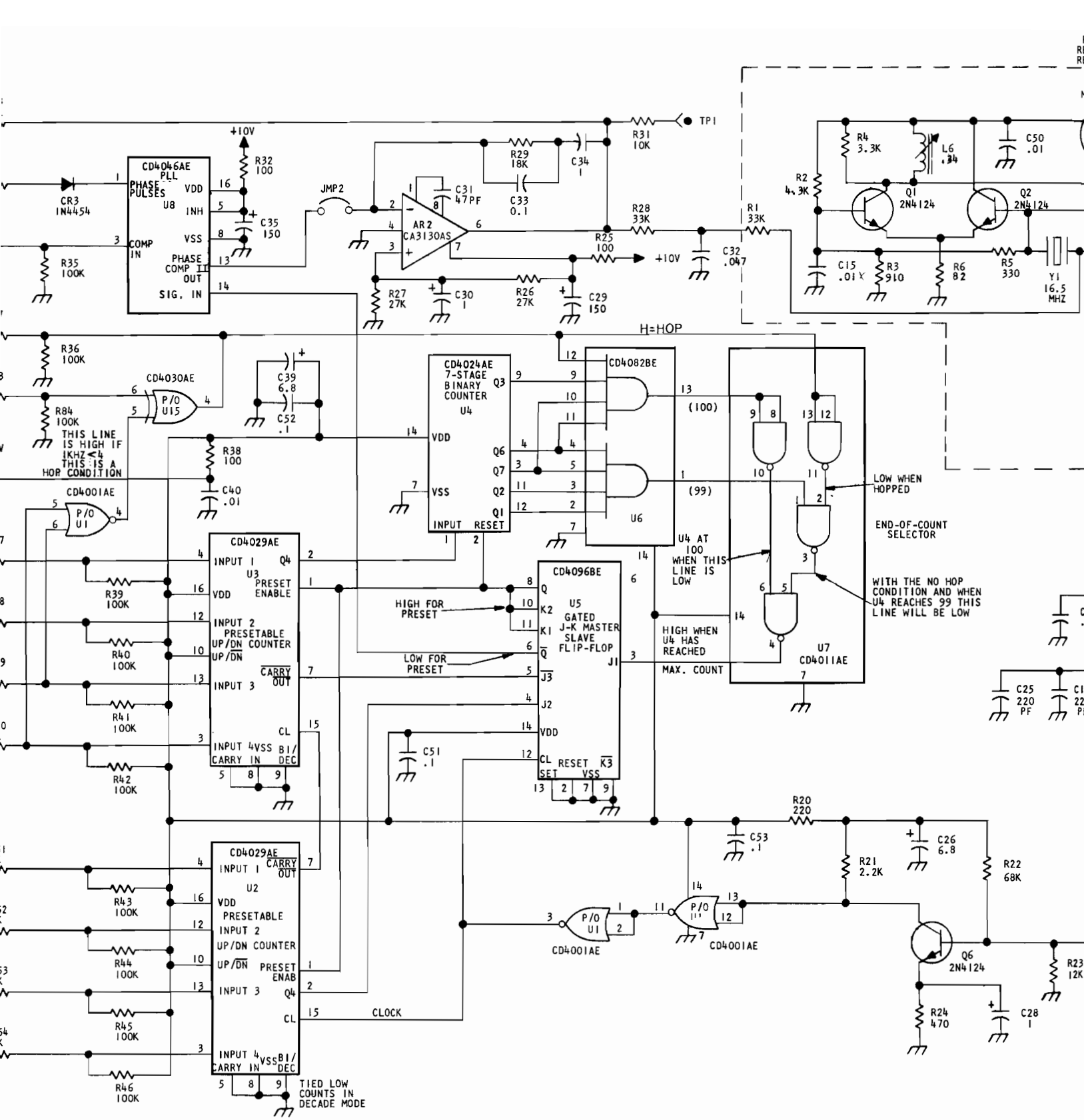
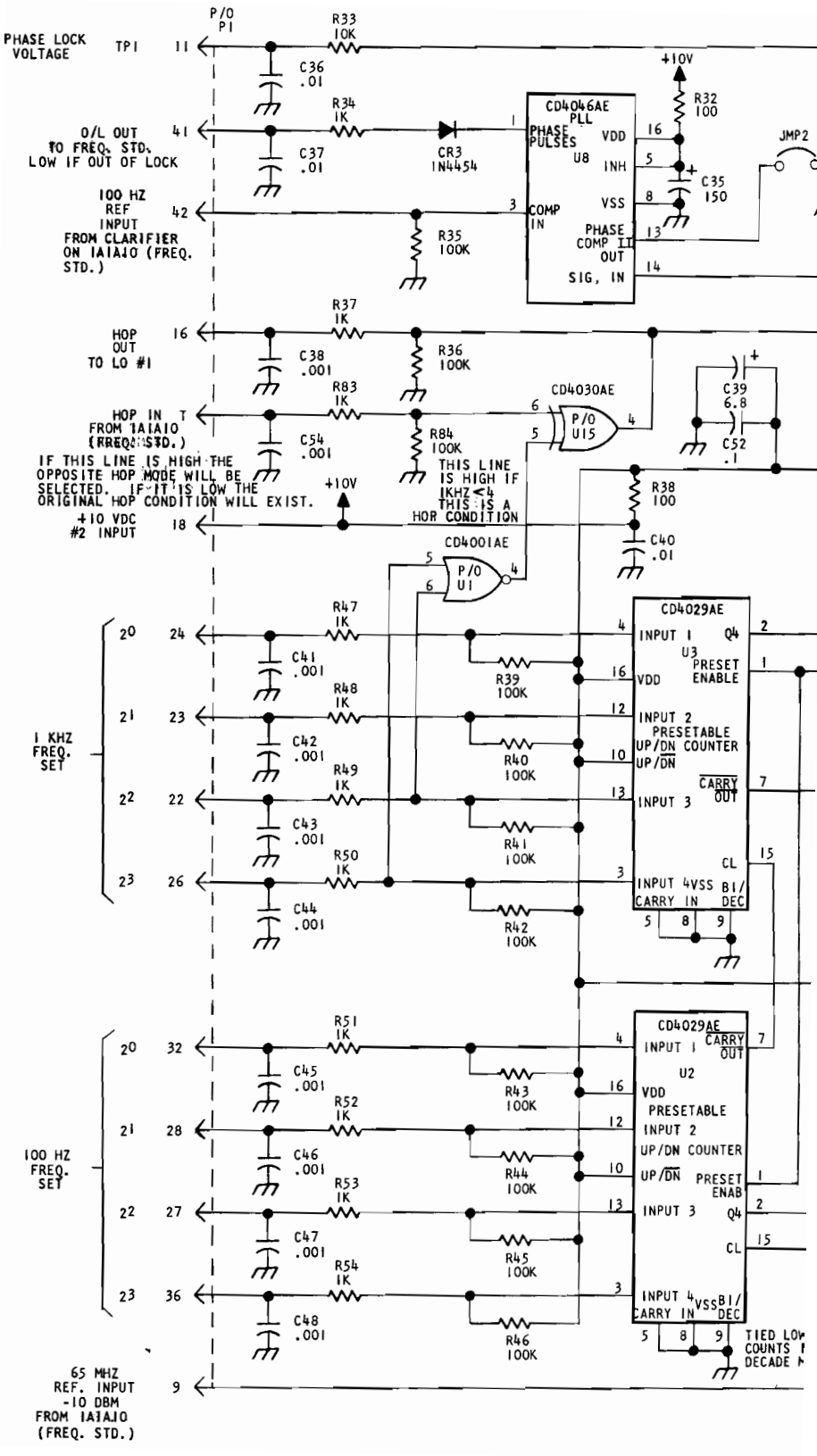


Figure 4. 1A1A8 LO No. 2 PC Board Schematic Diagram (6628-9080) (Sheet 2 of 2)

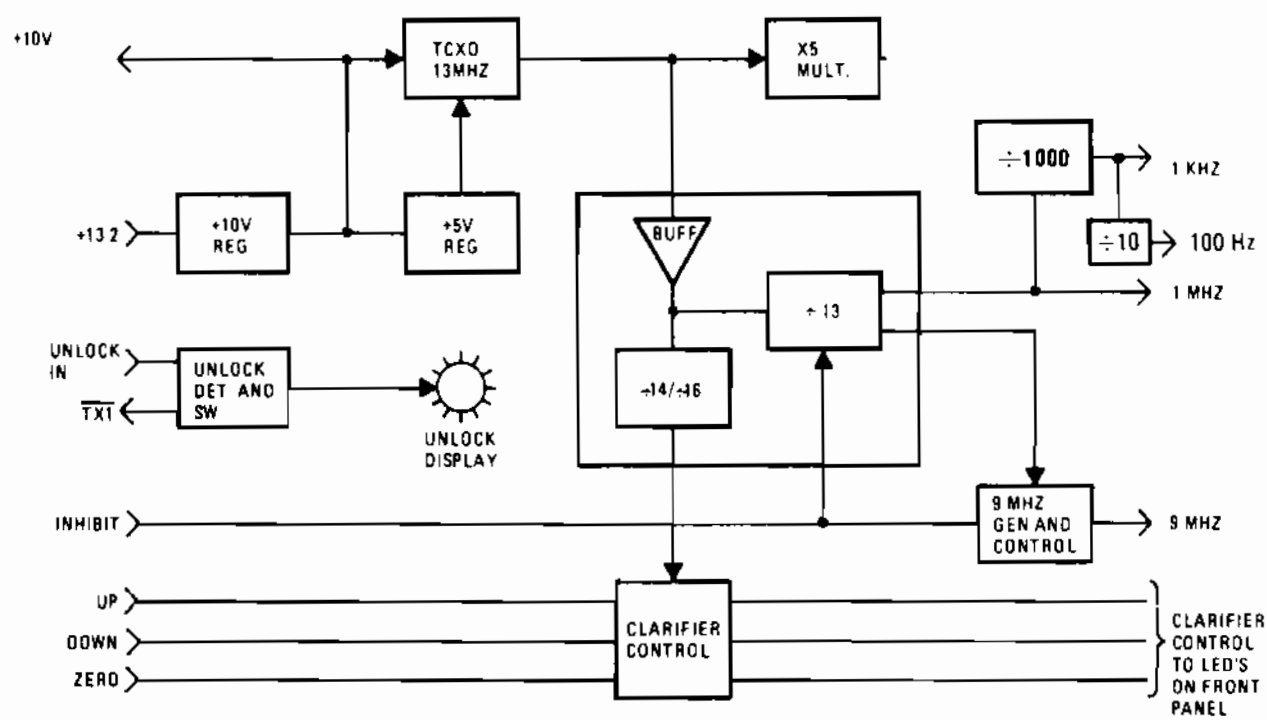

+10V
CD4046AE PLL
PHASE PULSES
COMP IN
PHASE COMP II OUT
SIG. IN
VDD
INH
VSS
U8
R32 100
C35 150
CR3 IN4454
R35 100K
JMP2
AR2 CA3130AS
C31 47PF
R29 18K
C33 0.1
C34 1
R31 10K
TP1
R28 33K
R25 100
+10V
C32 .047
R1 33K
R27 27K
C30 1
R26 27K
C29 150
R4 3.3K
L6 .34
C50 .01
R2 4.3K
Q1 2N4124
Q2 2N4124
C15 .01
R3 910
R6 82
R5 330
Y1 16.5 MHZ
H=HOP
R36 100K
CD4030AE
P/O U15
R84 100K
THIS LINE IS HIGH IF 1KHZ<4 THIS IS A HOP CONDITION
C39 6.8
C52 .1
R38 100
C40 .01
CD4001AE
P/O U1
CD4024AE 7-STAGE BINARY COUNTER
Q3
Q6
Q7
Q2
Q1
INPUT
RESET
U4
CD4082BE
U6
(100)
(99)
U4 AT 100 WHEN THIS LINE IS LOW
LOW WHEN HOPPED
END-OF-COUNT SELECTOR
WITH THE NO HOP CONDITION AND WHEN U4 REACHES 99 THIS LINE WILL BE LOW
U7 CD4011AE
CD4029AE
INPUT 1
INPUT 2 PRESETABLE UP/DN COUNTER
INPUT 3
INPUT 4
CARRY IN
CARRY OUT
PRESET ENABLE
BI/DEC
U3
R39 100K
R40 100K
R41 100K
R42 100K
CD4096BE
U5 GATED J-K MASTER SLAVE FLIP-FLOP
HIGH FOR PRESET
LOW FOR PRESET
HIGH WHEN U4 HAS REACHED MAX. COUNT
C51 .1
C25 220 PF
R20 220
C53 .1
R21 2.2K
C26 6.8
R22 68K
CD4029AE
U2
R43 100K
R44 100K
R45 100K
R46 100K
CLOCK
TIED LOW COUNTS IN DECADE MODE
CD4001AE
Q6 2N4124
R23 12K
R24 470
C28 1


PHASE LOCK VOLTAGE
TP1
P/O P1
11
R33 10K
C36 .01
+10V
R32 100
R34 1K
C37 .01
O/L OUT TO FREQ. STD. LOW IF OUT OF LOCK
41
CR3 IN4454
CD4046AE PLL
PHASE PULSES
U8
VDD
INH
VSS
COMP IN
PHASE COMP II OUT
SIG. IN
16
5
8
13
14
C35 150
JMP2
100 HZ REF INPUT FROM CLARIFIER ON 1A1A10 (FREQ. STD.)
42
3
R35 100K
R37 1K
HOP OUT TO LO #1
16
C38 .001
R36 100K
R83 1K
HOP IN FROM 1A1A10 (FREQ. STD.)
C54 .001
R84 100K
CD4030AE
P/O U15
6
5
4
C39 6.8
C52 .1
IF THIS LINE IS HIGH THE OPPOSITE HOP MODE WILL BE SELECTED. IF IT IS LOW THE ORIGINAL HOP CONDITION WILL EXIST.
+10V
THIS LINE IS HIGH IF 1KHZ<4 THIS IS A HOR CONDITION
R38 100
+10 VDC #2 INPUT
18
C40 .01
CD4001AE
P/O U1
5
6
4
R47 1K
C41 .001
R39 100K
CD4029AE
INPUT 1
Q4
U3
PRESET ENABLE
VDD
INPUT 2
PRESETABLE UP/DN COUNTER
UP/DN
CARRY OUT
INPUT 3
CL
INPUT 4
VSS
CARRY IN
BI/DEC
4
2
1
16
12
10
7
13
15
3
5
8
9
2⁰
24
R48 1K
C42 .001
R40 100K
2¹
23
R49 1K
C43 .001
R41 100K
2²
22
R50 1K
C44 .001
R42 100K
2³
26
1 KHZ FREQ. SET
R51 1K
C45 .001
R43 100K
CD4029AE
U2
R52 1K
C46 .001
R44 100K
2⁰
32
2¹
28
2²
27
2³
36
100 HZ FREQ. SET
R53 1K
C47 .001
R45 100K
R54 1K
C48 .001
R46 100K
65 MHZ REF. INPUT -10 DBM FROM 1A1A10 (FREQ. STD.)
9
TIED LOW COUNTS DECADE

UNIT INSTRUCTIONS

FREQUENCY STANDARD

1A1A9



1A1A9 FREQUENCY STANDARD
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1. GENERAL DESCRIPTION

The 1A1A9 Frequency Standard PWB generates all reference frequencies from a TCXO (Temperature Compensated Xtal Oscillator) internal standard or from an optional 13 MHz external source. The 1A1A9 Frequency Standard PWB Simplified Diagram is illustrated on the cover. It demonstrates all significant internal functions and their related inputs and outputs.

2. TECHNICAL CHARACTERISTICS

Power Requirements:		
+13.8 Vdc Input	P1-20	
+10T	P1-17	
+10R	P1-19	
Control Inputs		
O/L In	P1-3	
Clarifier Down	P1-13 (0 = Down)	
Clarifier Up	P1-14 (0 = Up)	
Clarifier Zero	P1-12 (0 = Zero)	
+10T	P1-17	
+10R	P1-19	
LO3 Inhibit	P1-6	
Control Outputs		
Zero Output	P1-9 (1 = Zero)	
Up Output	P1-10 (1 = Up)	
Down Output	P1-11 (1 = Down)	
Xmit Inhibit	P1-2 (1 = Inhibit)	
Signal Outputs		
9 MHz	P1-8	0 dBm
65 MHz	P1-5	-10 ±5 dBm
100 Hz Ref	P1-42	(10V P-P)
1 MHz	P1-16	(5V P-P)
1 kHz	P1-40	280 mV rms

3. SEMICONDUCTOR COMPLEMENT

REF. DESIG.	TYPE	FUNCTION
AR1	LM124J	Quad Op Amp
U1	SN5400J	Quad 2-Input NAND Gate
U11	CD4011B	Quad 2-Input NAND Gate
U15	SN54LS00	Quad 2-Input NAND Gate
U16	CD4518BF	Dual Decade Counter
U17	CS4518BF	Dual Decade Counter
U18	SN54LS163J	Programmable Counter
U20	SN54LS26J	Quad 2-Input NAND Gate
U21	CA3083F	NPN Transistor Array

4. TECHNICAL DESCRIPTION

4.1 65 MHz LO2 Reference

The 65 MHz LO2 reference is synthesized by selecting the 5th harmonic of the 13 MHz TCXO output. The NAND Gate U1-2 is enabled through jumper 4. The 13 MHz TCXO output at U1-1 is gated through to U1-12. The path through jumper 5 provides a low at U1-5, forcing U1-6 and U1-13 high. The internal TCXO output is then gated through at U1-11 and U1-8. The U1-11 13 MHz output is applied to bandpass filter elements L3, L4, and L5 for selection of the 5th harmonic. The filter group insertion loss is approximately 8 dB when properly tuned. The output to the base of 65 MHz output amplifier Q6 is approximately -25 dBm. Q6 provides a fixed gain of 15 dB to produce the desired -10 dBm drive level to the 1A1A8 LO2 PWB.

4.2 1 MHz, 1 kHz, -100 Hz Reference Frequencies

The 1 MHz, 1 kHz, and 100 Hz reference frequencies are developed from the 13 MHz square wave output at U1-8. U18 is a synchronous 4-bit counter configured to divide by 13 to produce a 1 MHz output at U18-11, the QD output. This 1 MHz output is routed via R31 to P1-16 at a level of approximately 280 mV rms. The signal is then fed to U16 to derive the 1 kHz and 100 Hz outputs. U16 performs a divide by 100 function to produce a 10 kHz output at U16-14, the Q4B output. This 10 kHz output is divided by 10 and by 100 at U17 to produce the desired 1 kHz and 100 Hz outputs. The divide-by-100 output (100 Hz) is selected at U17 Q4B. The 1 kHz signal is used for CW tone generation because of its low harmonic content. The U17/U16 Timing Diagram is illustrated in Figure 1. Operational amplifier AR1 and related circuitry provide a sinusoidial output at the required 0.7V P-P level.

4.3 9 MHz LO3 Output

The 9 MHz LO3 output is derived by selecting the 1 MHz U18 QD output and routing this square wave signal through two NAND gate elements of U15. The U15 output section is configured as an inverter and is coupled through C32 to drive T1. Each transformer, T1, T2, T3, and T4 is resonated at 9 MHz. U21 at the output section is a Darlington pair driving an emitter follower, with the output controlled on or off by the logic level at 1A1A9P1-6.

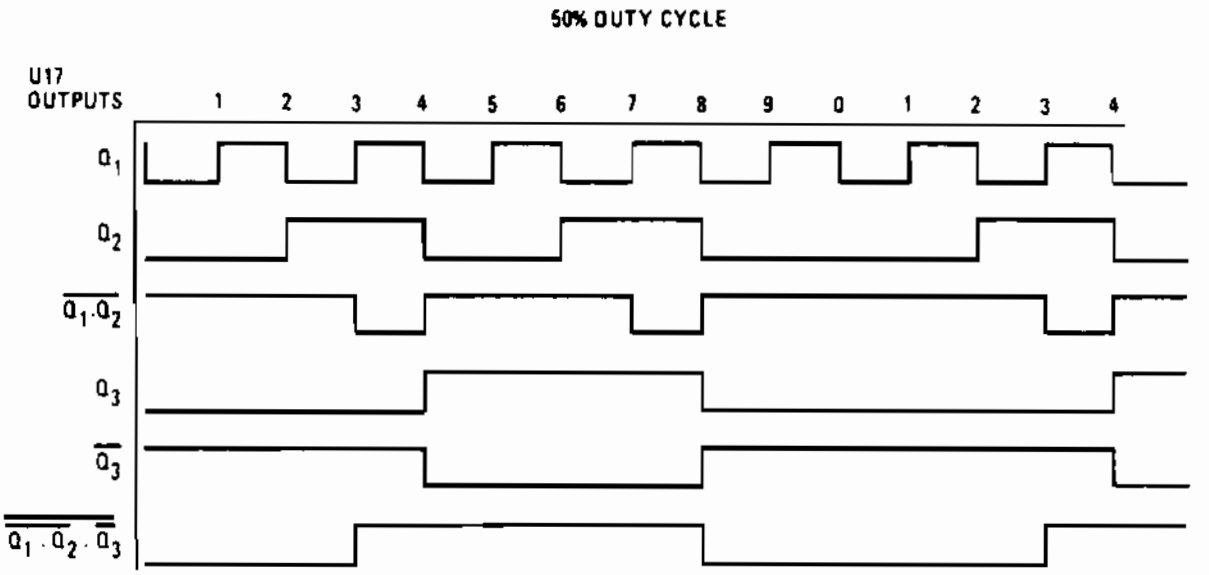


Figure 1. U16/U17 Timing Diagram

4.4 Clarifier Control Signal

Clarifier control is exercised through option diodes CR2 and CR3. In most applications, clarifier operation would only be desirable in the receive mode (to prevent the operational phenomenon called "leap frogging", which means varying the transmit frequency of the transceiver when keyed). Clip-out type diodes are installed to provide a normal one-time selection of this option. By removing CR2, the +10R control signal is removed from the circuit, thus permitting clarifier operation in the receive mode. By removing CR3, the +10T control signal is removed from the circuit, thus permitting clarifier operation in the transmit mode. Clipping both diodes permits full-time clarifier operation. With no inhibit voltage at U13-11, this control NOR gate has only two inputs: an end-of-range signal from U12-10, and the UP CLARIFIER signal from P1-14. The ZERO SIGNAL output driving Q7 places C35 in the timing circuit to slow U6, an NE555 timer, as it reaches zero. This allows easy manual zeroing of the clarifier. The U6 timer output is available for measurement at P1-23 (ATP1).

4.4.1 Clarifier Inhibit and Control

If either clarifier inhibit diode is present to allow the +10V signal at P1-17 or P1-19, control NAND gate U13 inverts this signal to ground. This in turn forces U11-4 to go high, turning on Q5, which grounds the D_B input on U19 synchronous 4-bit counter. This causes the counter to divide by 16. U13-6 also commands U14-9 to cause it's associated circuit to divide by 8, 125. This results in a total division factor of 130,000, providing a resulting signal output of exactly 100 Hz (from 13 MHz). This signal is routed through the 1A1A11 assembly to the 1A1A8 LO2 assembly and applied to the phase comparator input of the U8 Phase Detector as the primary signal reference. If neither clarifier inhibit diode is present, then the control counter circuit comprised of U4, U5, U7, and U14 instructs U3 to divide by 14 for the number of times commanded by U5 and U7. U14-9 is now high, causing its associated circuitry to divide by 8, 127. With U5 and U7 set for zero offset, U3 divides by 14 sixteen times and by 16 for 8, 111 times, resulting in a total division of 130,000, providing the same 100-Hz output. However, if U5 and U7 are set for one step above zero (by the UP/DOWN input of U5), U3 divides by 14 seventeen times and by 16 for 8, 110 times. This results in a total division of 129,998, providing a resultant frequency of 100.00153 Hz. When this signal is applied to the reference input of the LO2 Phase Detector circuit, the output signal is 15.3 Hz higher in frequency. As the control counter circuit advances through its counting sequence, each step advances the 100 Hz frequency by an additional 15.3 Hz. Because

there are a total of thirty-two steps, this results in an overall clarifier range of -246 Hz to +230 Hz. Because of the extremely small difference between 100,00000 Hz and 100.00153 Hz, the exact step size may vary slightly during actual operation.

4.5 Out of Lock/TX Inhibit

If a synthesizer phase locked loop goes out of lock, 1A1A9P1-3 goes low and turns Q2 on. This generates a TX (Transmit Inhibit) control output via Q4 and an out-of-lock indication via Q3 and DS1. When Q4 is on 1A1A9, P1-2 goes low.

4.6 +10V and +5V Regulators

VR1, AR1, and Q1 provide a fold-back protected and regulated +10V power source. This supply also drives the VR2 +5 Vdc regulator. R1 is used to set the +10V output.

5. MAINTENANCE

The Frequency Standard PC Board is mounted on an extender card (part of the MRK) during test and adjustment procedures. All test equipment items required for test and adjustment of this assembly are shown in Figure 2. Figure 3 shows the 1A1A9 Input/Output Summary.

CAUTION

Ensure primary power is removed when removing or installing plug-in assemblies.

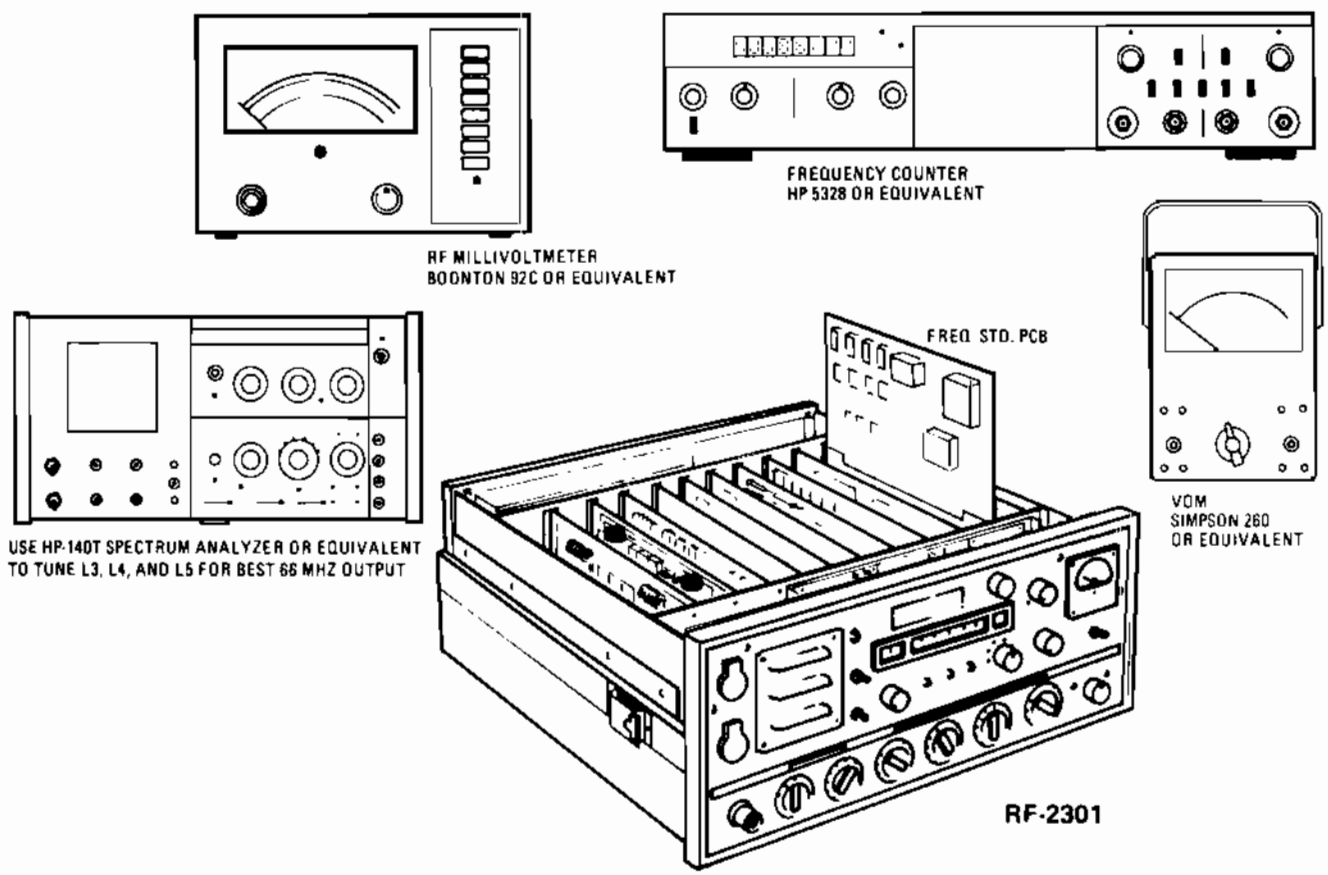


Figure 2. 1A1A9 Test Configuration

1	GND	A	
2	XMT INH	B	EXT STD
3	O/L IN	C	SHLD GND
4	GND	D	GND
5	65 MHZ (-10 DBM NOMINAL)	E	65 MHZ (-10 DBM NOMINAL)
6	LO3 INH	F	
7	GND	H	GND
8	LO3 9 MHZ (0 DBM NOMINAL)	J	LO3 9 MHZ (0 DBM NOMINAL)
9	ZERO SIG	K	ZERO SIG
10	UP SIG	L	UP SIG
11	DOWN SIG	M	DOWN SIG
12	ZERO CLARIFIER	N	ZERO CLARIFIER
13	DOWN CLARIFIER	P	DOWN CLARIFIER
14	UP CLARIFIER	R	UP CLARIFIER
15	GND	S	GND
16	1 MHZ REF	T	1 MHZ REF
17	+10T	U	+10 T
18	+10V REG	V	+10 V REG
19	+10R	W	+10 R
20	UNREG IN	X	UNREG IN
21	ATP2	Y	ATP2
22		Z	
23	ATP1	a	ATP1
24		b	
25		c	
26		d	
27		e	
28		f	
29		h	
30		j	
31		k	
32		l	
33		m	
34		n	
35		p	
36		r	
37		s	
38		t	
39		u	
40	1 KHZ TONE	v	1 KHZ TONE
41	GND	w	GND
42	100 HZ REF	x	100 HZ REF
43	GND	y	GND

Figure 3. 1A1A9 Input/Output Summary

5.1 R1, +10V Regulator Adjustment

With the 1A1A9 Frequency Standard PWB mounted on an extender card and power on for normal operation, perform the following:

a. Verify 11-16 Vdc (nominal 13.8 Vdc) at P1-20.

b. Connect VOM to P1-18 and verify +10 Vdc. If +10 Vdc is not indicated, adjust R1 as required for a +10 Vdc indication.

c. Disconnect all test equipment. The adjustment procedure is not complete.

5.2 65 MHz Output Tuning and Verification

With the 1A1A9 Frequency Standard PWB mounted on an extender card, and power on for normal operation, connect spectrum analyzer and a frequency counter at P1-5. Proceed as follows:

a. Verify 65 MHz output and a level at P1-5. The nominal level with L3 and L4 properly adjusted is -15 dBm. Verify tuning and adjustment as follows, if the level indicated is below -15 dBm.

b. Adjust L3 and L4 for maximum output on spectrum analyzer.

c. Use TCXO adjustment at top of sealed assembly to adjust for 65 MHz indication on frequency counter.

d. Verify frequency standard accuracy is at least 1 ppm. The 65 MHz output is 5 times the 13 MHz TCXO output. Therefore, note the offset stamped on the TCXO in Hz, multiply that number by five, add or subtract that to 65 MHz, and set the 65 MHz output for that frequency at 25° C.

5.3 9 MHz RF Output Tuning Adjustment

With the 1A1A9 Frequency Standard PWB mounted on an extender card, connect VTVM and a frequency counter at P1-8 and verify 9 MHz at 0 dBm. If 0 dBm is not indicated, proceed as follows:

a. Tune T1, T2, T3, and T4 for maximum indication on VTVM.

b. Verify 0 dBm at P1-8.

Note

A logic "1" at P1-6 will inhibit this output.

c. Disconnect all test equipment. The adjustment procedure is now complete.

5.4 100 Hz Reference Output Verification

Verify "fixed" tuning mode and measure 100 Hz 10V peak-to-peak (CMOS) at P1-42. For "clarifier" operation, there will be a very subtle frequency change at this output (99.975 Hz at the low end and 100.0230 Hz at the high end). This very subtle change, when multiplied by 10,000 (on LO2), can equal an operating frequency change of +230 Hz, or -246 Hz.

5.5 1 MHz Output Verification

The 1 MHz output is at TTL levels. This means that the "1" level will be 2.4 Vdc, and the "0" will (nominally be 0.7 Vdc). The frequency should be at 1 MHz.

5.6 1 kHz Output Verification

The CW tone output will measure exactly 1 kHz when measured with a frequency counter. The sine wave output is developed by dividing the 1 MHz output by a factor of 1000 and passing the square wave divider output through a low pass filter and voltage follower (AR1) at an output level of 700 mVp-p.

5.7 ATP1 Clock Output

This is a CMOS output (approximately 9V/1V) with very narrow on pulses at approximately 13 Hz when clarifier is stepping up or down.

Approximately 13 Hz PRF in Fixed Mode

In the clarifier mode, the PRF is slowed to approximately one fourth this rate (just over 3 Hz), and it is not a continuous series of pulses, but rather a single pulse as the frequency reaches zero.

5.8 Zero Output

This output does not provide an external control function, but can be used as a test point to observe the control condition. With a high logic level at this point, Q7, is switched ON and C35 is added in parallel with C34 to control U6 operating frequency. The narrow pulse width is obtained by the long charge path through R56 and R57, and the relatively quick discharge path of C34 through only R57.

5.9 Up/Down Control Outputs

These outputs control UP/DOWN front panel indicators. The "1" state equals a related lamp ON condition (active).

5.10 Other Functions

A logic "0" on the O/L control line indicates an out-of-lock condition, and will be associated with a TXI (transmit inhibit) condition. The TXI line will be low (0.7V) in response to an O/L IN condition. A logic "0" on the INHIBIT line inhibits the 9 MHz carrier output.

6. PARTS LIST

Table 1 lists all 1A1A9 Maintenance Parts. These parts can be identified in figure 4. Refer to General Information section for list of manufacturers.

7. Schematic

Figure 5 is a complete schematic diagram of the 1A1A9 Assembly.

Table 1. 1A1A9 Maintenance Parts List (PL 6628-0880)

Ref. Desig.	Name & Description	Mfr. Code	Part Number
1A1A9	Frequency Standard PWB	14304	6628-0880
A1	TCXO Assembly	14304	6628-0860
AR1	IC, Quad, OP, Amp	14304	I30-0011-000
C1	Capacitor, .01 uF, Ceramic	Mil type	M39014/02-1378
C2	Capacitor, 47 pF, Mica	Mil type	CM04ED470J03
C3	Capacitor, 220 pF, Mica	Mil type	CM04FD221J03
C4	Capacitor, 3 pF, Mica	14304	C40-0002-003
C5	Capacitor, 39 pF, Mica	Mil type	CM04ED390J03
C6	Capacitor, 3 pF, Mica	14304	C40-0002-003
C7	Capacitor, 47 pF, Mica	Mil type	CM04ED470J03
C8	Capacitor, 220 pF, Mica	Mil type	CM04FD221J03
C9-C11	Capacitor, .001 uF, Ceramic	Mil type	M39014/01-1238
C12	Capacitor, Fixed, Mica, 820 pF	Mil type	CM05FC821J03
C13	Capacitor, 6.8 uF, Tantalum, 35V	Mil type	M39003/01-2305
C14	Capacitor, .1 uF, Ceramic	Mil type	M39014/02-1391
C15	Capacitor, 1 uF, Tantalum, 50V	Mil type	M39003/01-2357
C16	Capacitor, 6.8 uF, Tantalum, 35V	Mil type	M39003/01-2305
C17	Capacitor, .01 uF, Ceramic	Mil type	M39014/02-1378
C18	Capacitor, 1 uF, Tantalum, 50V	Mil type	M39003/01-2357
C19	Capacitor, .01 uF, Ceramic	Mil type	M39014/02-1378
C20	Capacitor, 2700 pF, Mica	Mil type	CM06FD272J03
C21	Capacitor, 910 pF, Mica	14304	C-2451
C22	Capacitor, 910 pF, Mica	14304	C-2451
C23,C24	Capacitor, .1 uF, Ceramic	Mil type	M39014/02-1391
C25	Capacitor, 47 pF, Mica	Mil type	CM04ED470J03
C26	Capacitor, .01 uF, Ceramic	Mil type	M39014/02-1378
C27	Capacitor, 3 pF, Mica	14304	C40-0002-003
C28	Capacitor, 2 pF, Mica	14304	C40-0002-002

Table 1. 1A1A9 Maintenance Parts List (PL 6628-0880) (Cont.)

Ref. Desig.	Name & Description	Mfr. Code	Part Number
C29	Capacitor, 3 pF, Mica	14304	C40-0002-003
C30	Capacitor, 2 pF, Mica	14304	C40-0002-002
C31	Capacitor, 3 pF, Mica	14304	C40-0002-003
C32	Capacitor, 820 pF, Mica	Mil type	CM05FC821J03
C33	Capacitor, 68 uF, Tantalum, 25V	14304	C25-0002-212
C34	Capacitor, 2.2 uF, Tantalum, 20V	14304	C25-0001-303
C35	Capacitor, 3.3 uF, Tantalum, 15V	14304	C25-0002-403
C36	Capacitor, .01 uF, Ceramic	Mil type	M39014/02-1378
C37,C38	Capacitor, .1 uF, Ceramic	Mil type	M39014/02-1391
C39	Capacitor, .01 uF, Ceramic	Mil type	M39014/02-1378
C40,C41	Capacitor, .1 uF, Ceramic	Mil type	M39014/02-1391
C42-C44	Not Used		
C45	Capacitor, 10K pF, Ceramic	14304	C-3219
CR1-CR6	Diode, Signal, 1N4454	14304	CR-0705
DS1	LED, Red	14304	919-4314
JMP1	Circuit Jumper	14304	MP-1142
JMP2	Not Used		
JMP3-JMP5	Circuit Jumper	14304	MP-1142
L1	Choke, RF, 100 uH	14304	L-0640
L2	Choke, RF-39 uH	14304	L-0635
L3-L5	Inductor, Variable	14304	L11-0004-003
L6	Choke, RF, .47 uH	14304	L-0612
L7	Choke, RF, 100 uH	14304	L-0640
L8	Choke, RF, 39 uH	14304	L-0635
Q1	Transistor, PNP, 2N6312	14304	Q02-6312-000
Q2	Transistor, PNP, 2N2907A	14304	Q12-2907-000
Q3,Q4	Transistor, NPN, 2N2222A	14304	Q12-2222-000
Q5-Q7	Transistor, NPN, MPS2369	14304	Q25-2369-000
Q8	Transistor, NPN, 2N2222A	14304	Q12-2222-000
R1	Resistor, Variable, 5K	14304	R-2227
R2	Resistor, 1/8W, 5%, 560	14304	R-2282
R3,R4	Not Used		
R5	Resistor, 1/8W, 4.7K	Mil type	RCR05G472JM
R6	Resistor, 1/8W, 1K	Mil type	RCR05G102JM
R7	Resistor, 1/8W, 2.2K	Mil type	RCR05G222JM
R8	Resistor, 1/8W, 5%, 470	Mil type	RCR05G471JM
R9	Resistor, 1/4W, 5%, 1.1	14304	R17-0001-002
R10	Resistor, 1/8W, 5%, 100	Mil type	RCR05G101JM
R11	Resistor, 1/8W, 5%, 100	Mil type	RCR05G101JM
R12	Resistor, 1/2W, 5%, 27	Mil type	RCR20G270JM
R13	Resistor, 1/8W, 1%, 3.92K	Mil type	RNR55H3921FS
R14	Resistor, 1/8W, 5%, 3.3K	Mil type	RCR05G332JM
R15	Resistor, 1/8W, 5%, 27K	Mil type	RCR05G273JM
R16	Resistor, Wirewound, 2W, 5%, .51	14304	R13-0001-005
R17	Resistor, 1/8W, 5%, 3.3K	Mil type	RCR05G332JM
R18	Resistor, 1/8W, 1%, 4.75K	Mil type	RNR55H4751FS
R19	Resistor, 1/8W, 1%, 4.75K	Mil type	RNR55H4751FS
R20	Resistor, 1/8W, 5%, 27K	Mil type	RCR05G273JM
R21	Resistor, 1/8W, 5%, 1K	Mil type	RCR05G102JM

Table 1. 1A1A9 Maintenance Parts List (PL 6628-0880) (Cont.)

Ref. Desig.	Name & Description	Mfr. Code	Part Number
R22	Resistor, 1/8W, 1%, 3.92K	Mil type	RNR55H3921FS
R23	Resistor, 1/8W, 5%, 100K	Mil type	RCR05G104JM
R24	Resistor, 1/8W, 5%, 3.3K	Mil type	RCR05G332JM
R25	Resistor, 1/8W, 5%, 100K	Mil type	RCR05G104JM
R26	Resistor, 1/8W, 5%, 1K	Mil type	RCR05G102JM
R27	Resistor, 1/4W, 5%, 470	Mil type	RCR07G471JM
R28	Resistor, 1/8W, 5%, 1K	Mil type	RCR05G102JM
R29	Resistor, 1/8W, 5%, 1K	Mil type	RCR05G102JM
R30	Resistor, 1/2W, 5%, 22	Mil type	RCR20G220JM
R31	Resistor, 1/8W, 5%, 10	Mil type	RCR05G100JM
R32	Resistor, 1/8W, 5%, 2.2K	Mil type	RCR05G222JM
R33	Resistor, 1/4W, 5%, 100	Mil type	RCR07G101JM
R34	Resistor, 1/4W, 5%, 220K	Mil type	RCR07G224JM
R35	Resistor, 1/8W, 5%, 68K	Mil type	RCR05G683JM
R36	Resistor, 1/8W, 5%, 68K	Mil type	RCR05G683JM
R37	Resistor, 1/8W, 5%, 27K	Mil type	RCR05G273JM
R38	Resistor, 1/8W, 5%, 1K	Mil type	RCR05G102JM
R39	Resistor, 1/8W, 5%, 10	Mil type	RCR05G100JM
R40	Resistor, 1/4W, 5%, 220	Mil type	RCR07G221JM
R41	Resistor, 1/8W, 5%, 3.3K	Mil type	RCR05G332JM
R42	Resistor, 1/8W, 5%, 4.7K	Mil type	RCR05G472JM
R43	Resistor, 1/8W, 5%, 4.7K	Mil type	RCR05G472JM
R44	Resistor, 1/8W, 5%, 56	Mil type	RCR05G560JM
R45	Resistor, 1/2W, 5%, 560	Mil type	RCR20G561JM
R46	Resistor, 1/8W, 5%, 3.3K	Mil type	RCR05G332JM
R47	Resistor, 1/8W, 5%, 2.2K	Mil type	RCR05G222JM
R48	Resistor, 1/4W, 5%, 47	Mil type	RCR07G470JM
R49	Resistor, 1/8W, 5%, 560	Mil type	RCR05G561JM
R50	Resistor, 1/8W, 5%, 3.3K	Mil type	RCR05G332JM
R51-R53	Resistor, 1/4W, 5%, 1K	Mil type	RCR07G102JM
R54,R55	Resistor, 1/4W, 5%, 27K	Mil type	RCR07G273JM
R56	Resistor, 1/8W, 5%, 100K	Mil type	RCR05G104JM
R57	Resistor, 1/4W, 5%, 3.9K	Mil type	RCR07G392JM
R58-R60	Resistor, 1/4W, 5%, 27K	Mil type	RCR07G273JM
R61	Resistor, 1/4W, 5%, 1K	Mil type	RCR07G102JM
R62,R63	Resistor, 1/8W, 5%, 2.2K	Mil type	RCR05G222JM
R64	Resistor, 1/4W, 5%, 100	Mil type	RCR07G101JM
R65	Resistor, 1/8W, 5%, 2.2K	Mil type	RCR05G222JM
R66	Resistor, 1/8W, 5%, 1K	Mil type	RCR05G102JM
R67,R68	Not Used		
R69	Resistor, 1/4W, 5%, 10	14304	R-1215
R70	Resistor, Film, 5%, 1K	14304	R65-0002-101
S1	Switch, DPDT (optional)	14304	S30-0006-000
T1-T4	Transformer, 9 MHz	14304	919-1319
U1	Integrated Circuit, Quad 2-Input NAND, SN54S00J	14304	I01-0034-000
U2	Integrated Circuit, Dual Flip-Flop CD4027AE	14304	I05-0010-000

Table 1. 1A1A9 Maintenance Parts List (PL 6628-0880) (Cont.)

Ref. Desig.	Name & Description	Mfr. Code	Part Number
U3	Integrated Circuit, Ripple Counter, CD4040AE	14304	I41-0007-000
U4,U5	Integrated Circuit, Counter, CD4029AE	14304	I41-0001-000
U6	Integrated Circuit, Timer, NE555	14304	I35-0004-000
U7	Integrated Circuit, Dual Flip-Flop, CD4027AE	14304	I05-0010-000
U8	Integrated Circuit, Quad Exclusive OR, CD4070BE	14304	I01-0038-000
U9	Integrated Circuit, Triple Gate, MC14501UBAL	14304	I01-0037-000
U10	Integrated Circuit, Quad 4 Input AND, CD4082BE	14304	I01-0032-000
U11	Integrated Circuit, Quad 2 Input NAND, CD4011BF	14034	I01-0000-008
U12	Integrated Circuit, Quad 2 Input NOR, CD4001AE	14304	I01-0003-000
U13	Integrated Circuit, Triple 3 Input NOR, CD4025AE	14304	I01-0024-000
U14	Integrated Circuit, Analog Multiplexer, CD4053BE	14304	I09-0005-000
U15	Integrated Circuit, 54S00	14304	I01-0034-000
U16,U17	Integrated Circuit, Dual Decade Counter, CD4518BF	14304	I40-0006-000
U18	Integrated Circuit, Programmable Counter SN54LS163AJ-00	14304	I05-0000-163
U19	Integrated Circuit, Programmable Counter, SN54LS163AN-00	14304	I05-0000-163
U20	Integrated Circuit, Quad 2 Input NAND, SN54LS26J-00	14304	I02-0013-000
U21	Integrated Circuit, NPN Transistor, Array, CA3083	14304	I90-0001-000
VR1	Integrated Circuit, Voltage Regulator, MC1723L	14304	I12-0004-000
VR2	Integrated Circuit, Voltage Regulator, 5V, LM140LAH-5.0	14304	I11-0004-005
VR3	Zener, Diode, 6.2V, 1N4735	14304	CR-0585

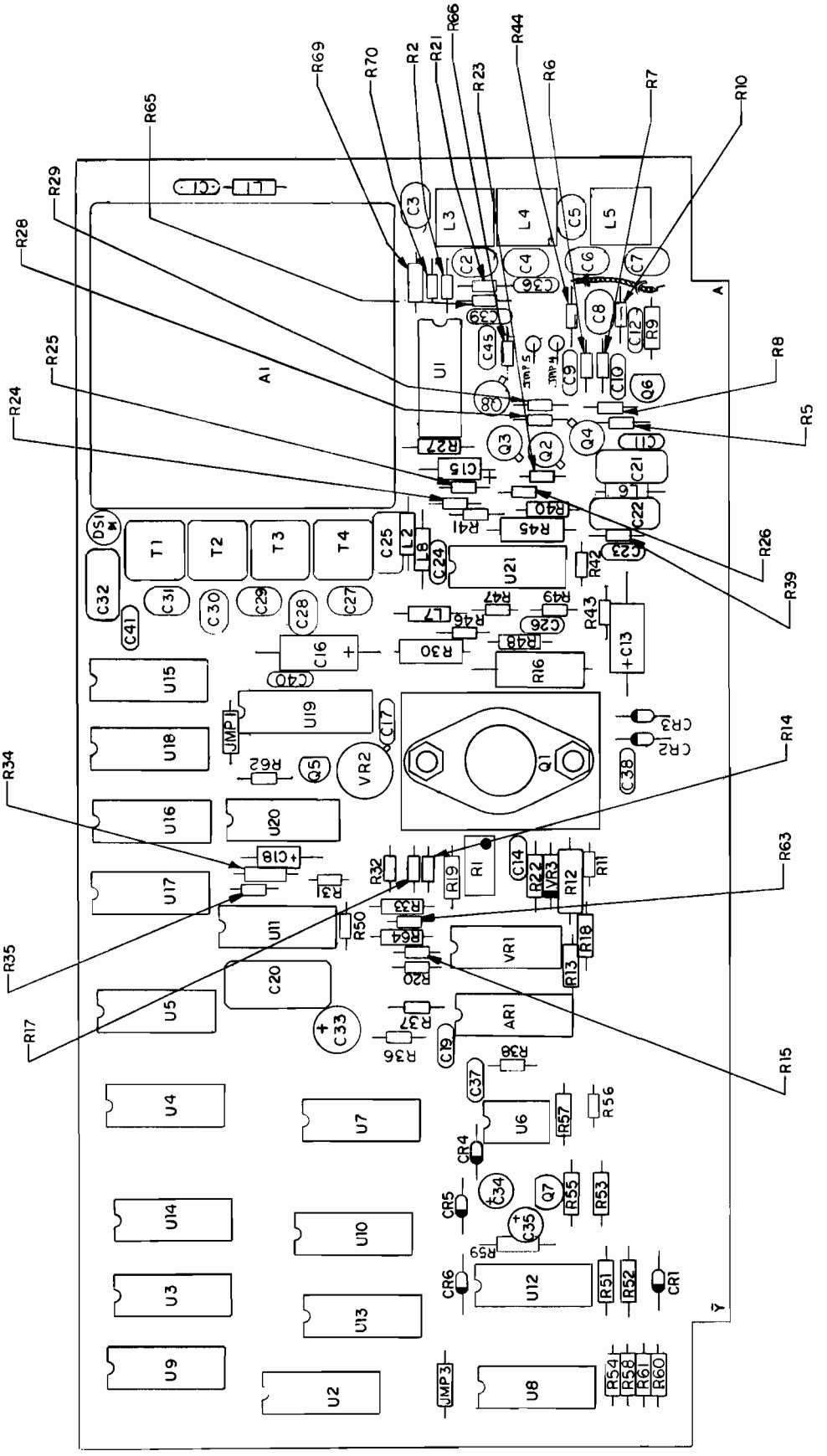


Figure 5. 1A1A9 Component Locations

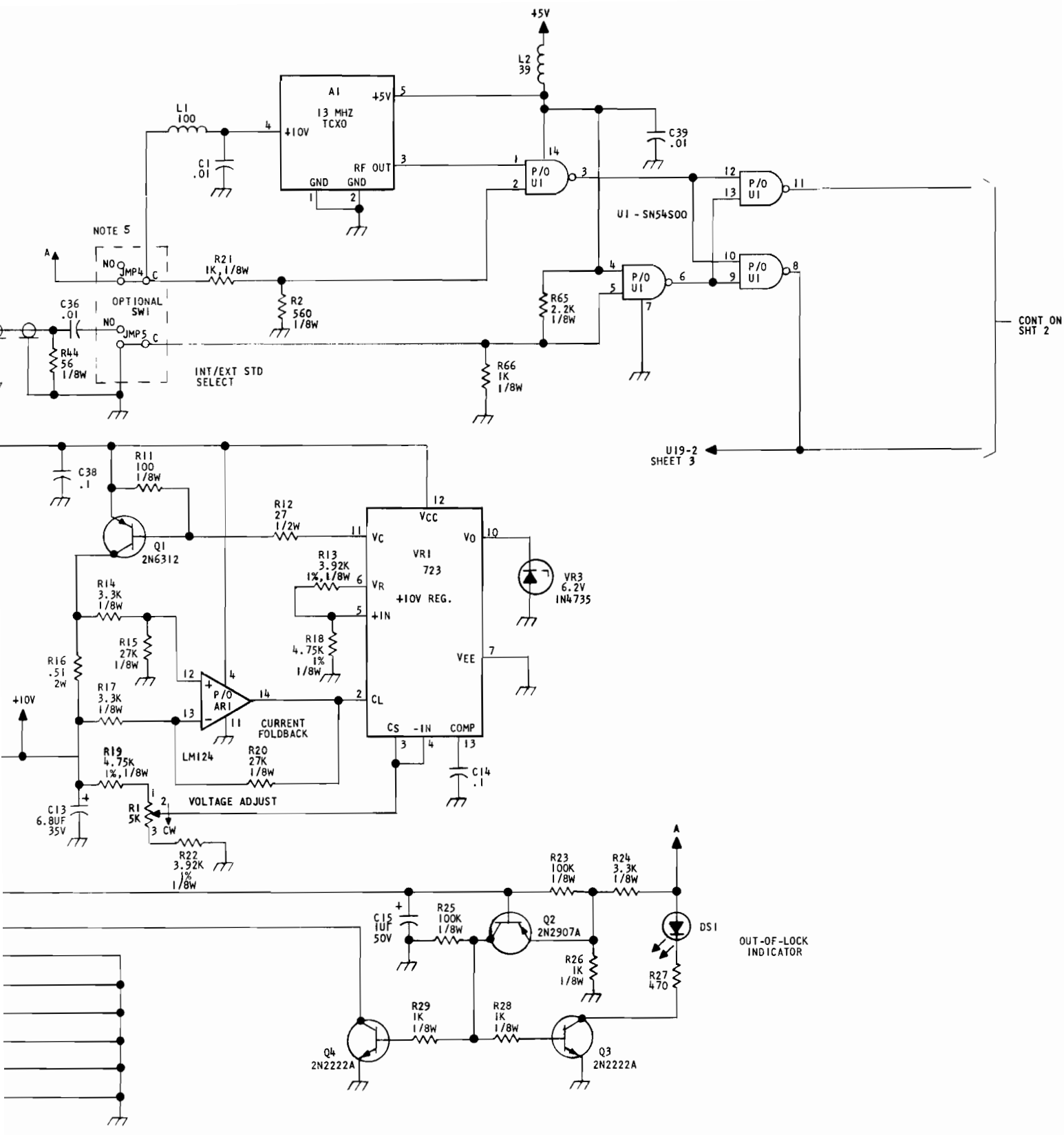
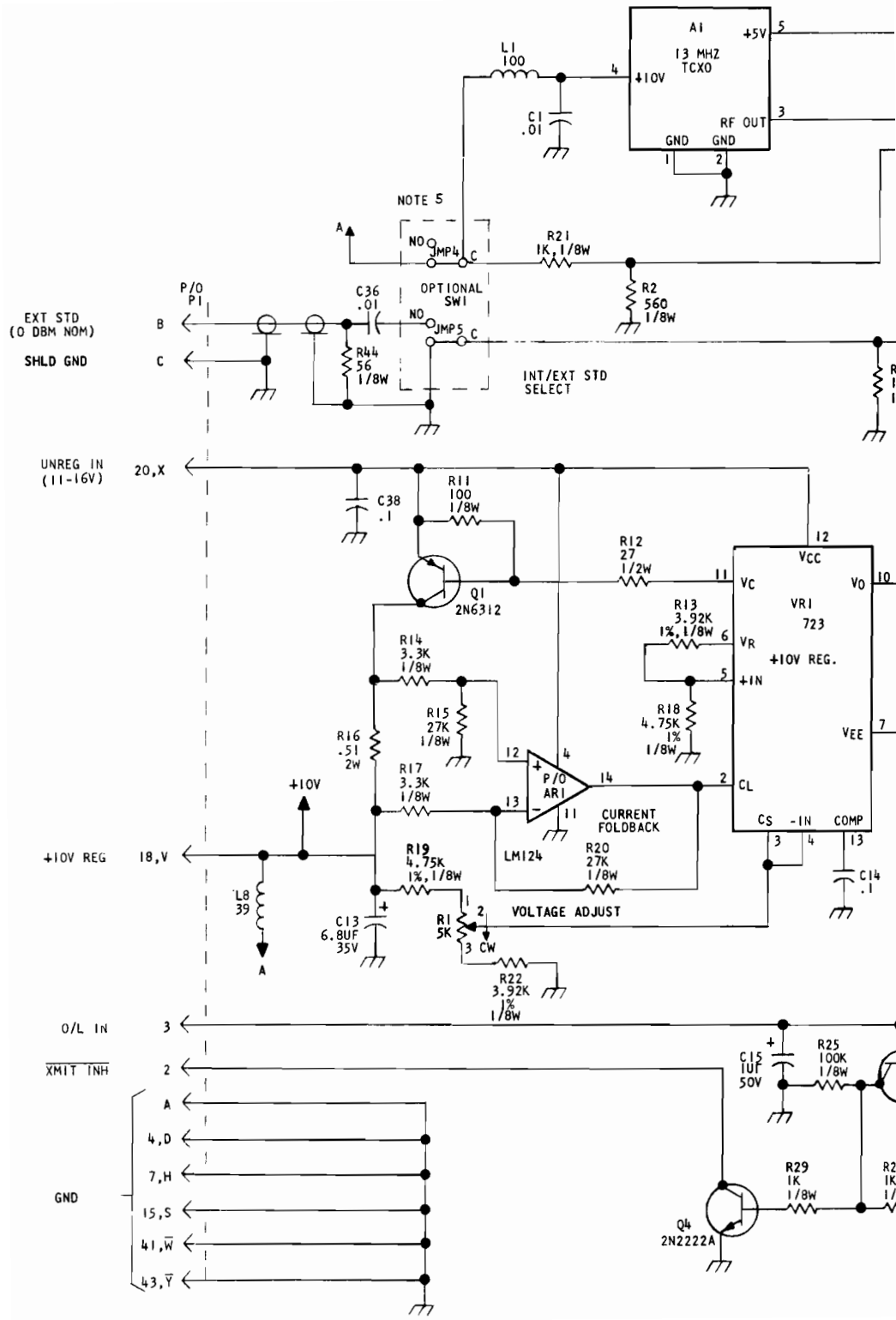


Figure 6. 1A1A9 Assembly Schematic Diagram (6628-9088) (Sheet 1 of 4)


A1
13 MHZ
TCXO
+5V
+10V
RF OUT
GND
GND
L1
100
C1
.01
NOTE 5
NO
JMP4
C
R21
1K, 1/8W
R2
560
1/8W
P/O
P1
C36
.01
OPTIONAL
SW1
NO
JMP5
C
EXT STD
(0 DBM NOM)
B
SHLD GND
C
R44
56
1/8W
INT/EXT STD
SELECT
UNREG IN
(11-16V)
20,X
C38
.1
R11
100
1/8W
Q1
2N6312
R12
27
1/2W
VRI
723
+10V REG.
Vcc
VC
VO
VR
+IN
VEE
CL
CS
-IN
COMP
R13
3.92K
1%,1/8W
R14
3.3K
1/8W
R15
27K
1/8W
R16
.51
2W
R17
3.3K
1/8W
R18
4.75K
1%
1/8W
P/O
AR1
LM124
CURRENT
FOLDBACK
+10V
+10V REG
18,V
R19
4.75K
1%,1/8W
R20
27K
1/8W
C14
.1
L8
39
A
C13
6.8UF
35V
R1
5K
3 CW
VOLTAGE ADJUST
R22
3.92K
1%
1/8W
O/L IN
3
XMIT INH
2
A
4,D
7,H
GND
15,S
41,W
43,Y
C15
1UF
50V
R25
100K
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R29
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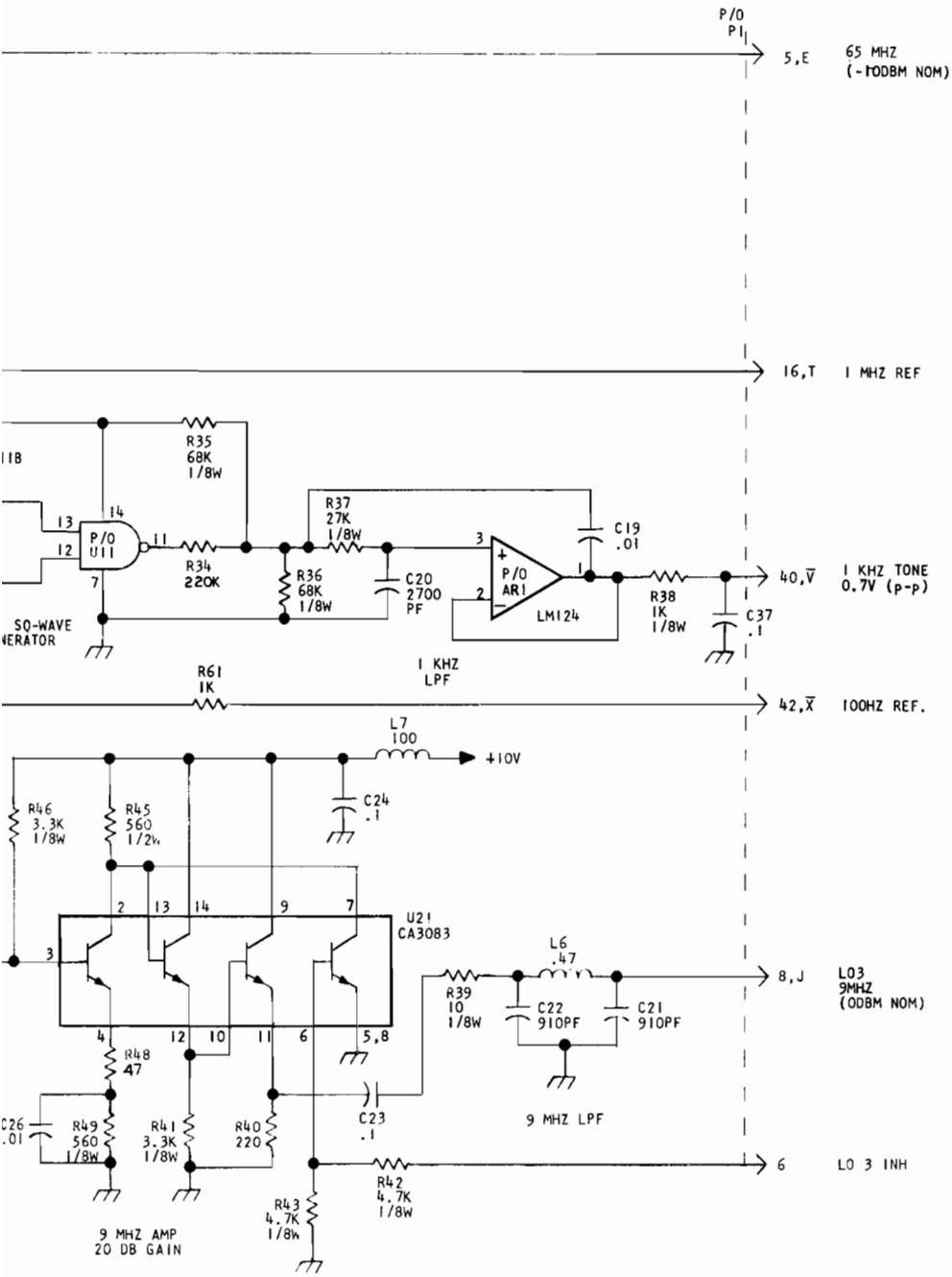
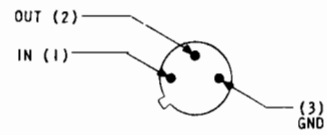
1/8W
Q4
2N2222A



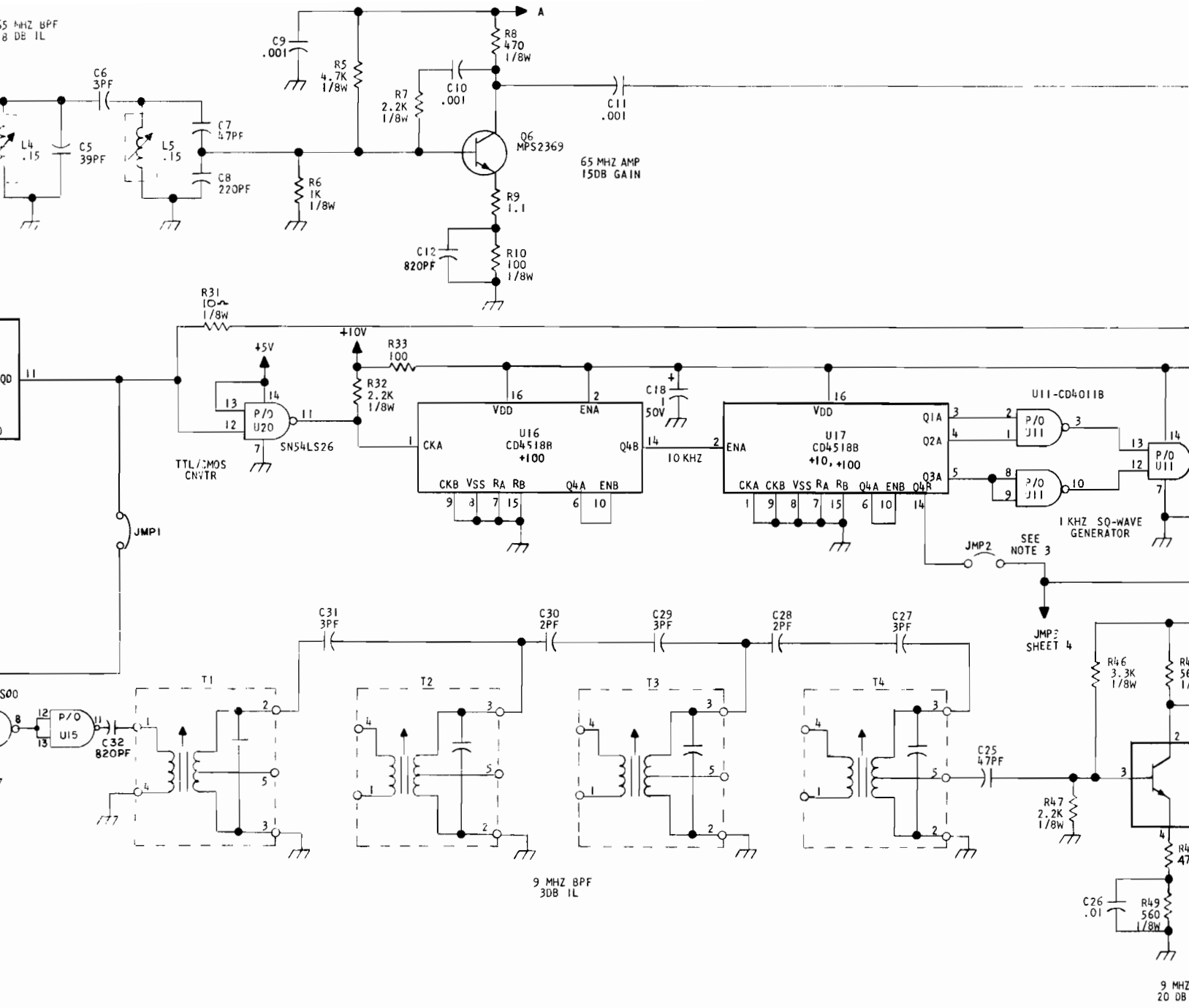
NOTES:

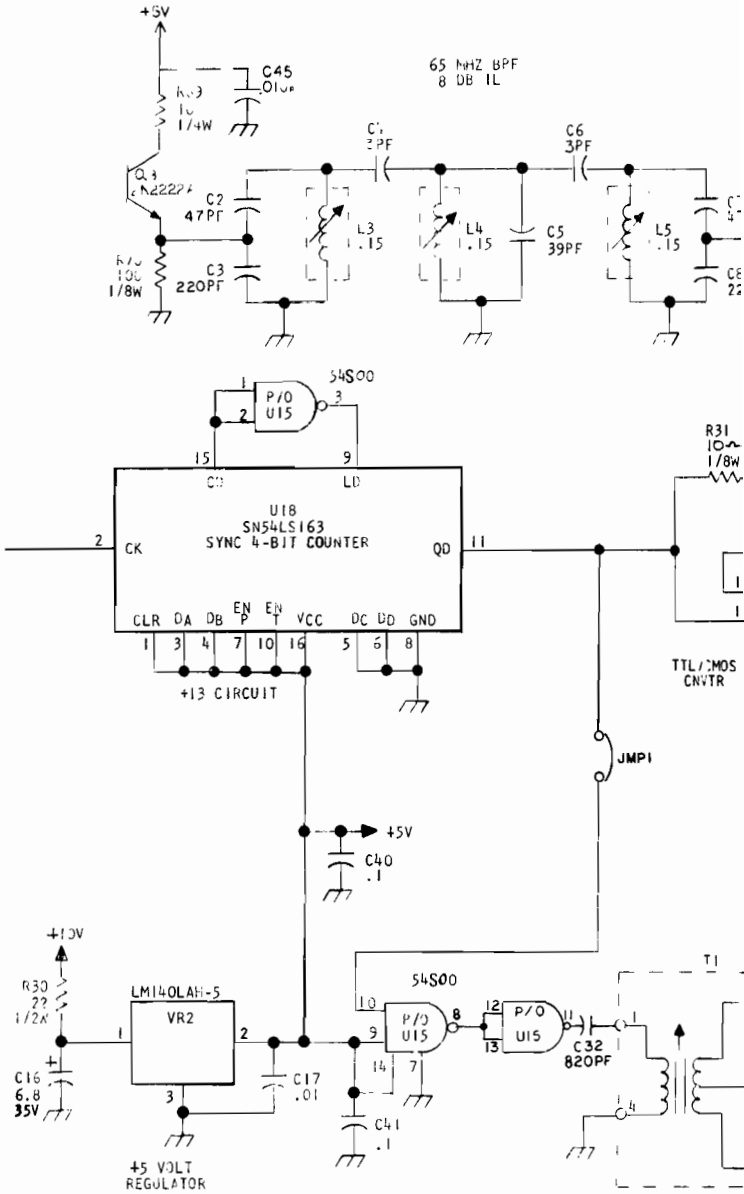
1. UNLESS OTHERWISE SPECIFIED:
   ALL RESISTORS ARE IN OHMS, 1/4W, ±5%.
   ALL CAPACITORS ARE IN MICROFARADS.
   ALL INDUCTORS ARE IN MICROHENRIES.
   ALL DIODES ARE 1N4454.
2. DIGITAL CLARIFIER CIRCUITRY, (SHTS 3&4) IS NOT USED ON SYSTEMS WITHOUT CLARIFIER.
3. FOR SYSTEMS WITH CLARIFIER, DELETE JMP2.
4. VR2 BOTTOM VIEW:



5. IN RF-4040 SYSTEM JMP4 AND JMP5 ARE DELETED AND OPTIONAL SW1 IS ADDED.
6. REMOVE CR3 FOR CLARIFIER DISABLE IN TRANSMIT. REMOVE CR2 FOR CLARIFIER DISABLE IN RECEIVE.

Figure 6. 1A1A9 Assembly Schematic Diagram (6628-9088) (Sheet 2 of 4)


65 MHZ BPF
8 DB IL
C6
3PF
L4
.15
C5
39PF
L5
.15
C7
47PF
C8
220PF
C9
.001
R5
4.7K
1/8W
R6
1K
1/8W
R7
2.2K
1/8W
C10
.001
R8
470
1/8W
A
C11
.001
Q6
MPS2369
65 MHZ AMP
15DB GAIN
R9
1.1
C12
820PF
R10
100
1/8W
R31
10
1/8W
+5V
+10V
R33
100
R32
2.2K
1/8W
P/O
U20
SN54LS26
TTL/CMOS
CNVTR
U16
CD4518B
+100
VDD
ENA
CKA
CKB
VSS
RA
RB
Q4A
Q4B
ENB
C18
1
50V
10 KHZ
U17
CD4518B
+10, +100
Q1A
Q2A
Q3A
Q4B
U11-CD4011B
P/O
U11
1 KHZ SQ-WAVE
GENERATOR
JMP1
JMP2
SEE
NOTE 3
JMP3
SHEET 4
C31
3PF
C30
2PF
C29
3PF
C28
2PF
C27
3PF
T1
T2
T3
T4
P/O
U15
C32
820PF
C25
47PF
R46
3.3K
1/8W
R47
2.2K
1/8W
C26
.01
R49
560
1/8W
9 MHZ BPF
3DB IL
9 MHZ
20 DB


+5V
C45
.01uF
R29
10
1/4W
Q3
2N2222A
65 MHZ BPF
8 DB IL
C1
3PF
C6
3PF
C2
47PF
C3
220PF
L3
.15
L4
.15
C5
39PF
L5
.15
R28
100
1/8W
54S00
P/O
U15
U18
SN54LS163
SYNC 4-BIT COUNTER
CK
QD
CLR
DA
DB
EN P
EN T
VCC
DC
DD
GND
+13 CIRCUIT
R31
10
1/8W
TTL/CMOS
CNVTR
JMP1
+5V
C40
.1
+10V
R30
22
1/2W
LM140LAH-5
VR2
C16
6.8
35V
C17
.01
+5 VOLT
REGULATOR
54S00
P/O
U15
P/O
U15
C41
.1
T1
C32
820PF

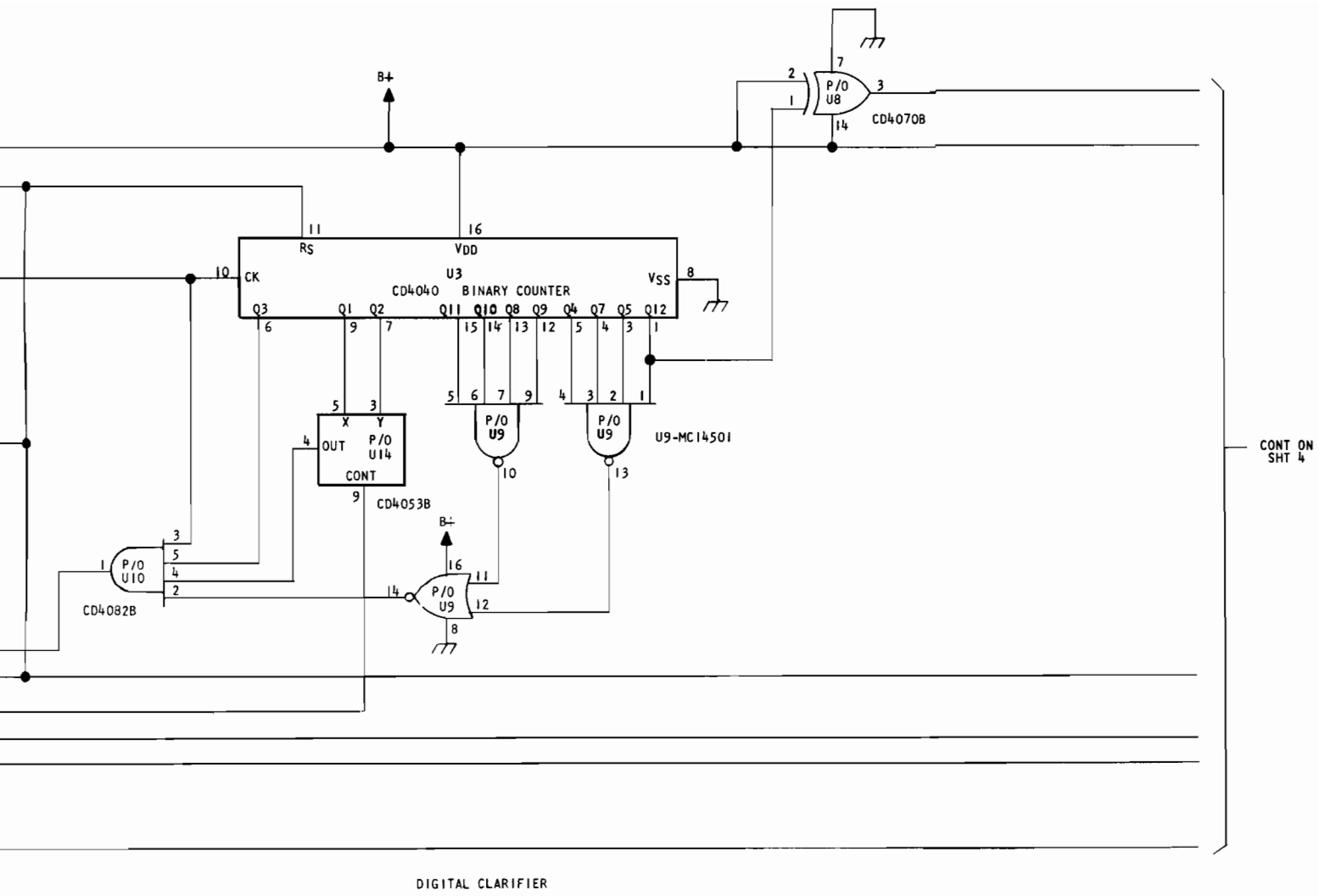
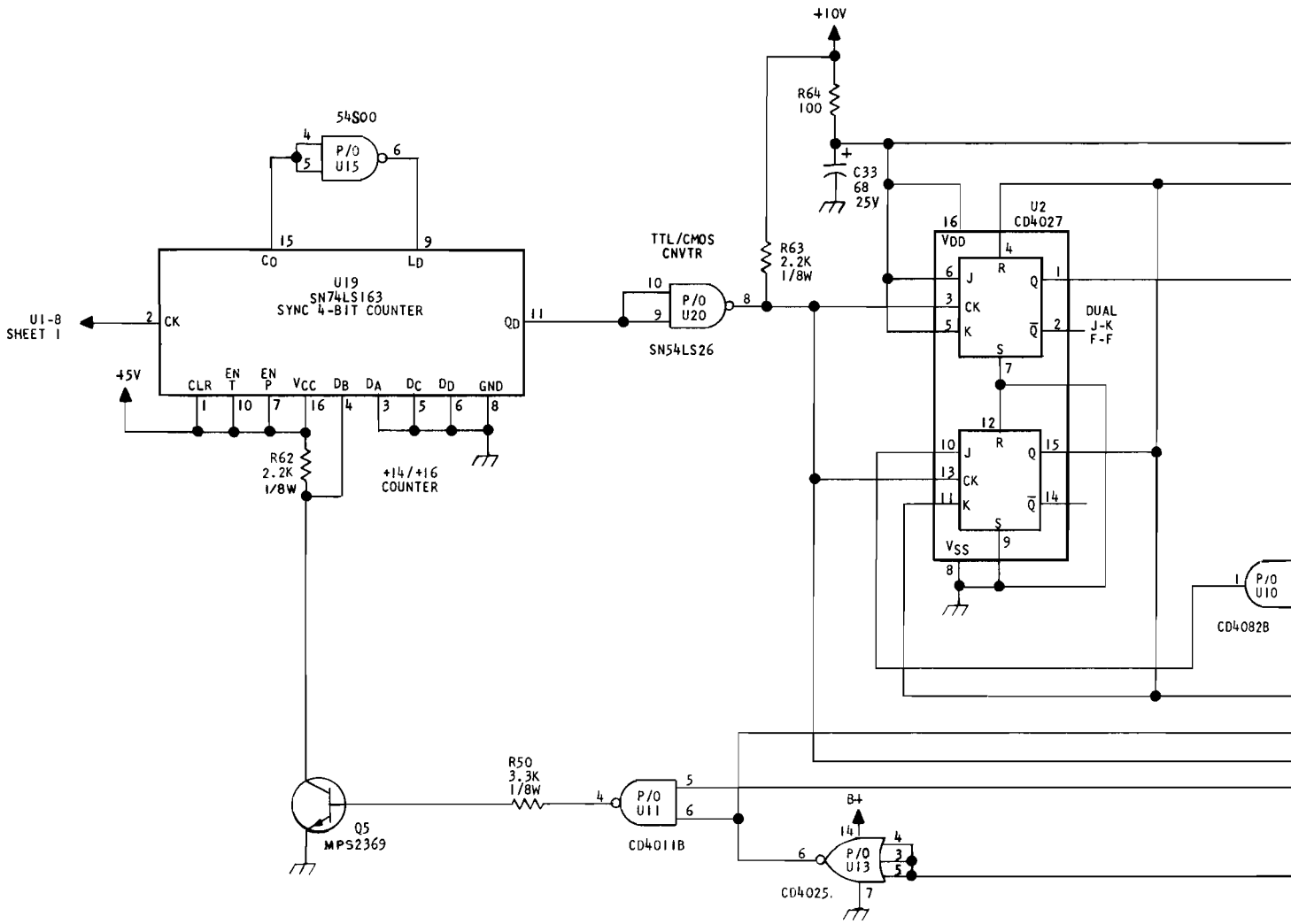


Figure 6. 1A1A9 Assembly Schematic Diagram (6628-9088) (Sheet 3 of 4)


+10V
R64
100
C33
68
25V
54S00
P/O
U15
U19
SN74LS163
SYNC 4-BIT COUNTER
CO
LD
CK
QD
CLR
ENT
ENP
VCC
DB
DA
DC
DD
GND
U1-8
SHEET 1
+5V
R62
2.2K
1/8W
+14/+16
COUNTER
TTL/CMOS
CNVTR
P/O
U20
SN54LS26
R63
2.2K
1/8W
U2
CD4027
VDD
VSS
J
K
CK
R
S
Q
DUAL
J-K
F-F
P/O
U10
CD4082B
R50
3.3K
1/8W
Q5
MPS2369
P/O
U11
CD4011B
B+
P/O
U13
CD4025.

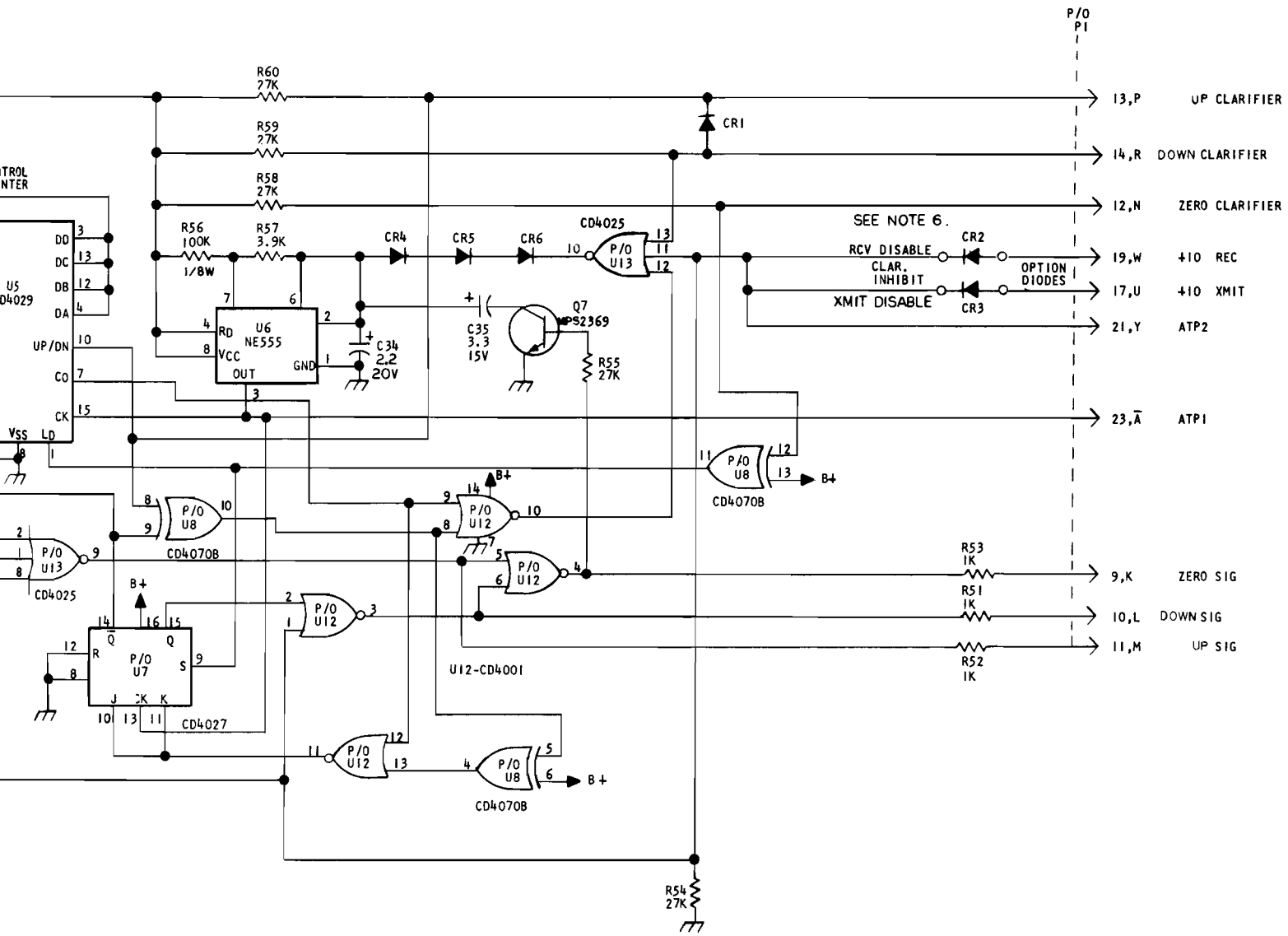
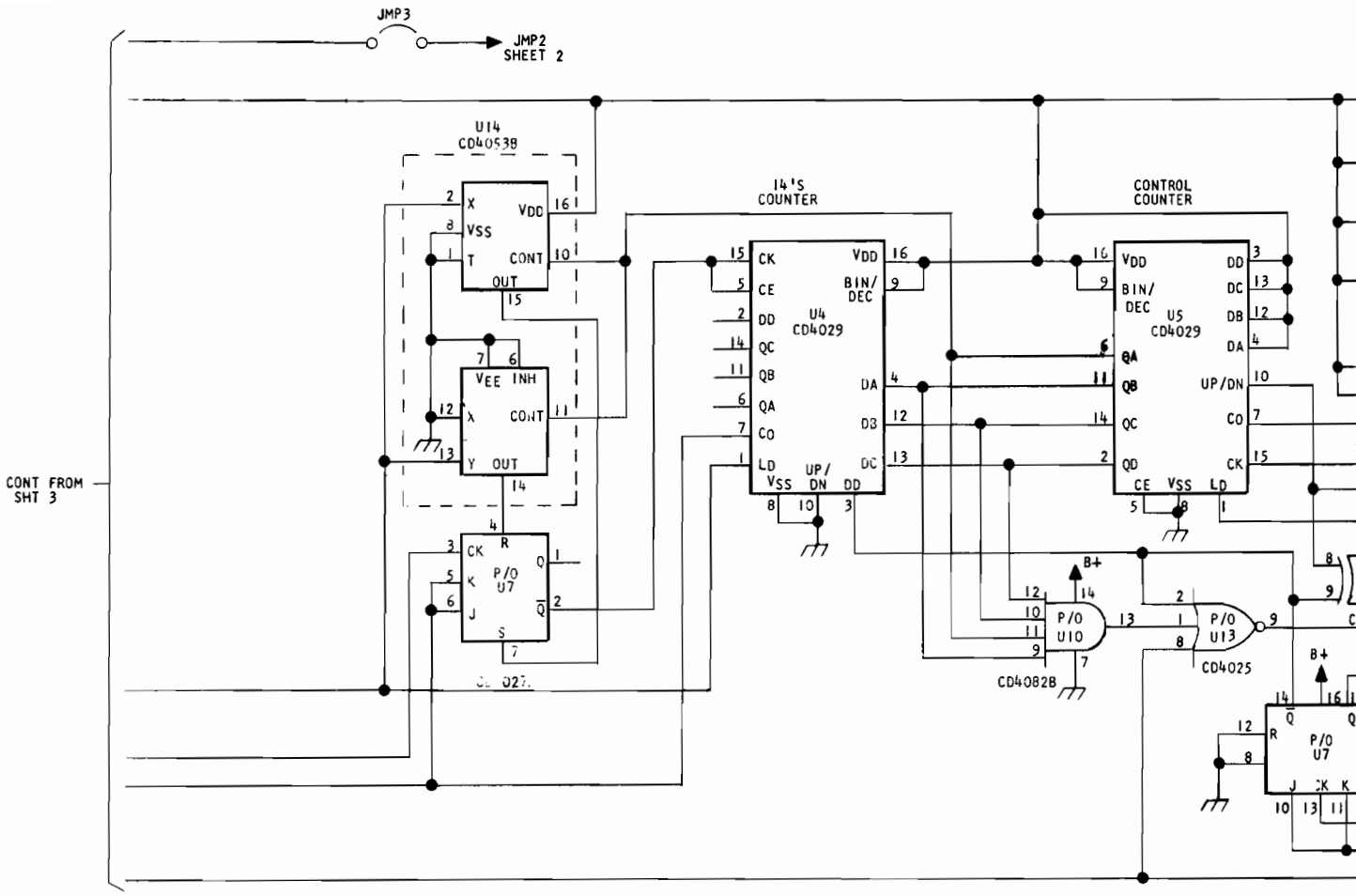


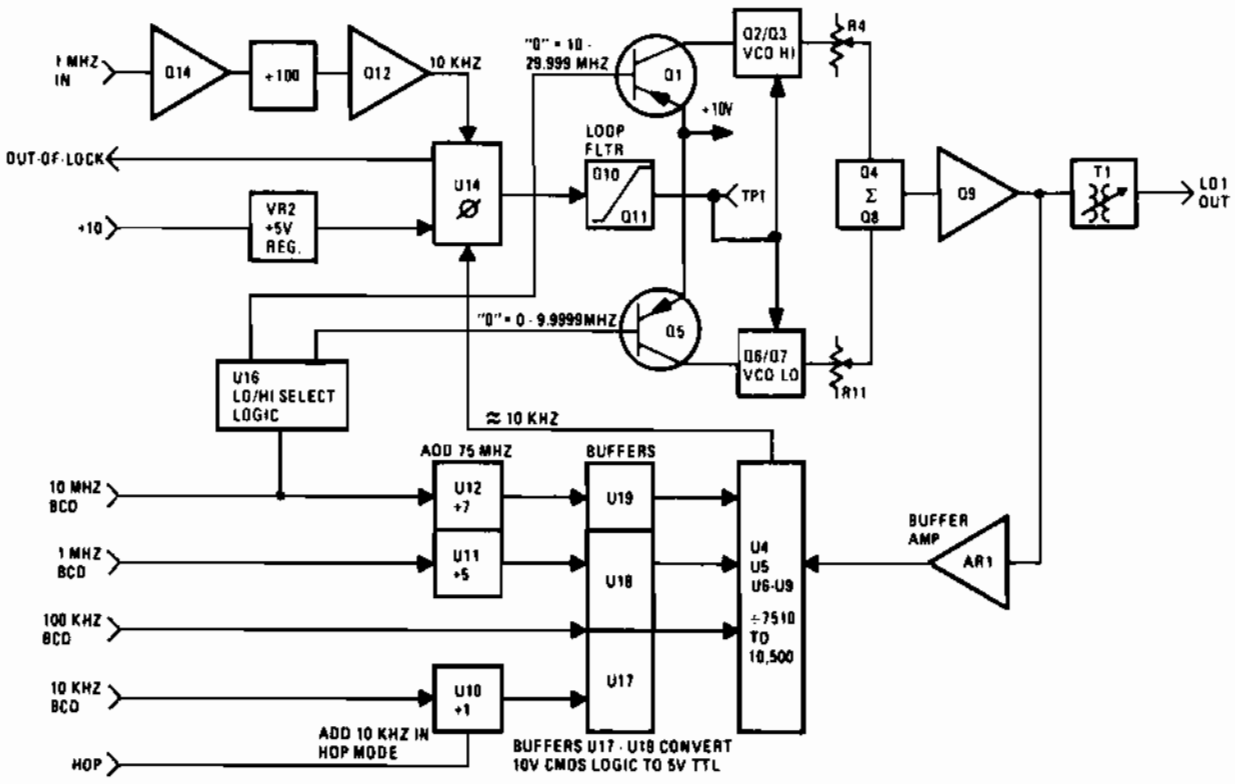
Figure 6. 1A1A9 Assembly Schematic Diagram (6628-9088) (Sheet 4 of 4)


JMP3
JMP2
SHEET 2
CONT FROM
SHT 3
U14
CD4053B
X
VSS
T
VDD
CONT
OUT
VEE
INH
X
CONT
Y
OUT
CK
K
J
R
S
Q
P/O
U7
14'S
COUNTER
U4
CD4029
CK
CE
DD
QC
QB
QA
CO
LD
VSS
UP/
DN
DD
BIN/
DEC
DA
DB
DC
CONTROL
COUNTER
U5
CD4029
QD
CK
UP/DN
P/O
U10
CD4082B
P/O
U13
CD4025
B+

UNIT INSTRUCTIONS

LO NO.1

1A1A10



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3	Semiconductor Complement	1
4	Functional Description	1
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1. GENERAL DESCRIPTION

LO No. 1 generates the Fo +75 MHz signal required at the 1A1A6 Mixer to perform the final transmit mixer up-conversion to the Fo, and in the receive mode, to perform the first up conversion to the 75 MHz IF. The Fo +75 MHz output can be any discrete frequency (in 10 kHz increments) between 75.0 MHz and 104.99 MHz. The output frequency is synthesized from a single 1 MHz signal input. Synthesizer control is exercised automatically in response to BCD frequency control inputs from the memory board (or in remote control applications, via optional RF-2370 Channelized Remote Control Unit). HOP spur avoidance is also exercised through this assembly.

2. TECHNICAL CHARACTERISTICS

Power Inputs:
+10V P1-18

Signal Inputs:
1 MHz Ref. P1-23

Signal Outputs:
LO No. 2 Out P1-2 75.1 MHz - 104.99 MHz (10 kHz Increments)

Control Inputs:
10 kHz 1^0, 2^1, 2^2, 2^3
100 kHz 2^0, 2^1, 2^2, 2^3
1 MHz 2^0, 2^1, 2^2, 2^3
10 MHz 2^0, 2^1
HOP P1-25 1 = +10 kHz

Control Outputs:
Out-of-Lock P1-41 0 = Out-of-Lock

3. SEMICONDUCTOR COMPLEMENT

REF. DESIG.	TYPE	DESCRIPTION
AR1	CA3028AS	Differential Cascoce Ampl.
CR1-CR3		Diode, Voltage, Variable Capacitance
CR4, CR5	1N4454	Diode, Signal
Q1	2N4126	Transistor, PNP
Q2, Q3	2N5486	Transistor, FET
Q4	2N3563	Transistor, NPN
Q5	2N4126	Transistor, PNP
Q6, Q7	2N5486	Transistor, FET
Q8, Q9	2N3563	Transistor, NPN
Q10, Q11	MPS6571	Transistor, NPN
Q12	MPS2369	Transistor, NPN
Q13	MPSA13	Transistor, Darlington, NPN
Q14	MPS2369	Transistor, NPN
U4	FSC11C90	650 MHz ÷10/11 Prescaler
U5	MC7470P	Gated JK Flip-Flop
U6 - U9	74LS190N	Synchronous Up/Down BCD Counter
U10-U12	CD4008	4-Bit Full Adder
U13	SN781.05	Positive Fixed Voltage Regulator
U14	MC4044	Phase Detector
U15	CD4518BE	Duad BCD Up-counter
U16	CD4001AE	Quad 2-Bit NOR Gates
U17-U19	CD4010	Hex Buffers/Converters
U20	74LS27PC	Triple 3-Input NOR Gates
VR1	MC7805CP	Positive 5-Volt Regulator
VR2	SN781.05	3-Terminal 5 Volt Regulator

4. FUNCTIONAL DESCRIPTION

The LO No. 1 output signal is synthesized from a single 1 MHz reference signal input in response to BCD control inputs of 10 MHz, 1 MHz, 100 kHz, and 10 kHz. Recall that 1 kHz and 100 Hz frequency control elements are added to the signal by LO2. HOP, the 10 kHz frequency shift spur evasion technique, is also effected at LO1.

The 1 MHz reference input from 1A1A9 enters LO1 at P1-23 and is buffered at Q14 to drive U15, configured to divide by 100. The 10 kHz CMOS output from U15 is converted to TTL by Q12.

Refer to figure 1, a detail diagram of Phase Detector U14 as it is employed in this circuit, for the following discussion. Only the phase detector and charge pump features of U14 are used in this circuit. They are used to measure a phase lock condition and to generate an error voltage proportional to departure of the divide-by-N input from the reference input.

Loop Lockup occurs when both outputs U1 and D1 remain high. This occurs only when all the negative transitions on R, the reference input, and V, the feedback input, coincide. The circuit responds only to transitions, and as a consequence, phase error is independent of input waveform, duty cycle, or amplitude variation. As long as the loop remains locked (no phase or frequency difference of the input signals), the output voltage at R56 will be low and the U1 and D1 outputs will be low.

With an out of lock condition, there will be a pulsed waveform on either U1 or D1 (to either PU or PD), depending on the phase-frequency relationship of the two inputs at R and V. The charge pump serves to invert one of the waveforms (D1) and translates the voltage levels before they are applied to the loop filters. When PD is low and PU is high, Q1 will be conducting in the normal direction and Q2 will be off. Current will be following through Q3 and CR2; the base of Q3 will be two V_{BE} drops above ground or approximately 1.5 volts. Since both of the resistors connected to the base of Q3 are equal, the emitter of Q4 (base of Q5) will be approximately 3.0 volts. For this condition, the emitter of Q5 (DF) will be one V_{BE} below this voltage, or about 2.25 volts. The PU input to the charge pump is high ($\geq$ 2.4 volts) and CR1 will be reversed biased.

When PU is low and PD is high, CR1 is forward biased and UF will be approximately one V_{BE} above ground (neglecting the $V_{CE(sat)}$ of the driving gate). With PD high, Q1 conducts in the reverse direction, supplying base current for Q2. While Q2 is conducting, Q4 is prevented from supplying base drive to Q5.

If both inputs to the charge pump are high (zero phase difference), both CR1 and the base-emitter junction of Q5 are reverse biased and there is no tendency for the error voltage to change.

The phase detector output is fed via Q10 and Q11 and the Loop Filter circuit to both the VCO High, and the VCO Low circuits. Loop characteristics are set by L6 and L7. The VCO control voltage is measurable at TP1. U16 monitors the 10 MHz control line to select VCO High whenever a frequency equal to or greater than 10 MHz is selected. A low logic level output from U16-10 will enable Q1, and a low logic level at U16-11 will enable Q5.

With VCO Low selected, the dc control voltage at varicap CR3 will drive this oscillator frequency until it agrees with the reference input, as modified by the frequency control reference inputs. L2 is adjusted for +6.5 Vdc at TP1 (with 9.999 MHz selected. R11 adjusts the VCO Low output level to +7 dBm at P1-2, with the output coupled to this point via Q8, Q9, and T1 (tuned for optimum output).

Q13 is used to provide super decoupling for the +10 Vdc oscillator supply volts. VCO High provides an identical function for frequencies 10 MHz and above, with CR1 and CR2 providing the frequency

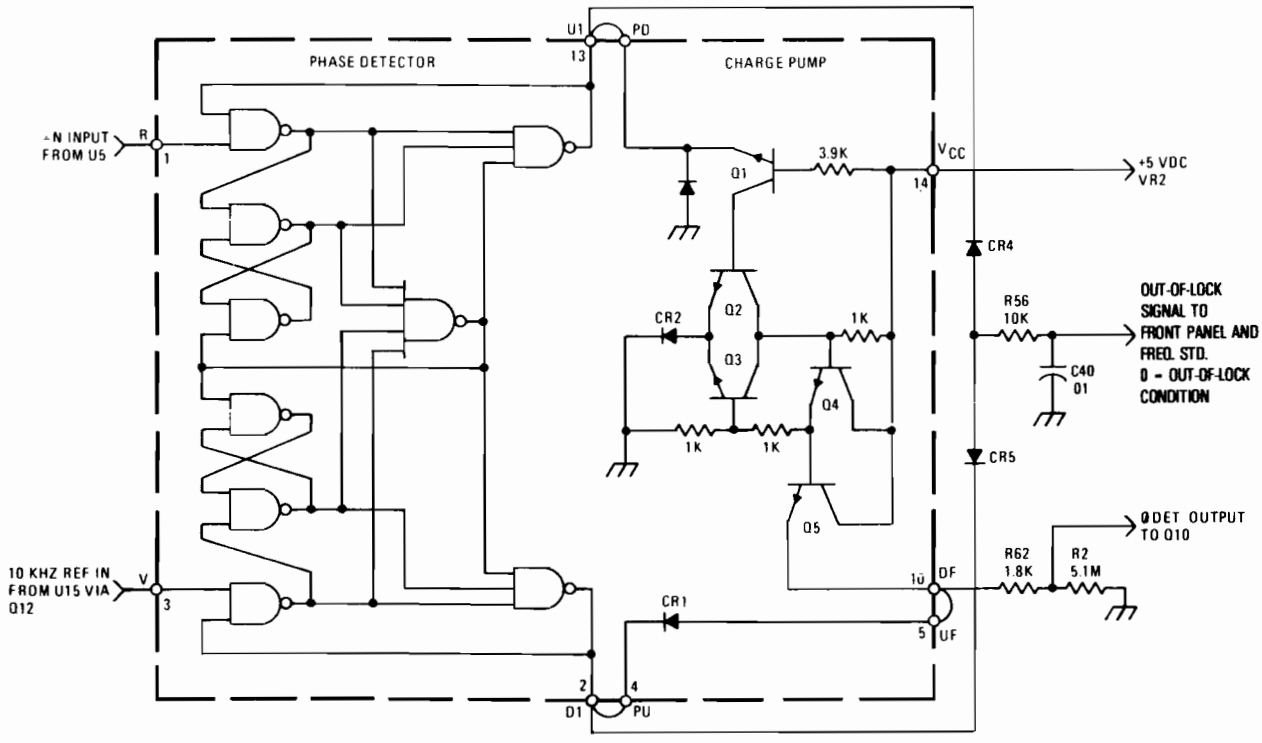


Figure 1. 1A1A10 U14 Phase Detector Detail

control in response to the control input. L1 is also adjusted for +6.5 Vdc at TP1, but with a frequency of 29.999 MHz selected. R4 adjusts this level to +7 dBm at the output.

Part of the Q9 output of T1 is picked off by C14 and fed via buffer amplifier AR1 to the divide-by-N circuit. The divide-by-N function will produce the desired 10 kHz (approximately) output to the phase detector in response to control inputs from the frequency control lines and the associated adders, buffers, and counters.

On the MHz control lines, U11 and U12 are configured to add 75 (7 at U12 and 5 at U11), to any BCD input instructions. 100 kHz control lines are fed direct to the CMOS-TO-TTL converters because no "add" function is required. U10 will automatically add +1 to any 10 kHz BCD instructions under control of the HOP select line. With P1-23 high, U10 will add +10 kHz to counter the complimentary 10 kHz HOP instruction at LO2. This system of adding 10 kHz as a spur evasion technique will not actually alter the frequency of operation because of the cancelling effect inherent in the mixing process. Buffer/converters U17, U18, and U19 perform the 10V CMOS to 5V TTL conversion function for use by the divide-by-N logic.

Table 1 is included to demonstrate the relationship of the LO1 output to the selected F_O. 10 kHz select information is included, even though this function is accomplished at LO2 and not at LO1, to demonstrate the "Auto HOP" effect when the selected kHz digit is less than 4. The columns at the right demonstrate the effect of manually selecting or programming HOP for both conditions.

5. MAINTENANCE

All of the adjustments indicated in this paragraph have been made at the factory prior to shipment. It should not be necessary to repeat any of these adjustments unless component failure is experienced, or unless readjustment becomes necessary for some other specific reason. All of these adjustments can be made by removing the PC Board and reinstalling it on the extender card as shown in figure 2 this will facilitate maintenance and adjustment by making all test points readily available. These adjustments can all be made using the test equipment shown or the electrical equivalents. Figure 2 summarizes 1A1A10 Inputs/Outputs and locates significant adjustment points.

CAUTION

Always remove power when removing or reinstalling subassemblies.

5.1 L6/L7/T1 Adjustment

a. Terminate the RF-2301RF Output in a 50 ohm load.

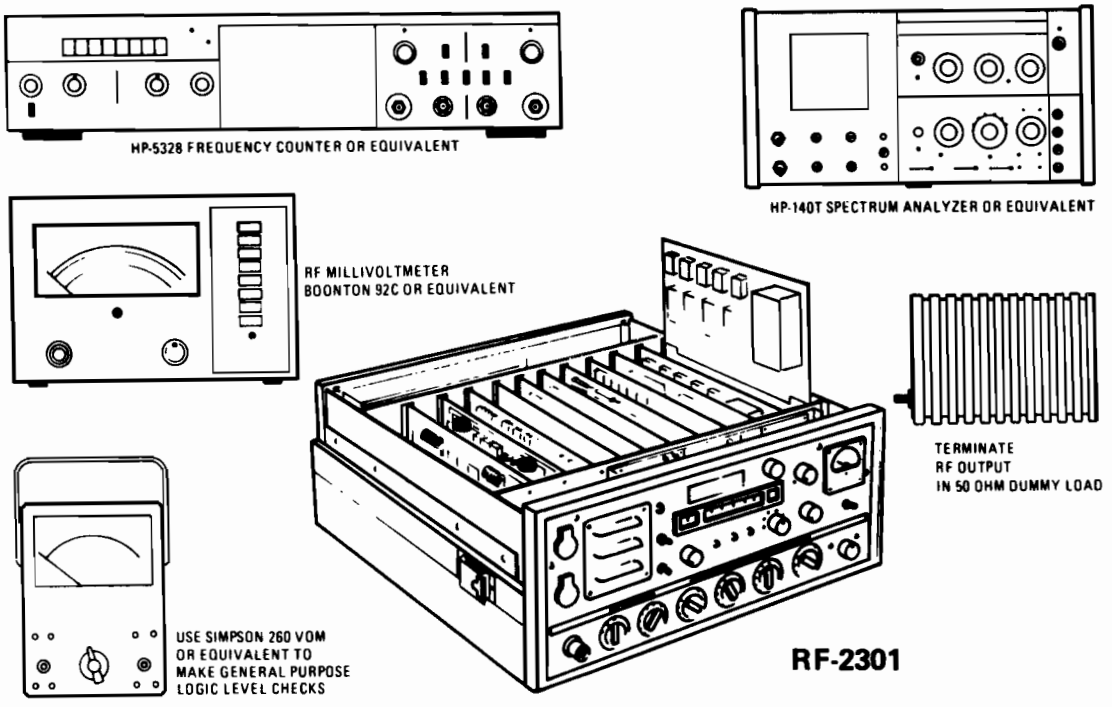


Figure 2. 1A1A10 Test Setup and Equipment

b. Connect a spectrum analyzer to the 1A1-A11 RF Output at P1-2 and adjust to display 10 kHz components on either side of the desired output.

c. Adjust L6 and L7 for minimum 10 kHz component in the RF output at P1-2.

d. Remove the spectrum analyzer from the RF output at P1-2 and connect an RF Sensitive VTVM (Boonton 92C unterminated).

e. Adjust T1 for maximum output at P1-2, using a channel frequency close to mide-range (i.e., approximately 15 MHz).

f. This completes adjustment. Reconfigure for normal operation or as desired.

5.2 HI/LO VCO Adjustments

a. Terminate RF-2301 RF Output in a 50 ohm load.

b. Set frequency to 09.99 MHz. Adjust L2 for 6.5 volts measured at TP1 with a voltmeter.

c. Set frequency to 00.00 MHz. Observe that the voltmeter at TP1 reads between 1.5 and 3.5 volts.

d. Set frequency to 29.99 MHz. Adjust L1 for 6.5 volts on the voltmeter at TP1.

e. Set frequency to 10.00 MHz. Observe that the voltmeter at TP1 is between 1 and 3 volts.

f. Set frequency to 15.00 MHz. With the analyzer set at 90 MHz peak T1.

g. Set frequency to 09.99 MHz. Adjust R11 for +7 dBm at 84.99 MHz on the analyzer.

h. Set frequency to 29.99 MHz. Adjust R4 for +7 dBm at 104.99 MHz on the analyzer.

i. This completes all LO1 adjustments. Reconfigure for normal operation.

6. PARTS LIST

Table 1 lists all 1A1A10 Maintenance Parts. All of these components can be identified in Figure 4.

7. SCHEMATIC

Figure 5 is a complete schematic diagram of the 1A1A10 assembly.

Table 1. Partial Fo vs. LO1 Output Table Demonstrating Hop Action

SELECTED F_0 IN MHZ	LO1 OUTPUT (NORMAL)	DIVIDE BY N FACTOR	HOP NOTES	LO1 OUTPUT IN MHZ HOP MANUALLY SELECTED	DIVIDE BY N FACTOR
01.6000	76.61*	7661	FOR FREQUENCIES	76.60	7660
01.7000	76.71*	7671	WHERE THE KHZ	76.70	7670
01.8000	76.81*	7681	SELECT DIGIT IS	76.80	7680
01.9000	76.91*	7691	LESS THAN 4,	76.90	7690
02.0000	77.01*	7701	"AUTO HOP" IS	77.00	7700
02.1820	77.19*	7719	COMMANDED BY	77.18	7718
02.2010	77.21*	7721	LO2 AND WILL	77.20	7720
02.2020	77.21*	7721	FORCE U10 TO	77.20	7720
02.2030	77.21*	7721	ADD 10 KHZ TO	77.20	7720
02.2040	77.20	7720	THE F_0 SHOWN	77.21	7721
02.2050	77.20	7720		77.21	7721
02.2060	77.20	7720		77.21	7721
INCOMPLETE TABLE - ELEMENTS SHOWN TO DEMONSTRATE PROGRESSION AND HOP ACTION					
29.8000	104.81*	10481	THE EFFECT OF	104.80	10480
29.9000	104.91*	10491	MANUALLY SEL	104.90	10490
29.9100	104.92*	10492	ECTING OR PRO	104.91	10491
29.9200	104.93*	10493	GRAMMING HOP	104.92	10492
29.9300	104.94*	10494	IS SHOWN AT THE	104.93	10493
29.9400	104.95*	10495	RIGHT	104.94	10494
29.9500	104.96*	10496		104.95	10495
29.9600	104.97*	10497		104.96	10496
29.9700	104.98*	10498		104.97	10497
29.9800	104.99*	10499		104.98	10498
29.9900	105.00*	10500		104.99	10499
29.9910	105.00*	10500		104.99	10499
29.9920	105.00*	10500		104.99	10499
29.9930	105.00*	10500		104.99	10499
29.9940	104.99	10499		105.00	10500
29.9950	104.99	10499		105.00	10500
29.9960	104.99	10499		105.00	10500
29.9970	104.99	10499		105.00	105.00
29.9980	104.99	10499		105.00	10500
29.9990	104.99	104.99		105.00	10500
29.9991 THRU 29.9999	104.99	10499		105.00	10500

*DENOTES 10 KHZ ADDED BY "AUTO HOP"

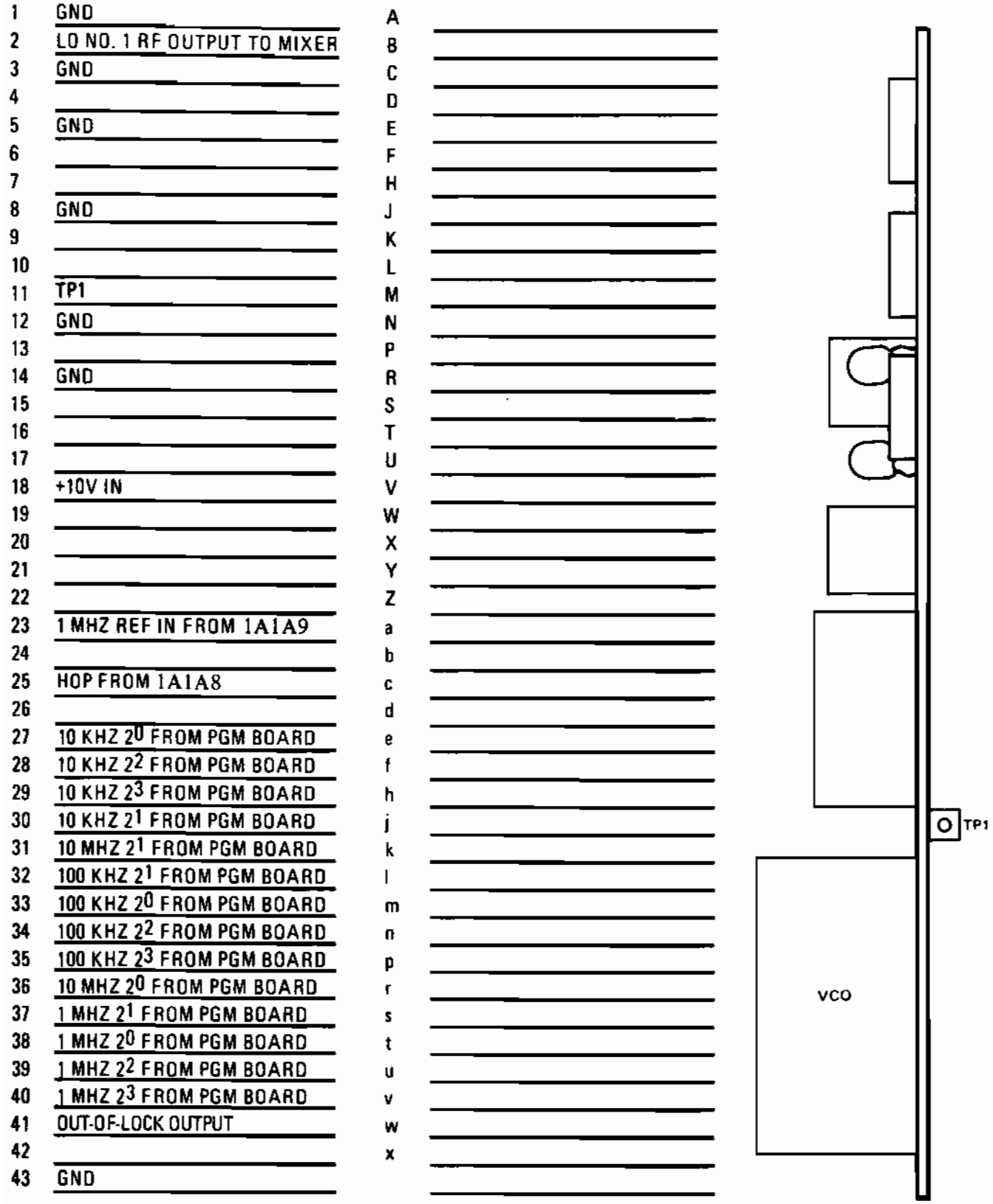


Figure 3. 1A1A10 Input/Output Summary

Table 2. 1A1A10 Maintenance Parts List

Ref. Desig.	Name & Description	Mfr. Code	Part No.
1A1A10	L.O. No. 1 PWB Assembly	14304	6628-0900
AR1	Integrated Circuit, Differential/Cascade Amplifier	14304	IC-0031
C1 to C3	Capacitor, Fixed, Ceramic, .01 uF ±20%, 50V	14304	C-4952
C4	Capacitor, Fixed, Ceramic, .001 uF ±10%, 500V	14304	C-3513
C5	Capacitor, Fixed, Ceramic, 5.6 pF ±.5 pF, 1000V	14304	C-4738
C6,C7	Capacitor, Fixed, Ceramic, .001 uF ±10%, 500V	14304	C-3513
C8	Capacitor, Fixed, Ceramic, 10 pF ±5%, 1000V	14304	C-4741
C9	Capacitor, Fixed, Mica, 91 pF ±5%, 500V	14304	C-0125
C10	Capacitor, Fixed, Ceramic, .001 pF ±10%, 500V	14304	C-3513
C11	Capacitor, Fixed, Ceramic, 150 pF ±10%, 500V	14304	C-3502
C12,C13	Capacitor, Fixed, Ceramic, .01 uF ±20%, 50V	14304	C-4952
C14	Capacitor, Fixed, Ceramic, 1 pF ±.5 pF, 1000V	14304	C-4727
C15	Capacitor, Fixed, Ceramic, .001 uF ±10%, 500V	14304	C-3513
C16,C17	Capacitor, Fixed, Ceramic, .01 uF ±20%, 50V	14304	C-4952
C18	Capacitor, Fixed, Tantalum, 68 uF ±10%, 25V	14304	C25-0003-212
C19 to C21	Capacitor, Fixed, Ceramic, .01 uF ±20%, 50V	14304	C-4952
C22	Capacitor, Fixed, Ceramic, .47 uF	14304	M39014/02-1320
C23	Capacitor, Fixed, Tantalum, 1 uF ±10%, 35V	14304	C25-0003-107
C24 to C37	Capacitor, Fixed, Ceramic, .001 uF ±10%, 500V	14304	C-3513
C38,C39	Capacitor, Fixed, Tantalum, 1 uF ±10%, 35V	14304	C25-0003-107
C40	Capacitor, Fixed, Ceramic, .01 uF ±20%, 50V	14034	C-4952
C41	Capacitor, Fixed, Polycarbonate, .033 uF, 250V	14304	C-8006
C42	Capacitor, Fixed, Polycarbonate, 1 uF ±10%, 100V	14304	C-8043
C43	Capacitor, Fixed, Tantalum, 150 uF ±10%, 15V	14304	C25-0003-411
C44	Capacitor, Fixed, Polycarbonate, .039 uF ±3%, 50V	14304	C-8214
C45	Capacitor, Fixed, Polycarbonate, .0033 uF ±3%, 50V	14304	C-8216
C46	Capacitor, Fixed, Polycarbonate, .047 uF ±3%, 50V	14304	C-8217
C47	Capacitor, Fixed, Polycarbonate, .018 uF ±3%, 50V	14304	C-8206
C48	Capacitor, Fixed, Polycarbonate, .033 uF ±3%, 50V	14304	C-8218
C49,C50	Capacitor, Fixed, Tantalum, 1 uF ±10%, 35V	14304	C11-0008-104
C51,C52	Capacitor, Fixed, Ceramic, .01 uF ±20%, 50V	14304	C-4952
C53	Capacitor, Fixed, Tantalum, 6.8 uF ±10%, 35V	14304	C25-0003-112
CR1 to CR3	Diode, Voltage Variable Capacitance	14304	D25-0002-001
CR4, CR5	Diode, Signal, 1N4454	14304	CR-0705
L1,L2	Inductor, Variable, .13 uH	14304	L-0253
L3,L4	Choke, RF, 15 uH ±10%	14304	L-0630
L5	Choke, RF, .22 uH ±10%	14304	L-0608
L6	Inductor, Variable, 14.3 mH	14304	6628-0920
L7	Inductor, Variable, 19.2 mH	14304	6628-0921
L8	Choke, RF, 1 uH ±10%	14304	L-0616
Q1	Transistor, PNP, 2N4126	14304	2N4126
Q2,Q3	Transistor, NPN, 2N5486	14304	2N5486
Q4	Transistor, NPN, 2N3563	14304	Q-0309

Table 2. 1A1A10 Maintenance Parts List (Continued)

Ref. Desig.	Name & Description	Mfr. Code	Part Number
Q5	Transistor, PNP, 2N4126	14304	2N4126
Q6,Q7	Transistor, NPN, 2N5486	14304	2N5486
Q8,Q9	Transistor, NPN, 2N3563	14304	Q-0309
Q10,Q11	Transistor, NPN, MPS6571	14304	Q-0391
Q12	Transistor, NPN, MPS2369	14304	Q-0062
Q13	Transistor, NPN, Darlington, MPS-A13	14304	Q-0076
Q14	Transistor, NPN, MPS2369	14304	Q-0062
R1	Resistor, Fixed, Composition, 18K ±5%, 1/4W	81349	RCR07G183JM
R2	Resistor, Fixed, Composition, 1.5M ±5%, 1/4W	81349	RCR07G155JM
R3	Resistor, Fixed, Composition, 47 ohm ±5%, 1/4W	81349	RCR07G470JM
R4	Resistor, Variable, 500 ohm	14304	R-2205
R5	Resistor, Fixed, Composition, 6.8K ±5%, 1/4W	81349	RCR07G682JM
R6	Resistor, Fixed, Composition, 1.8K ±5%, 1/4W	81349	RCR07G182JM
R7	Resistor, Fixed, Composition, 5.6K ±5%, 1/4W	81349	RCR07G562JM
R8	Resistor, Fixed, Composition, 1K ±5%, 1/4W	81349	RCR07G102JM
R9	Resistor, Fixed, Composition, 5.6K ±5%, 1/4W	81349	RCR07G562JM
R10	Resistor, Fixed, Composition, 1K ±5%, 1/4W	81349	RCR07G102JM
R11	Resistor, Variable, 500 ohm	14304	R-2205
R12	Resistor, Fixed, Composition, 6.8K ±5%, 1/4W	81349	RCR07G682JM
R13	Resistor, Fixed, Composition, 1.8K ±5%, 1/4W	81349	RCR07G182JM
R14	Resistor, Fixed, Composition, 82 ohm ±5%, 1/4W	81349	RCR07G820JM
R15	Resistor, Fixed, Composition, 1K ±5%, 1/4W	81349	RCR07G102JM
R16 to R19	Resistor, Fixed, Composition, 15K ±5%, 1/4W	81349	RCR07G153JM
R20	Resistor, Fixed, Composition, 470 ohm ±5%, 1/4W	81349	RCR07G471JM
R21	Resistor, Fixed, Wirewound, 8.2 ohm ±10%, 2W	14304	R-3792
R22	Resistor, Fixed, Composition, 100 ohm ±5%, 1/4W	81349	RCR07G101JM
R23	Resistor, Fixed, Composition, 2.7K ±5%, 1/4W	81349	RCR07G272JM
R24	Resistor, Fixed, Composition, 470 ohm ±5%, 1/4W	81349	RCR07G471JM
R25	Resistor, Fixed, Composition, 5.6K ±5%, 1/4W	81349	RCR07G562JM
R26 to R40	Resistor, Fixed, Composition, 100K ±5%, 1/4W	81349	RCR07G104JM
R41 to R54	Resistor, Fixed, Composition, 1K ±5%, 1/4W	81349	RCR07G102JM
R55	Resistor, Fixed, Composition, 100 ohm ±5%, 1/4W	81349	RCR07G101JM
R56	Resistor, Fixed, Composition, 10K ±5%, 1/4W	81349	RCR07G103JM
R57	Resistor, Fixed, Composition, 2.7K ±5%, 1/4W	81349	RCR07G272JM
R58	Resistor, Fixed, Composition, 27K ±5%, 1/4W	81349	RCR07G273JM
R59	Resistor, Fixed, Composition, 100 ohm ±5%, 1/4W	81349	RCR07G101JM
R60	Resistor, Fixed, Composition, 2.2K ±5%, 1/4W	81349	RCR07G222JM
R61	Resistor, Fixed, Composition, 100 ohm ±5%, 1/4W	81349	RCR07G101JM
R62	Resistor, Fixed, Composition, 620 ±5%, 1/4W	81349	RCR07G621JM
R63	Resistor, Fixed, Composition, 2.7K ±5%, 1/4W	81349	RCR07G272JM
R64	Resistor, Fixed, Composition, 1K ±5%, 1/4W	81349	RCR07G102JM
R65	Resistor, Fixed, Composition, 100K ±5%, 1/4W	81349	RCR07G104JM
R66	Resistor, Fixed, Composition, 1K ±5%, 1/4W	81349	RCR07G102JM
R67	Resistor, Fixed, Composition, 100 ohm ±5%, 1/4W	81349	RCR07G101JM
R68	Resistor, Fixed, Composition, 10K ±5%, 1/4W	81349	RCR07G103JM
R69	Resistor, Fixed, Composition, 100 ohm ±5%, 1/4W	81349	RCR07G101JM

Table 2. 1A1A10 Maintenance Parts List (Continued)

Ref. Desig.	Name & Description	Mfr. Code	Part Number
R70	Resistor, Fixed, Composition, 3.9K ±5%, 1/4W	81349	RCR07G392JM
R71	Resistor, Fixed, Composition, 2.7K ±5%, 1/4W	81349	RCR07G272JM
T1	Transformer	14304	L-0129
TP1	Test Point, Brown	14304	J-0392
U1 to U3	Not used		
U4	Integrated Circuit, 650 MHz ÷ 10/11 Prescaler	14304	IC-0402
U5	Integrated Circuit, Gated J-K Flip-Flop	14304	IC-0062
U6 to U9	Integrated Circuit, Synchronous Up/Down BCD Counter	14304	I05-0000-190
U10 to U12	Integrated Circuit, 4-Bit Full Adder	14304	IC-0377
U13	Not used		
U14	Integrated Circuit, Phase Detector	14304	IC-0052
U15	Integrated Circuit, Dual BCD Up-Counter	14304	IC-0396
U16	Integrated Circuit, Quad 2-Input NOR Gate	14304	IC-0135
U17 to U19	Integrated Circuit, HEX Buffer/Converter	14304	IC-0378
U20	Integrated Circuit, Triple 3-Input NOR Gate	14304	IC-0403
VR1	Integrated Circuit, Positive 5 Volt Regulator	14304	I11-0001-001
VR2	Integrated Circuit, Three Terminal Positive Fixed Voltage Regulator	14304	IC-0291

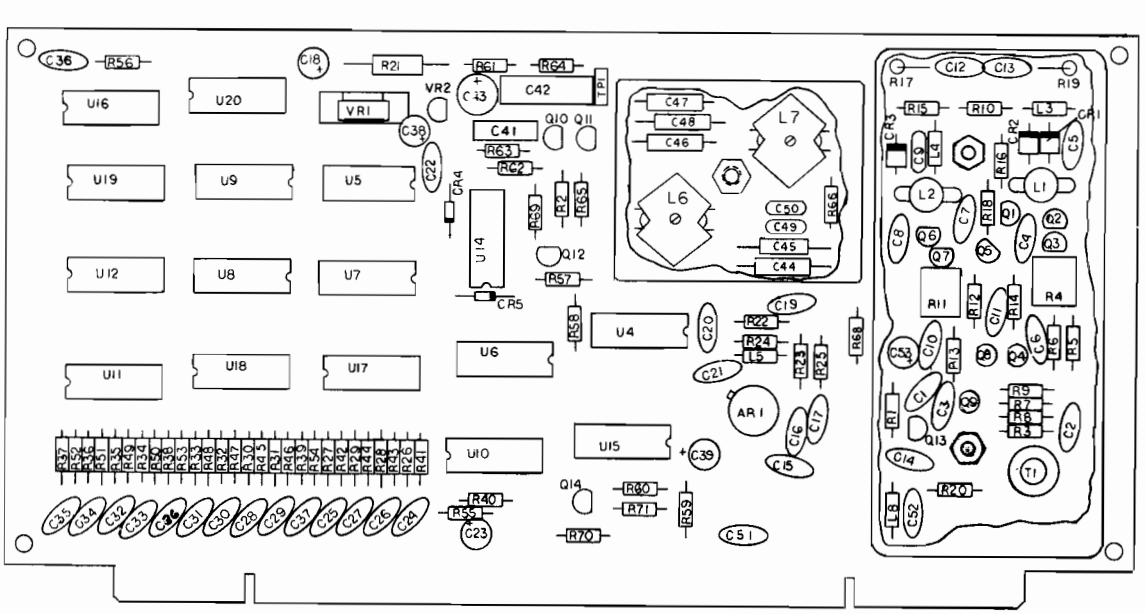


Figure 4. 1A1A10 Component Locations

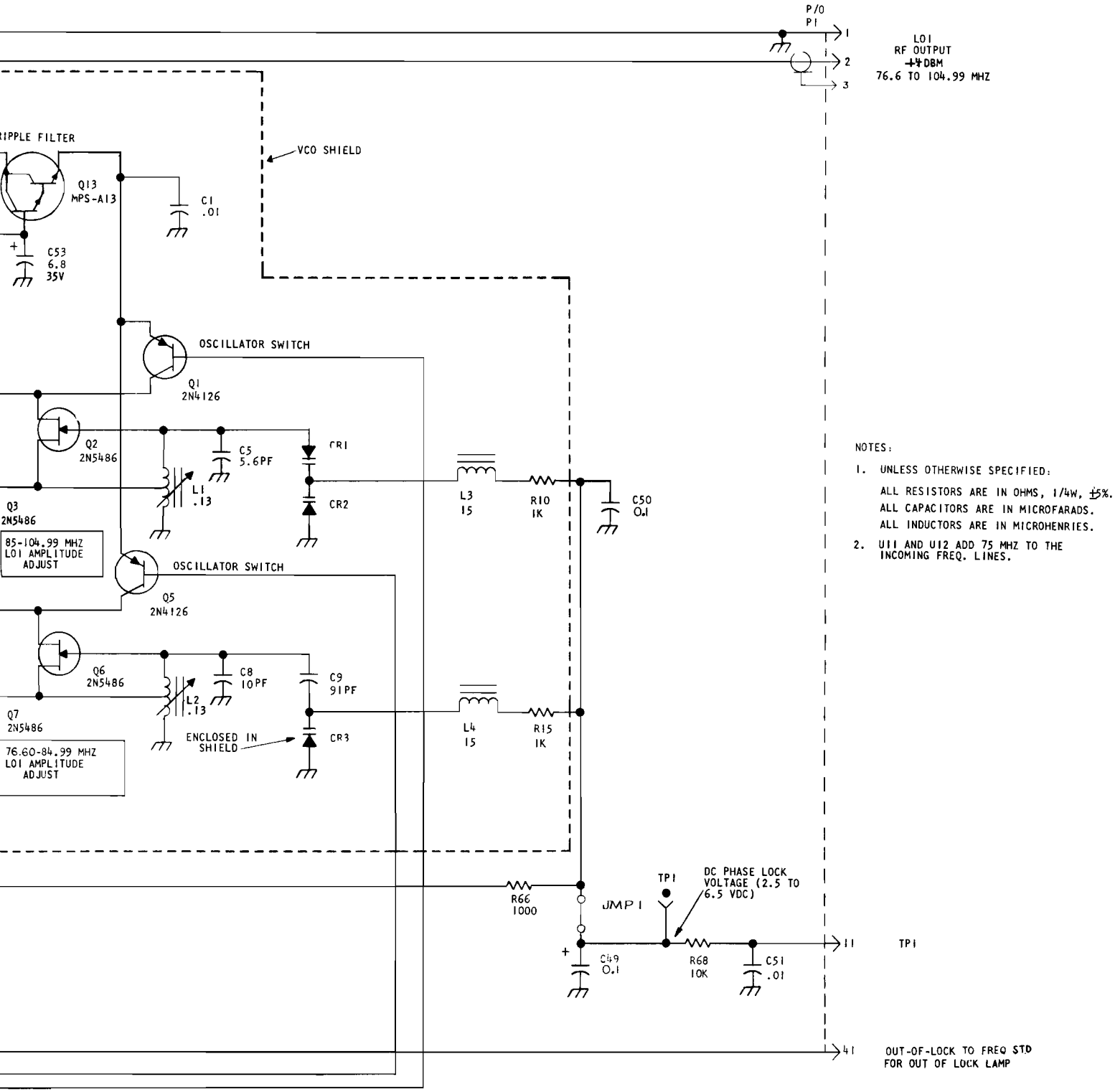
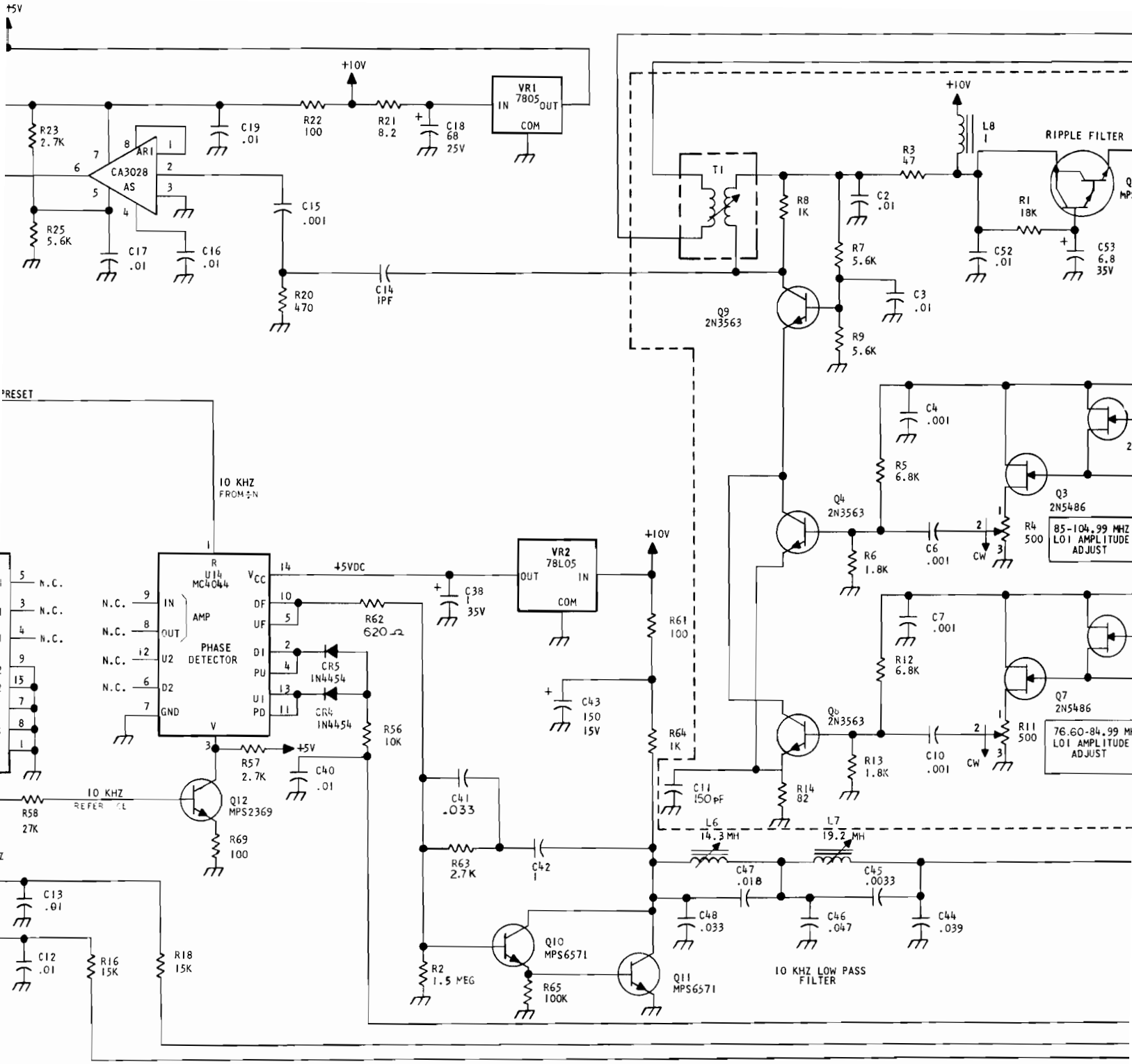
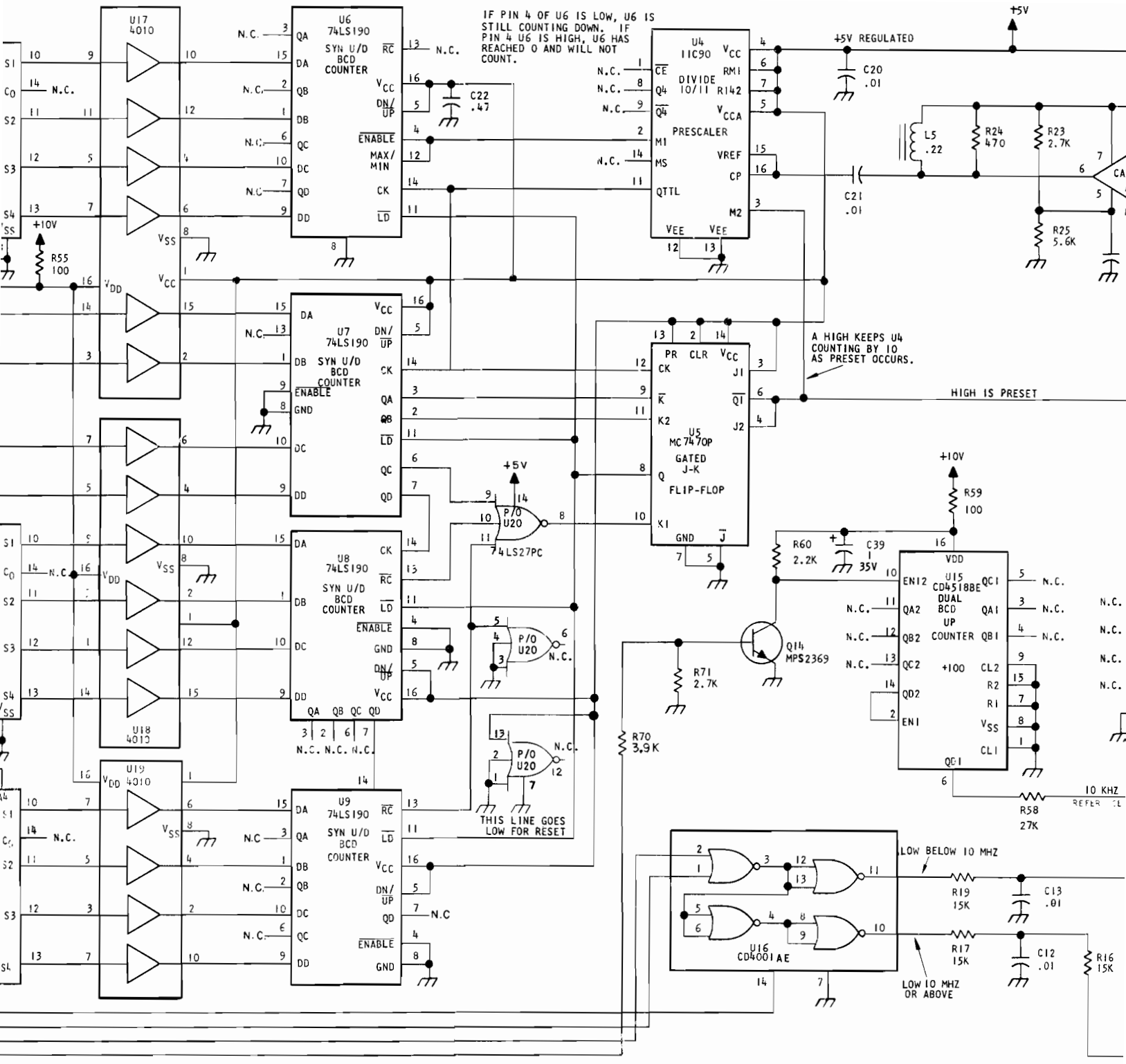
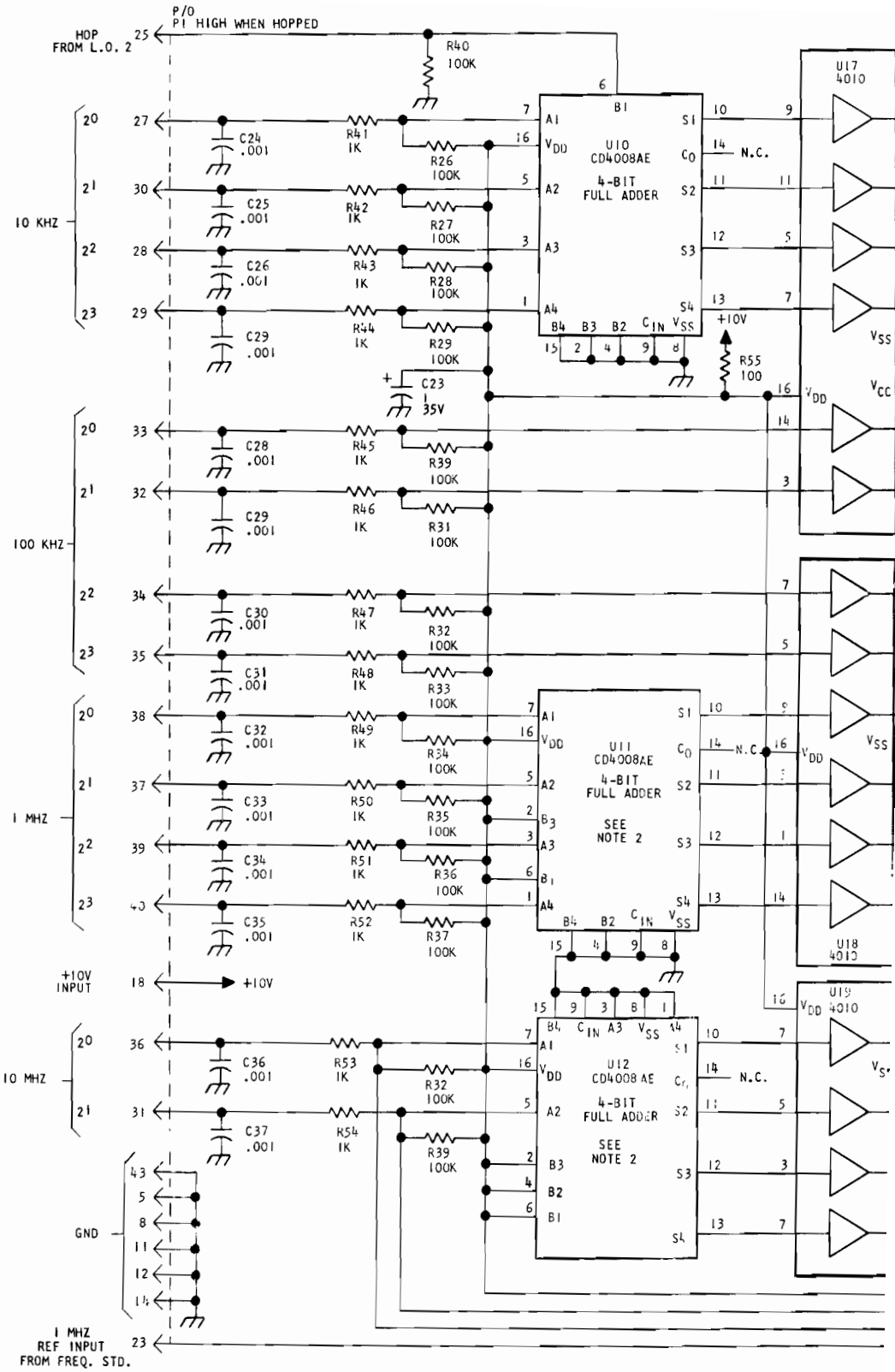


Figure 5. 1A1A10 LO No. 1 Schematic Diagram (6628-9090)

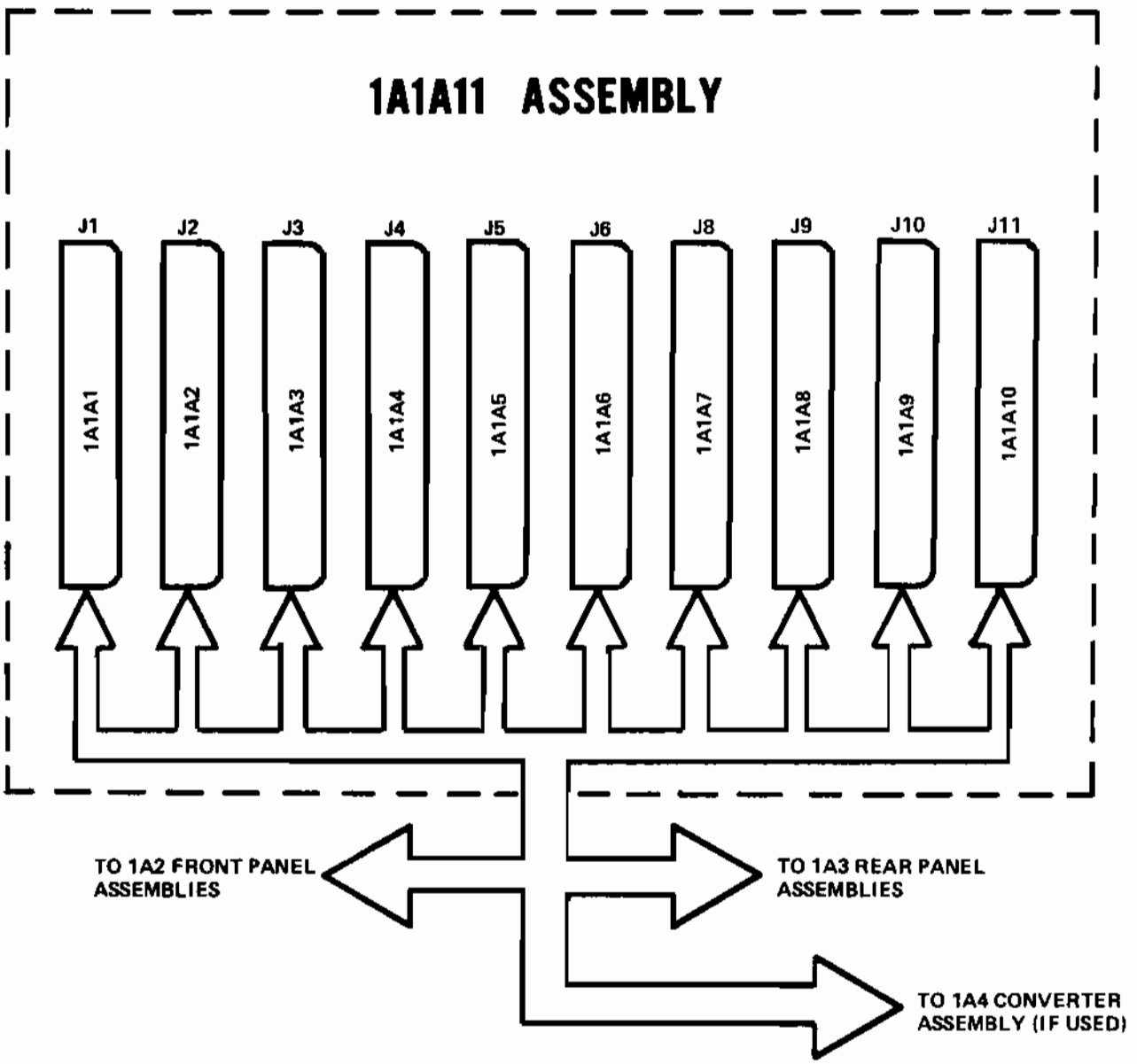

+5V
+10V
VR1 7805 OUT IN COM
R23 2.7K
CA3028 AS
C19 .01
R22 100
R21 8.2
C18 68 25V
C15 .001
R25 5.6K
C17 .01
C16 .01
R20 470
C14 IPF
T1
L8 1
RIPPLE FILTER
R3 47
R8 1K
C2 .01
R1 18K
C52 .01
C53 6.8 35V
R7 5.6K
C3 .01
Q9 2N3563
R9 5.6K
PRESET
10 KHZ FROM ÷N
U14 MC4044
PHASE DETECTOR
AMP
N.C.
IN
OUT
U2
D2
GND
VCC
DF
UF
DI
PU
UI
PD
+5VDC
VR2 78L05 OUT IN COM
C38 1 35V
R62 620Ω
CR5 IN4454
CR4 IN4454
R56 10K
R57 2.7K
+5V
C40 .01
10 KHZ REFERENCE
R58 27K
Q12 MPS2369
R69 100
C41 .033
R63 2.7K
C42 1
C43 150 15V
R61 100
R64 1K
C4 .001
R5 6.8K
Q4 2N3563
Q3 2N5486
R4 500
85-104.99 MHZ LOI AMPLITUDE ADJUST
R6 1.8K
C6 .001
CW
C7 .001
R12 6.8K
Q8 2N3563
Q7 2N5486
R11 500
76.60-84.99 MHZ LOI AMPLITUDE ADJUST
R13 1.8K
C10 .001
C11 150 pF
R14 82
L6 14.3 MH
L7 19.2 MH
C47 .018
C45 .0033
C48 .033
C46 .047
C44 .039
10 KHZ LOW PASS FILTER
C13 .01
C12 .01
R16 15K
R18 15K
Q10 MPS6571
Q11 MPS6571
R2 1.5 MEG
R65 100K


IF PIN 4 OF U6 IS LOW, U6 IS STILL COUNTING DOWN. IF PIN 4 U6 IS HIGH, U6 HAS REACHED 0 AND WILL NOT COUNT.
+5V
+5V REGULATED
U6 74LS190 SYN U/D BCD COUNTER
U7 74LS190 SYN U/D BCD COUNTER
U8 74LS190 SYN U/D BCD COUNTER
U9 74LS190 SYN U/D BCD COUNTER
U4 11C90 DIVIDE 10/11 PRESCALER
U5 MC7470P GATED J-K FLIP-FLOP
U15 CD4518BE DUAL BCD UP COUNTER
U16 CD4001AE
U17 4010
U18 4010
U19 4010
C22 .47
C20 .01
C21 .01
C39 1 35V
L5 .22
R24 470
R23 2.7K
R25 5.6K
R55 100
R59 100
R60 2.2K
R71 2.7K
R70 3.9K
R58 27K
R19 15K
R17 15K
R16 15K
C13 .01
C12 .01
Q14 MPS2369
74LS27PC
A HIGH KEEPS U4 COUNTING BY 10 AS PRESET OCCURS.
HIGH IS PRESET
THIS LINE GOES LOW FOR RESET
LOW BELOW 10 MHZ
LOW 10 MHZ OR ABOVE
10 KHZ
N.C.


P/O P1 HIGH WHEN HOPPED
HOP FROM L.O. 2
25
R40 100K
10 KHZ
20
21
22
23
27
30
28
29
C24 .001
C25 .001
C26 .001
C29 .001
R41 1K
R42 1K
R43 1K
R44 1K
R26 100K
R27 100K
R28 100K
R29 100K
C23 1 35V
U10 CD4008AE 4-BIT FULL ADDER
A1
A2
A3
A4
B1
B4 B3 B2 C IN VSS
S1
S2
S3
S4
C0
N.C.
+10V
R55 100
U17 4010
VDD
VSS
VCC
100 KHZ
33
32
34
35
C28 .001
C29 .001
C30 .001
C31 .001
R45 1K
R46 1K
R47 1K
R48 1K
R39 100K
R31 100K
R32 100K
R33 100K
1 MHZ
38
37
39
40
C32 .001
C33 .001
C34 .001
C35 .001
R49 1K
R50 1K
R51 1K
R52 1K
R34 100K
R35 100K
R36 100K
R37 100K
U11 CD4008AE 4-BIT FULL ADDER SEE NOTE 2
U18 4010
+10V INPUT
18
10 MHZ
36
31
C36 .001
C37 .001
R53 1K
R54 1K
R32 100K
R39 100K
U12 CD4008AE 4-BIT FULL ADDER SEE NOTE 2
U19 4010
GND
43
5
8
11
12
14
1 MHZ REF INPUT FROM FREQ. STD.
23

INTERCONNECTING MOTHERBOARD

1A1A11



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3	Parts List	1
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1A1A11 INTERCONNECTING MOTHERBOARD ASSEMBLY DATA

1. GENERAL INFORMATION

The 1A1A11 Interconnecting Motherboard Assembly provides interconnections to and from the various RF-2301 subassemblies. All subassemblies in the transceiver plug directly into the 1A1A11 assembly, or receive their signal interconnections through this assembly. Individual assembly information is contained in the indexed Unit Instructions.

2. CONSTRUCTION DETAIL

Figure 1 identifies the 1A1A11 component locations, and illustrates the relative positions of the assemblies which plug into the 1A1A11 interface connectors.

3. PARTS LIST

Table 1 is a maintenance parts list for all 1A1A11 component elements. A complete list of manufacturers is included in the Maintenance section, Part V, paragraph 5-10.

4. SCHEMATIC DIAGRAMS

Figure 2 is a complete schematic diagram of the 1A1A11 assembly, and identifies interconnection points of the RF-2301 Transceiver subassemblies according to the nomenclature printed on each of the 1A1A11 interface connectors.

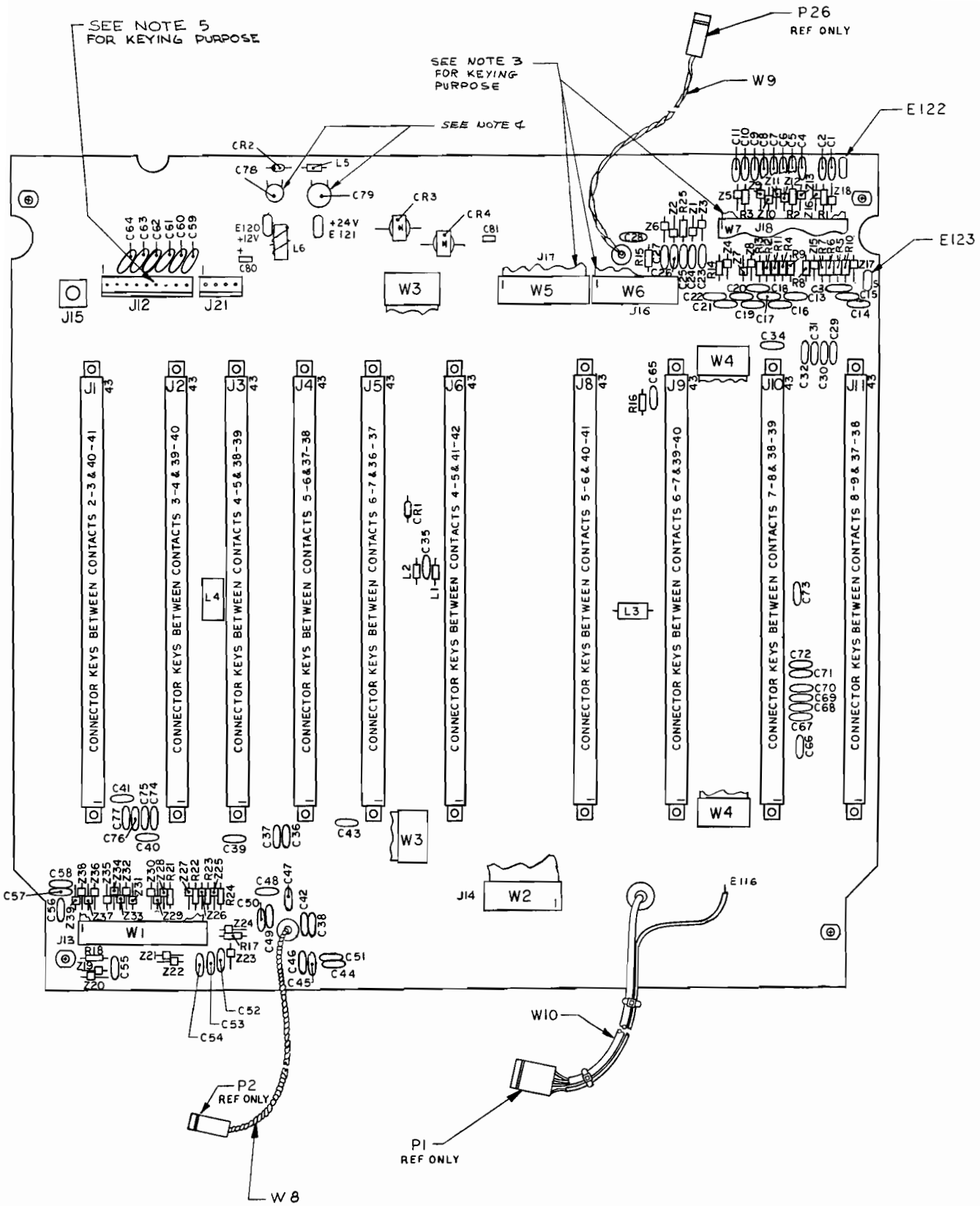


Figure 1. 1A1A11 Component Location

Table 1. Interconnect PWB Maintenance Parts List

Ref. Desig.	Name & Description	Mfr. Code	Part Number
1A1A11	Interconnect PWB	14304	10007-1100
C1 to C7	Capacitor, Ceramic, 0.01 uF, 100 volt	14304	C-4952
C8, C9	Capacitor, Ceramic, 0.001 uF, 100 volt	14304	C-3513
C10 to C34	Capacitor, Ceramic, 0.01 uF, 100 volt	14304	C-4952
C35	Capacitor, Mica, 56 pF, 500 volt	14304	C-0120
C36 to C38	Capacitor, Ceramic, 0.01 uF, 100 volt	14304	C-4952
C39	Capacitor, Ceramic, 0.001 uF, 100 volt	14304	C-3513
C40 to C62	Capacitor, Ceramic, 0.01 uF, 100 volt	14304	C-4952
C63, C64	Capacitor, Ceramic, 0.1 uF, 50 volt	14304	C-3202
C65 to C78	Capacitor, Ceramic, 0.01 uF, 100 volt	14304	C-4952
C79	Capacitor, Ceramic, .001 uF, 500 V	14304	C-3513
C80	Capacitor, Tantalum, 1 uF, 50 V	14304	C25-0001-007
C81	Capacitor, Ceramic, .1 uF, 50 V	14304	C-1185
CR1, CR2	Diode, Signal, 1N4454	14304	1N4454
J1 to J11	Connector, Card Edge	14304	J-0415
J12, J13	Connector, Nine Pin	14304	P-0426
J14	Not Used		
J15	Connector, Coaxial	14304	J-0031
J16 to J20	Not Used		
J21	Connector, Four Pin	14304	J42-0004-004
L1, L2	Inductor, .15 uH	14304	L-0606
L3	Inductor, Wideband, 50 MHz	14304	L-0814
L4	Inductor, Toroid	14304	6628-0370
L5	RF Coil, Molded	14304	L-0648
L6	Inductor, Toroid	14304	6628-573
R1 to R14	Resistor, 100 ohm, 1/4W, 5%	14304	RCR07G101JM
R15	Resistor, 1K ohm, 1/4W, 5%	14304	RCR07G102JM
R16 to R25	Resistor, 100 ohm, 1/4W, 5%	14304	RCR07G101JM
W1	Assembly Cable	14304	10007-1115
W2	Assembly Cable	14304	10007-1111
W3	Assembly Cable	14304	6628-0360
W4	Assembly Cable	14304	6628-0358
W5	Assembly Cable	14304	10007-1114
W6	Assembly Cable	14304	10007-1113
W7	Assembly Cable	14304	10007-1112
W8	Assembly Cable	14304	10007-1118
W9	Assembly Cable	14304	10007-1118
W10	Assembly Cable	14304	10007-1119
Z1 to Z39	Ferrite Bead	14304	E-2192

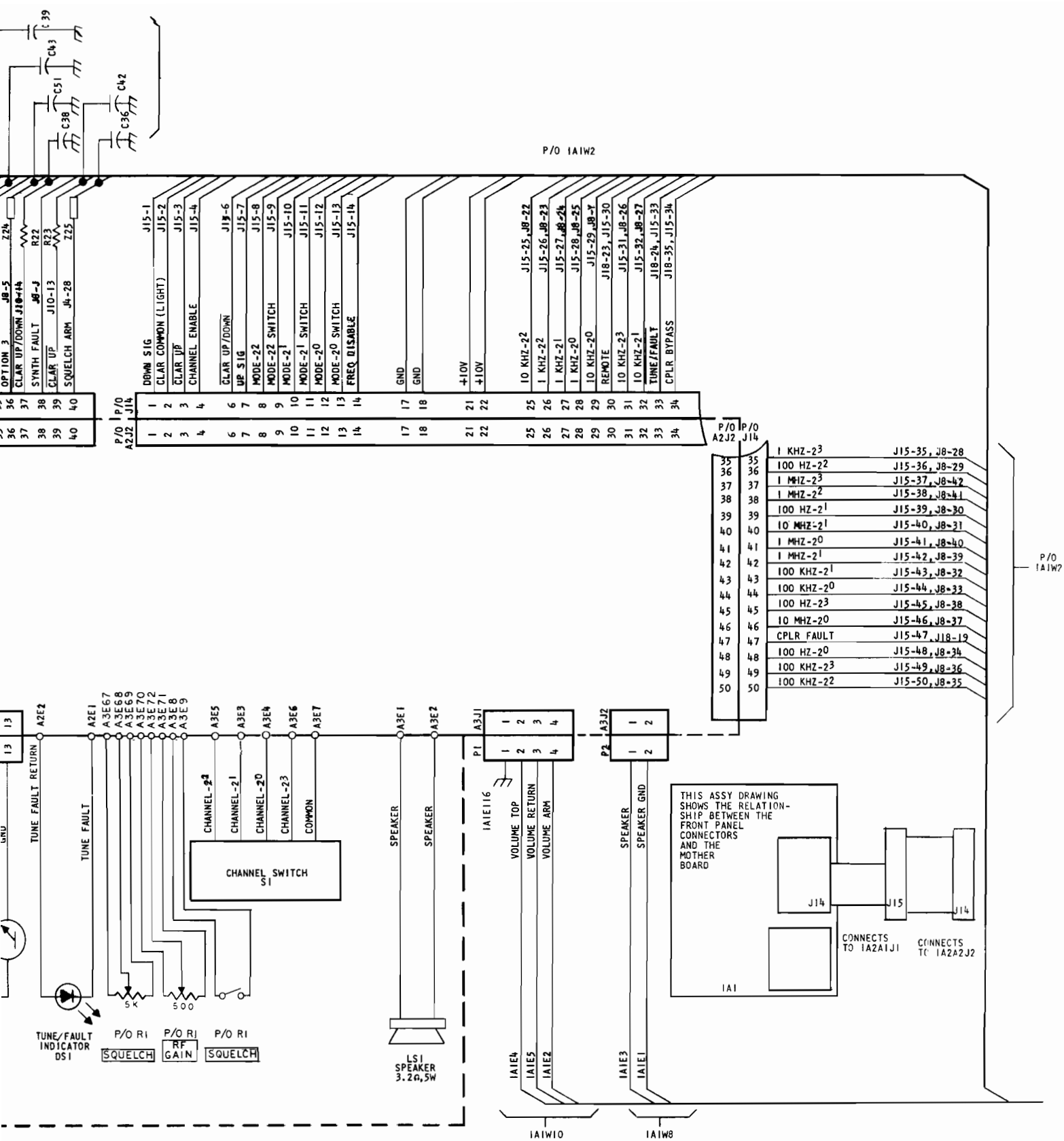
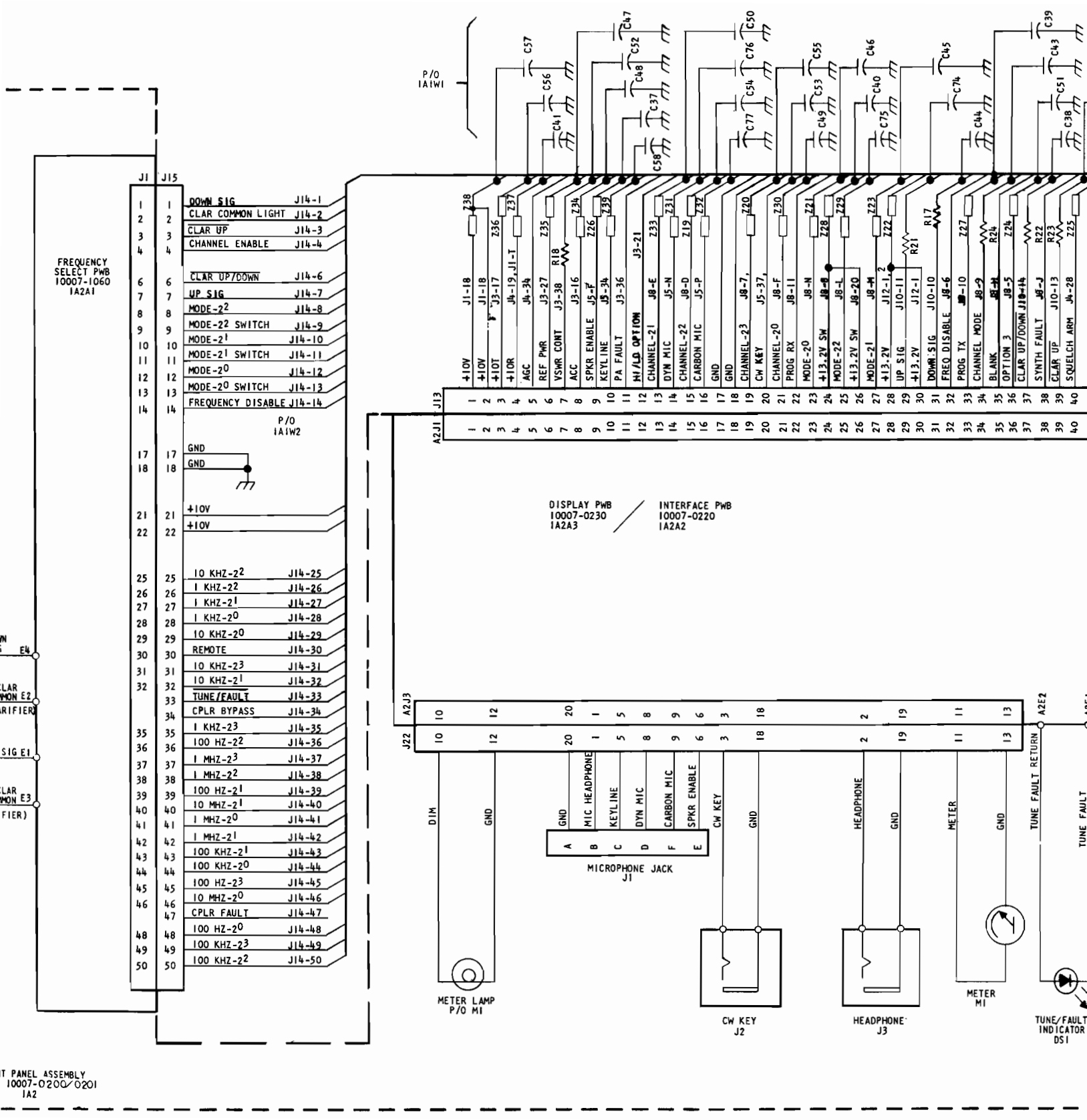
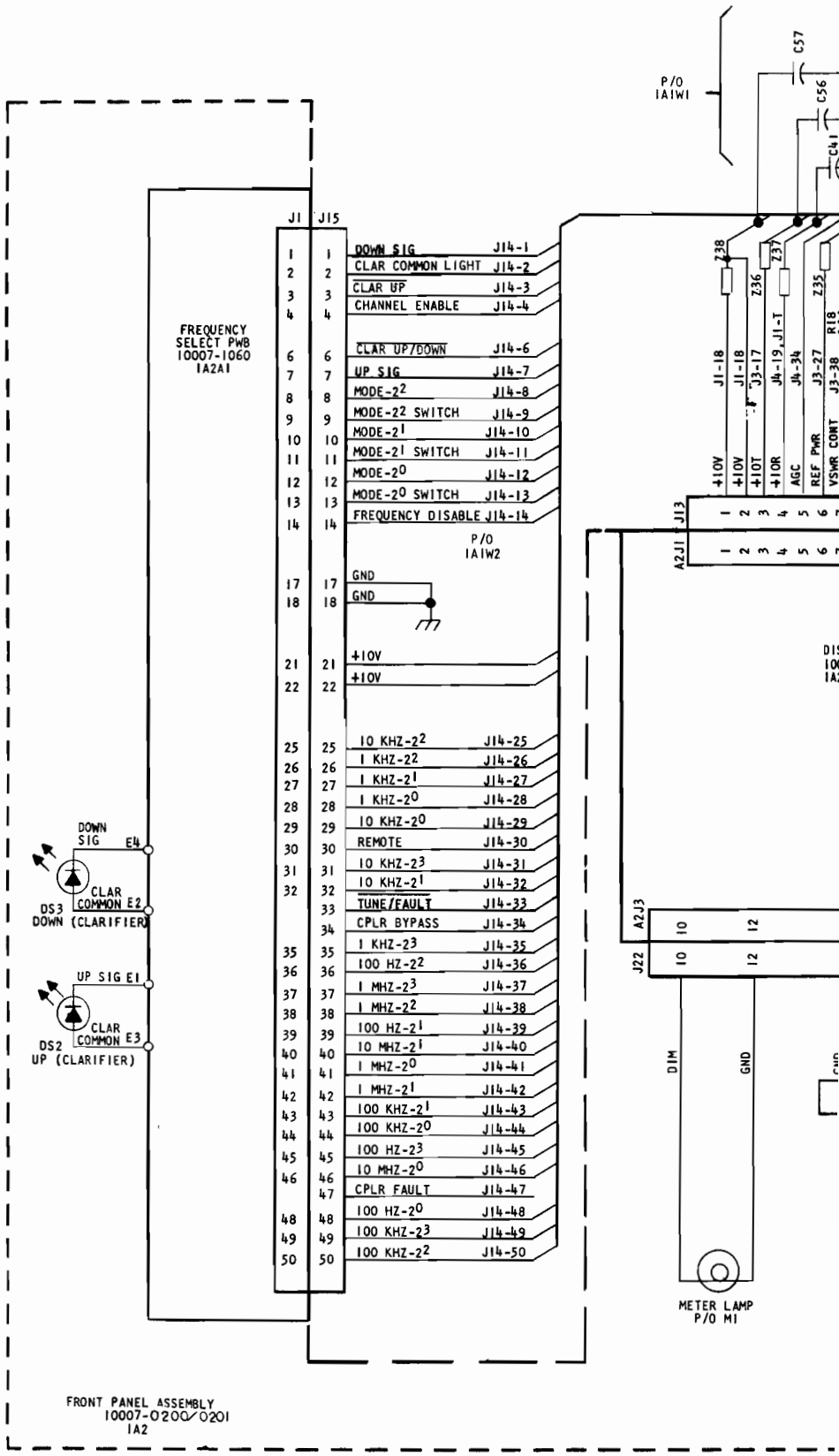


Figure 2. 1A1A11/RF-2301 Transceiver Schematic Diagram (10007-0009) (Sheet 1 of 6)


FREQUENCY SELECT PWB 10007-1060 1A2A1
J1
J15
DOWN SIG J14-1
CLAR COMMON LIGHT J14-2
CLAR UP J14-3
CHANNEL ENABLE J14-4
CLAR UP/DOWN J14-6
UP SIG J14-7
MODE-2^2 J14-8
MODE-2^2 SWITCH J14-9
MODE-2^1 J14-10
MODE-2^1 SWITCH J14-11
MODE-2^0 J14-12
MODE-2^0 SWITCH J14-13
FREQUENCY DISABLE J14-14
P/O 1A1W2
GND
GND
+10V
+10V
10 KHZ-2^2 J14-25
1 KHZ-2^2 J14-26
1 KHZ-2^1 J14-27
1 KHZ-2^0 J14-28
10 KHZ-2^0 J14-29
REMOTE J14-30
10 KHZ-2^3 J14-31
10 KHZ-2^1 J14-32
TUNE/FAULT J14-33
CPLR BYPASS J14-34
1 KHZ-2^3 J14-35
100 HZ-2^2 J14-36
1 MHZ-2^3 J14-37
1 MHZ-2^2 J14-38
100 HZ-2^1 J14-39
10 MHZ-2^1 J14-40
1 MHZ-2^0 J14-41
1 MHZ-2^1 J14-42
100 KHZ-2^1 J14-43
100 KHZ-2^0 J14-44
100 HZ-2^3 J14-45
10 MHZ-2^0 J14-46
CPLR FAULT J14-47
100 HZ-2^0 J14-48
100 KHZ-2^3 J14-49
100 KHZ-2^2 J14-50
P/O 1A1W1
A2J1
J13
+10V J1-18
+10V J1-18
+10T J3-17
+10R J4-19, J1-T
AGC J4-34
REF PWR J3-27
VSWR CONT J3-38
ACC J3-16
SPKR ENABLE J5-F
KEYLINE J5-34
PA FAULT J3-36
HI/LO OPTION J3-21
CHANNEL-21 J8-E
DYN MIC J5-N
CHANNEL-22 J8-D
CARBON MIC J5-P
GND
GND
CHANNEL-23 J8-7, J5-37,
CW KEY J5-37,
CHANNEL-20 J8-F
PROG RX J8-11
MODE-20 J8-N
+13.2V SW J8-8
MODE-22 J8-L
+13.2V SW J8-20
MODE-21 J8-M
+13.2V J12-1, 2
UP SIG J10-11
+13.2V J12-1
DOWN SIG J10-10
FREQ DISABLE J8-6
PROG TX J8-10
CHANNEL MODE J8-9
BLANK J8-H
OPTION 3 J8-5
CLAR UP/DOWN J10-14
SYNTH FAULT J8-J
CLAR UP J10-13
SQUELCH ARM J4-28
DISPLAY PWB 10007-0230 1A2A3
INTERFACE PWB 10007-0220 1A2A2
A2J3
J22
A2E2
DIM
GND
METER LAMP P/O M1
GND
MIC HEADPHONE
KEYLINE
DYN MIC
CARBON MIC
SPKR ENABLE
CW KEY
GND
MICROPHONE JACK J1
CW KEY J2
HEADPHONE
GND
HEADPHONE J3
METER
GND
METER M1
TUNE FAULT RETURN
TUNE FAULT
TUNE/FAULT INDICATOR DS1
T PANEL ASSEMBLY 10007-0200/0201 1A2


P/O 1A1W1
C57
C56
C41
J1
J15
FREQUENCY SELECT PWB 10007-1060 1A2A1
DOWN SIG J14-1
CLAR COMMON LIGHT J14-2
CLAR UP J14-3
CHANNEL ENABLE J14-4
CLAR UP/DOWN J14-6
UP SIG J14-7
MODE-2^2 J14-8
MODE-2^2 SWITCH J14-9
MODE-2^1 J14-10
MODE-2^1 SWITCH J14-11
MODE-2^0 J14-12
MODE-2^0 SWITCH J14-13
FREQUENCY DISABLE J14-14
P/O 1A1W2
GND
GND
+10V
+10V
10 KHZ-2^2 J14-25
1 KHZ-2^2 J14-26
1 KHZ-2^1 J14-27
1 KHZ-2^0 J14-28
10 KHZ-2^0 J14-29
REMOTE J14-30
10 KHZ-2^3 J14-31
10 KHZ-2^1 J14-32
TUNE/FAULT J14-33
CPLR BYPASS J14-34
1 KHZ-2^3 J14-35
100 HZ-2^2 J14-36
1 MHZ-2^3 J14-37
1 MHZ-2^2 J14-38
100 HZ-2^1 J14-39
10 MHZ-2^1 J14-40
1 MHZ-2^0 J14-41
1 MHZ-2^1 J14-42
100 KHZ-2^1 J14-43
100 KHZ-2^0 J14-44
100 HZ-2^3 J14-45
10 MHZ-2^0 J14-46
CPLR FAULT J14-47
100 HZ-2^0 J14-48
100 KHZ-2^3 J14-49
100 KHZ-2^2 J14-50
DOWN SIG E4
CLAR COMMON E2
DS3 DOWN (CLARIFIER)
UP SIG E1
CLAR COMMON E3
DS2 UP (CLARIFIER)
Z38
Z36
Z37
Z35
R18
J1-18
J1-18
J3-17
J4-19, J1-T
J4-34
J3-27
J3-38
+10V
+10V
+10T
+10R
AGC
REF PWR
VSWR CONT
A2J1
J13
A2J3
J22
DIM
GND
METER LAMP P/O M1
FRONT PANEL ASSEMBLY 10007-0200/0201 1A2

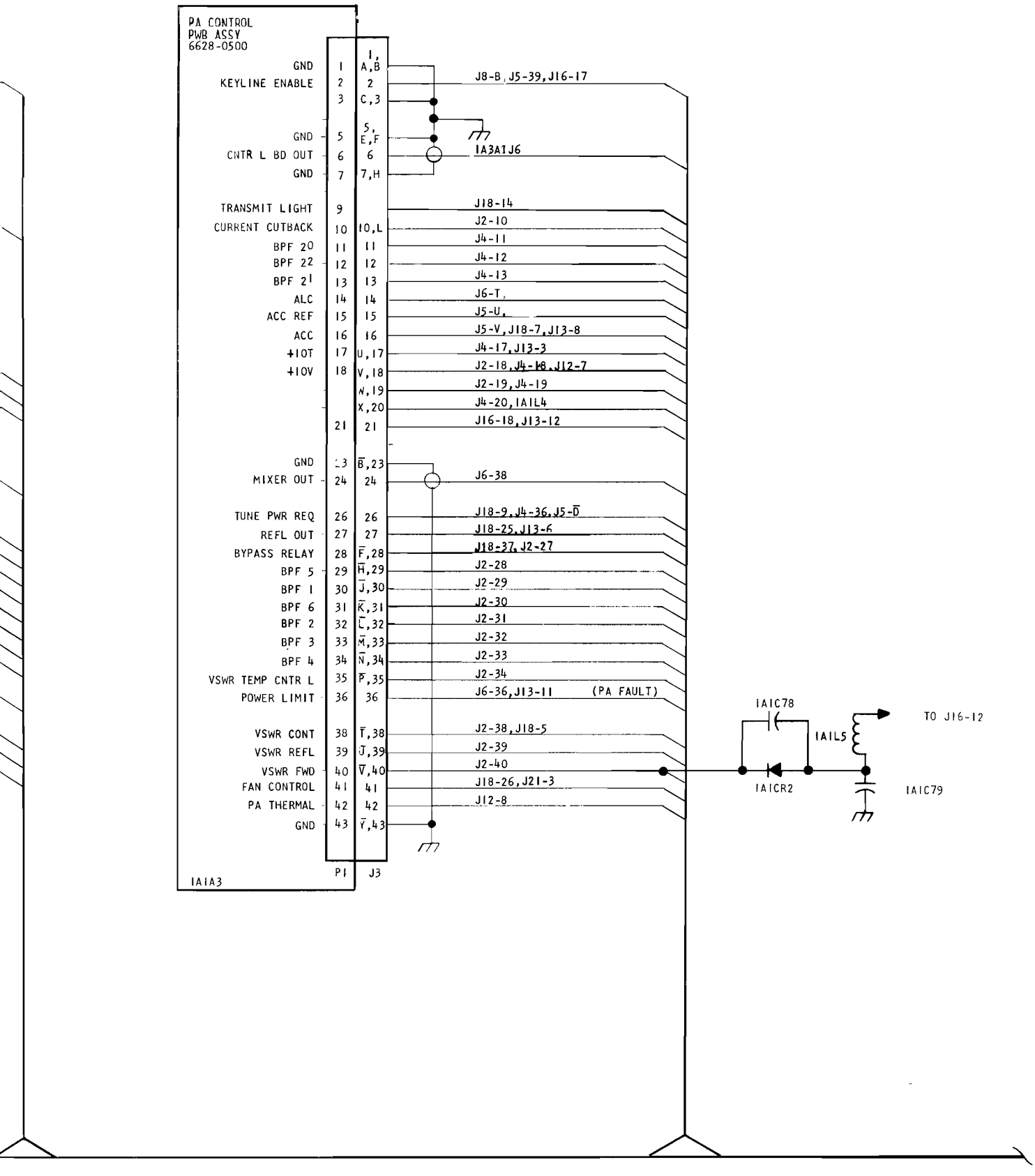
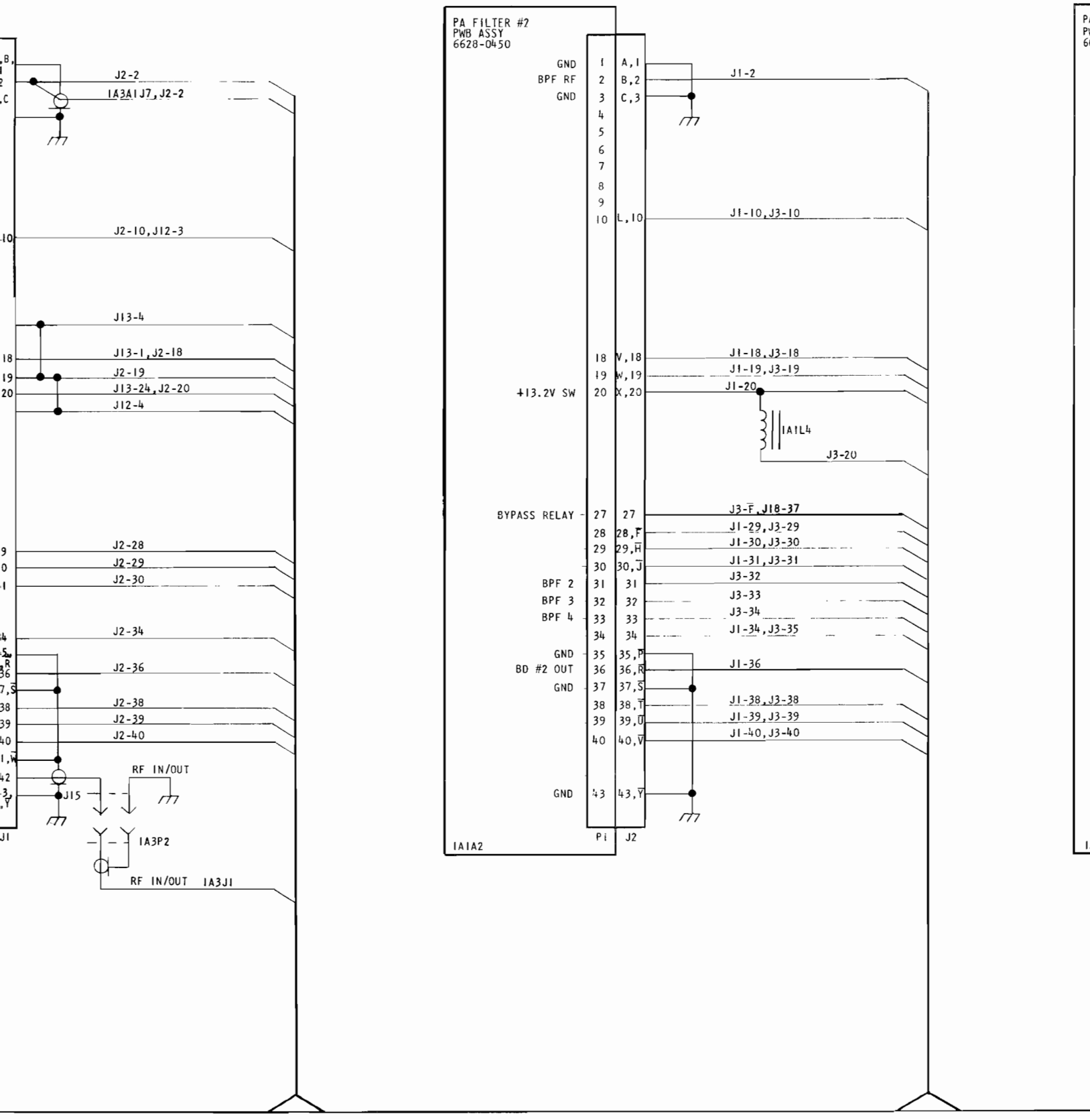
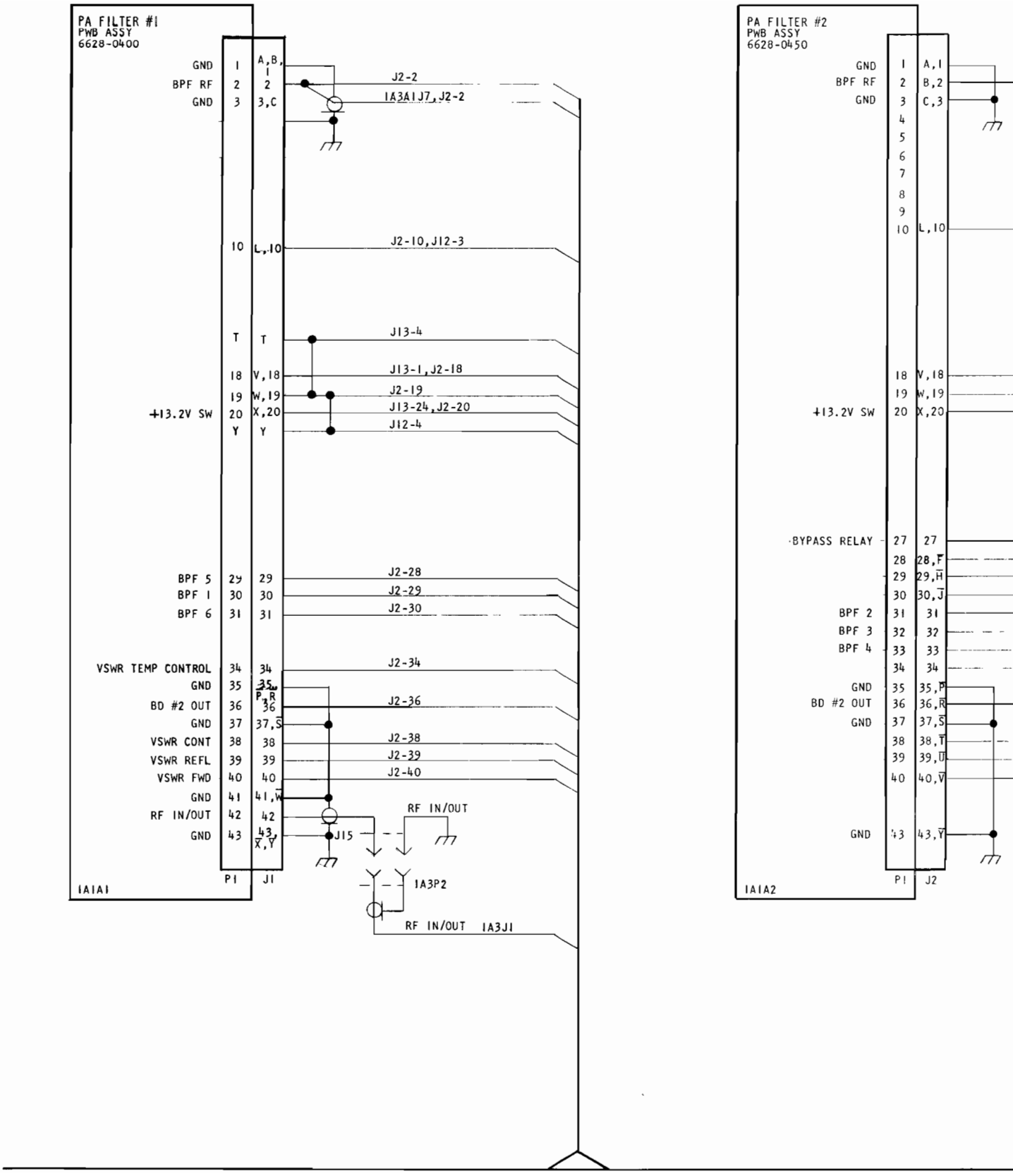


Figure 2. 1A1A11/RF-2301 Transceiver Schematic Diagram (10007-0009) (Sheet 2 of 6)


PA FILTER #2
PWB ASSY
6628-0450
GND 1 A,1
BPF RF 2 B,2
GND 3 C,3
4
5
6
7
8
9
10 L,10
18 V,18
19 W,19
+13.2V SW 20 X,20
BYPASS RELAY 27 27
28 28,F
29 29,H
30 30,J
BPF 2 31 31
BPF 3 32 32
BPF 4 33 33
34 34
GND 35 35,P
BD #2 OUT 36 36,R
GND 37 37,S
38 38,T
39 39,U
40 40,V
GND 43 43,Y
P1 J2
1A1A2
J1-2
J1-10,J3-10
J1-18,J3-18
J1-19,J3-19
J1-20
1A1L4
J3-20
J3-F,J18-37
J1-29,J3-29
J1-30,J3-30
J1-31,J3-31
J3-32
J3-33
J3-34
J1-34,J3-35
J1-36
J1-38,J3-38
J1-39,J3-39
J1-40,J3-40
J2-2
1A3A1J7,J2-2
J2-10,J12-3
J13-4
J13-1,J2-18
J2-19
J13-24,J2-20
J12-4
J2-28
J2-29
J2-30
J2-34
J2-36
J2-38
J2-39
J2-40
RF IN/OUT
J15
1A3P2
RF IN/OUT 1A3J1


PA FILTER #1
PWB ASSY
6628-0400
GND 1 A,B,I
BPF RF 2 2
GND 3 3,C
J2-2
1A3A1J7,J2-2
10 L,10
J2-10,J12-3
T T
J13-4
18 V,18
J13-1,J2-18
19 W,19
J2-19
+13.2V SW 20 X,20
J13-24,J2-20
Y Y
J12-4
BPF 5 29 29
J2-28
BPF 1 30 30
J2-29
BPF 6 31 31
J2-30
VSWR TEMP CONTROL 34 34
J2-34
GND 35 35,P,R
BD #2 OUT 36 36
J2-36
GND 37 37,S
VSWR CONT 38 38
J2-38
VSWR REFL 39 39
J2-39
VSWR FWD 40 40
J2-40
GND 41 41,W
RF IN/OUT 42 42
GND 43 43,X,Y
J15
RF IN/OUT
1A3P2
RF IN/OUT 1A3J1
P1 J1
1A1A1
PA FILTER #2
PWB ASSY
6628-0450
GND 1 A,I
BPF RF 2 B,2
GND 3 C,3
10 L,10
18 V,18
19 W,19
+13.2V SW 20 X,20
BYPASS RELAY 27 27
28 28,F
29 29,H
30 30,J
BPF 2 31 31
BPF 3 32 32
BPF 4 33 33
34 34
GND 35 35,P
BD #2 OUT 36 36,R
GND 37 37,S
38 38,T
39 39,U
40 40,V
GND 43 43,Y
P1 J2
1A1A2

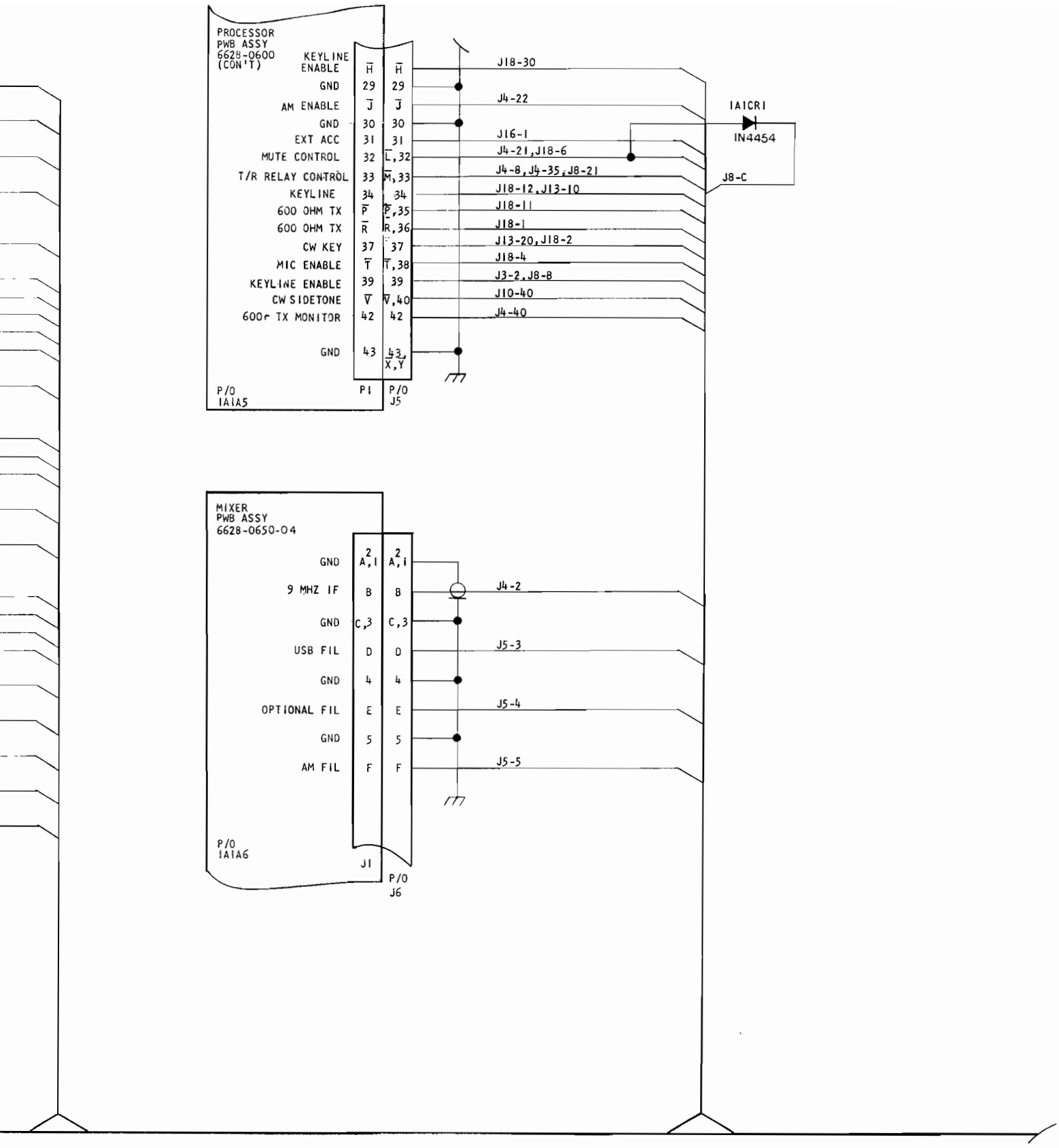
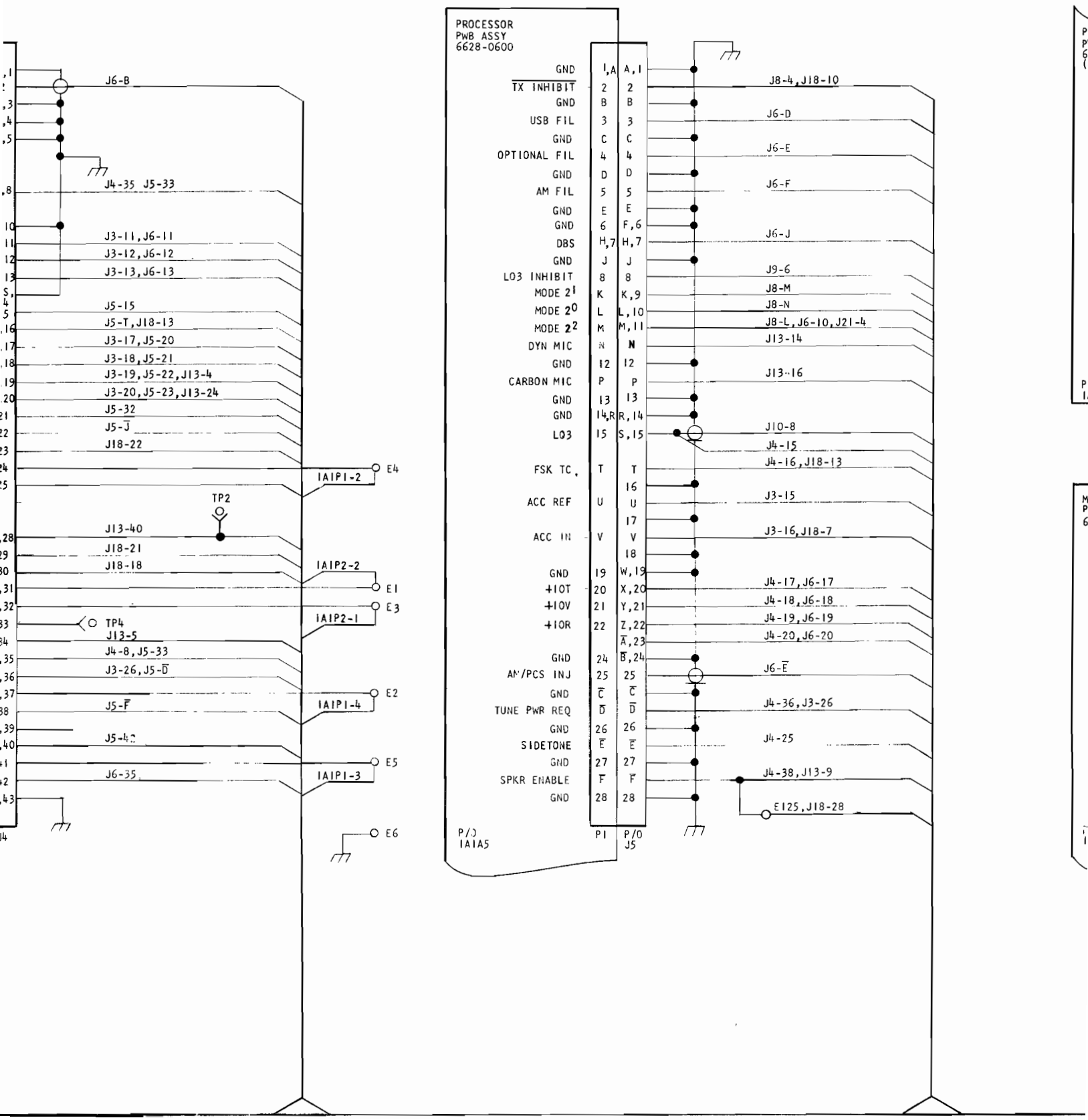
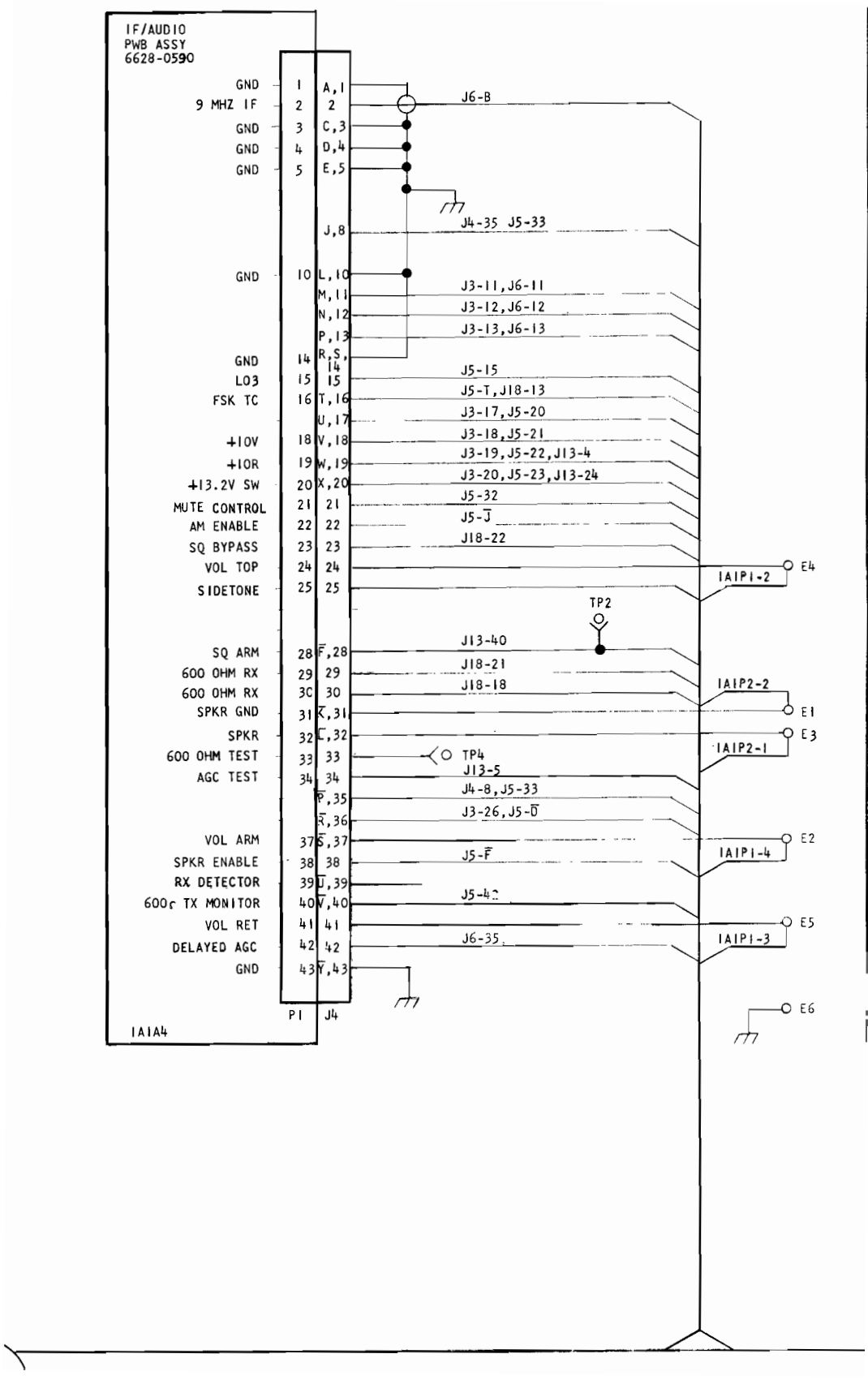


Figure 2. 1A1A11/RF-2301 Transceiver Schematic Diagram (10007-0009) (Sheet 3 of 6)


PROCESSOR
PWB ASSY
6628-0600
GND
TX INHIBIT
GND
USB FIL
GND
OPTIONAL FIL
GND
AM FIL
GND
GND
DBS
GND
LO3 INHIBIT
MODE 2^1
MODE 2^0
MODE 2^2
DYN MIC
GND
CARBON MIC
GND
GND
LO3
FSK TC
ACC REF
ACC IN
GND
+10T
+10V
+10R
GND
AM/PCS INJ
GND
TUNE PWR REQ
GND
SIDETONE
GND
SPKR ENABLE
GND
P1
P/O J5
P/J 1A1A5
J6-B
J4-35 J5-33
J3-11, J6-11
J3-12, J6-12
J3-13, J6-13
J5-15
J5-T, J18-13
J3-17, J5-20
J3-18, J5-21
J3-19, J5-22, J13-4
J3-20, J5-23, J13-24
J5-32
J5-J
J18-22
1A1P1-2
E4
TP2
J13-40
J18-21
J18-18
1A1P2-2
E1
E3
1A1P2-1
TP4
J13-5
J4-8, J5-33
J3-26, J5-D
J5-F
1A1P1-4
E2
J5-40
E5
J6-35
1A1P1-3
E6
J8-4, J18-10
J6-D
J6-E
J6-F
J6-J
J9-6
J8-M
J8-N
J8-L, J6-10, J21-4
J13-14
J13-16
J10-8
J4-15
J4-16, J18-13
J3-15
J3-16, J18-7
J4-17, J6-17
J4-18, J6-18
J4-19, J6-19
J4-20, J6-20
J6-E
J4-36, J3-26
J4-25
J4-38, J13-9
E125, J18-28


IF/AUDIO
PWB ASSY
6628-0590
GND 1 A,1
9 MHZ IF 2 2
GND 3 C,3
GND 4 D,4
GND 5 E,5
J,8
GND 10 L,10
M,11
N,12
P,13
GND 14 R,S,14
LO3 15 15
FSK TC 16 T,16
U,17
+10V 18 V,18
+10R 19 W,19
+13.2V SW 20 X,20
MUTE CONTROL 21 21
AM ENABLE 22 22
SQ BYPASS 23 23
VOL TOP 24 24
SIDETONE 25 25
SQ ARM 28 F,28
600 OHM RX 29 29
600 OHM RX 30 30
SPKR GND 31 K,31
SPKR 32 L,32
600 OHM TEST 33 33
AGC TEST 34 34
P,35
R,36
VOL ARM 37 S,37
SPKR ENABLE 38 38
RX DETECTOR 39 U,39
600Ω TX MONITOR 40 V,40
VOL RET 41 41
DELAYED AGC 42 42
GND 43 Y,43
P1 J4
1A1A4
J6-B
J4-35 J5-33
J3-11, J6-11
J3-12, J6-12
J3-13, J6-13
J5-15
J5-T, J18-13
J3-17, J5-20
J3-18, J5-21
J3-19, J5-22, J13-4
J3-20, J5-23, J13-24
J5-32
J5-J
J18-22
1A1P1-2
E4
TP2
J13-40
J18-21
J18-18
1A1P2-2
E1
E3
1A1P2-1
TP4
J13-5
J4-8, J5-33
J3-26, J5-D
E2
1A1P1-4
J5-F
J5-42
E5
J6-35
1A1P1-3
E6

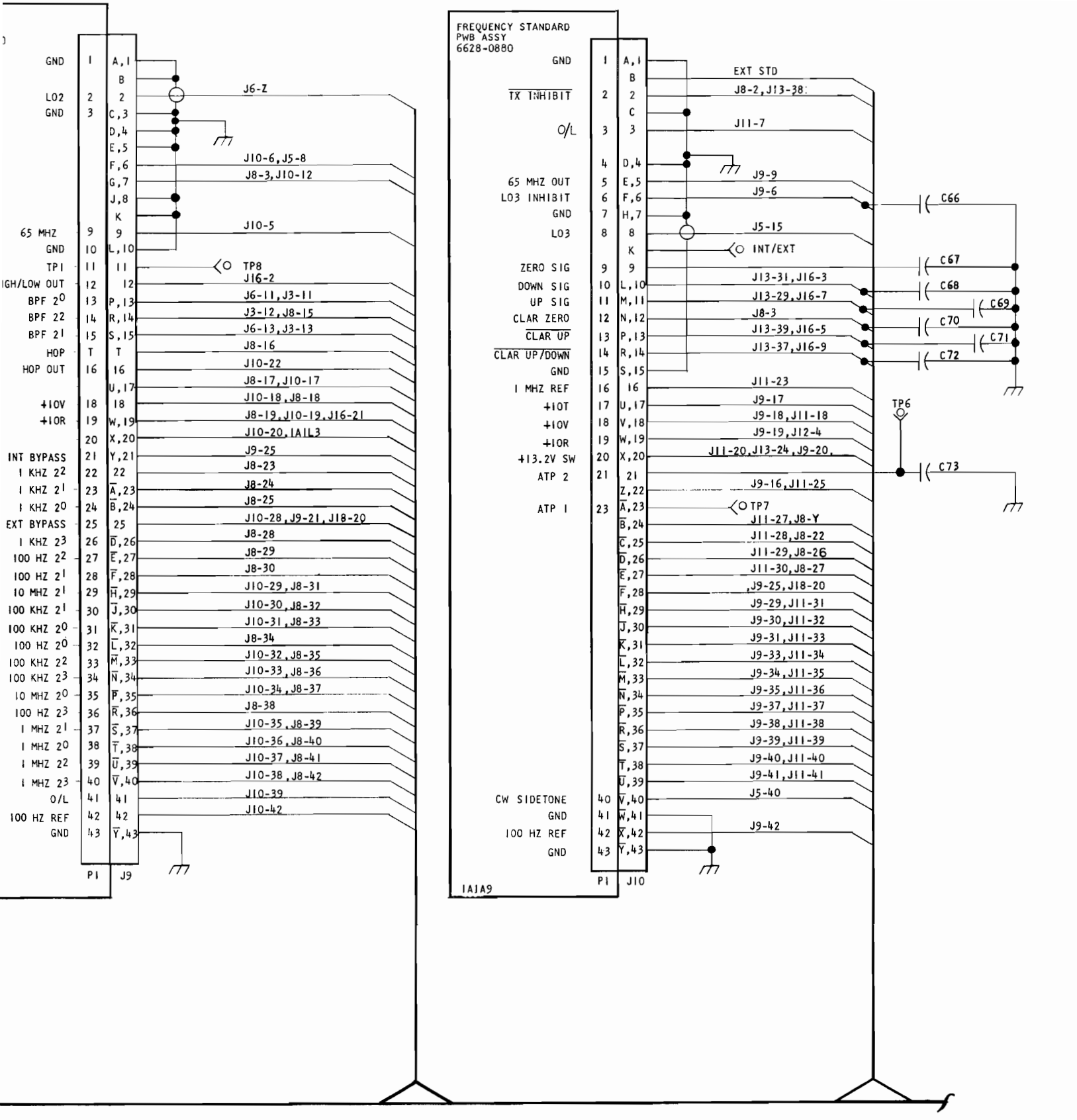
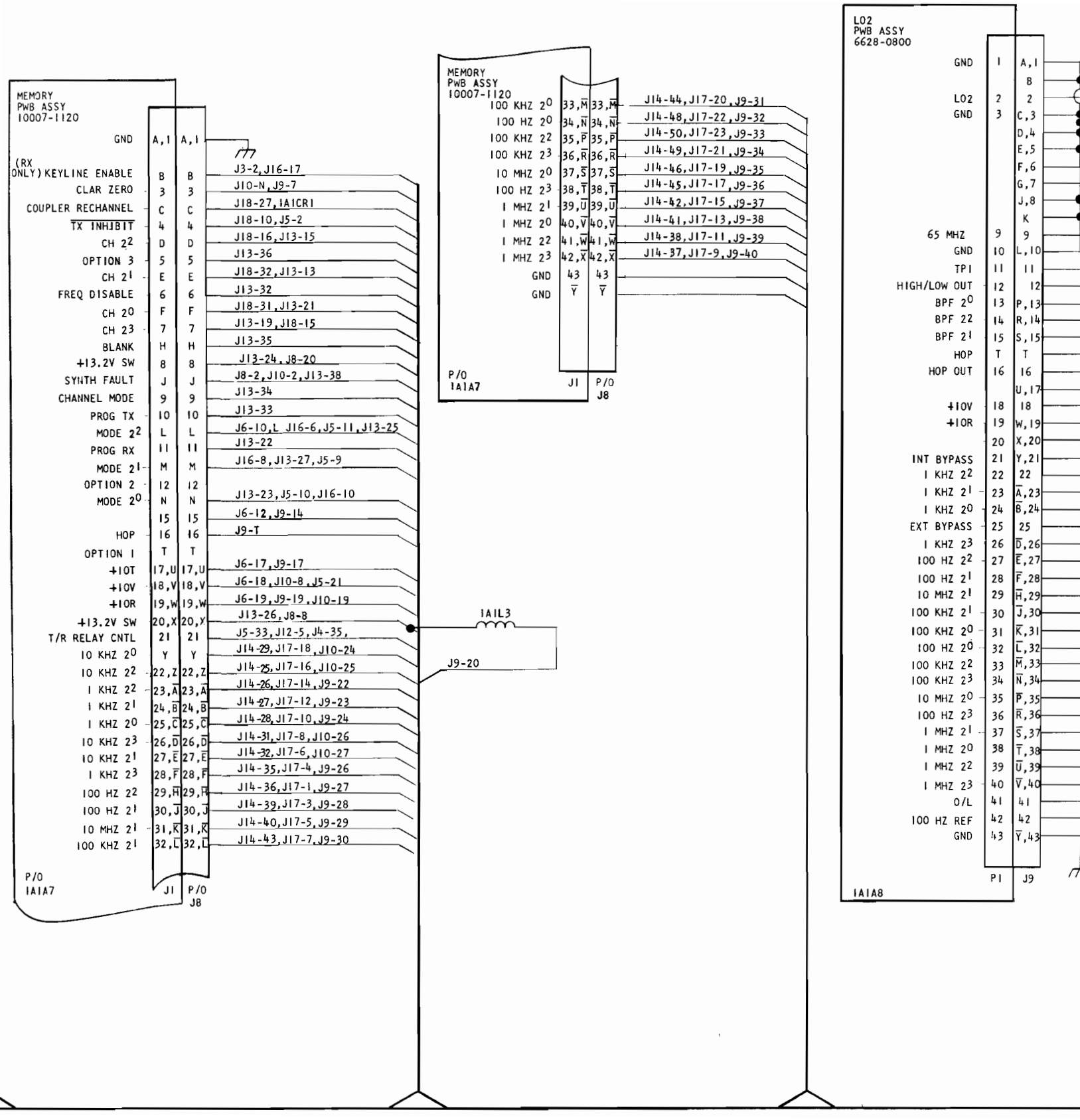
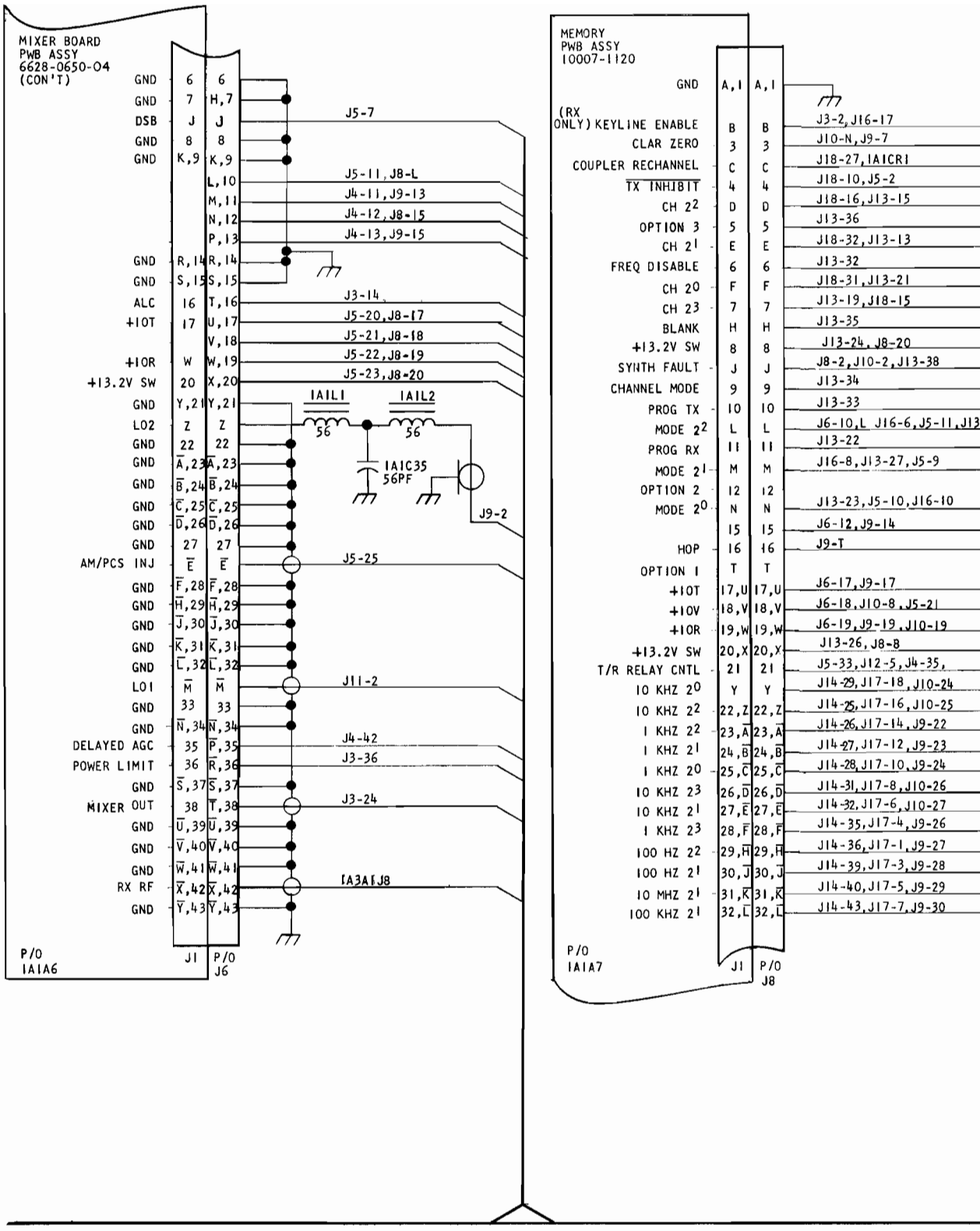


Figure 2. 1A1A11/RF-2301 Transceiver Schematic Diagram (Sheet 4 of 6)


MEMORY
PWB ASSY
10007-1120
GND A,1 A,1
(RX ONLY) KEYLINE ENABLE B B J3-2,J16-17
CLAR ZERO 3 3 J10-N,J9-7
COUPLER RECHANNEL C C J18-27,1A1CR1
TX INHIBIT 4 4 J18-10,J5-2
CH 2^2 D D J18-16,J13-15
OPTION 3 5 5 J13-36
CH 2^1 E E J18-32,J13-13
FREQ DISABLE 6 6 J13-32
CH 2^0 F F J18-31,J13-21
CH 2^3 7 7 J13-19,J18-15
BLANK H H J13-35
+13.2V SW 8 8 J13-24,J8-20
SYNTH FAULT J J J8-2,J10-2,J13-38
CHANNEL MODE 9 9 J13-34
PROG TX 10 10 J13-33
MODE 2^2 L L J6-10,L J16-6,J5-11,J13-25
PROG RX 11 11 J13-22
MODE 2^1 M M J16-8,J13-27,J5-9
OPTION 2 12 12
MODE 2^0 N N J13-23,J5-10,J16-10
15 15 J6-12,J9-14
HOP 16 16 J9-T
OPTION 1 T T
+10T 17,U 17,U J6-17,J9-17
+10V 18,V 18,V J6-18,J10-8,J5-21
+10R 19,W 19,W J6-19,J9-19,J10-19
+13.2V SW 20,X 20,Y J13-26,J8-8
T/R RELAY CNTL 21 21 J5-33,J12-5,J4-35,
10 KHZ 2^0 Y Y J14-29,J17-18,J10-24
10 KHZ 2^2 22,Z 22,Z J14-25,J17-16,J10-25
1 KHZ 2^2 23,A 23,A̅ J14-26,J17-14,J9-22
1 KHZ 2^1 24,B 24,B̅ J14-27,J17-12,J9-23
1 KHZ 2^0 25,C 25,C̅ J14-28,J17-10,J9-24
10 KHZ 2^3 26,D 26,D̅ J14-31,J17-8,J10-26
10 KHZ 2^1 27,E 27,E̅ J14-32,J17-6,J10-27
1 KHZ 2^3 28,F 28,F̅ J14-35,J17-4,J9-26
100 HZ 2^2 29,H 29,H̅ J14-36,J17-1,J9-27
100 HZ 2^1 30,J 30,J̅ J14-39,J17-3,J9-28
10 MHZ 2^1 31,K 31,K̅ J14-40,J17-5,J9-29
100 KHZ 2^1 32,L 32,L̅ J14-43,J17-7,J9-30
P/O 1A1A7
J1
P/O J8
1A1L3
J9-20
MEMORY
PWB ASSY
10007-1120
100 KHZ 2^0 33,M 33,M̅ J14-44,J17-20,J9-31
100 HZ 2^0 34,N 34,N̅ J14-48,J17-22,J9-32
100 KHZ 2^2 35,P 35,P̅ J14-50,J17-23,J9-33
100 KHZ 2^3 36,R 36,R̅ J14-49,J17-21,J9-34
10 MHZ 2^0 37,S 37,S̅ J14-46,J17-19,J9-35
100 HZ 2^3 38,T 38,T̅ J14-45,J17-17,J9-36
1 MHZ 2^1 39,U 39,U̅ J14-42,J17-15,J9-37
1 MHZ 2^0 40,V 40,V̅ J14-41,J17-13,J9-38
1 MHZ 2^2 41,W 41,W̅ J14-38,J17-11,J9-39
1 MHZ 2^3 42,X 42,X̅ J14-37,J17-9,J9-40
GND 43 43
GND Y̅ Y̅
P/O 1A1A7
J1
P/O J8
LO2
PWB ASSY
6628-0800
GND 1 A,1
B
LO2 2 2
GND 3 C,3
D,4
E,5
F,6
G,7
J,8
K
65 MHZ 9 9
GND 10 L,10
TP1 11 11
HIGH/LOW OUT 12 12
BPF 2^0 13 P,13
BPF 2^2 14 R,14
BPF 2^1 15 S,15
HOP T T
HOP OUT 16 16
U,17
+10V 18 18
+10R 19 W,19
20 X,20
INT BYPASS 21 Y,21
1 KHZ 2^2 22 22
1 KHZ 2^1 23 A̅,23
1 KHZ 2^0 24 B̅,24
EXT BYPASS 25 25
1 KHZ 2^3 26 D̅,26
100 HZ 2^2 27 E̅,27
100 HZ 2^1 28 F̅,28
10 MHZ 2^1 29 H̅,29
100 KHZ 2^1 30 J̅,30
100 KHZ 2^0 31 K̅,31
100 HZ 2^0 32 L̅,32
100 KHZ 2^2 33 M̅,33
100 KHZ 2^3 34 N̅,34
10 MHZ 2^0 35 P̅,35
100 HZ 2^3 36 R̅,36
1 MHZ 2^1 37 S̅,37
1 MHZ 2^0 38 T̅,38
1 MHZ 2^2 39 U̅,39
1 MHZ 2^3 40 V̅,40
O/L 41 41
100 HZ REF 42 42
GND 43 Y̅,43
P1
J9
1A1A8


MIXER BOARD
PWB ASSY
6628-0650-04
(CON'T)
GND 6 6
GND 7 H,7
DSB J J
GND 8 8
GND K,9 K,9
L,10
M,11
N,12
P,13
GND R,14 R,14
GND S,15 S,15
ALC 16 T,16
+10T 17 U,17
V,18
+10R W W,19
+13.2V SW 20 X,20
GND Y,21 Y,21
LO2 Z Z
GND 22 22
GND A,23 A,23
GND B,24 B,24
GND C,25 C,25
GND D,26 D,26
GND 27 27
AM/PCS INJ E E
GND F,28 F,28
GND H,29 H,29
GND J,30 J,30
GND K,31 K,31
GND L,32 L,32
LO1 M M
GND 33 33
GND N,34 N,34
DELAYED AGC 35 P,35
POWER LIMIT 36 R,36
GND S,37 S,37
MIXER OUT 38 T,38
GND U,39 U,39
GND V,40 V,40
GND W,41 W,41
RX RF X,42 X,42
GND Y,43 Y,43
P/O 1A1A6
J1
P/O J6
J5-7
J5-11, J8-L
J4-11, J9-13
J4-12, J8-15
J4-13, J9-15
J3-14
J5-20, J8-17
J5-21, J8-18
J5-22, J8-19
J5-23, J8-20
1A1L1
1A1L2
56
56
1A1C35
56PF
J9-2
J5-25
J11-2
J4-42
J3-36
J3-24
1A3A1J8
MEMORY
PWB ASSY
10007-1120
GND A,1 A,1
(RX ONLY) KEYLINE ENABLE B B J3-2, J16-17
CLAR ZERO 3 3 J10-N, J9-7
COUPLER RECHANNEL C C J18-27, 1A1CR1
TX INHIBIT 4 4 J18-10, J5-2
CH 2^2 D D J18-16, J13-15
OPTION 3 5 5 J13-36
CH 2^1 E E J18-32, J13-13
FREQ DISABLE 6 6 J13-32
CH 2^0 F F J18-31, J13-21
CH 2^3 7 7 J13-19, J18-15
BLANK H H J13-35
+13.2V SW 8 8 J13-24, J8-20
SYNTH FAULT J J J8-2, J10-2, J13-38
CHANNEL MODE 9 9 J13-34
PROG TX 10 10 J13-33
MODE 2^2 L L J6-10, L J16-6, J5-11, J13
PROG RX 11 11 J13-22
MODE 2^1 M M J16-8, J13-27, J5-9
OPTION 2 12 12
MODE 2^0 N N J13-23, J5-10, J16-10
15 15 J6-12, J9-14
HOP 16 16 J9-T
OPTION 1 T T
+10T 17, U 17, U J6-17, J9-17
+10V 18, V 18, V J6-18, J10-8, J5-21
+10R 19, W 19, W J6-19, J9-19, J10-19
+13.2V SW 20, X 20, X J13-26, J8-8
T/R RELAY CNTL 21 21 J5-33, J12-5, J4-35,
10 KHZ 2^0 Y Y J14-29, J17-18, J10-24
10 KHZ 2^2 22, Z 22, Z J14-25, J17-16, J10-25
1 KHZ 2^2 23, A 23, A J14-26, J17-14, J9-22
1 KHZ 2^1 24, B 24, B J14-27, J17-12, J9-23
1 KHZ 2^0 25, C 25, C J14-28, J17-10, J9-24
10 KHZ 2^3 26, D 26, D J14-31, J17-8, J10-26
10 KHZ 2^1 27, E 27, E J14-32, J17-6, J10-27
1 KHZ 2^3 28, F 28, F J14-35, J17-4, J9-26
100 HZ 2^2 29, H 29, H J14-36, J17-1, J9-27
100 HZ 2^1 30, J 30, J J14-39, J17-3, J9-28
10 MHZ 2^1 31, K 31, K J14-40, J17-5, J9-29
100 KHZ 2^1 32, L 32, L J14-43, J17-7, J9-30
P/O 1A1A7
J1
P/O J8

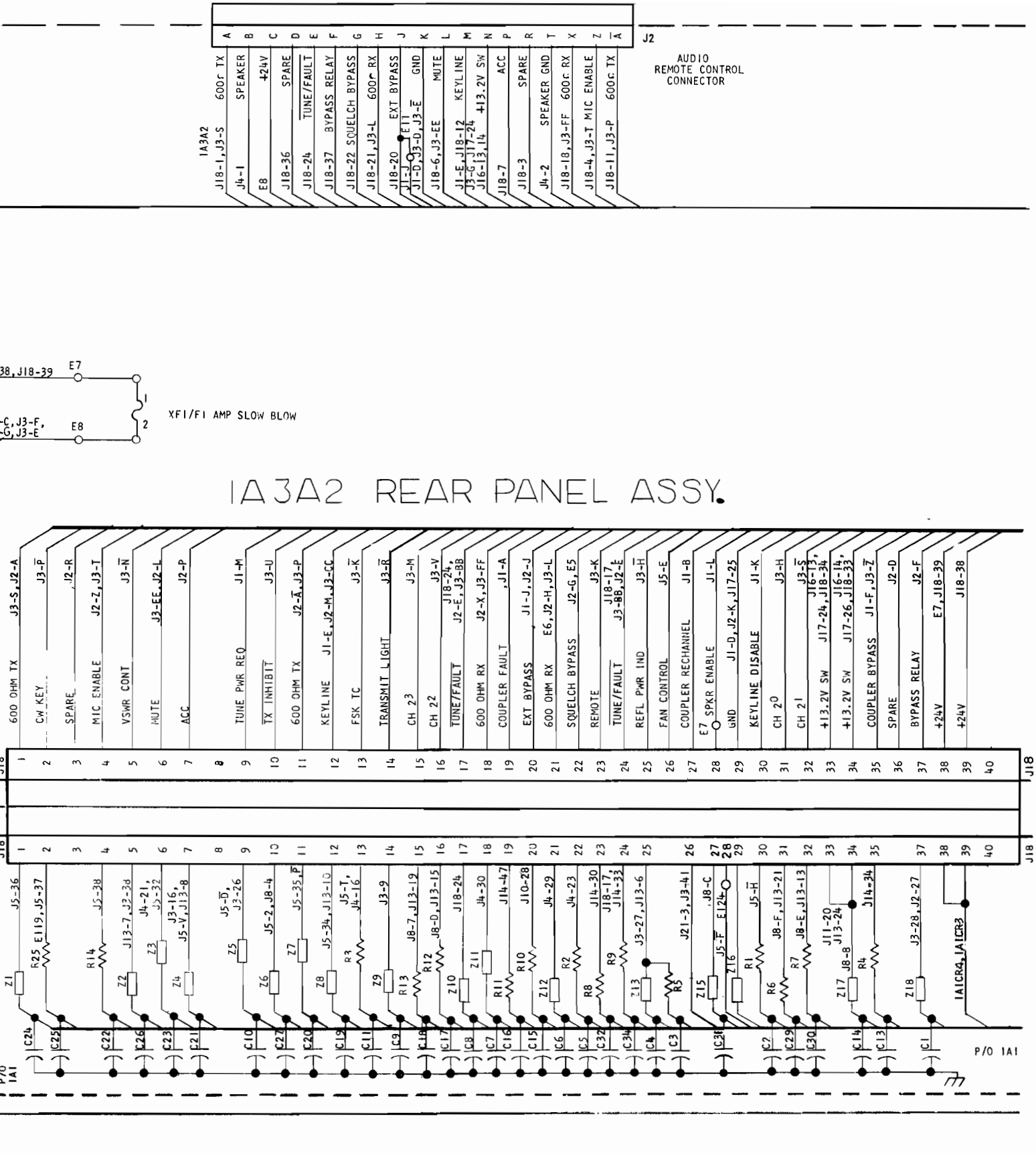
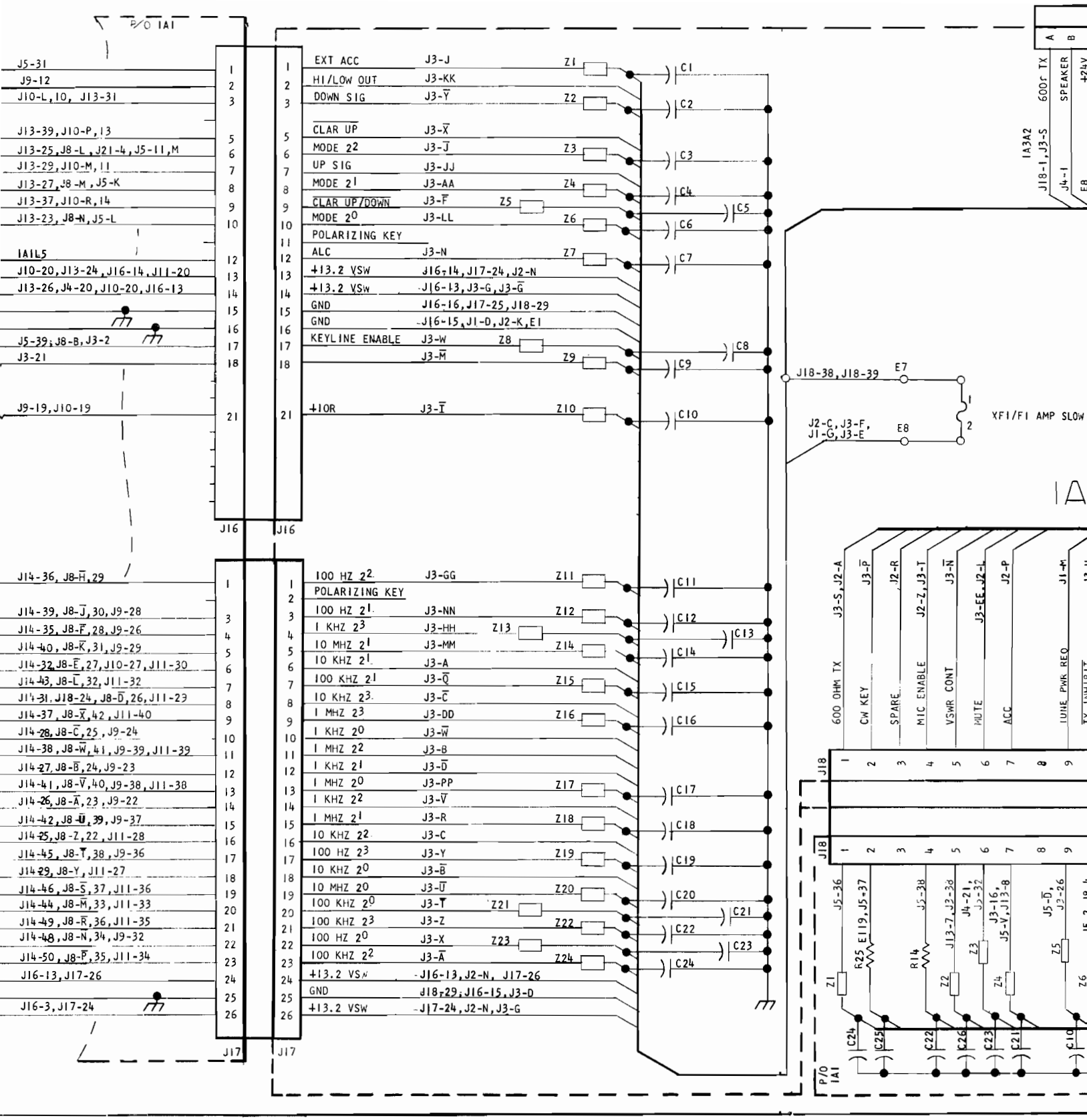
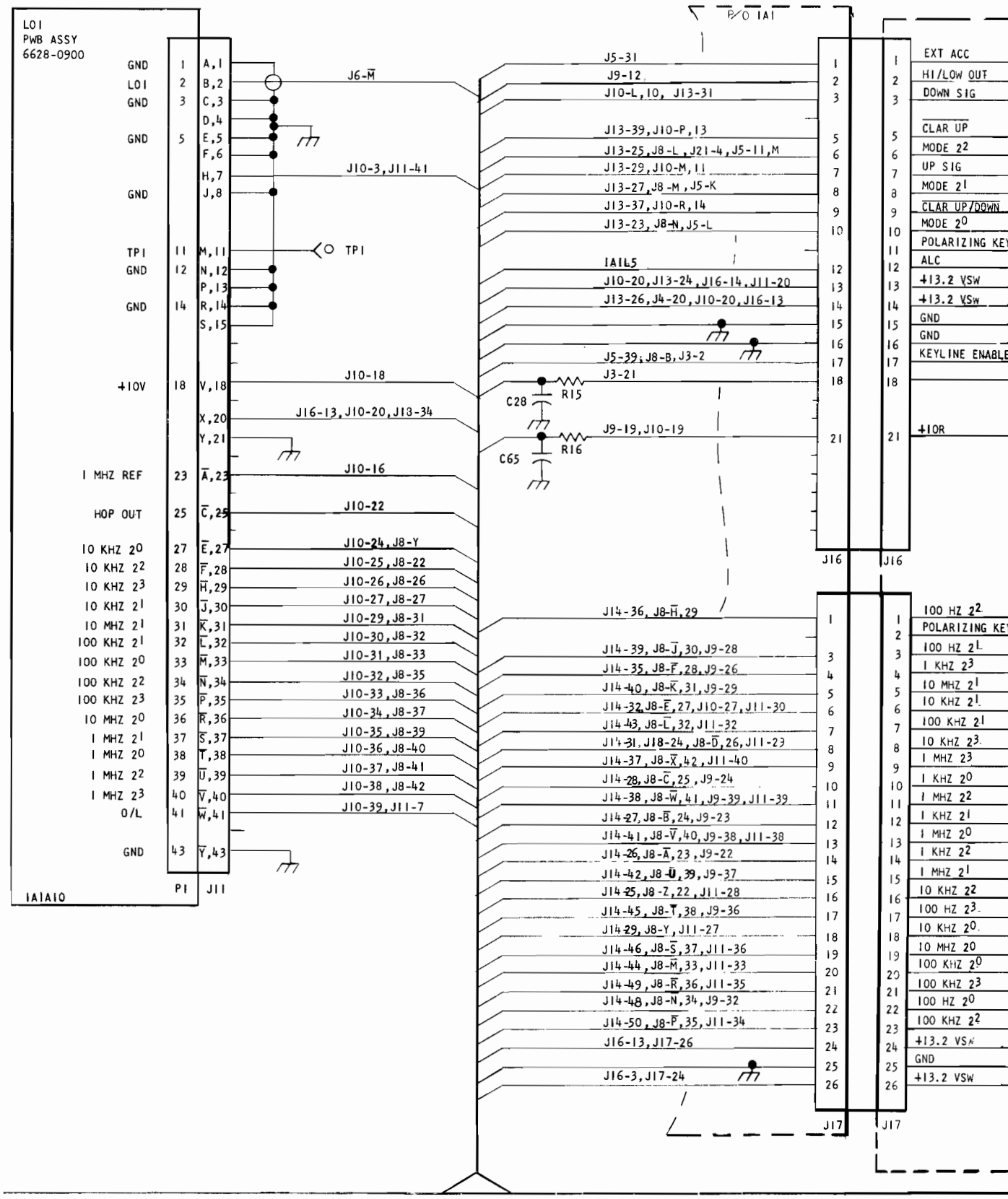


Figure 2. 1A1A11/RF-2301 Transceiver Schematic Diagram (Sheet 5 of 6)


P/O 1A1
J5-31
J9-12
J10-L, 10, J13-31
J13-39, J10-P, 13
J13-25, J8-L, J21-4, J5-11, M
J13-29, J10-M, 11
J13-27, J8-M, J5-K
J13-37, J10-R, 14
J13-23, J8-N, J5-L
1A1L5
J10-20, J13-24, J16-14, J11-20
J13-26, J4-20, J10-20, J16-13
J5-39, J8-B, J3-2
J3-21
J9-19, J10-19
J16
J16
EXT ACC J3-J Z1 C1
HI/LOW OUT J3-KK
DOWN SIG J3-Ȳ Z2 C2
CLAR UP J3-X̄
MODE 2² J3-J̄ Z3 C3
UP SIG J3-JJ
MODE 2¹ J3-AA Z4 C4
CLAR UP/DOWN J3-F̄ Z5 C5
MODE 2⁰ J3-LL Z6 C6
POLARIZING KEY
ALC J3-N Z7 C7
+13.2 VSW J16-14, J17-24, J2-N
+13.2 VSW J16-13, J3-G, J3-Ḡ
GND J16-16, J17-25, J18-29
GND J16-15, J1-D, J2-K, E1
KEYLINE ENABLE J3-W Z8 C8
J3-M̄ Z9 C9
+10R J3-Ī Z10 C10
J18-38, J18-39 E7
J2-C, J3-F, J1-G, J3-E E8
XF1/F1 AMP SLOW
1A
J14-36, J8-H̄, 29
J14-39, J8-J̄, 30, J9-28
J14-35, J8-F̄, 28, J9-26
J14-40, J8-K̄, 31, J9-29
J14-32, J8-Ē, 27, J10-27, J11-30
J14-43, J8-L̄, 32, J11-32
J14-31, J18-24, J8-D̄, 26, J11-23
J14-37, J8-X̄, 42, J11-40
J14-28, J8-C̄, 25, J9-24
J14-38, J8-W̄, 41, J9-39, J11-39
J14-27, J8-B̄, 24, J9-23
J14-41, J8-V̄, 40, J9-38, J11-38
J14-26, J8-Ā, 23, J9-22
J14-42, J8-Ū, 39, J9-37
J14-25, J8-Z, 22, J11-28
J14-45, J8-T̄, 38, J9-36
J14-29, J8-Y, J11-27
J14-46, J8-S̄, 37, J11-36
J14-44, J8-M̄, 33, J11-33
J14-49, J8-R̄, 36, J11-35
J14-48, J8-N̄, 34, J9-32
J14-50, J8-P̄, 35, J11-34
J16-13, J17-26
J16-3, J17-24
J17
J17
100 HZ 2² J3-GG Z11 C11
POLARIZING KEY
100 HZ 2¹ J3-NN Z12 C12
1 KHZ 2³ J3-HH Z13 C13
10 MHZ 2¹ J3-MM Z14 C14
10 KHZ 2¹ J3-A
100 KHZ 2¹ J3-Q̄ Z15 C15
10 KHZ 2³ J3-C̄
1 MHZ 2³ J3-DD Z16 C16
1 KHZ 2⁰ J3-W̄
1 MHZ 2² J3-B
1 KHZ 2¹ J3-D̄
1 MHZ 2⁰ J3-PP Z17 C17
1 KHZ 2² J3-V̄
1 MHZ 2¹ J3-R Z18 C18
10 KHZ 2² J3-C
100 HZ 2³ J3-Y Z19 C19
10 KHZ 2⁰ J3-B̄
10 MHZ 2⁰ J3-Ū Z20 C20
100 KHZ 2⁰ J3-T̄ Z21 C21
100 KHZ 2³ J3-Z Z22 C22
100 HZ 2⁰ J3-X Z23 C23
100 KHZ 2² J3-Ā Z24 C24
+13.2 VSW J16-13, J2-N, J17-26
GND J18-29, J16-15, J3-D
+13.2 VSW J17-24, J2-N, J3-G
J3-S, J2-A 600 OHM TX
J3-P̄ CW KEY
J2-R SPARE
J2-Z, J3-T MIC ENABLE
J3-N̄ VSWR CONT
J3-EE, J2-L MUTE
J2-P ACC
J1-M TUNE PWR REQ
J18
J18
J5-36
E119, J5-37
J5-38
J13-7, J3-38
J4-21, J3-32
J3-16, J5-V, J13-8
J5-D̄, J3-26
R25
R14
Z1
Z2
Z3
Z4
Z5
C24
C25
C22
C26
C23
C21
C10
P/O 1A1
1A3A2
J18-1, J3-S 600Ω TX
J4-1 SPEAKER
A
B
E8


LO1
PWB ASSY
6628-0900
P/O 1A1
GND
LO1
GND
GND
TP1
GND
+10V
1 MHZ REF
HOP OUT
10 KHZ 2^0
10 KHZ 2^2
10 KHZ 2^3
10 KHZ 2^1
10 MHZ 2^1
100 KHZ 2^1
100 KHZ 2^0
100 KHZ 2^2
100 KHZ 2^3
10 MHZ 2^0
1 MHZ 2^1
1 MHZ 2^0
1 MHZ 2^2
1 MHZ 2^3
O/L
GND
J6-M
J10-3,J11-41
TP1
J10-18
J16-13,J10-20,J13-34
J10-16
J10-22
J10-24,J8-Y
J10-25,J8-22
J10-26,J8-26
J10-27,J8-27
J10-29,J8-31
J10-30,J8-32
J10-31,J8-33
J10-32,J8-35
J10-33,J8-36
J10-34,J8-37
J10-35,J8-39
J10-36,J8-40
J10-37,J8-41
J10-38,J8-42
J10-39,J11-7
1A1A10
P1
J11
J5-31
J9-12
J10-L,10, J13-31
J13-39,J10-P,13
J13-25,J8-L,J21-4,J5-11,M
J13-29,J10-M,11
J13-27,J8-M,J5-K
J13-37,J10-R,14
J13-23,J8-N,J5-L
1A1L5
J10-20,J13-24,J16-14,J11-20
J13-26,J4-20,J10-20,J16-13
J5-39,J8-B,J3-2
J3-21
C28
R15
J9-19,J10-19
C65
R16
J14-36,J8-H,29
J14-39,J8-J,30,J9-28
J14-35,J8-F,28,J9-26
J14-40,J8-K,31,J9-29
J14-32,J8-E,27,J10-27,J11-30
J14-43,J8-L,32,J11-32
J14-31,J18-24,J8-D,26,J11-23
J14-37,J8-X,42,J11-40
J14-28,J8-C,25,J9-24
J14-38,J8-W,41,J9-39,J11-39
J14-27,J8-B,24,J9-23
J14-41,J8-V,40,J9-38,J11-38
J14-26,J8-A,23,J9-22
J14-42,J8-U,39,J9-37
J14-25,J8-Z,22,J11-28
J14-45,J8-T,38,J9-36
J14-29,J8-Y,J11-27
J14-46,J8-S,37,J11-36
J14-44,J8-M,33,J11-33
J14-49,J8-R,36,J11-35
J14-48,J8-N,34,J9-32
J14-50,J8-P,35,J11-34
J16-13,J17-26
J16-3,J17-24
J16
J17
EXT ACC
HI/LOW OUT
DOWN SIG
CLAR UP
MODE 2^2
UP SIG
MODE 2^1
CLAR UP/DOWN
MODE 2^0
POLARIZING KEY
ALC
+13.2 VSW
+13.2 VSW
GND
GND
KEYLINE ENABLE
+10R
100 HZ 2^2
POLARIZING KEY
100 HZ 2^1
1 KHZ 2^3
10 MHZ 2^1
10 KHZ 2^1
100 KHZ 2^1
10 KHZ 2^3
1 MHZ 2^3
1 KHZ 2^0
1 MHZ 2^2
1 KHZ 2^1
1 MHZ 2^0
1 KHZ 2^2
1 MHZ 2^1
10 KHZ 2^2
100 HZ 2^3
10 KHZ 2^0
10 MHZ 2^0
100 KHZ 2^0
100 KHZ 2^3
100 HZ 2^0
100 KHZ 2^2
+13.2 VSW
GND
+13.2 VSW

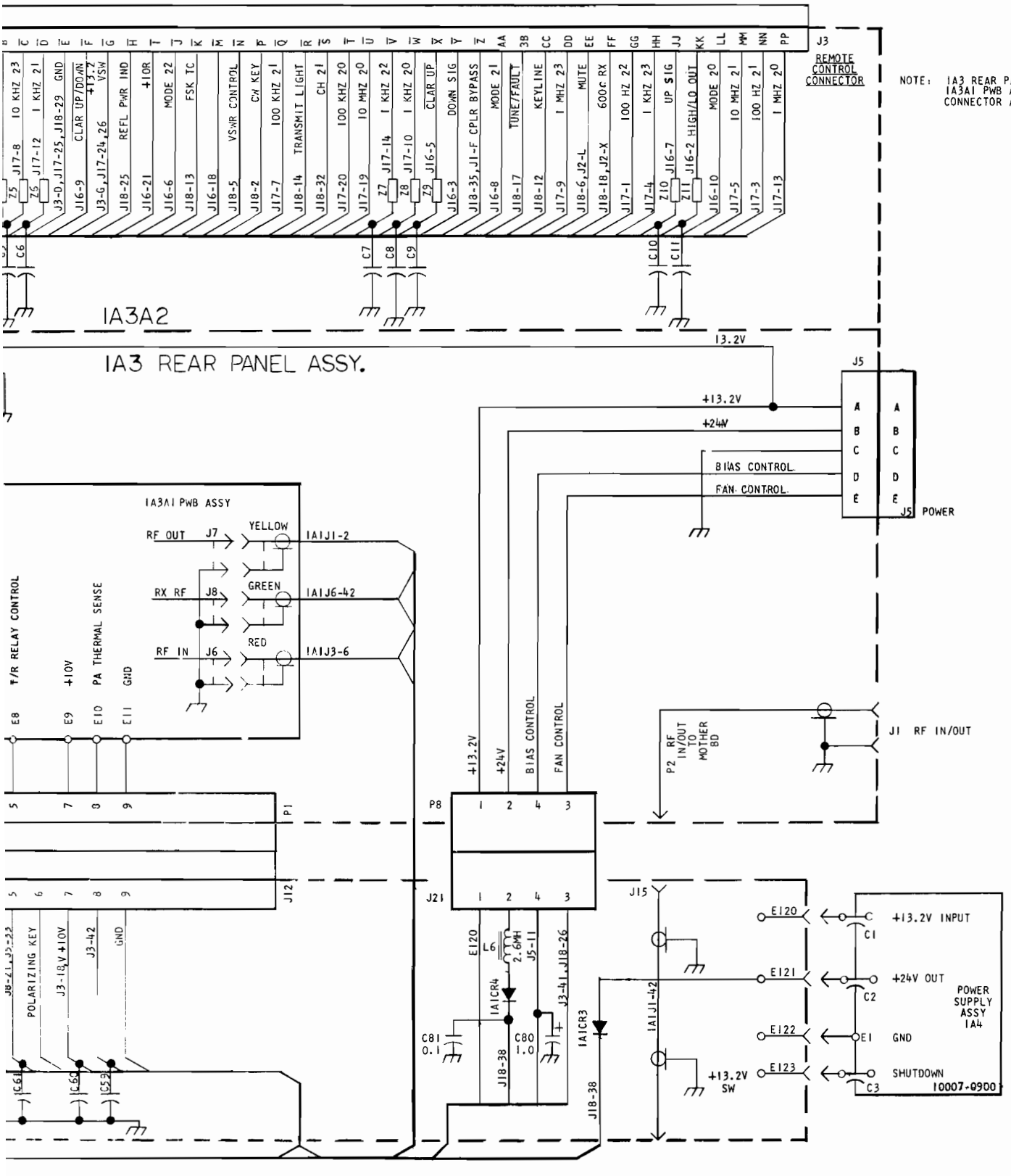
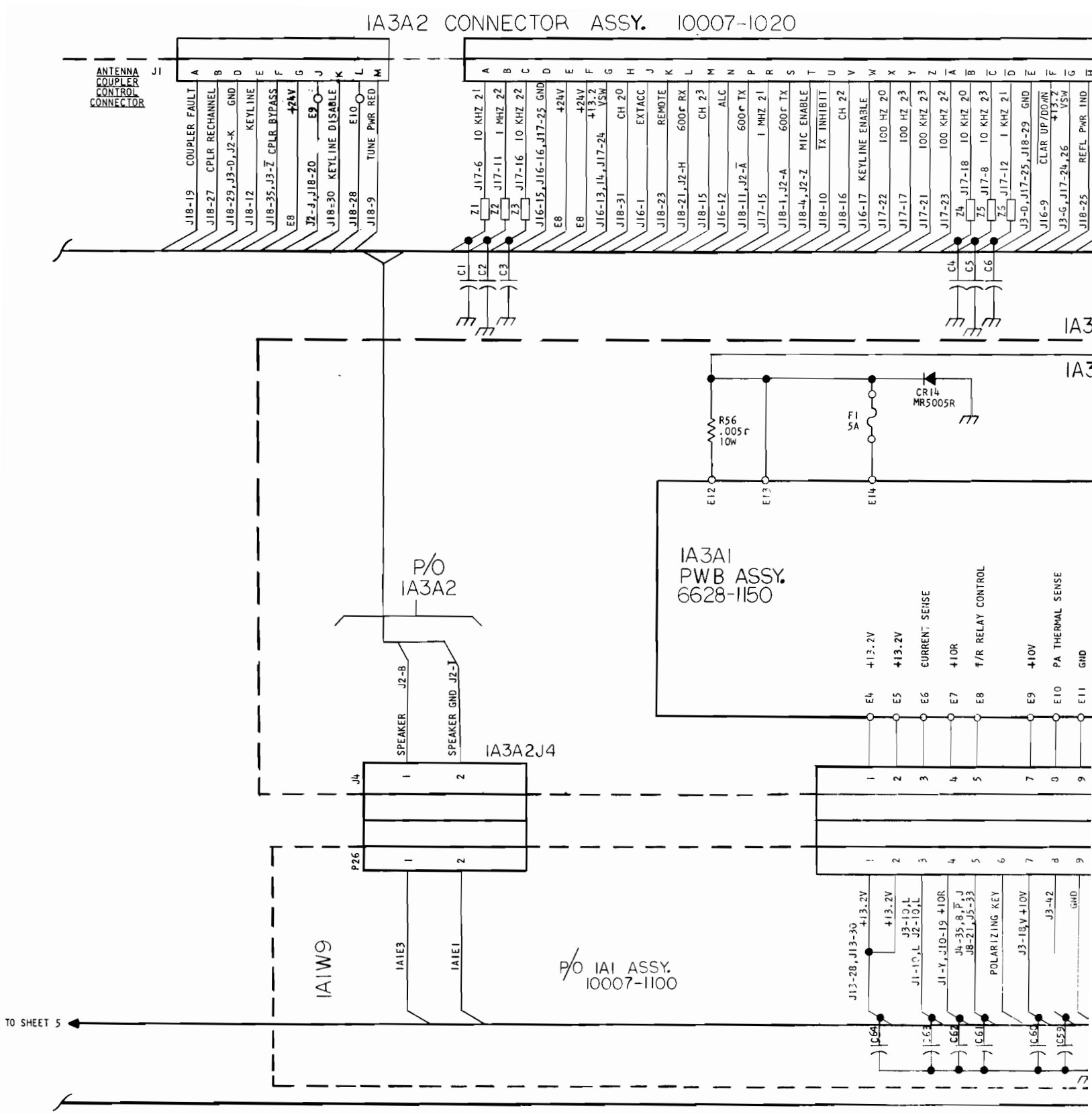


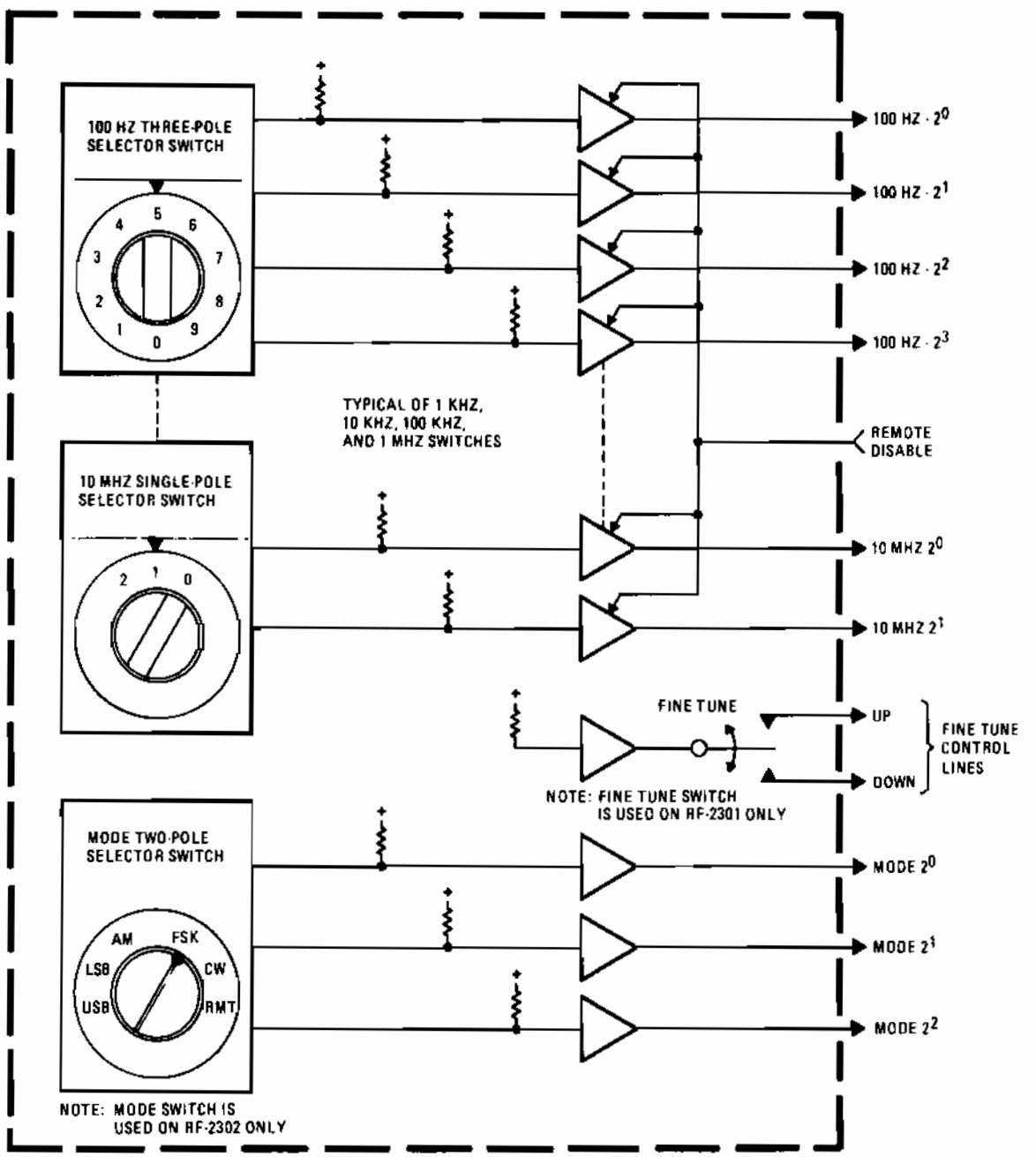
Figure 2. 1A1A11/RF-2301 Transceiver Schematic Diagram (Sheet 6 of 6)


1A3A2 CONNECTOR ASSY. 10007-1020
ANTENNA COUPLER CONTROL CONNECTOR
J1
J18-19 COUPLER FAULT
J18-27 CPLR RECHANNEL
J18-29, J3-D, J2-K GND
J18-12 KEYLINE
J18-35, J3-Z CPLR BYPASS
E8 +24V
J2-J, J18-20 E9
J18-30 KEYLINE DISABLE
J18-28 E10
J18-9 TUNE PWR RED
J17-6 10 KHZ 21
J17-11 1 MHZ 22
J17-16 10 KHZ 22
J16-15, J16-16, J17-25 GND
E8 +24V
E8 +24V
J16-13, 14, J17-24 +13.2 VSW
J18-31 CH 20
J16-1 EXTACC
J18-23 REMOTE
J18-21, J2-H 600Ω RX
J18-15 CH 23
J16-12 ALC
J18-11, J2-Ā 600Ω TX
J17-15 1 MHZ 21
J18-1, J2-A 600Ω TX
J18-4, J2-Z MIC ENABLE
J18-10 TX INHIBIT
J18-16 CH 22
J16-17 KEYLINE ENABLE
J17-22 100 HZ 20
J17-17 100 HZ 23
J17-21 100 KHZ 23
J17-23 100 KHZ 22
J17-18 10 KHZ 20
J17-8 10 KHZ 23
J17-12 1 KHZ 21
J3-D, J17-25, J18-29 GND
J16-9 CLAR UP/DOWN
J3-G, J17-24, 26 +13.2 VSW
J18-25 REFL PWR IND
Z1
Z2
Z3
Z4
Z5
Z6
C1
C2
C3
C4
C5
C6
IA3
R56 .005Ω 10W
F1 5A
CR14 MR5005R
E12
E13
E14
IA3A1 PWB ASSY. 6628-1150
E4 +13.2V
E5 +13.2V
E6 CURRENT SENSE
E7 +10R
E8 T/R RELAY CONTROL
E9 +10V
E10 PA THERMAL SENSE
E11 GND
P/O IA3A2
J2-8 SPEAKER
J2-1 SPEAKER GND
IA3A2J4
J4
P26
IA1W9
IA1E3
IA1E1
P/O IA1 ASSY. 10007-1100
J13-28, J13-30 +13.2V
+13.2V
J3-10, L J2-10, L
J1-Y, J10-19 +10R
J4-35, 8, J J8-21, J5-33
POLARIZING KEY
J3-18 +10V
J3-42
GND
C64
C63
C62
C61
C60
C53
TO SHEET 5

UNIT INSTRUCTIONS

FREQUENCY SELECT BOARD

1A2A1



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FREQUENCY SELECT BOARD 1A2A1

1. GENERAL INFORMATION

The Frequency Select PWB (1A2A1) performs the frequency selection and Fine Tune control functions for the RF-2301. The assembly consists of six frequency select swtiches, a Fine Tune momentary switch, and associated digital circuitry. The binary format of the Frequency Select control lines is routed to the Interface PWB (1A2A2) for conversion to discrete digital data, and ultimately to the local oscillators for control of the transceiver operating frequency. The binary data also controls the front panel alpha-numeric readouts for displaying the operating frequency. The assembly is mounted directly behind the front panel assembly such that the select switches may be controlled by the operator. The assembly also contains the necessary circuitry to generate the 'Frequency Disable' function, which is utilized in the transceiver whenever the transceiver is placed in either the Channelized or Remote modes of operation.

2. TECHNICAL CHARACTERISTICS

Power Inputs:

+10 Vdc from 1A1A11 (J1-21, 22)

Control Inputs:

CHANNEL ENABLE

Control Outputs:

Binary control lines for 100 Hz, 1 KHz, 10 KHz, 100 KHz, 1 MHz, and 10 MHz selector switches. CLAR UP/DOWN control lines and FREQUENCY DISABLE output.

3. SEMICONDUCTOR COMPLEMENT

U1 through U5 MM80C97 (Hex Tri-state Buffers)

U6 CD4071B (Quad OR-gate)

4. CIRCUIT DESCRIPTION

Refer to Figure 1 during the course of this discussion. The frequency select switches are wired in such a manner as to produce a binary output according to the number of outputs assigned to each switch. The chart below indicates the manner in which this data is presented:

#	2^0	2^1	2^2	2^3
0	0	0	0	0
1	1	0	0	0
2	0	1	0	0
3	1	1	0	0
4	0	0	1	0
5	1	0	1	0
6	0	1	1	0
7	1	1	1	0
8	0	0	0	1
9	1	0	0	1

Each individual switch pole is wired to generate the above data bits according to their significance, the exception being the 2^3 bit, which is derived from the 2^2 pole in the last two positions of the switch. Each switch pole is connected to a Tri-State Buffer input. The outputs of the buffers are controlled by the 'Inhibit' control inputs on each IC. The six sets of binary data, corresponding to the six selector switches, are commonly controlled by these inhibit lines. Whenever the FREQUENCY DISABLE control line is activated, the INHIBIT inputs associated with these outputs cause the tri-state buffers to become disabled, thus preventing selection of the operating frequency from the selector switches. The INHIBIT state is the result of a control signal from either the REMOTE input or the CHANNEL ENABLE input activating the OR gate associated with the FREQUENCY DISABLE control line. The buffer driving the FINE TUNE switch is not affected by the INHIBIT control signal.

5. MAINTENANCE

Operation of the switches should be checked periodically to insure positive contact. Electrical operation of the assembly may be verified by determining the respective digital outputs of each switch with a VOM (see Figure 1 below).

6. PARTS LIST

Table 1 lists all 1A2A1 components and integrated circuit assemblies. These parts may be located in Figure 3 . Refer to Part V, paragraph 5.11 for cross-referencing of part numbers.

7. SCHEMATIC DIAGRAM

Figure 4 presents a complete schematic diagram of the 1A2A1 Frequency Select assembly.

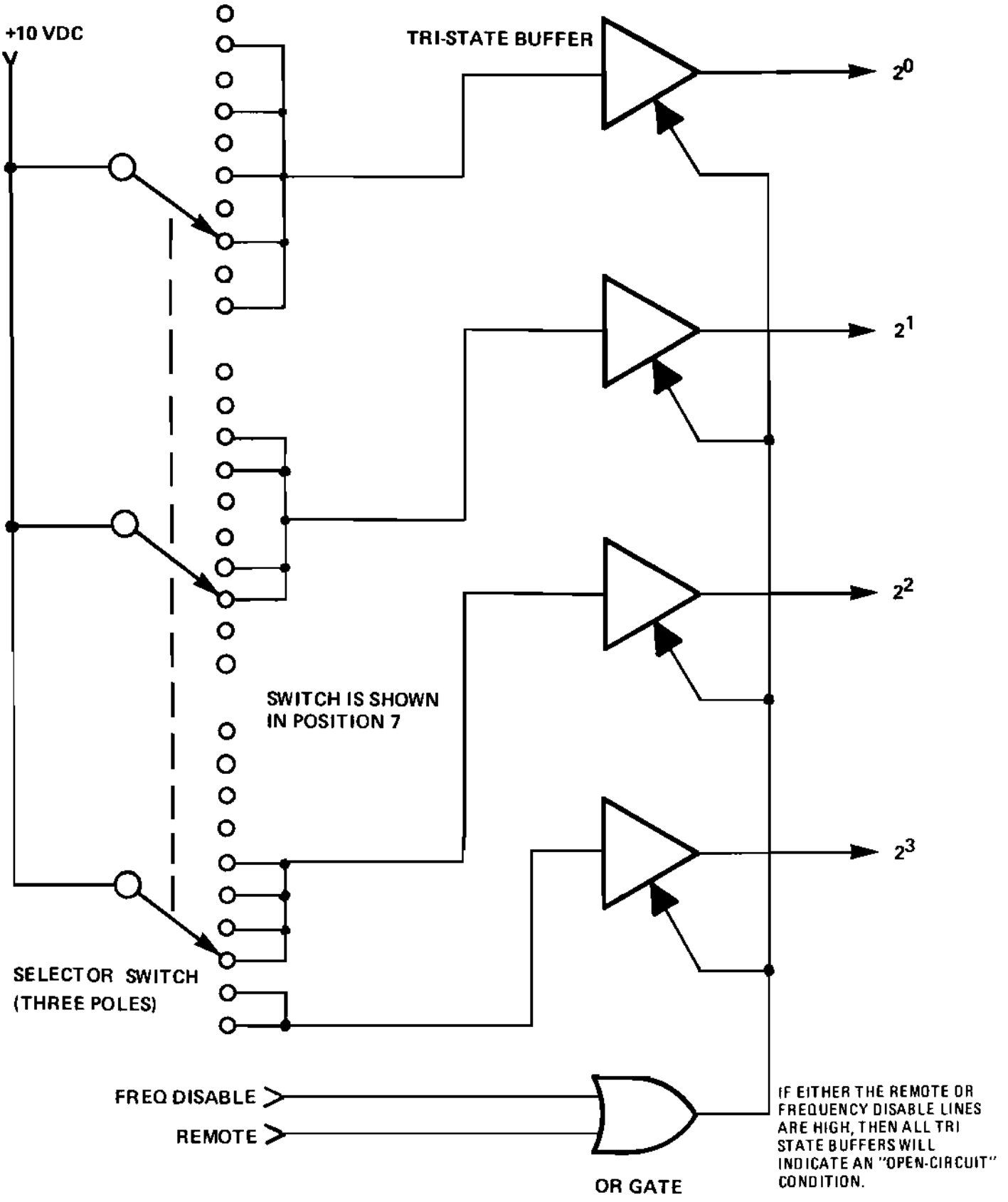


Figure 1. Simplified Switch Schematic Diagram

1	UP SIGNAL
2	CLAR COMMON
3	CLAR DOWN
4	CHANNEL ENABLE
5	
6	CLAR UP
7	DOWN SIGNAL
8	MODE - 2^2 (not used)
9	MODE - 2^2 SWITCH (not used)
10	MODE - 2^1 (not used)
11	MODE - 2^1 SWITCH (not used)
12	MODE - 2^0 (not used)
13	MODE - 2^0 SWITCH (not used)
14	FREQ DISABLE
15	
16	
17	GROUND
18	GROUND
19	
20	
21	+10 VDC
22	+10 VDC
23	
24	
25	10 KHZ - 2^2
26	1 KHZ - 2^2
27	1 KHZ - 2^1
28	1 KHZ - 2^0
29	10 KHZ - 2^0
30	REMOTE CONTROL
31	10 KHZ - 2^3
32	10 KHZ - 2^1
33	
34	
35	1 KHZ - 2^3
36	100 HZ - 2^2
37	1 MHZ - 2^3
38	1 MHZ - 2^2
39	100 HZ - 2^1
40	10 MHZ - 2^1
41	1 MHZ - 2^0
42	1 MHZ - 2^1
43	100 KHZ - 2^1
44	100 KHZ - 2^0
45	100 HZ - 2^3
46	10 MHZ - 2^0
47	
48	100 HZ - 2^0
49	100 KHZ - 2^3
50	100 KHZ - 2^2

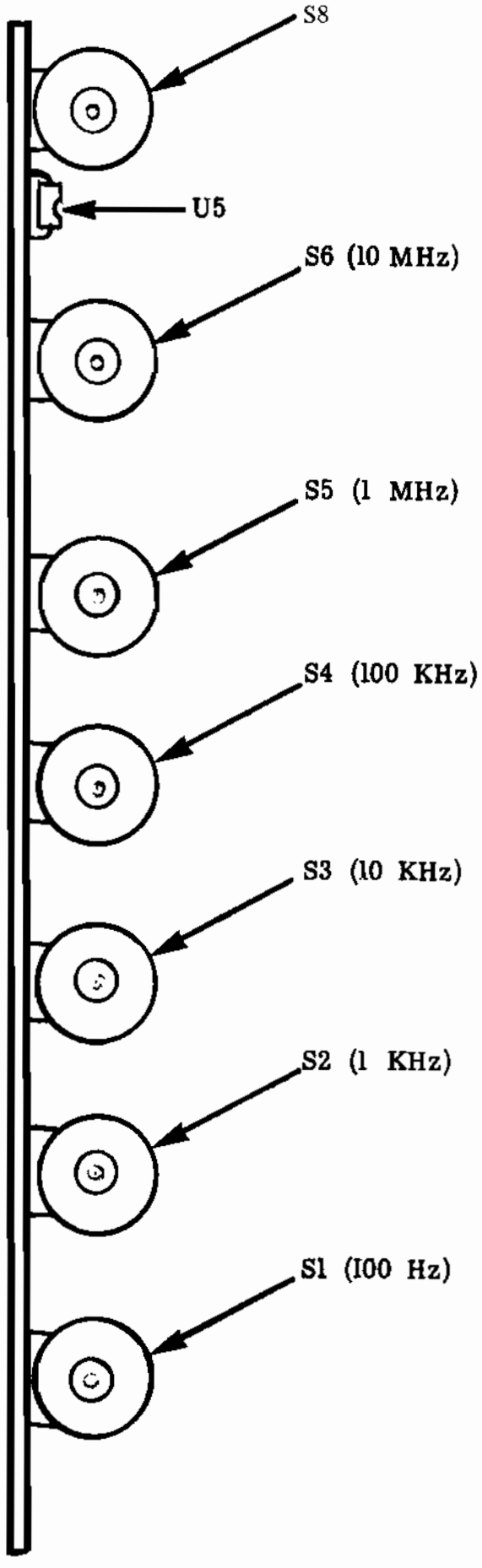


Figure 2. Input/Output Summary

Table 1. Frequency Select PWB Maintenance Parts List (10007-1067)

Ref. Desig.	Name & Description	Mfr. Code	Part Number
1A2	Front Panel Assembly	14304	10007-0200/Green 10007-0201/Gray
1A2DS1 thru DS3	Indicator Light	14304	10007-1070
1A2J1	Connector Audio	14304	J-0339
1A2J2, J3	Phone Jack	14304	J-0104
1A2LS1	Speaker	14304	ZO1-0003-000
1A2M1	Meter	14304	10007-0205
1A2R1	Potentiometer, Dual	14304	10007-0248
1A2S1	Switch Channel	14304	10007-1074
1A2S2	Switch Assembly, Mode	14304	10007-0212
1A2W1	Harness Assembly, Front Panel	14304	10007-0214
1A2A1	Frequency Select PWB	14304	10007-1067
E1	Pin, Connector, PC Mount	14304	MP-0287
E2	Pin, Connector, PC Mount	14304	MP-0287
E3	Pin, Connector, PC Mount	14304	MP-0287
E4	Pin, Connector, PC Mount	14304	MP-0287
J1	Connector, Right-Angle, 50 Pin	14304	J46-0020-050
R1	Resistor, Network, 8 Pin	14304	R50-0008-333
R2	Resistor, Network, 8 Pin	14304	R50-0008-333
R3	Resistor, Network, 8 Pin	14304	R50-0008-333
R4	Resistor, Network, 6 Pin	14304	R50-0006-333
R5	Resistor, Network, 6 Pin	14304	R50-0006-333
R6	Resistor, 33K ohm, 1/4W, 5%	14304	RCR07G333JM
R7	Resistor, 470 ohm, 1/4W, 5%	14304	RCR07G471JM
R8	Resistor, 1K ohm, 1/4W, 5%	14304	RCR07G102JM
R9	Resistor, 1K ohm, 1/4W, 5%	14304	RCR07G102JM
R10	Resistor, 1K ohm, 1/4W, 5%	14304	RCR07G102JM
R11	Resistor, 1K ohm, 1/4W, 5%	14304	RCR07G102JM
R12	Resistor, 1K ohm, 1/4W, 5%	14304	RCR07G102JM
R13	Resistor, 1K ohm, 1/4W, 5%	14304	RCR07G102JM
R14	Resistor, 1K ohm, 1/4W, 5%	14304	RCR07G102JM
S1	Switch, 0-2 (10 MHz)	14304	10007-1077
S2	Switch, 0-9 (1 MHz)	14304	S24-0001-003
S3	Switch, 0-9 (100 KHz)	14304	S24-0001-003
S4	Switch, 0-9 (10 KHz)	14304	S24-0001-003
S5	Switch, 0-9 (1 KHz)	14304	S24-0001-003
S6	Switch, 0-9 (100 Hz)	14304	S24-0001-003
S7	Not Used		
S8	Switch, Fine Tune	14304	10007-0219
U1	Integrated Circuit, MM80C97	14304	I03-0004-000
U2	Integrated Circuit, MM80C97	14304	I03-0004-000
U3	Integrated Circuit, MM80C97	14304	I03-0004-000
U4	Integrated Circuit, MM80C97	14304	I03-0004-000
U5	Integrated Circuit, MM80C97	14304	I03-0004-000
U6	Integrated Circuit, CD4071BE	14304	I01-0000-023

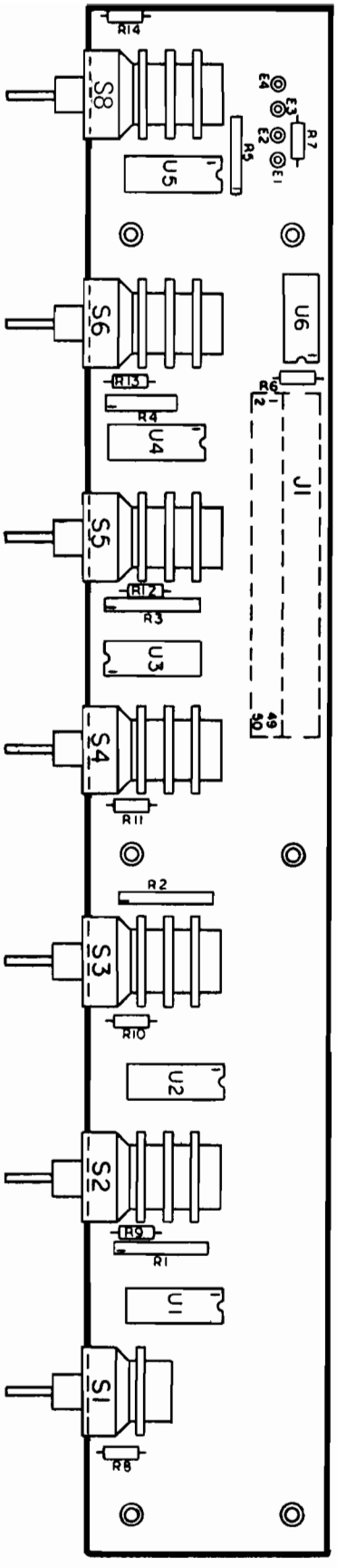


Figure 3. 1A2A1 Component Locations

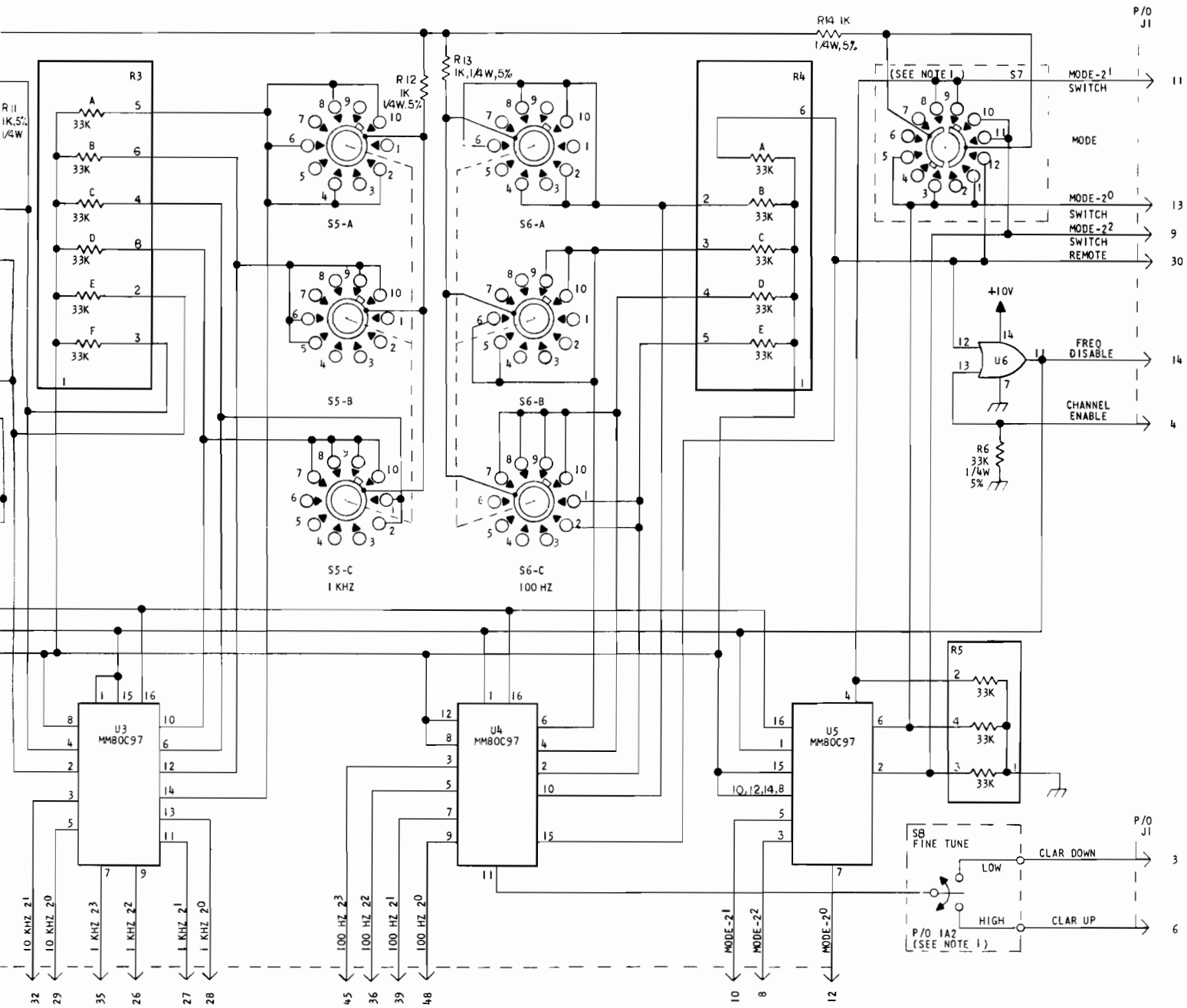
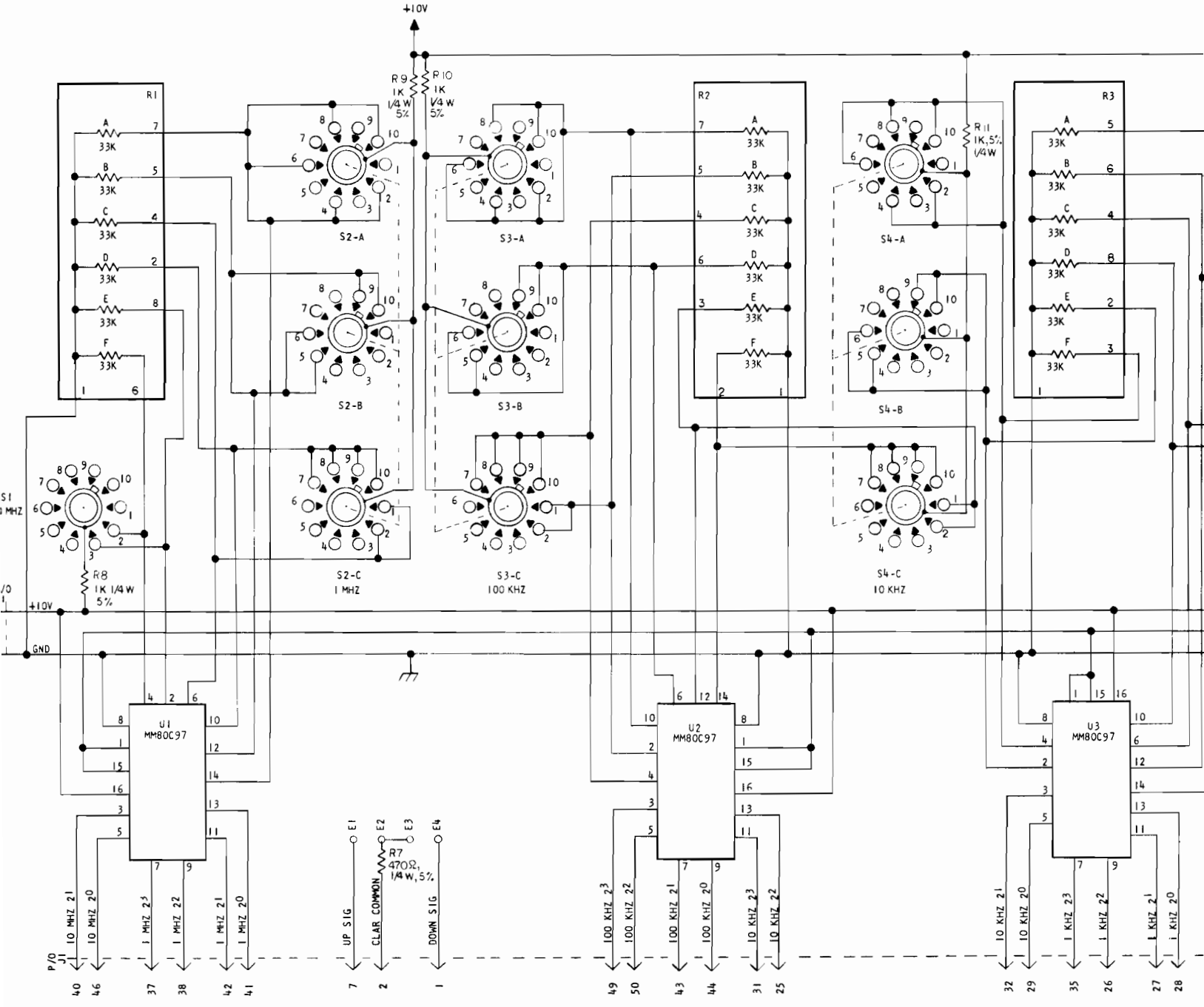


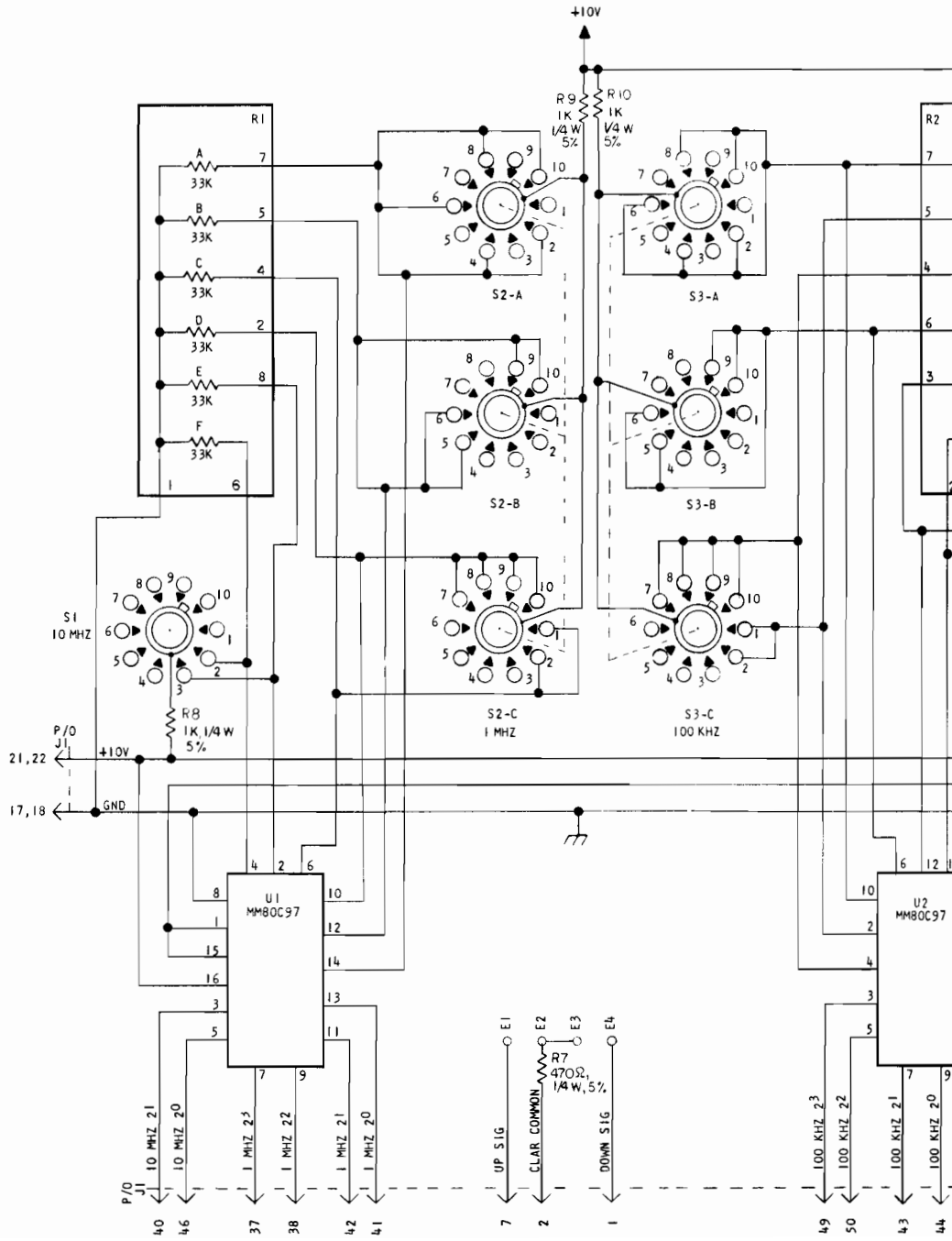
Figure 4. 1A2A1 Frequency Select PC Board Schematic Diagram (10007-1061)

DE SWITCH (S7) IS USED ON RF-2302 ONLY.
NE TUNE SWITCH (S8) IS USED ON RF-2301 ONLY.



NOTE:

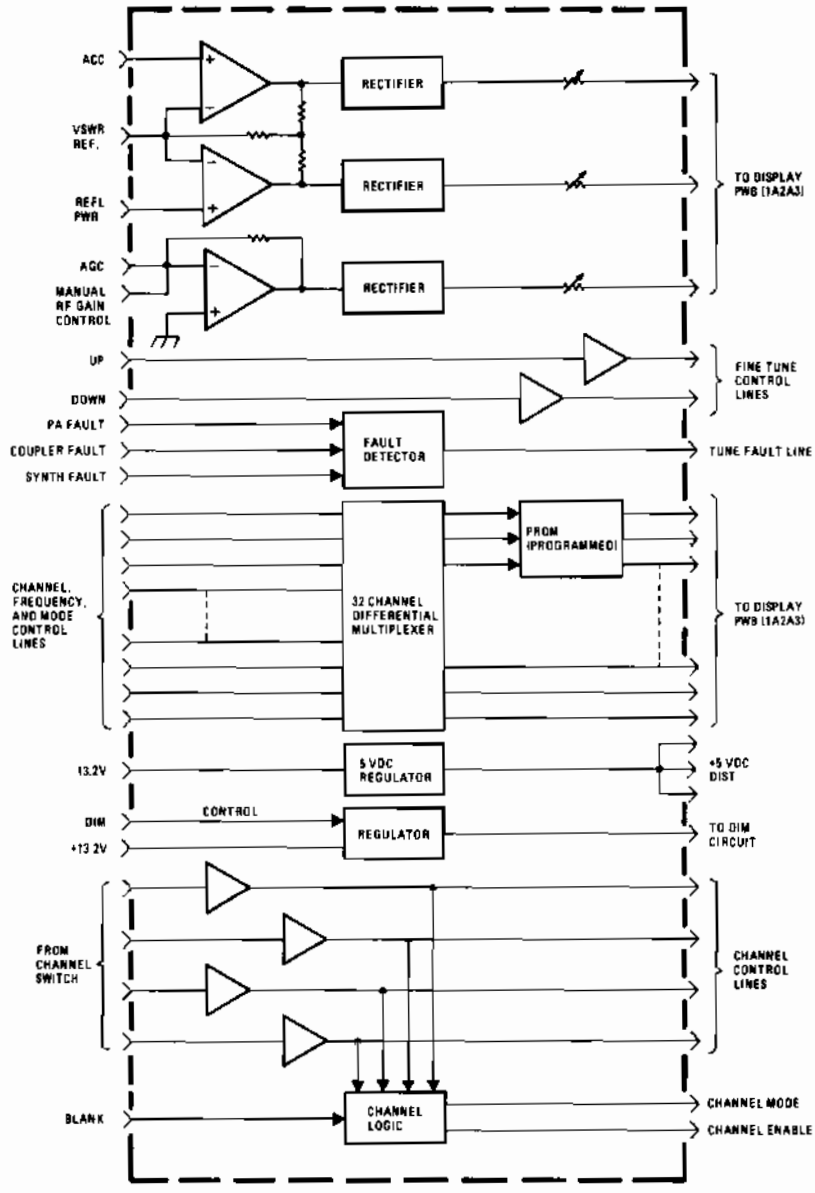
1. MODE SWITCH (S7) IS USED ON RF-2302 ONLY.
   FINE TUNE SWITCH (S8) IS USED ON RF-2301 ONLY.



UNIT INSTRUCTIONS

INTERFACE BOARD

1A2A2



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INTERFACE BOARD 1A2A2

1. GENERAL INFORMATION

The 1A2A2 Interface PWB contains circuitry associated with several functional blocks of the RF-2301. These functions essentially relate to the Frequency Select PWB 1A2A1 and the Display PWB 1A2A3. Thus, the functional description presented in support of the Interface Board is presented with respect to these two related assemblies.

2. TECHNICAL CHARACTERISTICS

Power Inputs:

+10 Vdc from 1A1A11 (J1-1, 2)
+13.8 Vdc from 1A1A11 (J1-28, 30)
Ground

Signal Inputs:

PA Fault, Coupler Fault, Synthesizer Fault, Channel, Frequency, and Mode Control Lines, Channel Switch Select Lines, BLANK Control Line, ACC, AGC, VSWR REF, REFL PWR, UP/DOWN Control Lines.

Signal Outputs:

FWD, REFL, and RX envelope (for meter driver), UP/DOWN Control Lines, Multiplexed Channel, Frequency, and Mode Control Lines, +5 Vdc, DIM Operating voltage, Channel Control Lines, Channel Mode, Channel Enable.

3. SEMICONDUCTOR COMPLEMENT

Ref. Des.	Type	Description
CR1-CR6	1N4454	Rectifier Diode
Q1-Q3	2N4124	Transistor
U1	74S470	PROM
U2	CD4025	Triple NOR Gate
U3	CA324E	Operational Amplifier
U4	CD4001	Quad NOR Gate
U5	CD4071	Quad OR Gate
U6/7	CD4050	Hex Buffer
U8/9	CD4097	16 Channel MUX
U10	MM80C97	Hex Tri-State Buffer
U11	CD4071B	Quad OR Gate
U12	LM340T	Voltage Regulator
U13	LM317T-5	Voltage Regulator

4. CIRCUIT DESCRIPTION

Analog signals applied to U3 Quad Operational Amplifier are rectified by U3A (ACC), U3B (Reflected Power), and U3C (AGC). The resulting dc signals are then applied to variable resistors R4 (Forward Power Meter Calibrate), R2 (Reflected Power Meter Calibrate), and R5 ("S" Meter Calibrate) for setting of the proper dc levels. These signals are connected to test points TP6, TP3, and TP2 respectively for measurement during testing of the assembly or during troubleshooting of the RF-2301. These three signals are then applied through the 1A1A11 Interconnect Board to the 1A2A3 Display PWB CMOS Bi-lateral switches, which operate according to the TX/RX conditions of the radio (see section 6.14 'Display Board 1A2A3 Unit Instructions'). The UP and DOWN signal lines applied to J1-29 and 31 are buffered by U5 OR gates, and applied to the bases of Q1 and Q2 to operate these transistors. The analog voltage generated on the 1A3A1 PA assembly is applied to comparator U3D. The comparator output feeds one input of three-input NOR gate U2B. The remaining inputs are tied to the Coupler Fault and Synthesizer Fault lines. When any of these three inputs goes high, the NOR gate output goes low, in turn operating U2A and U5A. The resulting signal turns on Q3 to activate the Fault lamp contained in the front panel. The PA Fault line is the Current Sense Output, which produces a voltage proportional, to the voltage drop across the dc dropping resistor in series with the primary 13.8 Vdc input to the PA. High current will cause this voltage to increase, thus triggering the comparator. The comparator activating level is approximately 2.5 Vdc. The Interface PWB also contains the necessary circuitry to format the channel, frequency, and mode control lines before application to the programmed PROM (Programmable Read Only Memory). This is accomplished by multiplexing the thirty-two control lines to four channels via U8 and U9. These differential multiplexers are clocked in synchronous fashion by signals originating on the Display PWB assembly (1A2A3). The resulting four output channels are fed to the address inputs of the PROM via buffers U6A, U6B, U6C, and U6D. The states of the eight output lines of the PROM are determined by the pre-programmed information contained in the PROM as opposed to the address format presented at the inputs. Each clock cylce causes a new channel of information to be presented to the PROM, which is clocked in the 10 MHz, Mode, and Channel states. The rest of the time,

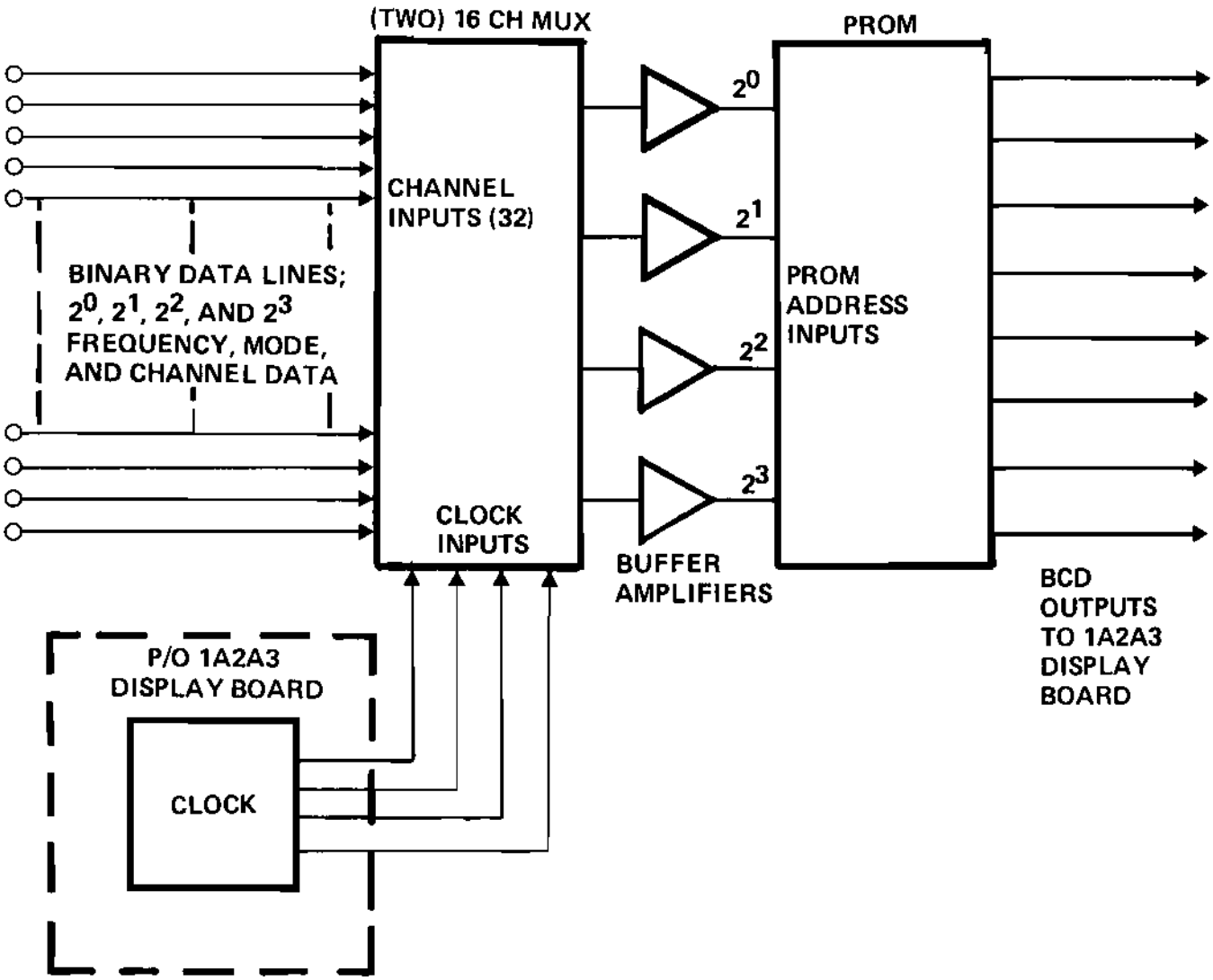


Figure 1. Interface Board Assembly Simplified Multiplexer Diagram

the PROM presents a particular BCD output corresponding to the decimal number represented by the frequency control lines (2^0, 2^1, etc.). These outputs are fed to the Display PWB for further decoding. The Interface Board also contains buffer amplifiers and control logic to accommodate the four channel control lines. These four lines, originating at the Channel Switch, are applied to U10 tri-state buffers, and then to U11 OR gates. When any of these four lines is high, the outputs of either U11A or U11B will also be high, causing the output of U4B to become low, in turn causing the output of U4C to go high, and sending the CHANNEL MODE signal to the Display Board. This also results in the output of U4D going high, sending the CHANNEL ENABLE signal to the Display Board as well. The Interface Board contains two voltage regulators; U12, which presents +5 Vdc to operate the digital circuitry, and U13, which is a variable regulator that is dependent upon the voltage presented at its control input via R35 (DIM control). The Interface Board also contains the Power Switch, which switches the primary +13.2 Vdc voltage to operate the transceiver. The assembly is also used for the purpose of jumpering numerous signal and control lines to/from the 1A1A11 Interconnect Board Assembly.

5. MAINTENANCE

All of the adjustments indicated in this paragraph have been performed at the factory prior to shipment. It should not be necessary to repeat any of these adjustments unless component failure is experienced, or unless the entire 1A2A2 assembly is replaced with a new printed circuit board. All of the adjustments may be performed by from the top of the assembly without the need of removing the front panel. However, should it become necessary to remove the 1A2A2 assembly, this may easily be accomplished simply by removing the front panel retaining screws of the transceiver. The entire 1A2 assembly (consisting of 1A2A1 Frequency Select Board, 1A2A2 Interface Board, and 1A2A3 Display Board) disconnects from the transceiver chassis for expedient servicing.

5.1 Adjustments

The following adjustments should be performed only after establishing proper receiver and transmitter operation of the RF-2301 (refer to paragraph 5.6 of Part V, Maintenance). These three adjustments establish the meter ranges for receive mode, forward transmitter power, and reflected transmitter power.

Receive "S-Meter" Adjustment

a. Set transceiver front panel controls to the following positions:

Frequency Select Switches	2.4000 MHz
Channel Switch	Select Freq
Volume Control	On position
Squelch Control	Off position
Coupler Bypass	Off position
Display Dim Control	Max intensity
Speaker Switch	On position
Mode Control	USB position

b. Connect RF signal generator to RF-2301 RF input connector (J5). Set generator to 2.4010 MHz at an output level of 100 uV.

c. Adjust R5 for S9 on meter. This should correspond to approximately 3.8 Vdc at TP2 (refer to Table 2).

FWD Power Adjustment

a. Disconnect signal generator from RF-2301; connect 50 ohm dummy load to RF output connector. Connect CW key to front panel jack. Set mode control to CW.

b. Depress CW key; transmitter should key, and full RF output power should be present.

c. Adjust R4 for 125 watts output on meter. This should correspond to a voltage of approximately 6.5 Vdc at TP6.

d. Disconnect CW key; connect supplied microphone to AUDIO connector.

REFL Power Adjustment

a. Disconnect 50 ohm dummy load from transceiver. Do not connect RF output to any external equipment (open circuit).

b. Connect CW key to front panel jack. Set mode control to CW position.

c. Move meter power switch to the REFLECTED position. Depress CW key while keeping meter switch in REFLECTED position.

d. Move meter switch back and forth between REFLECTED and FORWARD position, noting indication in each position. Adjust R2 until both indications are approximately the same. This should correspond approximately to 5.5 Vdc at TP3.

5.2 Test Points

Table 2 lists all 1A2A2 test points with respect to their individual functions and expected indications under particular conditions. For additional information, refer to Part V, Maintenance, paragraphs, 5.6, 5.7, 5.8.

Table 2. 1A2A2 Interface Assembly Test Points

Test Point	Description of Function/Description of Signal
TP1	Coupler Fault Indication (10V = coupler fault)
TP2	AGC Receive signal (no signal = 0.1 Vdc (100 uV input = 3.8 Vdc)
TP3	Reflected Power indication • Receive mode = 0 Vdc • 125 Watts into 50 ohm load = 0 Vdc • 125 Watts into open circuit = 5.5 Vdc
TP4	Synthesizer Fault Indication (10V = synthesizer fault)
TP5	PA Fault Indication (10V = PA Fault)
TP6	Forward power present (ACC) • Receive mode = 0 Vdc • 125 Watts into 50 ohm load = 6.5 Vdc • 50 Watts into 50 ohm load = 2.7 Vdc
TP7	Indicates selected operating frequency mode • Select Freq mode = 0 Vdc • Channel mode = 10 Vdc (note: pulses to 0 Vdc when either Prog Tx or Prog Rx cycle initiated)
TP8	DIM control voltage indication • Display off (multiplexer inhibited) = 2.6 Vdc • Display maximum intensity = 8.0 Vdc

Table 3. 1A2A2 Interface PWB Maintenance Parts List (10007-0220)

Ref. Desig.	Name & Description	Mfr. Code	Part Number
1A2A2	Interface PWB	14304	10007-0220
C1	Capacitor, Tant., 10 uF, 20 volt	14304	C25-0002-307
C2	Capacitor, Ceramic, 0.1 uF, 50 volt	14304	C11-0005-104
C3	Capacitor, Ceramic, 0.1 uF, 50 volt	14304	C11-0005-104
C4	Capacitor, 100 uF, 25 volt	14304	C-6468
C5	Capacitor, 0.1 uF, 20 volt	14304	C25-0002-301
C6	Capacitor, Ceramic, 0.01 uF, 50 volt	14304	C11-0005-103
C7	Capacitor, Tant., 10 uF, 20 volt	14304	C25-0002-307
C8	Capacitor, Tant., 10 uF, 20 volt	14304	C25-0002-307
C9	Capacitor, Tant., 10 uF, 20 volt	14304	C25-0002-307
C10	Capacitor, Tant., 10 uF, 20 volt	14304	C25-0002-307
C11	Capacitor, Tant., 1.0 uF, 20 volt	14304	C25-0002-301
C12	Capacitor, Ceramic, 0.1 uF, 50 volt	14304	C11-0005-104
C13	Capacitor, Elec., 220 uF, 16V	14304	C19-0003-221
CR1, CR2	Diode, 1N4454	14304	1N4454
CR3	Diode, 1N4454	14304	1N4454
CR4	Diode, 1N4454	14304	1N4454
CR5	Diode, 1N4454	14304	1N4454
CR6	Diode, 1N4454	14304	1N4454
E1	Pin, Connector	14304	MP-0287
E2	Pin, Connector	14304	MP-0287
E73	Pin, Connector	14304	MP-0287
J1	Header, Protected, 40 Pin	14304	J46-0013-040
J2	Header, Protected, 50 Pin	14304	J46-0013-050
J3	Header, Protected, 20 Pin	14304	J46-0009-020
L1	Choke, Toroidal	14304	10007-0246
Q1	Transistor, 2N4124	14304	2N4124
Q2	Transistor, 2N4124	14304	2N4124
Q3	Transsitor, 2N4124	14304	2N4124
R1	Resistor, 10K ohm, 1/4W, 5%	14304	RCR07G103JM
R2	Resistor, Variable, 5K ohm	14304	R-2227
R3	Resistor, 15K ohm, 1/4W, 5%	14304	RCR07G153JM
R4	Resistor, Variable, 5K ohm	14304	R-2227
R5	Resistor, Variable, 5K ohm	14304	R-2227
R6	Resistor, 100K ohm, 1/4W, 5%	14304	RCR07G104JM
R7	Resistor, 200K ohm, 1/4W, 5%	14304	RCR07G204JM
R8	Resistor, 100K ohm, 1/4W, 5%	14304	RCR07G104JM
R9	Resistor, 100K ohm, 1/4W, 5%	14304	RCR07G104JM
R10	Resistor, 200K ohm, 1/4W, 5%	14304	RCR07G204JM
R11	Resistor, 100K ohm, 1/4W, 5%	14304	RCR07G104JM
R12	Resistor, 200K ohm, 1/4W, 5%	14304	RCR07G204JM
R13	Resistor, 7.5K ohm, 1/8W, 1%	14304	RN55D7501F
R14	Resistor, 100K ohm, 1/4W, 5%	14304	RCR07G104JM
R15	Resistor, 390K ohm, 1/4W, 5%	14304	RCR07G394JM
R16	Resistor, 200K ohm, 1/4W, 5%	14304	RCR07G204JM
R17	Resistor, 100K ohm, 1/4W, 5%	14304	RCR07G104JM
R18	Resistor, 2.74K ohm, 1/8W, 1%	14304	RN55D2741F

Table 3. 1A2A2 Interface PWB Maintenance Parts List (10007-0220) (Continued)

Ref. Desig.	Name & Description	Mfr. Code	Part Number
R19	Resistor, 100K ohm, 1/4W, 5%	14304	RCR07G104JM
R20	Resistor, 470 ohm, 1/4W, 5%	14304	RCR07G471JM
R21	Resistor, 39K ohm, 1/4W, 5%	14304	RCR07G393JM
R22	Resistor, 39K ohm, 1/4W, 5%	14304	RCR07G393JM
R23	Resistor, 1 Meg ohm, 1/4W, 5%	14304	RCR07G105JM
R24	Resistor, 1 Meg ohm, 1/4W, 5%	14304	RCR07G105JM
R25	Resistor, 39K ohm, 1/4W, 5%	14304	RCR07G393JM
R26	Resistor, 1 Meg ohm, 1/4W, 5%	14304	RCR07G105JM
R27	Resistor, 2 Meg ohm, 1/4W, 5%	14304	RCR07G205JM
R28	Not Used		
R29	Resistor, 100K ohm, 1/4W, 5%	14304	RCR07G104JM
R30	Resistor, 100K ohm, 1/4W, 5%	14304	RCR07G104JM
R31	Resistor, Network, 100K ohm, 6 Pin	14304	R50-0006-104
R32	Resistor, Network, 100K ohm, 10 Pin	14304	R50-0010-104
R33	Resistor, Network, 100K ohm, 8 Pin	14304	R50-0008-104
R34	Resistor, 100K ohm, 1/4W, 5%	14304	RCR07G104JM
R35	Resistor, Network, 100K ohm, 10 Pin	14304	R50-0010-104
R36	Resistor, Network, 100K ohm, 10 Pin	14304	R50-0010-104
R37	Resistor, Network, 33K ohm	14304	R50-0006-333
R38, R39	Resistor, 33K ohm, 1/4W, 5%	14304	RCR07G333JM
R40	Resistor, 3.9 ohm, 1/2W, 5%	14304	RCR20G3R9JM
TP1	Test Point, Brown	14304	J60-0001-008
TP2	Test Point, Red	14304	J60-0001-002
TP3	Test Point, Orange	14304	J60-0001-006
TP4	Test Point, Yellow	14304	J60-0001-007
TP5	Test Point, Green	14304	J60-0001-004
TP6	Test Point, Blue	14304	J60-0001-010
TP7	Test Point, Violet	14304	J60-0001-012
TP8	Test Point, Grey	14304	J60-0001-013
U1	Integrated Circuit, SN74S471(PROM)	14304	10007-0240
U2	Integrated Circuit, CD4025AE	14304	IC-0143
U3	Integrated Circuit, CA324E	14304	I30-0003-000
U4	Integrated Circuit, CD4001AE	14304	IC-0135
U5	Integrated Circuit, CD4071BE	14304	I01-0000-023
U6	Integrated Circuit, CD4050AE	14304	IC-0261
U7	Integrated Circuit, CD4050AE	14304	IC-0261
U8	Integrated Circuit, CD4097BE	14304	I09-0004-000
U9	Integrated Circuit, CD4097BE	14304	I09-0004-000
U10	Integrated Circuit, MM80C97M	14304	I03-0004-000
U11	Integrated Circuit, CD4071BE	14304	I01-0000-023
U12	Integrated Circuit, Voltage Regulator, 340T	14304	I11-0001-000
U13	Integrated Circuit, Voltage Regulator, 317T	14304	IC-0358

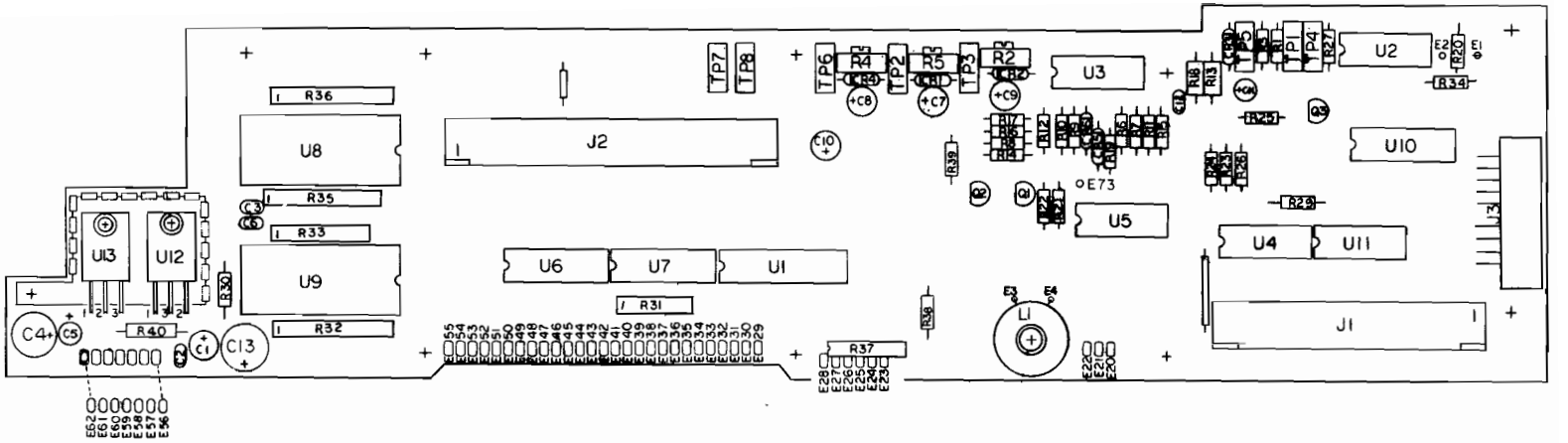
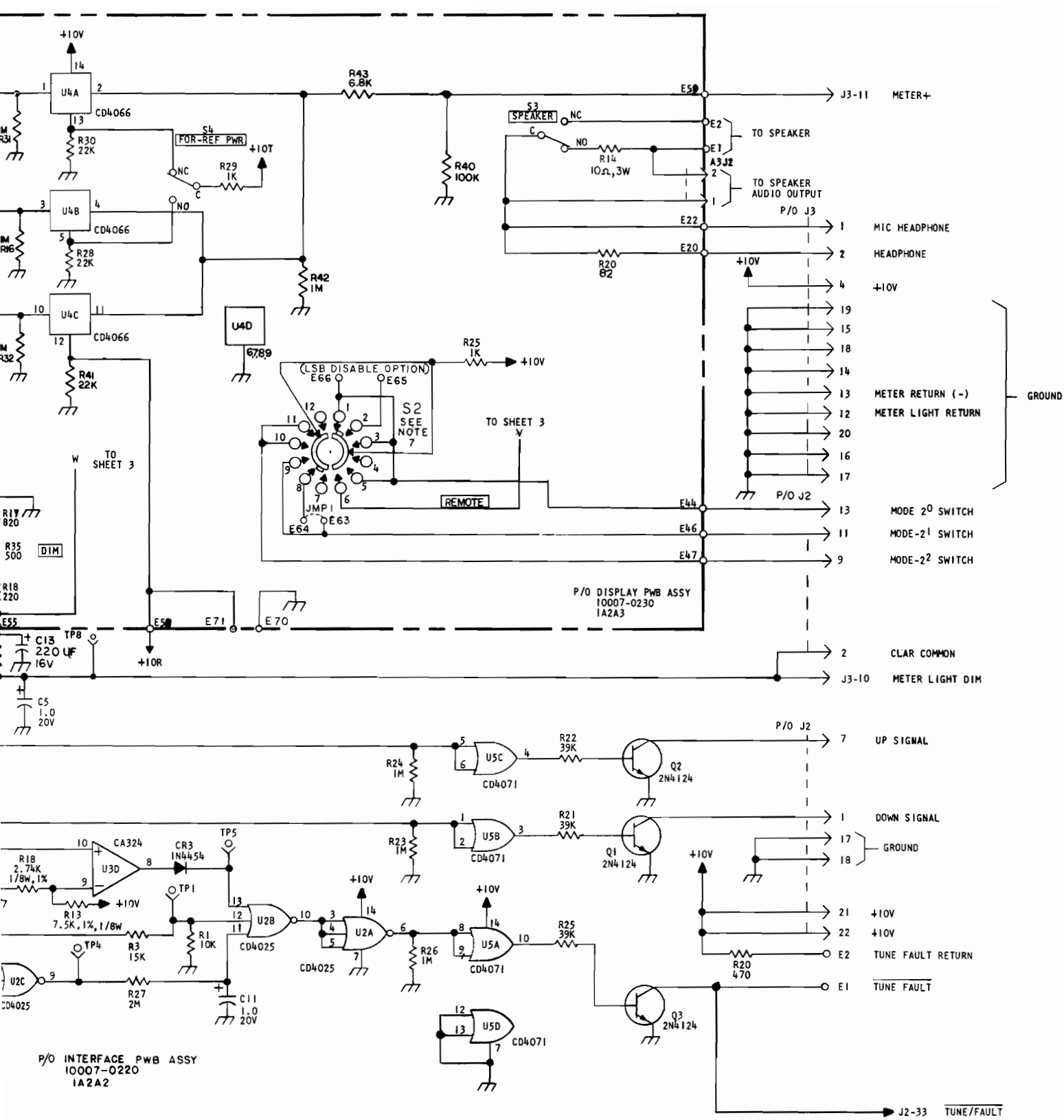


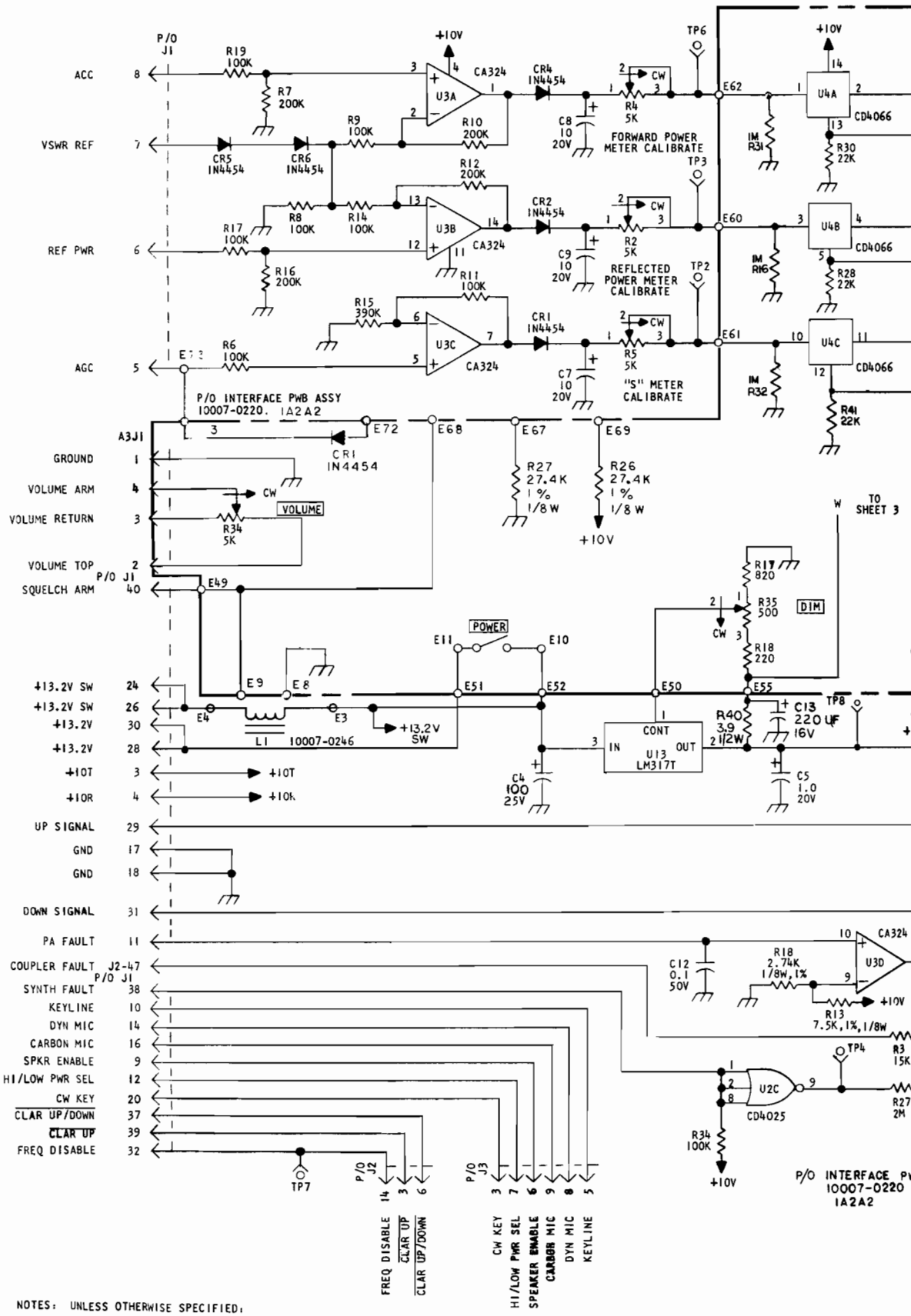
Figure 2. 1A2A2 Interface Board Assembly Component Locations



007-0200/0201 FRONT PANEL ASSY.

ED BETWEEN E63 AND E64. FOR THE
, LSB DISPLAY MUST BE DISABLED ON
ACCOMPLISHED BY REMOVING JMP 1
ALLING A JUMPER BETWEEN E66 AND

Figure 3. 1A2A2 Interface Board Assembly Schematic Diagram (10007-0221) (Sheet 1 of 3)



NOTES: UNLESS OTHERWISE SPECIFIED:

1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. FOR COMPLETE DESIGNATION, PREFIX WITH UNIT NUMBER AND/OR ASSEMBLY DESIGNATION.
2. RESISTOR VALUES ARE IN OHMS.
3. CAPACITOR VALUES ARE IN MICROFARADS.
4. VENDOR AND/OR JEDEC PART NUMBER CALLOUTS ARE FOR REFERENCE ONLY; COMPONENTS ARE SUPPLIED PER PART NUMBER IN PARTS LIST.
5. TERMINALS E20-E62 ARE ON BOTH THE 10007-0220 PWB ASSY AND THE 10007-0230 PWB ASSY. THERE ARE FLEX STRIP JUMPERS LOCATED BETWEEN THE TWO BOARDS TO CONNECT THE RESPECTIVE TERMINALS.
6. ▭ INDICATES FRONT PANEL MARKING.
7. S2 IS INSTALLED ON THE 10007-0200/0201 FRONT PANEL
8. JMP 1 IS NORMALLY INSTALLED BETWEEN E63 AND E64. OPTIONAL FILTER SELECTION, LSB DISPLAY MUST BE DISA THE FRONT PANEL. THIS IS ACCOMPLISHED BY REMOVING FROM E64 AND E63 AND INSTALLING A JUMPER BETWEEN E E65.

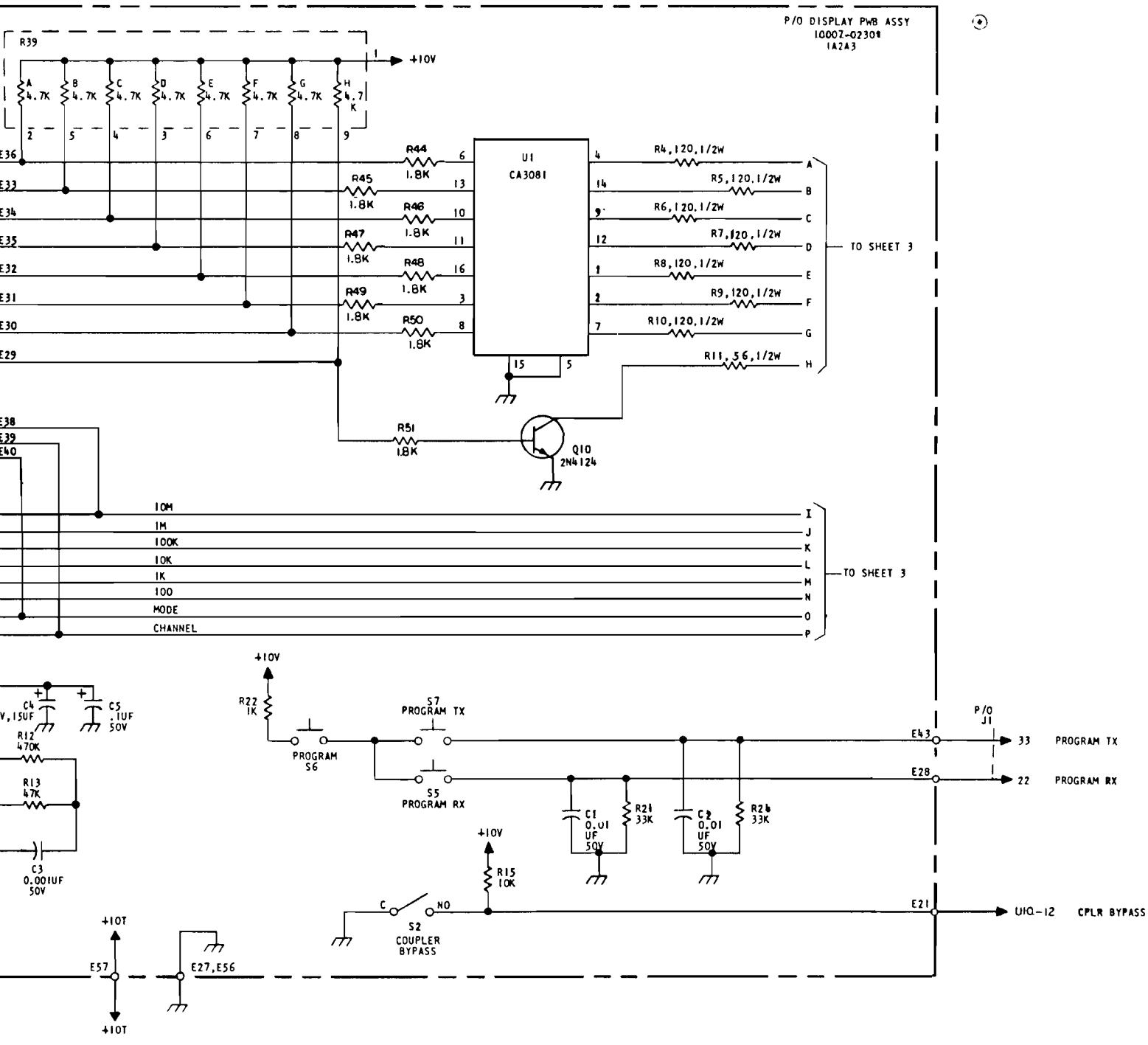
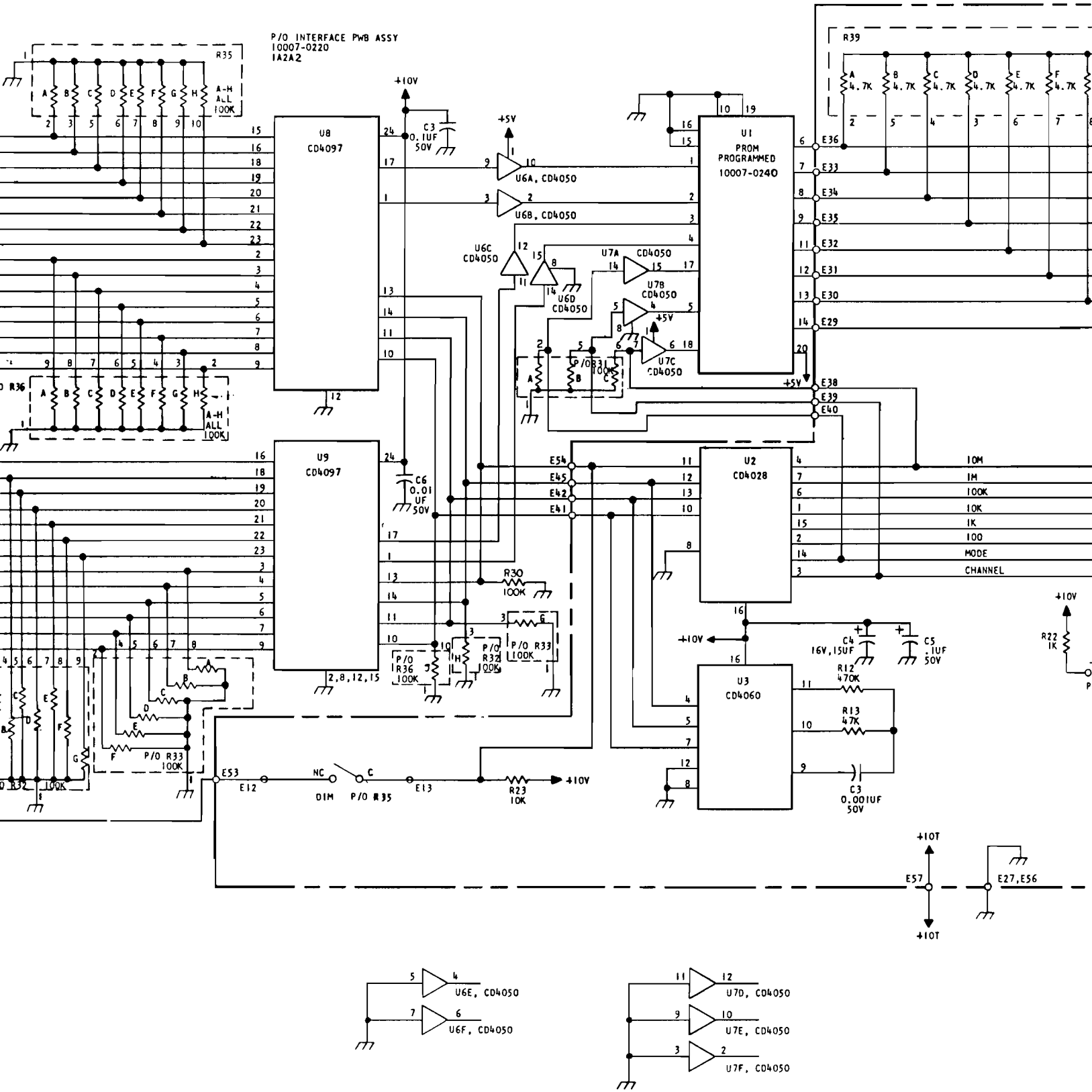


Figure 3. 1A2A2 Interface Board Assembly Schematic Diagram (10007-0221) (Sheet 2 of 3)


P/O INTERFACE PWB ASSY
10007-0220
1A2A2
R35
A-H ALL 100K
R36
A-H ALL 100K
R39
A 4.7K
B 4.7K
C 4.7K
D 4.7K
E 4.7K
F 4.7K
U8 CD4097
U9 CD4097
U1 PROM PROGRAMMED 10007-0240
U2 CD4028
U3 CD4060
U6A, CD4050
U6B, CD4050
U6C CD4050
U6D CD4050
U6E, CD4050
U6F, CD4050
U7A CD4050
U7B CD4050
U7C CD4050
U7D, CD4050
U7E, CD4050
U7F, CD4050
+10V
+5V
C3 0.1UF 50V
C6 0.01 UF 50V
C4 16V,15UF
C5 .1UF 50V
C3 0.001UF 50V
R30 100K
R12 470K
R13 47K
R22 1K
R23 10K
P/O R33 100K
P/O R32 100K
P/O R36 100K
P/O R31 100K
P/O R35
DIM
NC
C
E12
E13
E53
E54
E45
E42
E41
E36
E33
E34
E35
E32
E31
E30
E29
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100K
10K
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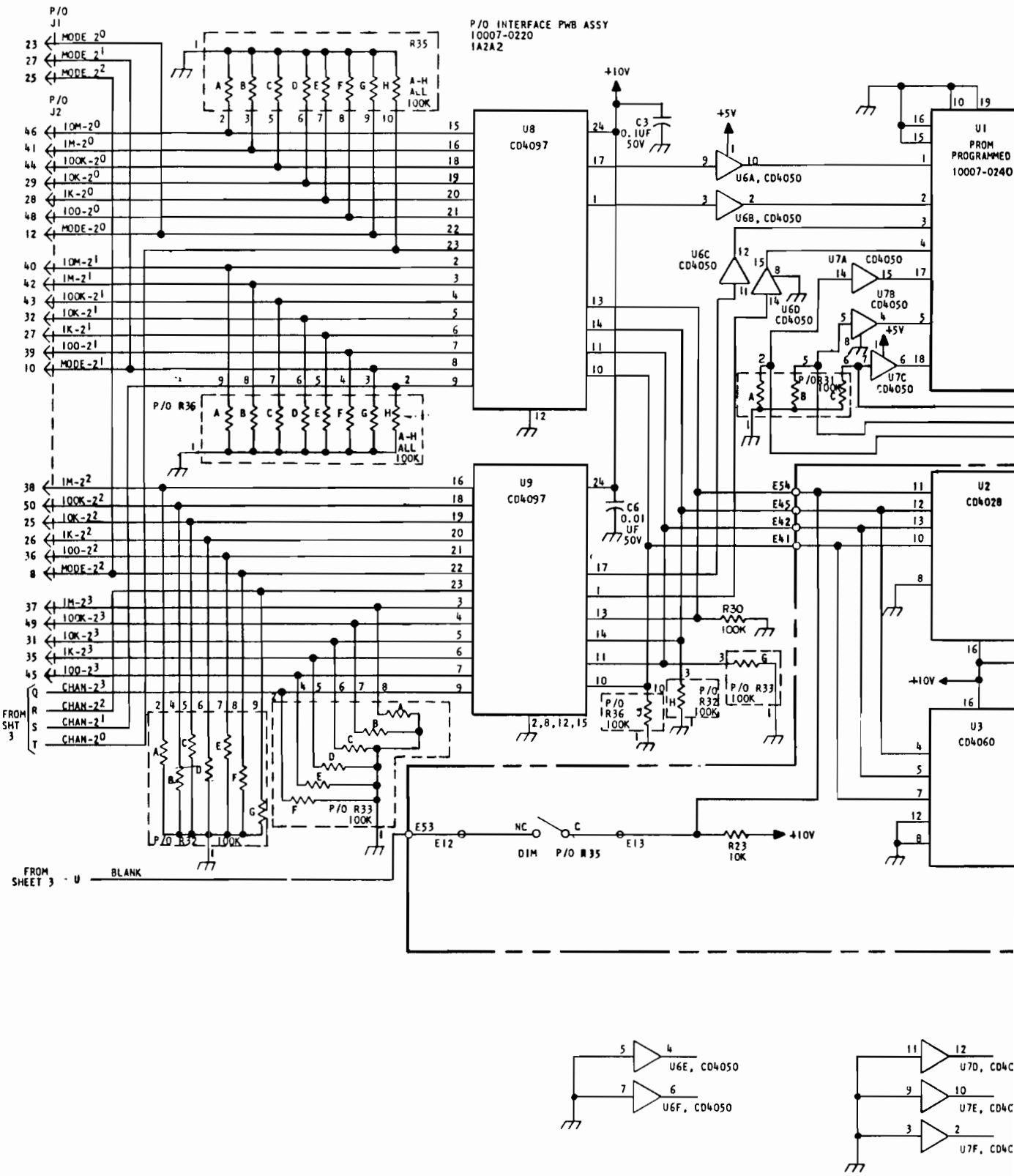
100
MODE
CHANNEL
+10T


P/O INTERFACE PWB ASSY
10007-0220
1A2A2
P/O J1
P/O J2
MODE 2^0
MODE 2^1
MODE 2^2
10M-2^0
1M-2^0
100K-2^0
10K-2^0
1K-2^0
100-2^0
MODE-2^0
10M-2^1
1M-2^1
100K-2^1
10K-2^1
1K-2^1
100-2^1
MODE-2^1
1M-2^2
100K-2^2
10K-2^2
1K-2^2
100-2^2
MODE-2^2
1M-2^3
100K-2^3
10K-2^3
1K-2^3
100-2^3
CHAN-2^3
CHAN-2^2
CHAN-2^1
CHAN-2^0
FROM SHT 3
R35
A-H ALL 100K
P/O R36
U8 CD4097
U9 CD4097
+10V
+5V
C3 0.1UF 50V
C6 0.01 UF 50V
U6A, CD4050
U6B, CD4050
U6C CD4050
U6D CD4050
U7A CD4050
U7B CD4050
U7C CD4050
P/O R31 100K
R30 100K
P/O R32 100K
P/O R33 100K
P/O R34 100K
P/O R36 100K
U1 PROM PROGRAMMED 10007-0240
U2 CD4028
U3 CD4060
E54
E45
E42
E41
E53
E12
E13
NC
C
DIM
P/O R35
R23 10K
FROM SHEET 3 - U
BLANK
U6E, CD4050
U6F, CD4050
U7D, CD4
U7E, CD4
U7F, CD4

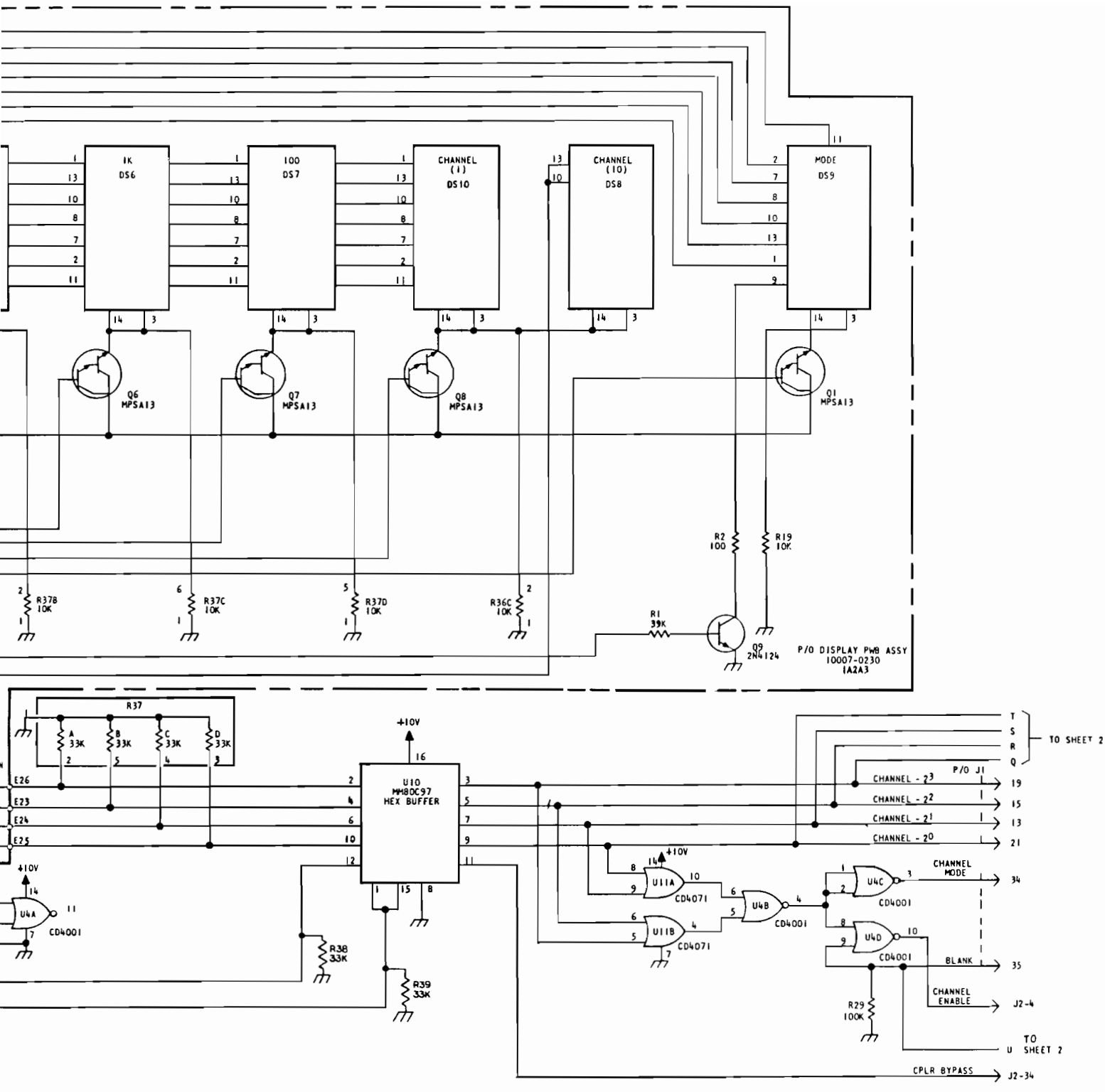
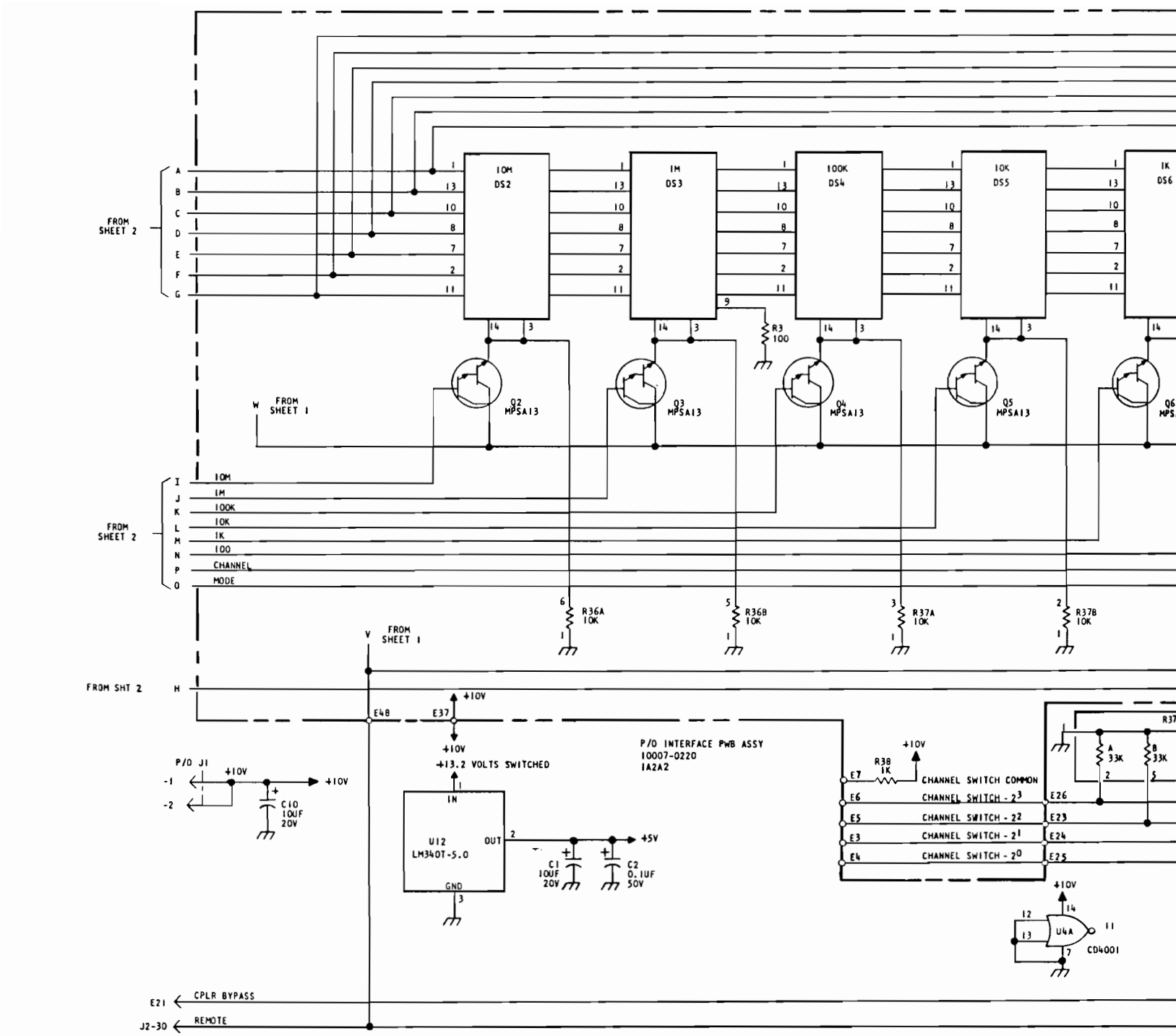


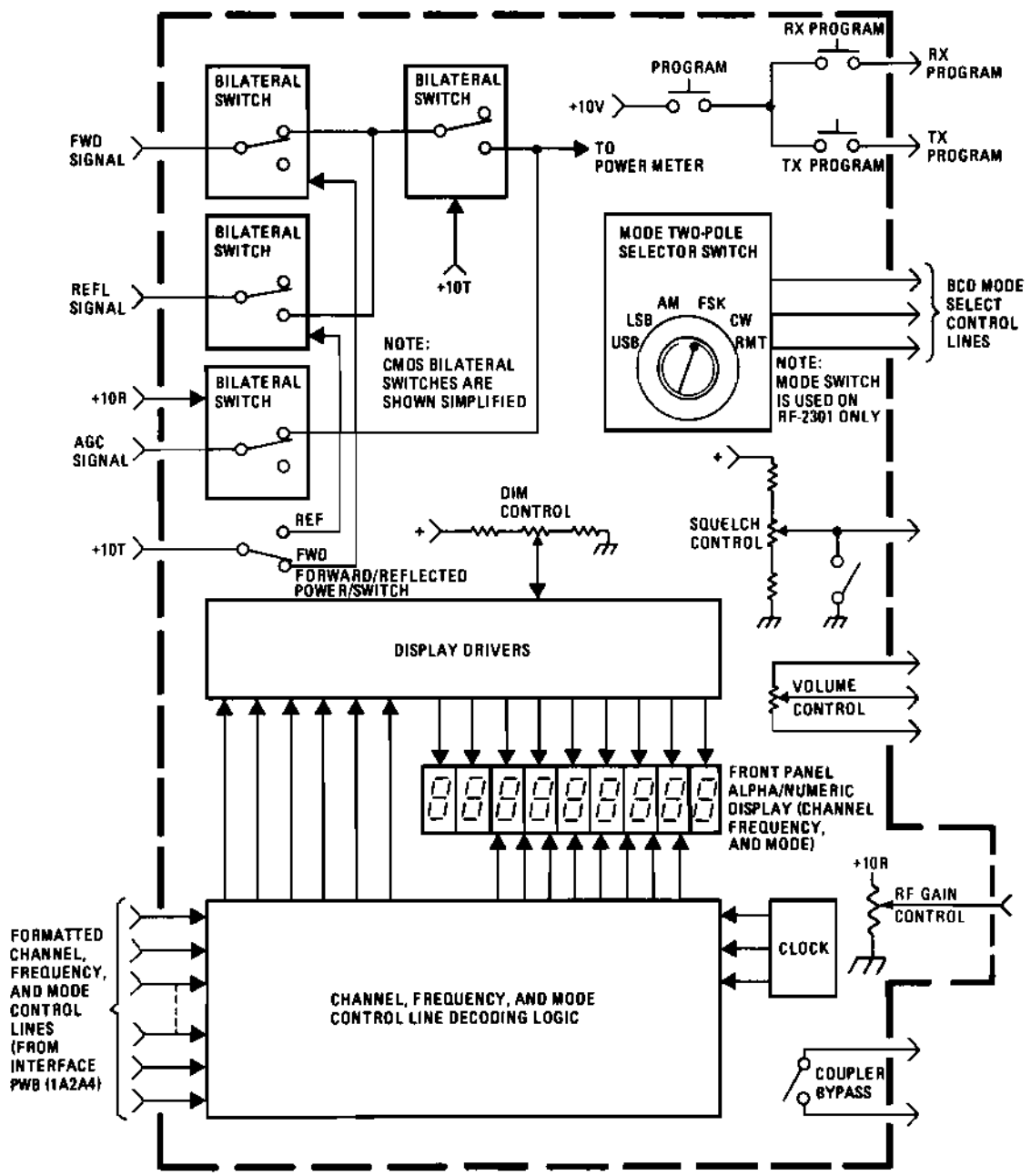
Figure 3. 1A2A2 Interface Board Assembly Schematic Diagram (10007-0221) (Sheet 3 of 3)


FROM SHEET 2
A
B
C
D
E
F
G
10M DS2
1M DS3
100K DS4
10K DS5
1K DS6
R3 100
Q2 MPSA13
Q3 MPSA13
Q4 MPSA13
Q5 MPSA13
W FROM SHEET 1
FROM SHEET 2
I
J
K
L
M
N
P
O
10M
1M
100K
10K
1K
100
CHANNEL
MODE
R36A 10K
R36B 10K
R37A 10K
R37B 10K
V FROM SHEET 1
FROM SHT 2
H
E48
E37
+10V
+13.2 VOLTS SWITCHED
P/O J1
-1
-2
C10 10UF 20V
U12 LM340T-5.0
IN
OUT
GND
C1 10UF 20V
C2 0.1UF 50V
+5V
P/O INTERFACE PWB ASSY 10007-0220 1A2A2
R38 1K
E7
E6
E5
E3
E4
CHANNEL SWITCH COMMON
CHANNEL SWITCH - 2^3
CHANNEL SWITCH - 2^2
CHANNEL SWITCH - 2^1
CHANNEL SWITCH - 2^0
E26
E23
E24
E25
A 33K
B 33K
U4A
CD4001
E21
CPLR BYPASS
J2-30
REMOTE

UNIT INSTRUCTIONS

DISPLAY BOARD

1A2A3



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DISPLAY BOARD 1A2A3

1. GENERAL INFORMATION

The 1A2A3 Display PWB Assembly performs a number of functions associated with many of the RF-2301 front panel controls and indicators. The assembly is mounted directly behind the front panel for accessability and ease of removal. Interconnections to/from the PWB are made via interface connectors J13, J14, J19, J20 and J22, as well as several hardwired connections to the Tune/Fault Indicator, the Channel Switch, and the front panel speaker.

2 TECHNICAL CHARACTERISTICS

Power Requirements:

+13.8 Vdc (switched)	J13-24, 26
+10 Vdc	J13-1, 2
Ground	J13-17, 18

Signal Inputs:

AGC Signal from 1A2A2	J13-5
REF PWR from 1A2A2	J13-6
VSWR REF from 1A2A2	J13-7
ACC Signal from 1A2A2	J13-8
DYN MIC from J1	J22-8
CAR MIC from J1	J22-9
CW KEY from J2	J22-20
SPEAKER Audio	J22-1, 2

Signal Outputs:

METER Output	J22-11
MIC Headphone	J22-1
SPEAKER Outputs	A3E6, E7

Control Inputs:

PA Fault	J13-11
HIGH/LO PWR Select	J13-12
UP Signal	J13-31
FREQ DISABLE	J13-32
DOWN Signal	J14-7
REMOTE	J14-30
Coupler Fault	J14-47
Synthesizer Fault	J13-38
Frequency, Mode, and Channel Binary Format Control Lines (see Figure 2; 1A2A3 Schematic Diagram).	

Control Outputs:

SPKR Enable	J13-9
Keyline	J13-10
CLAR UP	J14-6
CLAR DOWN	J14-39
TUNE FAULT	J14-33
Channel Mode	J13-34
Channel Enable	J14-4
Program TX	J13-33
Program RX	J13-22
Coupler Bypass	J14-34

Table 1. Semiconductor Complement

DS2	LED Display	N50-0002-000
Q1-Q8	Transistor	MPSA13
Q9-Q10	Transistor	2N4124
U1	NPN Array	CA3081
U2	BCD/Decimal	CD4028AE
U3	BCD/Counter	CD4060AE
U4	Quad Switch	CD4066AE

4. CIRCUIT DESCRIPTION

4.1 Power Meter Circuit

Analog voltages developed and rectified on the 1A2A2 Interface Assembly are applied to A2J1-8 (ACC), A2J1-7 (VSWR REF), A2J1-6 (REF PWR), and A2J1-5 (AGC), and are fed to the inputs of Quad Bilateral switches U4A, U4B, and U4C. These switches are controlled by a positive control signal applied to each switches control input. The outputs of U4A (ACC) and U4B (REF PWR) are tied together. These two switches are operated by the position of the FWD/REF switch on the front panel, activating the signal line appropriate for the switch position. The switched signal is applied to the input of the TX/RX switch, which is operated by the +10T voltage line. The output of U4D is tied to the output of U4C, which switches the AGC signal according ot the +10R voltage line. The result of this switching configuration is as follows: when the RF-2301 is in the receive mode, +10V is applied to U4C allowing the AGC signal to pass, whereas 0V is applied to U4D, preventing the ACC or REF PWR signals to pass. In the transmit mode, the reverse is true. Thus, in the receive

mode, the meter is controlled by the AGC signal, and in the transmit mode by either the ACC or the REF PWR signal, depending upon the position of the front panel switch..

4.2 Mode Switch

The Mode switch, mounted on the Front Panel assembly and wired to points on the 1A2A3 assembly, determines the operating mode of the transceiver. This switch provides four control outputs: MODE 2^0, 2^1, and 2^2, and REMOTE output, which activates Q9 to operate the LED display. The three binary outputs are applied to U8 and U9 of the 1A2A2 Interface PWB, and are eventually formatted and reapplied to U1, NPN Transistor array, to control the MODE LED Display, DS9.

4.3 Display Circuitry

BCD outputs from 1A2A2 PROM U1 are applied to Transistor Array U1 of the 1A3A3 assembly. These lines are applied in parallel to all LED displays, with the exception of single-digit display DS8. Each display is activated by a control signal generated by BCD to Decimal Decoder U2. When the output corresponding to any one particular display is activated (in sequence), the associated transistor (Q1-Q8) is in turn activated, turning on the display. Since the BCD Counter U3 is also clocking the 1A2A2 32-channel MUX, the displays operate in synchronization with the data presented at the output of 1A2A2 PROM U1. Hence, as soon as the display is deactivated, the next display is activated and is presented with the correct control information by the PROM. Clocking rate of the MUX/PROM/Display circuitry is approximately 600 Hz. Clock frequency is set by C3/R12/R13.

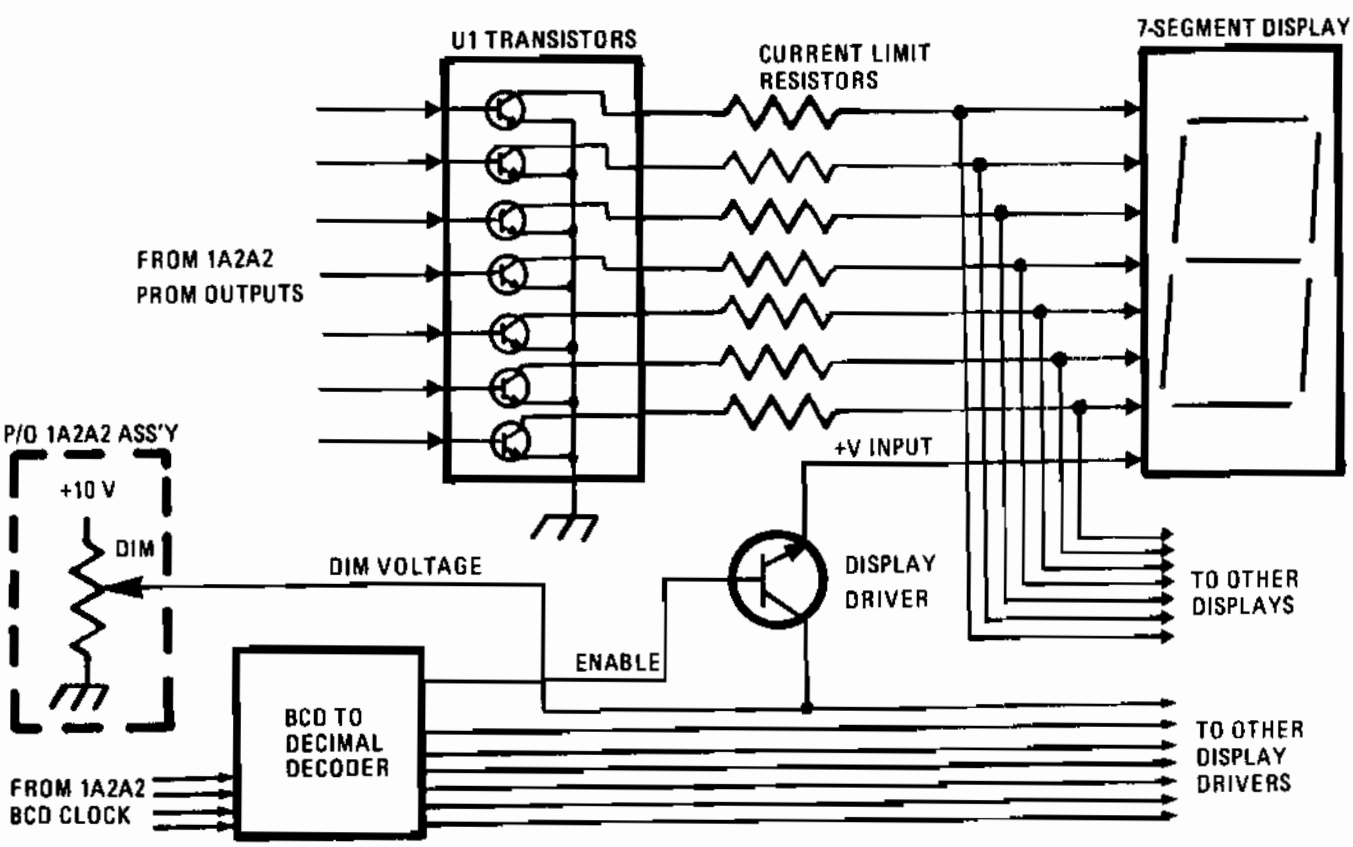


Figure 1. Simplified 1A2A3 Functional Diagram

5. MAINTENANCE

The 1A2A3 Display Board Assembly requires no periodic maintenance, nor does it require adjustment or alignment. Should it become necessary to perform component servicing on this assembly, the Display board may be easily removed from the transceiver by detaching the entire 1A2 Front Panel assembly from the unit. This is accomplished by removing the front panel retaining screws on the transceiver, placing the front panel face down, and removing the ten screws holding the 1A2A2 Interface PWB. The 1A2A3 Display board is held in place by ten M-F standoffs which feed through the 1A2A2 standoffs.

6. PARTS LIST

Table 2 lists all 1A2A3 Display PWB maintenance parts. All of these components may be located in Figure 2, which illustrates the positioning of the components on the PWB.

7. SCHEMATIC DIAGRAM

The 1A2A3 Display Board Assembly operates closely in conjunction with the 1A2A2 Interface Board Assembly. For this reason, the 1A2A3 schematic diagram has been included as part of the schematic diagram presented in the 1A2A2 Unit Instructions section.

Table 2. Display PWB Maintenance Parts List

Ref. Desig.	Name & Description	Mfr. Code	Part Number
1A2A3	Display PWB	14304	10007-0230
C1, C2	Capacitor, Ceramic, 0.01 uF, 50 volt	14304	C11-0005-103
C3	Capacitor, Ceramic, 0.001 uF, 50 volt	14304	C11-0005-102
C4	Capacitor, Ceramic, .1 uF, 50 volt	14304	C11-0005-104
C5	Capacitor, Tantalum, 15 uF, 16 volt	14304	C25-0005-307
CR1	Diode, Silicon	14304	1N4454
DS1	Not Used		
DS2	LED Display, Seven-segment	14304	N50-0002-000
DS3	LED Display, Seven-segment	14304	N50-0002-000
DS4	LED Display, Seven-segment	14304	N50-0002-000
DS5	LED Display, Seven-segment	14304	N50-0002-000
DS6	LED Display, Seven-segment	14304	N50-0002-000
DS7	LED Display, Seven-segment	14304	N50-0002-000
DS8	LED Display, Seven-segment	14304	N50-0002-000
DS9	LED Display, Seven-segment	14304	N50-0002-000
DS10	LED Display, Seven-segment	14304	N50-0002-000
J1	Connector, 4 Pin	14304	J42-0003-001
J2	Connector, 2 Pin, Right-Angle	14304	J46-0008-002
JMP1	Jumper, Molded	14304	MP-1142
Q1	Transistor, MPSA13	14304	Q-0076
Q2	Transistor, MPSA13	14304	Q-0076
Q3	Transistor, MPSA13	14304	Q-0076
Q4	Transistor, MPSA13	14304	Q-0076
Q5	Transistor, MPSA13	14304	Q-0076
Q6	Transistor, MPSA13	14304	Q-0076
Q7	Transistor, MPSA13	14304	Q-0076
Q8	Transistor, MPSA13	14304	Q-0076
Q9	Transistor, 2N4124	14304	Q-0385
Q10	Transistor, 2N4124	14304	Q-0385
R1	Resistor, 39K ohm, 1/4W, 5%	14304	R-1287
R2	Resistor, 100 ohm, 1/4W, 5%	14304	R-1225
R3	Resistor, 100 ohm, 1/4W, 5%	14304	R-1225
R4	Resistor, 120 ohm, 1/2W, 5%	14304	R-1427
R5	Resistor, 120 ohm, 1/2W, 5%	14304	R-1427
R6	Resistor, 120 ohm, 1/2W, 5%	14304	R-1427
R7	Resistor, 120 ohm, 1/2W, 5%	14304	R-1427
R8	Resistor, 120 ohm, 1/2W, 5%	14304	R-1427
R9	Resistor, 120 ohm, 1/2W, 5%	14304	R-1427
R10	Resistor, 120 ohm, 1/2W, 5%	14304	R-1427
R11	Resistor, 56 ohm, 1/2W, 5%	14304	R-1419
R12	Resistor, 470K ohm, 1/4W, 5%	14304	R-1313
R13	Resistor, 47K ohm, 1/4W, 5%	14304	R-1289
R14	Resistor, 100 ohm, wire-wound, 3 watt	81349	RW69V100
R15	Resistor, 10K ohm, 1/4W, 5%	14304	R-1273
R16	Resistor, 1 MEG ohm, 1/4W, 5%	14304	R-1321
R17	Resistor, 820 ohm, 1/4W, 5%	14304	R-1247
R18	Resistor, 220 ohm, 1/4W, 5%	14304	R-1233
R19	Resistor, 10K ohm, 1/4W, 5%	14304	R-1273
R20	Resistor, 82 ohm, 1/4W, 5%	14304	RCR07G820JM

Table 2. Display PWB Maintenance Parts List (Continued)

Ref. Desig.	Name & Description	Mfr. Code	Part Number
R21	Resistor, 33K ohm, 1/4W, 5%	14304	R-1285
R22	Resistor, 1K ohm, 1/4W, 5%	14304	R-1249
R23	Resistor, 10K ohm, 1/4W, 5%	14304	R-1273
R24	Resistor, 33K ohm, 1/4W, 5%	14304	R-1285
R25	Resistor, 1K ohm, 1/4W, 5%	14304	R-1249
R26	Resistor, 27.4K ohm, 1/4W, 1%	14304	RN55D2742F
R27	Resistor, 27.4K ohm, 1/4W, 1%	14304	RN55D2742F
R28	Resistor, 22K ohm, 1/4W, 5%	14304	R-1281
R29	Resistor, 1K ohm, 1/4W, 5%	14304	R-1249
R30	Resistor, 22K ohm, 1/4W, 5%	14304	R-1281
R31	Resistor, 1 MEG ohm, 1/4W, 5%	14304	R-1321
R32	Resistor, 1 MEG ohm, 1/4W, 5%	14304	R-1321
R34	Resistor, Variable, 5K ohm, Log Taper	14304	10007-0244
R35	Resistor, Variable (DIM)	14304	10007-0242
R36	Resistor, Network, 10K ohm, 6 Pin	14304	R50-0006-103
R37	Resistor, Network, 10K ohm, 6 Pin	14304	R50-0006-103
R38	Resistor, 1K ohm, 1/4W, 5%	14304	R-1249
R39	Resistor, Network, 4.7K ohm, 10 Pin	14304	R50-0010-472
R40	Resistor, 100K ohm, 1/4W, 5%	14304	R-1297
R41	Resistor, 22K ohm, 1/4W, 5%	14304	R-1281
R42	Resistor, 1 MEG, 1/4W, 5%	14304	R-1321
R43	Resistor, 6.8K ohm, 1/4W, 5%	14304	R-1269
R44	Resistor, 1.8K, 1/4W, 5%	14304	R-1255
R45	Resistor, 1.8K, 1/4W, 5%	14304	R-1255
R46	Resistor, 1.8K, 1/4W, 5%	14304	R-1255
R47	Resistor, 1.8K, 1/4W, 5%	14304	R-1255
R48	Resistor, 1.8K, 1/4W, 5%	14304	R-1255
R49	Resistor, 1.8K, 1/4W, 5%	14304	R-1255
R50	Resistor, 1.8K, 1/4W, 5%	14304	R-1255
R51	Resistor, 1.8K, 1/4W, 5%	14304	R-1255
S1	Not Used		
S2	Switch, SPDT	14304	S10-0113-001
S3	Switch, SPDT	14304	S10-0113-001
S4	Switch, Momentary SPDT	14304	S10-0113-002
S5	Switch, Push-button	14304	S06-0003-002
S6	Switch, Push-button	14304	S06-0003-002
S7	Switch, Push-button	14304	S06-0003-002
U1	Integrated Circuit, CA3081	14304	IC-0435
U2	Integrated Circuit, CD4028AE	14304	IC-0257
U3	Integrated Circuit, CD4060AE	14304	IC-0385
U4	Integrated Circuit, 4066B, Plastic	14304	I01-0000-253

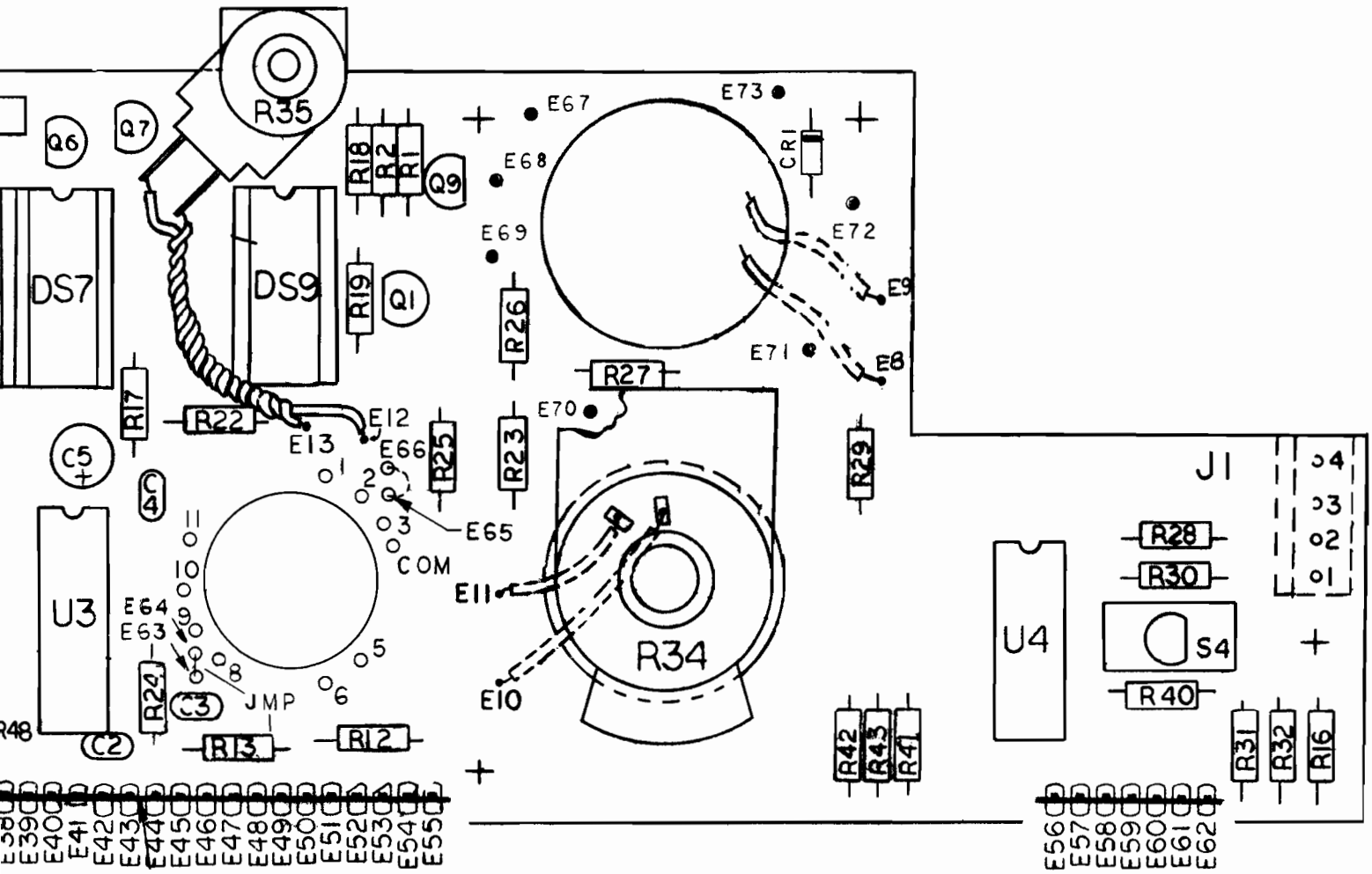
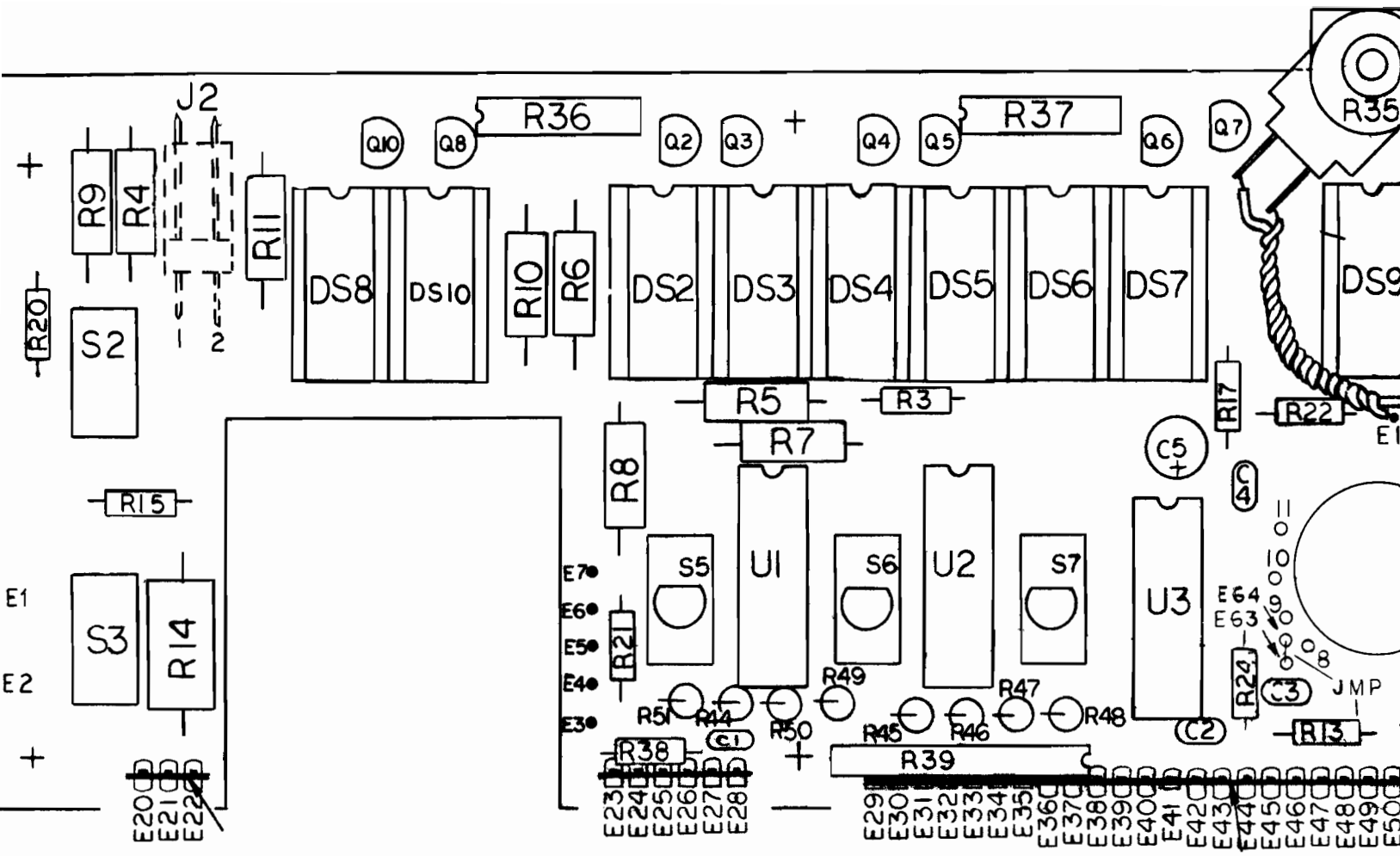


Figure 2. 1A2A3 Component Locations


J2
R36
R37
R35
Q10
Q8
Q2
Q3
Q4
Q5
Q6
Q7
R9
R4
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R10
R6
DS8
DS10
DS2
DS3
DS4
DS5
DS6
DS7
DS9
R20
S2
R5
R3
R7
R17
R22
C5
R8
R15
S5
U1
S6
U2
S7
U3
E64
E63
JMP
E1
E2
S3
R14
E7
E6
E5
E4
E3
R21
R49
R51
R44
C1
R50
R47
R48
R45
R46
R24
C3
C2
R13
R38
R39
E20
E21
E22
E23
E24
E25
E26
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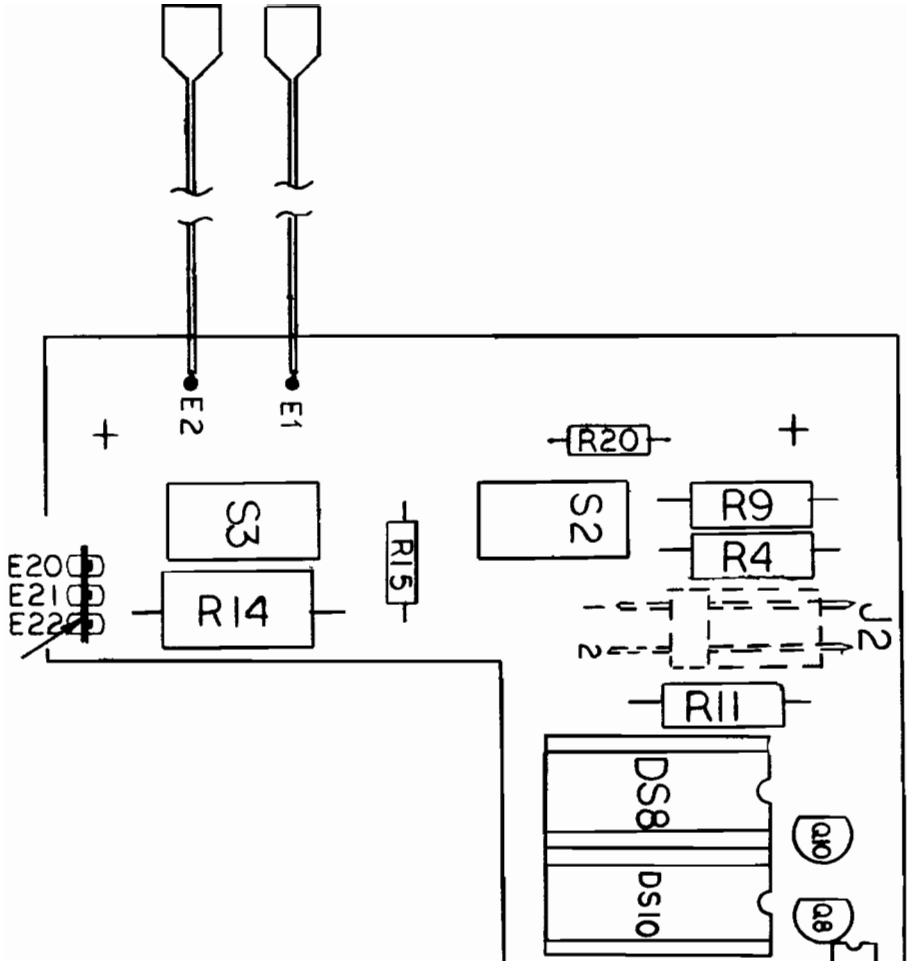
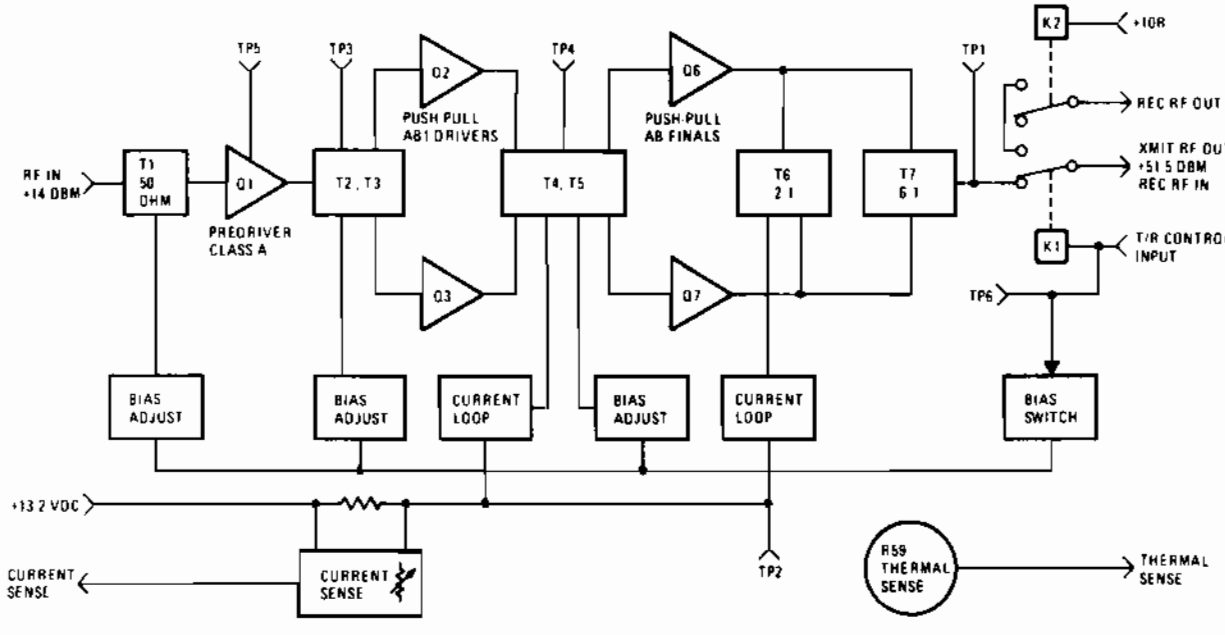
E49
E50


E2
E1
R20
S3
S2
R9
R4
R15
E20
E21
E22
R14
J2
R11
DS8
DS10
Q10
Q8

UNIT INSTRUCTIONS

POWER AMPLIFIER PC BOARD

1A3A1



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1. GENERAL DESCRIPTION

The all solid state power amplifier accepts the +14 dBm RF Drive Input from 1A1A4 and provides a nominal 36.5 dB amplification to produce the final >125 watt output to the PA Filters and the antenna system. Receive/transmit signal paths are controlled by K1 & K2 to route the antenna input directly to the Mixer in receive mode, and to connect the PA output to the antenna (thru the PA Filters) in the transmit mode. A control voltage analogous to total power amplifier current is also developed on this assembly and fed to 1A1A4 to effect power control.

2. TECHNICAL CHARACTERISTICS

Power Inputs:
+13.8 Vdc
+10 Vdc

Power Outputs:
+13.8 Vdc to front panel

Control Inputs:
T/R Relay Control gnd
+10R K2 control

Control Outputs.
Thermal Sense Analog voltage to 1A1A3
Current Sense Analog voltage to 1A1A3

Signal Inputs:
+14.5 dBm PA drive from 1A1A3
Rec RF In From 1A3A1-J1

Signal Outputs:
+51.5 dBm PA Output to 1A1A1
Rec RF Out To 1A1A6

3. SEMICONDUCTOR COMPLEMENT

REF. DESIG.	TYPE	DESCRIPTION
CR1	1N4004	Diode, Rectifier
CR2	1N4720	Diode, Rectifier
CR3	1N4004	Diode, Rectifier
CR4, CR5	1N4454	Diode, Signal
CR6	1N4004	Diode, Rectifier
CR7, CR8	1N4454	Diode, Signal
CR9, CR10	1N4004	Diode, Rectifier
CR12	1N4720	Diode, Rectifier
CR13	1N4004	Diode, Rectifier
CR14	MR5005R	Diode, Reverse Polarity
CR16	1N4004	Diode, Rectifier
CR17, CR18	1N4454	Diode, Signal
Q1	6628-1126	Transistor, NPN
Q2, Q3	6628-1177	Transistor, NPN
Q4	MJE1100	Darlington, NPN
Q5	2N4124	Transistor, NPN
Q6, Q7	6628-1175	Transistor, NPN
Q8	MJF1100	Darlington, NPN
Q9	2N4124	Transistor, NPN
Q10	MJE1090	Darlington, NPN
Q11	2N4124	Transistor, NPN
VR1	BZY88-C5V1	Diode, Zener 5.1V
VR3	MC7808CT	Regulator, Voltage, 8 V

4. FUNCTIONAL DESCRIPTION

Figure 1 is a detailed diagram of the Power Amplifier Assembly showing functional relationships of all major elements. Refer to the complete schematic diagram of the end of this section for circuit details. The nominal signal input level at J6 is +14.5 dBm. This input level from the 1A1A3 PA Control Board should drive the amplifier to full rated output. The transmit RF Output level at J7 will be greater than 125 watts for a normally functioning system. The output at J7 is not directly to the 50 ohm antenna system, but rather to PA Filter No. 1, or for bands 2, 3, and 4, to PA Filter No. 2 via PA Filter No. 1. The PA Filter transmit output is routed back through P2 on the PA Assembly, and via coaxial to J1. J1 is the 50 ohm interface with the antenna system. The antenna system will normally comprise an antenna coupler and a suitable radiating element.

4.1 Pre-Driver

Q1 is operated as a class A amplifier and functions to introduce approximately 12.5 dB gain to the nominal +14.5 dBm input. All amplifier stages are broad-banded so that no tuning is required. Pre-Driver operating parameters are established by adjusting R9 for a 0.43 Vdc indication at TP5. Notice on figure 1 that each stage has a convenient test output. Assuming full rated output, the test point level at TP3 should be approximately 5.7 Vdc. This level corresponds to a signal level of +27 dBm.

4.2 Driver

Q2 and Q3 operate in class AB as the driver amplifier. With +27 dBm input from the predriver, this stage will introduce approximately 13 dB gain to provide a +40 dBm drive level to the final amplifiers. Driver amplifier parameters are established by adjusting R20 for 250 mV across R62 (with the R62 current shunt temporarily removed). Driver output can be measured at TP4. The test point voltage at this point is a detected sample of the driver output and is analogous to the signal level. At full power output this level should be approximately 11.8 Vdc.

4.3 Final Amplifier

Q6 and Q7 are the class AB final amplifiers, and introduce the final 11 dB gain to increase the output signal level to greater than 125 watts. Final amplifier operating parameters are established by bias adjust potentiometer R40. This level is adjusted by temporarily removing the shunt across R63 and adjusting R40 until the voltage drop across R63 is exactly 300 mV.

CAUTION

Do not use a grounded voltmeter for this adjustment. An accurate VOM such as a Simpson 260 should be satisfactory.

TP1 is the final amplifier output test point, and like for the predriver and driver output test points this is an analog voltage representative of the detected sample, in this case from Q9. At full power this test point voltage will be approximately 11.7 Vdc.

4.4 T/R Relay Control

Transmit/Receive Relay K1 is controlled by the voltage at P1-5. With this line low the coil of K1 will energize thru CR16, to ground. This line will read +13.8 Vdc when unkeyed, and one diode drop above ground when keyed. This same control ground will bias ON Q10 to effect bias control for the predriver, driver, and final amplifiers. In the receive position, note that K1 is deenergized and that K2 is energized by +10R and thus will route the incoming receive signal to the 1A1A6 Mixer PC Board.

4.5 Current Limit

Power Amplifier current loading is monitored by U1, an NPN/PNP transistor array configured to produce a "current sense output" proportional to the voltage drop across R56, the .005 ohm 10 watt resistor in series with the +13.8 Vdc supply line to the PA. The sense output level can be adjusted by R49. R49 is adjusted so that current cutback action will start simultaneous with a 165 mV voltage drop across R56.

4.6 Thermal Sense

RT1 is mounted to the PA heatsink to monitor PA operating temperature. The resistance of RT1 is nominally 119 K ohms, and will change as a function of temperature so that at 105°C, the resistance drops to 5K ohms (the point at which power cutback would start). If the temperature should increase to 115°C, the resistance of RT1 would drop to 3.6K ohm, and at this point the thermal sense output voltage would shut off the transmitter. This control is adjusted at 1A1A3.

5. MAINTENANCE

Power Amplifier performance can be measured using test point data shown in figure 2. TP5 and TP6 measurements can only be made by lowering the assembly as shown in figure 2. These test points can be identified on component location diagram figure 3. Table 1 gives a complete input/output summary for the assembly. All tests and adjustments in the following paragraphs have been made at the factory and should not be reaccomplished unless required by associated circuit changes.

5.1 Test Setup

Terminate the transmitter output (J1) in a 50 ohm dummy load for all of these tests. Install a Bird thru-line wattmeter (or equivalent) in series with the output for these tests.

5.2 Bias Adjustments

This procedure involves gaining access to 1A3A1 PC Board components, and as a consequence, the rear panel PA Assembly must be removed as shown in figure 2. The transmitter can be safely operated in this manner for short periods.

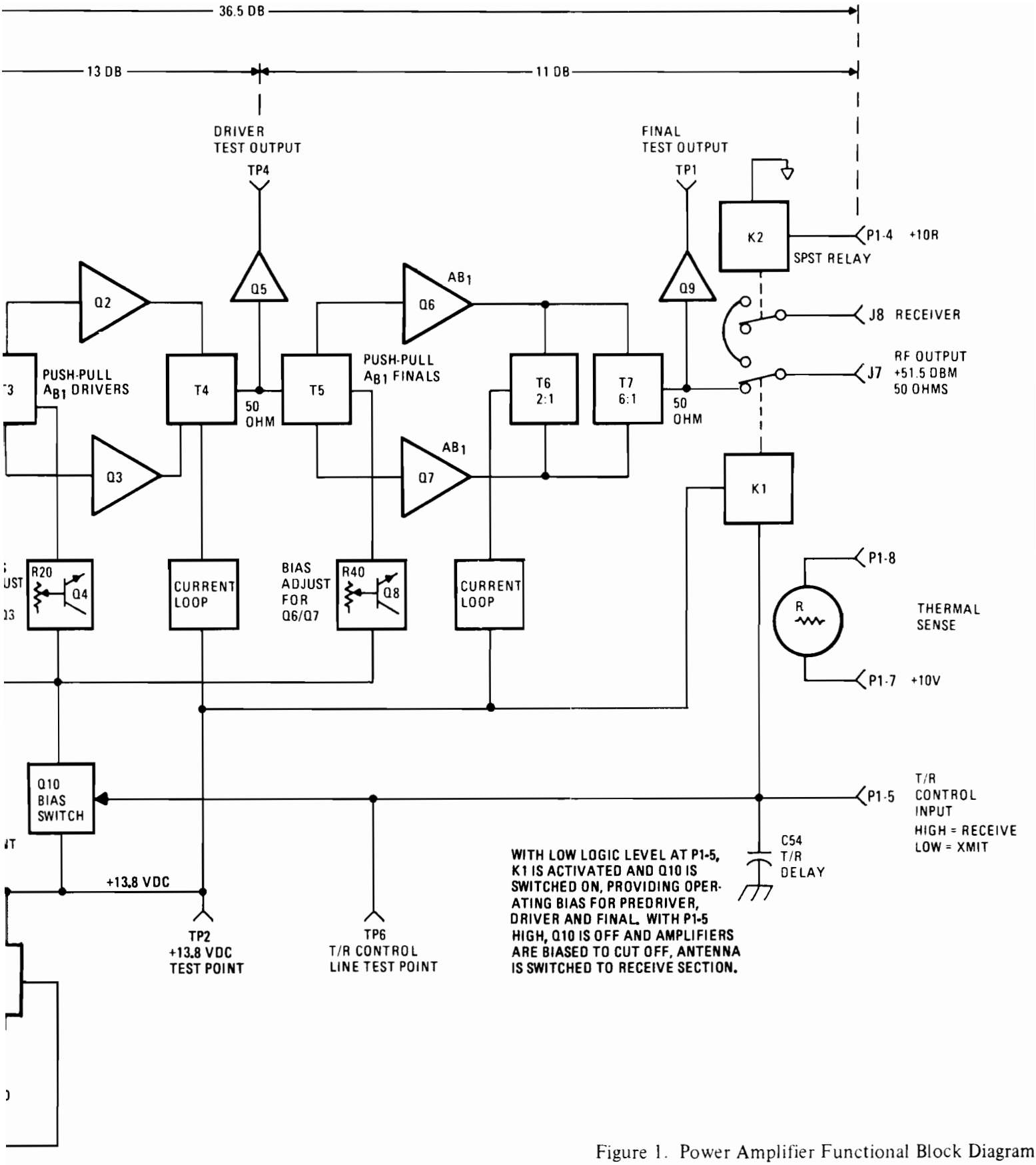
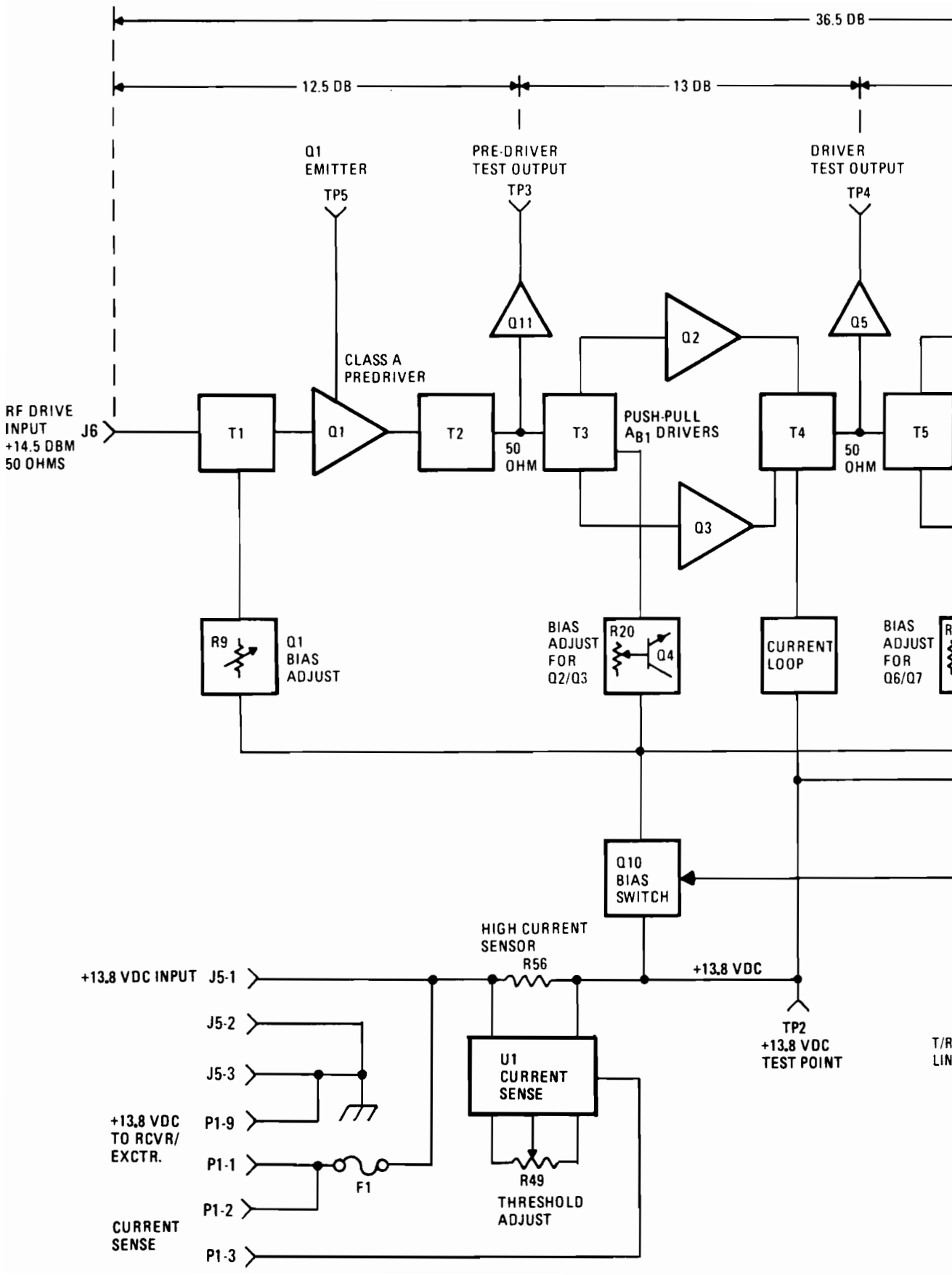


Figure 1. Power Amplifier Functional Block Diagram


36.5 DB
12.5 DB
13 DB
Q1
EMITTER
TP5
PRE-DRIVER
TEST OUTPUT
TP3
DRIVER
TEST OUTPUT
TP4
Q11
Q2
Q5
CLASS A
PREDRIVER
RF DRIVE
INPUT
+14.5 DBM
50 OHMS
J6
T1
Q1
T2
50
OHM
T3
PUSH-PULL
A_{B1} DRIVERS
T4
50
OHM
T5
Q3
R9
Q1
BIAS
ADJUST
BIAS
ADJUST
FOR
Q2/Q3
R20
Q4
CURRENT
LOOP
BIAS
ADJUST
FOR
Q6/Q7
Q10
BIAS
SWITCH
HIGH CURRENT
SENSOR
R56
+13.8 VDC INPUT
J5-1
+13.8 VDC
TP2
+13.8 VDC
TEST POINT
J5-2
J5-3
U1
CURRENT
SENSE
+13.8 VDC
TO RCVR/
EXCTR.
P1-9
P1-1
F1
R49
THRESHOLD
ADJUST
P1-2
CURRENT
SENSE
P1-3

CAUTION

When operating the PA in an exposed position, as described in this procedure, be very careful to verify all inter-and terminating connections, and a general safe test setup.

a. With the PA component board exposed, locate TP5 and connect a VOM.

b. Select any operating channel, USB mode, and verify no audio input.

c. With properly terminated transmitter (50 ohm load at output), key transmitter and adjust R9 for 0.43 Vdc at TP5. This completes predriver bias adjustment. Temporarily unkey transmitter.

d. Temporarily remove the current shunt bypassing R62 (see component location diagram for details), and connect an ungrounded voltmeter to measure the voltage drop between these two points (across R62).

e. Key transmitter (USB, no modulation) and adjust R20 for 250 mV across R62. There should be 250 mA flowing thru R62 when properly adjusted.

f. This completes the driver bias adjustment, unkey transmitter and replace R62 current shunt.

g. Temporarily remove the final amplifier current shunt bypassing R63 and connect a voltmeter (ungrounded) to measure the voltage drop between these two points (across R63).

h. Key transmitter (USB, no modulation) and adjust R40 for 300 mV across R63. (There should be 1.5 A flowing through R63 when properly adjusted.)

i. This completes final amplifier bias adjustment, unkey transmitter and replace R63 current shunt.

Note

If current limit adjustment is to be made, do not reassemble PA.

NOMINAL DC VOLTAGES AT TEST POINTS

TEST POINT	@ 125W OUTPUT	DESCRIPTION
TP1	11.7 VDC	FINAL AMPL OUTPUT
TP2	13.8 VDC	B+ TEST
TP3	5.7 VDC	PRE DRIVER OUTPUT
TP4	11.8 VDC	DRIVER OUTPUT
TP5	.43 VDC	PREDRIVER BIAS
TP6	0 KEY	KEYLINE

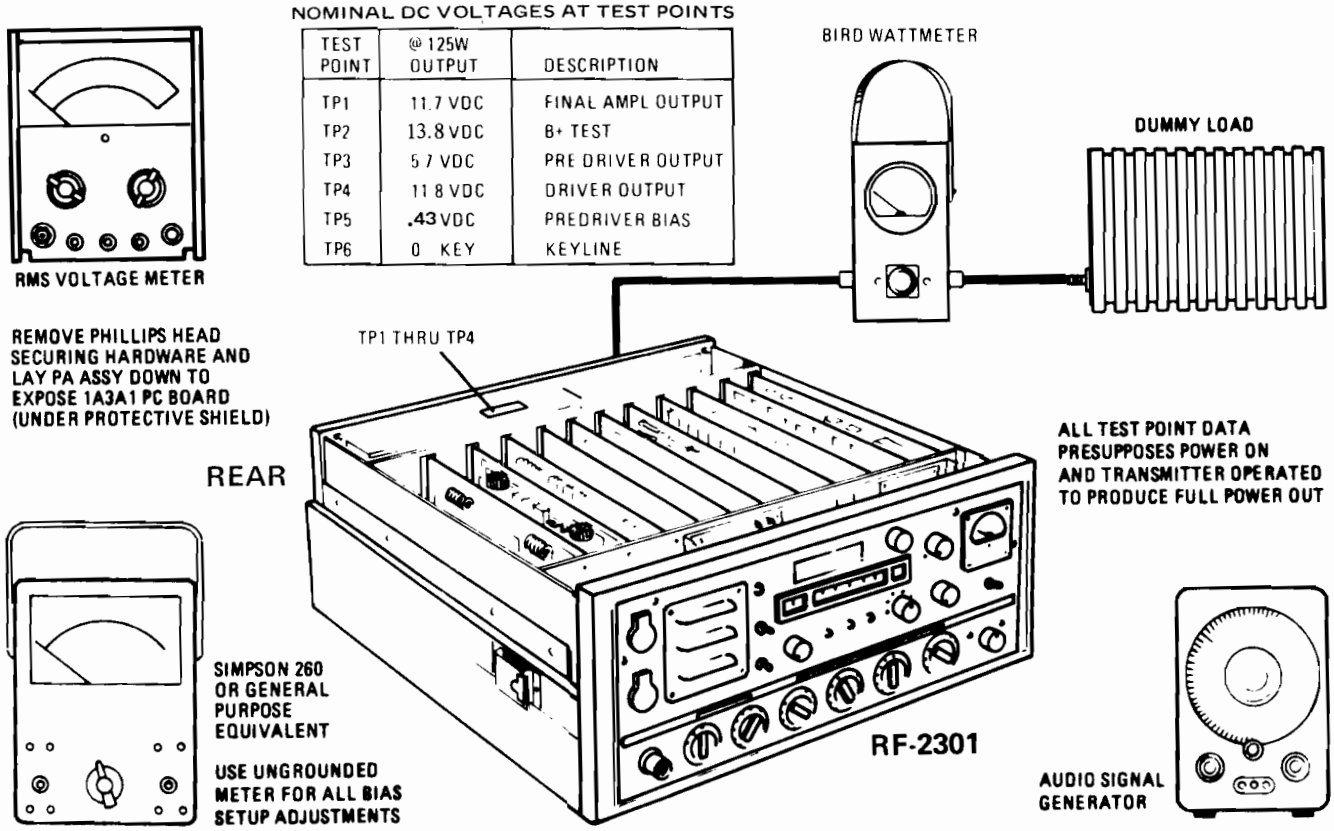


Figure 2. Power Amplifier Tests and Adjustments

Table 1. Input/Output Summary

Connector	Function	To/From General
P1-1	+13.8 Vdc	6 Amp fused output to front panel
P1-2	+13.8 Vdc	6 Amp fused output to front panel
P1-3	Current Sense	0 5V analog voltage to 1A1A3
P1-4	+10R	K2 control
P1-5	T/R Relay	K1 control ground
P1-6	N/C	
P1-7	+10 Vdc	Thermistor B+
P1-8	Thermal Sense	Thermal analog voltage to 1A1A3
P1-9	Gnd	
P2	RF IN/OUT	Via 1A1A11 to 1A1A1 PA Filters (from J1)
J1*	RF IN/OUT	To Antenna System (from 1A1A1 via P2)
J2	Audio Remote Control Conn.	Located on 1A3A2 Assy
J3	Remote Control Conn.	Mounted on Rear Panel
J1	Antenna Coupler Conn.	
J5-A*	+13.8 Vdc	Primary Power IN from external power source
J5-B*	+24Vdc IN	From external power source
J5-C*	Gnd	
J5-D*	Reduced Voltage Control	To external power source
J5-E*	Fan Control	To external power source
1A3A1-J6	RF IN +14 dBm	Transmit RF IN from 1A1A3
1A3A1-J7	RF OUT +51.5 dBm	Transmit RF OUT to 1A1A1 (Receive RF IN from 1A1A1)
1A3A1-J8	Receive RF	Receive RF Out to 1A1A6
P8-1	+13.8V	To Front Panel
P8-2	24 Vdc	From J5-B (On Rear Panel)
P8-3	Reduced Voltage Control	To J5-D (On Rear Panel)
P8-4	Fan Control	To J5-E (On Rear Panel)

*Denotes rear panel connector to system

5.3 Current Limit Adjustments

a. Select USB Mode and 2.599 MHz channel frequency.

b. Preposition current limit adjustment potentiometer to extreme cw position.

c. Connect Audio Oscillator to 600 ohm line audio input and adjust level to minimum (it will be adjusted up in step e).

d. Remove ALC control by positioning ALC control R90 on 1A1A3 PA Control PC Board to the full ccw position.

e. Connect a dc voltmeter from E1 to E3 (positive lead to E1) on the PA Assembly and gradually increase the audio drive level until the voltage drop from E1-E3 reaches 280 mV.

f. Adjust R49, the current limit adjust, until the voltage drop from E1-E3 decreases to 270 mV. Leave R49 adjusted to this threshold. This level includes the voltage drop in the wire which connects R56 to E3.

g. Adjust ALC control to normal operating conditions as indicated in section 1A1A3, paragraph 5.2.

h. This completes all PA adjustments. Unkey transmitter, remove power by selecting power OFF at the front panel, and also at the external power source. Reconfigure the transceiver for normal operation.

Note

Selecting POWER OFF at the front panel does not remove +13.8 Vdc from the PA. This can be removed by selecting POWER OFF at the external power source.

6. PARTS LIST

Table 2 is a Maintenance Parts List for the Power Amplifier Assembly. These parts can be identified on figure 3. Refer to the General Information Section for list of manufacturers.

7. SCHEMATIC

Figure 4 is a complete schematic of the 1A3A1 Power Amplifier Assembly.

Table 2. 1A3 Maintenance Parts List

Ref. Desig.	Name & Description	Mfr. Code	Part Number
1A3	Rear Panel Assembly	14304	6628-1000-04
CR1	Not Used		
CR2	Diode, Rectifier, 1N4720	14304	CR-0701
CR3-CR11	Not Used		
CR12	Diode, Rectifier, 1N4720	14304	CR-0701
CR13	Not Used		
CR14	Diode, Reverse Polarity, MR-5005R	14304	CR-0449
F1	Fuse, 6A, 250V	14304	F-0016
J1	Connector, Coaxial	14304	J-0200
J2 to J4	Not Used		
J5	Connector, Power, Modified	14304	10007-1019
Q1	Transistor, NPN, RF Power, PT4787	14304	6628-1176
Q2,Q3*	Transistor, NPN, RF Power PT9796	14304	6628-1177
Q4	Transistor, NPN, Darlington, MJE-1100	14304	Q-0142
Q5	Not Used		
Q6,Q7*	Transistor, NPN, RF Power PT9785	14304	6628-1175
Q8	Transistor, NPN, Darlington, MJE-1100	14304	Q-0142
Q9	Not Used		
Q10	Transistor, PNP, Darlington, MJE-1090	14304	Q-0399
R1 to R21	Not Used		
R22, R23	Resistor, Fixed, Composition, 12 ohm, ±5%, 2W	81349	RCR42G120JM
R24,R25	Resistor, Fixed, Composition, 220 ohm, ±5%, 2W	81349	RCR42G221JM
R26	Not Used		
R27 to R30	Resistor, Fixed, Composition, 18 ohm, ±5%, 2W	81349	RCR42G180JM
R31, R32	Not Used		
R33 to R36	Resistor, Fixed, Composition, 18 ohm, ±5%, 2W	81349	RCR42G180JM
R37 to R55	Not used		
R56	Resistor, Fixed, Wirewound, .005 ohm, ±3%, 10W	14304	R-2199
RT1	Thermistor Assembly	14304	6628-1050
TB1	Terminal Strip	14304	TB-0387
XF1	Fuseholder	14304	F01-0002-106
1A3A1	PA PWB	14304	6628-1150
1A3A1C1	Capacitor, Fixed, Mono, .1 μF	14304	C-3202
1A3A1C2	Capacitor, Fixed, Electrolytic, 33 uF, 25V	14304	C18-0125-330
1A3A1C3	Capacitor, Fixed, Cer, .01 μF, ±20%	14304	C-4952
1A3A1C4 to 1A3A1C5	Capacitor, Fixed, Mono, .1 μF	14304	C-3202
1A3A1C6	Capacitor, Fixed, Ceramic, .047 μF	14304	M39014/02-1305
1A3A1C7	Capacitor, Fixed, Cer, .01 μF, ±20%	14304	C-4952
1A3A1C8	Capacitor, Fixed, Tant, 330 μF, 6V	14304	C25-0003-611
1A3A1C9	Capacitor, Fixed, Poly, .1 μF	14304	C-8031
1A3A1C10	Capacitor, Fixed, Cer, .01 μF, ±20%	14304	C-4952

*These transistors supplied in matched pairs using appropriate part number.

Table 2. 1A3 Maintenance Parts List (Continued)

Ref. Desig.	Name & Description	Mfr. Code	Part Number
1A3A1C11	Capacitor, Fixed, Poly, .1 μF	14304	C-8031
1A3A1C12	Capacitor, Fixed, Mica, 680 pF, ±5%, 500V	14304	CM06FD681J03
1A3A1C13	Capacitor, Fixed, Mica, 910 pF, ±5%, 500V	14304	CM06FD911J03
1A3A1C14	Capacitor, Fixed, Poly, .1 μF	14304	C-8031
1A3A1C15	Capacitor, Fixed, Cer, .01 μF, ±20%	14304	C-4952
1A3A1C16	Capacitor, Fixed, Cer, 15 pF	14304	C-4743
1A3A1C17	Capacitor, Fixed, Cer, .01 μF, ±20%	14304	C-4952
1A3A1C18	Capacitor, Fixed, Electrolytic, 100 μF	14304	C-6468
1A3A1C19	Capacitor, Fixed, Poly, .22 μF	14304	C-8035
1A3A1C20	Capacitor, Fixed, Mica, 82 pF	14304	C-0124
1A3A1C21	Capacitor, Fixed, Mica, 180 pF	14304	C-0132
1A3A1C22	Not Used		
1A3A1C23	Capacitor, Fixed, Cer, 39 pF	14304	C-4751
1A3A1C24	Capacitor, Fixed, Tant, 330 μF, 6V	14304	C25-0003-611
1A3A1C25	Capacitor, Fixed, Poly, .1 μF	14304	C-8031
1A3A1C26	Capacitor, Fixed, Cer, .01 μF, ±20%	14304	C-4952
1A3A1C27	Capacitor, Fixed, Poly, .39 μF	14304	C-8038
1A3A1C28	Capacitor, Fixed, Mica, 15 pF, ±5%, 500V	14304	CM05CD150J03
1A3A1C29, 1A3A1C30	Capacitor, Fixed, Mica, 1000 pF	14304	C-1187
1A3A1C31	Capacitor, Fixed, Mica, 500 pF	14304	C-6684
1A3A1C32, 1A3A1C33	Capacitor, Fixed, Cer, .33 μF, ±10%	14304	C-4947
1A3A1C34	Capacitor, Fixed, Poly, .39 μF	14304	C-8038
1A3A1C35	Capacitor, Fixed, Cer, .01 μF, ±20%	14304	C-4952
1A3A1C36	Capacitor, Fixed, Cer, .33 μF, ±10%	14304	C-4947
1A3A1C37	Capacitor, Fixed, Cer, .01 μF, ±20%	14304	C-4952
1A3A1C38	Capacitor, Fixed, Mica, 12 pF ±5%, 500V	14304	C-0105
1A3A1C39	Capacitor, Fixed, Mica, 180 pF ±5%, 500V	14304	C-0132
1A3A1C40, 1A3A1C41	Capacitor, Fixed, Ceramic, .01 μF ±20%, 50V	14304	C-4952
1A3A1C42	Capacitor, Fixed, Ceramic, 0.1 μF	14304	C-3202
1A3A1C43 to 1A3A1-C45	Capacitor, Fixed, Ceramic, .01 μF ±20%, 50V	14304	C-4952
1A3A1C46	Capacitor, Fixed, Mica, 1100 pF (Part of T5)	14304	C-0153
1A3A1C47	Capacitor, Fixed, Mica, 270 pF ±2%, 500V	14304	C-0137
1A3A1C48	Capacitor, Fixed, Mica, 43 pF ±5%, 500V	14304	C-0116
1A3A1C49	Capacitor, Fixed, Ceramic, 5.6 pF ±.5 pF, 1000V	14304	C-4738
1A3A1C50	Capacitor, Fixed, Ceramic, .01 μF ±20%, 50V	14304	C-4952
1A3A1C51	Capacitor, Fixed, Ceramic, .1 μF +80 -20%, 50V	14304	C-3202
1A3A1C52 to 1A3A1-C55	Not Used		
1A3A1C56 to 1A3A1-C59	Capacitor, Fixed, Ceramic, .01 μF ±20%, 50V	14304	C11-0005-103

Table 2. 1A3 Maintenance Parts List (Continued)

Ref. Desig.	Name & Description	Mfr. Code	Part Number
1A3A1C60	Capacitor, Fixed, Mica, 30 pF ±5%, 500V	14304	C-0112
1A3A1C61	Capacitor, Fixed, Mica, 68 pF ±5%, 500V	14304	C-0122
1A3A1C62, 1A3A1C63	Capacitor, Fixed, Ceramic, .01 μF ±20%, 50V	14304	C-4952
1A3A1C64	Capacitor, Fixed, Ceramic, 0.1 μF	14304	C-3202
1A3A1CR1	Diode, Rectifier, 1N4004	14304	CR-0725
1A3A1CR2	Not used		
1A3A1CR3	Diode, Rectifier, 1N4004	14304	CR-0725
1A3A1CR4, 1A3A1CR5	Diode, Signal, 1N4454	14304	CR-0705
1A3A1CR6	Diode, Rectifier, 1N4004	14304	CR-0725
1A3A1CR7, 1A3A1CR8	Diode, Signal, 1N4454	14304	CR-0705
1A3A1CR9, 1A3A1CR10	Diode, Rectifier, 1N4004	14304	CR-0725
1A3A1CR11	Not used		
1A3A1CR12	Not used		
1A3A1CR13	Diode, Rectifier, 1N4004	14304	CR-0725
1A3A1CR14, 1A3A1CR15	Not used		
1A3A1CR16	Diode, Rectifier, 1N4004	14304	CR-0725
1A3A1CR17, 1A3A1CR18	Diode, Signal, 1N4454	14304	CR-0705
1A3A1CR19, 1A3A1CR20	Diode, Rectifier, 1N4004	14304	CR-0725
1A3A1J1 to 1A3A1J3	Not used		
1A3A1J6 to 1A3A1J8	Connector, Coax	14304	J-0031
1A3A1JMP2	Jumper, Circuit	14304	MP-1142
1A3A1K1	Relay, SPDT, 12V	14304	6628-0405
1A3A1K2	Relay, SPST, 12V	14304	K-0095
1A3A1L1	Choke, RF, .33 μH, ±20%	14304	L-0035
1A3A1L2	Choke, RF, 22 μH ±10%	14304	L-0632
1A3A1L3	Choke, RF, .33 μH ±10%	14304	L-0610
1A3A1L4, 1A3A1L5	Not used		
1A3A1L6	Choke, RF, .33 μH ±10%	14304	L-0610
1A3A1L7	Choke, RF, .33 μH ±20%	14304	L-0035
1A3A1L8, 1A3A1L9	Choke, RF, .15 μH ±20%	14304	L-0074
1A3A1L10, 1A3A1L11	Not used		
1A3A1L12	Choke, RF, .15 μH ±20%	14304	L-0074
1A3A1L13, 1A3A1L14	Choke, RF, 15 μH	14304	L-0630

Table 2. 1A3 Maintenance Parts List (Continued)

Ref. Desig.	Name & Description	Mfr. Code	Part Number
1A3A1Q1 to 1A3A1Q4	Not used		
1A3A1Q5	Transistor, NPN, 2N4124	14304	Q-0385
1A3A1Q6 to 1A3A1Q8	Not used		
1A3A1Q9	Transistor, NPN, 2N4124	14304	Q-0385
1A3A1Q10	Not used		
1A3A1Q11	Transistor, NPN, 2N4124	14304	Q-0385
1A3A1R1	Not used		
1A3A1R2	Resistor, Fixed, Film, 10 ohms, ±5%, 1/4W	14304	R65-0003-100
1A3A1R3	Not used		
1A3A1R4	Resistor, Fixed, Composition, 1K ±5%, 1/4W	81349	RCR07G102JM
1A3A1R5	Resistor, Fixed, Composition, 47 ohm ±5%, 1/4W	81349	RCR07G470JM
1A3A1R6	Resistor, Fixed, Composition, 3 ohm ±5%, 1W	81349	RCR32G3R0JM
1A3A1R7			
1A3A1R8	Resistor, Fixed, Composition, 15 ohm ±5%, 1/4W	81349	RCR07G150JM
1A3A1R9	Resistor, Variable, 200 ohm		R-2223
1A3A1R10	Resistor, Fixed, Wirewound, 120 ohm ±5%, 2W	81349	R13-0002-121
1A3A1R11	Resistor, Fixed, Composition, 1K ±5%, 1/4W	81349	RCR07G102JM
1A3A1R12	Resistor, Fixed, Composition, 39 ohm ±5%, 2W	81349	RCR42G6390JM
1A3A1R13	Not used		
1A3A1R14, 1A3A1R15	Resistor, Fixed, Composition, 10 ohm ±5%, 1/2W	81349	RCR20G100JM
1A3A1R16	Resistor, Fixed, Composition, 39 ohm ±5%, 1/2W	81349	RCR42G390JM
1A3A1R17	Not used		
1A3A1R18	Resistor, Fixed, Wirewound, 3.3 ohm ±5%, 2W	14304	R-2181
1A3A1R19	Resistor, Fixed, Composition, 100 ohm ±5%, 1/4W	81349	RCR07G101JM
1A3A1R20	Resistor, Variable, 200 ohm		R-2223
1A3A1R21	Resistor, Fixed, Composition, 390Ω ±5%, 1/4W	81349	RCR07G391JM
1A3A1R22 to 1A3A1R25	Not used		
1A3A1R26	Resistor, Fixed, Composition, 10K ±5%, 1/4W	81349	RCR07G103JM
1A3A1R27 to 1A3A1R30	Not used		
1A3A1R31, 1A3A1R32	Resistor, Fixed, Composition, 10 ohm ±5%, 1W	81349	RCR32G100JM
1A3A1R33 to 1A3A1R36	Not used		
1A3A1R37, 1A3A1R38	Resistor, Fixed, Wirewound, 1.0 ohm ±5%, 2W	14304	R13-0001-100
1A3A1R39	Resistor, Fixed, Composition, 33 ohm ±5%, 1/4W	81349	RCR07G330JM
1A3A1R40	Resistor, Variable, 200 ohm		R-2223
1A3A1R41	Resistor, Fixed, Composition, 270 ohm ±5%, 1/4W	81349	RCR07G271JM

Table 2. 1A3 Maintenance Parts List (Continued)

Ref. Desig.	Name & Description	Mfr. Code	Part Number
1A3A1R42	Resistor, Fixed, Composition, 1K ±5%, 1/4W	81349	RCR07G102JM
1A3A1R43	Resistor, Fixed, Composition, 3.3K ±5%, 1/4W	81349	RCR07G332JM
1A3A1R44 to 1A3A1R46	Resistor, Fixed, Composition, 1K ±5%, 1/4W	81349	RCR07G102JM
1A3A1R47	Resistor, Fixed, Composition, 3.3K ±5%, 1/4W	81349	RCR07G332JM
1A3A1R48	Resistor, Fixed, Composition, 4.7K ±5%, 1/4W	81349	RCR07G472JM
1A3A1R49	Resistor, Variable, 200 ohm		R-2223
1A3A1R50	Resistor, Fixed, Composition, 120 ohm ±5%, 1/4W	81349	RCR07G121JM
1A3A1R51	Resistor, Fixed, Composition, 82 ohm ±5%, 1/4W	81349	RCR07G820JM
1A3A1R52	Resistor, Fixed, Composition, 8.2K ±5%, 1/4W	81349	RCR07G822JM
1A3A1R53	Resistor, Fixed, Composition, 100 ohm ±5%, 1/4W	81349	RCR07G101JM
1A3A1R54, 1A3A1R55	Resistor, Fixed, Composition, 4.7K ±5%, 1/4W	81349	RCR07G472JM
1A3A1R56	Not used		
1A3A1R57	Resistor, Fixed, Composition, 1K ±5%, 1/4W	81349	RCR07G102JM
1A3A1R58	Resistor, Fixed, Composition, 8.2K ±5%, 1/4W	81349	RCR07G822JM
1A3A1R59	Not used		
1A3A1R60	Resistor, Fixed, Composition, 10K ±5%, 1/4W	81349	RCR07G103JM
1A3A1R61	Resistor, Fixed, Composition, 1K ±5%m 1/4W	81349	RCR07G102JM
1A3A1R62	Resistor, Fixed, Composition, 1.0 ohm, ±5%, 1/2W	14304	R-1567
1A3A1R63	Resistor, Fixed, Wirewound, .2 ohm, ±5%, 2W	14304	R-2062
1A3A1R64	Not Used		
1A3A1R65	Resistor, Fixed, Film, 150 ohm, ±5%, 1/4W	14304	R65-0003-151
1A3A1R66	Resistor, Fixed, Composition, 1.0 ohm, ±5%, 1/2W	14304	RCR20G1R0JM
1A3A1RT1	Not used		
1A3A1T1	Transformer	14304	919-1280
1A3A1T2	Transformer	14304	6628-1178
1A3A1T3	Transformer	14304	6628-1180
1A3A1T4	Transformer	14304	6628-1182
1A3A1T5	Transformer	14304	6628-1181
1A3A1T6	Transformer	14304	6628-1183
1A3A1T7	Transformer	14304	6628-1179
1A3A1TP1	Test Point, Brown	14304	J-0392
1A3A1TP2	Test Point, Red	14304	J-0387
1A3A1TP3	Test Point, Orange	14304	J-0390
1A3A1TP4	Test Point, Yellow	14304	J-0391
1A3A1TP5	Test Point, Green	14304	J-0068
1A3A1TP6	Test Point, Blue	14304	J-0072
1A3A1U1	Integrated Circuit, CA3096AE	14304	IC-0153
1A3A1VR1	Diode, Zener, 5.1V ±5%,	14304	CR-0267
1A3A1VR2	Not Used		
1A3A1VR3	Regulator, Voltage, 8V, MC7808CT	14304	112-0001-003

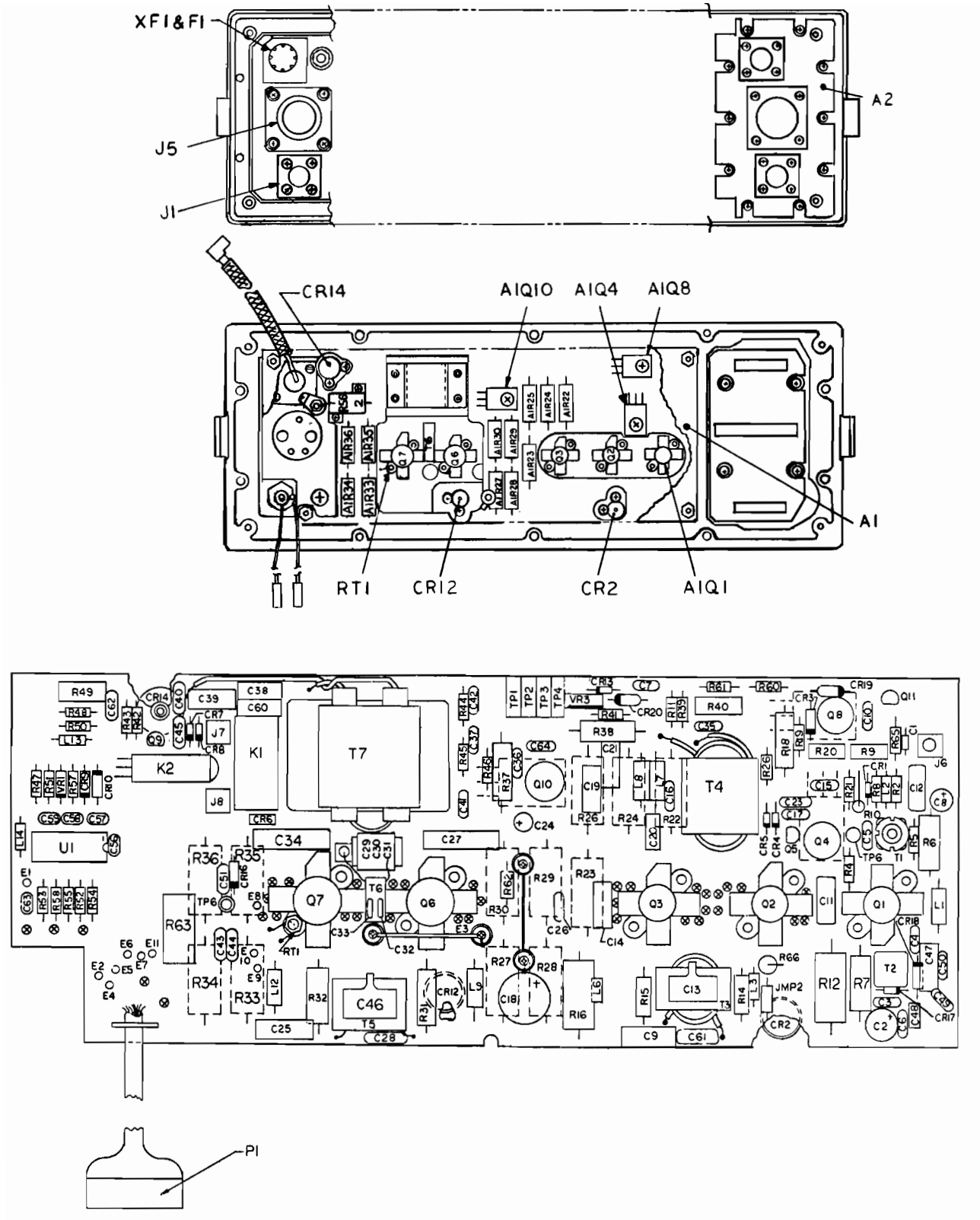


Figure 3. Power Amplifier Assembly Component Locations (6628-1000-04 and 6628-1150)

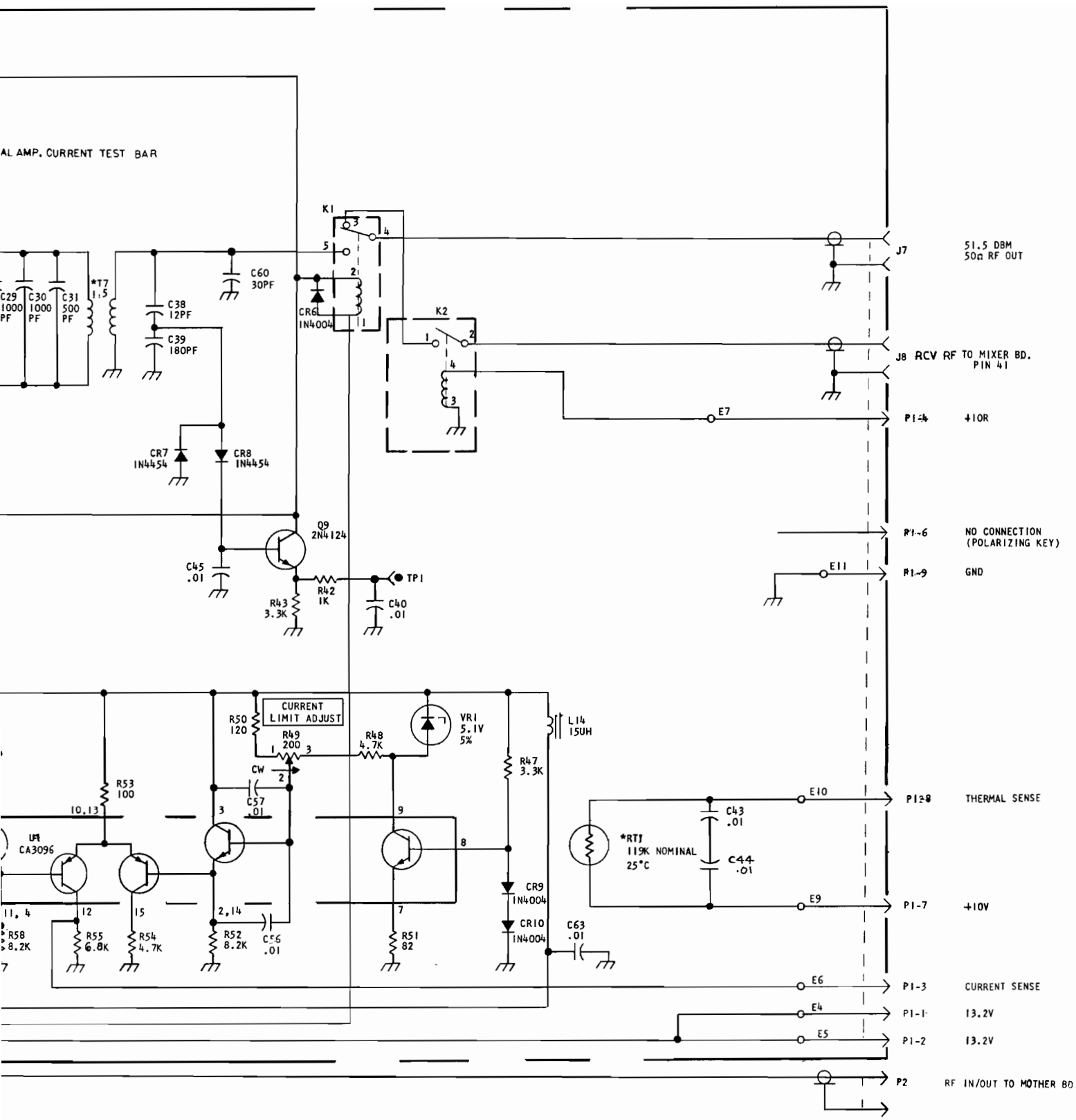
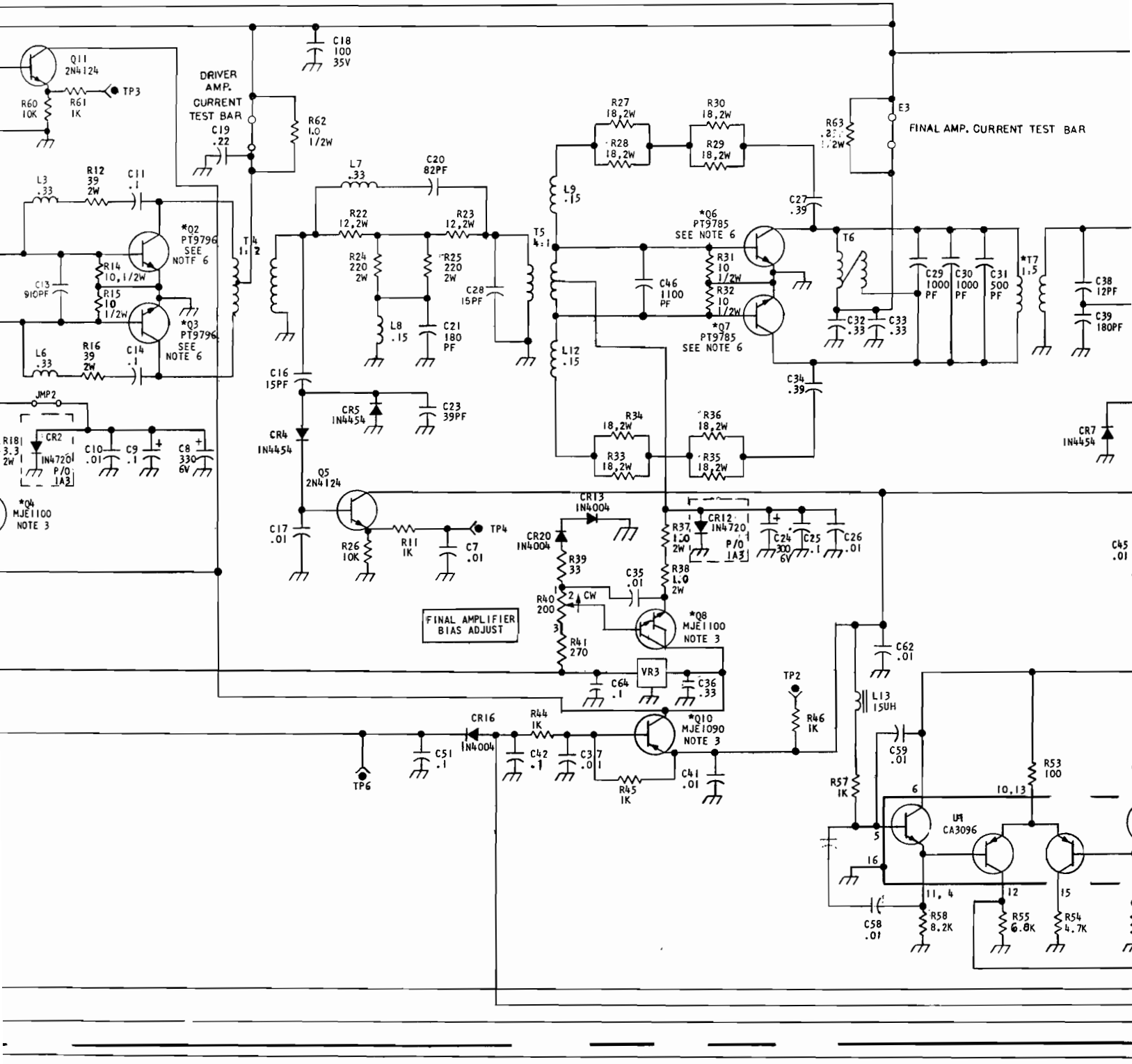
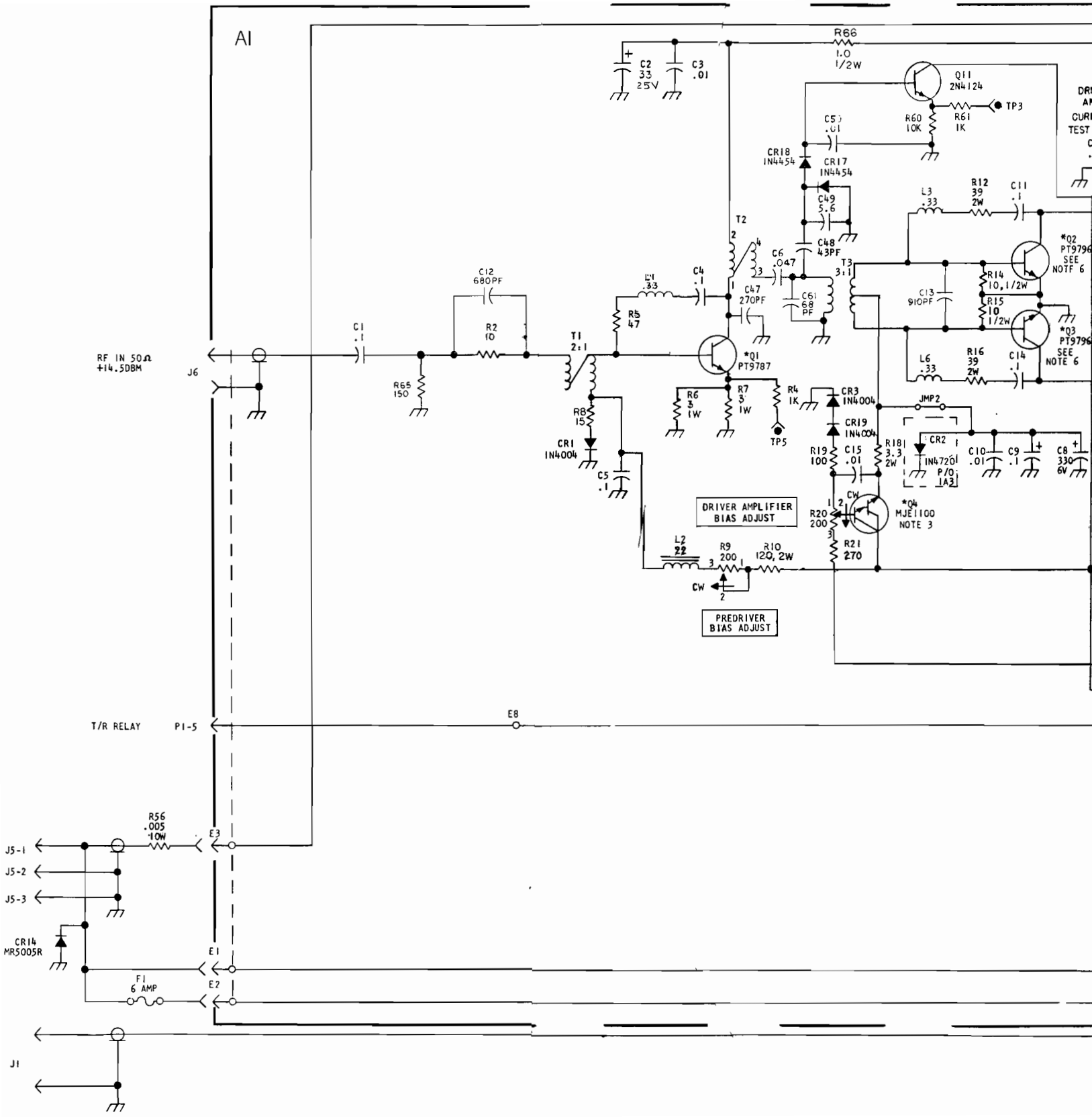
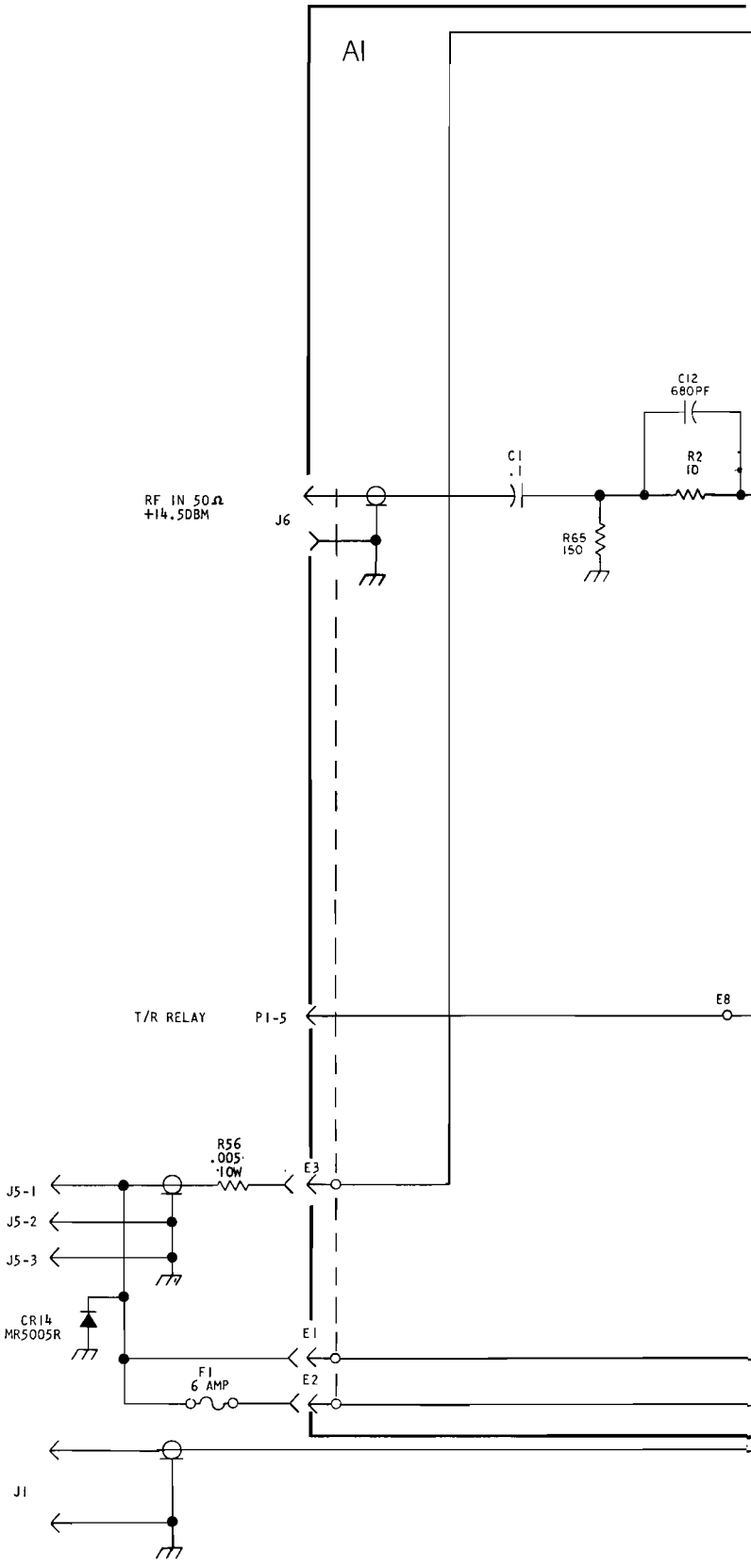


Figure 4. Power Amplifier Assembly Schematic Diagram (6628-9115)


Q11 2N4124
TP3
R60 10K
R61 1K
DRIVER AMP. CURRENT TEST BAR
C18 100 35V
C19 .22
R62 1.0 1/2W
L3 .33
R12 39 2W
C11 .1
*Q2 PT9796 SEE NOTE 6
R14 10, 1/2W
R15 10 1/2W
*Q3 PT9796 SEE NOTE 6
C13 910PF
L6 .33
R16 39 2W
C14 .1
T4 1:2
JMP2
R18 3.3 2W
CR2 IN4720 P/O 1A3
C10 .01
C9 .1
C8 330 6V
*Q4 MJE1100 NOTE 3
L7 .33
C20 82PF
R22 12,2W
R23 12,2W
R24 220 2W
R25 220 2W
C28 15PF
L8 .15
C21 180 PF
T5 4:1
C16 15PF
CR4 IN4454
CR5 IN4454
C23 39PF
Q5 2N4124
C17 .01
R26 10K
R11 1K
TP4
C7 .01
R27 18,2W
R28 18,2W
R30 18,2W
R29 18,2W
L9 .15
C46 1100 PF
*Q6 PT9785 SEE NOTE 6
R31 10 1/2W
R32 10 1/2W
*Q7 PT9785 SEE NOTE 6
L12 .15
C27 .39
C34 .39
R34 18,2W
R33 18,2W
R36 18,2W
R35 18,2W
E3
FINAL AMP. CURRENT TEST BAR
T6
C32 .33
C33 .33
C29 1000 PF
C30 1000 PF
C31 500 PF
*T7 1:5
C38 12PF
C39 180PF
CR7 IN4454
CR13 IN4004
CR20 IN4004
R39 33
C35 .01
R37 1.0 2W
CR12 IN4720 P/O 1A3
C24 300 6V
C25 .1
C26 .01
R38 1.0 2W
R40 200
CW
R41 270
FINAL AMPLIFIER BIAS ADJUST
*Q8 MJE1100 NOTE 3
VR3
C64 .1
C36 .33
C62 .01
TP2
L13 15UH
CR16 IN4004
R44 1K
*Q10 MJE1090 NOTE 3
R46 1K
C51 .1
C42 .1
C37 .01
R45 1K
C41 .01
TP6
C59 .01
R57 1K
R53 100
U1 CA3096
C58 .01
R58 8.2K
R55 6.8K
R54 4.7K
C45 .01

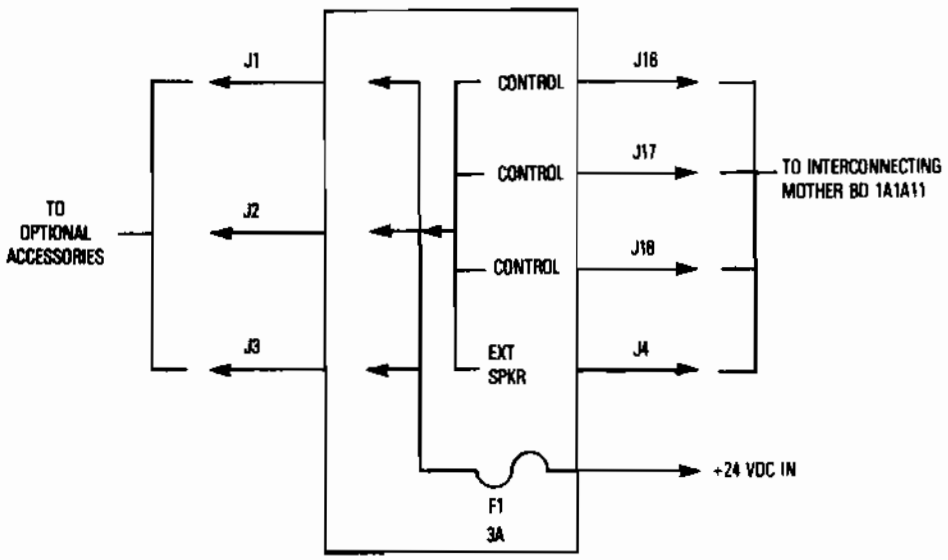

A1
R66
1.0
1/2W
C2
33
25V
C3
.01
Q11
2N4124
TP3
R60
10K
R61
1K
C55
.01
CR18
IN4454
CR17
IN4454
C49
5.6
C48
43PF
C6
.047
C61
68
PF
T2
T3
3:1
L3
.33
R12
39
2W
C11
.1
*Q2
PT9796
SEE
NOTE 6
R14
10, 1/2W
R15
10
1/2W
C13
910PF
*Q3
PT9796
SEE
NOTE 6
L6
.33
R16
39
2W
C14
.1
C12
680PF
R2
10
L1
.33
C4
.1
C47
270PF
C1
.1
RF IN 50Ω
+14.5DBM
J6
R65
150
T1
2:1
R5
47
*Q1
PT9787
R6
3
1W
R7
3
1W
R4
1K
TP5
R8
15
CR1
IN4004
C5
.1
CR3
IN4004
JMP2
CR19
IN4004
R19
100
C15
.01
R18
3.3
2W
CR2
IN4720
P/O
A3
C10
.01
C9
.1
C8
330
6V
DRIVER AMPLIFIER
BIAS ADJUST
CW
*Q4
MJE1100
NOTE 3
R20
200
R21
270
L2
22
R9
200
R10
120, 2W
CW
PREDRIVER
BIAS ADJUST
T/R RELAY
P1-5
E8
R56
.005
10W
E3
J5-1
J5-2
J5-3
CR14
MR5005R
E1
F1
6 AMP
E2
J1


A1
C12
680PF
C1
.1
R2
10
RF IN 50Ω
+14.5DBM
J6
R65
150
T/R RELAY
P1-5
E8
R56
.005
10W
E3
J5-1
J5-2
J5-3
CR14
MR5005R
E1
F1
6 AMP
E2
J1

UNIT INSTRUCTIONS

INTERFACE CONNECTOR

1A3A2



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1. GENERAL INFORMATION

The 1A3A2 Interface Connector assembly is actually part of the 1A3 Power Amplifier assembly. Consisting of two printed wiring boards, three connectors, and a fuse holder, the assembly provides internal/external interfacing for connectors J1, J2 and J3 on the RF-2301 transceiver rear panel assembly.

2. ASSEMBLY DIAGRAMS

Figure 1 shows the A1 Adaptor PWB assembly component locations as mounted on the board. Figure 2 shows the A2 Adaptor PWB assembly component locations as mounted on the board. Figure 3 illustrates the construction detail of the entire integrated 1A3A2 assembly from three views (front, side, and bottom), noting all major component locations.

3. PARTS LIST

Table 1 presents a maintenance parts list for all 1A3A2 components and subassemblies. The parts list indicates the major 1A3A2 components, the A1 PWB assembly, and the A2 PWB assembly.

4. SCHEMATIC DIAGRAM

Interconnection diagram for the 1A3A2 assembly is included in the overall RF-2301 Transceiver Main Frame Schematic Diagram included in the 1A1A11 Unit Instructions Section. This is to facilitate understanding and identification of key interconnection points within the transceiver as relating to the 1A3A2 Interface Connector Assembly.

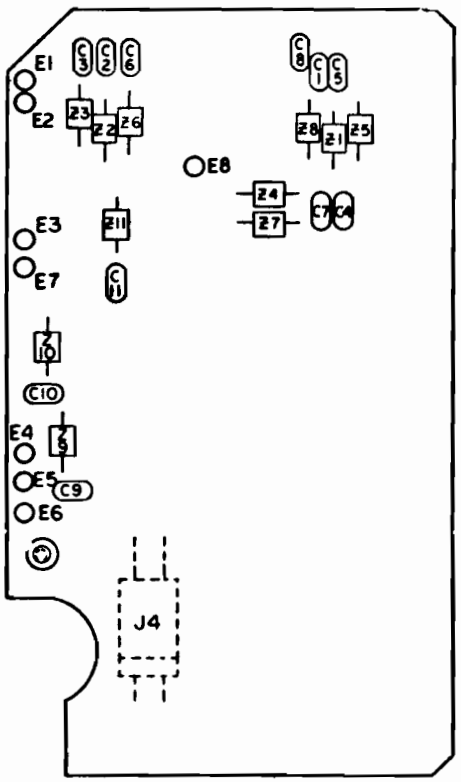


Figure 1. A1 Adaptor PWB Assembly Component Locations

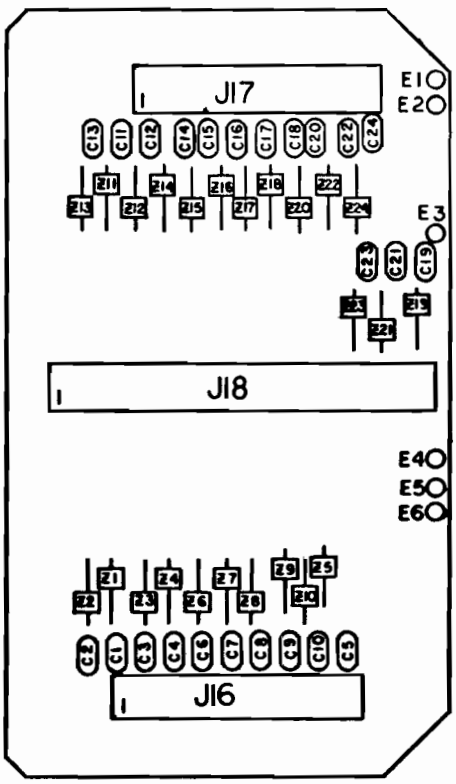


Figure 2. A2 Adaptor PWB Assembly Component Locations

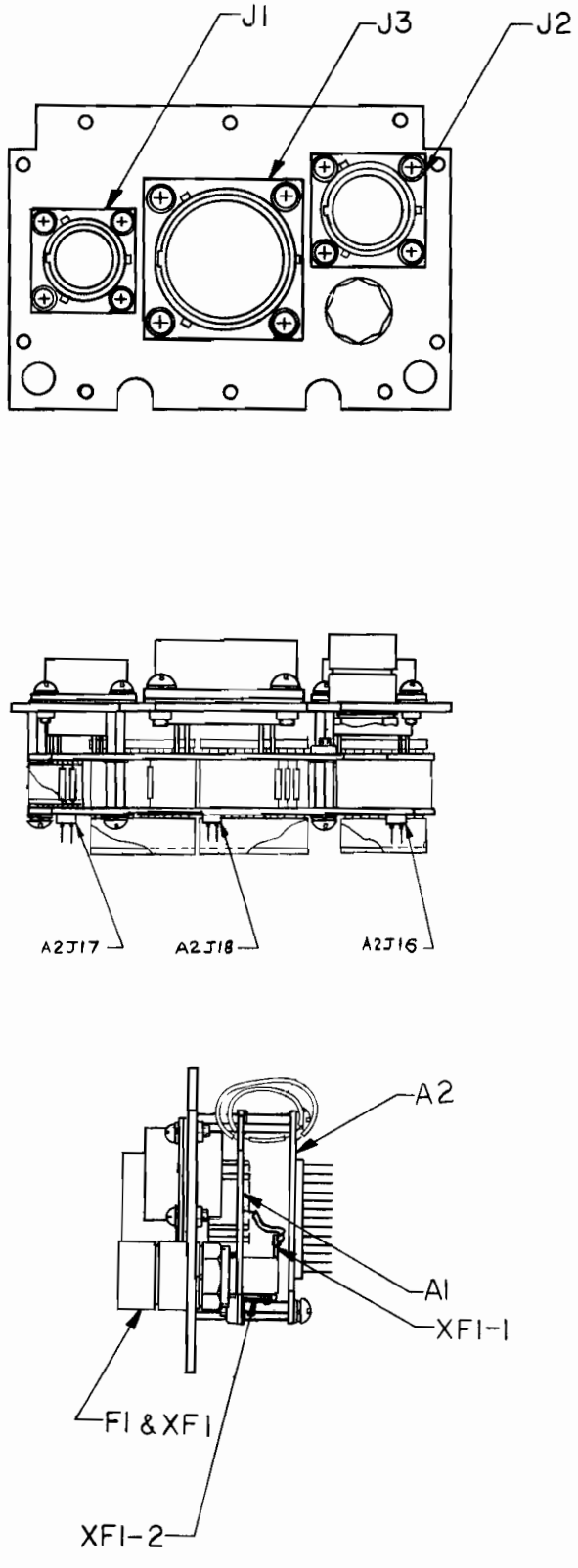


Figure 3. 1A3A2 Construction Detail

Table 1. 1A3A2 Interface Assembly Maintenance Parts List

Ref. Desig.	Name & Description	Mfr. Code	Part Number
1A3A2	Interface Assembly	14304	10007-1020
1A3A2A1	Adaptor PWB Assembly, bottom	14304	10007-1030
1A3A2A2	Adaptor PWB Assembly, top	14304	10007-1040
1A3A2F1	Fuse, 3A, Standard-blo	14304	F-0013
1A3A2J1	Connector, 19 Pin	14304	J09-0002-000
1A3A2J2	Connector, 26 Pin	14304	J09-0001-000
1A3A2J3	Connector, 61 Pin	14304	J09-0003-000
1A3A2XF1	Fuse Holder	14304	F01-0002-006

Table 2. 1A3A2A1 PWB Assembly (10007-1030)

Ref. Desig.	Name & Description	Mfr. Code	Part Number
1A3A2A1 C1 to C11	Capacitor, .01 uF, 50 volt, ceramic	14304	C11-0005-103
1A3A2A1 J1 to J3	Not used		
1A3A2A1 J4	Connector, 2 pin, right angle type	14304	J46-0008-002
1A3A2A1 Z1 to Z11	Ferrite Bead	14304	F-2192

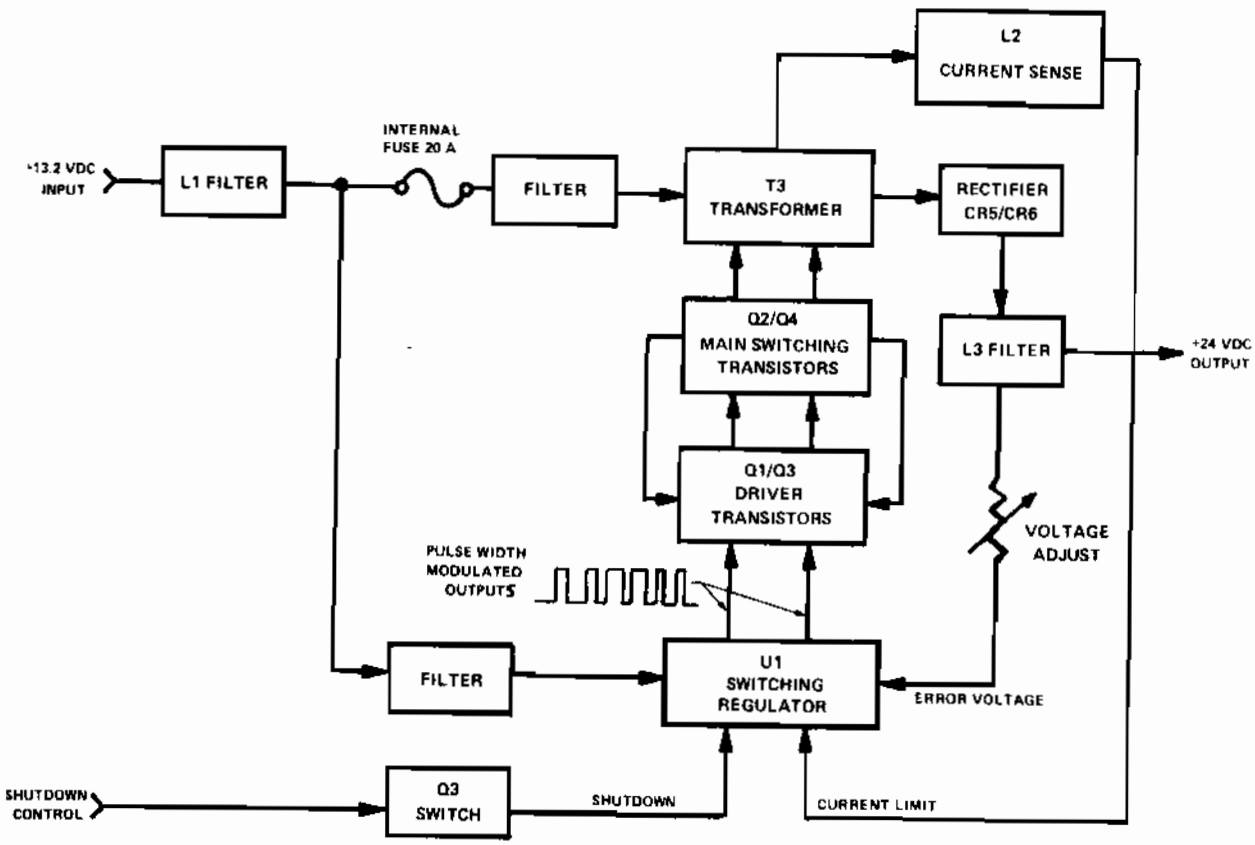
Table 3. 1A3A2A2 PWB Assembly (10007-1040)

Ref. Desig.	Name & Description	Mfr. Code	Part Number
1A3A2A2 C1 to C24	Capacitor, .01 uF, 50 volt, ceramic	14304	C11-0005-103
1A3A2A2 J16, J17	Connector, Ribbon, 26 pin	14304	J46-0004-026
1A3A2A2 J18	Connector, Ribbon, 40 pin	14304	J46-0004-040
1A3A2A2 Z1 to Z24	Ferrite Bead	14304	F-2192

UNIT INSTRUCTIONS

12-24 VOLT POWER SUPPLY

1A4



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resistor R16 via R17/C15/CR3. R15/R16/R17 form a voltage divider which feeds the inverting input of the comparator within U1 (refer to Part VII, paragraph 4.2.1). This is the error voltage. The comparator in U1 is referenced to the input voltage (+13.2) and the ramp signal applied to the non-inverting input. As the error voltage increases, the pulse width of the switching regulator is varied proportionately to maintain a constant output. R16 is used to establish the no-load voltage of the supply by adjusting the error voltage to the proper value.

5. MAINTENANCE

The 1A4 12/24 Power Supply has been tested and aligned at the factory, and should not require further adjustment. However, if adjustments become necessary due to replacement of the A1 or A2 PWB assemblies, or due to component failure/replacement, the following operational test procedure should be observed.

5.1 Test Equipment

The following items are required for testing of the 1A4 assembly:

Digital Voltmeter (DVM) ..... ±24 Vdc
Oscilloscope ..... Single Trace
Active Load or variable power resistor (0-10Ω . . 100 Watt

5.2 Adjustments

a. Connect DVM (+) lead to 1A4 output (C2). Connect the (-) lead to the chassis (ground).

b. Adjust R16 for +26 Vdc output with no load connected to the supply output.

c. Connect load to 1A4 output. Set DVM to measure current from 0-5 amperes. Place DVM in series with load.

d. Apply power to the 1A4 assembly. Adjust active load, or variable power resistor until current meter indicates approximately 4 amperes. This should be approximately the point at which current limiting action should begin (±10%).

e. Connect oscilloscope probe between E7 and E8 (Probe conductor to E7). Disconnect the load from the supply output. Observe the waveforms shown in figure 1.

f. Connect load to supply output. Set load to draw slightly less than the current limit established in step d. Observe the waveforms shown in figure 1.

g. Connect oscilloscope probe between pin 3 of the SG2524 switching regulator chip and ground. Observe the waveforms shown in figure 1.

h. Disconnect load from supply output. Connect oscilloscope probe between E3 and E4 on the A1 PWB (probe conductor to E3). Observe the waveforms shown in figure 1.

j. Reconnect load to supply output, and set to draw approximately 3 amperes of current. Leave oscilloscope probe connected to E3 and E4. Observe the waveforms shown in figure 1.

k. Set current to maximum (just ahead of current limiting). Measure input current to the 1A4 assembly (should draw between 7.5 and 8.5 amperes).

This completes the 1A4 operational test. Further information may be obtained by refering to Part VII, RF-2360 Power Supply Unit Instructions. Much of the information concerning the SG2524 Switching Regulator contained in Part VII also applies to the 1A4 circuitry.

6. INSTALLATION OF 10007-0900 12 TO 24 VOLT DC CONVERTER

Follow these steps to install the 12 to 24 Vdc converter.

a. Disconnect power to the RF-2301/2302.

b. Remove the top cover.

c. Remove the Power Amplifier from the rear of the unit.

NOTE

Mother Board E connectors may be labeled with E numbers and/or voltage values.

d. On the 10007-0900 module, connect the orange wire from C2 (+24 Vdc output) to the +24 Vdc (E121) on the Mother Board.

e. Connect the red wire from C1 to the +12 Vdc (E-120) on the Mother Board.

f. Connect the blue wire from C3 to the S (E-123) on the Mother Board.

g. Connect the black wire from the ground lug on E1 on converter to ground (E-122) on Mother Board.

h. Install 10007-0900 to the mounting bracket on the back of the card cage.

NOTE

Hardware should be tight for good heat transfer.

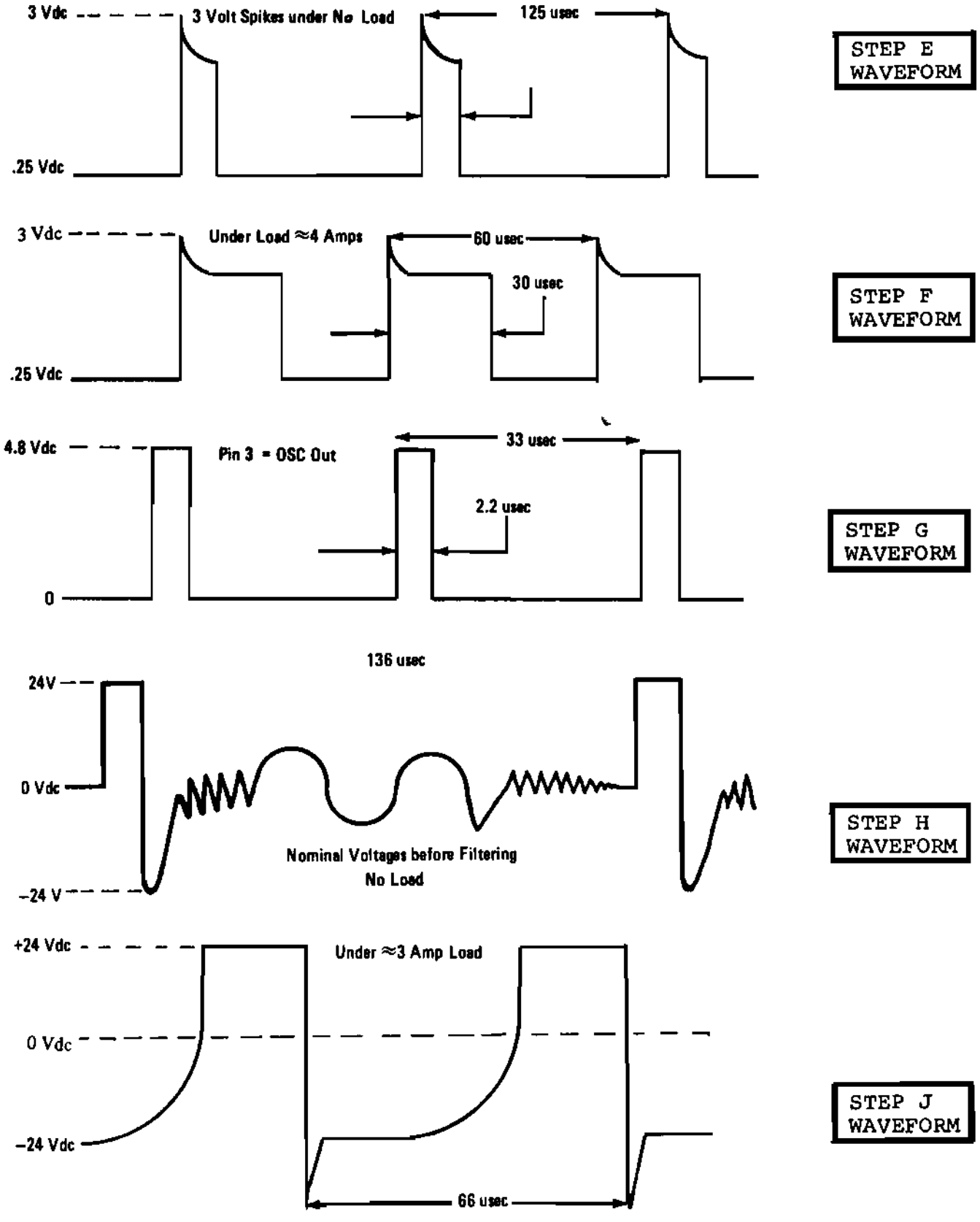


Figure 1. 1A4 Power Supply Waveforms

6. INSTALLATION OF 10007-0900 12 TO 24 VOLT DC CONVERTER (Continued)

i. Reinstall Power Amplifier module, being careful not to pinch ribbon cables or coax cables.

j. Replace top cover.

k. Replace unit in system and apply power.

7. PARTS LIST

Table 1 lists all 1A4 Maintenance parts. All of these components may be identified in Figure 1/2. Refer to Part V for list of component manufacturers.

8. SCHEMATIC DIAGRAM

Figure 3 is a complete schematic diagram of the 1A4 Power Supply assembly.

Table 1. 1A4 12/24 Vdc Power Supply Maintenance Parts List

Ref. Desig.	Name of Part and Description	Part No.	Mfr. Code
1A4	12/24 Vdc Power Supply	10007-0900	14304
1A4C1, C2, C3	Capacitor, Feed-Thru, 1500 pF	10007-0904	14304
1A4A1	Bracket PWB Assembly	10007-0930	
C1	Capacitor, 0.01 uF, 200 volt	C-0811	14304
C2	Capacitor, 0.1 uF, 100 volt	C-0805	14304
C3	Capacitor, 0.0033 uF, 400 volt	C-0834	14304
C4	Capacitor, 0.01 uF, 200 volt	C-0811	14304
CR1	Diode, MR811	D22-0007-002	14304
CR2	Diode, MR851	D22-0014-004	14304
CR3	Diode, MR811	D22-0007-002	14304
CR4	Diode, MR851	D22-0014-004	14304
R1	Resistor, 470 ohm, 1/4W, 5%	RCR07G471JM	81349
R2	Resistor, 33 ohm, 1/4W, 5%	RCR07G330JM	81349
R3	Resistor, 10 ohm, 1/2W, 5%	RCR20G100JM	81349
R4	Resistor, 12 ohm, 2W, 5%	RCR42G120JM	81349
R5	Resistor, 470 ohm, 1/4W, 5%	RCR07G471JM	81349
R6	Resistor, 33 ohm, 1/4W, 5%	RCR07G330JM	81349
R7	Resistor, 10 oh, 1/2W, 5%	RCR20G100JM	81349
R8	Resistor, 12 ohm, 2W, 5%	RCR42G120JM	81349
R9	Resistor, 68 ohm, 2W, 5%	RCR42G680JM	81349
T1	Transformer, Driver	10007-0924	14304
T2	Transformer, Driver	10007-0924	14304
1A4A1U1	Bridge Rectifier	D22-5009-004	14304
1A4A2	Power Supply PWB Assembly	10007-0910	14304
C1	Capacitor, 470 uF, 25 volt	C20-0018-477	14304
C2	Capacitor, 470 uF, 25 volt	C20-0018-477	14304
C3	Capacitor, 470 uF, 25 volt	C20-0018-477	14304
C4	Capacitor, 15 uF, 35 volt	C25-0002-114	14304
C5	Capacitor, 0.1 uF, 50 volt	C-1185	14304
C6	Capacitor, 0.1 uF, 50 volt	C-1185	14304
C7	Capacitor, 47 pF, 1KV	C-4752	14304
C8	Capacitor, Mylar, 0.01 uF, 200 volt	C60-0003-103	14304
C9	Capacitor, Ceramic, 0.001 uF, 500 volt	C-3513	14304
C10	Capacitor, Mylar, 0.022 uF, 200 volt	C60-0003-233	14304
C11	Capacitor, 0.1 uF, 50 volt	C-1185	14304
C12	Capacitor, 1100 uF, 30 volt	C20-0014-001	14304
C13	Capacitor, 1100 uF, 30 volt	C20-0014-001	14304
C14	Capacitor, 33 uF, 35 volt	C25-0002-116	14304
C15	Capacitor, 0.1 uF, 50 volt	C-1185	14304
C16	Capacitor, 0.1 uF, 50 volt	C-1185	14304
C17	Capacitor, 0.1 uF, 50 volt	C-1185	14304
C18	Capacitor, 470 uF, 25 volts	C20-0018-477	14304
C19	Capacitor, 470 uF, 25 volts	C20-0018-477	14304
CR1	Diode, 1N4454	1N4454	14304
CR2	Diode, 1N4454	1N4454	14304
CR3	Diode Transorb, 1N6050	1N6050	14304
CR4	Diode, 1N4454	1N4454	14304

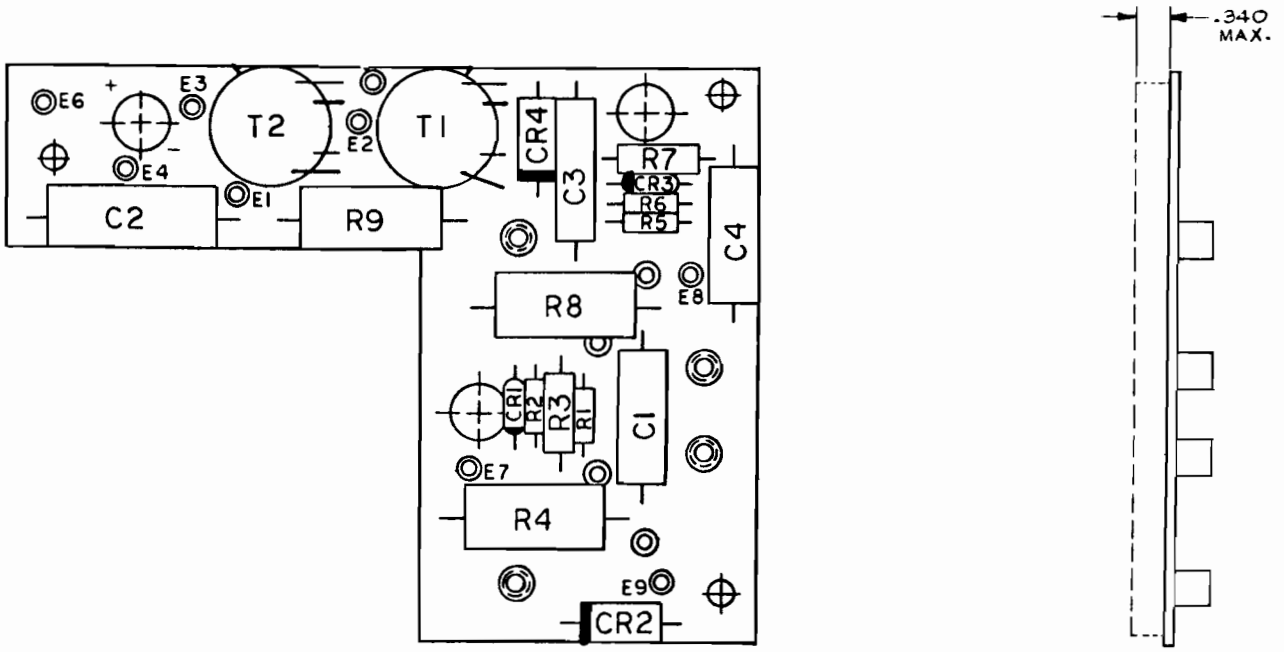


Figure 2. 1A4A1 Bracket Assembly 10007-0930

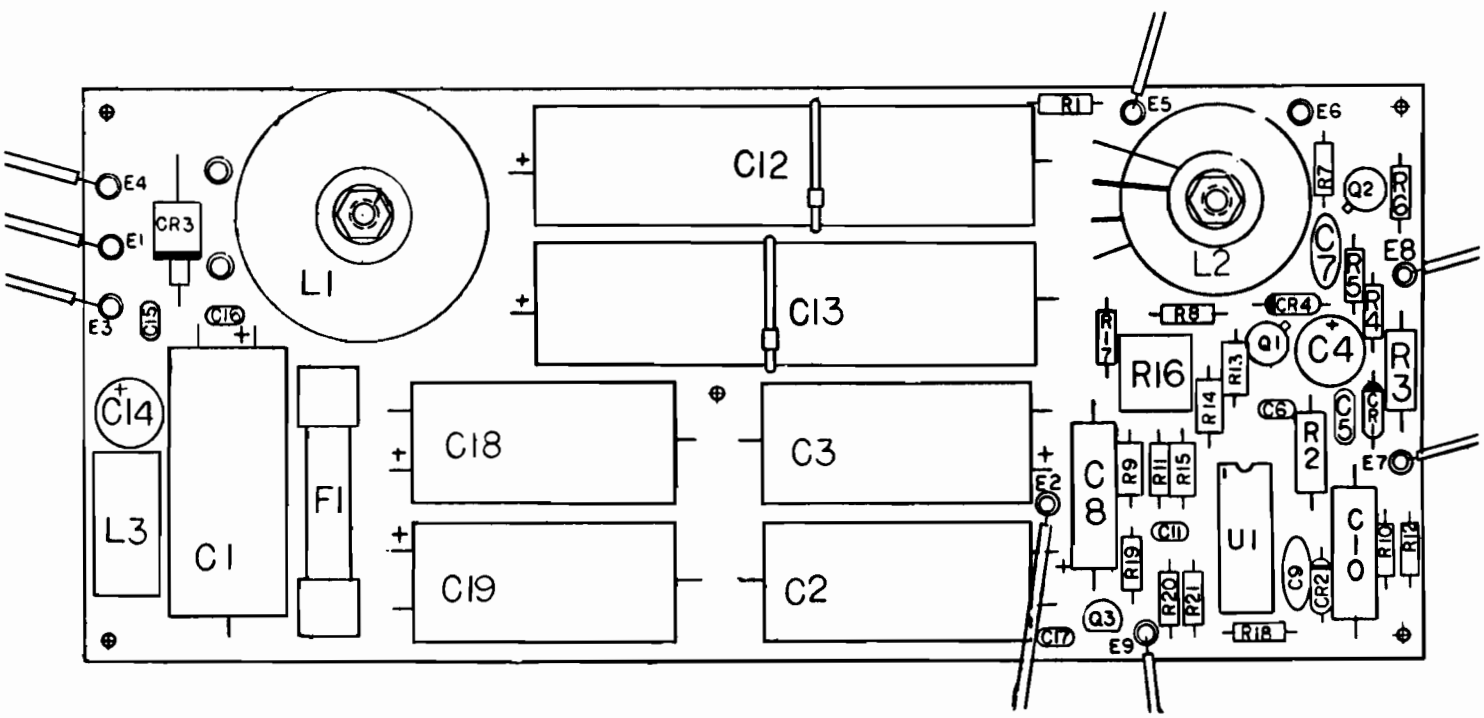


Figure 3. 1A4A2 12/24 VDC Power Supply 10007-0910

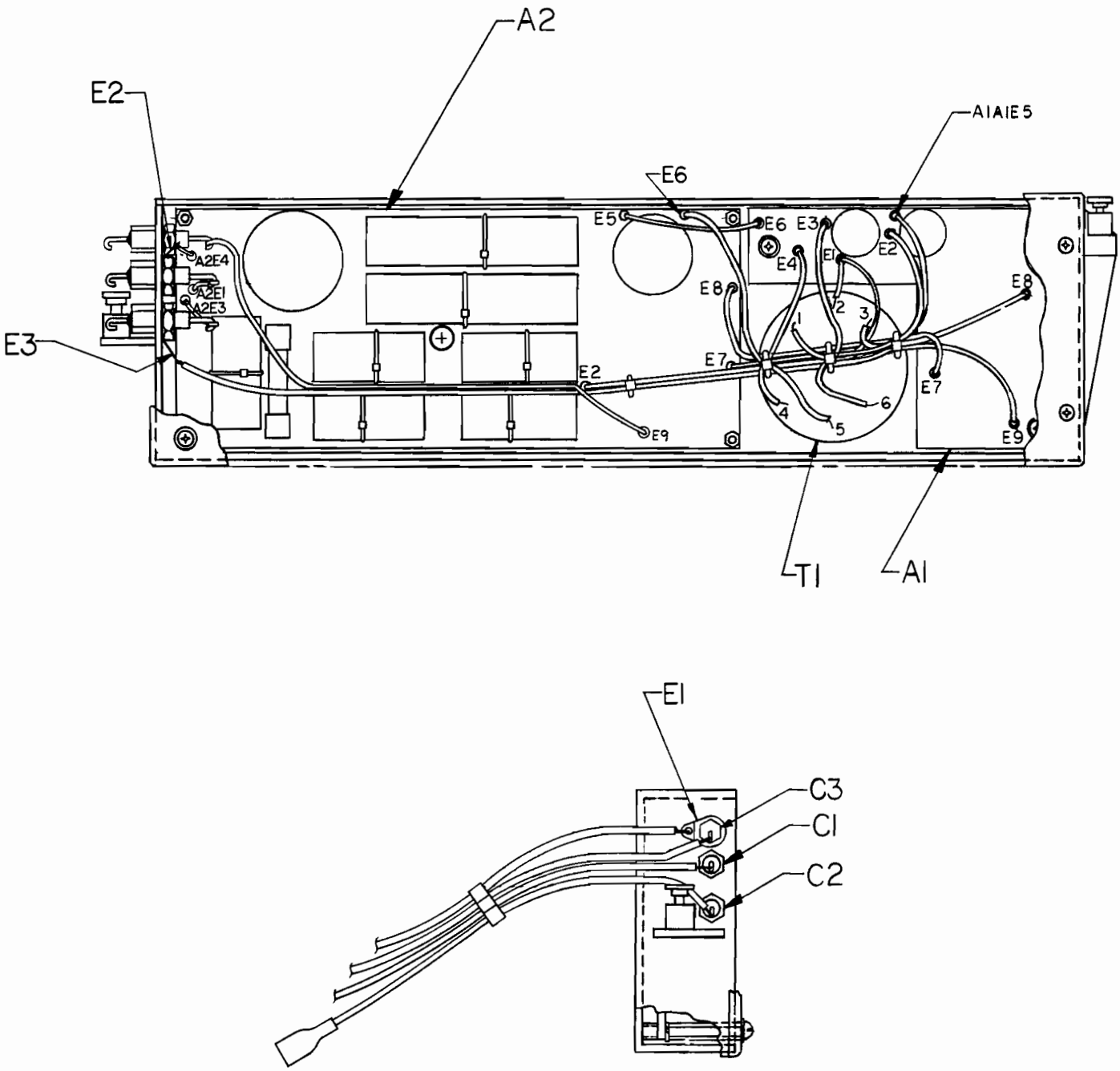


Figure 4. 1A4 12/24 VDC Power Supply Component Locations (10007-0900)

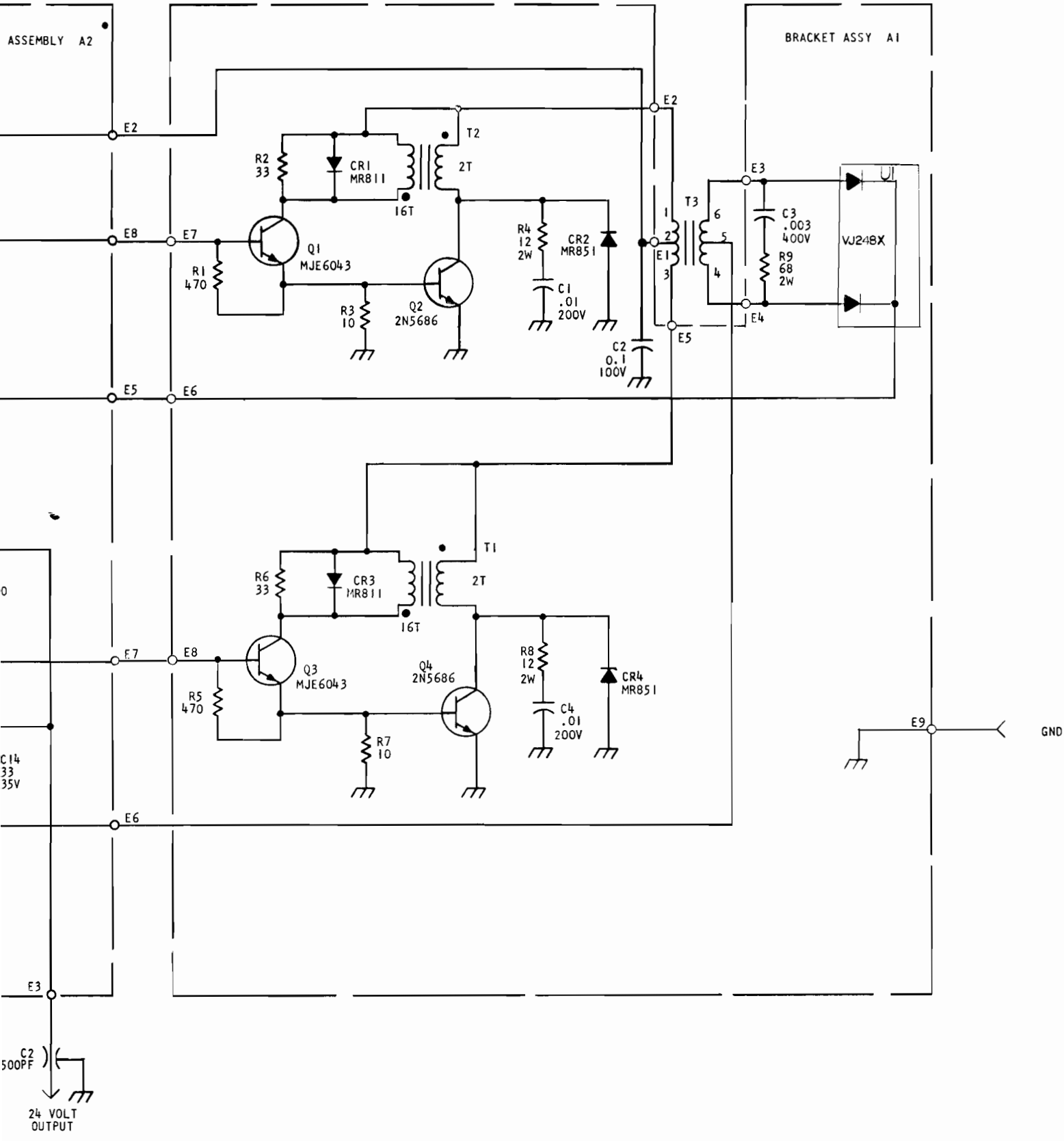
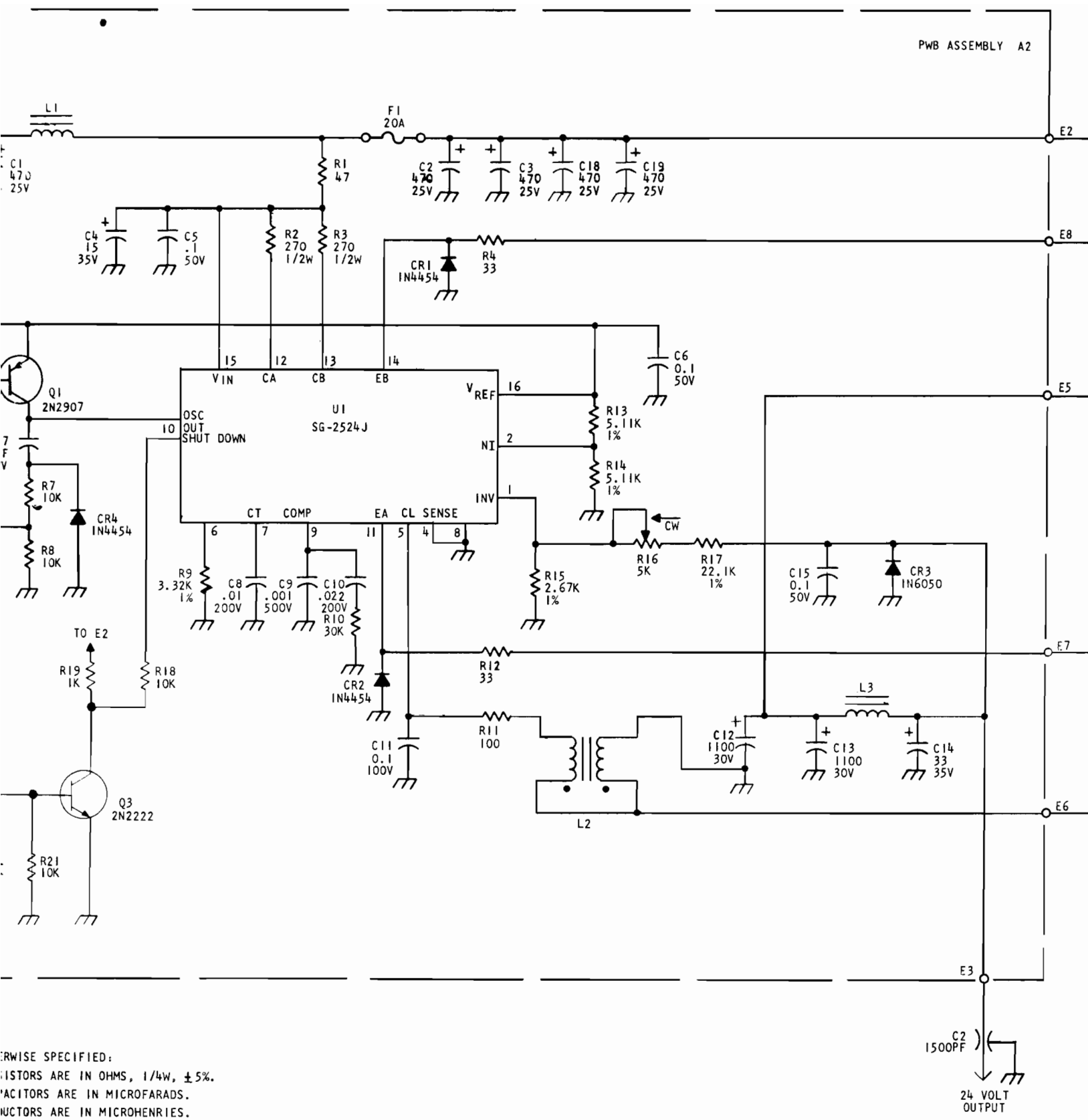


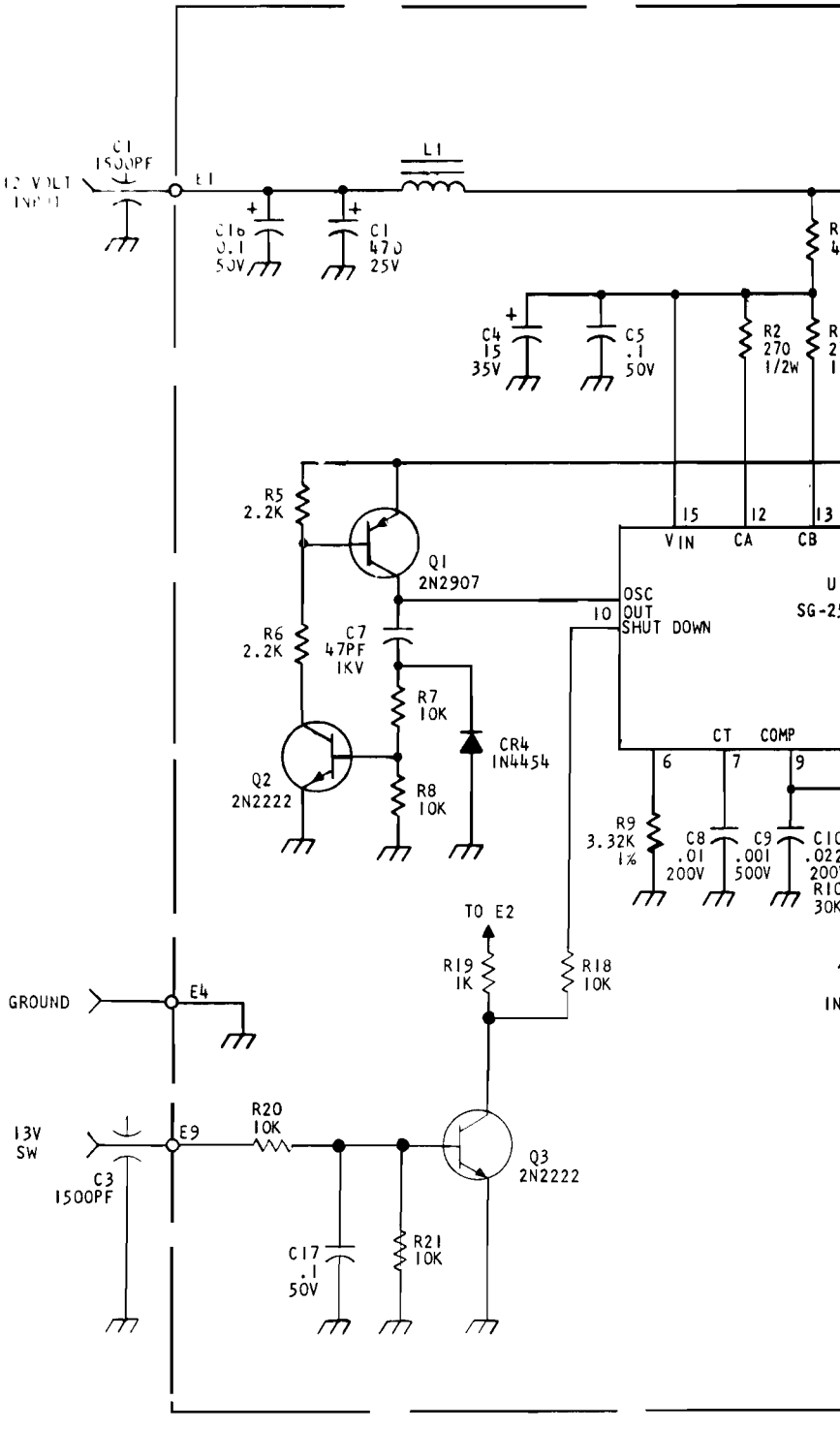
Figure 5. 1A4 Power Supply Schematic Diagram (10007-0901)

PWB ASSEMBLY A2



ERWISE SPECIFIED:
ISTORS ARE IN OHMS, 1/4W, ±5%.
'ACITORS ARE IN MICROFARADS.
UCTORS ARE IN MICROHENRIES.

'OR JEDEC PART NUMBER CALLOUTS ARE
ICE ONLY; COMPONENTS ARE SUPPLIED AS
MBER ON PARTS LIST.



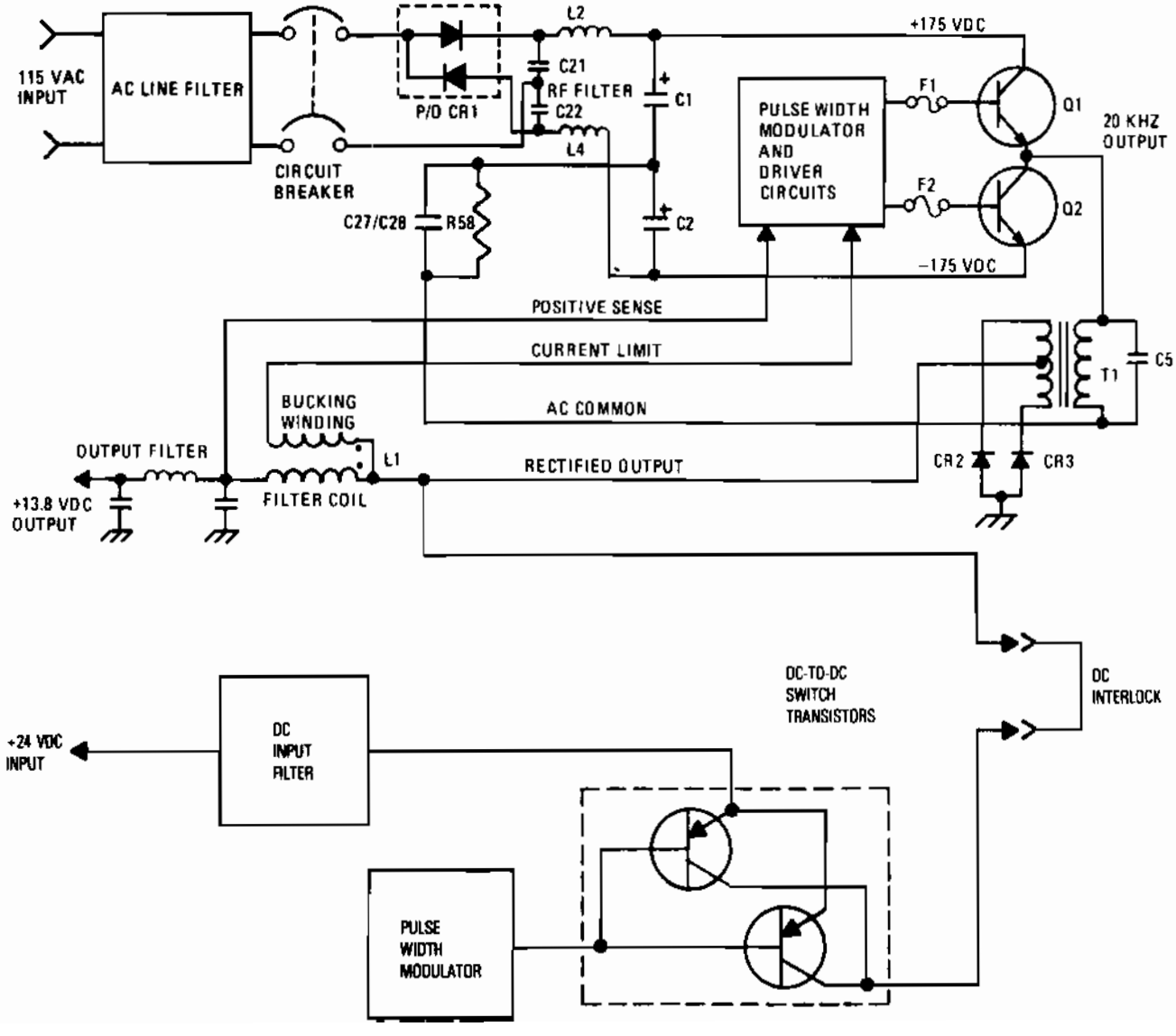
NOTES:

1. UNLESS OTHERWISE SPECIFIED:
   A. ALL RESISTORS ARE IN OHMS, 1/4W, ±5%.
   B. ALL CAPACITORS ARE IN MICROFARADS.
   C. ALL INDUCTORS ARE IN MICROHENRIES.
2. VENDOR AND/OR JEDEC PART NUMBER CALLOUTS ARE FOR REFERENCE ONLY; COMPONENTS ARE SUPPLIED AS PER PART NUMBER ON PARTS LIST.

UNIT INSTRUCTIONS

POWER SUPPLY

RF-2360



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1. GENERAL INFORMATION

The RF-2360 Power Supply is a high-efficiency switching regulated power supply which also includes a 24 Vdc/12 Vdc converter. The supply may be operated from a +24 Vdc primary power source (±15%) or from a 115/230 Vac 60 Hz primary power source (±20%). Power consumption is typically 440 watts at 24 Vdc and 400 watts at 115 or 230 Vac, operating at approximately 80% efficiency. The dual switching regulators provide current on a demand basis, maintaining regulation to within ±1% of rated output. In order to improve efficiency, the supply output voltage is reduced to 11.8 Vdc during continuous-duty use

The power supply is essentially divided into two operational units; the ac to dc converter, and the dc to dc converter. There are four major assemblies which constitute these two units (refer to Figure 1, 'RF-2360 Assembly-Level Block Diagram'). Some of the circuitry is common to both units (refer to Figure 2, 'RF-2360 Functional Block Diagram').

2. TECHNICAL CHARACTERISTICS

Power Requirements

+24 Vdc (negative ground) at 20A maximum
115/230 Vac at 60 Hz/400 watts nominal

Signal Inputs

Reduced Voltage (J1 pin D)
External Fan Control (J1 pin E)

Signal Outputs

+13.8 Vdc at 36A maximum
+24 Vdc at 3A maximum

3. SEMICONDUCTOR COMPLEMENT

Ref Des	Type	Description
Q1/2	2N6547	Transistor (1A2)
Q3	2N6286	Transistor (1A2)
Q4/5	2N5684	Transistor (1A2)
Q1/2	2N2907	Transistor (1A1)
Q3/4	2N2222	Transistor (1A1)
Q5	2N6122	Transsitor(1A1)
Q6	2N4922	Transistor (1A1)
Q7	2N6122	Transistor (1A1)
Q8	2N4922	Transistor (1A1)
Q9	2N2222	Transistor (1A1)
Q10	2N2907	Transistor (1A1)
Q11	2N2222	Transistor (1A1)
Q12	2N2907	Transistor (1A1)
Q13	2N3642	Transistor (1A1)
Q14	2N5190	Transistor (1A1)
Q15	2N5193	Transistor (1A1)
Q16	2N5190	Transistor (1A1)
Q17	2N5193	Transistor (1A1)
Q18	2N5190	Transistor (1A1)
Q19	MJE1091	Transistor (1A1)
Q20	2N3642	Transistor (1A1)
Q22	2N2222	Transistor (1A1)
U1	MC1558	Dual Op-Amp (1A1)
U2	78L12	Voltage Regulator (1A1)
U3	SG2524	Pulse-Width Mod. (1A1)
U4	SG2524	Pulse-Width Mod. (1A1)
U5	MC1558	Dual Op-Amp
U6	MC1558	Dual Op-Amp
U7	MC78L12	Voltage Regulator

NOTE: *Refer to paragraph 4.4 for details concerning SG2524 Pulse Width Modulator.*

CAUTION

Observe ac line polarity when connecting to power supply, in particular the 115 Vac line to NEUTRAL line polarity. Reversal of these two lines will cause the circuit breaker to trip when activated. The RF-2360 is not polarity-sensitive when used in 230 Vac Line-to-Line or Line-to-Neutral systems. Before connecting to ac power line, check the position of the 115/230 switch, located under the bottom cover of the supply case. Always remove ac line cord before connecting +24 Vdc to the RF-2360. Observing these points will prevent possible damage to equipment, or injury to operating personnel.

WARNING

High voltages exist within the RF-2360 which, if contacted, could cause serious injury or death. Exercise caution when servicing interior of power supply when energized.

4. FUNCTIONAL DESCRIPTION

4.1 GENERAL INFORMATION

The following paragraphs describe the functional operation of the circuits contained in the RF-2360 Power Supply. The description is presented on a functional block basis for ease of understanding. Refer to Figure 2, 'RF-2360 Power Supply Functional Block Diagram' during the course of this discussion.

4.2 AC TO DC CONVERTER

The RF-2360 Power Supply essentially consists of two separate power supplies, an ac to dc converter, and a dc to dc converter. The following description explains the functional operation of the circuits associated with the ac to dc converter.

4.2.1 MAIN SWITCHING CIRCUITS

Transistors Q1 and Q2 comprise the high voltage switching transistors that form the ac to dc converter half of the RF-2360. Primary ac line voltage is applied to the main circuit breaker, to an ac line filter, and then fed to bridge CR1 on the heatsink assembly for rectification. The 115/230 Vac selector switch determines the mode of rectification; e.g., halfwave for 115 Vac operation, and full-wave for 230 Vac operation (see Figure 3). C21 and C22, in conjunction with L2/L3/L4 and other associated components, form an RF filter. The resulting ±175V outputs of the filter are applied to C1 and C2 on the 1A3 assembly, which act as filter capacitors for the line ripple. This line ripple will occur at a 60 Hz rate for 115 Vac operation and at a 120 Hz rate for 230 Vac operation. The different ripple frequencies for the two line voltages occur because, in 115 Vac operation, only half of bridge CR1 is used. Each of the active diodes in the bridge acts as a half-wave rectifier, one conducting on the positive half-cycle of the ac input and the other on the negative half-cycle. See Figure 3. In 230 Vac operation, all diodes in the bridge are connected and act as a full-wave bridge rectifier circuit. +175 Vdc is applied to the collector of Q1, and -175 Vdc to the emitter of Q2. Base drive for Q1/Q2 is supplied by the 1A1 assembly through fuses F1/F2. Base drive between Q1 and Q2 will alternate at approximately 20 kHz. When Q1 receives positive base drive, it will conduct, with the resultant current flow from C1(+) through Q1 and T1 primary to C1(-). When Q2 turns on, it will also conduct, pulling current from C2(+) through Q2 and T1 primary to C2(-). The current flow through T1's primary induces a voltage in the secondary winding, which is rectified and applied to filter coil L1. L1 acts to smooth out the rectified square wave and produce a constant dc output voltage. Capacitors C1, C2 and filter choke L2 serve to reduce high frequency ripple in the output of the power supply. Current limiting in this power supply is accomplished by sensing the dc voltage drop across L1 (which has .007Ω of dc resistance). Current limiting occurs when the voltage fed back to the regulator chip ≅ 200 mv. L1 includes an internal bucking winding (connected out of phase with the main winding), which cancels the ac component of the current limit voltage fed back to current limit input on the regulator chip. Resistor R37 is used to adjust the point at which current limiting occurs and is normally set at 36A. L1 is designed to include an internal bucking winding, which is tapped off the unfiltered side of L1. The winding effectively removes the 20 kHz ac component from the signal by applying an out-of-phase signal to the filter coil. The resulting dc voltage is applied to the comparator/error amplifier contained inside the SG2524 Switching Regulator integrated circuit. The other input of the error amplifier is connected to the positive sense line, which is the filtered sense line. The comparator senses the voltage drop across L1. In cases of heavy loads, the voltage drop will increase proportionately to the current drain, thus causing the pulse width of the output of the switching regulator to vary according to the levels applied to the comparator and error amplifier inputs. The dc voltage from L1 receives further filtering before being applied to pin A of J1 as the primary +13.8 Vdc output.

4.2.2 ONE SHOT PULSE EXPANDER

Transistors Q2 and Q3 of the 1A1 assembly form a monostable multivibrator circuit which expands the oscillator pulse generated at U3 to a period of 5.5 uS. The oscillator pulse appearing at pin 3 of U3 is applied to the base of Q3 through coupling capacitor C5. Q3 then saturates, providing a path for base current from Q2 to flow, thus turning on Q2. When Q2 turns on, C5 begins to charge through the timing circuit formed by C5/R18/R19. Once C5 charges, current ceases to flow to the base of Q3 and both transistors turn off until the next pulse appears.

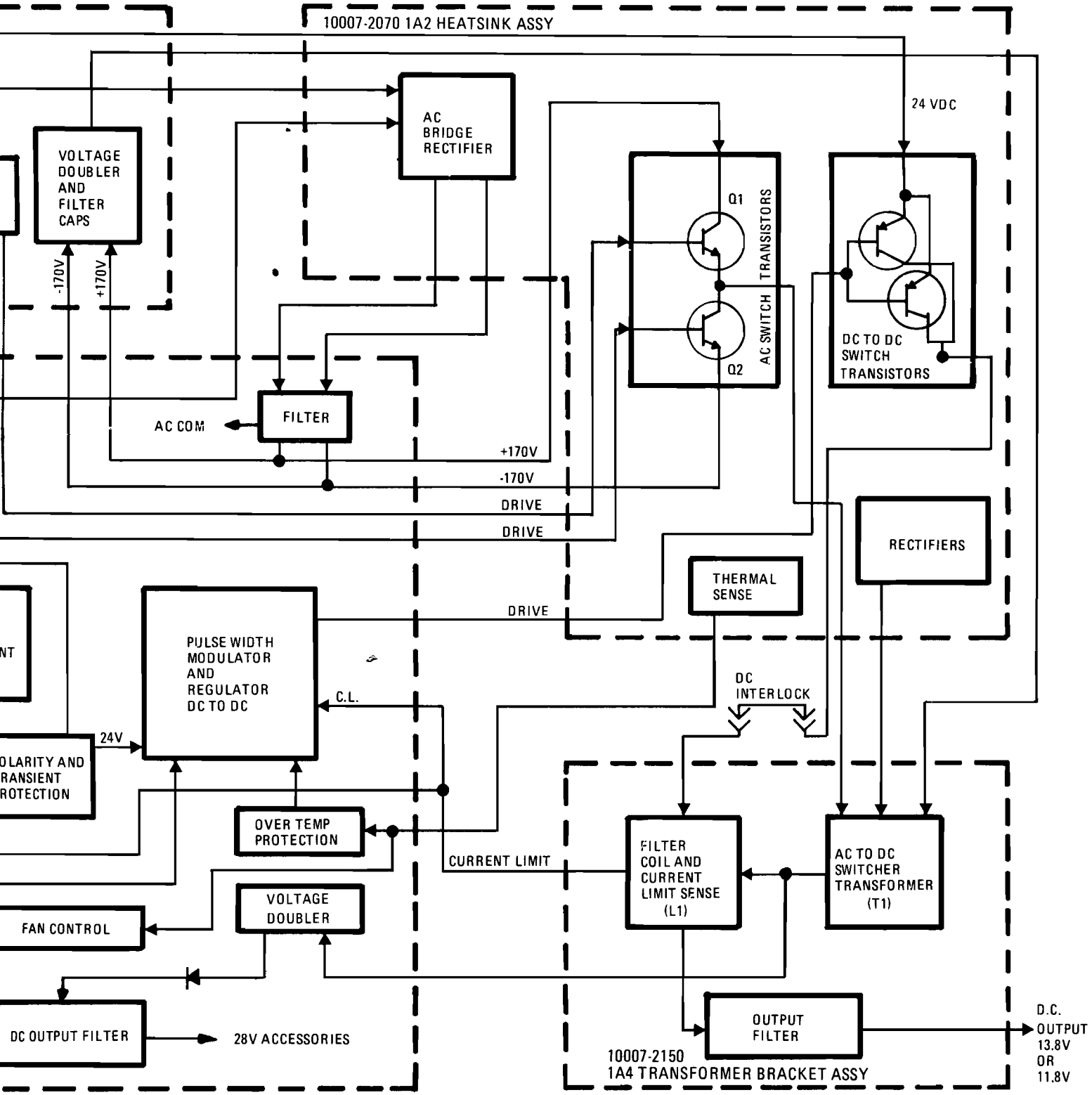
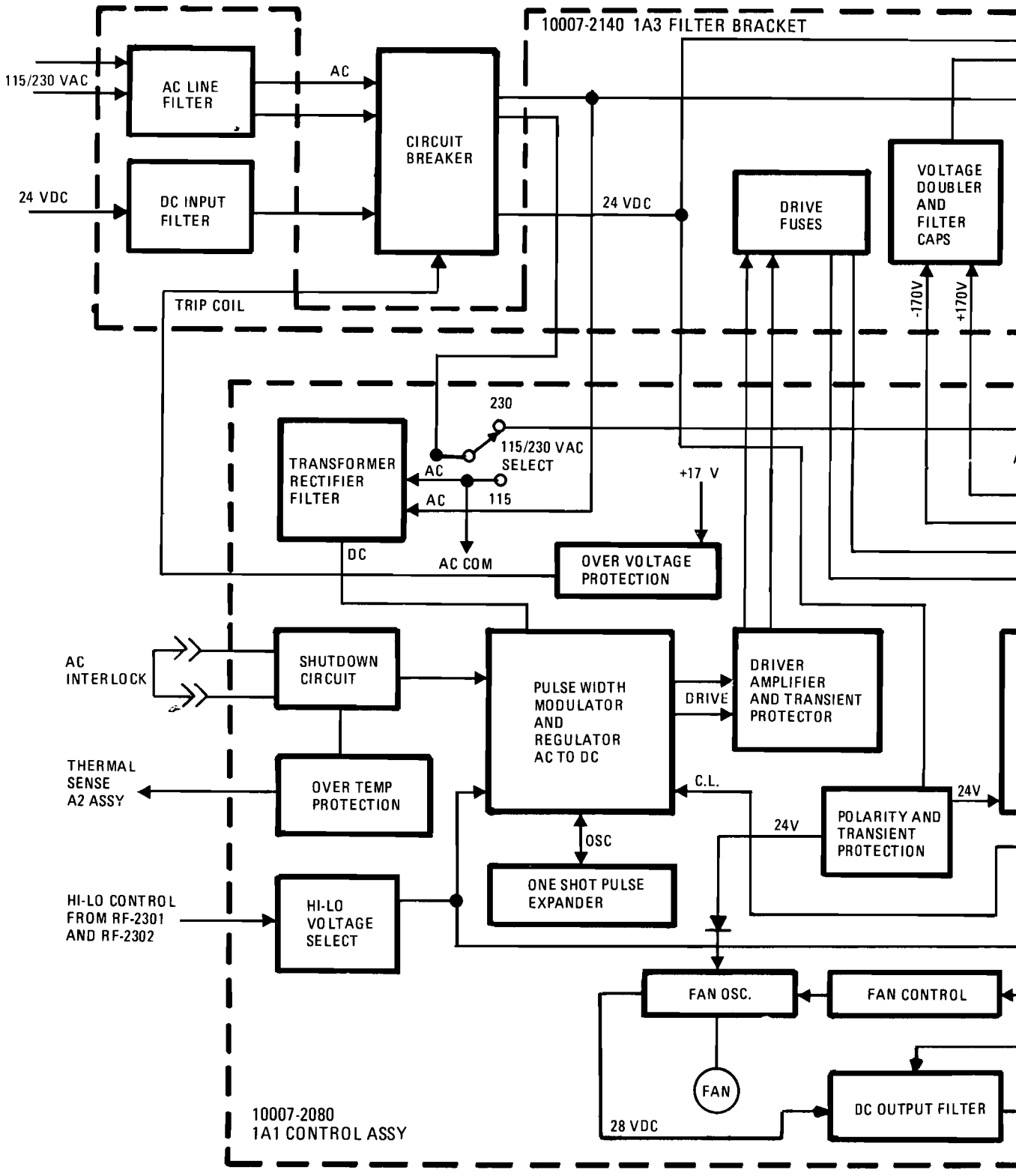


Figure 1. RF-2360 Assembly-Level Block Diagram



NOTE: S1 IS ACCESSABLE FROM THE BOTTOM OF THE CASE. BE CERTAIN SWITCH IS PLACED IN CORRECT POSITION BEFORE APPLYING PRIMARY AC POWER.

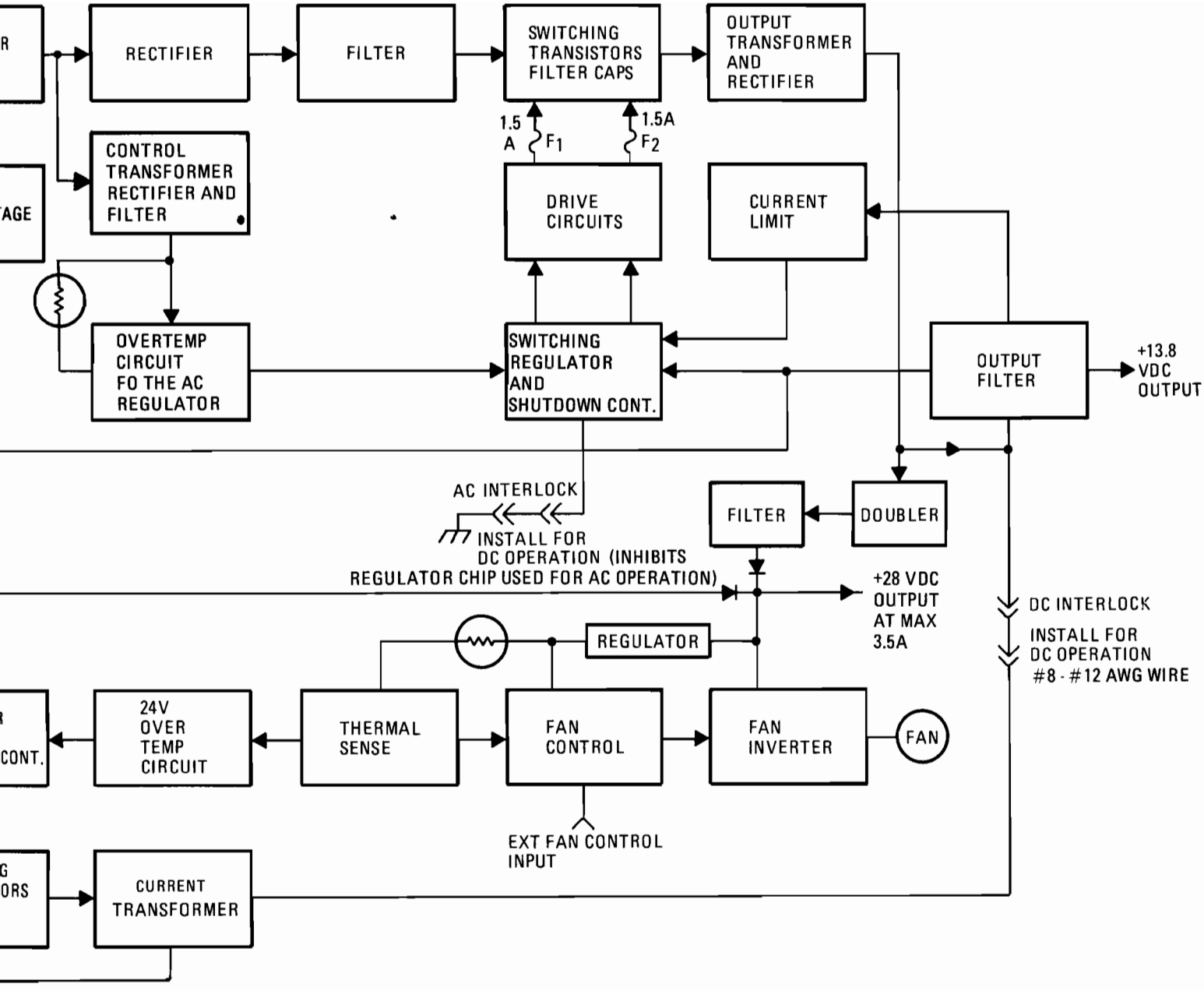
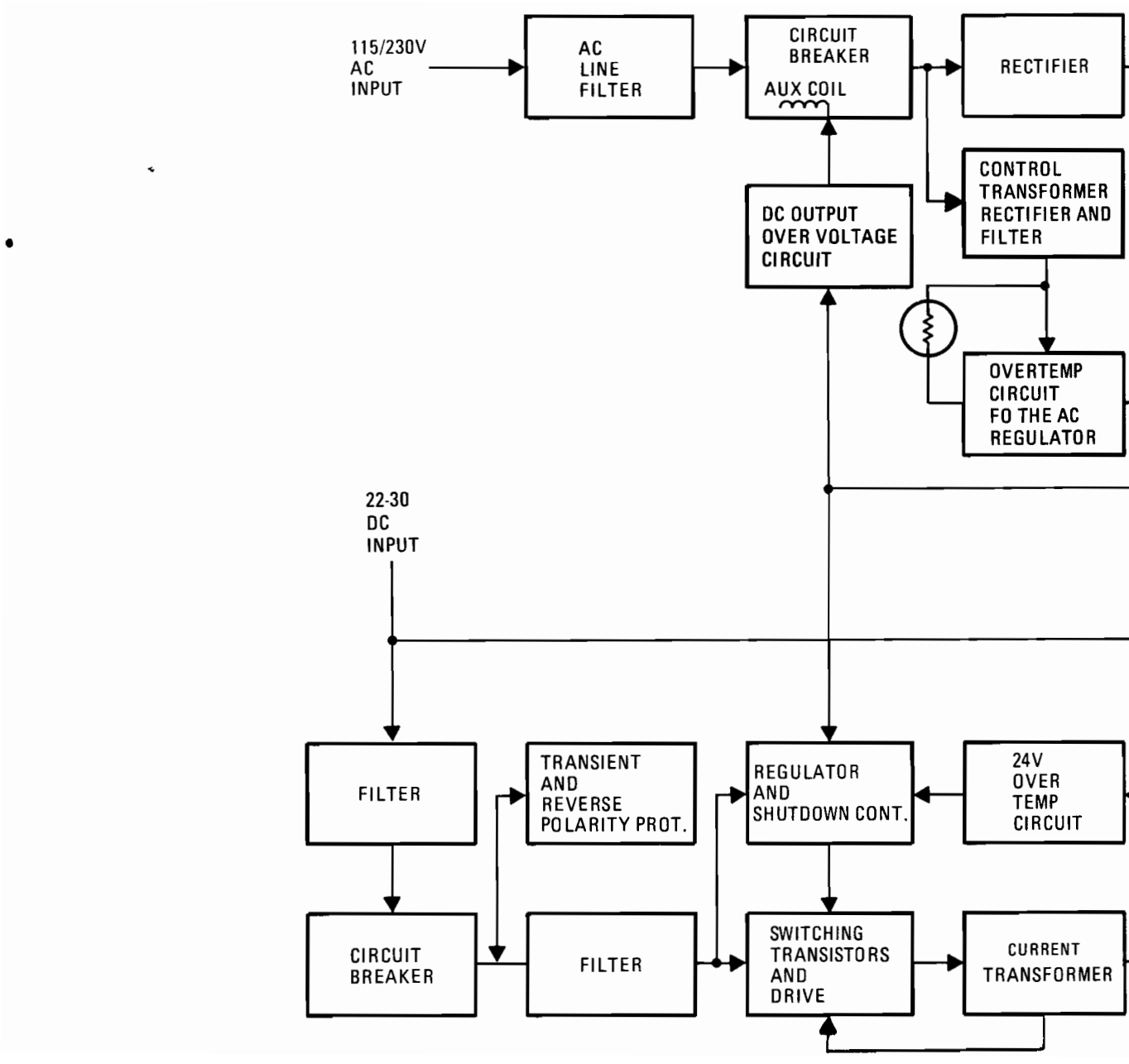


Figure 2. RF-2360 Power Supply Functional Diagram


115/230V
AC
INPUT
AC
LINE
FILTER
CIRCUIT
BREAKER
AUX COIL
RECTIFIER
CONTROL
TRANSFORMER
RECTIFIER AND
FILTER
DC OUTPUT
OVER VOLTAGE
CIRCUIT
OVERTEMP
CIRCUIT
FO THE AC
REGULATOR
22-30
DC
INPUT
FILTER
TRANSIENT
AND
REVERSE
POLARITY PROT.
REGULATOR
AND
SHUTDOWN CONT.
24V
OVER
TEMP
CIRCUIT
CIRCUIT
BREAKER
FILTER
SWITCHING
TRANSISTORS
AND
DRIVE
CURRENT
TRANSFORMER

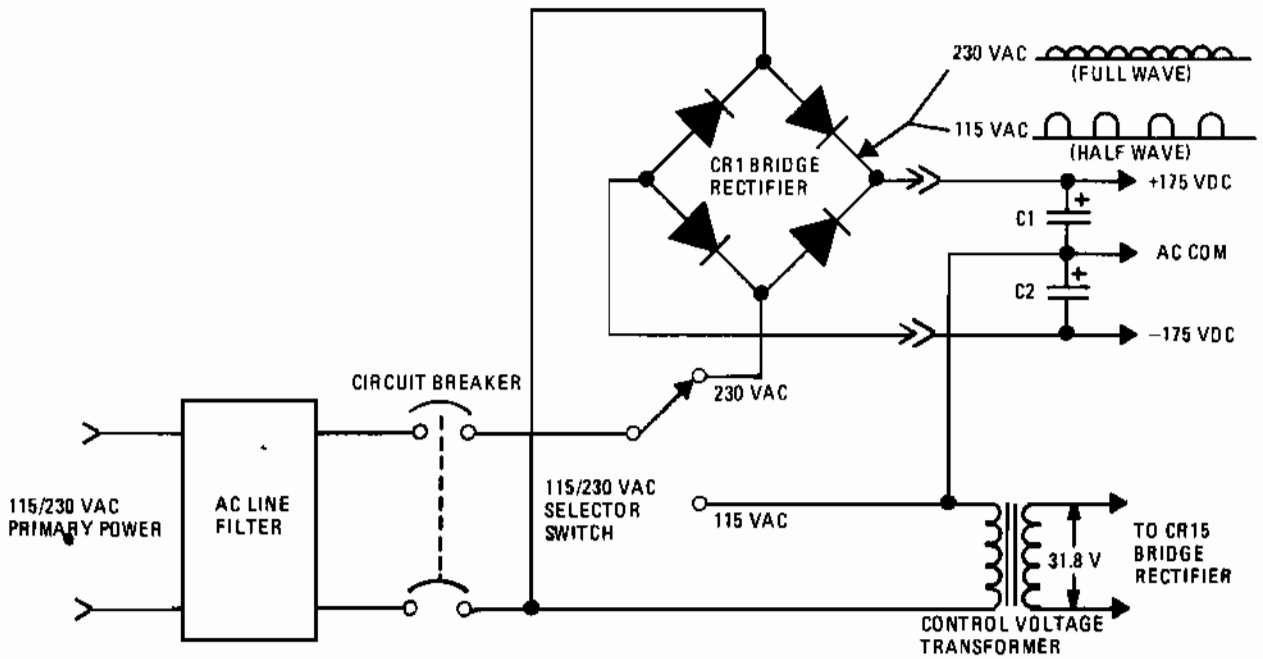


Figure 3. Primary Power Selection Diagram

4.2.3 LO/HI VOLTAGE ADJUST

The logic level (high) applied from the RF-2301 mode switch during FSK or CW operation is connected through a filter to the (+) input of operational amplifier U6. This unity-gain follower acts as a buffer amplifier, transferring the logic level to the base of Q4. Once Q4 has saturated, resistors R26 and R28 are placed in parallel with R27 and R29, thus altering the total resistance seen from pin 2 to ground, determined by the positioning of R26 and R27. Low voltage is adjusted via R26 for 11.8 Vdc while high voltage is adjusted for 13.8 Vdc using R27.

4.2.4 VOLTAGE REGULATION

The 5V generated by U3 (see Figure 4) will always be 5V above the U3 common regardless of the degree of common voltage fluctuation. This insures that the error amplifier is provided with a stable supply voltage, and also insures that 2.5V will always be present at pin 1 with respect to U3 common. When the power supply is loaded, the 13.8V line (U3 common) will begin to drop in voltage. Pin 1, the (-) input of the error amplifier, is tied to a voltage divider which is placed between the +5 volt reference and U3 common. Pin 2, the (+) input, is tied to a voltage divider connected between the +5 volt reference and chassis ground. Under current demand conditions, the common of the error amplifier drops in voltage, causing the voltage appearing at the positive input to appear larger with respect to its own ground (negative sense). The voltage present at the (-) input remains stable at 2.5V with respect to the positive sense line. Hence, from the point of view of the error amplifier, the voltage at the (+) input appears to increase, whereas the voltage present at the (-) input remains constant. Thus, the error amplifier output increases, which causes the U3 comparator to alter its output pulse width. This is because less of the ramp wave present at the (+) input of the comparator now exceeds the voltage at the (-) input (see Figure 9). This causes the driver circuits to switch on the main switching transistors, Q1 and Q2, for longer periods of time, proportional to the current demand.

4.2.5 DRIVER CIRCUITS

The driver pulses originating from pins 11 and 14 of U3 are applied to identical driver circuits. The pulse originating from pin 14 is coupled through a resistive divider to the base of Q5. Q5 saturates, and induces a current flow through T3 from pin 6 to pin 10. This is the Base Drive Current for the switching transistor (Q1) on the heatsink assembly. During Q5's 'on-time', the drive pulse is applied to the emitter of Q6 after passing through Q5 base-emitter junction. This pulse turns off Q6 and charges C19 through R44. When the drive pulse disappears, Q5 turns off, and Q6 is now presented with a charged capacitor at its base, which saturates the transistor. Its collector current induces current flow in the Base Drive winding of T3 in the opposite direction (from pin 10 to pin 6), resulting in rapid turn-off of Q1.

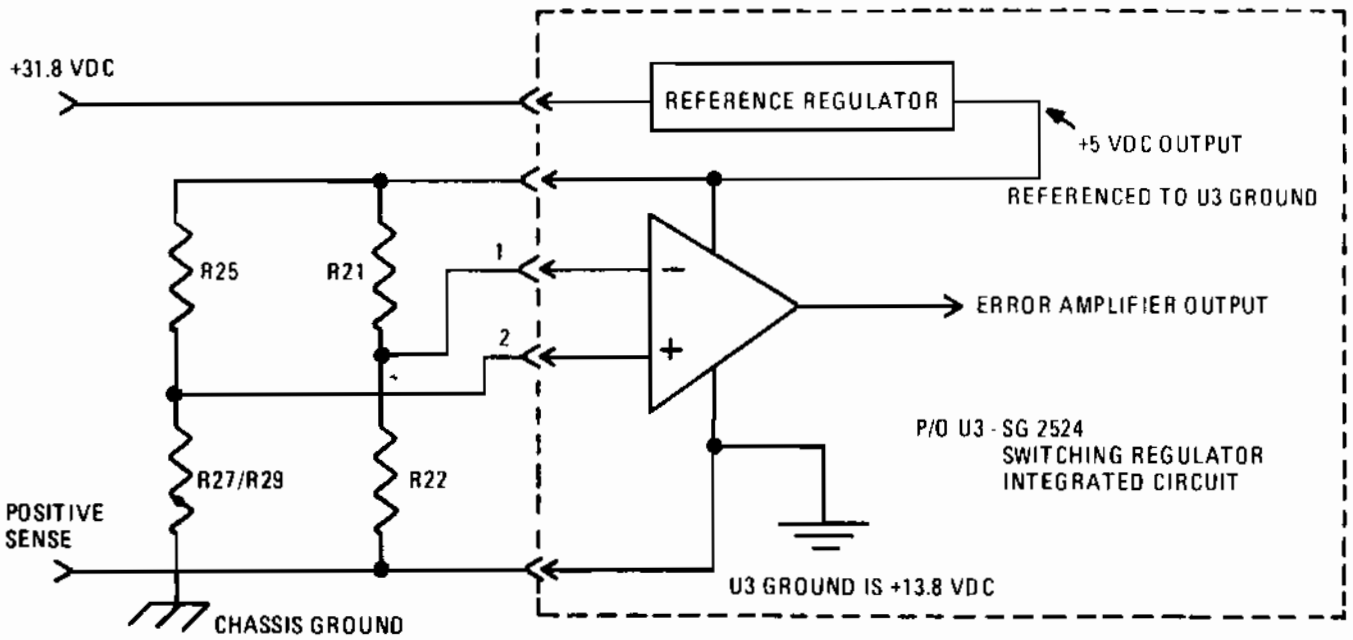


Figure 4. Simplified Voltage Error Detector Diagram

4.2.6 OVERVOLTAGE PROTECTION

Q20 comprises the dc overvoltage protection circuit. Resistors R113/R114 and CR32 form a voltage divider connected between chassis ground and the positive sense (+13.8V) line. If the voltage present on the positive sense line exceeds approximately 17.7 volts, the voltage developed across the divider feeding Q20 will cause it to turn on. This provides a current path from the base of Q19. When Q19 turns on, the base of Q22 is pulled high, which insures that Q19 remains conducting. Hence, Q19 and Q22 form a latch circuit. When Q19 activates, current is supplied to the auxiliary coil contained in circuit breaker CB1, causing it to trip the breaker, which disconnects primary power from the RF-2360. The action of the breaker is positive, thus the breaker remains tripped, preventing the supply from oscillating. The Q19/Q22 latch is also activated by the Low Ac Line Shutdown circuit, which turns the supply off when the Ac line voltage input is low enough to prevent transistors Q1 and Q2 from operating in a saturated condition, and by the Overtemperature Circuit for the Ac regulator via buffer amplifier and comparator U1.

4.2.7 TEMPERATURE PROTECTION FOR THE AC TO DC POWER SUPPLY

Under conditions of high ambient temperature or excessive current for prolonged periods of time, the heat generated by the RF-2360 will increase. As heat increases on the heatsink, the resistance of thermistor RT1 decreases, in turn causing the voltage present at the (+) input of U1 to increase. U1 comprises a unity-gain amplifier, applying its signal through a voltage divider to an operational amplifier with positive feedback. The voltage presented at the (+) input must exceed 9.7 volts relative to chassis ground in order for U1 pin 7 to go high. This occurs when the heatsink temperature tries to exceed 100°C. At this point, the amplifier will latch at approximately 24V with respect to chassis ground, and will remain in that state until the power is turned off. When U1 pin 7 goes high, a logic level is applied to the 'Shut Down' input of the SG2524 regulator (U3) and also to Q19/Q22, which disconnects the supply from the primary power source. When the heatsink temperature has lowered to approximately 75°C, the supply can be reactivated by tuning the breaker on again. (See Figure 5).

4.3 DC TO DC CONVERTER

The following description explains the functional operation of the dc to dc converter circuits. Note that both the ac to dc converter and the dc to dc converter utilize the SG2524 Pulse Width Modulator Integrated Circuit, and hence the functional operation of the regulation circuitry is identical.

4.3.1 DC TO DC CONVERTER SWITCHING CIRCUITS

In the dc to dc converter, the base drive outputs from the Pulse Width Modulator are tied together in parallel. The main switching transistors, Q4 and Q5, are also connected

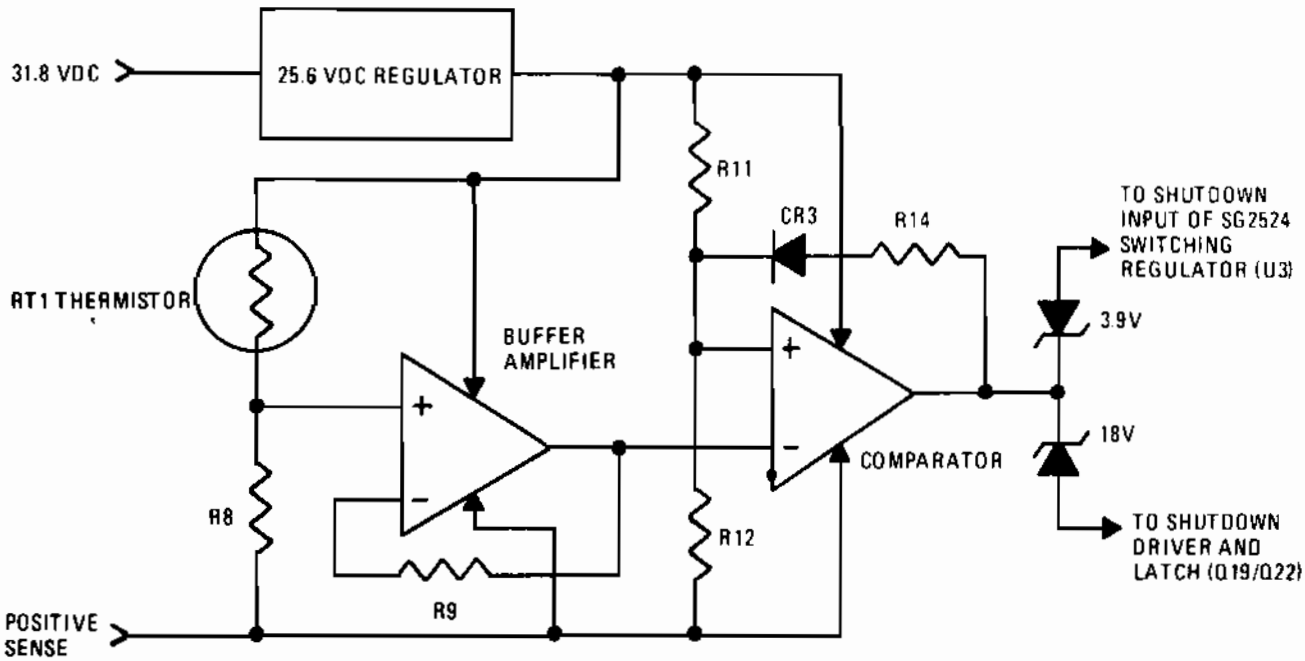


Figure 5. Simplified Temperature Detector Diagram

in parallel, and therefore conduct at the same time. The +24 Vdc line from J3 is filtered by L1/C1/C2/C3, applied to circuit breaker CB1, and is then routed to three points in the circuit: (1) to the dc to dc converter output transistors, (2) the 24V regulator, and (3) fan inverter. The drive line connects pins 12 and 13 of U4 to the base of Q3. These are the open collectors of U4's drive outputs. When these transistors saturate, they pull the base of Q3 low, providing a path for base current to flow, turning on Q3. Once Q3 saturates, the bases of Q4 and Q5 are pulled low, turning them on. 24 Vdc is applied to the emitters of Q4 and Q5 when base drive is present. This results in a square wave at the collectors of the transistors. This signal is filtered into an average dc level (approximately 13.8 Vdc). T1 is a current transformer which has a turns ratio of 8:1. By sensing the output current with respect to the base drive current supplied by Q3, T1 insures that the base drive current for Q4 and Q5 will always be 1/8 of the output current (T1 primary) regardless of total current drain. This feature improves the operating efficiency of the switching regulator under varying load conditions.

4.3.2 DC TO DC POWER SUPPLY TEMPERATURE PROTECTION

As heatsink temperature increases, the resistance of thermistor RT2 decreases, causing the voltage at the (+) input of unity-gain amplifier U5 to increase. The resulting analog voltage is coupled to the (+) input of the voltage comparator through a voltage divider. The voltage at the (+) input must exceed 4.5 volts in order to activate the comparator. This occurs at a heatsink temperature of 100°C. The comparator is a latching circuit, using positive feedback provided by CR4 and R82 to remain latched once the output voltage has reached 4.5V at the (+) input. The amplifier will remain latched at 12 Vdc until the power supply is turned off. Once the latch has activated, Q11 is in turn activated, turning on Q10. Q10 provides a current path to the Shutdown transistor contained in the SG2524 Pulse Width Modulator, which disables the switching regulator circuitry.

4.3.3 FAN CONTROL CIRCUIT

The output of the unity-gain amplifier U5 is coupled to the (+) input of U6. U6 is an identical latching circuit as previously described. When U6 turns on, Q13 is in turn activated, turning on Q14. When Q14 saturates, a ground path is provided for the Fan Oscillator circuit. The fan can also be activated by an external control signal consisting of a logic low or ground applied to Q12 through power connector J1 Pin E. When he base of Q12 is pulled low by this signal, it turns on, supplying base drive for Q13/Q14, in turn activating the Fan Oscillator. The output of the

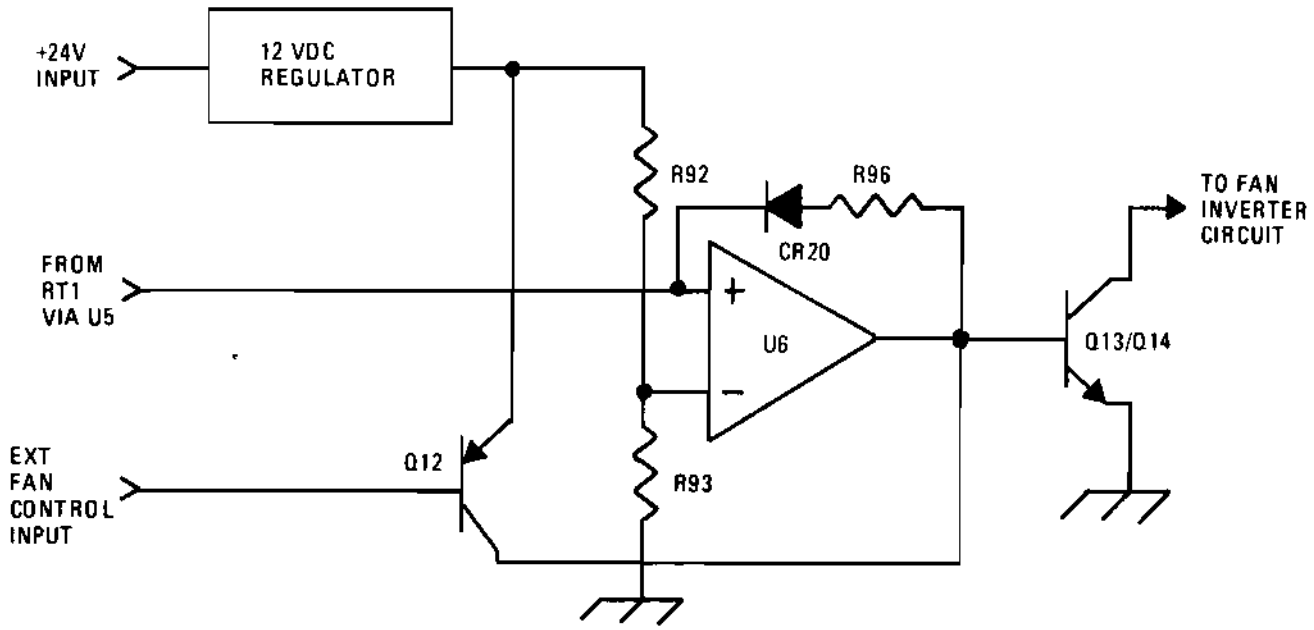


Figure 6. Simplified Fan Control Circuit

unity-gain amplifier feeding the circuit must exceed approximately 6V in order to activate the fan, and must exceed approximately 9.4V in order to cause the shutdown circuit to activate. Thus, U5 controls both the Fan and Temperature control circuits. The simplified fan control circuit is shown in figure 6.

4.3.4 FAN OSCILLATOR CIRCUIT

Oscillator transistors Q15-Q18 are controlled by saturable driver transformer T4. 24V is applied to the circuit from either CR19 (when primary power source is 24 Vdc) or CR21 (when ac to dc converter is utilized) via rectifier circuit CR35 on the 1A1 PWB assembly. When ground is supplied to the circuit via Q14 as previously described, Q16 is supplied base drive through R101, and Q17 is supplied base drive through R106. These two transistors turn on, pulling current through T4 from pin 1 to 6. During the time required for T4 primary to saturate, a voltage will be induced in the secondary windings. This, in turn, results in Q15/Q18 becoming reverse-biased and in Q16/Q17 becoming forward-biased. Once the primary of T4 reaches inductive saturation, the fields of the two secondaries collapse, reversing the polarity of the two windings. This reverse in polarity causes Q16/Q18 to become forward-biased, and Q16/Q17 to become reverse-biased. Thus, current flows through T4 primary in the opposite direction, until saturation occurs again. This cycle continues until Q14 is turned off, and the ground to the circuit is removed. The oscillator supplies a 48V p-p signal at approximately 60 Hz. Funtioning of T4 is illustrated in Figure 7.

4.4 SWITCHING REGULATOR SG2524.

Switching Regulator SG2524 Functional Operation diagram is illustrated in Figure 8.

4.4.1 REFERENCE REGULATOR

The reference regulator operates from the primary dc voltage, as applied to pin 15, and produce a constant +5 Vdc at pin 16. This +5 Vdc source is also used to provide operating voltage to the SG2524 internal circuit. The relative output of the reference regulator will always be 5 volts higher than the chip ground (which may be either 13.8 Vdc or 11.8 Vdc, depending on the operating conditions at the moment).

4.4.2 OSCILLATOR

The internal oscillator provides two synchronous outputs, a clock signal and a ramp signal. The frequency of these two signals are set by the RC time constant formed by R32 at pin 6 and C10 at pin 7. The pulse oscillator output may be measured at pin 3, and the ramp output at pin 7.

4.4.3 SHUTDOWN/CONTROL

The error amplifier and current limit amplifiers are operational amplifiers which amplify the difference between voltages present at their respective (+) and (-) inputs. The comparator is also an operational amplifier, operating in an open-loop configuration. The output of the comparator will swing from 5V to ground depending on which input is presented the higher voltage. If the (+) input is higher than the (-) input, then the output will be 5V.

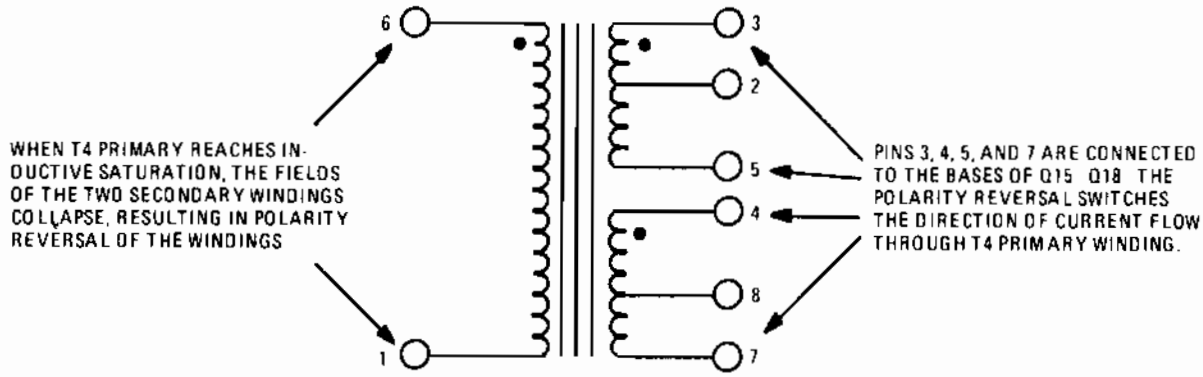


Figure 7. Transformer T4 Functional Operation Diagram

4.4.4 NOR GATES/DRIVERS

The dual NOR gates operate the output driver transistors, which provide the pulse-width modulated output of the device. The NOR gates are configured in such a way that they are both simultaneously operated from (1) the ramp output of the oscillator, (2) and Q and $\overline{Q}$ outputs of the flip-flop, and (3) the output of the comparator.

4.4.5 FUNCTIONAL OPERATION

The on-board oscillator output pulses are fed to the clock input of the flip-flop and simultaneously to the inputs of the NOR gates. Since a NOR gate must show a low condition on all inputs in order to produce a high output, both gates will be disabled for as long as the clock pulse is present. Since both gates are disabled in this case, both driver transistors are cut off, and the switcher is 'dead' for the duration of each clock pulse. Hence, these pulses are called 'dead time' pulses. The purpose of the dead time pulses are two-fold: first, they clock the flip-flop such that its Q and $\overline{Q}$ outputs alternate high and low; secondly, these pulses insure that at no time will the output driver transistors both be on at the same time by simultaneously switching both the associated NOR gates and the flip-flop. The dead time pulse width should be approximately 5.5 uS (according to the one-shot pulse expander). The output pulse width will vary according to the loading of the power supply. The error amplifier is responsible for regulation of the RF-2360 output voltage. As the loading of the supply increases, the voltage present at the (+) input of the error amplifier will increase with respect to the ground of the SG2524. The voltage at the (-) input will always remain at 2.5V above the SG2524 ground. The error amplifier will sense the increase in voltage at the (+) input and amplify this voltage. This signal is then applied to the (-) input of the comparator. The ramp signal is applied to the (+) input of the comparator. The output of the comparator will swing to 5V whenever the ramp exceeds the voltage at the (-) input, and will swing low whenever the ramp is below this voltage. Thus, the voltage at the (-) input controls the pulse width at the output of the comparator. One of the NOR gates will be on only when the comparator output is low. The other NOR gate is operated via the flip-flop. The current limit amplifier senses the dc voltage drop across the output filter coil, and will switch to a low condition when excessive current causes a higher voltage drop across the filter. This will cause the comparator (-) input to become low, forcing the comparator output high and hence disabling the switching transistors. The shutdown circuit of the RF-2360, when activated, will also pull the same point low to disable the switching transistors.

An example of the pulse-width modulation technique used in the switching regulator is shown in Figure 9. It is important to remember that the comparator output is dependent upon the voltage presented at the (-) input with respect to the ramp at the (+) input. The NOR gates operating the switching transistors are enabled only when the comparator output is low. It can be seen from this example that the comparator output will be low for longer periods of time as the load increases.

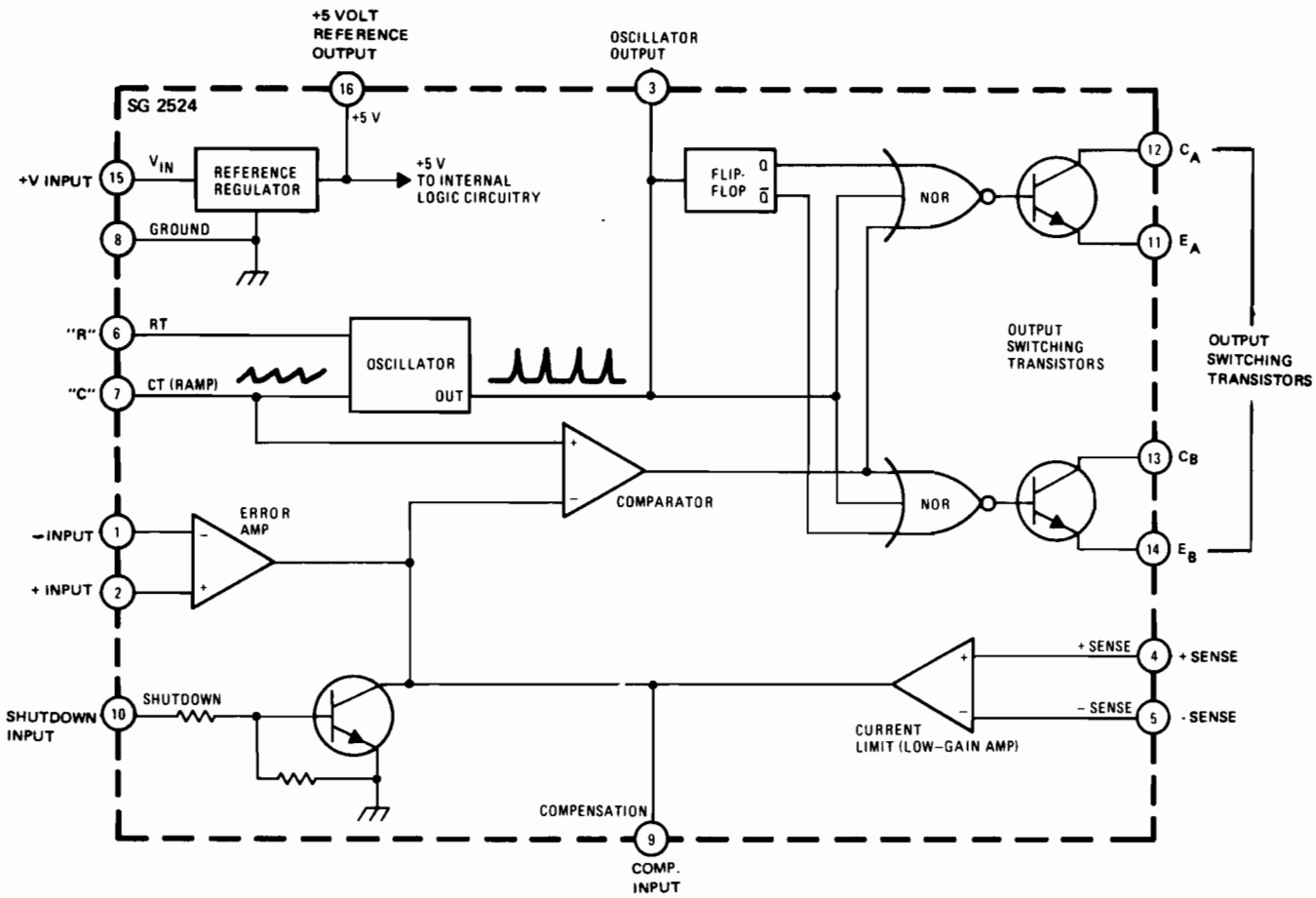


Figure 8. SG2524 Switching Regulator Functional Operation Diagram

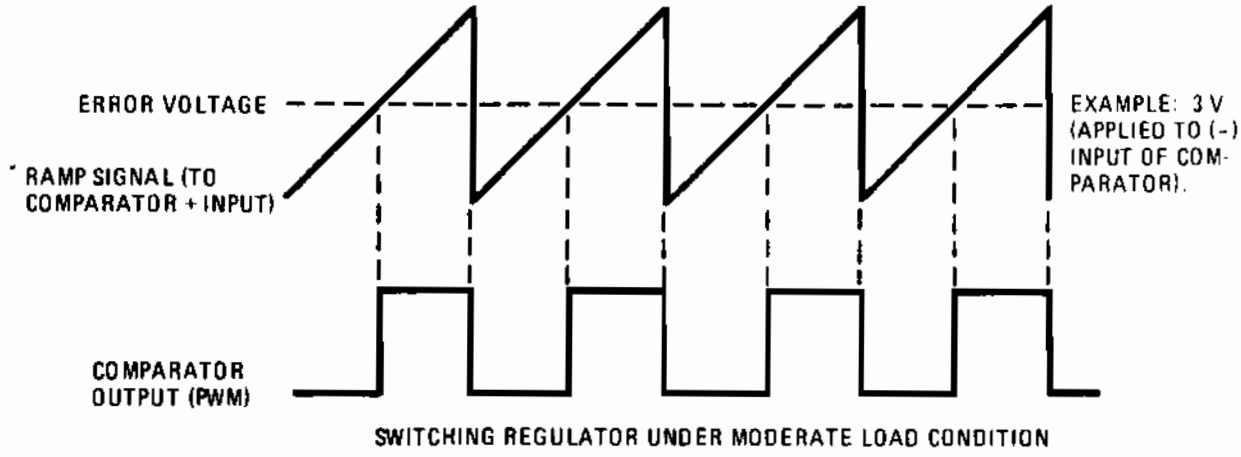


Figure 9. Switching Regulator Operation

5. MAINTENANCE

5.1 GENERAL INFORMATION

The following setup adjustments have been made at the factory and should not be performed as part of a regular maintenance routine. Perform only as required in conjunction with related component replacement. Figure 11 illustrates the RF-2460 Power Supply block diagram.

WARNING

Use extreme caution when performing this procedure. Voltages hazardous to life are present within the power supply.

5.2 SPECIAL PRECAUTIONS

WARNING

When powering up for AC operation, be sure to use an isolation transformer and a variac compatible with local line voltage and rated for a minimum of 600 watts for the duration of testing.

It is imperative that S1, located on the 1A1 circuit board, be set for the line voltage used in testing and subsequent operation. Failure to do so will cause serious damage to the power supply and possible personal injury.

- Use ground isolators on all test equipment power plugs.
- It is recommended that rubber-soled shoes or gloves be worn.

5.3 RECOMMENDED TEST EQUIPMENT

- Test Cable shown in figure 10.
- Oscilloscope, dual trace preferred - Tektronix 465 or equivalent.
- Multimeter, digital preferred - Digitec 2610 or equivalent.
- Load - active load similar to Transistor Device DLP50-150-3000 preferred, but any load capable of a 0-40 amp adjustable rating is suitable.
- Power Supply (for board test) - Any 1 to 2 amp, 20 volt current limited supply similar to Hewlett Packard HP6021B is suitable.
- 24 VDC AC power supply or 24 vehicle battery (for DC test only).
- Current probe and amplifier - Tektronix P6302 and AM503 or equivalent.

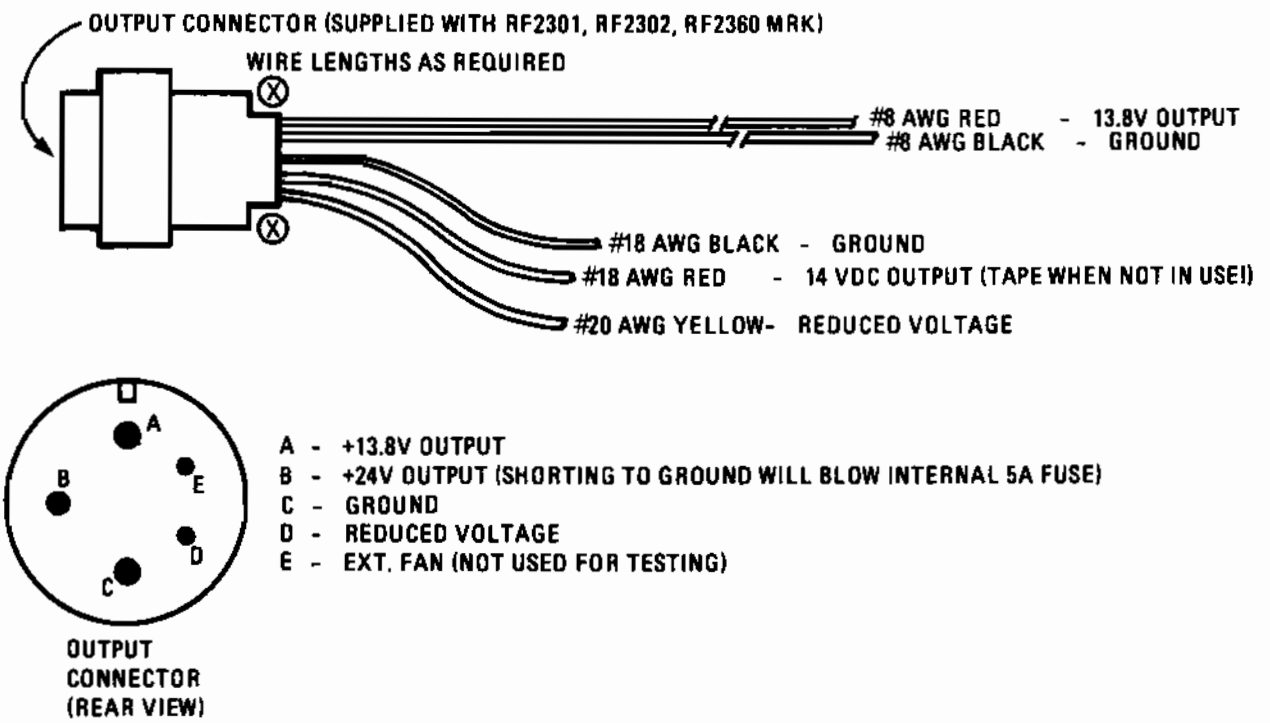


Figure 10. RF-2360 Recommended Test Cable

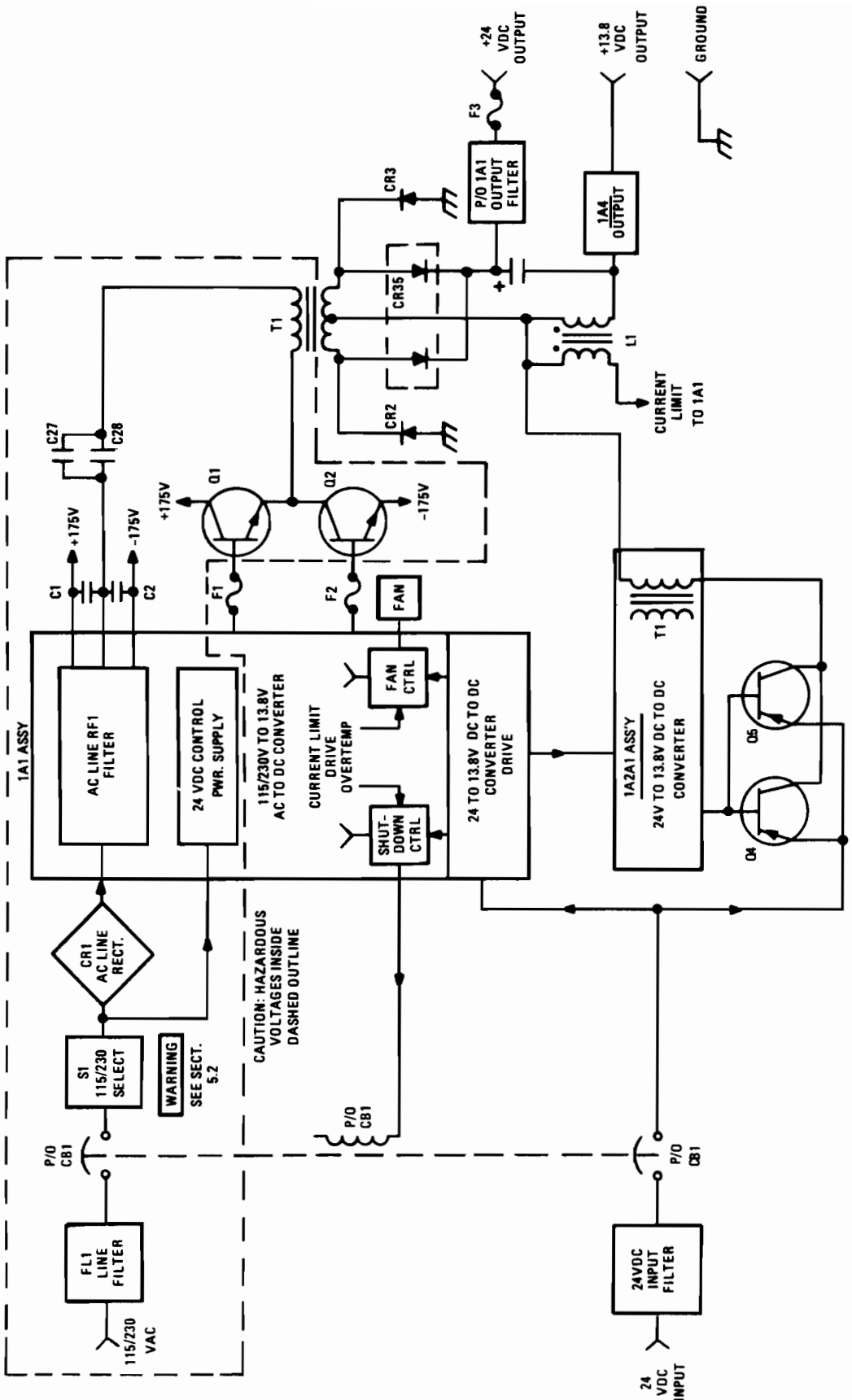


Figure 11. RF-2360 Power Supply Block Diagram

5.4 TEST PROCEDURE - 115/230 VAC OPERATION

Use the following procedure for power supply testing and setup when in AC input operation. Table 1 provides AC troubleshooting information.

a. Turn power switch off. Configure for test per figure 13.

b. With the isolation transformer disconnected from AC power, connect the 20 volt power supply to C30 on the 1A1 circuit board. Be sure to observe correct polarity. The monitored current drain will be approximatelly 300 mA to 500 mA. Do not connect AC power until instructed to do so.

c. Clip the current probe on the wires leading to F1 or F2 on the 1A3 assembly. The following waveforms should be observed.

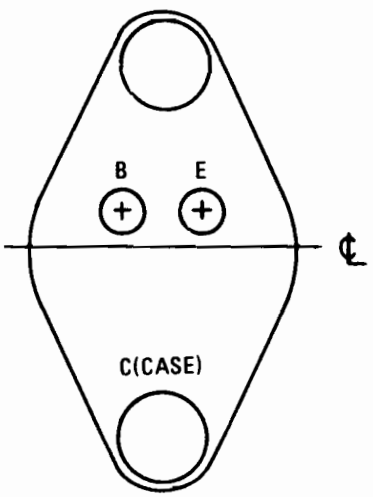
d. Connect the oscilloscope to U3-3 (on the 1A1 board). Connect the common lead to C30 minus. With the scope set at 1 V/div and 5-10mS/div observe the waveform shown in figure-14. Disconnect oscilloscope.

e. With the variac at zero and the load set for minimum loading, apply AC power to the isolation transformer. Clip the current probe to the wire connected to 1A1J3, pin 7 or 10. Turn the power switch on and slowly bring up the AC line. Observe the waveform shown in figure 14. If the current peaks exceed 2 amps by a significant anount, do not apply full power.

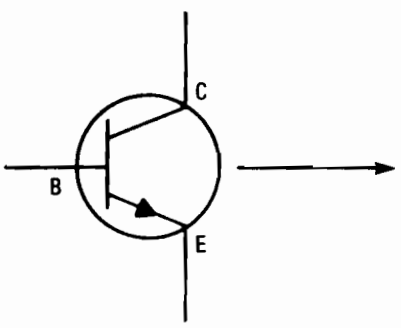
f. Slowly increase loading to 30 amps and observe the waveform shown in figure 14. Set load at minimum loading. Disconnect the 20V power supply.

g. Connect the plus lead of the multimeter to the +13.8 volt pin (J1-A) on the output connector. Connect the common lead to case ground. Set 1A1R27 for 13.8V ± .1volts. Connect the yellow wire on the test cable (from J1-D, reduced voltage) to the +13.8 volt line. Set 1A1R26 for 11.8V ± .1 volts. Disconnect the multimeter and the yellow test cable wire.

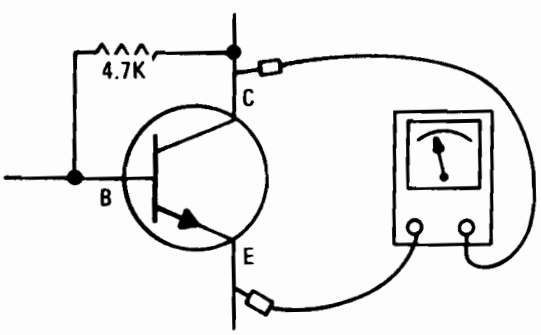
h. Set the load for 36 amps. Set 1A1R37 such that the 13.8V line voltage just starts to foldback. This will correspond to a 38 amp short circuit current value. Short the load. If the ammeter on the load indicates more than 38 amps, readjust 1A1R37 until the meter indicates 38 amps.



Q1 & Q2 (NPN)



OHM–	OHM+	READING
B	E	500-600 Ω NOM.
B	C	500-600 Ω NOM.
E	B	INFINITE
C	B	INFINITE
C	E	INFINITE
E	C	INFINITE



INDICATION WITH 4.7K CONNECTED TO B&C – 1K TO 2K Ω NOM.

Figure 12. Q1 and Q2 Output Transistor Test Procedure

i. Connect multimeter common to case ground. Connect plus lead to small red wire on test cable (+24V OUTPUT). Indication will be +25 VDC ±3 volts. Disconnect multimeter.

j. Connect scope common to ground wire in test cable (J1-C). Connect probe tip to +13.8 V line. Observe 40 KHz ripple at approximately 75mV p-p. Disconnect oscilloscope.

k. Connect multimeter common to case ground. Connect plus lead to J1-A (+13.8VDC output) at the connector. Vary the load from 1 to 30 amps. Observe deviation of no more than .3V.

The Q1 and Q2 output transistor test procedure is illustrated in figure 12. Use multimeter on ohms x 100 scale. When using a digital multimeter, ensure voltage between the common and the ohms probe when in ohms function exceeds 0.8V. Otherwise, there will be insufficient voltage to turn-on the internal transistor junction and erroneous indications will result.

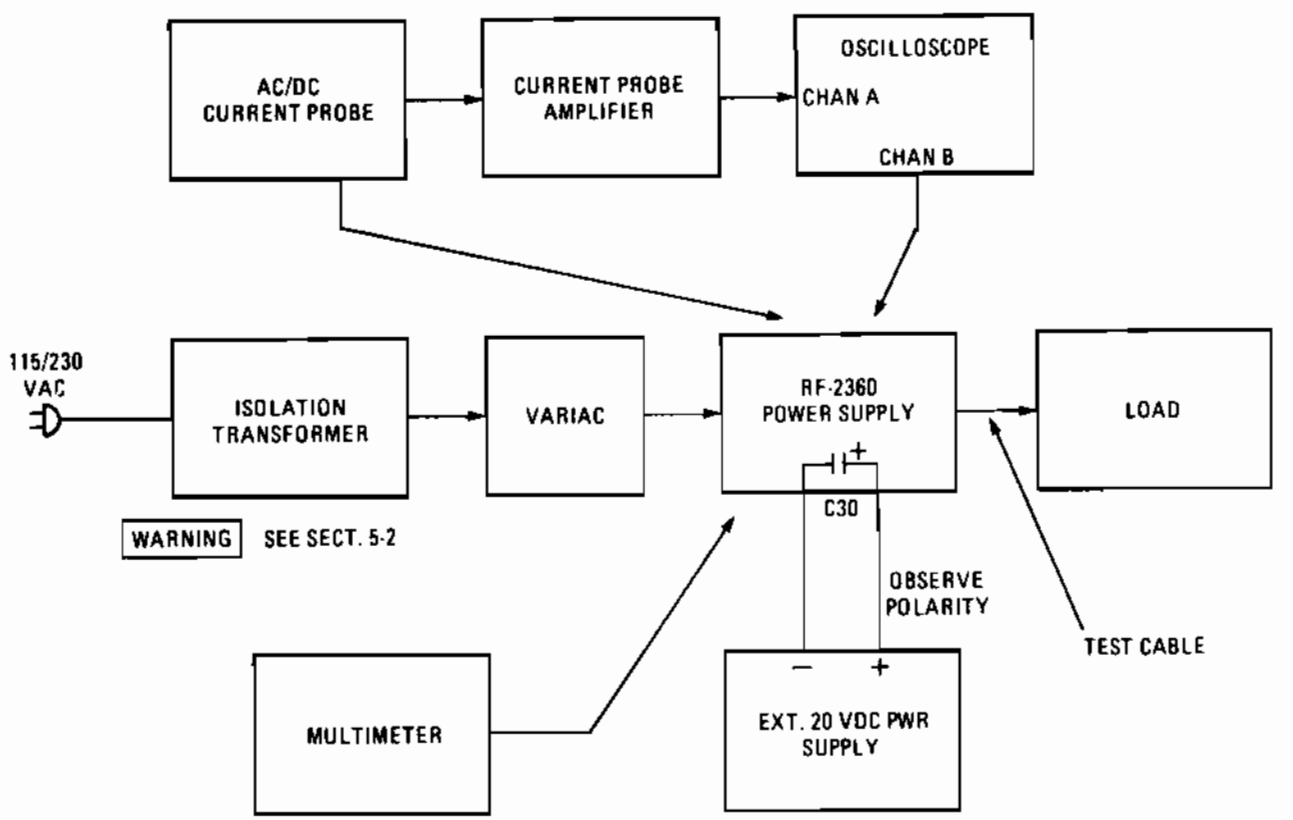


Figure 13. RF-2360 AC Test Set-Up

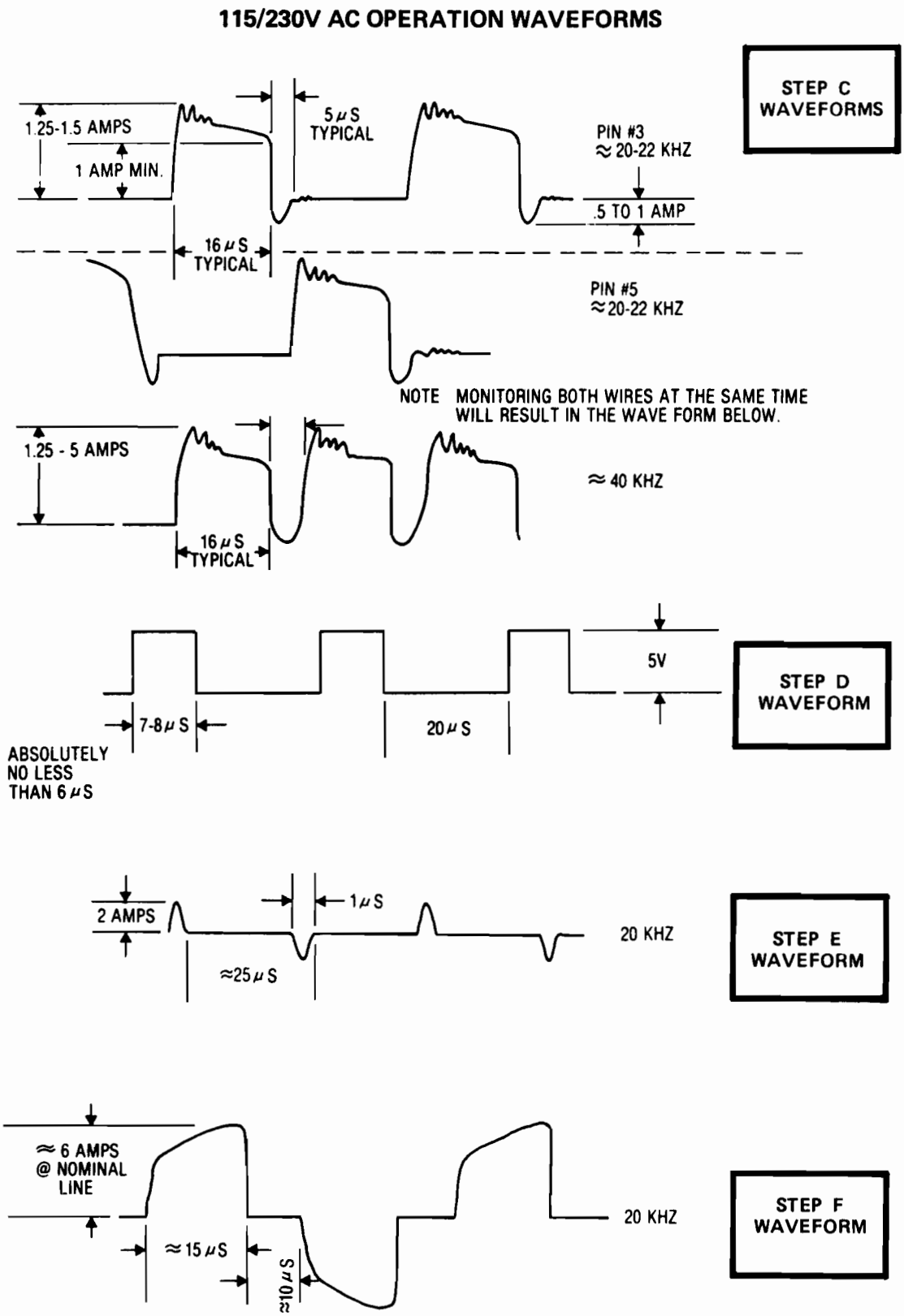


Figure 14. 115/230 Vac Operation Waveforms

Table 1. RF-2360 Switching Power Supply-AC Operation Troubleshooting Chart

SYMPTOM	POSSIBLE CAUSE	CHECK
(1) No 13.8 V output	(A) No AC line input	(1) Power cable and AC input jack for broken connections
		(2) FL1, CB1, CR1 for opens or shorts
	(B) No 24 VDC control voltage	(1) S1, T1, CR15 for opens or shorts
	(C) F1 and F2	(1) If F1 and or F2 are blown, replace Q1 and Q2. Remove F1 and F2. Test supply from steps a through d in Section 5.4. If ok, then replace F1 and F2 and continue testing. If not ok, replace 1A1 circuit board and start test from 5.4a.
	(D) Q1 and Q2	(1) Remove Q1 and Q2. Check with ohmmeter. If one or both are bad, replace both Q1 and Q2 (check transistors per Sect. 5.41).
	(E) No drive	(1) Test per Section 5.4a through c. If drive waveforms do not approximate those shown, replace 1A1 circuit board and test again.
(2) Poor regulation under load	(A) 1A1 circuit board	(1) Replace and test per Sect. 5.4k
(3) No 24 VDC output (Note: 24 VDC will not provide output if +13.8 VDC section of supply is inoperative or in current limit).	(A) F3	(1) Replace and test. F3 will blow if +24 VDC output subjected to a short to ground, or more than a 5 amp load
	(B) CR35 or L6	(2) Check and replace if bad

5.5 TEST PROCEDURE - 24 VDC OPERATION

Use the following procedure for power supply testing and setup when in DC input operation. Table 2 provides DC troubleshooting information.

a. Turn main power switch off. Configure for test per figure 16.

b. With the load set for minimum loading, turn the main switch on. Connect the common lead of the multimeter to case ground. Connect the plus lead to the 13.8 VDC output on the output connector (J1-A). The meter will indicate 13.8 VDC ±b 1 V. If not, adjust 1A1R-64 for 13.8 volts.

c. Connect the yellow wire on the test cable to the +13.8 VDC line. The meter will indicate 11.8 V ± .1 V. If not, adjust 1A1R63 for 11.8 volts. Disconnect multimeter and the yellow test cable wire.

d. Clip the current probe on the wire connected to 1A1J3-7. Observe the waveform shown in figure 17.

e. Set the load for 10 amps. Clip the current probe on the wire connected to E1 on the 1A1A2 circuit board. Observe the waveform shown in figure 17.

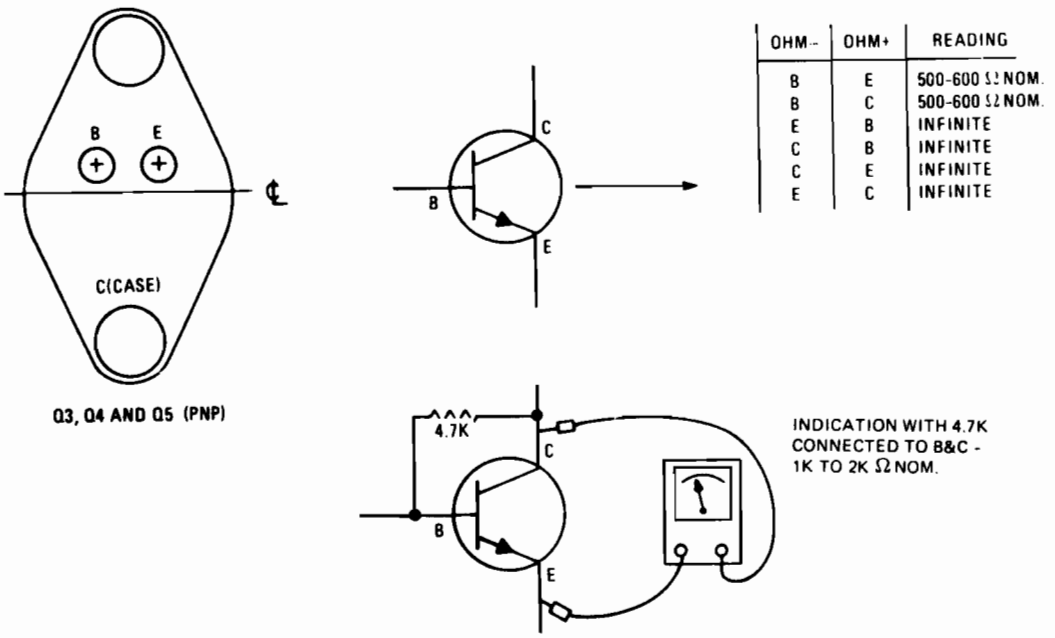
f. Clip the current probe on the output side of L2 (ferrite core with single turn of wire-located near output jack). Observe waveform shown in figure 17.

g. Set the load for 36 amps. Set 1A1R74 such that the 13.8 V line voltage just starts to fold back. This will correspond to a 38 amp short circuit current value. Short the load. If ammeter on the load indicates more than 38 amps, readjust 1A1R74 until the meter indicates 38 amps.

h. Connect multimeter common to case ground. Connect plus lead to small red wire in test cable (24 V output). Indication will be +25 VDC ±3 volts.

i. Connect multimeter plus load to J1-A(+13.8 V output) at the connector. Vary the load from 1 to 30 amps. Observe deviation of no more than .3V.

The Q3 to Q5 output transistor test procedure is illustrated in figure 7-15. Use multimeter on ohms x 100 scale. When using a digital multimeter, ensure the voltage between the common and the ohms probe when in ohms function exceeds 0.8V. Otherwise, there will be insufficient voltage to turn-on the internal transistor junction and erroneous indications will result.



OHM-	OHM+	READING
B	E	500-600 Ω NOM.
B	C	500-600 Ω NOM.
E	B	INFINITE
C	B	INFINITE
C	E	INFINITE
E	C	INFINITE

Figure 15. Q3 to Q5 Output Transistor Test Procedure

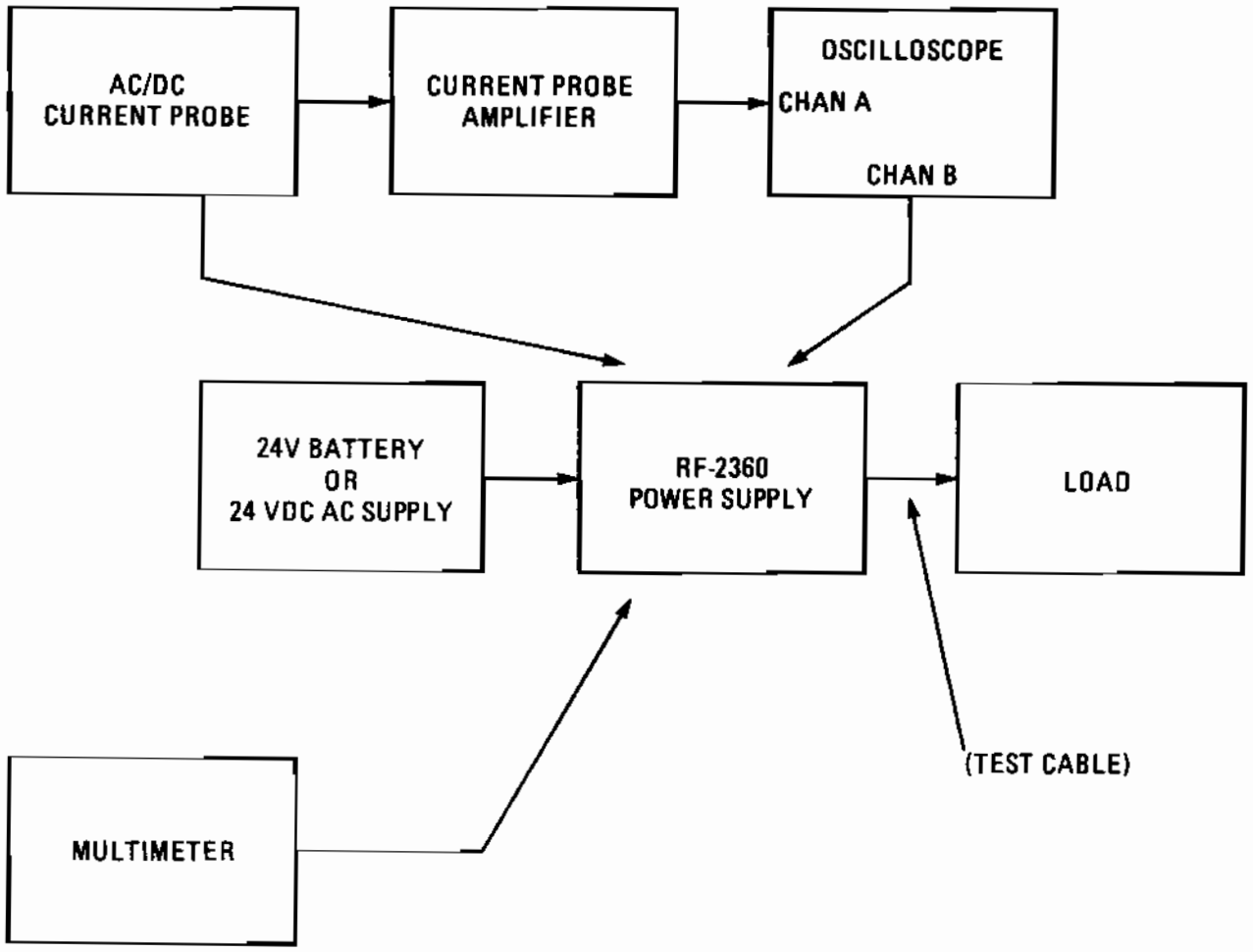


Figure 16. RF-2360 DC Test Set-Up

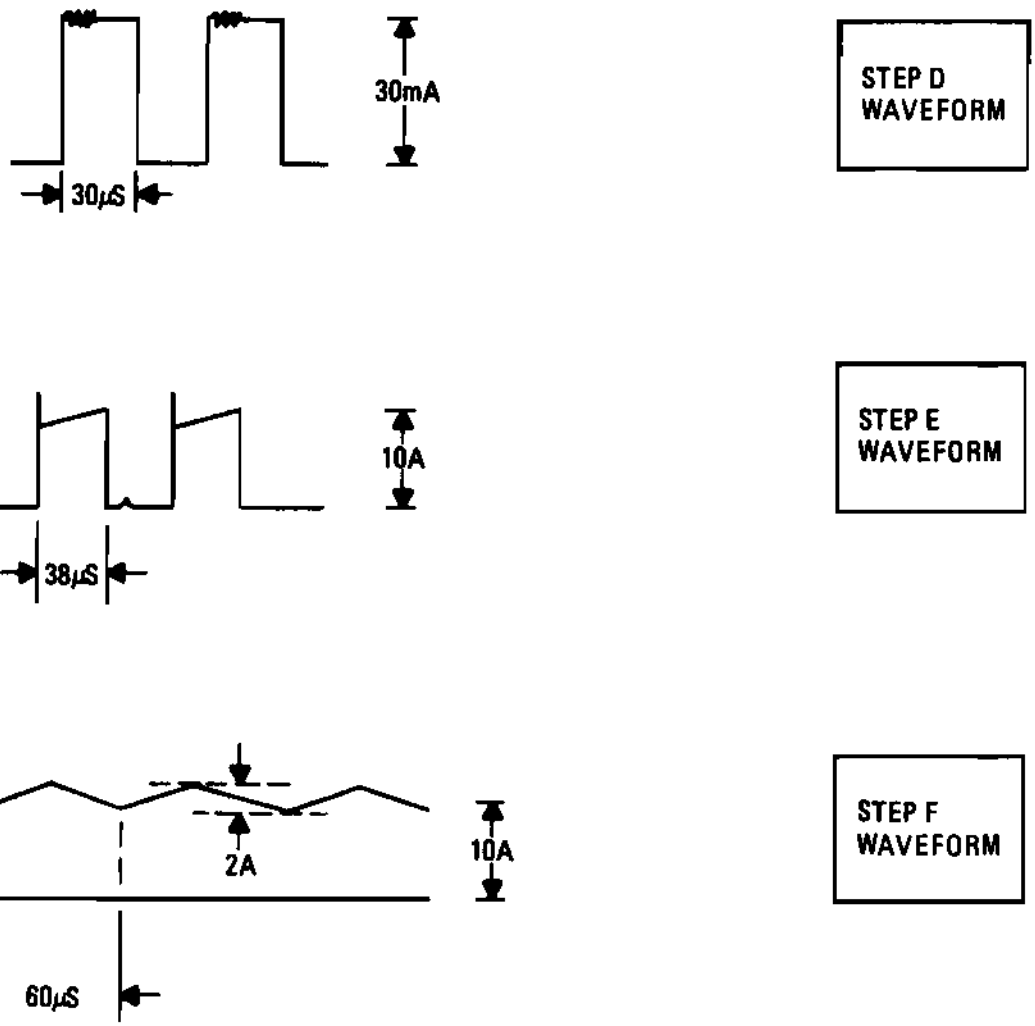


Figure 17. 24 Vdc Operation Waveforms

Table 2. RF-2360 Switching Power Supply-DC Operation Troubleshooting Chart

SYMPTOM	POSSIBLE CAUSE	CHECK
(1) No 13.8 VDC output	(A) No DC input	(1) Power cable and DC input jack for broken connections
		(2) L1, CB1, CR28 for opens or shorts
	(B) Q3, Q4, Q5	(1) Test Q3, 4 and 5 per Sect. 5.5, j and replace as required
	(C) 1A2A1T1	(1) Replace 1A2A1 circuit board and test
	(D) No drive	(1) Test per Sect. 5.5, d. If no drive waveform is seen, or is significantly different from the waveform shown, replace 1A1 circuit board and test again. (Note: If 1A1 circuit board is bad, and subsequently replaced, both AC and DC setups must be performed).
(2) Poor regulation under load	(A) 1A1 circuit board	(1) Replace and test per 5.5, i
(3) No 24 VDC output	(A) F3	See AC troubleshooting chart
	(B) CR35 or L6	

6. PARTS LIST

Tables 3 through 7 list the RF-2360 Parts Lists. Refer to Part V for list of parts manufacturers.

7. SCHEMATIC DIAGRAM

Figure 23 is a complete schematic diagram of the RF-2360 Power Supply. All component designations are cross-referenced in the parts list.

Table 3. RF-2360 Mainframe Maintenance Parts List

Ref. Desig.	Name & Description	Mfr. Code	Part Number
1	Chassis Assembly	14304	10007-2040 (O.D. Green) 10007-2041 (Gray)
1A1	Control Assembly PWB	14304	10007-2080
1A2	Heatsink Assembly	14304	10007-2070
1A3	Filter Bracket Assembly	14304	10007-2140
1A4	Transformer Bracket Assembly	14304	10007-2150
B1	Fan, Modified	14304	10007-2064
C1	Capacitor, Fixed, Alum, 10 uF, 50V	14304	C-1109
C2 thru C4	Capacitor, Fixed, Cer, 0.1 uF, 50V	14304	C-1185
CB1	Breaker, Circuit	14304	10007-2063
CR15	Diode Bridge, 1 Amp, MDA 101	14304	Q25-0006-101
F3	Fuse, 5 Amp, 250V	14304	F-0015
J1	Connector, 7 Pin	14304	10007-2069
J2	Connector, 5 Pin	14304	919-0758
J3	Connector, 7 Pin	14304	10007-2068
P1, P2	Connector, Shell	14304	J21-0001-013
P3	Connector, Shell	14304	J21-0001-010
P4	Jack, 4 Terminal	14304	J40-0003-004
W1	Assembly, Harness	14304	10007-2110
XF2	Fuseholder	14304	F01-0005-001

Table 4. 1A1 Maintenance Parts List

Ref. Desig.	Name & Description	Mfr. Code	Part Number
1A1	Control PWB Assembly		10007-2080
C1	Capacitor, Tant, 10 uF, 20V	14304	C25-0001-307
C2	Capacitor, Tant, 33 uF, 35V	14304	C25-0002-116
C3	Capacitor, Tant, 1 uF, 35V	14304	C25-0003-107
C4	Capacitor, Tant, 10 uF, 20V	14304	C25-0001-307
C5	Capacitor, Mica, 200 pF, 500V	14304	C-0133
C6	Capacitor, Tant, 10 uF, 20V	14304	C25-0001-303
C7	Capacitor, Ceramic, 0.1 uF, 50V	14304	C11-0005-104
C8	Capacitor, Ceramic, 0147 uF, 50V	14304	C11-0005-474
C9	Capacitor, Ceramic, 0.1 uF, 50V	14304	C11-0005-104
C10	Capacitor, Mica, .0068 uF, 500V	14304	CM07FD682J03
C11	Capacitor, Ceramic, .001 uF	14304	C11-0005-102
C12	Capacitor, Mylar, .047 uF, 200V	14304	C-0815
C13	Capacitor, Ceramic, 0.1 uF, 50V	14304	C11-0005-104
C14	Capacitor, Tant, 2.2 uF, 20V	14304	C25-0001-303
C15	Capacitor, Tant, 33 uF, 35V	14304	C25-0002-116
C16	Capacitor, Tant, 33 uF, 35V	14304	C25-0002-116
C17	Capacitor, Tant, 33 uF, 35V	14304	C25-0002-116
C18	Capacitor, Mylar, .001 uF, 600V	14304	C-0846
C19	Capacitor, Mylar, .0033 uF, 400V	14304	C-0834
C20	Capacitor, Mylar, .0033 uF, 400V	14304	C-0834
C21	Capacitor, Elec, 12 uF, 250V	14304	C-6111
C22	Capacitor, Elec, 12 uF, 250V	14304	C-6111
C23	Capacitor, Ceramic, .01 uF, 1KV	14304	C-0008
C24	Capacitor, Ceramic, .01 uF, 1KV	14304	C-0008
C25	Capacitor, Mylar, .01 uF, 600V	14304	C-0852
C26	Capacitor, Mylar, .001 uF, 600V	14304	C-0846
C27	Capacitor, Mylar, 1 uF, 200V	14304	C-0859
C28	Capacitor, Mylar, 1 uF, 200V	14304	C-0859
C29	Capacitor, Mylar, .01 uF, 400V	14304	C-0837
C30	Capacitor, Elec, 470 uF, 50V	14304	C-8212
C31	Capacitor, Mylar, .01 uF, 400V	14304	C-0837
C32	Capacitor, Ceramic, .1 uF, 50V	14304	C11-0005-104
C33	Capacitor, Ceramic, .01 uF, 50V	14304	C-4952
C34	Capacitor, Ceramic, 0.1 uF, 50V	14304	C-1185
C35	Capacitor, Tant, 4.7 uF, 50V	14304	C25-0001-011
C36	Capacitor, Mylar, 0.01 uF, 200V	14304	C-0811
C37	Capacitor, Mylar, 0.047 uF, 200V	14304	C-0815
C38	Capacitor, Ceramic, .001 uF	14304	C11-0005-102
C39	Capacitor, Tant, 1 uF, 35V	14304	C25-0001-107
C40	Capacitor, Mica, 270 pF, 500V	14304	C-0137
C41	Capacitor, Ceramic, 0.1 uF, 50V	14304	C-1185
C42	Capacitor, Tant, 1.0 uF, 35V	14304	C25-0003-107
C43	Capacitor, Ceramic, 0.1 uF, 50V	14304	C-1185
C44	Capacitor, Ceramic, 0.1 uF, 50V	14304	C-1185
C45	Capacitor, Ceramic, 0.1 uF, 50V	14304	C-1185
C46	Capacitor, Ceramic, 0.1 uF, 50V	14304	C-1185
C47	Capacitor, AC, 10 uF, 220V	14304	C71-0001-106
C48	Capacitor, Tant, 100 uF, 50V	14304	C-1135

Table 4. 1A1 Maintenance Parts List (Continued)

Ref. Desig.	Name & Description	Mfr. Code	Part Number
C49	Capacitor, Ceramic, 0.1 uF, 50V	14304	C-1185
C50	Capacitor, Ceramic, .01 uF, 50V	14304	C-4952
C51	Capacitor, Tant, 33 uF, 35V	14304	C25-0002-116
C52	Capacitor, Ceramic, .01 uF, 50V	14304	C-4952
C53	Capacitor, Ceramic, .01 uF, 50V	14304	C-1185
C54	Capacitor, Elec, 470 uF, 25V	14304	C-1419
C55	Capacitor, Elec, 470 uF, 25V	14304	C-1419
C56	Capacitor, Elec, 100 uF, 50V	14304	C-1135
C57	Capacitor, Ceramic, .1 uF, 50V	14304	C11-0005-104
C58	Capacitor, Tant, 10 uF, 20V	14304	C25-0001-307
C59	Capacitor, Tant, 22 uF, 125V	14304	C-6439
C60	Capacitor, Ceramic, .01 uF, 50V	14304	C11-0005-103
C61	Capacitor, Tant, 1 uF, 35V	14304	C25-0003-107
C62, C63	Capacitor, Ceramic, .1 uF, 50V	14304	C11-0005-104
CR1	Diode, Signal, 1N4454	14304	1N4454
CR2	Diode, Signal, 1N4454	14304	1N4454
CR3	Diode, Signal, 1N4454	14304	1N4454
CR4	Diode, Signal, 1N4454	14304	1N4454
CR5	Diode, Signal, 1N4454	14304	1N4454
CR6	Diode, Rectifier, 1N4004	14304	1N4004
CR7	Diode, Rectifier, 1N4004	14304	1N4004
CR8	Diode, Rectifier, MR811	14304	D22-0007-002
CR9	Diode, Rectifier, MR811	14304	D22-0007-002
CR10	Diode, Rectifier, MR816	14304	D22-0007-006
CR11	Diode, Rectifier, MR816	14304	D22-0007-006
CR12	Diode, Rectifier, MR811	14304	D22-0007-002
CR13	Diode, Rectifier, MR811	14304	D22-0007-002
CR14	Diode, Fast Recovery, MR851	14304	D22-0014-004
CR15	Diode, Bridge, 1A, MDA101	14304	Q25-0006-101
CR16	Diode, Transorb	14304	1N6036
CR17	Diode, Transorb	14304	1N6036
CR18	Diode, Rectifier, 1N4004	14304	1N4004
CR19	Diode, Rectifier, MR751	14304	CR-0407
CR20	Diode, Signal, 1N4454	14304	1N4454
CR21	Diode, Rectifier, MR751	14304	CR-0407
CR22	Diode, Rectifier, 1N4004	14304	1N4004
CR23	Diode, Rectifier, 1N4004	14304	1N4004
CR24	Diode, Rectifier, 1N4004	14304	1N4004
CR25	Diode, Rectifier, 1N4004	14304	1N4004
CR26	Diode, Rectifier, 1N4004	14304	1N4004
CR27	Diode, Rectifier, 1N4004	14304	1N4004
CR28	Diode, Rectifier, MR751	14304	CR-0407
CR29	Diode, Rectifier, 1N4004	14304	1N4004
CR30	Diode, Signal, 1N4454	14304	1N4454
CR31	Diode, Signal, 1N4454	14304	1N4454
CR32	Diode, Signal, 1N4454	14304	1N4454
CR33	Diode, Signal, 1N4454	14304	1N4454
CR34	Diode, Signal, 1N4454	14304	1N4454
CR35	Bridge, Fast Recovery	14304	D22-5009-103
CR36	Diode, Signal, 1N4454	14304	1N4454

Table 4. 1A1 Maintenance Parts List (Continued)

Ref. Desig.	Name & Description	Mfr. Code	Part Number
CR37	Varistor, V36ZA80	14304	D60-0003-000
J1	Connector, 13Pin	14304	J42-0004-013
J2	Connector, 13Pin	14304	J42-0004-013
J3	Connector, 10Pin	14304	J42-0004-010
L1	Choke, 27 uH	14304	L10-0006-270
L2	Choke, 90 uH	14304	6628-3833
L3	Choke, 47 uH	14304	6628-3835
L4	Choke, 90 uH	14304	6628-3833
L5	Choke, 470 uH	14304	L-0648
L6	Choke, 2MH	14304	10007-2095
L7	Choke, 47 uH	14304	6628-3835
L8	Choke, 820 uH	14304	L-0651
Q1	Transistor, PNP, 2N2907	14304	2N2907
Q2	Transistor PNP, 2N2907	14304	2N2907
Q3	Transistor, NPN, 2N2222	14304	2N2222A
Q4	Transistor, NPN, 2N2222	14304	2N2222A
Q5	Transistor, NPN, 2N6122	14304	2N6122
Q6	Transistor, NPN, 2N4922	14304	2N4922
Q7	Transistor, NPN, 2N6122	14304	2N6122
Q8	Transistor, NPN, 2N4922	14304	2N4922
Q9	Transistor, NPN, 2N2222	14304	2N2222A
Q10	Transistor, PNP, 2N2907	14304	2N2907
Q11	Transistor, NPN, 2N2222	14304	2N2222A
Q12	Transistor, PNP, 2N2907	14304	2N2907
Q13	Transistor, NPN, 2N3642	14304	Q-0320
Q14	Transistor, NPN, 2N5190	14304	2N5190
Q15	Transistor, PNP, 2N5193	14304	2N5193
Q16	Transistor, NPN, 2N5190	14304	2N5190
Q17	Transistor, PNP, 2N5193	14304	2N5193
Q18	Transistor, NPN, 2N5190	14304	2N5190
Q19	Transistor, MJE1090	14304	Q-0399
Q20	Transistor, 2N3642	14304	Q-0320
Q21	Transistor, 2N3642	14304	Q-0320
Q22	Transistor, NPN, 2N2222	14304	2N2222A
R1	Resistor, 1/4W, ±5%, 2.2K	81349	RCR07G22JM
R2	Resistor, 1/8W, ±1%, 10K	81349	RN55D1002F
R3	Resistor, 1/8W, 1%, 8.25K	81349	RN55D8251F
R4	Resistor, 1/8W, 1%, 10K	81349	RN55D1002F
R5	Resistor, 1/4W, ±5%, 10K	81349	RCR07G103JM
R6	Resistor, 1/4W, ±5%, 10K	81349	RCR07G103JM
R7	Resistor, 1/4W, ±5%, 10K	81349	RCR07G103JM
R8	Resistor, 1/8W, 1%, 33.2K	81349	R-7288
R9	Resistor, 1/4W, ±5%, 8.2K	81349	RCR07G822JM
R10	Resistor, 1/8W, 1%, 8.25K	81349	RN55D8251F
R11	Resistor, 1/8W, 1%, 10K	81349	RN55D1002F
R12	Resistor, 1/8W, 1%, 6.04K	81349	RN55D6041F
R13	Resistor, 1/8W, 1%, 8.25K	81349	RN55D8251F
R14	Resistor, 1/4W, ±5%, 4.7K	81349	RCR07G472JM

Table 4. 1A1 Maintenance Parts List (Continued)

Ref. Desig.	Name & Description	Mfr. Code	Part Number
R15	Resistor, 1/4W, ±5%, 10K	81349	RCR07G103JM
R16	Resistor, 1/4W, ±5%, 2.2K	81349	RCR07G222JM
R17	Resistor, 1/4W, ±5%, 2.2K	81349	RCR07G222JM
R18	Resistor, 1/4W, ±5%, 6.8K	81349	RCR07G682JM
R19	Resistor, 1/4W, ±5%, 10K	81349	RCR07G103JM
R20	Resistor, 1/4W, ±5%, 1K	81349	RCR07G102JM
R21	Resistor, 1/8W, 1%, 2.67K	81349	RN55D2671F
R22	Resistor, 1/8W, 1%, 2.67K	81349	RN55D2671F
R23	Resistor, 1/4W, ±5%, 6.8K	81349	RCR07G682JM
R24	Resistor, 1/4W, ±5%, 3.3K	81349	RCR07G332JM
R25	Resistor, 1/8W, 1%, 1.33K	81349	RN55D1331F
R26	Resistor, Variable, 200K	14304	R-2214
R27	Resistor, Variable, 2K	14304	R-2207
R28	Resistor, 1/8W, 1%, 24.9K	81349	RN55D2492F
R29	Resistor, 1/8W, 1%, 7.5K	81349	RN55D7501F
R30	Resistor, 1/4W, ±5%, 10K	81349	RCR07G103JM
R31	Resistor, 1/4W, 5%, 1.5K	81349	RCR07G152JM
R32	Resistor, 1/8W, 1%, 2.74K	81349	RN55D2741F
R33	Resistor, 1/4W, 5%, 33K	81349	RCR07G333JM
R34	Resistor, 1/4W, 5%, 180 ohm	81349	RCR07G181JM
R35	Resistor, 1/4W, 5%, 330 ohm	81349	RCR07G331JM
R36	Resistor, 1/4W, 5%, 910 ohm	81349	RCR07G911JM
R37	Resistor, Variable, 500 ohm	14304	R-2205
R38	Resistor, 1/4W, 5%, 100 ohm	81349	RCR07G101JM
R39	Resistor, 1W, 10%, .51 ohm	14304	R-3763
R40	Resistor, 1W, 5%, 10 ohm	81349	RCR32G100JM
R41	Resistor, 1W, 5%, 180 ohm	81349	RCR32G181JM
R42	Resistor, 1/4W, 5%, 100 ohm	81349	RCR07G101JM
R43	Resistor, 2W, 5%, 10 ohm	81349	RCR42G100JM
R44	Resistor, 1/4W, 5%, 4.7K	81349	RCR07G472JM
R45	Resistor, 1/4W, 5%, 27K	81349	RCR07G273JM
R46	Resistor, 1W, 10%, .51 ohm	14304	R-3763
R47	Resistor, 1W, 5%, 10 ohm	81349	RCR32G100JM
R48	Resistor, 1W, 5%, 180 ohm	81349	RCR32G181JM
R49	Resistor, 1/4W, 5%, 100 ohm	81349	RCR07G101JM
R50	Resistor, 2W, 5%, 10 ohm	81349	RCR42G100JM
R51	Resistor, 1/4W, 5%, 4.7K	81349	RCR07G472JM
R52	Resistor, 1/4W, 5%, 27K	81349	RCR07G273JM
R53	Resistor, 2W, 5%, 33K	81349	RCR42G333JM
R54	Resistor, 2W, 5%, 33K	81349	RCR42G333JM
R55	Resistor, 2W, 5%, 33 ohm	81349	RCR42G330JM
R56	Resistor, 2W, 5%, 33 ohm	81349	RCR42G330JM
R57	Resistor, 2W, 5%, 10 ohm	81349	RCR42G100JM
R58	Resistor, 2W, 5%, 27K	81349	RCR42G273JM
R59	Resistor, 2W, 5%, 10 ohm	81349	RCR42G100JM
R60	Resistor, 1/4W, 5%, 10K	81349	RCR07G103JM
R61	Resistor, 1/4W, 5%, 2.4K	81349	RCR07G242JM
R62	Resistor, 1/8W, 1%, 24.9K	81349	RN55D2492F
R63	Resistor, Variable, 200K	14304	R-2214

Table 4. 1A1 Maintenance Parts List (Continued)

Ref. Desig.	Name & Description	Mfr. Code	Part Number
R64	Resistor, Variable, 2K	81349	R-2207
R65	Resistor, 1/8W, 1%, 7.50K	14304	RN55D7501F
R66	Resistor, 1/8W, 1%, 1.33K	81349	RN55D1331F
R67	Resistor, 1/8W, 1%, 2.67K	81349	RN55D2671F
R68	Resistor, 1/8W, 1%, 2.67K	81349	RN55D2671F
R69	Resistor, 1/8W, 1%, 6.81K	81349	RN55D6811F
R70	Resistor, 1/4W, 5%, 10K	81349	RCR07G103JM
R71	Resistor, 1/4W, 5%, 15K	81349	RCR07G153JM
R72	Resistor, 1/4W, 5%, 180 ohm	81349	RCR07G181JM
R73	Resistor, 1/4W, 5%, 330 ohm	81349	RCR07G331JM
R74	Resistor, Variable, 500 ohm	14304	R-2205
R75	Resistor, 1/4W, 5%, 100 ohm	81349	RCR07G101JM
R76	Resistor, 2W, 5%, 270 ohm	81349	RCR42G271JM
R77	Resistor, 1/4W, 5%, 6.8K	81349	RCR07G682JM
R78	Resistor, 1/4W, 5%, 10K	81349	RCR07G103JM
R79	Resistor, 1/4W, 5%, 15K	81349	RCR07G153JM
R80	Resistor, 1/4W, 5%, 10K	81349	RCR07G103JM
R81	Resistor, 1/4W, 5%, 4.7K	81349	RCR07G472JM
R82	Resistor, 1/4W, 5%, 4.7K	81349	RCR07G472JM
R83	Resistor, 1/8W, 1%, 6.04K	81349	RN55D6041F
R84	Resistor, 1/8W, 1%, 10K	81349	RN55D1002F
R85	Resistor, 1/8W, 1%, 8.25K	81349	RN55D8251F
R86	Resistor, 1/8W, 1%, 8.25K	81349	RN55D8251F
R87	Resistor, 1/4W, 5%, 8.2K	81349	RCR07G822JM
R88	Resistor, 1/8W, 1%, 33.2K	81349	RN55D3322F
R89	Resistor, 1/4W, 5%, 10K	81349	RCR07G103JM
R90	Resistor, 1/4W, 5%, 10K	81349	RCR07G103JM
R91	Resistor, 1/4W, 5%, 2.7K	81349	RCR07G102JM
R92	Resistor, 1/8W, 1%, 10K	81349	RN55D1002F
R93	Resistor, 1/8W, 1%, 10K	81349	RN55D1002F
R94	Resistor, 1/4W, 5%, 270K	81349	RCR07G274JM
R95	Resistor, 1/8W, 1%, 10K	81349	RN55D1002F
R96	Resistor, 1/8W, 1%, 53.6K	81349	RN55D5362F
R97	Resistor, 1/4W, 5%, 2.2K	81349	RCR07G102JM
R98	Resistor, 1/4W, 5%, 4.7K	81349	RCR07G472JM
R99	Resistor, 2W, 5%, 150 ohm	81349	RCR42G151JM
R100	Resistor, 1/4W, 5%, 1K	81349	RCR07G102JM
R101	Resistor, 1/4W, 5%, 2.7K	81349	RCR07G272JM
R102	Resistor, 1W, 5%, 10 ohm	81349	RCR32G100JM
R103	Resistor, 1/4W, 5%, 330 ohm	81349	RCR07G331JM
R104	Resistor, 1/4W, 5%, 330 ohm	81349	RCR07G331JM
R105	Resistor, 1W, 5%, 10 ohm	81349	RCR32G100JM
R106	Resistor, 1/4W, 5%, 2.7K	81349	RCR07G272JM
R107	Resistor, 1/4W, 5%, 910 ohm	81349	RCR07G911JM
R108	Resistor, 1/4W, 5%, 1K	81349	RCR07G102JM
R109	Resistor, 1/4W, 5%, 4.7K	81349	RCR07G472JM
R110	Resistor, 1/4W, 5%, 1K	81349	RCR07G102JM
R111	Resistor, 1/4W, 5%, 2.2K	81349	RCR07G222JM
R112	Resistor, 1/4W, 5%, 10K	81349	RCR07G103JM

Table 4. 1A1 Maintenance Parts List (Continued)

Ref. Desig.	Name & Description	Mfr. Code	Part Number
R113	Resistor, 1/8W, 1%, 10.5K	81349	RN55D1052F
R114	Resistor, 1/8W, 1%, 6.19K	81349	RN55D6191F
R115	Resistor, 1/4W, 5%, 1K	81349	RCR07G102JM
R116	Resistor, 1/4W, 5%, 1K	81349	RCR07G102JM
R117	Resistor, 1/4W, 5%, 820 ohm	81349	RCR07G821JM
R118	Resistor, 1/2W, 5%, 15K	14304	R-1477
R119	Resistor, 1/8W, 1%, 6.19K	81349	RN55D6191F
R120, R121	Resistor, 2W, 5%, 220 ohm	81349	RCR42G221JM
R122	Resistor, 2W, 5%, 150 ohm	81349	RCR42G151JM
R123	Resistor, 1/4W, 5%, 1K	81349	RCR07G102JM
RT1	Thermistor, 1K	14304	919-2544
RT2	Thermistor, 1K	14304	919-2544
S1	Switch, Slide	14304	S30-0007-000
T1	Transformer, Line	14304	T40-0008-002
T2	Transformer, Driver	14304	6628-3834
T3	Transformer, Driver	14304	6628-3834
T4	Transformer, Driver	14304	10007-2091
U1	Dual Op Amp, MC1558	14304	I30-0009-000
U2	Voltage Regulator, MC78L12	14304	I12-0005-012
U3	IC, SG2524J	14304	I62-0002-000
U4	IC, SG2524J	14304	I62-0002-000
U5	Dual Op Amp, MC1558	14304	I30-0009-000
U6	Dual Op Amp, MC1558	14304	I30-0009-000
U7	Voltage Regulator, MC78L12	14304	I12-0005-012
VR1	Zener, 3.9V, 1N5228	14304	1N5228A
VR2	Zener, 4.7V, 10%, 1N5230A	14304	1N5230A
VR3	Zener, 4.7V, 10%, 1N5230A	14304	1N5230A
VR4	Zener, 3.9V, 1N5228	14304	1N5228A
VR5	Zener, 3.9V, 1N5228	14304	1N4730
VR6	Zener, 1N4746, 18V	14304	1N4746
VR7	Zener, 1N5232, 5.6V	14304	1N5232
VR8	Zener, 1N4764, 100V	14304	1N4764
VR9	Zener, 1N4764, 100V	14304	1N4764

Table 5. 1A2 Maintenance Parts List

Ref. Desig.	Name & Description	Mfr. Code	Part Number
1A2	Heatsink Assembly	14304	10007-2070
1A2A1	Heatsink PWB Assembly	14304	10007-2100
1A2A1C1	Capacitor, Mylar, .47 μF, 100V	14304	C-8039
1A2A1C2	Capacitor, Mylar, .01 μF, 400V	14304	C-0837
1A2A1C3	Capacitor, Mylar, .1 μF, 600V	14304	C-0858
1A2A1C4	Capacitor, Mylar, .1 μF, 600V	14304	C-0858
1A2A1C5	Capacitor, Mylar, .01 μF, 600V	14304	C-0852
1A2A1CR1	Diode, Rectifier	14304	D22-0007-002
1A2A1CR2	Diode, Rectifier	14304	D22-0007-002
1A2A1J4	Connector, 12 Pin	14304	J41-0001-112
1A2A1R1	Resistor, 1/2W, 5%, 10Ω	81349	RCR20G100JM
1A2A1R2	Resistor, 1/2W, 5%, 10Ω	81349	RCR20G100JM
1A2A1R3	Resistor, 1/4W, 5%, 47Ω	81349	RCR07G471JM
1A2A1R4	Resistor, 1/4W, 5%, 33Ω	81349	RCR07G330JM
1A2A1R5	Resistor, 3W, 5%, 10Ω	81349	RW69V100
1A2A1T1	Driver Transformer	14304	10007-2072
CR1	Rectifier, Bridge	14304	D22-5012-600
CR2	Diode, Rettifier, 1N3911	14304	1N3911R
CR3	Diode, Rectifier, 1N3911	14304	1N3911R
CR4	Rectifier, Bridge VJ248XTT	14304	D22-5009-004
P4	Pin Housing	14304	J40-0013-012
Q1	Transistor, 2N6547	14304	10007-2078
Q2	Transistor, 2N6547	14304	10007-2078
Q3	Transistor, 2N6286	14304	2N6286
Q4	Transistor, 2N5684	14304	2N5684
Q5	Transistor, 2N5684	14304	2N5684
R1	Resistor, 1% 25W, 15Ω	81349	RE70G15R0
RT1	Thermistor Assy.	14304	6628-1050
RT2	Thermistor Assy.	14304	6628-1050

Table 6. 1A3 Maintenance Parts List

Ref. Desig.	Name & Description	Mfr. Code	Part Number
1A3	Filter Bracket Assembly	14304	10007-2140
C1, C2	Capacitor, Fixed, 740 uF, 250V	14304	C23-0006-741
C3	Capacitor, Fixed, 2800 uF, 55V	14304	C24-0055-282
CR1-CR27	Not Used		
CR28	Diode Assembly	14304	10007-2075
F1, F2	Fuse, 1.5A STD, Blo	14304	F-0011
FL1	Filter, EMI 14304	14304	G01-0002-001
XF1	Holder, Fuse	14304	X-0119
1A3A1	Filter PWB Assembly	14304	10007-2120
1A3A1C1	Capacitor, Fixed, Mylar, 0.1 uF, 100V	14304	C-0805
1A3A1C2-1A3A1C5	Capacitor, Fixed, Alum, 470 uF, 50V	14304	C-8212
1A3A1C6	Capacitor, .01 uF, 200V	14304	M39014/02-1298
1A3A1CR1	Diode, 1N4004	14304	1N4004
1A3A1CR2	Diode, 1N4004	14304	1N4004
1A3A1CR3	Diode, 1N4004	14304	1N4004
1A3A1CR4	Diode, 1N4004	14304	1N4004
1A3A1L1	Choke, Filter	14304	10007-2131

Table 7. 1A4 Maintenance Parts List

Ref. Desig.	Name & Description	Mfr. Code	Part Number
1A4	Transformer Bracket Assembly	14304	10007-2150
C1, C2	Capacitor, Fixed, 880 μF, 20V	14304	C24-0020-882
L1	Inductor, Filter	14304	6628-3862
L2	Assembly, Choke	14304	6628-3855
T1	Transformer, Power, 12V	14304	6628-3863

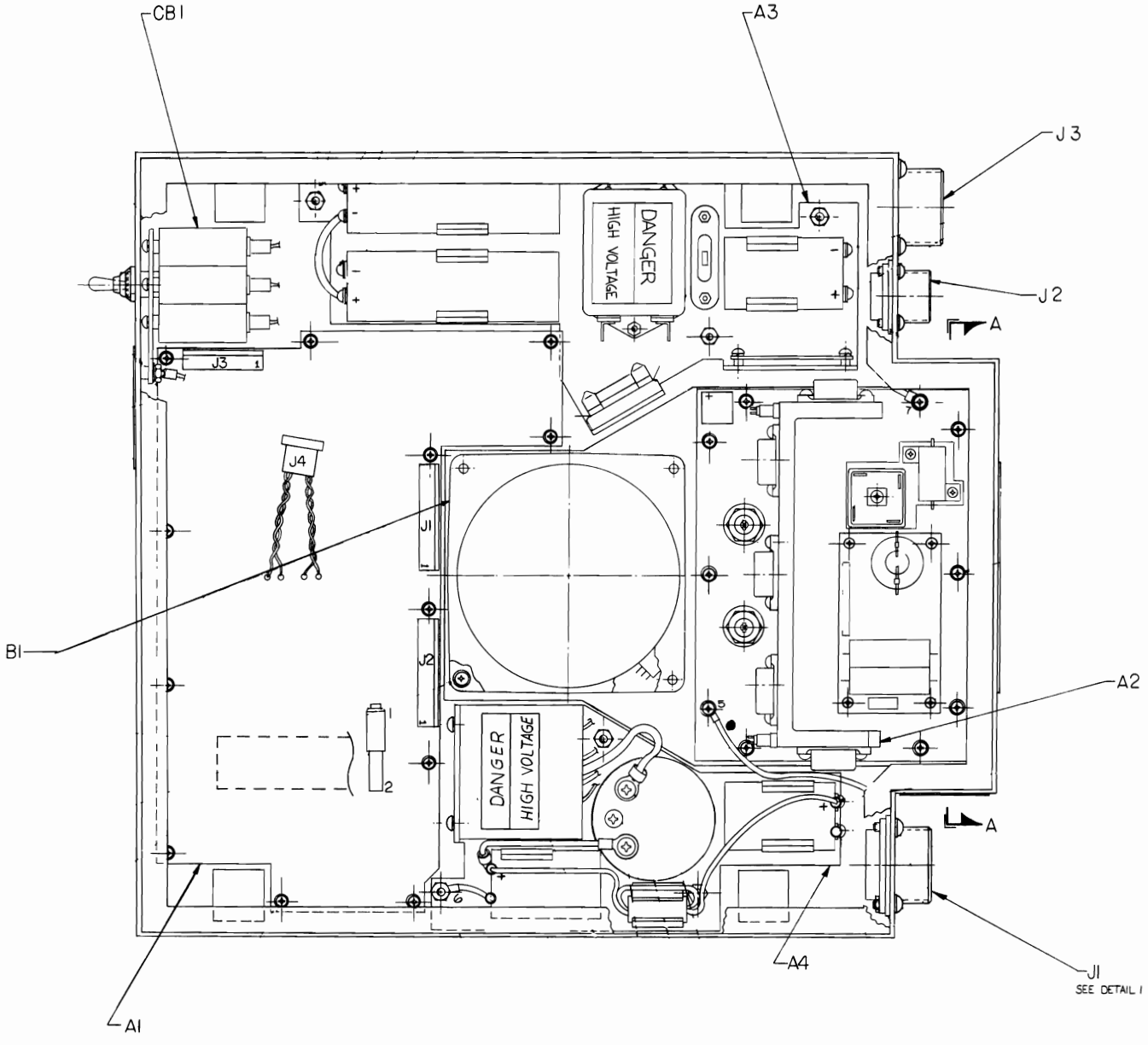


Figure 18. RF-2360 Power Supply Component Location

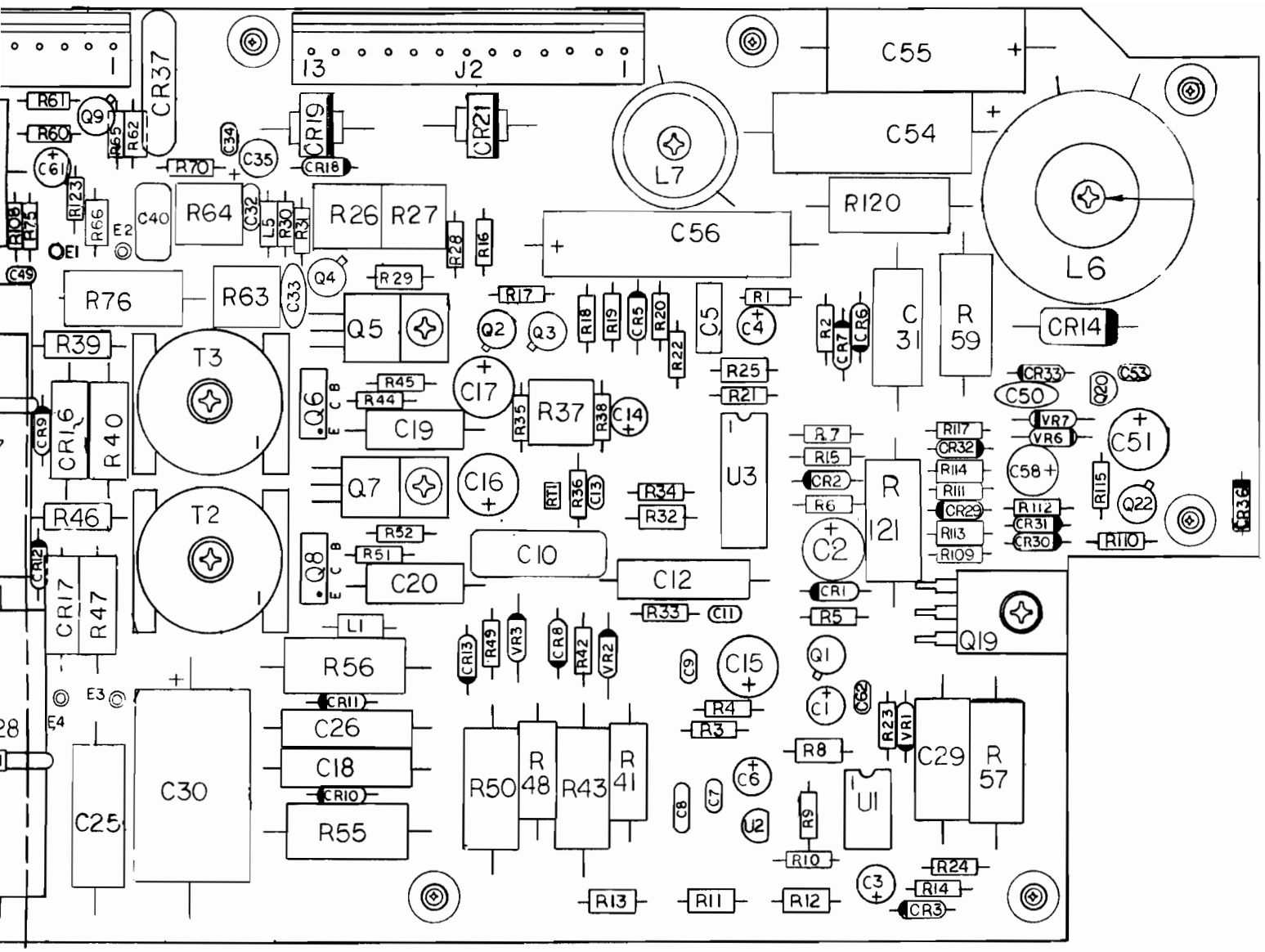


Figure 19. 1A1 Control PWB Component Locations

T4
R102
C45
Q17
CR24
R104
C46
Q18
R105
CR23
CR27
Q14
R105
CR26
CR22
U7
C43
C44
Q16
R101
CR25
R103
Q15
R99
E5
R122
C48
R100
VR5
R93
R95
R98
R97
R94
Q13
C60
R96
CR20
C63
R85
R86
R87
U5
U6
R92
R91
VR4
R81
R88
Q12
C42
C57
R83
R84
R82
CR4
C41
Q11
R79
C39
R78
R77
R107
R73
RT2
C
36
R89
R90
R69
R72
R67
R68
U4
C38
R71
C37
C22
R74
R80
J1
13
CR37
R61
Q9
R60
C61
R65
R62
C47
R123
R66
E2
C40
R108
R75
E1
C49
R76
R39
CR16
R40
C27
R53
L4
C24
L3
C23
L2
R46
CR12
CR17
R47
SI
115
R58
C21
C28
E3
E4
J3
10
R54
1
5
4
T1
8
CR
15
C25

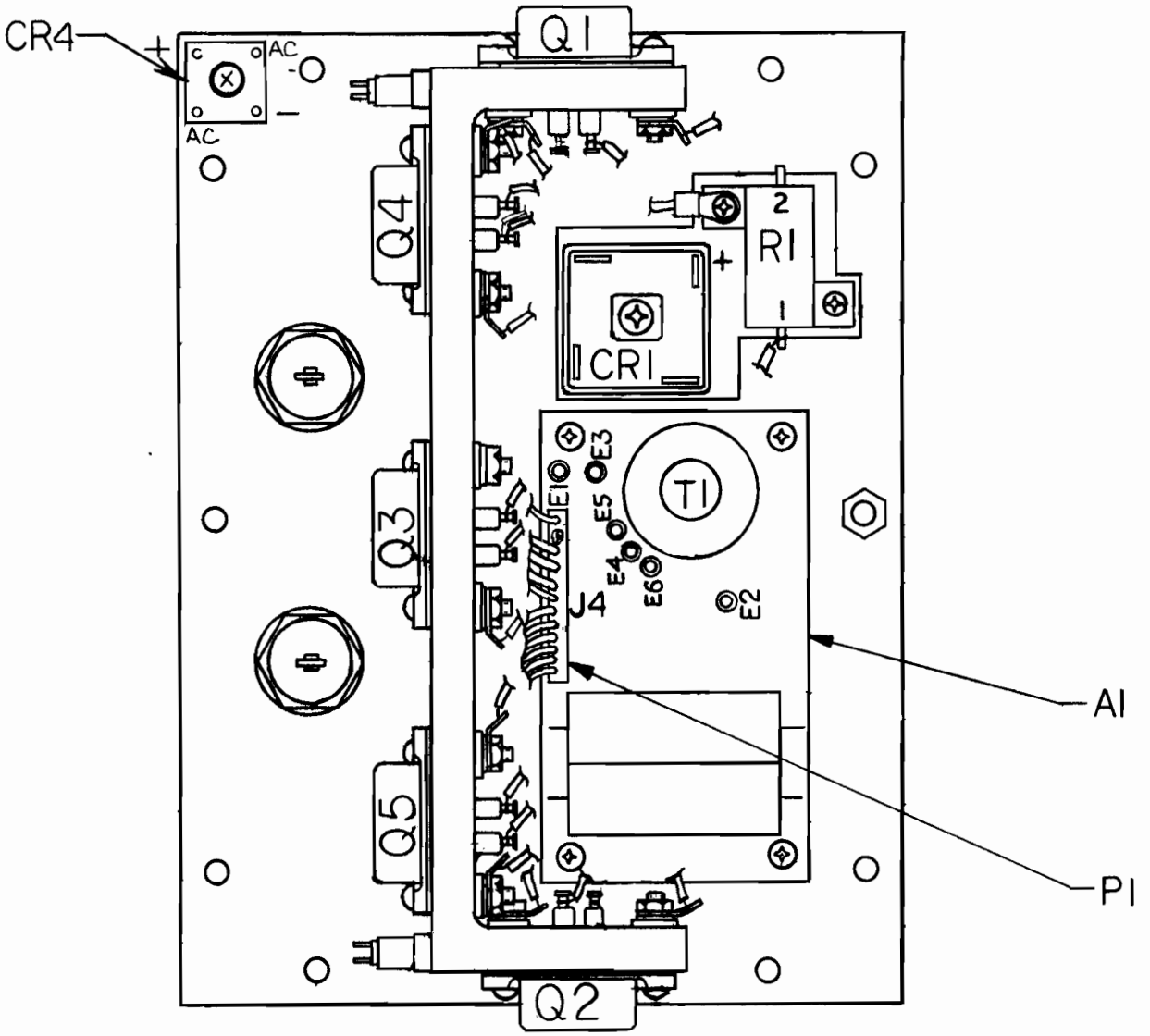


Figure 20. 1A2 Heatsink Assembly Component Locations

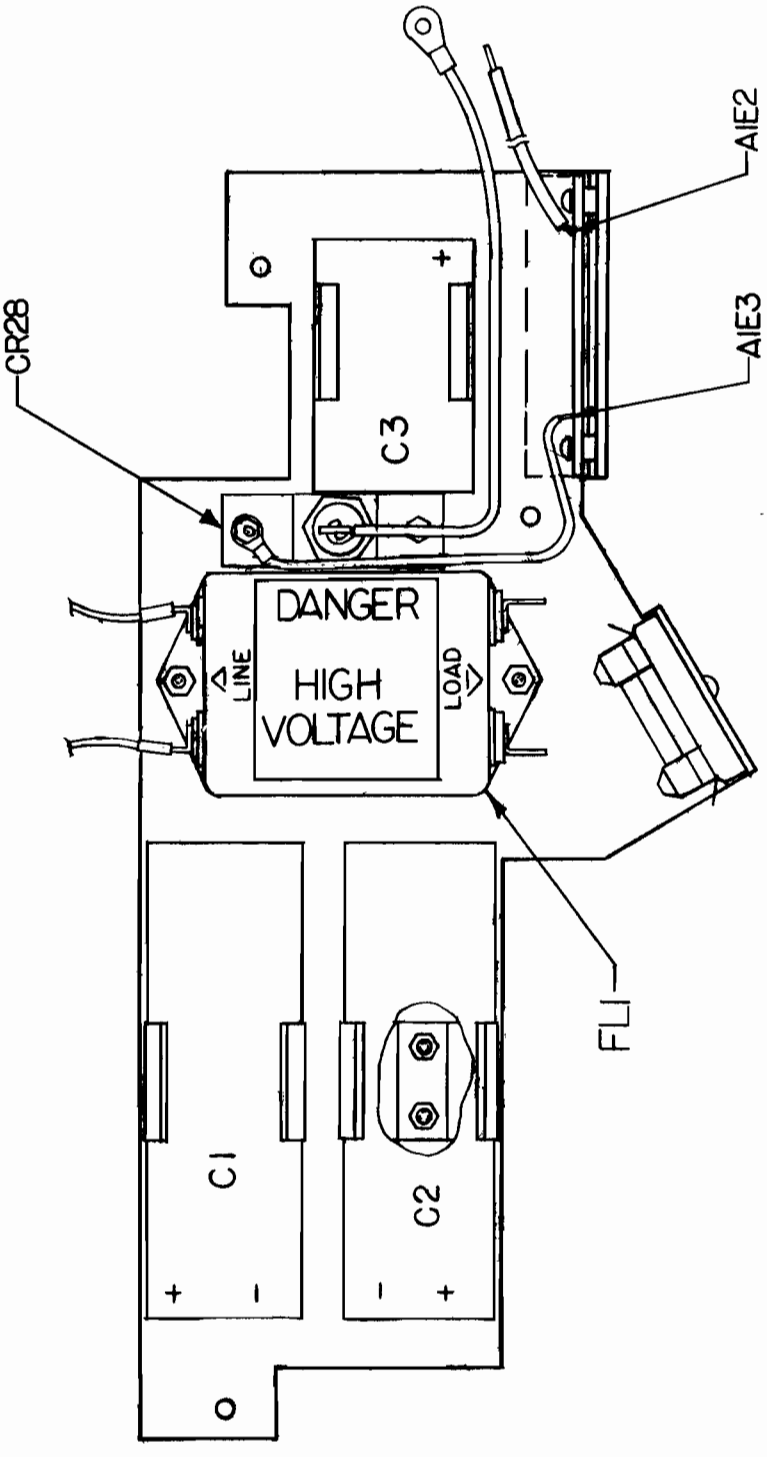


Figure 21. 1A3 Filter Bracket Assembly Component Locations

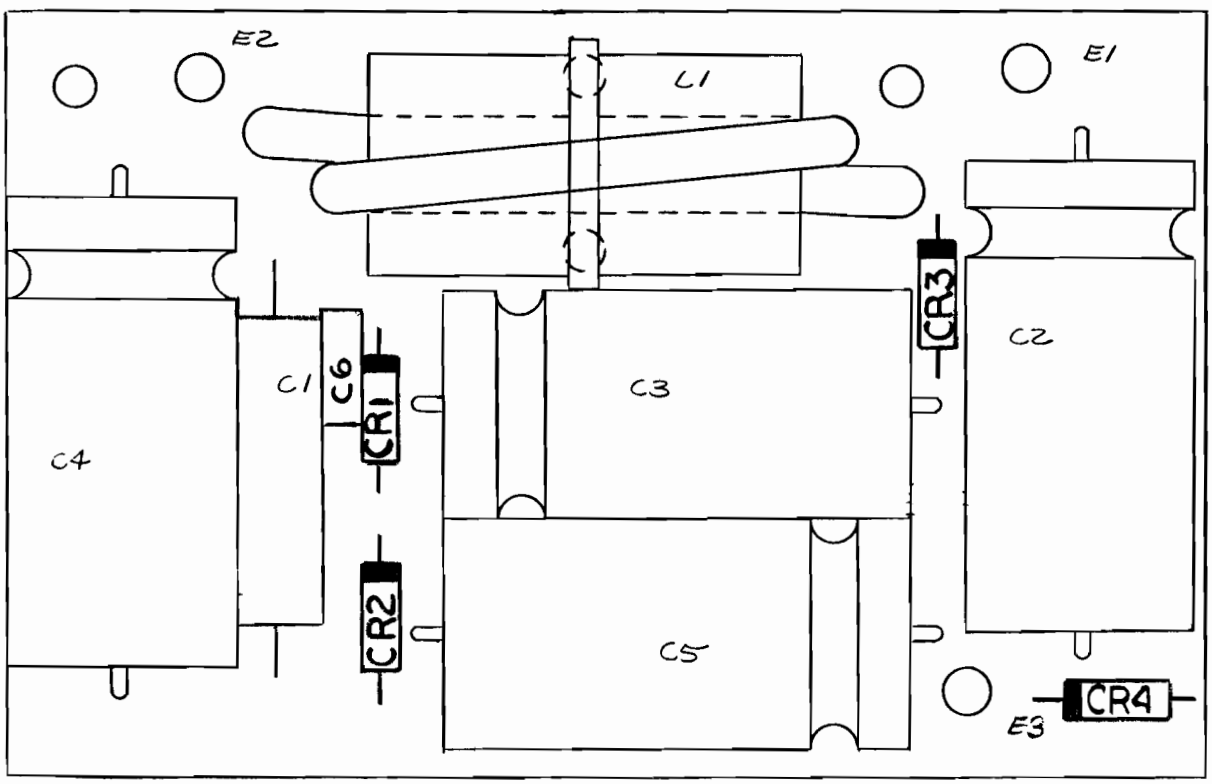


Figure 22. 1A3 Filter PWB

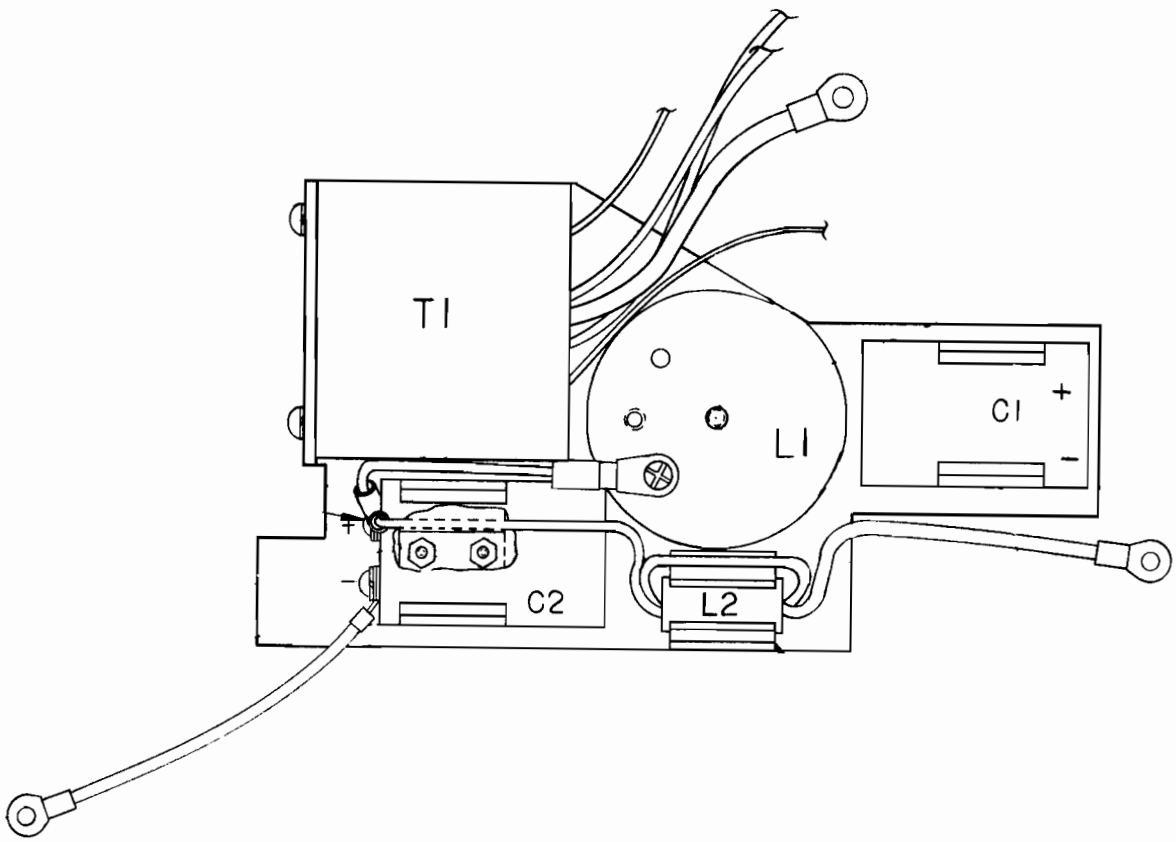


Figure 23. 1A4 Transformer Bracket Assembly Component Locations

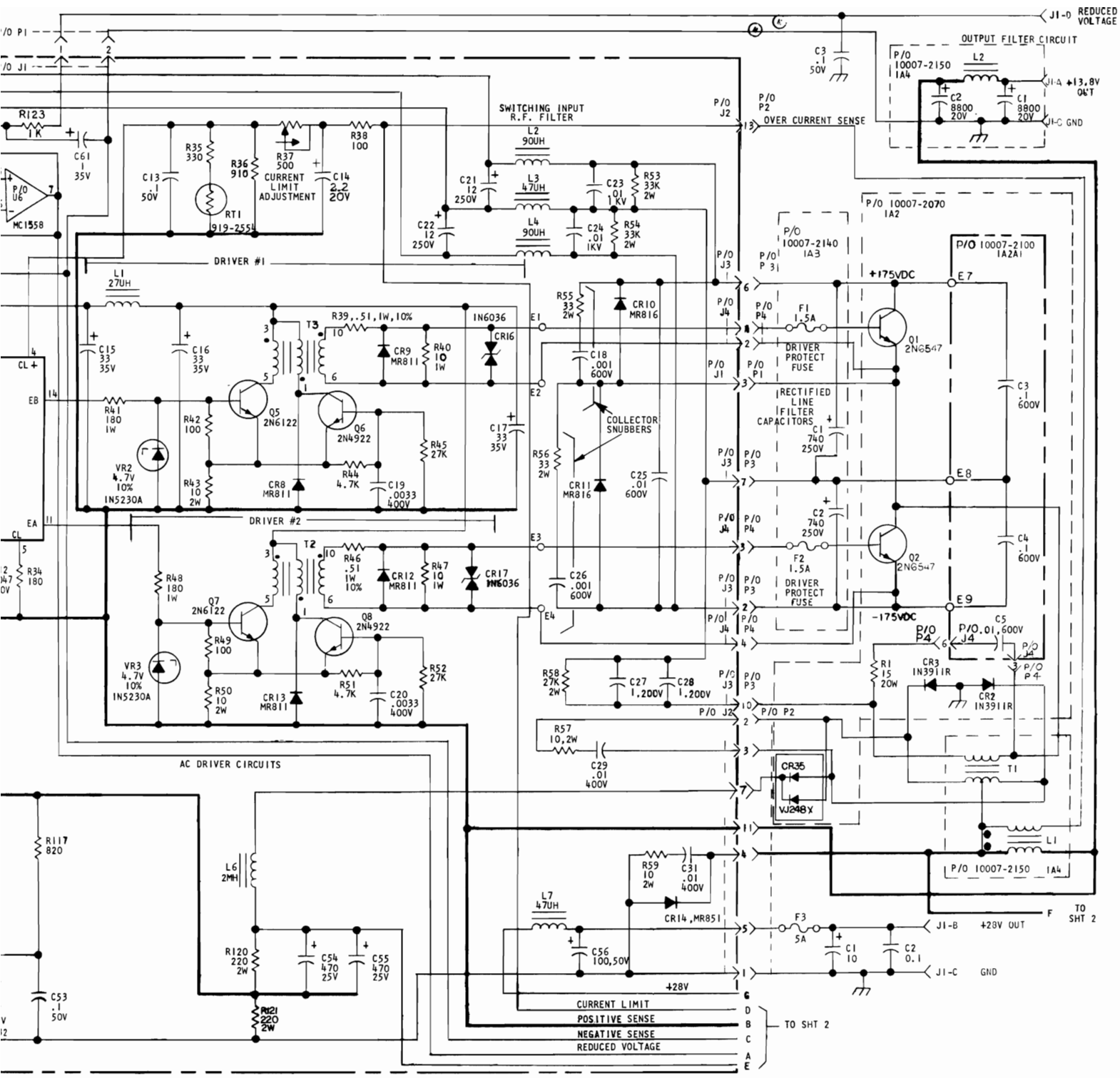
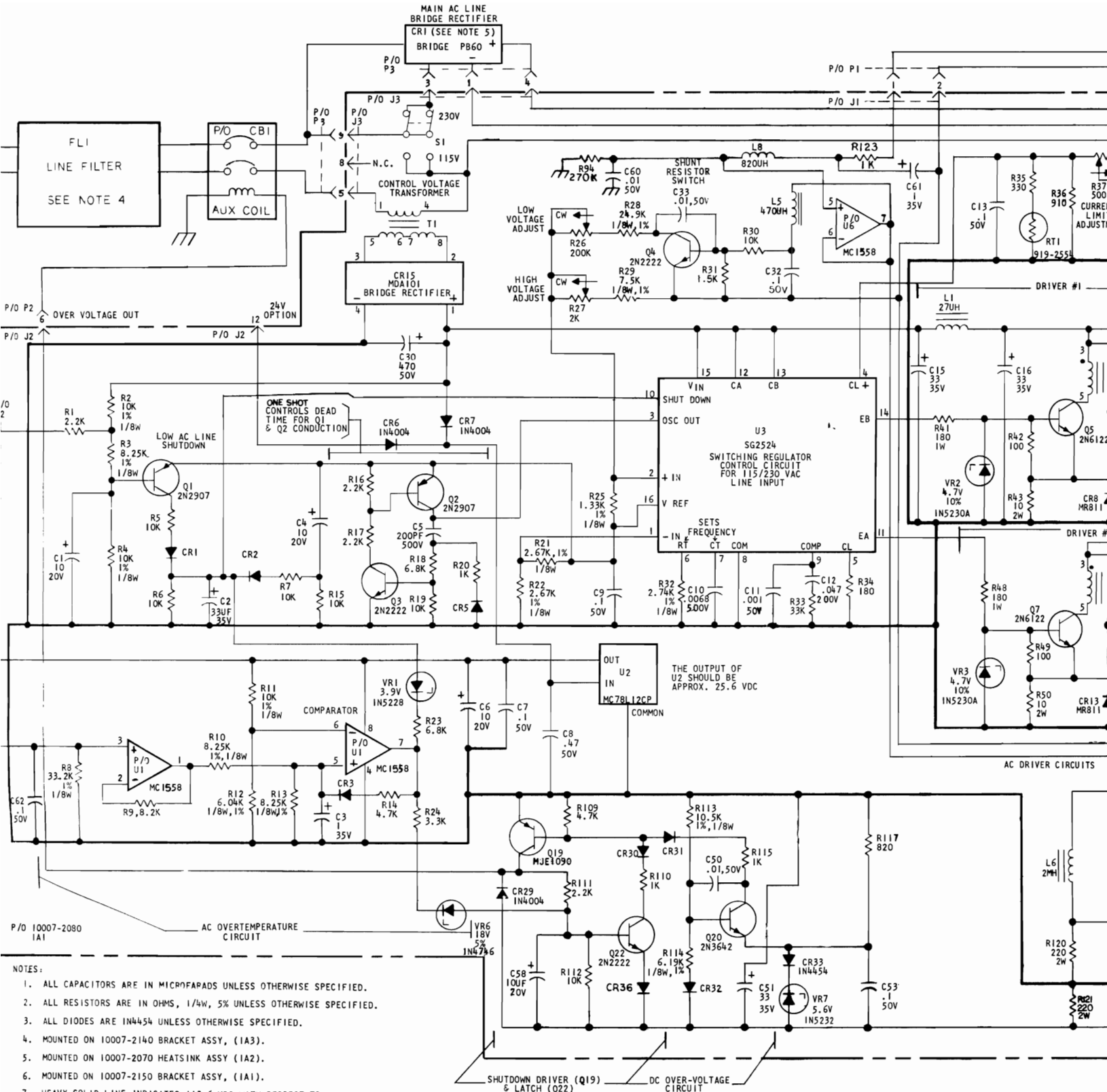
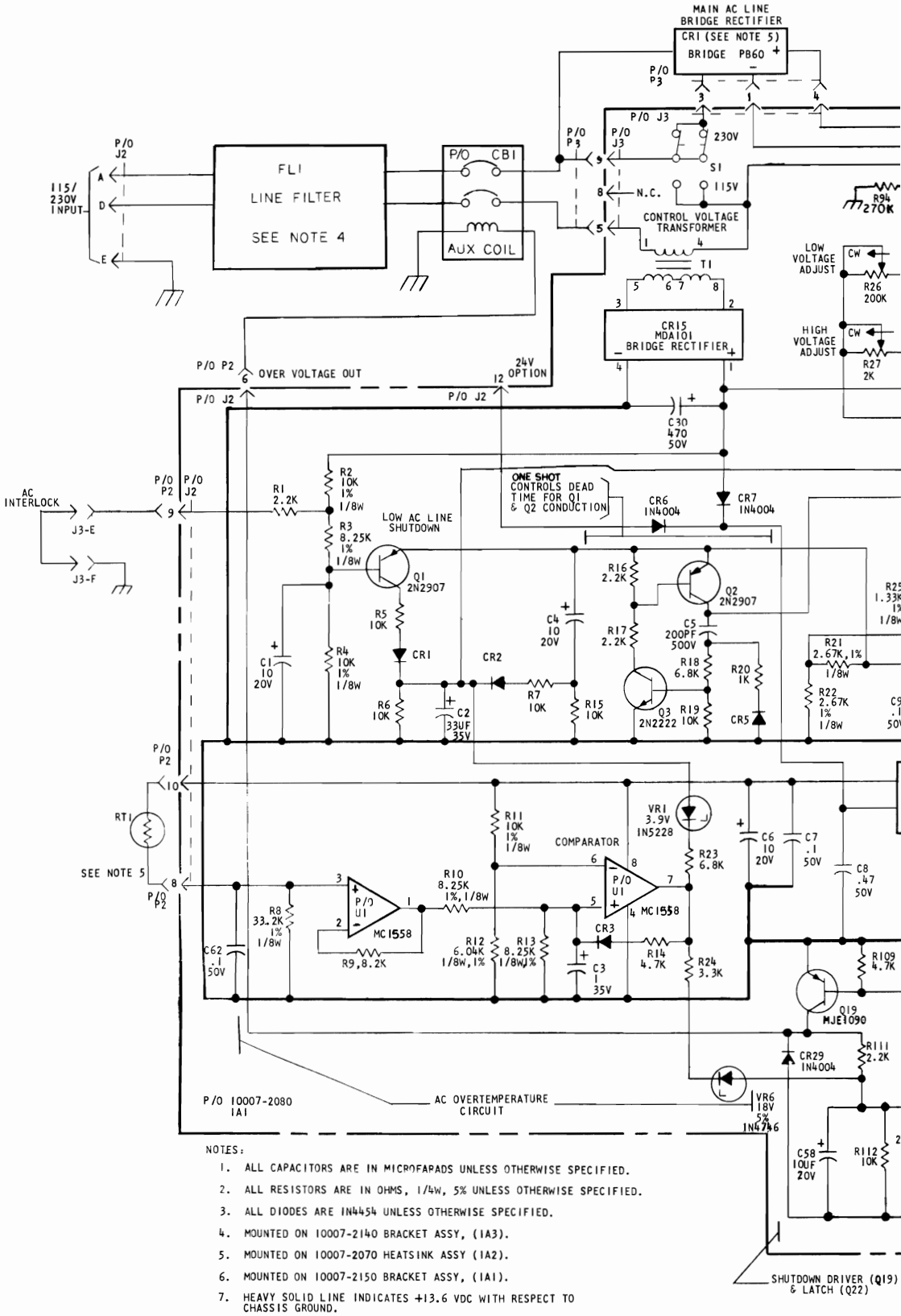


Figure 24. RF-2360 Power Supply Schematic Diagram (10007-2009) (Sheet 1 of 2)



NOTES:

1. ALL CAPACITORS ARE IN MICROFARADS UNLESS OTHERWISE SPECIFIED.
2. ALL RESISTORS ARE IN OHMS, 1/4W, 5% UNLESS OTHERWISE SPECIFIED.
3. ALL DIODES ARE IN4454 UNLESS OTHERWISE SPECIFIED.
4. MOUNTED ON 10007-2140 BRACKET ASSY, (1A3).
5. MOUNTED ON 10007-2070 HEATSINK ASSY (1A2).
6. MOUNTED ON 10007-2150 BRACKET ASSY, (1A1).
7. HEAVY SOLID LINE INDICATES +13.6 VDC WITH RESPECT TO CHASSIS GROUND.
8. SHEET 1 OF THE SCHEMATIC CONTAINS AC LINE REGULATOR AND PROTECTION CIRCUITRY.
9. SHEET 2 OF THE SCHEMATIC CONTAINS 24 VDC REGULATOR AND PROTECTION CIRCUITRY AS WELL AS FAN CIRCUITRY.
10. ALL WIRES FROM E1 TO F1 TO Q1 AND E2 TO Q1 TO BE TWISTED PAIR. ALL WIRES FROM E3 TO F2 TO Q2 AND E4 TO Q2 TO BE TWISTED PAIR.



NOTES:

1. ALL CAPACITORS ARE IN MICROFARADS UNLESS OTHERWISE SPECIFIED.
2. ALL RESISTORS ARE IN OHMS, 1/4W, 5% UNLESS OTHERWISE SPECIFIED.
3. ALL DIODES ARE IN4454 UNLESS OTHERWISE SPECIFIED.
4. MOUNTED ON 10007-2140 BRACKET ASSY, (1A3).
5. MOUNTED ON 10007-2070 HEATSINK ASSY (1A2).
6. MOUNTED ON 10007-2150 BRACKET ASSY, (1A1).
7. HEAVY SOLID LINE INDICATES +13.6 VDC WITH RESPECT TO CHASSIS GROUND.
8. SHEET 1 OF THE SCHEMATIC CONTAINS AC LINE REGULATOR AND PROTECTION CIRCUITRY.
9. SHEET 2 OF THE SCHEMATIC CONTAINS 24 VDC REGULATOR AND PROTECTION CIRCUITRY AS WELL AS FAN CIRCUITRY.
10. ALL WIRES FROM E1 TO F1 TO Q1 AND E2 TO Q1 TO BE TWISTED PAIR. ALL WIRES FROM E3 TO F2 TO Q2 AND E4 TO Q2 TO BE TWISTED PAIR.

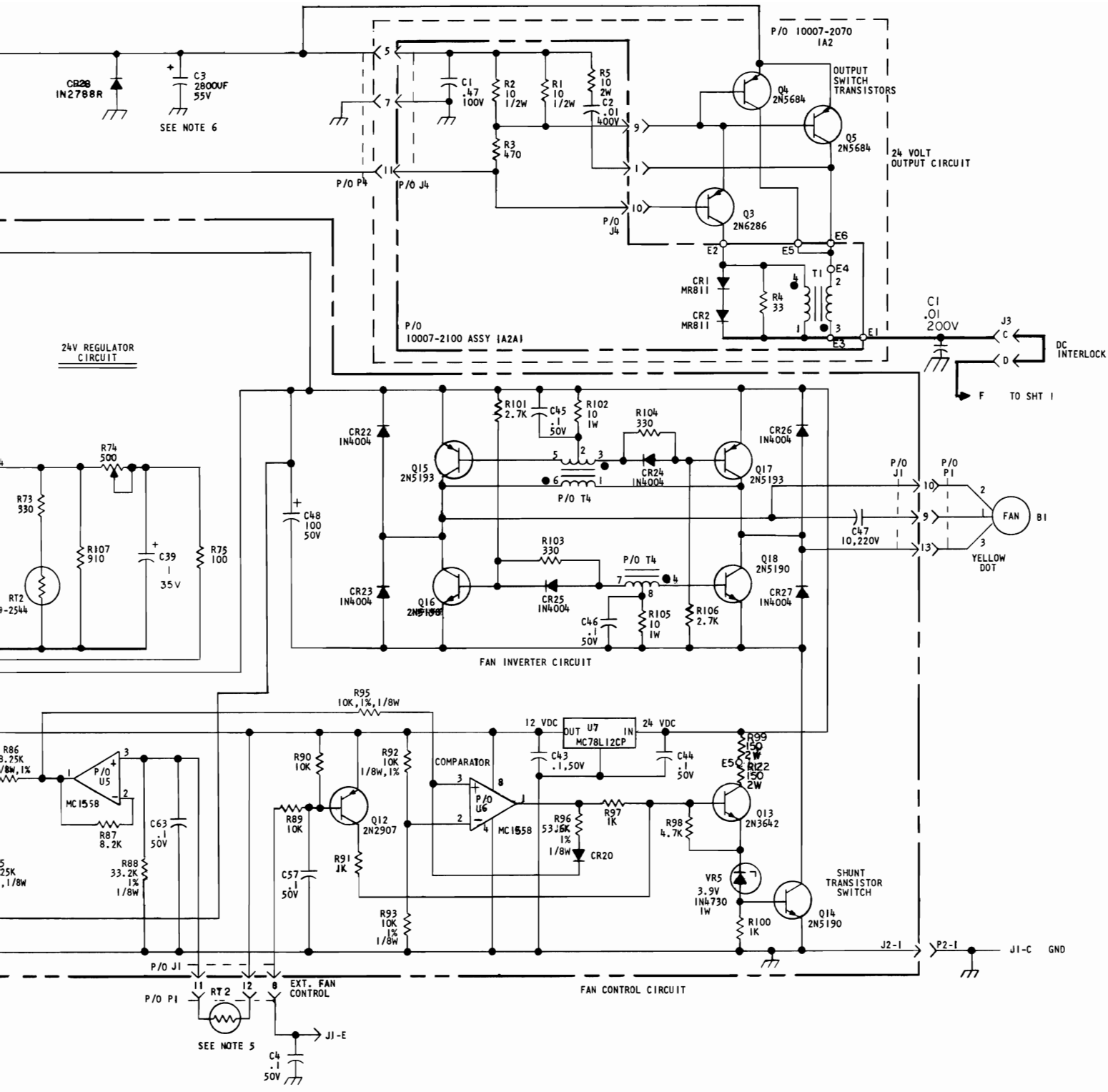
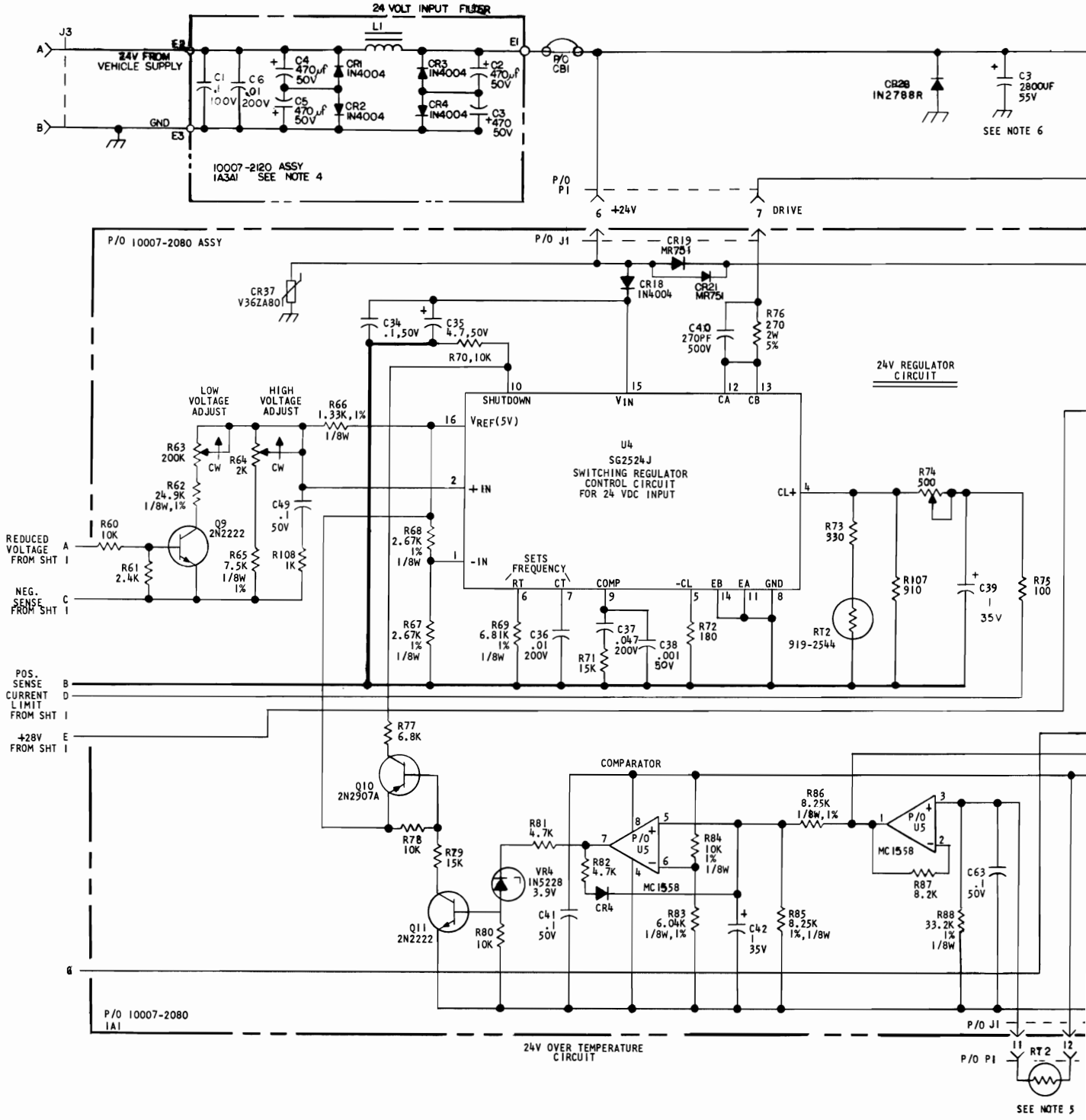


Figure 24. RF-2360 Power Supply Schematic Diagram (10007-2009) (Sheet 2 of 2)


24 VOLT INPUT FILTER
J3
24V FROM VEHICLE SUPPLY
GND
E2
E3
E1
L1
C1 .1 100V
C6 .01 200V
C4 470µf 50V
C5 470µf 50V
CR1 IN4004
CR2 IN4004
CR3 IN4004
CR4 IN4004
C2 470µf 50V
C3 470 50V
10007-2120 ASSY 1A3A1 SEE NOTE 4
P/O CB1
CR28 IN2788R
C3 2800UF 55V
SEE NOTE 6
P/O P1
6 +24V
7 DRIVE
P/O 10007-2080 ASSY
P/O J1
CR19 MR751
CR18 IN4004
CR21 MR751
CR37 V36ZA80
C34 .1,50V
C35 4.7,50V
R70,10K
C40 270PF 500V
R76 270 2W 5%
24V REGULATOR CIRCUIT
LOW VOLTAGE ADJUST
HIGH VOLTAGE ADJUST
R66 1.33K,1% 1/8W
R63 200K
R64 2K
CW
R62 24.9K 1/8W,1%
C49 .1 50V
R60 10K
Q9 2N2222
R61 2.4K
R65 7.5K 1/8W 1%
R108 1K
REDUCED VOLTAGE FROM SHT 1
NEG. SENSE FROM SHT 1
A
C
10 SHUTDOWN
15 VIN
12 CA
13 CB
16 VREF(5V)
2 +IN
1 -IN
4 CL+
U4
SG2524J
SWITCHING REGULATOR CONTROL CIRCUIT FOR 24 VDC INPUT
SETS FREQUENCY
RT 6
CT 7
COMP 9
-CL 5
EB 14
EA 11
GND 8
R68 2.67K 1% 1/8W
R67 2.67K 1% 1/8W
R69 6.81K 1% 1/8W
C36 .01 200V
R71 15K
C37 .047 200V
C38 .001 50V
R72 180
R73 330
R74 500
R107 910
C39 1 35V
R75 100
RT2 919-2544
POS. SENSE CURRENT LIMIT FROM SHT 1
+28V FROM SHT 1
B
D
E
R77 6.8K
Q10 2N2907A
R78 10K
R79 15K
Q11 2N2222
R80 10K
VR4 IN5228 3.9V
R81 4.7K
C41 .1 50V
COMPARATOR
P/O U5
R82 4.7K
CR4
MC1558
R83 6.04K 1/8W,1%
R84 10K 1% 1/8W
C42 1 35V
R85 8.25K 1%,1/8W
R86 8.25K 1/8W,1%
R87 8.2K
R88 33.2K 1% 1/8W
C63 .1 50V
G
P/O 10007-2080 1A1
P/O J1
11
12
RT2
P/O P1
SEE NOTE 5
24V OVER TEMPERATURE CIRCUIT

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Charles Dicecca

From: pkreutter [pkreutter@netzero.com]
Sent: Saturday, November 17, 2007 5:36 PM
To: bc375@comcast.net
Subject: RF-2301 / RF-230 MODIFICATIONS
Attachments: RF-2301 Modifications.doc

Charlie.

These are the RF-2301 mods that I have come up with.

I would NOT do the mod adding the 3.9 ohm resistor as it requires removing the front panel and two circuit boards. That mod eliminates the digital noise on the transmit audio as the display brightness is increased. The front panel can be very tricky to work on. You may even have that mod as it was cut in on later units as it was a factory mod. It can be checked for VISUALLY by looking down from the top of the front panel assembly and will be very close to the T0-220 3 terminal regulator. It is shown in the 1987 version of the manual but not the 1983 version.

The microphone connections are shown on the INTERCONNECT tab section, page 1 at the bottom.

The radio was not one of Harris best receivers as it used audio derrived AGC instead of IF derrived AGC. IF derrived has a much faster attack time.

I main 3 RF-2301's for myself and two for John, N2WHT.

Have worked at Harris-RF for 33 years now and still their!!

Regards.

Dick WA2IKC

RF-2301 MODIFICATIONS
(THE Mr. DICK MODS)

Their are FIVE modifications that greatly improve the operational characteristics the RF-2301 transceiver. They are:

1. 1A1A6 MIXER PWB: Remove C60. This is a 47uF @ 20Vdc tantalaum capacitor.

2. 1A1A4 IF / AUDIO PWB:

   Change C47: FROM: 22uF @ 25Vdc
   TO: 220-330uF @ 6Vdc

   Change #1 removes the long hang-up during a noise pulse or very strong signal. Change #2 slows the AGC time constant so the receiver DOES NOT return to maximum gain between words or static crashes. Makes the receiver 1000% less objectionable (less tiring) to listen to.

3. 1A1A5 PROCESOR PWB:

   Change C29: FROM: .01 uF ceramic cap
   TO: .033uF mylar cap

   Change #3 increases the low frequency response of the transmitter audio and removes the tinney sound of the transmitted audio their by greatly improving the intelligibility of the audio.

4. 1A2A2 INTERFACE PWB:

   C8: Original Value is 10uF @ 20Vdc.

   C8: Change to 68uF at 20Vdc

   This changes dampens the front panel meter characteristics on SSB-CW

5. 1A2A2 INTERFACE PWB:

   Refer to a 1987 technical manual. On sheet 1 of the 3 pages, locate resistor R40 (3.9 ohms ½ watt) and capacitor C13 (220uF @ 16Vdc). Check these components are on the PWB. This was a fairly late modification. They are located by the TO-220 voltage regulators. If not on the PWB, add them.

   Front Panel 6 position Microphone jack J1:

   Remove and tie back the black wire (ground wire) presently in J1-A.

Connect a 6 inch piece of #22 hook-up wire from J1-A to the mother board ground. I put a #4 ground lug under the front left #4 screw that holds the mother board into the RF-2301 chassis.

Connect the remaining end of this added black wire to this solder lug.

Change #5 totally eliminates the digital noise on the microphone ground return lead when decreasing the display brilliance anywhere below maximum display brightness.

Dick Kreutter
5/20/06 (updated)