Instruction Manual

MODEL 1100-AR SERIES
TELEMETRY RECEIVER
S/N 399 and above

July 1972

Microdyne
Excellence In Communications Technology

Revised: 5/16/73

Instruction Manual

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MODEL 1100-AR TELEMETRY RECEIVER
S/N 399 and above

July 1972

TRADE SECRETS

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SAFETY PRECAUTIONS

The following are general safety precautions that are not related to any specific procedures and therefore do not appear elsewhere in this publication. These are recommended precautions that personnel must understand and apply during many phases of operation and maintenance.

HIGH VOLTAGE

Operating and maintenance personnel must at all times observe all safety precautions. Care must be exercised when performing maintenance in and round the line filter, the power transformer, and the front panel. Line voltage is present in the vicinity of the power connector J17, the Audio Gain/Operate Mode switch on the front panel, pins 1, 3, 4, 5 of the power transformer and pins 13, 14, 16, 17 of XA21 front panel connector.

DO NOT SERVICE OR ADJUST ALONE

Maintenance personnel should not service or adjust the equipment except in the presence of someone who is capable of rendering aid.

RESUSCITATION

Personnel working with or near high voltages should be familiar with modern methods of resuscitation. Such information may be obtained from the Bureau of Medicine and Surgery.

ERRATA

Insert the following pen and ink corrections into the basic manual prior to using it to service the 1100-AR Receiver.

Replaceable Parts List:

Base Chassis; paragraph 6-3.

Change: C14 from 30 μF to 800 pF, 16V
R13 from part of S2 to part of S3.

Base Chassis; paragraph 6-4.

Add: C14, 800 pF, 16V
C15, 0.33 μF, 100V
C16, 0.33 μF, 100V

Change: R13 from part pf S2 to part of S3.

Replaceable Parts List, Base Chassis/Figure 7-2:

Add current limiting resistors, R25 and R26, 10 ohms, $\frac{1}{4}$ watt, between the CR2 (-) and the R17-C12-C13, and between CR2 (+) and C10.

INTRODUCTION

This instruction manual provides operation and maintenance information for the Model 1100-AR Telemetry Receiver designed and manufactured by Microdyne Corporation. The 1100-AR is a highly adaptable, completely modularized receiver which can be easily integrated into ground station and laboratory applications by simply selecting the module complement on order.

Being extremely versatile, the 1100-AR can be easily configured as a low cost general purpose receiver supplying the minimum number of outputs, or as a complex data receiver with predetection record and playback capabilities, automatic search and lock for signal acquisition, and spectrum analysis by simply selecting the module complement. An example of the receiver's versatility is readily apparent with the two types of rf tuners and i-f filter/amplifiers now available. These modules can be supplied in electro-mechanically and fixed tuned versions or in voltage tuned versions. The advantage of voltage tuned versions is that a receiver equipped with these modules can be controlled in frequency and bandwidth by analog inputs from a computer or remote console allowing for completely automated ground stations. Electro-mechanically and fixed tuned versions, while not being able to be computer controlled, offer the same signal handling capabilities and operating parameters as the voltage tuned models. Another feature which proves advantageous under certain conditions but relatively superfluous in others is the anti-sideband lock option of the wide angle phase demodulators. This feature prevents the receiver from locking on a sideband of a phase modulated carrier during the reacquisition cycle in applications where signal dropout is expected and frequent. Thus, operator time expended in monitoring receiver status or manually reacquiring phaselock is reduced to an absolute minimum. The receiver afc system may also be "tailored to fit" customer requirements with two types of afc circuits available. One circuit is a low cost unit which provides automatic frequency control only. The second type, being more complex, not only provides automatic frequency control but also automatically sweeps an adjustable search range upon loss of signal. This sweeping function continues until a signal of sufficient strength appears in the i-f passband at which time lock is automatically resumed.

Because of the many combinations of modules available for the 1100-AR, this manual is constructed to be readily adaptable to any receiver configuration. It is composed of nine individual sections preceded by a module complement page and contents pages. The module complement page is checked according to which modules are supplied in the associated receiver configuration. Using the information presented on this page, Sections I through VII can be modified as required to match the receiver. For example, if the applicable receiver does not contain predetection playback or record capabilities, the information pertaining to these items can be designated as not applicable. Similarly, should the receiver be equipped with the afc search and lock capability, only the portion of the afc system description dealing with that particular configuration need be applied. Maintenance procedures, replacement parts lists, and schematic diagrams are adapted in a like manner.

Manuals supplied for special receivers which have been slightly modified to meet particular requirements contain a Section VIII. This section thoroughly describes the modification and the effects it has on overall operating procedures and parameters. Also included in this section are any special instructions for modifying operating and maintenance procedures, parts lists, and schematic diagrams.

The final portion of this manual is Section IX. This section is composed of the instruction booklets for each plug-in module or a group of related modules excluding front panel plug-in modules. Included in each booklet is the theory of operation, special mounting procedures, repair and alignment procedures, parts lists, and schematic diagrams. The number of booklets contained in this section depends upon the module complement of the associated receiver.

Front panel modules, because of their complexity, are supplied with a complete instruction manual. These manuals are provided as supplements to this manual and may or may not be bound in this volume.

MODULE COMPLEMENT

The receiver for which this manual is supplied contains the following modules:

☑ First IF Filter _✓_ Wide ____ Int. ____ Narrow

☐ First IF Filter (Switchable) ____ Wide/ ____ Int. / ____ Narrow

☑ Second Mixer

☑ Second LO VCXO

☑ AM Detector

☑ Video Amplifier

☑ AGC Amplifier

☑ Metering Amplifier

☑ AFC Amplifier (AFC/Search & Lock)

☐ AFC Amplifier (AFC only)

☑ Calibration/Reference Oscillator

☐ ____ kHz Record Converter (10-1100 Series)

☐ ____ kHz Playback Converter (20-1100 Series)

☐ 10 MHz Playback Converter (30-1100)

☐ SDU Converter

☑ Video Filter # _1_

☑ Video Filter # _2_

☐ Special Video Filter ________

☐ Display Regulator

☐ 1st IF/SDU Amplifier

☐ ________________

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SECTION I
GENERAL INFORMATION

1-1. SCOPE. This manual provides information concerning the description, installation, operation, and maintenance of the Model 1100-AR Telemetry Receiver designed and manufactured by Microdyne Corporation, Rockville, Maryland. Schematic diagrams and replacement parts lists are also included herein.

1-2. PURPOSE AND DESCRIPTION

1-3. The Model 1100-AR Telemetry Receiver is an advanced, solid-state, dual conversion telemetry receiver making full use of integrated circuits and related subminiature components. The receiver is capable of receiving and processing any known or projected telemetry data format transmitted by amplitude, frequency, or phase modulated rf carriers over the range of 105 MHz to 6000 MHz. Modular construction techniques are used throughout the receiver for maximum versatility and to reduce maintenance down time.

1-4. The receiver can be supplied in either of two basic configurations designated 1100-AR(5) and 1100-AR. These configurations are identical in all respects with the exception that the 1100-AR includes mounting provisions for a spectrum analyzer and either a predetection record or playback converter. Both configurations are composed of a front panel, base chassis, and the necessary internal and front panel plug-in modules.

1-5. Front panel controls are logically grouped for ease of operation with concentric switches used in related areas. Lamps are included for indicating the status of certain receiver functions. These lamps illuminate to provide visual indications of whether the receiver is in the receive, playback, or calibration operating mode, whether there is a carrier present, and whether the automatic search circuits are energized and functioning. Meters are employed to indicate the video output level, signal level, tuning accuracy, and deviation. Calibration controls for the meters are located adjacent to the associated meter. Operating controls for the various front panel plug-in modules are also contained on the front panels and are grouped for ease of operation.

1-6. In order to provide a more complete description of the 1100-AR receiver, the various components of the receiver are described briefly in the following paragraphs. A list of modules available for use with the receiver is given in table 1-1. The electrical, environmental, and mechanical specifications are given in table 1-2.

1-7. BASE CHASSIS. The base chassis is the main part of the receiver. This section contains the mounting facilities and connectors for the plug-in modules, the power supply, and all interconnecting wiring. Connectors for signal inputs and outputs are mounted on the rear apron and are labeled as to their function and reference designation.

1-8. FRONT PANEL. The front panel of the receiver is considered to be a module. All operating controls and indicators except for those mounted on the plug-in modules are contained on the front panel and connected to the main chassis through a wiring harness and mating connectors. If need be, a complete front panel can be replaced in a matter of minutes.

1-9. RF TUNER. A series of rf tuners covering discrete frequency bands is available for use with the 1100-AR to enable reception of rf carriers ranging from 105 MHz to 6000 MHz. These units are front panel plug-ins and are available in both voltage tuned and mechanically tuned models. The tuners function to down convert the selected rf input to a 50 MHz i-f signal for further processing. The voltage tuned versions have the additional capability of being controlled by a voltage input from a remote tuning console or computer interface.

1-10. DEMODULATORS. Demodulator modules are available for the processing of fm, phase, and bi-phase data. FM demodulators comprise three basic units, each of which covers a certain range of i-f bandwidths. A narrow band unit covers up to and including 50 kHz, and intermediate and wide band units cover ranges of 100 kHz to 750 kHz and 750 kHz to 6 MHz. In addition, the intermediate and wide band units or all three ranges can be supplied in a single housing. The wide angle phase demodulator may be used with any i-f bandwidth and is capable of retrieving pm data having peak deviations up to 2.8 radians. This module may be equipped with an option anti-sideband lock feature which effectively prevents sideband lock on signal acquisition. A bi-phase demodulator is available for use with i-f bandwidths exceeding 100 kHz. Capabilities of this unit include demodulation of a ±90 PSK, bi-phase modulated signal at bit rates between 1 bit and 2 megabits, NRZ. It also is equipped with the anti-sideband lock feature.

1-11. SECOND IF FILTER/AMPLIFIERS. The second i-f filter/amplifier front panel plug-in modules are employed to establish the bandwidth of the 10 MHz second i-f signal. Both fixed and variable bandwidth units are available. Each of the fixed bandwidth models sets a single bandwidth in the range of 10 kHz to 6 MHz. Up to three of these filter/amplifiers can be installed in a module housing to enable multi-bandwidth operation. Modules of this type are equipped with a front panel selector switch. Variable bandwidth models are voltage tuned and are equipped with a front panel dial to permit selection of any i-f bandwidth within its operating range. One such unit is the Model 1120-VI(600) which is capable of setting any bandwidth from 100 kHz to 600 kHz.

1-12. FIRST IF FILTER. The first i-f filter space in the receiver may be equipped with any one of three types of modules as selected by the customer on order. The first type of module supplies steep skirted filtering of the first i-f signal and establishes either a 600 kHz, 1.2 MHz, or 4 MHz bandwidth. The second type contains any two of the standard or special bandwidths and is automatically switched by the second i-f filter/amplifier. Both of these modules supply an isolated 50 MHz output for display purposes. The third type of module supplies no filtering whatsoever but provides a 50 MHz output for display purposes.

1-13. SECOND MIXER. The second mixer accepts the 50 MHz first i-f input and a 60 MHz second local oscillator input, and provides a 10 MHz second i-f output. When the receiver is used in the playback configuration, the 50 MHz pre-recorded signal is injected into the second mixer and processed identically to the normal first i-f signal.

1-14. SECOND LOCAL OSCILLATOR. This module supplies the 60 MHz l-o signal to the second mixer. The oscillator may be operated in any one of five modes to supply the required signal. These modes, vfo, crystal, afc, pm, or off, are controlled by a front panel switch. In the vfo mode, the frequency is controlled by a front panel fine tune control. In the afc and pm modes, the frequency is controlled by a voltage generated by afc circuitry or the phase demodulator (pm). When set to the crystal mode, a fixed 60 MHz signal is generated. The off position permits the injection of an external 60 MHz input.

1-15. AM DETECTOR. An a-m detector module is employed in the 1100-AR to detect any a-m data, derive the raw agc voltage for gain control, and provide both linear and limited 10 MHz outputs for recording.

1-16. CALIBRATE/REFERENCE OSCILLATOR. The calibrate/reference oscillator is an optional module for receivers equipped with an fm demodulator and a required module for receivers equipped with a pm demodulator. The 10 MHz output of the module is employed to calibrate fm systems and serves as a reference for pm systems.

1-17. VIDEO FILTERS. The video filters are employed in the receiver to establish the video cutoff frequency. Any two of seven video filter modules can be included in the 1100-AR main chassis. Each of the modules contains a number of video filter circuits in various combinations as selected by the customer. Selection of which filter used is made through a front panel switch. In addition, a third filter can be installed to establish a special or non-standard cutoff frequency as specified by the customer.

1-18. VIDEO AMPLIFIER. The detected and filtered video signal is amplified by this module and coupled to a rear apron connector. A second output of this module also drives the front panel output meter. The gain of the video amplifier is adjustable through a front panel control.

1-19. AGC AMPLIFIER. The agc amplifier contains three separate circuits: an agc amplifier, an agc output amplifier, and a carrier operated relay (COR). The agc amplifier circuit is driven by an output from the a-m detector and is used to control the gain of the tuner, second mixer, and second i-f filter/amplifier. This amplifier circuit also feeds the signal level meter on the front panel of the receiver. Various agc time constants from 0.1 milliseconds to 1 second are selectable through a front panel switch. The output voltage can also be manually set to the desired level through a selector switch and potentiometer.

1-20. The agc output amplifier circuit is used to amplify the output of the agc amplifier circuit and feed it to a rear panel connector. Signals appearing at this connector can then be recorded or applied to combining equipment as required. The COR circuit is also driven by the agc amplifier circuit. This relay causes a front panel lamp to light when the receiver carrier is above preset threshold level. A double set of single pole double throw relay contacts (appearing at a rear panel connector) is also provided by the COR. These contacts operate when the front panel carrier lamp lights and may be used to control remote indicators.

1-21. METERING AMPLIFIER. The metering amplifier module supplies the drive voltages to the receiver deviation and output meters. These voltages are initially derived from the plug-in demodulator and video amplifier, respectively. Also contained in the metering amplifier module is a bridge amplifier circuit. This stage is employed to regulate the oven temperature when a crystal oven is installed in the tuner.

1-22. AFC AMPLIFIER. Two types of afc modules may be utilized with the 1100-AR. One type supplies afc voltages only. The second type contains automatic sweep circuitry in addition to the normal afc circuit. The automatic sweep circuit is employed in both the afc and pm modes of operation to generate search voltages to the second l-o to enable automatic search and lock after signal dropout. Outputs are also provided to control the search indicator lamp and to drive the tuning meter.

1-23. PLAYBACK CONVERTER. Two types of playback converters are available for use with the 1100-AR. These are designated 20-1100 series and 30-1100 series. When a receiver is equipped with a 20-1100 series, any one of the six standard video record carriers is up converted to 50 MHz and injected into the second mixer. When the receiver is equipped with a 30-1100 series converter, a 10 MHz signal is up converted to 50 MHz and injected into the second mixer.

1-24. RECORD CONVERTER. The record converters designed for use with the 1100-AR are designated 10-1100 series. There are six standard modules available, each of which supplies a single video record carrier output taken from a rear apron connector. The input to this module is supplied by the limited or linear 10 MHz output.

1-25. DISPLAY CONVERTER. An optional display converter can be installed in the receiver to permit mating the 1100-AR with a spectrum display unit having an input frequency requirement of other than 50 MHz. This module accepts the 50 MHz i-f signal and converts it to the customer specified frequency with unity gain.

1-26. SPECTRUM DISPLAY UNIT. The Model 1161-S(A) Spectrum Display Unit can be installed directly into the top left side equipment space in the 1100-AR receiver only. When used with the 1100-AR(5), it must be installed in a separate housing. The 1161-S(A) accepts the 50 MHz i-f signal and provides a visual representation of signals appearing in a 4 MHz passband on a crt. All controls necessary for operation of the display unit are located on its front panel.

1-27. PREDETECTION RECORD CONVERTER. The Model 1171-PR(A) Predetection Record Converter is also designed for use in the 1100-AR receiver. A separate housing is available for use with the 1100-AR(5). This module accepts the linear or limited 10 MHz i-f signal and provides any of six video record carrier outputs. Selection of the output frequency is made through a front panel switch.

1-28. PREDETECTION PLAYBACK CONVERTER. The Model 1181-PP(A) Predetection Playback Converter is a third auxiliary plug-in for the 1100-AR. Like the display unit and companion 1171-PR(A) record converter, it also can be placed in a separate housing for use with 1100-AR(5). The unit accepts any of the six standard video record carriers and up converts it to 10 MHz. This signal is then patched to the 30-1100 10 to 50 MHz converter and injected into the second mixer. A front panel switch is provided for selecting the particular video carrier input. The unit is also equipped with a level adjustment and meter to enable optimum operation.

1-29. CENTER FREQUENCY OFFSET AND AUXILIARY AGC OUTPUT MODULES. Center frequency offset (CFO) and auxiliary agc output modules are available for the 1100-AR.

The CFO modules provide a dc voltage output proportional to the frequency offset of the received signal in relation to the receiver i-f center frequency. The CFO circuitry is operable in all receiver modes of operation.

1-30. The auxiliary agc output modules provide a buffered agc voltage output for driving external recorders or diversity combiners. The output ranges from 0 to 8V dc and can be of either positive or negative polarity depending on customer requirements. Included on these modules are slope and zero adjustments for setting the agc output to match the input requirements of the external equipment. Additionally, both the CFO and auxiliary agc output capabilities can be included in a single module. The model numbers and capabilities of the four modules in this series are:

41-1100	CFO output only. Unless otherwise specified, the sensitivity is factory set to 100 kHz/volt with a 2V p-p maximum output.
42-1100	Auxiliary agc output only; 0 to -8V dc output range.
43-1100	Auxiliary agc output only; 0 to +8V dc range.
44-1100	CFO and auxiliary agc outputs. Unless otherwise specified, the CFO sensitivity is to 100 kHz/volt with a 2V p-p maximum output. The agc output ranges from 0 to -8V dc; the polarity can be set positive to provide a 0 to +8V dc range if specified at time of order.

1-31. REFERENCE TABLES

1-32. The reference data for both the 1100-AR(5) and 1100-AR is given in tables 1-1 and 1-2. Table 1-1 provides a list of the modules available, their reference designations, and their type classification. Table 1-2 lists the specifications for the receiver as a whole. The specifications are grouped into electrical, environmental, and mechanical classifications. Specifications for the various front panel plug-in modules are given in the applicable instruction manual.

Table 1-1. Basic Components of the Model 1100-AR Telemetry Receiver

	Reference Designation	Front Panel (F) Internal (I)
Positive voltage regulator	A1	I
Negative voltage regulator	A2	I
RF tuner	A3	F
First i-f filter	A4*	I
Second local oscillator	A5	I
Second mixer	A6	I
Second i-f filter/amplifier	A7	F
AM detector	A8	I

* Optional

continued

Table 1-1, continued

	Reference Designation	Front Panel (F) Internal (I)
Demodulator	A9	F
Calibrate/reference oscillator	A10*	I
Video filters	A11	I
Video filters	A12	I
Video filter	A13	I
Video amplifier	A14	I
AGC amplifier	A15	I
Metering amplifier	A16	I
AFC amplifier	A17*	I
Playback converter	A18*	I
Record converter	A19*	I
Display converter	A20*	I
Front panel	A21	--
Base unit	A22	--
Spectrum display unit	A23*	F
Spectrum display unit regulator	A24*	I
Predetection record (or playback) converter	A25*	F

* Optional

Table 1-2. Specifications

ELECTRICAL

Receiver Type	Double superheterodyne; 50 MHz first i-f; 10 MHz second i-f.
Frequency Range	105-6000 MHz as determined by plug-in rf tuner.
Input Impedance	50 ohms, unbalanced.
Noise Figure	5.5 to 10.0 dB depending on rf tuner used.
VSWR	2:1 maximum depending on rf tuner used.
Image Rejection	80 dB minimum.
IF Rejection	90 dB minimum.
Dynamic Range	Threshold to -10 dBm (threshold is defined as a 6 dB signal-to-noise ratio).

continued

Table 1-2, continued

NOTE

The following specifications are applicable to the respective portion of the receiver circuitry only. They are not to be interpreted as being applicable to a complete receiver or any configuration thereof due to variations in i-f and loop bandwidths, rf tuner noise figure, and other similar limitations of the circuitry utilized in the receiver design.

First LO Characteristics:	
Modes	Switch selectable: VFO, XTAL (crystal), OFF (external input).
Stability:	
VFO	±0.001% per degree Centigrade.
Crystal	±0.005% without oven; ±0.0005% with oven.
Second LO Characteristics:	
Modes	Switch selectable: VFO, XTAL (crystal), AFC, PM, OFF (external input).
Stability:	
VFO	±0.001% per degree Centigrade.
Crystal	±0.005%.
AFC Characteristics:	
Tracking Range	±400 kHz in addition to ±250 kHz fine tune control.
Acquisition Range	Up to ±400 kHz from center frequency in addition to ±250 kHz fine tune control.
Drift Reduction Factor	Greater than 10,000:1.
Search Range	50 kHz to greater than 800 kHz; approximately symmetrical about second l-o frequency as set by front panel fine tune control.
Search Rate	1.5 MHz/second.
PM Characteristics:	
Control Range	±250 kHz in addition to second l-o fine tuning range.

continued

Table 1-2, continued

PM Characteristics, continued	
Search Range	50 kHz to greater than 500 kHz; approximately symmetrical about second l-o frequency; set by loop bandwidth control.
Phase Loop Bandwidth	10, 30, 100, 300, 1000 Hz as determined by positioning of pm demodulator loop bandwidth switch.
Demodulation:	
FM Demodulation	Refer to applicable fm demodulator manual.
PM Demodulation	Refer to applicable pm demodulator manual.
AM Demodulation:	
AM Response	5 Hz to one-half i-f bandwidth (1.6 MHz maximum).
AM Distortion	Less than 3% with 90% modulation at a 1 kHz rate.
AGC Time Constant	Switch selectable; 0.1, 1.0, 10, 100, 1000 msec normally supplied. Others available.
Video Characteristics:	
Output Impedance	75 ohms.
Rated Output	4 volts peak-to-peak.
Maximum Output	10 volts peak-to-peak.
Distortion	Less than 0.5% at rated output; less than 1% at maximum output.
Source	Plug-in demodulator or a-m detector.
Coupling	AC or DC; switch selectable.
Response	AC coupled - 5 Hz to 2.0 MHz +1.0 dB -3 dB. DC coupled - DC to 2.0 MHz +1.0 dB -3 dB.
Power Requirements	115/230V ac ±10%, 50-400 Hz, 35 watts—1100-AR(5) or 50 watts—1100-AR maximum.

continued

Table 1-2, continued

ENVIRONMENTAL	
Temperature Range:	
Storage	149°F -62° to +65° Centigrade.
Operating	0° to +50° Centigrade.
Atmospheric Pressure:	
Storage	To 50,000 feet.
Operating	To 15,000 feet.
Humidity	To 95% relative humidity.
MECHANICAL	
Height	5-7/32 inches 1100-AR(5); 6-31/32 inches 1100-AR.
Width	19 inches.
Depth	19-1/4 inches.
Weight	1100-AR(5) approximately 35 pounds. 1100-AR approximately 42 pounds.

SECTION II
INSTALLATION

2-1. GENERAL

2-2. This section contains installation information for the Model 1100-AR Telemetry Receiver in both the 5- and 7-inch configurations. Instructions are also included for handling, storage, and packaging for reshipment.

2-3. RECEIVING

2-4. The 1100-AR is shipped with all internal subassemblies installed; front panel modules are shipped separately to prevent possible in-transit damage. The receiver and power cord are sealed in a polyethylene bag and packed in a polystyrene shipping case which is sealed with tape. To open the case, lay it flat with the topside up. Cut the tape and remove the receiver package. Place the receiver on a bench and remove the bag. Thoroughly check the receiver for in-transit damage; i.e., broken meter faces, damaged connectors, dents, broken knobs. If damaged, notify the proper authorities immediately.

NOTE

Do not destroy the packing case if the receiver is to be stored or transferred to another site.

2-5. Prior to installing the receiver, remove the bottom cover and insure that all modules are firmly secured in their receptacles. This may be done by simply pushing each module down into the receptacle. If the receiver was ordered with rack slides, the receiver portions of the slide assembly are installed before shipment and the rack portions shipped in a separate carton.

2-6. INSTALLATION

2-7. MOUNTING

2-8. The 1100-AR is designed for mounting in a standard 19-inch equipment rack. No special hardware is required to mount the receiver whether or not it is equipped with slides (Microdyne RSA-11). The 1100-AR(5) requires 5 inches of vertical space and the 1100-AR requires 7 inches of vertical space.

2-9. INTERCONNECTING CABLE

2-10. After mounting, all interconnections between the receiver and other equipment should be completed. Table 2-1 provides cabling requirements for the 1100-AR and includes the connectors and their functions, reference designations, types, and impedances. A rear view of an 1100-AR is shown in figure 2-1. Because of the many options available, certain rear apron connectors may or may not be supplied.

2-11. PRIMARY POWER

2-12. Unless otherwise requested, the 1100-AR is shipped wired for operation with a 115V ac input. Should it become necessary to operate at 230V ac, the primary of T1 must be rewired for 230 volt operation. Figure 2-2 shows the transformer wiring for both 115V ac and 230V ac operation. Access to T1 is obtained by removing the top cover. A power cord is supplied for connecting the receiver to the primary power outlet.

2-13. FRONT PANEL MODULE INSTALLATION

2-14. Two methods are employed to secure the receiver front panel modules. One type is used on both of the receiver configurations and consists of a release latch and bail. To install a module in the receiver, raise the top part of the mechanism in the direction of the arrow. Extend that bail marked PULL to limit. Insert the module into its slot and return the PULL handle to its original position until the latch lock engages.

NOTE

To install a demodulator into the receiver, the demodulator must first be mated to the companion i-f filter and the two units installed together. The same procedure applies when installing an i-f filter.

2-15. The second method of securing modules is evident on the 1100-AR only. This method involves the use of pawl fasteners and thumbscrews and is employed on the auxiliary modules only. To install a module which employs this type of fastener, adjust the thumbscrews until the pawls are retracted. Insert the module into its slot and adjust the thumbscrews as necessary to tighten the pawls.

2-16. FRONT PANEL MODULE REMOVAL

2-17. Removal procedures for front panel modules are simply the reverse of the installation procedures.

2-18. STORAGE AND HANDLING

2-19. When storing or transporting the receiver, the environmental storage conditions given in table 1-2 must not be exceeded. No special equipment is required to handle the receiver although care should be exercised to prevent excessive shock and vibration.

2-20. PACKAGING FOR RESHIPMENT

2-21. Should it become necessary to repack the receiver for shipment, proceed as follows:

a. Remove the front panel modules and package them following the instructions in the applicable instruction manuals. Shipment of front panel modules in the base chassis voids the warranty.

b. Place the receiver and a quantity of desiccant into a moisture proof polyethylene bag and seal.

c. If the original polystyrene shipping case is available, place the receiver into the case and seal with shipping tape. If the original case is not available, proceed as follows:

   1. Place the receiver into a heavy duty cardboard box using sufficient padding to prevent movement.
   2. Seal the carton and place it into a second carton or shipping crate, again using sufficient padding to prevent movement. Seal this carton.

d. Affix the necessary "Fragile" and "Delicate Equipment" labels.

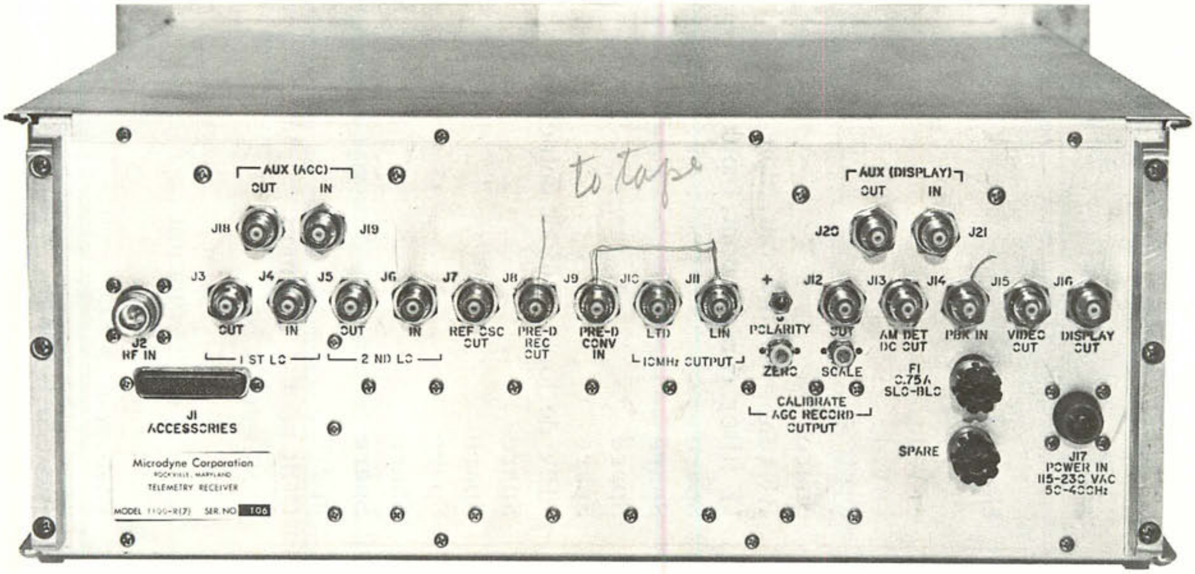


Figure 2-1. Model 1100-AR Telemetry Receiver,
Typical Rear View

Table 2-1. Rear Apron Connectors

Connector	Function	Reference Designation	Type	Impedance (Ohms)	Recommended Cable
ACCESSORIES		J1	Cannon DBM-25S	--	
Pin 1	Ground				24 AWG
Pin 2	+15V dc				24 AWG
Pin 3	+6V dc				24 AWG
Pin 4	-6V dc				24 AWG
Pin 5	-15V dc				24 AWG
Pin 6	Spare				24 AWG
Pin 7	RF tuner remote cont. input				24 AWG
Pin 8	IF filter remote cont. input				24 AWG
Pin 9	Spare				24 AWG
Pin 10	Spare				24 AWG
Pin 11	Spare				24 AWG
Pin 12	Spare				24 AWG
Pin 13	+10V dc lock; -10V dc unlocked	MF-7 Zener			24 AWG
Pin 14	Spare				24 AWG
Pin 15	Spare				24 AWG
Pin 16	Spare				24 AWG
Pin 17	Spare				24 AWG
Pin 18	Spare				24 AWG
Pin 19	Spare				24 AWG
Pin 20	COR sect. 1 common				24 AWG
Pin 21	COR sect. 1 NC				24 AWG
Pin 22	COR sect. 1 NO				24 AWG
Pin 23	COR sect. 2 common				24 AWG
Pin 24	COR sect. 2 NC				24 AWG
Pin 25	COR sect. 2 NO				24 AWG
RF IN	Input to rf tuner	J2	N	50	RG-223/U or RG-9/U

continued

Table 2-1, continued

Connector	Function	Reference Designation	Type	Impedance (Ohms)	Recommended Cable
1st LO OUT*	Monitor output of first local oscillator (in rf tuner)	J3	BNC	50	RG-223/U
1st LO IN*	Input for injecting external signal to be used instead of internally generated first local oscillator signal	J4	BNC	50	RG-223/U
2nd LO OUT*	Monitor output of second local oscillator	J5	BNC	50	RG-223/U
2nd LO IN*	Input for injecting external signal to be used instead of internally generated second local oscillator signal	J6	BNC	50	RG-223/U
REF OSC OUT*	Monitor output of calibration/ reference oscillator	J7	BNC	50	RG-223/U
PRE-D REC OUT*	Output from record converter A19	J8	BNC	75	RG-59/U
PRE-D CONV IN*	Input to pre-d converter	J9	BNC	50	RG-223/U
10 MHz OUTPUT LTD*	Output for limited 10 MHz signal from a-m detector	J10	BNC	50	RG-223/U
10 MHz OUTPUT LIN*	Output for linear 10 MHz signal from an a-m detector	J11	BNC	50	RG-223/U
AGC RECORD OUT*	Record output from agc amplifier	J12	BNC	--	RG-223/U

* These connectors are supplied only when specifically required.

continued

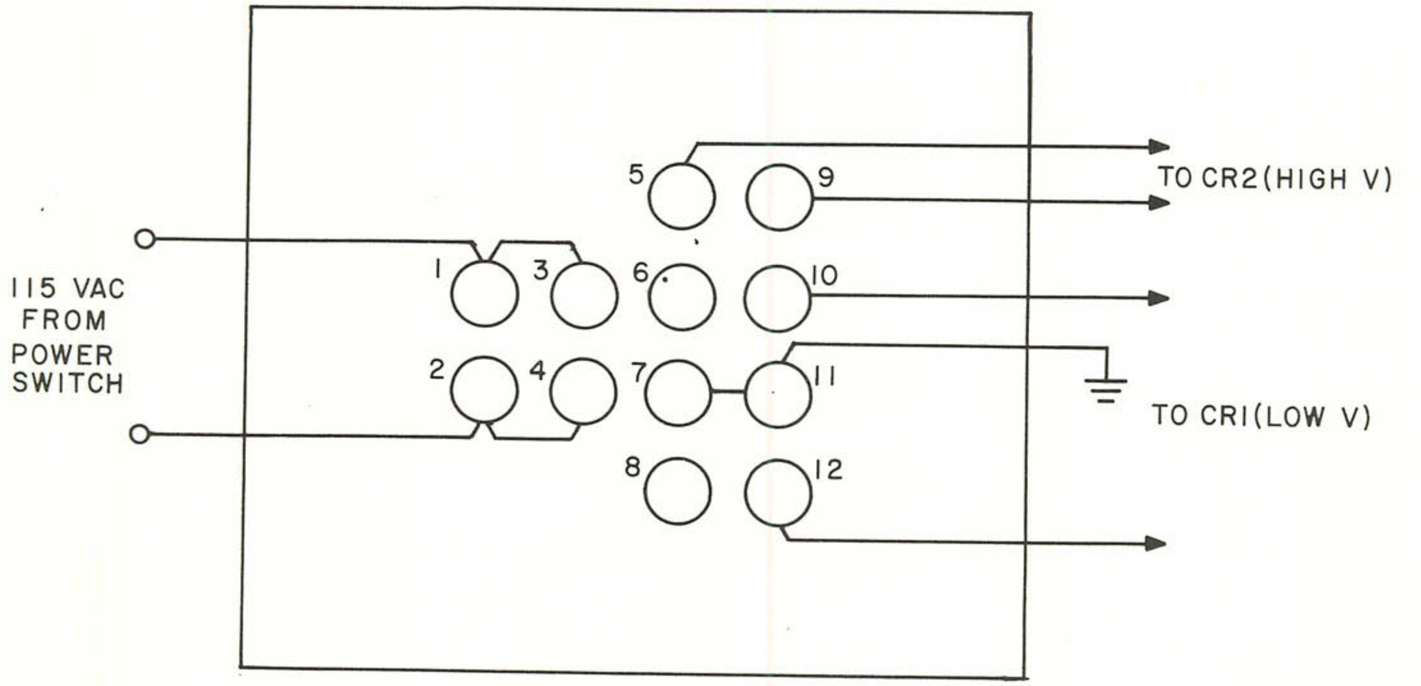
Table 2-1, continued

Connector	Function	Reference Designation	Type	Impedance (Ohms)	Recommended Cable
AM DET DC OUT*	High impedance monitor output of a-m detector	J13	BNC	--	RG-223/U
PBK IN*	Input to playback converter, A18	J14	BNC	75	RG-59/U
VIDEO OUT	Output for filtered video signals	J15	BNC	75	RG-59/U
DISPLAY OUT*#	Output (** MHz or 50 MHz) for spectrum display unit	J16	BNC	50	RG-223/U
POWER IN	Input for ac power to receiver; 115/230V ac, 50-400 Hz	J17	MS3102A10 SL-3P	--	18/3 AWG
AUX (ACC) OUT*#	Output from predetection playback (or record) converter A25	J18	BNC	50	RG-223/U
AUX (ACC) IN*#	Input to predetection playback (or record) converter A25	J19	BNC	50	RG-223/U
AUX (DISPLAY) OUT*#	Optional coaxial connection to display unit receptacle	J20	BNC	50	RG-223/U
AUX (DISPLAY) IN*#	Input to spectrum display unit	J21	BNC	50	RG-223/U

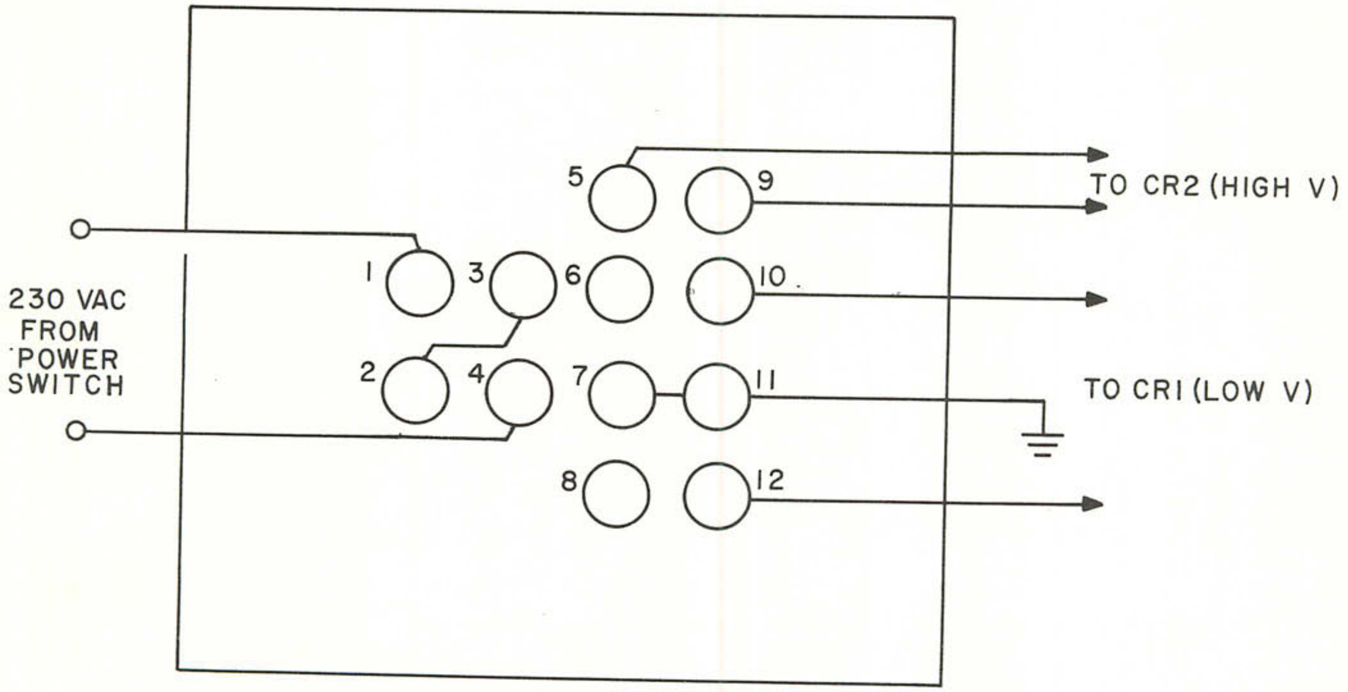
* These connectors are supplied only when specifically required.

\# These connectors are supplied on the 7-inch receiver version as required.

** Customer-specified frequency.



A. STRAPPING—115 VAC INPUT



B. STRAPPING—230 VAC INPUT

Figure 2-2. Power Transformer Strapping

SECTION III
OPERATION

3-1. GENERAL

3-2. This section provides operational information for the Model 1100-AR Telemetry Receiver. Included in this section is a list of all operating controls and indicators with their reference designations and functions, operating instructions, and operational information for the various receiver modes. Since the 1100-AR can be configured with many different modules to satisfy specific requirements, including operating instructions for each, configuration would be impractical. For this reason, only general operating instructions are provided. These instructions are, however, augmented by additional information for each operating mode to enable the operator to adjust the receiver controls to meet his specific requirements. Operating procedures for the auxiliary modules which plug into both the 5- and 7-inch versions are given in the applicable instruction manual or booklet supplementing this manual.

3-3. CONTROLS AND INDICATORS

3-4. The controls and indicators used in operating the 1100-AR are listed in table 3-1 with their reference designation and function. This table also includes the controls contained on the normal complement of front panel plug-in modules. The controls and indicators of the various auxiliary modules such as the spectrum display unit and predetection playback converter used in the 1100-AR are given in the applicable instruction manual. Figure 3-1 shows a front panel view of the 1100-AR receiver which contains all of the required operating controls.

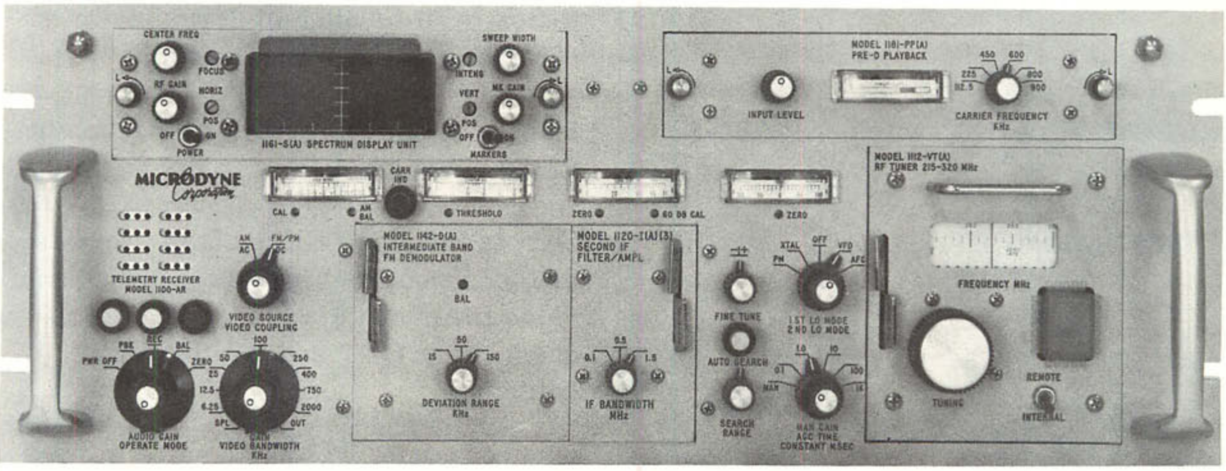


Figure 3-1. Model 1100-AR Telemetry Receiver,
Typical Front View

Table 3-1. Controls and Indicators

Control/Indicator	Reference Designation	Function
RECEIVER		
OPERATE MODE switch	S4	Used to select one of five receiver operating modes: PWR OFF - Removes operating voltage from receiver power supply. PBK - Permits receiver to be used to playback previously recorded data. REC - Normal receiver operation. BAL - Permits the demodulators to be balanced. ZERO - Permits adjustment of tuning meter.
PBK lamp (amber) REC lamp (white) Calibrate lamp (red)	DS1 DS2 DS3	These lamps light when the OPERATE MODE switch is set to the corresponding position.
AUDIO GAIN	R10	Used to adjust speaker level.
VIDEO SOURCE	A22-S1	Employed to select either the a-m detector (AM) or plug-in demodulator (FM/PM) as the video source.
VIDEO COUPLING switch	A22-S2	Selects either AC or DC video coupling to the video amplifier.
VIDEO BANDWIDTH KHZ	A22-S3	Selects the video filter cutoff frequency. SPL position is used to select a special video filter installed at customer request. The OUT position bypasses all filtering.
GAIN control	A22-R13	Sets the video output level.
FINE TUNE control	R6	Vernier tuning of second local oscillator. Permits ±250 kHz adjustment of second l-o frequency.

continued

Table 3-1, continued

Control/Indicator	Reference Designation	Function
AUTO SEARCH lamp (amber)	DS5	Lights when receiver is in auto search operation in afc and pm modes.
SEARCH RANGE control	R11	Permits adjustment of auto search range to ±250 kHz.
1ST LO MODE switch	S1	Selects the VFO, XTAL, or OFF mode of operation for the first local oscillator located in rf tuner.
2ND LO MODE switch	S2	Selects the PM, XTAL, OFF, VFO, and AFC operating modes for the second local oscillator.
AGC TIME CONSTANT MSEC switch	S3	Selects the time constant for the automatic gain control circuit to 0.1, 1, 10, 100, or 1000 milliseconds.
MAN GAIN control	R7	Used to manually set the gain control of the receiver.
TUNING meter	M1	Indicates the relative position of the applied signal in the i-f passband. It also indicates the loop stress when the receiver is in the afc or pm mode of operation.
ZERO control	R8	Used to zero the TUNING meter.
SIGNAL LEVEL DB meter	M4	Indicates signal level in dB above noise.
60 DB CAL control	R15	Used to calibrate the 60 dB level on the SIGNAL LEVEL DB meter.
ZERO control	R4	Used to set the SIGNAL LEVEL DB meter zero point.
DEVIATION KHZ meter	M3	Indicates the carrier deviation in kHz for FM and in degrees for PM.
CARR IND lamp (green)	DS4	Lights when the applied signal level is above threshold.

continued

Table 3-1, continued

Control/Indicator	Reference Designation	Function
THRESHOLD control	R2	Used to set the level at which the carrier indicator lamp illuminates.
OUTPUT DB meter	M2	Indicates the video output level in DB.
CAL control	R13	Used to calibrate the OUTPUT DB meter.
AM BAL	R2	Adjust video offset when the receiver is in a-m operation.
HUMBUCKING	R21	Rear panel control utilized to minimize power line hum on the afc/apc control line.
	FM DEMODULATOR	
DEVIATION RANGE switch	S1	Selects the full-scale range of the receiver DEVIATION meter.
BAL control	R1	Balances the fm video for zero dc output with no input.
	RF TUNER	
TUNING control	Various	Adjusts the rf tuner for receiving a specific frequency within its operating range.
FREQUENCY KHZ	--	Indicates the frequency to which the receiver is tuned.
INTERNAL/REMOTE (VT Series Only)	Various	Selects the local or remote tuning mode.
	PHASE DEMODULATOR (Not shown)	
LOOP BANDWIDTH HZ switch	S1	Used to select the phase loop bandwidth. Bandwidths available are: 10, 30, 100, 300, and 1000 Hz.
LOOP LOCK Lamp (red)	DS1	Illumination indicates phase loop locked condition.
SEARCH switch	S4	Selects either the AUTO or MANUAL search mode.

continued

Table 3-1, continued

Control/Indicator	Reference Designation	Function
OUTPUT switch	S2	Selects either the PM or synchronous AM detector video output.
FINE TUNE control	R64	Used to adjust the second l-o frequency to acquire lock in MANUAL search and to minimize static phase error in AUTO search.
LOOP switch	S3	Used to momentarily break the tracking loop.
BAL Controls:		
NOISE BAL	R20	Sets the demodulator dc output to zero with no signal input.
LOCK BAL	R70	Sets the locking threshold.
SECOND IF FILTER/AMPLIFIER		
IF BANDWIDTH KHZ (selectable bandwidth only)	Various	Selects one of the available i-f bandwidths.
INTERNAL/REMOTE (VT Series only)	Various	Selects local or remote bandwidth adjustment.

3-5. OPERATING INSTRUCTIONS

3-6. The following paragraphs provide generalized operating instructions for a receiver equipped with an fm demodulator only. For instructions pertaining to a receiver equipped with a pm demodulator, refer to paragraph 3-17.

3-7. INITIAL SETUP AND CALIBRATION

3-8. Before operating the receiver, the necessary modules should be selected and installed and all rear apron connections checked. The receiver should then be calibrated for the operational mission following the instructions given in paragraph 5-7 of Section V.

3-9. CONTROL SETTINGS

3-10. After checking and calibrating the receiver, set the controls to their initial positions as outlined in the following steps. Controls then may be readjusted, as necessary, for optimum operation following the information given in paragraphs 3-11 and 3-22.

a. Set the OPERATE MODE switch to REC.

b. Turn the AUDIO GAIN control to mid-range.

c. Set the VIDEO SOURCE switch to FM/PM position. This places the plug-in demodulator into the circuit as the video source. If a-m data is to be received, place the switch in the AM position.

d. Set the VIDEO COUPLING switch to AC. Set the VIDEO BANDWIDTH KHZ switch to the desired video bandwidth.

e. Set the FINE TUNE and AUTO SEARCH controls to mid-range.

f. Set the 1ST LO MODE switch to VFO. Set the 2ND LO MODE switch to XTAL.

g. Set the AGC TIME CONSTANT MSEC switch to 100 MSEC. If a-m data is to be received, set the switch to 1000 MSEC.

h. If the receiver is equipped with a multiple bandwidth second i-f filter/amplifier, set the IF BANDWIDTH KHZ switch to the widest position.

i. Set the demodulator DEVIATION RANGE KHZ switch to widest position.

j. Set the video GAIN control to mid-range.

k. If the receiver is equipped with a calibrate/reference oscillator, the demodulator balance and tuning meter zero may be checked as follows:

   1. Set the OPERATE MODE switch to BAL and adjust the demodulator BAL control for a zero indication on the TUNING meter.

   2. Set the OPERATE MODE switch to ZERO and adjust the tuning meter ZERO control for a zero indication on the TUNING meter.

l. Set the OPERATE MODE switch to the desired operating mode - REC or PBK.

3-11. RECEIVE MODE OPERATION

3-12. After the controls have been set to their initial positions as given in paragraph 3-10, they should be readjusted for optimum operation. This includes adjustment of the first and second local oscillators, video gain, agc time constant, search range, and audio level.

3-13. FIRST LOCAL OSCILLATOR. The first local oscillator may be operated in any of three modes: VFO, XTAL, and OFF. If the VFO mode is most desirable, set the 1ST LO MODE switch to VFO. Adjust the TUNING control until the desired frequency appears under the dial graticule and the TUNING meter indicates zero. If the XTAL (crystal) mode is selected, adjust the TUNING control until the desired frequency appears under the dial graticule. Insert the necessary crystal into the crystal socket in the tuner front panel using an adapter or oven as required. The formula for determining the correct crystal frequency is given in table 3-2. The OFF mode is provided to permit the injection of an externally generated l-o signal. Refer to the tuner manual for additional information.

Table 3-2. Crystal Determining Formulas

RF Tuner	Formula	RF Tuner	Formula
1111-VT(A)	$\frac{F_r + 50}{6}$	1116-T(A) 1116-VT(A)	$\frac{F_r + 50}{42}$
1112-VT(A)	$\frac{F_r + 50}{8}$	1117-T(A)	$\frac{F_r + 50*}{8}$ $\frac{F_r + 50**}{12}$
1113-VT(A)	$\frac{F_r + 50}{4}$	1118-VT(A)	$\frac{F_r + 50}{4}$
1114-T(A) 1114-VT(A)	$\frac{F_r + 50}{36}$	1119-T(A) 1119-VT(A)	$\frac{F_r + 50}{24}$
1115-T(A) 1115-VT(A)	$\frac{F_r + 50}{54}$		

where: F_r = received frequency

50 = intermediate frequency

* Used with input frequencies from 215 to 290 MHz

** Used with input frequencies from 290 to 410 MHz.

3-14. SECOND LOCAL OSCILLATOR. With an fm demodulator, the second local oscillator may be operated in the crystal (XTAL); external input (OFF), VFO, or AFC mode as determined by the position of the 2ND LO MODE switch; a PM mode is also available for use in phase mode operation (see paragraph 3-17).

a. XTAL (Crystal) mode. As in the case of the first local oscillator, no tuning of the second local oscillator is required when operated in the crystal mode. In this mode, the reception of a signal is indicated by the lighting of the CARR IND lamp and by a zero indication on the TUNING meter.

b. VFO mode. When operated in the VFO mode, the second local oscillator is tuned by adjusting its FINE TUNE control until the CARR IND lamp lights and there is a zero indication on the TUNING meter. The 2ND LO MODE switch should then be set to the AFC position to maintain proper tuning.

c. AFC mode. The 2ND LO MODE switch should be initially set to AFC only when automatic search tuning of the oscillator is desired. In this position, a control signal from the receiver afc amplifier causes the oscillator frequencies to be swept back and forth as indicated on the TUNING meter and by the lighting of the AUTO SEARCH lamp. The center of the frequency swept by the oscillator may be varied by adjusting the FINE TUNE control. The range swept by the oscillator may be varied ±250 kHz around the center frequency by adjusting the SEARCH RANGE control. When a signal is acquired in the channel, the AUTO SEARCH lamp goes out, the CARR IND lamp lights, and the TUNING meter shows steady indication. The meter may be indicating other than zero since it is controlled by the afc loop stress voltage. If other than zero, adjust the FINE TUNE control to obtain a zero indication. This method of tuning is automatic and proper tuning is maintained until no carrier is detected or until the control limit of the AFC circuit is exceeded.

d. External Input (OFF) mode. This mode is used when slaving two or more receivers together. The 2ND LO MODE switch is set to the OFF position and the 60 MHz external signal injected into J6 at a level of approximately -10 dBm.

3-15. VIDEO GAIN. Adjust the VIDEO GAIN control for the output level desired as indicated on the VIDEO OUTPUT meter.

3-16. AGC TIME CONSTANT. The agc time constant is selected by the AGC TIME CONSTANT MSEC switch. With this switch in the MAN position, the receiver gain is adjusted by means of the MAN GAIN control. The proper setting of switch depends upon the characteristics of the carrier and the type of format being received. Unless another setting is required for proper signal demodulation, the AGC TIME CONSTANT MSEC switch should be left in the 100 position.

3-17. PM MODE OPERATION

3-18. Two signal search (acquisition) modes are available in pm operation: manual and automatic. The procedure for adjusting the receiver controls in each mode is given in paragraphs 3-20 and 3-21 and should be used in conjunction with the instructions given in paragraph 3-9. Prior to operating the receiver in the PM mode, carefully read the operating precautions in the following paragraph.

3-19. PM MODE OPERATING PRECAUTIONS. When operating an 1100-AR receiver with any 1150-Series Phase Demodulator, the following precautions should be observed and implemented to obtain satisfactory receiver operation.

a. Operate the first local oscillator only in the XTAL mode.

b. Calibrate the HUMBUCKING potentiometer on the receiver rear panel using the following procedure. Normally, this adjustment is only required when setting up the receiver for the first time. It should be checked at least semiannually and when the power line frequency has changed.

   1. Apply a strong, stable, cw signal to the receiver.

   2. Tune the receiver to the signal and phase lock using the 30 Hz loop bandwidth.

   3. Connect an oscilloscope to the receiver video output (J15); terminate the connection in 75 ohms.

   4. Adjust the HUMBUCKING control on the rear panel for minimum hum on the video output.

   5. Disconnect the test equipment.

c. After warming up the receiver for a period of 30 minutes, the BAL controls on the phase demodulator may be normalized using the following procedure:

1. Install the demodulator into the receiver.
2. Set the OPERATE MODE switch to REC and the LOOP BANDWIDTH Hz switch to 300 Hz.
3. Set the demodulator SEARCH switch to MANUAL. Set the ANTI-SIDEBAND switch to OUT, if applicable.
4. With no signal input to the receiver, adjust the LOCK BAL control counterclockwise until the LOOP LOCK lamp is out, if necessary.
5. Adjust the NOISE BAL control for a zero indication on the applicable receiver TUNING meter.
6. Set the SEARCH switch to AUTO and adjust the LOCK BAL control counterclockwise until the applicable receiver AUTO SEARCH lamp begins to flicker.
7. Slowly turn the LOCK BAL clockwise until the AUTO SEARCH lamp is constantly on; the LOOP LOCK lamp will be out.
8. Rotate the LOCK BAL one full turn past the point at which the AUTO SEARCH lamp remains lit.
9. Optimize the N BAL control setting by injecting a 1 mV cw test signal into the receiver at frequency within the range of the tuner and phase lock. Set the generator for an output which will produce a -15 dB S/N ratio in the second IF and adjust the N BAL control until the LOOP LOCK lamp is just locking on the signal. The level required can be calculated as:

   -174 + IF BW/dB + NF -15 = Negative SNR in the IF for phase lock

   when: -174 = Constant
   IF BW/dB = i-f bandwidth in dB; see table 5-2.
   NF = rf tuner noise figure; see table 5-3 or perform actual measurement.

d. The phase lock loop in the 1100-AR is an adaptive loop and is restricted as to the minimum modulation frequencies that can be handled at the various loop bandwidths. For unattenuated sine wave and accurate square wave video outputs, the minimum modulating frequencies at each loop bandwidth are listed below:

Loop Bandwidth Hz	10	30	100	300	1000
MIN. Sine Wave Frequency	70 Hz	210 Hz	700 Hz	2100 Hz	5000 Hz
MIN. Square Wave Frequency	350 Hz	1000 Hz	3500 Hz	10 kHz	25 kHz

3-20. MANUAL SEARCH:

a. Set the 1ST LO MODE switch to XTAL. Adjust the TUNING control to the desired frequency and insert the required crystal (see table 3-2). Set the 2ND LO MODE switch to PM.

b. Set the demodulator SEARCH switch to MANUAL and the LOOP BANDWIDTH HZ switch to 1000.

c. Hold the LOOP switch in the OPEN position and adjust the demodulator FINE TUNE control for an aural zero beat tone from the speaker. The LOOP LOCK lamp should light. Release the switch.

d. Slowly adjust the demodulator FINE TUNE control to minimize the static phase error as indicated by a zeroing of the TUNING meter.

e. Reduce the loop bandwidth to the desired range.

f. Set the receiver video controls as required.

3-21. AUTOMATIC SEARCH:

a. Set the 1ST LO MODE switch to XTAL. Adjust the TUNING control to the desired frequency and insert the required crystal. (See table 3-2.) Set the 2ND LO MODE switch to PM. Set the ANTI-SIDEBAND switch to OUT, if supplied.

b. Set the demodulator LOOP BANDWIDTH Hz switch to 1000. Set the demodulator FINE TUNE control to 5.

c. Set the SEARCH switch to AUTO. The LOOP LOCK lamp should light, indicating phase lock.

d. Adjust the demodulator FINE TUNE control to minimize the static phase error as indicated by a zeroing of the TUNING meter.

e. Reduce the loop bandwidth to the desired range.

f. Set the receiver video controls as required.

g. If the demodulator is equipped with an anti-sideband lock circuit, place the ANTI-SIDEBAND switch to ON. This will effectively prevent sideband locks during reacquisition cycles.

3-22. PLAYBACK MODE OPERATION

3-23. Set the controls and apply power to the receiver (refer to paragraphs 3-9 and 3-11). Set the OPERATE MODE switch to PBK; this disables the first l-o and effectively removes the rf tuner as an active module in the receiver. If the receiver is equipped with a pm demodulator, adjust the receiver controls as directed in paragraph 3-17. Set the video output level of the receiver as directed in paragraph 3-15.

3-24. COMPUTER/REMOTE CONTROL

3-25. The 1100-AR can be remotely tuned or computer controlled only when it is equipped with a voltage tuned rf tuner and a voltage tuned second i-f filter/amplifier. These units are easily recognized by the "VT" suffix of the model number and by the REMOTE/INTERNAL switch on their front panels. To operate the receiver in the remote or computer controlled mode, proceed as follows:

a. Refer to the applicable module instruction manuals to insure that the remote panel or computer interface is capable of supplying the correct range of control voltages.

b. Set all receiver controls to the positions required by the operating mission excluding the rf frequency and i-f bandwidth (refer to paragraph 3-9).

c. Set the REMOTE/INTERNAL switches on the module front panels to the REMOTE positions.

d. Connect the rf tuner control input to pin 7 of J1 (ACCESSORIES) on the receiver rear apron. Connect the i-f control input to pin 8 of J1. The common lead of the remote panel or computer interface must be connected to pin 1 of J1.

e. Refer to the tuner and i-f filter/amplifier instruction manuals for additional operational information.

3-26. AGC RECORDING

3-27. If the receiver agc voltage is to be recorded, the SCALE and ZERO controls on the rear panel must be adjusted for compatibility with the input requirements of the recording device. These adjustments are made as follows:

a. Connect a signal generator to the receiver rf input and set it for an output within the range of the rf tuner.

b. Tune the receiver to the test signal.

c. Connect an HP412A dc voltmeter to the AGC RECORD OUT (J12). Set the POLARITY switch to the position corresponding to the required agc output polarity (+ or -).

d. Set the signal generator to the minimum rf level to be recorded and adjust the ZERO control for a zero volt indication on the voltmeter.

e. Increase the signal generator output by 20 dB and adjust the SCALE control for 1 volt. This sets a 20 dB/volt scale.

f. Recheck the zero point and adjust the ZERO control, if necessary.

g. Recheck the 20 dB point and adjust the SCALE control, if necessary.

h. Disconnect all test equipment and connect the receiver for normal operation.

3-28. TURN-OFF PROCEDURE

3-29. To turn the receiver off, set the OPERATE MODE switch to the OFF position.

SECTION IV
THEORY OF OPERATION

4-1. GENERAL

4-2. This section discusses the theory of operation for the 1100-AR receiver on a system level only. The theory of operation is based on the block diagram shown in figure 4-1 and is divided into the various signal paths. In addition, descriptions of the various control circuits are discussed separately and are supported by the necessary block diagrams.

4-3. PRIMARY SIGNAL PATHS

4-4. The primary signal paths of the 1100-AR are: normal signal flow, predetection signal flow, and control signal flow.

4-5. NORMAL SIGNAL FLOW

4-6. The normal signal path of the 1100-AR consists of the circuits which accept and process the received rf signal. See figures 4-1 and 7-1.

4-7. The antenna input is made to J2 on the rear apron and coupled to the rf tuner module installed in receptacle A3. Two types of rf tuners may be installed in A3: mechanically tuned and voltage controlled. Both types function to down convert the applied rf signal to a 50 MHz first i-f signal by mixing it with a local oscillator frequency. The local oscillator input may be generated by switch selectable internal variable frequency or crystal controlled oscillators, or by an external source connected to J4. The external source can be a frequency synthesizer or another receiver and enables a group of receivers to be slaved together. Selection of which local oscillator source is used is made through front panel switch S1. The voltage controlled rf tuners have the additional capability of being tuned by an input from a remote panel or computer interface. When operated in this mode, the control voltage is applied to the tuner via J1-7 and XA3-6.

4-8. Outputs from the tuner are applied to the rear apron first l-o monitor output J3 and to the first i-f filter module A4. The signal applied to J3 is a submultiple of the local oscillator signal and is at a level of approximately 50 mV; the impedance of this output port is 50 ohms. The signal applied to the first i-f filter slot is the 50 MHz first i-f signal and is routed through the internal wiring to XA4-A1.

4-9. The first i-f filter slot may contain any one of three types of modules at the option of the buyer. The first type is one of three standard modules which establishes a first i-f bandwidth of 600 kHz, 1.2 MHz, or 4 MHz. The second type contains any two of the standard filters in a single housing. Selection of the filter used is made automatically by the choice of second i-f filter/amplifiers which connects a combination of positive and negative 15 volts to pins 9 and 10 to control a diode switching arrangement. Both of the first i-f filter types contain an integral 50 MHz buffer amplifier which provides an isolated 50 MHz output to the display output at J16 via a jumper installed between XA20-A1 and XA20-A3. If the receiver is a 7-inch version with a display unit installed, the output at J16 is routed to J21 with a length of 50 ohm coaxial cable and applied to the display via XA23-A1. If any version of the receiver is mated with a display unit having an input requirement other than 50 MHz, the 50 MHz i-f signal is down converted by an optional display converter installed in XA20 and then applied to J16.

4-10. The third type of module available provides no filtering but contains a 50 MHz buffer amplifier to obtain a display output.

4-11. Each of the three modules supplies a 50 MHz output at XA4-A2 for application to the second mixer at XA6-A3. If no module is installed in XA4, the output of the tuner is connected directly to the second mixer at XA6-A3.

4-12. The second mixer accepts both the 50 MHz i-f signal from A4 or the tuner and the 60 MHz input from the second local oscillator A5, and provides a 10 MHz second i-f output. This signal is made available at XA6-A7 and is routed to the input of the second i-f filter installed in XA7. The gain of the second mixer is controlled by agc voltage applied to pin 7.

4-13. Second i-f filter/amplifier A7 establishes the second i-f bandwidth. Any of three types of modules can be installed in A7: fixed single bandwidth, multi-bandwidth switchable, or voltage variable. The multi-bandwidth units contain any two or three of the single bandwidth types in a module housing equipped with a front panel selector switch. The voltage tuned units enable the selection of any bandwidth in their range and are supplied with a calibrated dial. These units have the additional capability of being tuned by a remote or computer input.

4-14. AGC circuits in each filter have a control range in excess of 60 dB to hold the 10 MHz output level to approximately -21 dBm. Total gain of each i-f filter/amplifier varies in proportion to the bandwidth to maintain a constant noise density to the a-m detector.

4-15. The a-m detector module consists of an a-m detector circuit, a limiter circuit, and various amplifier stages. The 10 MHz i-f signal from the second i-f filter amplifier output at XA7-A1 is applied to XA8-A4 and routed to the three main circuits of the module. Signals applied to the detector circuit are demodulated to provide a-m video data and an output to the agc amplifier. The a-m video signal is taken from XA8-A2 and routed through XA9-29 and XA9-32 to the front panel video source switch A22-S1. When A22-S1 is set to AM, the a-m video is applied to the video amplifier module. The output to the agc amplifier is taken from XA8-15 and routed through the plug-in demodulator to the agc amplifier at XA15-F. A third detector output is taken from XA8-13 and applied to rear apron connector J13 as an indication of the detector dc level.

4-16. The limiter and amplifier stages of the a-m detector provide limited and linear 10 MHz outputs for predetection recording purposes. These signals are taken from XA8-A3 and A1, and routed to J10 and J11 on the receiver rear apron. A third 10 MHz output is taken from XA8-A5 and applied to the plug-in demodulator at XA9-A4.

4-17. Two types of demodulators may be installed in the 1100-AR: fm or pm. When the receiver is equipped with an fm demodulator, the 10 MHz i-f signal is applied to XA9-A4. This signal is then demodulated to retrieve the fm video data which is taken from XA9-A2 and applied to the video source switch A22-S1. The fm demodulator also supplies an output at XA9-25 for driving the deviation meter via the metering amplifier. Tuning meter drive voltage is provided at XA9-23. Another output from the demodulator is taken from XA9-26. This output is the product of a mean-of-peaks detector and is further processed by the afc amplifier into automatic frequency control voltages and tuning meter drive voltage when the second l-o is in the afc mode of operation. The agc voltage from the a-m detector is also routed through the demodulator via pins 13, 14, and 15. This interface is necessary to allow coherent agc operation when a pm demodulator is employed.

4-18. When the receiver is equipped with a pm demodulator, the 10 MHz i-f signal is compared to a 10 MHz reference signal supplied by calibrate/reference oscillator A10. The result of this comparison is pm video data which is taken from XA9-A2 and coupled to the video source switch A22-S1. The pm demodulator also supplies an output for controlling the phase of the second l-o. This voltage is taken from XA9-A3 and applied to the second l-o via the afc module. When pm demodulator is used, the receiver fine tuning control R6 is disabled and the demodulator fine tuning control is placed into the circuit.

4-19. The video data from either the plug-in demodulator or a-m detector is taken from the video source switch (A22-S1) and applied to the video bandwidth selector switch A22-S3. From A22-S3, the video signal is routed through the selected video filter and the video coupling switch (A22-S2) to the input of video amplifier at XA14-2. The input level to the amplifier is set by front panel video gain control A22-R13. A more complete description of the video filters is given in paragraph 4-48.

4-20. The video amplifier module contains two separate amplifier circuits. One amplifier accepts the video input and supplies a video output to rear apron connector J15. This output may be at any level up to 10 volts peak-to-peak and is adjusted by gain control A22-R13. A second output is also provided by this amplifier to drive front panel output meter M2. This signal is taken from XA14-5 and applied to M2 via the front panel output calibrate control A21-R13.

4-21. The second amplifier stage is the audio amplifier. The input to this stage is the video signal before filtering and is supplied from A22-S3A to XA14-14 via front panel audio gain control R10. The signal is amplified and applied to front panel speaker LS1 from pins 8, 9, and 10 of XA14.

4-22. PREDETECTION SIGNAL FLOW

4-23. The predetection signal path is divided into two distinct and separate circuits. These two circuits designated predetection record and predetection playback are described separately in the following paragraphs.

4-24. PREDETECTION RECORD CIRCUIT. The 10 MHz predetection record signal can be processed using either of two methods in the 1100-AR and by one method in the 1100-AR(5) to obtain a video carrier signal suitable for recording. As shown in the receiver block diagram (figure 4-1), both receiver configurations can be equipped with the 10-1100 series record converters. The 10-1100 series consists of six separate modules each of which accepts the linear or limited 10 MHz second i-f signal and provides a single video record output. A module of this series plugs into receptacle XA19. The 10 MHz i-f signal, available at rear apron connectors J10 and J11, is patched into XA19-A1 via J9 also on the rear apron. The video record carrier signal is taken from XA19-A3 and is made available at J8. Input and output impedances are 50 ohms and 75 ohms, respectively, to satisfy interface requirements. Modules available in the 10-1100 series and their output signal frequency are listed below.

10-1100(112.5) - 112.5 kHz
10-1100(225) - 225 kHz
10-1100(450) - 450 kHz
10-1100(900) - 900 kHz
10-1100(600) - 600 kHz
10-1100(800) - 800 kHz

In addition to the above modules, other converters may be supplied to satisfy a particular requirement.

4-25. The second method of down conversion for recording is available in the 1100-AR configuration only. This method employs the Model 1171-PR(A) Predetection Record Converter which mounts in auxiliary equipment slot XA25. When the 1171-PR(A) is used with the 1100-AR, any of the six standard video carriers can be selected through a front panel selector switch. Data bandwidths normally associated with each of the six carriers are also provided by the 1171-PR(A). Input to the converter can be supplied by either the linear or

OPTIONAL FEATURES

* Control voltage input for voltage tuned rf tuners and second i-f filter/amplifiers.

1 Optional SDU converter - Employed to convert the 50 MHz i-f to a customer specified compatibility with other vendor spectrum display units.

2 First i-f filter - If the module is not supplied, the output of the rf tuner is jumpered directly to the second mixer.

3 Optional playback modules - 20-1100 series up converts a single pre-d carrier to 50 MHz. 30-1100 up converts to 10 MHz pre-d carrier to 50 MHz. A receiver may be equipped with either, but not both.

4 Optional pre-d playback and record modules for 7-inch receiver - A receiver may be equipped with either, but not both.

5 Spectrum display unit - Installed in 7-inch receiver only.

6 Pre-d record converter module - Converts 10 MHz second i-f to one of six previously specified pre-d carriers.

7 10 MHz calibrate/reference oscillator - Optional for receivers equipped with an fm demodulator; required for receivers equipped with a pm demodulator.

8 Two types of afc module available - One supplies both automatic frequency control and search and lock. The other supplies afc only.

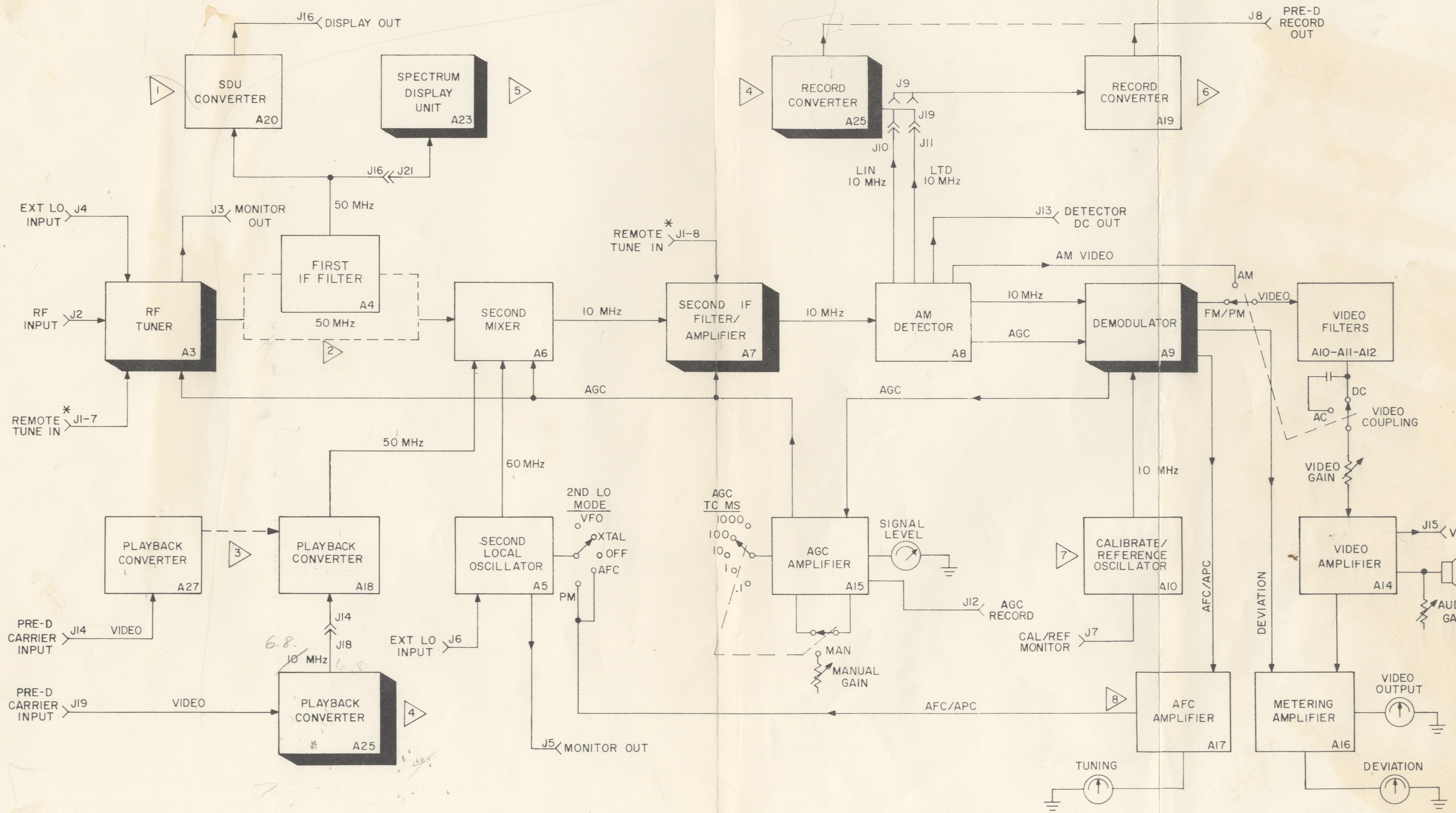


Figure 4-1. Functional Block Diagram

limited 10 MHz second i-f signal available at J10 or J11 and connected to the 1171-PR(A) via J19 and XA25-A1. The output of the converter is taken from XA25-A3 and routed to rear apron connector J18. Input and output impedances of the 1171-PR(A) are also 50 and 75 ohms, respectively, to satisfy interface requirements. Additional information for the 1171-PR(A) is given in its instruction manual.

4-26. PREDETECTION PLAYBACK CIRCUIT. As shown by the block diagram in figure 4-1, two methods of playback up conversion are available depending on the receiver configuration.

4-27. The first method of up conversion employs the 20-1100 series of playback converters. This series of converters consists of a 6.8 MHz to 50 MHz up converter and six video carrier to 6.8 MHz up converters. For complete operation, the receiver must be equipped with one video up converter and the 6.8 to 50 MHz up converter. When installed, the video up converter is installed in XA27, and the 6.8 to 50 MHz converter is installed in XA18.

NOTE

If the receiver is not initially equipped with these modules, a special installation kit is available from Microdyne.

4-28. The video carrier from the recording device is applied to J14 on the rear apron and connected to the video up converter at XA27-A1. This signal is converted to 6.8 MHz and applied to the 6.8 to 50 MHz up converter via XA27-A3 and XA18-A3. The 50 MHz output present at XA18-A1 is then coupled to the second mixer at XA6-A5.

4-29. The second method of up conversion employs the 30-1100 and 1181-PP(A) up converters. Both of these assemblies can be mounted in the 1100-AR. In the 1100-AR(5), the 30-1100 is mounted in the receiver and the 1181-PP(A) is mounted elsewhere in the receiving system. When employed in the 1100-AR, the 1181-PP(A) is installed in the upper right front panel equipment slot and plugs into XA25 and the 30-1100 converter is installed in XA18. These two units operate in conjunction to up convert any of six video carriers to 50 MHz for injection into the first i-f signal path.

4-30. The video signal from the recording device is applied to J19 on the receiver rear apron and connected to the 1181-PP(A) via XA25-A1. A front panel switch on the 1181-PP(A) is provided to select the applicable conversion frequency. The output frequency of the 1181-PP(A) is 10 MHz and is made available at J18 via XA25-A3. This signal is then patched to the 30-1100 up converter via J14 and XA18-A1. In the 30-1100, the 10 MHz signal is up converted to 50 MHz and is applied to the second mixer at XA6-A5 from XA18-A3.

4-31. When the 1181-PP(A) and 30-1100 are used with the standard 1100-AR, the 1181-PP(A) is mounted external to the receiver and the 30-1100 is mounted in the receiver. The 10 MHz output of the 1181-PP(A) is connected to J14 on the receiver rear apron and applied to the 30-1100 for up conversion to 50 MHz. The input and output impedances of the 1181-PP(A) are 75 and 50 ohms, respectively, and the input and output impedances for the 30-1100 are 50 ohms.

4-32. CONTROL SIGNAL FLOW

4-33. The control signals in the 1100-AR provide automatic gain control and either automatic frequency or phase control depending on the demodulator in use. Each control system is described separately in the following paragraphs.

4-34. AUTOMATIC FREQUENCY CONTROL (AFC) SYSTEM. The afc system is operable when the receiver is equipped with an fm demodulator and afc module. Two types of afc modules are available for use with the 1100-AR. One type supplies afc voltage only and the other type supplies both afc and search and lock voltages. In both cases, the center frequency of the second local oscillator is determined by the receiver fine tune control. A simplified schematic of the afc only circuit is shown in figure 4-2A and a simplified schematic of the afc with search and lock is shown in figure 4-2B.

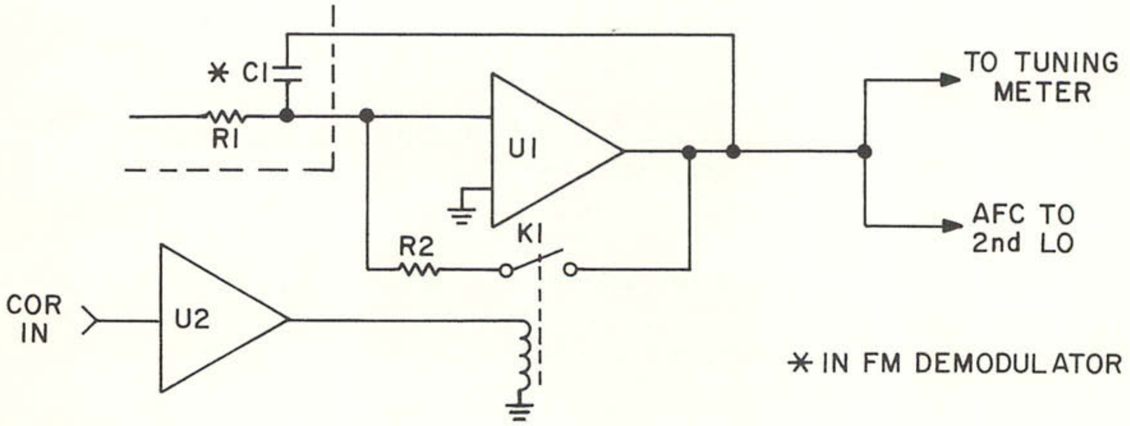


Figure 4-2A. AFC Only

4-35. The afc only circuit consists of operational amplifier U1, driver U2, and K1 mounted in the afc amplifier module. When the receiver is properly tuned to a signal, the input from the mean-of-peaks detector in the demodulator is amplified by U1 and applied to the second l-o for frequency control. The polarity and amplitude of the input are determined by the frequency of the received i-f in relation to the 10 MHz center frequency of the i-f passband. The afc tracking loop bandwidth is set by R1 and C1 and varies between demodulators. When the afc loop is tracking, the gain of U1 is approximately 120 dB with the COR input holding K1 open. Should the COR input cease, as would be experienced with loss of signal, K1 closes and places R2 into the feedback loop. Under these conditions, the gain of U1 is decreased to approximate unity allowing the second l-o to return to the center frequency as set by the fine tune control. Should the signal reappear, the fine tune control can then be adjusted to center the signal in the i-f passband.

4-36. The second type of afc system, shown in figure 4-2B, generates an afc voltage and a search voltage to sweep the second l-o for reacquisition should signal fade cause loss of lock. When the receiver is locked to an input, the agc voltage from the a-m detector and the COR input is holding the acquisition amplifier on. The output from this amplifier turns on one of the two FET switches coupling the input from the demodulator mean-of-peaks detector to the integrator. In the locked state, the integrator functions as an operational amplifier which amplifies the demodulator input and couples it to the second l-o for frequency control and to the tuning meter as an indication of loop stress. Should the frequency drift exceed the afc loop limits as set by capacitor C and drop lock, the afc system automatically switches to the search cycle. Under these conditions, the voltage from the a-m detector goes positive and turns off the acquisition amplifier and turns on the other FET switch connecting the retrace amplifier across the integrator and lighting the front panel sweep indicator lamp. The integrator now generates a ramp output used to sweep the second l-o over its tuning range. The maximum amplitude of the ramp is determined by the positioning of the front panel search range control R11 now in the feedback loop. Using R11, the search range can be adjusted from ±50 to ±250 kHz. When a 10 MHz signal appears in the i-f passband, the output from the a-m detector triggers the acquisition amplifier on removing the sweep and returning the afc system to the tracking mode.

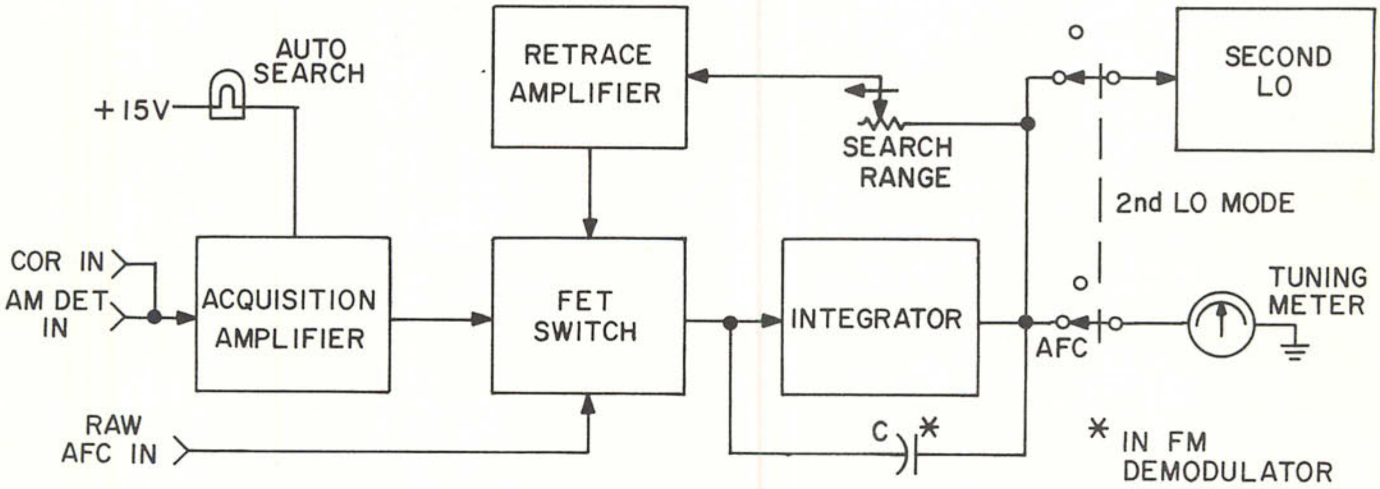


Figure 4-2B. AFC with Search and Lock

4-37. AUTOMATIC PHASE CONTROL (APC) SYSTEM. The apc system in the 1100-AR is operable only when the receiver is equipped with a pm demodulator and the second l-o mode switch is set to pm. The system is composed of the afc and retrace amplifiers in the afc module (A17) and the apc board in the pm demodulator. Additionally, the system operating mode and the RC networks for determining the loop bandwidth are also contained in the pm demodulator. When the receiver is set for apc operation, the normal receiver fine tune control is replaced by the demodulator fine tuning control. During this mode, the apc system not only maintains the correct phase relationship between the second l-o and received signals, but will also search a range of frequencies determined by loop bandwidth should phase lock be broken. A simplified block diagram of the apc system is shown in figure 4-3.

4-38. The apc system in the 1100-AR permits two signal acquisition modes: automatic and manual. When set to the automatic mode and phase locked as shown in figure 4-3, the output of the phase detector in the pm demodulator is applied to the afc amplifier module via demodulator loop switch S3A and the loop bandwidth switch S1A. The RC network composed of

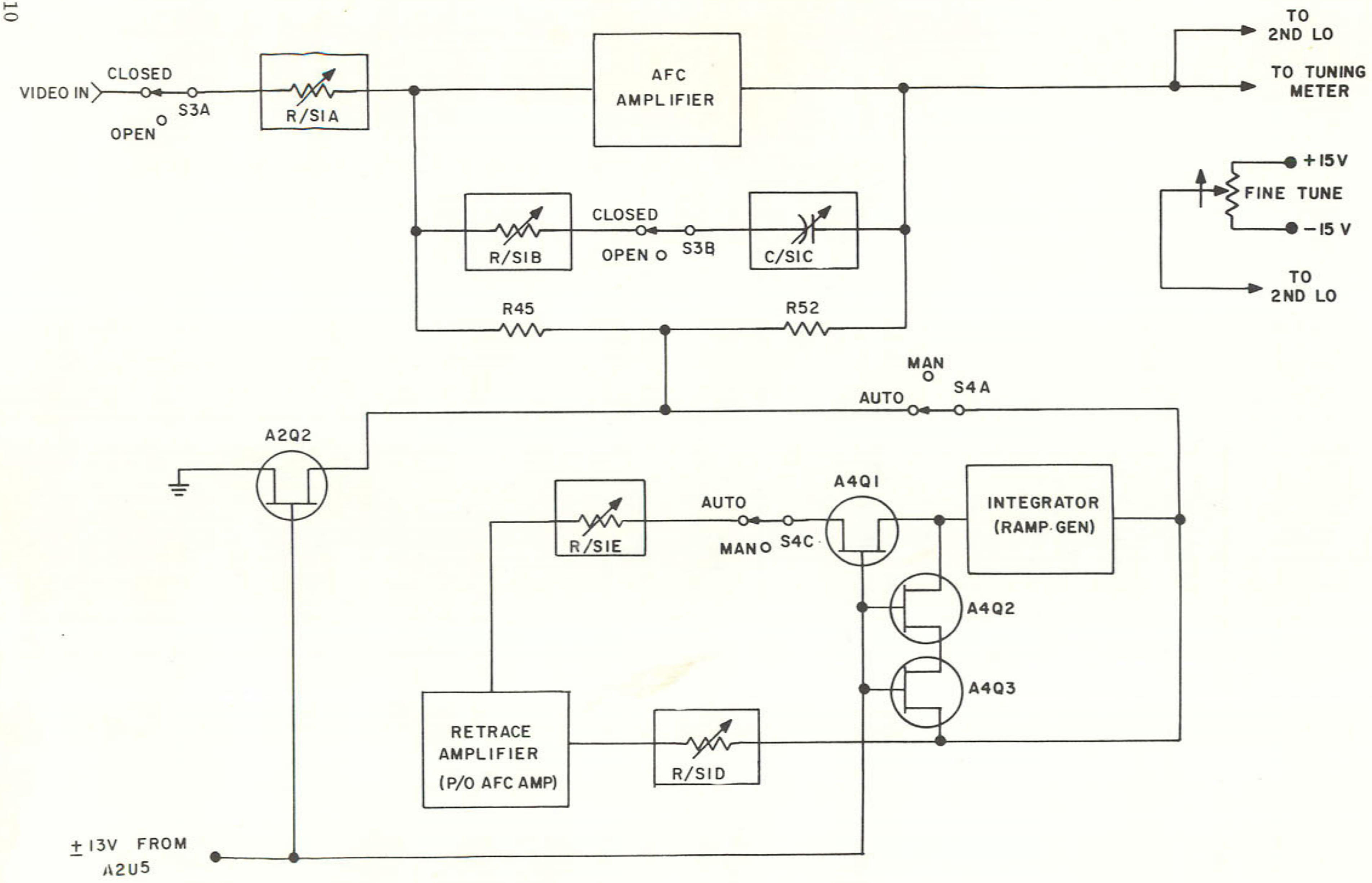


Figure 4-3. Sweep Circuitry, Block Diagram

resistors and capacitors mounted on S1 is the loop filter for the afc amplifier. Time constants are provided by S1 to establish loop bandwidths of 10, 30, 100, 300, and 1000 Hz. The output of the afc amplifier is then applied to the second local oscillator for frequency control purposes and to the receiver tuning meter for loop stress indications.

4-39. When the demodulator is phase locked, the +13V gate holds FET switch A4Q1 off, and holds A4Q2, A4Q3, and A2Q2 on. In this configuration, the video output of the phase detector circuit is coupled through S3A and R/S1A to the afc amplifier in the parent unit. The afc integrator is configured as an operational amplifier with infinite gain and with a response time determined by the rc network associated with S1A, S1B, and S1C. Output from the amplifier is routed to the second local oscillator for frequency control purposes and to the tuning meter as an indication of loop stress.

4-40. When phase lock is broken, the -13V gate turns on FET A4Q1 and turns off A4Q2, A4Q3, and A2Q2. In this configuration, the output of integrator (ramp generator) is coupled to the afc retrace amplifier via S1D. Since A2Q2 is off, the afc amplifier gain is reduced to approximately 4. Also, the integrator is enabled and generates a ramp output to the second l-o via the afc amplifier. The level of the ramp at the afc amplifier output ranges from approximately 1V peak-to-peak to approximately 30V peak-to-peak depending on the positioning of the demodulator loop bandwidth switch S1 sections D and E. This corresponds to sweep rates of 69.2 kHz/sec for the 1000 Hz bandwidth, 2.8 kHz/sec for the 300 Hz bandwidth, and 1 kHz/sec for the 10, 30, and 100 Hz bandwidths. The demodulator fine tune control sets the sweep center frequency ±250 kHz from 60 MHz. The sweep range is dependent on the loop bandwidth and varies ±150 kHz on either side of the fine tune center frequency for the 1000 Hz bandwidth, ±30 kHz for the 300 Hz loop bandwidth, and ±5 kHz for the 10, 30, and 100 Hz loop bandwidths. During the sweep cycle, the search indicator lamp on the parent unit is illuminated by the action of a switching circuit in the afc amplifier module. When a 10 MHz signal appears in the i-f passband, the output of the demodulator synchronous a-m detector causes the gate to switch to +13V. This causes FET switch A4Q1 to be turned off, and switches A4Q2, A4Q3, and A2Q2 to be turned on. In this mode, the integrator is disabled and afc amplifier resumes control as an infinite gain operational amplifier. The +13V gate also turns on the demodulator lock lamp while the afc amplifier turns off the search lamp.

4-41. If the receiver is equipped with a demodulator having an anti-sideband circuit, the +13V gate is inhibited except when the unit is within the self-acquisition range of the loop. This action then prevents the disabling of the sweep circuit and the illumination of the lock lamp. The sweep action will continue until such a time that the input signal is recognized as the carrier. When this occurs, the 13V gate switches to its positive sense, thus disabling the sweep and illuminating the lock lamp.

4-42. AUTOMATIC GAIN CONTROL (AGC) SYSTEM. The automatic gain control system in the 1100-AR supplies either non-coherent or coherent agc voltages depending on the type of demodulator installed. With an fm demodulator installed, only non-coherent agc voltages, which are a function of the carrier envelope, are generated. When a pm demodulator is used, both coherent and non-coherent voltages may be generated depending on whether or not the receiver is phase locked. If the receiver is phase locked, coherent agc is supplied by

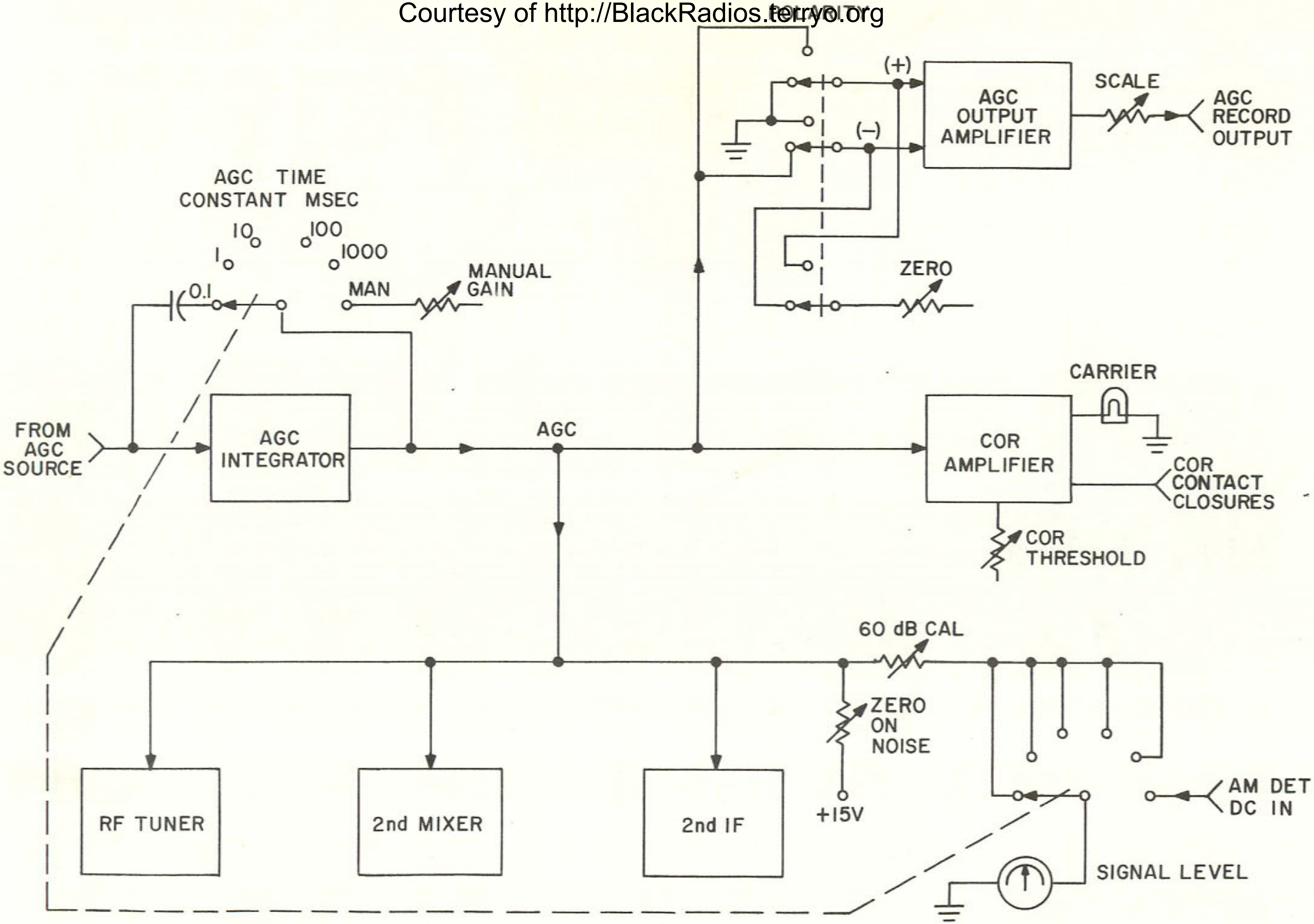


Figure 4-4. AGC System, Simplified Block Diagram

the pm demodulator and is a function of the phase modulation amplitude. Using this type of gain control, the dynamic range of the receiver is increased by approximately 15 dB. Should phase lock be broken, non-coherent agc is supplied by the a-m detector via the demodulator. A simplified block diagram of the agc system is shown in figure 4-4.

4-43. The agc system has two modes of operation: automatic and manual. In the automatic mode, voltage from the agc source (a-m detector or demodulator) is applied to the agc module at XA15-F. The signal is coupled to an integrator whose response time is determined by the positioning of front panel time constant switch S3. This switch configures an RC network in the integrator feedback loop to provide response times of 0.1, 1.0, 10, 100, and 1000 milliseconds. The output of the integrator is taken from XA15-N and coupled to the rf tuner, second mixer, and second i-f filter/amplifier to effectively control the gain of the receiver.

4-44. Another output is taken from XA15-14 and applied to signal level meter M4. This voltage is applied to M4 via front panel 60 dB calibrate control R15. The zero point on the meter is set by front panel control R4 which is adjusted to supply a bucking voltage at XA15-M to cancel any input to the agc amplifier resulting from noise.

4-45. Outputs from the integrator are also supplied to an agc output amplifier and a COR amplifier also located in the agc module. The signal applied to the output amplifier is routed through rear panel polarity switch S4. When S4 is placed in the positive position, the negative agc signal from the integrator is inverted to a positive signal and applied to rear apron output J12. When S4 is placed to the negative position, the agc signal is simply amplified and coupled to J12. Rear panel controls R10 and R11 are employed to adjust the scale and zero of the agc record output for optimum operation with external recording devices and signal combiners.

4-46. The agc signal applied to the COR amplifier is employed to energize the carrier operated relay and to turn on the front panel carrier indicator lamp DS4. When there is an input to the amplifier, the relay is energized, providing contact closure indications at rear apron accessories connector J1. At the same time, a transistor is turned on to complete the signal path for turning on the carrier indicator lamp. The level at which the lamp is lit and the relay energized is determined by front panel COR threshold control R2 electrically connected to XA15-P. Normally, R2 is set so that a signal at +6 dB IF SNR will cause the COR amplifier to be turned on.

4-47. When the agc system is set to the manual mode, the gain control voltage source is switched to front panel gain control R7. In this mode, the gain voltage is determined by the positioning of R7 only. The signal level meter is disconnected from the agc system and connected to the a-m detector module at XA8-10 and now indicates the dc level at the a-m detector.

4-48. VIDEO FILTERS

4-49. The video filters employed in the 1100-AR are two-pole, maximum linear phase response filters exhibiting 24 dB above per octave attenuation for signals out of their passband (see figures 7-3 and 7-4). Filter circuits are mounted on printed circuit cards which plug into receptacles XA11 and XA12. Seven printed circuit cards each of which contains a specific group of filter circuits are available. Normally, the receiver is equipped with video filter card 1 and any one of the remaining six cards depending on the customer's requirements. The seven video filter cards and the frequencies are:

Video Filter #1 - 6.25 kHz, 12.5 kHz, 25 kHz, 100 kHz.
Video Filter #2 - 250 kHz, 400 kHz, 750 kHz, 2 MHz.
Video Filter #3 - 250 kHz, 500 kHz, 1000 kHz, 1500 kHz.
Video Filter #4 - 300 kHz, 500 kHz, 750 kHz, 1000 kHz.
Video Filter #5 - 250 kHz, 500 kHz, 750 kHz, 1000 kHz, 1500 kHz.
Video Filter #6 - 250 kHz, 400 kHz, 750 kHz, 1000 kHz, 1500 kHz.
Video Filter #7 - 300 kHz, 500 kHz, 750 kHz, 1000 kHz, 1500 kHz.

Additionally, should a special filter be required, that filter is installed in receptacle XA13.

4-50. Video data from the demodulator or the a-m detector, as selected by video source switch A22-S1, is coupled to the video bandwidth switch A22-S3A (see figure 7-2 sheet 3). This switch is employed to connect the video signal to one of the filter cards or to bypass all filters. The signal is taken from A22-S3B and routed through video gain control R13 and video coupling switch A22-S2 to the input of the video amplifier at XA14-2 or XA14-3.

4-51. POWER SUPPLY

4-52. The power supply circuit of the 1100-AR provides the ±15V and ±6V dc operating voltages and the heater voltage for the crystal ovens in the rf tuners. Additionally, in the 1100-AR, a current regulator is included to compensate for the increased current requirements when a signal display unit is installed. The power supply is composed of the main supply circuitry mounted on the chassis, and two plug-in voltage regulators. The voltage regulators, like other plug-in modules, are discussed separately in Section IX.

4-53. Power supply components are: line filter FL1, power switch S4 on the front panel, diode rectifiers CR1 and CR2, +15V regulator Q1, +6V regulator Q2, -15V regulator Q3, -6V regulator Q4, heater supply Q5, +5V supply for digital display tuners, and the display regulator. Primary power of 115V ac or 230V ac is applied to J17 and is coupled to power transformer T1 through FL1 and power switch S4. In T1, the primary input is stepped down to provide outputs to rectifiers CR1 and CR2. The positive output of CR1 (approximately +30V dc) is applied to the display and positive regulating circuitry composed of Q1-Q2-A1 with filtering provided by C1. The negative output of CR1 (approximately -30V dc) is applied to the negative regulating and heater supply composed of Q3-Q4-A2 and Q5. Filtering of the negative voltage is accomplished by C2. Rectifier CR2 is utilized to supply positive and negative 70V dc to the voltage controlled tuner and second i-f filter/amplifier when installed.

4-54. The positive regulator consists of series regulators Q1 and Q2. These two transistors operate in conjunction with voltage regulator A1 to provide +15 and +6V operating voltages to the receiver circuitry. The +15V output is taken from the collector of Q1 and the +6V output is taken from the collector of Q2. A more detailed description of the operation of Q1 and Q2 is given in the regulator supplement contained in Section IX.

4-55. The positive output is also applied to display regulator A24 (see figures 7-2 and 7-5). This circuit functions to supply the positive operating voltage to the display unit when installed in the 1100-AR and is necessary to compensate for the resultant high turn-on current. Positive 15 volts from Q1 is employed as a reference level and the input is supplied from the positive output of CR1. The module consists of series regulator Q4, voltage amplifiers Q2 and Q3, and current limiter Q1. Regulator Q4 and the two amplifiers function in a closed control loop to maintain a +15.7V output to the display unit. Should the output vary, the difference between it and the +15V reference is amplified by Q2 and Q3, and applied to the base of Q4 as bias. This effectively increases or decreases the conduction of Q4 raising or lowering the output as necessary. Should the drain on the regulator cause more than approximately 0.7V to be dropped across the input resistors (R1-R6), current limiter Q1 is turned on. With Q1 turned on, Q4 cuts off to return the output to its normal level. The current limiter cuts off the regulator should the output current exceed approximately 700 mA.

4-56. The negative output of CR2 is applied to the negative regulator circuitry Q3-Q4-A2. This circuit functions in the same manner as the positive circuit with -15V taken from the collector of Q3 and -6V taken from the collector of Q4.

4-57. Negative voltage from CR1 is also applied to oven heater supply Q5. This transistor operates in a similar manner to the series regulators. Control signals are generated within the metering amplifier (A16) and applied to the base of Q5.

4-58. The +5V supply for driving the digital display on the 1100-D series RF tuners consists of bridge rectifier CR3 and voltage regulator U1. This supply makes available 5V dc, 1 amp, at pin 11 of the tuner receptacle and is used to energize the digital displays when the D series tuners are employed in the receiver.

SECTION V
MAINTENANCE

5-1. GENERAL

5-2. This section contains information pertaining to the maintenance of the 1100-AR telemetry receiver. Included herein are: the list of required test equipment, pre-operational test, performance test, and the preventive and corrective maintenance instructions.

5-3. REQUIRED TEST EQUIPMENT

5-4. The test equipment required to maintain the 1100-AR is listed in table 5-1. In all cases, the individual equipment listed is recommended by Microdyne Corporation to obtain satisfactory results. Equivalent equipment may be used where applicable.

Table 5-1. Test Equipment Required

Signal Generator	Boonton 202J
Signal Generator	HP608E
Signal Generator	HP606A or B
Oscilloscope	HP1200A
Oscilloscope	HP180A
Vertical Amplifier	HP1801A
Horizontal Sweep	HP1820A
DC Voltmeter	HP412A
Univerter	Boonton 207H
Noise Figure Meter (modified for 10 MHz input)	HP342A
VHF Noise Source	HP343A
UHF Noise Source	HP349A
Sweep Generator	Jerrold 900C
Sweep Generator	Texscan VS-80
Test Oscillator	HP652A
Frequency Counter	HP5245L
Counter Converter	HP5253B
RF Sampling Voltmeter	HP3406A
RF Detector	HP8471A

5-5. SPECIAL TOOLS AND TEST EQUIPMENT

5-6. The special tools and test equipment required to maintain the 1100-AR consist of various test cables and extender modules needed for testing, troubleshooting, and aligning the plug-in modules. These components and their Microdyne part numbers are listed on the following page.

Component	Part No.
Extender Module	300-355
Extender Module	300-356
Extender Card	300-343
Tuner Test Cables	200-452, 200-453
Demodulator Test Cable	200-493
IF Filter/Amplifier Test Cable	200-494

5-7. PREOPERATIONAL TEST AND CALIBRATION WITH FM DEMODULATOR

5-8. The following procedure should be accomplished prior to an operational mission. Before starting the calibration, install an fm demodulator and set the front panel controls as follows:

Control	Position
OPERATE MODE	REC
AUDIO GAIN	Mid-range
VIDEO GAIN	Mid-range
VIDEO SOURCE	FM/PM
VIDEO COUPLING	AC
1ST and 2ND LO MODE	VFO
AGC TIME CONSTANT MSEC	100
DEVIATION RANGE	Compatible with i-f bw
VIDEO BANDWIDTH	As desired

a. For receivers equipped with a calibrate/reference oscillator, make the following adjustments:

1. Set the OPERATE MODE switch to CAL. Adjust R22 on the video amplifier for 0.0V dc at J15 on rear apron. Adjust the demodulator BAL control for a zero indication on the TUNING meter.

2. Set the OPERATE MODE switch to ZERO and adjust the tuning meter ZERO control for a zero meter indication.

3. Reset the OPERATE MODE switch to REC.

b. For receivers with an afc system and calibrate/reference oscillator, set the OPERATE MODE switch to REC, and proceed as follows:

1. Remove the rf tuner, and inject a 50.000 MHz, 50 mV signal into XA3-A3. Place the afc amplifier on a 300-423 extender card.

2. Set the 2ND LO MODE switch to VFO and adjust the FINE TUNE control for a 10.000 MHz output at J11 on the rear apron.

3. Adjust R22 on the video amplifier module (A14) for 0.0V dc at J15.

4. Set the VIDEO COUPLING switch to DC and adjust the demodulator BAL control for 0.0V dc at J15. Adjust the tuning meter ZERO control to a zero indication on the TUNING meter.

5. Set the 2ND LO MODE switch to AFC and adjust the balance control on the afc amplifier for a 10.000 MHz output at J11. The balance control is R8 on the 100-444 afc only module and R30 on the 300-089 afc search and lock module. Also observe that the receiver TUNING meter is on zero.

6. Remove the test signal and replace the tuner.

7. If the receiver is equipped with a 300-078 afc search and lock module, adjust the symmetry following steps 8 and 9. If equipped with the 100-444 module, proceed to step d.

8. Connect a dc coupled oscilloscope to pin 11 of the extender card.

9. Set the receiver SEARCH RANGE control fully counterclockwise and adjust R37 on the afc amplifier for a vertical deflection which is symmetrical about zero volts dc.

c. For receivers without an afc system or calibrate/reference oscillator, set the OPERATE MODE switch to REC and proceed as follows:

1. Remove the tuner and inject a 50 MHz, 50 mV signal into XA3-A3.

2. Set the 2ND LO MODE switch to VFO and adjust the FINE TUNING control for exactly 10.000 MHz at J11 on the rear apron. Adjust R22 on the video amplifier for 0.0V dc at J15.

3. Adjust the demodulator BAL control for a zero volt level at J15 with the VIDEO COUPLING set to DC.

4. Adjust the tuning meter ZERO control for a zero meter indication.

5. Remove all test equipment and replace the tuner.

d. Apply an rf signal to the receiver from an external generator. Set the OPERATE MODE switch to REC. Adjust the rf tuner TUNING control and the FINE TUNE control for a zero tuning meter indication.

e. Set the signal generator attenuator for maximum attenuation.

f. Adjust the ZERO control beneath the SIGNAL LEVEL DB meter for a zero meter indication.

g. Set the signal generator for an output that is 60 dB above noise. This level is determined by the following formula:

$$-174 + \text{NF} + \text{IF BW/dB} + 60 \text{ dB} = \text{Input Level}$$

where: -174 dB = constant

NF = maximum tuner noise figure. See table 5-3.

IF BW/dB = IF bandwidth expressed in dB. See table 5-2.

For example, if the i-f bandwidth is 300 kHz and the maximum noise figure is 7 dB, the 60 dB level is calculated as follows:

-174 + 7 dB + 54 dB + 60 dB = -53 dBm

h. With the input level set, adjust the signal level meter 60 DB CAL control for a 60 dB meter indication.

i. Decrease the input signal level until the SIGNAL LEVEL DB meter indicates 6 dB. Adjust the THRESHOLD control until the CARR IND (carrier indicator) lamp just lights.

j. Set the VIDEO SOURCE switch to AM and DC coupling. Connect an HP412A dc voltmeter to the VIDEO OUT (J15) on the rear apron. Adjust the AM BAL control (under the OUTPUT meter) for a zero volt dc output.

k. Reset the VIDEO SOURCE switch to FM/PM.

l. Use a Boonton 202J signal generator and a Boonton 207H univerter to produce a 50 MHz signal frequency modulated with a 1700 Hz sine wave.

m. Remove the tuner from the receiver and connect the univerter output to XA3-A3.

n. Adjust the level of the modulation, as necessary, to obtain a carrier deviation equal to 30% of the second i-f bandwidth. If the DEVIATION meter indicates other than the correct deviation (insure that the setting of the demodulator DEVIATION RANGE switch is considered), refer to the booklet applicable to the metering amplifier for maintenance data.

o. Adjust the carrier deviation to the minimum level required to produce rated video output; i.e., 2.0 kHz 1141-D(A), 20 kHz 1142-D(A), 200 kHz 1143-D(A).

p. Connect an RMS voltmeter terminated in 75 ohms to the video output. Adjust the VIDEO GAIN control for a meter indication of 1.414V rms (4V p-p).

q. Set the modulation deviation to the average deviation to be encountered.

r. Set the CAL control for zero on the VIDEO OUTPUT meter.

s. Disconnect all test equipment and replace the rf tuner.

t. If the receiver agc voltage is to be recorded, the SCALE and ZERO controls on the rear apron must be adjusted for compatibility with the input requirements of the recording device. These adjustments are made as follows:

  1. Connect a signal generator to the receiver rf input and set it for an output within the range of the rf tuner.

2. Tune the receiver to the test signal.

3. Connect an HP412A dc voltmeter to the AGC RECORD OUT (J12). Set the POLARITY switch to the position corresponding to the required agc output polarity (+ or -).

4. Set the signal generator to the minimum rf level to be recorded and adjust the ZERO control for a zero volt indication on the voltmeter.

5. Set the generator for the highest signal level to be recorded and adjust the SCALE control for the desired output; this may be set up to 12 volts at a -10 dBm rf input level.

6. Recheck the zero point and adjust the ZERO control, if necessary.

7. Recheck the maximum point and adjust the SCALE control, if necessary.

8. Disconnect all test equipment.

Table 5-2. IF Bandwidth in dB

Bandwidth	dB	Bandwidth	dB
10 kHz	40	750 kHz	58
30 kHz	44	1.0 MHz	60
50 kHz	47	1.5 MHz	62
100 kHz	50	2.0 MHz	63
300 kHz	54	3.3 MHz	64
500 kHz	57	6.0 MHz	68

Table 5-3. RF Tuner Noise Figure

Tuner	NF	Tuner	NF
1111-VT(A)	5.5 dB	1116-T(A)/VT	10.0 dB
→ 1112-VT(A)	7.0 dB	1117-T(A)	7.5 dB
1113-VT(A)	7.0 dB	1118-VT(A)	8.0 dB
1114-T(A)VT	10.0 dB	1119-T(A)/VT(A)	10.0 dB
1115-T(A)/VT	10.0 dB		

5-9. PREOPERATIONAL TEST AND CALIBRATION WITH PHASE DEMODULATOR

5-10. When the receiver is equipped with a phase demodulator, the BAL and ZERO positions on the OPERATE MODE switch are inoperable. Functions calibrated are the TUNING meter, SIGNAL LEVEL DB meter, demodulator locking threshold, a-m balance and video output. The procedure for calibrating the receiver is as follows:

a. Set the OPERATE MODE switch to REC and allow 30 minutes for stabilization. Set the 2ND LO MODE switch to PM.

b. Set the demodulator SEARCH switch to MANUAL and the VIDEO SOURCE/ COUPLING to FM/PM AC. Set the ANTI-SIDEBAND switch to OUT, if applicable.

c. With no signal input, adjust the LOOP LOCK clockwise until the LOOP LOCK lamp is out.

d. Set the NOISE BAL control for zero on the TUNING meter.

e. Set the SEARCH switch to AUTO and adjust the LOOP LOCK counterclockwise until the AUTO SEARCH lamp begins to flicker. Slowly turn the LOOP LOCK clockwise until the SEARCH lamp is ON; the LOOP LOCK lamp will be out. Set the ANTI-SIDEBAND switch to IN, if applicable.

f. Apply an unmodulated signal to the receiver and lock the loop.

g. Adjust R22 on the video amplifier for 0.0 volts dc at J15.

h. Set the 2ND LO MODE switch to XTAL.

i. Calibrate the zero and 60 dB points of the SIGNAL LEVEL meter as follows:

   1. Set the signal generator for maximum attenuation (-130 dBm max signal) and adjust the ZERO control for a zero indication on the SIGNAL LEVEL meter.

   2. Set the generator for an input signal 60 dB above noise; this level is determined by:

      -174 + NF + IF BW/DB + 60 dB = Input level

      where: -174 = constant

      NF = max. tuner noise figure. See table 5-3.

      IF BW/DB = IF bandwidth expressed in dB. See table 5-2.

   3. With the input level set, adjust the 60 dB control for a 60 dB SIGNAL LEVEL meter indication.

j. Set the 2ND LO MODE switch to PM. Insure the loop is locked.

k. Calibrate the VIDEO OUTPUT meter to be compatible with mission requirements as follows:

   1. Modulate the carrier with the phase deviation to be encountered.

   2. Set the VIDEO GAIN control for the desired output level (usually 1.414V rms) using a 75-ohm terminated RMS voltmeter at J15.

   3. Set the front panel CAL potentiometer for a zero indication on the VIDEO OUTPUT meter.

l. Remove the modulation.

m. Set the VIDEO SOURCE/VIDEO COUPLING switch to AM/DC and set the VIDEO GAIN control to max (CW). Adjust the AM BAL for 0.0 volts dc at J15.

n. If receiver AGC (coherent) is to be recorded, adjust the rear panel SCALE and ZERO controls as follows:

1. Connect a signal to the receiver and lock the phase lock loop.
2. Connect a DC voltmeter to the AGC RECORD OUT (J12).
3. Set the POLARITY switch for the desired recording polarity.
4. Set the signal generator for the minimum signal level to be encountered in the mission.
5. Adjust the ZERO control for a zero volt level at J12.
6. Increase the input signal level by 20 dB and adjust the SCALE control for 1 volt at J12. This establishes a 20 dB/volt sensitivity and is typical. Other sensitivity settings can be made to satisfy particular requirements.
7. Repeat steps 4, 5, and 6, as often as necessary.
8. Disconnect all test equipment.

5-11. AGC ADJUSTMENT

5-12. This procedure insures the proper setting of the receiver agc system and should be initiated after the repair and/or replacement of the following modules:

a. Second Mixer
b. AM Detector
c. Second IF Filter/Amplifier
d. AGC Amplifier

5-13. To adjust the agc system, an HP606A signal generator and an HP412A dc voltmeter are required. The procedure for adjustment is:

a. Set the OPERATE MODE switch REC and allow 30 minutes for warmup. Remove the tuner and set the 2ND LO MODE switch to XTAL. If the receiver contains a phase demodulator, the 2ND LO MODE switch must also be set to XTAL to prevent locking and allow the envelope agc to be set.

b. Remove the second i-f filter/amplifier (A7) and inject a 10.000 MHz -21 dBm signal into XA7-A1.

c. Connect the HP412A to J13 on the rear panel and adjust R20 on the a-m detector for exactly +5.0V dc.

d. Disconnect the signal source and replace the i-f filter/amplifier using the 200-494 test cable.

e. Remove the second mixer module (A6).

f. Connect the HP606A to XA6-A7.

g. Set the HP606A to exactly 10.000 MHz at -16 dBm.

h. Adjust R25 on the a-m detector for +5V dc at J13. Then adjust R52 (R54 on the xtal filters) on the second i-f filter for -5V dc on the agc buss.

i. Disconnect the HP606A and replace the mixer.

j. Install the tuner and set the receiver 1ST LO MODE switch to VFO.

k. Connect the HP412A to the agc buss.

l. Rotate the TUNING control over the entire range and observe that the agc voltage remains within a -0.2 to -0.8V dc range.

m. Adjust R49 on the second i-f filter/amplifier, if necessary, to bring the agc within the -0.2 to -0.8V dc range.

n. If R49 on the i-f filter was adjusted in step m, it is necessary to repeat steps e through l.

o. Connect a signal generator compatible with the rf tuner to the receiver antenna input.

p. Adjust the receiver and signal generator to tune in a signal in the mid-range of the tuner.

q. Set the generator for a -7 dBm output and observe that the agc buss voltage is -5.0(±0.5)V dc.

r. Calibrate the receiver SIGNAL LEVEL meter and THRESHOLD control as directed in steps e through i of paragraph 5-8.

s. The procedure is completed. Disconnect all test equipment.

5-14. PREVENTIVE MAINTENANCE

5-15. Preventive maintenance for the 1100-AR consists of a visual inspection and a performance test. The performance test delineates the minimum acceptable standards for proper receiver operation.

5-16. VISUAL INSPECTION

5-17. A visual inspection of the receiver should be performed at monthly intervals to prevent possible malfunctions caused by a mechanical fault or failure. The inspection should include but is not limited to the following checks:

a. Rear apron connectors for corrosion, looseness, and damaged or loose contacts.

b. Internal wiring for cut, cracked, and frayed insulation, and nuts and bolts for looseness.

c. Solder joints for crystallization and corrosions.

d. Switches and internal connectors for loose connections and corrosion.

e. Resistors and wiring for discoloration and other evidence of overheating.

f. Dust and dirt accumulation. If dusty, blow out the receiver chassis using low pressure air.

g. Front panel for scratches and bare spots.

5-18. All loose hardware should be tightened immediately. Damaged and corroded switches and connectors should be replaced. Overheated resistors and wiring should be replaced only after determining the cause of overheating. Scratches and bare spots on the front panel should be covered using a matching touchup paint.

5-19. LUBRICATION

5-20. Lubrication of components within the receiver is not required.

5-21. PERFORMANCE TESTS

5-22. The following tests should be performed at six-month intervals to insure proper receiver operation. Prior to beginning the tests, the receiver should be calibrated following the procedures given in paragraph 5-7.

5-23. FM TESTS. Install an fm demodulator into the receiver and set the front panel controls as follows:

OPERATE MODE	REC
1ST LO MODE	XTAL
2ND LO MODE	XTAL
DEVIATION RANGE	Maximum
VIDEO SOURCE/COUPLING	AM/AC
VIDEO BANDWIDTH KHZ	6.25
AGC TIME CONSTANT MSEC	100
SEARCH RANGE	Fully counterclockwise
VIDEO GAIN	Fully counterclockwise
AUDIO GAIN	Mid-Range

a. NOISE FIGURE. The following test insures that the 1100-AR meets noise figure requirements. Test equipment required for this test consists of an HP342A noise figure meter and either an HP343A VHF noise source or an HP349A UHF noise source depending on the frequency range of the rf tuner.

1. Connect the noise source to the noise figure meter and to the receiver rf input.

2. Connect the receiver LIN 10 MHz OUTPUT (J11) to the noise meter input. Calibrate the noise equipment.

3. Set the 1ST LO MODE switch to VFO and tune the receiver over its range. Note that the noise level does not exceed the maximum level specified for the tuner installed. The tuners available for use with the 1100-AR and their maximum noise figure are listed in table 5-3.

4. Set the 1ST LO MODE switch to XTAL. Insert a crystal into the front panel socket and adjust the TUNING control for the corresponding dial frequency. Observe that the noise figure does not exceed the maximum level noted above.

5. Repeat step 4 using crystals at the high, low, and middle portions of the tuning range.

6. Disconnect all test equipment.

b. AGC RANGE. This test is to insure that the agc circuit maintains the i-f signal level within a 3 dB range at the demodulator input. Test equipment required consists of an HP3406A rf voltmeter and a signal generator compatible with the tuner frequency range.

1. Connect the signal generator to the receiver rf input. Connect the LIN 10 MHz OUTPUT (J11) to the input of the HP3406A rf voltmeter.

2. Set the 1ST LO MODE to XTAL.

3. Insert a mid-band crystal into the tuner socket. Set the generator output to approximately -60 dBm and tune it to the receiver.

4. Vary the input level from -100 dBm to -7 dBm and observe that the voltmeter indication varies less than 3 dB.

5. Vary input level from 0 dB SNR_{IF} to -7 dBm and again note that the voltmeter indication varies less than 3 dB. The starting level is determined by the following formula using the figures given in tables 5-2 and 5-3.

$$-174 + \text{IF BW/dB} + \text{NF} = 0 \text{ dB } SNR_{IF}$$

where: IF BW/dB = the i-f bandwidth expressed in dB. See table 5-2.

NF = maximum rf tuner noise figure. See table 5-3.

For example, using an i-f bandwidth of 300 kHz and an 1115-T(A) tuner, threshold is:

$$-174 + 54 + 10 = -110 \text{ dB}$$

6. If the receiver is equipped with a multi-bandwidth filter, repeat step 5 for each bandwidth.

7. Disconnect all test equipment.

c. AFC RANGE. This test demonstrates the afc system tracking range and drift reduction factor. Required test equipment consists of an HP5245L counter equipped with an HP5453B or HP5254B converter, a second HP5245L counter, and a signal generator compatible with the rf tuner frequency range.

1. Connect the counter and converter to the signal generator uncalibrated output. Connect the second counter to the LIN 10 MHz OUTPUT (J11).
2. Connect the signal generator calibrated output to the receiver input.
3. Set the 2ND LO MODE switch to VFO and tune the receiver to the input signal. Adjust the FINE TUNE control for a 10 MHz indication on the counter.
4. Set the 2ND LO MODE switch to AFC.
5. Slowly vary the input signal frequency ±250 kHz. Record the 10 MHz counter indications at the ±250 kHz limits.
6. Calculate the drift reduction by dividing the change of the 10 MHz i-f signal into 500,000. The reduction should be greater than 5,000.
7. Disconnect the test equipment.

5-24. PM TESTS. Install a pm demodulator into the receiver and set the front panel controls as follows:

OPERATE MODE	REC
1ST LO MODE	XTAL
2ND LO MODE	PM
LOOP BANDWIDTH	1000
VIDEO SOURCE/COUPLING	FM/PM-AC
VIDEO BANDWIDTH	6.25 kHz
AGC TIME CONSTANT MSEC	100
SEARCH RANGE	Fully counterclockwise
VIDEO GAIN	Fully counterclockwise
AUDIO GAIN	Mid-range

a. PHASE LOCK. This test insures that the locking threshold of the receiver is within specifications. Test equipment required consists of a signal generator and a 10 dB attenuator.

1. Connect the output of the signal generator to the receiver rf input through the 10 dB attenuator, locating the attenuator directly at the receiver input jack.
2. Set the generator output level to -90 dBm and lock the receiver to the signal.

3. Vary the input level from threshold to -7 dBm and note that the receiver remains phase locked over the entire range. Threshold is defined by the following formula:

   $-174 + \text{IF BW/dB} + \text{NF} - 15 = \text{Threshold}$

   where: -174 = constant; -15 = Negative SNR_{IF} for Lock

   IF BW/dB = i-f bandwidth expressed in dB. See table 5-2.

   NF = maximum tuner noise figure. See table 5-3.

   For example, with an i-f bandwidth of 750 kHz and a tuner noise figure of 10 dB, threshold is:

   $-174 + 58 + 10 - 15 = -121$ dBm

4. Disconnect the test equipment.

b. PHASE DEMODULATION. The following test demonstrates that the receiver is capable of demodulating a signal with up to 150° of phase deviation. Test equipment required is:

Signal Generator	Boonton 202J
Univerter	Boonton 207H
Oscillator	HP651B
Spectrum Analyzer	HP852A/8551A
Distortion Analyzer	HP334A

1. Connect the 202J to the 207H and adjust for an output of 50 MHz.
2. Connect the HP651B to the fm input of the 202J. Set the HP651B to 5 kHz.
3. Connect the 207H output, at 50 mV, to the spectrum analyzer input.
4. Set the output of the HP651B to 1.38 on the 3 volt scale of the 651B meter.
5. Adjust the FM MOD control on the 202J for a carrier null as observed on the analyzer. The 202J/207H configuration is now calibrated for 138° of pm and the first carrier null.
6. Adjust the HP651B output level to zero.
7. Disconnect the HP651B from the 202J. Disconnect the 207H from the analyzer.
8. Remove the tuner from the receiver and connect the output of the 207H to A3 of the receiver tuner receptacle through a 10 dB pad. Lock the receiver to the signal and adjust the FINE TUNE control for a zero tuning meter indication.

9. Connect the HP334A distortion analyzer, terminated in 75 ohms, to the receiver video output (J14). Set for voltmeter operation.

10. Reconnect the HP651B to the 202J and increase its output to 1.50 (150°).

11. Set the VIDEO BANDWIDTH KHZ switch to 25 and adjust the VIDEO GAIN control for a meter indication of 2.5V rms.

12. Reset the HP334A for distortion measurement and check the distortion; it should be less than 3%.

13. Disconnect all test equipment.

5-25. CORRECTIVE MAINTENANCE

5-26. The corrective maintenance for the 1100-AR consists of troubleshooting, repair and replacement, and realignment. Information pertaining to these subjects is given in paragraphs 5-27, 5-31, and 5-37.

5-27. TROUBLESHOOTING

5-28. Troubleshooting requirements for the 1100-AR consist of the steps and procedures necessary to isolate the problem to a defective plug-in module or to the base unit and power supply. Normal practices such as checking all connections, checking the fuse, and checking for power application are not spelled out in the following procedure since these are considered to be automatic preliminary troubleshooting steps.

5-29. The procedure recommended to isolate a malfunction to specific modules within the receiver is: 1) note the symptoms; i.e., rear apron outputs, meter indications, the effects that operating controls have and do not have, etc.; 2) refer to the functional block diagram and other supporting block diagrams and schematics and determine which modules are common to the recognized symptoms; 3) using the various extender modules and test cables listed in paragraph 5-5, check the inputs and outputs of the suspected modules; 4) verify that the suspected module is defective by inserting a known good module in its place. Should the problem remain, check the socket for broken leads and contacts, and that the correct operating voltages are present at the applicable pins. A further step would be to check the continuity of the applicable wiring following the base unit schematic diagrams.

5-30. Using the above recommendations, a malfunction within the 1100-AR can be easily located and remedied. For example, with a known input, there is no video or audio outputs, but the signal level, tuning, and deviation meters are operating normally, the logical area to start troubleshooting would be at the video source switch A22S1. This is indicated by recognizing that all meters except the OUTPUT meter (M2) are functioning normally and that only the video and audio outputs are absent. Once the defective module has been isolated, it should then be placed on an extender card and checked following the information given in the applicable booklet in Section IX.

5-31. REPAIR

5-32. Repair procedures for the 1100-AR are grouped into three categories: base unit, front panel, and internal plug-in modules. Repair procedures for front panel plug-in modules are given in the applicable instruction manual. All electrical components used in the 1100-AR, excluding modules, are considered non-repairable and should be replaced when found defective.

5-33. BASE UNIT. No special tools or procedures are required to remove and replace components mounted on the base unit. The power transformer and filter capacitor securing screws and nuts are accessible with the top cover removed. Series regulator transistors and load resistors are fixed to a mounting plate. This plate is secured to the rear panel with machine screws and will drop from the receiver with the screws removed.

5-34. FRONT PANEL. The majority of the front panel controls and indicators can be removed and replaced without removing the front panel from the receiver. The panel should be removed, however, if there is a possibility of destroying or damaging any other components or wiring in the repair process. To remove the front panel, disconnect plug XA21 on the top of the receiver. Remove the knobs from the VIDEO BANDWIDTH KHZ and VIDEO COUPLING/VIDEO SOURCE switches. Remove the four screws (two on either side) adjacent to the demodulator/i-f filter slot. Remove the three Phillips screws on either side of the receiver chassis next to the front panel. Pull the front panel away from the chassis. All wiring is now exposed on the rear of the front panel. No special procedures are required to replace front panel components. After replacing components, verify all connections against the schematic diagram prior to replacing the front panel.

5-35. INTERNAL PLUG-IN MODULES. There are two types of plug-in modules in the 1100-AR: printed circuit cards and metal-encased modules. In both cases, the modules plug into base unit connectors and are held in place with module clips. A hole is provided in the modules for inserting a Microdyne 200-396 removal tool. To remove a module, simply insert the tool and lift out. To gain access to the circuitry in the metal-encased modules, the screws securing the wraparound cover must be removed. With the cover removed, the circuitry contained in the module is readily accessible.

5-36. The following procedure is recommended for removing components from a printed circuit board:

a. Gather the following material and equipment:

   1. Liquid soldering flux.
   2. Flux remover.
   3. Wire braid.
   4. Soldering iron, soldering aid, and longnose pliers.

b. Dip one end of the braid in the soldering flux.

c. Place and hold the braid over the solder joint and apply heat; the braid will absorb most of the solder.

CAUTION

Excess heat may permanently damage the circuit board.

d. Apply heat directly to the solder joint and gently pry the component loose.

e. Clean the affected area using flux remover. If the hole remains clogged, repeat the process using the braid and the flux.

f. Position the component on the pc board.

g. Solder in place and trim the leads.

h. Clean the area with flux remover.

5-37. ALIGNMENT

5-38. No alignment procedures can be directly applied to the 1100-AR receiver. After repairing and aligning any of the internal modules, the receiver should be recalibrated and tested following the procedures given in paragraphs 5-7 and 5-21.

SECTION VI
REPLACEMENT PARTS LIST

6-1. GENERAL

6-2. This section contains the replacement parts list for the 1100-AR base chassis, front panel, and video filters. Certain components such as rear panel connectors and module receptacles listed herein may or may not be used depending on the particular receiver configuration supplied. Therefore, before applying the parts list data, first determine the receiver module complement by referring to page "c" in the manual front matter. Next, refer to the schematic diagrams, wire list, and the receiver itself, noting which connectors and other components are employed and the associated reference designations. With this information, the component part, type, manufacturer, and manufacturer's part number can then be easily located in the following alphanumerical parts list. All component information and the receiver serial number should be included when ordering spare or replacement parts.

6-3. RECEIVER BASE CHASSIS (See figure 7-2)

Reference Designation	Description
C1	Capacitor, electrolytic, 5200 μf, GE 86F147L
C2	Capacitor, electrolytic, 5200 μf, GE 86F147L
C3	Capacitor, tantalum, 47 μf, 35V, Kemet T360D476K035AS
C4	Capacitor, tantalum, 47 μf, 35V, Kemet T360D476K035AS
C5	Capacitor, ceramic, 0.01 μf ±20%, 100V, Erie 8121-100-X5V-103M
C6	Capacitor, ceramic, 0.0047 μf ±20%, 100V, Erie 8131-100-X5T-472M
C7	Capacitor, ceramic, 0.01 μf ±20%, 100V, Erie 8121-100-X5V-103M
C8	Not Assigned
C9	Not Assigned
C10 thru C14	Capacitor, electrolytic, 30 μf, 100V, Sprague TE1411
C15	Capacitor, ceramic, 0.33 μF ±20%, 100V, Erie 8131-100-651-334M
C16	Capacitor, ceramic, 0.33 μF ±20%, 100V, Erie 8131-100-651-334M
CR1	Rectifier, bridge, SemTech SCAJ1
CR2	Rectifier, bridge, SemTech SCAJ2
CR3	Rectifier, bridge, SemTEch SCAJ2
F1	Fuse, 1.0 amp, SLO-BLO 3 AG
J1	Connector, Cannon DBM-25S
J2	Connector, Amphenol UG-1095A
J3	Connector, Dage 30517-10

Replacement Parts List, Receiver Base Chassis, continued

Reference Designation	Description
J4 thru J16	Connector, BNC, Dage 30517-10 (used as required)
J17	Connector, Cannon MS3102A-10SL-3P
J18 thru J21	Connector, BNC, Dagoe 30517-10 (used as required)
L1	Inductor, 1000 μH ±5%, Jeffers 1331-35J
Q1	Transistor, pnp, Motorola 2N4901
Q2	Transistor, pnp, Motorola 2N4901
Q3 thru Q5	Transistor, npn, Motorola 2N5067
Q6	Transistor, npn, Motorola 2N4901
R1	Resistor, wirewound, 0.33Ω ±10%, 2w, IRC BWH
R2	Resistor, wirewound, 1Ω ±10%, 2w, IRC BWH
R3	Resistor, wirewound, 0.33Ω ±10%, 2w, IRC BWH
R4	Resistor, wirewound, 1Ω ±10%, 2w, IRC BWH
R5	Resistor, wirewound, 300Ω ±10%, 2w, IRC BWH
R6	Resistor, wirewound, 820Ω ±10%, 2w, IRC BWH
R7	Resistor, wirewound, 300Ω ±10%, 2w, IRC BWH
R8	Resistor, wirewound, 820Ω ±10%, 2w, IRC BWH
R9	Resistor, fixed composition, 1KΩ ±5%, ¼w, Allen Bradley CB1025
R10	Potentiometer, 25KΩ, Allen Bradley WA2L04S253UC
R11	Potentiometer, 10KΩ, Allen Bradley WA2L04S103UC
R12	Resistor, fixed composition, 2.4KΩ ±5%, ¼w, Allen Bradley CB2425
R13	Potentiometer, 100Ω, Ohmite ASM-6661, integral part of S2
R14	Resistor, fixed composition, 33KΩ ±5%, ¼w, Allen Bradley CB3335
R15	Resistor, fixed composition, 4.7KΩ ±5%, ¼w, Allen Bradley CB4725
R16	Resistor, fixed composition, 3.3KΩ ±5%, ¼w, Allen Bradley CB3325
R17	Resistor, fixed composition, 200KΩ ±5%, 1/2w, Allen Bradley EB2045
R18	Resistor, fixed composition, 200KΩ ±5%, 1/2w, Allen Bradley EB2045
R19	Resistor, fixed composition, 1.2KΩ ±5%, 1/2w, Allen Bradley EB1225
R20	Resistor, fixed composition, 100Ω ±5%, ¼w, Allen Bradley CB1015
R21	Potentiometer, 50KΩ, Allen Bradley WA2L040S503UC
R22	Resistor, fixed composition, 30KΩ ±5%, ¼w, Allen Bradley CB3035
R23	Resistor, fixed composition, 30KΩ ±5%, ¼w, Allen Bradley CB3035
R24	Resistor, fixed composition, 120Ω ±5%, ¼w, Allen Bradley CB1215

Replacement Parts List, Receiver Base Chassis, continued

Reference Designation	Description
S1/S2	Switch Assembly, Microdyne 200-109
S3	Switch rotary, Microdyne 200-110
S4	Switch, toggle, C & K 7301
T1	Transformer, power, Microdyne 300-567
U1	Voltage Regulator, Motorola MC 7805CP
XA1, 2	Connector, Cinch 250-15-30-201
XA3	Connector, Cannon DCMF-25W3S
XA3A4	Connector, Dage 11749-1
XA4, 5	Connector, Cannon DBMF-13W3S
XA6	Connector, Cannon DDMF-24W7S
XA7	Connector, Cannon DBMF-17W3S
XA8	Connector, Cannon DDMF-24W7S
XA9	Connector, Cannon DDMF-36W4S
XA10	Connector, Cannon DBMF-13W3S
XA11, 12	Connector, Cinch 250-15-30-201
XA13	Not Assigned
XA14	Connector, Cinch 250-15-30-201
XA15	Connector, Cinch 251-15-30-221
XA16, 17	Connector, Cinch 250-15-30-201
XA18	Connector, Cannon DBMF-13W3S
XA19	Not Assigned
XA20	Not Assigned
XA21	Connector, AMP 205-211-1
XA22	Not Assigned
XA23	Connector, Cannon DBMF-13W3S
XA24	Not Assigned
XA25	Not Assigned
XF1	Fuse Holder, Littelfuse 342004
XF2	Fuse Holder, Littelfuse 342004

Replacement Parts List, continued

6-4. BASE CHASSIS, 1100-AR(5)

Reference Designation	Description
C1	Capacitor, fixed, electrolytic, 5200 μF, 30V, General Electric 86F147F
C2	Capacitor, fixed, electrolytic, 5200 μF, 30V, General Electric 86F147F
C3	Capacitor, tantalum, 47 μF ±10%, 35V, Kemet T360D476K035AS
C4	Capacitor, tantalum, 47 μF ±10%, 35V, Kemet T360D476K035AS
C5	Capacitor, ceramic, 0.01 ±20%, 100V, Erie 8131-B106-X5V0-103M
C6	Capacitor, ceramic, 0.0047 μF ±20%, 100V, Erie 8131-100-X5T-472M
C7	Capacitor, 800 μF, 16V, Sprague TVA1162.3
C8	Capacitor, ceramic, 0.33 μF ±10%, 100V, Erie 8131-100-651-334M
C9	Capacitor, ceramic, 0.33 μF ±10%, 100V, Erie 8131-100-651-334M
C10 thru C13	Capacitor, ceramic, 30 μF, 100V, Sprague TE1411
CR1	Rectifier, bridge, Semtech SCAJ1
CR2	Rectifier, bridge, Semtech SCAJ2
CR3	Rectifier, bridge, Semtech SCAJ2
F1	Fuse, 3AG, .75A, SLO-BLO
J1	Connector, Cinch DBM-25S
J2	Connector, Amphenol UG-1095A
J3 thru J11	Connector, Dage 30517-10
J12	Not Assigned
J13	Connector, Amphenol 31-2225
J14 thru J16	Connector, Dage 30517-10
J17	Connector, Cannon MS3102A-10SL-3P
L1	Inductor, 1000 μH ±5%, Jeffers 1331-35J
Q1	Transistor, pnp, Motorola 2N4901
Q2	Transistor, pnp, Motorola 2N4901
Q3	Transistor, npn, Motorola 2N5067
Q4	Transistor, npn, Motorola 2N5067
Q5	Transistor, npn, Motorola 2N5067

Replacement Parts List, Base Chassis, 1100-AR(5), continued

Reference Designation	Description
R1	Resistor, wirewound, 0.33Ω ±10%, 2w, IRC BWH
R2	Resistor, wirewound, 1Ω ±10%, 2w, IRC BWH
R3	Resistor, wirewound, 0.33Ω ±10%, 2w, IRC BWH
R4	Resistor, wirewound, 1Ω ±10%, 2w, IRC BWH
R5	Resistor, wirewound, 300Ω ±10%, 2w, IRC BWH
R6	Resistor, wirewound, 820Ω ±10%, 2w, IRC BWH
R7	Resistor, wirewound, 300Ω ±10%, 2w, IRC BWH
R8	Resistor, wirewound, 820Ω ±10%, 2w, IRC BWH
R9	Resistor, fixed composition, 1KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1025
R10	Potentiometer, 25K, Ohmite AS3608
R11	Potentiometer, 10K, Ohmite AS3607
R12	Resistor, fixed composition, 2.4KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB2425
R13	Resistor, fixed composition, 100Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB1015
R14	Not Assigned
R15	Resistor, fixed composition, 4.7KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB4725
R16	Resistor, fixed composition, 1.2KΩ ±5%, 1/2w, Allen Bradley EB1257
R17	Resistor, fixed composition, 200KΩ ±5%, 1/2w, Allen Bradley EB2045
R18	Resistor, fixed composition, 200KΩ ±5%, 1/2w, Allen Bradley EB2045
R19	Not Assigned
R20	Not Assigned
R21	Potentiometer, 50KΩ, Allen Bradley WA2L040S503UC
R22	Resistor, fixed composition, 20KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB2035
R23	Resistor, fixed composition, 20KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB2035
S1/S2	Switch Assembly, Microdyne 200-109
S3	Switch, rotary, Microdyne 200-110
S4	Switch, toggle, C & K 7301
T1	Power Transformer, spec., Microdyne 301-555
U1	Voltage Regulator, Motorola MC7805CP
XA1, 2	Connector, Cinch 250-15-30-201
XA3	Connector, Cannon DCMF-25W3S
XA4, 5	Connector, Cannon DBMF-13W3S
XA6	Connector, Cannon DDMF-24W7S
XA7	Connector, Cannon DBMF-17W2S
XA8	Connector, Cannon DDMF-24W7S
XA9	Connector, Cannon DDMF-36W4S
XA10	Connector, Cannon DBMF-13W3S
XA11 thru XA14	Connector, Cinch 250-15-30-201

Replacement Parts List, Base Chassis, 1100-AR(5), continued

Reference Designation	Description
XA15	Connector, Cinch 251-15-30-221
XA16	Connector, Cinch 250-15-30-201
XA17	Connector, Cinch 251-15-30-221
XA18	Connector, Cannon DBMF-13W3S
XA19	Connector, Cannon DBMF-13W3S
XA20	Connector, Cannon DBMF-13W3S
XA21	Connector, AMP 205-212-1
XA22	Not Assigned
XF1	Fuseholder, Littelfuse 342004
XF2	Fuseholder, Littelfuse 342004

6-5. FRONT PANEL SUBASSEMBLY

Reference Designation	Description
DS1	Lamp, amber, Eldema CF03YTS2107
DS2	Lamp, white, Eldema CF03WTS2107
DS3	Lamp, red, Eldema LF03RTS2107
DS4	Lamp, green, Eldema CF03GTS2107
DS5	Lamp, amber, Eldema CF03YTS2107
J1	Connector, AMP 205-211-1
LS1	Speaker, Microdyne 100-066
M1	Meter, tuning, Microdyne 200-008
M2	Meter, output, Microdyne 200-006
M3	Meter, deviation, Microdyne 200-004
M4	Meter, signal level, Microdyne 200-007

Replacement Parts List, Front Panel Subassembly, continued

Reference Designation	Description
R1	Resistor, fixed composition, 13KΩ ±5%, ¼w, Allen Bradley CB1335
R2	Potentiometer, 25KΩ, Beckman 78SR25KBW
R3	Resistor, fixed composition, 2KΩ ±5%, ¼w, Allen Bradley CB2025
R4	Potentiometer, 25KΩ, Beckman 78SR25KBW
R5	Potentiometer, 25KΩ, Beckman 78SR25KBW
R6	Potentiometer, 20KΩ, Allen Bradley WA2G056S101UA
R7	Potentiometer, 10KΩ, ipo S3
R8	Potentiometer, 25KΩ, Beckman 78SR25KBW
R9	Resistor, fixed composition, 150Ω ±5%, 1/2w, Allen Bradley EB1515
R10	Potentiometer, 5KΩ, ipo S4
R11	Potentiometer, 50KΩ, Allen Bradley WA2G056S503UA
R12	Resistor, fixed composition, 2KΩ ±5%, ¼w, Allen Bradley CB2025
R13	Potentiometer, 100Ω, Beckman 78SR100BW
R14	Resistor, fixed composition, 4.7Ω ±5%, 1/2w, Allen Bradley EB4R75
R15	Potentiometer, 25KΩ, Beckman 78SR25KBW
R16	Resistor, fixed composition, 24KΩ ±5%, ¼w, Allen Bradley CB2435
R17	Resistor, fixed composition, 2.4KΩ ±5%, ¼w, Allen Bradley CB2425
R18	Resistor, fixed composition, 47KΩ ±5%, ¼w, Allen Bradley CB4735
S1/S2	Switch assembly, Microdyne 200-106
S3	Switch, Microdyne 200-107
S4	Switch, Microdyne 200-108

6-6. VIDEO FILTER #1

Reference Designation	Description
C1	Capacitor, film, 0.27 µf, 80V, Sprague 192P2749R8
C2	Capacitor, film, 0.056 µf, 80V, Sprague 192P5639R8
C3	Capacitor, film, 0.15 µf, 80V, Sprague 192P1549R8
C4	Capacitor, ceramic, 0.027 µf ±10%, 100V, Erie 8131-100-W5R-273K
C5	Capacitor, film, 0.068 µf, 80V, Sprague 192P6839R8
C6	Capacitor, ceramic, 0.015 µf ±10%, 100V, Erie 8131-100-W5R-153K
C7	Capacitor, ceramic, 0.033 µf ±10%, 100V, Erie 8131-100-W5R-333K
C8A	Capacitor, ceramic, 6800 pf ±10%, 100V, Erie 8121-100-W5R-682K
C8B	Capacitor, ceramic, 820 µf ±5%, 100V, Erie 8131-100-COG-821J
C9	Capacitor, ceramic, 0.018 µf ±10%, 100V, Erie 8131-100-W5R-182K
C10	Capacitor, ceramic, 3600 pf ±10%, 100V, Erie 8121-100-W5R-362K
L1	Inductor, variable, 6.8 mH, Cambion 3387-30
L2	Inductor, variable, 1.5 mH, Cambion 3387-26

Replacement Parts List, Video Filter #1, continued

Reference Designation	Description
L3	Inductor, variable, 3.3 mH, Cambion 3387-28
L4	Inductor, variable, 1.0 mH, Cambion 3387-25
L5	Inductor, variable, 1.5 mH, Cambion 3387-26
L6	Inductor, variable, 470 μH, Cambion 3387-23
L7	Inductor, variable, 680 μH, Cambion 3387-24
L8	Inductor, variable, 220 μH, Cambion 3387-21
L9	Inductor, variable, 330 μH, Cambion 3387-22
L10	Inductor, variable, 100 μH, Cambion 3387-19

6-7. VIDEO FILTER #2

Reference Designation	Description
C1	Capacitor, ceramic, 6800 pf ±10%, 100V, Erie 8121-100-W5R-682K
C2	Capacitor, ceramic, 1500 pf ±10%, 100V, Erie 8121-100-W5R-152K
C3A	Capacitor, ceramic, 3300 pf ±10%, 100V, Erie 8121-100-W5R-332K
C3B	Capacitor, ceramic, 1000 pf ±5%, 100V, Erie 8131-100-COG-102J
C4	Capacitor, ceramic, 910 pf ±5%, 100V, Erie 8131-100-COG-911J
C5	Capacitor, ceramic, 2200 pf ±10%, 100V, Erie 8121-100-W5R-222K
C6	Capacitor, ceramic, 470 pf ±5%, 100V, Erie 8131-100-COG-471J
C7	Capacitor, ceramic, 820 pf ±5%, 100V, Erie 8131-100-COG-821J
C8	Capacitor, ceramic, 180 pf ±5%, 100V, Erie 8131-100-COG-181J
L1	Inductor, variable, 150 μH, Cambion 3387-20
L2	Inductor, variable, 47 μH, Cambion 3387-17
L3	Inductor, variable, 100 μH, Cambion 3387-19
L4	Inductor, variable, 22 μH, Cambion 3387-15
L5	Inductor, variable, 47 μH, Cambion 3387-17
L6	Inductor, variable, 15 μH, Cambion 3387-13
L7	Inductor, variable, 18 μH, Cambion 3387-14
L8	Inductor, variable, 5.6 μH, Cambion 3387-8

6-8. VIDEO FILTER #3

Reference Designation	Description
C1	Capacitor, ceramic, 6800 pf ±10%, 100V, Erie 8121-100-W5R-682K
C2	Capacitor, ceramic, 1500 pf ±10%, 100V, Erie 8121-100-W5R-152K
C3	Capacitor, ceramic, 3300 pf ±10%, 100V, Erie 8121-100-W5R-332K
C4	Capacitor, ceramic, 680 pf ±5%, 100V, Erie 8131-100-COG-681J
C5	Capacitor, ceramic, 1800 pf ±10%, 100V, Erie 8121-100-W5R-182K

Replacement Parts List, Video Filter #3, continued

Reference Designation	Description
C6	Capacitor, ceramic, 390 pf ±5%, 100V, Erie 8121-100-COG-391J
C7	Capacitor, ceramic, 1200 pf ±10%, 100V, Erie 8121-100-W5R-122K
C8	Capacitor, ceramic, 270 pf ±5%, 100V, Erie 8121-100-COG-271J
L1	Inductor, variable, 150 μH, Cambion 3387-20
L2	Inductor, variable, 47 μH, Cambion 3387-17
L3	Inductor, variable, 68 μH, Cambion 3387-18
L4	Inductor, variable, 18 μH, Cambion 3387-14
L5	Inductor, variable, 33 μH, Cambion 3387-16
L6	Inductor, variable, 10 μH, Cambion 3387-11
L7	Inductor, variable, 22 μH, Cambion 3387-15
L8	Inductor, variable, 6.8 μH, Cambion 3387-9

6-9. VIDEO FILTER #4

Reference Designation	Description
C1	Capacitor, ceramic, 5600 pf ±10%, 100V, Erie 8121-100-W5R-562K
C2	Capacitor, ceramic, 1200 pf ±10%, 100V, Erie 8121-100-W5R-122K
C3	Capacitor, ceramic, 3300 pf ±10%, 100V, Erie 8121-100-W5R-332K
C4	Capacitor, ceramic, 680 pf ±5%, 100V, Erie 8131-100-COG-681J
C5	Capacitor, ceramic, 2200 pf ±10%, 100V, Erie 8121-100-W5R-222K
C6	Capacitor, ceramic, 470 pf ±5%, 100V, Erie 8131-100-COG-471J
C7	Capacitor, ceramic, 1800 pf ±10%, 100V, Erie 8121-100-W5R-182K
C8	Capacitor, ceramic, 390 pf ±5%, 100V, Erie 8121-100-COG-391J
L1	Inductor, variable, 100 μH, Cambion 3387-19
L2	Inductor, variable, 33 μH, Cambion 3387-16
L3	Inductor, variable, 68 μH, Cambion 3387-18
L4	Inductor, variable, 18 μH, Cambion 3387-14
L5	Inductor, variable, 47 μH, Cambion 3387-17
L6	Inductor, variable, 15 μH, Cambion 3387-13
L7	Inductor, variable, 33 μH, Cambion 3387-16
L8	Inductor, variable, 10 μH, Cambion 3387-11

6-10. VIDEO FILTER #5

Reference Designation	Description
C1	Capacitor, ceramic, 6800 pf ±10%, 100V, Erie 8121-100-W5R-682K
C2	Capacitor, ceramic, 1500 pf ±10%, 100V, Erie 8121-100-W5R-152K

Replacement Parts List, Video Filter #5, continued

Reference Designation	Description
C3	Capacitor, ceramic, 3300 pf ±10%, 100V, Erie 8121-100-W5R-332K
C4	Capacitor, ceramic, 680 pf ±5%, 100V, Erie 8131-100-COG-681J
C5	Capacitor, ceramic, 2200 pf ±10%, 100V, Erie 8121-100-W5R-222K
C6	Capacitor, ceramic, 470 pf ±10%, 100V, Erie 8131-100-W5R-471K
C7	Capacitor, ceramic, 1800 pf ±10%, 100V, Erie 8131-100-W5R-182K
C8	Capacitor, ceramic, 390 pf ±5%, 100V, Erie 8131-100-COG-391J
C9	Capacitor, ceramic, 1200 pf ±10%, 100V, Erie 8121-100-W5R-122K
C10	Capacitor, ceramic, 270 pf ±5%, 100V, Erie 8121-100-COG-271J
L1	Inductor, variable, 150 µH, Cambion 3387-20
L2	Inductor, variable, 47 µH, Cambion 3387-17
L3	Inductor, variable, 68 µH, Cambion 3387-18
L4	Inductor, variable, 18 µH, Cambion 3387-14
L5	Inductor, variable, 47 µH, Cambion 3387-17
L6	Inductor, variable, 15 µH, Cambion 3387-13
L7	Inductor, variable, 33 µH, Cambion 3387-16
L8	Inductor, variable, 10 µH, Cambion 3387-11
L9	Inductor, variable, 22 µH, Cambion 3387-15
L10	Inductor, variable, 6.8 µH, Cambion 3387-9

6-11. VIDEO FILTER #6

Reference Designation	Description
C1	Capacitor, ceramic, 6800 pf ±10%, 100V, Erie 8121-100-W5R-682K
C2	Capacitor, ceramic, 1500 pf ±10%, 100V, Erie 8121-100-W5R-152K
C3A	Capacitor, ceramic, 3300 pf ±10%, 100V, Erie 8121-100-W5R-332K
C3B	Capacitor, ceramic, 1000 pf ±5%, 100V, Erie 8131-100-COG-102J
C4	Capacitor, ceramic, 910 pf ±5%, 100V, Erie 8131-100-COG-911J
C5	Capacitor, ceramic, 2200 pf ±10%, 100V, Erie 8121-100-W5R-222K
C6	Capacitor, ceramic, 470 pf ±5%, 100V, Erie 8131-100-COG-471J
C7	Capacitor, ceramic, 1800 pf ±10%, 100V, Erie 8121-100-W5R-182K
C8	Capacitor, ceramic, 390 pf ±5%, 100V, Erie 8121-100-COG-391J
C9	Capacitor, ceramic, 1200 pf ±10%, 100V, Erie 8121-100-W5R-122K
C10	Capacitor, ceramic, 270 pf ±5%, 100V, Erie 8121-100-COG-271J
L1	Inductor, variable, 150 µH, Cambion 3387-20
L2	Inductor, variable, 47 µH, Cambion 3387-17
L3	Inductor, variable, 100 µH, Cambion 3387-19
L4	Inductor, variable, 22 µH, Cambion 3387-15
L5	Inductor, variable, 47 µH, Cambion 3387-17
L6	Inductor, variable, 15 µH, Cambion 3387-13

Replacement Parts List, Video Filter #6, continued

Reference Designation	Description
L7	Inductor, variable, 33 μH, Cambion 3387-16
L8	Inductor, variable, 10 μH, Cambion 3387-11
L9	Inductor, variable, 22 μH, Cambion 3387-15
L10	Inductor, variable, 6.8 μH, Cambion 3387-9

6-12. VIDEO FILTER #7

Reference Designation	Description
C1	Capacitor, ceramic, 5600 pf ±10%, 100V, Erie 8121-100-W5R-562K
C2	Capacitor, ceramic, 1200 pf ±10%, 100V, Erie 8121-100-W5R-122K
C3	Capacitor, ceramic, 3300 pf ±10%, 100V, Erie 8121-100-W5R-332K
C4	Capacitor, ceramic, 680 pf ±5%, 100V, Erie 8131-100-COG-681J
C5	Capacitor, ceramic, 2200 pf ±10%, 100V, Erie 8121-100-W5R-222K
C6	Capacitor, ceramic, 470 pf ±5%, 100V, Erie 8131-100-COG-471J
C7	Capacitor, ceramic, 1800 pf ±10%, 100V, Erie 8121-100-W5R-182K
C8A	Capacitor, ceramic, 390 pf ±5%, 100V, Erie 8121-100-COG-391J
C9	Capacitor, ceramic, 1200 pf ±10%, 100V, Erie 8121-100-W5R-122K
C10	Capacitor, ceramic, 270 pf ±5%, 100V, Erie 8121-100-COG-271J
L1	Inductor, variable, 100 μH, Cambion 3387-19
L2	Inductor, variable, 33μH, Cambion 3387-16
L3	Inductor, variable, 68 μH, Cambion 3387-18
L4	Inductor, variable, 18 μH, Cambion 3387-14
L5	Inductor, variable, 47 μH, Cambion 3387-17
L6	Inductor, variable, 15 μH, Cambion 3387-13
L7	Inductor, variable, 33 μH, Cambion 3387-16
L8	Inductor, variable, 10 μH, Cambion 3387-11
L9	Inductor, variable, 22 μH, Cambion 3387-15
L10	Inductor, variable, 6.8 μH, Cambion 3387-9

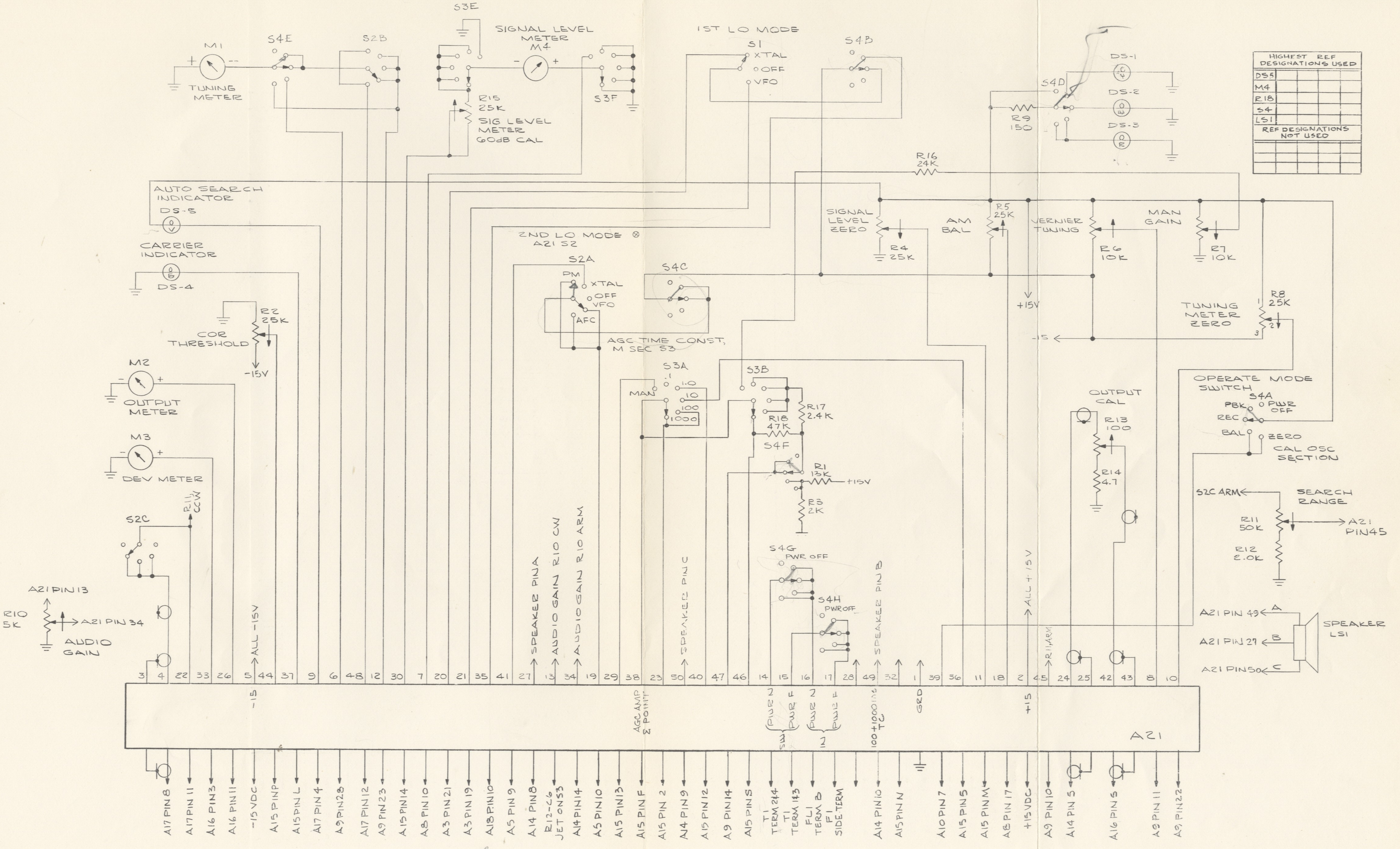
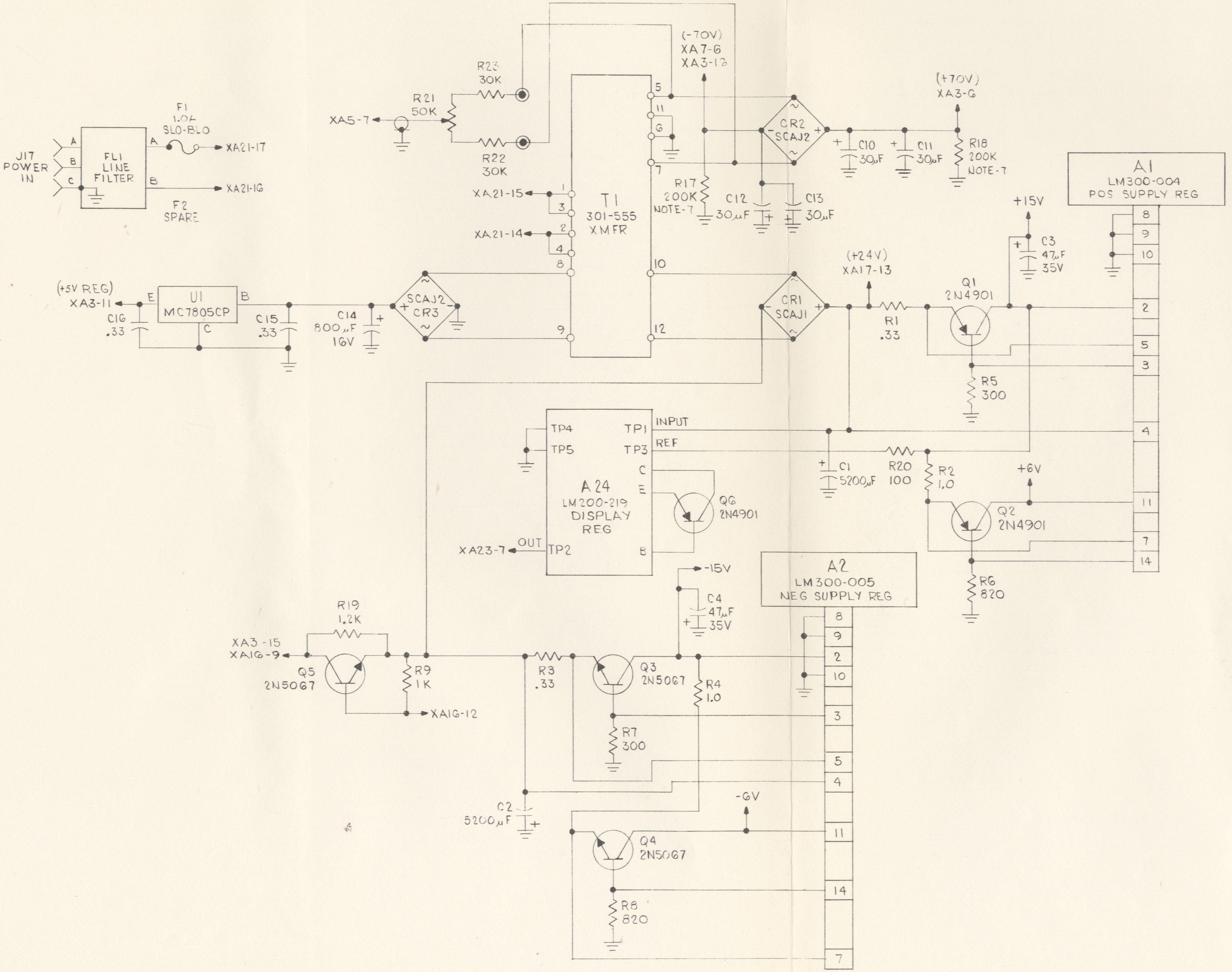


Figure 7-1. 1100-AR Front Panel, Schematic Diagram



NOTES:
UNLESS OTHERWISE SPECIFIED:

1. CAPACITOR VALUES GREATER THAN 1.0 ARE IN PICOFARADS.
2. CAPACITOR VALUES LESS THAN 1.0 ARE IN MICROFARADS.
3. INDUCTOR VALUES ARE IN MICROHENRYS.
4. RESISTOR VALUES ARE IN OHMS; K=X 1000, M=X 1,000,000.
5. ✱ DENOTES SELECTED VALUE.
6. -⊖⊃- FERRITE BEAD.
7. ADD INSULATING COVERING ON GND END OF R17 & R18.
8. WHEN THE PRE-D-PLAYBACK (1181-PP(A) & THE PRE-D-RECORD (1171-PR(A)) ARE PROVIDED FOR THE FOLLOWING CABLE 201-734 SHOULD BE EQUIPPED WITH THE BASE UNIT.
9. WHEN A4 IS NOT USED INSTALL A1 & A2 JUMPERED
10. CONNECTOR IS NOT INSTALLED UNLESS MODULE IS FURNISHED.

Figure 7-2. 1100-AR Base Chassis, Schematic Diagram Sheet 1 of 8

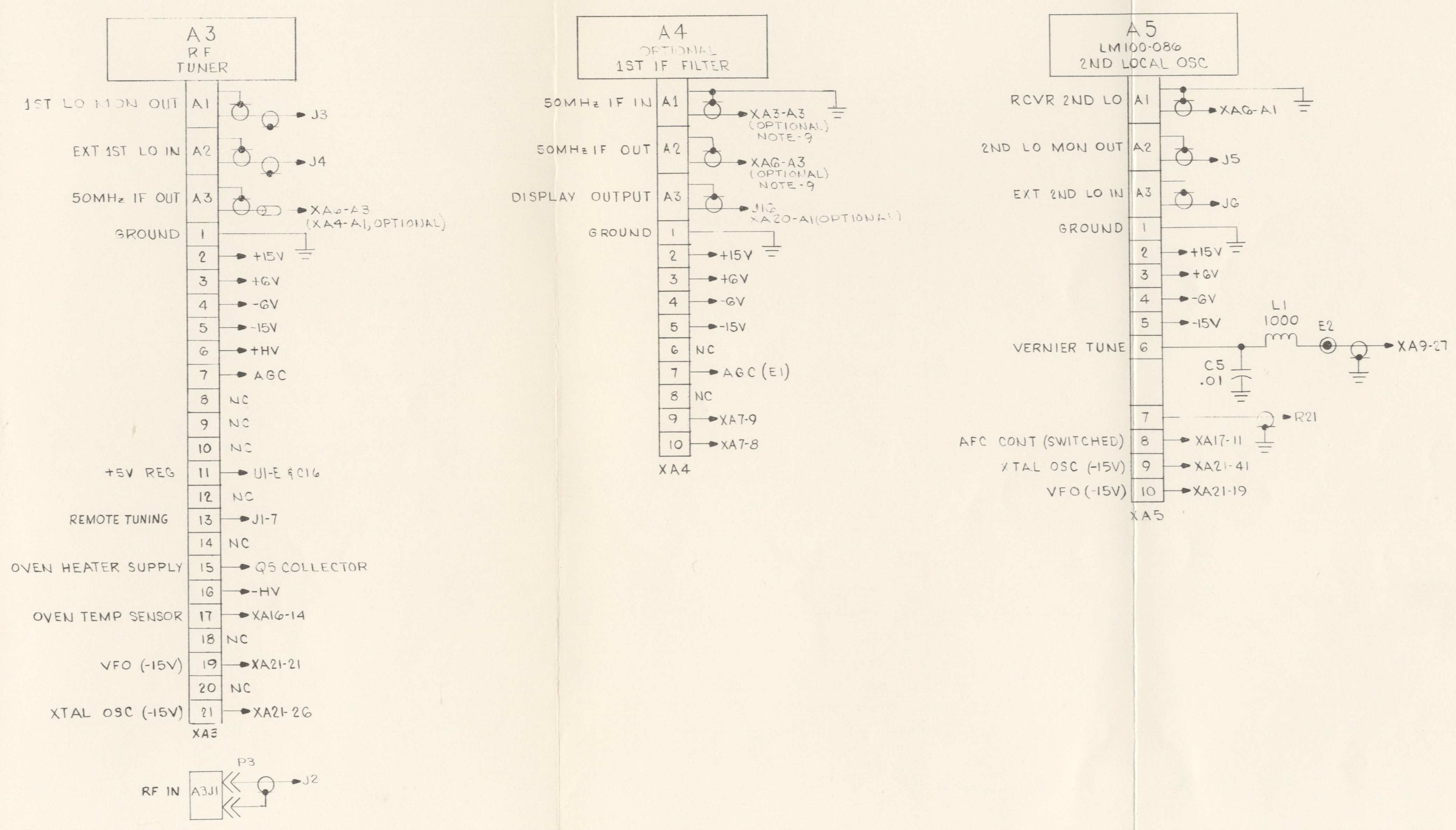


Figure 7-2. 1100-AR Base Chassis, Schematic Diagram Sheet 2 of 8

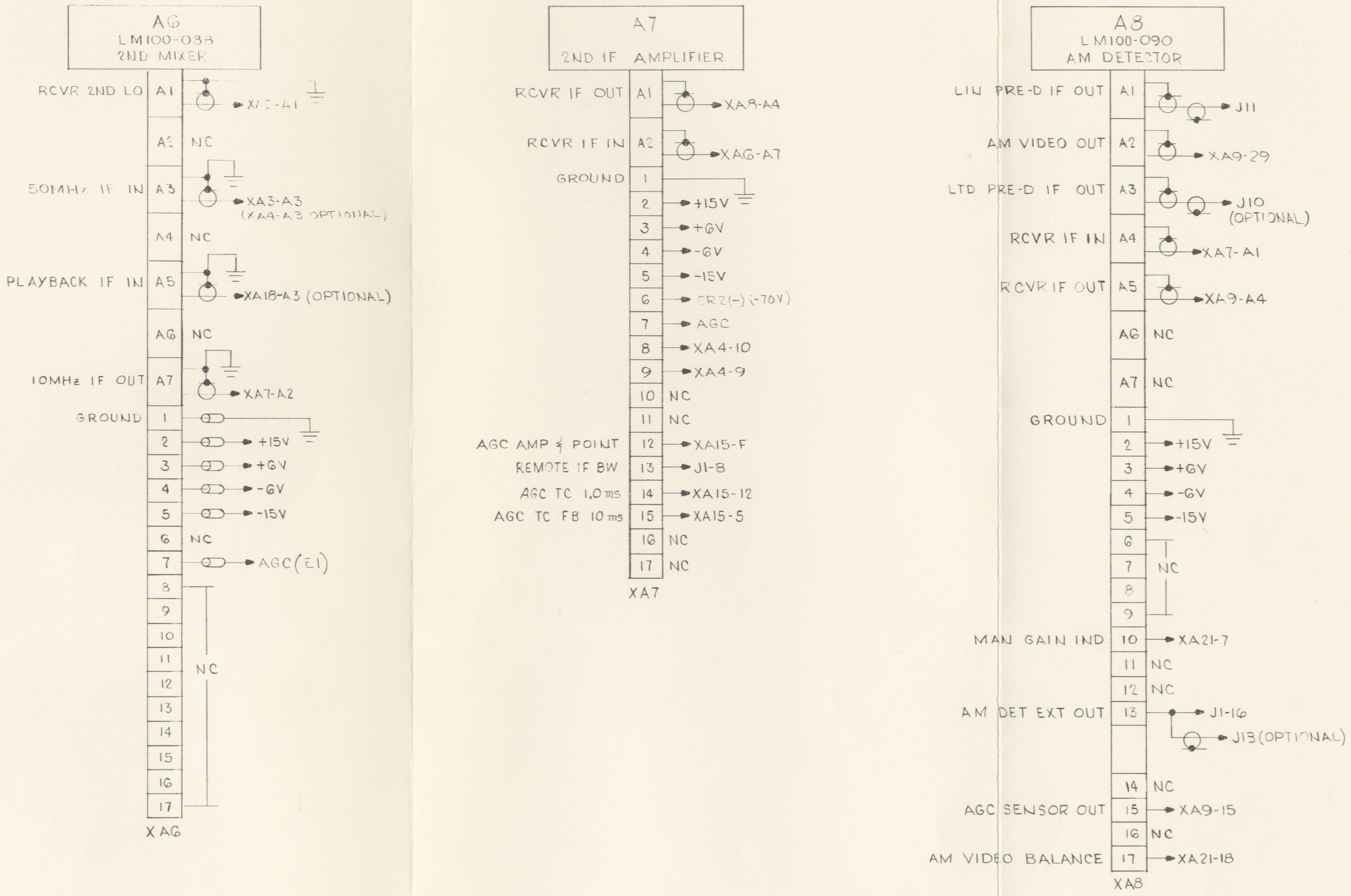


Figure 7-2. 1100-AR Base Chassis,
Schematic Diagram
Sheet 3 of 8

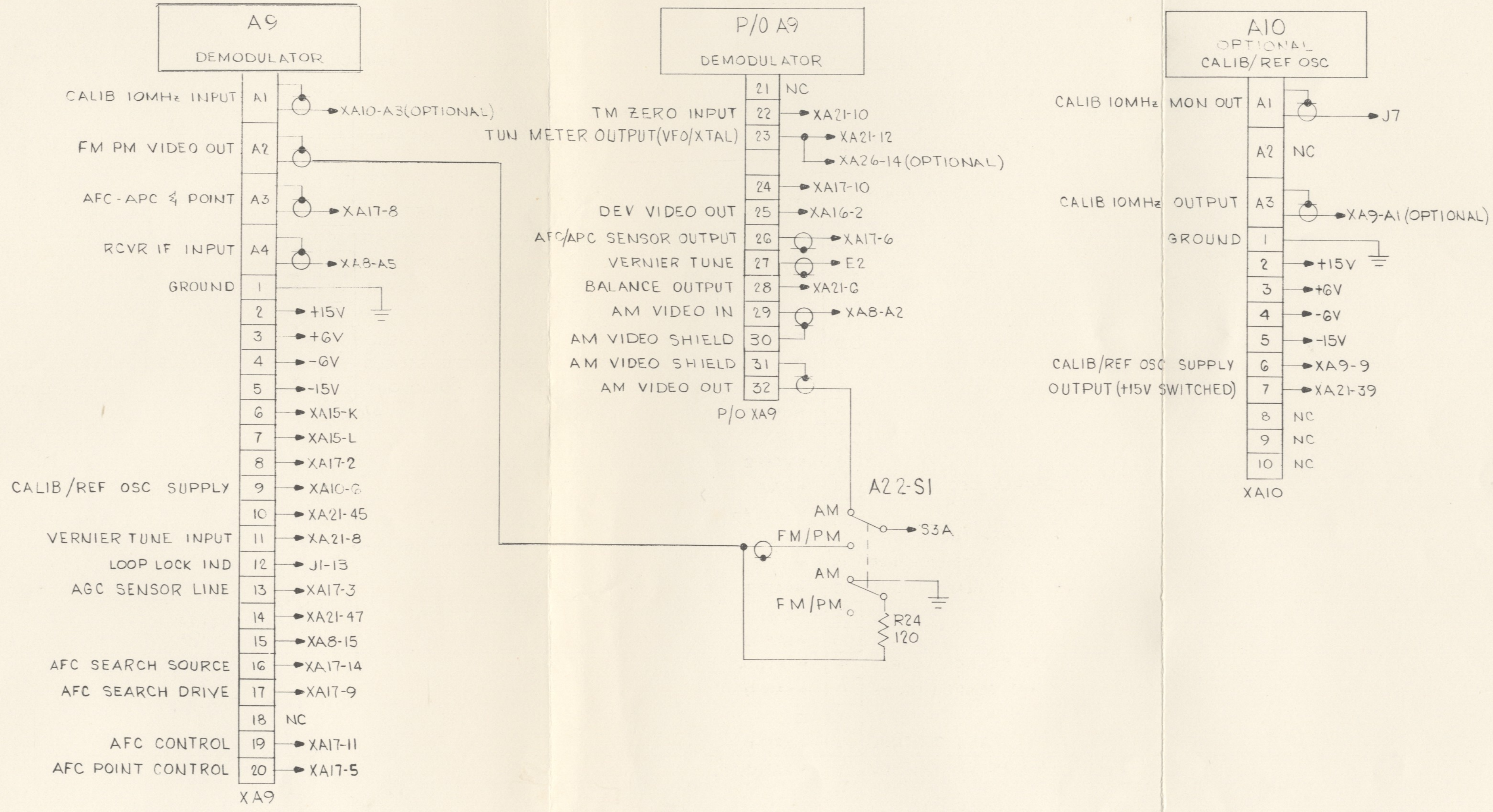


Figure 7-2. 1100-AR Base Chassis,
Schematic Diagram
Sheet 4 of 8

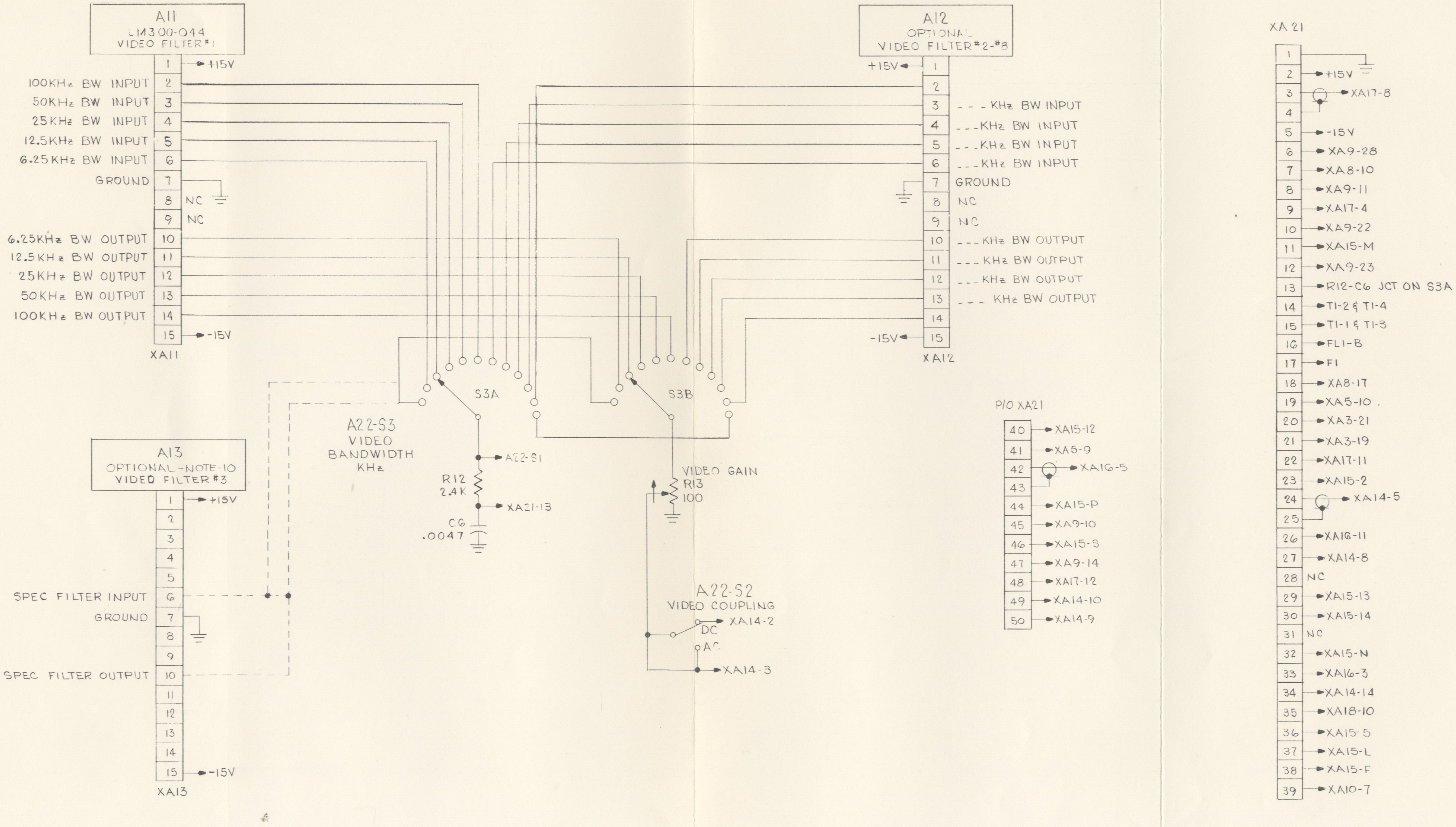


Figure 7-2. 1100-AR Base Chassis,
Schematic Diagram
Sheet 5 of 8

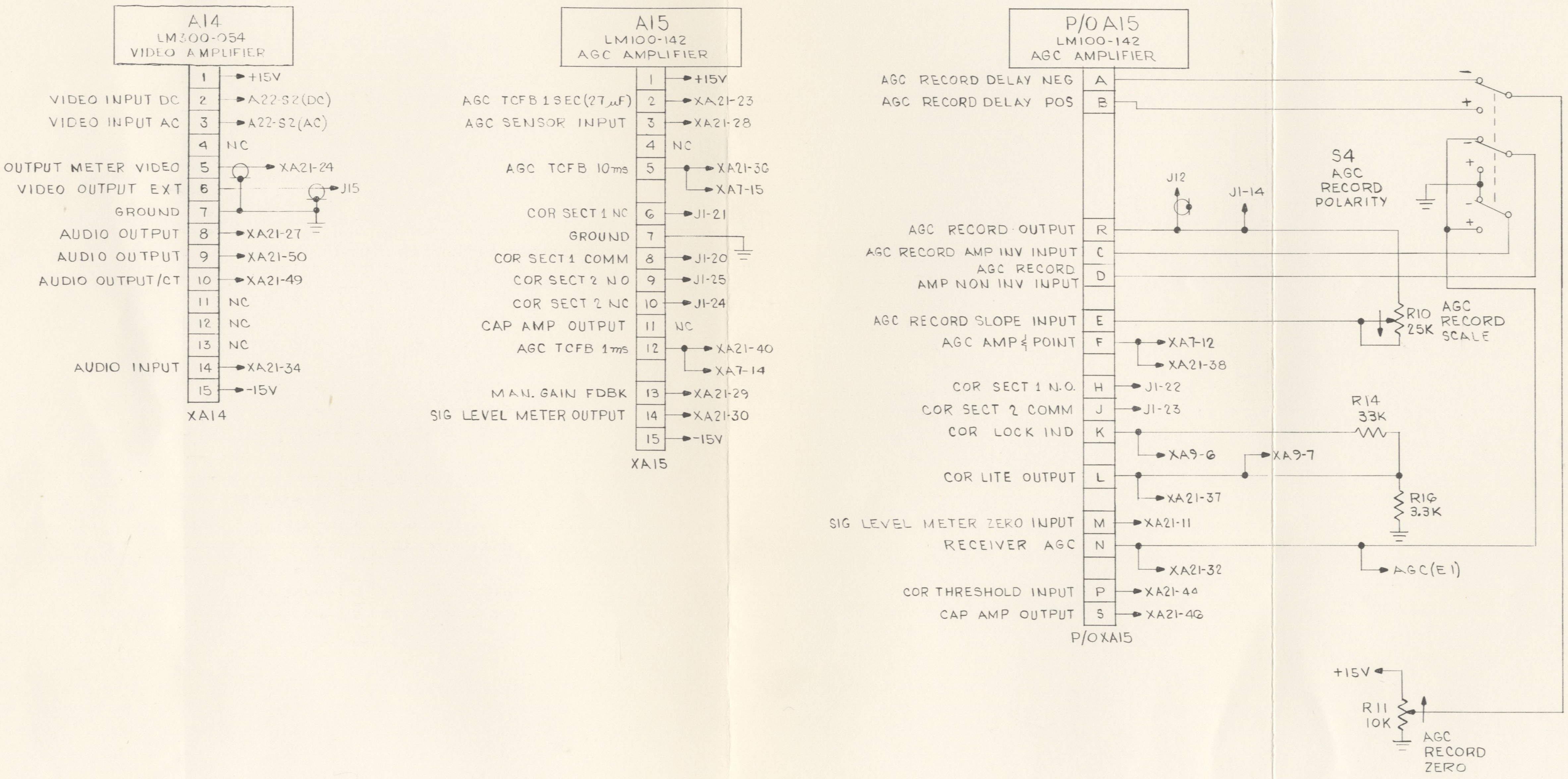


Figure 7-2. 1100-AR Base Chassis, Schematic Diagram Sheet 6 of 8

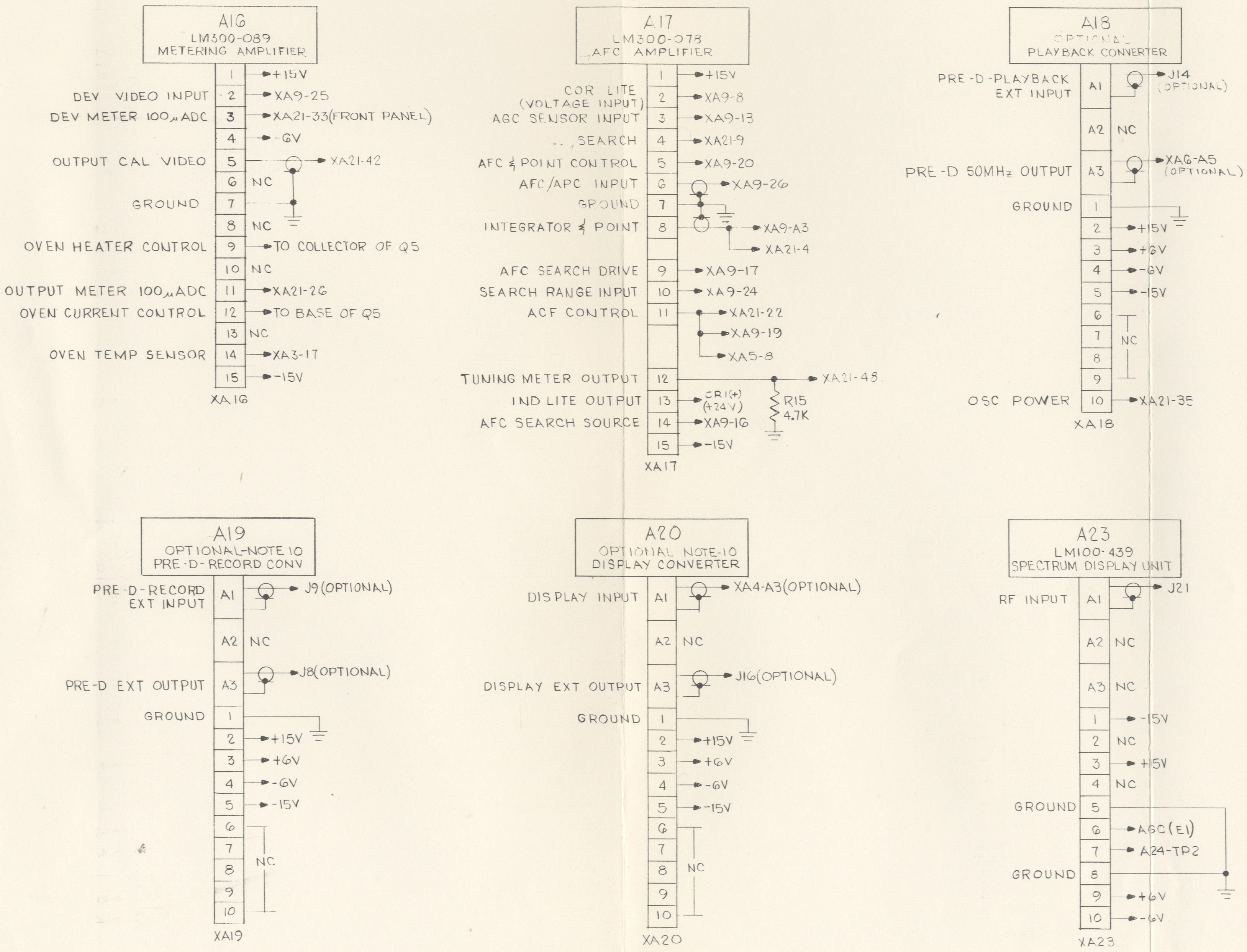


Figure 7-2. 1100-AR Base Chassis, Schematic Diagram Sheet 7 of 8

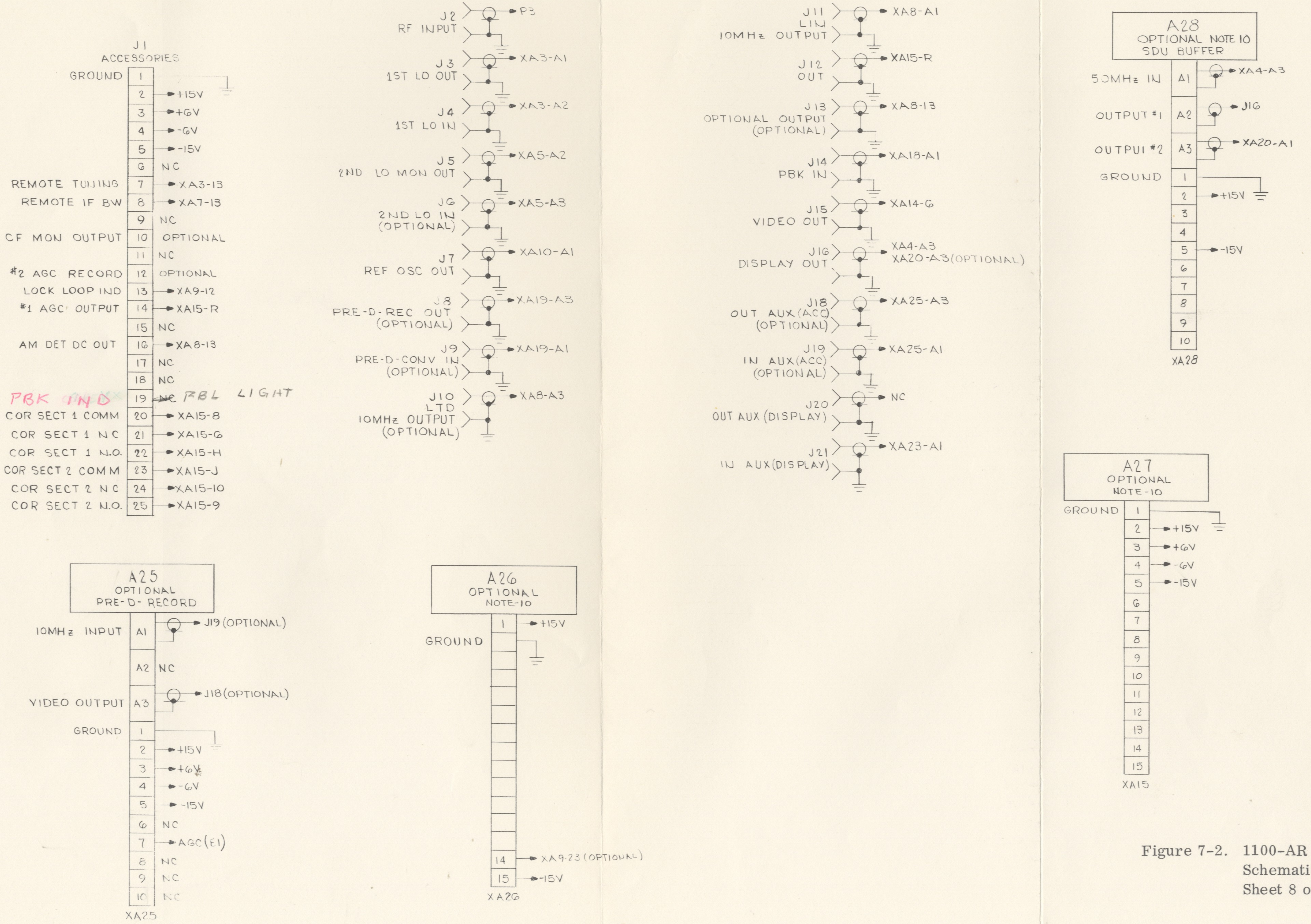


Figure 7-2. 1100-AR Base Chassis, Schematic Diagram Sheet 8 of 8

NOTE:

Values shown are for video filter #1. See table below for video filters #5, #6, and #7 component values.

		Filter	
	#5	#6	#7
C1	6800 pF	6800 pF	6800 pF
C2	1500 pF	1500 pF	1200 pF
C3A	3300 pF	3300 pF	3300 pF
C3B	Not Used	Not Used	Not Used
C4	680 pF	910 pF	680 pF
C5	2200 pF	2200 pF	2200 pF
C6	470 pF	470 pF	470 pF
C7	1800 pF	1800 pF	1800 pF
C8A	390 pF	390 pF	390 pF
C8B	Not Used	Not Used	Not Used
C9	1200 pF	1200 pF	1200 pF
C10	270 pF	270 pF	270 pF
L1	150 µH	150 µH	100 µH
L2	47 µH	47 µH	33 µH
L3	68 µH	100 µH	68 µH
L4	18 µH	22 µH	18 µH
L5	47 µH	47 µH	47 µH
L6	15 µH	15 µH	15 µH
L7	33 µH	33 µH	33 µH
L8	10 µH	10 µH	10 µH
L9	22 µH	22 µH	22 µH
L10	6.8 µH	6.8 µH	6.8 µH
Pin			
6	250 kHz	250 kHz	250 kHz
5	500 kHz	400 kHz	500 kHz
4	750 kHz	750 kHz	750 kHz
3	1000 kHz	1000 kHz	1000 kHz
2	1500 kHz	1500 kHz	1500 kHz

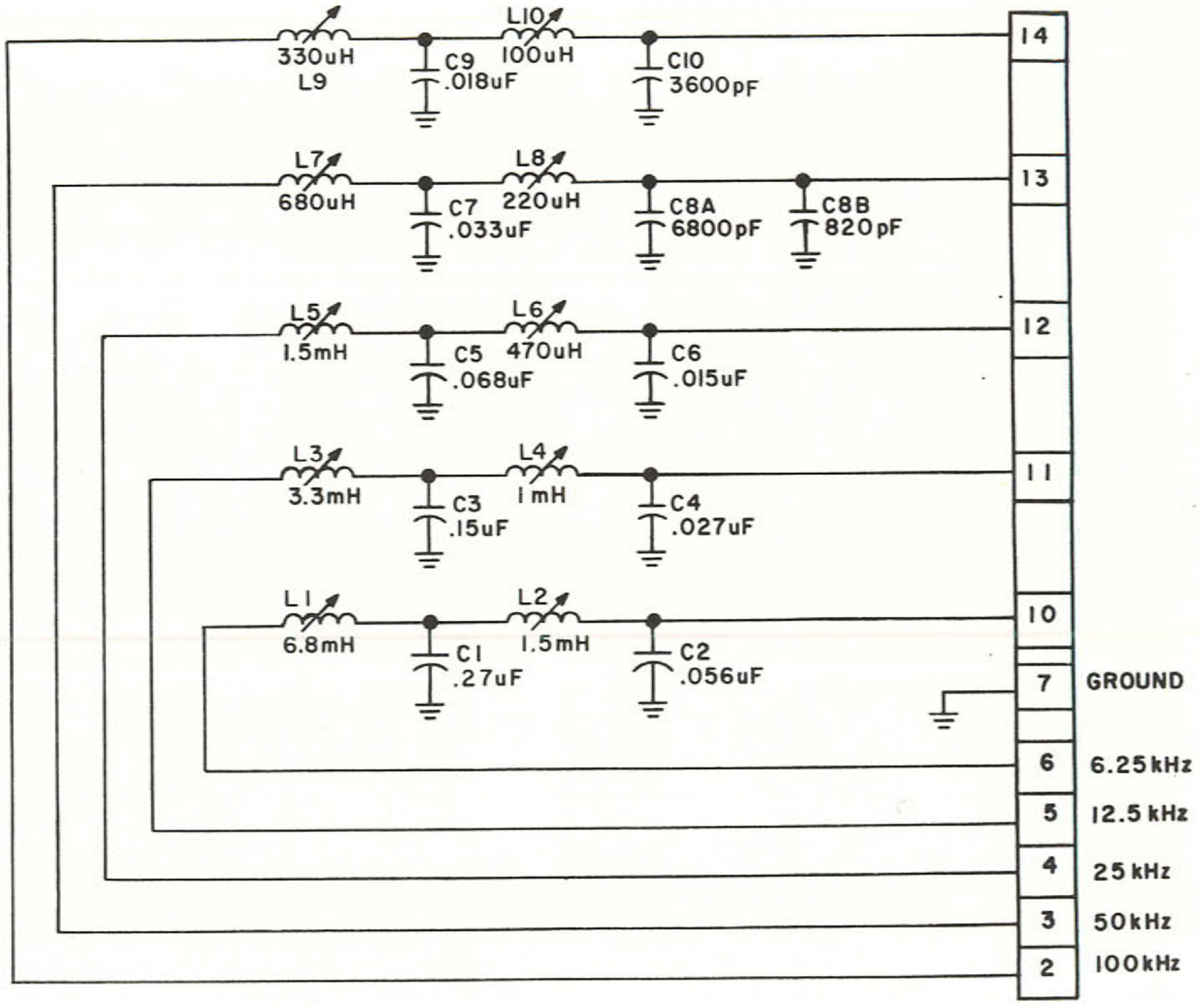


Figure 7-3. Video Filter #1, #5, #6, and #7 Schematic Diagram

NOTE:

Values shown are video filter #2. See table below for video filters #3 and #4 component values.

	Filter	
	#3	#4
C1	6800 pF	5600 pF
C2	1500 pF	1200 pF
C3A	3300 pF	3300 pF
C3B	Not Used	Not Used
C4	680 pF	680 pF
C5	1800 pF	2200 pF
C6	390 pF	470 pF
C7	1200 pF	1800 pF
C8	270 pF	390 pF
L1	150 μH	100 μH
L2	47 μH	33 μH
L3	68 μH	68 μH
L4	18 μH	18 μH
L5	33 μH	47 μH
L6	10 μH	15 μH
L7	22 μH	33 μH
L8	6.8 μH	10 μH
Pin		
6	250 kHz	300 kHz
5	500 kHz	500 kHz
4	1000 kHz	750 kHz
3	1500 kHz	1000 kHz

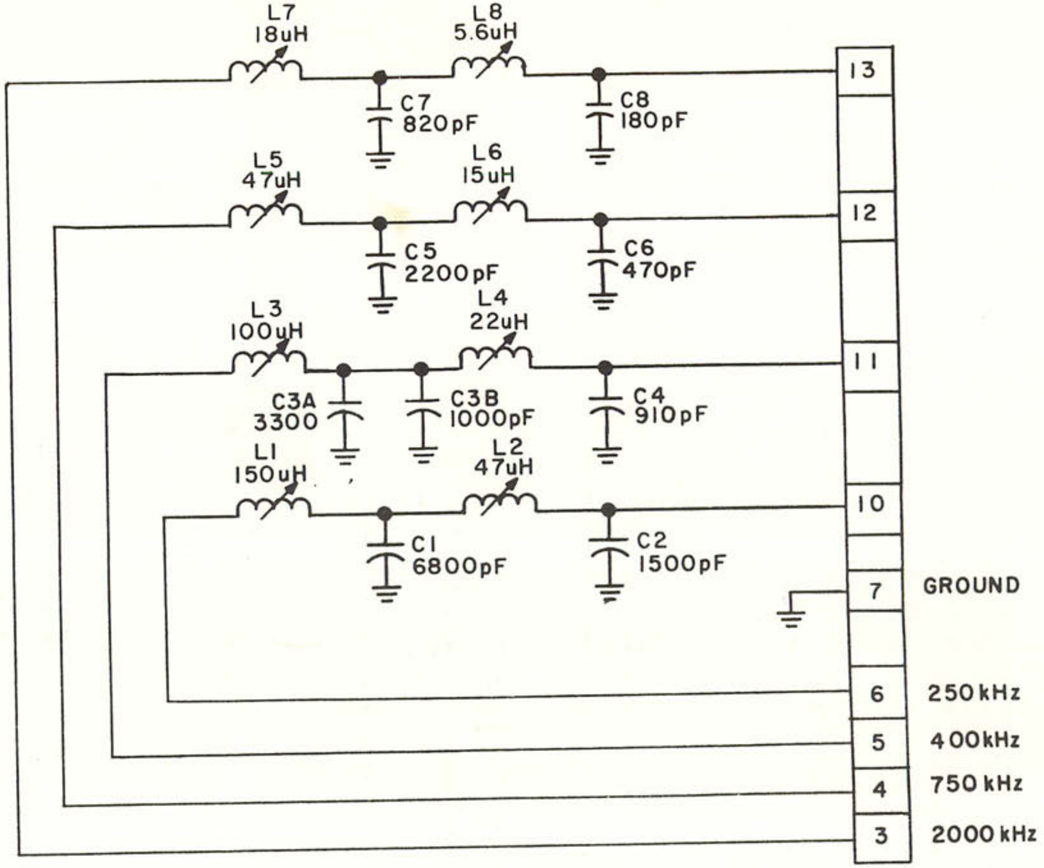
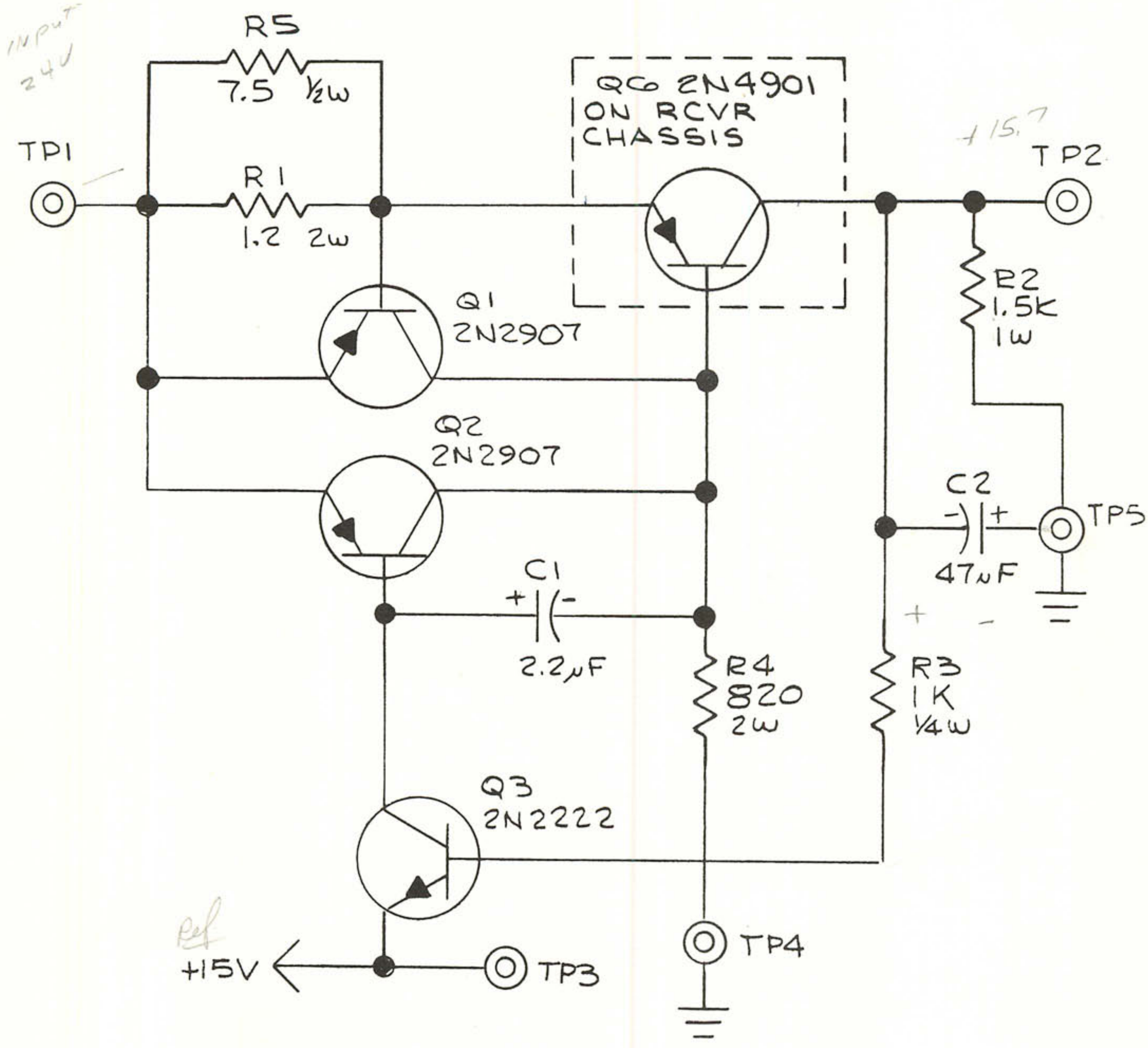


Figure 7-4. Video Filter #2, #3, and #4, Schematic Diagram



C1 Cap., 2.2 µF, 20V, Kemet K2R2E20
C2 Cap., 47 µF, 20V, Kemet K47E20
Q1, Q2, Motorola 2N2907
Q3 Motorola 2N2222
R1 Res., 1.2Ω, ±2%, 2w, IRC BWH
R2 Res., 1.5KΩ, ±5%, 1w, AB GB1525
R3 Res., 1KΩ, ±5%, ¼w, AB CB1025
R4 Res., 820Ω, ±2%, 2w, IRC BWH
R5 Res., 7.5Ω, ±5%, 1/2w, AB EB75R5

Figure 7-5. Display Regulator, Schematic Diagram

SECTION VIII
MODIFICATIONS

This section provides information pertaining to special purpose versions of the Model 1100-AR Telemetry Receiver modified, as necessary, to meet a particular requirement. Data is included in this section only if the manual is supplied with a modified receiver.

SECTION IX
SUBASSEMBLY MODULES

This section contains the instruction booklets for the various internal plug-in subassembly modules contained within the 1100-AR base chassis. Booklets for modules contained in the receiver for which this manual is supplied are included in this section only.

Instruction Booklet

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VOLTAGE REGULATORS

February 1973

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VOLTAGE REGULATORS

GENERAL

The 300-004 and 300-005 voltage regulators are designed for use in Microdyne equipment requiring ±15V and ±6V regulated sources. These regulators are in the form of two separate plug-in printed circuit cards which are held in place in the parent unit by module clips. A parent unit may be equipped with one or both regulators or it may use only one portion of the regulator circuitry depending on the specific power requirements. This booklet provides operational information for both regulators and should be adapted for use with the equipment for which it is supplied.

INSTALLATION

No specific installation procedures are required for the positive and negative regulator boards since these modules are normally supplied as part of a parent unit. Reference should be made to the REPAIR section of the parent unit instruction manual for any unique installation procedures. Each regulator module consists of a single printed circuit card. All interface connections are made through the card edge connector. Refer to figure 1 for the location of the different components.

THEORY OF OPERATION

Since the positive and negative regulators are identical except for the polarity differences of the transistors, diodes, and polarized capacitors, only the positive supply is discussed in the following paragraphs. The schematic diagrams for the regulators are shown in figures 2 and 3.

The positive regulator shown in figure 2 consists of a +15V regulator circuit and a +6V regulator circuit. The +15V regulator is composed of differential amplifier Q2-Q4, buffer Q1, and current limiter Q3, which function to control the parent unit series regulator connected between pins 2, 3, and 5. The +15V level is set by R9 which determines the bias of Q2, the reference level of the differential is determined by zener diode CR2 and buffer Q4. Any change in the normal +15V output of the power supply is amplified by Q2 and coupled by buffer Q1 to the base of the series regulator as bias. By controlling the base bias of the regulator, the current flow and the output voltage at the collector are also controlled.

Current limiter Q3 functions to shut the regulator off should the voltage developed by the current drain across the series emitter resistor exceed approximately 600 mV. In the normal state, Q3 is cut off and the regulator is functioning. If the current flow through the emitter resistor of the base unit series regulator becomes high enough to drop approximately 0.6V, Q3 conducts. This action then cuts off the series regulator through Q2 and Q1.

The +6V regulator is composed of differential amplifier Q5-Q6, buffer Q7, and current limiter Q8. Potentiometer R12 is provided as the 6V adjustment and the emitter resistor of the 6V series regulator determines the conduction point of current limiter Q8.

The negative regulator board shown in figure 3 functions in the same manner as the positive board except that all polarities are reversed.

MAINTENANCE

PREVENTIVE MAINTENANCE

Preventive maintenance requirements for the positive and negative regulators consist of a visual inspection checking for evidence of overheating and corrosion, and calibration of the voltage controls. These tasks should be performed at six-month intervals.

TROUBLESHOOTING

Due to the interrelationship of components in the regulator circuitry, the recommended method of troubleshooting is to check each individual component for proper operation. Begin by checking the pc board for broken circuit strips and connections. Second, check diodes and transistors for shorts and opens. Last, check resistors, capacitors, and potentiometers for proper operation. When checking the components, it may become necessary to disconnect one end from the pc board. In this case, use a medium wattage soldering iron (45 watts) and adequate heat sinks to prevent damage. Avoid excessive heat and pressure on the pc board as this can cause irreparable damage.

The following voltage charts are included to aid in isolating a defective component. When performing the voltage checks, the module should be inserted in the parent unit with a Microdyne 300-423 card extender. The indicated voltages were obtained with an HP412A dc voltmeter and may vary ±10% between modules.

Positive Voltage Regulator

Device	E	B	C
Q1	+20.2	+19.5	+19.1
Q2	+ 8.5	+ 9.2	+18.9
Q3	+20.2	+19.8	+ 9.2
Q4	+ 8.5	+ 9.2	+15.5
Q5	+ 5.4	+ 6.1	+ 7.3
Q6	+ 5.4	+ 6.0	+ 6.0
Q7	+15.0	+14.1	+14.1
Q8	+15.0	+14.8	+ 6.0

Negative Voltage Regulator

Device	E	B	C
Q1	-19.6	-19.0	-18.5
Q2	- 8.4	- 9.0	-18.8
Q3	-19.6	-19.3	- 8.9
Q4	- 8.4	- 9.0	-15.0
Q5	- 5.4	- 6.1	- 7.1
Q6	- 5.4	- 6.0	-14.0
Q7	-14.9	-14.2	-14.0
Q8	-14.9	-14.6	- 6.0

REPAIR

All components in the positive and negative power regulators are considered nonrepairable and must be replaced when found defective. For optimum performance, defective components should be replaced with identical items, as described in the Replacement Parts List.

CALIBRATION

The following procedure should be used to calibrate the positive and negative regulators. When calibrating the positive regulator (300-004), all measured voltages will be positive. When calibrating the negative regulator (300-005), all measured voltages will be negative. The calibration procedure requires the following equipment:

DC Voltmeter	HP412A
Oscilloscope	HP180A
Card Extender	Microdyne 300-423

Procedure:

a. With the unit plugged into a parent unit and power applied, connect the HP412A dc voltmeter to the 15 volt output. Adjust R9 for a 15.0 volt meter indication.

b. Disconnect the meter from the 15 volt output and connect it to the 6 volt output. Adjust R12 for a 6.0 volt meter indication.

c. Disconnect the voltmeter.

d. Connect the HP180A oscilloscope to the 15 volt output and check the ripple; it should be less than 2 mV. If greater than 2 mV, replace transistor Q3.

e. Disconnect the oscilloscope from the 15 volt output and connect it to the 6 volt output.

f. Check the ripple, it should be less than 0.2 mV. If out of tolerance, replace transistor Q6.

g. Disconnect all test equipment.

REPLACEMENT PARTS LIST - Positive Regulator

Reference Designation	Description
C1	Capacitor, tantalum, 15 μF ±10%, 20V, Sprague CS13BE156K
C2	Capacitor, electrolytic, 68 μF ±20%, 10V, Kemet K68E10
C3	Capacitor, electrolytic, 47 μF ±20%, 15V, Kemet K47E20
C4	Capacitor, electrolytic, 100 μF ±20%, 10V, Kemet K100E10
C5	Capacitor, tantalum, 15 μF ±10%, 20V, Sprague CS13BE156K
C6	Capacitor, electrolytic, 100 μF ±20%, 10V, Kemet K100E10
C7	Capacitor, ceramic, 0.01 μF ±20%, 100V, Erie 8131-B106-X5V0-103M
CR1	Diode, JEDEC 1N914
CR2	Diode, zener, 9V, JEDEC 1N937
CR3 thru CR5	Diode, JEDEC 1N914

Replacement Parts List - Positive Regulator, continued

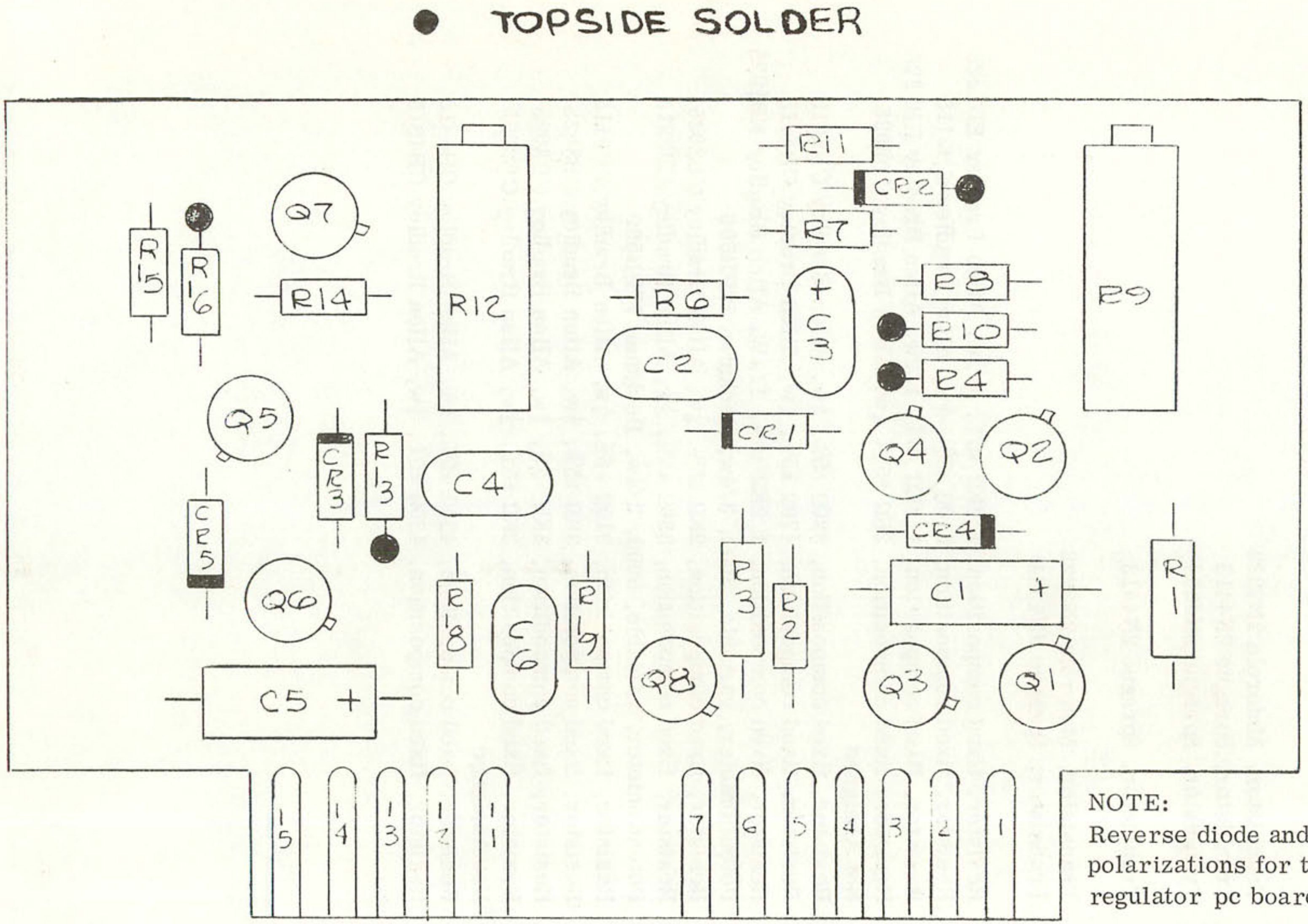
Reference Designation	Description
Q1	Transistor, Motorola 2N2907
Q2	Transistor, Sprague 2N4384
Q3	Transistor, Sprague 2N4413
Q4 thru Q6	Transistor, Sprague 2N4384
Q7	Transistor, Motorola 2N2907
Q8	Transistor, Sprague 2N4413
R1	Resistor, fixed composition, 1.2KΩ ±5%, 1/2w, Allen Bradley EB1225
R2	Resistor, fixed composition, 510Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB5115
R3	Resistor, fixed composition, 1.2KΩ ±5%, 1/2w, Allen Bradley EB1225
R4	Resistor, fixed composition, 2KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB2025
R5	Not Assigned
R6	Resistor, fixed composition, 820Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB8215
R7	Resistor, fixed composition, 470Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB4715
R8	Resistor, fixed composition, 1.2KΩ ±5%, 1/2w, Allen Bradley EB1225
R9	Potentiometer, variable, 500Ω, 3/4w, Beckman 77PR500
R10	Resistor, fixed composition, 2KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB2025
R11	Resistor, fixed composition, 330Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB3315
R12	Potentiometer, variable, 500Ω, 3/4w, Beckman 77PR500
R13	Resistor, fixed composition, 910Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB9115
R14	Resistor, fixed composition, 3KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB3025
R15	Resistor, fixed composition, 3KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB3025
R16	Resistor, fixed composition, 2KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB2025
R17	Not Assigned
R18	Resistor, fixed composition, 430Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB4315
R19	Resistor, fixed composition, 430Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB4315

Negative Regulator

Reference Designation	Description
C1	Capacitor, tantalum, 15 μF ±10% 20V, Sprague CS13BE156K
C2	Capacitor, electrolytic, 68 μF ±20%, 10V, Kemet K68E10
C3	Capacitor, electrolytic, 47 μF ±20%, 20V, Kemet K47E20
C4	Capacitor, electrolytic, 100 μF ±20%, 10V, Kemet K100E10
C5	Capacitor, tantalum, 15 μF ±10%, 20V, Sprague CS13BE156K
C6	Capacitor, electrolytic, 100 μF ±20%, 10V, Kemet K100E10
C7	Capacitor, ceramic, 0.01 μF ±20%, 100V, Erie 8131-B106-X5V0-103M
CR1	Diode, JEDEC 1N914
CR2	Diode, zener, 9V, JEDEC 1N937
CR3 thru CR5	Diode, JEDEC 1N914

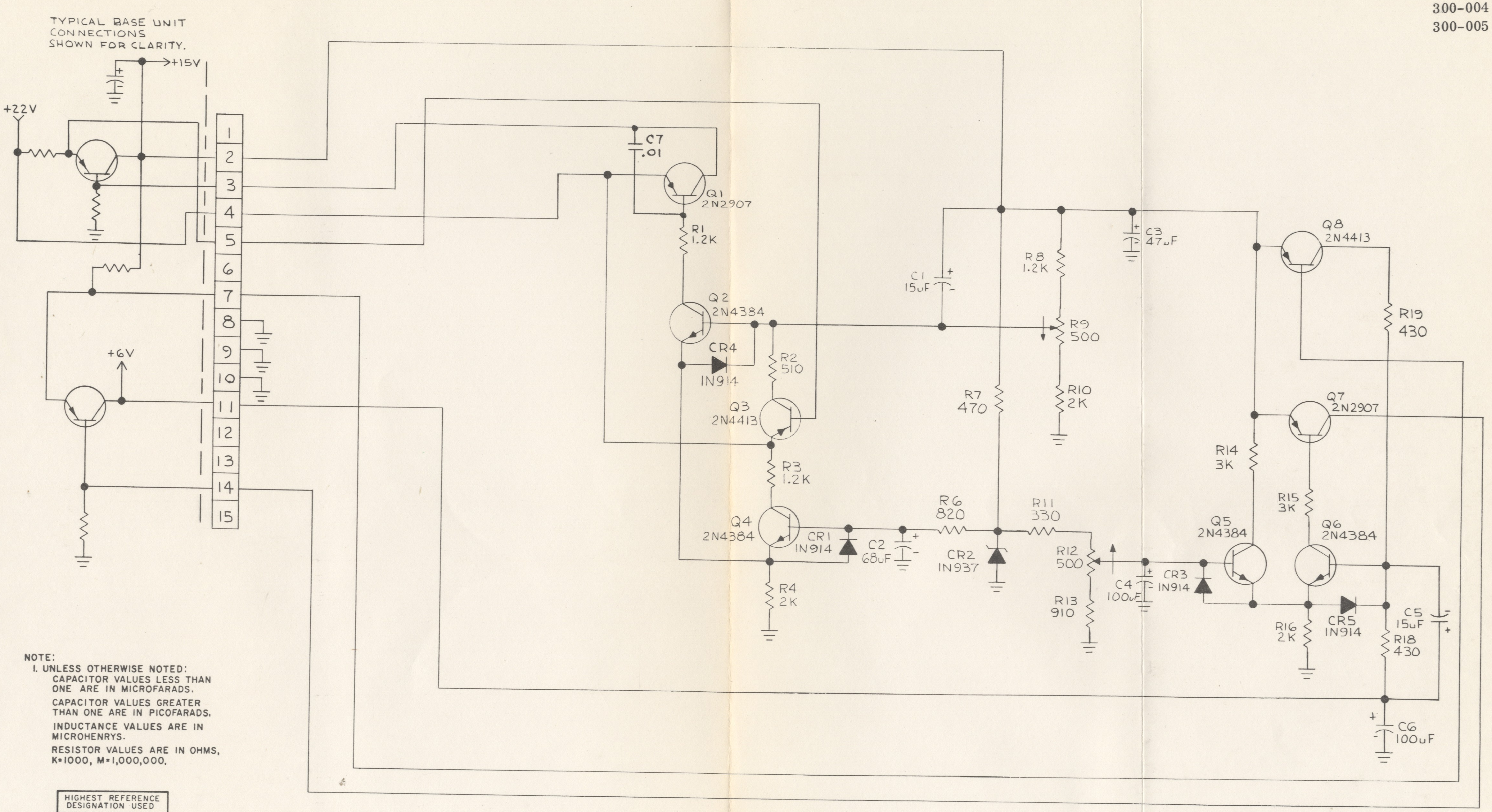
Replacement Parts List - Negative Regulator, continued

Reference Designation	Description
Q1	Transistor, Motorola 2N2222
Q2	Transistor, Sprague 2N4413
Q3	Transistor, Sprague 2N4384
Q4 thru Q6	Transistor, Sprague 2N4413
Q7	Transistor, Motorola 2N2222
Q8	Transistor, Sprague 2N4384
R1	Resistor, fixed composition, 1.2KΩ ±5%, 1/2w, Allen Bradley EB1225
R2	Resistor, fixed composition, 510Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB5115
R3	Resistor, fixed composition, 1.2KΩ ±5%, 1/2w, Allen Bradley EB1225
R4	Resistor, fixed composition, 2KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB2025
R5	Not Assigned
R6	Resistor, fixed composition, 820Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB8215
R7	Resistor, fixed composition, 470Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB4715
R8	Resistor, fixed composition, 1.2KΩ ±5%, 1/2W, Allen Bradley EB1225
R9	Potentiometer, variable, 500Ω, 3/4w, Beckman 77PR500
R10	Resistor, fixed composition, 2KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB2025
R11	Resistor, fixed composition, 330Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB3315
R12	Potentiometer, variable, 500Ω, 3/4w, Beckman 77PR500
R13	Resistor, fixed composition, 910Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB9115
R14	Resistor, fixed composition, 3KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB3025
R15	Resistor, fixed composition, 3KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB3025
R16	Resistor, fixed composition, 2KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB2025
R17	Not Assigned
R18	Resistor, fixed composition, 430Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB4315
R19	Resistor, fixed composition, 430Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB4315



NOTE:
Reverse diode and capacitor polarizations for the negative regulator pc board.

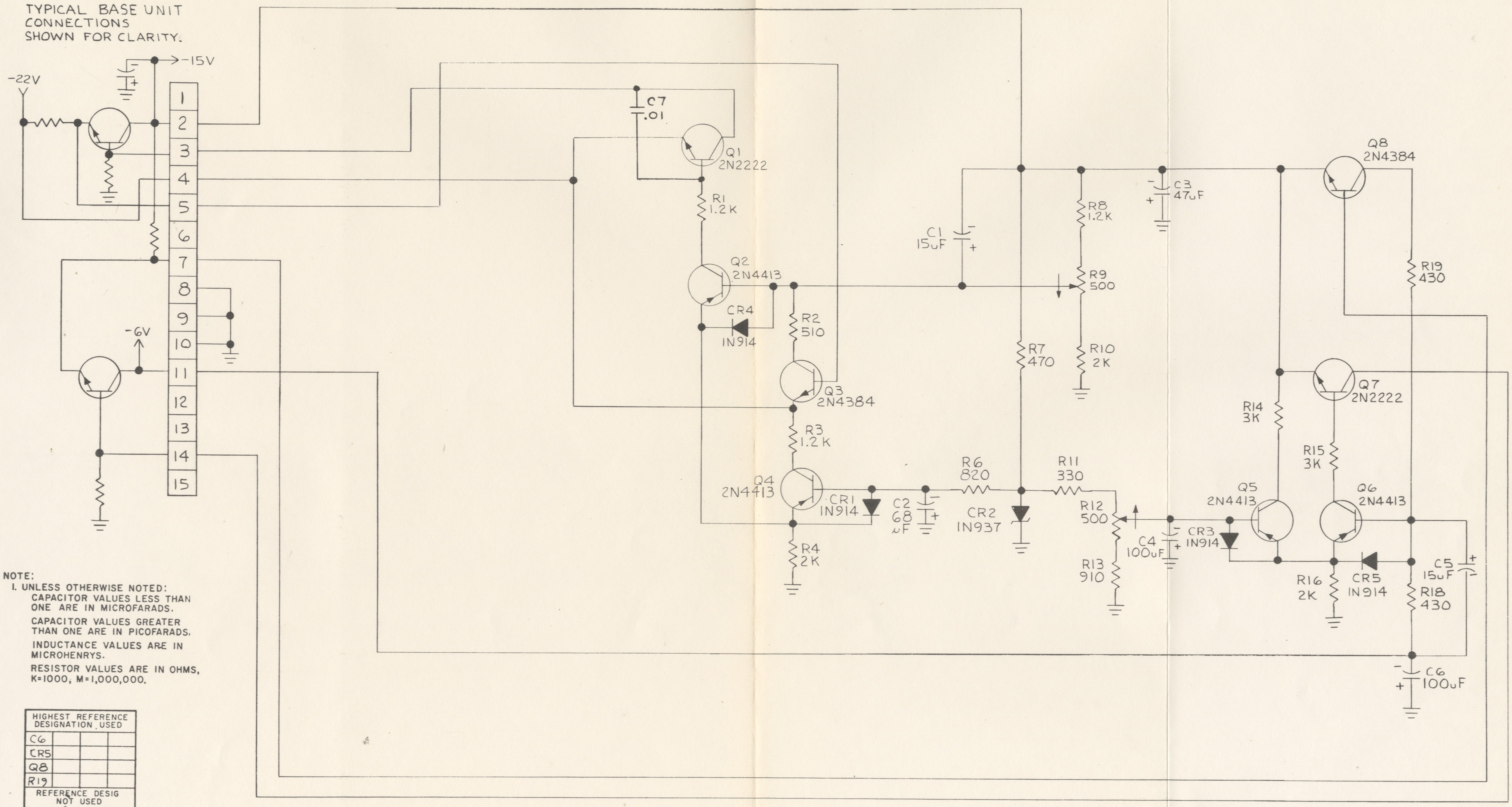
Figure 1. Positive Regulator Component Location



NOTE:
1. UNLESS OTHERWISE NOTED:
CAPACITOR VALUES LESS THAN ONE ARE IN MICROFARADS.
CAPACITOR VALUES GREATER THAN ONE ARE IN PICOFARADS.
INDUCTANCE VALUES ARE IN MICROHENRYS.
RESISTOR VALUES ARE IN OHMS, K=1000, M=1,000,000.

HIGHEST REFERENCE DESIGNATION USED			
C6			
CR5			
Q8			
R19			
REFERENCE DESIG NOT USED			
R5			
R17			

Figure 2. 300-004 Positive Voltage Regulator, Schematic Diagram



NOTE:
1. UNLESS OTHERWISE NOTED:
CAPACITOR VALUES LESS THAN ONE ARE IN MICROFARADS.
CAPACITOR VALUES GREATER THAN ONE ARE IN PICOFARADS.
INDUCTANCE VALUES ARE IN MICROHENRYS.
RESISTOR VALUES ARE IN OHMS, K=1000, M=1,000,000.

HIGHEST REFERENCE DESIGNATION USED			
C6			
CR5			
Q8			
R19			
REFERENCE DESIG NOT USED			
R5			
R17			

Figure 3. 300-005 Negative Voltage Regulator, Schematic Diagram

Revised: 10/74

Instruction Booklet

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STANDARD BANDWIDTH
FIRST IF FILTERS

July 1973

Model 100-229 Narrow Band Filter
Model 100-051 Intermediate Band Filter
Model 100-159 Wide Band Filter

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STANDARD BANDWIDTH IF FILTERS

GENERAL

The standard bandwidth series of first i-f filters is designed for use in various Microdyne telemetry equipment having a first i-f center frequency of 50 MHz. Three separate filter modules comprise the standard series: a 600 kHz narrow band filter, a 1.2 MHz intermediate band filter, and a 4 MHz wide band filter. A wiring diagram of the filter series is shown in figure 1.

INSTALLATION

No specific installation procedure can be applied to the filters since they can be installed in various parent units. Any special procedures required to install the units are given in the parent unit instruction manual.

THEORY OF OPERATION

Each of the filter modules in the standard series consists of an amplifier stage followed by a filtering stage (see figure 1). The 50 MHz i-f input signal is coupled through P1-A1 to the amplifier circuitry A1. Two types of amplifier circuits are employed in the series. A high gain amplifier is employed in the narrow and intermediate bands, and a low gain amplifier is used in the wide band. A schematic diagram of the amplifier circuit is shown in figure 2.

The 50 MHz i-f signal applied to P1-A1 is coupled to grounded base amplifier Q1, amplified and applied to filter FL1 which determines the specific bandwidth: 600 kHz, 1.2 MHz, or 4 MHz. Total gain of the unit is approximately unity which is accomplished by amplifying the signal as necessary to overcome the insertion loss of the filter. The high gain amplifier amplifies the signal by approximately 14 dB and the low gain amplifier amplifies the signal by approximately 5 dB. The pi filters preceding and following the amplifier stage are employed to obtain optimum impedance matching.

The standard bandwidth filters also provide an output for application to an external 50 MHz display unit. A sample of the 50 MHz i-f signal is coupled by C2 to amplifier U1 which is configured as a grounded base amplifier and Darlington pair. The signal is amplified by approximately 6 dB and applied to the display output P1-A3.

MAINTENANCE

PREVENTIVE MAINTENANCE

Preventive maintenance requirements for the first i-f filters consist of a semiannual check of the connector for loose pins and corrosion, and the module itself for signs of damage and loose hardware.

REPAIR

Due to the construction of the modules, it is recommended that they be returned to Microdyne Corporation in the event of failure.

REPLACEMENT PARTS LIST - MAIN CHASSIS - WIDE BAND FILTER

Reference Designation	Description
A1	Amplifier, Low Gain, Microdyne 100-165
FL1	Filter Assembly, Microdyne 100-164
P1	Connector, Cannon DBM-13W3P with three DM 53740-1 coaxial inserts

A1, Amplifier PC Board - Wide Band

A1	Integrated Circuit, RCA CA3018A
C1	Capacitor, ceramic, 91 pF ±5%, 100V, Erie 8131-100-COG-910J
C2	Capacitor, ceramic, 24 pF ±5%, 100V, Erie 8111-100-COG-240J
C3	Capacitor, ceramic, 0.001 μF ±20%, 100V, Erie 8111-100-X5R-102M
C4	Capacitor, ceramic, 180 pF ±5%, 100V, Erie 8131-100-COG-181J
C5 thru C10	Capacitor, ceramic, 0.001 μF ±20%, 100V, Erie 8111-100-X5R-102M
C11	Capacitor, ceramic, 20 pF ±5%, 100V, Erie 8111-100-COG-200J
C12	Capacitor, ceramic, 0.001 μF ±20%, 100V, Erie 8111-100-X5R-102M
C13	Capacitor, ceramic, 47 pF ±5%, 100V, Erie 8131-100-COG-470J
C14	Capacitor, ceramic, 20 pF ±5%, 100V, Erie 8111-100-COG-200J
C15	Capacitor, ceramic, 0.001 μF ±20%, 100V, Erie 8111-100-X5R-102M
C16	Capacitor, ceramic, 62 pF ±5%, 100V, Erie 8131-100-COG-620J
C17	Capacitor, ceramic, 0.001 μF ±20%, 100V, Erie 8111-100-X5R-102M
L1	Inductor, 5.6 μH ±10%, Jeffers 4435-1K
L2	Inductor, 5.6 μH ±10%, Jeffers 4435-1K
L3	Inductor, 0.1 μF, Cambion 7107-01
L4 thru L6	Inductor, 5.6 μH ±10%, Jeffers 4435-1K
L7	Inductor, 0.47 μH, Microdyne 100-303
L8	Inductor, 0.47 μH, Microdyne 100-303
Q1	Transistor, RCA 2N4936
R1	Resistor, fixed composition, 8.2KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB8225
R2	Resistor, fixed composition, 4.7KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB4725

A1, Amplifier PC Board, continued

Reference Designation	Description
R3	Resistor, fixed composition, 510Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB5115
R4	Resistor, fixed composition, 1.2KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1225
R5	Resistor, fixed composition, 510Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB5115
R6	Resistor, fixed composition, 10Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB1005
R7	Resistor, fixed composition, 270Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB2715
R8	Resistor, fixed composition, 2.4KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB2425
R9	Resistor, fixed composition, 1KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1025
R10	Resistor, fixed composition, 510Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB5115
R11	Resistor, fixed composition, 10Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB1005

MAIN CHASSIS - NARROW BAND FILTER

A1	Amplifier, Microdyne 100-163
FL1	Filter Assembly, Microdyne 400-061
P1	Connector, Cannon DBM-13W3P with three DM 53741-1 coaxial inserts
W1	Cable Assembly, Microdyne 201-855-10
W2	Cable Assembly, Microdyne 201-855-5
W3	Cable Assembly, Microdyne 201-855-6
W4	Cable Assembly, Microdyne 201-856-6

A1, Amplifier PC Board - Narrow Band

A1	Integrated Circuit, RCA CA3018A
C1	Capacitor, ceramic, 91 pF ±5%, 100V, Erie 8131-100-COG-910J
C2	Capacitor, ceramic, 0.001 μF ±20%, 100V, Erie 8111-100-X5R-102M
C3	Capacitor, ceramic, 0.001 μF ±20%, 100V, Erie 8111-100-X5R-102M
C4	Capacitor, ceramic, 180 pF ±5%, 100V, Erie 8131-100-COG-181J
C5 thru C10	Capacitor, ceramic, 0.001 μF ±20%, 100V, Erie 8111-100-X5R-102M
C11	Capacitor, ceramic, 5.1 pF ±0.25 pF, 100V, Erie 8101-100-COG-519C
C12	Capacitor, ceramic, 0.001 μF ±20%, 100V, Erie 8111-100-X5R-102M
C13	Capacitor, ceramic, 30 pF ±5%, 100V, Erie 8121-100-COG-300J
C14	Capacitor, ceramic, 20 pF ±5%, 100V, Erie 8111-100-COG-200J
C15	Capacitor, ceramic, 0.001 μF ±20%, 100V, Erie 8111-100-X5R-102M
C16	Capacitor, ceramic, 62 pF ±5%, 100V, Erie 8131-100-COG-620J
C17	Capacitor, ceramic, 0.001 μF ±20%, 100V, Erie 8111-100-X5R-102M
L1	Inductor, 5.6 μH ±10%, Jeffers 4435-1K

A1, Amplifier PC Board, continued

Reference Designation	Description
L2	Inductor, 5.6 μH ±10%, Jeffers 4435-1K
L3	Inductor, 0.1 μH, Cambion 7107-01
L4	Inductor, 5.6 μH ±10%, Jeffers 4435-1K
L5	Inductor, 5.6 μH ±10%, Jeffers 4435-1K
L6	Inductor, 10 μH ±10%, Jeffers 4445-2K
L7	Inductor, 1.0 μH ±10%, Jeffers 4425-6K
L8	Inductor, 0.47 μH ±20%, Jeffers 4425-2M
Q1	Transistor, npn, RCA 2N4936
R1	Resistor, fixed composition, 8.2KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB8225
R2	Resistor, fixed composition, 4.7KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB4725
R3	Resistor, fixed composition, 510Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB5115
R4	Resistor, fixed composition, 1.2KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1225
R5	Resistor, fixed composition, 510Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB5115
R6	Resistor, fixed composition, 10Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB1005
R7	Resistor, fixed composition, 2.4KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB2425
R8	Resistor, fixed composition, 2.4KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB2425
R9	Resistor, fixed composition, 1KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1025
R10	Resistor, fixed composition, 510Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB5115
R11	Resistor, fixed composition, 10Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB1005
R12	Resistor, fixed composition, 470Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB4715

MAIN CHASSIS - INTERMEDIATE BAND

A1	Amplifier, Microdyne 101-163
FL1	Filter Assembly, Microdyne 400-751
P1	Connector, Cannon DBM-13W3P with three DM 53741-1 coaxial inserts

A1, Amplifier PC Board - Intermediate

A1	Integrated Circuit, RCA CA3018A
C1	Capacitor, ceramic, 91 pF ±5%, 100V, Erie 8131-100-COG-910J
C2	Capacitor, ceramic, 24 pF ±5%, 100V, Erie 8111-100-COG-240J
C3	Capacitor, ceramic, 0.001 μF ±20%, 100V, Erie 8111-100-X5R-102M
C4	Capacitor, ceramic, 180 pF ±5%, 100V, Erie 8131-100-COG-181J
C5 thru C10	Capacitor, ceramic, 0.001 μF ±20%, 100V, Erie 8111-100-X5R-102M
C11	Capacitor, ceramic, 5.1 pF ±0.25 pF, 100V, Erie 8101-100-COG-519C
C12	Capacitor, ceramic, 0.001 μF ±20%, 100V, Erie 8111-100-X5R-102M

A1, Amplifier PC Board, continued

Reference Designation	Description
C13	Capacitor, ceramic, 24 pF ±5%, 100V, Erie 8111-100-COG-240J
C14	Capacitor, ceramic, 20 pF ±5%, 100V, Erie 8111-100-COG-200J
C15	Capacitor, ceramic, 0.001 μF ±20%, 100V, Erie 8111-100-X5R-102M
C16	Capacitor, ceramic, 62 pF ±5%, 100V, Erie 8131-100-COG-620J
C17	Capacitor, ceramic, 0.001 μF ±20%, 100V, Erie 8111-100-X5R-102M
L1	Inductor, 5.6 μH ±10%, Jeffers 4435-1K
L2	Inductor, 5.6 μH ±10%, Jeffers 4435-1K
L3	Inductor, 0.1 μH, Cambion 7107-01
L4	Inductor, 5.6 μH ±10%, Jeffers 4435-1K
L5	Inductor, 5.6 μH ±10%, Jeffers 4435-1K
L6	Inductor, 10 μH ±10%, Jeffers 4445-2K
L7	Inductor, 0.47 μH, Microdyne 100-303
L8	Inductor, 0.47 μH, Microdyne 100-303
Q1	Transistor, RCA 2N4936
R1	Resistor, fixed composition, 8.2KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB8225
R2	Resistor, fixed composition, 4.7KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB4725
R3	Resistor, fixed composition, 510Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB5115
R4	Resistor, fixed composition, 1.2KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1225
R5	Resistor, fixed composition, 510Ω ±5%, $\frac{1}{4}$w, Allen Bradley C5115
R6	Resistor, fixed composition, 10Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB1005
R7	Resistor, fixed composition, 1.2KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1225
R8	Resistor, fixed composition, 2.4KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB2425
R9	Resistor, fixed composition, 1KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1025
R10	Resistor, fixed composition, 510Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB5115
R11	Resistor, fixed composition, 10Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB1005

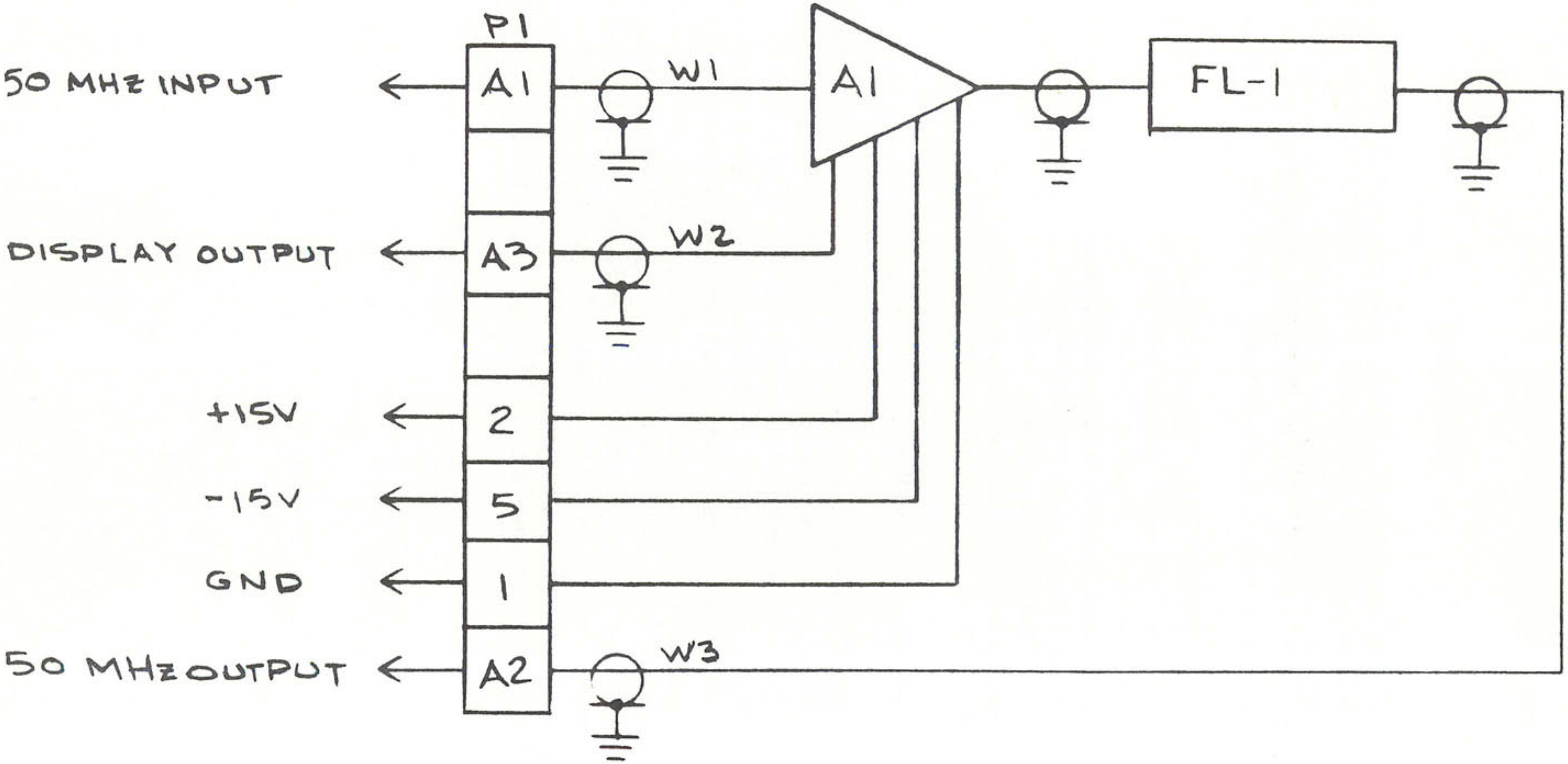
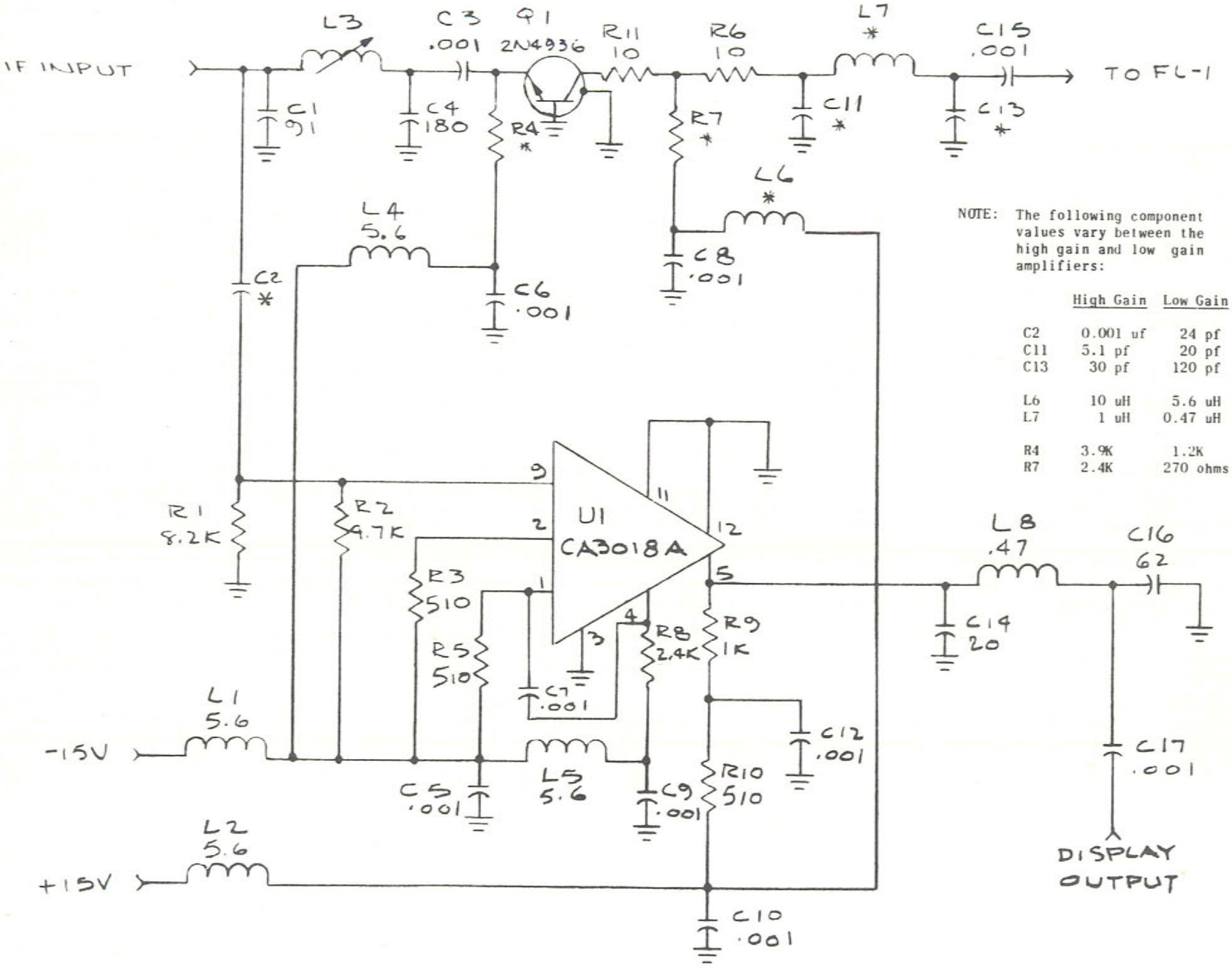


Figure 1. Filter Module Wiring Diagram



NOTE: The following component values vary between the high gain and low gain amplifiers:

	High Gain	Low Gain
C2	0.001 uf	24 pf
C11	5.1 pf	20 pf
C13	30 pf	120 pf
L6	10 uH	5.6 uH
L7	1 uH	0.47 uH
R4	3.9K	1.2K
R7	2.4K	270 ohms

Figure 2. Amplifier Subassembly, Schematic Diagram

Instruction Booklet

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100-088/4181 SECOND MIXER

August 1975

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MICRODYNE
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POST OFFICE BOX 1527 ROCKVILLE, MD. 20850
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ADDENDUM

The 100-088/4181 Second Mixer is a 100-088 second mixer that has been modified for increased bandwidth. The modification consists of changing the following component values:

C5 from 39 pF to 51 pF, Erie 8131-100-COG-510J
C7 from 110 pF to 220 pF, Erie 8121-100-COG-221J
C17 from 12 pF to Not Assigned
C25 from 220 pF to 150 pF, Erie 8121-100-COG-151J
C23 from 130 pF to Not Assigned
R7 from 510Ω to 620Ω ±5%, Allen Bradley CB6215

The attached booklet may be used to service the 100-088/4181 Second Mixer by incorporating the above changes and using the following alignment procedures:

1. Connect extender module between the parent unit and the second mixer. Set the parent unit 2ND LO MODE switch to off.

2. Using the frequency counter, set the signal generator for 60 MHz, -40 dBm output.

3. Connect the signal generator to the external l-o input on the receiver rear apron.

4. Remove the receiver first i-f filter, if applicable.

5. Connect the sweep generator to the oscilloscope.

6. Connect the rf output of the sweep generator to the input side of C2. Set the attenuator to 20 dB and its frequency to 50 MHz. Adjust the vertical sensitivity of the oscilloscope for a reasonable response.

7. Adjust L3 and L6 for a maximum deflection of the 50 MHz marker.

8. Tune the VS-50 sweep generator to 70 MHz and increase its output by 20 dB. Adjust the vertical control on the oscilloscope for a usable reasponse. Adjust L13 on the mixer for a null in the response at 70 MHz.

9. Adjust L2, L11, and L12 for a bandpass response centering at 50 MHz with 47 MHz and 53 MHz less than 0.5 dB down from the 50 MHz.

10. Disconnect the sweep generator and connect the signal generator in its place. Set the receiver manual gain control for 0V agc at pin 7 of the module connector.

11. Connect the HP3406A, terminated in 50 ohms, to the second i-f output (A7).

12. Set the signal generator frequency to 50 MHz at -20 dBm.

13. Adjust R14 for a -20 dB(+1 dB, -2 dB) indication on the HP3406A.

14. Set the receiver manual gain control for -5.0V agc and adjust R26 for a -6(±0.5)dB drop at A7 (HP3406).

15. Disconnect the test equipment.

Instruction Booklet

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100-088
SECOND MIXER

October 1972

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SECOND MIXER

GENERAL

The 100-088 second mixer is designed for use with Microdyne telemetry receivers and is utilized to heterodyne the 50 MHz first i-f signal with the 60 MHz output of the second local oscillator. The result is the 10 MHz second i-f signal. An input is also provided on the module to permit recorded signals to be injected for predetection playback operation of the receiver. A schematic diagram of the mixer is shown in figure 2.

INSTALLATION

The module is composed of a printed circuit card mounted in a wraparound metal housing which plugs into a receptacle in the parent receiver. All signal and power connections are made to the receiver through a single connector located on the bottom of the module. Since the module can be installed in various receiver chassis, any installation procedures are listed in the overall receiver instruction manual REPAIR procedures.

THEORY OF OPERATION

Module circuitry is made up of integrated circuits U1, U2, low noise amplifiers Q1 and Q2, FET Q3, and mixer U3. The second mixer functions to convert the 50 MHz carrier from the rf tuner to the 10 MHz second i-f frequency. The second local oscillator signal is applied at P1-A1, limited, and then mixed with the rf carrier in U3. This results in a difference frequency output at the output connector with all other components attenuated.

The 60 MHz local oscillator input is coupled through C1 to the base of the input amplifier Q1. The output circuit of Q1 is tuned to 60 MHz by L3, C8, and C9, and couples the 60 MHz signal to the input of limiter U1. Here the signal is limited to a level of approximately -20 dB. From U1, the 60 MHz signal is coupled through tuned circuit C13, L6, C15, and C21 to port W of mixer U3. The tuned circuit at the output of U1 is loaded with a 51 ohm resistor to provide a 50 ohm source impedance to U3.

The 50 MHz i-f input from the rf tuner is applied to the grounded base, low noise amplifier Q2 through an impedance matching network L2, C5, and C7. R10 determines the gain of the amplifier, and L9, C17, and C18 control the impedance match to the rf input port of U3. The second i-f output is fed through a 16 MHz cutoff elliptic function low pass filter which rejects all local oscillator signals, noise, and other signals resulting from the mixer. The 10 MHz output of the filter is applied to the module output at P1-A7.

FET transistor Q3 is used as a variable load at the output of Q2 and handles agc voltage for that stage. The amplifier action of the differential pair in U2, one of which is in series with the FET, forces dc current through Q3 and varies the resistance. When no current flows through the FET, as would occur with zero volts agc, the impedance is high and the gain is approximately 6 dB. When the input at U2 increases toward -5V, the current flowing through the transistor in series with Q3 lowers the resistance of the FET. The parallel resistance of R10 and Q3 changes correspondingly, thus compensating for change in input signal level. R14 is adjusted so that the gain at 0V is unity from the first i-f input to the second i-f output. When the receiver is in the playback mode, the predetected signal is applied to the mixer through R10.

MAINTENANCE

PREVENTIVE MAINTENANCE

Preventive maintenance requirements for the second mixer consist of a semiannual check of the connector for corrosion and loose pins, and the module itself for signs of damage and loose components. Any discrepancies should be corrected by component replacement or module substitution.

TROUBLESHOOTING

In the event of a malfunction, the trouble must first be isolated to a certain section of the module circuitry: integrated circuits, transistors, and mixer U3. This is accomplished by using normal signal tracing methods. Once the defective circuit is located, the faulty component should be detected and replaced. The voltage chart in table 1 is provided to aid in fault isolation.

Table 1. Voltage Chart

Device	1	2	3	4	5	6	7
	E	B	C				
Q1	-8.2	-7.5	0	0			
Q2	5.2	4.7	3	0			
U1	-	-	-	-	10	15	15
U2	-	-	-	-0.7	15	0	- 0.7

Refer to figure 1 for component location of the second mixer.

REPAIR

All components used in the second mixer are non-repairable and must be replaced when found defective. A list of replacement parts is given in this booklet and the recommended procedure for replacing components mounted on printed circuit boards is given in the parent unit REPAIR procedures.

ALIGNMENT

After the fault has been located and corrected, the module should be realigned. The test equipment necessary for alignment is as follows:

Extender Module	Microdyne 300-355
Frequency Counter	HP5245L
Broadband Sampling Voltmeter	HP3406A
Voltmeter	HP412A
Signal Generator	HP606A
RF Detector	HP8471A
Sweep Generator	VS-80

Procedure:

a. Local Oscillator Limiter/Amplifier

1. Connect extender module between the parent unit and the second mixer. Set the parent unit 2ND LO MODE switch to OFF.
2. Connect the signal generator to the external l-o input on the receiver rear apron.
3. Set the signal generator for 60 MHz, -10 dBm output, as indicated on the frequency counter.
4. Adjust L3 and L6 for a maximum indication at port W of U3 as indicated on the HP3406A; this level should be +5 dBm.

b. RF Amplifier

1. Remove the receiver first i-f filter, if applicable.
2. Attach a BNC clip lead adapter to the HP8471A detector and to port A of U3.
3. Connect VS-80 sweep generator to the oscilloscope.
4. Connect the rf output of the sweep generator to the input side of C2.
5. Set the attenuator to 20 dB and adjust the vertical sensitivity of the oscilloscope for a reasonable response.
6. Adjust L2 for a symmetrical response centered at 50 MHz.
7. Set the receiver 2ND LO MODE switch to crystal (XTAL) operation.
8. Connect the HP8471A detector to the second i-f output using clipleads.
9. Adjust the vertical control on the oscilloscope for a usable response.
10. Adjust L11 and L12 for a low pass response with 1 dB cutoff at 16 MHz.
11. Disconnect the sweep generator and connect the signal generator in its place. Set the receiver manual gain control for 0V agc at pin 7 of the module connector.
12. Connect the HP3406A , terminated in 50 ohms, to the second i-f output pin.
13. Set the signal generator frequency to 50 MHz at -21 dBm.
14. Adjust R14 for a -21 dB(±0.2 dB) output on the HP3406A 0 dB scale.
15. Set the receiver manual gain control for -4.8V agc and adjust R26 for a - -6.5(±0.5 dB) level on the 0 dB meter range.
16. Disconnect the test equipment.

REPLACEMENT PARTS LIST

The following replacement parts list provides the reference designation, description, manufacturer, and manufacturer's part numbers for each electrical component used in the second mixer. Include all information when ordering spare or replacement components.

Reference Designation	Description
C1 thru C4	Capacitor, ceramic, 0.001 µF ±20%, 100V, Erie 8111-100-X5R-102M
C5	Capacitor, ceramic, 39 pF ±5%, 100V, Erie 8121-100-COG-390J
C6	Capacitor, ceramic, 0.001 µF ±20%, 100V, Erie 8111-100-X5R-102M
C7	Capacitor, ceramic, 110 pF ±5%, 100V, Erie 8121-100-COG-111J
C8	Capacitor, ceramic, 27 pF ±5%, 100V, Erie 8121-100-COG-270J
C9	Capacitor, ceramic, 27 pF ±5%, 100V, Erie 8121-100-COG-270J
C10	Capacitor, ceramic, 0.001 µF ±20%, 100V, Erie 8111-100-X5R-102M
C11	Not Assigned
C12 thru C14	Capacitor, ceramic, 0.001 µF ±20%, 100V, Erie 8111-100-X5R-102M
C15	Capacitor, ceramic, 3.9 pF ±0.1 pF,100V, Erie 8101-100-COG-399C
C16	Capacitor, ceramic, 0.001 µF ±20%, 100V, Erie 8111-100-X5R-102M
C17	Capacitor, ceramic, 12 pF ±5%, 100V, Erie 8101-100-COG-120J
C18	Capacitor, ceramic, 51 pF ±5%, 100V, Erie 8121-100-COG-510J
C19	Capacitor, ceramic, 0.001 µF ±20%, 100V, Erie 8111-100-X5R-102M
C20	Capacitor, ceramic, 0.001 µF ±20%, 100V, Erie 8111-100-X5R-102M
C21	Capacitor, ceramic, 15 pF ±5%, 100V, Erie 8111-100-COG-150J
C22	Capacitor, ceramic, 0.01 µF ±20%, 100V, Erie 8121-B106-X5V0-103M
C23	Capacitor, ceramic, 130 pF ±5%, 100V, Erie 8131-100-COG-131J
C24	Capacitor, ceramic, 180 pF ±5%, 100V, Erie 8131-100-COG-181J
C25	Capacitor, ceramic, 220 pF ±5%, 100V, Erie 8131-100-COG-221J
C26	Capacitor, ceramic, 360 pF ±5%, 100V, Erie 8121-100-COG-361J
C27	Capacitor, ceramic, 180 pF ±5%, 100V, Erie 8131-100-COG-181J
C28	Capacitor, ceramic, 0.01 µF ±20%, 100V, Erie 8121-B106-X5V0-103M
C29	Capacitor, ceramic, 0.001 µF ±20%, 100V, Erie 8111-100-X5R-102M
C30	Capacitor, ceramic, 0.001 µF ±20%, 100V, Erie 8111-100-X5R-102M
L1	Inductor, fixed, 4.7 µH ±10%, Jeffers 4425-14K
L2	Inductor, variable, 0.1 µH, Cambion 7101-1
L3	Inductor, variable, 0.33 µH, Cambion 7107-7
L4	Inductor, fixed, 5.6 µH ±10%, Jeffers 4435-1K
L5	Inductor, fixed, 4.7 µH ±10%, Jeffers 4425-14K
L6	Inductor, variable, 0.33 µH, Cambion 7107-7
L7	Inductor, fixed, 4.7 µH ±10%, Jeffers 4425-14K
L8	Not Assigned

Replacement Parts List, continued

Reference Designation	Description
L9	Inductor, fixed, 0.56 µH ±10%, Jeffers 4425-3K
L10	Inductor, fixed, 10 µH ±10%, Jeffers 4445-2K
L11	Inductor, variable, 0.68 µH, Cambion 7107-11
L12	Inductor, variable, 0.47 µH, Cambion 7107-09
L13	Inductor, Microdyne 200-850
P1	Connector, Cannon DBM-24W7P
Q1	Transistor, RCA 2N5179
Q2	Transistor, RCA 2N4936
Q3	Transistor, field effect, Union Carbide 2N4416
R1	Resistor, fixed composition, 51Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB5105
R2	Resistor, fixed composition, 15KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1535
R3	Resistor, fixed composition, 15KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1535
R4	Not Assigned
R5	Resistor, fixed composition, 51Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB5105
R6	Resistor, fixed composition, 1KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1025
R7	Resistor, fixed composition, 510Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB5115
R8	Resistor, fixed composition, 1.6KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1625
R9	Resistor, fixed composition, 3KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB3025
R10	Resistor, fixed composition, 510Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB5115
R11	Resistor, fixed composition, 510Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB5115
R12	Resistor, fixed composition, 2KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB2025
R13	Resistor, fixed composition, 1KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1025
R14	Potentiometer, 10KΩ, Beckman 77PR10K
R15	Resistor, fixed composition, 7.5KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB7525
R16	Resistor, fixed composition, 51Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB5105
R17	Resistor, fixed composition, 1KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1025
R18	Resistor, fixed composition, 51Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB5105
R19	Resistor, fixed composition, 100Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB1015
R20	Resistor, fixed composition, 10Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB1005
R21	Resistor, fixed composition, 1.5KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1525
R22	Resistor, fixed composition, 1KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1025
R23	Resistor, fixed composition, 510Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB5115
R24	Resistor, fixed composition, 4.3KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB4325
R26	Potentiometer, composition, 5KΩ, Bourns 3329H-1-502
U1	Integrated Circuit, RCA CA3028A
U2	Integrated Circuit, RCA CA3018A
U3	Balanced Mixer, Microdyne 201-057

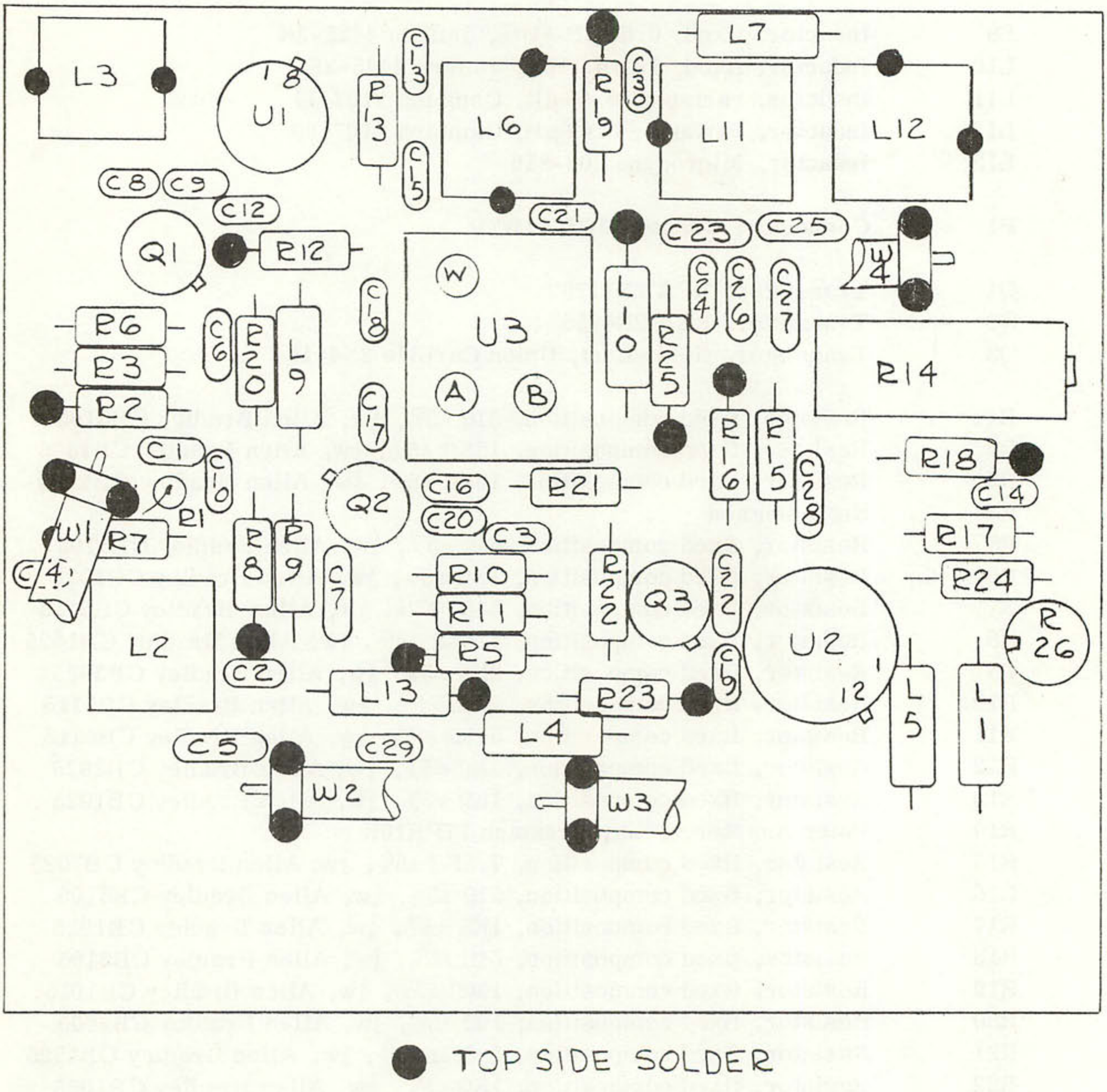
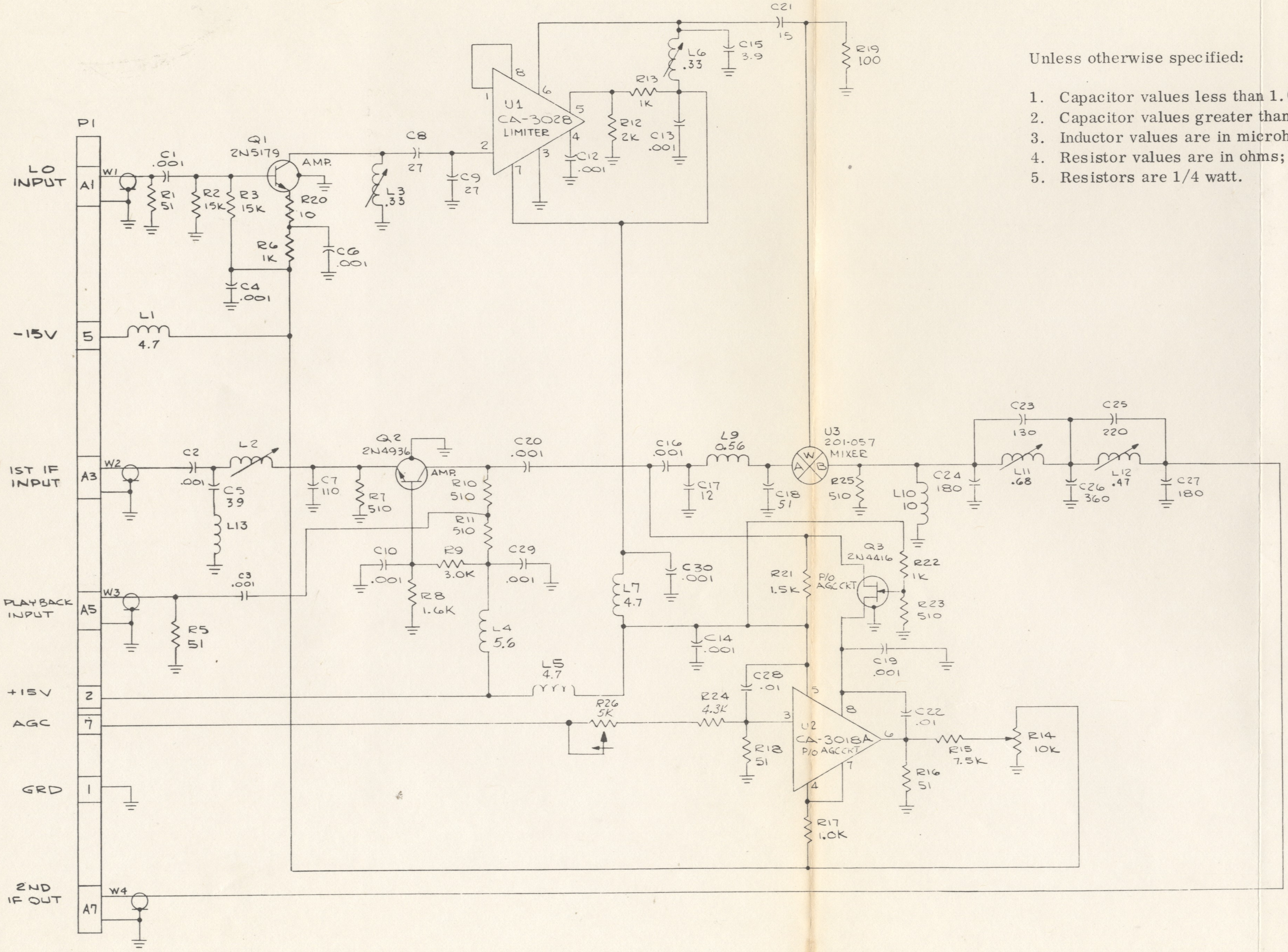


Figure 1. Component Location



Unless otherwise specified:

1. Capacitor values less than 1.0 are in microfarads.
2. Capacitor values greater than 1.0 are in picofarads.
3. Inductor values are in microhenrys.
4. Resistor values are in ohms; K = X1000.
5. Resistors are 1/4 watt.

HIGHEST REF DESIGNATIONS				
	P1			
C30	U3			
L12	R26			
Q3				
REF DESIGNATIONS NOT USED				
L8	C11	R4		

Figure 2. Second Mixer Module, Schematic Diagram 400-006

Instruction Booklet

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101-342
VOLTAGE CONTROLLED CRYSTAL OSCILLATOR

November 1974

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VOLTAGE-CONTROLLED CRYSTAL OSCILLATOR

GENERAL

The 101-342 Voltage-Controlled Oscillator (VCXO) is designed for use with Microdyne telemetry receivers and functions as the second local oscillator. The VCXO generates a 60 MHz signal for application to the associated second mixer.

A schematic diagram of the VCXO is shown in figure 2. The oscillator consists basically of a voltage-controlled crystal oscillator U1, a summing amplifier U2, and a multipole L-C filter. The mean frequency of the oscillator is 60 MHz. The oscillator frequency is controlled by the output of U2 which sums its three inputs to develope the tuning voltage for U1.

INSTALLATION

The module is composed of a printed circuit card mounted in a wraparound metal housing which plugs into a receptacle in the parent receiver. All signal and power connections are made to the VCXO through a single connector located on the bottom of the module. Since the module can be installed in various receiver chassis, any special installation procedures are presented in the overall receiver instruction manual.

MAINTENANCE

PREVENTIVE MAINTENANCE

Preventive maintenance requirements for the second local oscillator consists of a semi-annual check of the connector for corrosion and loose pins, and the module itself for signs of damage and loose components.

TROUBLESHOOTING

In the event of a malfunction, the trouble should first be isolated to a certain section of the module circuitry; crystal oscillator, summing amplifier, or output filter. This is accomplished by using normal signal tracing methods. Once the defective circuit is found, the faulty component should be located and replaced.

REPAIR

All components used in the second l-o module are non-repairable and must be replaced when found defective. A list of replaceable components is given in this booklet and a recommended procedure for replacing components mounted on a printed circuit board is given in the parent unit REPAIR section.

ALIGNMENT

After the fault has been located and corrected, the module should be realigned.

ALIGNMENT

After the fault has been located and corrected, the module should be realigned.

The test equipment necessary for alignment is as follows:

Extender Module	Microdyne 300-355
Frequency Counter	HP5245L
DC Voltmeter	HP412A
Broadband Sampling Voltmeter	HP 3406A w/50Ω Tee/Termination

a. Connect the second local oscillator module to the parent unit through extender module.

b. Place the front panel 2ND LO MODE switch to the XTAL position.

c. Connect the HP3406 RF Millivoltmeter to the receiver second l-o monitor.

d. Adjust the receiver controls for 0(±0.01)V AFC/APC and 0(±0.01)V fine tuning at pins 6 and 8 of the VCXO card.

e. Adjust L1 through L5 for a maximum output indication on the HP3406.

f. Disconnect the HP3406 and connect the HP5245L counter to the l-o monitor. Note a frequency of 60 MHz ±200 Hz.

g. Adjust the frequency trimmer located on the end of the module, if necessary, to obtain the 60 MHz ±200 Hz counter reading.

REPLACEMENT PARTS LIST

The following replacement parts list provides the reference designation, description, manufacturer, and manufacturer's part numbers for each electrical component used in the second local oscillator.

Reference Designation	Description
C1	Capacitor, ceramic, .001 uF ±5%, 100V, Erie 8121-100-COG-102J
C2	Capacitor, ceramic, 100 pF ±5%, 100V, Erie 8131-100-COG-101J
C3	Capacitor, ceramic, 39 pF ±5%, 100V, Erie 8131-100-COG-390J
C4	Capacitor, ceramic, 7.5 pF ±0.5 pF, 100V, Erie 8101-100-COG-759D
C5	Capacitor, ceramic, 39 pF ±5%, 100V, Erie 8131-100-COG-390J
C6	Capacitor, ceramic, 39 pF ±5%, 100V, Erie 8131-100-COG-390J
C7	Capacitor, ceramic, 6.8 pF ±0.25 pF, 100V, Erie 8101-100-COG-689C
C8	Capacitor, ceramic, 39 pF ±5%, 100V, Erie 8131-100-COG-390J
C9	Capacitor, ceramic, 39 pF ±5%, 100V, Erie 8131-100-COG-390J
C10	Capacitor, ceramic, 6.8 pF ±0.25 pF, 100V, Erie 8101-100-COG-689C

Reference Designation	Description
C11	Capacitor, ceramic, 39 pF ±5%, 100V, Erie 8131-100-COG-390J
C12	Capacitor, ceramic, 39 pF ±5%, 100V, Erie 8131-100-COG-390J
C13	Capacitor, ceramic, 7.5 pF ±5%, 100V, Erie 8101-100-COG-759J
C14	Capacitor, ceramic, 39 pF ±5%, 100V, Erie 8131-100-COG-390J
C15	Capacitor, ceramic, 100 pF ±5%, 100V, Erie 8131-100-COG-101J
C16	Capacitor, ceramic, .001 uF ±5%, 100V, Erie 8121-100-COG-102J
C17	Capacitor, ceramic, .01 uF ±20%, 100V, Erie 8131-B106-X5V-103M
C18	Capacitor, ceramic, 30 pF ±5%, 100V, Erie 821-100-COG-300J
E1	Cable terminal, P/O W1
L1	Inductor, variable, Microdyne 202660
L2	Inductor, variable, Microdyne 202661
L3	Inductor, variable, Microdyne 202661
L4	Inductor, variable, Microdyne 202661
L5	Inductor, variable, Microdyne 202660
L6	Inductor, 5.6 uH ±10%, Jeffers 4435-1K
P1A1	Coaxial Insert, P/O W1, Cannon
R1	Resistor, fixed composition, 180Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB1815
R2	Resistor, fixed composition, 30Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB3005
R3	Resistor, fixed composition, 180Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB1815
R4	Resistor, fixed composition, 180Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB1815
R5	Resistor, fixed composition, 30Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB3005
R6	Resistor, fixed composition, 180Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB1815
R7	Resistor, fixed composition, 9.1KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB9125
R8	Resistor, fixed composition, 39KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB3935
R9	Resistor, fixed composition, 24KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB2435
R10	Resistor, fixed composition, 20KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB2035
R11	Resistor, fixed composition, 10Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB1005
U1	Crystal Oscillator, 60 MHz, Vectron 275-1952
U2	Integrated Circuit, Fairchild 114148TC

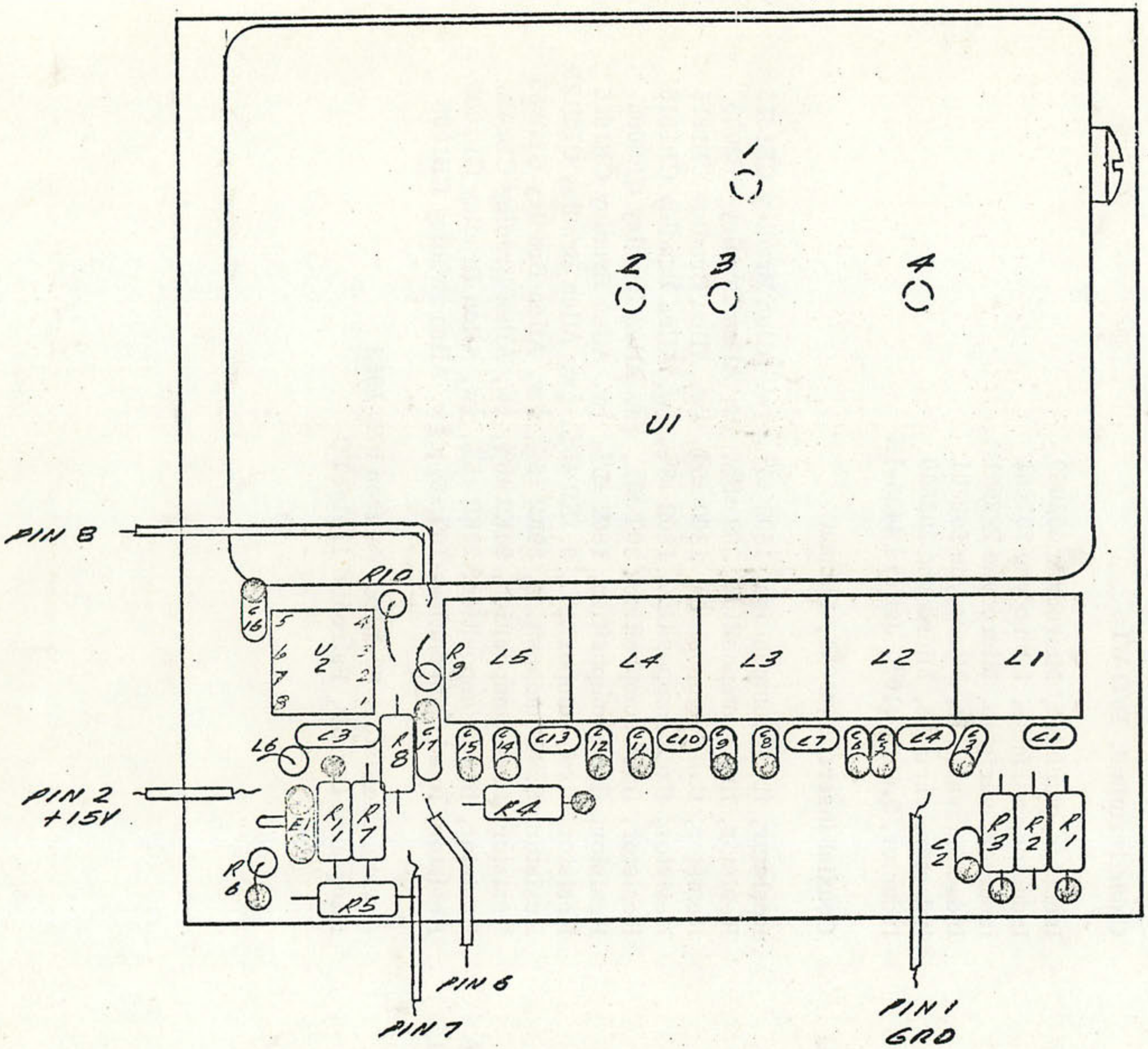

Figure 1. Component Location Drawing

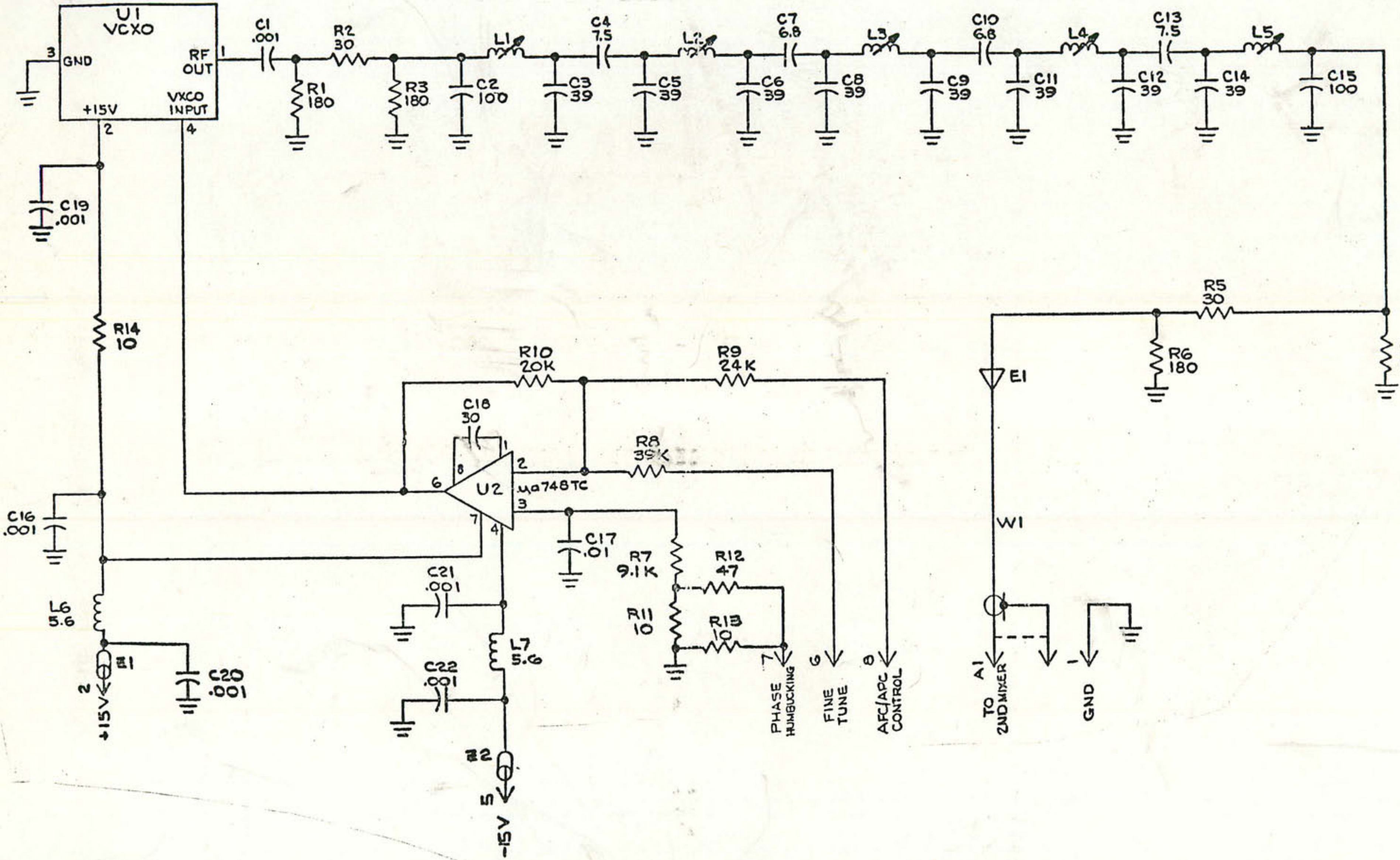

Figure 2. Voltage Controlled Oscillator, Schematic Diagram

Revised: July 1974

Instruction Booklet

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100-090 AM DETECTOR

December 1972

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AM DETECTOR

GENERAL

The a-m detector is designed for use with Microdyne telemetry equipment and performs the following functions: it detects a-m signals, provides gain control voltage to the agc amplifier, and provides amplified, limited and linear 10 MHz i-f outputs for recording and/or combining equipment. A schematic diagram of the a-m detector is shown in figure 2.

INSTALLATION

No definite installation procedures can be applied to the a-m detector since it can be installed in various parent units. Any special procedures required to install the module are specified in the parent unit instruction manual REPAIR procedures.

The a-m detector is constructed on a printed circuit board and enclosed in a metal housing which plugs into a parent unit receptacle. Refer to figure 1 for component layout.

THEORY OF OPERATION

The a-m detector consists of integrated circuit amplifiers U1, U2, U3, transistor driver Q1, and integrated circuit limiter U4. These stages function to provide an a-m video output, a high impedance a-m detected output, an agc sensor signal, and amplification of the 10 MHz for application to the demodulator. The module also supplies a 10 MHz linear output and a 10 MHz limited output.

Integrated circuit U1 consists of four silicon epitaxial transistors, two of which are isolated and two of which are connected in a Darlington configuration for emitter follower operation. The 10 MHz carrier is coupled through C1 to the first isolated transistor U1Q1, amplified, and applied to the second isolated transistor U1Q2. The amplified signal is fed to driver Q1 through C16. Negative feedback is used in this stage to improve stability and linearity. The Darlington transistors in U1 operate as a buffer amplifier to supply a 10 MHz output to the demodulator module and limiter stage U4. Limiter U4 operates with the first stage of the Darlington amplifier in U2 to provide a 50 mV limited output at P1-A1.

Driver stage Q1 provides sufficient output through transformer T1 to drive the a-m detector. The modulated signal is fed to diode detector CR1, CR2, CR3, and CR4, which is operated in a bridge configuration for maximum linearity and sensitivity. Output from the detector is coupled through voltage divider R26 and R27 and low pass filter C32, L7, C35, and L8. This signal is then applied to buffer amplifier U3Q1. The a-m detector high impedance output is taken from the detector and routed to the output at pin 13 via R25.

The agc sensor voltage is coupled through R28 to buffer amplifier U2Q1 whose output is connected to emitter resistor R31. The collector of U2Q2 (an isolated transistor used as a constant current source) is also tied to R31. The output voltage from this stage is fed to the agc amplifier module and processed to derive the automatic gain control voltage. The 10 MHz post-limited output originating at the emitter of the first transistor of the Darlington in U1, is limited by U2 and applied to pin 9 of U2. The post-limited output is taken from U2-2 and applied to the module output at pin A3.

Integrated circuit U3 performs the same way as U2. Isolated transistor U3Q1 is an emitter follower with the output connected to R38. The collector of the second transistor U3Q2 is also tied to R38. A balance control on the parent unit is utilized to set the dc output of this stage to zero volts with no signal input.

The prelimited output also originates at the emitter of the first transistor of the Darlington in U1 and is coupled through C40 to the input at U3-9. Output from this section of U3 is fed to pin A1 of the module.

MAINTENANCE

PREVENTIVE MAINTENANCE

Preventive maintenance requirements for the a-m detector consist of a semiannual check of the connector for corrosion and loose pins and the module itself for signs of damage and loose components. Any defects noted during the inspection should be corrected at once.

TROUBLESHOOTING

In the event of a malfunction, the trouble should first be isolated to a certain section of the module circuitry: buffer amplifier, transformer, diode bridge, LC filter, and emitter follower. This is accomplished by using normal signal tracing methods and by comparing the dc voltage levels with those given below. In the event that there is no a-m output at either P1-13 or P1-A2, check diodes CR1 through CR4, and transformer T1 for shorted or open conditions. Once the defective circuit has been located, the faulty component should be detected and replaced. A dc voltage chart is given below to aid in fault isolation. Voltages listed may vary ±20% between units.

Device	1	2	3	4	5	6	7	8	9	10	11	12
U1	-5.8	-5	- 0.005	- 0.7	+11.4	-0.6	-1.34	+ 9.4	-4.2	-0.330	0	0
U2	0	-2	-10.8	-11.4	- 3.4	+0.27	-0.42	+14	-1.34	-3.2	0	0
U3	0	-3.5	-13	-13	- 1	+0.33	-0.38	+ 8.8	-2.7	-0.88	0	0
U4	+2.2	+2.2	+ 2.2	+ 2.2	+ 7.8	+1.75	0	0	+0.96	+8		

	E	B	C
Q1	-1.9	-1.3	+15

Refer to figure 1 for component location of the a-m detector.

ALIGNMENT

After the fault has been located and corrected, the module must be realigned. The test equipment necessary for alignment is as follows:

Extender Module	Microdyne 300-355
Signal Generator	HP606A
DC Voltmeter	HP412A

Procedure:

a. Connect the module to the parent unit using the extender module. Remove the preceding second i-f filter module.

b. Set the HP606A for a 10 MHz output at -21 dBm and connect it to the 10 MHz output connector on the parent unit second i-f filter receptacle.

c. Connect the HP412A P1-13 and adjust R20 for +5V dc. Disconnect the voltmeter.

d. Connect the voltmeter to P1-15 and adjust R24 for +1.5V dc.

e. Disconnect the test equipment. Replace the second i-f filter.

f. Install the a-m detector and recalibrate the parent unit as required.

REPLACEMENT PARTS LIST - (Reference Figure 1.)

The following replacement parts list provides the reference designation, description, manufacturer, and manufacturer's part numbers for each electrical component used in the a-m detector.

Reference Designation	Description
C1	Capacitor, ceramic, 0.01 μF ±20%, 100V, Erie 8131-B106-X5VO-103M
C2	Capacitor, ceramic, 0.001 μF ±20%, 100V, Erie 8111-100-X5R-102M
C3 thru C10	Capacitor, ceramic, 0.01 μF ±20%, 100V, Erie 8131-B106-X5VO-103M
C11	Capacitor, ceramic, 0.001 μF ±20%, 100V, Erie 8111-100-X5R-102M
C12 thru C26	Capacitor, ceramic, 0.01 μF ±20%, 100V, Erie 8131-B106-X5VO-103M
C27	Capacitor, ceramic, 56 pF ±5%, 100V, Erie 8131-100-COG-560J
C28	Capacitor, ceramic, 180 pF ±5%, 100V, Erie 8121-100-COG-181J
C29	Capacitor, ceramic, 43 pF ±5%, 100V, Erie 8121-100-COG-430J

Replacement Parts List, continued

Reference Designation	Description
C30	Capacitor, ceramic, 0.01 µF ±20%, 100V, Erie 8131-B106-X5VO-103M
C31	Capacitor, ceramic, 0.0047 µF ±20%, 100V, Erie 8131-100-X5T-472M
C32	Capacitor, ceramic, 30 pF ±5%, 100V, Erie 8121-100-COG-300J
C33	Capacitor, ceramic, 0.01 µF ±20%, 100V, Erie 8131-B106-X4VO-103M
C34	Capacitor, ceramic, 2700 pF ±20%, 100V, Erie 8131-100-X5R-272M
C35	Capacitor, ceramic, 39 pF ±5%, 100V, Erie 8121-100-COG-390J
C36	Not Assigned
C37 thru C44	Capacitor, ceramic, 0.01 µF ±20%, 100V, Erie 8131-B106-X5VO-103M
C45	Capacitor, ceramic, 30 pF ±5%, 100V, Erie 8121-100-COG-300J
C46 thru C49	Capacitor, ceramic, 0.001 µF ±20%, 100V, Erie 8111-100-X5R-102M
CR1 thru CR4	Diode, JEDEC 1N277
L1 thru L3	Inductor, fixed, 82 µH ±5%, Jeffers 1315-10J
L4	Not Assigned
L5	Inductor, fixed, 4.7 µH ±10%, Jeffers 4425-14K
L6	Inductor, fixed, 5.6 µH ±10%, Jeffers 4435-1K
L7	Inductor, fixed, 270 µH ±5%, Jeffers 1331-21J
L8	Inductor, fixed, 200 µH ±5%, Jeffers 1315-19J
L9	Inductor, fixed, 82 µH ±5%, Jeffers 1315-10J
Q1	Transistor, RCA 2N5189
R1	Resistor, fixed composition, 51Ω ±5%, ¼w, Allen Bradley CB5105
R2	Resistor, fixed composition, 470Ω ±5%, ¼w, Allen Bradley CB4715
R3	Resistor, fixed composition, 510Ω ±5%, ¼w, Allen Bradley CB5115
R4	Resistor, fixed composition, 30Ω ±5%, ¼w, Allen Bradley CB3005
R5	Resistor, fixed composition, 4.7KΩ ±5%, ¼w, Allen Bradley CB4725
R6	Resistor, fixed composition, 100Ω ±5%, ¼w, Allen Bradley CB1015
R7	Resistor, fixed composition, 10KΩ ±5%, ¼w, Allen Bradley CB1035
R8	Resistor, fixed composition, 100Ω ±5%, ¼w, Allen Bradley CB1015
R9	Resistor, fixed composition, 100Ω ±5%, ¼w, Allen Bradley CB1015
R10	Resistor, fixed composition, 300Ω ±5%, ¼w, Allen Bradley CB3015
R11	Resistor, fixed composition, 300Ω ±5%, ¼w, Allen Bradley CB3015
R12	Resistor, fixed composition, 51Ω ±5%, ¼w, Allen Bradley CB5105
R13	Resistor, fixed composition, 1.5KΩ ±5%, ¼w, Allen Bradley CB1525
R14	Resistor, fixed composition, 1KΩ ±5%, ¼w, Allen Bradley CB1025

Replacement Parts List, continued

Reference Designation	Description
R15	Resistor, fixed composition, 100Ω ±5%, ¼w, Allen Bradley CB1015
R16	Resistor, fixed composition, 100Ω ±5%, ¼w, Allen Bradley CB1015
R17	Resistor, fixed composition, 470Ω ±5%, ¼w, Allen Bradley CB4715
R18	Resistor, fixed composition, 100Ω ±5%, ¼w, Allen Bradley CB1015
R19	Resistor, fixed composition, 100Ω ±5%, ¼w, Allen Bradley CB1015
R20	Potentiometer, 5KΩ, 3/4w, Beckman 77PR5K
R21	Resistor, fixed composition, 510Ω ±5%, 1/2w, Allen Bradley EB5115
R22	Resistor, fixed composition, 10Ω ±5%, ¼w, Allen Bradley CB1005
R23	Resistor, fixed composition, 300Ω ±5%, ¼w, Allen Bradley CB3015
R24	Potentiometer, 5KΩ, 3/4w, Beckman 77PR5K
R25	Resistor, fixed composition, 10KΩ ±5%, ¼w, Allen Bradley CB1035
R26	Resistor, fixed composition, 5.1KΩ ±5%, ¼w, Allen Bradley CB5125
R27	Resistor, fixed composition, 2KΩ ±5%, ¼w, Allen Bradley CB2025
R28	Resistor, fixed composition, 5.1KΩ ±5%, ¼w, Allen Bradley CB5125
R29	Resistor, fixed composition, 10KΩ ±5%, ¼w, Allen Bradley CB1035
R30	Resistor, fixed composition, 200Ω ±5%, ¼w, Allen Bradley CB2015
R31	Resistor, fixed composition, 2.7KΩ ±5%, ¼w, Allen Bradley CB2725
R32	Resistor, fixed composition, 2.7KΩ ±5%, ¼w, Allen Bradley CB2725
R33	Resistor, fixed composition, 510Ω ±5%, ¼w, Allen Bradley CB5115
R34	Resistor, fixed composition, 510Ω ±5%, ¼w, Allen Bradley CB5115
R35	Resistor, fixed composition, 10KΩ ±5%, ¼w, Allen Bradley CB1035
R36	Resistor, fixed composition, 4.7KΩ ±5%, ¼w, Allen Bradley CB4725
R37	Resistor, fixed composition, 1KΩ ±5%, ¼w, Allen Bradley CB1025
R38	Resistor, fixed composition, 100Ω ±5%, ¼w, Allen Bradley CB1015
R39	Resistor, fixed composition, 100Ω ±5%, ¼w, Allen Bradley CB1015
R40	Resistor, fixed composition, 10KΩ ±5%, ¼w, Allen Bradley CB1035
R41	Resistor, fixed composition, 39Ω ±5%, ¼w, Allen Bradley CB3905
R42	Resistor, fixed composition, 1.5KΩ ±5%, ¼w, Allen Bradley CB1525
R43	Resistor, fixed composition, 100Ω ±5%, ¼w, Allen Bradley CB1015
R44	Resistor, fixed composition, 1.5KΩ ±5%, ¼w, Allen Bradley CB1525
R45	Resistor, fixed composition, 100Ω ±5%, ¼w, Allen Bradley CB1015
R46	Resistor, fixed composition, 39Ω ±5%, ¼w, Allen Bradley CB3905
R47	Resistor, fixed composition, 10KΩ ±5%, ¼w, Allen Bradley CB1035
R48	Resistor, fixed composition, 1KΩ ±5%, ¼w, Allen Bradley CB1025
R49	Resistor, fixed composition, 10KΩ ±5%, ¼w, Allen Bradley CB1035
R50	Resistor, fixed composition, 5.6KΩ ±5%, ¼w, Allen Bradley CB5625
R51	Resistor, fixed composition, 51Ω ±5%, ¼w, Allen Bradley CB5105
R52	Resistor, fixed composition, 27KΩ ±5%, ¼w, Allen Bradley CB2735
R53	Resistor, fixed composition, 5.1KΩ ±5%, ¼w, Allen Bradley CB5125
R54	Resistor, fixed composition, 51KΩ ±5%, ¼w, Allen Bradley CB5135
R55	Resistor, fixed composition, 20KΩ ±5%, ¼w, Allen Bradley CB2035
R56	Resistor, fixed composition, 51KΩ ±5%, ¼w, Allen Bradley CB5135
R57	Resistor, fixed composition, 120Ω ±5%, ¼w, Allen Bradley CB1215

Replacement Parts List, continued

Reference Designation	Description
R58	Resistor, fixed composition, 100KΩ ±5%, 1/8w, Allen Bradley BB1045
R59	Resistor, fixed composition, 100KΩ ±5%, 1/8w, Allen Bradley BB1045
R60	Resistor, fixed composition, 100KΩ ±5%, 1/8w, Allen Bradley BB1045
T1	Transformer, Microdyne 200-402
U1	Integrated Circuit, RCA CA3018A
U2	Integrated Circuit, RCA CA3018A
U3	Integrated Circuit, RCA CA3018A
U4	Integrated Circuit, RCA CA3012
W1 thru W5	Cable Assembly, Microdyne 300-208
Z1 thru Z6	Ferrite Bead, Fair Rite 2673000101

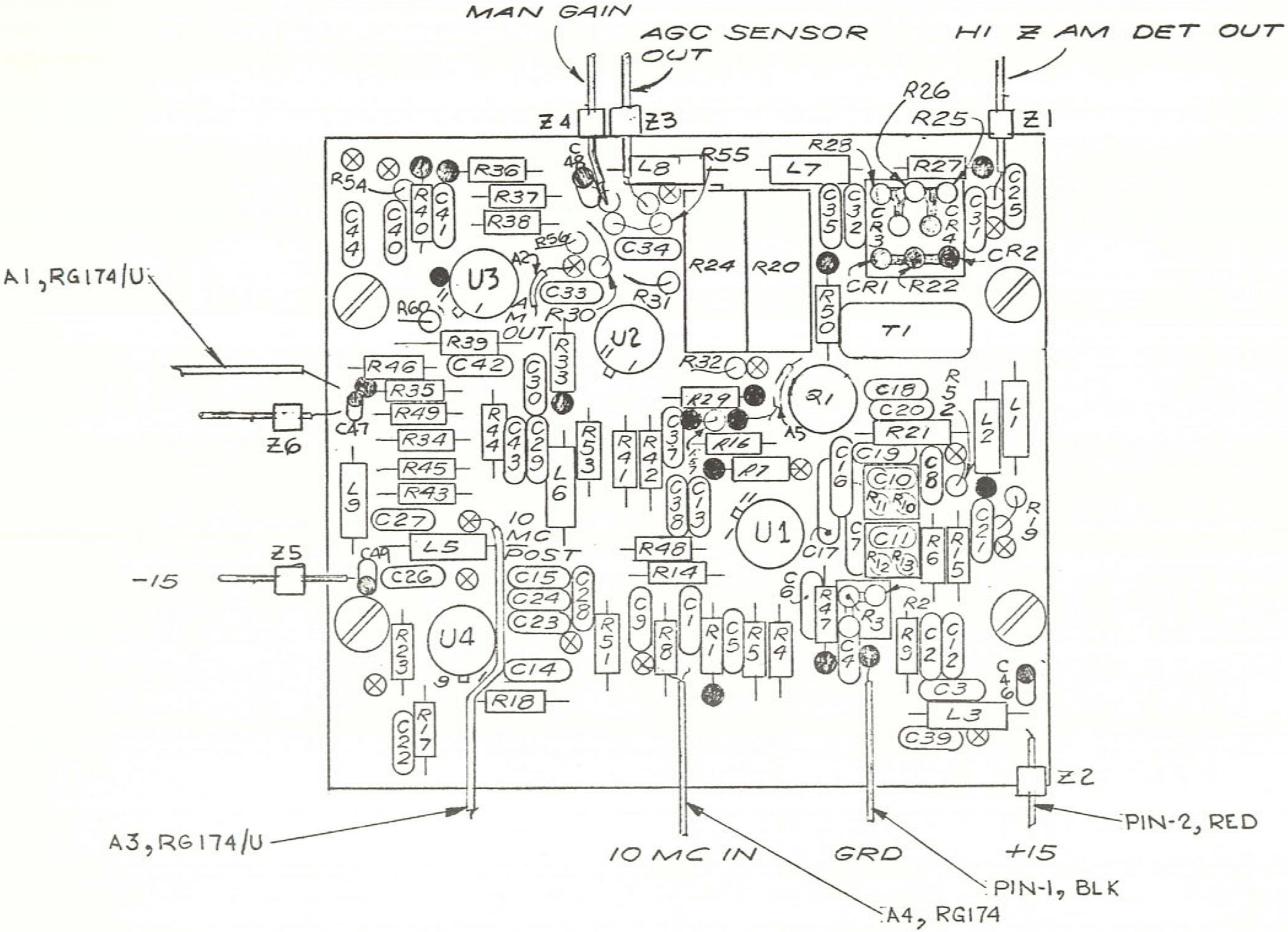
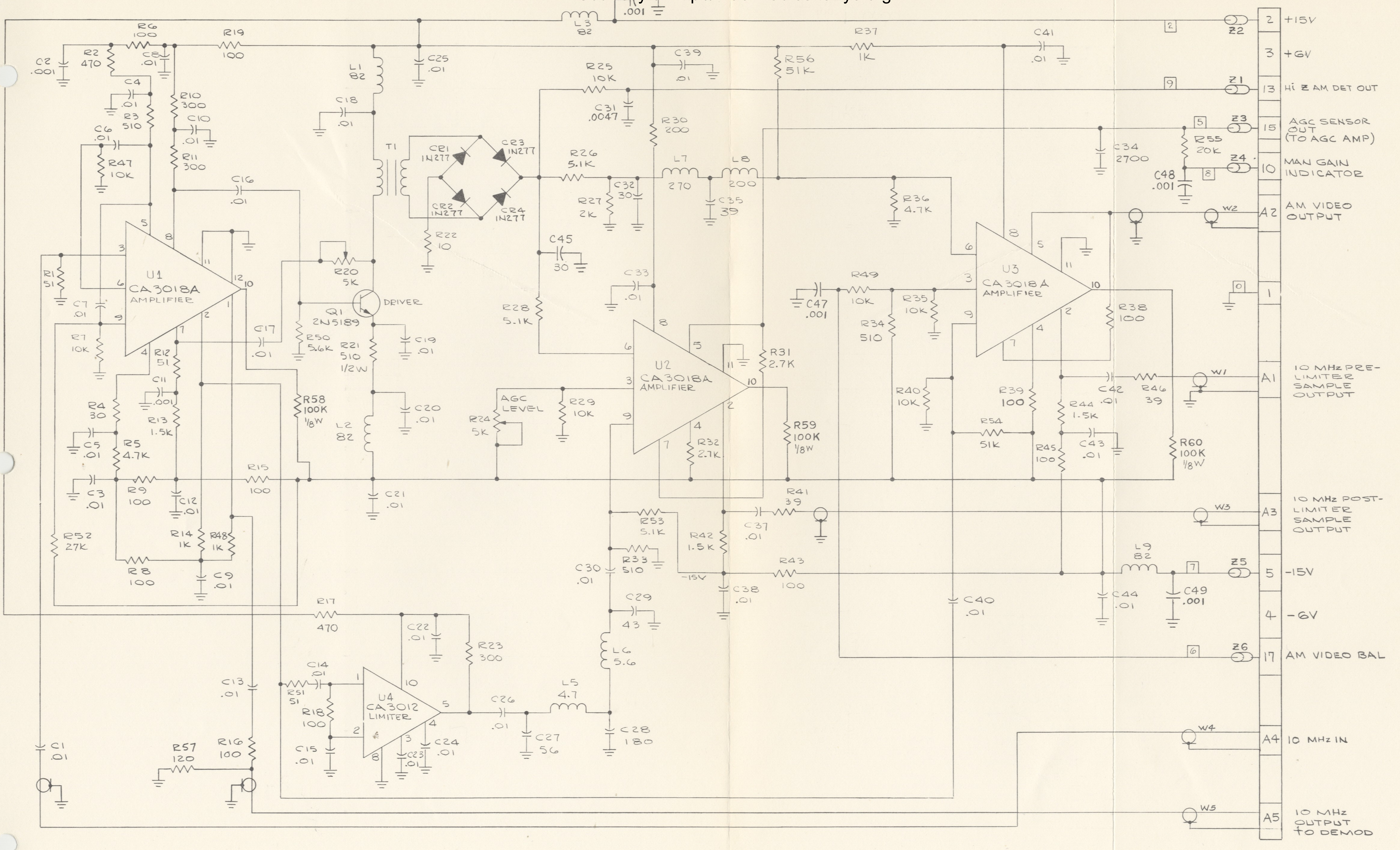


Figure 1. AM Detector, Component Location



2. CAPACITOR VALUES LESS THAN ONE ARE IN MICROFARADS.
3. CAPACITOR VALUES GREATER THAN ONE ARE IN PICOFARADS.
4. INDUCTANCE VALUES ARE IN MICROHENRYS.
5. RESISTOR VALUES ARE IN OHMS, K=1000, M=1,000,000.

NOTE UNLESS OTHERWISE NOTED:
1-FOR CHIP SCHEMATICS OF INTEGRATED CIRCUITS OTHER THAN OPERATIONAL AMPLIFIERS REFER TO DWG 400-494

Figure 2. AM Detector,
Schematic Diagram 400-007

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Instruction Booklet

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300-054 VIDEO AMPLIFIER

March 1973

TRADE SECRETS

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VIDEO AMPLIFIER

GENERAL

The video amplifier is designed for use in Microdyne telemetry and tracking receivers. The unit provides power amplification for both filtered and unfiltered input signals and is used in applications requiring video outputs as high as 10V peak-to-peak; a sample of this output is used to drive the receiver video output meter. Also included on this module is an audio amplifier for driving the speaker on the receiver front panel. A schematic diagram of the module is shown in figure 2.

INSTALLATION

The video amplifier is constructed as a single printed circuit board having an edge-type connector at one end for mating with a parent receiver receptacle. Since the module can be installed in various parent receivers, no definite installation procedures can be given here. For this reason, reference must be made to the parent unit instruction manual REPAIR procedures for data concerning both installation and removal.

THEORY OF OPERATION

The video amplifier consists of two independent sections, video and audio. The video section employs operational amplifiers U1 and U2, driver Q1-Q2, and power amplifier Q3-Q4 for an output capability of 10V peak-to-peak into a 75 ohm load. The audio section is a monolithic integrated circuit, class B, wide band amplifier with a current of 300 mA into a high impedance, center-tapped speaker.

Operational amplifier U1 is used for low-level amplification. The video signal is directly coupled to the inverting input (U1-2) and amplified by a factor of 39. For optimum performance with a high frequency input, pins 2 and 3 of U1 are frequency compensated by C1 and R2 to permit a full output swing. Pins 5 and 6 are compensated by C3 and for lead-lag frequency compensation. Feedback resistor R6 controls the closed loop gain, and CR1 clamps the input driving to a .6V level to prevent overdriving U1. Output from U1 is applied to U2 which operates in the same manner as U1 and also has a gain factor of 39. From U2, the signal is applied to dc coupled driver stage Q1-Q2 which feeds complementary output stage Q3-Q4. Potentiometer R22 is utilized as a dc offset to set the dc output level to zero volts. Two outputs are supplied by Q3-Q4 and are routed to connector pins 5 and 6. The level of the output signal is capable of being set as high as 10V peak-to-peak into 75 ohms and is dependent on the module input level. This level, in turn, is determined by the parent unit video gain control.

U3 is a wide band integrated circuit and consists of a voltage regulator, buffer amplifier, differential amplifier and phase splitter, driver, and power output amplifier on one substrate. The audio signal which is derived from the video output is ac coupled through C16 to the input at U3-10. Outputs are taken from U3-4 and 7 and are connected to the outside terminals of the center-tapped speaker. The audio level is adjusted by the parent unit audio gain control which controls the input level applied to U3-10 via module pin 14.

MAINTENANCE

PREVENTIVE MAINTENANCE

Preventive maintenance requirements for the video amplifier consist of a semiannual check of the connector for corrosion and loose pins, and the module itself for signs of damage and loose components.

TROUBLESHOOTING

In the event of a malfunction, the trouble should first be isolated to a certain section of the module circuitry: amplifier U1, amplifier U2, amplifier U3, or transistors Q1, Q2, Q3, and Q4. This is accomplished by applying a 1 kHz 7 mV signal as in the ALIGNMENT procedure and tracing the signal through the module. Once the area of signal loss is determined, check that stage for proper operation. A static dc voltage chart is shown below to assist in troubleshooting.

Table 1. Voltage Chart

Device	1	2	3	4	5	6	7	8	9	10	11	12
U1	Grd.	+0.0055	-0.0015	-3.5	+1.8	+0.26	+0.1	+12				
U2	0	-0.025	-0.04	-4.1	+2.65	+0.65	-0.87	+12.5				
U3	+6.5	+1.05	+1.05	0	0	0	0	+13	+13	+7.1	+2.15	0

	E	B	C
Q1	- 0.86	- 0.9	-13
Q2	-13.6	-13	- 2.35
Q3	- 2.1	- 2.45	-13.5
Q4	- 2	- 2.35	-13.5

NOTE: Voltages measured under "no signal" conditions using an HP412A or 414A DC voltmeter.
Voltages listed may vary 10% between units.

REPAIR

After determining the component at fault, that component is to be replaced with an identical part as referenced in the REPLACEMENT PARTS LIST. Information for replacing components mounted on printed circuit boards is given in the parent unit instruction manual REPAIR procedures.

ALIGNMENT

After repairs have been made, the unit should be aligned and tested prior to use to insure proper operation. Test equipment for alignment and test consists of:

Extender Card	Microdyne 300-423
DC Voltmeter	HP412A or 414A
Test Oscillator	HP651B
Distortion Analyzer	HP334B

Procedure:

a. Remove the parent receiver demodulator.

b. Install the video amplifier under test into the applicable receiver receptacle using the extender card. Apply power to the receiver.

c. Set the receiver VIDEO BANDWIDTH kHz control to the OUT position to bypass all filtering. Set the VIDEO COUPLING switch to DC. Set the VIDEO GAIN control fully clockwise.

d. Ground pin 2 of the video amplifier using a short cliplead.

e. Connect the dc voltmeter to pin 6 of the amplifier card and adjust R22 for 0.0V dc.

f. Disconnect the ground from pin 2 and connect it to pin 3. Observe that the voltmeter indicates a dc level of not more than ±200 mV. If greater than ±200 mV, recheck the adjustment of R22. If the problem cannot be corrected, check and if necessary replace U1 and U2.

g. Disconnect the voltmeter and the short.

h. Connect the HP334A distortion analyzer to the receiver video output connector using a 75 ohm termination. Set the analyzer for voltmeter operation.

i. Connect the HP651B 50 ohm output to XA9-A2 (demodulator connector). Set the HP651B for a 1 kHz output at 7 mV as indicated on the HP651B output meter. Observe the voltage indicated on the HP334A distortion analyzer; it should be greater than 1.4V rms.

j. Reduce the level of the 1 kHz input signal until the video output level is exactly 1.4V rms.

k. Measure the distortion; it should be less than 0.5%.

l. Set the HP334A for voltmeter operation and increase the HP651B output until the analyzer meter indicates +15 dB; this is the reference level.

m. Increase the HP651B output frequency to 2 MHz and observe the video output level; it should have changed no more than ±1 dB.

n. Increase the frequency until the output level is 3 dB less than the level observed in step l. Observe the HP651B frequency; it should be greater than 2.5 MHz.

o. Reset the HP651B to 1 kHz at 7 mV rms. Set the receiver VIDEO COUPLING switch to AC. Observe that the video output is approximately 1.4V rms.

p. With the 1 kHz, 7 mV input applied, turn the receiver AUDIO GAIN control clockwise. An audible tone should be heard from the speaker. If not, check U3 for proper operation.

q. Disconnect all test equipment.

REPLACEMENT PARTS LIST

Reference Designation	Description
C1	Capacitor, ceramic, 130 pF ±5%, 100V, Erie 8121-100-COG-131J
C2	Capacitor, ceramic, 0.01 μF ±20%, 100V, Erie 8121-100-X5V-103M
C3	Capacitor, ceramic, 470 pF ±20%, 100V, Erie 8111-100-X5R-471M
C4	Capacitor, ceramic, 0.01 μF ±20%, 100V, Erie 8121-100-X5V-103M
C5	Capacitor, ceramic, 130 pF ±5%, 100V, Erie 8121-100-COG-131J
C6	Capacitor, ceramic, 0.01 μF ±20%, 100V, Erie 8121-100-X5V-103M
C7	Capacitor, ceramic, 470 pF ±20%, 100V, Erie 8111-100-X5R-471M
C8	Capacitor, ceramic, 0.01 μF ±20%, 100V, Erie 8121-100-X5V-103M
C9	Capacitor, ceramic, 56 pF ±5%, 100V, Erie 8131-100-COG-560J
C10	Capacitor, tantalum, 47 μF, 20V, Kemet T362C476M020AS
C11	Capacitor, tantalum, 47 μF, 20V, Kemet T362C476M020AS
C12	Capacitor, ceramic, 0.01 μF ±20%, 100V, Erie 8121-100-X5V-103M
C13	Capacitor, tantalum, 47 μF, 20V, Kemet T362C476M020AS
C14	Capacitor, tantalum, 47 μF, 20V, Kemet T362C476M020AS
C15	Capacitor, ceramic, 0.01 μF ±20%, 100V, Erie 8121-100-X5V-103M
C16	Capacitor, tantalum, 1 μF, 20V, Sprague 150D105X9020A2
C17	Capacitor, paper film, 0.1 μF, Sprague 192P1049R8
C18	Capacitor, ceramic, 0.01 μF ±20%, 100V, Erie 8121-100-X5V-103M
C19	Capacitor, paper film, 1 μF, Sprague 150D105X9020A2
C20	Capacitor, tantalum, 47 μF, 20V, Kemet T362C476M020AS
C21	Capacitor, tantalum, 150 μF, 6V, Kemet T362C157M006AS
C22	Capacitor, tantalum, 150 μF, 6V, Kemet T362C157M006AS
C23	Capacitor, ceramic, 470 pF ±5%, 100V, Erie 8121-100-COG-471J nominal
CR1 thru CR4	Diode, 1N914, JETEC
L1	Inductor, 82 μH, Jeffers 1315-10J
L2	Inductor, 82 μH, Jeffers 1315-10J

Replacement Parts List, continued

Reference Designation	Description
Q1	Transistor, Motorola 2N2907
Q2	Transistor, Motorola 2N2222
Q3	Transistor, Motorola 2N2219
Q4	Transistor, Motorola 2N2905
R1	Resistor, fixed composition, 1KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1025
R2	Resistor, fixed composition, 1KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1025
R3	Resistor, fixed composition, 1KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1025
R4	Resistor, fixed composition, 3.9KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB3925
R5	Resistor, fixed composition, 620Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB6215
R6	Resistor, fixed composition, 39KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB3935
R7	Resistor, fixed composition, 1.6KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1625
R8	Resistor, fixed composition, 200Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB2015
R9	Resistor, fixed composition, 1KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1025
R10	Resistor, fixed composition, 1KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1025
R11	Resistor, fixed composition, 1KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1025 nominal
R12	Resistor, fixed composition, 100KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1045
R13	Resistor, fixed composition, 3.9KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB3925
R14	Resistor, fixed composition, 11KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1135
R15	Resistor, fixed composition, 3.9KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB3925
R16	Resistor, fixed composition, 620Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB6215
R17	Resistor, fixed composition, 39KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB3935
R18	Resistor, fixed composition, 51Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB5105
R19	Resistor, fixed composition, 100Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB1015
R20	Resistor, fixed composition, 91Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB9105
R21	Resistor, fixed composition, 5.1KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB5125
R22	Potentiometer, 5KΩ, Beckman 77PR5K
R23	Resistor, fixed composition, 1KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1025
R24	Resistor, fixed composition, 30Ω ±5%, 1/2w, Allen Bradley EB3005
R25	Resistor, fixed composition, 13Ω ±5%, 1/2w, Allen Bradley EB1305
R26	Resistor, fixed composition, 13Ω ±5%, 1/2w, Allen Bradley EB1305
R27	Resistor, fixed composition, 30Ω ±5%, 1/2w, Allen Bradley EB3005
R28	Resistor, fixed composition, 39Ω ±5%, 1/2w, Allen Bradley CB 3905
R29	Resistor, fixed composition, 100KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1045
R30	Resistor, fixed composition, 680Ω ±5%, 1/2w, Allen Bradley EB6815
R31	Resistor, fixed composition, 130Ω ±5%, 1/2w, Allen Bradley EB1315
R32	Resistor, fixed composition, 1MΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1055
R33	Resistor, fixed composition, 1.1KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1125
R34	Resistor, fixed composition, 3.9KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB3925
R35	Resistor, fixed composition, 1KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1025
R36	Resistor, fixed composition, 750KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB7545
R37	Resistor, fixed composition, 100KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1045

Replacement Parts List, continued

Reference Designation	Description
U1	Integrated circuit, Fairchild uA702C
U2	Integrated circuit, Fairchild uA702C
U3	Integrated circuit, RCA CA3020

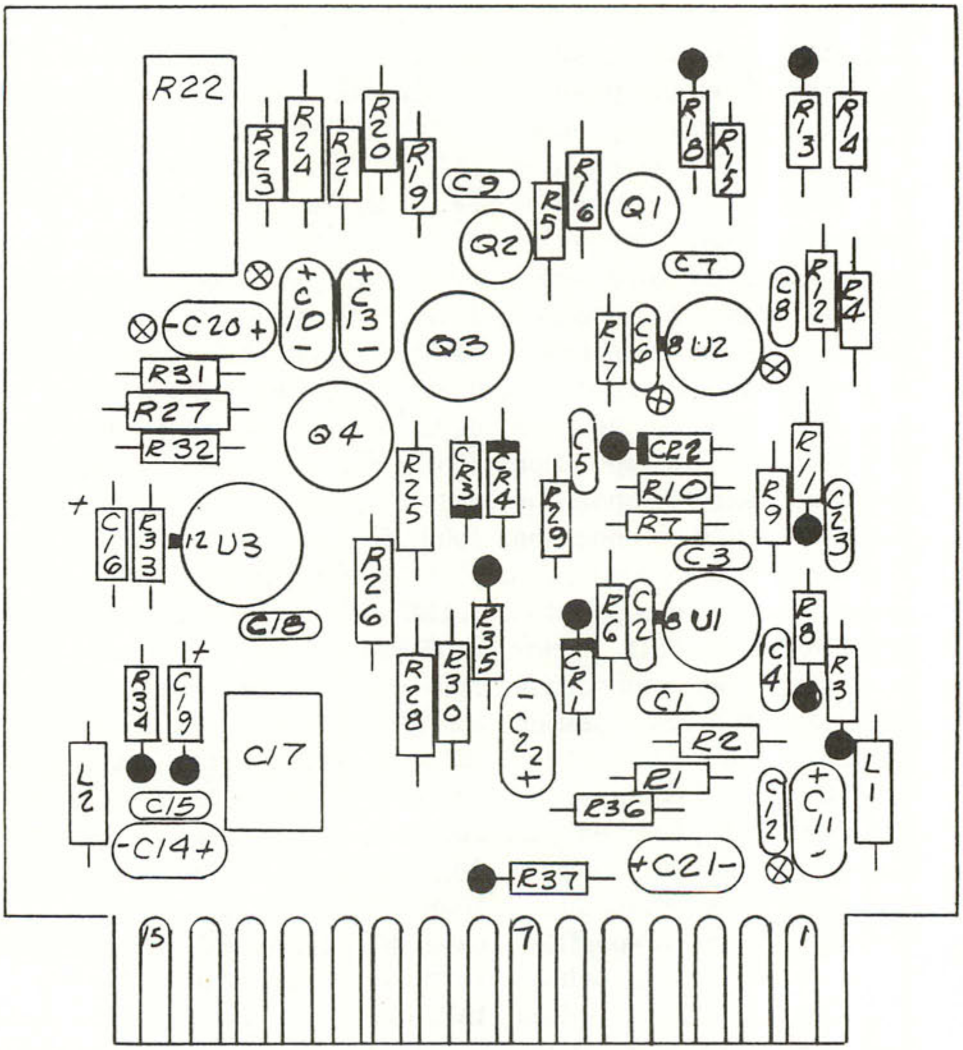
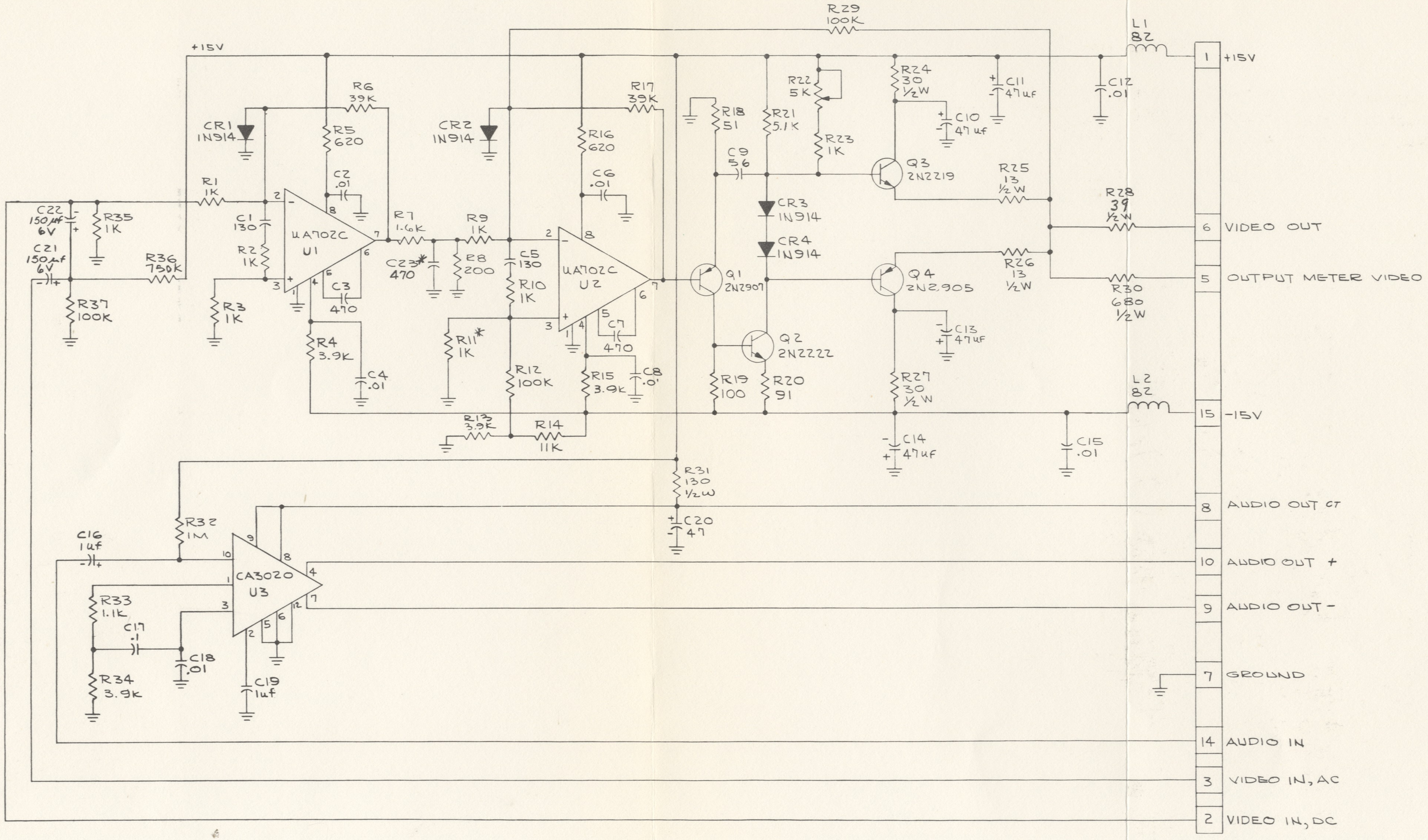


Figure 1. Video Amplifier, Component Location



* FACTORY SELECTED VALUE

HIGHEST REF DESIGNATION
R37
C23
CR4
A3
Q4

Figure 2. Video Amplifier, Schematic Diagram

Instruction Booklet

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101-938 AGC AMPLIFIER

October 1975

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AGC AMPLIFIER

GENERAL

The 101-938 AGC Amplifier module is designed for use with Microdyne telemetry equipment. Module circuitry is composed of an agc amplifier, an agc record amplifier, and a carrier operated relay (cor). The agc amplifier portion of the circuit is driven by an output from the a-m detector and is used to control the gain of the tuner, second mixer, and second i-f filter/amplifier. It also drives the signal level meter on the parent unit front panel, the agc record amplifier, and cor amplifier. The agc record amplifier circuit supplies a voltage output for application to an external recorder or diversity combiner. In order to provide an indication of carrier reception, the agc voltage also controls a relay circuit which operates in conjunction with the parent unit threshold control and carrier indicator lamp. The threshold control sets the point at which the relay circuit is energized to illuminate the lamp. A schematic of the module is shown in figure 2.

INSTALLATION

No definite installation procedures can be applied to the agc amplifier since it can be installed in various parent units. Any special procedures required to install the module are specified in the parent unit instruction manual REPAIR procedure.

THEORY OF OPERATION

The agc amplifier consists of the agc record amplifier U1, Q1-Q2; cor amplifier U2, Q3; and agc integrator U3, Q4-Q5. Gain control voltages originate in the a-m detector and are processed by the agc amplifier module to control the signal level at the rf tuner, second mixer, and the second i-f filter/amplifier. The agc module also provides outputs to the signal level meter, carrier indicator, and the rear panel record output. Refer to the circuit schematic diagram, figure 2.

The nominal +1.5V dc a-m detector output is coupled through pin F to U3-2 and a +1.5V reference level is applied to U3-3. Any differences between the two inputs, which are measured in microvolts, are amplified by approximately 100 dB in U3. The resultant 0 to -5V dc output is coupled through buffer amplifier Q4-Q5 to the module output at pin N and to the cor amplifier U2. Additional outputs are applied to the receiver signal level ZERO control via pin M and the 60 dB calibrate control via pin 14.

The response time of U3 is determined by the positioning of the receiver AGC TIME CONSTANT MSEC switch. This switch contains a number of resistors which are configured with C3, C4, C5, and R30 to provide time constants of 0.1, 1.0, 10, 100, and 1000 milliseconds. The output of U3 is also clamped by CR3 to prevent agc levels more positive than +2V dc.

A portion of the agc output is applied to cor amplifier U2 which functions as a regenerative switch to control the receiver CARRIER INDICATOR lamp. In a no signal state, the positive output of U2 holds Q3 in a cutoff condition preventing an output at pin L. When the receiver is tuned to a signal above the threshold level, the output of U3 causes the output of U2 to switch to a negative voltage thereby turning on Q3. The level at which U2 switches from negative to positive is determined by the receiver COR THRESHOLD adjustment which is felt through pin P. With Q3 conducting, +15V dc is coupled through CR2 to the CARRIER INDICATOR lamp via pin L. The conduction of Q3 also energizes relay K1, providing contact operation at pins 6, 8, 9, 10, H, J which may be used to control external indicators via the parent unit ACCESSORIES connector.

The setting of the parent base unit AGC RECORD POLARITY switch sets the configuration of U1 as an inverting (+ setting) or a non-inverting amplifier)-setting) by routing the agc voltage to pin 2 or 3 of U1 (respectively) and grounding the other pin through the input resistor. See the parent unit wiring-schematic diagram for interface connections.

The ZERO and SCALE controls are utilized to set the agc record output to ±12V maximum for compatibility with external equipment. Setup procedures are given in the parent unit instruction manual. The output of U1 is applied to the output amplifier Q1-Q2 which drives the agc record output at pin R.

MAINTENANCE

PREVENTIVE MAINTENANCE

The only preventive maintenance requirement is a semiannual check of the module for loose components and corrosion. Any discrepancies noted during the inspection should be corrected either by component replacement or by module substitution.

TROUBLESHOOTING

In the event of malfunction, the trouble should first be isolated to one of the three independent circuits; the AGC integrator, the COR amplifier or the AGC RECORD amplifier. To determine the faulty circuit, set the receiver OPERATE MODE switch to PBK, the AGC TIME CONSTANT switch to MAN and place the AGC card on the extender. Connect a DC voltmeter to pin N of the extender and adjust the receiver MAN GAIN control for a VM indication of -0.5(±0.1)V DC. (Inability to make this adjustment indicates a fault in the AGC integrator.) Connect the DC VM to pin P of the extender and adjust the receiver COR THRESHOLD for a VM indication of 5.0(±0.1)V DC. Connect the DC VM to pin R of the extender. Set the receiver AGC RECORD POLARITY (on the rear apron) to + and adjust the AGC RECORD ZERO for a VM indication of 0(±0.1)V DC. (Inability to make this adjustment indicates a fault in the AGC record amplifier.)

Using Voltage Chart #1, the schematic and component location diagram, check the circuit operation.

NOTE that some of the voltages are measured relative to card terminals which were previously set.

Voltage Chart #1

Device/Pin	1	2	3	4	5	6	7	8
U1	-15	0	0	-15	-15	R ±.03	+15	0
U2	-15	- .56	- .18	-15	-15	1 -.30	+15	0
U3	-15	+1.5	+1.5	-15	-15	N -.04	+15	0

	E	B	C
Q1	R +.15	R +.75	1 - .55
Q2	R -.15	R -.75	15 + .55
Q3	+15	+15	-15
Q4	N +.08	N +.70	1 -1.65
Q5	N -.12	N -.75	15 + .65

Note: Extender Board Terminals ①, ⑮, Ⓝ, Ⓡ are used as the references for differential measurements.

Set the voltage at extender pin N to -5.0(±0.1)V DC (using the MAN GAIN control). Adjust the AGC RECORD SCALE (on the rear apron) for +10.0(±0.1)V DC at extender pin R. Check for proper circuit operation using Voltage Chart #2.

Voltage Chart #2

Device/Pin	1	2	3	4	5	6	7	8
U1	-15	0	0	-15	-15	R + .6	+15	0
U2	-15	- .58	-1.9	-15	-15	-13	+15	0
U3	-15	+1.5	+1.5	-15	-15	N -.55	+15	0

	E	B	C
Q1	R +.15	R + .75	1 - .8
Q2	R -.15	R - .75	15 + .6
Q3	1 -.25	1 -1.0	1 - .4
Q4	N ±.1	N + .45	1 - .2
Q5	N -.35	N -1.0	15 +1.8

Note: Extender Board Terminals ①, ⑮, Ⓝ, Ⓡ are used as the references for differential measurements.

ALIGNMENT

After the fault has been located and corrected, the module should be tested for proper operation. The test equipment necessary for alignment is as follows:

Extender Card	Microdyne 300-423
Signal Generator	Compatible with rf tuner
DC Voltmeter	HP312A

Procedure:

a. Apply a 50 MHz, -50 dBm signal to the receiver with an HP606A signal generator.

b. The receiver agc output level at pin N should be from -3V to -3.5V.

c. The output at pin L should cause the front panel CARRIER INDICATOR lamp to go on.

d. When the input is varied, the agc record output should vary. If the agc amplifier outputs are not present, refer to the voltage chart.

NOTE

When part replacement does not remedy the problem, it is recommended that the agc card be returned to the Microdyne Corporation.

REPLACEABLE PARTS LIST (Reference Figure 1.)

Reference Designation	Description
C1	Capacitor, tantalum, 47 μF ±10%, 35V, Union Carbide T362D476K035AS
C2	Capacitor, tantalum, 47 μF ±10%, 35V, Union Carbide T362D476K035AS
C3	Capacitor, tantalum, 100 μF ±10%, 20V, Union Carbide T362D107K020AS
C4	Capacitor, tantalum, 10 μF ±10%, 25V, Union Carbide T360B106K025AS
C5	Capacitor, tantalum, 1 μF ±10%, 35V, Union Carbide T360A105K035AS
C6	Capacitor, ceramic, 0.001 μF ±20%, 100V, Erie 8111-100-X5R-102M
C7	Capacitor, tantalum, 330 μF ±10%, 6V, Union Carbide T362D337K006AS
C8	Capacitor, ceramic, 47 pF ±20%, 100V, Erie 8101-100-X5R-470M
C9	Capacitor, tantalum, 2.2 μF ±10%, 20V, Union Carbide T360A225K020AS
C10	Capacitor, paper, 0.1 μF ±10%, 80V, Sprague 192P1049R8
C11	Capacitor, ceramic, 220 pF ±20%, 100V, Erie 8101-100-X5R-221M
CR1	Diode, silicon, rectifier, JEDEC 1N4001
CR2	Diode, silicon, rectifier, JEDEC 1N4001
CR3	Diode, silicon, signal, JEDEC 1N914

Replaceable Parts List, continued

Reference Designation	Description
K1	Relay, DPDT, G. E. 3SAV5004L1
L1	Inductor, 82 μH ±5%, Airco Speer 1315-10J
L2	Inductor, 82 μH ±5%, Airco Speer 1315-10J
Q1	Transistor, npn, Si, To-18, JEDEC 2N2222
Q2	Transistor, pnp, Si, To-18, JEDEC 2N2907
Q3	Transistor, pnp, Si, To-18, JEDEC 2N2907
Q4	Transistor, npn, Si, To-18, JEDEC 2N2222
Q5	Transistor, pnp, Si, To-5, JEDEC 2N2905
R1	Not Assigned
R2	Not Assigned
R3	Resistor, fixed composition, 1.6KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1625
R4	Resistor, fixed composition, 36KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB3635
R5	Resistor, fixed composition, 7.5KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB7525
R6	Resistor, fixed composition, 36KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB3635
R7	Resistor, fixed composition, 7.5KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB7525
R8	Resistor, fixed composition, 51KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB5135
R9	Resistor, fixed composition, 8.2KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB8225
R10	Resistor, fixed composition, 18KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1835
R11	Resistor, fixed composition, 10KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1035
R12	Not Assigned
R13	Resistor, precision, 6.19KΩ ±1%, 1/8w, MIL RN55D6191F
R14	Resistor, precision, 332Ω ±1%, 1/8w, MIL RN55D3320F
R15	Resistor, precision, 332Ω ±1%, 1/8w, MIL RN55D3320F
R16	Resistor, precision, 6.19KΩ ±1%, 1/8w, MIL RN55D6191F
R17	Resistor, fixed composition, 110Ω ±5%, 2w, Allen Bradley HB1115
R18	Resistor, fixed composition, 30Ω ±5%, 1/2w, Allen Bradley EB3005
R19	Resistor, fixed composition, 30Ω ±5%, 1/2w, Allen Bradley EB3005
R20	Resistor, fixed composition, 110Ω ±5%, 2w, Allen Bradley HB1115
R21	Resistor, fixed composition, 10KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1035
R22	Resistor, fixed composition, 6.2KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB6225
R23	Resistor, fixed composition, 30KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB3035
R24	Resistor, fixed composition, 3.9KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB3925
R25	Resistor, fixed composition, 3.0MΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB3055
R26	Resistor, fixed composition, 100Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB1015
R27	Resistor, fixed composition, 15KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1535
R28	Resistor, fixed composition, 10KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1035
R29	Resistor, fixed composition, 47Ω ±5%, 1/8w, Allen Bradley BB4705
R30	Resistor, fixed composition, 5.6KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB5625
R31	Resistor, fixed composition, 5.1KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB5125

Replaceable Parts List, continued

Reference Designation	Description
R32	Resistor, fixed composition, 300Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB3015
R33	Resistor, fixed composition, 2.7KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB2725
R34	Resistor, precision, 8.25KΩ ±1%, 1/8w, MIL RN55D8251F
R35	Resistor, precision, 432Ω ±1%, 1/8w, MIL RN55D4320F
R36	Resistor, precision, 432Ω ±1%, 1/8w, MIL RN55D4320F
R37	Resistor, precision, 8.25KΩ ±1%, 1/8w, MIL RN55D8251F
R38	Resistor, fixed composition, 560Ω ±5%, 1/2w, Allen Bradley EB5615
R39	Resistor, fixed composition, 30Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB3005
R40	Resistor, fixed composition, 30Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB3005
R41	Resistor, fixed composition, 150Ω ±5%, 2w, Allen Bradley HB1515
U1	Operational Amplifier, G. P., Mini Dip, Nat'l Semi LM741CN
U2	Operational Amplifier, G. P., Mini Dip, Nat'l Semi LM741CN
U3	Operational Amplifier, G. P., Mini Dip, Nat'l Semi LM741CN
XQ1 to XQ5	Transipad to 5, to 18, Milton Ross 10109,(10044 maybe used in place of 10109)
XR1	Transipad, relay, Milton Ross 10105
XU1 thru XU3	Socket, 8 pin, Mini Dip, Augat 508-AG1D

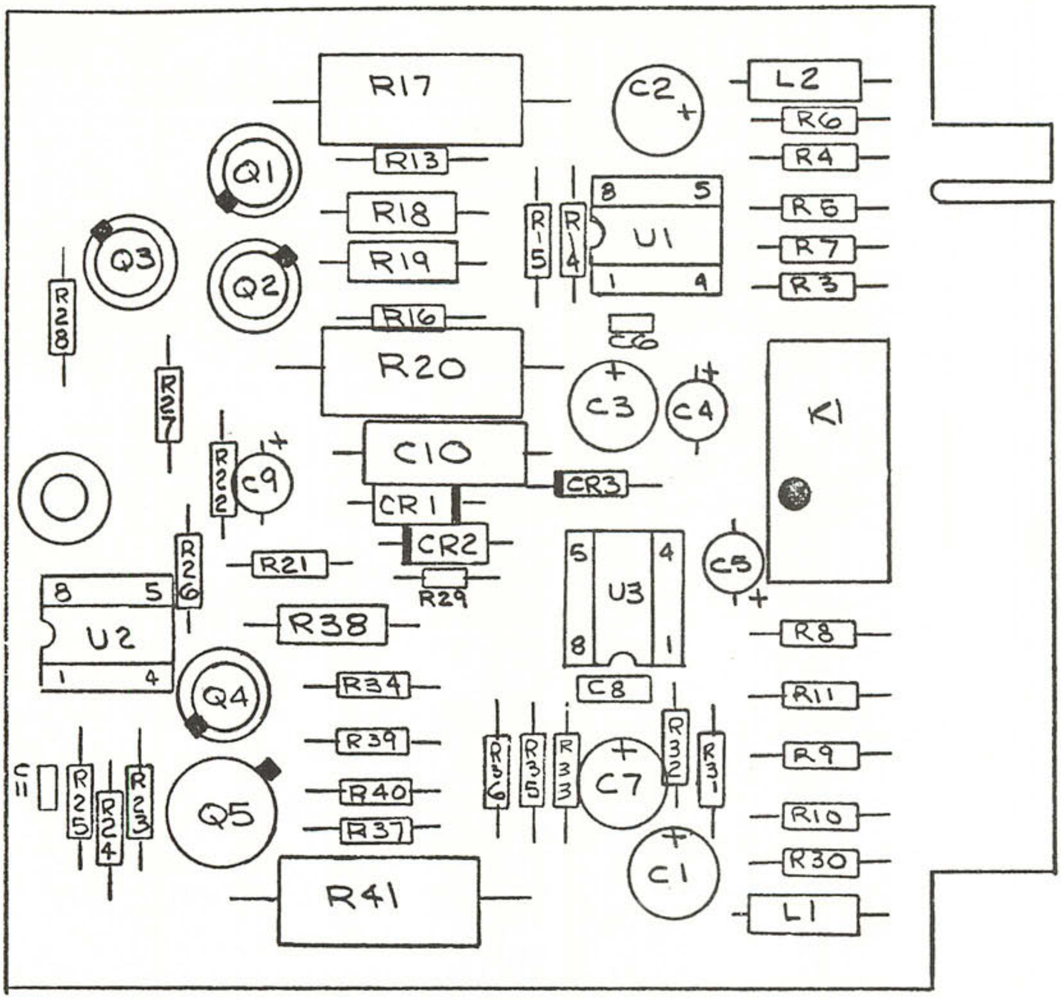
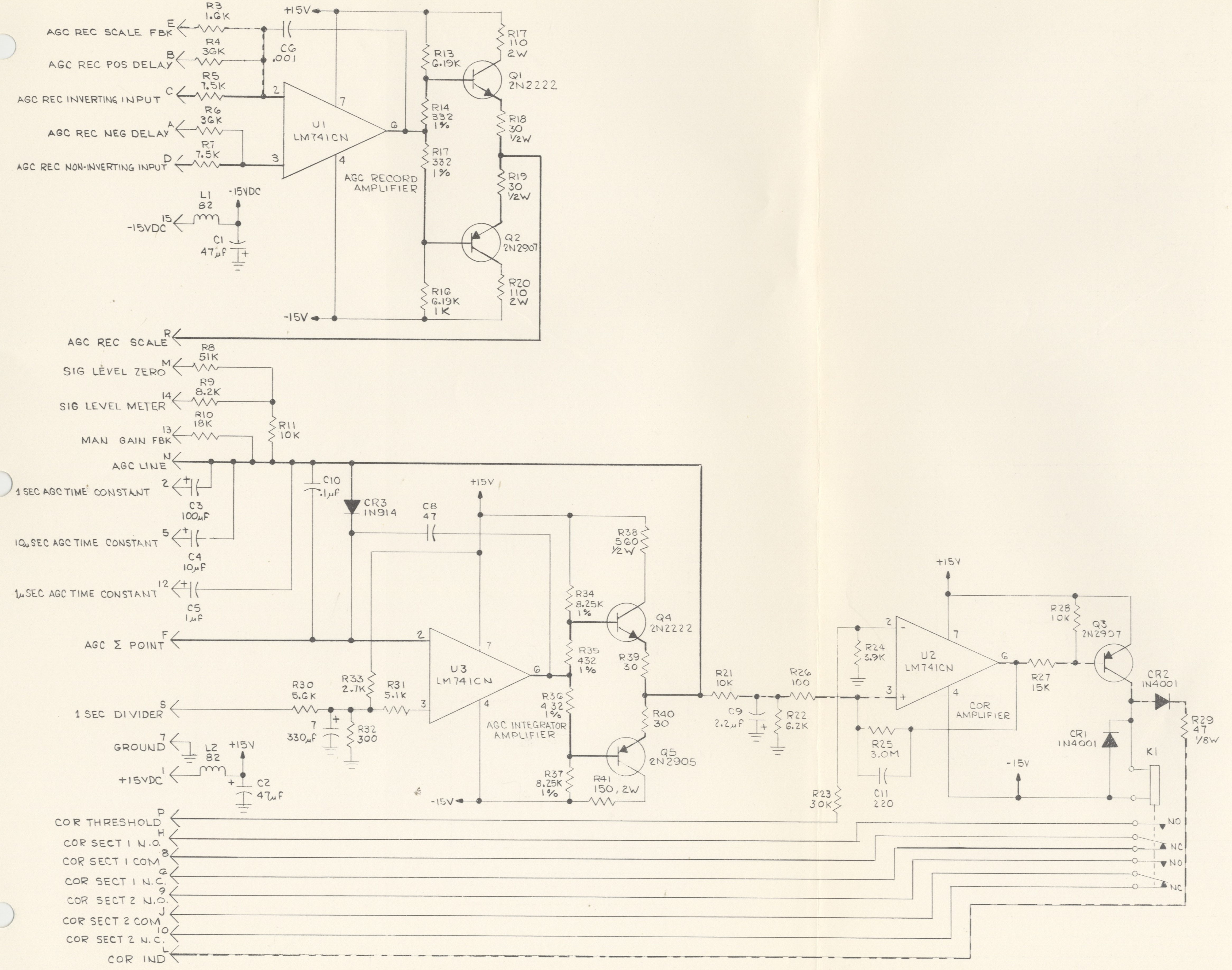


Figure 1. Component Location Drawing



NOTES:
UNLESS OTHERWISE SPECIFIED:

1. CAPACITOR VALUES GREATER THAN 1.0 ARE IN PICOFARADS.
2. CAPACITOR VALUES LESS THAN 1.0 ARE IN MICROFARADS.
3. INDUCTOR VALUES ARE IN MICROHENRYS.
4. RESISTOR VALUES ARE IN OHMS; K=X 1000, M=X 1,000,000.
5. LINE INFORMATION:

——————— SIGNAL FLOW
- - - - - - - FEEDBACK
— — — — COR SIGNAL

Figure 2. AGC Amplifier, Schematic Diagra

Revised: July 1974

Instruction Booklet

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300-089 METERING AMPLIFIER

January 1973

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METERING AMPLIFIER

GENERAL

The 300-089 metering amplifier is designed for use with Microdyne telemetry equipment and accepts inputs from the associated parent unit demodulator and video amplifier. These signals are then amplified and rectified, and applied to front panel deviation and video output level meters. A schematic diagram of the module is shown in figure 2.

INSTALLATION

No definite installation procedures are applicable to the metering amplifier since it can be installed in various parent units. Any special procedures required to install the module are specified in the parent unit instruction manual REPAIR procedures.

The metering amplifier is constructed on a printed circuit board which plugs into a parent unit receptacle.

THEORY OF OPERATION

The metering amplifier consists of two integrated circuit amplifiers, U1 and U2, and the crystal oven heater control circuit composed of transistors Q1, Q2, and Q3. These stages perform the following functions: they amplify the signal received from the demodulator, rectify it, and apply it to a deviation meter; secondly, they amplify the received signal from a video amplifier, rectify it, and apply it to the front panel output level meter; thirdly, they act as a thermistor bridge amplifier and current source driver for the crystal oven in the parent unit rf tuner module.

The video input at pin 5, from the parent unit OUTPUT dB CAL control, is amplified by U1 and peak detected by CR5 and CR6 prior to being applied to the front panel OUTPUT dB meter via pin 11. Diodes CR3 and CR4 are utilized to obtain dc feedback for the amplifier circuitry.

The deviation signal input, originating in the demodulator, is applied to pin 2 and fed to amplifier U2 where it is amplified, peak detected, and applied to a deviation meter through pin 3. Potentiometer R28 is provided to set the output level for compatibility with the requirements of various parent units.

The oven sensor input at pin 14 is applied to the oven heater control circuit. When the sensor signal increases, conduction in transistor Q2 is increased causing a corresponding decrease in the conduction of transistor Q1 thereby decreasing the current flow through the heater. When the sensor signal decreases, the conduction in transistor Q2 is decreased which causes a corresponding increase in the conduction of transistor Q1 thereby increasing the current flow through the heater.

MAINTENANCE

PREVENTIVE MAINTENANCE

Preventive maintenance requirements for the metering amplifier consist of a semiannual check of the connector for corrosion and loose pins, and the module itself for signs of damage and loose components. Any defects observed during the inspection should be corrected immediately.

TROUBLESHOOTING

In the event of a malfunction, the trouble should first be isolated to a certain section of the module circuitry: amplifier U1, amplifier U2, and the crystal oven heater control circuit. This is accomplished by injecting a test signal as in steps e and f of the alignment procedure and observing whether the associated OUTPUT and DEVIATION meters are functioning. If the OUTPUT meter is inoperative, the fault lies in U1 and associated circuitry. Should the DEVIATION meter be inoperative, troubleshoot the circuitry associated with U2. A failure in the oven control circuit will be indicated by the rf tuner crystal oven not heating. Once the defective circuit has been located, the faulty component should be detected and replaced. Refer to figure 1 for component location of the metering amplifier. The following voltage chart is provided as an aid to troubleshooting the metering amplifier. The voltages were obtained with an HP412A dc voltmeter under "no signal" conditions, and may vary ±20% between modules.

Device	1	2	3	4	5	6	7	8	9	10	11	12
U1	+1 mV	-1 mV	-2 mV	-5.9	+4.2	+0.6	+0.025	+15	-			
U2	-7.5	-6.8	-	-14.6	+15	-6	-5.2	+5	-6	-15	+15	-6

	E	B	C
Q1	-2.9	-3.7	-3
Q2	-3.8	-3.1	-3.7
Q3	-3.8	-4.4	0

REPAIR

All components contained in the metering amplifier module are considered non-repairable and must be replaced when found defective. Components should be replaced with identical items, as described in the replacement parts list, for optimum performance.

ALIGNMENT

After the fault has been located and corrected, the module should be realigned. The test equipment necessary for alignment is as follows:

Extender Card	Microdyne 300-423
Signal Generator	As required
AC Voltmeter	HP3400A
Test Oscillator	HP652A

Procedure:

a. Install the tuner and the demodulators in the receiver.

b. Place the metering amplifier module on the extender card.

c. Connect the signal generator to the rf input. Connect the HP652A to the generator modulation input.

d. Connect the ac voltmeter to pin 2 of the extender card. Terminate the voltmeter in 75 ohms.

e. Set the signal generator for a 1 mV rf output at a frequency within the range of the tuner. Tune the receiver to the signal. Set the demodulator DEVIATION switch to its maximum position.

f. Set the HP652A for a modulating frequency of 1.7 kHz. Adjust the modulation level until the ac voltmeter indicates 15(±0.1) mV rms.

g. Adjust R28 on the metering amplifier for a full-scale indication on the DEVIATION meter.

h. If the deviation required to obtain a full-scale meter indication is other then the full-scale level engraved on the meter, check the operation of the parent unit demodulator.

i. Disconnect the test equipment.

REPLACEMENT PARTS LIST - (Reference Figure 1.)

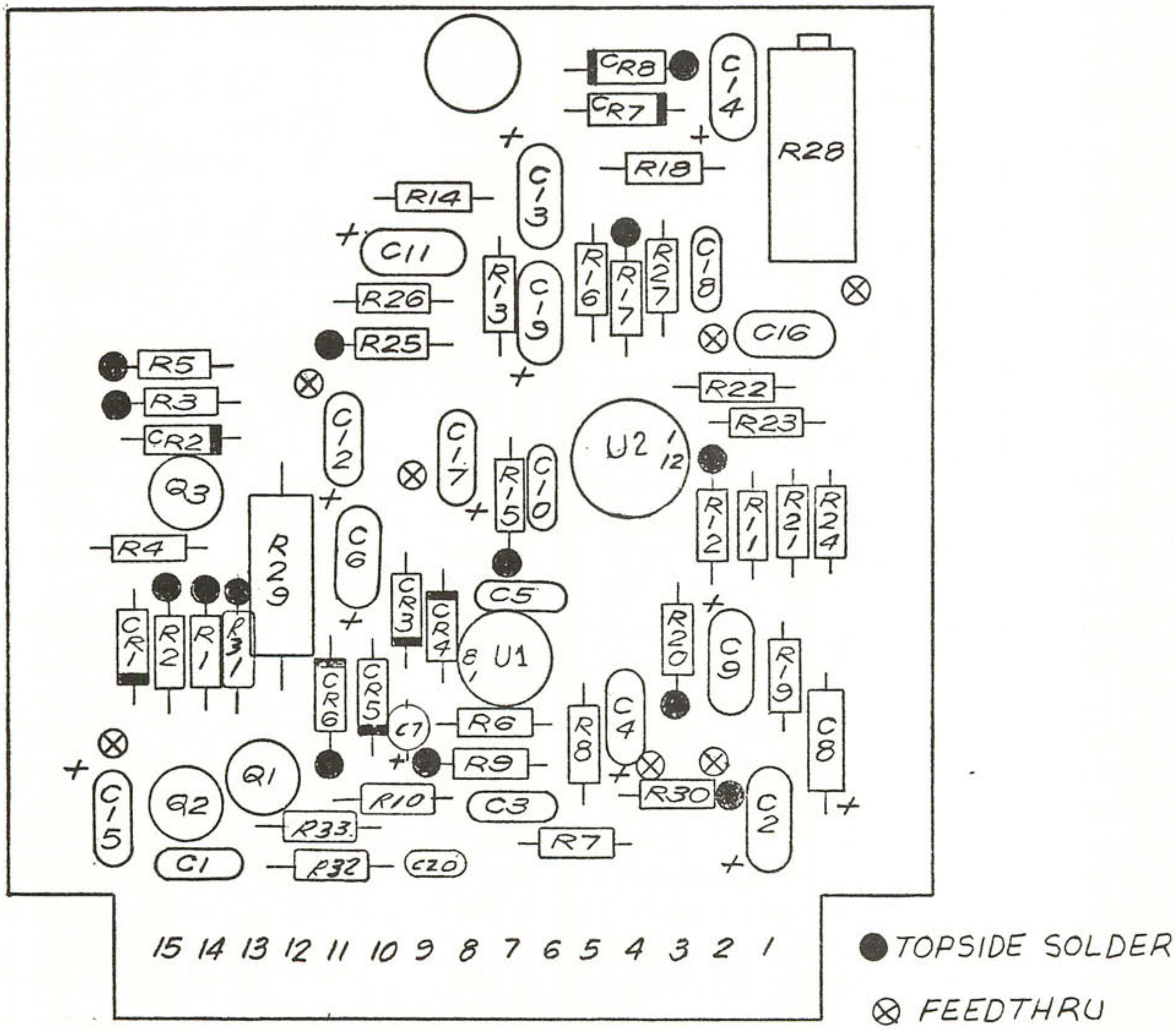
Reference Designation	Description
C1	Capacitor, ceramic, 0.015 µF ±20%, 100V, Erie 8131-100-X5U-153M
C2	Capacitor, tantalum, 100 µF ±20%, 20V, Kemet T362D107M020AS
C3	Capacitor, ceramic, 1000 pF ±5%, 100V, Erie 8121-100-COG-102J
C4	Capacitor, tantalum, 10 µF ±20%, 20V, Kemet T362B106M020AS
C5	Capacitor, ceramic, 750 pF ±5%, 100V, Erie 8121-100-COG-751J
C6	Capacitor, tantalum, 15 µF ±10%, 10V, Kemet T362B156M010AS
C7	Capacitor, tantalum, 15 µF ±10%, 10V, Kemet T362B156M010AS
C8	Capacitor, paper, 0.47 µF, Sprague 150D474X9035A2
C9	Capacitor, tantalum, 10 µF ±20%, 20V, Kemet T362B106M020AS
C10	Capacitor, ceramic, 1.3 pF ±0.1 pF, 100V, Erie 8101-100-COG-139B
C11	Capacitor, tantalum, 10 µF ±20%, 20V, Kemet T362B106M020AS
C12	Capacitor, tantalum, 10 µF ±20%, 20V, Kemet T362B106M020AS
C13	Capacitor, tantalum, 100 µF ±20%, 20V, Kemet T362D107M020AS
C14	Capacitor, tantalum, 100 µF ±20%, 20V, Kemet T362D107M020AS
C15	Capacitor, tantalum, 10 µF ±20%, 20V, Kemet T362B106M020AS
C16	Capacitor, tantalum, 47 µF ±20%, 20V, Kemet T362C476M020AS
C17	Capacitor, tantalum, 47 µF ±20%, 20V, Kemet T362C476M020AS
C18	Capacitor, ceramic, 3 pF ±0.1 pF, 100V, Erie 8101-100-COG-309B

Replacement Parts List, continued

Reference Designation	Description
C19	Capacitor, tantalum, 10 μF ±20%, 20V, Kemet T362B106M020AS
C20	Capacitor, ceramic, 10 pF ±5%, 100V, Erie 8101-100-COG-100J
C21	Capacitor, ceramic, 10 pF ±5%, 100V, Erie 8101-100-COG-100J
CR1	Diode, Sylvania 1N914
CR2	Diode, Sylvania 1N914
CR3 thru CR8	Diode, Sylvania 1N277
Q1	Transistor, Motorola 2N2907
Q2	Transistor, Motorola 2N2222
Q3	Transistor, Motorola 2N2222
R1	Resistor, fixed composition, 510Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB5115
R2	Resistor, film, 10KΩ ±1%, IRC RN55D1002F
R3	Resistor, film, 10KΩ ±1%, IRC RN55D1002F
R4	Resistor, fixed composition, 820Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB8215
R5	Resistor, film, 5.1KΩ ±1%, IRC RN55D5111F
R6	Resistor, fixed composition, 27KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB2735
R7	Resistor, fixed composition, 680Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB6815
R8	Resistor, fixed composition, 270Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB2715
R9	Resistor, fixed composition, 1KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1025
R10	Resistor, fixed composition, 36KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB3635
R11	Resistor, fixed composition, 13KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1335
R12	Resistor, fixed composition, 5.6KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB5625
R13	Resistor, fixed composition, 560Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB5615
R14	Resistor, fixed composition, 4.7KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB4725
R15	Resistor, fixed composition, 51Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB5105
R16	Resistor, fixed composition, 100KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1045
R17	Resistor, fixed composition, 10KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1035
R18	Resistor, fixed composition, 30KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB3035
R19	Resistor, fixed composition, 1KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1025
R20	Resistor, fixed composition, 62KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB6235
R21	Resistor, fixed composition, 91KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB9135
R22	Resistor, fixed composition, 100KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1045
R23	Resistor, fixed composition, 56Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB5605
R24	Resistor, fixed composition, 8.2KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB8225
R25	Resistor, fixed composition, 3.9KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB3925
R26	Resistor, fixed composition, 1.5KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1525
R27	Resistor, fixed composition, 6.8KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB6825
R28	Potentiometer, 25KΩ, Beckman 77PR25K
R29	Resistor, fixed composition, 1KΩ ±5%, 1w, Allen Bradley GB1025

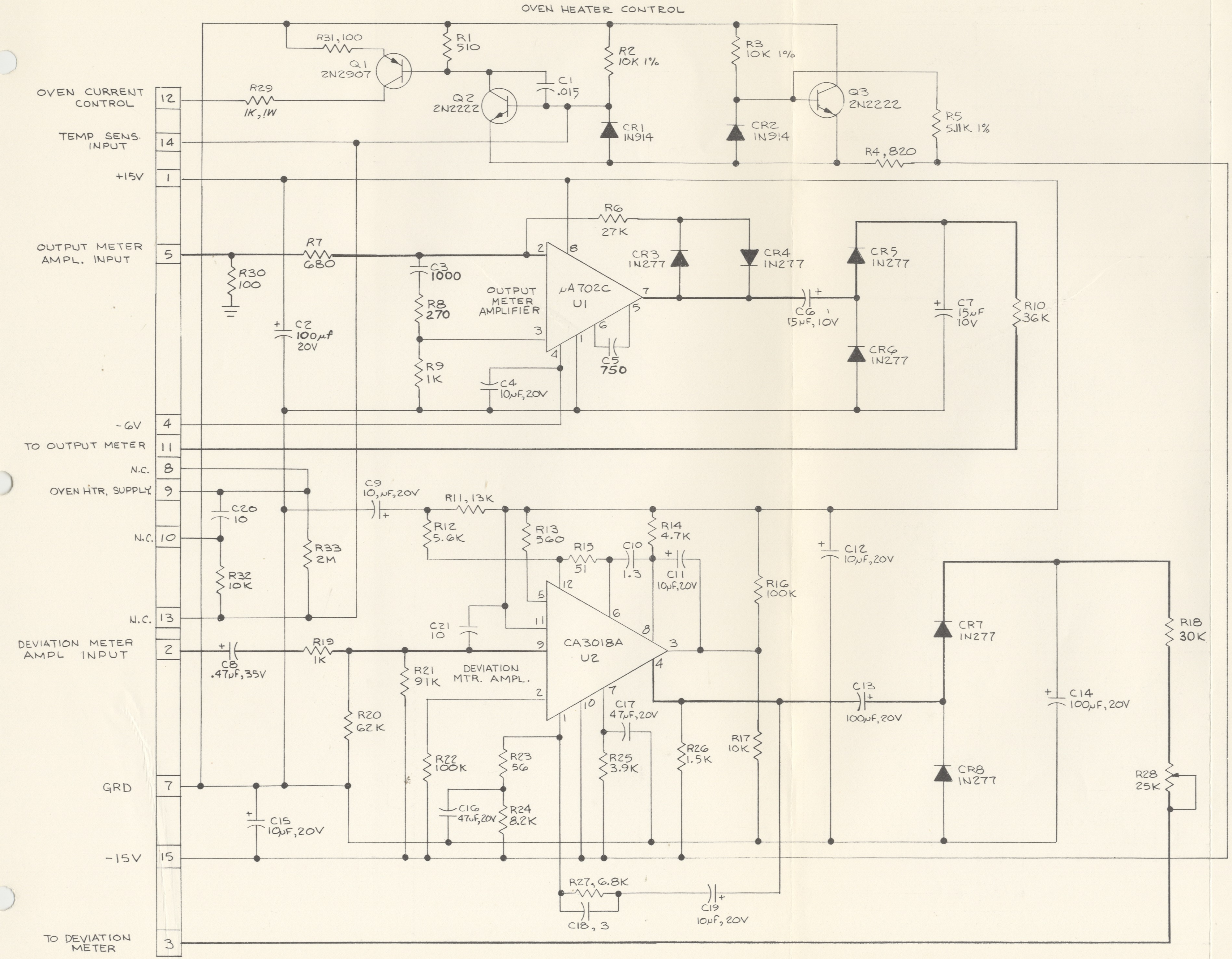
Replacement Parts List, continued

Reference Designation	Description
R30	Resistor, fixed composition, 100Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB1015
R31	Resistor, fixed composition, 100Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB1015
R32	Resistor, fixed composition, 10KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1035
R33	Resistor, fixed composition, 2MΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB2055
U1	Integrated circuit, Fairchild μA702C
U2	Integrated circuit, RCA CA3018A



C21 connected across U2

Figure 1. Metering Amplifier, Component Location



NOTE:
1. UNLESS OTHERWISE NOTED:
CAPACITOR VALUES LESS THAN ONE ARE IN MICROFARADS.
CAPACITOR VALUES GREATER THAN ONE ARE IN PICOFARADS.
INDUCTANCE VALUES ARE IN MICROHENRYS.
RESISTOR VALUES ARE IN OHMS, K=1000, M=1,000,000.

Figure 2. Metering Amplifier, Schematic Diagram 400-0

Instruction Booklet

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300-078 AFC AMPLIFIER

December 1972

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AFC AMPLIFIER

GENERAL

The afc amplifier is utilized in Microdyne telemetry equipment to supply automatic frequency control of the parent unit second local oscillator. Should the parent unit be equipped with a phase demodulator, the afc amplifier operates in conjunction with the phase demodulator to supply the oscillator with automatic phase control voltages (APC). Outputs are also supplied to the parent unit tuning meter as an indication of the afc or apc loop stress, and for controlling a front panel search indicator lamp. A schematic diagram of the module is shown in figure 2.

INSTALLATION

AFC amplifier circuitry is mounted on a printed circuit card which plugs into a designated receptacle in the base unit. Any special procedures required to remove or install the module are given in the parent unit instruction manual.

THEORY OF OPERATION

The afc amplifier is composed of acquisition amplifier U2-Q4, retrace amplifier U1-Q1-Q2-Q3, integrator U3, and fet switches Q5 and Q6. See figure 2.

In actual operation, the afc amplifier functions in either a locked or sweeping mode to control the frequency of the second local oscillator. When the afc loop is locked and tracking, acquisition amplifier is held on by a voltage input from the a-m detector and carrier indicator lamp. With U2 on, Q4 is off, turning off the parent unit search lamp, and fet Q6 is on, coupling the afc/apc input from the demodulator to integrator U3.

U3 functions as an infinite gain stage to couple the afc/apc control voltage from the demodulator to the second local oscillator module for frequency control. Response time of the stage is determined by a capacitor in the demodulator module which is electrically connected between pins 11 and 8 on afc module. Potentiometer R30 is provided as the balance adjustment.

Should the afc tracking loop be broken, acquisition amplifier U2 is shut off by the input from the receiver carrier indicator lamp. With U2 off, Q4 is turned on providing the circuit ground to illuminate the receiver search lamp. At the same time Q6 is turned off, Q5 is turned on connecting retrace amplifier (U1, Q1, Q2, Q3) across integrator U3. These two stages then function together to generate a ramp output employed to sweep the second local oscillator over its tuning range. The center frequency of the oscillator is determined by the positioning of the parent unit fine tune control. Frequency excursions on either side of the selected center frequency are set by the integrator/retrace amplifier. These limits are in turn controlled by the positioning of the parent unit search range control electrically connected to U1 via pin 10. Voltage limits are from 600 mV p-p at minimum search range to 20V ±3V p-p at maximum search range. Transistor Q1 in the retrace amplifier serves to amplify the regenerative feedback to maintain the ramp output. Transistors Q2 and Q3 serve as amplifiers to the ramp signal. This amplification is necessary because of the voltage divider in the associated fm demodulator and electrically connected between pins 9 and 14 of the afc module. The voltage divider is utilized to maintain the ±250 kHz sweep range regardless of whether the narrow, intermediate, or wide band demodulator circuit is used.

The module will generate the ramp output until the voltage input from the a-m detector and that from the carrier indicator lamp are indicative that a carrier is present in the i-f passband. Once these conditions are met, the acquisition amplifier is turned on to disable the sweep, turn off the search lamp, and configure U3 as an infinite gain stage to couple the afc signal to the oscillator module.

When the afc amplifier is utilized with a phase demodulator, the acquisition amplifier is not utilized. Parent unit wiring configures the retrace amplifier section with the demodulator ramp generator circuit and U3 is employed as an operational amplifier only. A complete description of the use of these stages for pm operation is given in the phase demodulator instruction manual.

MAINTENANCE

PREVENTIVE MAINTENANCE

Preventive maintenance requirements for the afc amplifier consist of a semiannual check of the connector for corrosion and loose pins, and the module itself, for signs of damage and loose components. Any discrepancies should be corrected by component replacement or module substitution.

TROUBLESHOOTING

In the event of a malfunction, the problem must first be isolated to one of the three main circuits; retrace amplifier, acquisition amplifier, and integrator/operational amplifier. This is accomplished as follows:

a. If the associated receiver search indicator can be turned on and off by the application of an rf signal to the receiver, the acquisition amplifier circuit is operative. If the indicator cannot be controlled in this manner, compare the dc voltages at pins 2, 3, and 6 of U2 with those given in the following table. If present, check the base voltage at Q4 with that in the table plus condition of CR2—open or shorted.

b. Connect a dc voltmeter to pin 11 of the module and adjust R30 from stop to stop. This action should cause the level at pin 11 to cross through 0V dc from a positive to a negative voltage or vice versa (the actual level is not important only the action of a voltage swing through 0V is). If the swing cannot be obtained, replace U3.

c. If all indications in a and b above are obtained, check the retrace amplifier by measuring the base to emitter voltage drop of Q1, Q2, and Q3. If these components are operating, there will be a 0.7V drop across the two points. Also check the condition of CR1 (open or shorted). If all conditions are met, compare the voltages at U1 pins 2, 3, and 6 with those in the following table. In addition, connect an oscilloscope to pin 6 of U1 and observe a signal switching from +15V to -15V dc. Should this level be absent, replace U1. If present, check for the same signal at the (-) input of U3. If this level is absent, replace Q5. If this level ls present, balance the fm demodulator per its instruction manual (balance is not required in the pm demodulator). Next, apply a 10 mV signal to the receiver at a frequency in the middle of the applicable rf tuner range. Tune the receiver to the signal with the 1ST and 2ND LO MODE switches set to VFO for an fm demodulator or to XTAL for a phase demodulator. With the receiver tuned (10.000 MHz i-f output measured at the receiver 10 MHz linear output connector), the voltage at the (-) input of U3 should be 0V dc. If other than 0V dc, replace Q6.

The voltage table given below provides the voltage levels necessary for troubleshooting the afc amplifier module. The voltage levels given are dynamic levels since the afc module cannot be checked in a static condition. Voltages were measured with an HP412A dc voltmeter and may vary ±20% between units.

Device	Pin Numbers	Voltage
U1	2	+190 mV
	3	- 24 mV
	6	- 12.4V
U2	2	+ 7.78V
	3	+ 1.64V
	6	+ 13.6V
Q1	Collector	+ 13.6V
Q2	Base	+ 13.5V
	Emitter	+ 14.4V
	Collector	+ 14.3V
Q3	Base	- 12.6V
	Collector	- 13.1V
Q4	Base	-590 mV
Q5	2 (gate)	- 12.4V
Q6	2 (gate)	- 12.4V

Refer to figure 1 for component location of the afc amplifier.

ALIGNMENT

The following alignment procedure should be followed when aligning the afc amplifier module. This procedure requires that the module be inserted in the parent unit with a Microdyne module extender card. This procedure requires the following equipment:

Extender Card	Microdyne 300-423
Oscilloscope	HP180A
DC Voltmeter	HP412A

Procedure:

a. Install the module in the parent unit with the extender card.

b. With the fm demodulator installed in the parent unit, set the 2ND LO MODE switch to the XTAL position.

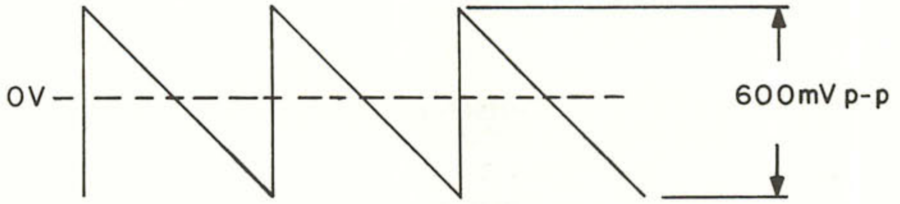
c. Connect the dc voltmeter to pin 11 of the module.

d. Adjust R30 on the afc module for 0(±0.5) mV dc voltmeter reading.

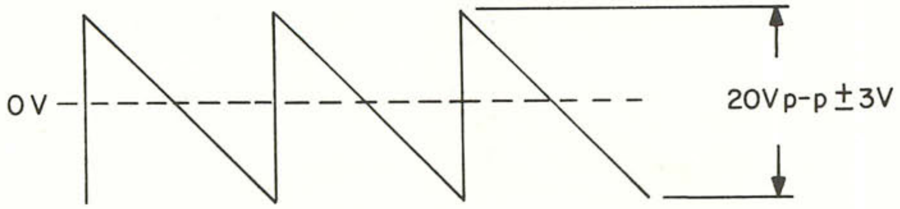
e. Set the 2ND LO MODE switch on the parent unit to the AFC position.

f. Connect the HP180A oscilloscope to pin 11. Set the SEARCH RANGE control on the parent unit fully counterclockwise.

g. Insure that the calibration/reference oscillator is not enabled. The oscilloscope should display a sawtooth waveform and the AUTO SEARCH lamp on the parent unit should be illuminated.



h. Slowly turn the SEARCH RANGE control on the parent unit to a fully clockwise (maximum) position. Adjust potentiometer R37 on the afc amplifier module for a vertical deflection which is symmetrical about 0V dc.



i. Disconnect the test equipment and return the module to the parent unit.

REPLACEMENT PARTS LIST - (Reference Figure 1.)

Reference Designation	Description
C1	Capacitor, ceramic, 220 pF ±20%, 100V, Erie 8111-100-X5R-221M
C2	Capacitor, ceramic, 470 pF ±20%, 100V, Erie 8111-100-X5R-471M
C3	Capacitor, ceramic, 470 pF ±20%, 100V, Erie 8111-100-X5R-471M
C4	Capacitor, electrolytic, 47 μF ±20%, 20V, Kemet K47E20
C5	Capacitor, electrolytic, 47 μF ±20%, 20V, Kemet K47E20
C6	Capacitor, tantalum, 0.47 μF ±20%, 35V, Sprague CS13BF474K
C7	Capacitor, electrolytic, 47 μF ±20%, 20V, Kemet K47E20
C8	Capacitor, ceramic, 220 pF ±20%, 100V, Erie 8111-100-X5R-221M
C9	Capacitor, ceramic, 470 pF ±20%, 100V, Erie 8111-100-X5R-471M
C10	Capacitor, tantalum, 3.3 μF ±20%, 15V, Sprague CS13BD335K
C11	Capacitor, tantlaum, 3.3 μF ±20%, 15V, Sprague CS13BD335K
C12	Capacitor, ceramic, 0.01 μF ±20%, 100V, Erie 8131-B106-X5VO-103M
C13	Capacitor, ceramic, 0.01 μF ±20%, 100V, Erie 8131-B106-X5VO-103M
*C14	Capacitor, ceramic, 150 pF ±5%, 100V, Erie 8121-100-COGO-151J if U3 is Zeltex 133 or Capacitor, ceramic, 47 pF ±5%, 100V, Erie 8121-100-COGO-470J if U3 is Nexus QFT-2 or Capacitor, ceramic, 47 pF ±5%, 100V, Erie 8121-100-COGO-470J if U3 is Analog Devices 43K
CR1 thru CR3	Diode, silicon, Sylvania 1N914
CR4	Diode, zener, silicon, JEDEC 1N748
Q1	Transistor, npn, Motorola 2N3947
Q2	Transistor, pnp, Motorola 2N3251
Q3	Transistor, npn, Motorola 2N3947
Q4	Transistor, npn, Motorola 2N2222
Q5	Transistor, fet, Motorola 2N4351
Q6	Transistor, fet, Motorola 2N4352
R1	Resistor, fixed composition, 18KΩ ±5%, ¼w, Allen Bradley CB1835
R2 thru R4	Resistor, fixed composition, 1KΩ ±5%, ¼w, Allen Bradley CB1025
R5	Resistor, fixed composition, 1.5KΩ ±5%, ¼w, Allen Bradley CB1525
R6	Resistor, fixed composition, 360KΩ ±5%, ¼w, Allen Bradley CB3645
R7	Resistor, fixed composition, 15KΩ ±5%, ¼w, Allen Bradley CB1535
R8 thru R11	Resistor, fixed composition, 100KΩ ±5%, ¼w, Allen Bradley CB1045

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*Depends on Operational Amplifier used.

Replacement Parts List, continued

Reference Designation	Description
R12	Resistor, fixed composition, 62KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB6325
R13	Resistor, fixed composition, 15KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1535
R14	Resistor, fixed composition, 100KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1045
R15	Resistor, fixed composition, 750Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB7515
R16	Resistor, fixed composition, 3KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB3025
R17	Resistor, fixed composition, 47KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB4735
R18	Resistor, fixed composition, 20KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB2035
R19	Resistor, fixed composition, 10KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1035
R20	Resistor, fixed composition, 10KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1035
R21	Resistor, fixed composition, 750KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB7545
R22	Resistor, fixed composition, 1.5KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1525
R23	Resistor, fixed composition, 20KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB2035
R24	Resistor, fixed composition, 100KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1045
R25	Resistor, fixed composition, 20KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB2035
R26	Resistor, fixed composition, 160Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB1615
R27	Resistor, fixed composition, 1MΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1055
R28	Resistor, fixed composition, 1MΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1055
R29	Resistor, fixed composition, 47KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB4735
*R30	Potentiometer, 5KΩ, 3/4w, Beckman 89WR5K if U3 is Zeltex 133 or
	Potentiometer, 1KΩ,3/4w, Beckman 89WR1K if U3 is Nexus QFT-2 or
	Potentiometer, 1KΩ, 3/4w, Beckman 89WR1K if U3 is Analog Devices 43K
R31	Resistor, fixed composition, 47Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB4705
R32	Resistor, fixed composition, 47Ω ±5%, $\frac{1}{4}$w, Allen Bradley CB4705
R33	Resistor, fixed composition, 62KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB6235
R34	Resistor, fixed composition, 750KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB7545
R351	Resistor, fixed composition, 1KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1025
R36	Resistor, fixed composition, 1MΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1025
R37	Potentiometer, 100KΩ, 1/2w, Allen Bradley SV1041
R38	Resistor, fixed composition, 6.2KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB6225
R39	Resistor, fixed composition, 15KΩ ±5%, $\frac{1}{4}$w, Allen Bradley CB1535
U1	Integrated Circuit, Fairchild µA709C
U2	Integrated Circuit, Fairchild ΩA709C
*U3	Operational Amplifier, Zeltex 133 or Nexus QFT-2 or Analog Devices 43K

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*Depends on Operational Amplifier used.

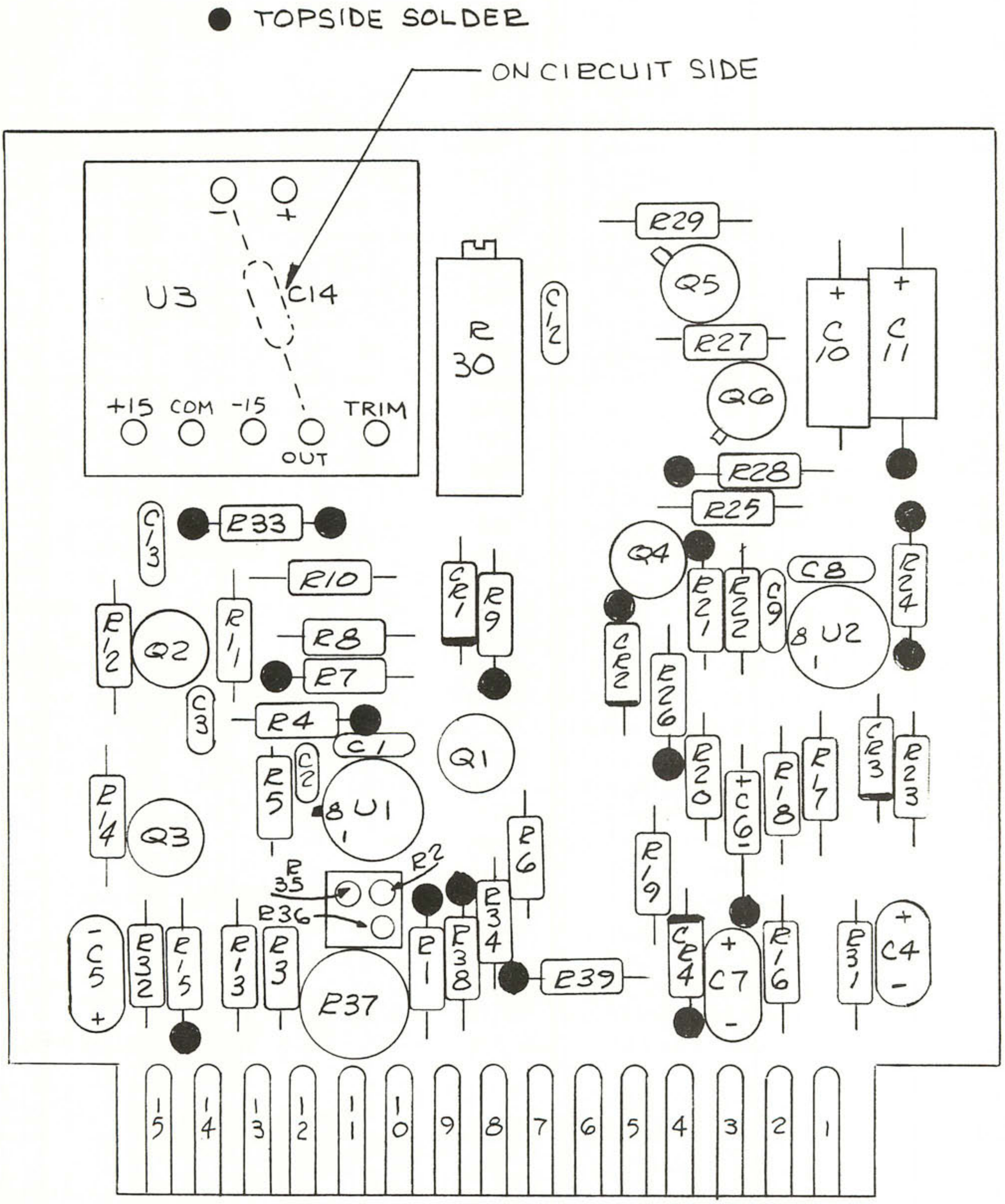
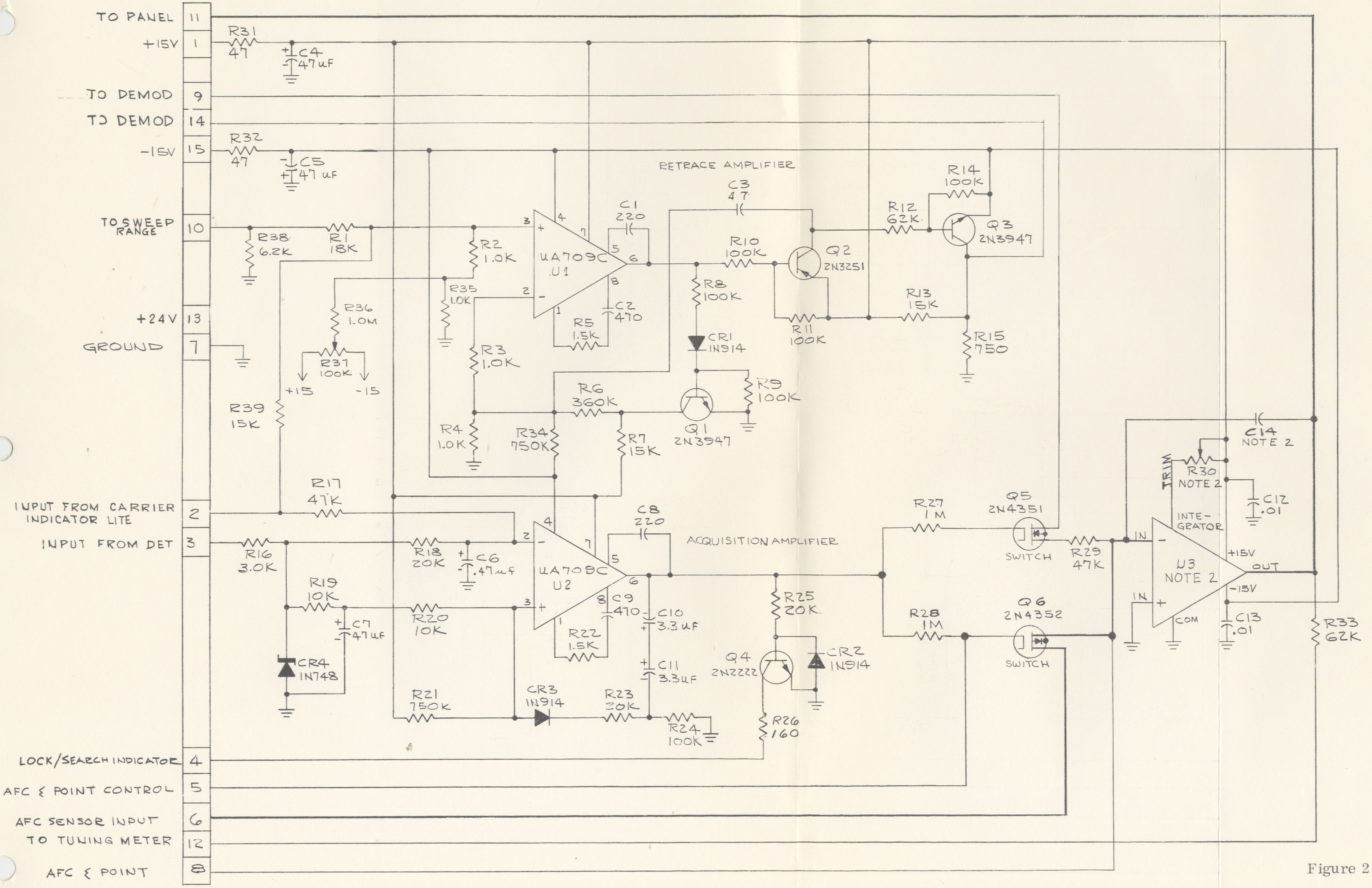


Figure 1. AFC Amplifier, Component Location



NOTE:
1. UNLESS OTHERWISE NOTED:
CAPACITOR VALUES LESS THAN ONE ARE IN MICROFARADS.
CAPACITOR VALUES GREATER THAN ONE ARE IN PICOFARADS.
INDUCTANCE VALUES ARE IN MICROHENRYS.
RESISTOR VALUES ARE IN OHMS K=1000, M=1,000,000.

Figure 2. AFC Amplifier
Schematic Diagram 400-030