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MICRO-TEL CORPORATION
6310 Blair Hill Lane
Baltimore, Maryland 21209

OPERATION AND MAINTENANCE MANUAL for SERIES 1200 WIDE RANGE RECEIVERS

IF Reference source.

NARROW SWEEP

IF gain MAX ↻

SET REF to zero on OP meter

GHz	
3.0	-65 dBm
4.0	-70 dBm
3.5	-65 dBm

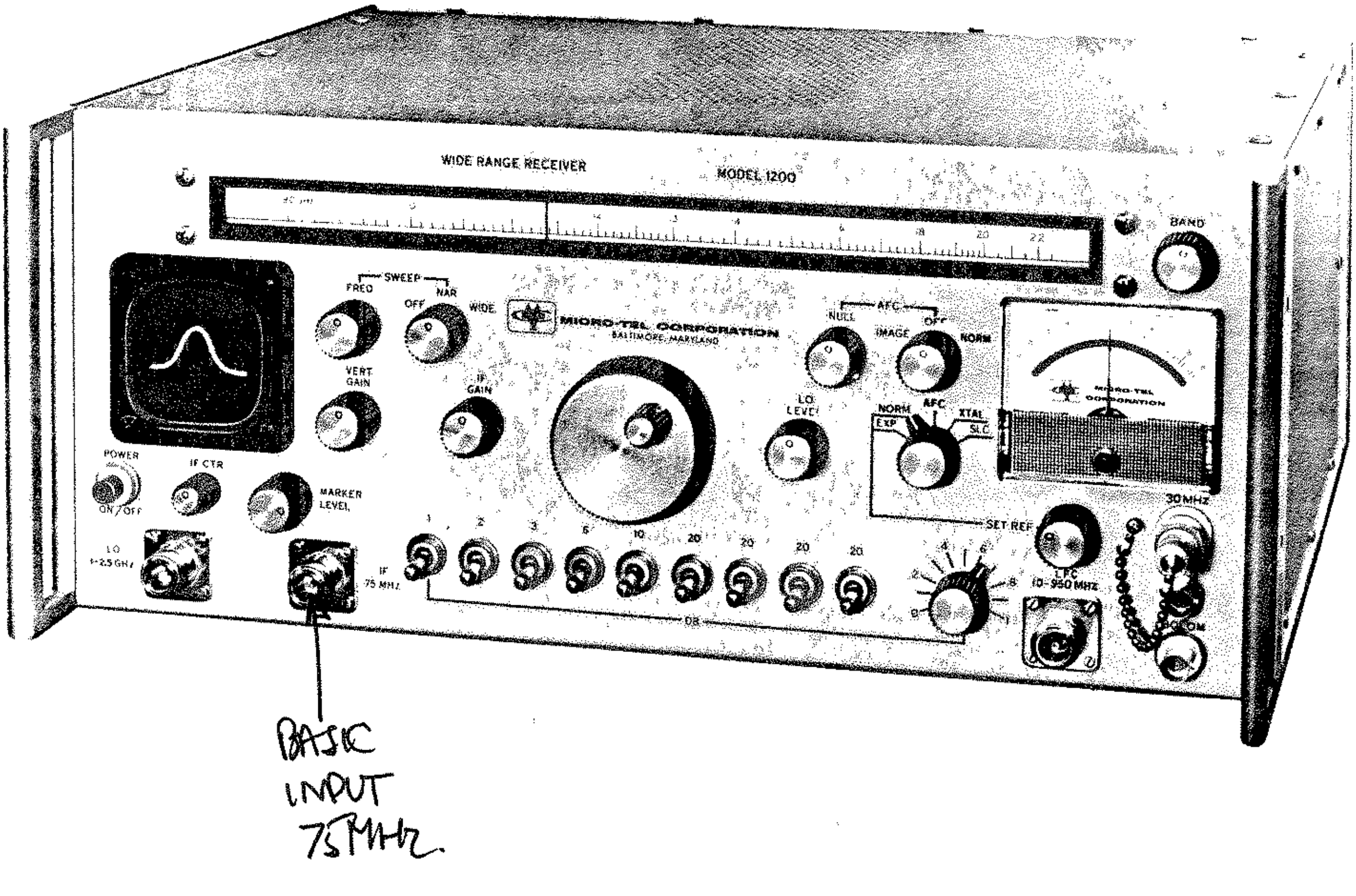
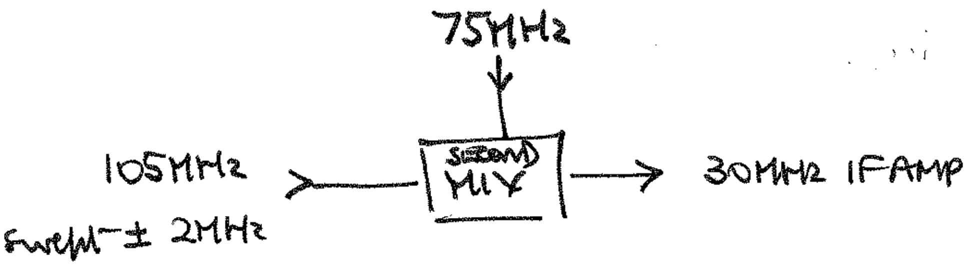


Figure 1-1. Series 1200 Wide Range Receiver, Overall View


75MHz
SECOND
MIX
105MHz
swept ± 2MHz
30MHz IFAMP

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1.0 GENERAL DESCRIPTION

1.1 INTRODUCTION

The purpose of this manual is to describe the operation and maintenenace of the Micro-Tel Series 1200 Wide Range Receiver. It is intended for personnel who are responsible for the operation and/or maintenance of the Receiver equipment.

The manual is intended to instruct electronics technicians and engineers in the operation, check out, alignment, calibration, and servicing of the 1200 Receiver. Section 1 contains a functional description of the major system components. Section 2 contains unpacking and initial set-up instructions; Section 3 describes complete operation; Section 4 provides a brief theory of operation for each major subsystem; Section 5 includes alignment, measurement, and replacement procedures; Section 6 provides a complete parts list; and Section 7 contains schematic diagrams of the major subassemblies.

Optional equipment and/or accessories included with the basic 1200 Receiver (for the latest Serial Number indicated on Page A) are described in Section 8.

1.2 GENERAL

The Micro-Tel Series 1200 Wide Range Receiver is a versatile laboratory instrument designed for antenna pattern ranges, attenaution measurements, spectrum surveillance, and general laboratory use. It is a highly linear receiver which features a square law bolometer output, an audio-video crystal detector, IF output, internal attenuator, and reference channel for slideback measurements. The receiver covers the frequency range of 950 MHz to 150 GHz, with a sliderule dial directly calibrated to 150 GHz. A built-in low frequency converter can be added for accurate coverage down to 20 MHz (useful coverage to 10 MHz).

All major components are contained in a single case as shown in Figure 1.1. The receiver is fully solid state except for the cathode-ray tuning indicator and the first local oscillator.

At Frequencies above 950 MHz a signal combiner and remote mixer permit the use of a single coaxial cable between the receiver and antenna with reduced loss of sensitivity, since the cable carries the first local oscillator signal up to the mixer and the first intermediate frequency returns through the cable to the receiver.

The receiver signal may be CW, pulse or squarewave modulated. An internal modulator provides the 1000-Hz output signal required for antenna pattern recorder use. The bolometer output is linear over a 40-dB range, and the receiver may be operated over a 100-dB range as a slideback device with continuous readout of attenuation. Mechanical and electronic automatic frequency control permits the reception of CW signals from simple signal sources. Frequency preselection is not required below 950 MHz because of the conversion method.

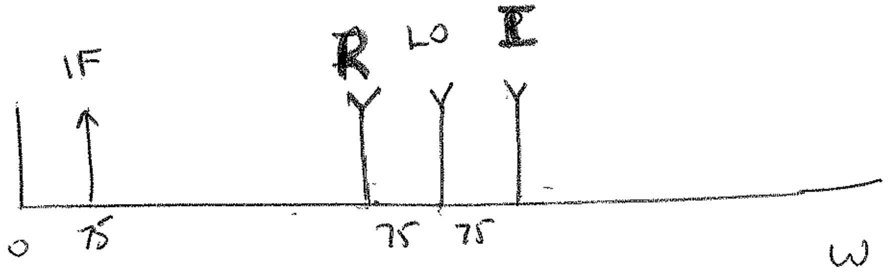
1.3 PRINCIPLES OF OPERATION (Figure 1.2)

For convenience, assume the presence of a 75-MHz signal at the input to the step attenuator. Operation of the first local oscillator, mixer, and optional and accessory equipment will be covered in subsequent paragraphs.

The step attenuator is a step unit which can be adjusted to attenuate the input signal to the 75-MHz preamplifier over a range of 102 dB in 1-dB steps. In addition, the 0-1 dB attenuator control provides finer adjustment, but it actually controls the gain of the IF amplifier. The preamplifier has a bandwidth of 5 MHz and is extremely flat over at least 2 MHz. The flatness is required so that AFC corrections will not cause a change in the amplitude response of the amplifier. The output of the 75-MHz preamplifier is fed to the second mixer.

The swept oscillator provides a heterodyne signal to the second mixer. It may be operated CW or in a swept mode. The CW mode is selected when the receiver is used for the detection of pulse signals. For the reception of CW signals, the oscillator is swept about its center frequency at a 1000-Hz rate, adjustable plus a minus 5 percent. The swept oscillator operates at a center frequency of 105 MHz and may be swept up to ±2 MHz. The oscillator mode is selected by a control on the front panel. Wide sweep is used for convenience in tuning to display the maximum frequency spectrum on the scope display. Narrow sweep ensures the maximum

LO 1 to 2.575 GHz.
200mW



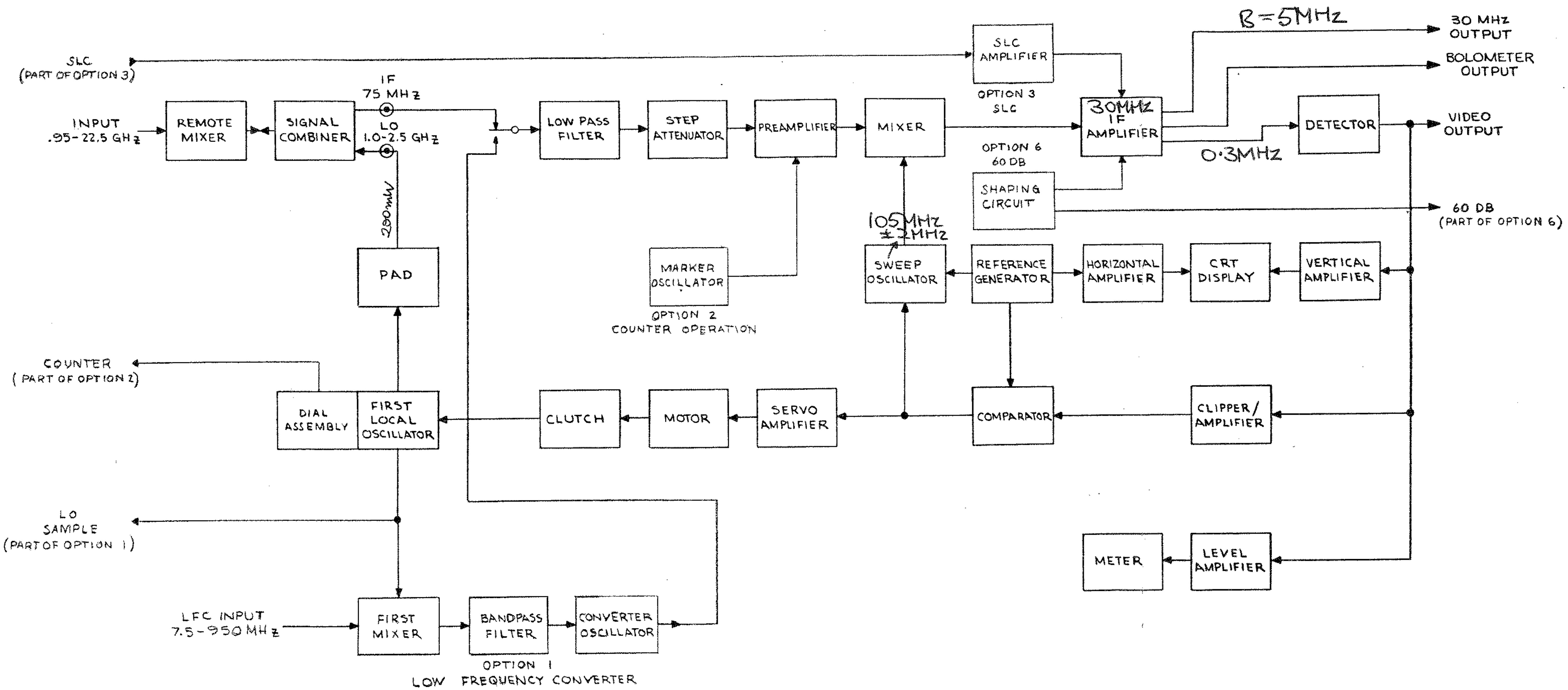


Figure 1-2. Receiver, Simplified Block Diagram

transfer of useable energy through the receiver to the VSWR amplifier or antenna pattern recorder.

The second mixer output, sweeping about a center frequency of 30 MHz, produces a 1000-Hz AM signal at the output of the linear 30-MHz IF amplifier. The amplitude of this signal is precisely proportional to the incoming signal level over a 40-dB dynamic range.

Three output signals are derived from the IF amplifier: One is connected to a square law detector (bolometer), and the bolometer output is available at the front panel for direct connection to a VSWR amplifier, antenna pattern recorder, or other device calibrated for use with square law detectors. The second output is connected to a crystal diode (the detected envelope is displayed on the front panel cathode-ray tube) and it is also used for the AFC and level signal. This output is placarded VIDEO on the front panel. The scope display shows frequency versus amplitude with the horizontal axis representing up to 4 MHz depending on the position of the sweep control. The third output is a sample of the 30-MHz IF and is also available on the front panel. It has a bandwidth of 5 MHz and may be used to drive a noise meter or crystal detector. With a crystal detector, the 1200 Receiver becomes a broadband receiver for observing pulses.

For AFC, a sample of the diode detector output is filtered, amplified, and applied to a phase comparator. The reference generator, which provides the sweep to the swept oscillator, also supplies a reference square wave to the phase comparator. A shift in phase balance between these two signals is interpreted as a shift in the incoming 75-MHz signal. The output of the phase comparator shifts the center frequency of the swept oscillator electronically to keep the incoming signal in the center of the receiver passband. The phase comparator output is further amplified and applied to a servo motor which mechanically repositions the first local oscillator to compensate for large frequency shifts in the received signal.

For normal operation, the output of the first local loscillator is passed to a signal combiner which isolates the local oscillator frequency and the intermediate frequency. Oscillator energy is passed along the coaxial cable to the remote mixer. Fundamental ~~or~~ and harmonics of the oscillator heterodyne the incoming RF signal to generate a 75-MHz signal which is returned to the combiner on the same cable.

The combiner mounts directly to the LO and IF connectors on the receiver front panel. A three-port mixer may be used by connecting its IF and LO ports to these same connectors.

1.4 STANDARD EQUIPMENT

All of the Series 1200 Wide Range Receivers are supplied with a coaxial mixer and signal combiner. Both may be mounted at any distance up to 100 feet from the receiver. This mixer is rated for operation from 950 MHz to 15 GHz. At higher frequencies, waveguide mixers (not supplied) are recommended. (Refer to Paragraph 3.2.)

For short distances between the receiver and the signal source, RG-9B/U coaxial cable (not supplied) may be used between the receiver and the combiner or between the combiner and the mixer. When increased sensitivity is required or where longer cable runs are necessary, the coaxial cable should be a low-loss type. A printed circuit extender board is provided to facilitate testing of the individual boards.

1.5 ACCESSORIES

1.5.1 WAVEGUIDE MIXERS

A set of waveguide mixer-antennas is available for reception from 3.95 - 150 GHz. These mixers (Series 1205) are external to the receiver and may be operated remotely to avoid loss at the signal frequency.

1.5.2 DIRECTIONAL COUPLER

Model 1203 Directional Coupler (1-12.4 GHz) may be assembled to the coaxial mixer supplied with the receiver to obtain a 3-port mixer.

1.5.3 BATTERY SUPPLY

A rechargeable battery (model 2100) may be obtained to supply receiver power. The battery may be recharged from either a 110-vac or 12-vdc source.

1.6 SPECIFICATIONS

Frequency Range:	950 MHz to 150 GHz	
N.B. max level * Input:	CW, Pulse, Squarewave -15 dBm maximum	3.10^{-5} watts
Dial:	Direct Reading 950 MHz 150 GHz, Accuracy +1%	

video OP presumably

IF OP.

Bandwidth:	300 kHz and 5 MHz
Output:	Bolometer, crystal (Video) and IF (5 MHz BW)
Dynamic Range:	Bolometer linear to +0.25 dB over 40-dB range
IF Attenuation:	102 dB in 1-dB steps 0-1 dB continuous Accuracy 1% or 0.2 dB whichever is greater
Reference Level:	±10 dB and ±0.5 dB full scale, zero-center
AFC:	Electronic over 4-MHz range; Mechanical-continuous. Operable to 10 dB above noise. +2 volt control signal for external use.
Size:	19" x 7" x 15" Rack Mount; 17" x 7" x 15" Case
Weight:	34 pounds
Power:	115/230 volts, 50-400 Hz, 45 watts

The 1200 Receiver uses only two vacuum tubes. A type 2AP1-A cathode ray tube is the display, and a planar triode is used in the first local oscillator.

The power line is protected by a 1-ampere type 3AG fuse which is located on the rear panel of the receiver.

The basis 1200 Receiver without the external mixer, consists of a low-noise 75-MHz receiver and a tuneable oscillator. The oscillator covers the frequency range of 1000 to 2575 MHz and provides a power output of at least 200 milliwatts at the LO connector on the front panel (with the internal oscillator attenuator removed). The receiver has an equivalent noise input of -120 dBm at 75 MHz.

Sensitivity:	0.95 to 2.5 GHz	-110 dBm min.
	2.5 to 10 GHz	-85 to -105 dBm min.

N.B. LO OP available if requ'd

These sensitivity figures are for the untuned coaxial mixer supplied with the receiver. Significant improvement will be realized by use of a double stub tuner, by tuned waveguide mixers, or by a 3-port mixer. Sensitivities of -105 dBm may be attained at X-band by optimum choice of mixer components. Sensitivites continue to decrease above 10 GHz because of the harmonic mixing technique employed; sensitivities of -60 dBm at 70 GHz may be expected. By employing backward wave oscillators up to 40 GHz (with AFC supplied by the receiver) sensitivities of -105 dBm are attainable.

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2.0 INSTALLATION

2.1 UNPACKING AND INSPECTION

The receiver should be unpacked and visually inspected for any damage during shipment. Locate the signal combiner, the remote mixer, and printed circuit extender board. Next remove the top and bottom receiver covers and inspect for loose components. Push all printed circuit cards firmly down into their connectors. Check all coaxial connectors to ensure that they are firmly mated.

The receiver may be mounted in any convenient position or attitude, and no consideration need be given to cooling unless it is operating in a high ambient temperature or is placed next to equipment which radiates excessive heat.

2.2 POWER REQUIREMENTS AND MIXER CONNECTION

Locate the power selection adjustment on the rear panel (to the left of the FUSE), and using a screwdriver, slide the switch up or down until the appropriate line voltage shows.

Connect the receiver to a 3-wire grounded 50/400-Hz power source, either 115 volts or 230 volts.

CAUTION

This unit will be damaged if operated from a 230-volt source with the power selection switch in the 115-volt position.

Current drain is well below one ampere, so any conventional power cable or connectors are suitable. If the receiver has not been exposed to a large change in ambient temperature, it will be ready for operation in a few minutes.

Connect the remote coaxial mixer as follows:

If the two-port mixer supplied is to be used, connect the signal combiner to the receiver, either directly mounted to the front-panel LO and IF or connected through cables. Then connect the combiner to the mixer. The female type-N connector on the mixer connects to the MIXER fitting on the combiner. If a three-port mixer is used, the combiner is not required; instead its LO and IF ports are connected to the corresponding receiver outputs. Use RG-9B/U coaxial cable for short distances; for distances in excess of 75-100 feet, use 50-ohm cable with lower loss, such as styrofoam.

3.0 OPERATION

This section contains complete operating instructions for the Series 1200 Wide Range Receivers. Individual models are available with options and accessories as described in Paragraph 3.9 to enhance the performance of the following basic measurement functions:

Antenna Pattern Recording

Attenuation Measurement

Table 3.1 lists each front panel control and display, and each rear panel function of the 1200 Receivers.

3.1 TURN-ON

Connect the receiver to a primary power source, and observe the CAUTION in Paragraph 2.2.

Set each control as follows:

SWEEP FREQ	Centered
SWEEP Width	NAR (narrow)
VERT GAIN	Centered
IF GAIN	Clockwise
AFC NULL Centered	
AFC	OFF
SET REF	Centered
LO LEVEL	Counterclockwise
Meter Switch	XTAL
BAND	Desired Frequency Range
Step Attenuator	0 dB

Push the POWER ON/OFF switch, noting that the integral amber lamp illuminates, after about 30 seconds, observe a horizontal trace on the cathode-ray tube. A small amount of noise may be observed on the trace.

CAUTION

Always connect the 50-ohm termination to the 30-MHz output if it is not loaded externally.

3.2 NORMAL OPERATION

Turn the BAND selector so that the appropriate band appears in the dial window.

NOTE

For operation between 950 MHz and 15 GHz, use the frequency combiner and coaxial mixer supplied with the receivers. At higher frequencies accessory wave-guide mixers to 150 GHz are available from the factory.

Connect the combiner directly to the receiver LO and IF connectors or via a length of RG-9B/U cable. Then connect the mixer to the combiner. The total cable length may be as long as 100 feet although, at extreme lenghts, it may not be possible to read mixer crystal current. Inability to read crystal current at the receiver does not infer that mixing action will not take place. Since the mixer presents a severe mismatch to the coaxial cable, varying the length of the cable slightly may markedly change the indicated crystal current.

Tune to the approximate frequency to be measured and adjust LO LEVEL for approximately 1 ma of crystal current (or use maximum LO LEVEL if necessary). This adjustment is not critical.

Now adjust the tuning control so the incoming CW signal is centered on the cathode-ray tube. Adjust the SWEEP FREQ and LO LEVEL for maximum output by observing the VSWR meter, recorder, or CRT.

When searching for a signal, set VERT GAIN fully clockwise for maximum gain. As the signal level increases reduce gain to limit the CRT display height.

3.3 AUTOMATIC FREQUENCY CONTROL

When the CW signal has been tuned in and properly centered on the cathode-ray tube, and the LO LEVEL adjusted for maximum output, proceed as follows:

Turn the AFC switch from OFF to NORM and the meter switch to AFC. Remove or lower the signal to at least -120 dBm, adjust the NULL control for 0 deflection on meter.

NOTE

Another setting of the SWEEP FREQ, LO LEVEL, or IF GAIN controls may require resetting the NULL control as above.

Check the operation of the AFC by very slightly shifting the incoming signal. The tuning control should automatically retune to keep the pip and the meter centered. Above 950 MHz, the receiver does not discriminate between upper and lower image. However, the tuning dial is arbitrarily calibrated on the upper image for which the AFC switch should be set to NORM. If operation on the lower image is desired, this will be found 150 MHz lower in frequency (above 950 MHz only) and the AFC switch should be set to IMAGE.

The mechanical AFC is designed to correct only for slow drift of the signal source over extremely wide excursions.

3.4 ANTENNA PATTERN MEASUREMENTS

For antenna pattern measurements assure that the desired signal is properly tuned, that the AFC is operative, and that the maximum signal is being received; i.e., the test and source antennas are pointing directly at each other. Now, proceed as follows:

Set the VERT GAIN control, fully counterclockwise (reference position). The CRT gain is now set to a fixed value. Adjust the IF GAIN so that the response curve on the cathode-ray tube just fills the space between the two scribed horizontal lines. At this setting the bolometer output is at the maximum level below bolometer saturation. If signal level is excessive, reduce the IF gain, or switch in the step attenuator.

The step attenuation is located between the mixer and preamplifier, and reduces the signal level to the preamplifier in 1-dB steps. Finer resolution is achieved by use of the continuous 1-dB control, which varies IF gain.

CAUTION

Consideration must be given to the signal level at the mixer input. The mixer can be expected to be highly linear from approximately -15 dBm to the noise level of the receiver which occurs between -85 and -105 dBm, depending on frequency. Therefore, the incoming signal must always be 1 less than -15 dBm at the mixer.

Connect the antenna pattern recorder input to the BOLOM (bolometer) output of the receiver.

CAUTION

> Observe the usual precautions when connecting and disconnecting to the bolometer. The recorder bolometer bias supply should always be turned off when making or breaking the connection.

bias 8.75mA Bolometer

Adjust the bias supply in the recorder for 8.75 ma. Adjust the SWEEP FREQ control for maximum deflection of the recorder pen. Receiver and Recorder linearity can be checked by inserting attenuation in the receiver.

The receiver is now ready to record over a 40-dB dynamic range. Greater dynamic ranges can be recorded by IF substitution, but the saturation level of the mixer must be observed.

3.5 ATTENUATOR CALIBRATION

In this mode of operation, the receiver functions as an IF substitution device and is limited only by the saturation level of the mixer, receiver noise level, and accuracy of the step attenuator supplied in the receiver. When greater accuracy is desired, other types of attenuators are available. Contact the factory for details.

Apply a CW signal whose level is not greater than -20 dBm to the mixer. Turn the meter selector switch to NORM (or EXP). Refer to Table 3.1. By a combination of IF GAIN, SET REF and the attenuator, set the meter to zero. Note the amount of attenuation inserted including the 0-1 dB control. Now insert the attenuator to be measured between the mixer and signal source. Note the usual precautions involved in attenuation measurement; i.e., mismatch and the necessity for padding.

Readjust the step attenuator and 0-1 dB control to again establish zero on the meter. The difference between the first and second setting of attenuation represents the value of the unknown attenuator, provided the precautions concerning mixer saturation and VSWR error have been considered.

3.6 MODULATED SIGNALS

The receiver will operate properly with most modulated signals. However, adjust the SWEEP FREQ control to ensure that a zero beat does not occur between the external modulating frequency and the internal sweep. Turn off the internal sweep if the incoming signal is modulated at exactly 1000 Hz.

3.7 PULSE OPERATION

The channel bandwidth is approximately 300 kHz, and will pass pulses of 5 microseconds width or greater with reasonable fidelity. The IF output bandwidth is approximately 5 MHz. For reception of pulses with widths down to about 0.2 microsecond, connect an external crystal detector to the front panel 30 MHz output. Turn the SWEEP control to the OFF position and connect an appropriate oscilloscope to the VIDEO output on the front panel or to the external 30 MHz detector. Care should be taken to tune the receiver exactly to the frequency of the RF pulse.

AFC is not provided in this mode of operation; however, an option is available. Contact the factory for details.

3.8 EXTERNAL FIRST LOCAL OSCILLATOR

The receiver may be used with an external first local oscillator and will operate with any oscillator-mixer combination having an output frequency of 75 MHz. No modifications to the receiver are necessary, and the mixer output is connected directly to the IF 75 MHz connector on the front panel. An AFC signal, available at the rear panel, of approximately 2 volts may be used to control the external oscillator.

TABLE 3.1

CONTROLS, INDICATORS AND CONNECTORS

1200 Receiver Front Panel (Reference Figure 1.1)

Name	Ref. Design.	Function
POWER ON/OFF	S1	Applies electrical line power to receiver, and indicates the application of power.
BAND	S701	Selects operating frequency band and rotates drum dial to corresponding segment.
Tuning Control	---	Selects incoming frequency within range showing on dial.
Cathode-Ray Display (CRT)	V1	Provides a visual observation of received signal waveform.
VERT GAIN	R9	Controls the gain of vertical CRT amplifier.
IF GAIN		Varies gain of receiver IF strip.
IF CTR	R16	Option 2: Adjusts the frequency of the second local oscillator to center the receiver passband at its nominal frequency. (Center this control for normal receiver operation).
LO 1-2.5 GHz	J2	Local oscillator output to external mixer.
IF 75 MHz	J1	IF input
SWEEP:		
FREQ	R7	Adjusts the sweep frequency of the second local oscillator over a range of approximately ±5% about the nominal center frequency of 1000 Hz. When an antenna pattern recorder or VSWR meter is used, adjust for maximum deflection; this sets the receiver sweep frequency to the center frequency of the recorder or meter

TABLE 3.1 (Continued)

Name	Ref. Design.	Function
NAR	S4	Narrow dispersion of second local oscillator sweep and gives maximum deflection of the pattern recorder, VSWR meter, or integral level meter.
WIDE	S4	Widens dispersion of second local oscillator sweep; aids tuning when viewing CRT display.
OFF	S4	Disables sweep, and the incoming signal is not internally modulated at 1000 Hz.
AFC:		
NULL	R13	Balances residual noise in the automatic frequency control circuit to prevent the tuning motor from driving in either direction when no signal is present.
IMAGE	S5	Correctly operates the mechanical and electronic automatic frequency control when the receiver is tuned to an image frequency. (The image frequency is received by tuning 150 MHz below the correct dial frequency.)
NORM (normal)	S5	Correctly operates the mechanical and electronic automatic frequency control when the receiver is tuned to the correct frequency--and not the image.
OFF	S5	Disables receiver automatic frequency control.
SLC SET NA	R11/0	Option 3: Adjusts gain at SLC amplifier.
LO LEVEL	---	Varies the power output of the first local oscillator.
SET REF (reference)	R14	Adjust gain of internal level amplifier. Use this control to zero meter when receiver is used as slideback power meter.

TABLE 3.1 (Continued)

Name	Ref. Design.	Function
Step Attenuator	Z1	Permits receiver to be used as an accurate, convenient slideback power meter, and also prevents overload of the preamplifier.
Meter	M1	Displays crystal current.
30 MHz	J4	Provides 30-MHz broadband output.
VIDEO	J6	This connector, located directly under the 30 MHz output, provides a video output from the IF amplifier for external displal.
BOLOM (bolometer)	J5	Bolometer output.
MARKER LEVEL	R1210	Option 2: Provision for operation with Model 1201 Frequency Counter.
LFC 10-950 MHz	J3	Option 1: Low Frequency Converter signal input connector.
Meter Switch:	S6	Selects meter function.
NORM (normal) 20dB fullscale	---	Meter is connected to internal level amplifiers and has a full scale range of approximately 20 dB
EXP (expand) 1dB	---	Increases meter sensitivity to approximately 1 dB full scale.
AFC	---	Indicates error signal in the automatic frequency control servo loop.
XTAL	---	Indicates crystal current of the external mixer only.
SLC NA	---	Option 3: Indicates output from SLC amplifier.
1200 Receiver Rear Panel Functions (Reference Figure 3.1)		
Power Selection Adjustment	S2	Adapts receiver for either 115-volt or 230-volt primary power.

TABLE 3.1 (Continued)

Name	Ref. Design.	Function
60 dB		Option 6: 60-dB Recording Connector.
AFC	J7	Output from AFC circuit in receiver. May be used to supply AFC voltage to an external LO. Output is ±1 vdc into 10 k load.
COUNTER	J1201	Option 2: Provision for operation with Frequency Counter.
SLC	J1101	Option 3: Source Level Compensator Connector.
BAL	R1104	Option 3: Balance SLC amplifier output to 0 volts with 0-volts input.
POLARITY	S1101	Option 3: Changes SLC amplifier polarity to accept detectors with either a positive or negative output
LO SAMPLE	J1202	Option 2: Supplies an LO sample to drive the Model 1201 Frequency Counter.

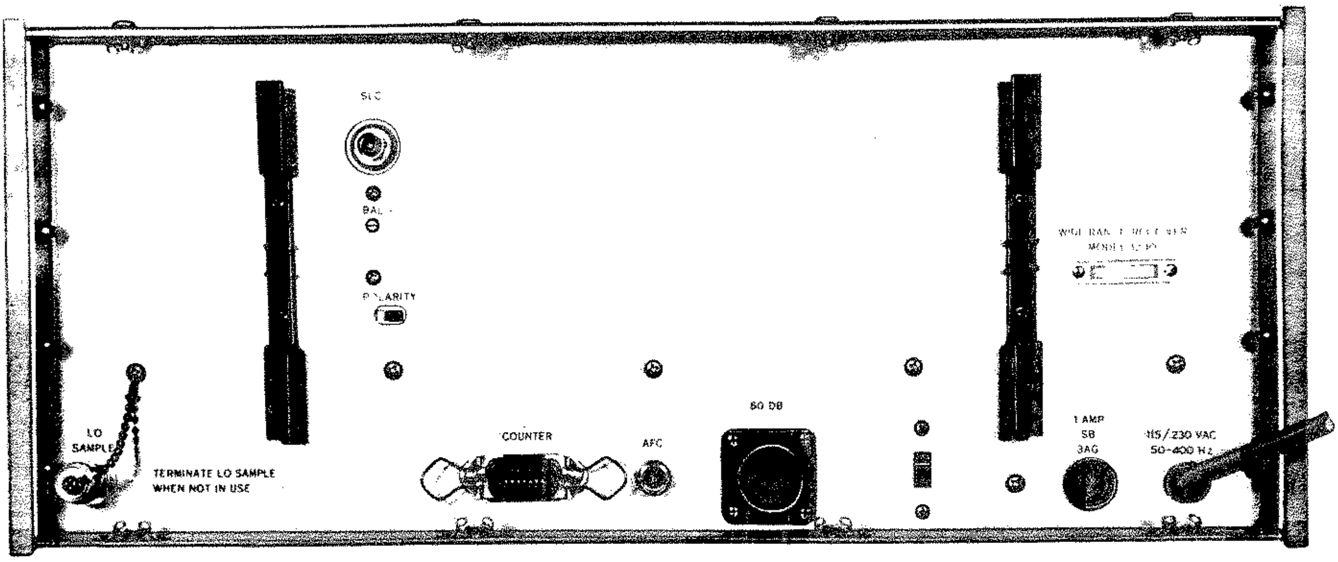


Figure 3.1
Receiver Rear Panel

4.0 THEORY OF OPERATION

This section explains in detail the operation of circuits and components of the Series 1200 Wide Range Receiver. Reference should be made to the corresponding schematics contained in Section 7 when reading the following paragraphs. It is recommended that the general description and principles of operation contained in Section 1 be read beforehand.

4.1 SIGNAL COMBINER

The signal combiner permits the use of a two-port remote mixer which can be connected to the receiver by a single coaxial cable. The combiner is a three-port device which directs the first local oscillator energy up to the mixer, and directs the returned heterodyned signal to the preamplifier.

The local oscillator energy passes from the LO input to the mixer because a built-in capacity offers a low impedance to the relatively high frequency (1-2.5 GHz). A series inductor attenuates the oscillator energy entering the IF connector. The heterodyne output from the remote mixer is 75 MHz. At this comparatively low frequency, the inductor is a low impedance, so the 75 MHz entering the mixer connector is directed to the IF and isolated from the LO port.

4.2 FIRST LOCAL OSCILLATOR

The first local oscillator is tuneable over the range of 1000 to 2575 MHz, and consists of a planar triode tuned by two concentric coaxial-type cavities. The oscillator output, and therefore crystal current, is varied by mechanical adjustment of the oscillator output probe. The LO LEVEL control thus varies the output by approximately 20 dB.

4.3 OSCILLATOR ATTENUATOR

A 3-dB fixed attenuator pads the oscillator output. If additional oscillator power is required for long cable lengths, this attenuator may be removed. The cable length then supplies the necessary padding.

4.4 CRYSTAL MONITOR

The crystal monitor (Figure 7.2) provides the direct current path for the crystal in the remote mixer, and the means for metering crystal current for presentation on the front panel meter. The monitor is packaged with the low pass filter, and is itself a low pass filter which passes only direct current.

4.5 LOW PASS FILTER

The low pass filter (Figure 7.2) is a lumped-constant device with a cutoff frequency in the vicinity of 90 MHz. Its purpose is to eliminate any possible overloading of the IF amplifier by the local oscillator.

4.6 STEP ATTENUATOR

The step attenuator is a conventional ladder-type resistive network with toggle switch selection. It provides a total attenuation of 102 dB in 1-dB steps.

4.7 PREAMPLIFIER

The preamplifier, swept oscillator and IF amplifier are packaged as a single unit (see Figure 7.4). The 75-MHz output of the first mixer is amplified and converted to the second intermediate frequency of 30 MHz for further amplification. The swept oscillator is the second local oscillator. When swept by the reference generator, this oscillator converts the incoming signal into a swept signal at the second intermediate frequency and, due to the IF amplifier selectivity, amplitude modulates an incoming CW signal at the sweep frequency (1000 Hz).

The input stages Q901 and Q902 accept the 75-MHz signal output from the first mixer and frequency combiner. They are connected as a low-noise cascode amplifier. Q901 is a low-noise transistor and its base is impedance-matched to a 50-ohm input. A potentiometer across the collector circuit of Q902 is the RF Gain Control. The next stage, Q904 is a common emitter transistor amplifier. The preamplifier output, across the collector of Q904, connects to mixer Q905. This mixer is a dual gate field effect transistor with the signal introduced on one gate and the second local oscillator energy driving the second gate.

4.8 SWEPT OSCILLATOR

Swept oscillator Q906 (second local oscillator) is a Colpitts circuit with a grounded base. A varactor is connected across the oscillator resonant circuit. This varactor is ac coupled to the output of the reference generator and is therefore swept at 1000 Hz. Automatic frequency control is obtained by dc coupling of the varactor to the output of the AFC comparator.

4.9 IF AMPLIFIER

The mixer output is divided into two paths. One drives the base of common emitter amplifier Q907, which is followed by a similar amplifier, Q908. These two common emitter amplifiers are broadband and provide the 50-ohm front panel output at 30 MHz.

The second output from the mixer is capacitively coupled to common emitter amplifier Q909. Its collector is coupled to the following stage (Q910) through a narrow band double-tuned transformer. This transformer sets the IF bandwidth for the bolometer output and video output at approximately 300 kHz. Transistor Q910, Q912, and Q913 amplify the signal to a suitable level for the bolometer element. Field effect rransistor Q911 is connected in the signal path as an electronically controlled resistor to a source level compensator or other circuits to change the overall gain in the bolometer circuit. Q914 is tapped across the collector of Q913 through a resistive isolator and further amplifies the IF signal to drive Q915 and the internal crystal video detector.

4.10 AFC

The receiver has both electronic and mechanical automatic frequency control. The electronic AFC is applied to the second local oscillator (swept oscillator) and compensates for fast small changes in center frequency. The mechanical AFC drives the tuning shaft of the first local oscillator through the AFC clutch and will follow slow drifts of the signal source over the entire dial range.

4.10.1 REFERENCE GENERATOR

The reference generator (see Figure 7.5) located on printed circuit board 2 generates the 1000-Hz sawtooth and square wave signal which (1) drives the swept oscillator (2) supplies the reference signal to the AFC comparator and (3) is amplified to form the horizontal trace on the cathode-ray tube display.

The 1000-Hz sawtooth waveform is generated by the unijunction transistor Q201. The capacitor C203 and C204 charge through resistances R7, R202, R203, and R204 until the emitter voltage reaches its peak point voltage and discharges the capacitors. The frequency is dependent on the time constant of the resistors and capacitors in the emitter circuit. R202 is a coarse frequency adjustment which compensates for circuit tolerances, and R7 is the front panel SWEEP FREQ control. The components C201 and R205 increase the sweep linearity. The sawtooth waveform is fed to the base emitter-follower Q202. The output to the swept oscillator is taken from this stage through the front panel SWEEP NAR/WIDE switch.

The emitter of Q202 also drives the horizontal amplifier of the scope display through the H. GAIN control (R213) which is a screwdriver adjustment available on this board.

Output from the collector of Q202 drives the flip-flop Q203-Q204. Common charging capacitor C206 maintains a symmetrical square wave output as the frequency is varied. The output taken from the collector of Q204 is the reference input to the AFC comparator.

4.10.2 CLIPPER/AMPLIFIER

The Clipper/amplifier (see Figure 7.6) amplifies, filters, and clips the video detector output, and supplies the signal which is compared with the AFC reference signal to generate the tuning error signal. The clipper/amplifier is located on the same printed circuit board as the AFC comparator (board 3).

The base of the first amplifier stage Q301 is capacitively coupled to the detector output. This common emitter stage has a resonant collector circuit (the inductor L1 is located on the chassis) which reduces the noise bandwidth and thereby increases the output signal-to-noise ratio of the AFC subsystem.

The following three amplifiers stages Q302, Q303, Q304 are essentially identical. Each is a common emitter amplifier with diode clipping in the input circuit. The output at the collector of Q304 is a clipped 1000-Hz square wave which is synchronously detected by comparator DA301. The output at the emitter of Q304 drives the circuitry on board 4 to actuate the clutch when the signal level is sufficient to produce an AFC signal.

4.10.3 COMPARATOR

The comparator on board 2 (Figure 7.6) is a chopper switch, DA301, which is driven by the square wave from the reference amplifier. Transistor Q306 is an emitter-follower which provides a low impedance driving source for the chopper. The synchronous detection produces a dc voltage at the base of Q305 which is proportional in amplitude to the phase difference between the 1000-Hz output of Q304 and the 1000-Hz output of the reference generator. The polarity of the dc signal depends on the polarity of the phase difference. The reference of "zero-error" voltage of the AFC is varied by the AFC NULL control on the front panel. This control varies the dc level at the balanced modulator, DA301.

Transistor Q305 is a dc coupled emitter follower which drives the AFC servo amplifier and supplies the dc bias for center frequency correction of the swept oscillator. The emitter resistor of Q305 is returned to the negative 15-volt supply.

4.10.4 SERVO AMPLIFIER

The servo amplifier is located on board 4 and shown schematically on Figure 7.7. It increases the dc output of the comparator to a power level sufficient to drive the direct current motor which tunes the first local oscillator. Direction of motor rotation is determined by the polarity of the dc input voltage, and may be reversed by changing the AFC switch on the front panel from NORM to IMAGE, or vice versa. Refer to paragraph 3.3. The rectifier and voltage regulator for the servo amplifier are described in Paragraph 4.13.4.

The dc input drives the base of Q408 which is connected with Q409 to form a differential amplifier having a balanced output. The common emitter resistor is returned to the negative 15-volt supply. Potentiometer R428 is the balance control. The balance output is dc coupled to emitter followers Q410 and Q412 which, in turn, are dc coupled to power amplifier Q411 and Q413. The motor is connected between the emitters of the power amplifier, in series with the polarity-reversing switch functions.

The output of Q603 drives a class B power amplifier consisting of Q604, Q605, Q606, Q607. Under no-signal conditions, both Q606, and Q607 are cut off. The voltage gain from the base of Q604 to output (emitters of Q606 and Q607 is approximately unity, maintained by infinite feedback through capacitor C609. As the base of Q604 goes positive so does the output, charging capacitor C610 to the peak positive voltage. The capacitor is charged through Q606 but must be discharged through Q607 on the negative swing of the input voltage. During the negative swing, the charge placed in C611; through Q607 this change current flows out through the limiting network to the level meter. The class B amplifier functions as a power rectifier. Diode D603 limits the maximum meter current for overload protection. The zero center meter is initially deflected to the left by current through resistors R632 and R634 to bring the no-signal needle position on scale slightly for measuring small signal levels in NORM.

In EXP the amplifier gain is increased (ungrounding shunt signal path through R610), and the current through the meter increases. The current is shunted away from the meter in EXP by constant-current sink Q608 to balance the meter when switching between NORM and EXP, when the meter is "zeroed." Control R630 adjusts the balance through temperature compensating coupling transistor Q609.

4.12 SCOPE DISPLAY

The scope display circuits present a cathode-ray tube presentation of the receiver signal. The horizontal trace is swept by the sweep voltage applied to the swept oscillator, and the vertical trace is the amplified video detector output. In the presence of a CW signal, the scope pattern is the receiver response function. The height is proportional to received signal strength and may be changed by the IF GAIN control, the VERT GAIN control, or the step attenuator. The incoming signal is centered in the passband when the display is centered on the cathode-ray tube.

4.12.1 HORIZONTAL AMPLIFIER

The horizontal amplifier of the scope display is located on board 2 with the AFC reference generator and the sweep generator; its input is connected to the sweep generator. The amplifier consists of two transistors, Q205, and Q206, connected as an emitter

4.10.5 CLUTCH

The 1000-Hz output from the AFC clipper amplifier is amplified by transistor Q403 and rectified by diode D402. The dc output is applied to Schmitt trigger Q404 and Q405. The AFC threshold is set by control R412. When the input the Q404 rises above threshold, the output of Q405-Q406 through zener diode D403 and energizes the clutch coil. Therefore, the clutch operates when the receiver input signal is sufficient to generate an adequate signal-to-noise ratio in the AFC channel. It completes the mechanical link between the motor and the first local oscillator tuning shaft. If the clutch did not disengage the motor when the signal level dropped. residual noise could detune the receiver, and drive the tuning shaft against the mechanical stops.

4.10.6 MOTOR

The motor is a dc current type, and direction of rotation is determined by the polarity of the voltage across its terminals. The overall sense of the AFC system is changed when the AFC switch is changed between NORM and IMAGE. This is accomplished by interchanging the input leads to the motor.

4.11 LEVEL AMPLIFIER

The level amplifier (see Figure 7.9) amplifies the 1000-Hz output of the crystal detector to drive the reference level meter. It operates only when the meter switch is set to NORM or EXP (expand). The amplified signal is rectified and compared against a predetermined dc level, using a differential amplifier to drive the zero center meter.

The front panel SET REF control R14 is connected across the output of the video detector. The arm of the gain control drives the base of Q601 which is a common emitter amplifier. The collector load is a resonant circuit, L2 (on main chassis), and C602, which is tuned to 1000-Hz and establishes a narrow noise bandwidth for the amplifier. Q601 is directly coupled to the next stage, Q602, which is an emitter follower, and therefore, presents a minimum load on the resonant circuit. The dc negative feedback from the emitter of Q602 to the base of Q601 provides bias stablization. The overall gain of the level amplifier in the EXP mode is adjusted by R611 in the emitter circuit of Q602. The gain is decreased in the NORM mode by switching resistor R610 in parallel with R611. The output tap on R611 drives the voltage coupled phase splitter which provides an amplified balanced output from the unbalanced input. Control R221 balances the push-pull output to the horizontal plates of the cathode-ray tube. The input is connected to the base of Q205 through R213, the H. GAIN control, a screwdriver adjustment located on board 2.

4.12.2 VERTICAL AMPLIFIER

The vertical amplifier is located on board 5 (see Figure 7.8).

The video detector output is connected to the base of first vertical amplifier stage Q502 through continuously variable control R510 (the screwdriver adjustment located on the rear panel near the VERT GAIN control) and the front panel VERT GAIN control located just to the right of the bezel. The first two stages, Q501 and Q502, are common emitter amplifiers. Q501 and Q502 are directly coupled with dc feedback for bias stabilization. The output of Q502 is capacitively coupled to Q503, which combines with Q504 to form an emitter coupled phase splitter. The unbalanced input to Q503 is amplified and converted to a balanced output which drives the vertical plates of the cathode-ray tube.

4.12.3 POWER SUPPLY

The low-level stages of the scope amplifiers are connected to the common +20 volt supply located on board 1 (see Figure 7.10). The positive scope power supply is also located on this board and provides the higher positive potentials needed by the cathode-ray tube and the collectors of the transistors which drive the horizontal and vertical deflection plates. A separate high-voltage center-tapped winding on the power transformer connects the full-wave rectifiers D101 and D102. Capacitor C101 is the filter, and the output voltage is regulated at 250 volts nominal by the series-connected zener diodes, D105-D108.

Power transformer T1 has a 6.3-volt winding for the cathode-ray tube filament. This winding is at a high dc potential.

The high-voltage negative supply for the scope, along with the intensity and focus controls, is mounted directly behind the CRT socket. A separate high-voltage winding on the power transformer connects to half-wave rectifier D101 and input filter capacitors C102 and C103 to provide negative voltage of 1000 volts nominal.

4.13 POWER SUPPLY

The power supply provides power to the entire receiver except for portions of the scope display circuits as noted in Paragraph 4.12. The following outputs are available from the power supply:

6.3	vac
-15	vdc
+20	vdc
+140	vdc
+250	vdc

The 6.3-vac supply is a winding on power transformer T1 and goes only to the filament of the tube in the first local oscillator. In addition to this filament winding, the power transformer has two other secondary windings, one of which is center tapped and has two voltage ranges; this winding supplies all dc voltages except the +30 vdc for the servo amplifier.

4.13.1 NEGATIVE SUPPLY

The full-rectifier, part of DA102, uses the low-voltage taps of the center-tapped winding and is connected to capacitor input filter C107 through peak current limiting resistor R112. Zener diode D110 drops this voltage to drive integrated circuit regulator QA102. The output from QA102 is set to -15 volts nominal by resistors R114, and R115. Capacitor C108 provides additional filtering. R113 is a current-sensing resistor used for overload protection.

4.13.2 +20 vdc

The full-wave rectifier, part of DA102, uses the low-voltage taps of the center-tapped winding and is connected to capacitor input filter C104 through peak current limiting resistor R108.

Series transistor Q104 regulates the dc output voltage and further reduces the ripple. It is a conventional series regulator. Integrated circuit voltage regulator QA101 is connected across the supply output terminals. It compares the output to its internal reference, and amplifies the error signal and feeds it to the base of Q104 with the current polarity to oppose the error. R109 sets the output current level at which overload protection occurs.

4.13.3 +140 vdc

Full-wave rectifier DA101, DA102 uses the high-voltage center-tapped winding of T1 and is connected to capacitor input filter C1 located on the chassis. Series transistor Q101 regulates the dc output voltage. Zener diodes D103 and D104 reduce the ripple to the collector of Q103. Q103 is an error amplifier using the +20 volt supply as reference. Q103 amplifies the error signal and feeds it to the base of Q101 with the polarity to oppose the error. When the current through current limiting resistor R104 reaches the base-emitter potential of Q102, it conducts and reduces the base-emitter bias of Q101; this cuts off Q101 and prevents damage due to overload of this supply.

4.13.4 +30 vdc

The +30 volt supply is located on board 4 with the AFC servo amplifier. It powers the AFC drive motor and clutch. Full-wave bridge rectifier DA1 is connected to a separate secondary winding on the power transformer. The rectifier output is connected to the capacitor input filter through peak current limiting resistor R401. Transistor Q401 is a series regulator and further reduces the ripple. Zener diode D401 regulates the output voltage by maintaining the base of Q401 at a constant potential.

5.0 MAINTENANCE

This section describes the maintenance procedures for the Series 1200 Wide Range Receiver. Periodic adjustments are not normally required. Familarization with the previous sections of this manual is recommended before attempting any of the steps described herein.

WARNING

> Most components and circuits operate at low potentials; however, the power supply and scope display circuits contain dangerous high voltages. Become familiar with the circuit operation and component locations before servicing. Disconnect the power cord before installing or removing components and assemblies.

Most diagnoses, adjustments and repairs can be made on a modular basis. Printed circuit cards may be operated on the extender board supplied, without deteriorating performance.

CAUTION

> Remove the polarizing key from the card connector before inserting the extender board, and replace the key after servicing.

Typical values of voltages at transistor and tube terminals given in the following tables are measured using a voltmeter having a sensitivity of 20,000 ohms per volt dc and 1,000 ohms per volt ac. Values marked by an asterisk (*) are high-impedance points which must be measured with a VTVM. Readings are referred to chassis ground unless otherwise indicated. Care must be taken to avoid shorting adjacent terminals when making measurements. Then soldering small components, particularly semiconductors, clamp pliers on the leads between the component and solder joint to minimize heating of the component.

Figure 5.1 is the top view of the receiver; note that the printed circuit boards are numbered (1 through 6) starting at the rear of the receiver. Table 5.1 lists all of the voltage readings on the printed circuit connectors. These readings are taken with no signal input, and the meter switch in the NORM position. These values should be used only for isolating a failure to a specific board; then refer to the measurements for that board.

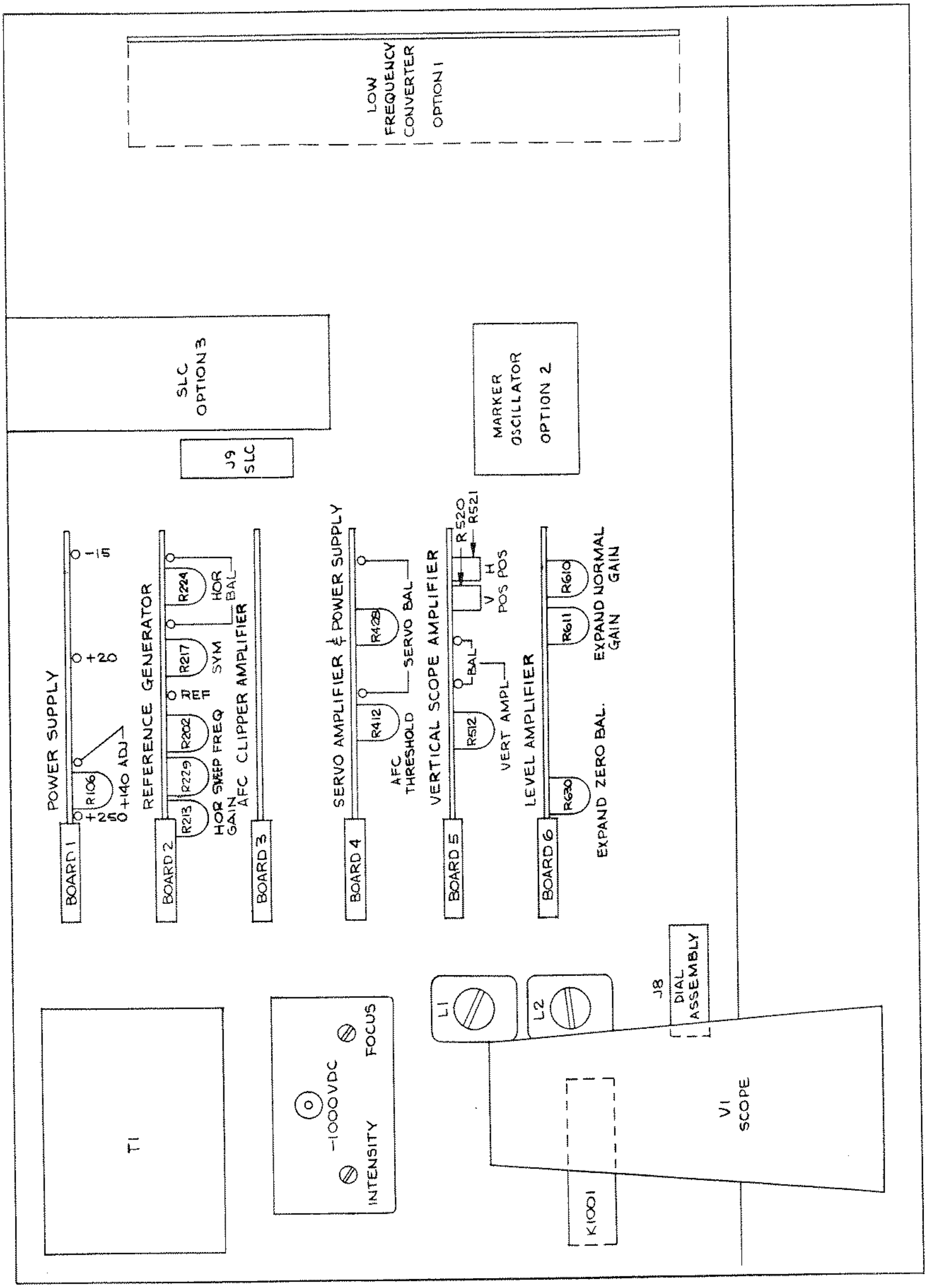


Figure 5-1. Receiver, Top View

TABLE 5.1

VOLTAGE READINGS, P.C. CONNECTORS

PIN	BOARD 1.	2.	3.	4.	5.	6.
A	Gnd.	Gnd.	Gnd	Gnd	Gnd	Gnd
B	260 VAC	---	17	45 VAC	---	20
C	260 VAC	1.5	---	45 VAC	0	0
D	250	0.2	17	---	Gnd	-15
E	145 VAC	18	1.1	28	---	0
F	195	20	---	28	---	-15
H	145 VAC	---	---	---	20	0
J	140	---	---	0	250	18
K	20	---	19	---	---	18
L	---	---	13	15	Gnd	---
M	---	13	---	15	30	---
N	29 VAC	---	---	0	50	---
P	29 VAC	---	0	-15	50	0
R	-15	250	0.8	20	40	---
S	Gnd	---	-15	0	80	0

Board 1	Power Supply
Board 2	Reference Generator
Board 3	AFC Clipper/Amplifier
Board 4	Servo Amplifier
Board 5	Vertical Scope Amplifier
Board 6	Level Amplifier

When a measurement, test, or observation requires an input signal, it is most convenient to connect a 75-MHz signal generator directly to the IF input connector on the front panel.

5.1 FIRST LOCAL OSCILLATOR

The first local oscillator is a triode vacuum tube oscillator, tuned by two concentric cavities which are ganged together and connected to the tuning shaft by a non-translating lead screw mechanism. The tuning shaft rotates 58 turns between mechanical stops, and the oscillator has lower and upper frequency limits of at least 1000 and 2575 MHz, respectively.

CAUTION

Use extreme care in servicing the cavity, and particularly avoid damage to the spring contacts which wipe against the cavity walls.

5.1.1 TUBE REPLACEMENT

Refer to Figure 5.2 during the following steps. Remove the anode retaining nut, the anode line assembly, anode stop and the grid retainer nut. Then pull the tube straight out until it is loosened from the cathode stem. Remove the filament wire feed-thru and push the filament wires into the cavity as the tube is pulled out. All parts are reusable except the mica washer.

Before installing a new tube, solder the filament wires to the tubes. Do not allow the soldering iron to remain on the filament pins longer than necessary, but the pins should be completely covered with solder to ensure good bonding. Replace the tube by pushing it into the cathode stem so the cathode rings make good contact.

Reassemble the remaining parts in the reverse order of disassembly. The oscillator should be checked for power output and frequency coverage. Minimum power should exceed 250 mw. If the oscillator does not perform satisfactorily, realign as indicated in Paragraph 5.1.2.

5.1.2 ALIGNMENT

Note the oscillator frequency coverage and power output over the band; if unsatisfactory, the grid and cathode fingers must be repositioned. The outside rods control frequency coverage, and the

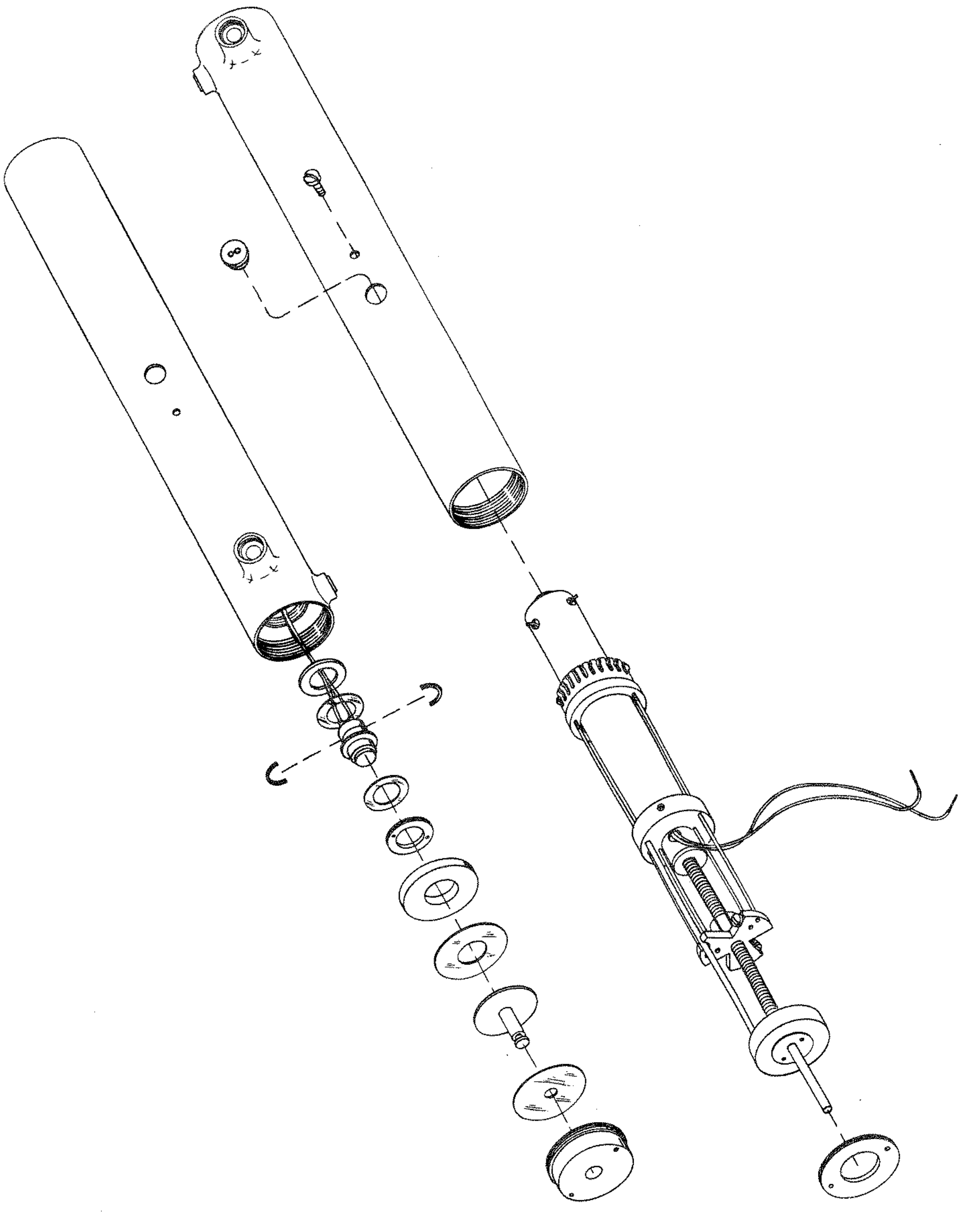


Figure 5-2. First Local Oscillator, Exploded Views

inside rods maintain the power over the band. The main assembly must be removed from the housing. Remove the anode retainer nut, the anode line assembly, the anode stop, and the rear plug. Tune the oscillator to the low end (full CCW) and feed the filament leads completely inside the housing. Push the main assembly out of the housing through the rear end.

CAUTION

> Ensure that the grid fingers and feedback probes are not damaged.

Remove the tuning shaft subassembly. Unscrew the three screws in the tuning nut, holding the pushrods. Loosen the rods so they slide easily in the tuning nut. If excess power is available at the high end, pull the inside rod backwards a slight amount. This will aid the lower end of the tuning range.

After having properly positioned the rods at the high end, slide the tuning nut forward until it rests against the phenolic insert in the rear of the main assembly. Tighten the retaining screws so the push rods cannot move in the tuning nut.

Check the oscillator over the complete tuning range. If its operation is unsatisfactory at any point in the frequency range, the problem may be due to the improper position of the pushrods or feedback probes. To adjust feedback, reposition the probes until best operation over the complete range is obtained. If this does not correct the problem, realign the pushrods as described above.

When operation over the complete frequency range is satisfactory, use some type of "Loctite" to ensure that pushrods will not slip.

Insert main assembly into housing from the front, pushing it down until the retaining-screw holds in the support block line up with the holes in the housing. Insert screws and tighten. Feed the filament leads back through housing and filament feed-thru. Replace the front-end assembly, using new mica washers. Insert the tuning shaft into the oscillator; push forward until front end of shaft rests in the phenolic insert. Replace and tighten the rear plug. Check oscillator for proper operation.

5.2 PREAMPLIFIER/SWEPT OSCILLATOR/IF AMPLIFIER ASSEMBLY

The preamplifier/swept oscillator/IF amplifier assembly is located on the underside of the chassis. All necessary tuning devices and level controls are accessible through openings in the cover plate.

5.2.1 MEASUREMENTS

Voltage measurements may be made with the unit in place by removing the cover plate. Set the SWEEP control to OFF, the IF GAIN fully counterclockwise and the 0-1 dB control fully counterclockwise.

The following voltages are present at the filter terminals shown in Figure 5-3A.

FL901	-15 vdc
FL902	- vdc
FL903	Variable 0 vdc to approximately +5 vdc ±20% with 0-1 dB control
FL904	2 vdc
FL905	0 vdc
FL906	+20 vdc
FL907	0 vdc with AFC OFF
FL908	+6 vdc

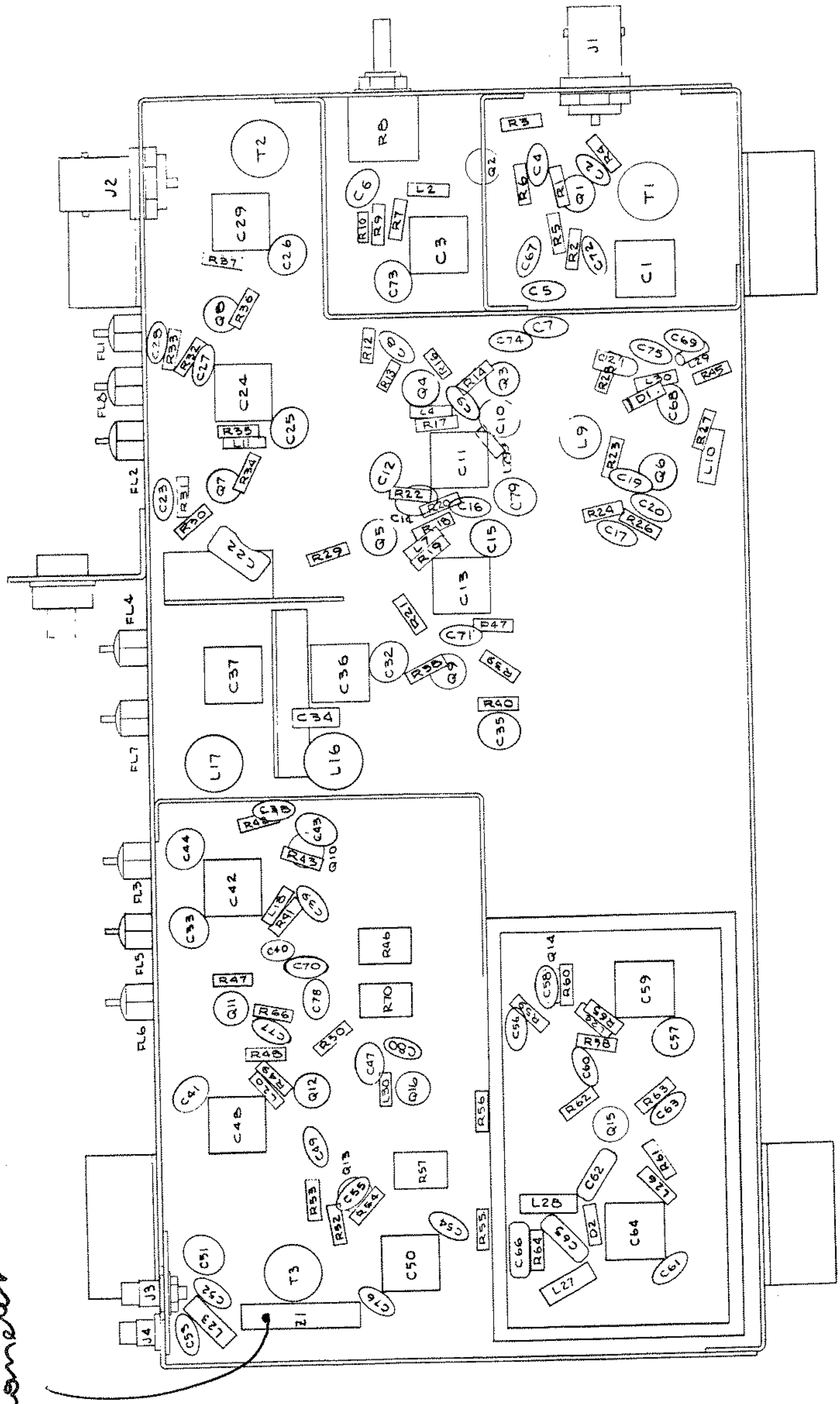
Transistor terminal voltages are measured by removing the amplifier cover plate.

CAUTION

Use care when making transistor measurements to prevent accidental burnout.

Readings may vary 20 percent from those tabulated below:

	EMITTER	BASE	COLLECTOR
Q901	+4.0	+4.7	+19.2
Q902	-0.75	0	+20
Q904	+4.0	+4.7	+20



NOTE: ADD 900 TO REFERENCE NUMBERS OF COMPONENTS IN THIS ASSEMBLY ONLY.

Figure 5-3A. Preamplifier/Swept Oscillator/IF Amplifier Assembly, Parts Location - Bottom View

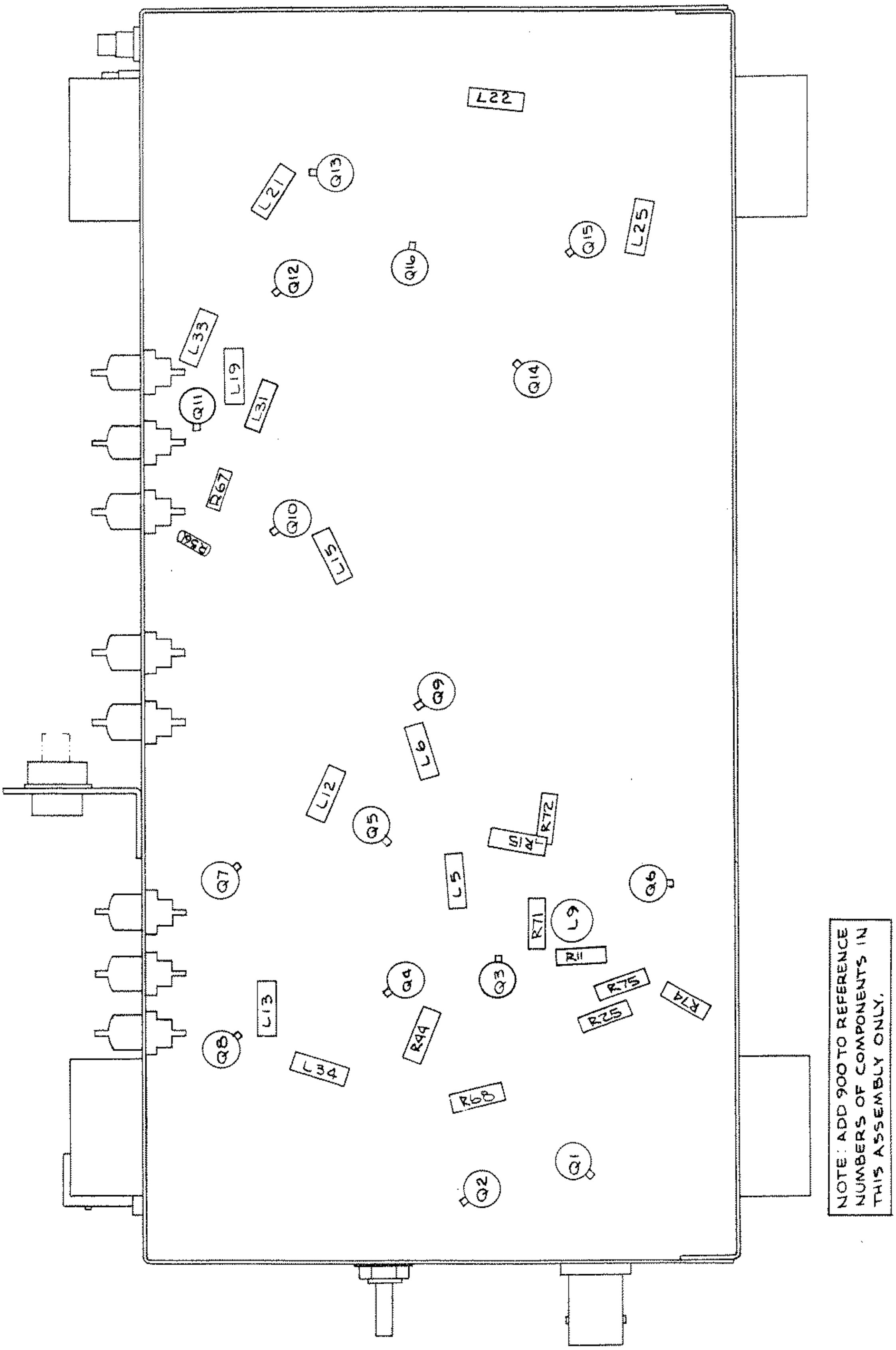


Figure 5-3B. Preamplifier/Swept Oscillator/IF Amplifier Assembly, Parts Location - Top View

Q906	+4.6	+3.8	+20
Q907	+4.0	+4.7	+20
Q908	+4.0	+4.7	+20
Q909	+4.0	+4.7	+20
Q910	+3.6	+4.2	+20
Q912	+4.0	+4.7	+20
Q913	+4.0	+4.7	+20
Q914	+4.0	+4.7	+20
Q915	+4.0	+4.7	+20

5.2.2 ALIGNMENT

Alignment is made with the unit fastened to the chassis and with its cover plate installed. Turn the IF GAIN fully clockwise and turn the SWEEP control to OFF. Turn the VERT GAIN control fully clockwise. Adjust R946 (30-MHz gain control) fully clockwise and R957 (video level control) fully counterclockwise. The 30-MHz section may be aligned as follows: Connect a signal generator to the IF 75 MHz input jack on the receiver front panel. Set the generator frequency to 30 MHz, modulated 50 percent with 1000 Hz. Increase the generator output until a signal appears on the scope display. The generator level required to produce this output will be typically -40 dBm.

The front panel SWEEP FREQ control may be adjusted to synchronize the scope speed with the 1000-Hz modulation, although this is not essential for alignment. Align the following capacitors for maximum video amplitude: C950, C948, C942, C936, C937, and C913. Adjust the generator level as required to maintain a suitable scope presentation. Capacitors C959 and C964 of the 30-MHz video section are located within the shielded subassembly and should not require tuning unless a component is replaced. The 75-MHz stages are aligned by changing the generator frequency to 75 MHz and adjusting the generator frequency to 75 MHz and adjusting L909, C911, C903 and C901 for maximum video amplitude. Switch the generator modulation off and the receiver SWEEP control to NAR. Adjust C936 and C937 for a symmetrical response of maximum amplitude.

Proper setting of the amplifier gain control is accomplished as follows: Connect an audio VTVM and VSWR meter in parallel at the BOLOM (bolometer) output jack J5. Set the VSWR meter for 8.75 ma bolometer bias. Set the signal generator level to -73 dBm and the receiver SWEEP control to NAR. Adjust R946 of the IF amplifier for a 4-mv meter indication on the VTVM, then connect the VTVM to VIDEO jack J6 and adjust R957 for a 225-mv indication.

The two 30-MHz broadband stages are aligned by connecting an RF voltmeter, or high-frequency oscilloscope to 30 MHz jack (J4) on the front panel and adjusting C929 and C924 for maximum output.

5.2.3 BOLOMETER REPLACEMENT

One common malfunction is the destruction of the bolometer element by transients in conventional VSWR meters and pattern recorders, particularly when it is connected with the bias supply on. A good operating practice is to turn off the bias supply in the external recorder before connecting or disconnecting the cable to the bolometer output of the receiver. The bolometer may be checked by measuring the resistance between the shell (not ground) and center conductor of the BOLOM output jack. The resistance value should read 200 ohms or less. An open circuit indicates a burned out bolometer.

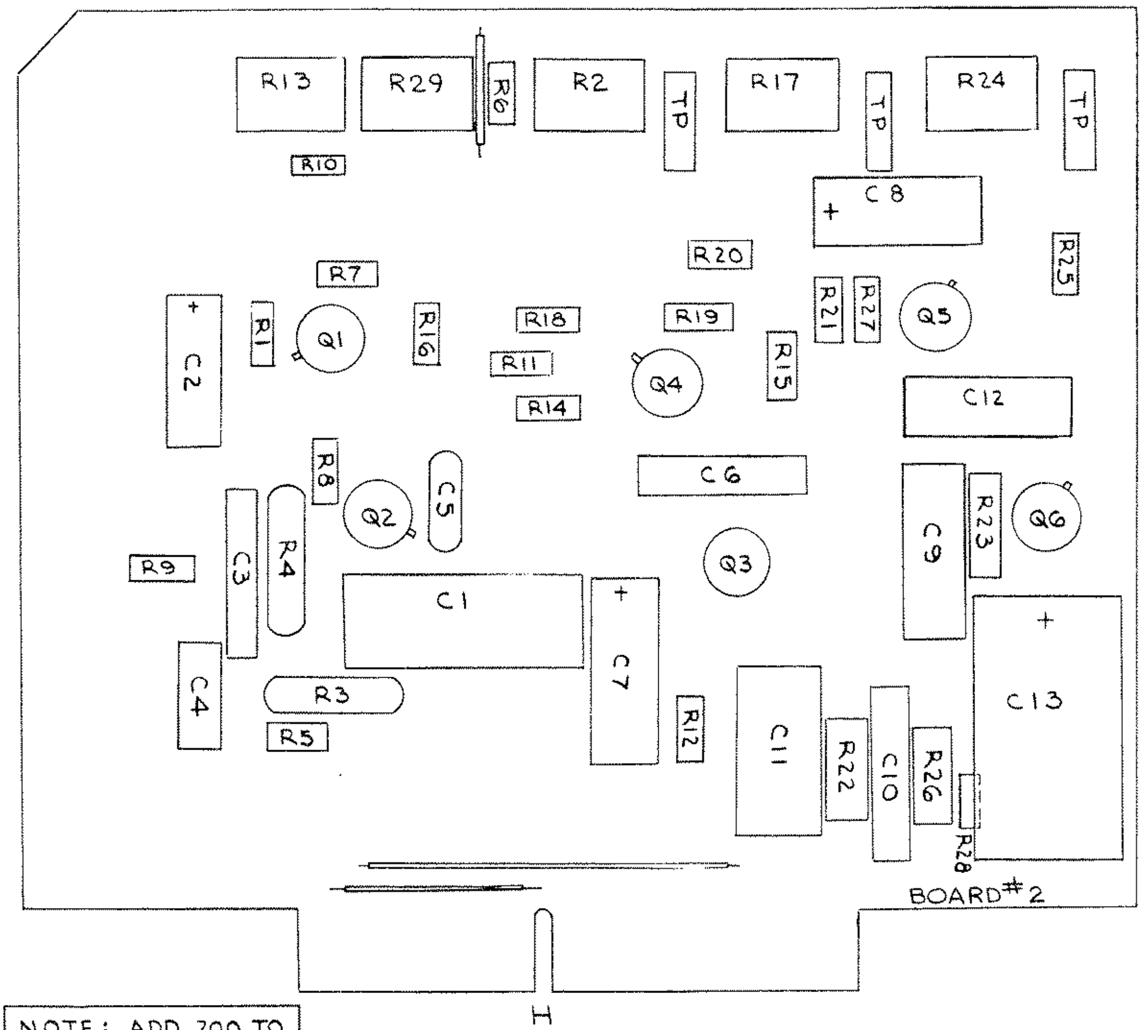
The bolometer (Z901) is located in the IF amplifier, as shown in Figure 5.3A and is held in place by the snap-in clips only. Do not solder.

5.3 REFERENCE GENERATOR

The reference generator located on board 2 (Figure 5.4) generates the 1000-Hz signal which sweeps the second local oscillator, and thereby, modulates the incoming RF signal. The 1000-Hz output of this reference generator is also the horizontal sweep of the scope display.

5.3.1 ALIGNMENT

It is most convenient to align the reference generator if a signal is being received, and the bolometer (or video) output is connected to a pattern recorder of VSWR meter. Set the front panel SWEEP FREQ control to its center position and set the SWEEP control to NAR. Connect the receiver to a CW signal



NOTE: ADD 200 TO REFERENCE NUMBERS OF COMPONENTS ON THIS BOARD.

Figure 5-4. Reference Generator, Board 2, Parts Location source (75 MHz into the front panel IF 75 MHz connector) and increase the input level until a reading appears on the indicating device. Adjust the frequency control, R202 on board 2, and the sweep adjustment potentiometer, R229, for maximum indicated output.

Connect an oscilloscope to the test point near the middle of board 2, and adjust R217 for the best symmetry of the waveform. Connect a voltmeter, 50-volt range, between the test points adjacent to R224 and adjust this balance control for zero on the meter. No incoming signal is required for this step.

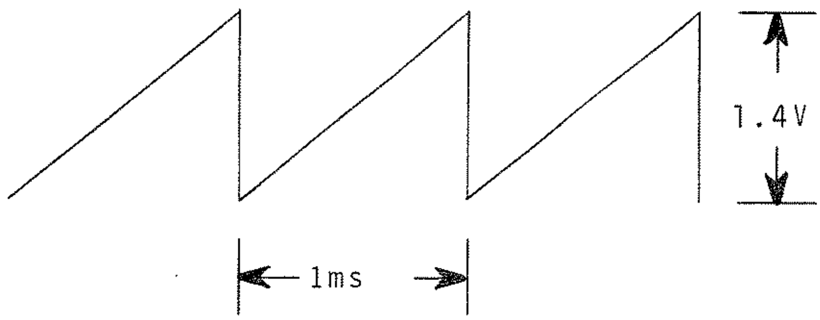
5.3.2 MEASUREMENTS

	EMITTER	BASE 1	BASE 2
Q201	6.1	0	18
	EMITTER	BASE	COLLECTOR
Q202	5.4	6.1	16
Q203	6.3	5.8	7.4
Q204	8.0	7.5	13
Q205	15	16	135
Q206	15	16	135

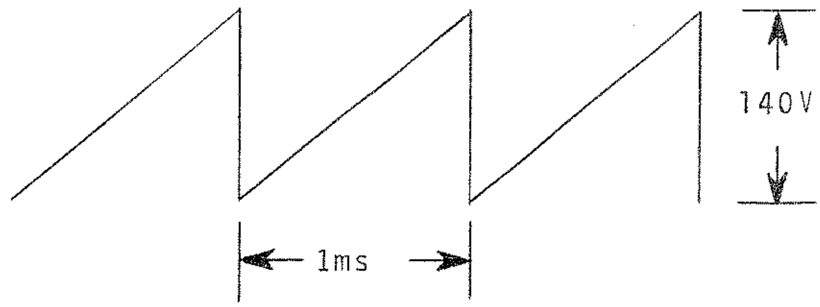
5.3.3 WAVEFORMS

The following waveforms are observed with the SWEEP control in the NAR position. No external receiver connections are necessary.

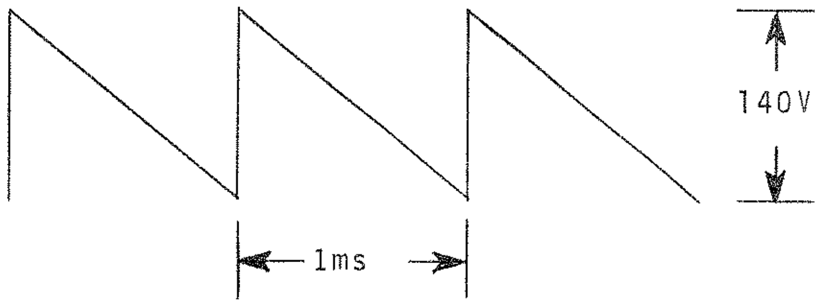
Pin D, Board 2



Pin S, Board 2



Pin P, Board 2



5.4 AFC CLIPPER/AMPLIFIER

The AFC clipper/amplifier is contained on board 3 (Figure 5-5).

All measurements and waveforms are taken with the front panel controls set as follows:

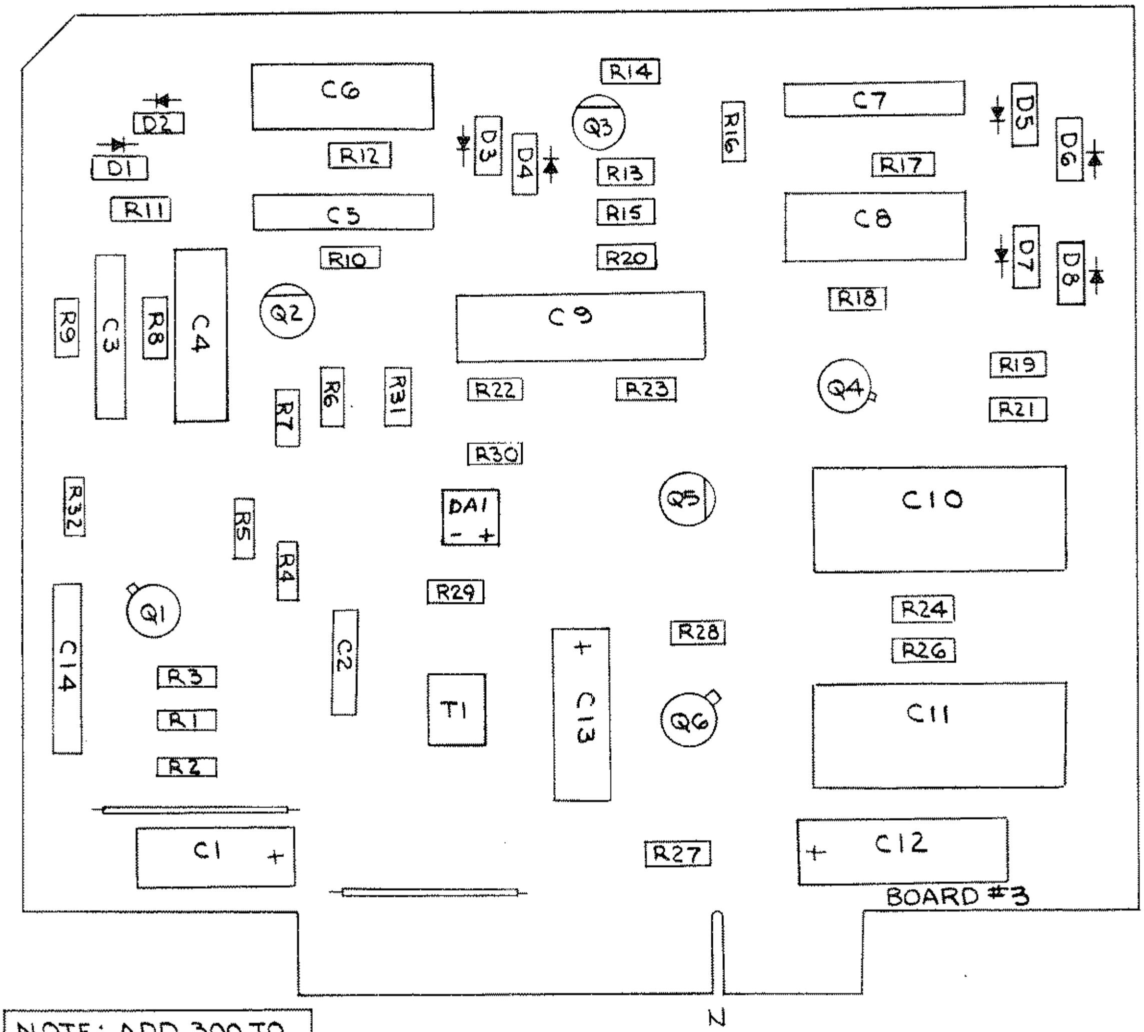
Control	Position
SWEEP	NAR
AFC	NORM
AFC NULL	Centered

Connect the receiver to a signal source (75 MHz into the IF 75 MHz front panel connector is satisfactory) and adjust the signal level to the reference level; refer to Paragraph 3.4.

5.4.1 MEASUREMENTS

	EMITTER	BASE	COLLECTOR
Q301	1.2	0.6*	17
Q302	0.4	0.2*	10
Q303	0.4	0.2*	10
Q304	0.4	0.9	8.0
Q305	0	0	18
Q306	13	13	18

* Measure with VTVM

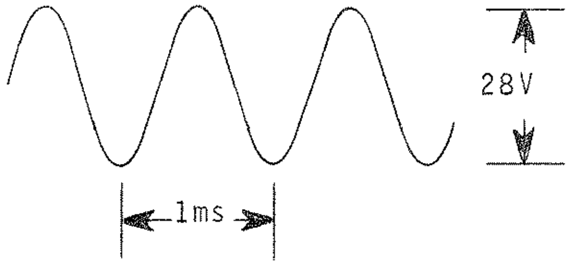


NOTE: ADD 300 TO REFERENCE NUMBERS OF COMPONENTS ON THIS BOARD.

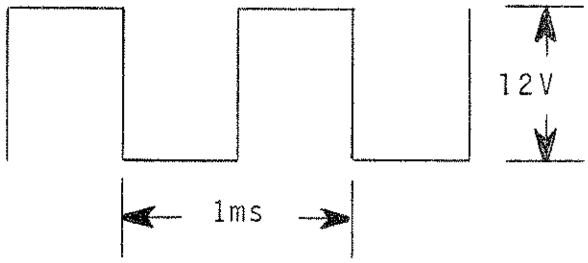
Figure 5-5. AFC Clipper/Amplifier, Board 3, Parts Location

5.4.2 WAVEFORMS

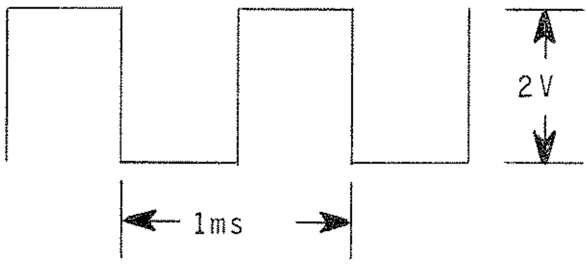
Collector Q301



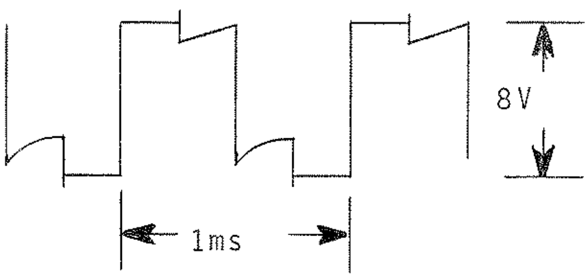
Collector Q303



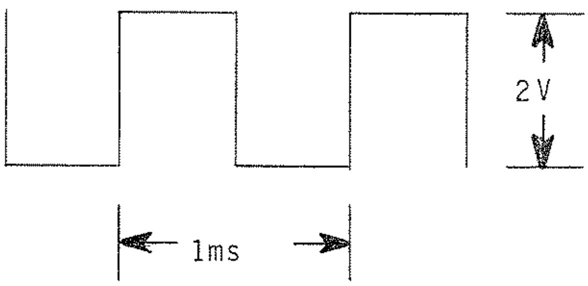
Base Q304



Collector Q304



Pin R



5.5 SERVO AMPLIFIER

The servo amplifier is located on board 4 (Figure 5.6) along with the 30-volt power supply and clutch circuits. When aligning the servo amplifier, or making measurements, ground pin S of the circuit board to the chassis.

CAUTION

Grounding of the connector pins may damage other circuits.

5.5.1 ALIGNMENT

With pin S grounded, adjust R428 for equal dc voltages at the two test points on each side of this control. This is the same as zero voltage between these two test points.

5.5.2 MEASUREMENTS

These measurements are taken with the AFC switch at NORM, no signal input, and the AFC NULL control adjusted to stop the motor.

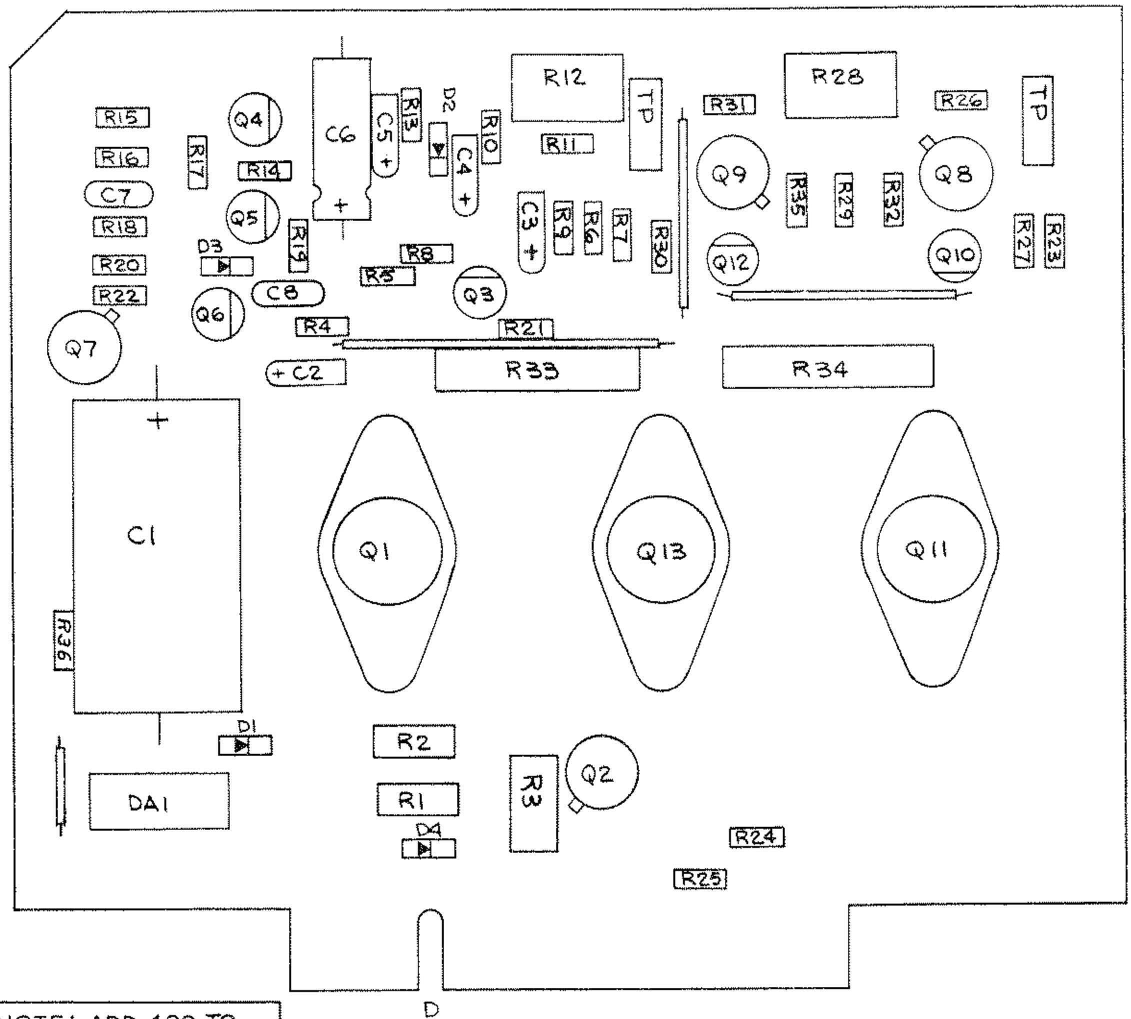
	EMITTER	BASE	COLLECTOR
Q401	29	30	40
Q402	29	29	30
Q408	0	0	11
Q409	13	13	11
Q410	13	13	20
Q411	12	13	40
Q412	12	13	40
Q413	13	13	20

5.6 CLUTCH

The clutch circuits are located on board 4 (Figure 5.6). When the clutch is engaged, the tuning knob is connected to the drive motor and requires significant torque to manually tune. It only operates with the AFC on.

5.6.1 ALIGNMENT

AFC threshold control R412 is set as follows: Turn the AFC on and set the SWEEP to NAR. Connect



NOTE: ADD 400 TO REFERENCE NUMBERS OF COMPONENTS ON THIS BOARD

Figure 5-6. Servo Amplifier and Power Supply, Board 4, Parts Location a VSWR meter to the BOLOM output and operate the receiver in accordance with Paragraph 3.2. Adjust R412 so that the clutch engages when the signal-to-noise ratio is about 10 dB. It may be adjusted for a lower level but may not release if mixer noise rises significantly.

5.6.2 MEASUREMENTS

These measurements are taken with the AFC set to NORM, and no input signal.

	EMITTER	BASE	COLLECTOR
Q403	2.0	2.5	11
Q406	0	0	20
Q407	0	0	31

	SOURCE	GATE	DRAIN
Q404	20	0	20
Q405	20	10*	20

*VTVM

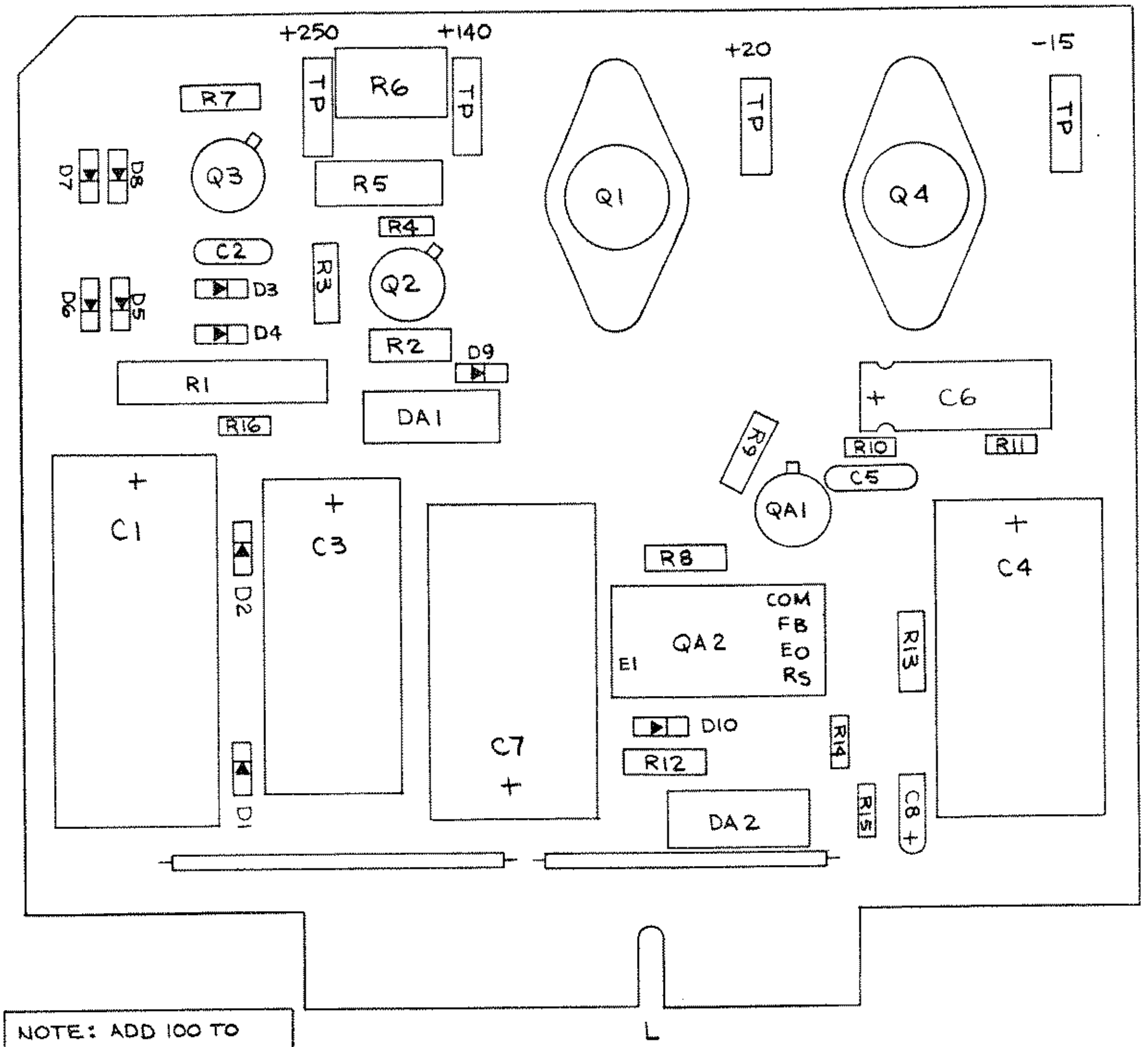
When the input signal level increases enough to operate the clutch, the collector voltage of Q407 approaches zero.

5.7 POWER SUPPLY

Power transformer T1 is located on the chassis (Figure 5.1). The 30-volt supply for the servo is located on Board 4 (Figure 5.6). All components for the -15, +20, +140, and +250 volt supplies are located on Board 1 (Figure 5.7), with the exception of filter capacitor C1 which is located on the chassis (Figure 5.1).

Test points on board 1 permit rapid measurement of all voltage supplies on this board without removal of the board. The +140 volt supply may be adjusted to exactly its nominal value by potentiometer R106. All other supplies are fixed and should remain within 10 percent of their nominal potentials.

Set the BAND selector for 1 GHz or above and take the following readings: These readings are valid for the basic Receiver, without Options.



NOTE: ADD 100 TO REFERENCE NUMBERS OF COMPONENTS ON THIS BOARD

Figure 5-7. Power Supply, Board 1, Parts Location

	EMITTER	BASE	COLLECTOR
Q101	140	141	190
Q102	140	140	141
Q103	20	21	141
Q103	34	33	21

	1	2	3	4	5	6	7	8
QA101	21	33	34	Gnd	-	1.6	21	20

	COM	E1	FB	EO	RS
QA102	Gnd	-25	-6.8	-15	-15

5.8 SCOPE DISPLAY

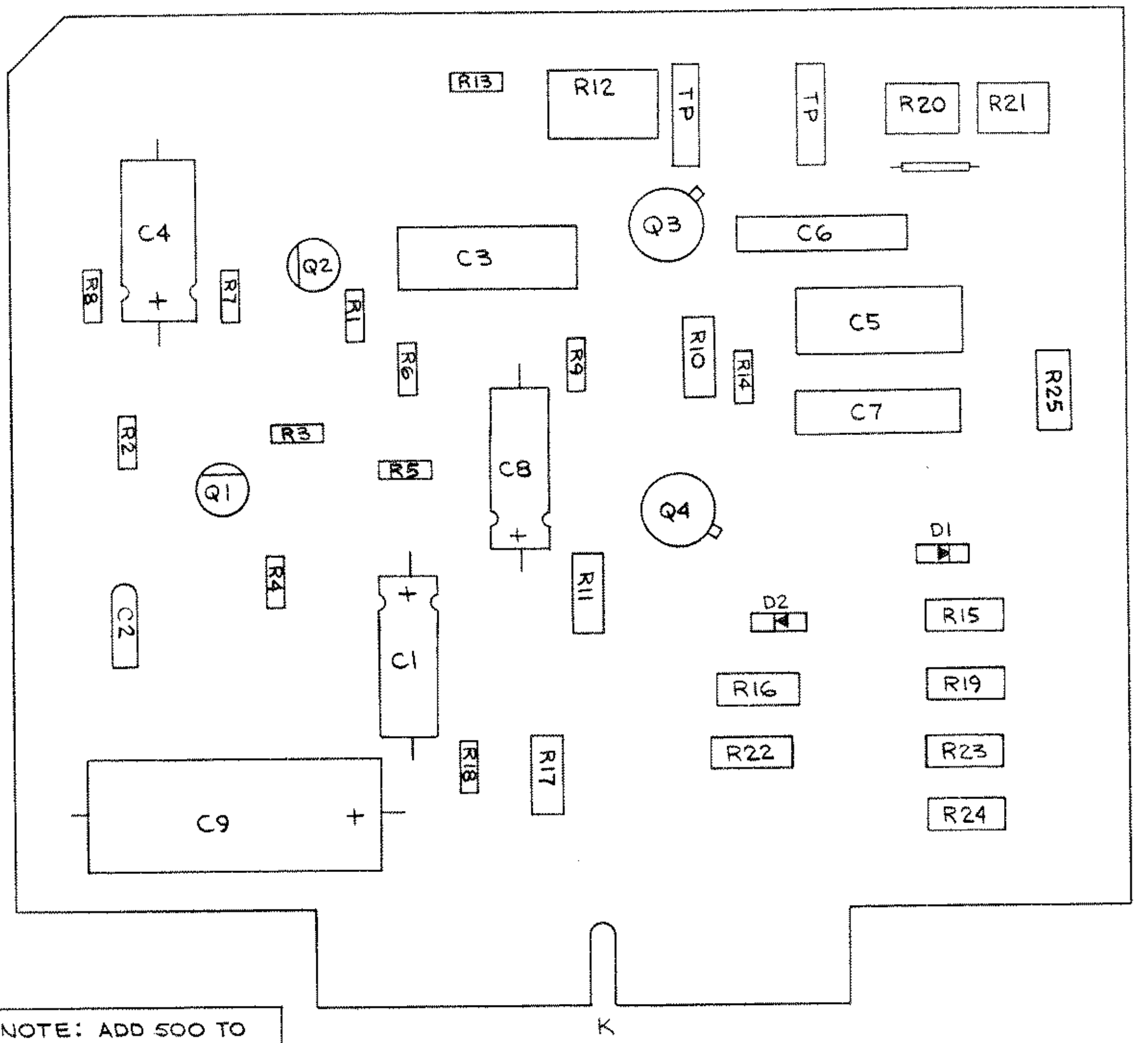
The alignment and maintenance of all circuits of the scope display are covered in this paragraph. The cathode-ray tube, high-voltage power supply, and several controls are located on the left portion of the chassis (Figure 5.1). The horizontal scope amplifier is on board 2 (Figure 5.4); the vertical amplifier is located on board 5 (Figure 5.8). Faults in the scope display can usually be identified by observing the cathode-ray tube display itself; i.e., no horizontal sweep indicates a fault in the horizontal scope amplifier.

WARNING

Exercise extreme caution -- potentials in the scope display circuitry are dangerous.

5.8.1 ALIGNMENT

The INTENSITY and FOCUS controls are located above the cathode-ray tube socket. (See Figure 5.1.) Adjust these for the best focus and minimum brightness consistent with ambient lighting. The horizontal and vertical position controls, located on Board 5 (Figure 5.8) are set, with no signal input, to give a straight horizontal line, centered with respect to the vertical axis and coincident with the lower horizontal scribed line on the bezel.



NOTE: ADD 500 TO REFERENCE NUMBERS OF COMPONENTS ON THIS BOARD

Figure 5-8. Vertical Scope Amplifier, Board 5, Parts Location

Connect the receiver to a CW signal source (75 MHz into the front panel IF 75 MHz connector is satisfactory) and connect the BOLOM output to a VSWR meter or recorder which can furnish 8.7 milliamperes bias. Set the SWEEP to NAR and raise this signal level to produce a 4-millivolt signal at the BOLOM output . Rotate the VERT GAIN control fully counterclockwise. Adjust R12, located on the back of the front panel near the VERT GAIN potentiometer so the cathode-ray tube presentation just fills the height between the two horizontal scribed lines. R10, which is adjacent to R12, is a vertical gain control in series with the front panel VERT GAIN when the latter is positioned fully counterclockwise. The setting of R10 is not critical, but may be conveniently adjusted to give an indication of receiver noise with no signal input and the VERT GAIN rotated fully clockwise.

5.8.2 POWER SUPPLY

The power supply is located on the bracket which mounts the cathode-ray tube socket. The test point above the socket may be used to check this supply.

WARNING

Be careful servicing this supply because the potentials are dangerous.

5.8.3 HORIZONTAL AMPLIFIER

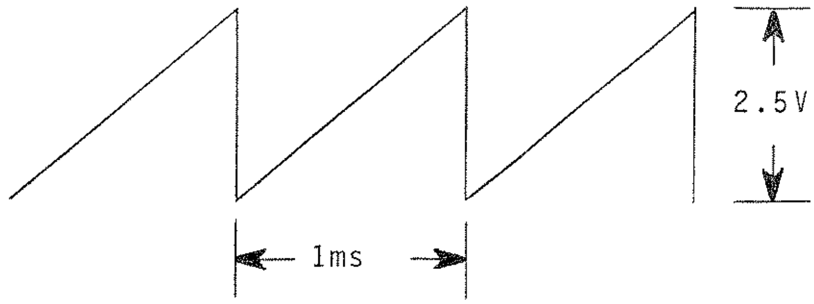
The horizontal amplifier is located on board 2 (Figure 5.4). Balance control R224 is adjusted for equal dc voltages at the collectors of Q205 and Q206. This is indicated by zero voltage between the two test jacks on either side of R224.

MEASUREMENTS

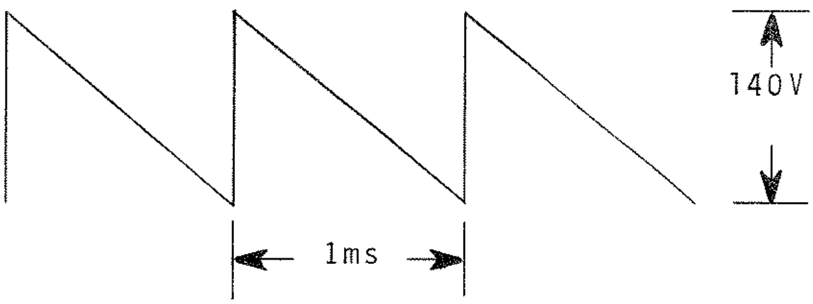
	EMITTER	BASE	COLLECTOR
Q205	15	16	135
Q206	15	16	135

WAVEFORMS

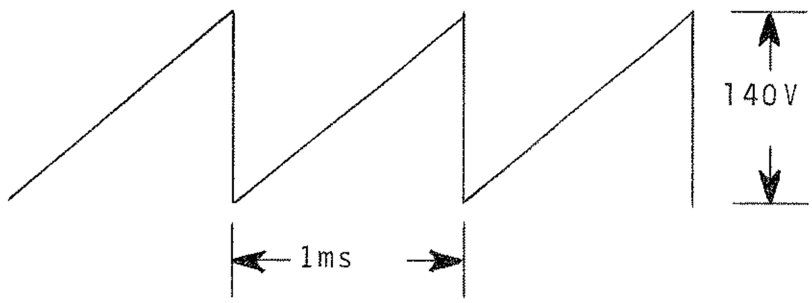
Base Q205



Collector Q205
Blue TP



Collector Q206
Blue TP



5.8.4 VERTICAL AMPLIFIER

The vertical scope amplifier is located on board 5 (Figure 5.8). The balance control R512 is adjusted for equal voltages at the collectors of Q503 and Q504. This is indicated by zero voltage between the two test jacks adjacent to R512.

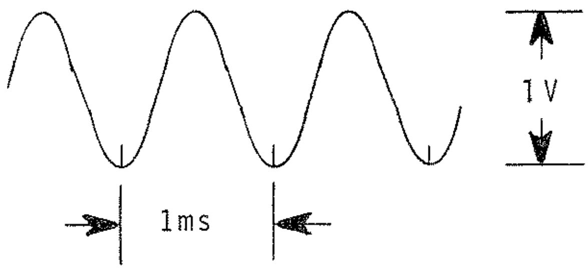
MEASUREMENTS

	EMITTER	BASE	COLLECTOR
Q501	0.6	1.0*	3.0
Q502	2.6	3.0	10
Q503	16	16	145
Q504	16	16	145

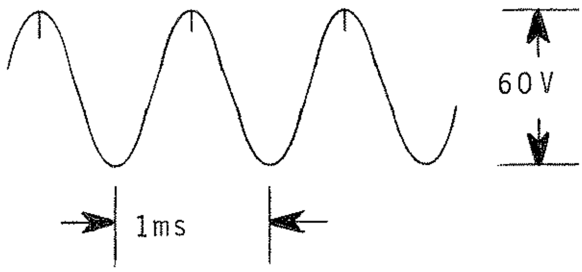
*Measure with VTVM

WAVEFORMS

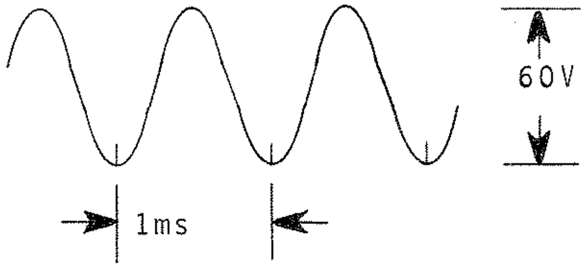
COLLECTOR Q502



COLLECTOR Q503



COLLECTOR Q504



5.8.5 CATHODE-RAY TUBE

The cathode-ray tube is a type 2AP1-A. The INTENSITY and FOCUS controls are located above the CRT socket, bracket, and the horizontal (R21) and vertical (R20) position controls are located on board 5 (Figure 5.8).

REPLACEMENT. Remove the two screws holding the bezel to the front panel. The cathode-ray tube is then removed through the front panel. It is not necessary to remove the tube shield. When installing a new tube, it may be necessary, because of variations in tube length, to loosen the screws holding the socket bracket to the chassis and adjust the position of this bracket until the new tube fits firmly against the bezel.

MEASUREMENTS. The following measurements are made at the cathode-ray tube socket with respect to chassis ground.

SOCKET PIN	VOLTS
1	-845
2	-845
3	+50*
4	-590**
5	----
6	
7	+97*
8	+67*
9	+67*
10	-890**
11	-850**

*Measure with VTVM
**Nominal value. Actual value may vary 20 percent depending on setting of scope controls.

Measure the ac voltage between pins 1 and 11. It should be 6.3 volts.

WARNING

Both of these pins are at dangerous potentials above ground.

5.9 LEVEL AMPLIFIER

Connect a 75-MHz CW signal generator to the IF 75 MHz input connector, and rotate the BAND selector to any band above 950 MHz.

5.9.1 ALIGNMENT

Set the IF GAIN fully counterclockwise, adjust the SET REF control to approximate mid-range, and place the meter switch to NORM. Increase the input signal until the meter is centered. Adjust L2, located on the chassis, for maximum meter deflection to the right; decrease the input signal, as necessary, to keep the meter near center.

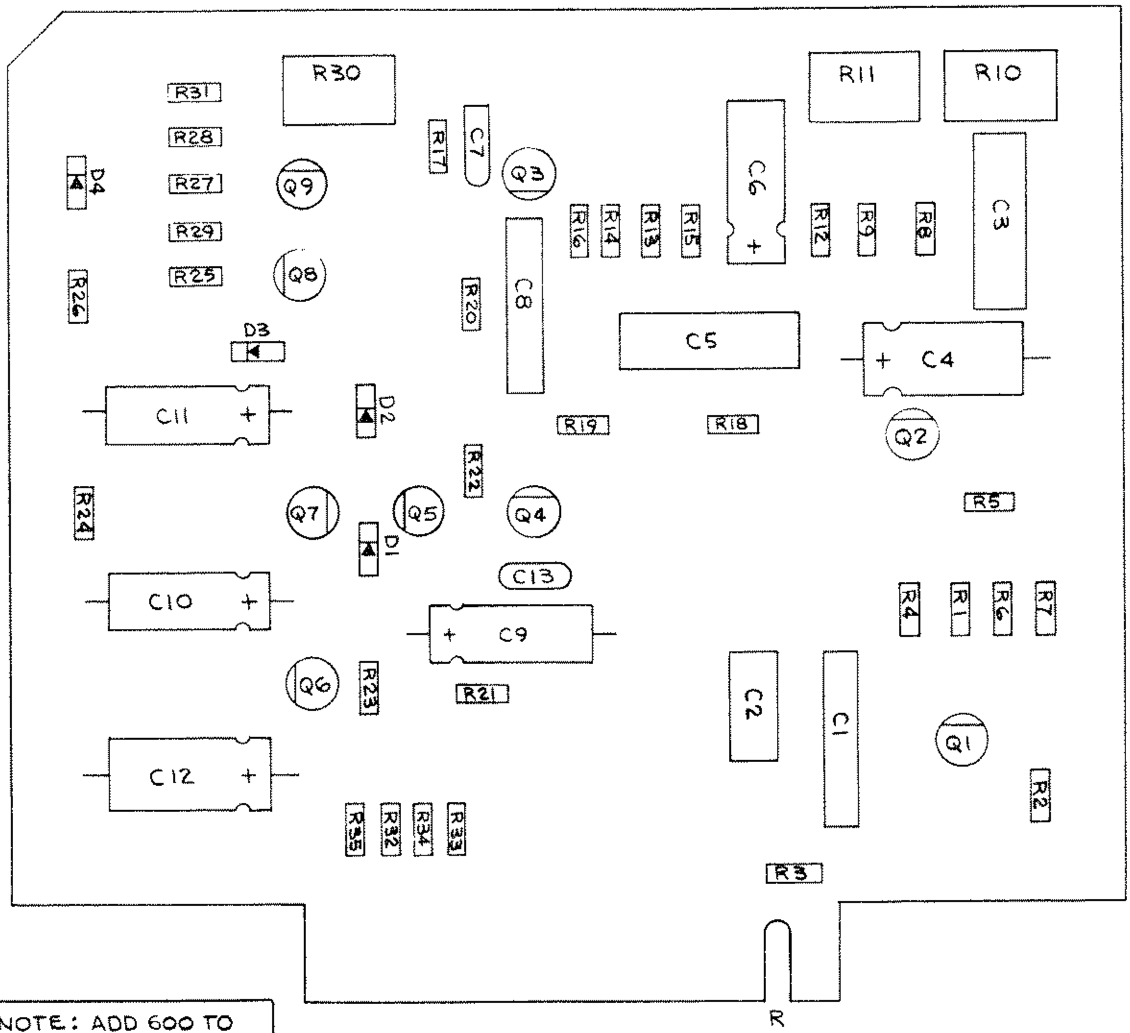
Set the IF GAIN fully clockwise, adjust the SET REF control one turn back from its maximum clockwise position, and position the meter switch to EXP. Using a VSWR meter connected to the BOLOM output, increase the input signal for a signal-to-noise ratio of 13 dB. Set expand gain control R611 (Figure 5.9) to about 90 percent of its clockwise rotation and adjust expand zero balance control R630 for zero centering of the meter. Vary the signal strength by 1 dB (the front panel control may be used for this purpose) and note the meter deflection. Adjust R611 for approximate full-scale meter deflection with the 1-dB change, and for each change of R611, re-adjust R630 for zero centering at about 13-dB signal-to-noise. Then switch to NORM, without changing any test conditions, and adjust the normal gain control for zero meter reading.

5.9.2 MEASUREMENTS

The following dc measurements are taken with no input signal, and the meter switch set to NORM.

	EMITTER	BASE	COLLECTOR
Q601	0.3	0.4*	18
Q602	7.0	7.5*	18
Q603	1.0	1.2	12
Q604	10	10	1.0
Q605	0	1.0	11
Q606	11	12	18
Q607	11	11	0
Q608	-14	-14	0
Q609	-14	-14	-14

*Measure with VTVM



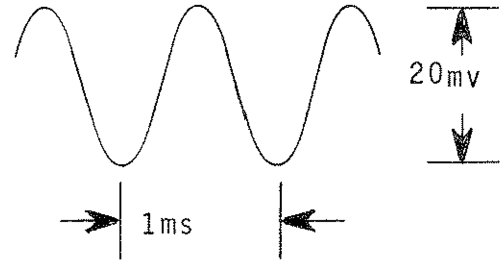
NOTE: ADD 600 TO REFERENCE NUMBERS OF COMPONENTS ON THIS BOARD

Figure 5-9. Level Amplifier, Board 6, Parts Location

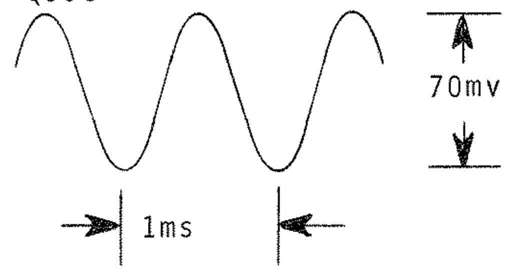
5.9.3 WAVEFORMS

The following waveforms are observed with the meter switch at NORM, with an input signal level which gives an output signal-to-noise ratio of about 20 dB, and with the SET REF control adjusted for centering of the meter:

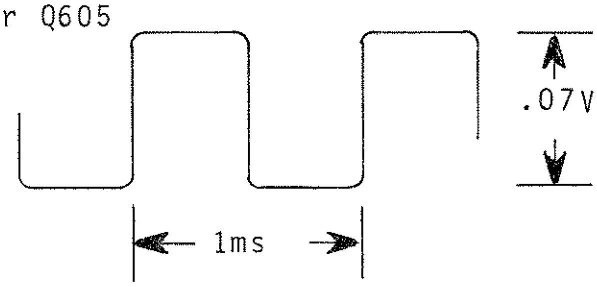
Emitter Q602



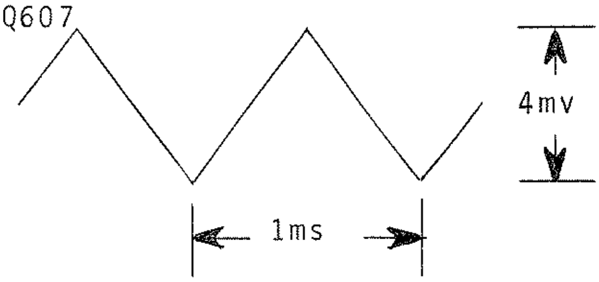
Collector Q603



Collector Q605



Emitter Q607



6.0 PARTS LIST

This section contains information for the procurement of replacement parts for the Series 1200 Receiver. To assist maintenance personnel in locating parts, location drawings and/or schematics are referenced for each assembly.

The following parts tables are contained in this section:

6.0 PARTS LIST

TABLE 6.1 MAIN CHASSIS
(Reference Figure 5.1)

Ref. Design.	Description	Mfr.	Drawing/ Part No.
C1	CAPACITOR, Alum. 100 uf, 250 WVDC	Sprague	TVL-1535
C2	CAPACITOR, Film, .1 uf, 1,600 WVDC	F-Dyne	MPE-11H-1-1600-10
D1	DIODE	EDI	LK5
DS1	Pilot Lamp	Marco-Oak	A1G
F1	Fuse, 1 Amp., Slo-Blo	Littelfuse	313001
J1,2	CONNECTOR, "N"		UG-1095B/U
J3	CONNECTOR, BNC		UG-492A/U
J5,6	CONNECTOR, BNC		UG-657-U
J7	CONNECTOR, BNC		UG-625/U
J8	CONNECTOR, Pwr.	Cinch-Jones	DBM-25S
J9	CONNECTOR, Pwr.	Cinch-Jones	DAM-15S
J11,12,13,14 15, 16	CONNECTOR, P.C.	Winchester	HB15-S-0-0
J17	CRT Socket	Cinch-Jones	3M11
L1,2	INDUCTOR, Variable 1-11	UTC	HVC-8
M1	METER, 50-0-50 ua	M-T	32-047
P1	CONNECTOR, TNC	Gremar	6002
P3,4,5,9	CONNECTOR, BNC		UG-88C/U
P6,7	CONNECTOR, SMC		UG-1465/U
P8	CONNECTOR, Pwr.	Cinch-Jones	DAM-15S
R1	RESISTOR, Comp., 47,000 ohms, 5%, 1/4 W		RC07GF473J
R2	RESISTOR, Variable, 500,000 ohms, 1 W	Mallory	SU-50

TABLE 6.1 (Continued)

Ref. Design.	Description	Mfr.	Drawing/ Part No.
R3	RESISTOR, Comp., 470,000 ohms, 5%, 1/2 W		RC020GF474J
R4	RESISTOR, Variable, 1 megohm, 1 W	Mallory	SU-54
R5	RESISTOR, Comp., 2.7 megohms, 5%, 1 W		RC32GF275J
R6	RESISTOR, Comp., 330,000 ohms, 5%, 1/2 W		RC20GF334J
R7	RESISTOR, Variable, 5,000 ohms, 1/2 W	IRC	PQ11-114
R9	RESISTOR, Variable, 250,000 ohms, 1/2 W	IRC	PQ11-130
R10	RESISTOR, Variable, 10,000 ohms, 1/2 W	Bourns	3067S-1-103
R11	RESISTOR, Comp., 680,000 ohms, 5%, 1/4 W		RC07GF684J
R12	RESISTOR, Variable, 10,000 ohms, 1/2 W	Bourns	3067S-1-103
R13	RESISTOR, Variable, 10,000 ohms, 1/2 W	IRC	PQ11-103
R14	RESISTOR, Variable, 50,000 ohms, 2 W	IRC	8400
R15	RESISTOR, Variable, 5,000 ohms, 1/2 W	IRC	PQ11-114
S1	SWITCH, Pushbutton	Marco-Oak	54-61681-28
S2	SWITCH, Slide	Switchcraft	46206LF
S3	SWITCH, Rotary	Mallory	3243J
S4	SWITCH, Rotary	Mallory	3223J
S5	SWITCH, SPDT	IRC	76-4
S6	SWITCH, Rotary	Oak	399225-A
T1	TRANSFORMER, Pwr.	M-T	32-004

TABLE 6.1 (Continued)

Ref. Design.	Description	Mfr.	Drawing/ Part No.
TP1	Test Jack	E.F. Johnson	106-602
V1	Cathode Ray Tube	RCA	2AP1A
W1	Power Cable	Belden	17236
XF1	Fuseholder	Littelfuse	342001
Z1	Step Attenuator	Telonic	TG-950
Z2	TERMINATION 50 ohm		MX-554/U-51

TABLE 6.2 POWER SUPPLY
(Reference Figure 5.7, 7.10)

C101	CAPACITOR, Alum., 16 uf, 450 WVDC		CDE BR16-450
C102	CAPACITOR, Ceramic, .001 uf, 1,000 WVDC	Sprague	5GA-D10
C103	CAPACITOR, Alum., 8uf, 350 WVDC		CDE BR8-350
C104,107	CAPACITOR, Alum., 250 uf, 50 WVDC		CDE BR250-50
C105	CAPACITOR, Mica, 50 pf, 300 WVDC		CM05ED510J03
C106	CAPACITOR, Alum., 20 uf, 50 WVDC	Sprague	TE1305
C108	CAPACITOR, Tant., 1.0 uf, 35 WVDC	Kemet	K13C5K
D101,102	DIODE, Rectifier, 700 PIV		1N4007
D103,104	DIODE, Zener		1N4761A
D105,106,107, 108	DIODE, Zener		1N4759A
D109	DIODE, Rectifier, 200 PIV		1N4002
D110	DIODE, Zener		1N4740A
DA101	DIODE Assembly	Mallory	CTP-500

TABLE 6.2 (Continued)

Ref. Design.	Description	Mfr.	Drawing/ Part No.
DA102	DIODE Assembly	Mallory	FW-200
Q101	TRANSISTOR, NPN		2N3738
Q102	TRANSISTOR, NPN		2N2270
Q103	TRANSISTOR, NPN		2N3440
Q104	TRANSISTOR, PNP		2N4898
QA101	MICROCIRCUIT		NSC LM-300
QA102	MICROCIRCUIT	Beckman	852
R101	RESISTOR, 8,000 ohms, 5%, 5 W	Sprague	243E8025
R102	RESISTOR, 5,600 ohms, 5%, 3 W	Ohmite	995-3A
R103	RESISTOR, 4,700 ohms, 5%, 1/2 W		RC20GF472J
R104	RESISTOR, 12 ohms, 5%, 1/4 W		RC07GF120J
R105	RESISTOR, 39,000 ohms, 5%, 1 W		RC32GF393J
R106	RESISTOR, Variable, 10,000 ohms, 1 W		IRC106-2
R107	RESISTOR, 3,900 ohms, 5%, 1/2 W		RC20GF392J
R108,112,113	RESISTOR, 10 ohms, 5%, 1/2 W		RC20GF100J
R109	RESISTOR, 1.5 ohms, 5%, 1.5 W	Ohmite	995-1A
R110	RESISTOR, 39,000 ohms, 5%, 1/4 W		RC07GF393J
R111,115	RESISTOR, 3,600 ohms, 5%, 1/4 W		RC07GF362J
R114	RESISTOR, 4,300 ohms, 5%, 1/4 W		RC07GF432J

TABLE 6.2 (Continued)

Ref. Design.	Description	Mfr.	Drawing/ Part No.
R116	RESISTOR, 1 megohm, 5%, 1/4 W		RC07GF105J

TABLE 6.3 REFERENCE GENERATOR
(Reference Figure 5.4, 7.5)

Ref. Design.	Description	Mfr.	Drawing/ Part No.
C201	CAPACITOR, 1.0 uf, 10%, 50 WVDC	GE	75F7R5A105
C202,207,208	CAPACITOR, 10 uf, 25 WVDC	Sprague	TE1204
C203,206	CAPACITOR, 0.1 uf, 10%, 50 WVDC	GE	75F7R5A104
C204	CAPACITOR, .056 uf, 10%, 100 WVDC	Sprague	225P56391
C205	CAPACITOR, 470 pf, 10%, 200 WVDC	Sprague	192P47192
C209,210	CAPACITOR, .022 uf, 10%, 400 WVDC	GE	75F3R4A223
C211,212	CAPACITOR, 1.0 uf, 35 WVDC	Kemet	K1C35K
C213	CAPACITOR, 4 uf, 350 WVDC		CDE BR4-350
Q201	TRANSISTOR		2N1671
Q202,203,204	TRANSISTOR		2N2270
Q205,206	TRANSISTOR		2N3440
R201	RESISTOR, 330 ohms, 5%, 1/4 W		RC07GF331J
R202	RESISTOR, Variable, 10,000 ohms, 1 W	IRC	106-2
R203	RESISTOR, 10,000 ohms, 5%, 1/4 W		RN55D1002F
R204	RESISTOR, 22,600 ohms, 1%, 1/4 W		RN55D2262F

TABLE 6.3 (Continued)

Ref. Design.	Description	Mfr.	Drawing/ Part No.
R205,211	RESISTOR, 15,000 ohms, 5%, 1/4 W		RC07GF153J
R207	RESISTOR, 100 ohms, 5%, 1/4 W		RC07GF101J
R208,209,210, 216,220,222	RESISTOR, 1,000 ohms, 5%, 1/4 W		RC07GF102J
R212,214	RESISTOR, 10,000 ohms, 5%, 1/4 W		RC07GF103J
R213	RESISTOR, Variable, 1,000 ohms, 1 W	IRC	106-2
R215,219	RESISTOR, 6,800 ohms, 5%, 1/4 W		RC07GF682J
R217	RESISTOR, Variable, 5,000 ohms, 1 W	IRC	106-2
R218	RESISTOR, 4,700 ohms,		RC07GF472J
R221,227	RESISTOR, 47,000 ohms, 5%, 1/4 W		RC07GF473J
R223,226	RESISTOR, 56,000 ohms, 5%, 1/2 W		RC20GF563J
R224	RESISTOR, Variable, 100 ohms, 1 W	IRC	106-2
R225	RESISTOR, 3,900 ohms, 5%, 1/4 W		RC07GF392J
R228	RESISTOR, 1 megohm, 5%, 1/4 W		RC07GF105J
R229	RESISTOR, Variable, 2,000 ohms, 1 W	IRC	106-2

TABLE 6.4 AFC CLIPPER/AMPLIFIER
(Reference Figure 5.6, 7.6)

Ref. Design.	Description	Mfr.	Drawing/ Part No.
C301,312,313	CAPACITOR, 10 uf, 25 WVDC	Sprague	TE1204
C302	CAPACITOR, .0047 uf, 10%, 400 WVDC	GE	75F1R4A472
C303,305,307 314	CAPACITOR, 0.1 uf, 10%, 50 WVDC	GE	75F2R5A104
C304,306,308	CAPACITOR, .22 uf, 10%, 50 WVDC	GE	75F3R5A224
C309	CAPACITOR, .47 uf, 10%, 50 WVDC	GE	75F7R5A474
C310,311	CAPACITOR, 1.0 uf, 10%, 50 WVDC	GE	75F7R5A105
D301,302,303 304,305,306, 307,308	DIODE		1N456
DA301	RECTIFIER, Bridge	Motorola	MDA920-2
Q301,304,306	TRANSISTOR		2N2270
Q302,303	TRANSISTOR		2N3391
Q305	TRANSISTOR		2N3904
R301,308,313	RESISTOR, 1 megohm, 5%, 1/4 W		RC07GF105J
R302,307,314, 319	RESISTOR, 150,000 ohms, 5%, 1/4 W		RC07GF154J
R303,328	RESISTOR, 4,700 ohms, 5%, 1/4 W		RC07GF472J
R304,318	RESISTOR, 200,000 ohms, 5%, 1/4 W		RC07GF204J
R305,311,316, 321	RESISTOR, 1,000 ohms, 5%, 1/4 W		RC07GF102J
R306,324,332	RESISTOR, 100,000 ohms, 5%, 1/4 W		RC07GF104J

TABLE 6.4 (Continued)

Ref. Design.	Description	Mfr.	Drawing/ Part No.
R309	RESISTOR, 27,000 ohms, 5%, 1/4 W		RC07GF273J
R310,315	RESISTOR, 15,000 ohms, 5%, 1/4 W		RC07GF153J
R312,317	RESISTOR, 68,000 ohms, 5%, 1/4 W		RC07GF683J
R320,322,323, 329,330	RESISTOR, 10,000 ohms, 5%, 1/4 W		RC07GF103J
R326	RESISTOR, 36,000 ohms, 5%, 1/4 W		RC07GF363J
R327	RESISTOR, 220 ohms, 5%, 1/4 W		RC07GF221J
R331	RESISTOR, 5,600 ohms, 5%, 1/4 W		RC07GF562J
T301	TRANSFORMER, 10,000: 10,000 ohms	Triad	SP-66

TABLE 6.5 SERVO AMPLIFIER
(Reference Figure 5.6, 7.7)

C401	CAPACITOR, 250 uf, 50 WVDC	CDE	BR250-50
C402,403,404	CAPACITOR, 1.0 uf, 35 WVDC	Kemet	K1C35K
C405	CAPACITOR, 2.2 uf, 20 WVDC	Kemet	K2R2C20K
C406	CAPACITOR, 10 uf, 25 WVDC	Sprague	TE1204
C407	CAPACITOR, 100 pf, 1000 WVDC		CM05FD101J03
C408	CAPACITOR, 390 pf, 500 WVDC		CM05FD391J03
D401	DIODE, Zener		1N4751A
D402	DIODE,		1N270
D403	DIODE, Zener		1N5245B

TABLE 6.5 (Continued)

Ref. Design.	Description	Mfr.	Drawing/ Part No.
D404	DIODE		1N4002
DA401	DIODE Assembly	Mallory	FW-200
Q401,411,413	TRANSISTOR		2N3054
Q402,407,408 409	TRANSISTOR		2N2270
Q403,406,410, 412	TRANSISTOR		2N3391
Q404,405	TRANSISTOR		2N5459
R401	RESISTOR, 2.7 ohms, 5%, 1.5 W	Ohmite	995-1A
R402	RESISTOR, 680 ohms, 5%, 1.5 W	Ohmite	995-1A
R403	RESISTOR, 3.3 ohms, 5%, 3 W	Sprague	242E3R35
R404,409,424	RESISTOR, 1,000 ohms, 5%, 1/4 W		RC07GF102J
R405	RESISTOR, 82,000 ohms, 5%, 1/4 W		RC07GF823J
R406	RESISTOR, 27,000 ohms, 5%, 1/4 W		RC07GF273J
R407	RESISTOR, 330 ohms, 5%, 1/4 W		RC07GF331J
R408	RESISTOR, 3,900 ohms, 5%, 1/4 W		RC07GF392J
R410,431,436	RESISTOR, 10,000 ohms, 5%, 1/4 W		RC07GF103J
R411,429	RESISTOR, 15,000 ohms, 5%, 1/4 W		RC07GF153J
R412	RESISTOR, Variable, 10,000, 1 W	IRC	106-2

TABLE 6.5 (Continued)

Ref Design.	Description	Mfr.	Drawing/ Part No.
R413,418	RESISTOR, 220,000 ohms, 5%, 1/4 W		RC07GF224J
R414,415,422	RESISTOR, 6,800 ohms, 5%, 1/4 W		RC07GF682J
R416	RESISTOR, 270,000 ohms, 5%, 1/4 W		RC07GF274J
R417	RESISTOR, 470 ohms, 5%, 1/4 W		RC07GF471J
R419	RESISTOR, 5,600 ohms, 5%, 1/4 W		RC07GF562J
R420,425,427 430	RESISTOR, 22,000 ohms, 5%, 1/4 W		RC07GF223J
R421	RESISTOR, 1,800 ohms, 5%, 1/4 W		RC07GF182J
R423	RESISTOR, 62,000 ohms, 5%, 1/4 W		RC07GF623J
R426	RESISTOR, 12,000 ohms, 5%, 1/4 W		RC07GF123J
R428	RESISTOR, Variable, 100 ohms, 1 W	IRC	106-2
R432,435	RESISTOR, 2,200 ohms, 5%, 1/4 W		RC07GF222J
R433,434	RESISTOR, 150 ohms, 5%, 5 W	Sprague	243E1515

TABLE 6.6 (Continued)

Ref. Design.	Description	Mfr.	Drawing/ Part No.
R510,511	RESISTOR, 56,000 ohms, 5%, 1/2 W		RC07GF563J
R512	RESISTOR, Variable, 100 ohms, 1 W	IRC	106-2
R513	RESISTOR, 3,900 ohms, 5%, 1/4 W		RC07GF393J
R515,516,519 525	RESISTOR, 2.2 megohms, 5%, 1/2 W		RC07GF225J
R517	RESISTOR, 1,000 ohms, 5%, 1/2 W		RC20GF102J
R518	RESISTOR, 2.2 megohms, 5%, 1/4 W		RC07GF102J
R520,521	RESISTOR, Variable, 1 megohm, 1 W	Helipot	62PARIM
R522	RESISTOR, 27,000 ohms, 5%, 1/2 W		RC20F273J
R523	RESISTOR, 22,000 ohms, 5%, 1/2 W		RC20GF223J
R524	RESISTOR, 68,000 ohms, 5%, 1/2 W		RC20GF683J

TABLE 6.7 LEVEL AMPLIFIER
(Reference Figure 5.9)

C601,608	CAPACITOR, .1 uf, 10%, 50 WVDC	GE	75F2R5A104
C602	CAPACITOR, .0047 uf, 10%, 400 WVDC	GE	75F1R4A472
C603,605	CAPACITOR, .22 uf, 10%, 50 WVDC	GE	75F3R5A224
C604,612	CAPACITOR, 25 uf, 25 WVDC	Sprague	TE1207
C606,609,610, 611	CAPACITOR, 10 uf, 25 WVDC	Sprague	TE1204
C607	CAPACITOR, 1.0 uf, 35 WVDC	Kemet	K1C35K

TABLE 6.7 (Continued)

Ref. Design	Description	Mfr.	Drawing/ Part No.
R601,619,620, 621,622,632, 634	RESISTOR, 100,000 ohms, 5%, 1/4 W		RC07GF104J
R602,R607,608	RESISTOR, 1,800 ohms, 5%, 1/4 W		RC07GF182J
R603,609,612, 617,618,631	RESISTOR, 1,000 ohms, 5%, 1/4 W		RC07GF102J
R604,605,609,612 613,617,618, 631	RESISTOR, 330,000 ohms, 5%, 1/4 W		RC07GF334J
R606,615,616 623,627,629	RESISTOR, 10,000 ohms, 5%, 1/4 W		RC07GF103J
R610	RESISTOR, Variable, 1,000 ohms, 1 W	Beckman	62PAR1K
R611,630	RESISTOR, Variable, 10,000 ohms, 1 W	Beckman	62PAR10K
R614	RESISTOR, 150,000 ohms, 5%, 1/4 W		RC07GF154J
R624	RESISTOR, 100 ohms, 5%, 1/4 W		RC07GF101J
R625	RESISTOR, 3,900 ohms, 5%, 1/4 W		RC07GF392J
R626	RESISTOR, 2,200 ohms, 5%, 1/4 W		RC07GF222J
R628	RESISTOR, 5,600 ohms, 5%, 1/4 W		RC07GF362J
R633	RESISTOR, 75,000 ohms, 5%, 1/4 W		RC07GF753J
R635	RESISTOR, 330 ohms, 5%, 1/4 W		RC07GF331J

TABLE 6.6 VERTICAL SCOPE AMPLIFIER
(Reference Figure 5.8, 7.8)

Ref. Design.	Description	Mfr.	Drawing/ Part No.
C501,508	CAPACITOR, 10 uf, 25 WVDC	Sprague	TE1204
C502	CAPACITOR, 1.0 uf, 35 WVDC	Kemet	K1C35K
C503,505	CAPACITOR, .22 uf, 10%, 50 WVDC	GE	75F3R5A224
C504	CAPACITOR, 50 uf, 6 WVDC	Sprague	TE1100
C506,507	CAPACITOR, .022 uf, 10%, 400 WVDC	GE	75F3R4A224
C509	CAPACITOR, 4 uf, 350 WVDC	CDE	BR4-350
D501,502	DIODE		1N4005
Q501,502	TRANSISTOR		2N3391
Q503,504	TRANSISTOR		2N3340
R501	RESISTOR, 220,000 ohms, 5%, 1/4 W		RC07GF224J
R502	RESISTOR, 1 megohm, 5%, 1/4 W		RC07GF105J
R503	RESISTOR, 51,000 ohms, 5%, 1/4 W		RC07GF513J
R504,505	RESISTOR, 2,200 ohms, 5%, 1/4 W		RC07GF222J
R506	RESISTOR, 10,000 ohms, 5%, 1/4 W		RC07GF103J
R507	RESISTOR, 330 ohms, 5%, 1/4 W		RC07GF331J
R508	RESISTOR, 3,000 ohms, 5%, 1/4 W		RC07GF302J
R509,514	RESISTOR, 47,000 ohms, 5%, 1/4 W		RC07GF473J

TABLE 6.8 DIAL ASSEMBLY
(Reference Figure 7.3)

Ref. Design.	Description	Mfr.	Drawing/ Part No.
B701	CLUTCH	Altair	MC545AA28
B702	MOTOR	Hayden	K5331-P-1-10 RPM
J701	CONNECTOR (Part of Probe Assembly)	Winchester	M4S-LRN
J702	CONNECTOR	Winchester	M4S-LRN
J703	CONNECTOR (Part of Cavity)		
P701	CONNECTOR		C-JDBM-25P
P702	CONNECTOR	Winchester	M4P-LS-H10C
S701	SWITCH	Grayhill	24004-10
Z701	PAD, 3 dB	Emco	A-303J
Z702	OSCILLATOR, 1-2.5 GHz	RFD	LS-5119

TABLE 6.9 LOW PASS FILTER AND CRYSTAL MONITOR
(Reference Figure 7.6)

C801,804	CAPACITOR, 33 pf, 5%, 300 WVDC		CM05ED330J03
C802,803	CAPACITOR, 75 pf, 5%, 300, WVDC		CM05ED750J03
C805	CAPACITOR, .005 uf, 5%, 50 WVDC	Sprague	TG-D50
E801	CABLE TERMINATION		MX-1684/U
E802	CABLE TERMINATION		MX-1684/U
FL801	FILTERCON	Erie	1201-052
L801,802,803	INDUCTOR, 0.15 uh	Delevan	1025-00
L804	INDUCTOR, 4.7 uh	Delevan	1537-28
P801	PLUG, BNC		UG-88C/U
R801	RESISTOR, 1.8 ohms 5%, 1/2W		RC20GF1R8J

TABLE 6.10 IF AMPLIFIER
(Reference Figure 5.3)

Ref. Design.	Description	Mfr.	Drawing/ Part No.
C901,903,911, 913,924,929, 936,937,942, 948,950,959, 964	CAPACITOR, Variable, 1-11 pf	E. F. Johnson	189-504-4
C902,904,905, 906,907,909, 910,914,915, 917,920,923, 925,926,928, 932,933,935, 940,941,943, 944,946,954, 956,957,958, 961,967,968, 970,971,972, 973,975,977	CAPACITOR, Ceramic, .005 uf, 50 WVDC	Sprague	TG-D50
C912,916,939	CAPACITOR, Ceramic, 2.2 pf NPO, 1000 WVDC	Sprague	10TCC-V22
C918	CAPACITOR, Mica, 51 pf 500 WVDC		CM05ED510J03
C919	CAPACITOR, Ceramic, 5 pf, N750, 1000 WVDC	Sprague	10TCU-V50
C921	CAPACITOR, Tant., 1.0 uf, 35 WVDC	Kemet	K1C35K
C922,962	CAPACITOR, Mica, 100 pf, 500 WVDC		CM05FD101J03
C927,949,960	CAPACITOR, Ceramic, 4.7 pf, NPO, 500 WVDC	Sprague	10TCC-V47
C931	CAPACITOR, Mica, 15 uf, 500 WVDC		CM06FD150J03
C934	CAPACITOR, Glass, 0.1pf	M-T	32-119
C938	CAPACITOR, Ceramic, 1.0 pf, NPO, 1000 WVDC	Sprague	10TCC-V10

TABLE 6.10 (Continued)

Ref. Design.	Description	Mfr.	Drawing/ Part No.
C947,951,952, 953,955,963	CAPACITOR, Ceramic, .01 uf, 50 WVDC	Sprague	TG-S10
C965,966	CAPACITOR, Mica, 680 pf		CM06FD681J03
D901	DIODE, Varactor		1N5140
D902	DIODE, Signal		1N270
D903	DIODE, Zener		1N5221
FL901,902,903 904,905,906, 907,908	FILTERCON	Erie	1201-052
J901,902	CONNECTOR, BNC		UG-625/U
J903,904	CONNECTOR, SMC	Micon	1004
J905	CONNECTOR, Pwr.	Cinch-Jones	DAM-15P
L901	INDUCTOR, Fixed, .15 uh	Delevan	1025-00
L902	INDUCTOR, Fixed, .47 uh	Delevan	1025-12
L904	INDUCTOR, Fixed, .56 uh	Delevan	1025-14
L905,906,932	INDUCTOR, Fixed, 2.2 uh	Delevan	1537-20
L907,920,924, 926	INDUCTOR, Fixed, 2.2 uh	Delevan	1025-28
L909	INDUCTOR, Variable	M-T	32-070-1
L911,918	INDUCTOR, Fixed, 1.5 uh	Delevan	1025-24
L912,913,915, 919,921,922 923,925,928, 931,933	INDUCTOR, Fixed, 6.8 uh	Delevan	1537-32
L916	INDUCTOR, Fixed	M-T	32-070-5

TABLE 6.10 (Continued)

Ref. Design.	Description	Mfr.	Drawing/ Part No.
L917	INDUCTOR, Fixed	M-T	32-070-9
L927	INDUCTOR, Fixed, 10 uh	Delevan	1025-44
Q901,902	TRANSISTOR, NPN		2N3478
Q904,907,908, 909,910,912, 913,914,915	TRANSISTOR, NPN	Amperex	A473
Q905	TRANSISTOR, FET		3N126
Q906	TRANSISTOR, NPN	Motorola	MPS-6546
Q911	TRANSISTOR, FET		3N128
R901,926	RESISTOR, Comp., 3000 ohms, 5%, 1/4 W		RC07GF302J
R902,911,916, 934,936,938, 948,952,958, 961	RESISTOR, Comp., 15,000 ohms, 5%, 1/4 W		RC07GF153J
R903	RESISTOR, Comp., 56 ohms, 5%, 1/4 W		RC07GF560J
R904,920	RESISTOR, Comp., 1,200 ohms, 5%, 1/4 W		RC07GF122J
R905	RESISTOR, Comp., 180 ohms, 5%, 1/4 W		RC07GF181J
R906,913	RESISTOR, Comp., 6,800 ohms, 5%, 1/4 W		RC07GF682J
R907	RESISTOR, Comp., 3,300 ohms, 5%, 1/4 W		RC07GF332J
R908	RESISTOR, Variable, 500 ohms		RV6NAYSD501A
R909,927,931, 933,940,960, 963,977	RESISTOR, Comp., 1,000 ohms, 5%, 1/4 W		RC07GF102J
R910	THERMISTER, 1,000 ohms	Fenwal	JB31J1
R912	RESISTOR, Comp., 390 ohms, 5%, 1/4 W		RC07GF391J

TABLE 6.10 (Continued)

Ref. Design.	Description	Mfr.	Drawing/ Part No.
R914,935,941, 945,947,949, 951,964,974	RESISTOR, Comp., 2,200 ohms, 5%, 1/4 W		RC07GF222J
R915,944,975, 976	RESISTOR, Comp., 100 ohms, 5%, 1/4 W		RC07GF101J
R917	RESISTOR, Comp., 1,800 ohms, 5%, 1/4 W		RC07GF182J
R918,924,925, 928	RESISTOR, Comp., 10,000 ohms, 5%, 1/4 W		RC07GF103J
R919,929,937, 955	RESISTOR, Comp., 2,700 ohms, 5%, 1/4 W		RC07GF272J
R921,922,930, 932,939,942, 950,953,956, 959,962,965	RESISTOR, Comp., 4,700 ohms, 5%, 1/4 W		RC07GF472J
R923	RESISTOR, Comp., 22,000 ohms, 5%, 1/4 W		RC07GF223J
R943	RESISTOR, Comp., 820 ohms, 5%, 1/4 W		RC07GF821J
R946,95 ,970	RESISTOR, Variable, 10,000 ohms, 1 W	Helipot	62PAR10K
R954	RESISTOR, Comp., 680 ohms, 5%, 1/4 W		RC07GF681J
R966	RESISTOR, Comp., 8,200 ohms, 5%, 1/4 W		RC07GF822J
R967	RESISTOR, Comp., 13,000 ohms, 5%, 1/4 W		RC07GF133J
R968	RESISTOR, Comp., 3,900 ohms, 5%, 1/4 W		RC07GF392J
R969	RESISTOR, Comp., 10,000 ohms, 5%, 1/4 W		RC07GF103J
R982	RESISTOR, Variable, 5,000 ohms, 1 W	Helipot	62PAR5K

TABLE 6.10 (Continued)

Ref. Design.	Description	Mfr.	Drawing/ Part No.
T901	TRANSFORMER	M-T	32-070-2
T902	TRANSFORMER	M-T	32-070-3
T903	TRANSFORMER	M-T	32-070-4
Z901	BOLOMETER	Filmohn	FSB 875-200

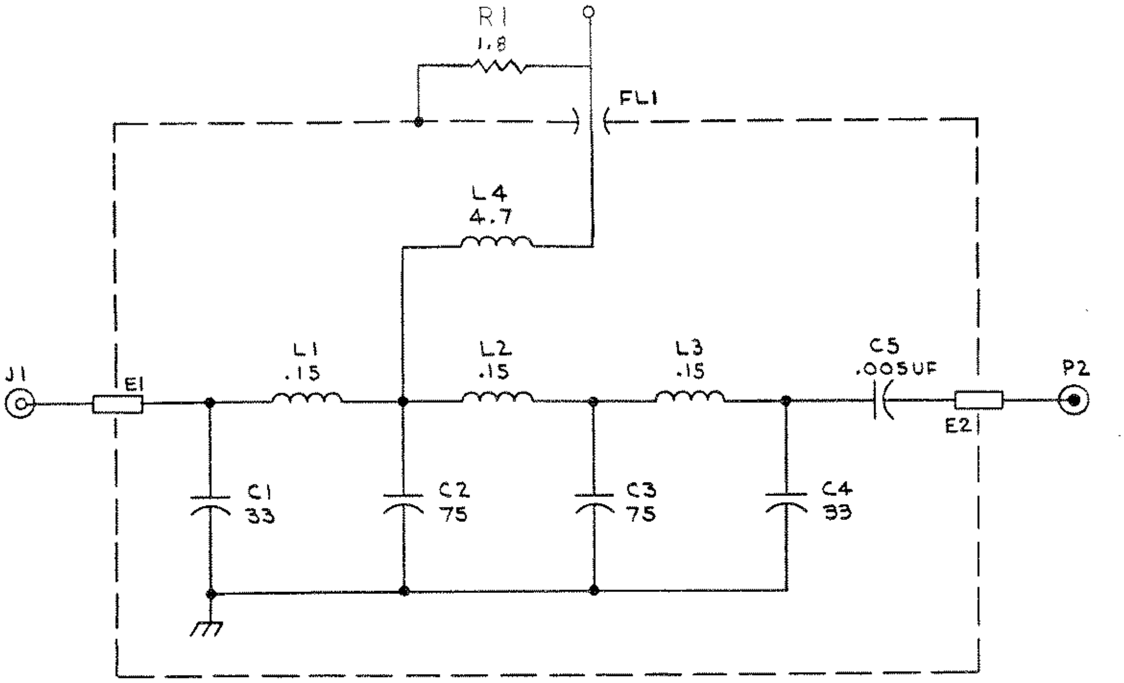
TABLE 6.11 MISCELLANEOUS SUBASSEMBLIES

M-100	External Mixer	Sage	1026H
	Crystal		1N23E
	P. C. Board Extender	M-T	32-016
MSR 1205/1705	Signal Combiner	MSC	1205/1705

7.0 SCHEMATIC DIAGRAMS

This section contains circuit schematic diagrams which are useful for reference by maintenance personnel.

7.1 LIST OF DRAWINGS



NOTE: ADD 800 TO REFERENCE NUMBERS OF COMPONENTS ON THIS ASSEMBLY.

UNLESS OTHERWISE SPECIFIED:
1. ALL CAPACITANCE VALUES IN PF.
2. ALL INDUCTANCE VALUES IN UH.

Figure 7-2. Low Pass Filter and Crystal Monitor, Schematic Diagram

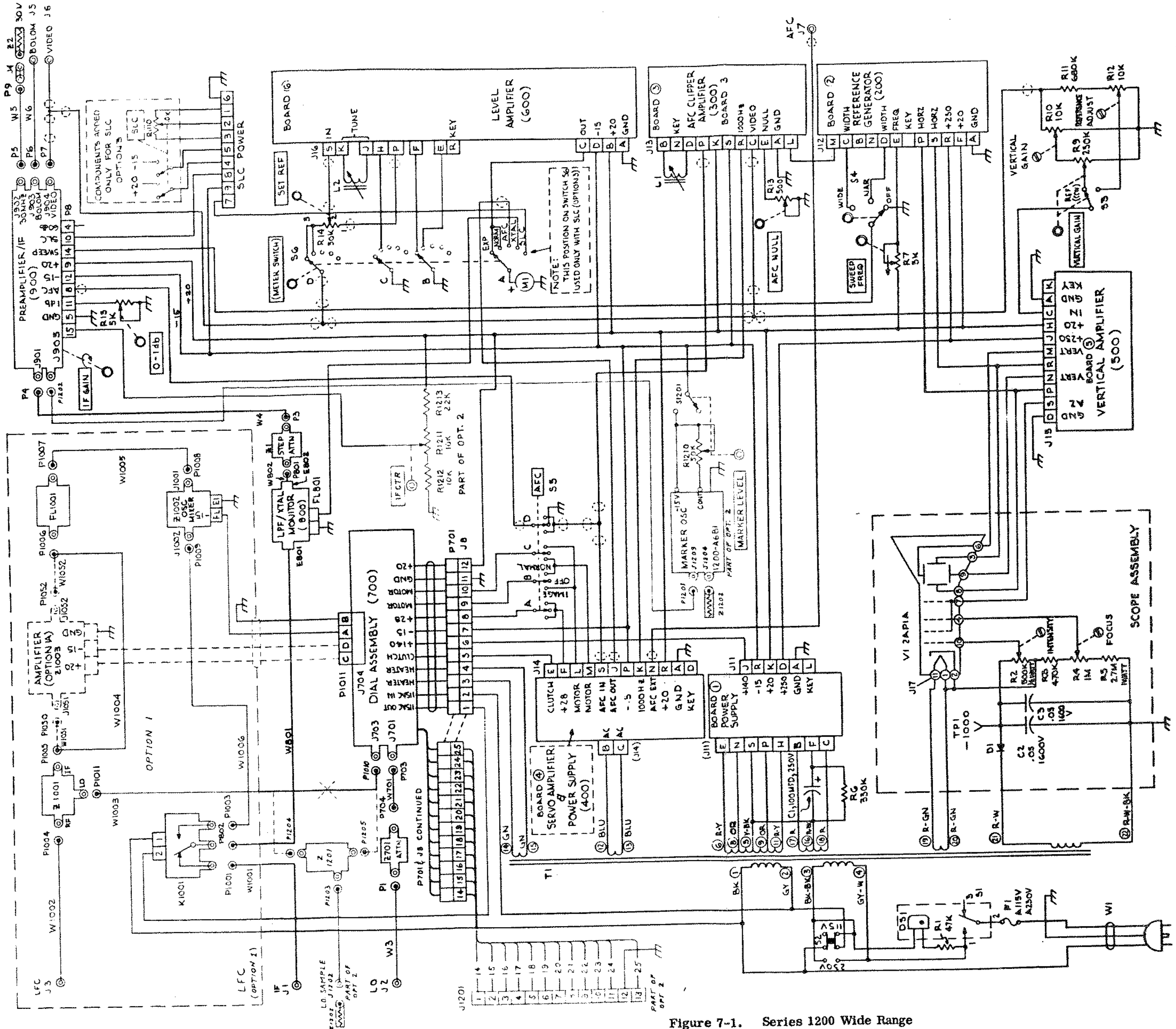


Figure 7-1. Series 1200 Wide Range Receiver, Overall Schematic

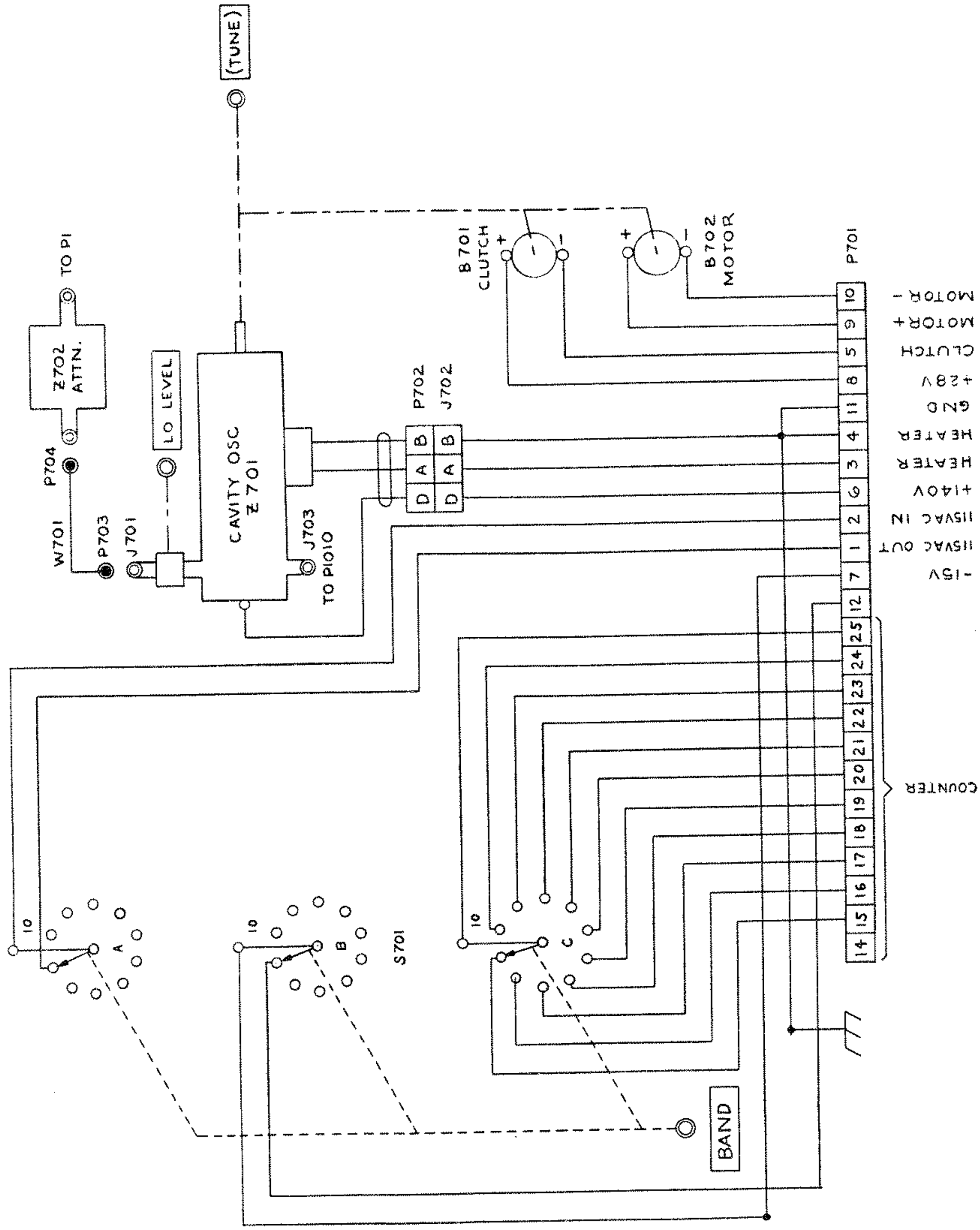


Figure 7-3. Dial Assembly, Schematic Diagram

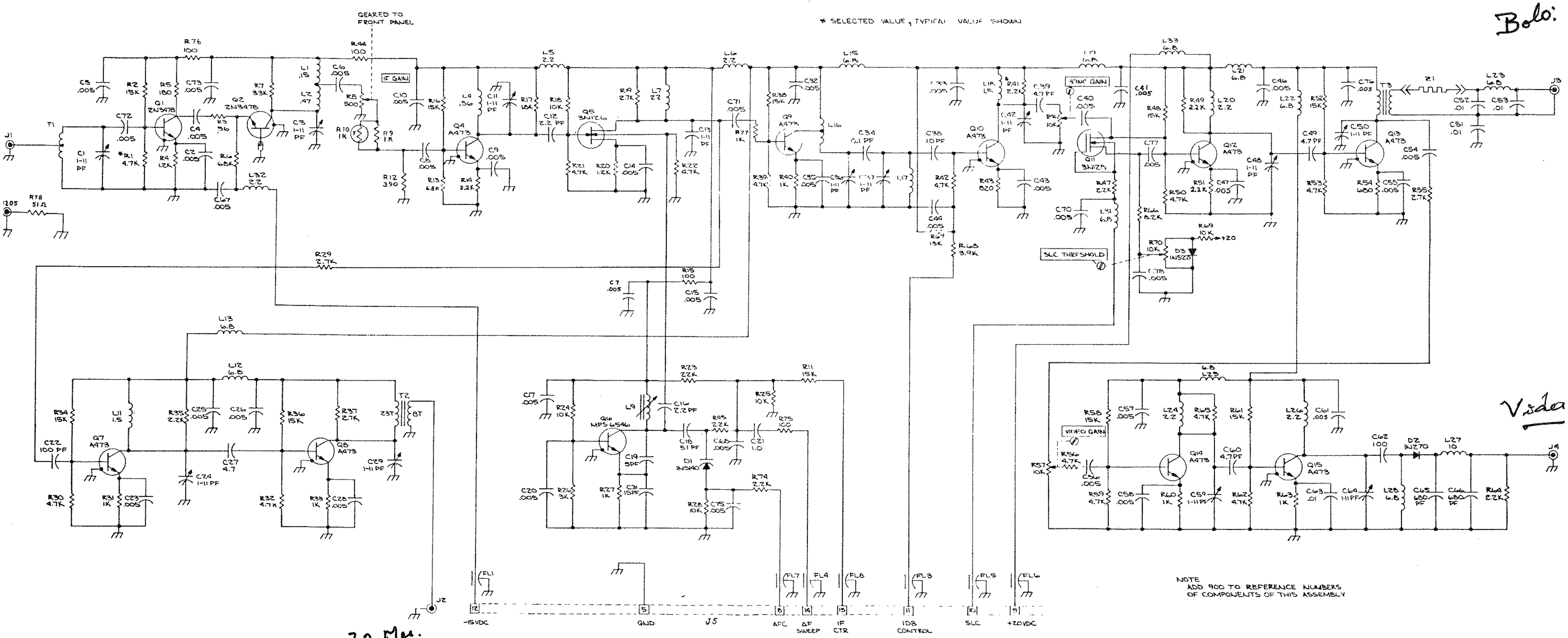


Figure 7-4. Preamplifier/Swept Oscillator/IF Amplifier, Schematic Diagram

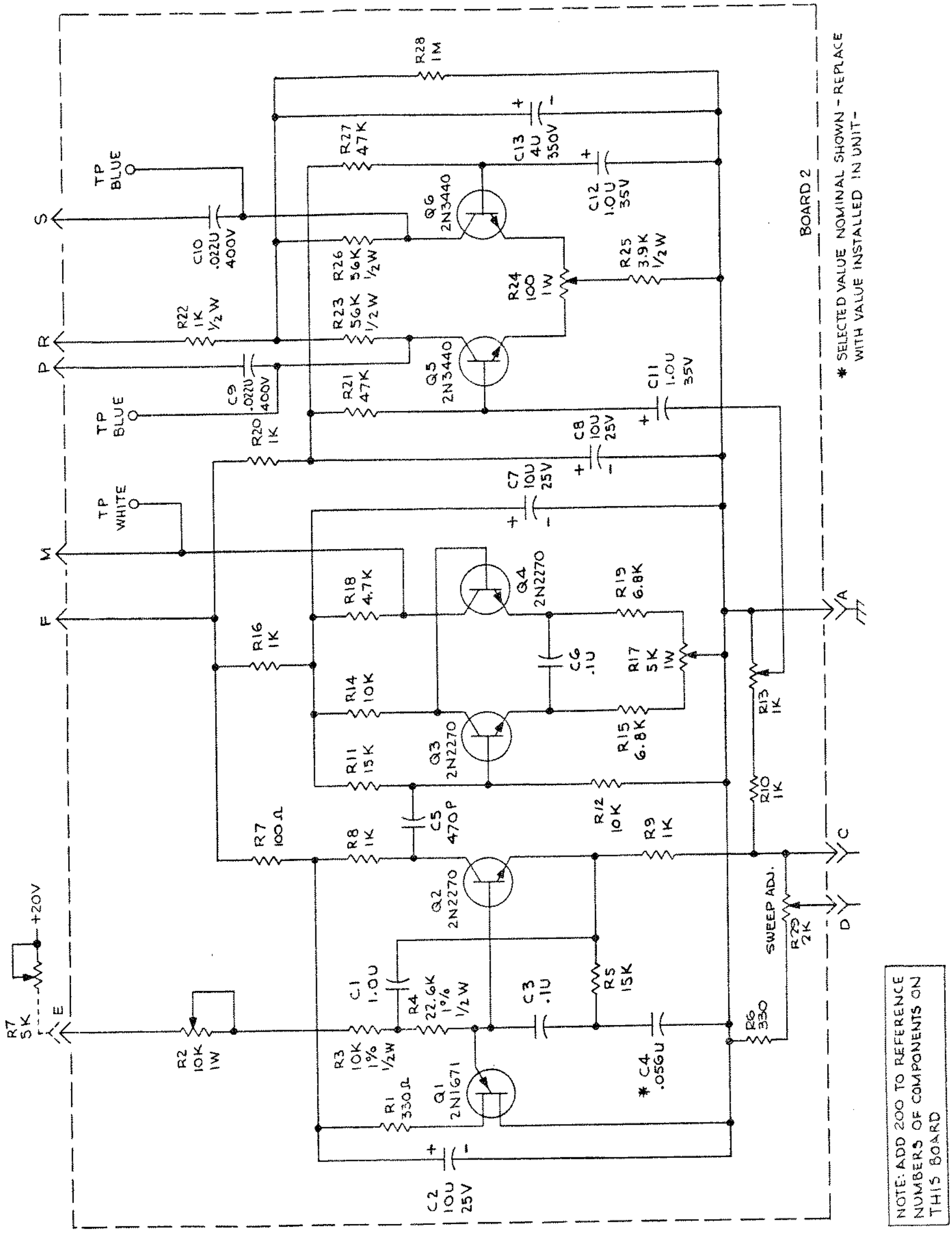
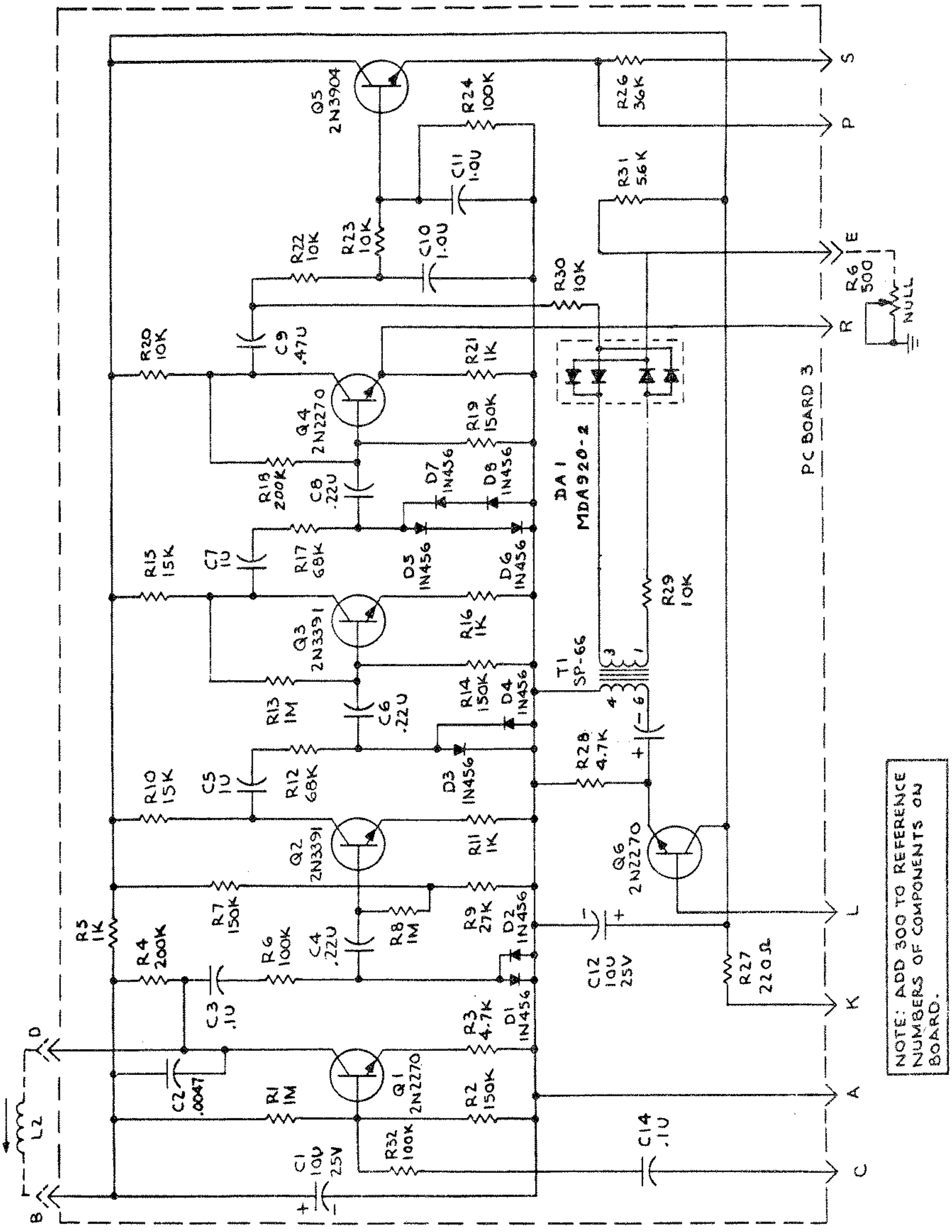
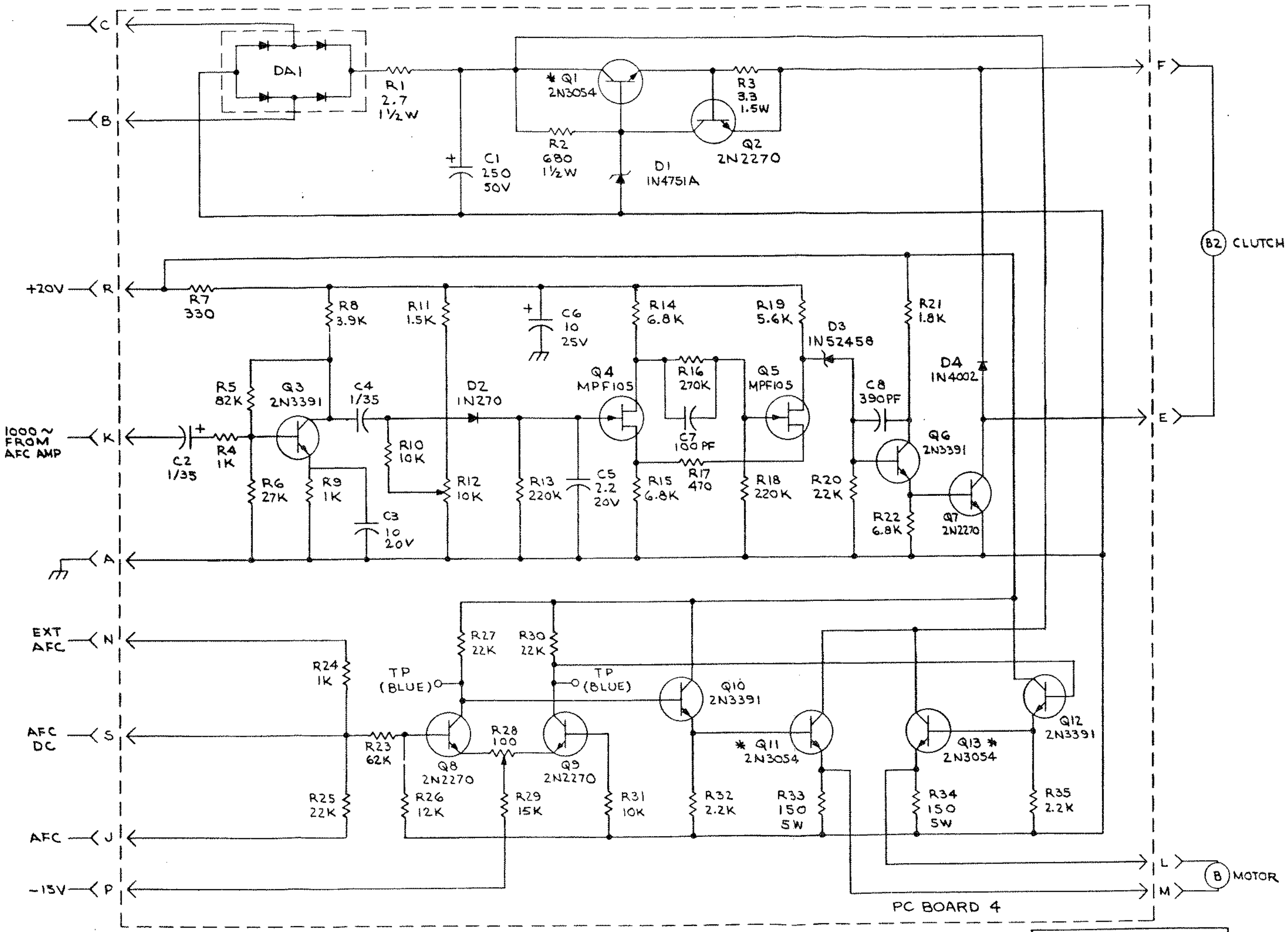


Figure 7-5. Reference Generator, Schematic Diagram



(A3B3)

Figure 7-6. AFC Clipper/Amplifier, Schematic Diagram



NOTES:
UNLESS OTHERWISE NOTED:
1. ALL RESISTANCE VALUES IN OHMS
2. ALL CAPACITANCE VALUES IN MICROFARADS
3. * TRANSISTOR MOUNTED ON HEAT SINK

ADD 400 TO REFERENCE NUMBERS OF COMPONENTS ON THIS BOARD

Figure 7-7. Servo Amplifier, Schematic Diagram

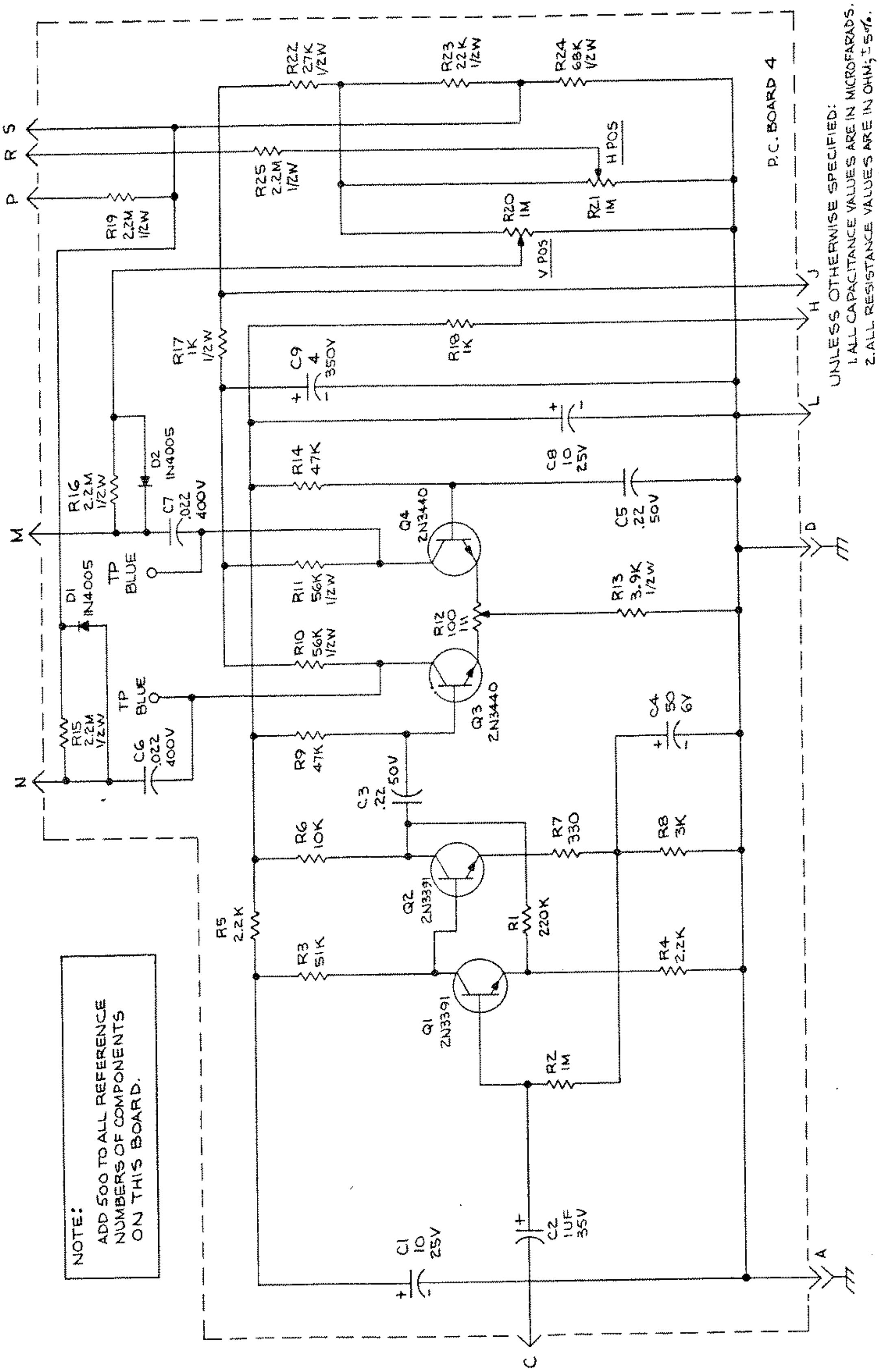
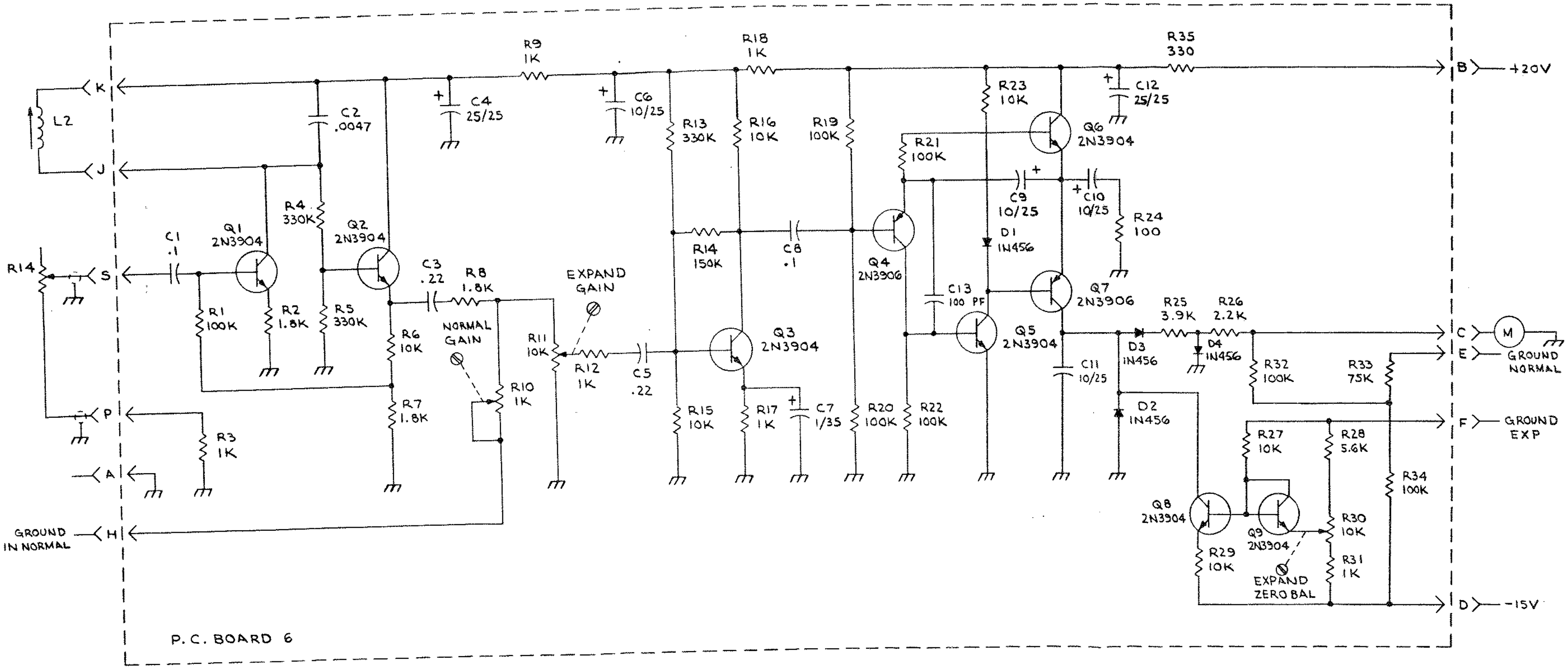


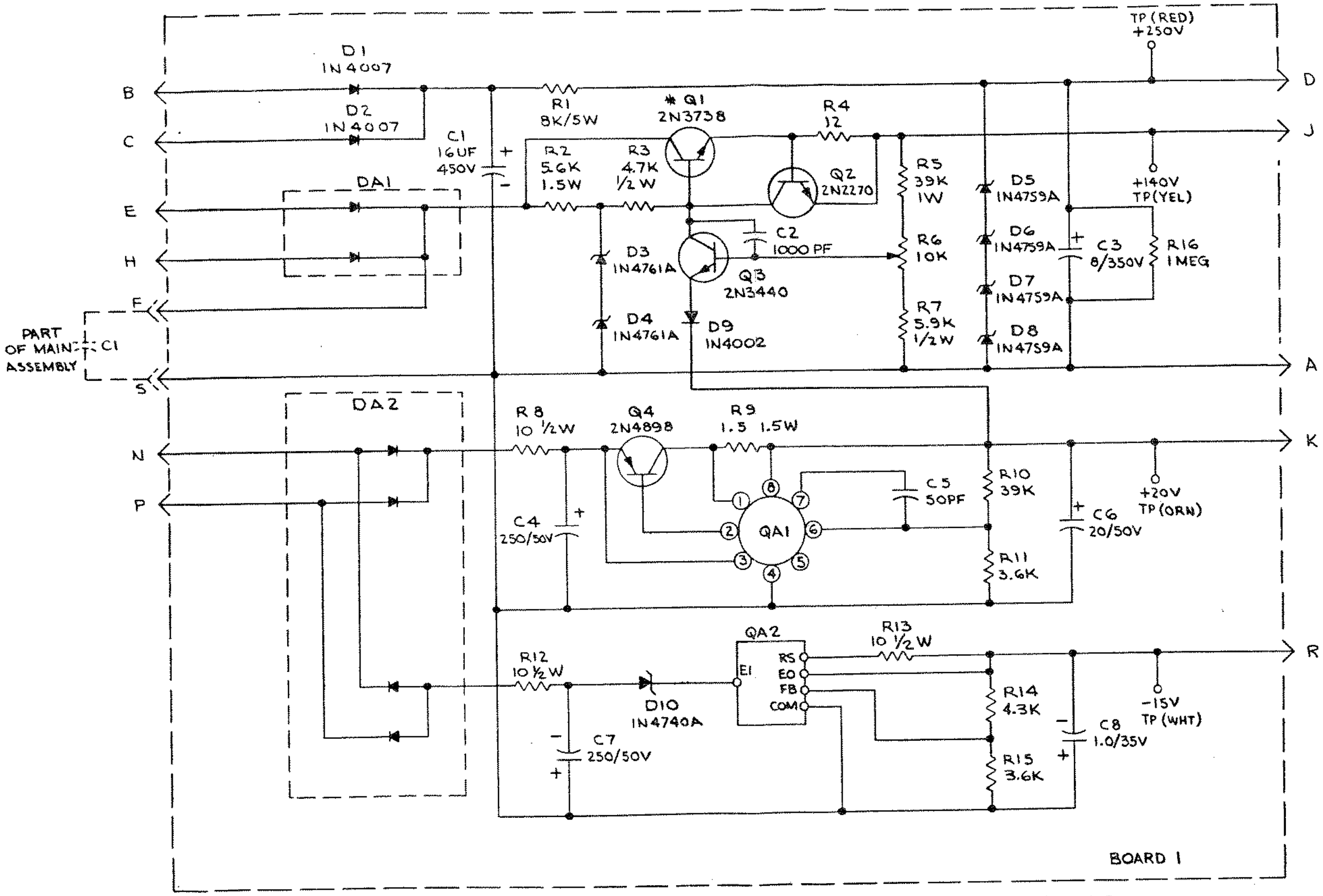
Figure 7-8. Vertical Scope Amplifier, Schematic Diagram



ADD 600 TO REFERENCE NUMBERS OF COMPONENTS ON THIS BOARD

NOTES:
UNLESS OTHERWISE NOTED
1. ALL RESISTANCE VALUES IN OHMS
2. ALL CAPACITANCE VALUES IN MICROFARADS

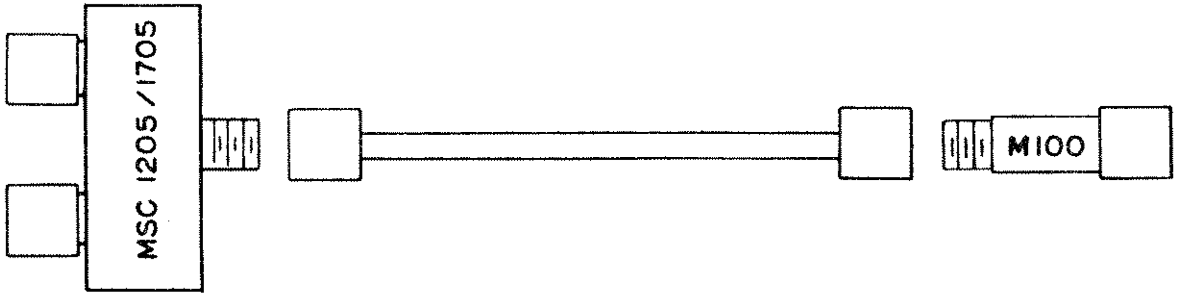
Figure 7-9. Level Amplifier, Schematic Diagram



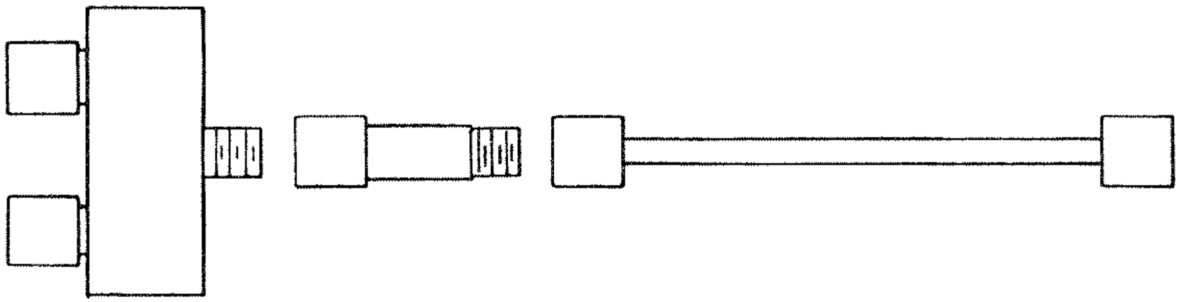
NOTE: ADD 100 TO REFERENCE NUMBERS OF COMPONENTS ON THIS BOARD.

* INDICATES TRANSISTOR MOUNTED ON HEAT SINK.

Figure 7-10. Power Supply, Schematic Diagram



YES



NO!!

8.0 OPTIONS

This section contains descriptive material on the various options supplied with your Series 1200 Receiver. The contents and organization of this section is the same as the basic manual.

8.1 OPTION 1, 1A, Low Frequency Converter

8.2 OPTION 2, LO Sample for Frequency Counter

8.2A OPTION 2A, IF Power Reference

8.3 OPTION 3, Source Level Compensator

8.6 OPTION 6, 60 dB Recording

8.7 OPTION 7, 60 dB Linear Meter

Option P is the 19 inch panel adaptor. It is only a replacement of the front panel handles and is not covered in the manual.

8.1.0 LOW FREQUENCY CONVERTER, OPTION 1, 1A

8.1.1.1 PRINCIPLES OF OPERATION

For operation between 10 and 950 MHz, a third local oscillator is introduced as shown in Figure 1-2. Mixing in this frequency range is performed internally within the Receiver. The first local oscillator is tuned from 1010 to 1950 MHz to generate a 100 MHz heterodyne with an incoming signal from 10 to 950 MHz. The 1000 MHz signal is passed through a steep-sided bandpass filter to another mixer for heterodyning with the fixed 925 MHz converter oscillator. The resulting 75 MHz heterodyne is fed to the preamplifier.

To increase the sensitivity of the Low Frequency Converter, a 1 GHz amplifier is added between the band-pass filter and the IF mixer, (Option 1A).

8.1.1.2 SPECIFICATIONS

Frequency Range:	20 to 950 MHz (useful to 10 MHz)
Dial:	Direct Reading
Sensitivity:	-100 dBm minimum from 20 to 950 MHz -110 dBm minimum with optional amplifier (Option 1A) Usable to 10 MHz

8.1.2 INSTALLATION

For operation below 950 MHz, with the optional low frequency converter installed, connect the signal source directly to the LFC 10-950 MHz type - N connector on the front panel.

NOTE: External mixers and signal combiners are not required below 950 MHz.

8.1.3 OPERATION

For low frequency operation (below 950 MHz) set and keep LO LEVEL control fully counterclockwise.

Turn the BAND selector so that the 10-950 MHz frequency band appears in the dial window. Connect a CW source to the front panel connector placarded LFC 10-950 MHz. Use RG-9B/U or other low loss 50 ohm cable.

NOTE: Do not use an external mixer. In low frequency operation, the first mixer is internal to the receiver.

Adjust the tuning control until the pip representing the desired incoming signal is centered on the cathode-ray tube.

In low frequency operation (below 950 MHz), the image frequency is 2000 MHz above the dial frequency, therefore the AFC switch should always be set to NORM. The mechanical and electronic AFC will operate correctly.

8.1.4 THEORY OF OPERATION

The Low Frequency Converter (Option 1, 1A) extends the operation of the 1200 Receiver down to 20 MHz (and useful to 10 MHz) by the addition of a third frequency conversion. The elements of this option are shown in Figures 1-2 and 7-1. The converter is automatically switched into the system by the bandswitch. There is a separate front-panel coaxial input for the converter, and no external mixer is necessary. For increased sensitivity, a 1 GHz pre-amplifier is available (Option 1A) and is connected in series with the bandpass filter to override the noise of the second mixer.

The first mixer is a balanced unit. The incoming signal 10 to 950 MHz, is mixed with the cavity oscillator, 1010 to 1950 MHz, to produce 1000 MHz at the mixer output.

The bandpass filter is a multi-section coaxial filter having steep sides and a passband centered at 1000 MHz. It eliminates spurious mixer products and restricts the receiver input bandwidth.

The second mixer heterodynes the 1000 MHz output from the bandpass filter down to 75 MHz. The injection frequency is 925 MHz. It is packaged with the converter oscillator which is a transistor LC oscillator. A fine tuning adjustment is available for alignment exactly to the operating frequency of 925 MHz.

The oscillator is a grounded-based circuit and drives a series diode mixer. The schematic is shown in Figure 8.1.2.

The 1 GHz amplifier, when supplied, overrides the noise of the second mixer and thereby increases the sensitivity of the Low Frequency Converter. As shown in Figure 8.1.3, the amplifier consists of two common emitter amplifiers. All resonant circuits are tuned to 1000 MHz.

8.1.5 MAINTENANCE

Maintenance section to be supplied at a future date.

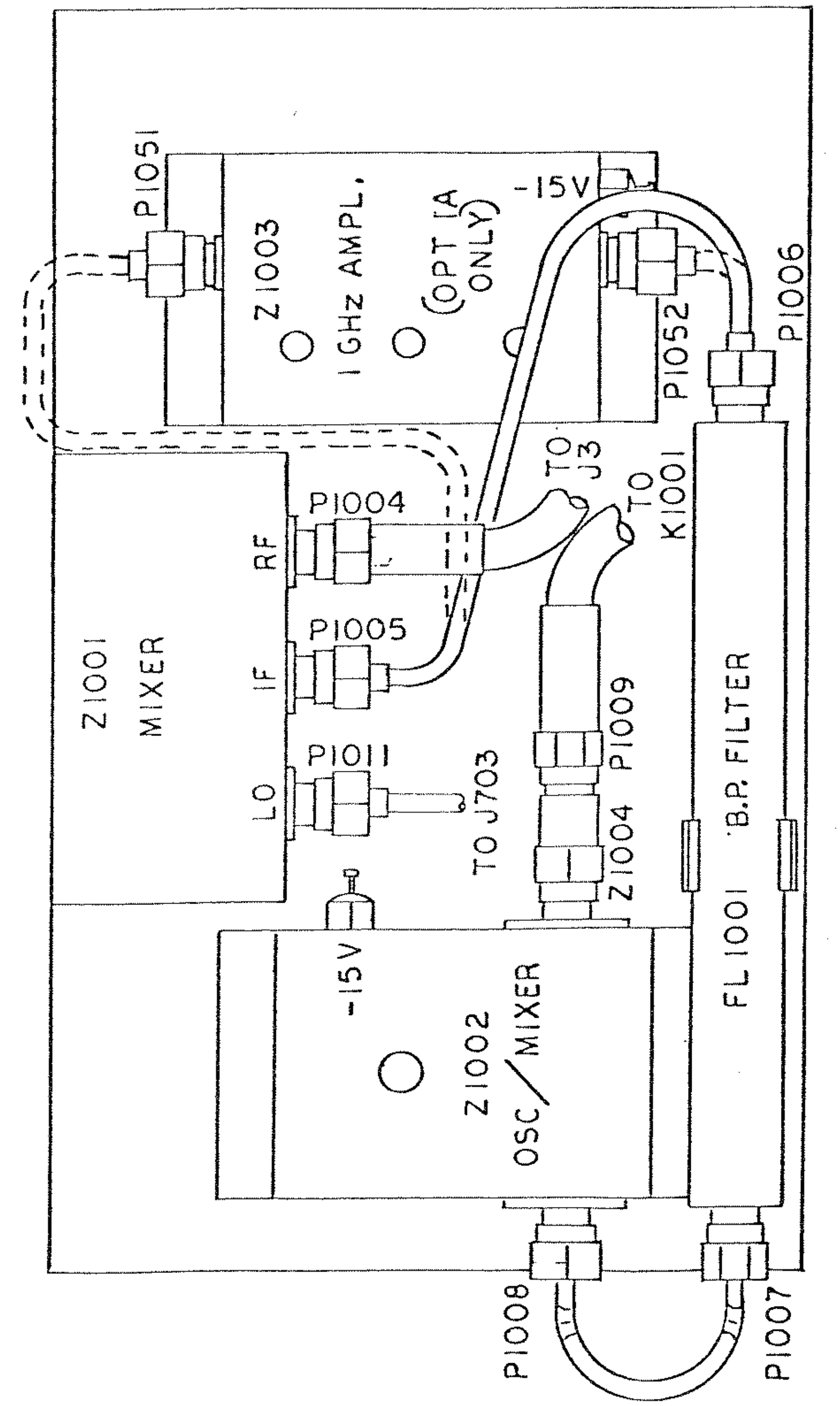


Figure 8.1.1 Low Frequency Converter (Options 1 and 1A). Parts Location

8.1.6 PARTS LIST

MAIN ASSEMBLY (Ref. Figure 8.1.1, 7.1)

Ref.	Description	Mfg. Type
FL1001	Bandpass Filter	K&L 6B120-1000/15-0
J3	Connector	UG-1095B/U
K1001	Relay, Coax	Amphenol 360-11892-46
P802, 1001 1003, 1009	Connector	Dage 8000-1
P1004	Connector	OSM 501-1
P1005, 1006 1007, 1008 1010, 1011 1050*, 1052*	Connector	OSM 201-2A
P1012	Connector, Pwr.	Win. M4S-LS-H10C
Z1001	Mixer	Anzac MD-525-4

OSCILLATOR-MIXER (A5B1) (Ref. Figure 8.1.2)

Ref.	Description	Mfg. Type
C1001	Capacitor, 500 pf	Aerovox 4420-500pf-20%-Z5U
C1002	Capacitor, Variable, .5-5 pf	JFD VC21GY
C1003	Capacitor, 25 pf	Erie CB11RD250K
D1001	Diode	Microwave Assoc, MA 4882
FL1001	Filtercon	Erie 1201-052
J1001	Connector	Gremar 9668
J1002	Connector	Gremar 6013
L1001	Inductor	M/T 32-070-6
L1002	Inductor, .15 uh	Delevan 1025-00
L1003	Inductor	M/T 32-070-7

*Used with Option 1A only

Ref.	Description	Mfg. Type
R1001, 1002	Resistor, 3,900 ohms 5%, 1/4W	RC07GF392J
R1003	Resistor, 820 ohms 5%, 1/4W	RC07GF821J

1 GHz AMPLIFIER (A5B2-A) OPTION 1A ONLY
(Ref. Figure 8.1.3)

Ref.	Description	Mfg. Type
C1051, 1056, 1061	Capacitor, Variable .6-4.5 pf	Johanson 7275
C1052,1057	Capacitor, Chip 22 pf, 10%, 500V	ATC-100-B-220-K-MS-500
C1053, 1054, 1058, 1059	Capacitor, Feedthru 500 pf, 20%, 500V	Aerovox 4420-500 pf 20%-Z5U
FL1051	Filtercon	Erie 1201-052
J1051, 1052	Jack, SMA	EFJ 142-0296-001
L1051, 1052 1053	Inductor (Microstrip)	M/T 32-033-26
Q1051, 1052	Transistor	HP 35824A
R1051, 1056	Resistor, 3.3K, 5%, 1/4W	RC07GF332J
R1052, 1057	Resistor, 1.2K 5%, 1/4W	RC07GF122J
R1053	Resistor, 1K, 5%, 1/4W	RC07GF102J
R1054, 1059	Resistor, 100 ohms, 5%, 1/4W	RC07GF101J
R1058	Resistor, 470 ohms, 5%, 1/4W	RC07GF471J

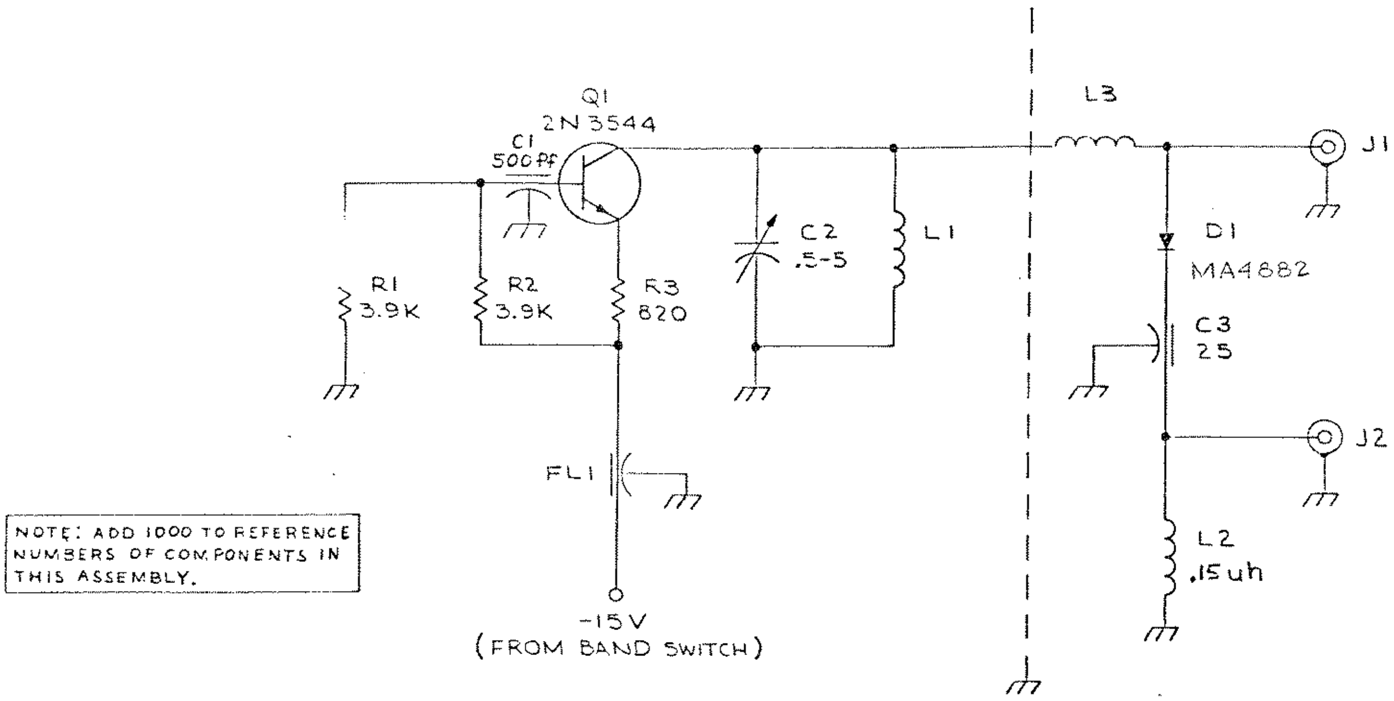


Figure 8.1.2. Oscillator-Mixer (A5B1), Schematic Diagram

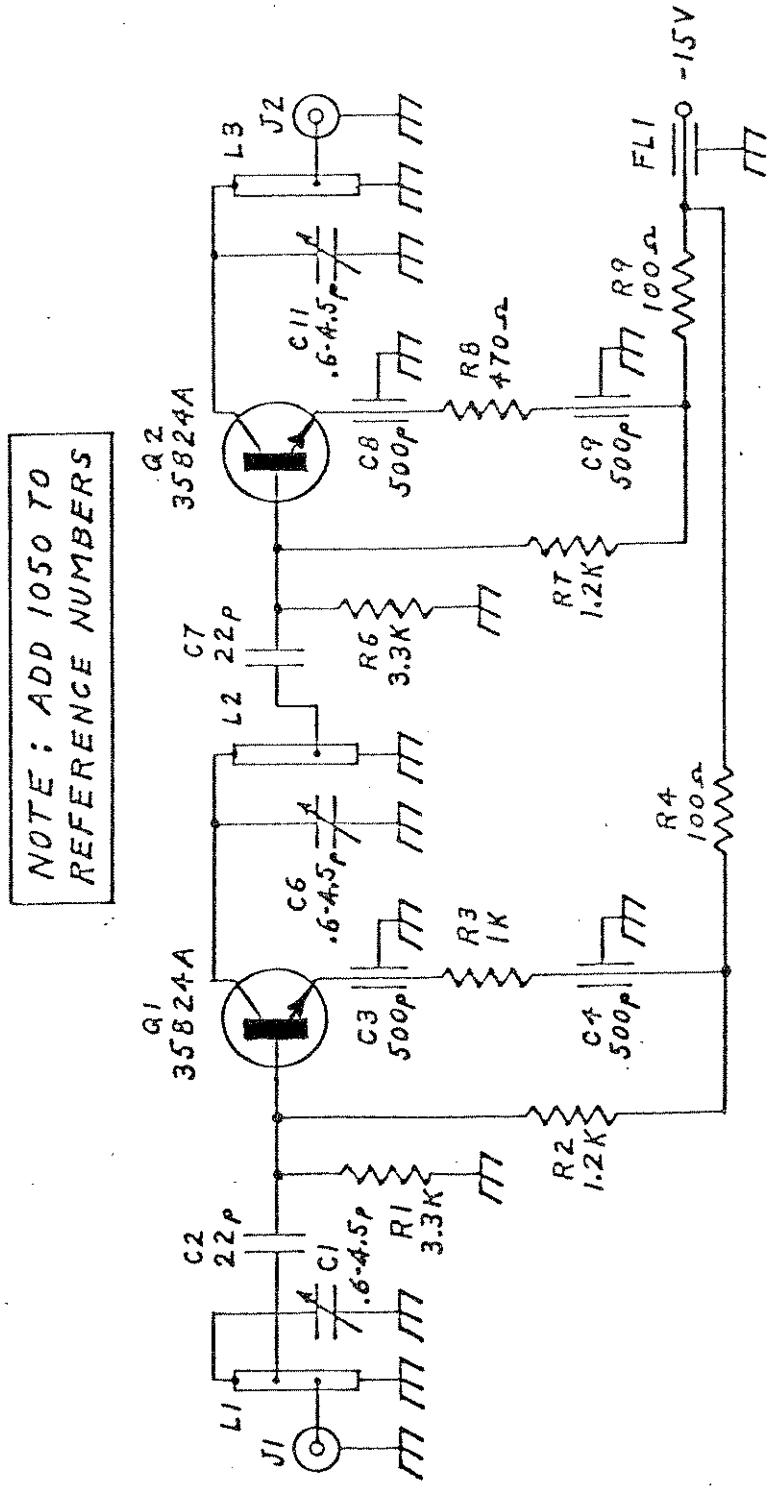


Figure 8.1.3. 1GHz Amplifier (A5B2-A)
Schematic Diagram (Option 1A)

8.2A IF POWER REFERENCE, OPTION 2A

8.2A.1 GENERAL DESCRIPTION

Option 2A adds an IF reference signal to the receiver. The reference signal is activiated by a front panel switch and is used to measure absolute power, once the receiver has been calibrated at the particular frequency.

8.2A.1.1 SPECIFICATIONS

The reference power level stability is ±1.0 dB from 0 to 50°C.

8.2A.1.2 PRINCIPLES OF OPERATION

This option adds a stable 75 MHz oscillator, a coax relay, and a front panel IF REFerence switch. The oscillator output is attenuated and switched into the IF line by the relay, which in turn is controlled by the front panel toggle switch.

8.2A.2 OPERATION

The receiver must be calibrated at each measurement frequency. Connect a signal generator to the receiver using the Signal Combiner and proper Mixer. Place the front panel IF REF switch in its ON position. Adjust the level meter to a convenient reference point using the meter controls and, if necessary, the IF GAIN and step attenuator. Place the IF REF switch in its OFF position and tune the receiver to the generator signal. Adjust the receiver LO LEVEL control for maximum response. Adjust the generator level to reestablish the reference on the meter. This generator level is the effective level of the IF reference <u>referred to the input at this frequency</u>.

To measure the level of an unknown signal at a calibrated frequency, tune the receiver to the frequency and adjust the LO LEVEL for maximum signal. Then switch the IF REF on and off and attenuate the stronger of the two signals until the two signals are of equal amplitude. Adjust meter controls and IF GAIN as required to obtain an indication on the meter. <u>Adjust only the step attenuator when switching the IF reference on and off.</u> The signal level equals the calibrated IF level plus or minus the attenuator setting.

The same cable and mixer must be used for making the measurement as was used for calibration. The LO LEVEL should also be set to the same peak or Xtal current.

If the receiver has Option 7, the Linear Meter Display, the meter can be set to read input power directly at any calibrated frequency. Set the meter to its 60 dB range and use the scale calibrated from -100 to -40 dBm. Turn the IF reference on and set the meter to the calibrated level at the frequency to be used; this is done using the meter GAIN control and if necessary the IF GAIN or step attenuator. Switch the IF reference off and tune the receiver in the normal manner but <u>do not change the attenuator</u>, <u>IF GAIN or meter controls</u>. The level meter will read power directly at this frequency.

8.2A.3 THEORY OF OPERATION

Refer to the schematic diagram, Figure 8.2A.1. The transistor Q1 is connected as a Colpitts oscillator with the feedback ratio set by C1, C2 and C4. The frequency is determined by the resonant circuit C5, L2. Resistors R4 - R9 attenuate the output and isolate the oscillator from changes in output loading. The output level is adjusted over a limited range by R5. Further attenuation is accomplished by attenuators Z1 and Z2.

Relay K1 switches the IF input (through the step attenuator) between the reference oscillator and the first mixer output.

8.2A.4 ALIGNMENT

With no signal input, switch the front panel IF REFerence switch to ON. Switch the AFC to OFF. Adjust L2 to place the CRT response in the center of the screen.

Next disconnect the cable at P4 of K1, and connect a signal generator to this terminal of K1. Set the generator to 75 MHz CW and a level of -100 dBm. Switch the IF REFerence to OFF and adjust the meter controls for a convenient reference reading. Then switch the IF REFerence to ON and adjust R6 to reestablish this reference.

8.2A.5 PARTS LIST (Ref. Figure 8.2A.1)

Ref. Design.	Description	Mfr.	Drawing/ Part No.
C1251	CAPACITOR, Mica, 51 pf, 5%, 300V	Arco	DM-15-510J
C1252	CAPACITOR, Mica, 100 pf, 5%, 300V	Arco	DM-15-101J
C1253	CAPACITOR, Ceramic, 0.1 µf, 10%, 100V	Erie	8131-100-651-104M
C1254	CAPACITOR, Mica, 15 pf, 5%, 300V	Sprague	10TCC-Q15
C1255	CAPACITOR, Mica, 20 pf, 5%, 300V	Sprague	10TCC-Q20
D1251	DIODE		1N4148
FL1251	FILTERCON	Erie	1201-052
J1251	CONNECTOR, SMA	E.F. Johnson	142-0296-001
K1251	RELAY, Coax, SMA	Amphenol	303-10002-3-2417
L1251	INDUCTOR, Fixed, 2.2µh	Delevan	1025-28
L1252	INDUCTOR, Variable	JFD	LV5P022
P1251,1252	CONNECTOR, SMA	OSM	501-3
P1253,1254	CONNECTOR, SMA	OSM	501-1
Q1251	TRANSISTOR, NPN	Motorola	MPS6546
R1251	RESISTOR, 560Ω, 5%, 1/4 W		RC07GF561J
R1252	RESISTOR, 1K, 5%, 1/4 W		RC07GF102J
R1253	RESISTOR, 8.2K, 5%, 1/4 W		RC07GF822J
R1254	RESISTOR, 2K, 5%, 1/4 W		RC07GF202J

(Ref. Figure 8.2A.1 Continued)

Ref. Design.	Description	Mfr.	Drawing/ Part No.
R1255	RESISTOR, Variable, 100Ω, 1 W	Helipot	62PAR100
R1256	RESISTOR, 510Ω, 5%, 1/4 W		RC07GF511J
R1257	RESISTOR, 2.7Ω, 5%, 1/4 W		RC07GF2R7J
R1258	RESISTOR, 47Ω, 5%, 1/4 W		RC07GF470J
R1259	RESISTOR, 10Ω, 5%, 1/4 W		RC07GF100J
S1251	SWITCH, Toggle	JBT	JMT-123
Z1251,1252	ATTENUATOR, 10 dB	EMC	4410

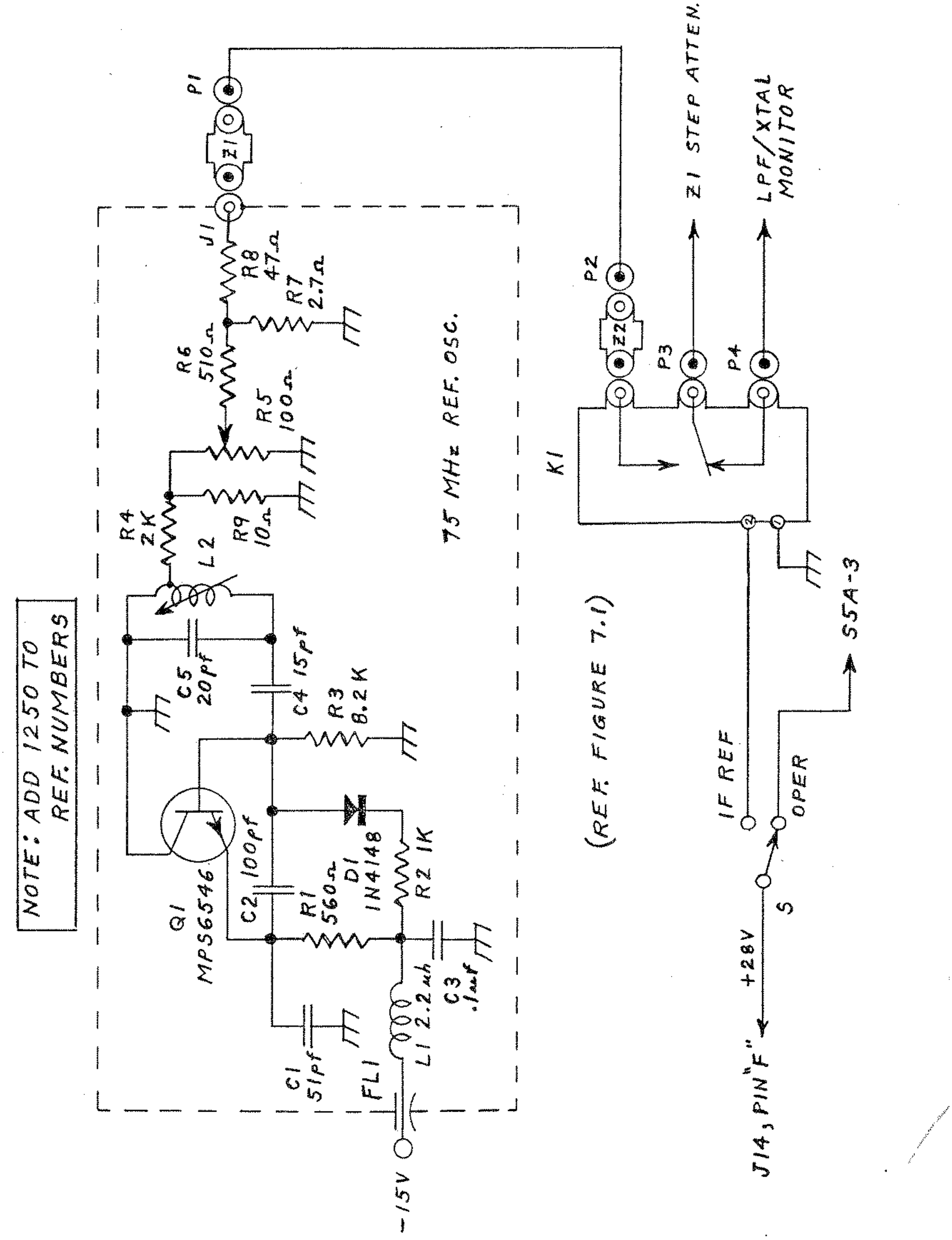


Figure 8.2A.1

OPT. 2A, 75 MHz I.F. REF

Schematic Diagram