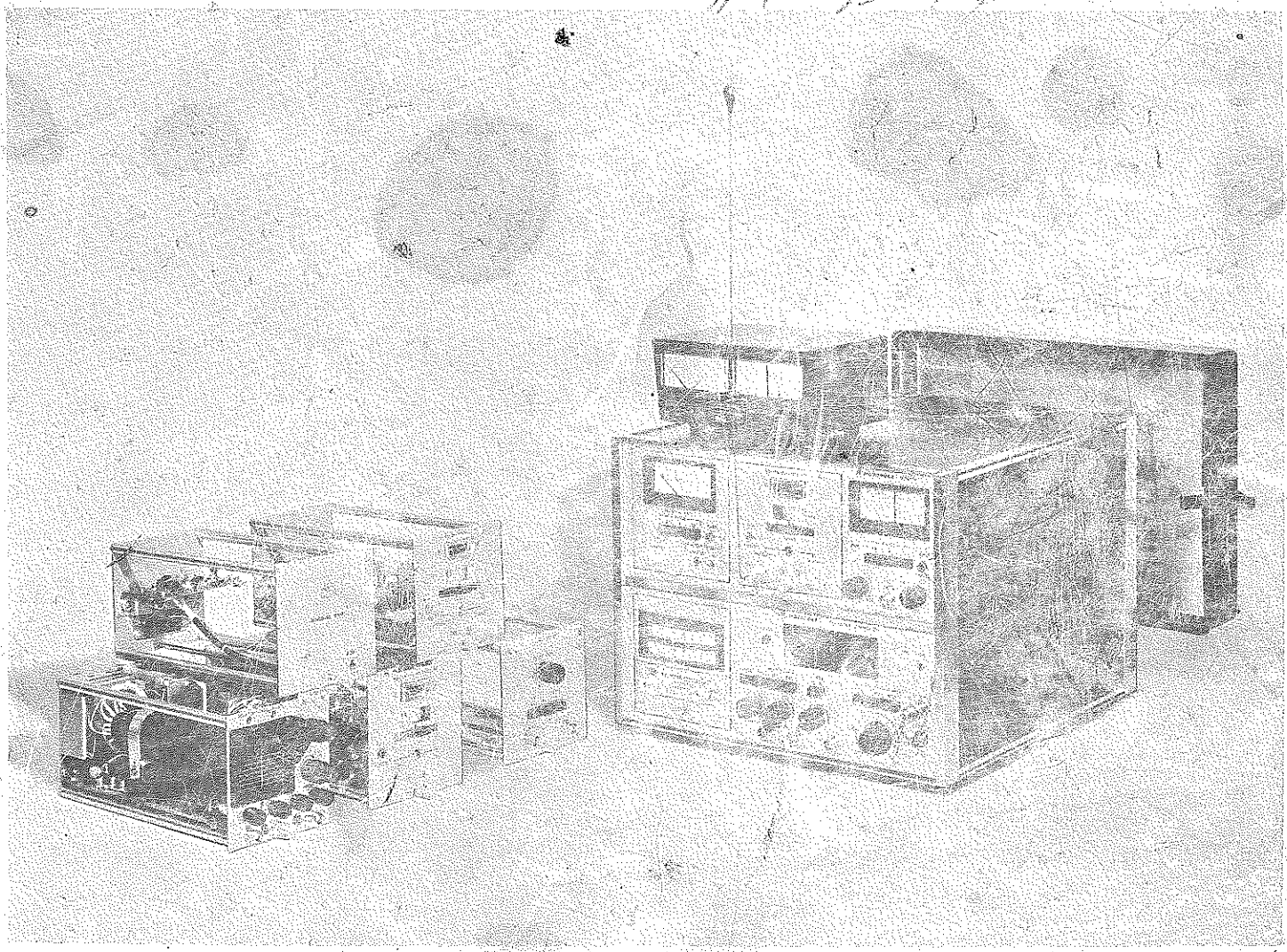
MOTOROLA

SERVICE MONITOR

MODEL S1327A



Mr Greg. Murray
312-397-3580
Ext. 3265

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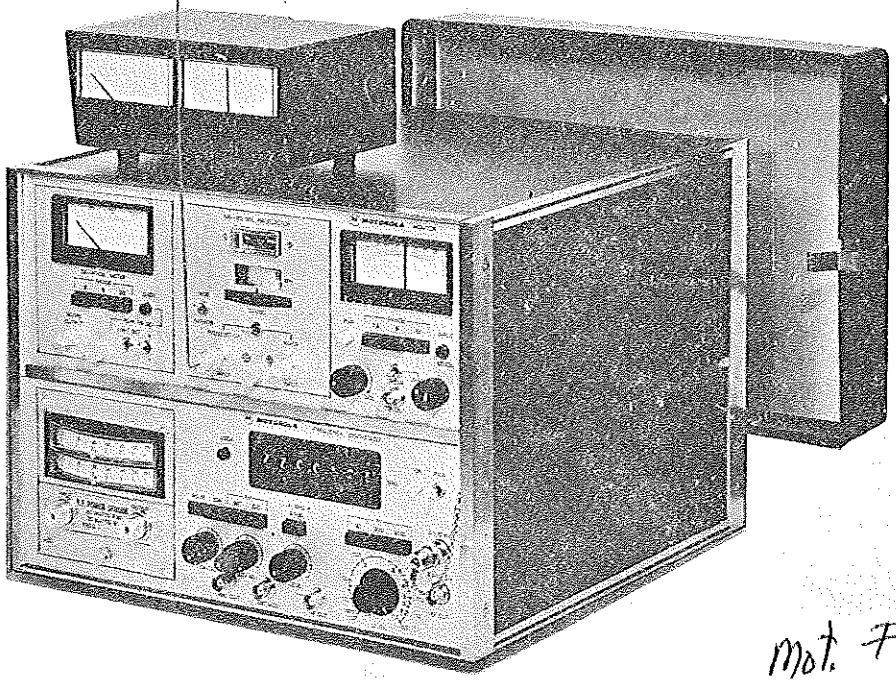

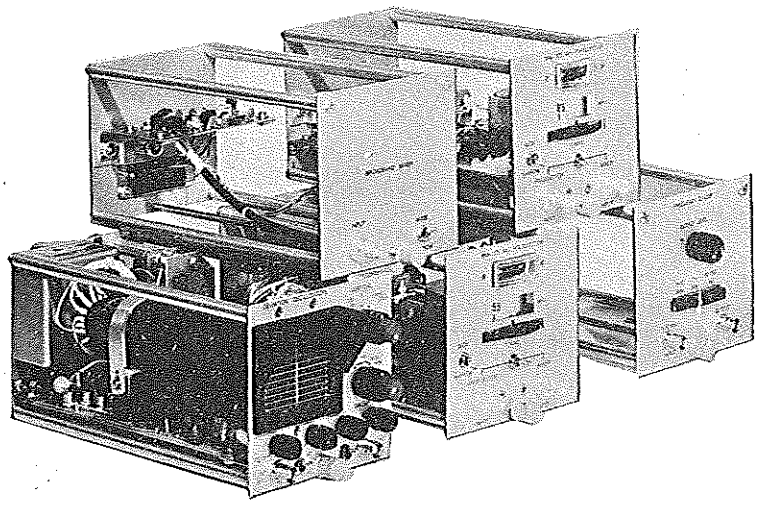

Mot. #

Type LM301A = 51-84204D30
Type YA754C = 51-84204037
Type YA723C = 51-82554F38

MOTOROLA INC. Communications Division

SPECIAL OPERATING NOTE

Service Monitors with serial numbers 301 and up incorporate a special A9 Power Supply Regulator which offers protection from accidentally shorting a supply while working on the instrument. This feature operates by detecting a sudden transition toward ground on any of the regulated supply outputs. When this occurs, all four supplies shut off; however, both the white front panel POWER-ON lamps will remain on, as they run off the unregulated supplies. To restore operation simply turn the front panel power switch off-then on again.

NOTE: Inserting plugins without first turning off the front panel Power switch will often cause power supply shut down. Restore operation as above.

FOREWORD

If any damage to the shipping container is apparent upon receipt, the delivering driver should be requested to note such damage on all copies of the freight bill. This is for your protection should the material have received damage.

The equipment should be unpacked immediately, examined for damage and tested. If it fails to operate properly, or is damaged in any way, a claim should be filed with the carrier. The claim should be filed within forty-eight hours after receipt, if possible, or during a period not to exceed fifteen days.

A full report of such damage should be obtained from the claim investigator, who will call upon you. For the purpose of this report, the shipping container and all packing materials should be retained for the investigator to examine.

The investigator's report should then be forwarded to:

MOTOROLA COMMUNICATIONS & ELECTRONICS, INC.
National Parts Department
1875 Greenleaf Avenue
Elk Grove Village, Illinois 60007

Include model number and serial number when referring to the instrument for any reason.

Arrangements for repair or replacement will be made and you will be advised of the disposition of the instrument.

WARRANTY

Motorola instrument equipment, other than tubes and fuses, is warranted by Motorola for a period of one year after delivery to the original purchaser, against defects in design, material and workmanship. Our liability under this warranty is limited to servicing or adjusting any instrument returned to the address indicated herein for that purpose, and to replace any defective parts thereof.

This warranty is in lieu of all other warranties, expressed or implied, and all other obligations or liabilities on Motorola's part.

Readout tubes carry their own 90-day manufacturer's warranty.

This warranty is effective for one year after delivery to the original purchaser, when the instrument is returned, transportation charges prepaid by the original purchaser, and when upon our examination it is disclosed to our satisfaction to be defective. If the fault has been caused by misuse or abnormal conditions of operation, repairs will be billed at the net price of necessary parts and a service charge at the manufacturer's then prevailing labor rate. In this case, an estimate will be submitted before the work is started.

REPAIR - RECALIBRATION

Before shipping the instrument notify the Parts Depot at the address shown, of the service required. Refer to the instrument by model number and serial number. On receipt of the information, you will be informed of shipping instructions. If requested, an estimate of the charges will be made before work begins, provided the instrument is not covered by the warranty.

WESTERN AREA

Parts Depot
1170 Chess Drive
San Mateo, Calif. 94404
Phone: (415) 349-3111

PACIFIC SOUTHWESTERN AREA

Parts Depot
2333 Utah Avenue
El Segundo, Calif. 90245
Phone: (213) 644-1101

MIDWEST AREA

Parts Depot
1875 Greenleaf Avenue
Elk Grove Vil., Ill. 60007
Phone: (312) 439-7150

EAST CENTRAL AREA

Parts Depot
12955 Snow Road
Parma, Ohio 44130
Phone: (216) 267-2210

SOUTHWESTERN AREA

Parts Depot
3320 Belt Line Road
Dallas, Texas 75234
Phone: (214) 241-2151

EASTERN AREA

Parts Depot
85 Harristown Road
Glen Rock, New Jersey 07452
Phone: (201) 447-4000

SOUTHEASTERN AREA

Parts Depot
Lake Mirror Road
Forest Park, Georgia 30050
Phone: (404) 366-6035

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CHAPTER 1

GENERAL INFORMATION

1.1 INTRODUCTION

The Model S1327A Service Monitor is a solid-state test instrument designed to provide a frequency-synthesized signal source and a receiver for precision high-resolution deviation and frequency measurements over the entire 20 MHz to 990 MHz spectrum.

1.2 STANDARD FEATURES

Simplicity of operation, reliability, and easy maintenance highlight the features of the S1327A. The circuitry is completely solid-state and mounted on modularized printed-circuit assemblies.

The Synthesizer portion of the unit (lower half) generates "drift free" signals with 100 Hz resolution. Frequency coverage is continuous from 1 MHz to 990 MHz with all outputs on fundamentals. Frequency modulation of the output is provided, either with the internal 1 kHz source or an external source such as "Private Line" or other tone equipment. Internal and external modulation may be used simultaneously. The internal 1 kHz source is available on the front panel for many uses, including modulation of a transmitter while setting the deviation.

The Synthesizer output is adjustable with a three-position pushbutton multiplier and a variable attenuator. A maximum output of 10,000 microvolts is available for adjusting severely detuned receivers. Both Synthesizer outputs are fused for protection against input overloads. An IF mode is also available with frequency coverage of 100 kHz to 90 MHz and maximum output levels of at least 1 V rms below 10 MHz, and 0.25 V rms above 10 MHz. This output is also "drift free" and has 100 Hz resolution.

The Synthesizer normally operates with an internal 1 MHz reference oscillator. A rear-panel BNC connector (1 MHz INT/EXT) provides a 1 MHz reference when the associated toggle switch is set to INT. If it is desired to use an external reference, the 1 MHz INT/EXT switch is set to EXT and the reference is applied to the BNC connector.

The Monitor portion of the unit (top half) is a broadband receiver which uses the "drift free" output of the Synthesizer as its local oscillator. With the broadband mixer plug-in installed, the receiver covers 20 MHz to 990 MHz. A high-linearity discriminator operates the illuminated front-panel error meter. A level lamp indicates the presence of sufficient signal to operate the receiver. A built-in audio amplifier and speaker provide an

aural indication of any modulation on the received signal. A RCVR IF output permits measuring the exact frequency error of the received signal with a frequency counter.

Two plug-in modules may be used in the Monitor and one in the Synthesizer, permitting simultaneous analog (meter) and visual (oscilloscope) display of deviation. The broadband mixer plug-in in the monitor may be replaced with one of several preselector plug-ins to give added sensitivity and selectivity. Each preselector also has a wideband input similar to the broadband mixer plug-in.

1.3 OPTIONAL FEATURES

The Service Monitor may be equipped with higher stability reference oscillators or with an "instant on" TCXO oscillator. These options are normally factory installed but may also be installed in the field, if necessary.

An optional dc inverter is also available to permit the Service Monitor to operate from the 12 V electrical system of a vehicle. This option is designed for field installation, or it may be factory installed.

1.4 SPECIFICATIONS

RF Signal Generation	Range:	1 MHz to 990 MHz, fundamental operation.
	Output Level:	0.1 µV to 10 mV (into 50 Ω).
	Amplitude Accuracy:	±2 dB 1 MHz to 590 MHz; ±5 dB 590 MHz to 990 MHz.
	Resolution:	100 Hz.
	Readout:	7-digit thumbwheels.
	Frequency Accuracy:	Related to reference oscillator used. Standard oscillator 1×10^{-7} parts per week aging rate. High stability options: (X) 3×10^{-9} per day; (Y) 1×10^{-9} per day; (Z) 5×10^{-10} per day.

IF Signal Generation	Range:	100 kHz to 90 MHz, fundamental operation.
	Output Level:	At least 1 V (adjustable) 100 kHz to 10 MHz; 0.25 V (adjustable) 10 MHz to 90 MHz (into 50 Ω).
	Resolution:	100 Hz.
	Frequency Accuracy:	Same as RF mode.
FM Mode	Internal Modulation:	1 kHz (1000 Hz) modulation frequency. Variable to 25 kHz deviation. Also available on front-panel BNC jack.
	1 kHz Frequency Accuracy:	Related to master oscillator.
	External Modulation:	60 Hz to 20 kHz frequency range. Panel control for varying deviation to 25 kHz.
Frequency Measurement	Range:	20 MHz to 990 MHz with Model SLN6352A broadband unit; 25 to 50 MHz, 145 to 175 MHz, 406 to 420 MHz, and 450 to 512 MHz with optional preselector plug-ins.
	Sensitivity:	With broadband unit, better than 10 mV from 20 MHz to 590 MHz; better than 20 mV 590 MHz to 990 MHz. With each preselector plug-in, better than 20 µV.
	Readout:	Zero-center meter, 1.5, 5, and 15 kHz ranges.
Deviation Measurement	Deviation Readout:	Meter (Plug-in Model SLN6350A). Oscilloscope (Plug-in Model SLN6351A) optional.

Deviation Measurement (Cont'd)

Meter Model SLN6350A

Range:	0 to 2, 6, 20 kHz.
Accuracy:	±4% of full scale.
Indicator:	Meter (analog) with peak deviation light, preset control, and oscilloscope output BNC jack.

Oscilloscope Model SLN6351A (optional)

Range:	±1.5, ±5, and ±15 kHz full scale deviation. .01, .1, 1, 10, 100 V p-p full scale.
Frequency Response:	50 kHz.
Accuracy:	±5%.
External Vertical Sensitivity:	10 mV p-p for full scale.
Inputs:	External vertical - 1 MΩ. External horizontal - 1 MΩ.

General

Temperature:	Operating, -12° C to +55° C. Storage, -55° C to +85° C.
Power Source:	115/230 V ±10%, 50 to 400 Hz. Optional inverter 12 V dc.
Dimensions:	(Less feet) 10 1/2" High X 14" Wide X 15 1/8" Deep.
Weight:	Less than 40 lbs.

CHAPTER 2
INSTALLATION

2.1 INTRODUCTION

This chapter presents procedures for inspection and initial installation of the Model S1327A Service Monitor. Reshipment instructions have been included should it become necessary to return the instrument for service or repair.

2.2 RECEIVING INSPECTION

Before accepting the instrument from the shipper, inspect the instrument shipping container for signs of external shipping damage. Any sign of such damage must be noted by both the shipper and customer, and should be reported to the insurance investigator.

As soon as the instrument is unpacked, inspect it for shipping damage. Check for scratches or dents, broken or cracked knobs, and damaged connectors. Should any damage be found, notify your nearest Motorola representative -- do not use the instrument until instructed to do so by the representative.

2.3 COOLING

The Model S1327A does not require forced air cooling. Installation, however, should be such as to allow normal circulation around the instrument, especially the rear panel.

2.4 POWER CONNECTION

Either 115 V or 230 V ac may be used to power the Service Monitor. The unit is factory-set to 115 V operation. To change over to 230 V operation, simply set the unit on its side (Synthesizer plug-in space down) and remove the bottom cover. Now remove the A9 power supply regulator plug-in circuit board which provides access to the circuit board and the line-voltage selection jumpers. Refer to Figure 2-1 and change the jumpers to correspond to the "230" markings on the board. Change the fuse as indicated in Figure 2-2. Replace the A9 Power Supply Regulator and the bottom cover.

A standard three-conductor power cord is supplied which automatically grounds the unit when a matching power receptacle is available. An adapter which provides an instrument ground should be used whenever the power cord must be connected to a two-conductor outlet.

2.5 INITIAL TURN-ON

This procedure will test the Service Monitor for any major internal shipping damage. Successful completion of these tests should precede use of the instrument.

a) Be certain power line matches the unit, then connect power cord to an outlet. Set the rear-panel INT/EXT 1 MHz switch to INT.

b) Turn on power switch. The ON lamp should be energized as well as the meter lights (if switched on).

c) Select CW mode. INPUT LEVEL light should be out. Depress ZERO switch on the monitor and zero the ERROR KHz meter with the ZERO knob (INPUT LEVEL light on).

d) Select INT FM mode. Set frequency within operating range, preferably select a frequency which can be monitored on a radio receiver. LOCK lamp and INPUT LEVEL lamp should light.

e) Adjust FM CAL to center error meter (15 KHz RANGE), and adjust DEV ADJ knob (black knob) for 4 kHz on Deviation Meter or Oscilloscope.

f) At this point, if a suitable radio receiver is available, connect the antenna to the .01 - 10 mV RF BNC output. Push on X 100 RF button; turn RF LEVEL knob full clockwise and verify that an output signal is present.

2.6 PREPARATION FOR RESHIPMENT

Should it become necessary to reship the instrument, contact the nearest Motorola field office for shipping instructions. If possible, use the original packaging materials or replace in accordance with MIL-P-116 and MIL-E-17555E. The field office can provide materials similar to those used for original factory packaging. All correspondence should refer to the full nomenclature and serial number of the instrument involved.

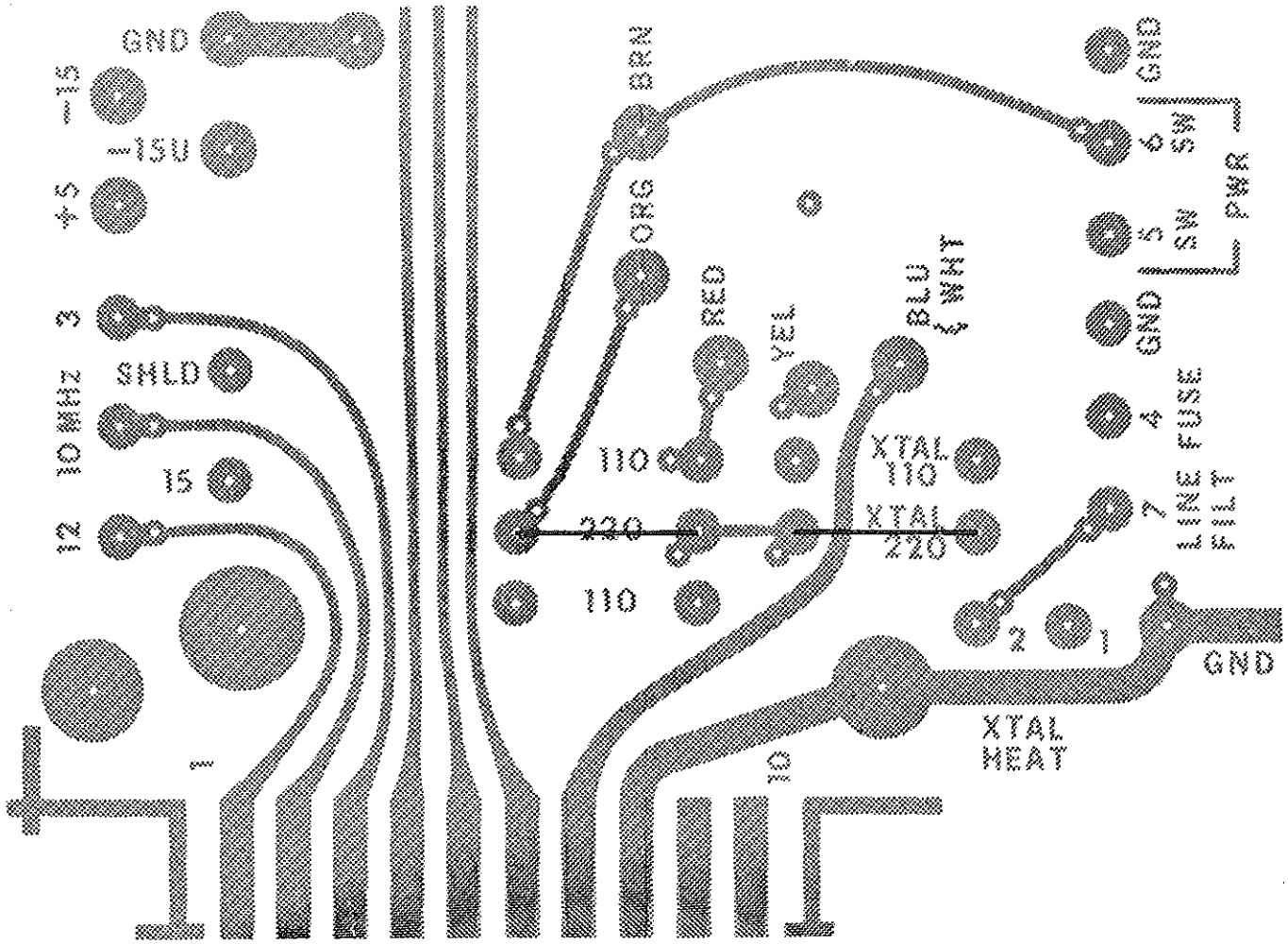


FIGURE 2.1 230 V JUMPER CHANGE

FOR 115 V OPERATION USE 1.5A SB FUSE.
FOR 230 V OPERATION USE .75A SB FUSE.

FIGURE 2.2 FUSE CHANGE

CHAPTER 3
OPERATION

3.1 INTRODUCTION

The Model S1327A Service Monitor is designed to produce the signals and indications required to test FM radio equipment. A frequency-synthesized generator for drift-free operation and a broadband receiver are the basic components.

The following sections describe the basic operation of each mode and note some of the possible sources of error when making measurements.

3.2 OPERATION OF THE SYNTHESIZER

3.2.1 Lock Indicator

A panel lamp (green) is provided to indicate that the Synthesizer is operating properly. Should the lamp blink on and off, or fail to light, check for improper operation or circuit malfunction. For example, setting a frequency over 99.9999 MHz in the IF mode will turn off the lamp.

3.2.2 RF Output Amplitude Controls

Two different output connectors, internally fuse-protected, provide two ranges of RF output voltage when in either CW or FM modes. The low-level output provides calibrated signals in the 0.1 to 100 µV range. The high-level output provides calibrated signals in the .01 to 10 mV range. A three-position pushbutton switch provides multiplying factors of 1, 10, and 100 to the calibration marked on the RF level control when using the low-level output. On the dBm scale, add 0, 20, or 40 dB corresponding to the X1, X10, and X100 positions. When using the high-level output multiply by an additional factor of 100 (add 40 dB).

NOTE

When using the low-level output, the high-level output connector must be terminated with the attached 50 Ω load.

To replace output fuses, simply remove the bottom cover of the instrument to gain access to the two fuse holders located behind the output connectors. Replace with Little Fuse Micro 1/20 A, or equivalent. A spare fuse is located near the fuse holders.

3.2.3 CW Mode

Depressing the CW button causes the Synthesizer to produce a signal whose frequency is selected by the seven thumbwheel switches. Any frequency from 1.000000 MHz to 989.9999 MHz may be generated.

3.2.4 FM Mode

The INT and EXT FM buttons are used, either individually or together, to produce a signal which is modulated by an internal 1 kHz signal, an external 60 Hz to 20 kHz signal, or a combination of both internal and external signals. As in the CW mode, the carrier frequency is set by the thumbwheel switches. When the INT FM button is depressed, an internally generated 1 kHz sine wave signal modulates the carrier. The FM CAL control is used to exactly center the carrier on the desired frequency. The frequency error meter on the receiver indicates the exact center when the pointer is at center-scale (zero error). The FM DEV control permits the modulation to be varied, with deviations of up to 25 kHz. The deviation meter on the receiver indicates the degree of modulation. Similarly, depressing the EXT FM button allows the use of an external modulating signal from 60 Hz to 20 kHz.

Should it be desired to use both the internal 1 kHz and an external signal to modulate the carrier, simply depress both the INT and EXT FM buttons simultaneously. Concentric controls are provided to allow independent variation of internal and external modulation.

3.2.5 RCVR Mode

In this mode, the Synthesizer is used as the local oscillator for the Monitor. The output frequency of the Synthesizer is automatically offset by the receiver IF to allow the thumbwheel switches to be set to the received signal frequency. In RCVR mode, no signals are produced at the RF output connectors.

3.2.6 IF Mode

In this mode, low-frequency, high-level outputs are available. Signals from 0.1 MHz to 90 MHz are generated. The amplitude is adjustable by the IF OUT control and is at least 1 V into 50 Ω with full output from 0.1 to 10 MHz; at least 0 dBm into 50 Ω from 10 MHz to 90 MHz.

3.3 OPERATION OF THE MONITOR

3.3.1 Wideband Receiver Plug-in

This plug-in has a sensitivity of better than 10 mV over a frequency range of 20 MHz to 590 MHz. Two bandwidths are available: WIDE-a multiple-stage tuned circuit with a bandwidth of approximately 100 kHz at the -3 dB points; NARROW-a crystal filter with a bandwidth of approximately 17 kHz at the -3 dB points and very steep "skirts". The WIDE position is useful to find a signal whose frequency may be significantly in error. The NARROW position provides extra selectivity to aid in rejecting other signals close to the desired frequency.

3.3.2 Error Meter

The error meter displays the amount that the carrier frequency is in error compared to the frequency selected on the Synthesizer. It is necessary to calibrate the zero point of the error meter. This is accomplished by depressing the momentary toggle switch and adjusting the zero control for a center scale reading. It is best to do this on the most sensitive meter range (1.5 kHz). The meter range appropriate to the measurement being made may now be selected. The volume control for the audio amplifier is also located on this portion of the Monitor. The 10-MHz receiver IF output may be monitored at the IF OUT connector. Connecting a counter to this point allows precise measurement of frequency error.

3.3.3 Deviation Meter Plug-In

The deviation meter plug-in supplied with this instrument measures the amount by which any modulation is shifting the carrier frequency. The meter circuit is basically a peak detector, although the meter itself will not respond to all short peaks. For this reason, a peak indicator lamp is provided. The recessed adjustment is used to set the point at which the lamp will light. This is most easily set by using the Synthesizer in INT FM Mode. In this mode, the meter automatically reads the deviation of the Synthesizer. Set the deviation control on the Synthesizer to give the meter reading desired on the deviation meter. Adjust the peak set control until the lamp lights. The lamp will now flash whenever the deviation exceeds the set point. Note that the set point is based on the range selected - e.g. if the lamp is set to 1 kHz on the 2 kHz range, it will light at 3 kHz on the 6 kHz range and 10 kHz on the 20 kHz range.

The peak detector for the meter (and the peak lamp) may be set to read either positive or negative peaks by means of the +/- switch on the plug-in front panel.

An output is provided on the deviation meter plug-in to permit observation of the detected signal on an oscilloscope. The output is ac-coupled and is designed for a load impedance of at least 10 kΩ.

3.4 ACCURACY OF MEASUREMENT

When the Service Monitor is used for critical measurements, several factors which cause errors must be considered. The following sections describe these factors and offer some practical solutions to problems created by such errors.

3.4.1 Oscillator Stability

The Frequency Synthesizer creates outputs which are all referenced to the 1 MHz crystal-controlled oscillator. Any error in this 1 MHz, due to aging, temperature, or line-voltage fluctuation will cause a proportional error in the output. For example, a 1 Hz error (1 part in 10^6) will cause the output at 100 MHz to

be in error by 100 Hz and the output at 900 MHz to be off by 900 Hz.

Temperature variations are minimized by placing the oscillator in a temperature-controlled oven. This oven is operating whenever the instrument is plugged into a power outlet. To obtain best temperature stability, leave the Service Monitor plugged in at all times.

Variations due to line-voltage changes are virtually eliminated since regulated power supplies are used.

The oscillator aging characteristics produce the most significant error. The basic oscillator used in the S1327A ages about 2 parts in 10^8 per day. Higher stability Motorola oscillators are available as options. These oscillators attain aging rates of better than 1 part in 10^9 per day (1 Hz/day at 1000 MHz). The high-stability oscillators are continuously under power with the Service Monitor plugged in. Since aging-rate depends to some extent (and improves) on the length of time the oscillator has been on, it is best to leave power connected to the unit.

Two methods are available to improve the frequency accuracy of the Service Monitor:

1) Frequent calibration with a primary frequency standard. This allows correction of the oscillator frequency to compensate for aging.

2) Substitution of a higher stability external oscillator. The rear-panel 1 MHz input permits usage of a higher stability 1 MHz source.

3.4.2 Frequency Jitter

Any oscillator exhibits some amount of short-term instability. Incidental FM, residual FM, and jitter are terms commonly used to describe this instability. The phase-locked oscillator system used in the S1327A may produce sufficient jitter to be noticeable on the error meter of the Monitor when in the RCVR mode. This same amount of jitter will also be present on the output of the Synthesizer when in CW or FM modes, but will not be visible on the meter.

This type of instability does not actually impair the basic accuracy of the measurement. Since the deviations are small and non-cumulative, the only effect is the slight movement of the meter pointer.

3.4.3 Spurious Receiver Inputs

Under severe interference conditions it is possible that the receiver will create spurious mixing products. This condition is

usually evidenced by difficulty in obtaining a correct frequency reading and by a noticable reading on the deviation meter. Use of a tunable preselector plug-in or a filter will often help. Sometimes attenuation of the input signal will eliminate the problem.

3.5 FRONT-PANEL DESCRIPTION

All front-panel controls, connectors and indicators are described in Table 3.1.

TABLE 3.1 FRONT PANEL

FRONT PANEL, MONITOR (top half)

1. Volume control (ON/OFF switch used only when Monitor is separate).
2. 10-MHz IF OUT BNC connector for counter.
3. Error meter ZERO adjust switch (momentary).
4. Error meter ZERO adjust control.
5. Pushbutton selector for determining error meter RANGE.
6. INPUT LEVEL lamp - illuminates when sufficient receiver input is present.
7. PWR lamp to indicate power on.
8. Illuminated zero center ERROR KHz meter shows amount the received signal is in error from dialed-in frequency.
9. WIDE/NARROW switch selects one of two bandwidths for receiver IF (BROADBAND MIXER plug-in).
10. Knob on plug-in locking screw. Turn to left to remove, turn to right to tighten (BROADBAND MIXER plug-in).
11. Receiver INPUT BNC connector (BROADBAND MIXER plug-in).
12. PEAK FM DEV selector switch; + selects positive peaks, - selects negative peaks (DEVIATION METER plug-in).
13. OVER-PEAK FM DEV lamp lights whenever deviation exceeds limit set (DEVIATION METER plug-in).
14. Recessed LIMIT SET adjustment for setting limit point of OVER-PEAK FM DEV lamp (DEVIATION METER plug-in).
15. Knob on plug-in locking screw. Turn to left to remove, turn to right to tighten (DEVIATION METER plug-in).
16. DEVIATION METER OUTPUT BNC connector permits viewing of received audio signal with an oscilloscope (DEVIATION METER plug-in).
17. Pushbutton selector for determining DEVIATION METER RANGE (DEVIATION METER plug-in).
18. Illuminated DEVIATION KHz meter shows amount of modulation (deviation) present on received signal (DEVIATION METER plug-in).

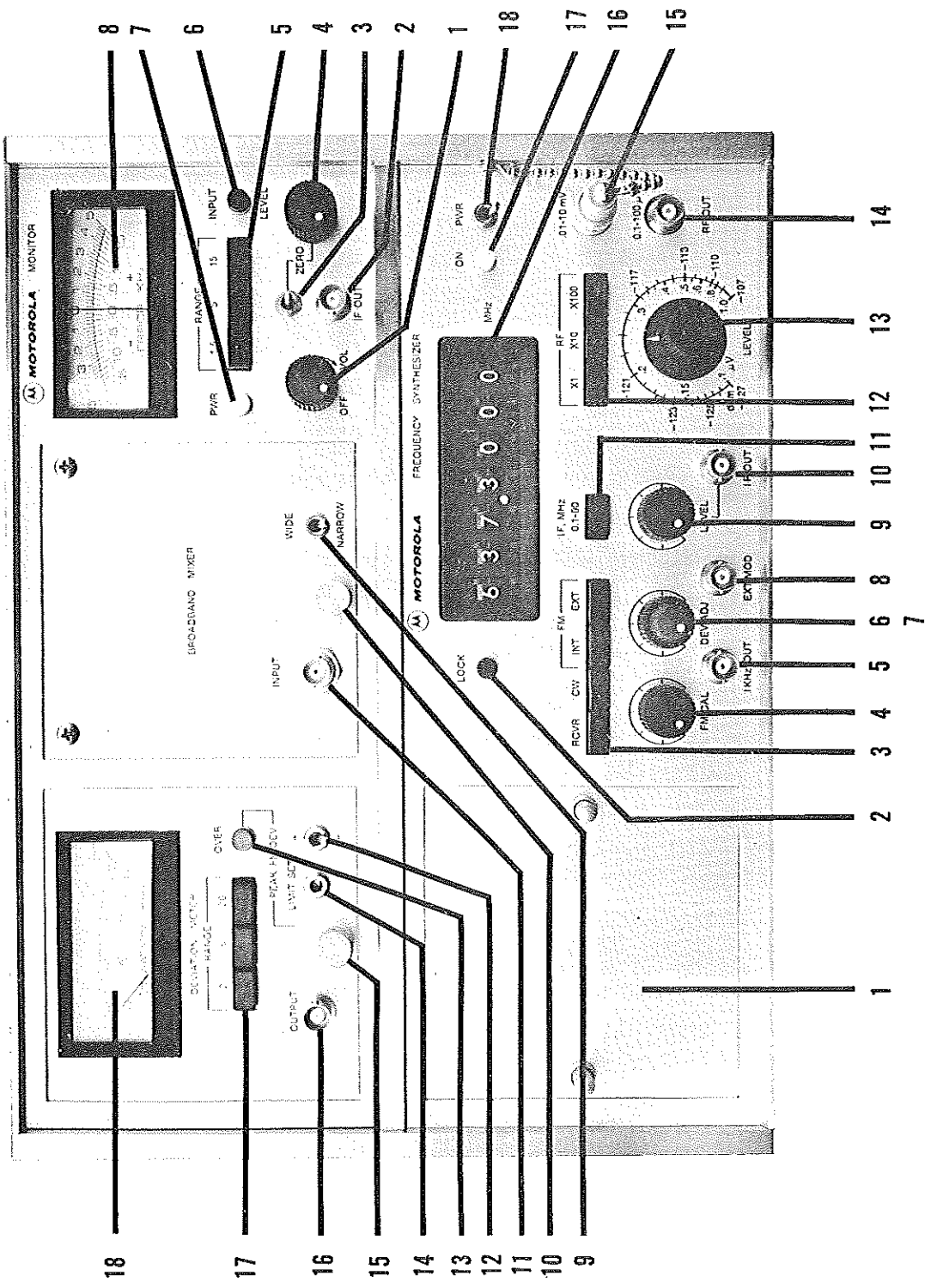


FIGURE 3.1 FRONT PANEL

TABLE 3.1 FRONT PANEL (Cont'd)

FRONT PANEL, SYNTHESIZER (bottom half)

1. Blank cover for plug-in space.
2. LOCK lamp, illuminates when SYNTHESIZER is operating properly and within its coverage range.
3. Four-button function selector for the SYNTHESIZER.

   RCVR - Causes the SYNTHESIZER to act as the local oscillator for the MONITOR.

   CW - Produces an unmodulated output at the RF OUT jacks.

   INT-FM - Initiates an output at the RF OUT jacks which is modulated by the internal 1 kHz source.

   EXT-FM - Initiates an output at the RF OUT jacks which is modulated by an external 60 Hz to 20 kHz source.
4. FM CAL knob - When in either FM Mode, allows center frequency to be varied.
5. 1 KHz OUT BNC connector is controlled by the INT-DEV ADJ knob (black) and produces up to 1 V rms into 50 Ω.
6. INT-DEV ADJ (black knob) controls the amplitude of the internal 1 KHz used to modulate the carrier. Also controls the 1 KHz OUT amplitude.
7. EXT-DEV ADJ (red knob) controls the amplitude of any external modulating signal.
8. EXT MOD BNC input connector accepts the external modulating signal.
9. IF-LEVEL control adjusts the amplitude of the signal at the IF OUT BNC connector.
10. IF OUT BNC connector feeds a 0.1 MHz to 90 MHz signal as selected by the thumbwheel switches when in IF MODE.
11. IF, MHz mode selector initiates the output to the IF OUT BNC connector.
12. RF LEVEL multiplier selects multiplication factor for RF OUT level.
13. RF LEVEL control adjusts the amplitude of the signal from the RF OUT jacks.
14. 0.1 to 100 µV RF OUT connector supplies an RF output in this amplitude range when in CW or FM modes.
15. .01 to 10 mV RF OUT connector supplies an RF output in this amplitude range when in CW or FM modes. Shown with 50-ohm termination.
16. Thumbwheel MHz switches control the output frequency of the SYNTHESIZER.

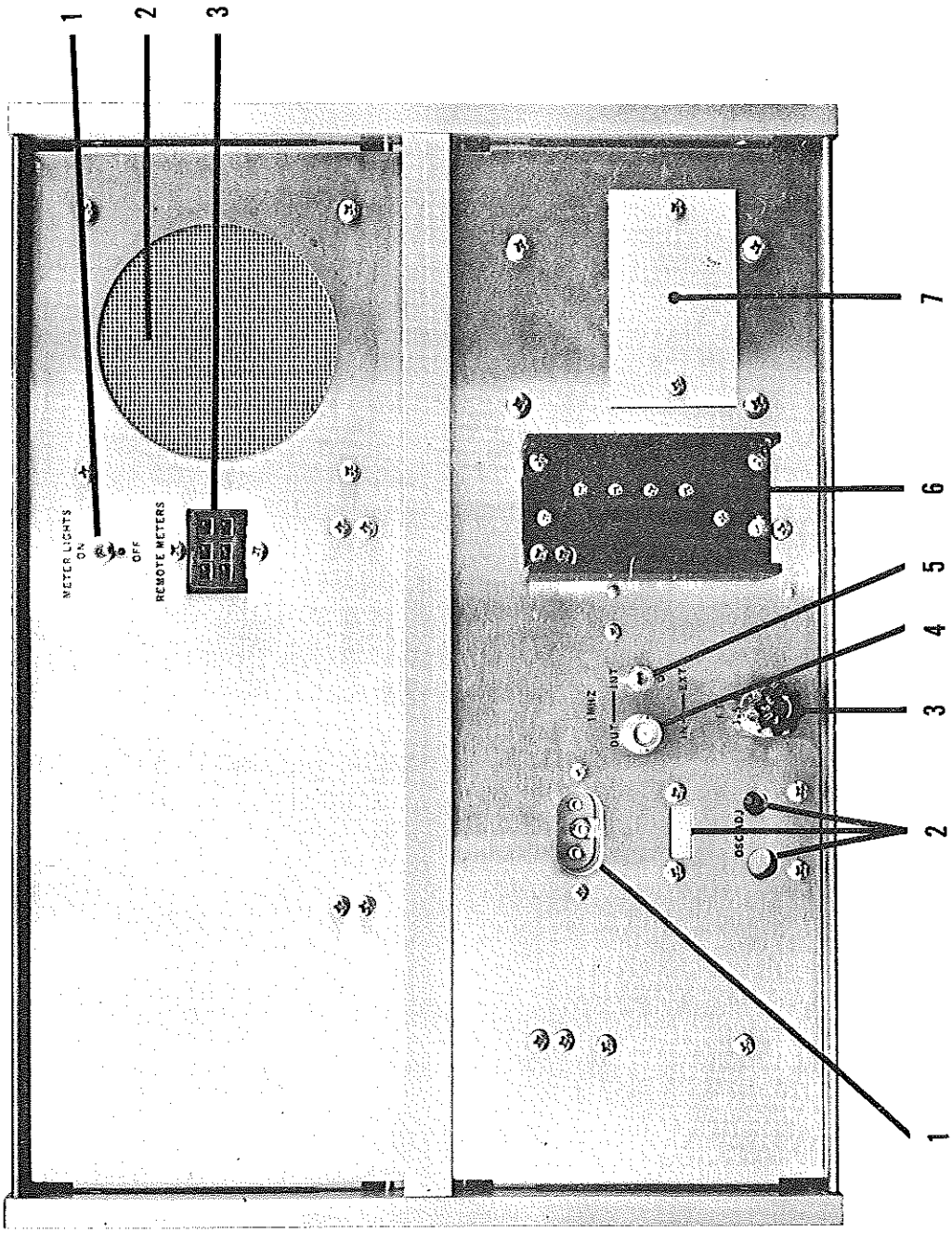


FIGURE 3.2 REAR PANEL

TABLE 3.1 FRONT PANEL (Cont'd)

FRONT PANEL, SYNTHESIZER (bottom half)-Cont'd

17. POWER ON lamp.
18. POWER on/off switch controls both MONITOR and SYNTHESIZER.

3.6 REAR-PANEL DESCRIPTION

All rear-panel controls, connectors and indicators are described in Table 3.2.

TABLE 3.2 REAR PANEL

REAR PANEL, MONITOR (top half)

1. Front panel METER LIGHTS ON/OFF switch.
2. Speaker.
3. REMOTE METERS/speaker connector.

REAR PANEL, SYNTHESIZER (bottom half)

1. ac line cord socket.
2. Oscillator adjustment access (only one used per oscillator).
3. Line fuse.
4. 1 MHz OUT/IN BNC connection.
5. 1 MHz INT/EXT switch.
6. Power supply regulator transistor heat sink.
7. dc inverter option cover plate.

soldered to printed-circuit boards, the procedures indicated below must be followed or damage to the board may result:

1) Determine by troubleshooting techniques, which integrated circuit or discrete component(s) has failed.

2) Remove the defective component(s) from the board by cutting the pins or leads with a small diagonal clipping tool. (Always remove and replace the entire component.)

3) Apply heat (40-50 W soldering iron) sparingly to each of the cut pins or leads and remove from the board; clean the hole(s) with a toothpick or solder suction tool.

4. Form the tinned leads of the replacement part and insert in the printed circuit holes; solder, then trim leads to extend 1/16-inch beyond the back surface of the board. (Use only 63-37 solder with maximum 1/16-inch diameter.)

CAUTION

Always trim semiconductor leads only after soldered installation is complete. This procedure greatly lessens the possibility of component failure due to shock-wave damage caused by the trimming tool.

5) When soldering semiconductor devices and all small components, be sure to use a heat sink tool or long-nosed plier connected to the component lead(s) while each is being soldered. Allow the soldered connection to cool before removing the heat sink.

6) Clean all dirt and solder-flux from the printed-circuit traces by liberal application of isopropyl alcohol or freon-type solvents.

4.4 CALIBRATION

This section describes the procedures which are used for normal, periodic, field calibration of the Service Monitor. Calibration is recommended every 60 days, (due to oscillator aging).

4.4.1 Preliminary

Place unit upside down and remove the bottom cover. Check that the line voltage is between 105 and 125 V rms or between 210 and 250 V rms, whichever is applicable. Turn unit on.

4.4.2 Power Supply Adjustment

The power supply regulators have excellent stability and it is unlikely that adjustment will be required. Power supply voltages, are referenced to chassis ground and should be within the following tolerances:

+5 V	±0.1 V	(Red Test Point)
-5.2 V	±0.05 V	(Green Test Point)
+15 V	±0.3 V	(Blue Test Point)
-15 V	±0.3 V	(Violet Test Point)

Adjustment potentiometers are adjacent to the respective test points. Exact location of these adjustments may be determined from the A9 Board parts location drawing.

	SERIAL # UP TO 301	SERIAL # 301 & UP
+5 V	Adjust R14	R24
-5.2 V	Adjust R17	R31
+15 V	Adjust R4	R6
-15 V	Adjust R8	R14

Measurements should be made with a digital voltmeter such as the Systron-Donner Model 9025.

4.4.3 OSCILLATOR ADJUSTMENT

Any heated oscillator used in the Service Monitor should be plugged-in and allowed to run uninterrupted for 72 hours prior to setting the frequency. In addition, instruments using the basic oscillator must be turned ON for this period of time to achieve best operational stability.

To set the oscillator, connect a reference 1 MHz signal with accuracy of at least 1 part in 10^{-10} short term to the external trigger of a Tektronix Model 581 Oscilloscope with Type 82 Plug-In. With the oscilloscope set to .01 μs/cm (expander on) and triggered externally, connect the input to the rear-panel 1 MHz BNC connector. Turn the INT/EXT switch to INT and set the oscillator adjustment(s) for a stationary waveform on the oscilloscope. This method permits the operator to visually determine the optimum setting. An error of 1 part in 10^{-9} is indicated if the displayed waveform moves full screen in 10 seconds.

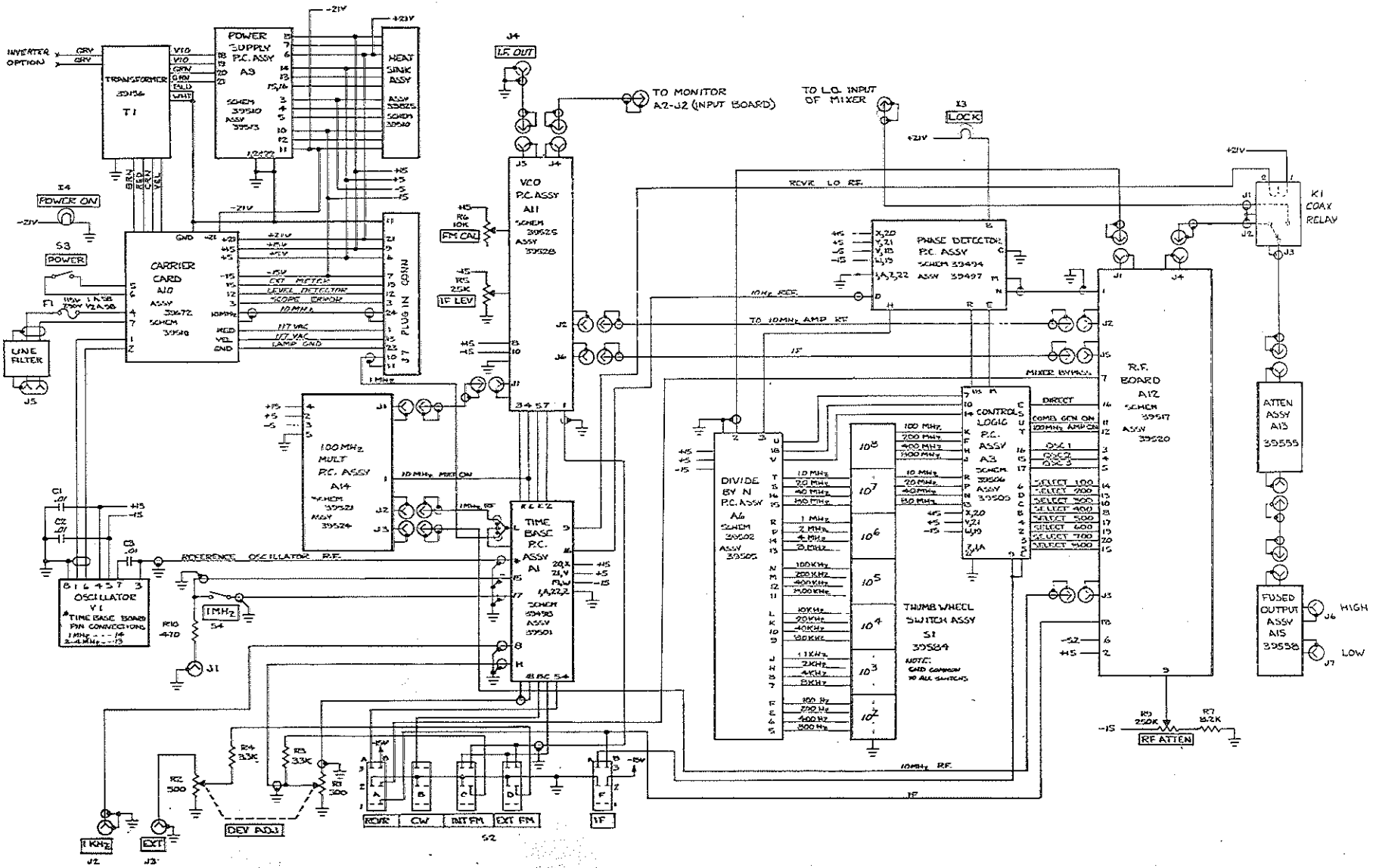
CHAPTER 5
CIRCUIT DESCRIPTIONS

5.1 INTRODUCTION

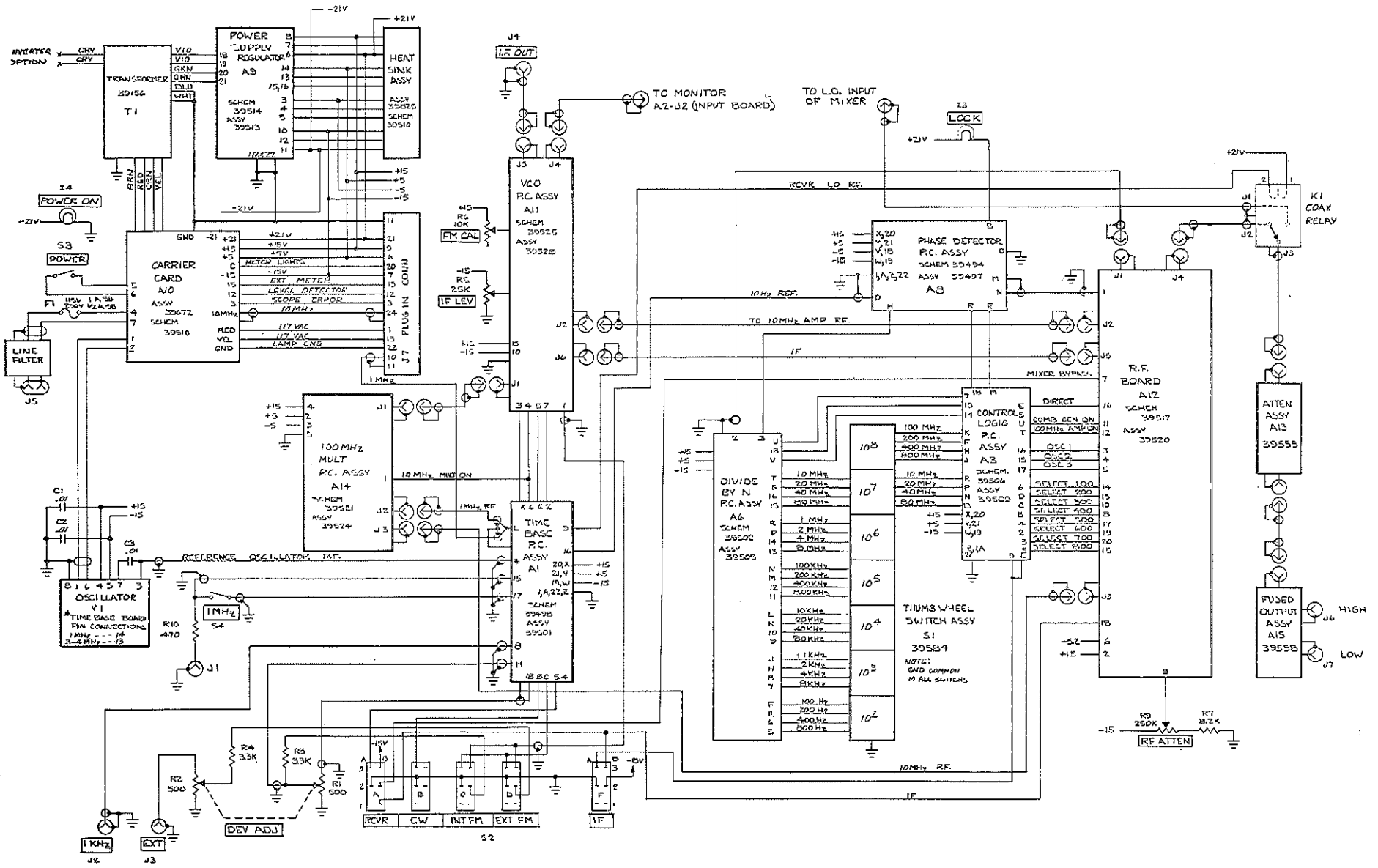
Contained in this Chapter are the circuit descriptions, assemblies, schematics, and parts lists for the standard S1327A.

5.2 CIRCUIT DESCRIPTIONS, DRAWINGS, AND PARTS LISTS

Ref.	Description	Assembly	Schematic
	SYNTHESIZER		
	Block Diagram (201-300)	—	D39930R2
	Block Diagram (301-up)	—	D39930R3
	Front Panel Subassembly	D39581R7	—
	Rear Panel Subassembly	D39585R8	—
	Card Cage Assembly	C39560R3	—
A1	Time Base Divider	D39501R2	D39498R4
A2	Shield	—	—
A3	Control Logic Board	D39509R2	D39506R4
A4	Not Used		
A5	Not Used		
A6	Divide-By-N Board	D39505R2	C39502R2
A7	Shield	—	—
A8	Phase Detector Board	D39497R1	D39494R2
A9	Power Supply (101-300)	D39513R1	D39510R4
	Power Supply (301-up)	—	D39510R5
	Power Supply Heat Sink	C39825R2	—
A9	Power Supply Regulator	D39513A	D39514R1
A10	Carrier Card	B39672R2	—
A11	VCO Board	D39528R1	D39525R2
A12	RF Board (201-300)	D39520R1	2D39517R1
	RF Final Assembly	D45314A	—
A12	RF Board (301-400)	D45312A	2D45309R1
A13	Attenuator	C39555R4	—
A14	100 MHz Multiplier	D39524R1	D39521R3
A15	RF Out	C39558R4	—
	MONITOR		
	Block Diagram	—	D39818R2
	Front Panel Subassembly	D39727R2	—
	Rear Panel Subassembly	D39728R3	—
A1	Audio Amplifier	D39637R2	B39634R2
A2	Input Board	D39607R2	C39604R2
A3	Discriminator & Level Detect	D39599A	D39596R3



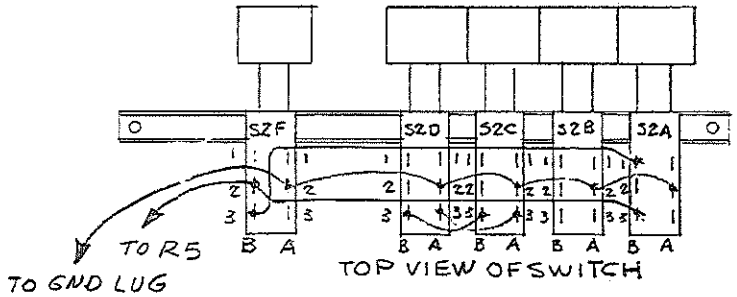
(SYNTHESIZER) BLOCK DIAGRAM D39930R2 (201-300)

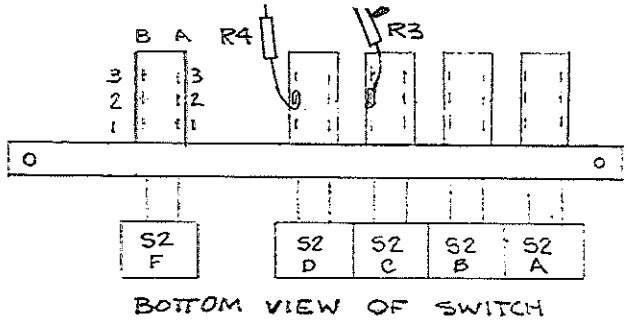


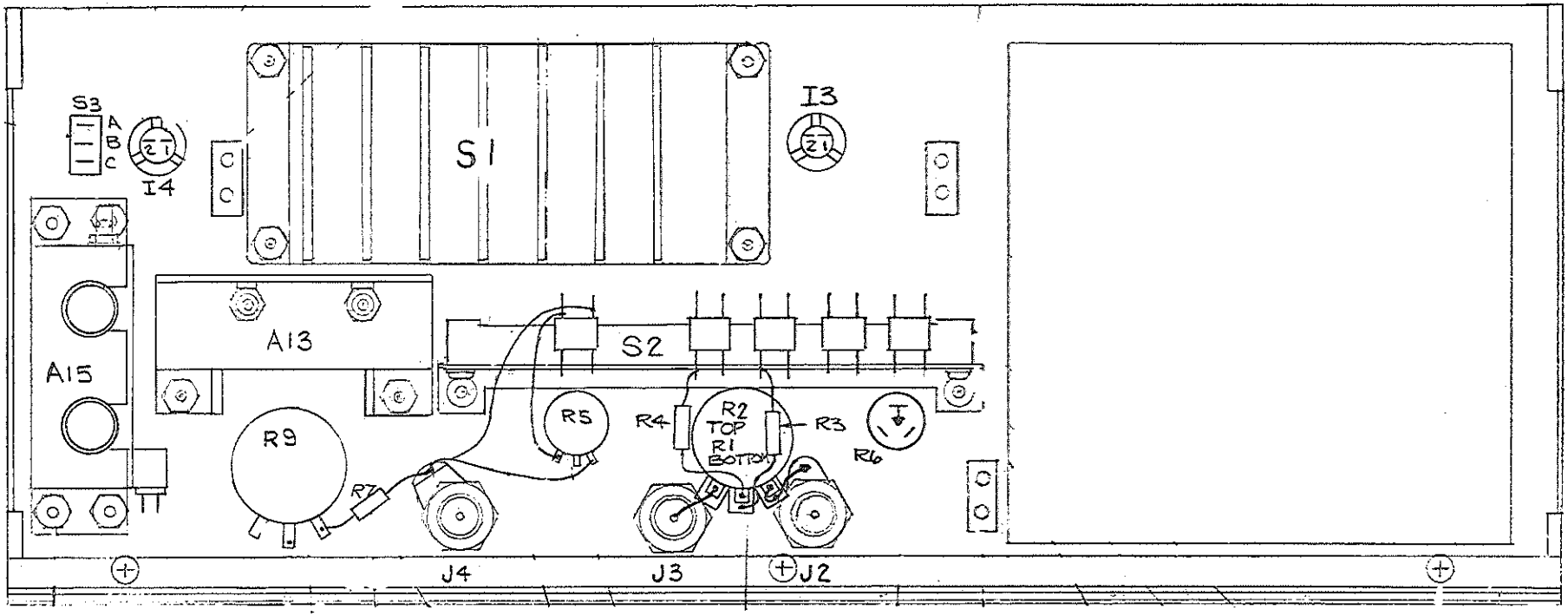
(SYNTHESIZER) BLOCK DIAGRAM D39930R3 (301-UP)

SYNTHESIZER, FINAL ASSEMBLY PARTS LIST

Ref.	Description	SD Part No.
C1	Capacitor, .01 µF	C0562
C2	Capacitor, .01 µF	C0562
C3	Capacitor, .01 µF	C0562
C7	Capacitor, 13,000 MFD, 12 V	C1122
C8	Capacitor, 4,600 MFD, 15 V	C1112
J7	Connector, 24 Pin, F	09061440
S1	Switch, Thumb Wheel	39584
Y1	Oscillator Crystal	Y0023
	Octal Socket	X0004



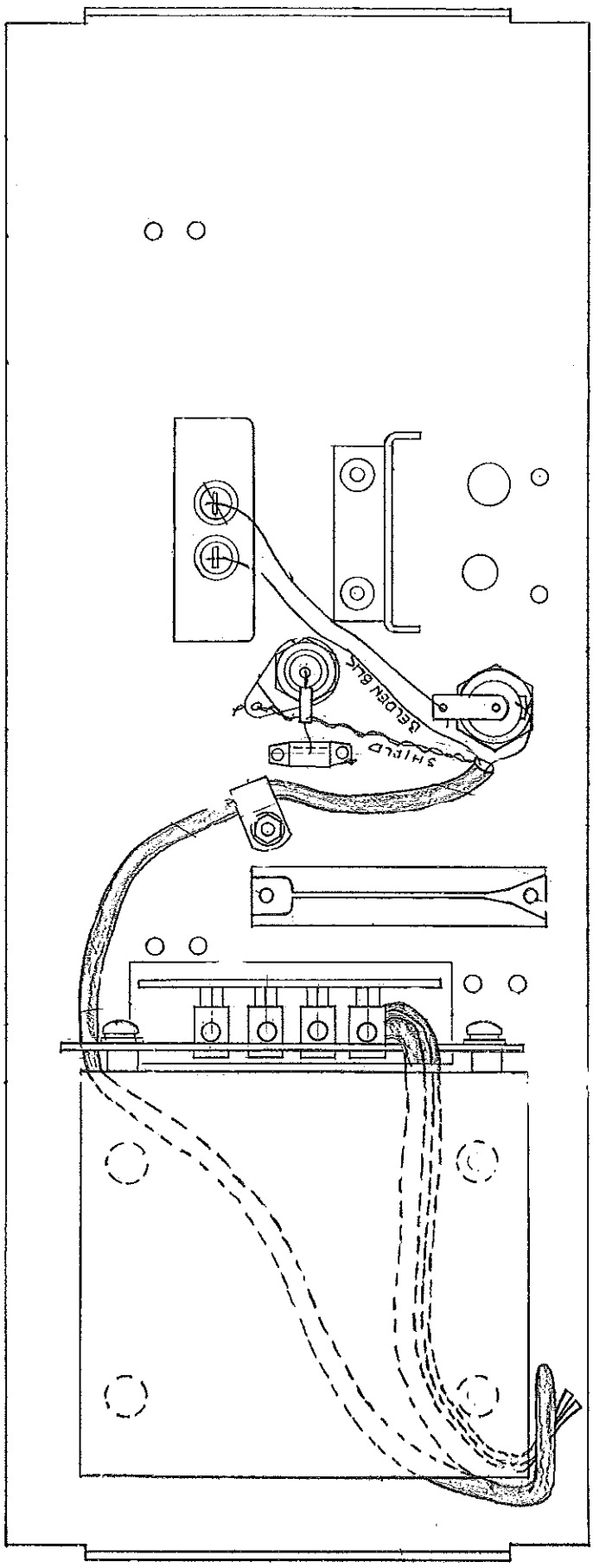




(SYNTHESIZER), FRONT PANEL SUBASSEMBLY D39581R7

(SYNTHESIZER) FRONT PANEL SUB-ASSEMBLY PARTS LIST

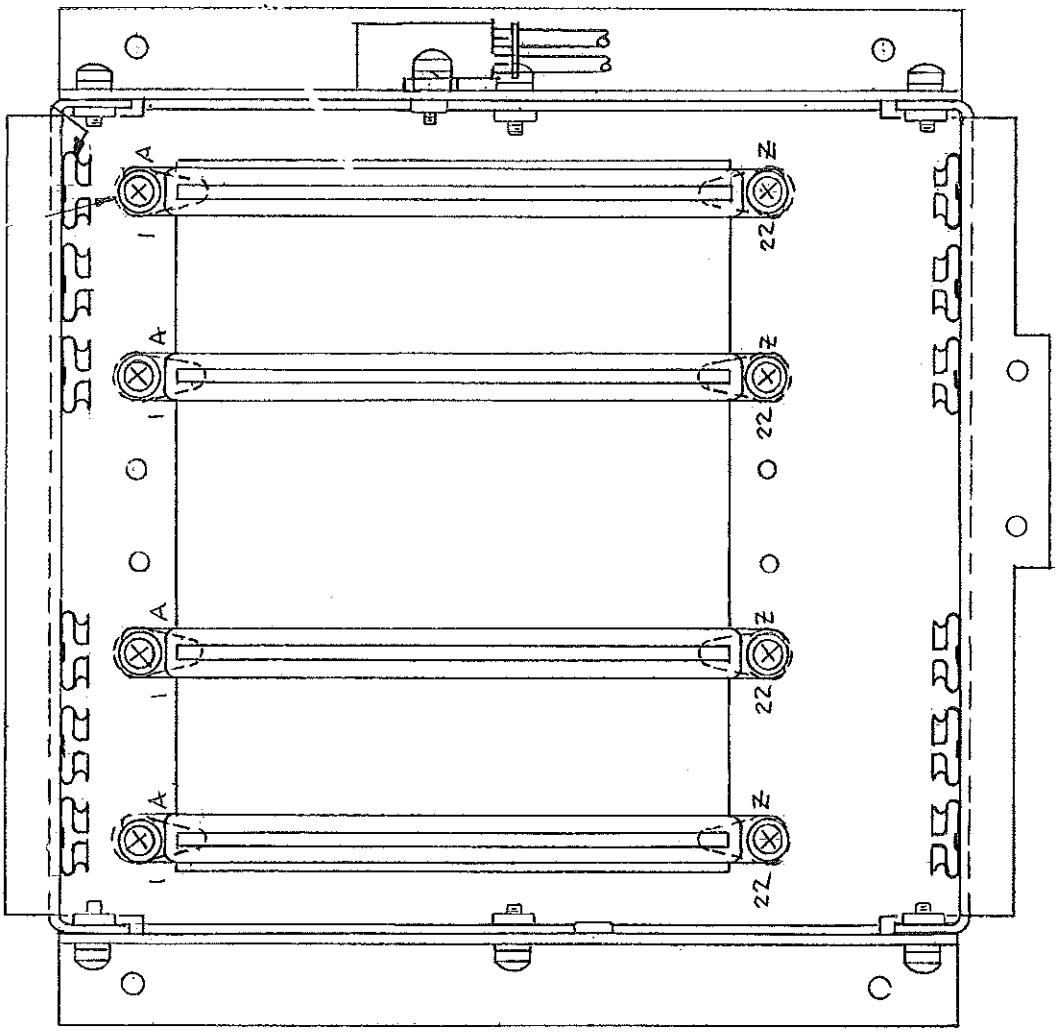
Ref.	Description	SD. Part No.
	Front Panel Sub-Assembly	D39581R6
A13	Attenuator Assembly	39555
A15	RF Out Assembly	39558
I3	Light, Green	I0104
I4	Light, White	I0103
J2	BNC Connector	J0260
J3	BNC Connector	J0260
J4	BNC Connector	J0260
R1	Potentiometer, 500 Ω, Dual Concentric	R2708
R2	Potentiometer, 500 Ω, Dual Concentric	R2708
R3	Resistor, 3.3 k, 1/4 W, 5%	R0742
R4	Resistor, 3.3 k, 1/4 W, 5%	R0742
R5	Potentiometer, 25 k	R2712
R6	Potentiometer, 10 k	R2738
R7	Resistor, 8.2 k, 1/4 W, 5%	R0883
R8	Resistor, 390 k, 1/4 W, 5%	R2420
R9	Potentiometer, 250 k	R2707
S2	Switch Push Button	S0403
S3	Switch SPDT	S0149
	Knob Concentric Base	H1979
	Knob Concentric, Red	H1297
	Knob	H1982
	Skirted Knob	H0679
	Lamp Socket	X0133



(SYNTHESIZER), REAR PANEL SUBASSEMBLY D39585R8

(SYNTHESIZER) REAR PANEL SUB-ASSEMBLY PARTS LIST

Ref.	Description	SD Part No.
	Rear Panel Sub-Assembly	D39585R8
	Heat Sink Assembly	39825
	Resistor, 470 Ω, 1/4 W, 5%	R1044
	Fuse, 1 1/2 A SLO-BLO	F0019
	Connector, BNC	J0260
	Line Filter	Z0007
	Fuse Holder	X0034
	Switch, SPDT, Slide	S0356
	Carrier/Transformer Assembly	39586



(SYNTHESIZER), CARD CAGE ASSEMBLY C3956OR3

(SYNTHESIZER) CARD CAGE ASSEMBLY PARTS LIST

Ref.	Description	SD Part No.
	Card Cage Assembly	C39560B
	Single Row 22 Pin P.C. Connector	J0195
	Dual 22 Pin P.C. Connector	J0246

CIRCUIT DESCRIPTION
TIME BASE DIVIDER
SCHEMATIC #D39498R4
A1 (SYNTHESIZER)

The Time Base Board contains: 1) the Oscillator Shaping Circuits 2) a Divider Chain and 3) various control circuits.

1) OSCILLATOR SHAPING CIRCUITS

The oscillator shaper/divider circuit is designed to accept an input of 1, 3, or 4 MHz, sine or square wave, and produce a square wave 1 MHz output. Various jumpers are provided to allow easy field change of oscillator options. Transistors Q3 and Q4 provide amplification and shaping for the 3 or 4 MHz oscillator input on Pin 13. The output from Q4 is a logic level (+5 V and 0 V) signal which feeds divider U6. This integrated circuit may be connected to divide-by-three or by-four (see tabulation on schematic), if a 3 or 4 MHz oscillator is used then jumper W5 is installed. If a 1 MHz oscillator is to be used, it is connected to Pin 14 and jumper W6 is installed instead of W5. Transistor Q8 provides amplification at this point. The output from Q8 goes to the rear-panel INT/EXT switch and connector via Pin 17.

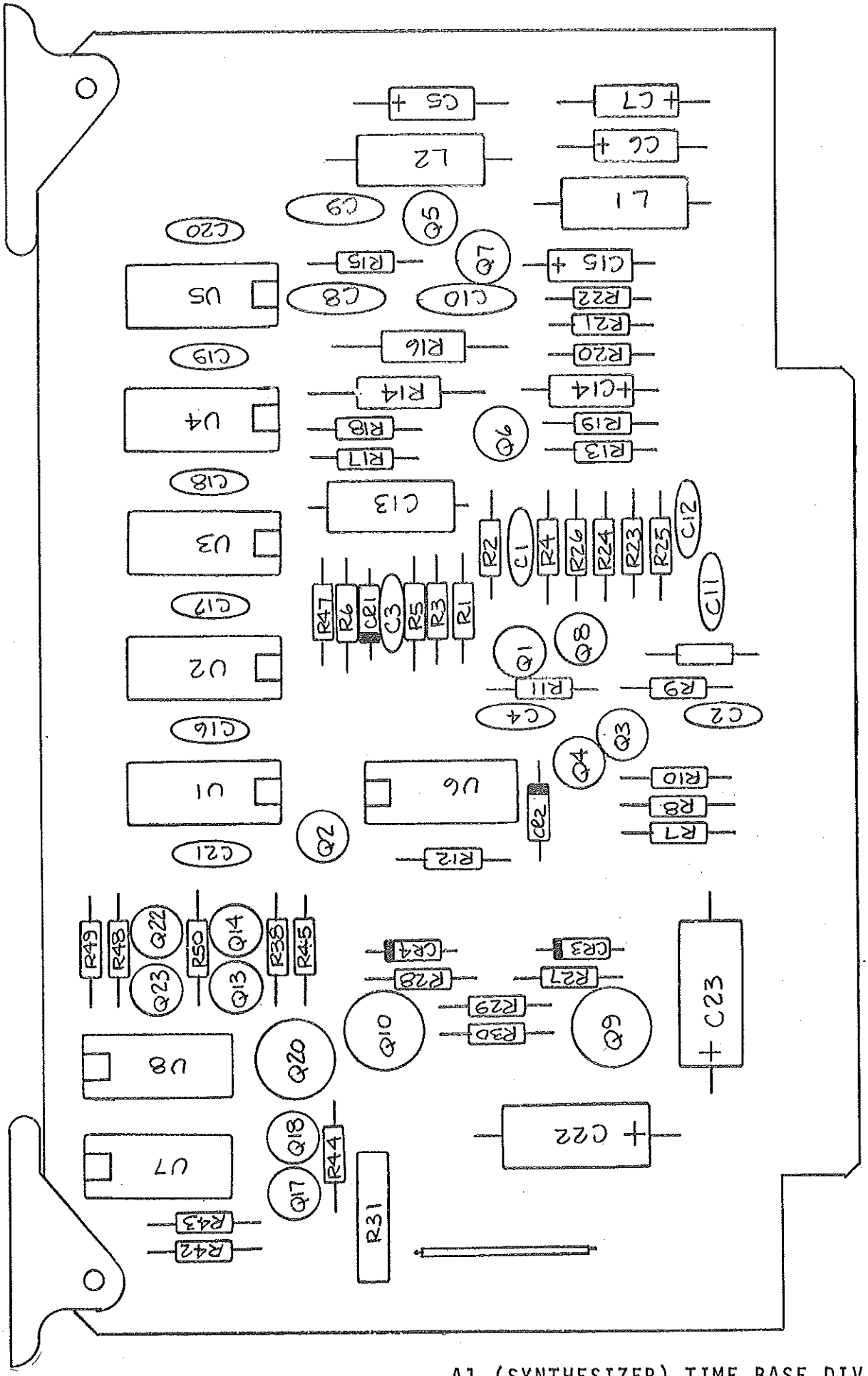
The signal on Pin 15 (from Q8 if in INT, or from an external 1 MHz if in EXT) is further amplified by Q1 and shaped to logic levels by Q2. The output on Pin L is the reference 1 MHz.

2) DIVIDER CHAIN

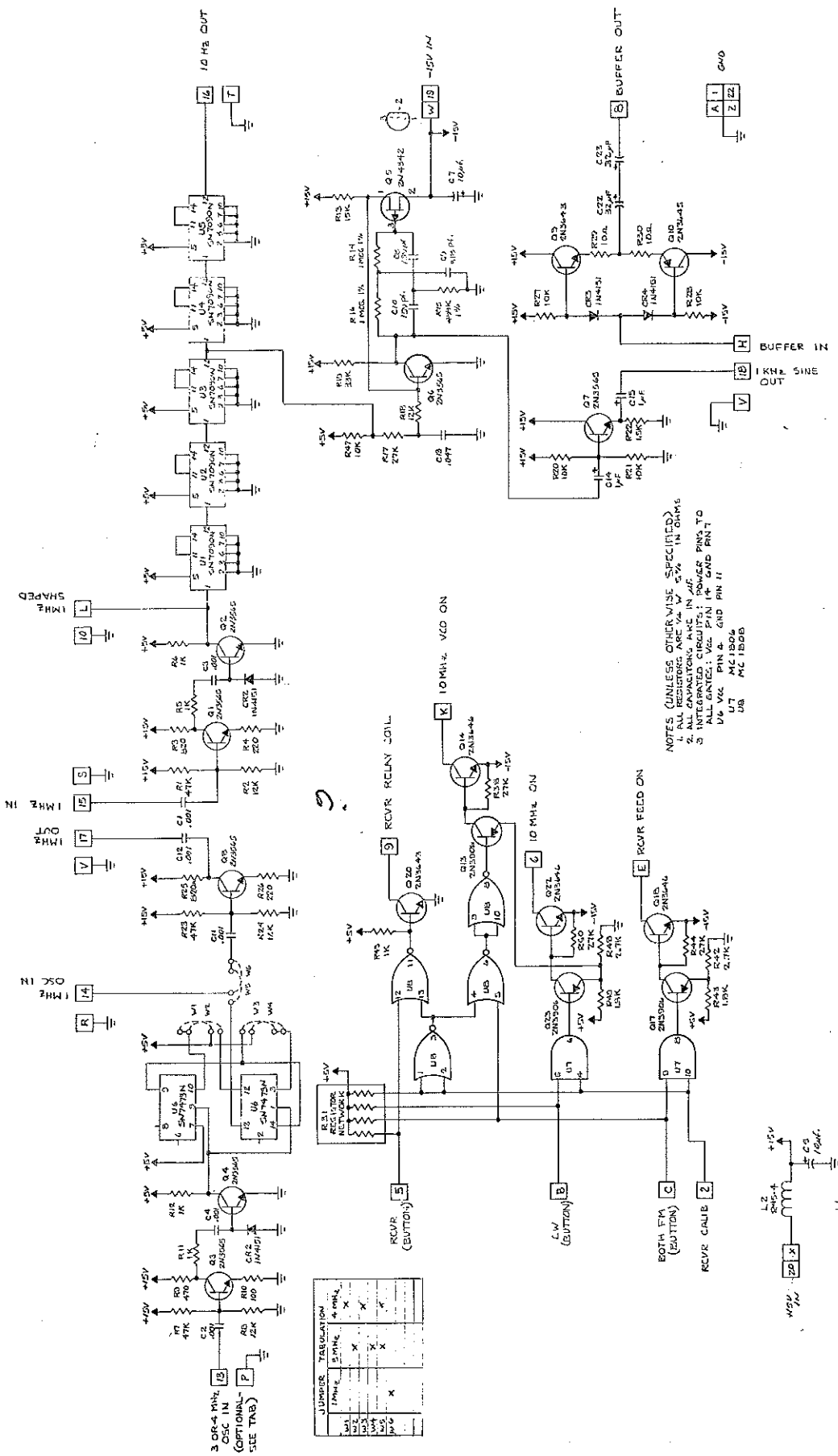
Integrated circuits U1 - U5 successively divide the 1 MHz down by factors of 10. The 10 Hz reference for the phase detector is available on Pin 16. The output from U3 at 1 kHz, is used to drive an active filter. Transistors Q5 and Q6, along with network R14, R15, R16, C8, C9, and C10, filter the 1 kHz square wave and produce a low-distortion sine wave. Buffer Q7 is connected as an emitter-follower. Transistors Q9 & Q10 provide a low-impedance output for the 1 kHz.

3) VARIOUS CONTROL CIRCUITS

The remaining circuitry performs a variety of control functions. Specific details of these functions is covered elsewhere. The circuit operation is as follows: Three identical level shift circuits are employed to convert from +5 volt logic levels to -15 volt control levels. For example, a low input (0 V) at the base of Q17 turns it on. This produces a base current in Q18 turning it on. In this way, the load connected to the collector of Q18 is supplied -15 volts. When a high input (over +2.5 V) is present on the base of Q17 it is off since the emitter is biased at +3 V. Q18 now turns off since there is no longer any base current for it. The integrated circuit gates perform logic functions required to operate the control lines at the proper time.



A1 (SYNTHESIZER) TIME BASE DIVIDER



A1 (SYNTHESIZER), TIME BASE DIVIDER D39498R4

A1 (SYNTHESIZER), TIME BASE DIVIDER PARTS LIST

Ref.	Description	SD Part No.
A1	Time Base Divider Assembly	**39501R2**
A1	Time Base Divider Schematic	**39498R4**
C1	Capacitor, .001 µF	C0424
C2	Capacitor, .001 µF	C0424
C3	Capacitor, .001 µF	C0424
C4	Capacitor, .001 µF	C0424
C5	Capacitor, 10 µF, 20 V, Tant	C0353
C6	Capacitor, 39 µF, 10 V, Tant	C0902
C7	Capacitor, 10 µF, 20 V, Tant	C0353
C8	Capacitor, 159 pF, DM	C1146
C9	Capacitor, 318 pF, DM	C1145
C10	Capacitor, 159 pF, DM	C1146
C11	Capacitor, .001 µF	C0424
C12	Capacitor, .001 µF	C0424
C13	Capacitor, .047 µF	C0700
C14	Capacitor, 1 µF, 35 V, Tant	C0524
C15	Capacitor, 1 µF, 35 V, Tant	C0524
C16	Capacitor, .001 µF	C0424
C17	Capacitor, .001 µF	C0424
C18	Capacitor, .001 µF	C0424
C19	Capacitor, .001 µF	C0424
C20	Capacitor, .001 µF	C0424
C21	Capacitor, .001 µF	C0424
C22	Capacitor, .32 µF	03290200
CR1	Diode, IN4151	CR0150
CR2	Diode, IN4151	CR0150
CR3	Diode, IN4151	CR0150
CR4	Diode, IN4151	CR0150
L1	Inductor, R45-1	L0143
L2	Inductor, R45-1	L0143
Q1	Transistor, 2N3565	Q0237
Q2	Transistor, 2N3565	Q0237
Q3	Transistor, 2N3565	Q0237
Q4	Transistor, 2N3565	Q0237
Q5	Transistor, P1086E	Q0309
Q6	Transistor, 2N3565	Q0237
Q7	Transistor, 2N3565	Q0237
Q8	Transistor, 2N3565	Q0237
Q9	Transistor, 2N3643	Q0179
Q10	Transistor, 2N3645	Q0215

A1 (SYNTHESIZER), TIME BASE DIVIDER PARTS LIST (Cont'd)

Ref.	Description	SD Part No.
Q11	Not Used	
Q12	Not Used	
Q13	Transistor, 2N3906	Q0248
Q14	Transistor, 2N3646	Q0218
Q15	Not Used	
Q16	Not Used	
Q17	Transistor, 2N3906	Q0248
Q18	Transistor, 2N3646	Q0218
Q19	Not Used	
Q20	Transistor, 2N3643	Q0179
Q21	Not Used	
Q22	Transistor, 2N3646	Q0218
Q23	Transistor, 2N3906	Q0248
R1	Resistor, 47 k, 1/4 W, 5%	R0777
R2	Resistor, 12 k, 1/4 W, 5%	R0759
R3	Resistor, 820 Ω, 1/4 W, 5%	R0762
R4	Resistor, 220 Ω, 1/4 W, 5%	R0760
R5	Resistor, 1 k, 1/4 W, 5%	R0765
R6	Resistor, 1 k, 1/4 W, 5%	R0765
R7	Resistor, 47 k, 1/4 W, 5%	R0777
R8	Resistor, 12 k, 1/4 W, 5%	R0759
R9	Resistor, 470 Ω, 1/4 W, 5%	R1044
R10	Resistor, 100 Ω, 1/4 W, 5%	R0966
R11	Resistor, 1 k, 1/4 W, 5%	R0765
R12	Resistor, 1 k, 1/4 W, 5%	R0765
R13	Resistor, 15 k, 1/4 W, 5%	R0728
R14	Resistor, 1 M, 1%	R2152
R15	Resistor, 499 k, 1%	R2372
R16	Resistor, 1 M, 1%	R2152
R17	Resistor, 27 k, 1/4 W, 5%	R0824
R18	Resistor, 12 k, 1/4 W, 5%	R0759
R19	Resistor, 3.3 k, 1/4 W, 5%	R0742
R20	Resistor, 10 k, 1/4 W, 5%	R0766
R21	Resistor, 10 k, 1/4 W, 5%	R0766
R22	Resistor, 820 Ω, 1/4 W, 5%	R0762
R23	Resistor, 47 k, 1/4 W, 5%	R0777
R24	Resistor, 12 k, 1/4 W, 5%	R0759
R25	Resistor, 820 Ω, 1/4 W, 5%	R0762
R26	Resistor, 220 Ω, 1/4 W, 5%	R0760
R27	Resistor, 10 k, 1/4 W, 5%	R0766
R28	Resistor, 10 k, 1/4 W, 5%	R0766

A1 (SYNTHESIZER), TIME BASE DIVIDER PARTS LIST (Cont'd)

Ref.	Description	SD Part No.
R29	Resistor, 10 Ω, 1/4 W, 5%	R0739
R30	Resistor, 10 Ω, 1/4 W, 5%	R0739
R31	Resistor Network	27867
R32	Not Used	
R33	Not Used	
R34	Not Used	
R35	Not Used	
R36	Not Used	
R37	Not Used	
R38	Resistor, 27 k, 1/4 W, 5%	R0824
R39	Not Used	
R40	Not Used	
R41	Not Used	
R42	Resistor, 2.7 k, 1/4 W, 5%	R0937
R43	Resistor, 1.8 k, 1/4 W, 5%	R0959
R44	Resistor, 27 k, 1/4 W, 5%	R0824
R45	Resistor, 1 k, 1/4 W, 5%	R0765
R46	Not Used	
R47	Resistor, 10 k, 1/4 W, 5%	R0766
R48	Resistor, 2.7 k, 1/4 W, 5%	R0937
R49	Resistor, 1.8 k, 1/4 W, 5%	R0959
R50	Resistor, 1.8 k, 1/4 W, 5%	R0959
U1	Integrated Circuit, SN7090N	25732
U2	Integrated Circuit, SN7090N	25732
U3	Integrated Circuit, SN7090N	25732
U4	Integrated Circuit, SN7090N	25732
U5	Integrated Circuit, SN7090N	25732
U6	Integrated Circuit, SN7473N	19709
U7	Integrated Circuit, MC1806P	25733
U8	Integrated Circuit, MC1810P	25735

CIRCUIT DESCRIPTION
CONTROL LOGIC BOARD
SCHEMATIC #D39506R4
A3 (SYNTHESIZER)

The Control Logic Board provides the necessary control signals to operate the RF board and associated circuits. Control is provided for: 1) oscillator switching and phase detector gain change; 2) multiplier selection; and 3) "LOCK" lamp disable.

1) OSCILLATOR SWITCHING AND PHASE DETECTOR GAIN CHANGE

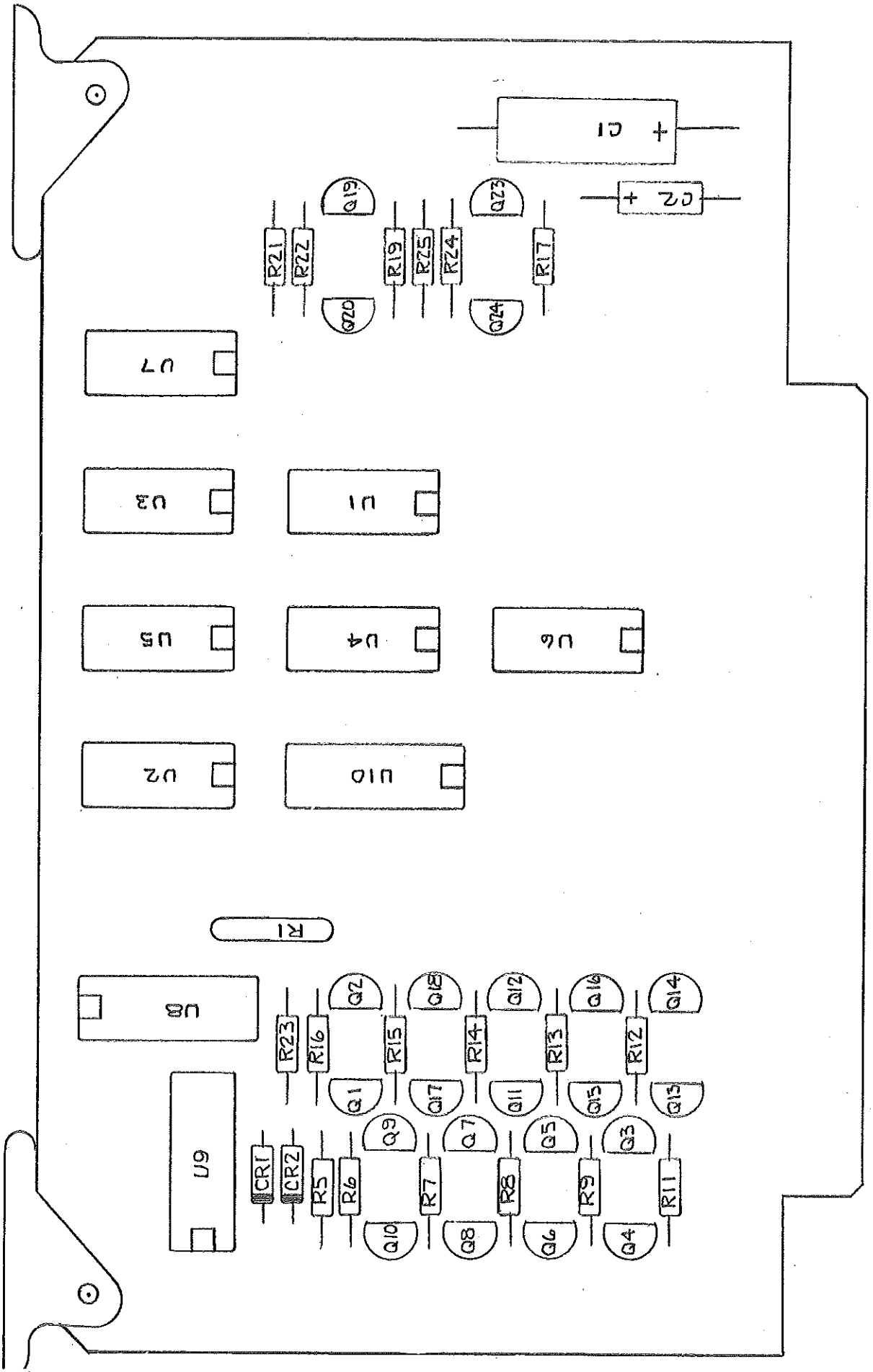
The oscillator switching and phase detector gain change functions are dependent on two parameters. If the Synthesizer is in any mode other than IF, the oscillators actually must run 10 MHz higher than the setting indicates. In IF mode, the oscillator frequency is as selected. Converter U10 takes the binary-coded-decimal (BCD) information from the "10's-of-MHz" switch and converts it to decimal numbers. This decimal information is then gated according to the selected mode and determines which oscillator to use for the required frequency. The phase detector gain-change control line is gated to produce a low-level whenever an oscillator is to operate in the top 10 MHz of its range.

2) MULTIPLIER SECTION

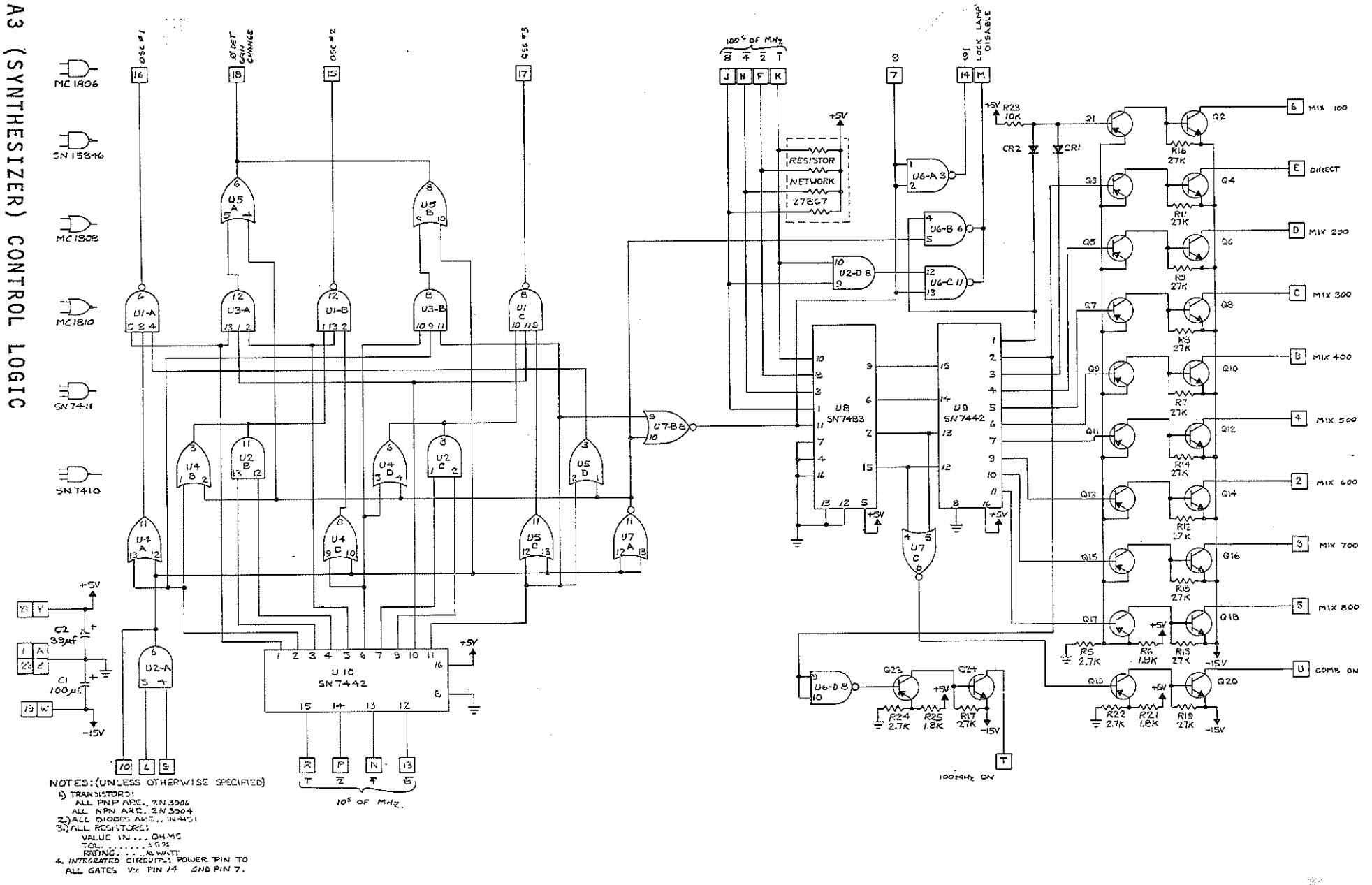
The majority of the remaining circuitry is used to control the input to the second mixer on the RF board. Integrated circuit U8 is a binary full-adder. Its function is to add one to the number selected in the "100's-of-MHz" position, whenever a nine is selected in the "10's-of-MHz" position. Exception: This is not done in IF mode. Gate U7-B performs the exception. The output from U8 feeds U9, another BCD-to-decimal converter. Each output from U9 drives a pair of transistors which convert from 5 V logic levels to -15 V for switching purposes. Diodes CR1 and CR2 perform an OR function to select the 100 MHz signal for either a dialed-in 0 or a dialed-in 2. U7-C detects a number of four or greater, and supplies a signal to turn on the comb generator. U6-D controls the 100 MHz amplifier on the RF board, turning it off when in the direct range.

3) "LOCK" LAMP DISABLE

Gates U6-B and U6-C generate a signal which turns off the lock lamp whenever a frequency of 990.0000 or higher is selected (U6-C detects a 9 from U2-D and A9 from U7-B), or when the 100's-of-MHz is not zero when in IF mode (U6-B detects IF mode and 0 from U9).



A3 (SYNTHESIZER), CONTROL LOGIC P.C. ASSEMBLY D39509R2



NOTES: (UNLESS OTHERWISE SPECIFIED)

1) TRANSISTORS:
   ALL PNP ARE.. 2N 3906
   ALL NPN ARE.. 2N 3904
2) ALL DIODES ARE... IN4151
3) ALL RESISTORS:
   VALUE IN ... OHMS
   TOL. 5%
   RATING .... ¼ WATT
4. INTEGRATED CIRCUITS: POWER PIN TO ALL GATES V_{cc} PIN 14 GND PIN 7.

A3 (SYNTHESIZER) CONTROL LOGIC SCHEMATIC D39506R4

A3 (SYNTHESIZER), CONTROL LOGIC PARTS LIST

Ref.	Description	SD Part No.
A3	Control Logic Assembly	D39509
A3	Control Logic Schematic	D39506R2
C1	Capacitor, 100 µF	C0832
C2	Capacitor, 39 µF, 10 V	C0902
CR1	Diode, 1N4151	CR0150
CR2	Diode, 1N4151	CR0150
Q1	Transistor, 2N3906	Q0248
Q2	Transistor, 2N3904	Q0247
Q3	Transistor, 2N3906	Q0248
Q4	Transistor, 2N3904	Q0247
Q5	Transistor, 2N3906	Q0248
Q6	Transistor, 2N3904	Q0247
Q7	Transistor, 2N3906	Q0248
Q8	Transistor, 2N3904	Q0247
Q9	Transistor, 2N3906	Q0248
Q10	Transistor, 2N3904	Q0247
Q11	Transistor, 2N3906	Q0248
Q12	Transistor, 2N3904	Q0247
Q13	Transistor, 2N3906	Q0248
Q14	Transistor, 2N3904	Q0247
Q15	Transistor, 2N3906	Q0248
Q16	Transistor, 2N3904	Q0247
Q17	Transistor, 2N3906	Q0248
Q18	Transistor, 2N3904	Q0247
Q19	Transistor, 2N3906	Q0248
Q20	Transistor, 2N3904	Q0247
Q21	Not Used	
Q22	Not Used	
Q23	Transistor, 2N3906	Q0248
Q24	Transistor, 2N3904	Q0247
R1	Resistor Network	27867
R2	Not Used	
R3	Not Used	
R4	Not Used	
R5	Resistor, 2.7 k, 1/4 W, 5%	R0937
R6	Resistor, 1.8 k, 1/4 W, 5%	R0959
R7	Resistor, 27 k, 1/4 W, 5%	R0824
R8	Resistor, 27 k, 1/4 W, 5%	R0824
R9	Resistor. 27 k, 1/4 W, 5%	R0824
R10	Not Used	

A3 (SYNTHESIZER), CONTROL LOGIC PARTS LIST (Cont'd)

Ref.	Description	SD Part No
R11	Resistor, 27 k, 1/4 W, 5%	R0824
R12	Resistor, 27 k, 1/4 W, 5%	R0824
R13	Resistor, 27 k, 1/4 W, 5%	R0824
R14	Resistor, 27 k, 1/4 W, 5%	R0824
R15	Resistor, 27 k, 1/4 W, 5%	R0824
R16	Resistor, 27 k, 1/4 W, 5%	R0824
R17	Resistor, 27 k, 1/4 W, 5%	R0824
R18	Not Used	
R19	Resistor, 27 k, 1/4 W, 5%	R0824
R20	Not Used	
R21	Resistor, 1.8 k, 1/4 W, 5%	R0959
R22	Resistor, 2.7 k, 1/4 W, 5%	R0937
R23	Resistor, 10 k, 1/4 W, 5%	R0766
R24	Resistor, 2.7 k, 1/4 W, 5%	R0937
R25	Resistor, 1.8 k, 1/4 W, 5%	R0959
U1	Integrated Circuit, SN7410N	19706
U2	Integrated Circuit, MC1808	25733
U3	Integrated Circuit, SN74H11N	25750
U4	Integrated Circuit, MC1808	25734
U5	Integrated Circuit, MC1808	25734
U6	Integrated Circuit, SN15846	19716
U7	Integrated Circuit, MC1810	25735
U8	Integrated Circuit, SN7483N	25738
U9	Integrated Circuit, SN7442	25749
U10	Integrated Circuit, SN7442	25749

CIRCUIT DESCRIPTION
DIVIDE-BY-N BOARD
SCHEMATIC #C39505R2
A6 (SYNTHESIZER)

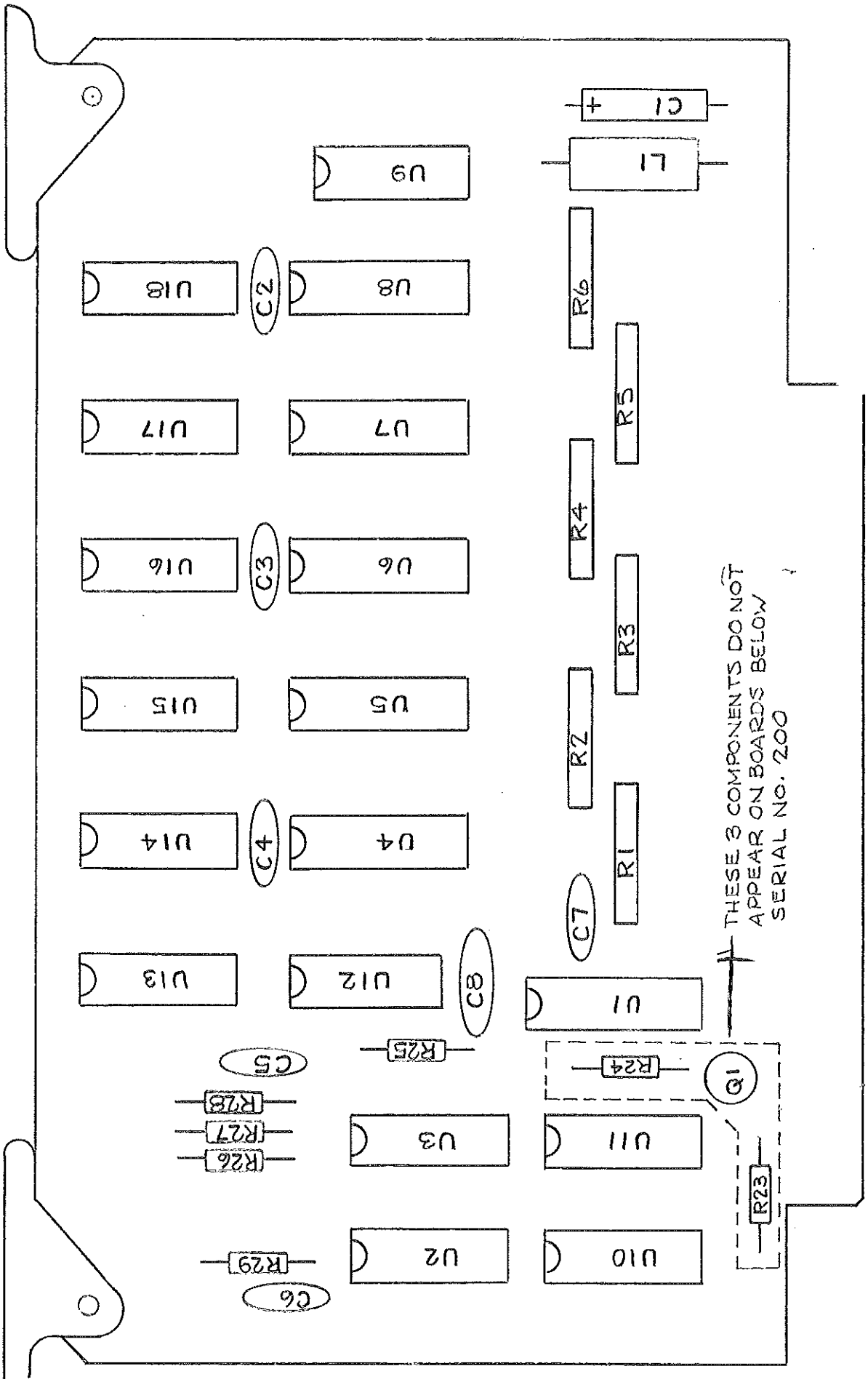
The Divide-By-N Board is used to divide the RF Board oscillator frequency by precisely the dialed-in number. In this way, an output pulse is generated every 100 milliseconds (10 Hz rate) when the loop is locked.

Integrated circuits U1 and U4 - U8 are presettable decade counters which are capable of counting down toward zero from the preset number. The outputs from each counter are decoded to detect when the decade has reached zero. The zero detectors are cascaded such that all decades except U1 (plus flip-flop U9-B) must be zero for the output of U14-A to go low. The outputs from U1 are decoded to detect a count of one. Thus the output of U10-A will go high when the total count is one. The detecting of zero in anticipation is necessary to allow time for the preset circuit to load the decades with the desired frequency setting.

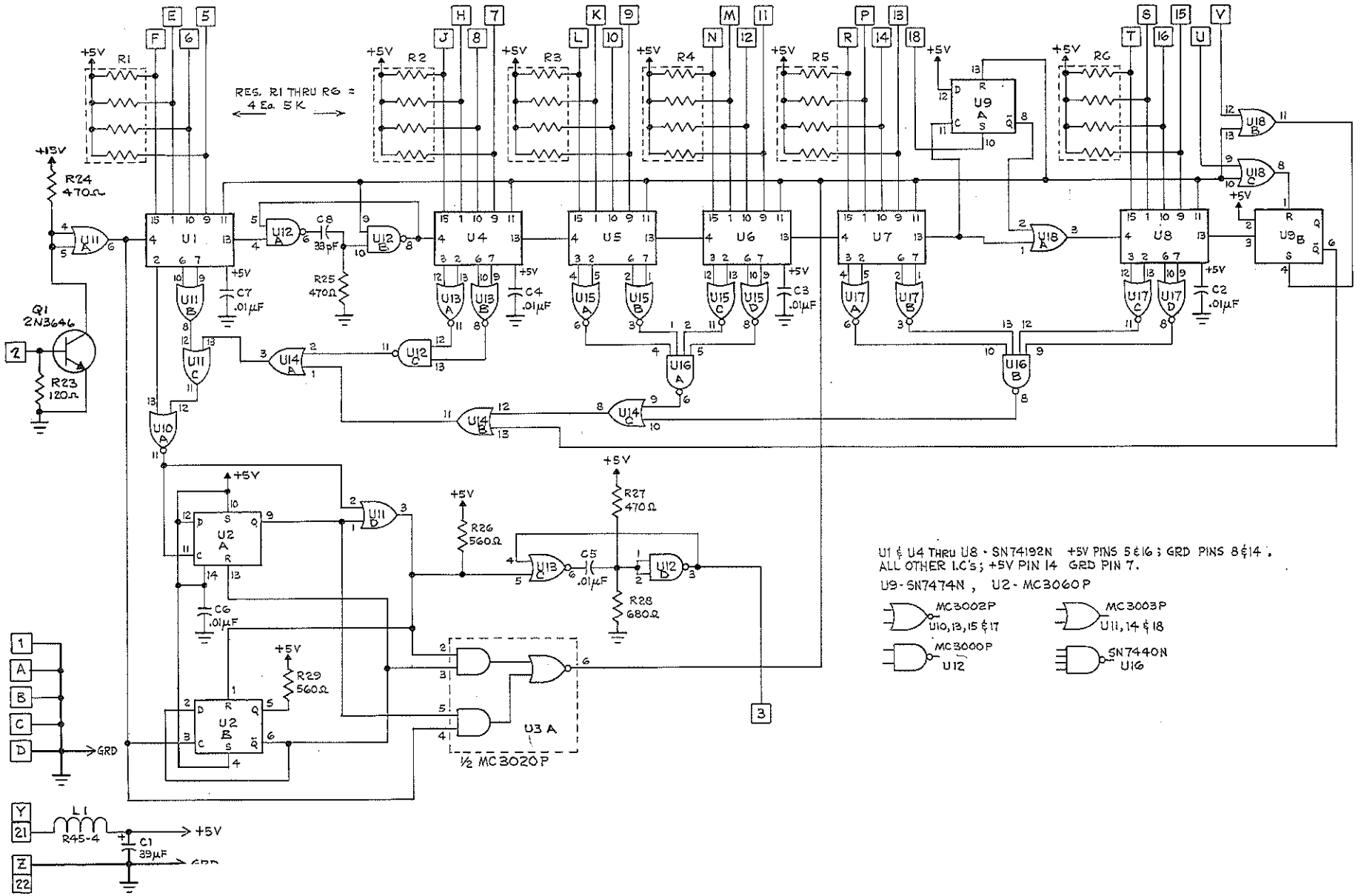
When the output of U10-A transitions positive, flip-flop U2-A will set its Q output high and the output of U11-D will go high. This transition initiates a pulse from one-shot U13-C and U12-D. It also enables flip-flop U2-B by releasing its reset input from a low state. Inputs 2 and 3 of U3-A are now high -- the output of U3-A (6) goes low, initiating the load (Preset) pulse. The positive-going transition of the next pulse on Pin 2 of the board will toggle flip-flop U2-B. This resets flip-flop U2-A and makes input 3 of U3-A low. However, since inputs 4 and 5 are now high, the output remains low. The next negative-going transition of the input counts U1 from one to zero. Depending on the input frequency, the output of U3-A will go high, ending the preset, either when the input pulse transitions negative or very shortly thereafter. This complex process is necessary to allow sufficient time to preset the decades when the input is near 20 MHz while not allowing false counts when it is near 10 MHz.

Gates U12-A and U12-B form a one-shot to ensure sufficient pulse width to operate the divide chain. Flip-flop U9-A and gate U18-A are used to make the oscillator run 10 MHz higher than the dialed-in number. This mode is selected by applying a high level to Pin 18. The load (preset) pulse now resets U9-A making its $\overline{Q}$ output go high. This holds the output of U18-A high, blocking any count pulses from U8. The first pulse from U7 toggles U9-A making the $\overline{Q}$ go low which effectively opens gate U18-A. Any succeeding count pulses now input U8. The next load pulse resets U9-A restarting this count subtraction process. With Pin 18 at a low level gate U18-A is always open.

Flip-flop U9-B is the final element in the count chain. It is preset to a zero output if the dialed-in frequency is below 100 MHz via U18-B. For settings over 100 MHz, it is preset to a one via U18-C; it then counts down to zero.



A6 (SYNTHESIZER), DIVIDE-BY-N ASSEMBLY D39505R2



A6 (SYNTHESIZER), DIVIDE-BY-N SCHEMATIC C39502R2

A6 (SYNTHESIZER), DIVIDE-BY-N PARTS LIST

Ref	Description	SD Part No.
A6	Divide-By-N Assembly	D39595R2
A6	Divide-By-N Schematic	D39502R2
C1	Capacitor, 39 µF, 10 V	C0902
C2	Capacitor, .01 µF	C0562
C3	Capacitor, .01 µF	C0562
C4	Capacitor, .01 µF	C0562
C5	Capacitor, .01 µF	C0562
C6	Capacitor, .01 µF	C0562
C7	Capacitor, .01 µF	C0562
C8	Capacitor, 330 pF, DM	C0540
L1	Inductor, R45-4	L0143
Q1	Transistor, 2N3646	Q0218
R1	Resistor Network, 5 k, .1 W, 20%	27867
R2	Resistor Network, 5 k, .1 W, 20%	27867
R3	Resistor Network, 5 k, .1 W, 20%	27867
R4	Resistor Network, 5 k, .1 W, 20%	27867
R5	Resistor Network, 5 k, .1 W, 20%	27867
R6	Resistor Network, 5 k, .1 W, 20%	27867
R7-R22	Not Used	
R23	Resistor, 120 Ω, 1/4 W, 5%	R1461
R24	Resistor, 470 Ω, 1/4 W, 5%	R1044
R25	Resistor, 470 Ω, 1/4 W, 5%	R1044
R26	Resistor, 560 Ω, 1/4 W, 5%	R0819
R27	Resistor, 470 Ω, 1/4 W, 5%	R1044
R28	Resistor, 680 Ω, 1/4 W, 5%	R1234
R29	Resistor, 560 Ω, 1/4 W, 5%	R0819
U1	Integrated Circuit, SN74192N	25762
U2	Integrated Circuit, MC3060	25769
U3	Integrated Circuit, MC3020	25768
U4	Integrated Circuit, SN74192N	25762
U5	Integrated Circuit, SN74192N	25762
U6	Integrated Circuit, SN74192N	25762
U7	Integrated Circuit, SN74192N	25762
U8	Integrated Circuit, SN74192N	25762
U9	Integrated Circuit, SN7474	25241
U10	Integrated Circuit, MC3002	25739
U11	Integrated Circuit, MC3003	25767
U12	Integrated Circuit, MC3000	25766
U13	Integrated Circuit, MC3002	25739
U14	Integrated Circuit, MC3003	25767
U15	Integrated Circuit, MC3002	25739

A6 (SYNTHESIZER), DIVIDE-BY-N PARTS LIST (Cont'd)

Ref.	Description	SD Part No.
U16	Intergrated Circuit, SN7440N	25714
U17	Intergrated Circuit, MC3002	25739
U18	Intergrated Circuit, MC3003	25767

CIRCUIT DESCRIPTION
PHASE DETECTOR BOARD
SCHEMATIC #D39494R2
A8 (SYNTHESIZER)

The Phase Detector Board contains circuitry to compare the phase of the divided-down RF oscillator with that of the divided-down 1 MHz reference. The resulting control voltage is used to maintain the oscillator on frequency. A more detailed description of the complete control loop is given in this section.

A complex slope ramp is generated by R22, C11, R23, and C12. This ramp is such that the rate of voltage increase is in itself increasing. This function coarsely approximates an exponential curve. Amplifier U5 provides a gain of approximately 3 with a high-impedance input to avoid loading the ramp generator. The output impedance is very low to permit the first sampling capacitor to charge rapidly.

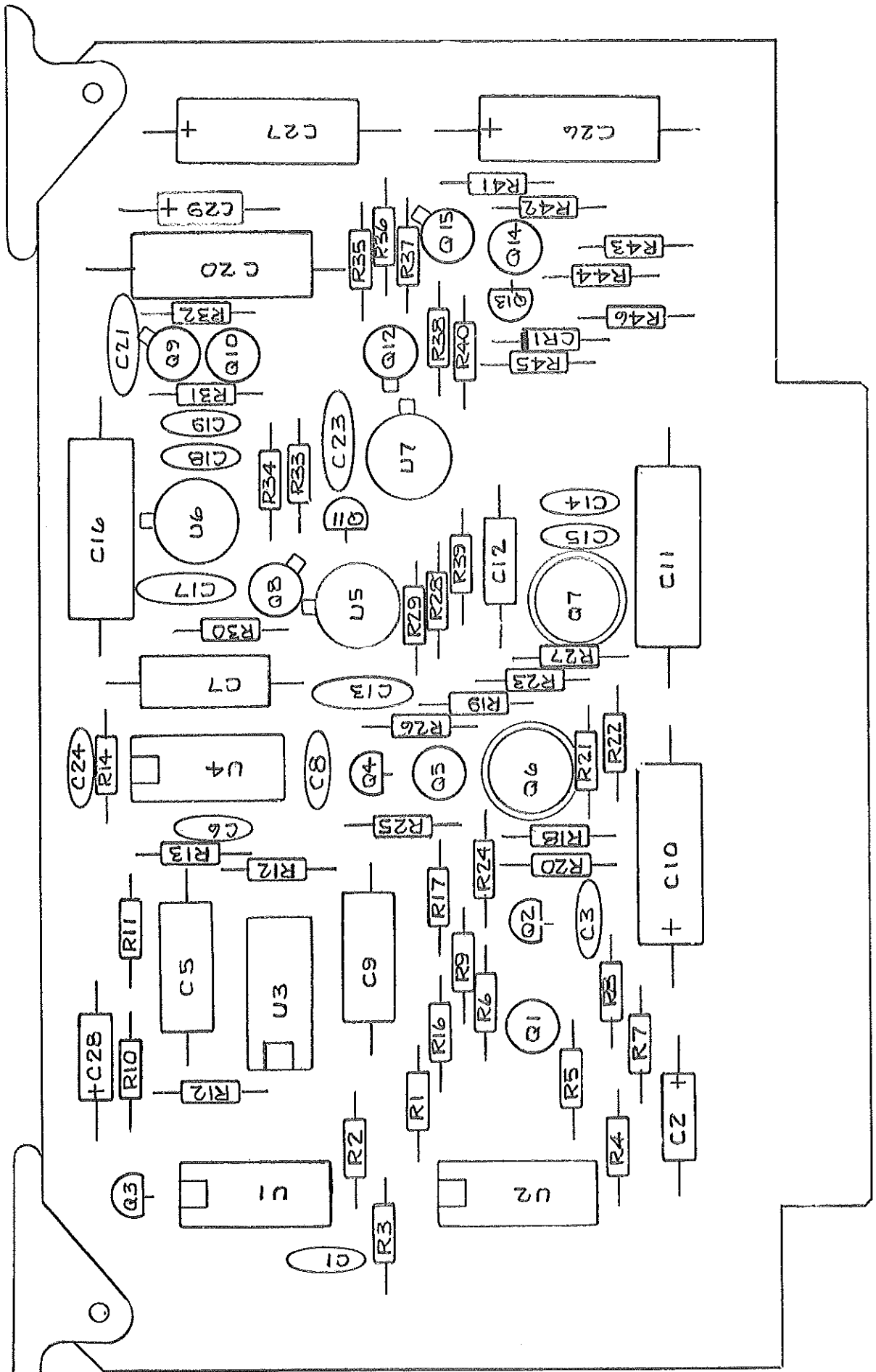
To generate the sampling pulses, the output from the Divide-by-N board (at 10 Hz) is used to trigger a one-shot pulse generator, U3-A and U3-B. This is sample pulse #1. Gate U4-A provides the proper polarity signal to drive delay one-shot U4-B and U4-C. This circuit provides a time delay between sample pulses. The output of the delay one-shot triggers the second one-shot generator. U3-C and U3-D generate the second sampling pulse. Each sampling pulse is converted from 5 V logic levels to a signal which is normally at -5 V and goes to an open circuit during the sample. Internal transistors Q4 and Q5 shift pulse #1; Q10 and Q11 shift pulse #2.

When the gate of FET Q8 is released from -5 V by the first sampling pulse, it is turned on via R30. Capacitor C16 now charges rapidly to the ramp voltage-level present. When the sample pulse ends, the gate returns to -5 V and Q8 turns off. Since the off resistance of Q8 and the input impedance of U6 are high, C16 holds the voltage it had at the end of the sample time. The decay in the voltage is slow enough that only a small fraction has been lost when the next sample pulse arrives. The delayed sample pulse #2 operates FET Q9 in the same way pulse #1 operated Q8. Amplifier U6 has a gain of 1 and simply provides a high-impedance load for C16 and a low-impedance source to drive C20. C20 will charge rapidly to the same voltage as C16 during the second sampling interval. Capacitor C21 is used to cancel transients produced by switching Q9.

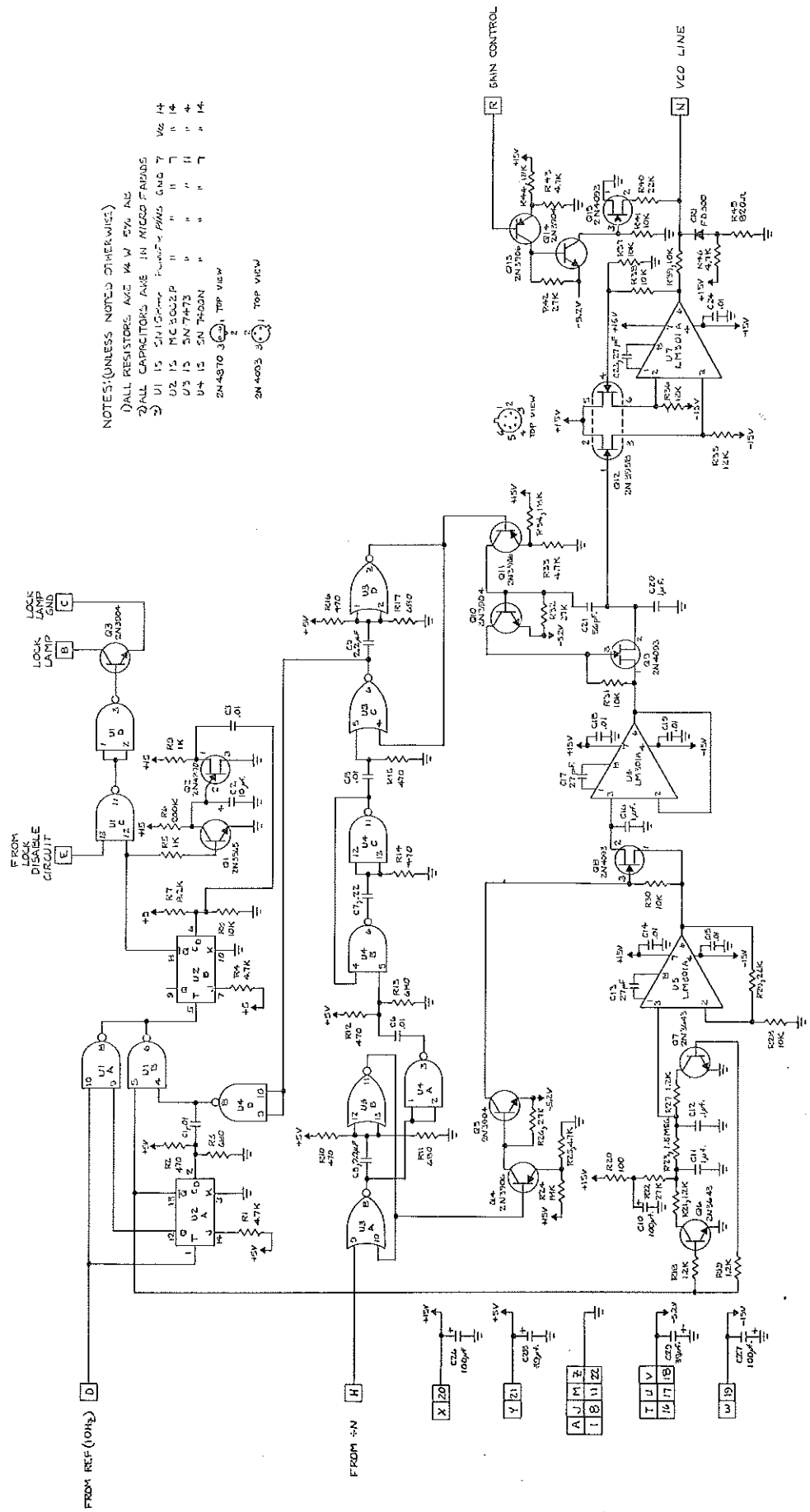
The output of U3-C, inverted by U4-D,is used to reset control flip-flop U2-A. This causes the $\overline{Q}$ output to go high (+5 V) thereby turning on transistors Q6 and Q7. With Q6 and Q7 on, the ramp capacitors are discharged to ground through R21 and R27, stopping the ramp. The next negative-going transition of the 10 Hz reference causes U2-A to switch states, the $\overline{Q}$ output goes low, Q6 and Q7 turn off,and the ramp starts upward from zero. The cycle is complete.

Gates U1-A and U1-B are used to detect an "out-of-lock" condition. This is done by detecting the presence of a second pulse (or negative transition) from one of the 10 Hz inputs prior to the other input producing a pulse. For example, two successive pulses from the divide-by-N 10 Hz signal with no intervening negative-going transition from the 10 Hz reference will cause U1-A to go low. This transition causes the $\overline{Q}$ output of U2-B to go low. The output of U1-C now goes high, U1-D goes low, Q3 turns off, and the front-panel lock-lamp goes out. The low output from U2-B also turns off transistor Q1, starting timer Q2. This timer holds the lamp off for about .1 second, then resets U2-B. If the out-of-lock condition persists, the lamp will blink on and off. The other input to U1-C is used to turn off the lock-lamp for two conditions. One is a dialed-in frequency exceeding 989.9999 MHz in RCVR, CW, or FM Mode. The other is when any digit, other than zero, is set into the highest dial when in IF Mode.

The second sampling capacitor, C20 is connected to amplifier U7 via the dual FET Q12. The amplifier provides a gain of two, the FET pair gives a very high input impedance with low leakage. Q15 is used as a switch to allow attenuation of the output voltage when operating in the lower end of the oscillator ranges. This improves loop stability. The switch is controlled automatically by a logic level signal on Pin R. Q13 and Q14 provide proper levels to control Q15. Diode CR1 and bias network R45 and R46 are used to prevent the output voltage from dropping below about 1 volt. This ensures that the oscillator control diodes will never be forward-biased.



A8 (SYNTHESIZER), PHASE DETECTOR P.C. ASSEMBLY D39497R1



A8 (SYNTHESIZER), PHASE DETECTOR SCHEMATIC D39494R2

A8 (SYNTHESIZER), PHASE DETECTOR PARTS LIST

Ref.	Description	SD Part No.
A8	Phase Detector Assembly	D39497R1
A8	Phase Detector Schematic	D39494R2
C1	Capacitor, .01 µF, Disc	C0562
C2	Capacitor, 10 µF, Tant	C0353
C3	Capacitor, .01 µF, Disc	C0562
C4	Not Used	
C5	Capacitor, 1 µF, 50 V, Paper	03279390
C6	Capacitor, .01 µF, Disc	C0562
C7	Capacitor, .22 µF, Mylar	03278830
C8	Capacitor, .01 µF, Disc	C0562
C9	Capacitor, 1 µF, 50 V, Paper	03279390
C10	Capacitor, 100 µF, Electro	C0832
C11	Capacitor, 1 µF	C0314
C12	Capacitor, .1 µF, 200 V	C0382
C13	Capacitor, 27 pF, DM	C0530
C14	Capacitor, .01 µF, Disc	C0562
C15	Capacitor, .01 µF, Disc	C0562
C16	Capacitor, 1 µF	C0314
C17	Capacitor, 27 pF, DM	C0530
C18	Capacitor, .01 µF, Disc	C0562
C19	Capacitor, .01 µF, Disc	C0562
C20	Capacitor, 1 µF	C0314
C21	Capacitor, 56 pF, DM	C0534
C22	Not Used	
C23	Capacitor, 27 pF, DM	C0530
C24	Capacitor, .01 µF, Disc	C0562
C25	Not Used	
C26	Capacitor, 100 µF, Electro	C0832
C27	Capacitor, 100 µF, Electro	C0832
C28	Capacitor, 39 µF, Tant	C0902
C29	Capacitor, 39 µF, Tant	C0902
CR1	Diode, FD300	26012320
Q1	Transistor, 2N3565	Q0237
Q2	Transistor, FET 2N4871	Q0266
Q3	Transistor, 2N3904	Q0247
Q4	Transistor, 2N3906	Q0248
Q5	Transistor, 2N3646	Q0218
Q6	Transistor, 2N3643	Q0179
Q7	Transistor, 2N3643	Q0179
Q8	Transistor, FET 2N4093	Q0301

A8 (SYNTHESIZER), PHASE DETECTOR PARTS LIST (Cont'd)

Ref.	Description	SD Part No.
Q9	Transistor, FET 2N4093	Q0301
Q10	Transistor, 2N3646	Q0218
Q11	Transistor, 2N3906	Q0248
Q12	Transistor, Dual FET 2N3958	26015100
Q13	Transistor, 2N3906	Q0248
Q14	Transistor, 2N3646	Q0218
Q15	Transistor, FET 2N4093	Q0301
R1	Resistor, 4.7 k, 1/4 W, 5%	R0982
R2	Resistor, 470 Ω, 1/4 W, 5%	R1044
R3	Resistor, 680 Ω, 1/4 W, 5%	R1234
R4	Resistor, 4.7 k, 1/4 W, 5%	R0982
R5	Resistor, 1 k, 1/4 W, 5%	R0765
R6	Resistor, 200 k, 1/4 W, 5%	R0823
R7	Resistor, 8.2 k, 1/4 W, 5%	R0883
R8	Resistor, 10 k, 1/4 W, 5%	R0766
R9	Resistor, 1 k, 1/4 W, 5%	R0765
R10	Resistor, 470 Ω, 1/4 W, 5%	R1044
R11	Resistor, 680 Ω, 1/4 W, 5%	R1234
R12	Resistor, 470 Ω, 1/4 W, 5%	R1044
R13	Resistor, 680 Ω, 1/4 W, 5%	R1234
R14	Resistor, 470 Ω, 1/4 W, 5%	R1044
R15	Resistor, 470 Ω, 1/4 W, 5%	R1044
R16	Resistor, 470 Ω, 1/4 W, 5%	R1044
R17	Resistor, 680 Ω, 1/4 W, 5%	R1234
R18	Resistor, 1.2 k, 1/4 W, 5%	R0908
R19	Resistor, 1.2 k, 1/4 W, 5%	R0908
R20	Resistor, 100 Ω, 1/4 W, 5%	R0966
R21	Resistor, 1.2 k, 1/4 W, 5%	R0908
R22	Resistor, 27 k, 1/4 W, 5%	R0824
R23	Resistor, 1.2 M, 1/4 W, 5%	R1299
R24	Resistor, 18 k, 1/4 W, 5%	R0785
R25	Resistor, 4.7 k, 1/4 W, 5%	R0982
R26	Resistor, 27 k, 1/4 W, 5%	R0824
R27	Resistor, 1.2 k, 1/4 W, 5%	R0908
R28	Resistor, 10 k, 1/4 W, 5%	R0766
R29	Resistor, 22 k, 1/4 W, 5%	R0768
R30	Resistor, 10 k, 1/4 W, 5%	R0766
R31	Resistor, 10 k, 1/4 W, 5%	R0766
R32	Resistor, 27 k, 1/4 W, 5%	R0824
R33	Resistor, 4.7 k, 1/4 W, 5%	R0982
R34	Resistor, 18 k, 1/4 W, 5%	R0785
R35	Resistor, 12 k, 1/4 W, 5%	R0759

A8 (SYNTHESIZER), PHASE DETECTOR PARTS LIST (Cont'd)

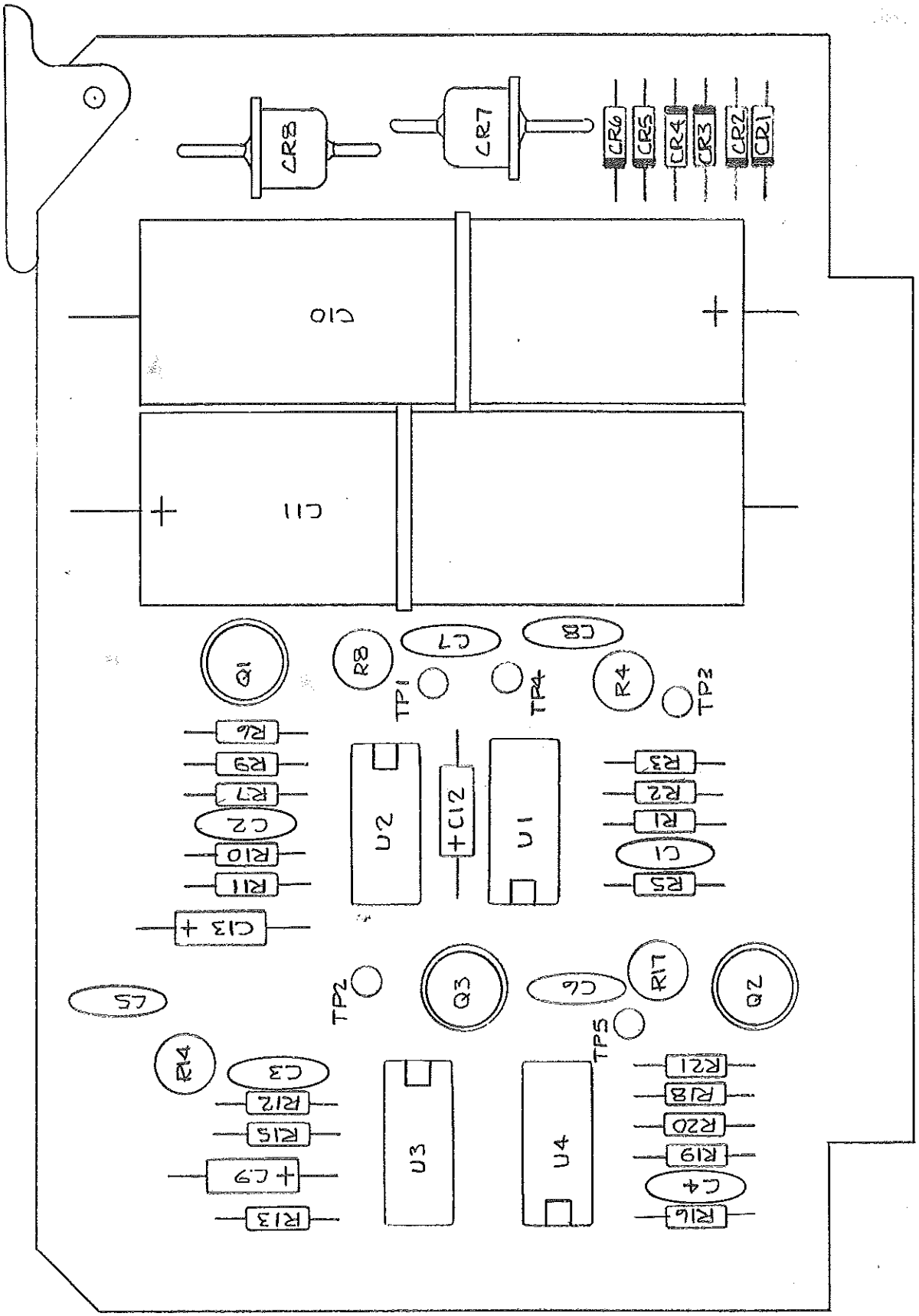
Ref.	Description	SD Part No.
R36	Resistor, 12 k, 1/4 W, 5%	R0759
R37	Resistor, 10 k, 1/4 W, 5%	R0766
R38	Resistor, 10 k, 1/4 W, 5%	R0766
R39	Resistor, 10 k, 1/4 W, 5%	R0766
R40	Resistor, 22 k, 1/4 W, 5%	R0768
R41	Resistor, 10 k, 1/4 W, 5%	R0766
R42	Resistor, 27 k, 1/4 W, 5%	R0824
R43	Resistor, 4.7 k, 1/4 W, 5%	R0982
R44	Resistor, 18 k, 1/4 W, 5%	R0785
R45	Resistor, 4.7 k, 1/4 W, 5%	R0982
R46	Resistor, 820 Ω, 1/4 W, 5%	R0762
U1	Integrated Circuit, SN15846N	19716
U2	Integrated Circuit, SN7473N	19709
U3	Integrated Circuit, MC3002P	25739
U4	Integrated Circuit, SN7400N	19705
U5	Integrated Circuit, LM301A	25745
U6	Integrated Circuit, LM301A	25745
U7	Integrated Circuit, LM301A	25745

CIRCUIT DESCRIPTION
POWER SUPPLY
SCHEMATIC #D39510R4
A9 (SYNTHESIZER)
101-300

The power supply consists of a transformer, a plug-in card containing the rectifier diodes and regulator circuits, and rear-panel series-pass transistors for the regulators.

Voltage from the split-primary transformer is fed to four full-wave rectifiers on the plug-in regulator card. Diodes CR1 and CR2 provide the -21 V unregulated supply (filtered by C11 on the board); diodes CR3 and CR4, the +21 V (filter C10 on the board); CR5 and CR6, the -9 V (filter C8 off the board); and CR7 and CR8, the +9 V (filter C9 off the board). The regulated +15 volts is derived from the +21 V supply. Integrated circuit regulator U1, with adjustment R4 and series-pass transistor Q9, comprise the +15 V regulator. U2, R8, Q10 and Q1 provide -15 volts. Q1 is required to provide additional current amplification. The remaining two regulated supplies, +5 V and -5 V, are produced in a similar manner.

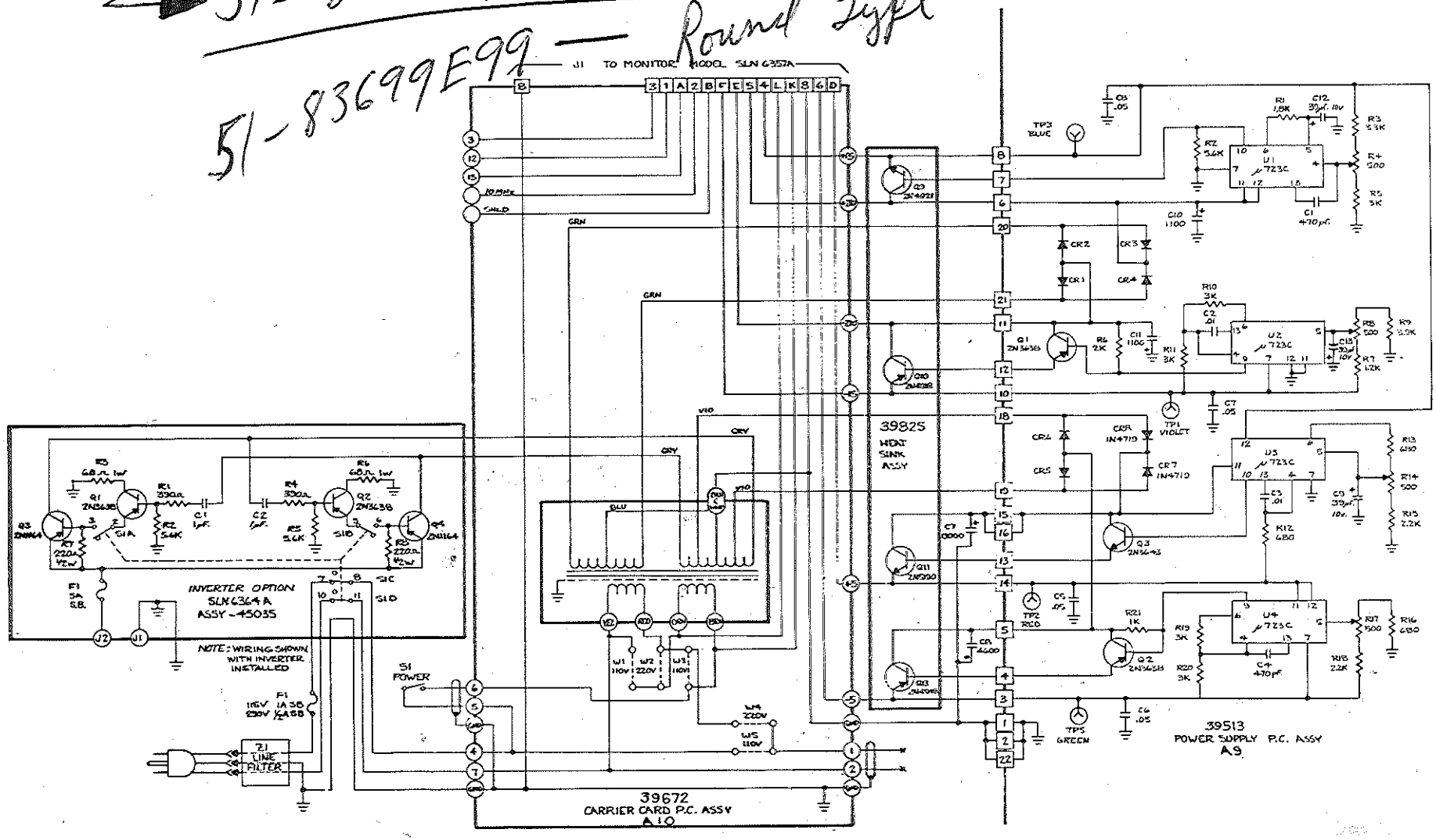
The printed circuit board mounted to the transformer makes provision for line voltage selection by means of jumper wires. Jumpers are provided for both the power transformer and the oscillator supply. An edge-connector is used to provide power and interconnects for the Model SLN6357A Monitor.



A9 (SYNTHESIZER), POWER SUPPLY P.C. ASSEMBLY D39513R1

Main one → 51-82554F38 Coffin Type

51-83699E99 — Round Type



R9 (SYNTHESIZER), POWER SUPPLY P.C. SCHEMATIC D39510R4

A9 (SYNTHESIZER), POWER SUPPLY PARTS LIST

Ref	Description	SD Part No.
A9	Power Supply Assembly	D39513R1
A9	Power Supply Schematic	C39510R4
C1	Capacitor, 470 pF, DM	C0542
C2	Capacitor, .01 µF, Disc	C0562
C3	Capacitor, .01 µF, Disc	C0562
C4	Capacitor, 470 pF, DM	C0542
C5	Capacitor, .05 µF, Disc	C0708
C6	Capacitor, .05 µF, Disc	C0708
C7	Capacitor, .05 µF, Disc	C0708
C8	Capacitor, .05 µF, Disc	C0708
C9	Capacitor, 39 µF, 10 V	C0902
C10	Capacitor, 110 µF, 30 V	C1162
C11	Capacitor, 110 µF, 30 V	C1162
C12	Capacitor, 39 µF, 10 V	C0902
C13	Capacitor, 39 µF, 10 V	C0902
CR1	Diode, IN4005	CR0284
CR2	Diode, IN4005	CR0284
CR3	Diode, IN4005	CR0284
CR4	Diode, IN4005	CR0284
CR5	Diode, IN4005	CR0284
CR6	Diode, IN4005	CR0284
CR7	Diode, IN4719	CR0251
CR8	Diode, IN4719	CR0251
Q1	Transistor, 2N3638	Q0181
Q2	Transistor, 2N3638	Q0181
Q3	Transistor, 2N3643	Q0179
R1	Resistor, 1.8 k, 1/4 W, 5%	R0959
R2	Resistor, 5.6 k, 1/4 W, 5%	R0821
R3	Resistor, 3.3 k, 1/4 W, 5%	R0742
R4	Resistor, 500 Ω, Potentiometer	R2375
R5	Resistor, 3 k, 1/4 W, 5%	R0711
R6	Resistor, 2 k, 1/4 W, 5%	R0734
R7	Resistor, 1.2 k, 1/4 W, 5%	R0809
R8	Resistor, 500 Ω, Potentiometer	R2375
R9	Resistor, 3.9 k, 1/4 W, 5%	R0939
R10	Resistor, 3 k, 1/4 W, 5%	R0711
R11	Resistor, 3 k, 1/4 W, 5%	R0711
R12	Resistor, 680 Ω, 1/4 W, 5%	R1234
R13	Resistor, 680 Ω, 1/4 W, 5%	R1234
R14	Resistor, 500 Ω, Potentiometer	R2375
R15	Resistor, 2.2 k, 1/4 W, 5%	R0749

A9 (SYNTHESIZER), POWER SUPPLY PARTS LIST (Cont'd)

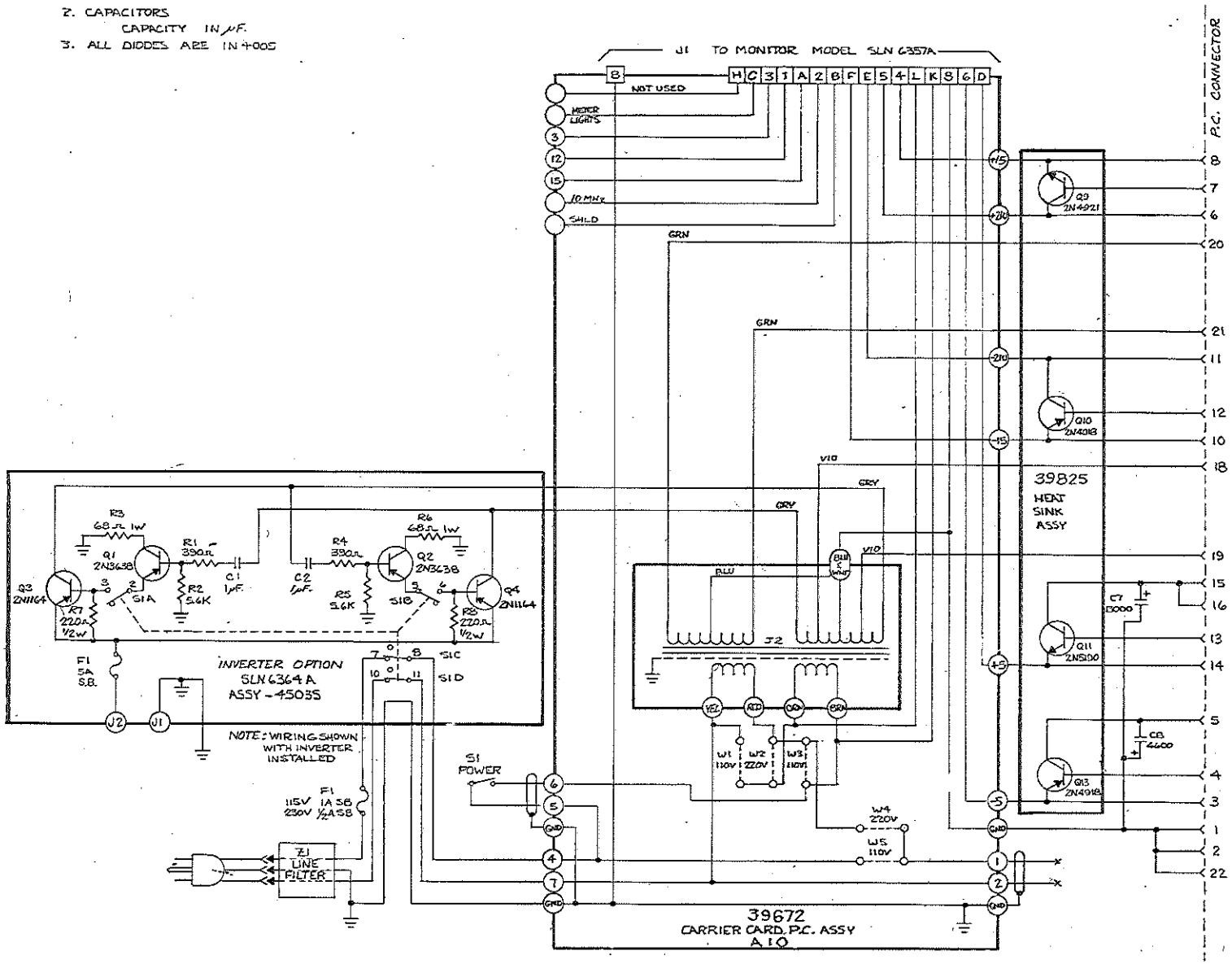
Ref.	Description	SD Part No.
R16	Resistor, 680 Ω, 1/4 W, 5%	R1234
R17	Resistor, 500 Ω, Potentiometer	R2375
R18	Resistor, 2.2k, 1/4 W, 5%	R0749
R19	Resistor, 3 k, 1/4 W, 5%	R0711
R20	Resistor, 3 k, 1/4 W, 5%	R0711
R21	Resistor, 1 k, 1/4 W, 5%	R0765
U1	Integrated Circuit, μ723C	25761
U2	Integrated Circuit, μ723C	25761
U3	Integrated Circuit, μ723C	25761
U4	Integrated Circuit, μ723C	25761
TP1	Test Point, Violet	E0286
TP2	Test Point, Red	E0279
TP3	Test Point, Blue	E0285
TP4	Test Point, Black	E0280
TP5	Test Point, Green	E0281

CIRCUIT DESCRIPTION
POWER SUPPLY
SCHEMATIC #D39510R5
(SYNTHESIZER)

The Power Supply consists of a transformer, a plug-in card containing the rectifier diodes and regulator circuits, and rear-panel series-pass transistors for the regulators.

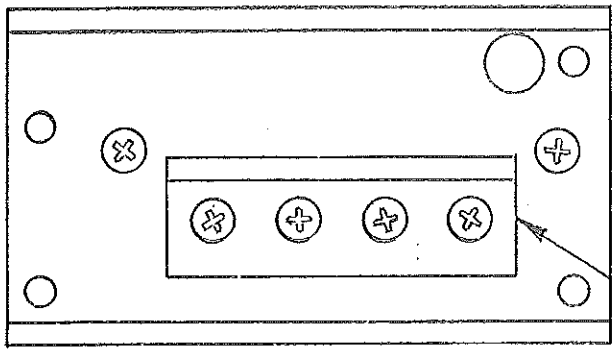
The printed-circuit board mounted to the transformer makes provision for line voltage selection by means of jumper wires. Jumpers are provided for both the power transformer and the oscillator supply. An edge-connector is used to provide power and interconnects for the Model SLN6357A Monitor.

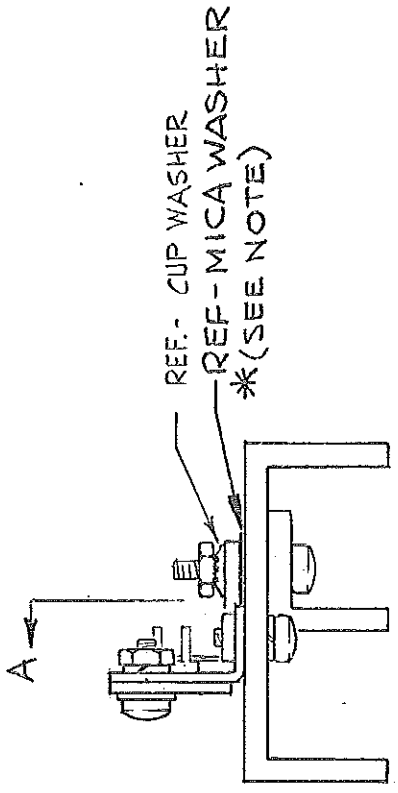
NOTES:(EXCEPT AS NOTED)
1. RESISTORS: VALUE IN OHMS
POWER 1/4 WATT
TOL. ± 5%
2. CAPACITORS
CAPACITY IN μF.
3. ALL DIODES ARE IN4005

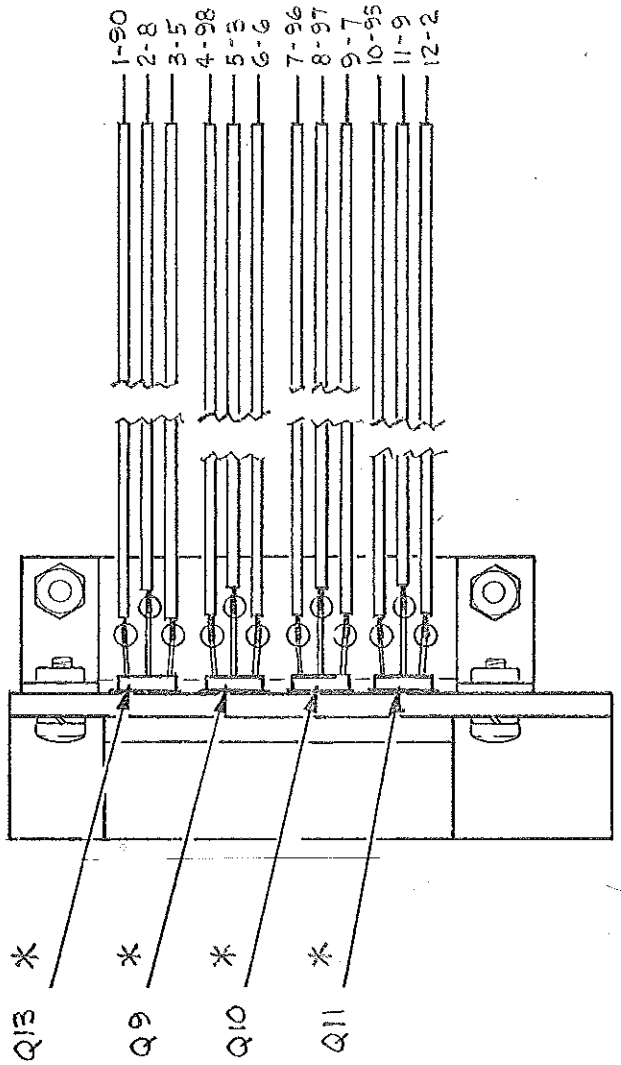


REFER TO D39514, A9, FOR POWER SUPPLY REGULATOR P.C. BOARD SCHEMATIC

(SYNTHESIZER), POWER SUPPLY SCHEMATIC #D39510R5







VIEW A-A

(SYNTHESIZER), POWER SUPPLY HEAT SINK ASSEMBLY C39825R2

(SYNTHESIZER) POWER SUPPLY HEAT SINK ASSEMBLY PARTS LIST

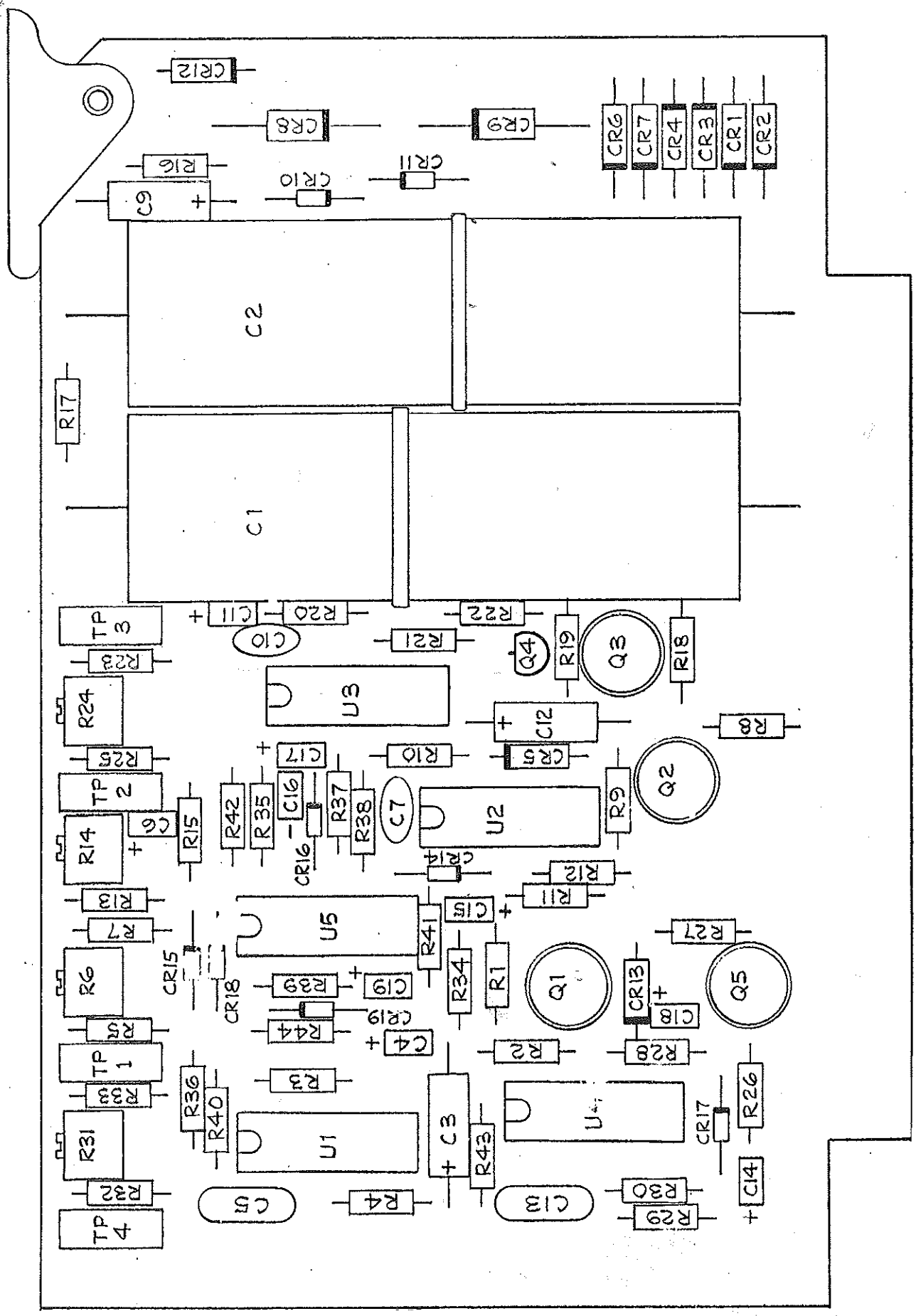
Ref.	Description	SD Part No.
	Power Supply Heat Sink Assembly	C39825R1
	Heat Sink	39814
Q9	Transistor 2N4921	Q0267
Q10	Transistor 2N4918	Q0268
Q11	Transistor 2N5190	Q0281
Q12	Not Used	
Q13	Transistor 2N4918	Q0268

CIRCUIT DESCRIPTION
POWER SUPPLY REGULATOR
SCHEMATIC #D39514R1
A9 (SYNTHESIZER)

This circuit regulates the critical dc voltages necessary to operate the Service Monitor.

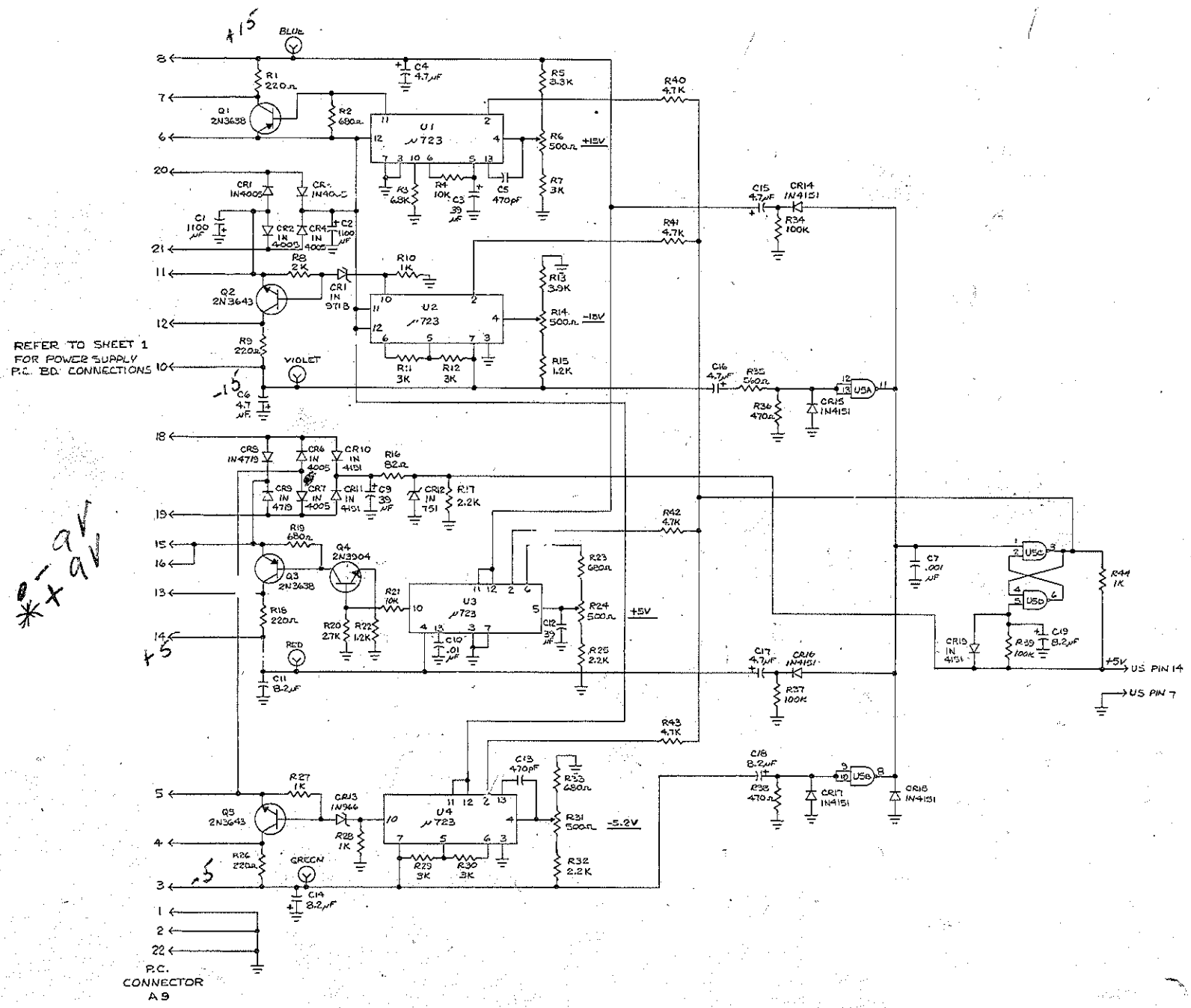
Voltage from the split-primary transformer is fed to four full-wave rectifiers on the plug-in regulator card. Diodes CR1 and CR2 provide the -21 V unregulated supply (filtered by C11 on the board); diodes CR3 and CR4, the +21 V (filter C10 on the board); CR5 and CR6, the -9 V (filter C8 off the board); and CR7 and CR8, the +9 V (filter C9 off the board). The regulated +15 volts is derived from the +21 V supply. Integrated circuit regulator U1, with adjustment R4 and series-pass transistor Q9, comprise the +15 V regulator. U2, R8, Q10 and Q1 provide -15 volts. The remaining two regulated supplies, +5 V and -5 V, are produced in a similar manner.

A short-circuit protection network has been incorporated into the power supply regulator. Four capacitive-coupling circuits sense when any of the supplies drop to zero (short circuit, for example). This causes all four supplies to instantly turn off. The supplies will remain off (although the power lights and meter lights stay on) until the main power switch has been turned off, then reenergized. This resets the protective network and power is reapplied to the instrument circuits.



A9 (SYNTHESIZER), POWER SUPPLY REGULATOR P.C. ASSEMBLY D39513A

A9 (SYNTHESIZER) POWER SUPPLY REGULATOR



A9 (SYNTHESIZER), POWER SUPPLY REGULATOR P.C. SCHEMATIC D39514R1

A9 (SYNTHESIZER), POWER SUPPLY REGULATOR PARTS LIST

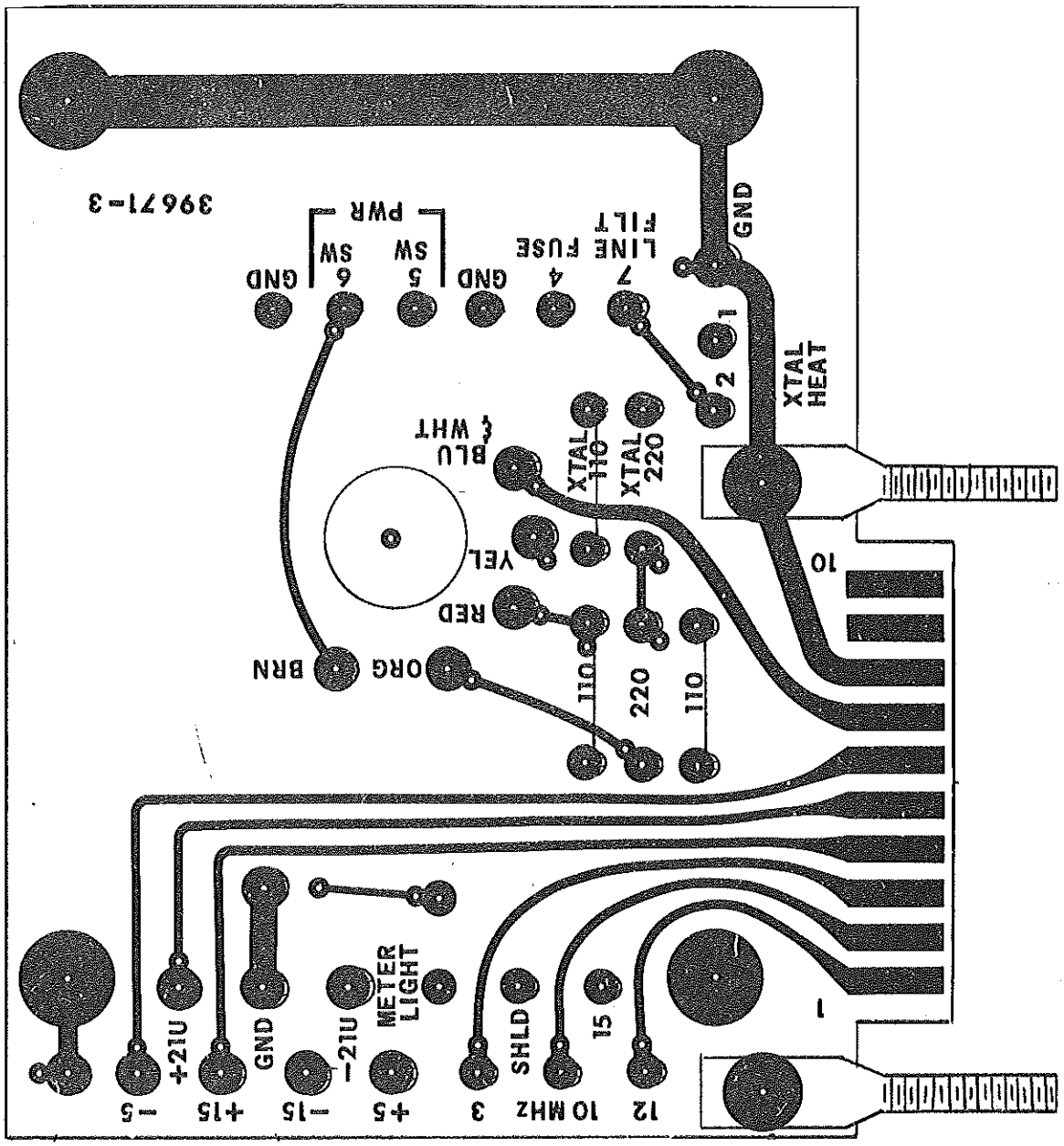
Ref.	Description	SD Part No
A9	Power Supply Assembly	D39513A
A9	Power Supply Schematic	D39514R1
C1	Capacitor, 1100 µF, 30 V	C1162
C2	Capacitor, 1100 µF, 30 V	C1162
C3	Capacitor, 39 µF, 10 V	C0902
C4	Capacitor, 4.7 µF, 25 V	03287820
C5	Capacitor, 470 pF, DM	C0542
C6	Capacitor, 4.7 µF, 25 V	03287820
C7	Capacitor, .001 µF, Disc	C0424
C8	Not Used	
C9	Capacitor, 39 µF, 10 V	C0902
C10	Capacitor, .01 µF, Disc	C0562
C11	Capacitor, 8.2 µF, 15 V	03287360
C12	Capacitor, 39 µF, 10 V	C0902
C13	Capacitor, 470 pF, DM	C0542
C14	Capacitor, 8.2 µF, 15 V	03287360
C15	Capacitor, 4.7 µF, 25 V	03287820
C16	Capacitor, 4.7 µF, 25 V	03287820
C17	Capacitor, 4.7 µF, 25 V	03287820
C18	Capacitor, 8.2 µF, 15 V	03287360
C19	Capacitor, 8.2 µF, 15 V	03287360
CR1	Diode, 1N4005	CR0284
CR2	Diode, 1N4005	CR0284
CR3	Diode, 1N4005	CR0284
CR4	Diode, 1N4005	CR0284
CR5	Diode, 1N971B	CR0229
CR6	Diode, 1N4005	CR0284
CR7	Diode, 1N4005	CR0284
CR8	Diode, 1N4719	CR0251
CR9	Diode, 1N4719	CR0251
CR10	Diode, 1N4151	CR0150
CR11	Diode, 1N4151	CR0150
CR12	Diode, 1N751	CR0198
CR13	Not Used	
CR14	Diode, 1N4151	CR0150
CR15	Diode, 1N4151	CR0150
CR16	Diode, 1N4151	CR0150
CR17	Diode, 1N4151	CR0150
CR18	Diode, 1N4151	CR0150
CR19	Diode, 1N4151	CR0150

A9 (SYNTHESIZER), POWER SUPPLY REGULATOR PARTS LIST (Cont'd)

Ref.	Description	SD Part No.
Q1	Transistor, 2N3638	Q0181
Q2	Transistor, 2N3643	Q0179
Q3	Transistor, 2N3638	Q0181
Q4	Transistor, 2N3904	Q0247
Q5	Transistor, 2N3643	Q0179
R1	Resistor, 220 Ω, 1/4 W, 5%	R0760
R2	Resistor, 680 Ω, 1/4 W, 5%	R1234
R3	Resistor, 6.8 k, 1/4 W, 5%	R0696
R4	Resistor, 10 k, 1/4 W, 5%	R0766
R5	Resistor, 3.3 k, 1/4 W, 5%	R0742
R6	Resistor, 500 Ω, Potentiometer, 1 Turn	R2448
R7	Resistor, 3 k, 1/4 W, 5%, CC	R0711
R8	Resistor, 2 k, 1/4 W, 5%, CC	R0734
R9	Resistor, 220 Ω, 1/4 W, 5%	R0760
R10	Resistor, 1 k, 1/4 W, 5%	R0765
R11	Resistor, 3 k, 1/4 W, 5%, CC	R0711
R12	Resistor, 3 k, 1/4 W, 5%, CC	R0711
R13	Resistor, 3.9 k, 1/4 W, 5%	R0939
R14	Resistor, 500 Ω, Potentiometer, 1 Turn	R2448
R15	Resistor, 1.2 k, 1/4 W, 5%	R0809
R16	Resistor, 82 Ω, 1/4 W, 5%	R1059
R17	Resistor, 2.2 k, 1/4 W, 5%	R0749
R18	Resistor, 220 Ω, 1/4 W, 5%	R0760
R19	Resistor, 680 Ω, 1/4 W, 5%	R1234
R20	Resistor, 2.7 k, 1/4 W, 5%	R0937
R21	Resistor, 10 k, 1/4 W 5%	R0766
R22	Resistor, 1/2 k, 1/4 W, 5%	R0809
R23	Resistor, 680 Ω, 1/4 W, 5%	R1234
R24	Resistor, 500 Ω, Potentiometer, 1 Turn	R2448
R25	Resistor, 2.2 k, 1/4 W, 5%	R0749
R26	Resistor, 220 Ω, 1/4 W, 5%	R0760
R27	Resistor, 1 k, 1/4 W, 5%	R0765
R28	Resistor, 1 k, 1/4 W, 5%	R0765
R29	Resistor, 3 k, 1/4 W, 5%, CC	R0711
R30	Resistor, 3 k, 1/4 W, 5%, CC	R0711
R31	Resistor, 500 Ω, Potentiometer, 1 Turn	R2448
R32	Resistor, 2.2 k, 1/4 W, 5%	R0749
R33	Resistor, 680 Ω, 1/4 W, 5%	R1234
R34	Resistor, 100 k, 1/4 W, 5%	R0741
R35	Resistor, 560 Ω, 1/4 W, 5%	R0819

A9 (SYNTHESIZER), POWER SUPPLY REGULATOR PARTS LIST (Cont'd)

Ref.	Description	SD Part No.
R36	Resistor, 470 Ω, 1/4 W, 5%	R1044
R37	Resistor, 100 k, 1/4 W, 5%	R0741
R38	Resistor, 470 Ω, 1/4 W, 5%	R1044
R39	Resistor, 100 k, 1/4 W, 5%	R0741
R40	Resistor, 4.7 k, 1/4 W, 5%	R0892
R41	Resistor, 4.7 k, 1/4 W, 5%	R0892
R42	Resistor, 4.7 k, 1/4 W, 5%	R0892
R43	Resistor, 4.7 k, 1/4 W, 5%	R0892
R44	Resistor, 1 k, 1/4 W, 5%	R0765
U1	Integrated Circuit, µ723C - mot. # 51-82554F38	25761
U2	Integrated Circuit, µ723C	25761
U3	Integrated Circuit, µ723C	25761
U4	Integrated Circuit, µ723C	25761
U5	Integrated Circuit, MC846P	19716
TP1	Test Point, Blue	09063160
TP2	Test Point, Violet	E0241
TP3	Test Point, Red	E0236
TP4	Test Point, Green	E0239



A10 (SYNTHESIZER), CARRIER CARD P.C. ASSEMBLY B39672R2

3) WIDE BAND, UNTUNED AMPLIFIER

The final circuit on this board is a wideband, untuned, amplifier which is used to produce the high level IF out. This circuit includes a diode attenuator, CR15 and CR16. A variable-voltage from the front-panel "IF ATTEN" controls the amplitude of the signal at the amplifier input and thus determines the output amplitude. The amplifier itself consists of two ac-coupled, untuned stages followed by a complimentary-symmetry emitter-follower output stage. Networks R34, C28, C27 and R38, C31, C30 provide frequency compensation by increasing the stage gain with increasing frequency to compensate for device rolloff. Diodes CR17 and CR18 reduce crossover-distortion in the output stage. R43 and R44 protect the output transistors from thermal instability. A high-voltage output coupling capacitor, C33, isolates any dc voltage which may be connected to the IF Out jack. Power supply filtering is provided by L6, L7, and C34 through C37.

CIRCUIT DESCRIPTION
VCO BOARD
SCHEMATIC #D39525R2
A11 (SYNTHESIZER)

The VCO board consists of three basic circuits. The first is a 10 MHz voltage-controlled oscillator (VCO) which produces a frequency-modulated signal. The second is a set of diode switches for signal routing. The third is an untuned amplifier for the IF mode.

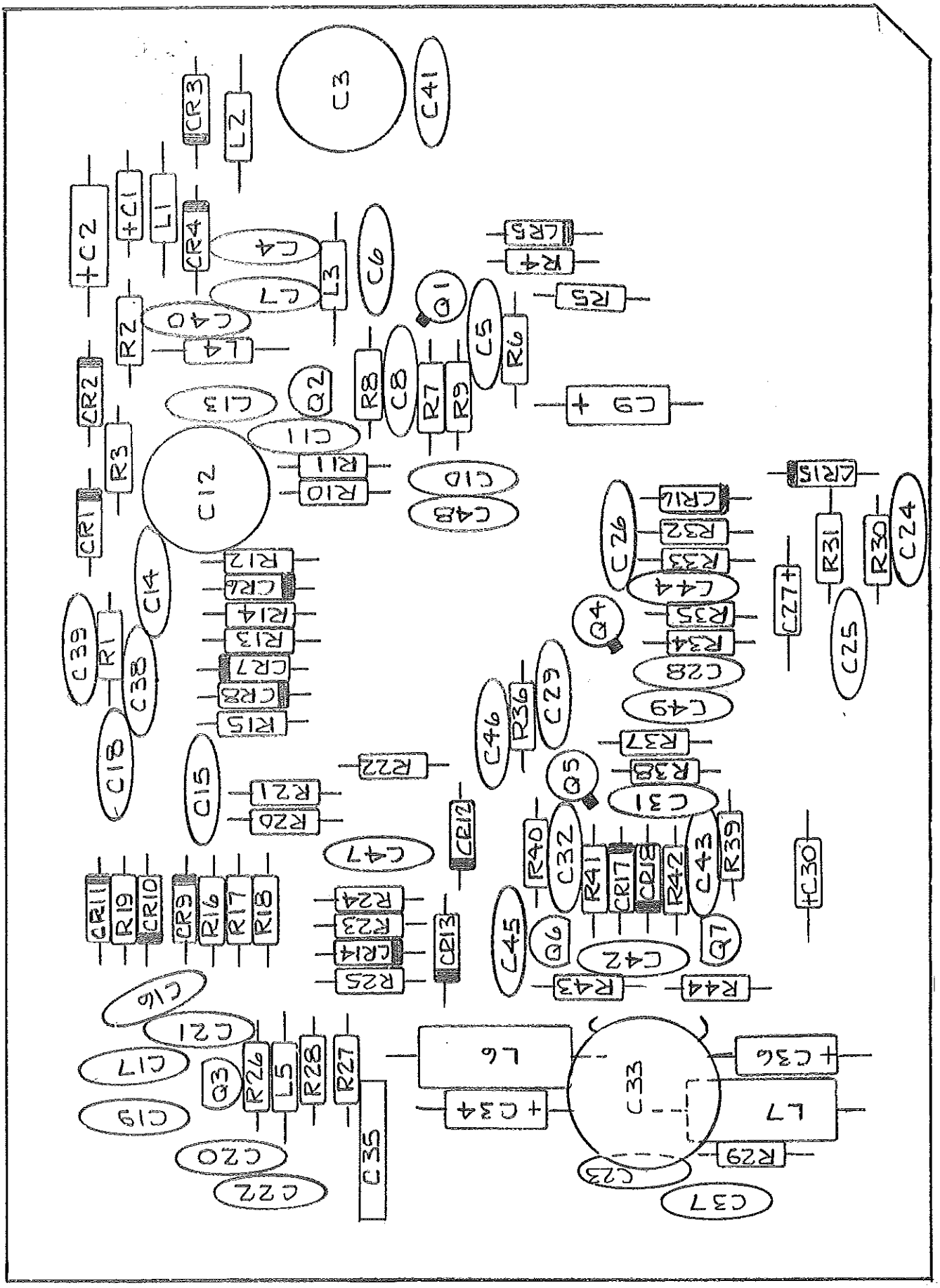
1) 10 MHz VCO

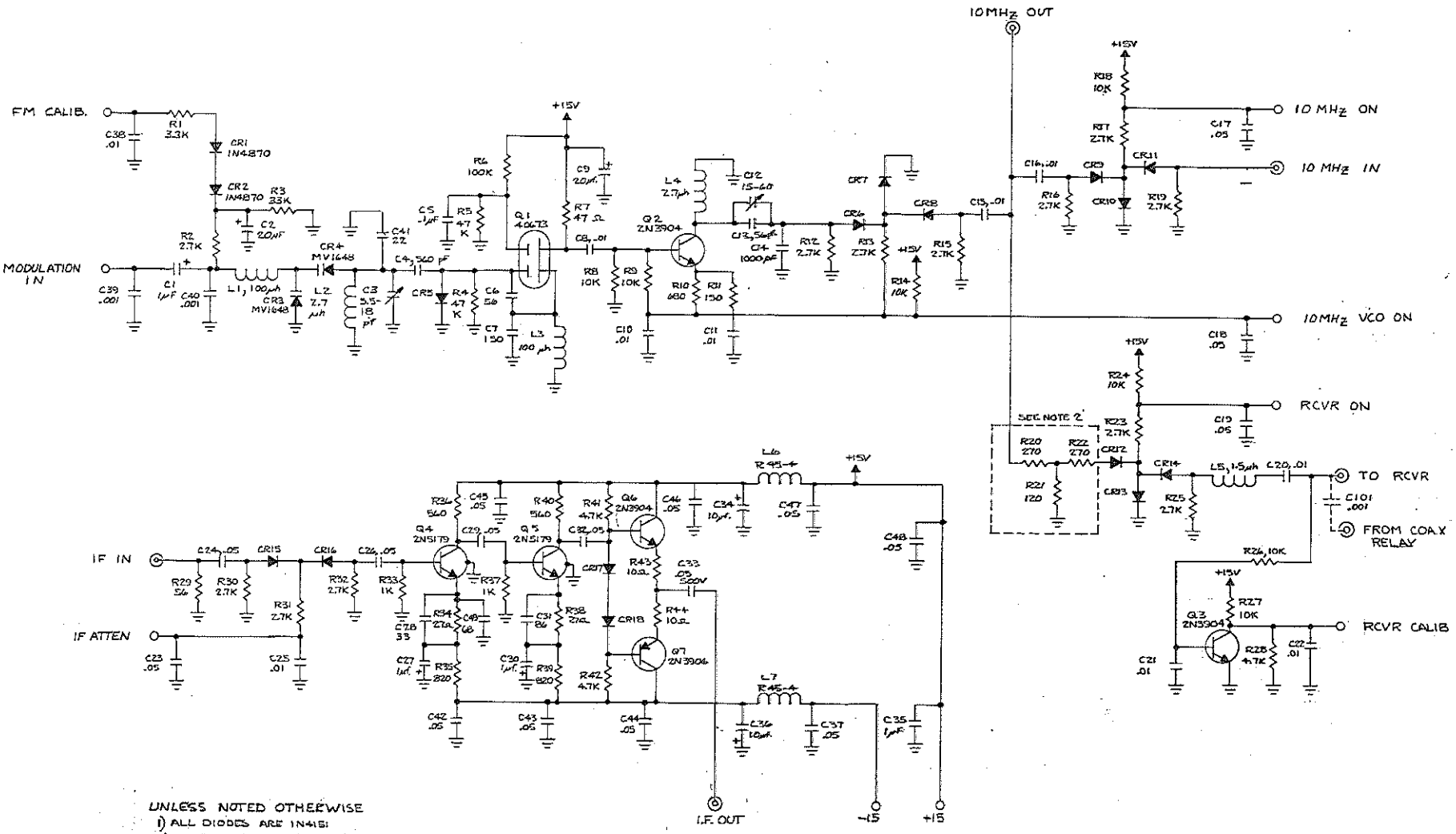
The 10 MHz VCO consists of Q1, a dual-insulated-gate MOS-type transistor, voltage-variable capacitors CR3 and CR4, inductor L2, and trimmer capacitor C3. Feedback and bias for the oscillator is supplied by C6, C7, and L3. The center frequency is set coarsely with C3. A voltage from a 10 k ohm rheostat (front panel FM CAL) is applied to the FM CALIB input. This voltage biases diodes CR3 and CR4 to set the precise center frequency desired. To produce FM, an audio signal is coupled to the tuning diodes (CR3 and CR4) through capacitor C1. The audio frequency voltage excursions cause the output of the oscillator to vary in frequency. The amount of frequency deviation is proportional to the amplitude of the audio signal, while the rate of change of the oscillator frequency is determined by the frequency of the audio signal. Since the frequency variations are fairly small compared to the center frequency, a tuned amplifier consisting of Q2, L4, C12 and C13 is used to both amplify and isolate the oscillator output. This amplifier is turned on when -15 V is applied to the "10 MHz ON" line.

2) DIODE SWITCHES

Three diode switch networks are located on this board. Two of these switches are used to select either the 10 MHz VCO or the locked 10 MHz signal as the input to the first mixer on the RF board. The remaining switch provides control for the receiver input line. All three switches operate in an identical manner. For example: to turn on the switch CR6, CR7, CR8; a -15 V signal on the "10 MHz VCO ON" line forward-biases CR6 and CR8 while reverse-biasing CR7. In this way CR6 and CR8 are low impedances, CR7 is a high impedance, and the switch is "ON". Without -15 V on the "10 MHz VCO" line, CR7 is forward-biased while CR6 and CR8 are reverse-biased. Thus the switch is "OFF".

Associated with the switch feeding the receiver, is Q3. When a positive voltage is applied to R26, Q3 turns on causing the voltage on the RCVR CALIB line to go from +5 V to 0V.


A11 (SYNTHESIZER), VCO P.C. ASSEMBLY D39528R1



A11 (SYNTHESIZER), VCO SCHEMATIC D39525R2

A11 (SYNTHESIZER), VCO PARTS LIST

Ref.	Description	SD Part No.
A11	VCO Assembly	D39527R1
A11	VCO Schematic	D39525R2
C1	Capacitor, 1 µF, 35 V, Tant	C0524
C2	Capacitor, 22 µF, 25 V, Tant	C0371
C3	Capacitor, 5.5 to 18 pF, Trim	C0712
C4	Capacitor, 560 pF, DM	C0644
C5	Capacitor, .1 µF, 50 V, Disc	C0881
C6	Capacitor, 56 pF, DM	C0534
C7	Capacitor, 150 pF, DM	C0537
C8	Capacitor, .01 µF, Disc	C0562
C9	Capacitor, 22 µF, 25 V, Tant	C0371
C10	Capacitor, .01 µF, Disc	C0562
C11	Capacitor, .01 µF, Disc	C0562
C12	Capacitor, 15-60 pF, Trim	C1132
C13	Capacitor, 56 pF, DM	C0534
C14	Capacitor 1000 pF, 100 V	C1144
C15	Capacitor, .01 µF, Disc	C0562
C16	Capacitor, .01 µF, Disc,	C0562
C17	Capacitor, .05 µF, Disc, 50 V	03281790
C18	Capacitor, .05 µF, Disc, 50 V	03281790
C19	Capacitor, .05 µF, Disc, 50 V	03281790
C20	Capacitor, .01 µF, Disc	C0562
C21	Capacitor, .01 µF, Disc	C0562
C22	Capacitor, .01 µF, Disc	C0562
C23	Capacitor, .05 µF, Disc, 50 V	03281790
C24	Capacitor, .05 µF, Disc, 50 V	03281790
C25	Capacitor, .01 µF, Disc	C0562
C26	Capacitor, .05 µF, Disc, 50 V	03281790
C27	Capacitor, 1 µF, 35 V, Tant	C0524
C28	Capacitor, 33 pF	C0267
C29	Capacitor, .05 µF, Disc, 50 V	03281790
C30	Capacitor, 1 µF, 35 V, Tant	C0524
C31	Capacitor, 86 pF	C0975
C32	Capacitor, .05 µF, Disc, 50 V	03281790
C33	Capacitor, .05 µF, 500 V, Disc	C0330
C34	Capacitor, 10 µF, 20 V, Tant	C0353
C35	Capacitor, 1 µF, 25 V, Disc	C0879
C36	Capacitor, 10 µF, 20 V, Tant	C0353
C37	Capacitor, .05 µF, Disc, 50 V	03281790
C38	Capacitor, .01 µF, Disc	C0562

A11 (SYNTHESIZER), VCO PARTS LIST (Cont'd)

Ref.	Description	SD Part No.
C39	Capacitor, .001 µF, Disc	C0424
C40	Capacitor, .001 µF, Disc	C0424
C41	Capacitor, 15 pF, DM (NOM)	C0528
C42	Capacitor, .05 µF, 50 V, Disc	03281790
C43	Capacitor, .05 µF, 50 V, Disc	03281790
C44	Capacitor, .05 µF, 50 V, Disc	03281790
C45	Capacitor, .05 µF, 50 V, Disc	03281790
C46	Capacitor, .05 µF, 50 V, Disc	03281790
C47	Capacitor, .05 µF, 50 V, Disc	03281790
C48	Capacitor, .05 µF, 50 V, Disc	03281790
C49	Capacitor, 68 pF	C0635
CR1	Diode, IN4830	CR0361
CR2	Diode, IN4830	CR0361
CR3	Diode, MV1648	CR0359
CR4	Diode, MV1648	CR0359
CR5	Diode, IN4151	CR0150
CR6	Diode, IN4151	CR0150
CR7	Diode, IN4151	CR0150
CR8	Diode, IN4151	CR0150
CR9	Diode, IN4151	CR0150
CR10	Diode, IN4151	CR0150
CR11	Diode, IN4151	CR0150
CR12	Diode, IN4151	CR0150
CR13	Diode, IN4151	CR0150
CR14	Diode, IN4151	CR0150
CR15	Diode, IN4151	CR0150
CR16	Diode, IN4151	CR0150
CR17	Diode, IN4151	CR0150
CR18	Diode, IN4151	CR0150
L1	Inductor, 100 µH	L0073
L2	Inductor, 2.7 µH	L0048
L3	Inductor, 100 µH	L0073
L4	Inductor, 2.7 µH	L0048
L5	Inductor, 1.5 µH	L0162
L6	Inductor, R45-4	L0143
L7	Inductor, R45-4	L0143
Q1	Transistor, 40673	Q0297
Q2	Transistor, 2N3904	Q0247
Q3	Transistor, 2N3904	Q0247
Q4	Transistor, 2N5179	Q0269
Q5	Transistor, 2N5179	Q0269

A11 (SYNTHESIZER), VCO PARTS LIST (Cont'd)

Ref.	Description	SD Part No.
Q6	Transistor, 2N3904	Q0247
Q7	Transistor, 2N3906	Q0248
R1	Resistor, 3.3 k, 1/4 W, 5%	R0742
R2	Resistor, 2.7 k, 1/4 W, 5%	R0937
R3	Resistor, 33 k, 1/4 W, 5%	R0780
R4	Resistor, 47 k, 1/4 W, 5%	R0777
R5	Resistor, 47 k, 1/4 W, 5%	R0777
R6	Resistor, 100 k, 1/4 W, 5%	R0741
R7	Resistor, 47 Ω, 1/4 W, 5%	R0743
R8	Resistor, 10 k, 1/4 W, 5%	R0766
R9	Resistor, 10 k, 1/4 W, 5%	R0766
R10	Resistor, 680 Ω, 1/4 W, 5%	R1234
R11	Resistor, 150 Ω, 1/4 W, 5%	R0983
R12	Resistor, 2.7 k, 1/4 W, 5%	R0937
R13	Resistor, 2.7 k, 1/4 W, 5%	R0937
R14	Resistor, 10 k, 1/4 W, 5%	R0766
R15	Resistor, 2.7 k, 1/4 W, 5%	R0937
R16	Resistor, 2.7 k, 1/4 W, 5%	R0937
R17	Resistor, 2.7 k, 1/4 W, 5%	R0937
R18	Resistor, 10 k, 1/4 W, 5%	R0766
R19	Resistor, 2.7 k, 1/4 W, 5%	R0937
R20	Not Used	
R21	Resistor, 2.7 k, 1/4 W, 5%	R0937
R22	Not Used	
R23	Resistor, 2.7 k, 1/4 w, 5%	R0937
R24	Resistor, 10 k, 1/4 W, 5%	R0766
R25	Resistor, 2.7 k, 1/4 W, 5%	R0937
R26	Resistor, 10 k, 1/4 W, 5%	R0766
R27	Resistor, 10 k, 1/4 W, 5%	R0766
R28	Resistor, 4.7 k, 1/4 W, 5%	R0982
R29	Resistor, 56 Ω, 1/4 W, 5%	R1554
R30	Resistor, 2.7 k, 1/4 W, 5%	R0937
R31	Resistor, 2.7 k, 1/4 W, 5%	R0937
R32	Resistor, 2.7 k, 1/4 W, 5%	R0937
R33	Resistor, 1 k, 1/4 W, 5%	R0765
R34	Resistor, 27 Ω, 1/4 W, 5%	R1548
R35	Resistor, 820 Ω, 1/4 W, 5%	R0762
R36	Resistor, 560 Ω, 1/4 W, 5%	R0819
R37	Resistor, 1 k, 1/4 W, 5%	R0765
R38	Resistor, 27 Ω, 1/4 W, 5%	R1548
R39	Resistor, 820 Ω, 1/4 W, 5%	R0762

A11 (SYNTHESIZER), VCO PARTS LIST (Cont'd)

Ref.	Description	SD Part No.
R40	Resistor, 560 Ω, 1/4 W, 5%	R0819
R41	Resistor, 4.7 k, 1/4 W, 5%	R0982
R42	Resistor, 4.7 k, 1/4 W, 5%	R0982
R43	Resistor, 10 Ω, 1/4 W, 5%	R0739
R44	Resistor, 10 Ω, 1/4 W, 5%	R0739

CIRCUIT DESCRIPTION
RF BOARD
SCHEMATIC #2D39517R1
A12 (SYNTHESIZER)

This board contains the majority of the circuitry needed to generate the RF output. Included are: 1) three voltage-tuned oscillators; 2) a divide-by-ten prescaler; and 3) two mixers and a frequency multiplier system.

1) THREE VOLTAGE TUNED OSCILLATORS

Three voltage-tuned oscillators are required to cover the 100-200 MHz frequency range. Selection of the proper oscillator is determined by the Control Logic Board. Each oscillator consists of an inductor, voltage-variable capacitor-diodes, and a dual-insulated-gate field-effect transistor. An untuned buffer-amplifier follows each oscillator to produce approximately 2 volts of signal. A filter, C14, L5, and C15, reduces the second harmonic from the lowest frequency (100 MHz to 120 MHz) oscillator. Diodes CR5, CR10, and CR14 are used to switch the oscillator outputs. Transistors Q3, Q6, and Q9 turn on the diodes and the buffer-amplifiers.

2) DIVIDE-BY-TEN PRESCALER

The switched output from the oscillators feeds two circuits. One of these circuits is a divide-by-ten prescaler for the divide-by-N frequency control system. Transistor Q11 is operated as an ac-coupled emitter-follower to prevent loading of the signal from the oscillators. Resistors R39 and R40 provide proper bias for the divider input. The divider is a divide-by-two, then-by-five type. Integrated Circuit U2 performs the divide-by-two function. U1, U3, and U4 are connected to divide-by-five. Transistor Q10 provides level-translation from the -5.2 V logic to standard +5 V TTL levels.

3) TWO MIXERS AND A FREQUENCY MULTIPLIER SYSTEM

The second circuit fed from the switched oscillator outputs is a balanced mixer. This mixer (T1, T2, CR15-CR18) mixes the selected oscillator output with a 10 MHz signal. The 10 MHz signal used by the mixer comes from a tuned amplifier, Q12. Variable resistor R125 at the input of Q12 adjusts the gain of the amplifier. When 10 MHz mixing is not desired, a bias voltage is applied to the mixer through R45 causing the input signal to appear at the output. A bandpass filter, composed of L13, C51, L14, C52, L15, and C53, passes only those signals in the 90 MHz to 200 MHz range, thus reducing any 10 MHz leakage and any harmonics generated by the mixer. Diode CR19 is a PIN diode and acts as a current-variable resistor. It operates as an attenuator and is controlled by the front-panel calibrated RF LEVEL control.

The remaining circuitry, shown on Sheet 2, of the schematic, produces the final output signal. The 100 MHz input signal is amplified by tuned amplifier Q13. The signal from this amplifier provides an input for the 100 and 200 MHz mixer amplifiers and for the comb generator. The comb generator, composed of tuned amplifier Q16 and diode CR24, produces a spectrum of outputs spaced 100 MHz apart and extending from 100 MHz to 800 MHz. These signals provide the inputs for the remaining six mixer amplifiers.

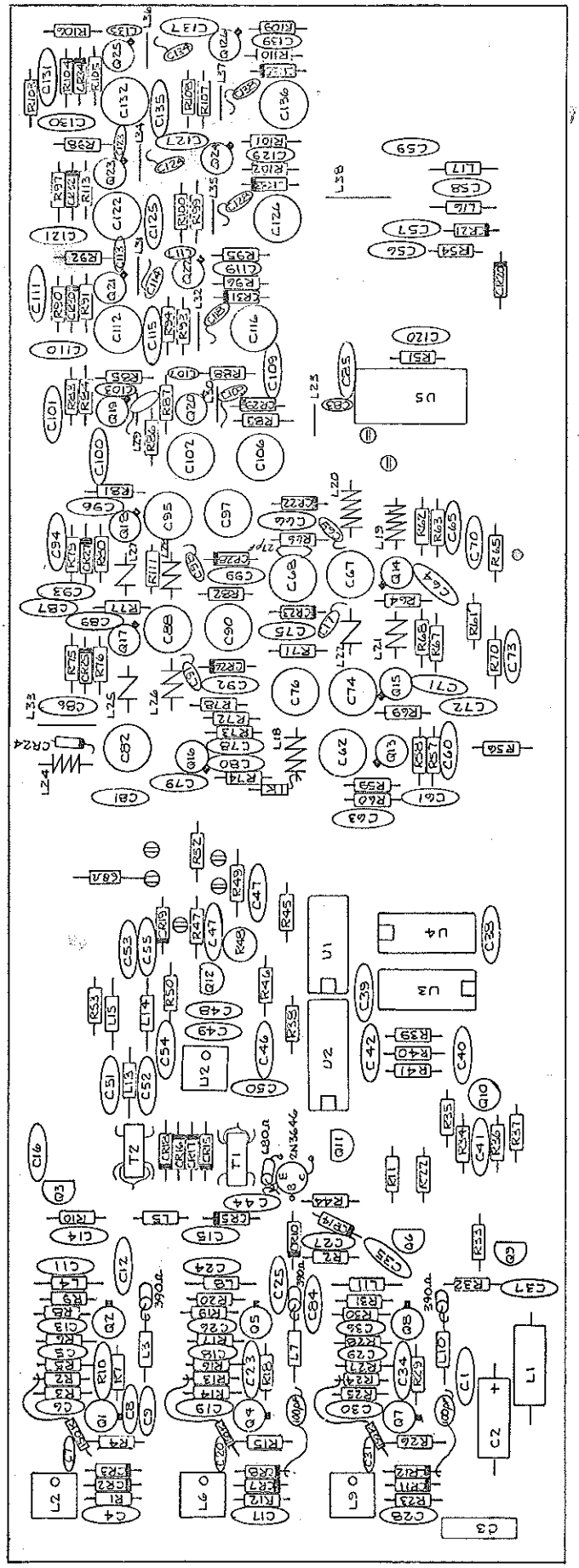
There are two types of mixer amplifiers. One is a single amplifier followed by a double-tuned circuit. This is used for the 100 MHz to 400 MHz amplifiers. The other type consists of two tuned amplifiers to achieve greater amplification for the 500 MHz to 800 MHz signals.

Diode switches are used to connect the individual amplifier outputs to the mixer input. Each diode switch is turned on at the same time power is applied to the selected amplifier. Additionally, diode switches are used in the inputs to the 300 MHz to 700 MHz amplifiers. These switches are likewise turned on with the amplifier.

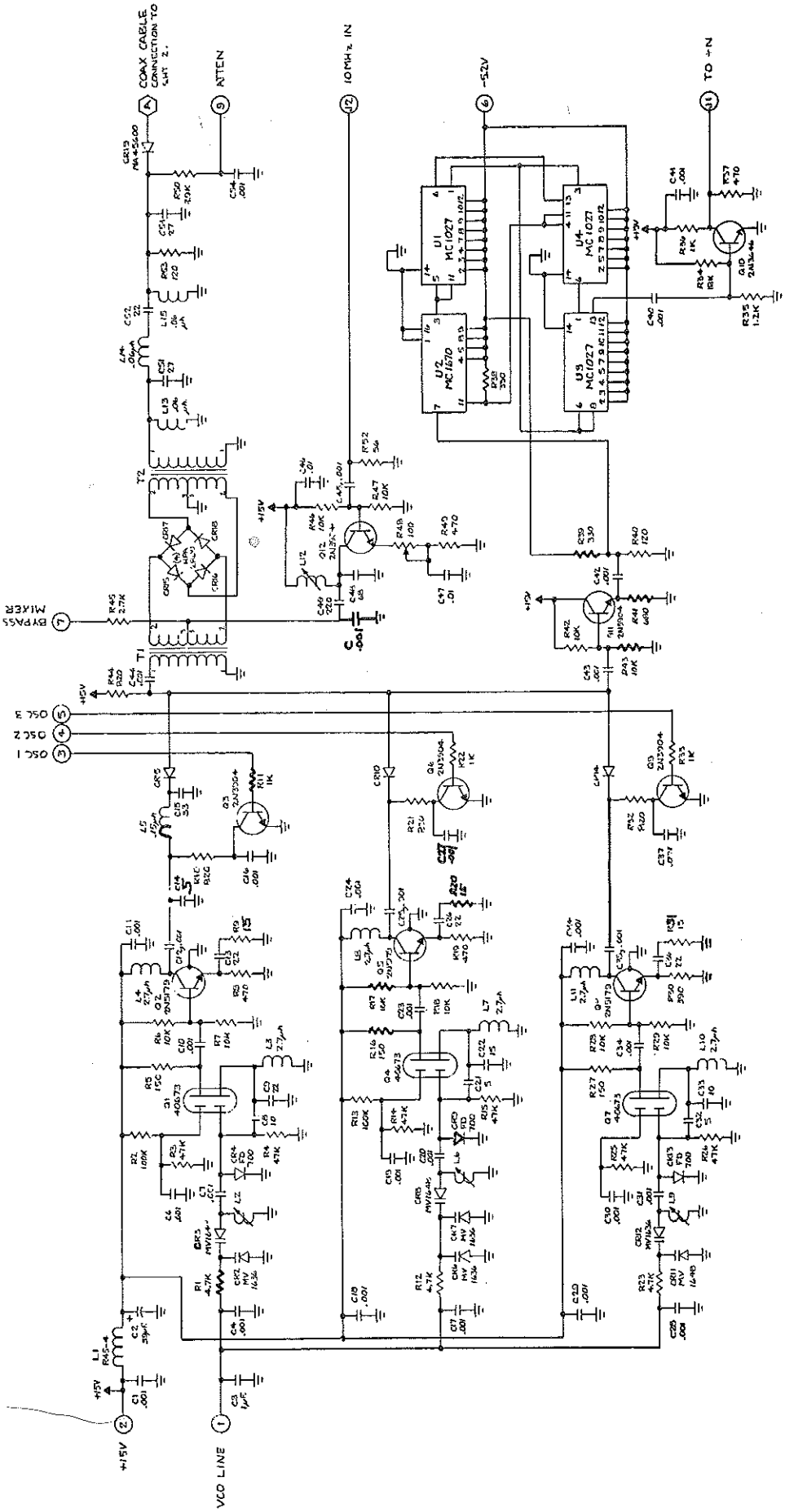
The balanced mixer U5 combines the 90 MHz to 200 MHz signal from the diode attenuator and one of the 100 MHz harmonics to produce a full-frequency-coverage spectrum. No mixing is required to cover the range from 100 MHz to 200 MHz. A voltage applied to the SELECT DIRECT input causes a bias current to flow in the mixer. The 90 MHz to 200 MHz input signal now passes directly through the mixer.

The IF output from this board is switched by diodes CR20 and CR21 to prevent loading the RF output. Filter C57, L16, C58, L17, and C59 is used to reduce any signals above the 90 MHz high-end of the IF range.

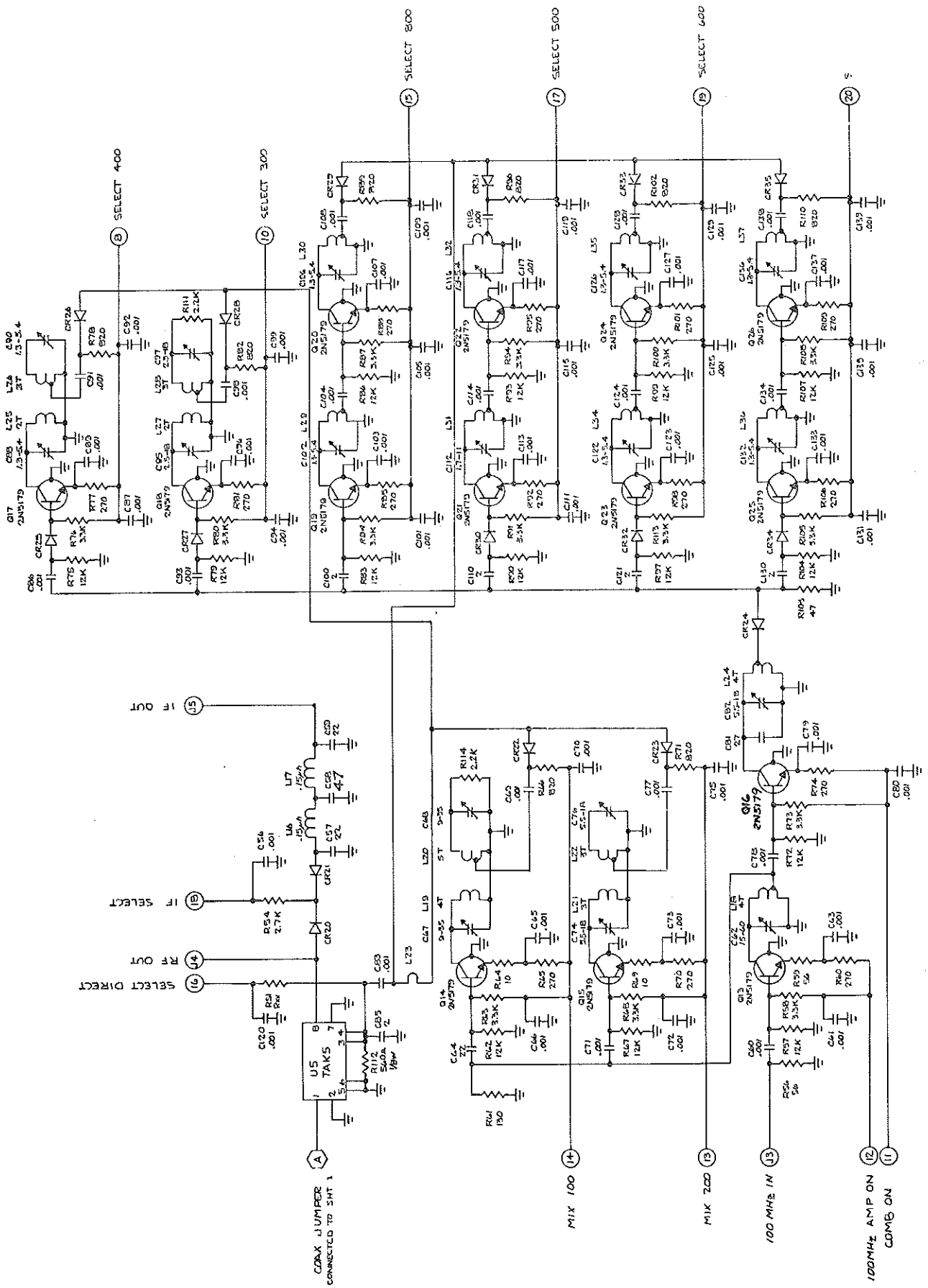
Screwdriver-adjusted potentiometers are mounted so that each may be adjusted from the outside of the instrument by simply removing the right side panel. These adjustments allow the setting of signal levels in the 1 MHz to 590 MHz range.



A12 (SYNTHESIZER), RF P.C. ASSEMBLY D3952OR1 [SER. 201-300]



A12 (SYNTHESIZER) RF SCHEMATIC (SHEET 1 OF 2) D39517R1 [SER. 201-300]



A12 (SYNTHESIZER), RF SCHEMATIC (SHEET 2 OF 2) D39517R1 [SER. 201-300]

A12 (SYNTHESIZER) RF PARTS LIST

Ref.	Description	SD Part No.
A12	RF Assembly	D39520R1
A12	RF Schematic	2D39517R1
C1	Capacitor, .001 µF, Cer, Disc	C0424
C2	Capacitor, 39 µF, 20 V	03279750
C3	Capacitor, 1 µF, 25 V	C0879
C4	Capacitor, .001 µF, Cer, Disc	C0424
C5	Capacitor, .001 µF, Cer, Disc	C0424
C6	Capacitor, .001 µF, Cer, Disc	C0424
C7	Capacitor, .001 µF, 75 V (.125")	C1155
C8	Capacitor, 10 pF, D.M.	C1160
C9	Capacitor, 22 pF, D.M.	C0529
C10	Capacitor, .001 µF, Cer, Disc	C0424
C11	Capacitor, .001 µF, Cer, Disc	C0424
C12	Capacitor, .001 µF, Cer, Disc	C0424
C13	Capacitor, 22 pF, D.M.	C0529
C14	Capacitor, 5 pF, DM	C1071
C15	Capacitor, 33 pF, DM	C0531
C16	Capacitor, .001 µF, Cer, Disc	C0424
C17	Capacitor, .001 µF, Cer, Disc	C0424
C18	Capacitor, .001 µF, Cer, Disc	C0424
C19	Capacitor, .001 µF, Cer, Disc	C0424
C20	Capacitor, .001 µF, 75 V (.125")	C1155
C21	Capacitor, 5 pF, D.M.	C1071
C22	Capacitor, 15 pF, D.M.	C0528
C23	Capacitor, .001 µF, Cer, Disc	C0424
C24	Capacitor, .001 µF, Cer, Disc	C0424
C25	Capacitor, .001 µF, Cer, Disc	C0424
C26	Capacitor, 22 pF, D.M.	C0529
C27	Capacitor, .001 µF, Cer, Disc	C0424
C28	Capacitor, .001 µF, Cer, Disc	C0424
C29	Capacitor, .001 µF, Cer, Disc	C0424
C30	Capacitor, .001 µF, Cer, Disc	C0424
C31	Capacitor, .001 µF, 75 V (.125")	C1155
C32	Capacitor, 5 pF, D.M.	C1071
C33	Capacitor, 10 pF, D.M.	C1160
C34	Capacitor, .001 µF, Cer, Disc	C0424
C35	Capacitor, .001 µF, Cer, Disc	C0424
C36	Capacitor, 22 pF, D.M.	C0529
C37	Capacitor, .001 µF, Cer, Disc	C0424
C38	Capacitor, .001 µF, Cer, Disc	C0424

A12 (SYNTHESIZER) RF PARTS LIST (Cont'd)

Ref.	Description	SD Part No.
C39	Capacitor, .001 µF, Cer, Disc	C0424
C40	Capacitor, .001 µF, Cer, Disc	C0424
C41	Capacitor, .001 µF, Cer, Disc	C0424
C42	Capacitor, .001 µF, Cer, Disc	C0424
C43	Capacitor, .001 µF, Cer, Disc	C0424
C44	Capacitor, .001 µF, Cer, Disc	C0424
C45	Capacitor, .001 µF, Cer, Disc	C0424
C46	Capacitor, .01 µF, Disc	C0556
C47	Capacitor, .01 µF, Disc	C0556
C48	Capacitor, 68 pF, D.M.	C0635
C49	Capacitor, 220 pF, D.M.	C0538
C50	Capacitor, 1000 pF, D.M.	C0543
C51	Capacitor, 27 pF, D.M.	C0530
C52	Capacitor, 22 pF, D.M.	C0529
C53	Capacitor, 27 pF, D.M.	C0530
C54	Capacitor, .001 µF, Cer, Disc	C0424
C55	Capacitor, .001 µF, Cer, Disc	C0424
C56	Capacitor, .001 µF, Cer, Disc	C0424
C57	Capacitor, 22 pF, D.M.	C0529
C58	Capacitor, 47 pF, D.M.	C0533
C59	Capacitor, 22 pF, D.M.	C0529
C60	Capacitor, .001 µF, Cer, Disc	C0424
C61	Capacitor, .001 µF, Cer, Disc	C0424
C62	Capacitor, 33 pF, D.M.	C0531
C63	Capacitor, .001 µF, Cer, Disc	C0424
C64	Capacitor, .001 µF, Cer, Disc	C0424
C65	Capacitor, .001 µF, Cer, Disc	C0424
C66	Capacitor, .001 µF, Cer, Disc	C0424
C67	Capacitor, 27 pF, D.M.	C0530
C68	Capacitor, 33 pF, D.M.	C0531
C69	Capacitor, 100 pF, D.M.	C0536
C70	Capacitor, .001 µF, Cer, Disc	C0424
C71	Capacitor, .001 µF, Cer, Disc	C0424
C72	Capacitor, .001 µF, Cer, Disc	C0424
C73	Capacitor, .001 µF, Cer, Disc	C0424
C74	Capacitor, 5 pF, D.M.	C1071
C75	Capacitor, .001 µF, Cer, Disc	C0424
C76	Capacitor, 10 pF, D.M.	C1160
C77	Capacitor, 10 pF, D.M.	C1160
C78	Capacitor, .001 µF, Cer, Disc	C0424

A12 (SYNTHESIZER) RF PARTS LIST (Cont'd)

Ref.	Description	SD Part No.
C79	Capacitor, .001 µF, Cer, Disc	C0424
C80	Capacitor, .001 µF, Cer, Disc	C0424
C81	Capacitor, 27 pF, D.M.	C0530
C82	Capacitor, 5.5 - 18 pF, Trimmer	C0712
C83	Capacitor, .001 µF, 75 V (.125")	C1155
C84	Capacitor, .001 µF, Cer, Disc	C0424
C85	Capacitor, 2 pF, Disc	C0261
C86	Capacitor, .001 µF, Cer, Disc	C0424
C87	Capacitor, .001 µF, Cer, Disc	C0424
C88	Capacitor, 1.3 - 5.4 pF, Trimmer	C1254
C89	Capacitor, .001 µF, Cer, Disc	C0424
C90	Capacitor, 1.3 - 5.4 pF, Trimmer	C1254
C91	Capacitor, .001 µF, 75 V (.125")	C1155
C92	Capacitor, .001 µF, Cer, Disc	C0424
C93	Capacitor, .001 µF, Cer, Disc	C0424
C94	Capacitor, .001 µF, Cer, Disc	C0424
C95	Capacitor, 2.5 - 11 pF, Trimmer	C1133
C96	Capacitor, .001 µF, Cer, Disc	C0424
C97	Capacitor, 2.5 - 11 pF, Trimmer	C1133
C98	Capacitor, .001 µF, 75 V (.125")	C1155
C99	Capacitor, .001 µF, Cer, Disc	C0424
C100	Capacitor, 2 pF, Disc	C0261
C101	Capacitor, .001 µF, Cer, Disc	C0424
C102	Capacitor, 1.3 - 5.4 pF, Trimmer	C1254
C103	Capacitor, .001 µF, 75 V (.125")	C1155
C104	Capacitor, .001 µF, 75 V (.125")	C1155
C105	Capacitor, .001 µF, 75 V (.125")	C1155
C106	Capacitor, 1.3 - 5.4 pF, Trimmer	C1254
C107	Capacitor, .001 µF, 75 V (.125")	C1155
C108	Capacitor, .001 µF, 75 V (.125")	C1155
C109	Capacitor, .001 µF, Cer, Disc	C0424
C110	Capacitor, 2 pF, Disc	C0261
C111	Capacitor, .001 µF, Cer, Disc	C0424
C112	Capacitor, 1.7 - 11 pF, Trimmer	C1255
C113	Capacitor, .001 µF, 75 V (.125")	C1155
C114	Capacitor, .001 µF, 75 V (.125")	C1155
C115	Capacitor, .001 µF, Cer, Disc	C0424
C116	Capacitor, 1.7 - 11 pF, Trimmer	C1255
C117	Capacitor, .001 µF, 75 V (.125")	C1155
C118	Capacitor, .001 µF, 75 V (.125")	C1155

A12 (SYNTHESIZER) RF PARTS LIST (Cont'd)

Ref.	Description	SD Part No.
C119	Capacitor, .001 µF, Cer, Disc	C0424
C120	Capacitor, .001 µF, Cer, Disc	C0424
C121	Capacitor, 2 pF, Disc	C0261
C122	Capacitor, 1.3 - 5.4 pF, Trimmer	C1254
C123	Capacitor, .001 µF, 75 V (.125")	C1155
C124	Capacitor, .001 µF, 75 V (.125")	C1155
C125	Capacitor, .001 µF, Cer Disc	C0424
C126	Capacitor, 1.3 - 5.4 pF, Trimmer	C1254
C127	Capacitor, .001 µF, Cer, Disc	C0424
C128	Capacitor, .001 µF, 75 V (.125")	C1155
C129	Capacitor, .001 µF, Cer, Disc	C0424
C130	Capacitor, 2 pF, Disc	C0261
C131	Capacitor, .001 µF, Cer, Disc	C0424
C132	Capacitor, 1.3 - 5.4 pF, Trimmer	C1254
C133	Capacitor, .001 µF, 75 V (.125")	C1155
C134	Capacitor, .001 µF, 75 V (.125")	C1155
C135	Capacitor, .001 µF, Cer, Disc	C0424
C136	Capacitor, 1.3 - 5.4 pF, Trimmer	C1254
C137	Capacitor, .001 µF, Cer, Disc	C0424
C138	Capacitor, .001 µF, 75 V (.125")	C1155
C139-142	Capacitor, .001 µF, Cer, Disc	C0424
CR1	Not used	
CR2	Diode, MV1636	CR0354
CR3	Diode, MV1648	CR0359
CR4	Diode, FD700	CR0356
CR5	Diode, IN4151	CR0150
CR6	Diode, MV1636	CR0354
CR7	Diode, MV1636	CR0354
CR8	Diode, MV1648	CR0359
CR9	Diode, FD700	CR0356
CR10	Diode, IN4151	CR0150
CR11	Diode, MV1648	CR0359
CR12	Diode, MV1636	CR0354
CR13	Diode, FD700	CR0356
CR14	Diode, IN4151	CR0150
CR15	Diode, HPA 2800	CR0363
CR16	Diode, HPA 2800	CR0363
CR17	Diode, HPA 2800	CR0363
CR18	Diode, HPA 2800	CR0363
CR19	Diode, MA47600	CR0373
CR20	Diode, IN4151	CR0150

A12 (SYNTHESIZER) RF PARTS LIST (Cont'd)

Ref.	Description	SD Part No.
CR21	Diode, IN4151	CR0150
CR22	Diode, IN4151	CR0150
CR23	Diode, IN4151	CR0150
CR24	Diode, IN4151	CR0150
CR25	Diode, IN4151	CR0150
CR26	Diode, IN4151	CR0150
CR27	Diode, IN4151	CR0150
CR28	Diode, IN4151	CR0150
CR29	Diode, IN4151	CR0150
CR30	Diode, IN4151	CR0150
CR31	Diode, IN4151	CR0150
CR32	Diode, IN4151	CR0150
CR33	Diode, IN4151	CR0150
CR34	Diode, IN4151	CR0150
CR35,36	Diode, IN4151	CR0150
L1	Inductor, R45-4	L0143
L2	Inductor, 2 3/4 T. #26	39667-6
	Coil Form	E0289
L3	Inductor, 2.7 µH	L0048
L4	Not Used	
L5	Inductor, .15 µH	L0080
L6	Inductor, 1 1/2 T. #26	39667-1
	Coil Form	E0289
L7	Inductor, 2.7 µH	L0048
L8	Not Used	
L9	Inductor, 1 1/2 T. #26	39667-1
L10	Inductor, 2.7 µH	L0048
L11	Not Used	
L12	Inductor, 12 1/4 #30	39667-5
	Coil Form	E0223
L13	Inductor, .06 µH	L0159
L14	Inductor, .06 µH	L0159
L15	Inductor, .06 µH	C0159
L16	Inductor, .15 µH	L0080
L17	Inductor, .15 µH	L0080
L18	Inductor, 4 T. #18, 1/4"	39678-3
L19	Inductor, 5 T. #18, 1/4"	39678-4
L20	Inductor, 5 T. #18, 1/4"	39678-4
L21	Inductor, 3 T. #18, 1/4"	39678-2
L22	Inductor, 3 T. #18, 1/4"	39678-2

A12 (SYNTHESIZER) RF PARTS LIST (Cont'd)

Ref.	Description	SD Part No.
L23	Inductor, Loop, 1/8" High X .2 Wide, #18	
L24	Inductor, 4 T. #18, 1/4"	39678-3
L25	Inductor, 2 T. #18, 1/4"	39678-1
L26	Inductor, 3 T. #18, 1/4"	39678-2
L27	Inductor, 2 T. #18, 1/4"	39678-1
L28	Inductor, 3 T. #18, 1/4"	39678-2
L29	Inductor, Loop, 1/8" High X 1/4" Wide #18	
L30	Inductor, Loop, 1/8" High X 1/4" Wide #18	
L31	Inductor, Loop, 3/16"High X 1/4" Wide #18	
L32	Inductor, Loop, 3/16"High X 1/4" Wide #18	
L33	Inductor, Loop, .4" High X .4" Wide #18	
L34	Inductor, Loop, 1/4" High X 1/4" Wide #18	
L35	Inductor, Loop, 3/16"High X 1/4" Wide #18	
L36	Inductor, Loop, 3/16"High X 1/4" Wide #18	
L37	Inductor, Loop, 1/8" High X 1/4" Wide #18	
L38	Inductor, Loop, .4" High X .4" Wide #18	
Q1	Transistor, 40673	Q0297
Q2	Transistor, 2N5179	Q0269
Q3	Transistor, 2N3904	Q0247
Q4	Transistor, 40673	Q0297
Q5	Transistor, 2N5179	Q0269
Q6	Transistor, 2N3904	Q0247
Q7	Transistor, 40673	Q0297
Q8	Transistor, 2N5179	Q0269
Q9	Transistor, 2N3904	Q0247
Q10	Transistor, 2N3646	Q0218
Q11	Transistor, 2N3904	Q0247
Q12	Transistor, 2N3904	Q0247
Q13	Transistor, 2N5179	Q0269
Q14	Transistor, 2N5179	Q0269
Q15	Transistor, 2N5179	Q0269
Q16	Transistor, 2N5179	Q0269
Q17	Transistor, 2N5179	Q0269
Q18	Transistor, 2N5179	Q0269
Q19	Transistor, 2N5179	Q0269
Q20	Transistor, 2N5179	Q0269
Q21	Transistor, 2N5179	Q0269
Q22	Transistor, 2N5179	Q0269
Q23	Transistor, 2N5179	Q0269
Q24	Transistor, 2N5179	Q0269
Q25	Transistor, 2N5179	Q0269
Q26	Transistor, 2N5179	Q0269
Q27	Transistor, 2N3904	Q0247

A12 (SYNTHESIZER) RF PARTS LIST (Cont'd)

Ref.	Description	SD Part No.
R1	Resistor, 4.7 k, 1/4 W, 5%	R0892
R2	Resistor, 100 k, 1/4 W, 5%	R0741
R3	Resistor, 47 k, 1/4 W, 5%	R0777
R4	Resistor, 47 k, 1/4 W, 5%	R0777
R5	Resistor, 150 Ω, 1/4 W, 5%	R0983
R6	Resistor, 10 k, 1/4 W, 5%	R0766
R7	Resistor, 10 k, 1/4 W, 5%	R0766
R8	Resistor, 470 Ω, 1/4 W, 5%	R1044
R9	Resistor, 15 Ω, 1/4 W, 5%	R1607
R10	Resistor, 820 Ω, 1/4 W, 5%	R0762
R11	Resistor, 1 k, 1/4 W, 5%	R0765
R12	Resistor, 4.7 k, 1/4 W, 5%	R0892
R13	Resistor, 100 k, 1/4 W, 5%	R0741
R14	Resistor, 47 k, 1/4 W, 5%	R0777
R15	Resistor, 47 k, 1/4 W, 5%	R0777
R16	Resistor, 150 Ω, 1/4 W, 5%	R0983
R17	Resistor, 10 k, 1/4 W, 5%	R0766
R18	Resistor, 10 k, 1/4 W, 5%	R0766
R19	Resistor, 470 Ω, 1/4 W, 5%	R1044
R20	Resistor, 15 Ω, 1/4 W, 5%	R1607
R21	Resistor, 820 Ω, 1/4 W, 5%	R0762
R22	Resistor, 1 k, 1/4 W, 5%	R0765
R23	Resistor, 4.7 k, 1/4 W, 5%	R0892
R24	Resistor, 100 k, 1/4 W, 5%	R0741
R25	Resistor, 47 k, 1/4 W, 5%	R0777
R26	Resistor, 47 k, 1/4 W, 5%	R0777
R27	Resistor, 150 Ω, 1/4 W, 5%	R0983
R28	Resistor, 10 k, 1/4 W, 5%	R0766
R29	Resistor, 10 k, 1/4 W, 5%	R0766
R30	Resistor, 390 Ω, 1/4 W, 5%	R0880
R31	Resistor, 15 Ω, 1/4 W, 5%	R1607
R32	Resistor, 820 Ω, 1/4 W, 5%	R0762
R33	Resistor, 1 k, 1/4 W, 5%	R0765
R34	Resistor, 18 k, 1/4 W, 5%	R0875
R35	Resistor, 1.2 k, 1/4 W, 5%	R0809
R36	Resistor, 1 k, 1/4 W, 5%	R0765
R37	Resistor, 470 Ω, 1/4 W, 5%	R1044
R38	Resistor, 330 Ω, 1/4 W, 5%	R0662
R39	Resistor, 1300 Ω, 1/4 W, 5%	R0737
R40	Resistor, 470 Ω, 1/4 W, 5%	R1044

A12 (SYNTHESIZER) RF PARTS LIST (Cont'd)

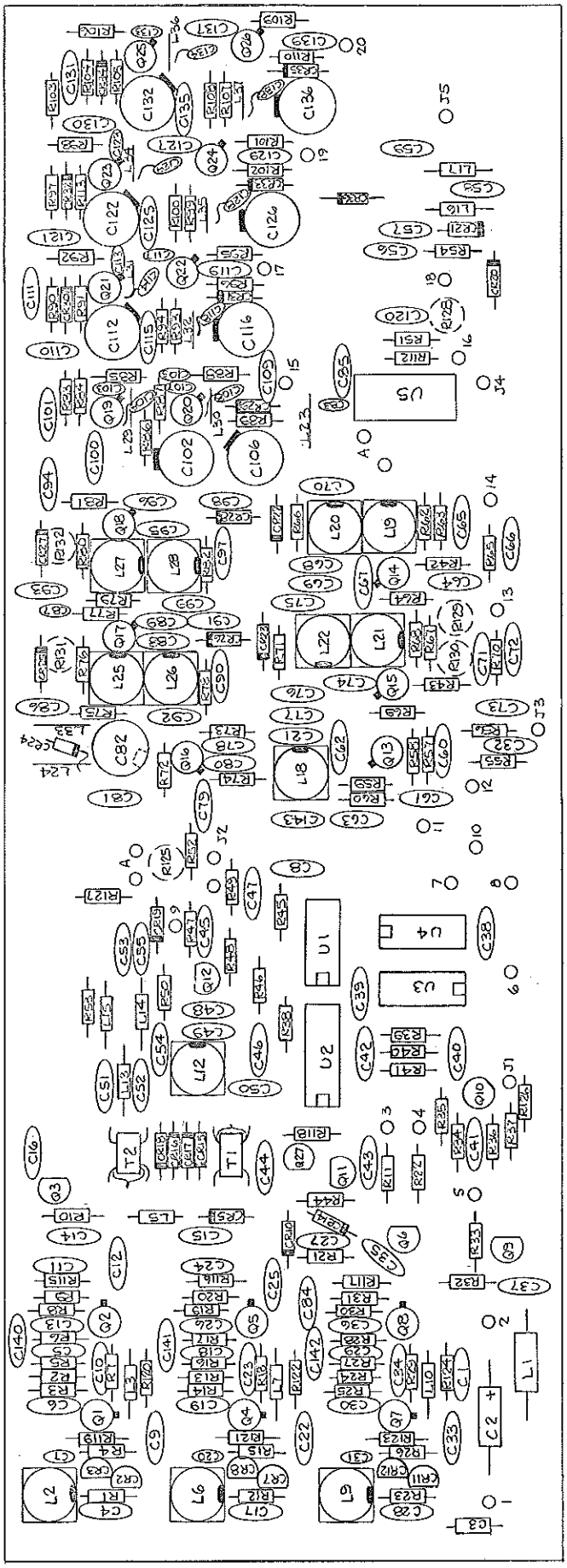
Ref.	Description	SD Part No.
R41	Resistor, 680 Ω, 1/4 W, 5%	R1234
R42	Resistor, 470 Ω, 1/4 W, 5%	R1044
R43	Resistor, 270 Ω, 1/4 W, 5%	R0694
R44	Resistor, 820 Ω, 1/4 W, 5%	R0762
R45	Resistor, 2.7 k, 1/4 W, 5%	R0937
R46	Resistor, 10 k, 1/4 W, 5%	R0766
R47	Resistor, 10 k, 1/4 W, 5%	R0766
R48	Resistor, 100 Ω, Potentiometer	R2374
R49	Resistor, 470 Ω, 1/4 W, 5%	R1044
R50	Resistor, 3.9 k, 1/4 W, 5%	R0939
R51	Resistor, 24 k, 1/4 W, 5%	R0735
R52	Resistor, 56 Ω, 1/4 W, 5%	R1554
R53	Resistor, 120 Ω, 1/4 W, 5%	R1461
R54	Resistor, 2.7 k, 1/4 W, 5%	R0937
R55	Resistor, 820 Ω, 1/4 W, 5%	R0762
R56	Resistor, 56 Ω, 1/4 W, 5%	R1554
R57	Resistor, 12 k, 1/4 W, 5%	R0759
R58	Resistor, 3.3 k, 1/4 W, 5%	R0742
R59	Resistor, 56 Ω, 1/4 W, 5%	R1554
R60	Resistor, 270 Ω, 1/4 W, 5%	R0694
R61	Resistor, 130 Ω, 1/4 W, 5%	R1052
R62	Resistor, 12 k, 1/4 W, 5%	R0759
R63	Resistor, 3.3, 1/4 W, 5%	R0742
R64	Resistor, 10 Ω, 1/4 W, 5%	R0739
R65	Resistor, 270 Ω, 1/4 W, 5%	R0694
R66	Resistor, 820 Ω, 1/4 W, 5%	R0762
R67	Resistor, 12 k, 1/4 W, 5%	R0759
R68	Resistor, 3.3 k, 1/4 W, 5%	R0742
R69	Resistor, 10 Ω, 1/4 W, 5%	R0739
R70	Resistor, 270 Ω, 1/4 W, 5%	R0694
R71	Resistor, 820 Ω, 1/4 W, 5%	R0762
R72	Resistor, 12 k, 1/4 W, 5%	R0759
R73	Resistor, 3.3 k, 1/4 W, 5%	R0742
R74	Resistor, 270 Ω, 1/4 W, 5%	R0694
R75	Resistor, 12 k, 1/4 W, 5%	R0759
R76	Resistor, 3.3 k, 1/4 W, 5%	R0742
R77	Resistor, 270 Ω, 1/4 W, 5%	R0694
R78	Resistor, 820 Ω, 1/4 W, 5%	R0762
R79	Resistor, 12 k, 1/4 W, 5%	R0759
R80	Resistor, 3.3 k, 1/4 W, 5%	R0742

A12 (SYNTHESIZER) RF PARTS LIST (Cont'd)

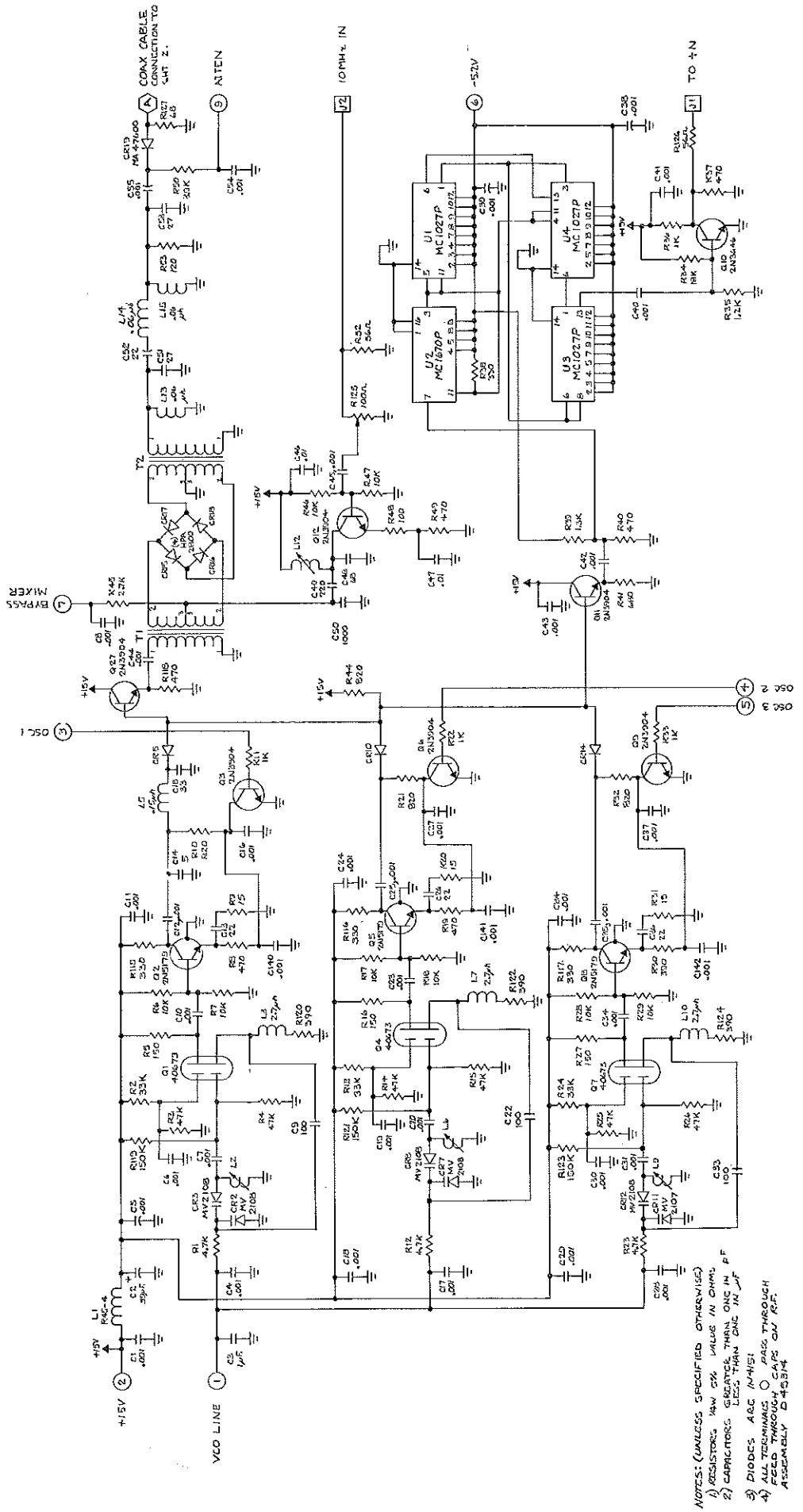
Ref.	Description	SD Part No.
R81	Resistor, 270 Ω, 1/4 W, 5%	R0694
R82	Resistor, 820 Ω, 1/4 W, 5%	R0762
R83	Resistor, 12 k, 1/4 W, 5%	R0759
R84	Resistor, 3.3 k, 1/4 W, 5%	R0742
R85	Resistor, 270 Ω, 1/4 W, 5%	R0694
R86	Resistor, 12 k, 1/4 W, 5%	R0759
R87	Resistor, 3.3 k, 1/4 W, 5%	R0742
R88	Resistor, 270 Ω, 1/4 W, 5%	R0694
R89	Resistor, 820 Ω, 1/4 W, 5%	R0762
R90	Resistor, 12 k, 1/4 W, 5%	R0759
R91	Resistor, 3.3 k, 1/4 W, 5%	R0742
R92	Resistor, 270 Ω, 1/4 W, 5%	R0694
R93	Resistor, 12 k, 1/4 W, 5%	R0759
R94	Resistor, 3.3 k, 1/4 W, 5%	R0742
R95	Resistor, 270 Ω, 1/4 W, 5%	R0694
R96	Resistor, 820 Ω, 1/4 W, 5%	R0762
R97	Resistor, 12 k, 1/4 W, 5%	R0759
R98	Resistor, 270 Ω, 1/4 W, 5%	R0694
R99	Resistor, 12 k, 1/4 W, 5%	R0759
R100	Resistor, 3.3 k, 1/4 W, 5%	R0742
R101	Resistor, 270 Ω, 1/4 W, 5%	R0694
R102	Resistor, 820 Ω, 1/4 W, 5%	R0762
R103	Resistor, 47 Ω, 1/4 W, 5%	R0743
R104	Resistor, 12 k, 1/4 W, 5%	R0759
R105	Resistor, 3.3 k, 1/4 W, 5%	R0742
R106	Resistor, 270 Ω, 1/4 W, 5%	R0694
R107	Resistor, 12 k, 1/4 W, 5%	R0759
R108	Resistor, 3.3 k, 1/4 W, 5%	R0742
R109	Resistor, 270 Ω, 1/4 W, 5%	R0694
R110	Resistor, 820 Ω, 1/4 W, 5%	R0762
R111	Resistor, 2.2 k, 1/4 W, 5%	R0749
R112	Resistor, 56 Ω, 1/4 W, 5%	R1554
R113	Resistor, 3.3 k, 1/4 W, 5%	R0742
R114	Resistor, 2.2 k, 1/4 W, 5%	R0749
R115	Resistor, 330 Ω, 1/4 W, 5%	R0662
R116	Resistor, 330 Ω, 1/4 W, 5%	R0662
R117	Resistor, 330 Ω, 1/4 W, 5%	R0662
R118	Resistor, 470 Ω, 1/4 W, 5%	R1044

A12 (SYNTHESIZER) RF PARTS LIST (Cont'd)

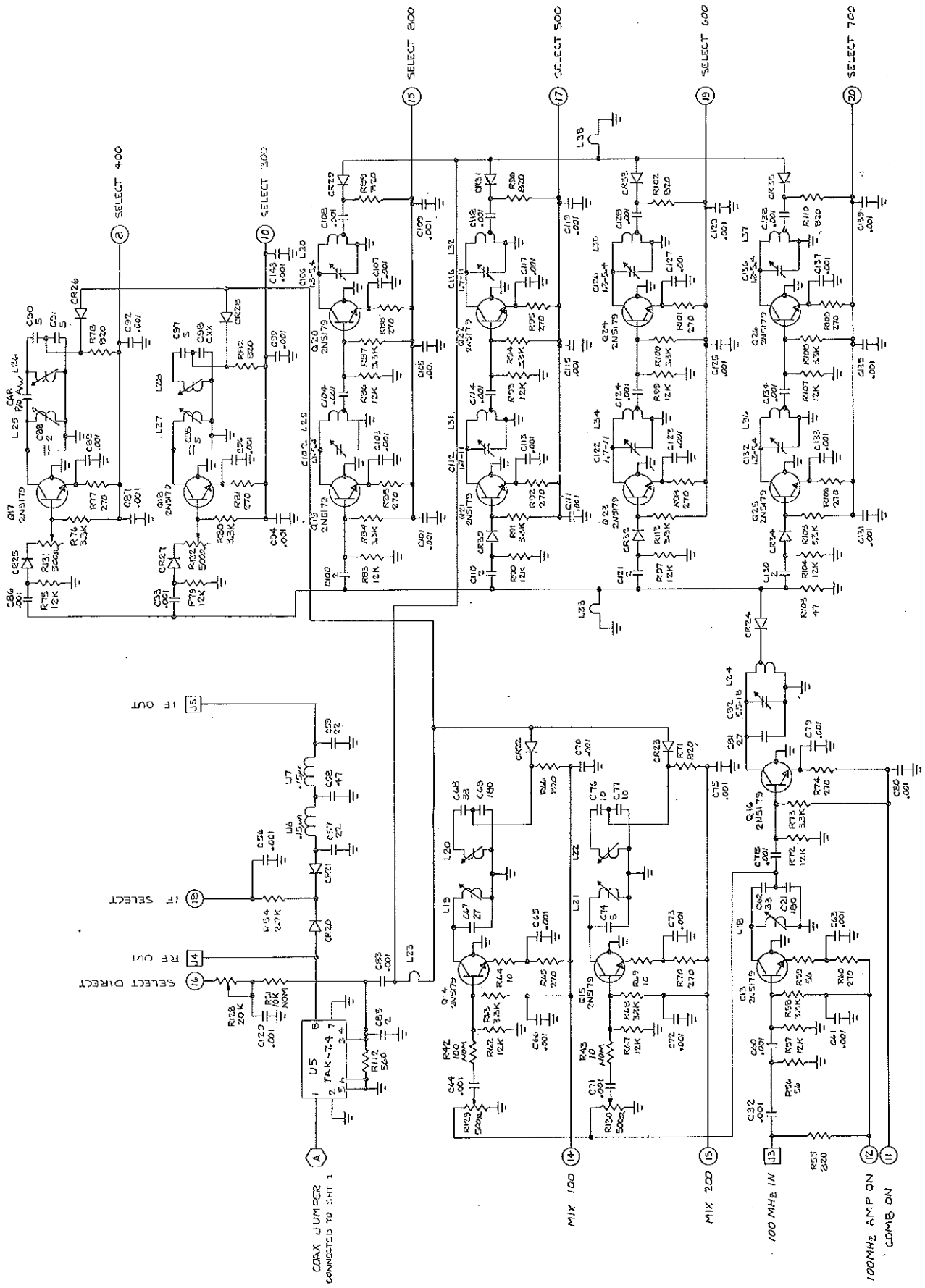
Ref.	Description	SD Part No.
T1	Transformer	39668
	Transformer, Toroidal Core	E0203
T2	Transformer	39668
U1	Integrated Circuit, MC1027P	25719
U2	Integrated Circuit, MC1670P	25765
U3	Integrated Circuit, MC1027P	25719
U4	Integrated Circuit, MC1027P	25719
U5	Integrated Circuit, Mixer MCL TAK-7	RF0015



A12 (SYNTHESIZER), RF P.C. ASSEMBLY D45312A [SER. 301-400]



A12 (SYNTHESIZER), R.F. BOARD SCHEMATIC D45309R1 (SHEET 1 of 2) [SER. 301-400]



A12 (SYNTHESIZER), R.F. BOARD SCHEMATIC D45309R1 (SHEET 2 of 2) [SER. 301-400]

A12 (SYNTHESIZER) RF PARTS LIST

Ref.	Description	SD Part No.
A12	RF Assembly	D45312A
A12	RF Schematic	D45309R1
C1	Capacitor, .001 µF, Cer, Disc	C0424
C2	Capacitor, 39 µF, 20 V	03279750
C3	Capacitor, 1 µF, 25 V	C0879
C4	Capacitor, .001 µF, Cer, Disc	C0424
C5	Capacitor, .001 µF, Cer, Disc	C0424
C6	Capacitor, .001 µF, Cer, Disc	C0424
C7	Capacitor, .001 µF, 75 V (.125")	C1155
C8	Capacitor, .001 µF, Cer, Disc	C0424
C9	Capacitor, 100 pF, D.M.	C0536
C10	Capacitor, .001 µF, Cer, Disc	C0424
C11	Capacitor, .001 µF, Cer, Disc	C0424
C12	Capacitor, .001 µF, Cer, Disc	C0424
C13	Capacitor, 22 pF, D.M.	C0529
C14	Capacitor, 5 pF, D.M.	C1071
C15	Capacitor, 33 pF, D.M.	C0531
C16	Capacitor, .001 µF, Cer, Disc	C0424
C17	Capacitor, .001 µF, Cer, Disc	C0424
C18	Capacitor, .001 µF, Cer, Disc	C0424
C19	Capacitor, .001 µF, Cer, Disc	C0424
C20	Capacitor, .001 µF, 75 V (.125")	C1155
C21	Capacitor, 180 pF, D.M.	C0707
C22	Capacitor, 100 pF, D.M.	C0536
C23	Capacitor, .001 µF, Cer, Disc	C0424
C24	Capacitor, .001 µF, Cer, Disc	C0424
C25	Capacitor, .001 µF, Cer, Disc	C0424
C26	Capacitor, 22 pF, D.M.	C0529
C27	Capacitor, .001 µF, Cer, Disc	C0424
C28	Capacitor, .001 µF, Cer, Disc	C0424
C29	Capacitor, .001 µF, Cer, Disc	C0424
C30	Capacitor, .001 µF, Cer, Disc	C0424
C31	Capacitor, .001 µF, 75 V (.125")	C1155
C32	Capacitor, .001 µF, Cer, Disc	C0424
C33	Capacitor, 100 pF, D.M.	C0536
C34	Capacitor, .001 µF, Cer, Disc	C0424
C35	Capacitor, .001 µF, Cer, Disc	C0424
C36	Capacitor, 22 pF, D.M.	C0529
C37	Capacitor, .001 µF, Cer, Disc	C0424
C38	Capacitor, .001 µF, Cer, Disc	C0424

A12 (SYNTHESIZER) RF PARTS LIST (Cont'd)

Ref.	Description	SD Part No.
C39	Capacitor, .001 µF, Cer, Disc	C0424
C40	Capacitor, .001 µF, Cer, Disc	C0424
C41	Capacitor, .001 µF, Cer, Disc	C0424
C42	Capacitor, .001 µF, Cer, Disc	C0424
C43	Capacitor, .001 µF, Cer, Disc	C0424
C44	Capacitor, .001 µF, Cer, Disc	C0424
C45	Capacitor, .001 µF, Cer, Disc	C0424
C46	Capacitor, .01 µF, Disc	C0556
C47	Capacitor, .01 µF, Disc	C0556
C48	Capacitor, 68 pF, D.M.	C0635
C49	Capacitor, 220 pF, D.M.	C0538
C50	Capacitor, .001 µF, Cer, Disc	C0424
C51	Capacitor, 27 pF, D.M.	C0530
C52	Capacitor, 22 pF, D.M.	C0529
C53	Capacitor, 27 pF, D.M.	C0530
C54	Capacitor, .001 µF, Cer, Disc	C0424
C55	Capacitor, .001 µF, Cer, Disc	C0424
C56	Capacitor, .001 µF, Cer, Disc	C0244
C57	Capacitor, 22 pF, D.M.	C0529
C58	Capacitor, 47 pF, DM	C0533
C59	Capacitor, 22 pF, D.M.	C0529
C60	Capacitor, .001 µF, Cer, Disc	C0424
C61	Capacitor, .001 µF, Cer, Disc	C0424
C62	Capacitor, 15 - 60 pF, Trimmer	C1132
C63	Capacitor, .001 µF, Cer Disc	C0424
C64	Capacitor, .001 µF, Cer Disc	C0424
C65	Capacitor, .001 µF, Cer Disc	C0424
C66	Capacitor, .001 µF, Cer Disc	C0424
C67	Capacitor, 9 - 35 pF, Trimmer	C0709
C68	Capacitor, 9 - 35 pF, Trimmer	C0709
C69	Capacitor, .001 µF, 75 V (.125")	C1155
C70	Capacitor, .001 µF, Cer, Disc	C0424
C71	Capacitor, .001 µF, Cer, Disc	C0424
C72	Capacitor, .001 µF, Cer, Disc	C0424
C73	Capacitor, .001 µF, Cer, Disc	C0424
C74	Capacitor, 5.5 - 18 pF, Trimmer	C0712
C75	Capacitor, .001 µF, Cer, Disc	C0424
C76	Capacitor, 5.5 - 18 pF, Trimmer	C0712
C77	Capacitor, .001 µF, 75 V (.125")	C1155
C78	Capacitor, .001 µF, Cer, Disc	C0424

A12 (SYNTHESIZER) RF PARTS LIST (Cont'd)

Ref.	Description	SD Part No.
C79	Capacitor, .001 µF, Cer, Disc	C0424
C80	Capacitor, .001 µF, Cer, Disc	C0424
C81	Capacitor, 27 pF, D.M.	C0530
C82	Capacitor, 5.5 - 18 pF, Trimmer	C0712
C83	Capacitor, .001 µF, 75 V (.125")	C1155
C84	Capacitor, .001 µF, Cer, Disc	C0424
C85	Capacitor, 2 pF, Disc	C0261
C86	Capacitor, .001 µF, Cer, Disc	Co424
C87	Capacitor, .001 µF, 75 V (.125")	C1155
C88	Capacitor, 2 pF, D.M.	03175030
C89	Capacitor, .001 µF, Cer, Disc	C0424
C90	Capacitor, 5 pF, D.M.	C1071
C91	Capacitor, 5 pF, D.M.	C1071
C92	Capacitor, .001 µF, Cer, Disc	C0424
C93	Capacitor, .001 µF, Cer, Disc	C0424
C94	Capacitor, .001 µF, Cer, Disc	C0424
C95	Capacitor, 5 pF, D.M.	C1071
C96	Capacitor, .001 µF, Cer, Disc	C0424
C97	Capacitor, 5 pF, D.M.	C1071
C98	Capacitor, Factory Selected	CXXXX
C99	Capacitor, .001 µF, Cer, Disc	C0424
C100	Capacitor, 2 pF, Disc	C0261
C101	Capacitor, .001 µF, Cer, Disc	C0424
C102	Capacitor, 1.3 - 5.4 pF, Trimmer	C1254
C103	Capacitor, .001 µF, 75 V (.125")	C1155
C104	Capacitor, .001 µF, 75 V (.125")	C1155
C105	Capacitor, .001 µF, 75 V (.125")	C1155
C106	Capacitor, 1.3 - 5.4 pF, Trimmer	C1254
C107	Capacitor, .001 µF, 75 V (.125")	C1155
C108	Capacitor, .001 µF, 75 V (.125")	C1155
C109	Capacitor, .001 µF, Cer, Disc	C0424
C110	Capacitor, 2 pF, Disc	C0261
C111	Capacitor, .001 µF, Cer, Disc	C0424
C112	Capacitor, 1.7 - 11 pF Trimmer	C1255
C113	Capacitor, .001 µF, 75 V (.125")	C1155
C114	Capacitor, .001 µF, 75 V (.125")	C1155
C115	Capacitor, .001 µF, Cer, Disc	C0424
C116	Capacitor, 1.7 - 11 pF, Trimmer	C1255
C117	Capacitor, .001 µF, 75 V (.125")	C1155
C118	Capacitor, .001 µF, 75 V (.125")	C1155

A12 (SYNTHESIZER) RF PARTS LIST (Cont'd)

Ref.	Description	SD Part No.
C119	Capacitor, .001 µF, Cer, Disc	C0424
C120	Capacitor, .001 µF, Cer, Disc	C0424
C121	Capacitor, 2 pF, Disc	C0261
C122	Capacitor, 1.7 - 11 pF, Trimmer	C1255
C123	Capacitor, .001 µF, 75 V (.125")	C1155
C124	Capacitor, .001 µF, 75 V (.125")	C1155
C125	Capacitor, .001 µF, Cer, Disc	C0424
C126	Capacitor, 1.3 - 5.4 pF Trimmer	C1254
C127	Capacitor, .001 µF, Cer, Disc	C0424
C128	Capacitor, .001 µF, 75 V (.125")	C1155
C129	Capacitor, .001 µF, Cer, Disc	C0424
C130	Capacitor, 2 pF, Disc	C0261
C131	Capacitor, .001 µF, Cer, Disc	C0424
C132	Capacitor, 1.3 - 5.4 pF Trimmer	C1254
C133	Capacitor, .001 µF, 75 V (.125")	C1155
C134	Capacitor, .001 µF, 75 V (.125")	C1155
C135	Capacitor, .001 µF, Cer, Disc	C0424
C136	Capacitor, 1.3 - 5.4 pF, Trimmer	C1254
C137	Capacitor, .001 µF, Cer, Disc	C0424
C138	Capacitor, .001 µF, 75 V (.125")	C1155
C139	Capacitor, .001 µF, Cer, Disc	C0424
C140	Capacitor, .001 µF, Cer, Disc	C0424
C141	Capacitor, .001 µF, Cer, Disc	C0424
C142	Capacitor, .001 µF, Cer, Disc	C0424
C143	Capacitor, .001 µF, Cer, Disc	C0424
CR1	NOT USED	
CR2	Diode, MV2108 or MV1636	CR0354
CR3	Diode, MV2108 or MV1636	CR0354
CR4	NOT USED	
CR5	Diode, IN4151	CR0150
CR6	NOT USED	
CR7	Diode, MV2108, or MV1636	CR0354
CR8	Diode, MV2108, or MV1636	CR0354
CR9	NOT USED	
CR10	Diode, IN4151	CR0150
CR11	Diode, MV2107 or MV1634	CR0375
CR12	Diode, MV2108 or MV1636	CR0354
CR13	NOT USED	
CR14	Diode, IN4151	CR0150
CR15	Diode, HPA2800	CR0363

A12 (SYNTHESIZER) RF PARTS LIST (Cont'd)

Ref.	Description	SD Part No.
CR16	Diode, HPA2800	CR0363
CR17	Diode, HPA2800	CR0363
CR18	Diode, HPA2800	CR0363
CR19	Diode, MA47600	CR0373
CR20	Diode, IN4151	CR0150
CR21	Diode, IN4151	CR0150
CR22	Diode, IN4151	CR0150
CR23	Diode, IN4151	CR0150
CR24	Diode, IN4151	CR0150
CR25	Diode, IN4151	CR0150
CR26	Diode, IN4151	CR0150
CR27	Diode, IN4151	CR0150
CR28	Diode, IN4151	CR0150
CR29	Diode, IN4151	CR0150
CR30	Diode, IN4151	CR0150
CR31	Diode, IN4151	CR0150
CR32	Diode, IN4151	CR0150
CR33	Diode, IN4151	CR0150
CR34	Diode, IN4151	CR0150
CR35	Diode, IN4151	CR0150
CR36	Diode, IN4151	CR0150
L1	Inductor, R45-4	L0143
L2	Inductor, 3 1/4 T	39667-4
	Coil Form	E0289
L3	Inductor, 2.7 µH	L0048
L4	Not Used	
L5	Inductor, .15 µH	L0080
L6	Inductor, 2 3/4 Turns	39667-6
	Coil Form	E0289
L7	Inductor, 2.7 µH	L0048
L8	Not Used	
L9	Inductor, 2 1/4 Turns #26	39667-2
	Coil Form	E0289
L10	Inductor, 2.7 µH	L0048
L11	Not Used	
L12	Inductor, 12 1/4 Turns #30	39667-5
	Coil Form	E0223
L13	Inductor, .06 µH	L0159
L14	Inductor, .06 µH	L0159
L15	Inductor, .06 µH	L0159
L16	Inductor, .15 µH	L0080

A12 (SYNTHESIZER) RF PARTS LIST (Cont'd)

Ref.	Description	SD Part No.
L17	Inductor, .15 µH	L0080
L18	Inductor, 3 1/2 Turns #26	39667-3
	Coil Form	E0289
L19	Inductor, 3 1/2 Turns #26	39667-3
L20	Inductor, 3 1/2 Turns #26	39667-3
L21	Inductor, 2 3/4 Turns #26	39667-6
L22	Inductor, 3 1/4 Turns #26	39667-4
L23	Loop 1/8" High X .2 Wide #18	
L24	4 Turns #18, 1/4" Diameter	39678-3
L25	Inductor, 1 1/4 Turns #26	39667-1
	Coil Form	E0223
L26	Inductor, 1 1/4 Turns #26	39667-1
L27	Inductor, 3/4 Turns #30	39667-7
	Coil Form	E0289
L28	Inductor, 3/4 Turns #30	39667-7
L29	Loop 1/8 High X 1/4 Wide #18	
L30	Loop 1/8 High X 1/4 Wide #18	
L31	Loop 3/16 High X 1/4 Wide #18	
L32	Loop 3/16 High X 1/4 Wide #18	
L33	Loop .4" High X .4 Wide #18	
L34	Loop 1/4 High X 1/4 Wide #18	
L35	Loop 3/16 High X 1/4 Wide #18	
L36	Loop 3/16 High X 1/4 Wide #18	
L37	Loop 1/8 High X 1/4 Wide #18	
Q1	Transistor, 40673	Q0297
Q2	Transistor, 2N5179	Q0269
Q3	Transistor, 2N3904	Q0247
Q4	Transistor, 40673	Q0297
Q5	Transistor, 2N5170	Q0269
Q6	Transistor, 2N3904	Q0247
Q7	Transistor, 40673	Q0297
Q8	Transistor, 2N5179	Q0269
Q9	Transistor, 2N3904	Q0247
Q10	Transistor, 2N3646	Q0218
Q11	Transistor, 2N3904	Q0247
Q12	Transistor, 2N3904	Q0247
Q13	Transistor, 2N5179	Q0269
Q14	Transistor, 2N5179	Q0269
Q15	Transistor, 2N5179	Q0269
Q16	Transistor, 2N5179	Q0269
Q17	Transistor, 2N5179	Q0269
Q18	Transistor, 2N5179	Q0269

A12 (SYNTHESIZER) RF PARTS LIST (Cont'd)

Ref.	Description	SD Part No.
Q19	Transistor, 2N5179	Q0269
Q20	Transistor, 2N5179	Q0269
Q21	Transistor, 2N5179	Q0269
Q22	Transistor, 2N5179	Q0269
Q23	Transistor, 2N5179	Q0269
Q24	Transistor, 2N5179	Q0269
Q25	Transistor, 2N5179	Q0269
Q26	Transistor, 2N5179	Q0269
Q27	Transistor, 2N3904	Q0247
R1	Resistor, 4.7 k, 1/4 W, 5%	R0892
R2	Resistor, 33 k, 1/4 W, 5%	R0780
R3	Resistor, 47 k, 1/4 W, 5%	R0777
R4	Resistor, 47 k, 1/4 W, 5%	R0777
R5	Resistor, 150 Ω, 1/4 W, 5%	R0983
R6	Resistor, 10 k, 1/4 W, 5%	R0766
R7	Resistor, 10 k, 1/4 W, 5%	R0766
R8	Resistor, 470 Ω, 1/4 W, 5%	R1044
R9	Resistor, 15 Ω, 1/4 W, 5%	R1607
R10	Resistor, 820 Ω, 1/4 W, 5%	R0762
R11	Resistor, 1 k, 1/4 W, 5%	R0765
R12	Resistor, 4.7 k, 1/4 W, 5%	R0892
R13	Resistor, 33 k, 1/4 W, 5%	R0780
R14	Resistor, 47 k, 1/4 W, 5%	R0777
R15	Resistor, 47 k, 1/4 W, 5%	R0777
R16	Resistor, 150 Ω, 1/4 W, 5%	R0983
R17	Resistor, 10 k, 1/4 W, 5%	R0766
R18	Resistor, 10 k, 1/4 W, 5%	R0766
R19	Resistor, 470 Ω, 1/4 W, 5%	R1044
R20	Resistor, 15 Ω, 1/4 W, 5%	R1607
R21	Resistor, 820 Ω, 1/4 W, 5%	R0762
R22	Resistor, 1 k, 1/4 W, 5%	R0765
R23	Resistor, 4.7 k, 1/4 W, 5%	R0892
R24	Resistor, 33 k, 1/4 W, 5%	R0789
R25	Resistor, 47 k, 1/4 W, 5%	R0777
R26	Resistor, 47 k, 1/4 W, 5%	R0777
R27	Resistor, 150 Ω, 1/4 W, 5%	R0983
R28	Resistor, 10 k, 1/4 W, 5%	R0766
R29	Resistor, 10 k, 1/4 W, 5%	R0766
R30	Resistor, 390 Ω, 1/4 W, 5%	R0880

A12 (SYNTHESIZER) RF PARTS LIST (Cont'd)

Ref.	Description	SD Part No.
R31	Resistor, 15 Ω, 1/4 W, 5%	R1607
R32	Resistor, 820 Ω, 1/4 W, 5%	R0762
R33	Resistor, 1 k, 1/4 W, 5%	R0765
R34	Resistor, 18 k, 1/4 W, 5%	R0875
R35	Resistor, 1.2 k, 1/4 W, 5%	R0809
R36	Resistor, 1 k, 1/4 W, 5%	R0765
R37	Resistor, 470 Ω, 1/4 W, 5%	R1044
R38	Resistor, 330 Ω, 1/4 W, 5%	R0662
R39	Resistor, 1.3 k, 1/4 W, 5%	R0737
R40	Resistor, 470 Ω, 1/4 W, 5%	R1044
R41	Resistor, 680 Ω, 1/4 W, 5%	R1234
R42	Resistor, 100 Ω, nom., 1/4 W, 5%	R0966
R43	Resistor, 10 Ω, 1/4 W, 5%	R0739
R44	Resistor, 820 Ω, 1/4 W, 5%	R0762
R45	Resistor, 2.7 k, 1/4 W, 5%	R0937
R46	Resistor, 10 k, 1/4 W, 5%	R0766
R47	Resistor, 10 k, 1/4 W, 5%	R0766
R48	Resistor, 10 Ω, 1/4 W, 5%	R0739
R49	Resistor, 470 Ω, 1/4 W, 5%	R1044
R50	Resistor, 3.9 k, 1/4 W, 5%	R0939
R51	Resistor, 10 k, 1/4 W, 5%	R0766
R52	Resistor, 56 Ω, 1/4 W, 5%	R1554
R53	Resistor, 120 Ω, 1/4 W, 5%	R1461
R54	Resistor, 2.7 k, 1/4 W, 5%	R0937
R55	Resistor, 820 Ω, 1/4 W, 5%	R0762
R56	Resistor, 56 Ω, 1/4 W, 5%	R1554
R57	Resistor, 12 k, 1/4 W, 5%	R0759
R58	Resistor, 3.3 k, 1/4 W, 5%	R0742
R59	Resistor, 56 Ω, 1/4 W, 5%	R1554
R60	Resistor, 270 Ω, 1/4 W, 5%	R0694
R61	Not Used	
R62	Resistor, 12 k, 1/4 W, 5%	R0759
R63	Resistor, 3.3 k, 1/4 W, 5%	R0742
R64	Resistor, 10 Ω, 1/4 W, 5%	R0739
R65	Resistor, 270 Ω, 1/4 W, 5%	R0694
R66	Resistor, 820 Ω, 1/4 W, 5%	R0762
R67	Resistor, 12 k, 1/4 W, 5%	R0759
R68	Resistor, 3.3 k, 1/4 W, 5%	R0742
R69	Resistor, 10 Ω, 1/4 W, 5%	R0739
R70	Resistor, 270 Ω, 1/4 W, 5%	R0694

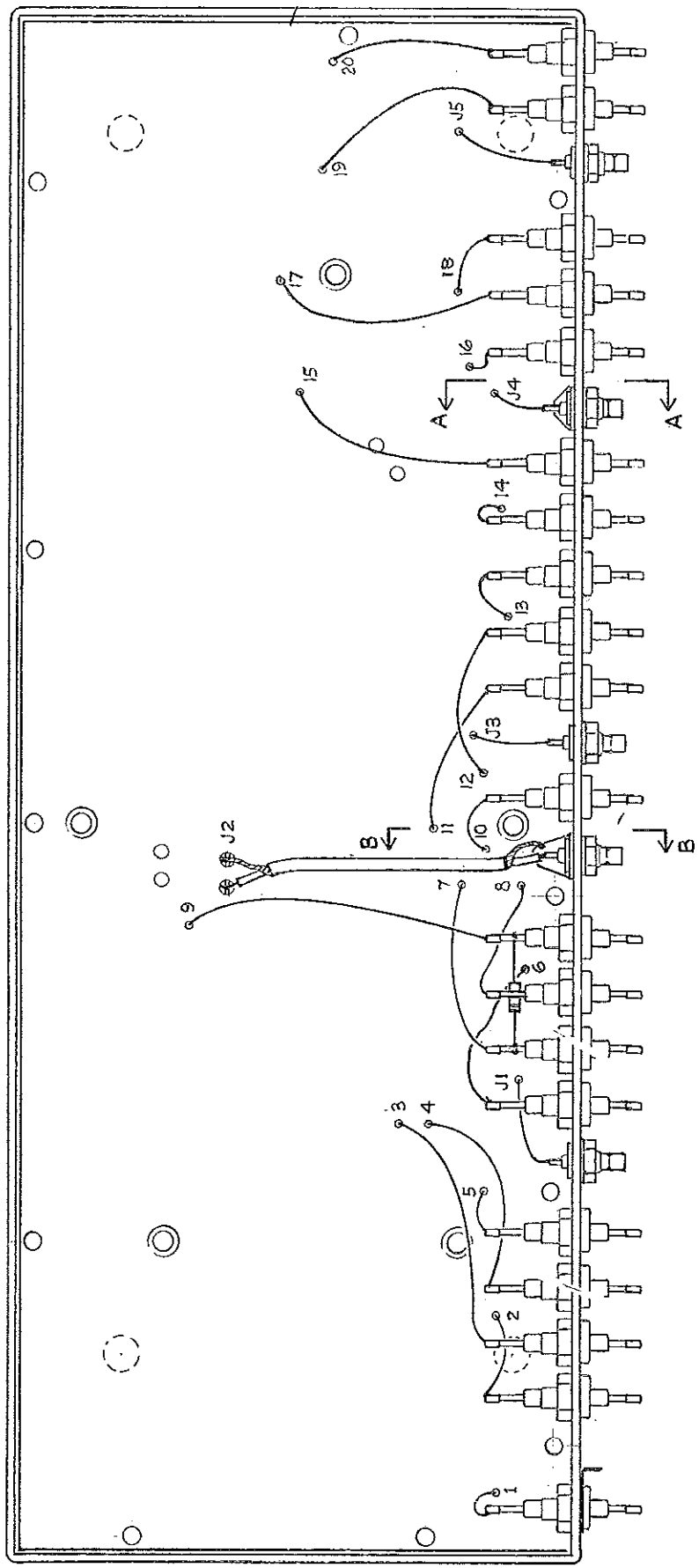
A12 (SYNTHESIZER) RF PARTS LIST (Cont'd)

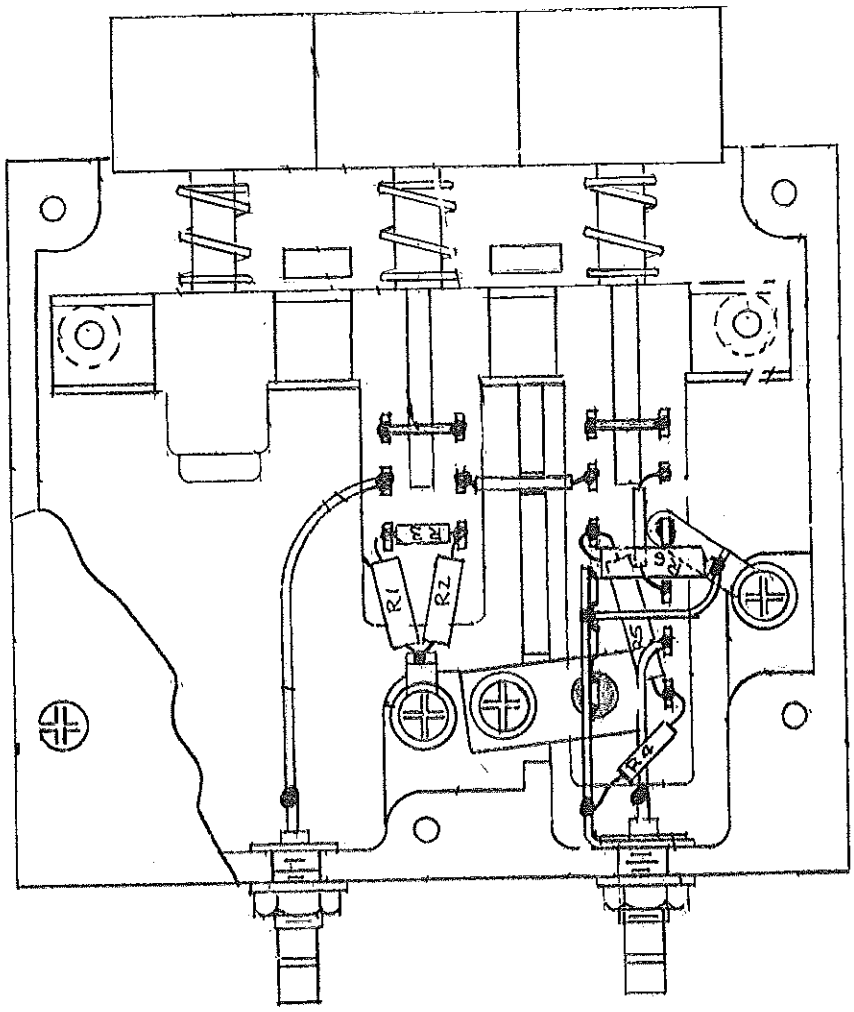
Ref.	Description	SD Part No.
R71	Resistor, 820 Ω, 1/4 W, 5%	R0762
R72	Resistor, 12 k, 1/4 W, 5%	R0759
R73	Resistor, 3.3 k, 1/4 W, 5%	R0742
R74	Resistor, 270 Ω, 1/4 W, 5%	R0694
R75	Resistor, 12 k, 1/4 W, 5%	R0759
R76	Resistor, 3.3 k, 1/4 W, 5%	R0742
R77	Resistor, 270 Ω, 1/4 W, 5%	R0694
R78	Resistor, 820 Ω, 1/4 W, 5%	R0762
R79	Resistor, 12 k, 1/4 W, 5%	R0759
R80	Resistor, 3.3 k, 1/4 W, 5%	R0742
R81	Resistor, 270 Ω, 1/4 W, 5%	R0694
R82	Resistor, 820 Ω, 1/4 W, 5%	R0762
R83	Resistor, 12 k, 1/4 W, 5%	R0759
R84	Resistor, 3.3 k, 1/4 W, 5%	R0742
R85	Resistor, 270 Ω, 1/4 W, 5%	R0694
R86	Resistor, 12 k, 1/4 W, 5%	R0759
R87	Resistor, 3.3 k, 1/4 W, 5%	R0742
R88	Resistor, 270 Ω, 1/4 W, 5%	R0694
R89	Resistor, 820 Ω, 1/4 W, 5%	R0762
R90	Resistor, 12 k, 1/4 W, 5%	R0759
R91	Resistor, 3.3 k, 1/4 W, 5%	R0742
R92	Resistor, 270 Ω, 1/4 W, 5%	R0694
R93	Resistor, 12 k, 1/4 W, 5%	R0759
R94	Resistor, 3.3 k, 1/4 W, 5%	R0742
R95	Resistor, 270 Ω, 1/4 W, 5%	R0694
R96	Resistor, 820 Ω, 1/4 W, 5%	R0762
R97	Resistor, 12 k, 1/4 W, 5%	R0759
R98	Resistor, 270 Ω, 1/4 W, 5%	R0694
R99	Resistor, 12 k, 1/4 W, 5%	R0759
R100	Resistor, 3.3 k, 1/4 W, 5%	R0742
R101	Resistor, 270 Ω, 1/4 W, 5%	R0694
R102	Resistor, 820 Ω, 1/4 W, 5%	R0762
R103	Resistor, 47 Ω, 1/4 W, 5%	R0743
R104	Resistor, 12 k, 1/4 W, 5%	R0759
R105	Resistor, 3.3 k, 1/4 W, 5%	R0742
R106	Resistor, 270 Ω, 1/4 W, 5%	R0694
R107	Resistor, 12 k, 1/4 W, 5%	R0759
R108	Resistor, 3.3 k, 1/4 W, 5%	R0742
R109	Resistor, 270 Ω, 1/4 W, 5%	R0694
R110	Resistor, 820 Ω, 1/4 W, 5%	R0762

A12 (SYNTHESIZER) RF PARTS LIST (Cont'd)

Ref.	Description	SD Part No.
R111	Not Used	
R112	Resistor, 560 Ω, 1/4 W, 5%	R0819
R113	Resistor, 3.3 k, 1/4 W, 5%	R0742
R114	Not Used	
R115	Resistor, 330 Ω, 1/4 W, 5%	R0662
R116	Resistor, 330 Ω, 1/4 W, 5%	R0662
R117	Resistor, 330 Ω, 1/4 W, 5%	R0662
R118	Resistor, 470 Ω, 1/4 W, 5%	R1044
R119	Resistor, 150 k, 1/4 W, 5%	R0961
R120	Resistor, 390 Ω, 1/4 W, 5%	R0880
R121	Resistor, 150 k, 1/4 W, 5%	R0961
R122	Resistor, 390 Ω, 1/4 W, 5%	R0880
R123	Resistor, 150 k, 1/4 W, 5%	R0961
R124	Resistor, 390 Ω, 1/4 W, 5%	R0880
R125	Resistor, 100 Ω, Potentiometer	R2374
R126	Resistor, 56 Ω, 1/4 W, 5%	R1554
R127	Resistor, 68 Ω, 1/4 W, 5%	R1426
R128	Resistor, 20 k, Potentiometer	R2419
R129	Resistor, 500 Ω, Potentiometer	R2375
R130	Resistor, 500 Ω, Potentiometer	R2375
R131	Resistor, 500 Ω, Potentiometer	R2375
R132	Resistor, 500 Ω, Potentiometer	R2375
T1	Transformer	39668
R2	Toroidal Core	E0203
T2	Transformer	39668
U1	Integrated Circuit, MC1027P	25719
U2	Integrated Circuit, MC1670P	25765
U3	Integrated Circuit, MC1027P	25719
U4	Integrated Circuit, MC1027P	25719
U5	Integrated Circuit, Mixer MCL TAK-7,4	RF0015
	Coax Cable (A-A) Prep W/L	39582

TOP VIEW - SHOWN WITH (10) COVER OFF.





A13 (SYNTHESIZER), ATTENUATOR ASSEMBLY C39555R4

A13 (SYNTHESIZER) ATTENUATOR ASSEMBLY PARTS LIST

Ref.	Description	SD Part No.
A13	Attenuator Assembly	C39555R4
	RF Connector	J0618
	Push Button Switch	39766
R1	Resistor, 62 Ω, 1/4 W, 5%	R1555
R2	Resistor, 62 Ω, 1/4 W, 5%	R1555
R3	Resistor, 270 Ω, 1/8 W, 5%	R1443
R4	Resistor, 56 Ω, 1/8 W, 5%	R1833
R5	Resistor, 2.7 k, 1/4 W, 5%	R0937
R6	Resistor, 47 Ω, 1/4 W, 5%	R0743

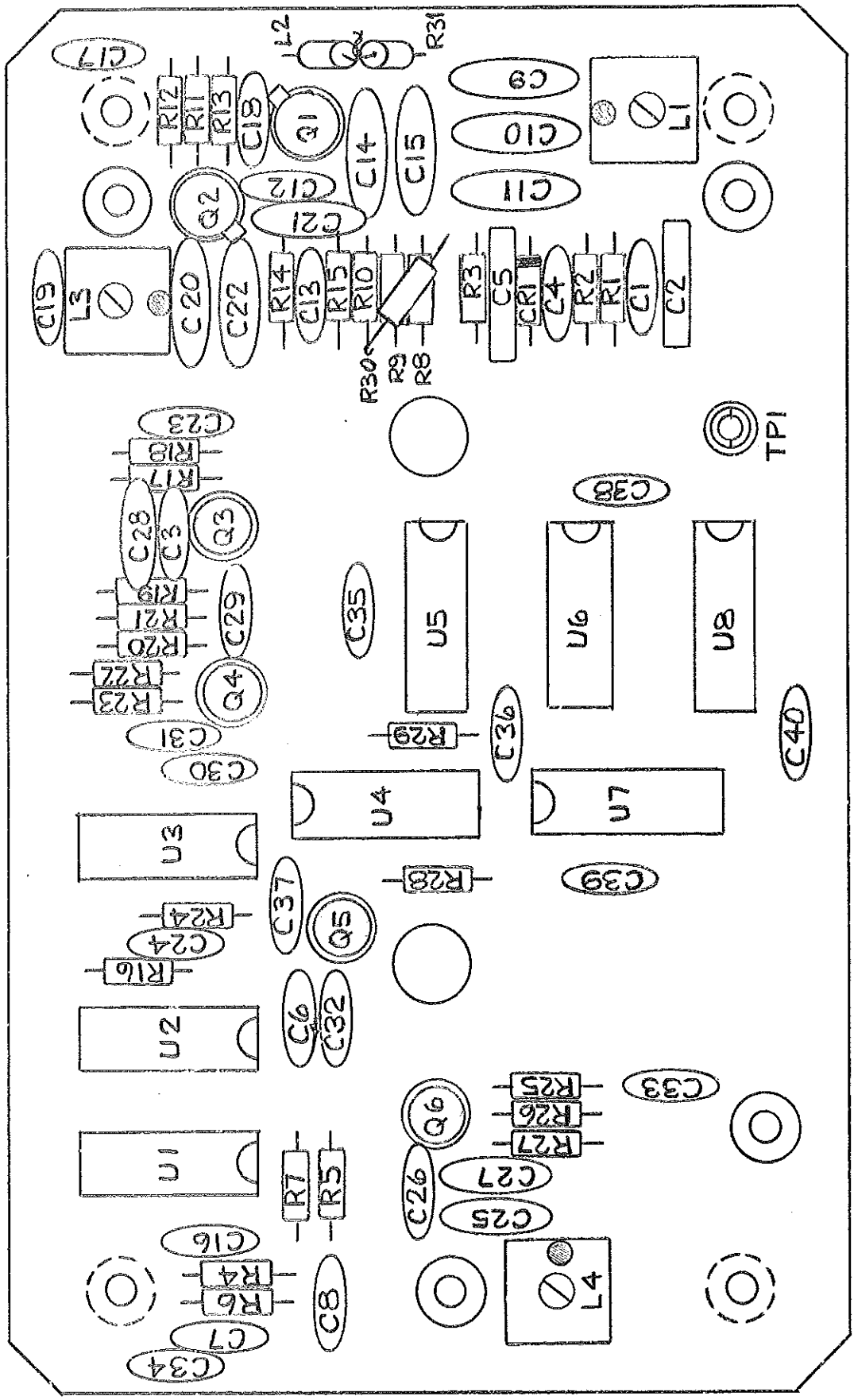
CIRCUIT DESCRIPTION
100 MHz MULTIPLIER
SCHEMATIC #D39521R3
A14 (SYNTHESIZER)

The 100 MHz Multiplier provides signals at both 100 MHz and 10 MHz which are phase-locked to the 1 MHz reference oscillator. A voltage-controlled oscillator (VCO) produces a frequency of 100 MHz which is divided-down to 1 MHz. This 1 MHz signal is compared to the reference 1 MHz and the resulting error voltage maintains the oscillator on exactly 100 MHz. The 10 MHz output is derived from the first divide-by-10.

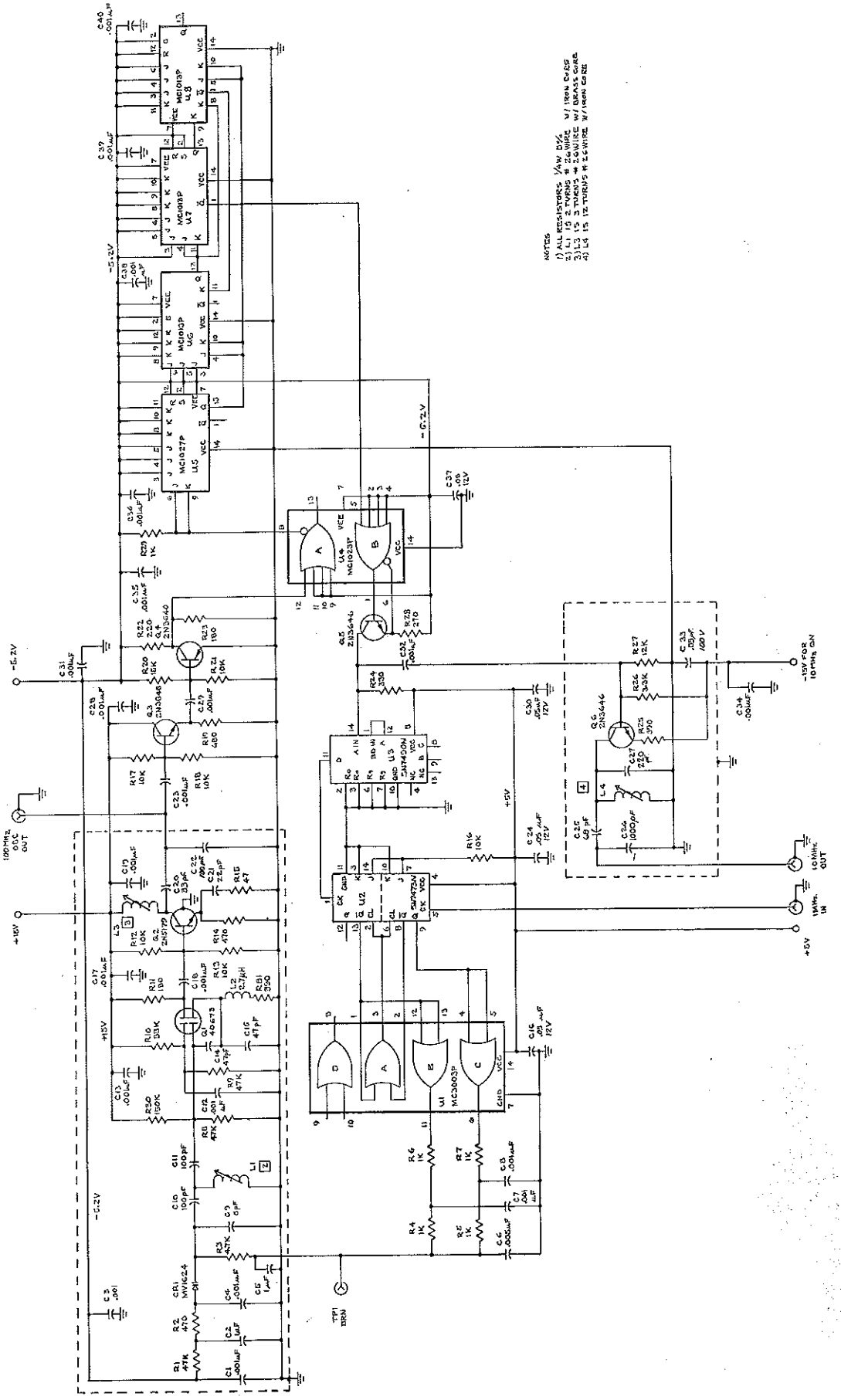
The VCO consists of Q1, a dual-insulated-gate MOS-type transistor, voltage-variable capacitor CR1, inductor L1, and capacitor C9. L1 is set to place the error-control voltage in the center of its range. Feedback and bias are provided by C14, C15, and C2. A tuned stage, Q2, amplifies and isolates the oscillator signal. An output is provided at this point. Transistors Q2 and Q3 provide a proper voltage level to operate the first divide-by-ten circuit.

Integrated circuits U4 - U8 perform a divide-by-ten function. The 100 MHz input signal is buffered by U4-A, divided-by-two by U5, and divided-by-five by U6 - U8. The resulting 10 MHz signal is buffered by U4-B and converted to +5 V logic levels by Q5. Transistor amplifier Q6 is tuned at 10 MHz and amplifies the 10 MHz signal. This amplifier operates only when -15 V is applied to the "10 MHz ON" line.

The remaining circuitry on the board consists of the second divide-by-ten circuit (U3) and the phase detector (U1 and U2). U2 is a dual J-K flip-flop with steering inputs (J & K) on each flip-flop connected so that the clock pulses on pins 1 and 5 (from the divided 1 MHz and the reference 1 MHz) cause the $\overline{Q}$ outputs to go low. When both $\overline{Q}$ outputs are low, then gate U1-A will have a low output which resets both flip-flops. Gates U1-B and U1-C are connected to opposite flip-flop outputs (Q on one and $\overline{Q}$ on the other). Their output voltages are summed by R4 through R7 and filtered by C5 through C8. If both 1 MHz signals are precisely the same frequency, the outputs of U1-B and U1-C will be of equal duration and the voltage fed to the oscillator will hold constant. If the oscillator frequency varies then one output will be of longer duration and the control voltage will move to place the oscillator back on frequency.



A14 (SYNTHESIZER), 100 MHz MULTIPLIER P.C. ASSEMBLY D39524R1



A14 (SYNTHESIZER), 100 MHz MULTIPLIER P.C. SCHEMATIC D39521R3

A14 (SYNTHESIZER), 100 MHz MULTIPLIER PARTS LIST

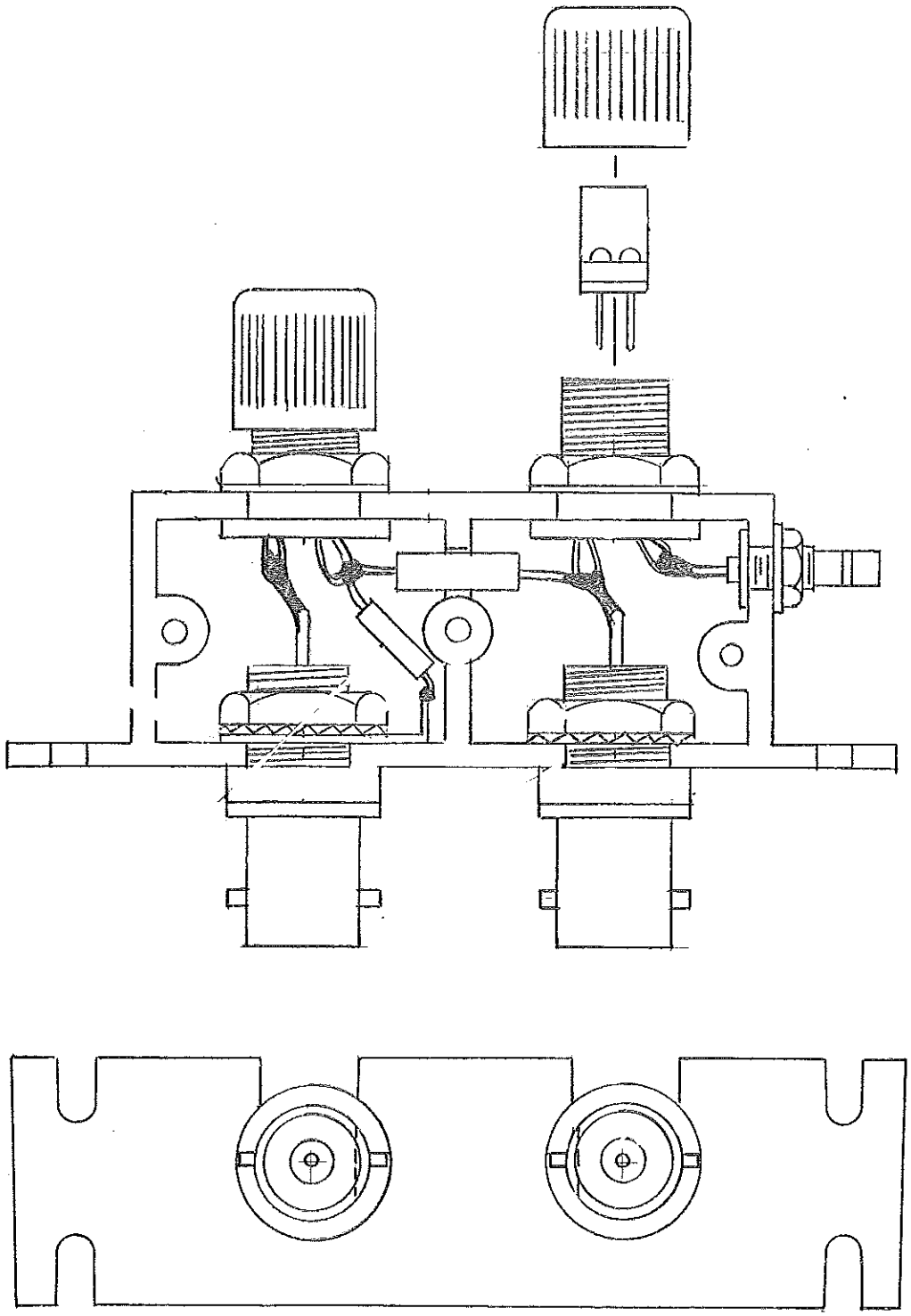
Ref.	Description	SD Part No.
A14	100 MHz Multiplier Assembly	D39524R1
A14	100 MHz Multiplier Schematic	D39521R3
C1	Capacitor, .001 µF, 500 V, Disc	C0424
C2	Capacitor, 1 µF, 25 V, Disc	C0879
C3	Capacitor, .001 µF, 500 V, Disc	C0424
C4	Capacitor, .001 µF, 500 V, Disc	C0424
C5	Capacitor, 1 µF, 25 V, Disc	C0879
C6	Capacitor, .005 µF, 150 V, Disc	C0325
C7	Capacitor, .001 µF, 500 V, Disc	C0424
C8	Capacitor, .001 µF, 500 V, Disc	C0424
C9	Capacitor, 5 pF, DM, DM15	C1071
C10	Capacitor, .05 µF, 12 V, Disc	C0672
C11	Capacitor, 100 pF, DM, DM15	C0536
C12	Capacitor, .001 µF, 500 V, Disc	C0424
C13	Capacitor, .001 µF, 500 V, Disc	C0424
C14	Capacitor, 47 pF, DM, DM15	C0533
C15	Capacitor, 47 pF, DM, DM15	C0533
C16	Capacitor, .001 µF, 500 V, Disc	C0424
C17	Capacitor, .001 µF, 500 V, Disc	C0424
C18	Capacitor, .001 µF, 500 V, Disc	C0424
C19	Capacitor, .001 µF, 500 V, Disc	C0424
C20	Capacitor, 33 pF, DM, DM15	C0531
C21	Capacitor, 22 pF, DM, DM15	C0529
C22	Capacitor, 100 pF, DM, DM15	C0536
C23	Capacitor, .001 µF, 500 V, Disc	C0424
C24	Capacitor, .05 µF, 12 V, Disc	C0672
C25	Capacitor, 68 pF, DM, DM15	C0635
C26	Capacitor, 1000 pF, 100 V, 5%	C1144
C27	Capacitor, 220 pF, DM, DM15	C0538
C28	Capacitor, .001 µF, 500 V, Disc	C0424
C29	Capacitor, .001 µF, 500 V, Disc	C0424
C30	Capacitor, .05 µF, 12 V, Disc	C0672
C31	Capacitor, .001 µF, 500 V, Disc	C0424
C32	Capacitor, .001 µF, 500 V, Disc	C0424
C33	Capacitor, .05 µF, 50 V, Disc	03281790
C34	Capacitor, .001 µF, 500 V, Disc	C0424
C35	Capacitor, .001 µF, 500 V, Disc	C0424
C36	Capacitor, .001 µF, 500 V, Disc	C0424
C37	Capacitor, .05 µF, 12 V, Disc	C0672
C38	Capacitor, .001 µF, 500 V, Disc	C0424
C39	Capacitor, .001 µF, 500 V, Disc	C0424

A14 (SYNTHESIZER), 100 MHz MULTIPLIER PARTS LIST (Cont'd)

Ref.	Description	SD Part No.
C40	Capacitor, .001 µF, 500 V, Disc	C0424
CR1	Diode, MV1624	CR0353
CR2	Diode, FD700	CR0356
L1	Inductor	39667-2
	Coil Form	E0223
L2	Inductor, 2.7 µH	L0048
L3	Inductor	39667-4
	Coil Form	E0289
L4	Inductor	39667-5
	Coil Form	E0223
Q1	Transistor, 40673	Q0297
Q2	Transistor, 2N5179	Q0269
Q3	Transistor, 2N3646	Q0218
Q4	Transistor, 2N3640	Q0178
Q5	Transistor, 2N3646	Q0218
Q6	Transistor, 2N3646	Q0218
R1	Resistor, 47 k, 1/4 W, 5%	R0777
R2	Resistor, 470 Ω, 1/4 W, 5%	R0744
R3	Resistor, 4.7 k, 1/4 W, 5%	R0892
R4	Resistor, 1 k, 1/4 W, 5%	R0765
R5	Resistor, 1 k, 1/4 W, 5%	R0765
R6	Resistor, 1 k, 1/4 W, 5%	R0765
R7	Resistor, 1 k, 1/4 W, 5%	R0765
R8	Resistor, 47 k, 1/4 W, 5%	R0777
R9	Resistor, 47 k, 1/4 W, 5%	R0777
R10	Resistor, 100 k, 1/4 W, 5%	R0741
R11	Resistor, 180 Ω, 1/4 W, 5%	R1233
R12	Resistor, 10 k, 1/4 W, 5%	R0766
R13	Resistor, 10 k, 1/4 W, 5%	R0766
R14	Resistor, 470 Ω, 1/4 W, 5%	R0744
R15	Resistor, 47 Ω, 1/4 W, 5%	R1043
R16	Resistor, 10 k, 1/4 W, 5%	R0766
R17	Resistor, 10 k, 1/4 W, 5%	R0766
R18	Resistor, 10 k, 1/4 W, 5%	R0766
R19	Resistor, 680 Ω, 1/4 W, 5%	R1234
R20	Resistor, 15 k, 1/4 W, 5%	R0728
R21	Resistor, 10 k, 1/4 W, 5%	R0766
R22	Resistor, 220 Ω, 1/4 W, 5%	R0760
R23	Resistor, 180 Ω, 1/4 W, 5%	R1233
R24	Resistor, 330 Ω, 1/4 W, 5%	R0662

A14 (SYNTHESIZER), 100 MHz MULTIPLIER PARTS LIST (Cont'd)

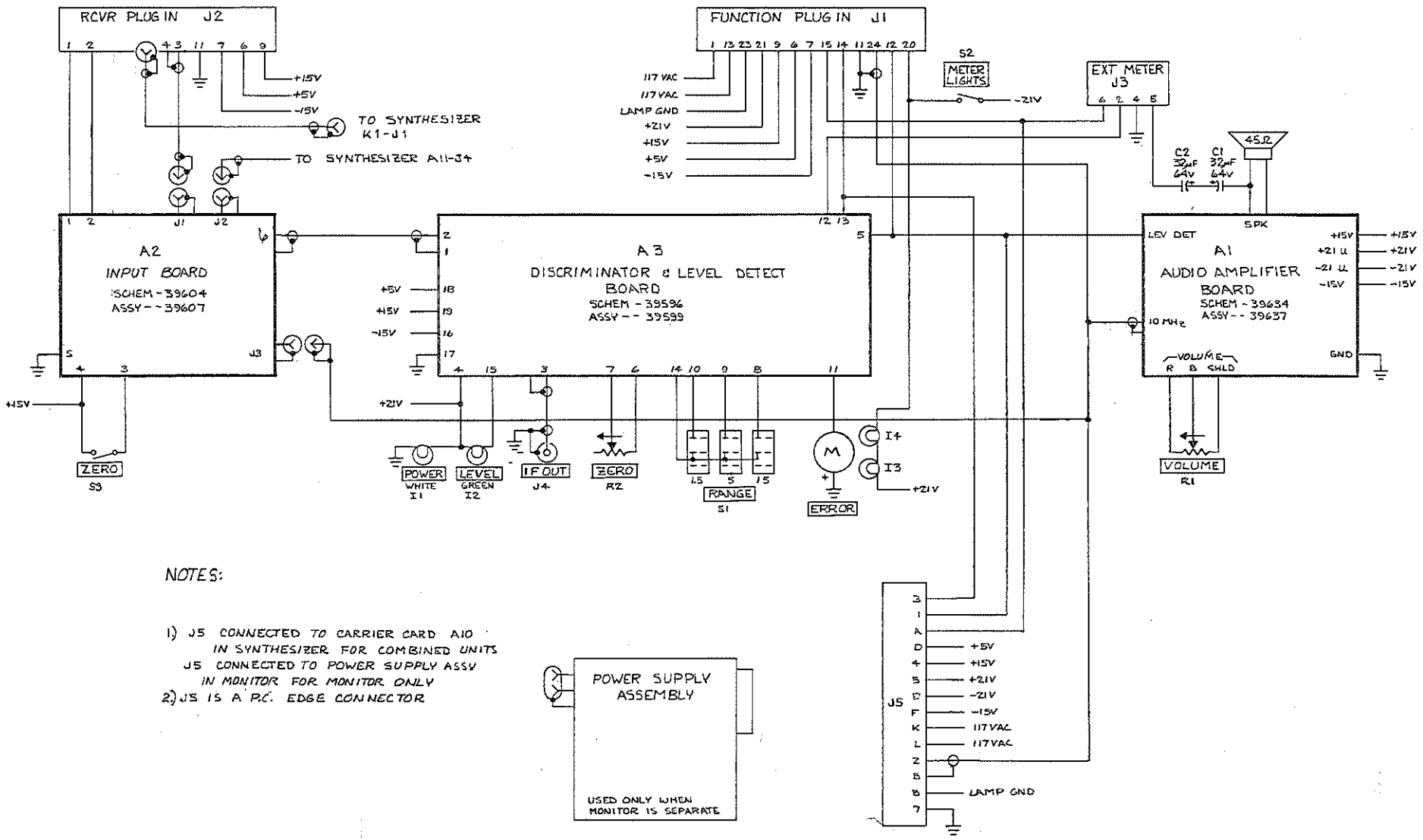
Ref.	Description	SD Part No.
R25	Resistor, 390 Ω, 1/4 W, 5%	R0880
R26	Resistor, 3.3 k, 1/4 W, 5%	R0742
R27	Resistor, 12 k, 1/4 W, 5%	R0759
R28	Resistor, 270 Ω, 1/4 W, 5%	R0694
R29	Resistor, 1 k, 1/4 W, 5%	R0765
U1	Integrated Circuit, MC3003P	25767
U2	Integrated Circuit, SN7473N	19709
U3	Integrated Circuit, SN7490N	19711
U4	Integrated Circuit, MC1023P	25718
U5	Integrated Circuit, MC1027P	25719
U6	Integrated Circuit, MC1013P	25716
U7	Integrated Circuit, MC1013P	25716
U8	Integrated Circuit, MC1013P	25716
	Test Point Brown	E0284



A15 (SYNTHESIZER), RF OUT ASSEMBLY C39558R4

A15 (SYNTHESIZER), RF OUT ASSEMBLY PARTS LIST

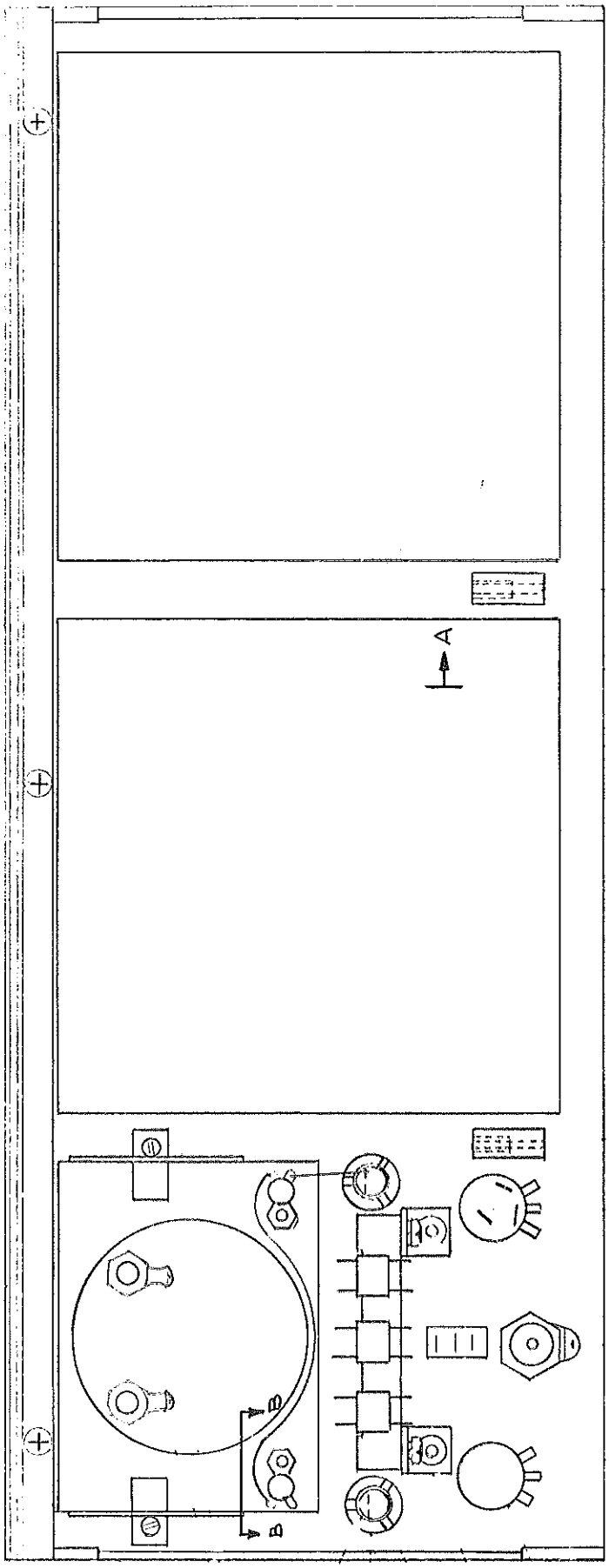
Ref.	Description	SD Part No.
A15	RF Out Assembly	C39558R4
	Fuse Clip	X0175
	Resistor, 1/4 W, 5%, 47 Ω	R0743
	BNC Connector	J0260
	RF Connector	J0618
	Fuse Holder	X0158
	Fuse, 1/20 A	F0068
	Resistor, 1/2 W, 5%, 2.7 K	R0143



(MONITOR) BLOCK DIAGRAM D39818R2

MONITOR, FINAL ASSEMBLY PARTS LIST

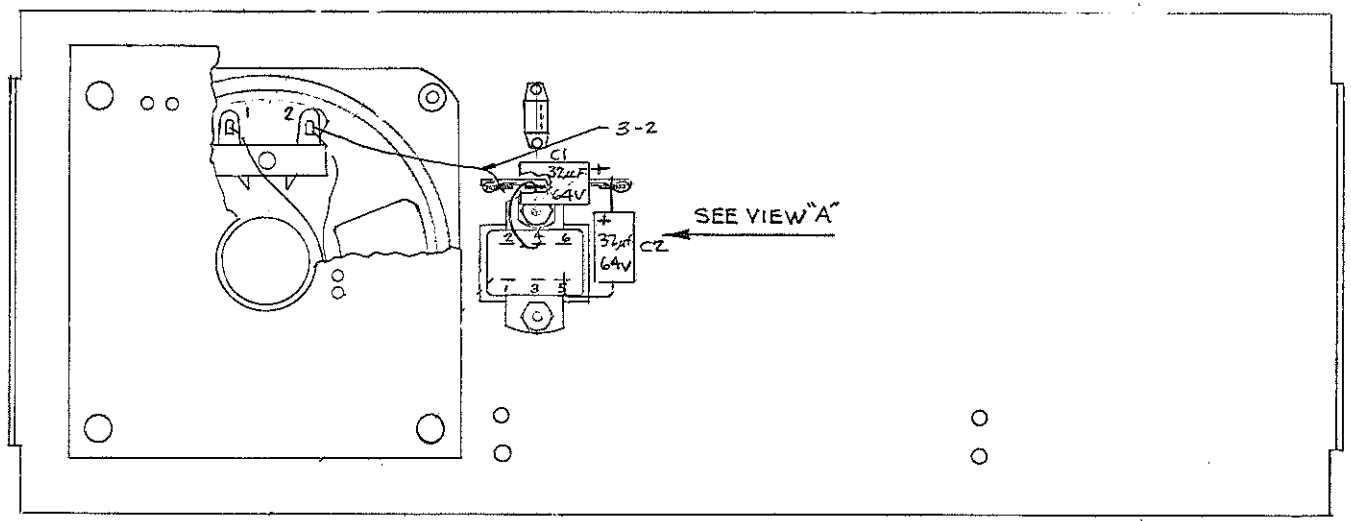
Ref.	Description	SD Part No.
	Connector, 10 Pin (2 Row)	J0620
	Connector, BNC	J0614
	Connector, Gremar 8212B	J0611
	Connector, BNC	J0633

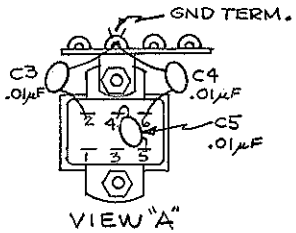


(MONITOR) FRONT PANEL SUBASSEMBLY D39727R2

(MONITOR) FRONT PANEL SUB-ASSEMBLY PARTS LIST

Ref.	Description	SD Part No.
	Front Panel Sub-Assembly	D39727R2
	Lamp Socket	X0133
	Switch, SPDT	S0355
	Potentiometer, CRL Model 3, 500 Ω	R2709
	Potentiometer/Switch, CRL Model 3, 5 k	R2710
	Lamp, White, Dialco 507-30918-1475-600	I0103
	Jack, BNC	J0260
	Knob, Raytheon, #70-2WD-1	H1982
	Lamp, Green, Dialco 507-3918-1472-600	I0104
	Push Button Switch	S0405
	Meter	M0021
	Lamp, Incandescent, (Meter)	I0100





VIEW "A"

(MONITOR) REAR PANEL SUBASSEMBLY D39728R3

(MONITOR) REAR PANEL SUB-ASSEMBLY PARTS LIST

Ref.	Description	SD Part No.
	Rear Panel Sub-Assembly	D39728R2
C1	Capacitor, 32 µF, @ 64 V	03290200
C2	Capacitor, 32 µF, @ 64 V	03290200
J3	Connector, Cinch-Jones, #S-306-AB	J0619
LS1	Speaker, Quam #4A1Z45	LS0001
	Speaker Screen	39645
S2	Switch, Slide	S0356

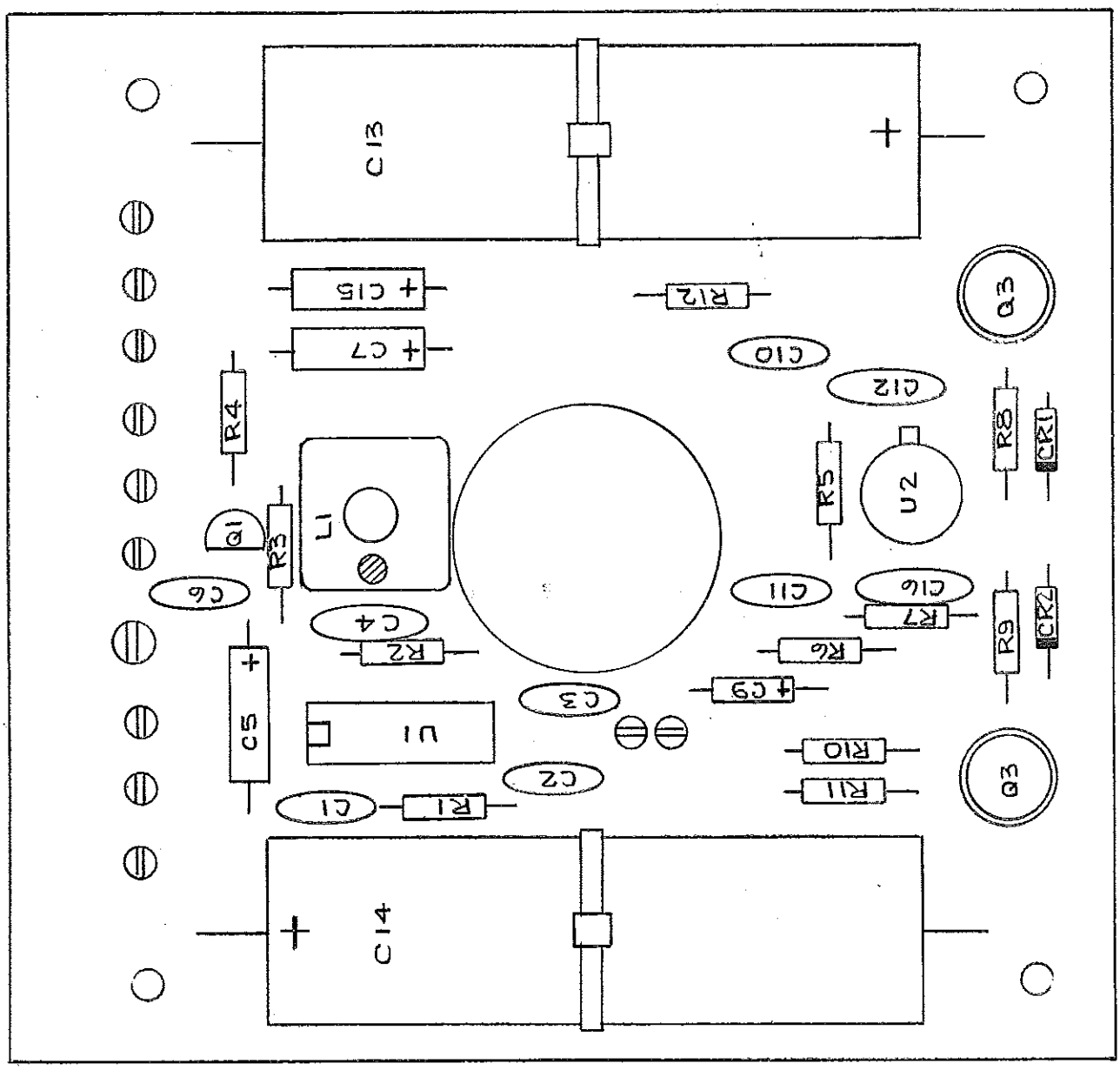
CIRCUIT DESCRIPTION
AUDIO AMPLIFIER
SCHEMATIC #B39634R2
A1 (MONITOR)

The Audio Amplifier assembly provides an audible output of any modulation present on signals received by the Monitor.

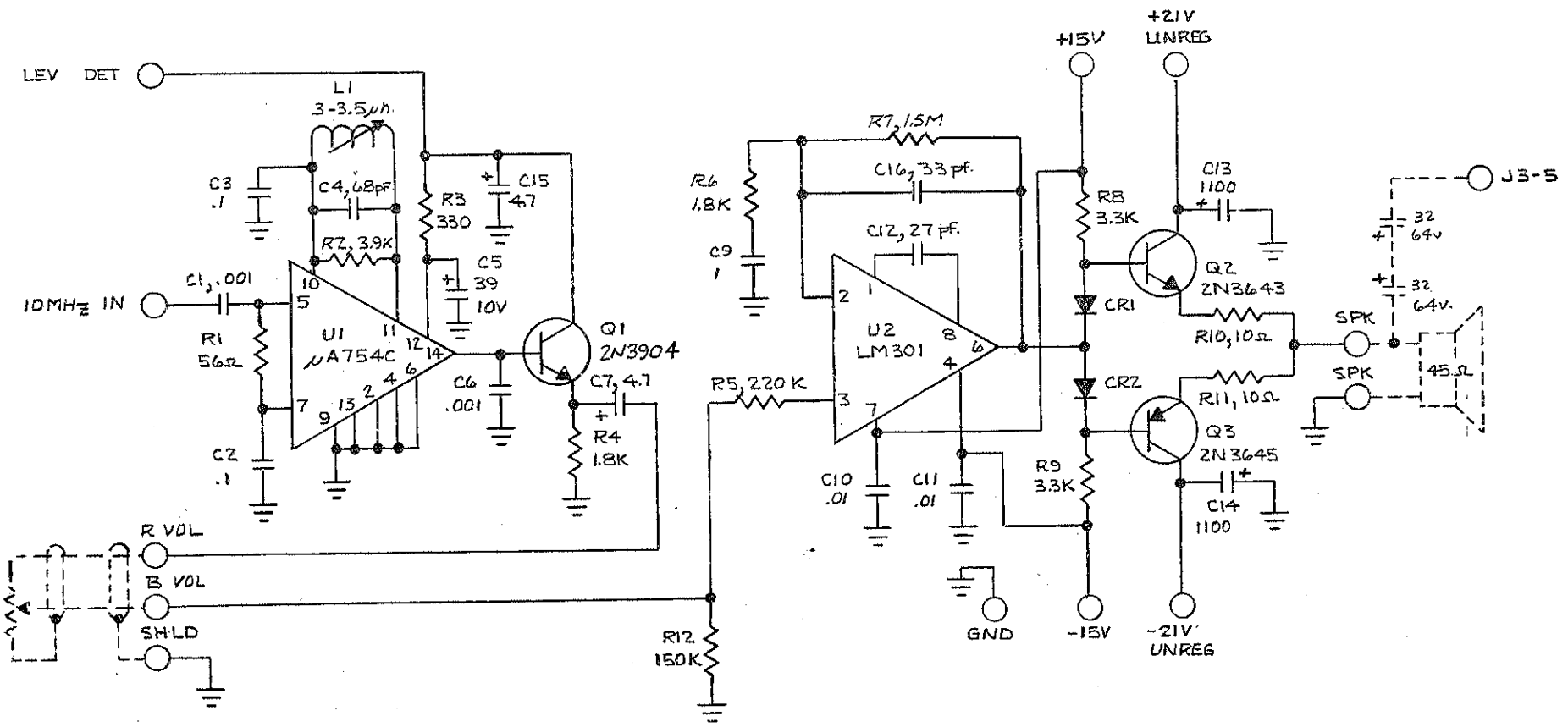
The low-level 10 MHz IF output from the input board provides a signal for integrated circuit U1. This device is a complete limiting amplifier/discriminator. Demodulation of the signal is performed by a quadrature detector in the I.C. Coil L1 and capacitor C4 provide the necessary phase shift for the detector. The supply voltage for U1 (and emitter-follower Q1) is turned on only when the input signal to the Monitor is sufficient to operate the level detector circuit. In this way, no audio signal is present until the input is large enough.

The audio signal from U1 is buffered by emitter-follower Q1 and routed through the front-panel volume control to the input of amplifier U2. This integrated-circuit device provides an amplification of over 800 times and provides sufficient output voltage to drive the output circuit. Transistors Q2 and Q3 are complementary emitter-followers which provide current amplification for power to drive the speaker. Bias network R8, CR1, CR2, R9 reduces crossover-distortion in the output stage. Capacitors C13 and C14 provide additional filtering for the power supplies.

The rear-panel-mounted speaker is a special 45-ohm type. An external 45-ohm speaker may be connected to the amplifier via rear panel connector J3. The external speaker is capacitor-coupled.



A1 AUDIO AMPLIFIER P.C. ASSEMBLY D39637R2



NOTES: (EXCEPT AS NOTED)

1 RESISTORS: VALUE IN OHMS, POWER 1/4W & TOL. ±5%

2. CAPACITORS: CAPACITY IN μF.

3 ALL DIODES ARE IN4451

A1 AUDIO AMPLIFIER P.C. SCHEMATIC B39634R2

A1 (MONITOR), AUDIO AMPLIFIER PARTS LIST

Ref.	Description	SD Part No.
A1	Audio Amplifier Assembly	D39637
	Audio Amplifier Schematic	B39634R1
C1	Capacitor, .001 µF, Disc	C0424
C2	Capacitor, .1 µF, 10 V, Disc	C0661
C3	Capacitor, .1 µF, 10 V, Disc	C0661
C4	Capacitor, 68 pF, DM	C0635
C5	Capacitor, 39 M, 10 V, Tant	C0902
C6	Capacitor, .001 µF, Disc	C0424
C7	Capacitor, 4.7 µF, 35 V, Tant	C0406
C8	Capacitor, .1 µF, 10 V, Disc	C0661
C9	Capacitor, 1 µF, 35 V, Tant	C0524
C10	Capacitor, .01 µF, Disc	C0562
C11	Capacitor, .01 µF, Disc	C0562
C12	Capacitor, 27 pF, DM	C0530
C13	Capacitor, 1100 µF, 30 V	C1162
C14	Capacitor, 1100 µF, 30 V	C1162
C15	Capacitor, 4.7 µF, 35 V, Tant	C0406
C16	Capacitor, 33 pF, DM	C0531
CR1	Diode, 1N4151	CR0150
CR2	Diode, 1N4151	CR0150
L1	Inductor, 3.3 µH	39666-1
	Coil Form	E0304
Q1	Transistor, 2N3904	Q0247
Q2	Transistor, 2N3643	Q0179
Q3	Transistor, 2N3645	Q0215
R1	Resistor, 56 Ω, 1/4 W, 5%	R1554
R2	Resistor, 3.9 k, 1/4 W, 5%	R0939
R3	Resistor, 330 Ω, 1/4 W, 5%	R0662
R4	Resistor, 1.8 k, 1/4 W, 5%	R0959
R5	Resistor, 220 k, 1/4 W, 5%	R0967
R6	Resistor, 1.8 k, 1/4 W, 5%	R0959
R7	Resistor, 1.5 M, 1/4 W, 5%	R1204
R8	Resistor, 3.3 k, 1/4 W, 5%	R0742
R9	Resistor, 3.3 k, 1/4 W, 5%	R0742
R10	Resistor, 10 Ω, 1/4 W, 5%	R0739
R11	Resistor, 10 Ω, 1/4 W, 5%	R0739
R12	Resistor, 150 k, 1/4 W, 5%	R0961

A1 (MONITOR), AUDIO AMPLIFIER PARTS LIST (Cont'd)

Ref.	Description	SD Part No.
U1	Integrated Circuit, μA754C	25781
U2	Integrated Circuit, LM301A	25745

CIRCUIT DESCRIPTION
INPUT BOARD
SCHEMATIC #C39604R2
A2 (MONITOR)

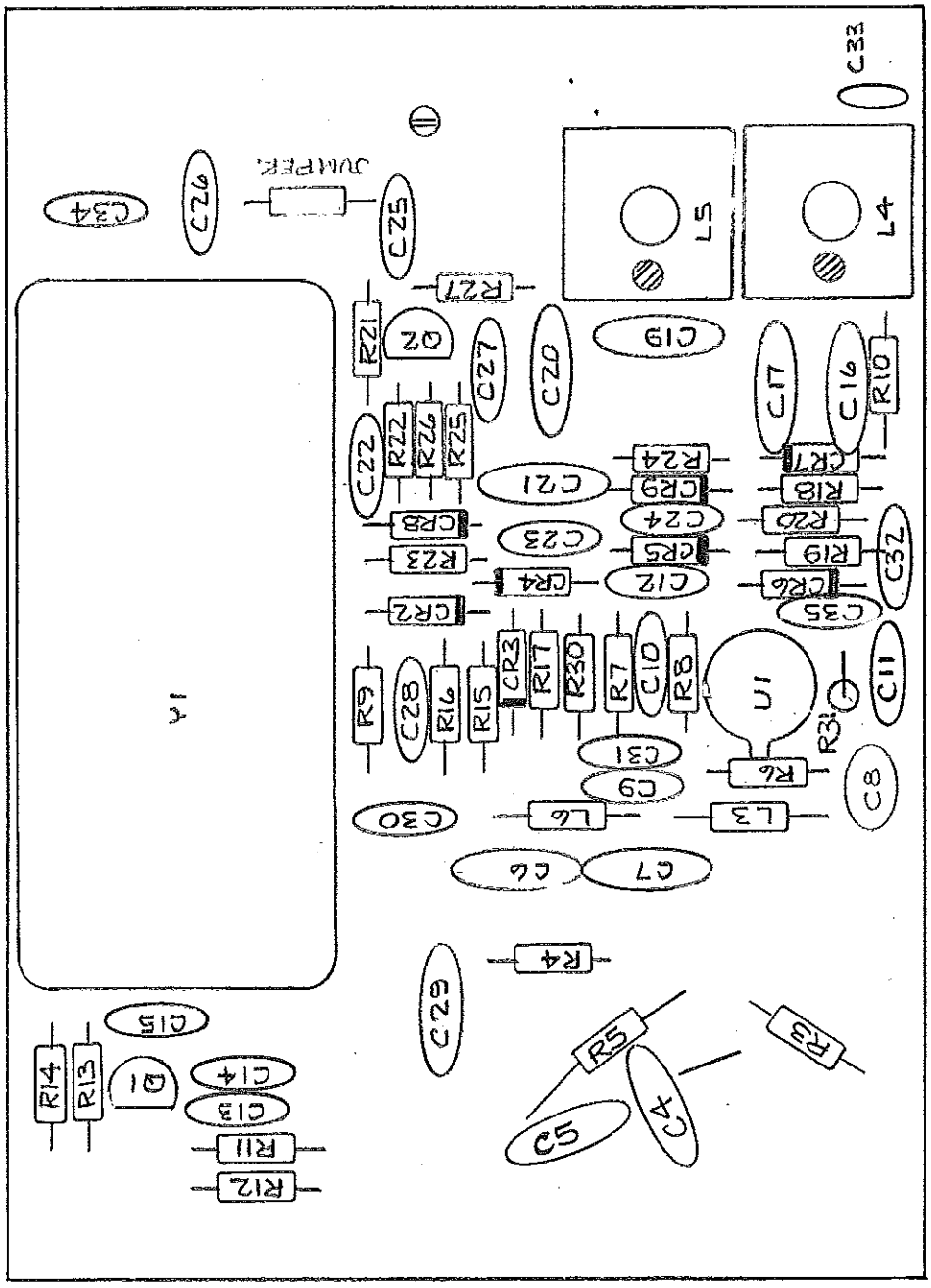
The Input Board consists of: 1) limiting amplifier; and 2) a dual-bandwidth filter system.

1) LIMITING AMPLIFIER

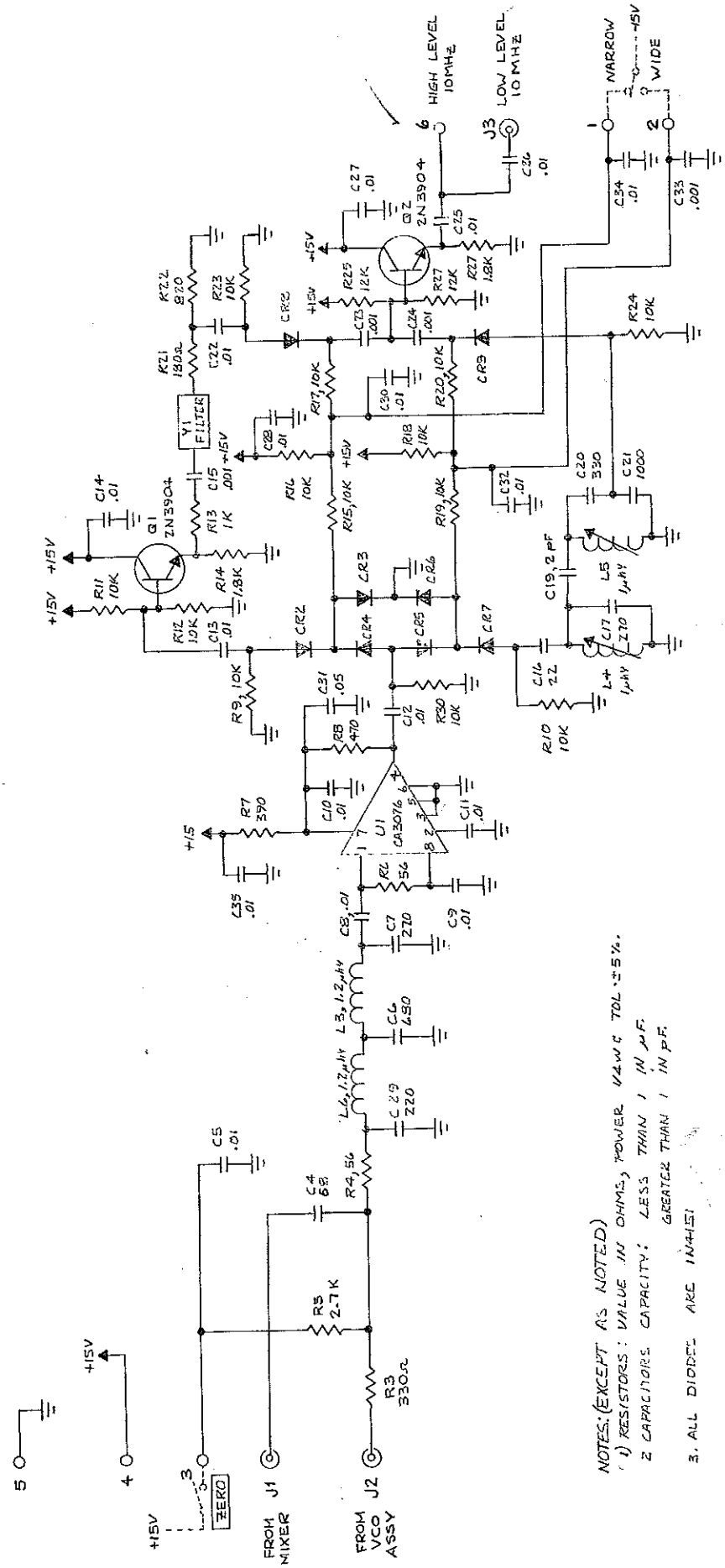
Input to the amplifier is filtered by C29, L6, C6, L3, and C7 to remove any frequencies above 10 MHz. The resulting 10 MHz IF signal is amplified by integrated circuit U1. This I.C. is a limiting-type amplifier and provides a nearly constant output level once a certain input level is reached.

2) DUAL-BANDWIDTH FILTER SYSTEM

Diodes CR2 - CR7 and CR8, CR9 provide switching to select either the wide or narrow modes. Switching the front-panel WIDE/NARROW switch to WIDE, forward-biases diodes CR5, CR7, and CR9; at the same time, diode CR6 is reverse-biased. This permits the output from U1 to pass through the tuned network composed of C16, L4, C18, C19, L5, C20,and C21. The bandwidth of this circuit is approximately 200 kHz at the 3 dB points. Switching the front panel WIDE/NARROW switch to NARROW, forward-biases diodes CR2, CR4 and CR8, and reverse-biases CR3. The signal from U1 now is buffered by Q1 and passes through crystal filter Y1. This filter has a 3 dB bandwidth of about 16 kHz and a 60 dB bandwidth of about 36 kHz. Buffer Q2 provides a low-impedance source for the 10 MHz IF lines.



A2 (MONITOR), INPUT BOARD ASSEMBLY D39607R2


NOTES: (EXCEPT AS NOTED)
1) RESISTORS: VALUE IN OHMS, POWER 1/4W ± TOL. ±5%.
2 CAPACITORS: CAPACITY: LESS THAN 1 IN μF.
GREATER THAN 1 IN pF.
3. ALL DIODES ARE 1N4151
A2 (MONITOR) INPUT BOARD

A2 (MONITOR), INPUT BOARD PARTS LIST

Ref.	Description	SD Part No.
A2	Input Board Assembly	D39607R2
A2	Input Board Schematic	C39604R2
C1	Not Used	
C2	Not Used	
C3	Not Used	
C4	Capacitor, .001 µF, Disc	C0424
C5	Capacitor, .01 µF, Disc	C0562
C6	Capacitor, 680 pF, DM	C0638
C7	Capacitor, 220 pF, DM	C0538
C8	Capacitor, .01 µF, Disc	C0562
C9	Capacitor, .01 µF, Disc	C0562
C10	Capacitor, .01 µF, Disc	C0562
C11	Capacitor, .01 µF, Disc	C0562
C12	Capacitor, .01 µF, Disc	C0562
C13	Capacitor, .01 µF, Disc	C0562
C14	Capacitor, .01 µF, Disc	C0562
C15	Capacitor, .001 µF, Disc	C0424
C16	Capacitor, 22 pF, DM	C0529
C17	Capacitor, 270 pF, DM	C0539
C18	Not Used	
C19	Capacitor, 2 pF, DM	03175030
C20	Capacitor, 330 pF, DM	C0540
C21	Capacitor, 1000 pF, DM	C0543
C22	Capacitor, .01 µF, Disc	C0562
C23	Capacitor, .001 µF, Disc	C0424
C24	Capacitor, .001 µF, Disc	C0424
C25	Capacitor, .01 µF, Disc	C0562
C26	Capacitor, .01 µF, Disc	C0562
C27	Capacitor, .01 µF, Disc	C0562
C28	Capacitor, .01 µF, Disc	C0562
C29	Capacitor, 220 pF, DM	C0538
C30	Capacitor, .01 µF, Disc	C0562
C31	Capacitor, .05 µF, 12 V, Disc	C0672
C32	Capacitor, .01 µF, Disc	C0562
C33	Capacitor, .001 µF	C1155
C34	Capacitor, .01 µF, Disc	C0562
C35	Capacitor, .01 µF, Disc	C0562
CR1	Not Used	
CR2	Diode, 1N4151	CR0150
CR3	Diode, 1N4151	CR0150
CR4	Diode, 1N4151	CR0150

A2 (MONITOR), INPUT BOARD PARTS LIST (Cont'd)

Ref.	Description	SD Part No.
CR5	Diode, 1N4151	CR0150
CR6	Diode, 1N4151	CR0150
CR7	Diode, 1N4151	CR0150
CR8	Diode, 1N4151	CR0150
CR9	Diode, 1N4151	CR0150
L1	Not Used	
L2	Not Used	
	Coil Form	E0304
L3	Inductor, 1/2 µH	L0173
L4	Inductor, 1 µH	39666-2
	Coil Form	E0304
L5	Inductor, 1 µH	39666-2
	Coil Form	E0304
L6	Inductor, 1.2 µH	L0173
Q1	Transistor, 2N3904	Q0247
Q2	Transistor, 2N3904	Q0247
R1	Not Used	
R2	Not Used	
R3	Resistor, 330 Ω, 1/4 W, 5%	R0662
R4	Resistor, 56 Ω, 1/4 W, 5%	R1554
R5	Resistor, 2.7 k, 1/4 W, 5%	R0937
R6	Resistor, 56 Ω, 1/4 W, 5%	R1554
R7	Resistor, 390 Ω, 1/4 W, 5%	R0880
R8	Resistor, 470 Ω, 1/4 W, 5%	R1044
R9	Resistor, 10 k, 1/4 W, 5%	R0766
R10	Resistor, 10 k, 1/4 W, 5%	R0766
R11	Resistor, 10 k, 1/4 W, 5%	R0766
R12	Resistor, 10 k, 1/4 W, 5%	R0766
R13	Resistor, 1 k, 1/4 W, 5%	R0765
R14	Resistor, 1.8 k, 1/4 W, 5%	R0959
R15	Resistor, 10 k, 1/4 W, 5%	R0766
R16	Resistor, 10 k, 1/4 W, 5%	R0766
R17	Resistor, 10 k, 1/4 W, 5%	R0766
R18	Resistor, 10 k, 1/4 W, 5%	R0766
R19	Resistor, 10 k, 1/4 W, 5%	R0766
R20	Resistor, 10 k, 1/4 W, 5%	R0766
R21	Resistor, 180 Ω, 1/4 W, 5%	R1233
R22	Resistor, 820 Ω, 1/4 W, 5%	R0762
R23	Resistor, 10 k, 1/4 W, 5%	R0766
R24	Resistor, 10 k, 1/4 W, 5%	R0766
R25	Resistor, 12 k, 1/4 W, 5%	R0759

A2 (MONITOR), INPUT BOARD PARTS LIST (Cont'd)

Ref	Description	SD Part No
R26	Resistor, 12 k, 1/4 W, 5%	R0759
R27	Resistor, 1.8 k, 1/4 W, 5%	R0959
R28	Not Used	
R29	Not Used	
R30	Resistor, 10 k, 1/4 W, 5%	R0766
R31	Resistor, 4.7 Ω, 1/4 W, 5%	R1741
U1	Integrated Circuit, CA3076	25770
Y1	Crystal Filter, 10 MHz Center	Y0049

CIRCUIT DESCRIPTION
DISCRIMINATOR & LEVEL DETECT
SCHEMATIC #D39596R3
A3 (MONITOR)

This board performs two basic functions: 1) The input amplitude is sensed to determine if sufficient level is present; and 2) The 10 MHz IF is converted to a 200 kHz IF signal which is processed by a high-linearity digital discriminator to drive the error meter circuit.

1. INPUT LEVEL DETECT CIRCUIT

The high-level 10 MHz IF is further amplified by untuned amplifier Q2, rectified by voltage-doubler CR1 and CR2, and applied to the input of Schmitt trigger Q4 and Q5. This circuit "fires" when a preset level is reached. Potentiometer R5 controls the gain of amplifier Q2 allowing the sensitivity of the LEVEL DETECT to be varied. When Q5 turns on, it turns on Q6 which supplies +15 volts to the level detect line. Q7 also turns on, energizing both the reed relay and the front-panel LEVEL lamp.

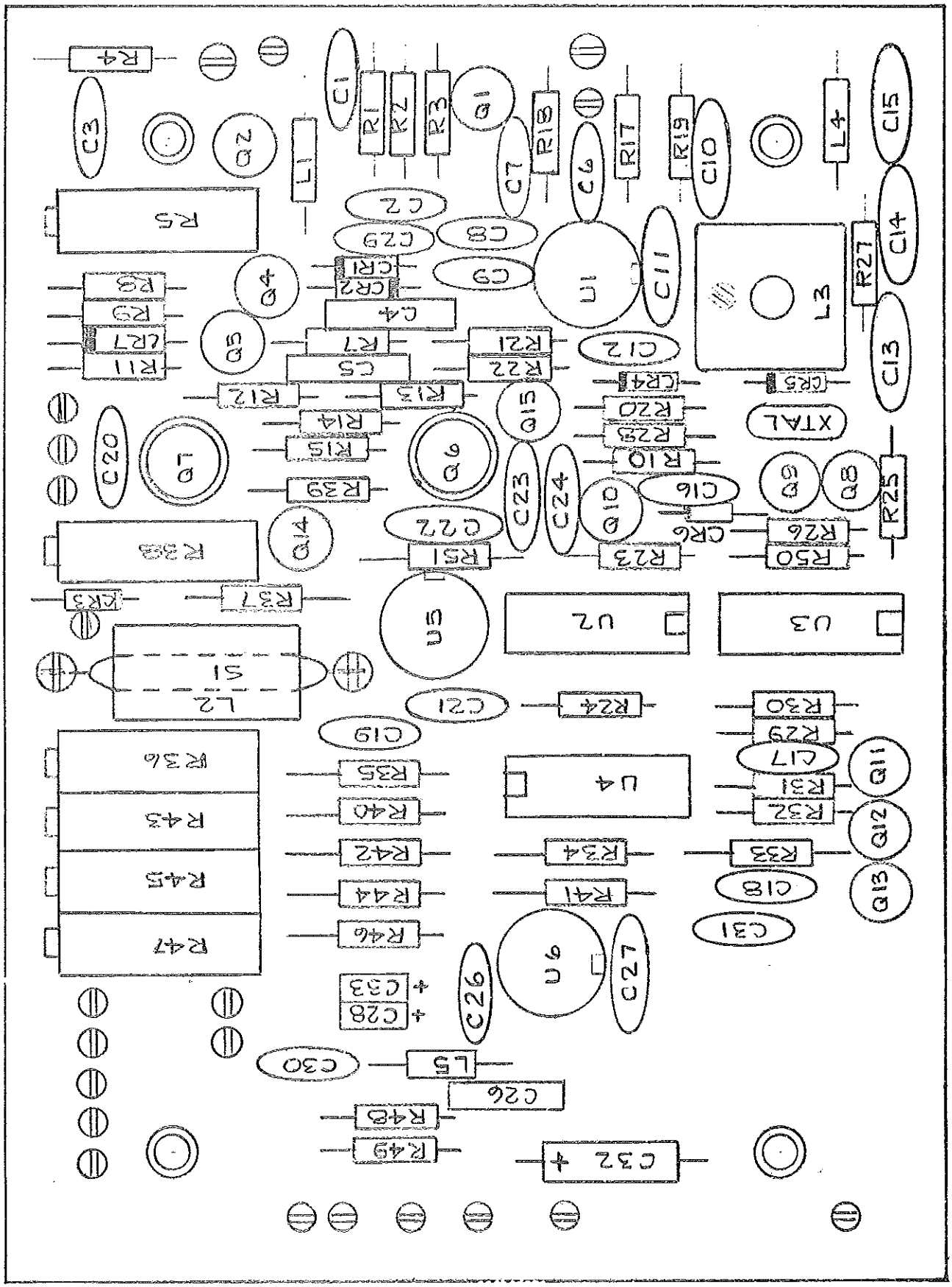
Transistor Q1 provides an amplified 10 MHz signal at the front panel for observing or counting the IF frequency.

2. 200 kHz IF SIGNAL PROCESSING

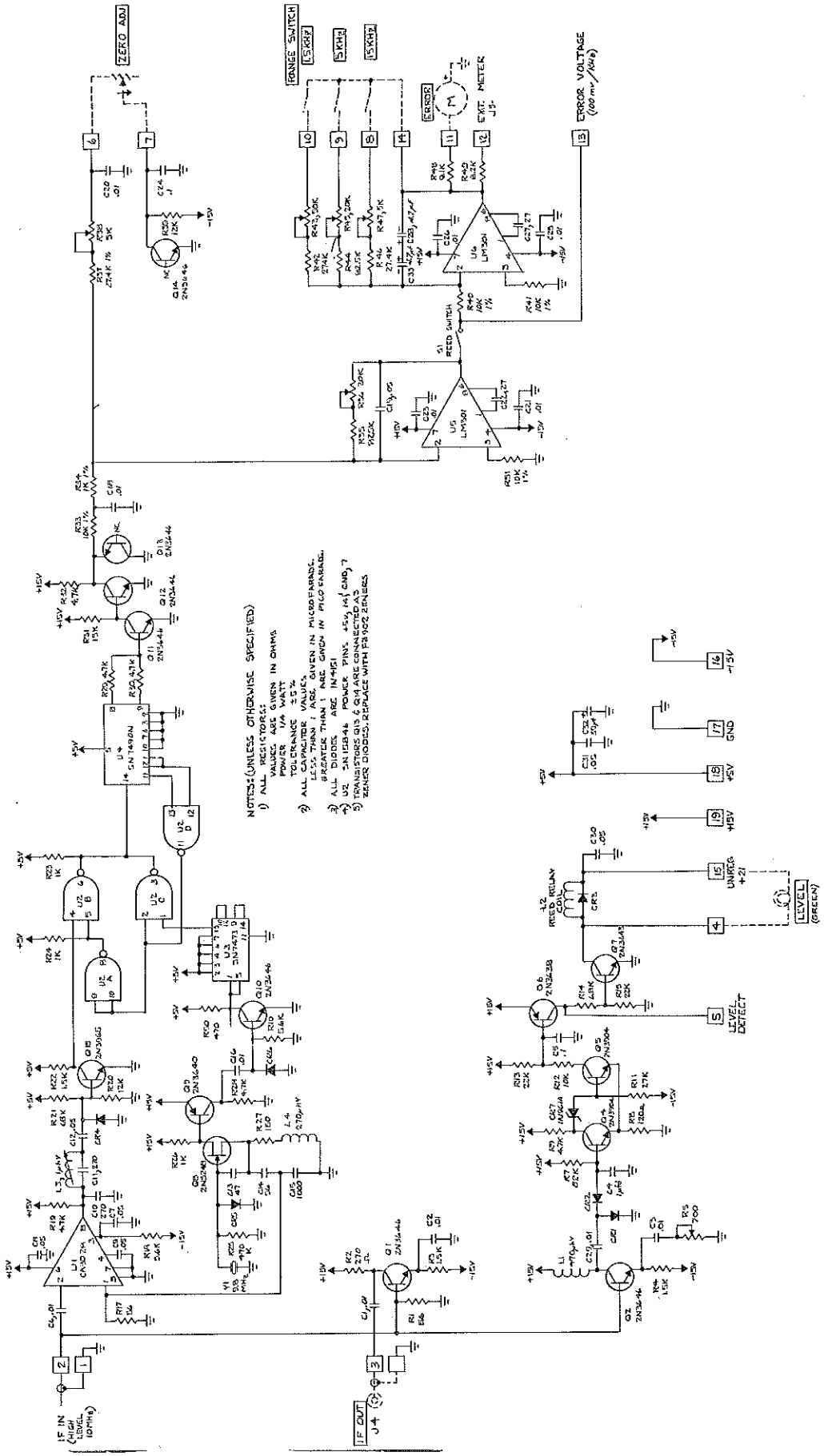
Integrated circuit U1 is used as a mixer to convert the 10 MHz IF to 200 kHz. One output from a 9.8 MHz crystal-controlled oscillator, Q8, mixes with the 10 MHz IF producting a 200 kHz IF. It is not necessary that the 200 kHz be precise. Filter, L3 and C11, rejects any 10 MHz which may be present on the output. To provide the required logic levels for the digital discriminator, transistor Q5 is used as a saturated switch producing a 0 to 5 V square wave. Similarly, the oscillator output is amplified by Q9 and made into a square wave by Q10.

The digital discriminator takes the 200 kHz IF and the 9.8 MHz oscillator signal and produces a dc voltage proportional to the frequency. Integrated circuit U3 divides the 9.8 MHz signal by four. Integrated circuit U4 is a divide-by-10 counter. Gate U2-D decodes a "9" from U4 and controls gates U2-B and U2-C. Gate U2-B is on during the "9" time and allows the 200 kHz to input the decade. Gate U2-C is on at all other times, allowing the 2.45 MHz (9.8 divided-by-four) signal to input the decade. This process produces a fixed-width pulse with a variable rate at the collector of Q11. Q12 is a Zener-clamped amplifier (Q13 acts as a Zener diode) and produces a pulse accurately clamped from 0 to 6 V. Network R33, C18, R34 provides filtering to extract the average dc from the pulse train. This dc voltage is one input to summing-amplifier U5.

Summing-amplifier U5 combines the output from the discriminator with a front-panel, adjustable voltage. This voltage, derived from Zener-connected transistor Q14, allows compensation of any error in either the discriminator or amplifier circuits. Reed switch S1 disables the meter until the input level is sufficient to operate the discriminator. Amplifier U6 is a gain-controlled stage which drives the error meter. Its input (from S1) is calibrated to produce an error voltage of 100 mV/kHz for use by the oscilloscope plug-in.



A3 (MONITOR), DISCRIMINATOR & LEVEL DETECT ASSEMBLY D39599A


A3 (MONITOR), DISCRIMINATOR & LEVEL DETECT SCHEMATIC D39596R3
NOTES: (UNLESS OTHERWISE SPECIFIED)
1) ALL RESISTORS:
VALUES ARE GIVEN IN OHMS
POWER 1/4 WATT
TOLERANCE ±5%
2) ALL CAPACITOR VALUES
LESS THAN 1 ARE GIVEN IN MICROFARADS.
GREATER THAN 1 ARE GIVEN IN PICOFARADS.
3) ALL DIODES ARE IN4151
4) U2 SN 15848 POWER PINS +5V, 14 GND, 7
5) TRANSISTORS Q13 & Q14 ARE CONNECTED AS ZENER DIODES. REPLACE WITH FB902 ZENERS
ZERO ADJ
RANGE SWITCH
15KM
5KM
1.5KM
ERROR
EXT. METER
ERROR VOLTAGE
(100 mv/KM)
REED SWITCH
IF IN
IF OUT
LEVEL (GREEN)
LEVEL DETECT
UNREG +21
+5V
-15V
GND

A3 (MONITOR), DISCRIMINATOR & LEVEL DETECT PARTS LIST

Ref.	Description	SD Part No.
A3	Discriminator & Level Detect Assembly	D39599A
A3	Discriminator & Level Detect Schematic	D39596R3
C1	Capacitor, .01 µF, Disc	C0562
C2	Capacitor, .01 µF, Disc	C0562
C3	Capacitor, .01 µF, Disc	C0562
C4	Capacitor, 1 µF	C0879
C5	Capacitor, .1 µF, 50 V	C0881
C6	Capacitor, .001 µF	C0424
C7	Capacitor, .05 µF, Disc	C0708
C8	Capacitor, .05 µF, Disc	C0708
C9	Capacitor, .05 µF, Disc	C0708
C10	Capacitor, 270 pF, DM	C0539
C11	Capacitor, 270 pF, DM	C0539
C12	Capacitor, .05 µF, Disc	C0708
C13	Capacitor, 47 pF, DM	C0533
C14	Capacitor, 56 pF, DM	C0534
C15	Capacitor, 1000 pF, DM	C0543
C16	Capacitor, .01 µF, Disc	C0562
C17	Capacitor, .01 µF, Disc	C0562
C18	Capacitor, .01 µF, Disc	C0562
C19	Capacitor, .05 µF, Disc	C0708
C20	Capacitor, .01 µF, Disc	C0562
C21	Capacitor, .01 µF, Disc	C0562
C22	Capacitor, 27 pF, DM	C0530
C23	Capacitor, .01 µF, Disc	C0562
C24	Capacitor, .1 µF, 10 V	C0661
C25	Capacitor, .01 µF, Disc	C0562
C26	Capacitor, 1 µF	C0879
C27	Capacitor, 27 pF, DM	C0530
C28	Capacitor, 4.7 µF	03287820
C29	Capacitor, .01 µF, Disc	C0562
C30	Capacitor, .05 µF, Disc	C0708
C31	Capacitor, .05 µF, Disc	C0708
C32	Capacitor, 39 µF, 10 V	C0902
C33	Capacitor, 4.7 µF	03298920
CR1	Diode, IN4151	CR0150
CR2	Diode, IN4151	CR0150
CR3	Diode, IN4151	CR0150
CR4	Diode, IN4151	CR0150
CR5	Diode, IN4151	CR0150

A3 (MONITOR), DISCRIMINATOR & LEVEL DETECT PARTS LIST (Cont'd)

Ref.	Description	SD Part No.
CR6	Diode, IN4151	CR0150
CR7	Diode, IN4151	CR0150
	Swage in Spacer #6 X 1/4" DIA X 1/4" L	E0275
	Terminal	E0190
	Terminal	E0191
	Transistor Pad	H0515
L1	Inductor, 470 µh	L0157
L2	Inductor, (Reed Coil)	L0055
L3	Inductor, (Red Dot)	39666
	Coil Form	E0304
L4	Inductor, 270 µh	L0067
L5	Inductor, 100 µh	L0073
Q1	Transistor, 2N3646	Q0247
Q2	Transistor, 2N3646	Q0247
Q3	Not Used	
Q4	Transistor, 2N3904	Q0247
Q5	Transistor, 2N3904	Q0247
Q6	Transistor, 2N3638	Q0181
Q7	Transistor, 2N3643	Q0179
Q8	Transistor, 2N5248	Q0244
Q9	Transistor, 2N3640	Q0178
Q10	Transistor, 2N3646	Q0247
Q11	Transistor, 2N3646	Q0247
Q12	Transistor, 2N3646	Q0247
Q13	Transistor, FZ902	26015850
Q14	Transistor, FZ902	26015850
Q15	Transistor, 2N3565	Q0237
R1	Resistor, 56 Ω, 1/4 W, CC	R1554
R2	Resistor, 270	R0694
R3	Resistor, 1.5 k	R0783
R4	Resistor, 1.5 k	R0783
R5	Resistor, 200 Ω, Potentiometer	01111080
R6	Not Used	
R7	Resistor, 82 k	R0784
R8	Resistor, 120	R1461
R9	Resistor, 4.7 k	R0892
R10	Resistor, 5.6 k	R0721
R11	Resistor, 27 k	R0824
R12	Resistor, 10 k	R0766
R13	Resistor, 22 k	R0768

A3 (MONITOR), DISCRIMINATOR & LEVEL DETECT PARTS LIST (Cont'd)

Ref.	Description	SD Part No.
R14	Resistor, 6.8 k	R0696
R15	Resistor, 22 k	R0768
R16	Not Used	
R17	Resistor, 56 , 1/4 W, CC	R1554
R18	Resistor, 5.6 k	R0821
R19	Resistor, 4.7 k	R0892
R20	Resistor, 20 k	R0759
R21	Resistor, 100 k	R0741
R22	Resistor, 1.5 k	R0783
R23	Resistor, 1 k	R0765
R24	Resistor, 1 k	R0765
R25	Resistor, 470 k	R1060
R26	Resistor, 1 k	R0765
R27	Resistor, 150Ω	R0983
R28	Resistor, 4.7 k	R0892
R29	Resistor, 4.7 k	R0892
R30	Resistor, 4.7 k	R0892
R31	Resistor, 15 k	R0728
R32	Resistor, 4.7 k	R0892
R33	Resistor, 10 k, 1%, MF	R2696
R34	Resistor, 1 k, 1%, MF	R2694
R35	Resistor, 82.5 k, 1%, MF	R2701
R36	Resistor, 20 k, Potentiometer	01111100
R37	Resistor, 27.4 k, 1%, MF	R2698
R38	Resistor, 5 k, Potentiometer	01111360
R39	Resistor, 12 k	R0759
R40	Resistor, 10 k, 1%, MF	R2696
R41	Resistor, 10 k, 1%, MF	R2696
R42	Resistor, 274 k	R2699
R43	Resistor, 50 k, Potentiometer	01111330
R44	Resistor, 82.5 k, 1%, MF	R2701
R45	Resistor, 20 k, Potentiometer	01111100
R46	Resistor, 27.4 k, 1%, MF	R2698
R47	Resistor, 5 k, Potentiometer	01111360
R48	Resistor, 9.1 k	R0776
R49	Resistor, 8.2 k	R0883
R50	Resistor, 470 Ω	R1044
R51	Resistor, 10 k, 1%, MF	R2696
S1	Reed Switch	S0132

A3 (MONITOR), DISCRIMINATOR & LEVEL DETECT PARTS LIST (Cont'd)

Ref.	Description	SD Part No.
U1	Integrated Circuit, CA 3028	25702
U2	Integrated Circuit, SN 15846	19716
U3	Integrated Circuit, SN 7473	19709
U4	Integrated Circuit, SN 7490	19711
U5	Integrated Circuit, LM 301 A	25745
U6	Integrated Circuit, LM 301 A	25745
Y1	918 MHz, XTAL	Y0050

CHAPTER 6
SERVICE MONITOR PLUG-INS

6.1 INTRODUCTION

This section contains descriptions of the various plug-in units available for the basic S1327A Service Monitor.

6.2 STANDARD PLUG-INS

The standard plug-ins shipped with the S1327A Service Monitor include:

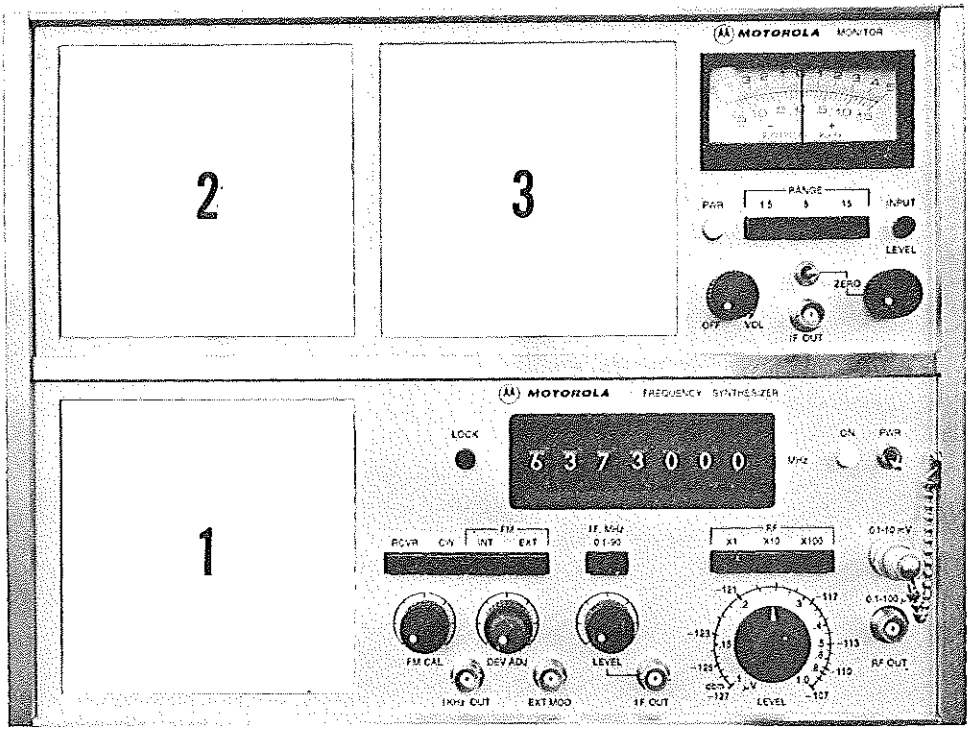
SLN-6350A Deviation Meter Plug-in
SLN-6352A Broadband Mixer Plug-in

6.3 OPTIONAL PLUG-INS

Optional plug-ins, in place of or in addition to the standard plug-ins, include the following:

SLN-6351A Deviation Oscilloscope Plug-in
SLN-6353A Preselector, 25-50 MHz Plug-in
SLN-6354A Preselector, 145-175 MHz Plug-in
SLN-6355A Preselector, 450-512 MHz Plug-in
SLN-6369A Preselector, 406-420 MHz Plug-in

6.4 PLUG-IN LOCATION CHART



SLN-6350A→1,2
SLN-6351A→1,2
SLN-6352A→3
SLN-6353A→3
SLN-6354A→3
SLN-6355A→3
SLN-6356A→1,2,3
SLN-6369A→3
SLN-6378A→1,2

CIRCUIT DESCRIPTION
DEVIATION METER
SCHEMATIC #C39600R1
MODEL SLN-6350A

The Deviation Meter circuit consists of: 1) a 10 MHz discriminator; 2) an ac-coupled amplifier; and 3) a peak and over-limit detector.

1) 10 MHz DISCRIMINATOR

The 10 MHz, low-level IF provides an input to U1, an integrated-circuit FM discriminator. Its action is basically that of a quadrature-detector with L1 and C4 providing phase shift. Power for U1 and emitter-follower Q1 is provided from the level detect circuit. In this way, the meter will not operate until sufficient signal is present.

2) AC-COUPLED AMPLIFIER

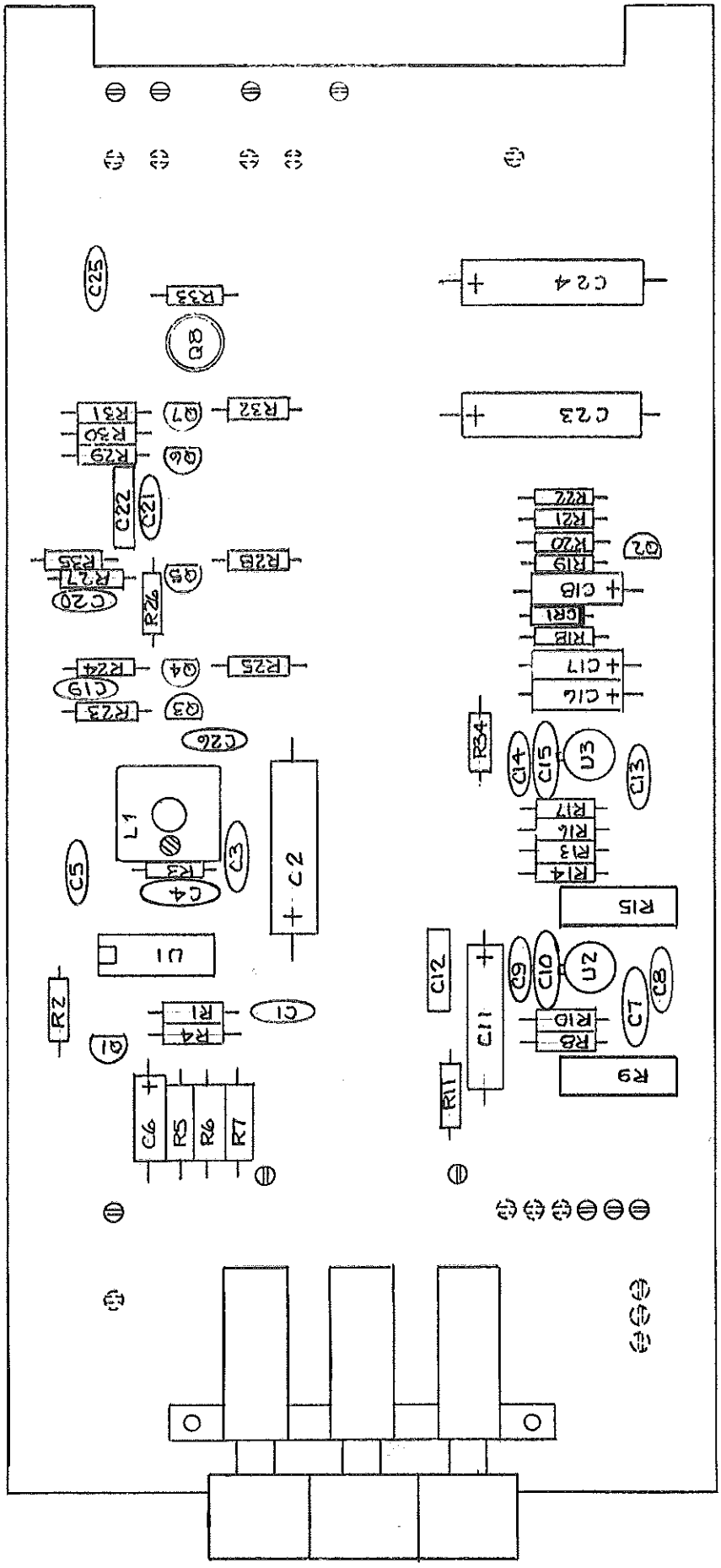
The capacitor-coupled output from Q1 feeds a two-stage amplifier via attenuator R5, R6, and R7. A polarity-reversing switch between the stages permits observation of either positive or negative deviation. The output from U3 drives peak-detector CR1. Integrating capacitor C18 and buffer Q2 provide a suitable signal for the meter readout. Provision for an external meter is included.

3) PEAK AND OVER-LIMIT DETECTOR

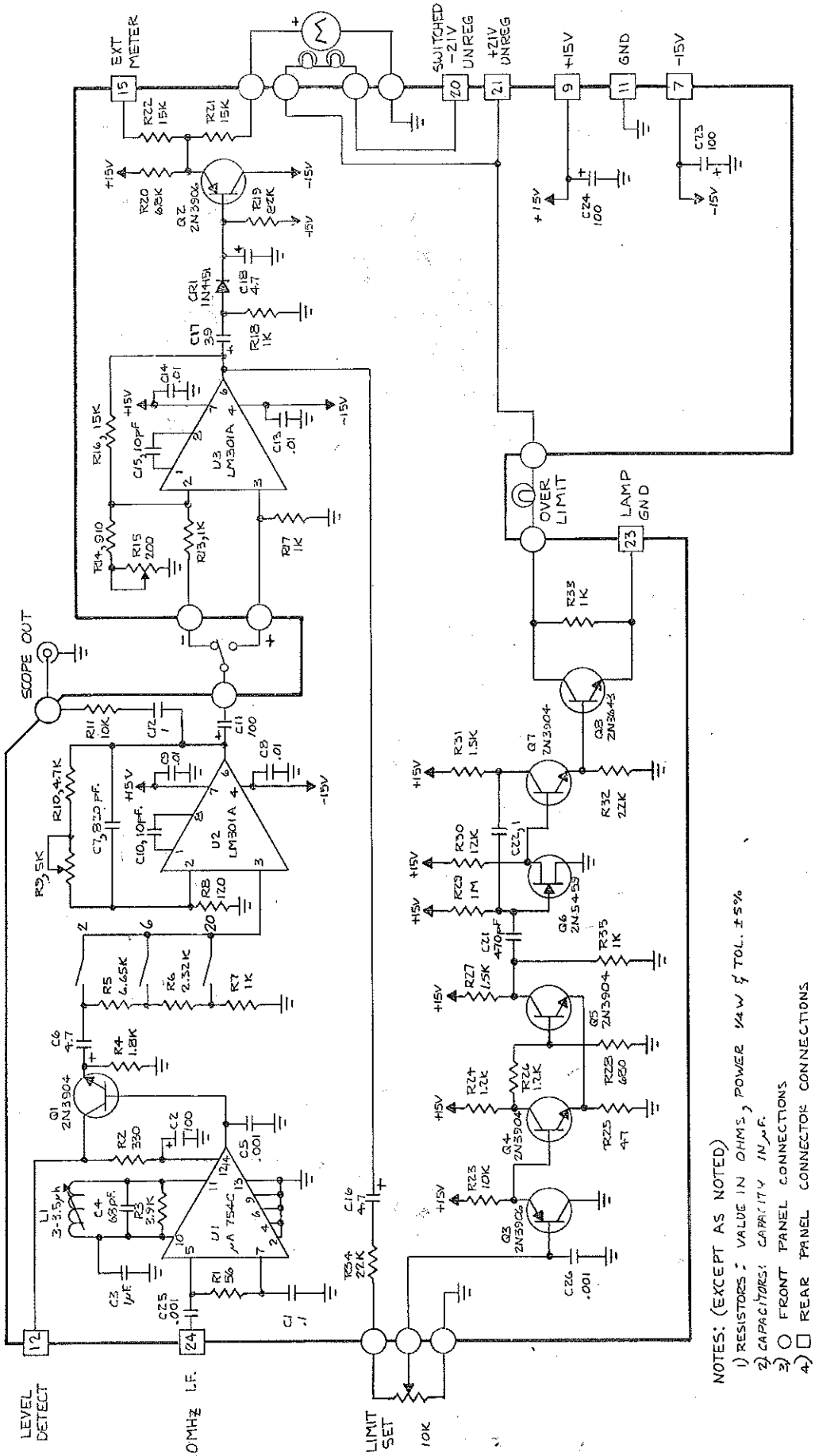
In addition to driving the peak-detector, U3 drives, via the limit-set potentiometer and buffer Q3, a Schmitt trigger circuit. This circuit (Q4 and Q5) "fires" when the input to it reaches a certain level. Its output operates a one-shot pulse generator (Q6, Q7) to provide sufficient pulse width to light the over-limit lamp. In this manner, a single peak which exceeds the limit set-point will give a visible indication.

4) CALIBRATION

A known-accuracy deviation source must be utilized. With the Deviation Meter installed connect a signal, modulated to 5 kHz deviation, to the Monitor. Select the 6 kHz range, and - peaks. Remove the instrument top-cover and use a totally nonmetallic screwdriver with blade of about 3/32-inch width to peak the meter reading by adjusting L1 (remove foam packing first, then replace). Next, adjust R9 for a 5 kHz reading. Switch to + peaks and adjust R15 for a 5 kHz reading.



SLN-6350A, DEVIATION METER P.C. ASSEMBLY D39603R1

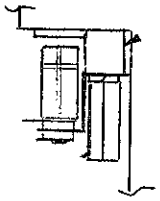

EXT METER
SWITCHED -21V UNREG
+21V UNREG
+15V
GND
-15V
SCOPE OUT
OVER LIMIT
LAMP GND
LEVEL DETECT
10MHz I.F.
LIMIT SET 10K
U1 μA 754C
U2 LM301A
U3 LM301A
Q1 2N3904
Q2 2N3906
Q3 2N3906
Q4 2N3904
Q5 2N3904
Q6 2N5459
Q7 2N3904
Q8 2N3645
CR1 1N4151
L1 3-3.5μh
NOTES: (EXCEPT AS NOTED)
1) RESISTORS: VALUE IN OHMS, POWER ¼W & TOL. ±5%
2) CAPACITORS: CAPACITY IN μF.
3) ○ FRONT PANEL CONNECTIONS
4) □ REAR PANEL CONNECTOR CONNECTIONS

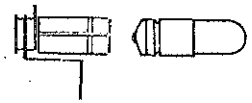
SLN6350A, DEVIATION METER PARTS LIST

Ref.	Description	SD Part No.
	Deviation Meter Assembly	D39603R1
	Deviation Meter Schematic	C39600R1
C1	Capacitor, .1 µF, 10 V Disc	C0661
C2	Capacitor, 100 µF, 25 V Electro	C0832
C3	Capacitor, .1µF, 10 V Disc	C0661
C4	Capacitor, 68 pF, DM	C0635
C5	Capacitor, .001 µF, Disc	C0424
C6	Capacitor, 4.7 µF, Tant	C0406
C7	Capacitor, 820 pF, DM	C0681
C8	Capacitor, .01 µF, Disc	C0562
C9	Capacitor, .01 µF, Disc	C0562
C10	Capacitor, 10 pF, DM	C0527
C11	Capacitor, 100 µF, Tant	C0660
C12	Capacitor, 1 µF, 25 V	C0879
C13	Capacitor, .01 µF, Disc	C0562
C14	Capacitor, .01 µF, Disc	C0562
C15	Capacitor, 10 pF, DM	C0527
C16	Capacitor, 4.7 µF, Tant	C0406
C17	Capacitor, 39 µF, Tant	C0902
C18	Capacitor, 4.7 µF, Tant	C0406
C19	Capacitor, .01 µF, Disc	C0562
C20	Capacitor, .01 µF, Disc	C0562
C21	Capacitor, 470 pF, DM	C0542
C22	Capacitor, 1 µF, 25 V	C0879
C23	Capacitor, 100 µF, 25 V Electro	C0832
C24	Capacitor, 100 µF, 25 V Electro	C0832
C25	Capacitor, .001 µF, Disc	C0424
C26	Capacitor, .001 µF, Disc.	C0424
CR1	Diode, IN4151	CR0150
L1	Inductor	C39666-1
	Coil Form	E0304
Q1	Transistor, 2N3904	Q0247
Q2	Transistor, 2N3906	Q0248
Q3	Transistor, 2N3906	Q0248
Q4	Transistor, 2N3904	Q0247
Q5	Transistor, 2N3904	Q0247
Q6	Transistor, 2N5459	Q0264
Q7	Transistor, 2N3904	Q0247
Q8	Transistor, 2N3643	Q0181

SLN6350A, DEVIATION METER PARTS LIST (Cont'd)

Ref.	Description	SD Part No.
R1	Resistor, 56 Ω, 1/4 W, 5%	R1554
R2	Resistor, 330 Ω, 1/4 W, 5%	R0662
R3	Resistor, 3.9 k, 1/4 W, 5%	R0939
R4	Resistor, 1.8 k, 1/4 W, 5%	R0959
R5	Resistor, 6.65 k, 1/2 W, 1% MF	R2691
R6	Resistor, 2.32 k, 1/2 W, 1% MF	R2693
R7	Resistor, 1 k, 1/2 W, 1% MF	R2694
R8	Resistor, 120 Ω, 1/4 W, 5%	R1461
R9	Resistor, 5 k, Potentiometer	01111360
R10	Resistor, 4.7 k, 1/4 W, 5%	R0892
R11	Resistor, 10 k, 1/4 W, 5%	R0766
R12	Not Used	
R13	Resistor, 1 k, 1/4 W, 5%	R0765
R14	Resistor, 910 Ω, 1/4 W, 5%	R1795
R15	Resistor, 1 k, Potentiometer	01111310
R16	Resistor, 15 k, 1/4 W, 5%	R0728
R17	Resistor, 1 k, 1/4 W, 5%	R0765
R18	Resistor, 1 k, 1/4 W, 5%	R0765
R19	Resistor, 82 k, 1/4 W, 5%	R0784
R20	Resistor, 6.8 k, 1/4 W, 5%	R0696
R21	Resistor, 15 k, 1/4 W, 5%	R0728
R22	Resistor, 15 k, 1/4 W, 5%	R0728
R23	Resistor, 10 k, 1/4 W, 5%	R0766
R24	Resistor, 1.2 k, 1/4 W, 5%	R0809
R25	Resistor, 47 Ω, 1/4 W, 5%	R0743
R26	Resistor, 1.2 k, 1/4 W, 5%	R0809
R27	Resistor, 1.5 k, 1/4 W, 5%	R0783
R28	Resistor, 680 Ω, 1/4 W, 5%	R1234
R29	Resistor, 1 M, 1/4 W, 5%	R0962
R30	Resistor, 12 k, 1/4 W, 5%	R0759
R31	Resistor, 1.5 k, 1/4 W, 5%	R0783
R32	Resistor, 22 k, 1/4 W, 5%	R0768
R33	Resistor, 1 k, 1/4 W, 5%	R0765
R34	Resistor, 47 k, 1/4 W, 5%	R0777
R35	Resistor, 1 k, 1/4 W, 5%	R0765
S1	Switch, Pushbutton	S0404
U1	Integrated Circuit, μA754C	25781
U2	Integrated Circuit, LM301A	25745
U3	Integrated Circuit, LM301A	25745

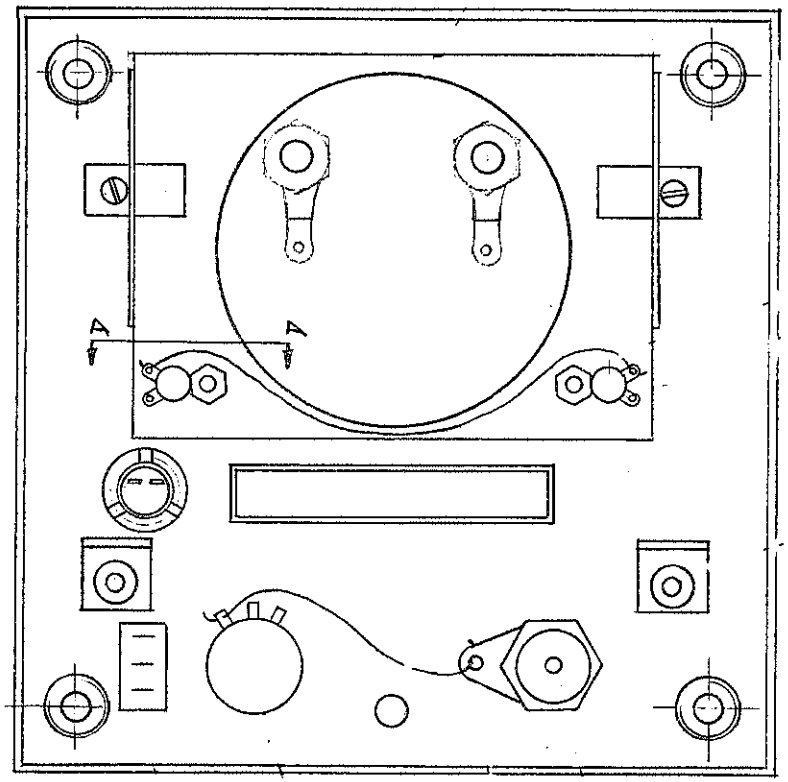


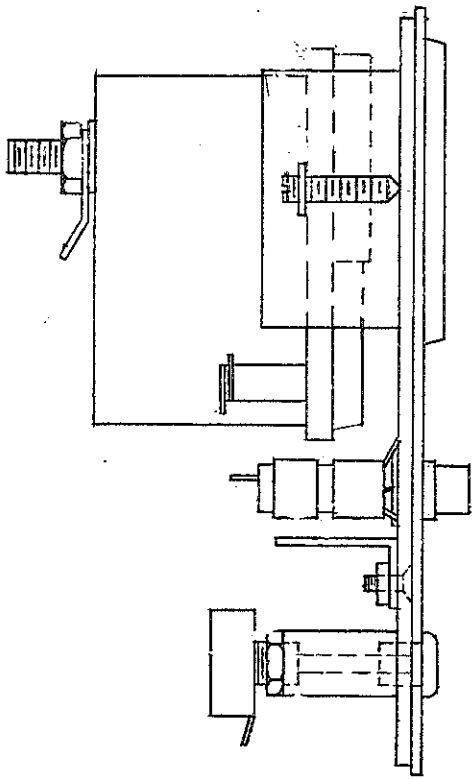


INSTALL LAMP I0100
AND REINSTALL SOCKET
IN METER

FIG 1

REMOVE STAND OFF, SPLIT LOCK & LAMP SOCKET & SEE FIG 1

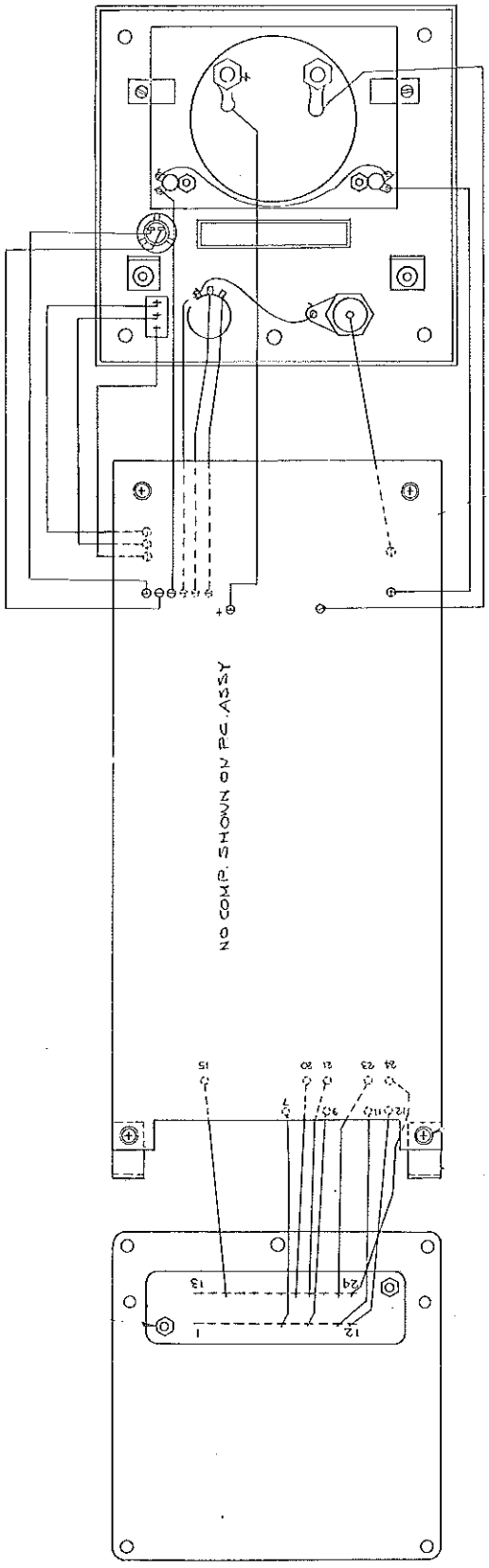


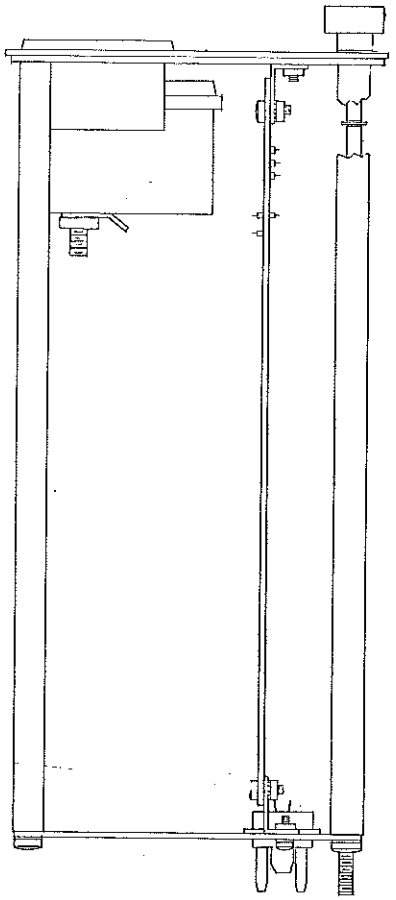


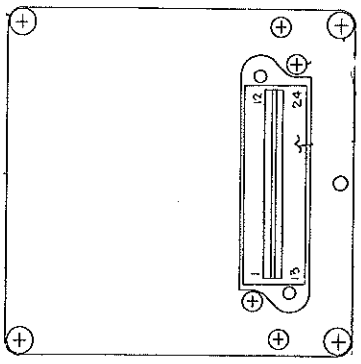
SLN-6350A, FRONT PANEL SUBASSEMBLY D39703R4

SLN-6350A, FRONT PANEL SUB-ASSEMBLY PARTS LIST

Ref.	Description	SD Part No.
	Front Panel Sub-Assembly	D39703R4
	Lamp, Incandescent, (Meter)	I0100
	Clip	I0088
	Lamp Socket	X0133
	Lamp, Incandescent, Red, 507-3918-1475-600	12013050
CRLJC103	Potentiometer, 10 k	R2711
	Meter, 2BA-DUA-500-B3-KW/28	M0022
	Switch, SPDT	S0149







SLN-6350A, FINAL ASSEMBLY D39577R3

SLN-6350A, FINAL ASSEMBLY PARTS LIST

Ref.	Description	SD Part No.
	Final Assembly	D39577R3
	Knob	H1959
	Rod	37340
	Connector, 24 Pin	09061450

CIRCUIT DESCRIPTION
BROADBAND MIXER PLUG-IN
SCHEMATIC B39973R1
MODEL SLN-6352A

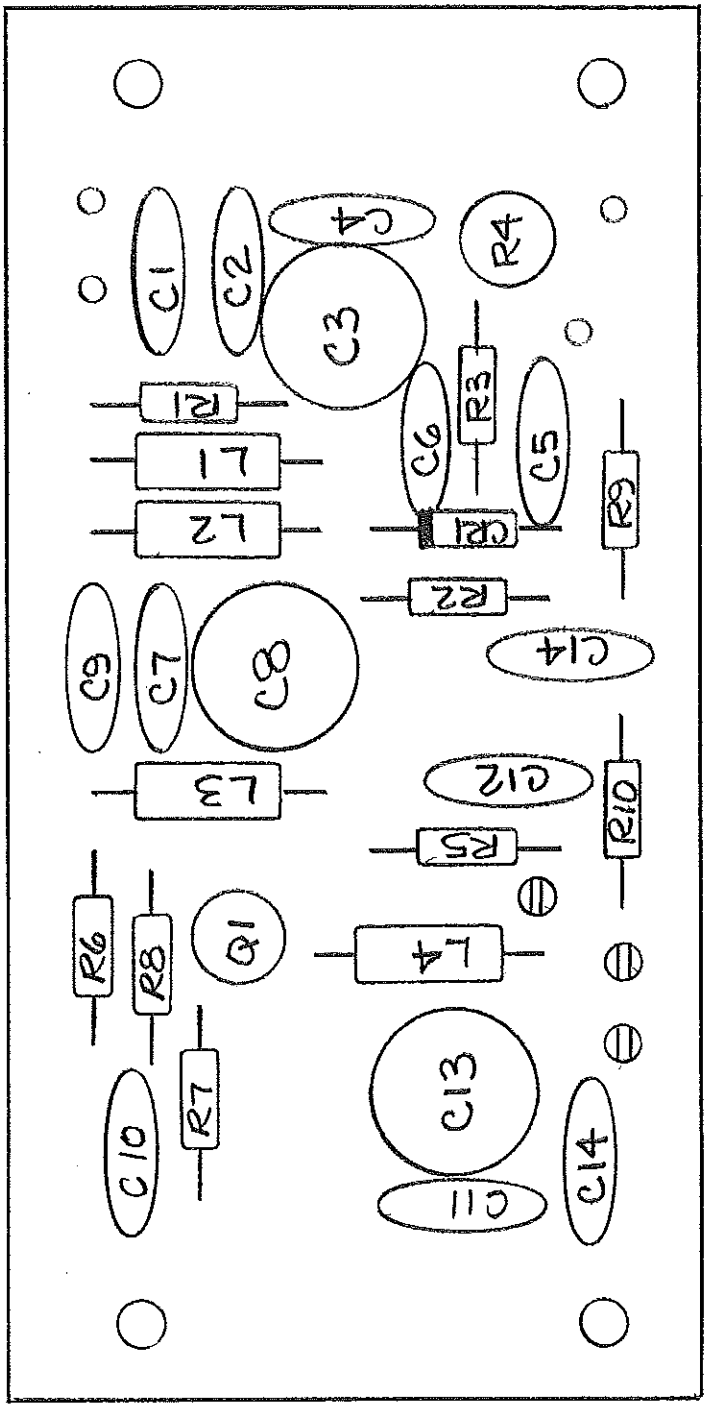
1) GENERAL

The Mixer plug-in contains a diode mixer and a low-gain IF amplifier. Its function permits the receiver to be used in any communications band by simply dialing-in the desired frequency on the Synthesizer.

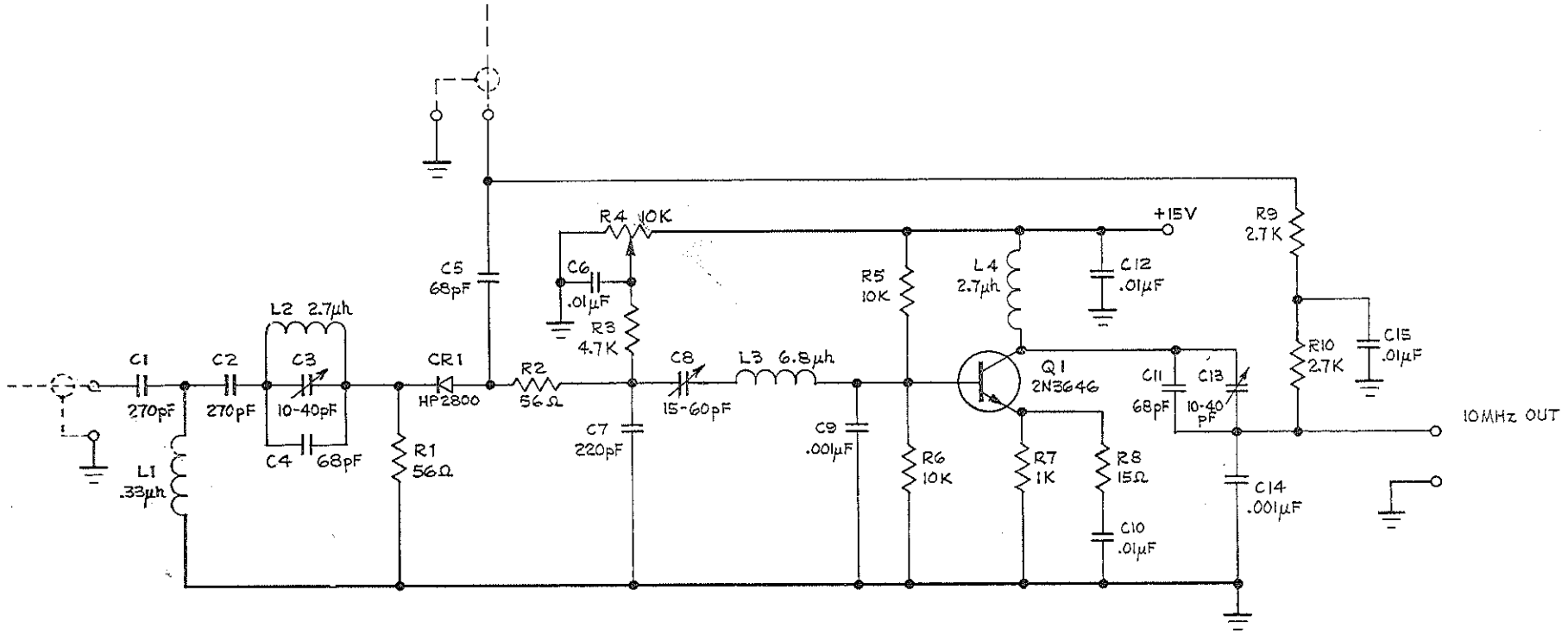
The front-panel input signal passes through a trap which reduces the 10 MHz component to avoid mixer overload. The mixer diode is a "hot carrier type" for increased sensitivity over the full input range. The output from the mixer is filtered by a circuit tuned to 10 MHz. A single transistor amplifier with a tuned output circuit provides the necessary gain.

2) CALIBRATION

The three adjustments on this plug-in are set using a variable-amplitude signal source (20 MHz to 990 MHz) and an oscilloscope capable of measuring 10 MHz. Connect the oscilloscope to the Monitor IF OUT jack. Connect the source to the INPUT on the Mixer and adjust its frequency to zero error on the 15 kHz range. Decrease the amplitude until the INPUT LEVEL lamp goes out. While watching the oscilloscope, adjust C8 and C13 for maximum amplitude. Maintain the level from the generator so that the INPUT LEVEL lamp stays out. Now, carefully adjust R4 for a maximum on the oscilloscope. Disconnect the signal generator. Select the IF MHz mode, dial-in 10,0000 MHz, and connect the Synthesizer IF OUT to the Mixer INPUT. Again, while maintaining the level below threshold, adjust C3 for a minimum oscilloscope display.



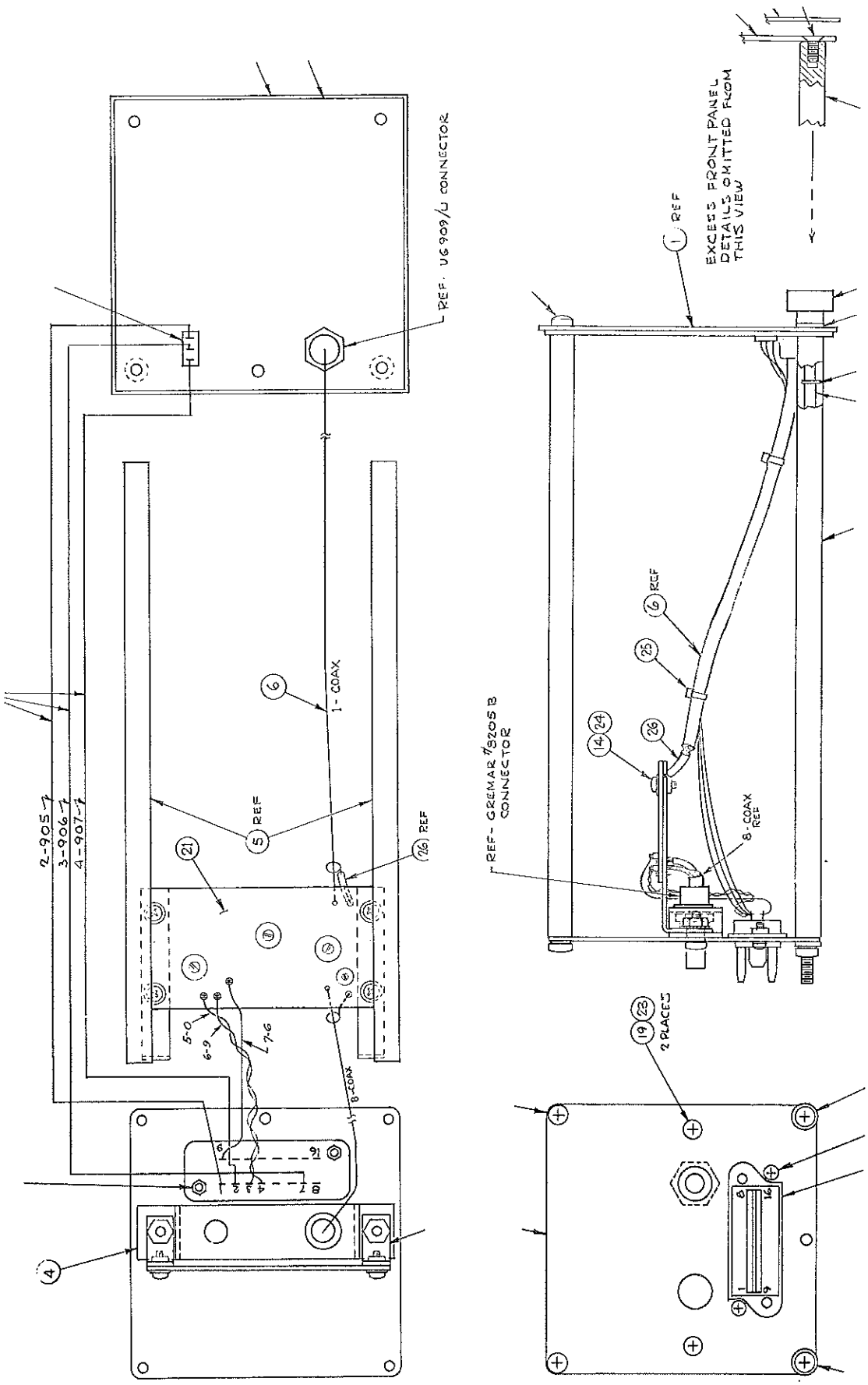
SLN-6352A, BROADBAND MIXER PLUG-IN P.C. ASSEMBLY B39974R1



SLN-6352A, BROADBAND MIXER PLUG-IN SCHEMATIC B39973R1

BROADBAND MIXER PLUG-IN PARTS LIST

Ref.	Description	SD Part No.
	Broadband Mixer Plug-in Assembly	D39974R1
	Broadband Mixer Plug-in Schematic	B39973R1
C1	Capacitor, 270 pF, DM	C0539
C2	Capacitor, 270 pF, DM	C0539
C3	Capacitor, Trim, 10-40 pF	C0709
C4	Capacitor, 68 pF, DM	C0635
C5	Capacitor, 68 pF, DM	C0635
C6	Capacitor, .01 MF, Ceramic Disc	C0556
C7	Capacitor, 220 pF, DM	C0538
C8	Capacitor, Trim, 15-60 pF	C1132
C9	Capacitor, .001 MF, Ceramic Disc	C0424
C10	Capacitor, .01 MF, Ceramic Disc	C0556
C11	Capacitor, 68 pF, DM	C0635
C12	Capacitor, .01 MF, Ceramic Disc	C0556
C13	Capacitor, Trim, 10-40 pF	C0709
C14	Capacitor, .001 MF, Ceramic Disc	C0424
C15	Capacitor, .01 MF, Ceramic Disc	C0556
CR1	Diode, HP2800	CR0363
L1	Inductor, .33 µH	L0161
L2	Inductor, 2.7 µH	L0048
L3	Inductor, 6.8 µH	L0053
L4	Inductor, 2.7 µH	L0048
Q1	Transistor, 2N3646	Q0218
R1	Resistor, 56 Ω, 1/4 W	R1554
R2	Resistor, 56 Ω, 1/4 W	R1554
R3	Resistor, 4.7 k, 1/4 W	R0892
R4	Resistor, Potentiometer, 10 k	R2383
R5	Resistor, 10 k, 1/4 W	R0766
R6	Resistor, 10 k, 1/4 W	R0766
R7	Resistor, 1 k	R0765
R8	Resistor, 15 Ω	R1607
R9	Resistor, 2.7 k	R0937
R10	Resistor, 2.7 k	R0937



SLN-6352A, BROADBAND MIXER PLUG-IN FINAL ASSEMBLY D39775R3

SLN-6352A FINAL ASSEMBLY PARTS LIST

Ref.	Description	SD Part No.
	Final Assembly	D39775R3
	Mixer P.C. Assembly	39974
	Switch	S0149
	Knob	H1959
	Retaining Rod	37340
	Connector, (Amphenol #26-159-16)	J0604
	BRKT, RF Connector	39631

OPTIONAL PLUG-IN
DEVIATION OSCILLOSCOPE
MODEL SLN-6351A

1.1 INTRODUCTION

The Model SLN-6351A Deviation Oscilloscope Plug-in is designed to provide a visual presentation of the modulation present on a received signal. Since the display is dc coupled, a shift in the base line indicates any frequency error. External inputs to both the vertical and horizontal channels are provided. Both inputs are one megohm impedance. The vertical input is calibrated with a basic sensitivity of 1 mV/div and a Decade Attenuator provides up to 10V/Div in 5 ranges. With the exception of the display tube, this unit is fully solid state for long life and minimum maintenance. All power is provided by the S-1327A mainframe The oscilloscope will operate in either left hand plug-in space (Synthesizer or Monitor).

1.2 SPECIFICATIONS

Range: ±1.5, ±5, ±15 kHz full scale deviation;

.001, .01, .1, 1, 10 V/Div (Vertical)

(500 V dc blocking in AC mode)

Frequency Response: 50 kHz min. (3 db down).

Vertical Accuracy: ±5% to 20 kHz.

1.3 RECEIVING INSPECTION

Before accepting the instrument from the shipper, inspect the instrument's shipping container for signs of external shipping damage. Any sign of such damage must be noted by both the shipper and customer, and should be reported to the insurance investigator.

As soon as the instrument is unpacked, inspect it for shipping damage. Check for scratches or dents, broken or cracked knobs, and damaged connectors. Should any damage be found, notify your nearest Motorola representative -- do not use the instrument until instructed to do so by the representative.

1.4 INSTALLATION:

Plug the oscilloscope into either the Synthesizer plug-in space or the left hand Monitor plug-in space.

1.5 OPERATION

The oscilloscope will operate whenever the main unit power is on. A few seconds will be required for the display tube filament to heat before a trace can be seen. After warmup, adjust the front panel intensity and focus and the two position controls for a horizontal line in center screen. This is best done with the scope in Internal mode and no input to the receiver.

1.5.1 DEVIATION MEASUREMENT (Int.)

With both the vertical and horizontal inputs switched to "INT" the oscilloscope will display both frequency error and any modulation present on the received signal. Accurate measurement of frequency error is best made with no modulation on the signal, however if modulation is present the frequency error will appear as a vertical offset in the displayed waveform. With the Synthesiser in FM mode the scope will display both the deviation & any frequency offset.

To set the baseline to zero, first zero the receiver error meter on the 1.5 kHz range by depressing the ZERO switch and adjusting the adjacent ZERO control. While holding the ZERO switch down, adjust the scope vertical position to center the horizontal line on the screen. Release the ZERO switch. A received signal will now cause the baseline (or waveform) to shift up or down depending on the direction of the frequency error. The peak deviation may be determined directly from the display. Two tone modulation (such as is generated by a private line system and a test signal) is readily checked for peak deviation. For convenience, the two unused positions of the range switch are connected to the closest deviation range. Thus full CCW is the 1.5 kHz range and full CW is the 15 kHz range. The vernier adjustment does not have any effect.

1.5.2 EXTERNAL VERTICAL INPUT

A one megohm impedance, calibrated input is provided for the vertical channel. A front panel switch selects either AC or DC coupling (as well as "INT" mode). The calibrated input has a five position decade step attenuator plus an uncalibrated vernier adjustment. To maintain calibration, the vernier (red knob in center of range switch) should be fully clockwise. Since the input is constant impedance, standard 10:1 oscilloscope probes may be used for test purposes. The frequency response is within 5% to at least 20 kHz. When the input is ac coupled, the response is down 5db at 300Hz and down 3 db at 15 Hz. To improve the low frequency response when ac coupling is required, place the SLN6351 input switch in DC and use an external capacitor whose voltage rating is greater than any dc to be blocked. A .1 µF capacitor gives 5% down at 30 Hz; a 1 µF, 5% at 3 Hz. The external vertical input of the SLN6351A is usable for general oscilloscope measuring.

1.5.3 HORIZONTAL CHANNEL

The horizontal channel is normally used in the internal mode. In this case, the synchronized sweep is in operation and a stationary waveform will be displayed for most inputs. The sweep selector switch and vernier are used to control the frequency of the sweep. By adjusting these two controls, the number of cycles of the input waveform which are displayed may be varied. When the horizontal channel is used in the external mode, external signals of about 300 mV pp will give full scale deflection. This input is also 1 megohm. It may be used for any application requiring both horizontal and vertical inputs.

1.6 CALIBRATION

The following procedure is recommended for calibration of the SLN6351A Deviation Oscilloscope:

1. Plug the oscilloscope into the left plug-in space in the Monitor half of the service monitor.
2. Remove the Service Monitor top cover.
3. Select INT mode for both VERT and HORIZ INPUTS.
4. Set Vertical to 1.5 kHz (DEV), SWEEP to .3-3 kHz with vernier (red knob) centered.
5. Turn on the Service Monitor and adjust front panel Focus and INTENsity for a sharp trace with the Service Monitor in CW mode.
6. Position the trace at center screen vertically.
7. Adjust R44 and the H. POS control such that the trace is slightly wider than the viewing area.
8. Select AC or DC VERT INPUT.
9. Apply a known amplitude ac signal to the VERT INPUT.
10. Adjust R29 for the correct peak-to-peak display. Readjust the V. POS if necessary.
11. Put the Service Monitor in INT FM mode and reduce the deviation to zero with the black DEV ADJ knob
12. Select INT, VERT INPUT.
13. Using the 1.5 kHz range on the Monitor ERROR meter, zero the pointer with the FM CAL control.
14. Adjust the scope V. POS for a center scale line.
15. Switch to AC or DC, VERT INPUT and adjust R10 to return the trace to center if required.
16. Switch back to INT, VERT INPUT and reset the FM CAL control for 1.5 kHz on the Monitor ERROR meter. Adjust R18 to give a reading of 1.5 kHz on the scope display. Return the line to center with the FM CAL control.

17. Calibration of the deviation measuring system requires either a signal with known deviation or a calibrated Deviation Meter SLN6350A or Deviation Scope SLN6351A.

18. If a known source is used, place the Service Monitor in RCVR mode and connect the source to the broadband input, in wide bandwidth. Peak L1 for maximum display amplitude. Then adjust R19 for proper peak-to-peak display.

19. If another calibrated plug-in is available, place the service monitor in INT FM mode and use the Deviation Adjust Control to give a reading of 15 kHz on the calibrated plug-in. Note that the Monitor must be in wide bandwidth. Peak L1 for maximum display amplitude. Then adjust R19 for proper peak-to-peak display.

20. If needed, R96 may be used to adjust the displayed waveform for maximum all over sharpness.

CIRCUIT DESCRIPTION
DEVIATION OSCILLOSCOPE
SCHEMATIC #D39918R2
SLN-6351A

The circuitry for the Oscilloscope plug-in is divided into four. basic sections: 1. The Vertical Channel, 2. Horizontal Channel, 3. Sync-Sweep Circuit, and 4. Power Supply-CRT Circuit.

1. VERTICAL CHANNEL

The vertical channel has both an internal input to measure deviation on a received signal and an external input for general oscilloscope use. A common deflection amplifier is used transistors Q2 and Q3 are connected in a differential amplifier configuration. Diodes CR3 and CR4 prevent excessive deflection with large inputs. An internal adjustment, R29, is used to set the overall vertical gain. R35 is the front panel vertical position control. The outputs from Q2 and Q3 drive differential deflection amplifier Q4 and Q5, this amplifier uses high voltage transistors to directly drive the vertical deflection plates of the CRT.

The external vertical input may be either AC or DC coupled to the calibrated attenuator. Switch S2A and its associated resistor network (R1-R5) allow reduction of input sensitivity in steps of 10 while maintaining a constant 1 megohn input impedance. Diodes CR1 and CR2 protect the circuitry from damage due to overvoltage. Dual FET Q1 acts as a dual source follower to provide a sufficiently high impedance to avoid loading effects on the attenuator. R10 permits balancing out any offset created by the source followers. Integrated circuit U1 is an operational amplifier whose gain may be adjusted by R92. The amplifier is non-inverting and operates with a gain of 10 when in the "CAL" position of R92, the front panel vertical gain control. When R92 is fully CCW, the amplifier operates at unity gain.

The internal vertical system is used to display frequency error and deviation as measured by the monitor mainframe. Integrated circuit U4 is an FM discriminator and is used to measure the amount of deviation on the received signal. Inductor L1 and capacitor C16 provide the required phase shift for the quadrature detector. The output of U4 is buffered by Q6 and provides summing amplifier U2.

Summing amplifier U2 combines the output from deviation detector U4 with the error voltage from the Monitor. In effect, the error voltage provides the dc portion of the signal and the deviation detector provides the ac portion. R18 and R19 are used to adjust the two signals to the proper relationship. A second pole of the input attenuator switch is used to select one of the three deviation measureing ranges when in the internal mode. Amplifier U3 is used to both invert the signal from U2 and to filter out any residual 200 kHz which is present. L2 and C44 in the feedback

path reduce the amplifier gain at their series resonant frequency (200 kHz) and thereby reduce any signal at 200 kHz.

2. HORIZONTAL CHANNEL

The horizontal channel consists of a differential amplifier (Q15 and Q16) with high input impedance provided by dual source followers Q14. The horizontal input is 1 megohm and is A.C. coupled. Diodes CR5 and CR6 provide overload protection. R76 is the front panel horizontal position control. A high voltage differential amplifier (Q17 and Q18) provides drive to the deflection plates.

3. SYNC-SWEEP CIRCUIT

The sync-sweep circuit provides a sweep voltage to the horizontal amplifier which is synchronized to the displayed waveform. A portion of the vertical signal from the emitter of Q4 is used to drive schmidt trigger Q11 and Q12. This circuit will produce a negative going pulse at the collector of Q12 each time the vertical signal crosses the trigger level in a negative direction. The sync circuit is very sensitive and will operate on a signal which is only 1/4 of 1 division in amplitude.

The negative going pulses from the Schmitt trigger are used to synchronize the end of the sweep ramp. Transistor Q13 normally biases the B2 of unijunction Q9 at 12V. When a sync pulse occurs this voltage drops slightly. If the emitter voltage of the unijunction is close to the firing point, the slight reduction in B2 voltage will initiate the firing slightly early. Since the retrace time is fixed for each range, the start of the sweep becomes synchronized with the vertical display. Transistor Q8 is a constant current source which charges the switch selected sweep timing capacitors. Front panel control R47 is a vernier for the sweep speed and operates by varying the charging current. Retrace occurs when the sweep voltage reaches the firing point of Q9. The sweep is recurring without any input signal on the vertical channel.

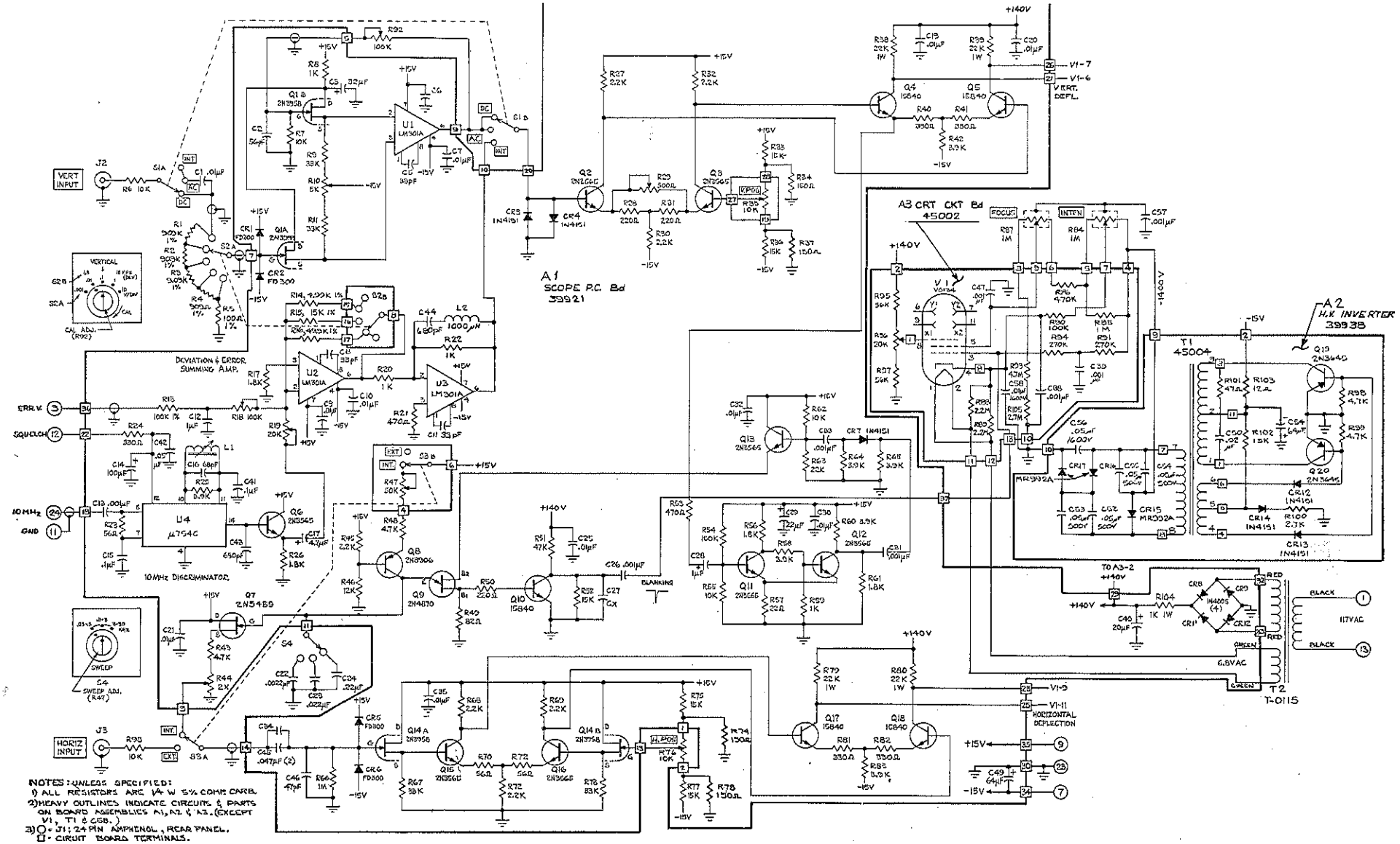
Retrace blanking is provided via high voltage transistor Q10. The B1 voltage from Q9 rises during retrace causing Q10 to turn on. This in turn creates a large negative going pulse which, when coupled to the control grid of the CRT, turns the bean off during retrace.

4. POWER SUPPLY-CRT CIRCUIT

Various controls are provided for the CRT. R84 and R87 are front panel mounted and adjust intensity and focus, respectively. R96 is an internal adjustment for astigmatism correction.

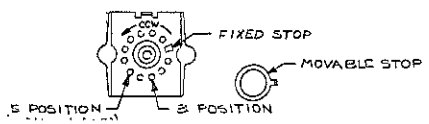
Two power supply voltages are generated within the oscilloscope plugin. Transformer T2 supplies 6.3 V for the CRT filament and, via rectifiers CR8-CR12 and filter R92 and C40, 140V for the deflection amplifiers.

The -1400 V anode supply is provided from a dc to dc converter. Transistors Q19 and Q20 along with transformer T1 generate a squarewave output of about 500 V pp. A voltage tripler circuit is then used to obtain the required anode voltage.



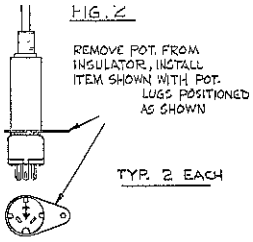
SLN-6351A DEVIATION OSCILLOSCOPE PLUG-IN SCHEMATIC D39918R2

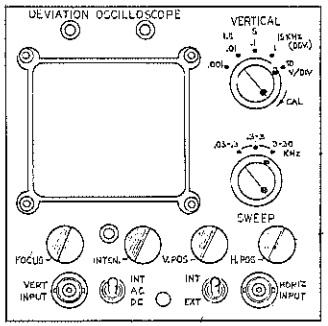
FIG 1
SWITCH STOP SETTINGS

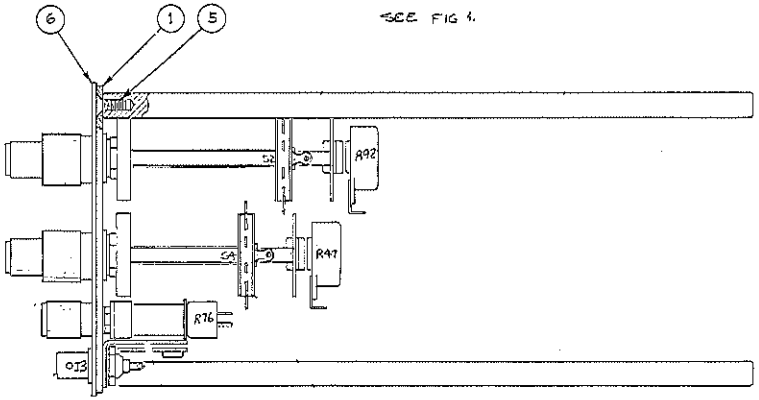


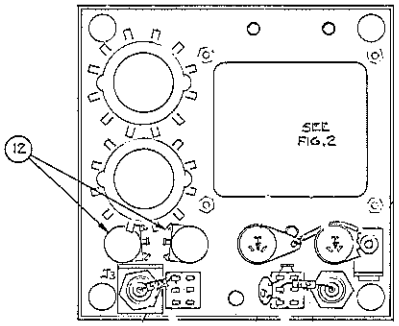
1) REMOVE MOVABLE STOP
2) ROTATE SWITCH SHAFT EXTREME CCW
3) INSTALL MOVABLE STOP AS SHOWN FOR SWITCHES S2 & S4, HOLD IN PLACE AND MOUNT BA. SWITCH IN POSITIONS SHOWN.

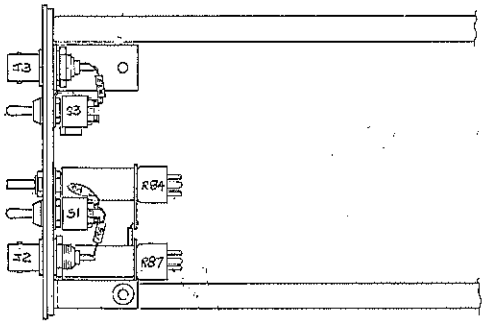
FIG. 2

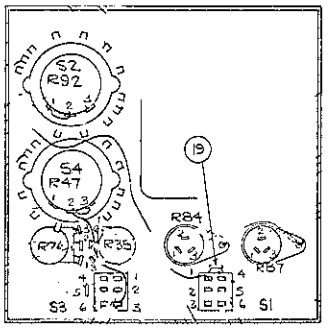








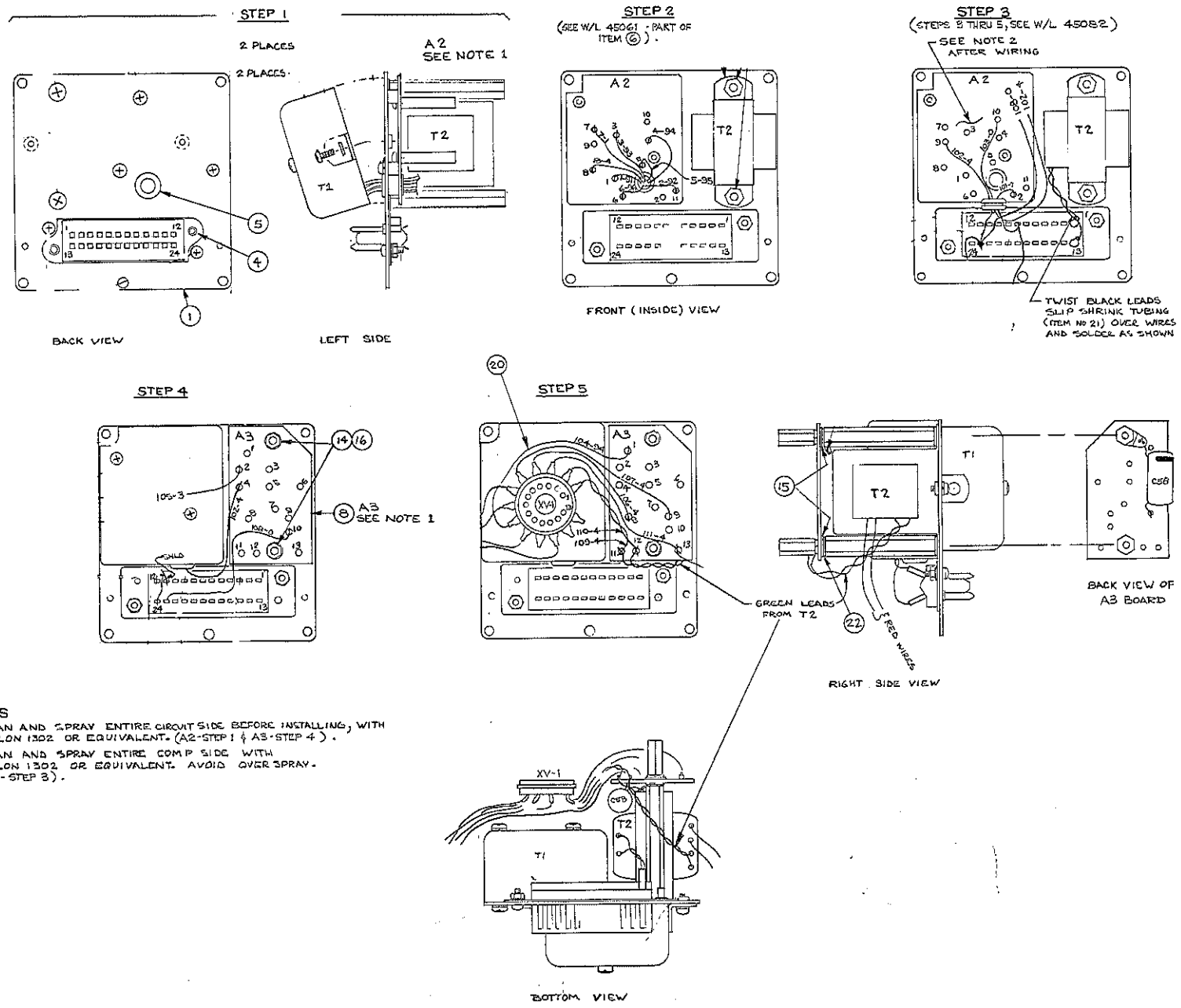




SLN-6351A, FRONT PANEL ASSEMBLY D45001A

SLN-6351A FRONT PANEL ASSEMBLY PARTS LIST

Ref.	Description	SD Part No.
	Scope Deviation Plug-In Front Panel Assembly	D45001A
	Knob, Black	H1189
	Knob, Concentric, Red	H1297
	Knob, Concentric Base	H1979
C1	Capacitor, .01MF, 500 V, Disc	C0423
J1	Not Used	
J2	Connector, BNC (Long Bushing)	J0260
J3	Connector, BNC (Long Bushing)	J0260
R6	Resistor, 10 K, 1/4 W, 5%, CC	R0766
R35	Potentiometer, 1 Turn, 10 K	R1860
R47	Sweep Range Switch Assembly	45056
R76	Potentiometer, 1 Turn, 10 K	R1860
R84	Potentiometer, H.V., 1 Turn, 1 Meg	R2790
R87	Potentiometer, H.V., 1 Turn, 1 Meg	R2790
R92	Attenuator Switch Assembly	45055
R93	Resistor, 10 K, 1/4 W, 5%, CC	R0766
S1	Switch, Toggle Min, 2P3T	S0410
S2	Attenuator Switch Assembly	45055
S3	Switch, Toggle Min, 2P2T	S0150
S4	Sweep Range Switch Assembly	45056



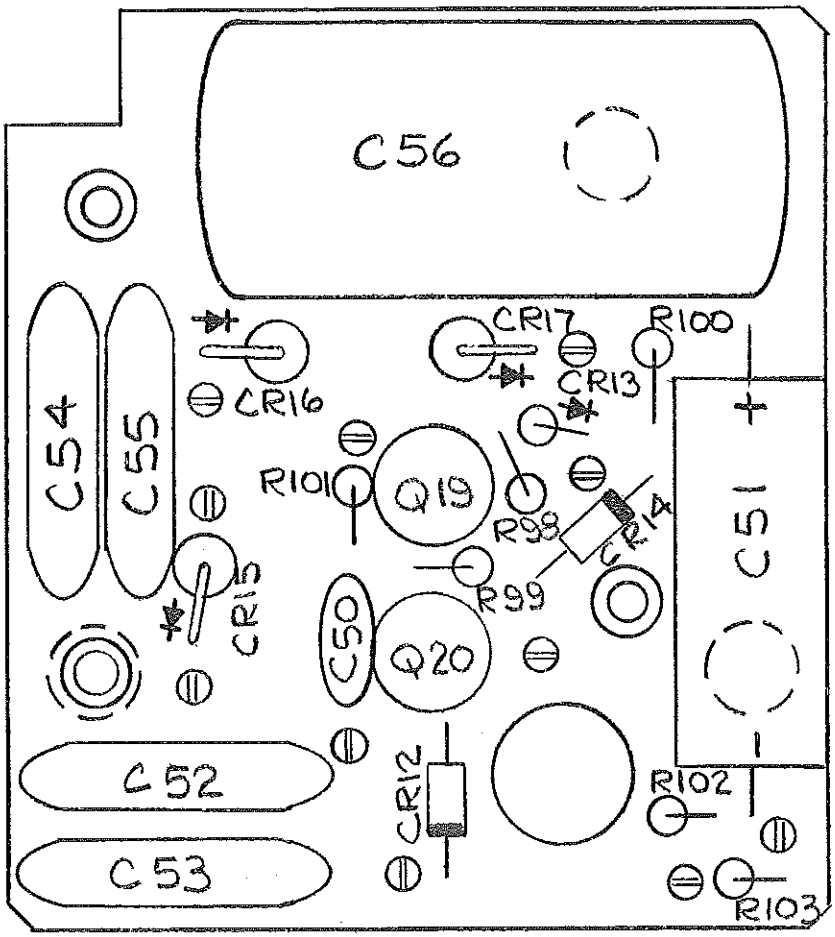
NOTES

1) CLEAN AND SPRAY ENTIRE CIRCUIT SIDE BEFORE INSTALLING, WITH KRYLON 1302 OR EQUIVALENT. (A2-STEP 1 & A3-STEP 4).
2) CLEAN AND SPRAY ENTIRE COMP SIDE WITH KRYLON 1302 OR EQUIVALENT. AVOID OVER SPRAY. (A2-STEP 3).

SLN-6351A, REAR PANEL SUB ASSEMBLY D45081A

SLN-6351A REAR PANEL SUB ASSEMBLY PARTS LIST

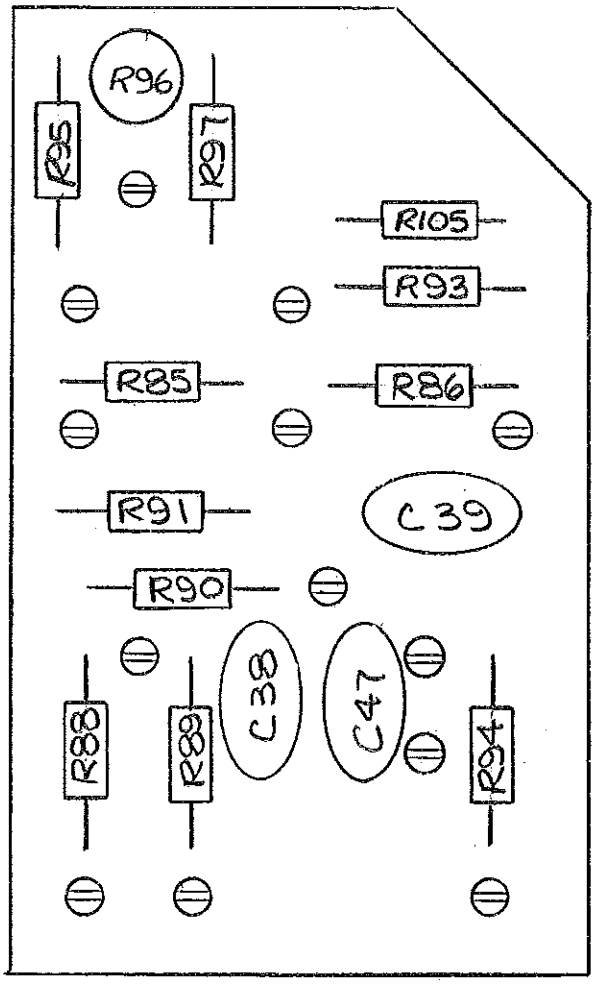
Ref.	Description	SD Part No.
	Can Mod H.V. Inverter	45020
	Rear Panel	39890
	Rear Panel Sub Assembly	D45081A
A1	Not Used	
A2	H.V. Inverter P.C. Bd. Assembly	39938
A3	CRT Circuit Bd P.C. Assembly	45002
C58	Capacitor, .01 µF 1600 V	C1287
J1	Connector, 24 Pin	09061450
T1	Inverter Transformer Assembly	45060
T2	Transformer	T0115



A2 H.V. INVERTER P.C. ASSEMBLY B39938R1

A2 H.V. INVERTER P.C. BOARD ASSEMBLY PARTS LIST

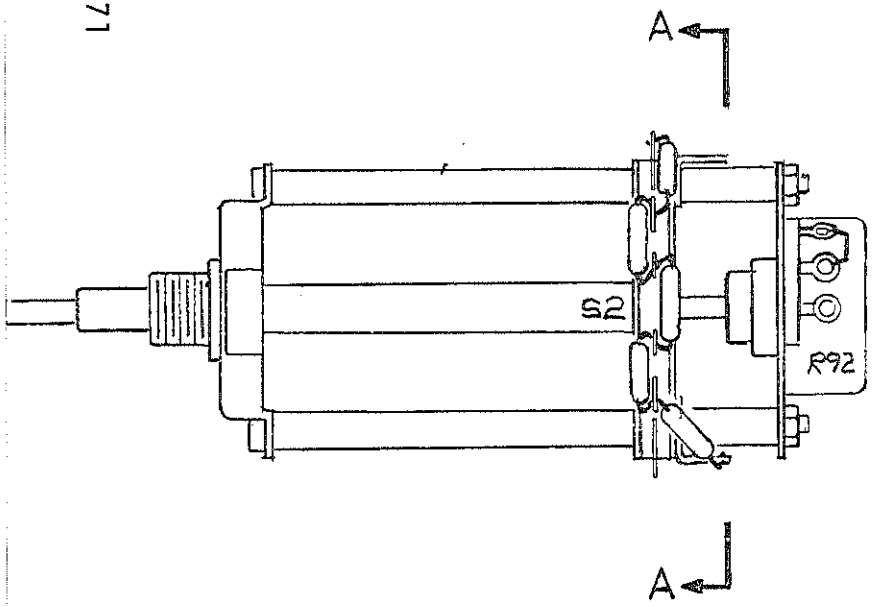
REF.	DESCRIPTION	SD PART NO.
A2	H.V. Inverter P.C. Board Assembly	B39938R1
A2	H.V. Inverter P.C. Board Schematic	D39918R2
C50	Capacitor, .02 µF, Disc	C0421
C51	Capacitor, 100 µF, 25 V, Electro	C0832
C52	Capacitor, .05 µF, 500 V, Disc	C0422
C53	Capacitor, .05 µF, 500 V, Disc	C0422
C54	Capacitor, .05 µF, 500 V, Disc	C0422
C55	Capacitor, .05 µF, 500 V, Disc	C0422
C56	Capacitor, .05 µF, 1600 V	C1273
CR12	Diode, IN4151	CR0151
CR13	Diode, IN4151	CR0151
CR14	Diode, IN4151	CR0151
CR15	Diode, MR991A	CR0374
CR16	Diode, MR991A	CR0374
CR17	Diode, MR991A	CR0374
Q19	Transistor, 2N3645	26012060
Q20	Transistor, 2N3645	26012060
R98	Resistor, 4.7 k, 1/4 W, 5%	R0892
R99	Resistor, 4.7 k, 1/4 W, 5%	R0892
R100	Resistor, 2.7 k, 1/4 W, 5%	R0937
R101	Resistor, 47 Ω, 1/4 W, 5%	R0743
R102	Resistor, 15 k, 1/4 W, 5%	R0728
R103	Resistor, 12 Ω, 1/4 W, 5%	R1587

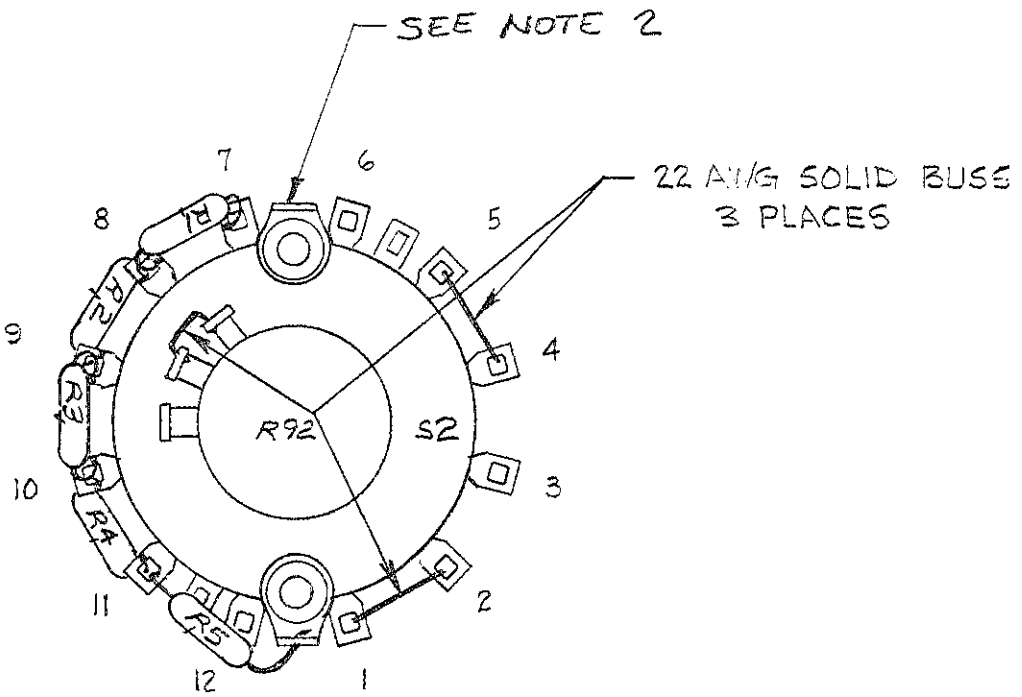


A3 CRT CIRCUIT ASSEMBLY B45002R1

A3 CRT CIRCUIT ASSEMBLY PARTS LIST

REF.	DESCRIPTION	SD PART NO.
A3	CRT Circuit Assembly	D45002**R1**
A3	CRT Circuit Schematic	D39918**R2**
C38	Capacitor, .001 µF, 3kV, Disc	C1274
C39	Capacitor, .00. µF, 3kV, Disc	C1274
C40	NOT USED	
C41	NOT USED	
C42	NOT USED	
C43	NOT USED	
C44	NOT USED	
C45	NOT USED	
C46	NOT USED	
C47	Capacitor, .001 µF, 3kV, Disc	C1274
R85	Resistor, 1 M, 1/4 W, 5%	R0962
R86	Resistor, 470 k, 1/4 W, 5%	R1060
R87	NOT USED	
R88	Resistor, 2.2 M, 1/4 W, 5%	R1014
R89	Resistor, 2.2 M, 1/4 W, 5%	R1014
R90	Resistor, 100 k, 1/4 W, 5%	R0741
R91	Resistor, 270 k, 1/4 W, 5%	R1622
R92	NOT USED	
R93	Resistor, 4.7 M, 1/4 W, 5%	R1206
R94	Resistor, 270 k, 1/4 W, 5%	R1622
R95	Resistor, 56 k, 1/4 W, 5%	R1235
R96	Potentiometer, 20 k, 1 T	R2419
R97	Resistor, 56 k, 1/4 W, 5%	R1235
R98	NOT USED	
R99	NOT USED	
R100	NOT USED	
R101	NOT USED	
R102	NOT USED	
R103	NOT USED	
R104	NOT USED	
R105	Resistor, 2.7 M, 1/4 W, 5%	R1020





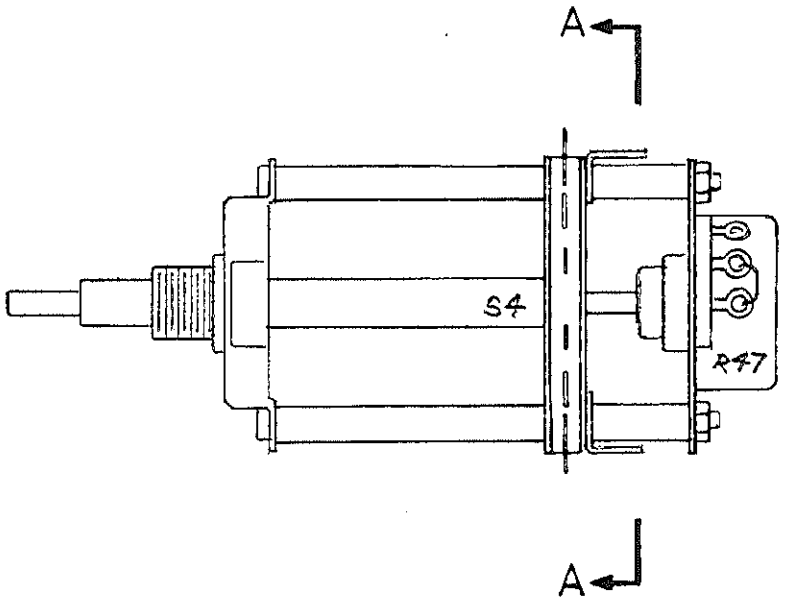
VIEW A-A

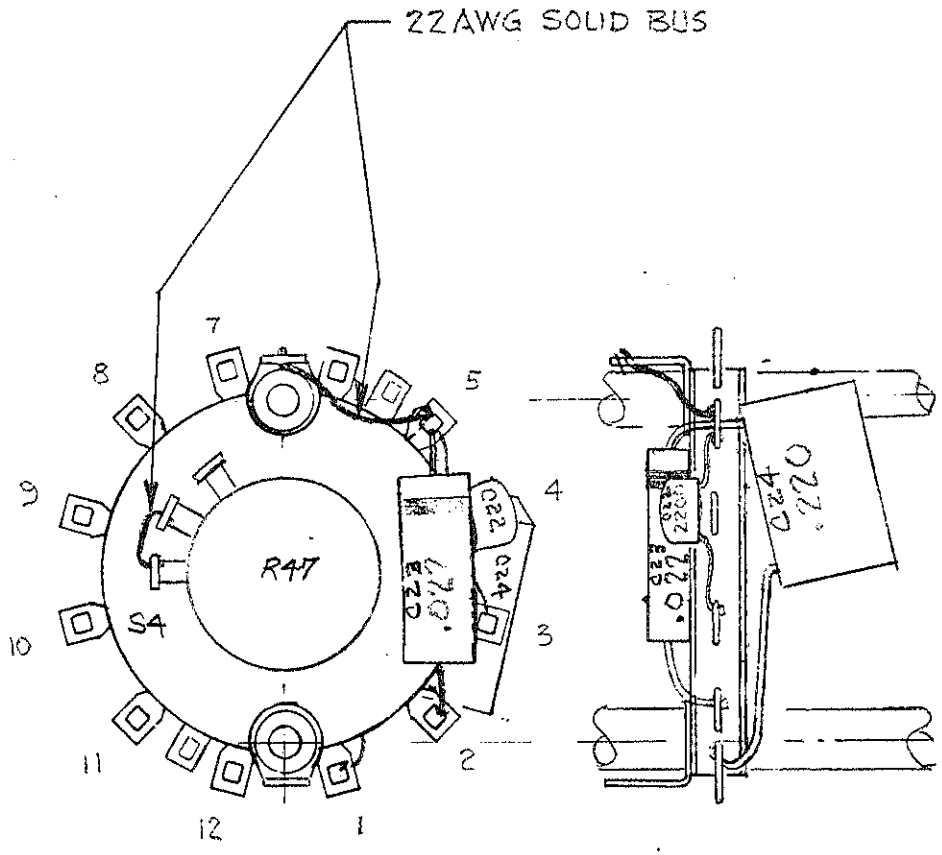
NOTE

1. MOUNT ITEMS 2 THRU 6 CLOSE TO TERMINALS.
2. BEND LUGS AS SHOWN

SLN-6351A, ATTENUATOR SWITCH ASSEMBLY PARTS LIST

REF.	DESCRIPTION	SD PART NO.
R1	Resistor, 909 k, MF, 1%	R2789
R2	Resistor, 90.9 k, MF, 1%	R2788
R3	Resistor, 9.09 k, MF, 1%	R2787
R4	Resistor, 909 Ω, MF, 1%	R2648
R5	Resistor, 100 Ω, MF, 1%	R2651
R92	Resistor, 50 k Potentiometer (Part of S2)	39981
S2	Switch, Sweep Range	39981





VIEW A-A

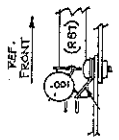
NOTE:

1. MOUNT ITEMS 2, 3 & 4 CLOSE TO TERMINALS.
2. TEFLON SLEEVE CAP. LEADS WHERE REQUIRED. SLEEVING ON LEADS TO COMMON TERMINAL (5), NOT REQUIRED.

SLN-6351A, SWEEP RANGE SWITCH ASSEMBLY B45056A

SLN-6351A, SWEEP RANGE SWITCH ASSEMBLY PARTS LIST

Ref.	Description	SD Part No.
C22	Capacitor, .0022 M.F.	03290790
C23	Capacitor, .022 M.F.	03278930
C24	Capacitor, .22 M.F.	03290240
R47	Resistor, 50 k Potentiometer (Part of S4)	39982
S4	Switch, Sweep Range	39982



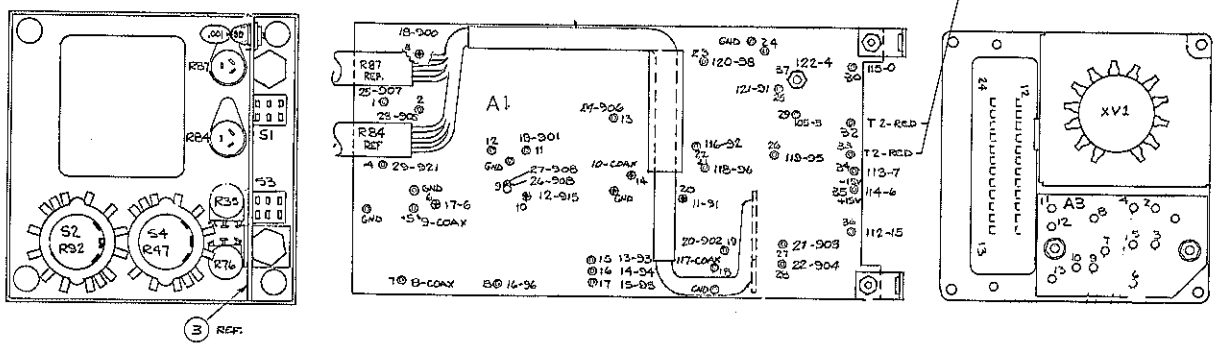
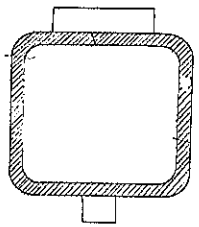


FIG. 1



NOTES:
1. BEND ITEM 7 TO 7/8 RADIUS AS SHOWN AND PLACE A 3½" STRIP OF ITEM 8 INSIDE OF ITEM 7 AS SHOWN. PLACE A 1½ STRIP OF ITEM 8 ON ITEM 6 AS SHOWN
2) WIRES ROUTED & SOLDERED ON BOTTOM SIDE OF P.C. Bd.
2) WIRES FROM REAR PANEL ASSY., 100 SERIES No's
3) TWIST RED WIRES FROM T2 TOGETHER AND SOLDER TO TERMINALS 32 & 33
4) CLEAN AND SPRAY COMPONENT SIDE WITH KRYLON 1302 OR EQUIVALENT OVER ENTIRE SURFACE.

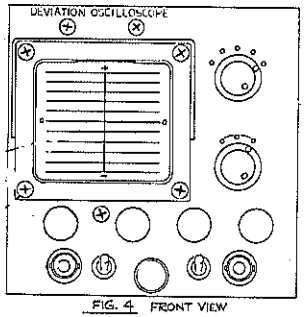
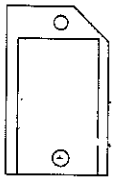
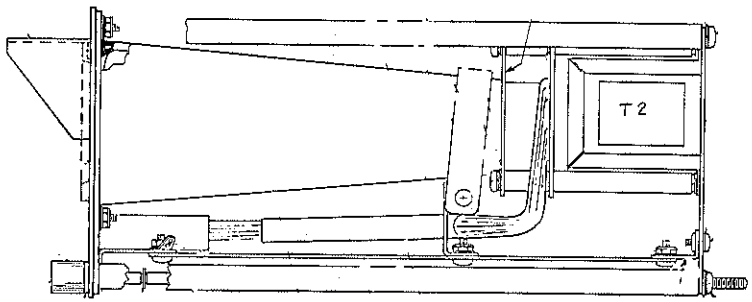


FIG. 4 FRONT VIEW



SOLVENT ACTIVATED ADHESIVE

FIG. 3



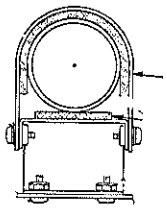
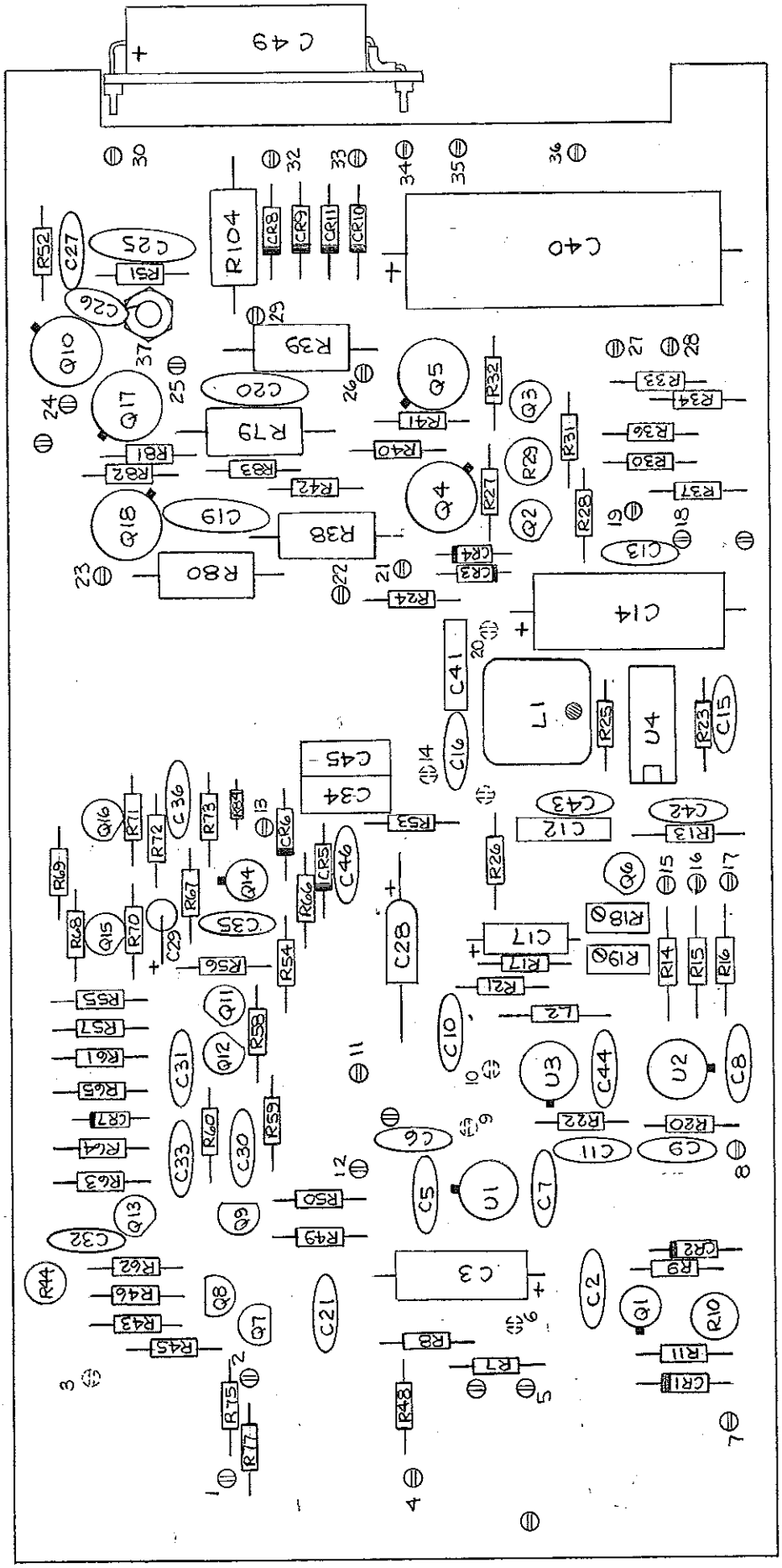


FIG 2

SLN-6351A, FINAL ASSEMBLY D45003A

SLN6351A, FINAL ASSEMBLY PARTS LIST

Ref.	Description	SD Part No.
	Scope Deviation Plug-In Assembly	D45003A
	Hood	39881
	Bezel	39878
	Graticule	39880
	Shield Board	45101
	Knob	H1959
	Rear Panel Sub Assembly	45081
	Front Panel Sub Assembly	45001
A1	Scope P.C. Bd.	39921
C57	Capacitor, .001 µF Disc, 3 Kv	C1274
V1	CRT	V0134



A1 DEVIATION OCILLOSCOPE P.C. ASSEMBLY D39921R1

OSCILLOSCOPE P.C. BOARD PARTS LIST

Ref.	Description	SD Part No.
	Scope P.C. Board Assembly	D39921R1
	Scope P.C. Board Schematic	D39918R8
C1	NOT USED	
C2	Capacitor, 56 pF, D.M.	C0534
C3	Capacitor, 32 µF Electro.	03290200
C4	NOT USED	
C5	Capacitor, 33 pF, D.M.	C0531
C6	Capacitor, .01 µF, 50 V, Disc	C0562
C7	Capacitor, .01 µF, 50 V, Disc	C0562
C8	Capacitor, 33 pF, D.M.	C0531
C9	Capacitor, .01 µF, 50 V, Disc	C0562
C10	Capacitor, .01 µF, 50 V, Disc	C0562
C11	Capacitor, 33 pF, D.M.	C0531
C12	Capacitor, 1 µF Monol. Cer.	C0879
C13	Capacitor, .001 µF, 500 V, Monol.	C0424
C14	Capacitor, 100 µF Electro.	C0832
C15	Capacitor, .1 µF, 10 V, Disc	C0661
C16	Capacitor, 68 pF, D.M.	C0635
C17	Capacitor, 4.7 µF, Tant.	C0406
C18	NOT USED	
C19	Capacitor, .01, 500 V, Disc	C0423
C20	Capacitor, .01, 500 V, Disc	C0423
C21	Capacitor, .01 µF, 50 V, Disc	C0562
C22	NOT USED	
C23	NOT USED	
C24	NOT USED	
C25	Capacitor, .01, 500 V, Disc	C0423
C26	Capacitor, .001 µF, 3 k V	C1274
C27	NOT USED	
C28	Capacitor, 1 µF, 35 V, Tant.	03290290
C29	Capacitor, 22 µF, 15 V, Electro.	C0693
C30	Capacitor, .01 µF, 50 V, Disc	C0562
C31	Capacitor, .001 µF, 500 V, Monol.	C0424
C32	Capacitor, .01 µF, 50 V, Disc	C0562
C33	Capacitor, .001 µF, 500 V, Monol.	C0424
C34	Capacitor, .047 µF, 250 V	03281080
C35	Capacitor, .01 µF, 50 V, Disc	C0562
C36	Capacitor, .01 µF, 50 V, Disc	C0562

OSCILLOSCOPE P.C. BOARD PARTS LIST (CONT'D)

Ref.	Description	SD Part No.
C37	NOT USED	
C38	NOT USED	
C39	NOT USED	
C40	Capacitor, 20 µF, 250 V, Electro.	03278700
C41	Capacitor, .1 µF, Monol. Cer.	C0881
C42	Capacitor, .05 µF, 12 V, Disc	C0672
C43	Capacitor, 680 pF, D.M.	C0638
C44	Capacitor, 680 pF, D.M.	C0638
C45	Capacitor, .047 µF, 250 V	03281080
C46	Capacitor, 47 pF, D.M.	C0533
C47	NOT USED	
C48	NOT USED	
C49	Capacitor, 64 µF, 64 V, Electro.	03286620
CR1	Diode, FD300	26012320
CR2	Diode, FD300	26012320
CR3	Diode, 1N4151	CR0150
CR4	Diode, 1N4151	CR0150
CR5	Diode, FD300	2601230
CR6	Diode, FD300	2601230
CR7	Diode, 1N4151	CR0150
CR8	Diode, 1N4005	CR0284
CR9	Diode, 1N4005	CR0284
CR10	Diode, 1N4005	CR0284
CR11	Diode, 1N4005	CR0284
L1	Inductor, 3-3.5 µH, 20 T	39666-1
	Inductor, Coil Form	E0304
L2	Inductor, 1000 µH	L0068
Q1	Transistor, 2N3958, Dual FET	26015100
Q2	Transistor, 2N3565, NPN	26012000
Q3	Transistor, 2N3565, NPN	26012000
Q4	Transistor, 15840, NPN	15840
Q5	Transistor, 15840, NPN	15840
Q6	Transistor, 2N3565, NPN	26012000
Q7	Transistor, 2N5459, FET	Q0264
Q8	Transistor, 2N3906, PNP	Q0248
Q9	Transistor, 2N4870, Univ.	Q0266
Q10	Transistor, 15840, NPN	15840

OSCILLOSCOPE P.C. BOARD PARTS LIST (CONT'D)

Ref.	Description	SD Part No.
Q11	Transistor, 2N3565, NPN	26012000
Q12	Transistor, 2N3565, NPN	26012000
Q13	Transistor, 2N3565, NPN	26012000
Q14	Transistor, 2N3958, Dual FET	26015100
Q15	Transistor, 2N3565, NPN	26012000
Q16	Transistor, 2N3565, NPN	26012000
Q17	Transistor, 15840, NPN	15840
Q18	Transistor, 15840, NPN	15840
R1	NOT USED	
R2	NOT USED	
R3	NOT USED	
R4	NOT USED	
R5	NOT USED	
R6	NOT USED	
R7	Resistor, 10 k	R0766
R8	Resistor, 1 k	R0765
R9	Resistor, 33 k	R0780
R10	Potentiometer, 5 k	R2697
R11	Resistor, 33 k	R0780
R12	NOT USED	
R13	Resistor, 100 k, 1%	R2638
R14	Resistor, 4.99 k, 1%	R2636
R15	Resistor, 15 k, 1%	R2073
R16	Resistor, 49.9 k, 1%	R2642
R17	Resistor, 1.8 k	R0959
R18	Potentiometer, 100 k (Bourns 3339H)	R2792
R19	Potentiometer, 20 k, (Bourns 3339H)	R2791
R20	Resistor, 1 k	R0765
R21	Resistor, 470Ω	R1044
R22	Resistor, 1 k	R0765
R23	Resistor, 56Ω	R1554
R24	Resistor, 330Ω	R0662
R25	Resistor, 3.9 k	R0939
R26	Resistor, 1.8 k	R0959
R27	Resistor, 2.2 k	R0749
R28	Resistor, 220Ω	R0760
R29	Potentiometer, 500 (Bourns 3339H)	R2793
R30	Resistor, 2.2 k	R0749

OSCILLOSCOPE P.C. BOARD PARTS LIST (CONT'D)

Ref.	Description	SD Part No.
R31	Resistor, 220Ω	R0760
R32	Resistor, 2.2 k	R0749
R33	Resistor, 15 k	R0728
R34	Resistor, 150Ω	R0983
R35	NOT USED	
R36	Resistor, 15 k	R0728
R37	Resistor, 150Ω	R0983
R38	Resistor, 22 k, 1 W	R2341
R39	Resistor, 22 k, 1 W	R2341
R40	Resistor, 330Ω	R0662
R41	Resistor, 330Ω	R0662
R42	Resistor, 3.9 k	R0939
R43	Resistor, 4.7 k	R0892
R44	Potentiometer, 2 k, (Bourns 3339H)	R2794
R45	Resistor, 2.2 k	R0749
R46	Resistor, 12 k	R0759
R47	NOT USED	
R48	Resistor, 4.7 k	R0892
R49	Resistor, 82Ω	R1059
R50	Resistor, 220Ω	R0760
R51	Resistor, 47 k	R0777
R52	Resistor, 15 k	R0728
R53	Resistor, 470Ω	R1044
R54	Resistor, 150 k	R0961
R55	Resistor, 10 k	R0766
R56	Resistor, 1.8 k	R0959
R57	Resistor, 22Ω	R1436
R58	Resistor, 3.9 k	R0939
R59	Resistor, 1 k	R0765
R60	Resistor, 3.9 k	R0939
R61	Resistor, 1.8 k	R0959
R62	Resistor, 10 k	R0766
R63	Resistor, 22 k	R0768
R64	Resistor, 3.9 k	R0939
R65	Resistor, 3.9 k	R0939
R66	Resistor, 1 M	R0962
R67	Resistor, 33 k	R0780
R68	Resistor, 2.2 k	R0749
R69	Resistor, 2.2 k	R0749
R70	Resistor, 56Ω	R1554

OSCILLOSCOPE P.C. BOARD PARTS LIST (CONT'D)

Ref.	Description	SD Part No.
R71	Resistor, 56Ω	R1554
R72	Resistor, 2.2 k	R0749
R73	Resistor, 33 k	R0780
R74	Resistor, 150Ω	R0983
R75	Resistor, 15 k	R0728
R76	NOT USED	
R77	Resistor, 15 k	R0728
R78	Resistor, 150Ω	R0983
R79	Resistor, 22 k, 1 W	R2341
R80	Resistor, 22 k, 1 W	R2341
R81	Resistor, 330Ω	R0662
R82	Resistor, 330Ω	R0662
R83	Resistor, 3.9 k	R0939
R84-103	NOT USED	
R104	Resistor, 1 k, 1 W	R1089
U1	Integrated Circuit, LM301A	25745
U2	Integrated Circuit, LM301A	25745
U3	Integrated Circuit, LM301A	25745
U4	Integrated Circuit, μA 754 C	25781

OPTIONAL PLUG-IN
PRESELECTORS
MODELS SLN-6353A & SLN-6354A
SLN-6369A & SLN-6355A

1.1 INTRODUCTION

There are four standard Preselector Plug-ins providing additional sensitivity and selectivity in the 25-50, 145-175, 406-420, and 450-512 MHz bands when used with the S1327A Service Monitor. Each plug-in preselector also features a broadband input, permitting the Service Monitor to be used on any frequency from 20 to 990 MHz without the need for a separate broadband mixer plug-in. Sensitivity of better than 20 MV for full quieting of the receiver is maintained across each band with a single, easy to read frequency tracking tuning dial. In the wideband mode (MIXER INPUT) sensitivity is better than 10 mV up to 590 MHz and 20 mV to 990 MHz.

1.2 OPERATION

Two switches, one tuning dial and a meter, are located on the front panel and provide control and monitoring for preselector operation.

With the center switch in PRESELECTOR mode, the input should be connected to the PRESELECTOR INPUT connector. The frequency which you wish to receive is then dialed into the thumbwheel switches of the Service Monitor (in RCVR mode). The tuning dial of the preselector is now set to approximately the frequency to be received. Note that the tuning dial actually only "peaks" the receiver and does not control its frequency. This frequency control is provided by the "drift free" signal generated by the Service Monitor. The tuning meter is an aid to proper peaking of the tuning dial and is so designed that the reading is greatly compressed at the high end of the scale, so even strong signals will read on scale. Having no relative calibration, the meter should not be used as a signal strength monitor - it is only intended to aid tuning.

Both WIDE and NARROW IF bandwidths are available by means of the remaining front panel switch. It is recommended that the NARROW position be used routinely to reduce noise and adjacent channel interference. Note, however, that for signals with large deviation or high modulating frequencies, the bandwidth in NARROW may not be sufficient to pass the modulation without distortion.

When in MIXER mode the right input is used and any frequency from 20 to 990 MHz may be received, as with the Broadband Mixer plug-in. The WIDE-NARROW selector and tuning meter function as in the PRESELECTOR mode.

1.3 SPECIFICATIONS

The plug-ins cover the following ranges:

SLN-6353A	25-50 MHz and broadband
SLN-6354A	145-175 MHz and broadband
SLN-6369A	406-420 MHz and broadband
SLN-6355A	450-512 MHz and broadband

CIRCUIT DESCRIPTION
PRESELECTOR PLUG-INS
MODELS SLN-6353A & SLN-6354A

1) CIRCUIT DESCRIPTION

The preselector contains all the circuitry required to amplify the received signal, to convert this signal to the 10 MHz IF, to amplify the IF, and to detect the proper level which activates the squelch. All tuning of the RF amplifier stage and the local oscillator amplifier stage is done by voltage variable capacitors. Diode switches are used to switch modes and IF bandwidths. A separate hot carrier diode mixer is used for the broadband mixer portion.

The input signal is coupled to a tuned circuit composed of L1, C2, and CR1. A dual, insulated gate, MOS field-effect transistor, Q1, is used for the RF amplifier to reduce cross modulation effects. The output of this amplifier is tuned by L3, C11, and CR2 and fed to one input of another FET, Q2. The local oscillator signal is amplified by grounded base amplifier Q3, tuned with L4, C20, and DR3, and fed to the other input of mixer Q2. Again, the use of the dual gate FET for the mixer reduces cross modulation and other spurious products. Coil L5 and capacitor C65 provide a resonant circuit at the 10 MHz IF output of the mixer.

Signals applied to the broadband MIXER input of the plug-in are first filtered by network L7, C53, and C54 to remove any 10 MHz component. The signal is then mixed with the local oscillator in diode CR14, and fed through a series-tuned 10 MHz filter which rejects any component not at the desired 10 MHz IF.

Diode switches CR4 and CR5 are used to select either the PRESELECTOR signal or the MIXER signal and feed it through emitter follower Q4 into the IF bandwidth switching network, which is composed of crystal filter Y1 and a diode switch bypass. When the NARROW mode is selected, diodes CR6 and CR9 are turned on, diodes CR7 and CR8 are turned off, and the signal is routed through the crystal filter. In the WIDE mode, the diode switch positions are reversed and the signal bypasses the filter. Emitter follower Q5 provides a low impedance source to drive the amplifier.

The 10 MHz signal from the bandwidth switching network is further amplified by a high gain, AGC type amplifier. Integrated circuit U1, tuned on both input and output, provides the gain; and transistor Q6 acts as an adjustable threshold AGC amplifier. By adjusting R69 the point at which AGC action begins may be set.

The output of Q6 is also used to drive the "level detect" circuit. A voltage doubler, composed of two hot-carrier type diodes (CR15 and 16), peak detects the 10 MHz signal and supplies a dc voltage to amplifier U2. This amplifier has a gain of three and

additionally provides the required low output impedance to drive the tuning meter and Schmidt trigger Q8, Q9. The "trip point" of the Schmidt trigger is adjustable with R60 and is set, such that, the monitor will turn on at a point where the signal is strong enough for proper quieting. Transistor Q10 provides the required voltage level to operate the output diode switch and allows a 10 MHz signal to be supplied to the Monitor Mainframe.

2) MAINTENANCE & CALIBRATION (SLN-6354A & SLN-6353A)

No routine maintenance other than periodic dusting of the plug-in with a soft brush is required. To recalibrate the plug-in, a variable amplitude signal generator will be required. The following adjustment procedure assumes that the unit is not totally misadjusted, i.e. it is possible to turn on the Monitor with a sufficiently strong signal.

a) Dial and tune in a frequency which is 1.1 MHz above the lower band edge and set the signal generator to give a zero frequency error reading on the error meter (15 KHz range). If possible, the tuning meter should be about half scale.

b) Using a nonmetallic tuning tool with a 3/32" wide blade, adjust L9 & L10 for a maximum tuning meter reading, reducing the generator amplitude as needed to keep the needle about half scale. Then adjust C65 for a maximum reading.

c) Carefully adjust L1, L3, and L4 for a maximum tuning meter reading, again reducing the generator amplitude, as required.

d) Dial and tune in a frequency which is 1 MHz below the upper band edge and set the signal generator to give a zero error reading on the error meter (15 KHz range). The tuning meter should be about half scale.

e) Adjust C3, C11, and C20 for a maximum reading on the tuning meter, reducing the generator amplitude as needed.

f) Repeat steps a) through e) (omitting step b) until no significant improvement in sensitivity is obtainable. This series of adjustments has aligned the RF and LO amplifier tracking.

g) Using whatever frequency is presently set up, increase the signal generator amplitude and adjust R69 such that the tuning meter does not go off scale at the high end with a signal of 10 mV.

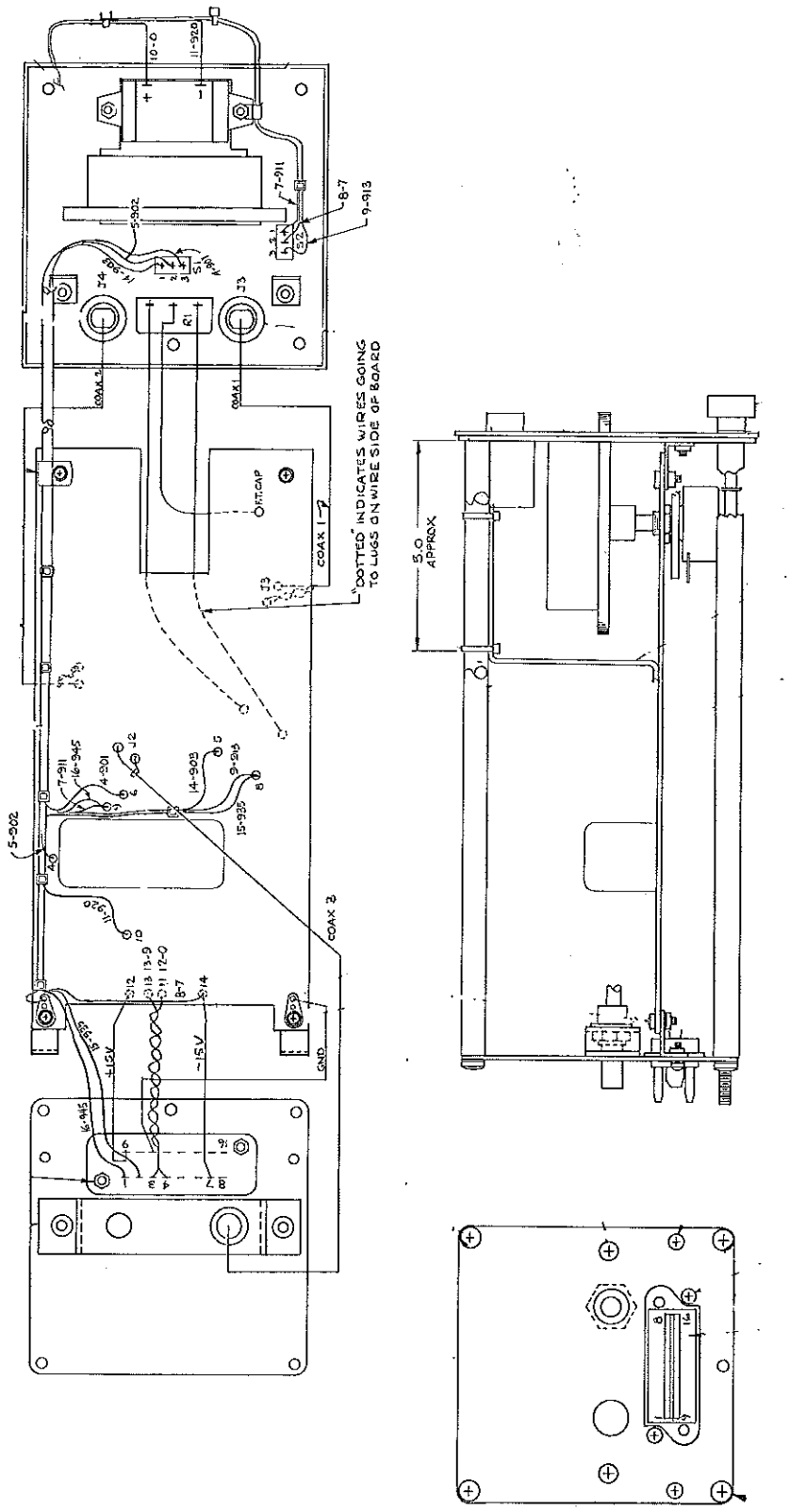
h) Reduce the signal amplitude; and, with the preselector

SLN-6355A,PRESELECTOR P.C. ASSEMBLY PARTS LIST (Cont'd)

Ref.	Description	SD Part No.
C36	Capacitor, Feed Through, 1500 pF	C6014
C37	Capacitor, D.M., 68 pF	C1140
C38	Capacitor, Ceramic Disc, .01 µF	C0562
C39	Capacitor, Ceramic Disc, .01 µF	C0562
C40	Capacitor, Ceramic Disc, .01 µF	C0562
C41	Capacitor, Ceramic Disc, .01 µF	C0562
C42	Capacitor, Ceramic Disc, .01 µF	C0562
C43	Capacitor, Ceramic Disc, .01 µF	C0562
C44	Capacitor, Ceramic Disc, .01 µF	C0562
C45	Capacitor, Ceramic Disc, .01 µF	C0562
C46	Capacitor, Ceramic Disc, .01 µF	C0562
C47	Capacitor, Ceramic Disc, .01 µF	C0562
C48	Capacitor, D.M., 270 pF	C1139
C49	Capacitor, D.M., 1000 pF	C1144
C50	Capacitor, Ceramic Disc, .01 µF	C0562
C51	Capacitor, Ceramic Disc, Mono, 1 µF	C0562
C52	Capacitor, Ceramic Disc, .01 µF	C0562
C53	Capacitor, Ceramic Disc, .01 µF	C0562
C54	Capacitor, D.M., 270 pF	C1139
C55	Capacitor, Ceramic Disc, .01 µF	C0562
C56	Capacitor, Ceramic Disc, .01 µF	C0562
C57	Capacitor, Ceramic Disc, .01 µF	C0562
C58	Capacitor, Ceramic Disc, .01 µF	C0562
C59	Capacitor, Ceramic Disc, .01 µF	C0562
C60	Capacitor, Ceramic Disc, .01 µF	C0562
C61	Capacitor, Ceramic Disc, .01 µF	C0562
C62	Capacitor, Ceramic Disc, .01 µF	C0562
C63	Capacitor, Ceramic Disc, .01 µF	C0562
C64	Capacitor, Electro Tant., 1 µF	03290290
C65	Capacitor, Ceramic Disc, .01 µF	C0562
C66	Capacitor, Ceramic Disc, Mono, .1 µF	C0881
C67	Capacitor, D.M., 33 pF	C0877
C68	Capacitor, Ceramic Disc, .01 µF	C0562
C69	Capacitor, Ceramic Disc, .01 µF	C0562
C70	Capacitor, Trimmer, 1.7-11 pF	C1255
C71	Capacitor, Chip, .005 µF	C1245
C72	Capacitor, Chip, .005 µF	C1245
C73	Capacitor, Trimmer, 1.3-5.4 pF	C1294
C74	Capacitor, Feed Through, 1500 pF	C6014
C75	Capacitor, Ceramic Disc, .01 µF	C0562
C76	Capacitor, Ceramic Disc, .01 µF	C0562
C77	Capacitor, Ceramic Disc, .01 µF	C0562

SLN-6355A, PRESELECTOR FRONT PANEL ASSEMBLY PARTS LIST

Ref.	Description	SD Part No.
	Assembly, Tuning Drum	45404
M1	Level Meter (MURA #TEH-15)	45302
R1	Potentiometer, Tune 100 k	R0408
S1	Switch, Toggle, Min. SPDT	S0149
S2	Switch, Toggle, Min. SPDT	S0149



SLN-6355A, PRESELECTOR FINAL ASSEMBLY D45428R1

SLN-6355A, PRESELECTOR FINAL ASSEMBLY PARTS LIST

Ref.	Description	SD Part No.
	Knob	H1959
	Rod	37340
	Connector, 16 Pin	J0604

CHAPTER 7
OPTIONS

7.1 INTRODUCTION

These options provide additional flexability for the S1327A Service Monitor and are obtainable upon request from your Motorola Representative.

7.2 OPTIONS

The options described in this Chapter include:

SLN-6364A DC Inverter Option
SLN-6379A Remote Meter Option
X-Oscillator Option
Y-Oscillator Option
Z-Oscillator Option

DC INVERTER OPTION
INSTALLATION AND USE
MODEL SLN-6364A

INTRODUCTION:

The Model SLN6364A D.C. Inverter Option allows full operation of the Model S1327 Service Monitor from a 12 V dc power source. Once installed, the inverter unit becomes a permanent part of the service monitor.

INSTALLATION:

To install the inverter, unplug the power cord from the service monitor and turn it upside down on a clean surface. Remove the bottom cover and set aside. Locate the two gray wires and the black cable which are held in a clamp fastened to the plug-in tray. Remove and discard the clamp, replace the screw. Now remove and discard the blank cover on the rear panel (directly behind the power transformer). Pull the two gray wires and the loop of black cable through the hole in the rear panel. Loosen the cover on the inverter.

Refer to the D.C. Inverter Assembly drawing and connect one of the gray wires to each of the two solder lugs on the transistor heatsink. Cut the black cable so the pieces are of approximately equal lengths. Carefully strip the two cable ends so about 1" of outer covering is removed. Separate the conductors; remove the shield wrap. Strip each red and black wire 1/4". Connect the red wires to lugs 7 and 8 on the switch and the black wires to lugs 10 and 11. Connect the two shield wires together, solder, and tape the ends of the cable to prevent the shield from shorting out any other lines.

Route the black wire with the ground lug on it through the rear panel. Mount the heatsink assembly to the rear panel, routing the wires back into the service monitor. Carefully replace the cover so as not to pinch any wires. Fasten the ground lug on the black wire to the plug-in tray rail with a #6 screw. There is a tapped hole in the rail near the rear panel.

OPERATION:

The D.C. Inverter is designed to operate the service monitor from a 12 V dc electrical source. To use, connect the positive side of the source to the red binding post and the negative side to the black binding post. Place the switch on the inverter in the 12 V dc position and the inverter will start. To turn off, place switch in the 115 V ac position.

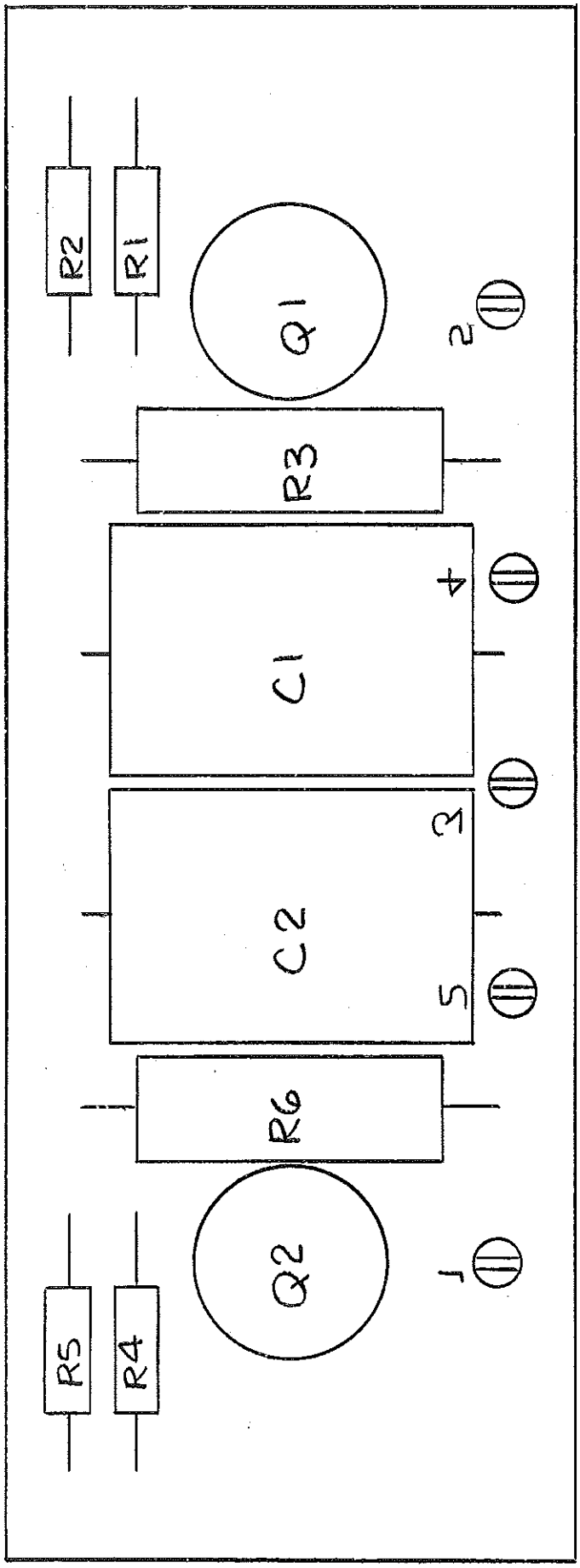
NOTE:

The instrument front panel power switch must be turned on to allow the master oscillator oven to operate.

CIRCUIT DESCRIPTION:

The circuitry contained in the inverter assembly consists of two power transistors and two driver transistors, with their associated resistors and capacitors. A special winding in the instrument transformer is driven to produce squarewave ac at about 100 Hz. The bases of Q1 and Q2 are connected to the "opposite" driver collector through capacitors C1 and C2. This provides the required feedback to operate the circuit.

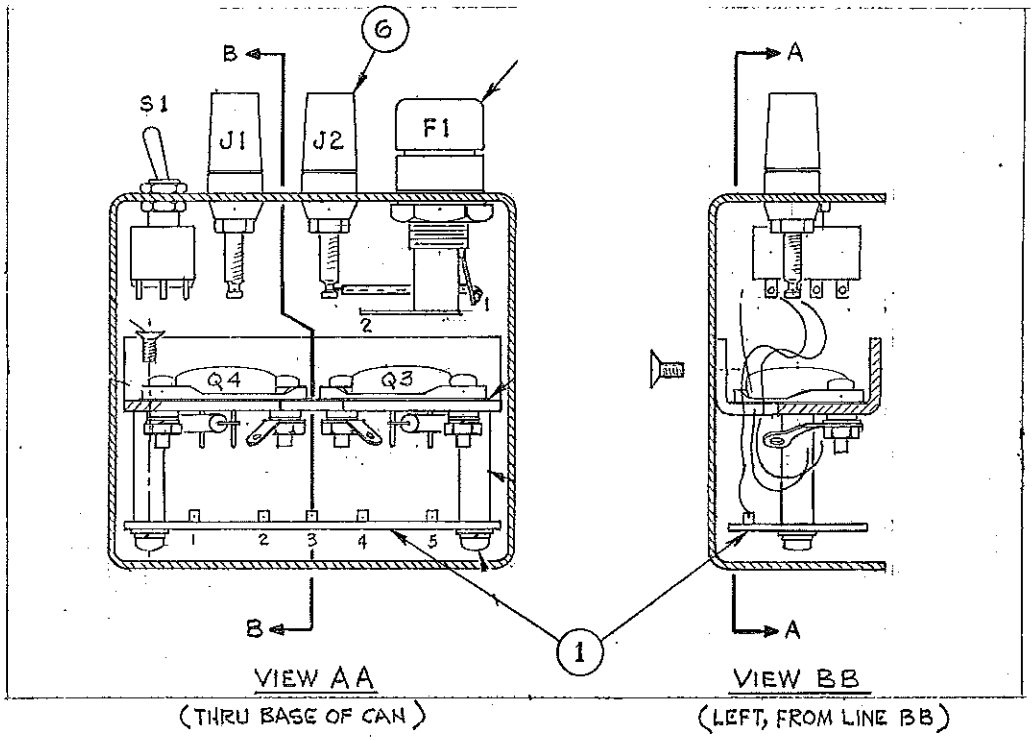
Switching is provided to disconnect both sides of the ac rear panel input connector when the inverter is in 12 V dc position. The same switch removes base drive from the power transistors when in 115 V ac position.

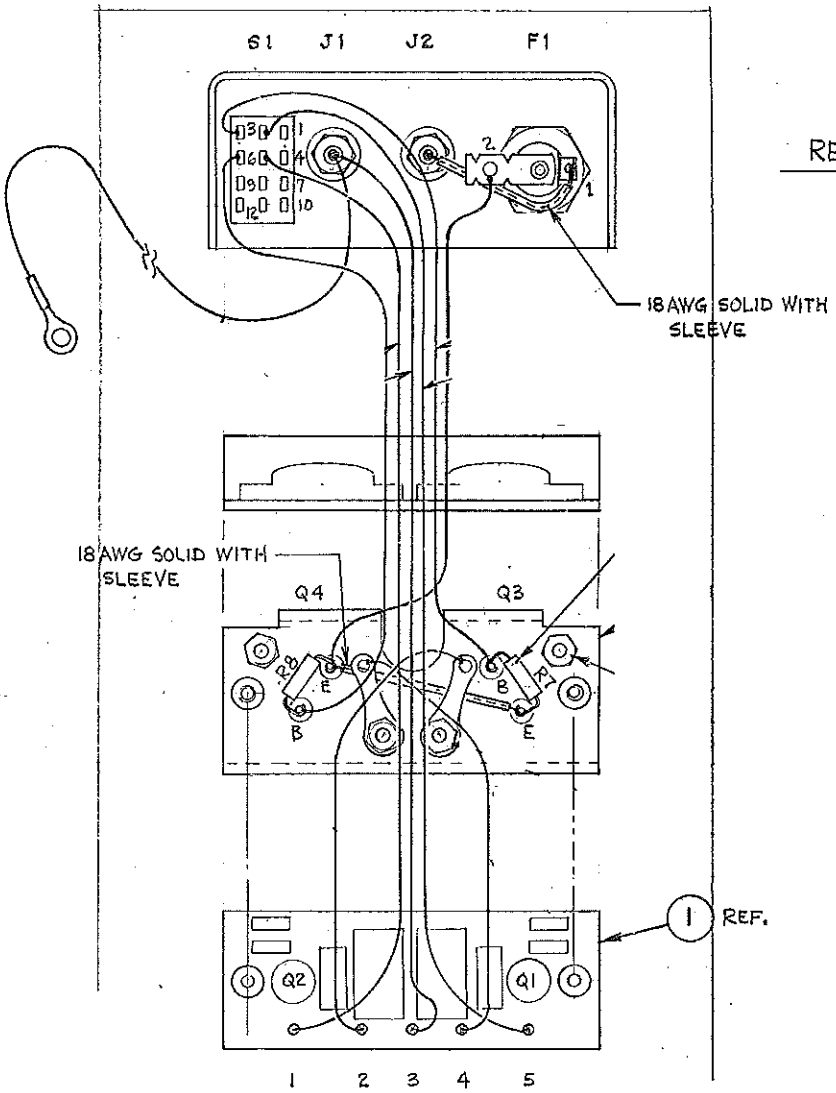


SLN-6364A, INVERTER OPTION P.C. ASSEMBLY C45034R1

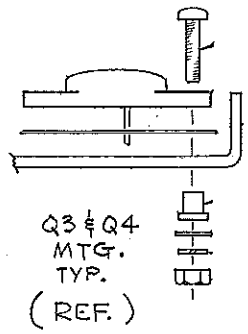
SLN-6364A, INVERTER OPTION PARTS LIST

Ref.	Description	SD Part No.
	Inverter Option P.C. Board Assembly	B45034R1
	Inverter Option P.C. Board Schematic	D39510R5
C1	Capacitor, 1 MF 50V	03279390
C2	Capacitor, 1 MF 50V	03279390
	Terminal	E0100
	Transistor Pad	H0515
Q1	Transistor, 2N3638	Q0181
Q2	Transistor, 2N3638	Q0181
R1	Resistor, 390 Ω, 1/4 W, 5%	R0880
R2	Resistor, 5.6 k 1/4 W, 5%	R0821
R3	Resistor, 68 Ω, 1 W, 5%	R1570
R4	Resistor, 390 Ω, 1/4 W, 5%	R0880
R5	Resistor, 5.6 k, 1/4 W, 5%	R0821
R6	Resistor, 68 Ω, 1 W, 5%	R1570





REF., SCHEMATIC 39510 .



SLN6364A INVERTER OPTION ASSEMBLY C45035A

SLN-6364A, INVERTER OPTION FINAL ASSEMBLY PARTS LIST

Ref.	Description	SD Part No.
	Inverter Option Final Assembly	C45035A
	Inverter Option P.C. Assembly	C45034R1
	Inverter Option Schematic	D39510R5
F1	Fuse, 5 AMP, SB	F0004
J1	Binding Post, 5 way Blk	09964480
J2	Binding Post, 5 way Red	09064470
R7	Resistor, 220 Ω, 1/2 W, CC	R1231
R8	Resistor, 220 Ω, 1/2 W, CC	R1231
S1	Switch, Toggle 4PDT Min.	S0379
Q1	Not Used	
Q2	Not Used	
Q3	Transistor, 2N1164	Q0313
Q4	Transistor, 2N1164	Q0313
XF1	Fuse Holder	X0034

REMOTE METER OPTION
INSTALLATION AND USE
MODEL SLN-6379A

1.1 INTRODUCTION

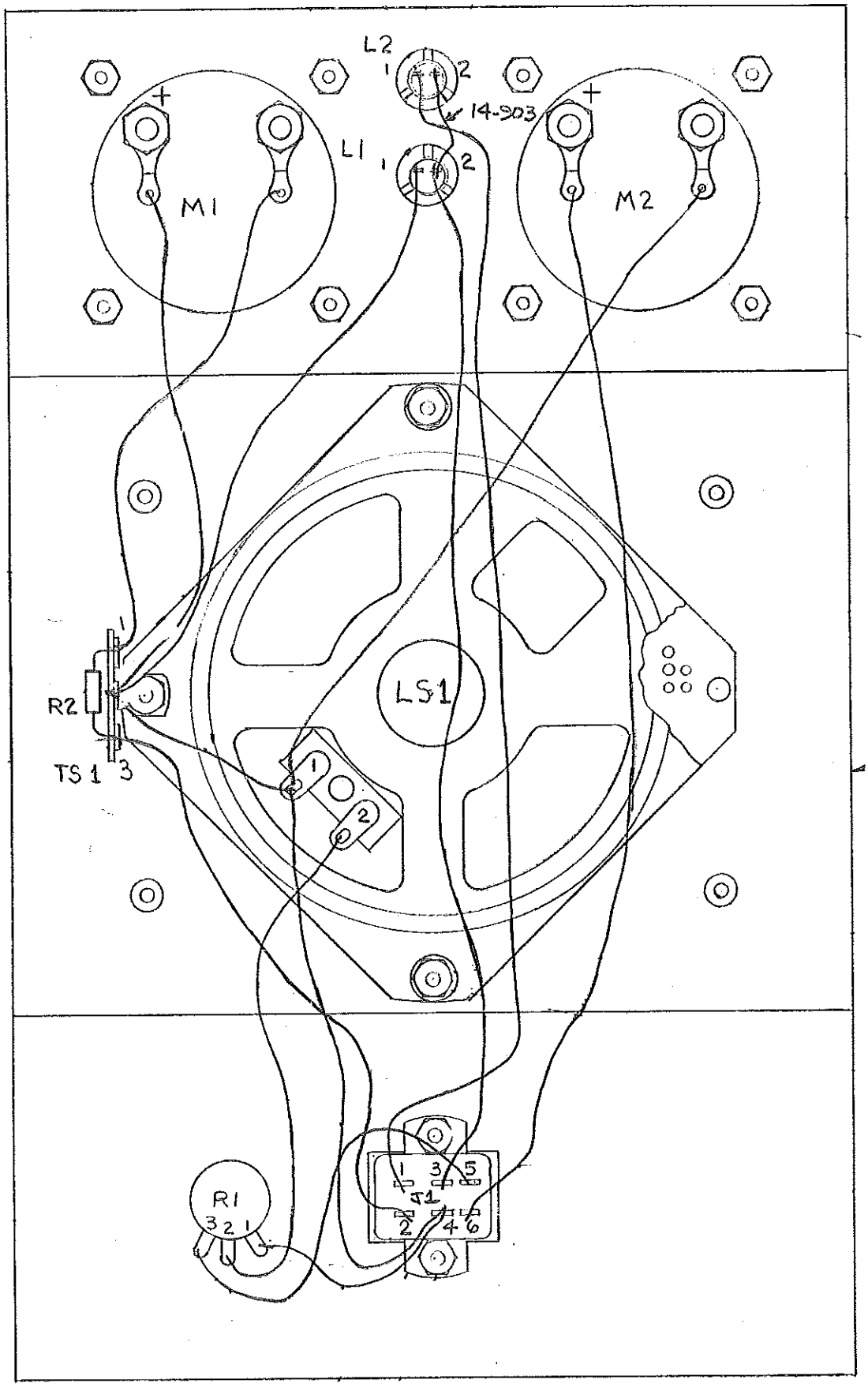
The Remote Meter Option is a set of two meters, a speaker, and two indicator lights packaged as a separate portable remote unit for the Model S1327A Service Monitor. Two Cinch Jones, male and female, cable connectors are supplied for making up the necessary mating cord for operating the remote unit.

1.2 INSTALLATION

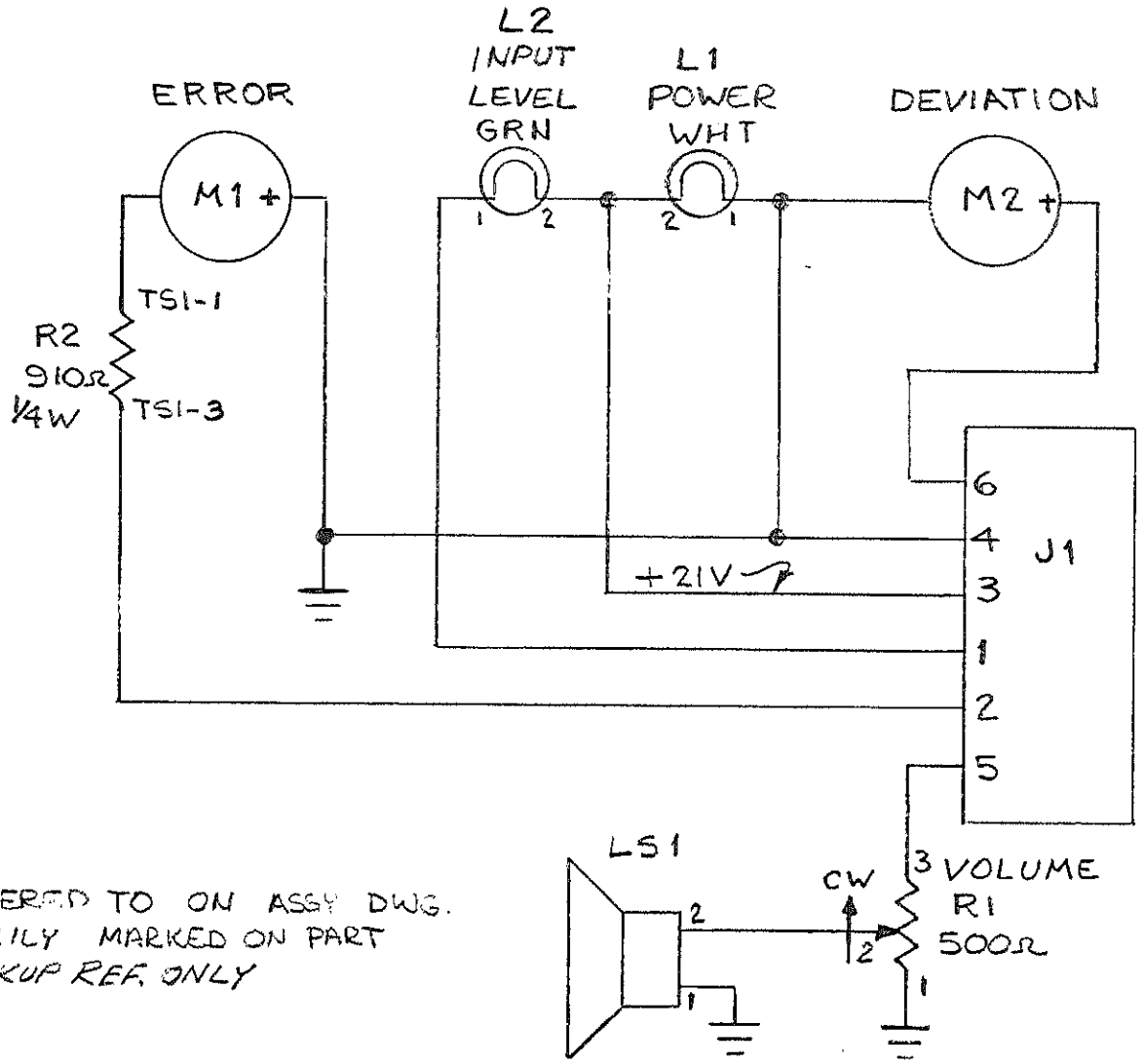
The Remote Meter unit is connected via a 6 conductor cable to the rear panel of the S1327A Service Monitor. There, the cable mates with the REMOTE METERS female Cinch Jones connector. The Remote Meter unit has a matching chassis mounted male Cinch Jones connector on its rear panel. The cable may be any length.

1.3 OPERATION

When the Remote Meter unit is connected to the extension cable, the operation of the unit is automatic. The ERROR and DEVIATION meters, INPUT LEVEL (green) light, and POWER (white) light parallel the identical indicators on the front panel of the S1327A Service Monitor. Also, the speaker and volume control in the Remote Meter unit and the speaker and volume control in the S1327A Service Monitor function identically. Note that, for the DEVIATION meter to operate in the Remote Meter unit, the DEVIATION METER plug-in (SLN-6350A) must be installed in the Monitor left hand plug-in position.

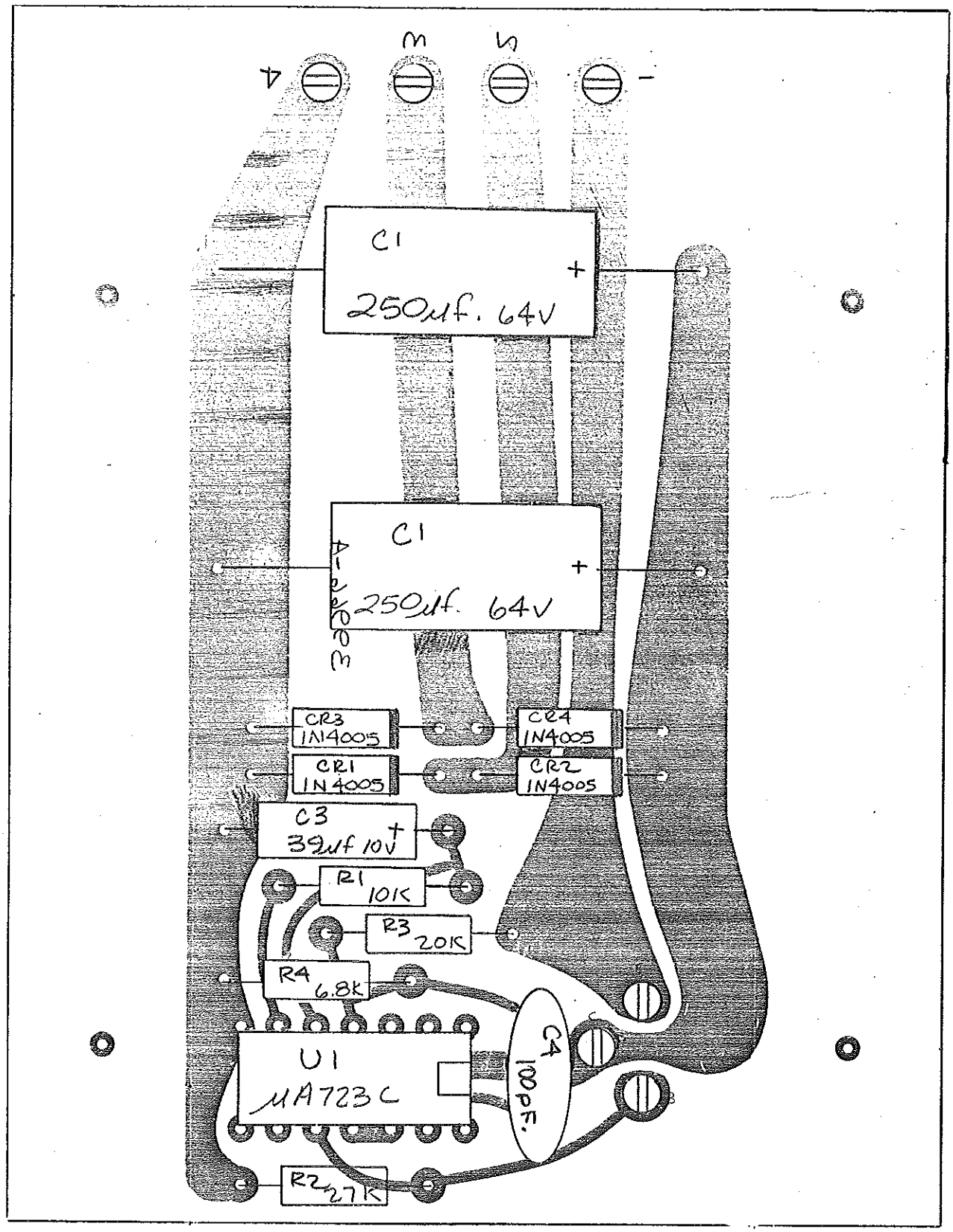


SLN-6379A, REMOTE METER FINAL ASSEMBLY D45370A



NOTE: PIN Nº REFERED TO ON ASSY DWG.
NOT NECESSARILY MARKED ON PART
& IS FOR HOOKUP REF. ONLY

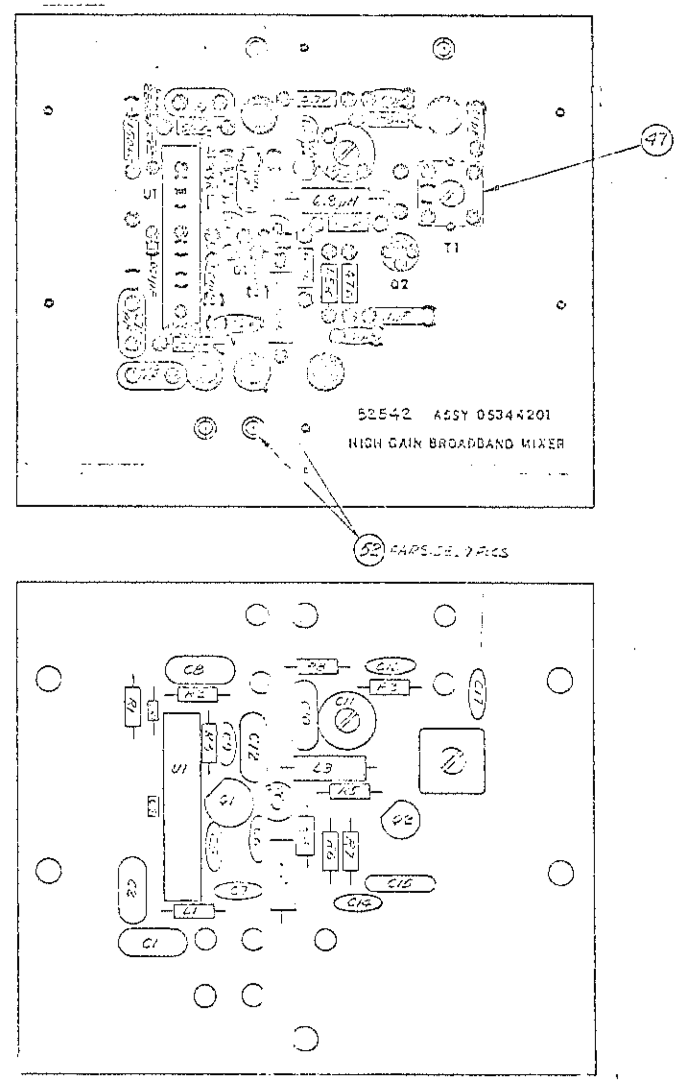
SLN-6379A, REMOTE METER SCHEMATIC A45373A



X,Y,Z OSCILLATOR OPTION, POWER SUPPLY ASSEMBLY B39968A

X,Y,Z OSCILLATOR OPTION PARTS LIST

Ref.	Description	SD Part No.
SLN-6377A	Oscillator Option Power Supply P.C. Assembly	B39968A
SLN-6377A	Oscillator Option Power Supply P.C. Schematic	B39965A
C1	Capacitor, 250 µF, 64 V, Elect.	03286650
C2	Capacitor, 250 µF, 64 V, Elect.	03286650
C3	Capacitor, 39 µF, 100 Tant.	C0902
C4	Capacitor, 100 pF, D.M.	C0536
CR1	Diode, 1N4005	CR0284
CR2	Diode, 1N4005	CR0284
CR3	Diode, 1N4005	CR0284
CR4	Diode, 1N4005	CR0284
R1	Resistor, 10 k, 1/4 W, 5%	R0766
R2	Resistor, 27 k, 1/4 W, 5%	R0824
R3	Resistor, 20 k, 1/4 W, 5%	R0964
R4	Resistor, 6.8 k, 1/4 W, 5%	R0696
T1	Transformer	19805
U1	Integrated Circuit, µA723C	25761
Q1	Transistor, 2N4921	Q0267
Y1	Oscillator, 3 MHz	X,Y,orZ



REVISIONS

LTR	DESCRIPTION			
1	[illegible]			
2	[illegible]			
A	[illegible]			

PROPRIETARY DATA

Furnished under United States Government Contract No. [illegible]

ITEM NO	QTY	PART NUMBER	DESCRIPTION	SCHEMATIC REF NO

LIST OF MATERIALS

SYSTRON DONNER CORPORATION
CONCORD CALIFORNIA

CODE IDENT 52542

P.C. ASSY HIGH GAIN BROADBAND MIXER

MATERIAL: P/L 05344201

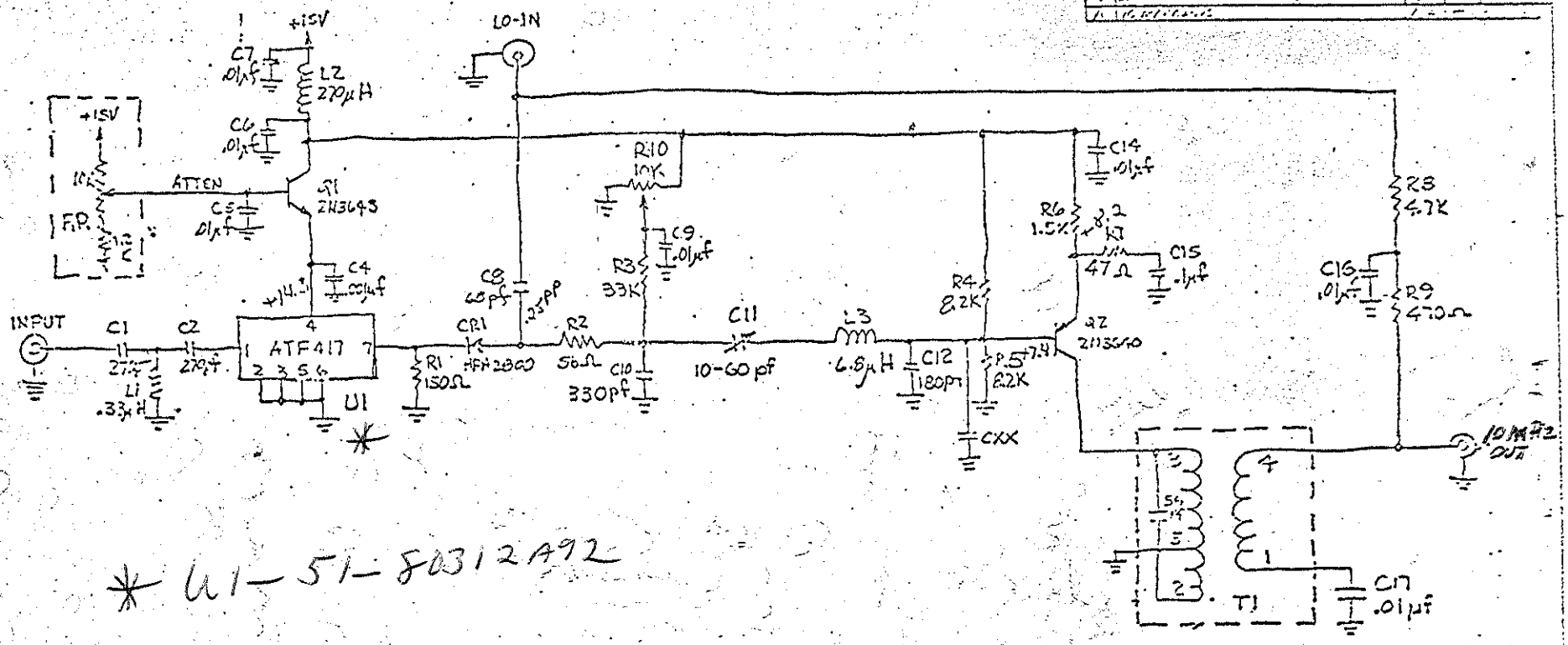
DWG NO: 05344201 REV: A

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
DECIMAL TOLERANCE .X .XX .XXX ANGLES ±

DWG SIZE C SH 1 OF 1

SCALE 2/1 DO NOT SCALE DRAWING

APPLICATION: USED ON / NEXT ASSY



* U1-51-80312492

HIGH GAIN BROAD BAND MIXER