TECHNICAL MANUAL

OPERATING, MAINTENANCE, INSTALLATION INSTRUCTIONS AND ILLUSTRATED PARTS BREAKDOWN

HF DSP RECEIVER
MODEL RX-330

TEN-TEC, INC.
P.O. BOX 8010
SEVIERVILLE, TN 37864

THIS MANUAL WAS PREPARED IN ACCORDANCE WITH MIL-M-7298C

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RECORD OF CHANGES

CHANGE NO.	DATE	TITLE OR BRIEF DESCRIPTION	ENTERED BY

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WARNING

HIGH VOLTAGE

is used in the operation of this equipment.

DEATH ON CONTACT

may result if personnel fail to observe safety precautions.
Learn the areas containing high voltage within the equipment.
Be careful not to contact high voltage connections when installing,
operating or maintaining this equipment.
Before working inside the equipment, turn power off
and ground points of high potential before touching them.

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INTRODUCTION

This technical manual provides operation and maintenance instructions for the RX-330 HF DSP Receiver. The manual was prepared in accordance with MIL-M-7298C, "Manuals, Technical: Commercial Equipment". This manual is organized into nine chapters along with a Table of Contents and lists of tables and illustrations.

Chapter 1 presents general information about the Receiver, which includes functional capabilities, performance specifications, and physical dimensions. Chapter 2 provides information concerning the unpacking and initial installation of the receiver. A general theory of operation is provided in Chapter 3 which describes the functioning of the Receiver's individual circuit boards. Chapter 4 contains information on operation of the multi-drop RS 232 Interface.

Chapter 5 provides information on maintenance and troubleshooting measures to be employed at the user's level. Instructions pertaining to the reshipment or long term storage are provided in Chapter 6. A detailed list of unique single source parts is provided in Chapter 7. In addition, Chapter 7 contains a list of manufacturers for these parts and their addresses. Chapter 8 provides a listing of replaceable modules and parts. Chapter 9 contains detailed parts lists for each of the replaceable modules. Chapter 9 also contains schematic diagrams for the electronic circuits.

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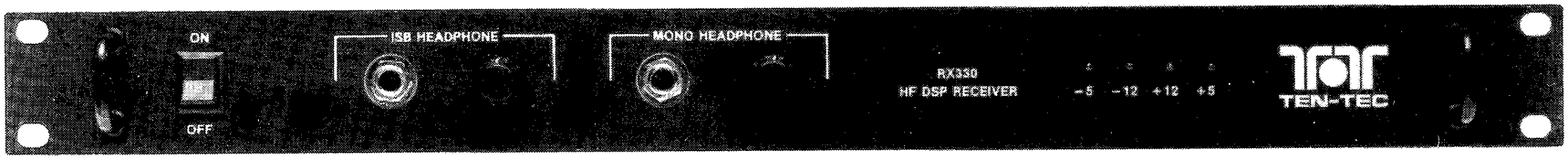

FIGURE I. RX330 FRONT VIEW

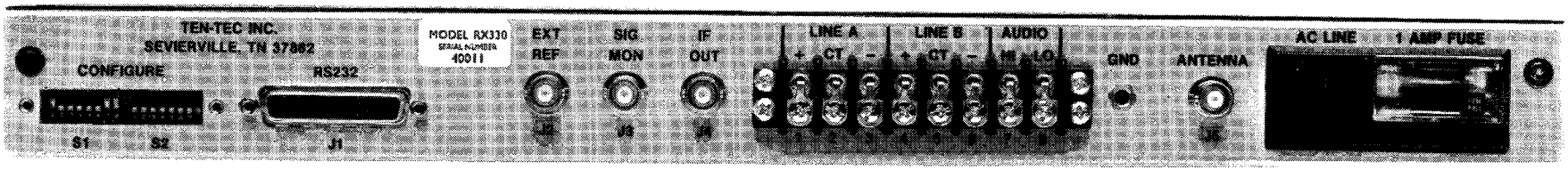

FIGURE II. RX 330 REAR VIEW

CHAPTER 1

GENERAL INFORMATION

1-1 PURPOSE AND FUNCTION The TEN-TEC RX-330 is a remotely controlled Monitor Receiver capable of tuning the .5 to 30 MHz HF range in 1 Hz steps. The Control Interface is Multi-drop RS-232, allowing multiple receivers to be addressed on one RS-232 line. Available detection modes are: USB, LSB, ISB, CW, AM, Synchronous AM, and FM. IF Bandwidth is selectable in 57 steps from 100 Hz to 16 KHz. Manual (MAGC) and automatic (AGC) gain control modes are selectable. In CW mode, the adjustable BFO has a range of ± 8000 Hz. In CW, LSB and USB modes, a passband tuning function allows simultaneous adjustment of BFO and receiver tuning over a ± 2000 Hz range. Three Audio and two IF outputs are provided.

The RX-330 power supply is internal, and accepts 48-440 Hz line power, 120/240 VAC, rear panel selectable.

1-2 SPECIFICATIONS

Frequency tuning system

Tuning Range: 500 KHz to 30 MHz. Tunable to 0 MHz with degraded performance.

Tuning Increment: 1 Hz minimum.

Synthesizer lock time: 10 mS nominal.

BFO: Tunable in CW mode only, ± 8 KHz, 10 Hz steps. Fixed frequency in SSB and ISB modes, disabled in AM and FM modes.

Accuracy: All internal oscillators can be locked to either internal or external frequency standards. The internal reference is adjustable by a continuously variable trimmer to allow calibration to any desired accuracy.

Stability (internal standard): ± 1 ppm per degree C within the operating range of 0 to 50 degrees C. An optional TCVCXO provides ± 1 ppm over entire range (0 to 50 degrees C).

External Frequency Standard: 1, 2, 5, or 10 MHz ± 1 ppm, 200 mV p-p, high impedance load. The receiver automatically detects and uses the external standard upon application, at power-up, or after any serial link activity. If the external standard input slews far outside the ± 1 ppm specified, the internal circuitry will lose lock until the input returns to within spec, or will re-lock at the next power-up or serial activity if the input is within specification at a valid reference frequency (1, 2, 5, or 10 MHz). A frequency-out-of-lock condition is always reported over the serial link. Removal of the external frequency standard input immediately returns the receiver to the internal standard.

Tuning Method: Remote control via multi-drop RS-232.

Frequency Indication: None visible. Frequency status reported by the RS-232 serial link.

Interface connections

RF Input:

Impedance:	50 Ohms, nominal.
VSWR:	2.5 : 1 maximum in preselector passband.
Connector:	rear panel BNC.
Protection:	internal surge protector.

Audio Outputs:

Two 600 Ohm lines

Level:	0 dBm nominal, center-tapped, ungrounded.
Connector:	3 rear panel screw terminals for each line.
Function:	Upper and lower sideband audio on separate lines in ISB mode. Same signal on both lines in other modes.

Stereo Headphone

Level:	10 mW maximum into 600 Ohm load. Front panel volume control.
Connector:	Front panel 1/4" stereo phone jack.
Function:	Upper and lower sidebands in ISB mode. Monaural output in other modes.

Single-ended Audio

Level:	10 mW maximum into 600 Ohm load.

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1-3 ENVIRONMENTAL CONDITIONS

Normal Operating

Temperature: 0 to 50 deg C (32-122F)
Humidity: Up to 95% Rel, non-cond.
Altitude: Up to 10,000 feet MSL
Shock: Not applicable
Vibration: Not applicable

Storage/Transport

Temperature: -46 to 71 deg C (-50-160F)
Humidity: Up to 95% Rel, non-cond.
Altitude: Up to 15,000 feet MSL
Shock: 10 G, 11 mS duration
Vibration: 1-1/2 G, 5 to 200 Hz

1-4 MECHANICAL

Size:
1.75H x 19W x 21.31D inches
44.45H x 482.6W x 541.4D mm

Weight:
12.2 lbs. (5.53 kg)

Cooling: Air convection cooled within fan ventilated rack cabinet. Units are directly stackable with no fillers required between chassis.

Mounting: Model RX-330 conforms to EIA standard 19 inch rack mount panel space and is 1 U (1.75) high. Slide mechanism attachment points (10-32 thread) are compatible with Jonathan slide type 375 QD.

Cable connectors Rear panel:
Receiver RF input: BNC female
IF output 455 kHz: BNC female
SIG MON: BNC female
External reference: BNC female
Remote Control: (Multi-drop RS-232) DB 25
Main Power: Detachable 3 conductor ac cord
Terminal Strip: #6 spade lug

Front Panel:
Mono headphone: 1/4" mono jack
Stereo headphone: 1/4" stereo jack

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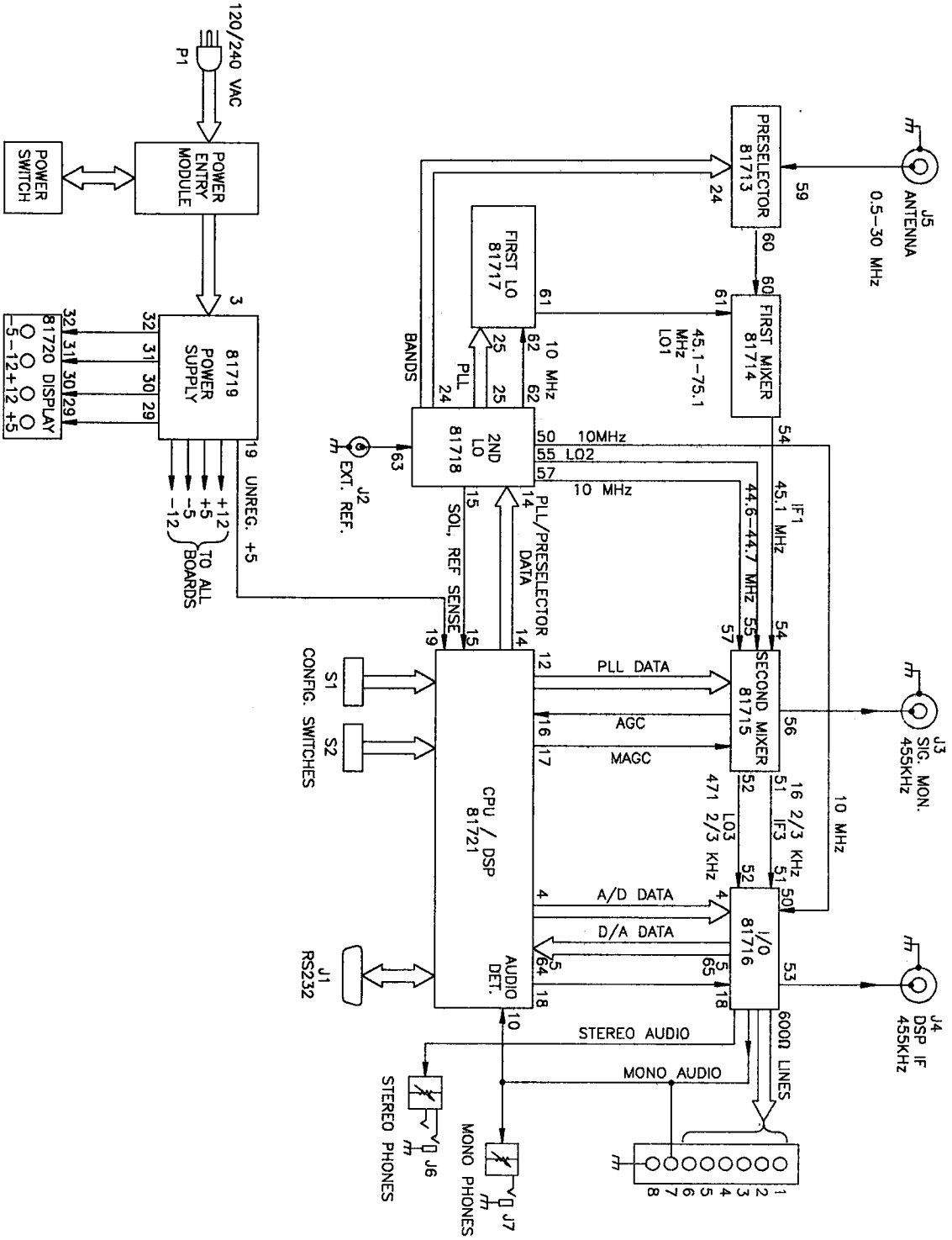

FIGURE 1-1 RX 330 INTERCONNECT DIAGRAM

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CHAPTER 2

PREPARATION FOR USE AND INSTALLATION

2-1 UNPACKING AND INSPECTION

Examine the shipping carton for damage before unpacking the unit. If the carton is damaged, open the carton in the presence of an agent of the shipping carrier if possible. If the carton is not damaged, retain the carton and packing materials for inspection if damage is found after the unit is unpacked.

Open the carton and remove the foam packing materials on top of the unit. Lift the unit free of the carton. No packing materials are required or provided inside the unit. Replace the foam packing material in the carton. The carton may be saved for possible reshipment if required.

Upon unpacking, inspect the unit for obvious external damage. Pay particular attention to dents or bent sheet metal. If damage is evident, remove the top cover of the unit and inspect for further damage such as damaged circuit boards. Do not attempt to operate the unit if such damage is noted until further checks are made.

2-2 MOUNTING RX-330 is designed for EIA standard 19 inch panel space rack. Slide mechanism attachment points (10-32th reading) are compatible with Jonathan slide type 375QD.

2-3 POWER The RX-330 is designed to operate from either 120 or 240 VAC. A small pc board located in the power entry module can be removed and reinserted to select proper ac voltage.

2-4 ANTENNA Connect the antenna to the BNC connector on the RX-330 labeled antenna (shown in Figure II).

2-5 IF OUT A 455 KHz signal with bandwidth dependent on filter selected (shown in Figure II).

2-6 SIG MON A 455 KHz signal with a fixed bandwidth of 16 KHz (shown in Figure II).

2-7 EXT REF Automatically turns off the internal 10 MHz reference if a 1 MHz - 2 MHz - 5 MHz or 10 MHz 200 mV p-p signal is applied (shown in Figure II).

2-8 RS-232 The RS-232 will accept a standard DB-25 connector (shown in Figure II).

2-9 LINE A Provides a 600 W balanced center tapped output (shown in Figure II).

2-10 LINE B Provides a 600 W balanced center tapped output (shown in Figure II).

2-11 AUDIO Provides a 600 W unbalanced output (shown in Figure II).

2-12 MONO HEADPHONE Provides a 600 W unbalanced output controlled by a front panel volume control (shown in Figure I).

2-13 ISB HEADPHONE Provides both sidebands controlled by front panel volume control (shown in Figure I).

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CHAPTER 3

GENERAL THEORY OF OPERATION

3-1 INTRODUCTION

The TEN-TEC Model RX-330 receiver combines a high dynamic range front end with a versatile DSP back end to provide extraordinary performance and flexibility. Refer to the overall block diagram Figure 9-1.

The RF signals applied to the receiver Antenna Input (J5) are bandpass filtered in one of eight bands of approximately one-half octave bandwidth. Balanced amplifiers and high level first mixer stages preserve the second and third order intercept points during conversion to the first IF of approximately 45.105 MHz. Two 2-pole crystal filters provide first IF selectivity to reject 1st mixer spurious products and the 2nd mixer image (at -910 KHz).

After conversion to the second IF of approximately 455 KHz in the second mixer stage, the signal is bandpass filtered to 16 KHz bandwidth and applied to an AGC'd 2nd IF amplifier with up to 80 dB gain. After post-filtering (again 16 KHz bandwidth), the signal is made available at the Signal Monitor output (J3) and also applied to the third mixer stage.

The third mixer converts the signal to a center frequency of 16 2/3 KHz where it is low pass filtered and applied to an analog to digital converter. The A/D converter produces a serial data stream at a 66 2/3 KHz sample rate for input to the Digital Signal Processor.

Serial data from the DSP at a 133 1/3 KHz sample rate is applied to a digital to analog converter. The D/A output samples are time de-multiplexed into two or three output channels, depending on the mode selection. Half of the D/A output time is devoted to the DSP'd IF output which is first converted back to 455 KHz by mixing with the third LO, then bandpass filtered to 16 KHz bandwidth,and finally made available at the IF Output connector (J4).

The other half of the D/A bandwidth is separated into USB and LSB audio channels in Independent Sideband mode, or into a single audio channel in all other modes.

3-2 PRESELECTOR (81713) Eight bandpass filters covering the frequency range of 500 KHz to 30 MHz are controlled by the DSP/CPU Board (81721). A six FET push-pull amplifier makes up for loss in the bandpass filter.

3-3 FIRST MIXER (81714) The input signal passes through a 30 MHz low pass filter to a diode mixer and mixes with the amplified first LO to produce an IF frequency of 45.105 MHz. The signal is applied to a six FET push-pull amplifier, then a 2 pole 45.105 MHz crystal filter. A second amplifier and 2 pole 45.105 MHz crystal filter produce an overall 4 pole response at the 1st IF to reject the 2nd mixer image. The 45.105 MHz signal is amplified again for use in the second mixer.

3-4 SECOND MIXER / 3RD LO (81715) The 2nd mixer / 3rd Lo board handles the conversion of the first IF of approximately 45.105 MHz to the second and third IFs of 455 KHz and 16 2/3 KHz respectively. It provides outputs to the Signal Monitor connector (J3 #56), the A/D converter (#51), AGC (#16), and LO3 (#52).

Required inputs are: 1st IF (#54), LO2 (#55), 10 MHz reference (#57), PLL data (#12), MAGC (#17), and power of $\pm$5 (#20) and +12V (#23). This board also distributes +12V power to the 1st Mixer and Preselector boards via connectors #21 and #22.

The 1st IF input (45.105 MHz) is applied to a high level diode ring mixer along with the amplified

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Controlled by SB select lines from connector #18, U15 sections y and z connect either one or both audio channels to the monaural audio driver U18a and to audio connectors #7, rear panel TB1, and front panel mono level control and phone jack J7.

3-6 FIRST LO (81717) The first conversion oscillator covers the range of 45.6-75.1 MHz. The VCO is split into four ranges to cover the 45.6-75.1 MHz spectrum. The VCO output is buffered by a J310 amplifier before being passed through a bandpass filter and on to the First Mixer (81714). An additional J310 amplifier isolates the VCOs from the MC145170P PLL Frequency Synthesizer IC. The MC145170P develops the reference frequency, accepts frequency information from the microprocessor and outputs a voltage that drives the loop filter and VCOs. Pin 11 of the MC145170P provides a lock detect signal to the SECOND LO Board (81718).

3-7 SECOND LOCAL OSCILLATOR (81718) The second LO board contains both 2nd LO and Reference frequency synthesizers. The 2nd LO synthesizer develops the second local oscillator injection frequency of 44.6 to 44.7 MHz in 1 KHz steps. The Reference synthesizer locks the 10 MHz internal reference oscillator to an optional external frequency standard.

Refer to 2nd LO schematic Fig. 9-25. The 2nd LO synthesizer is a two loop architecture. PLL chip U1 and charge pump U13 steer VCO Q1/D5/D6 over a range of 60 to 80 MHz in 200 KHz steps. The VCO output is buffered by Q2 and then divided by 200 in counters U2 and U3 to produce a tuning loop output of 300 to 400 KHz in 1 KHz steps for input to the mixing loop phase detector U6.

Phase detector U6, charge pump U7, VCO Q5, and mixer U4 form a mixing loop which translates the tuning loop output to the LO2 frequency range of 44.6 to 44.7 MHz, while preserving the 1 KHz tuning resolution.

The 45 MHz translation frequency required by the mixing loop is developed by first dividing the 10 MHz reference by 2 in U5 to produce a 5 MHz square wave, and then selecting the 9th harmonic with 45 MHz monolithic filter FL1. The resulting 45 MHz sine wave is applied to active mixer U7 along with a sample of the 2nd LO output to produce a 300 to 400 KHz intermediate frequency in the mixing loop.

Differential amplifier Q7/Q8 presents a high impedance to external reference input connector #63 and J2. A sample of Q8's output is detected by diode D13 and compared to a threshold voltage by U9b. When the external reference amplitude exceeds the threshold set by U9b, transistors Q9-Q11 change state, allowing the gate of FET switch Q12 to pull high. This condition connects the output of PLL U8, filtered by U9a, to VCO tuning diode D14, completing the loop and locking the VCXO Y1/Q13 to 10 MHz.

When no external reference is applied to J2, transistors Q9-Q11 conduct, holding the gate of FET switch Q12 low. In this condition the bias on tuning diode D5 is set by trimpot R1, and crystal Y1 is the frequency standard for the receiver.

3-8 DSP/CPU (81721) DSP/CPU BOARD 81721 The DSP/CPU board consists of two separate processor systems; the MAIN CPU (U1) which controls the RX330's interface and the DSP CPU (U22) which performs signal processing functions. The two system busses integrate together through parallel latches U5-U8. Communications between the MAIN CPU and DSP CPU is handled by a combination of hardware and software, providing bidirectional data capability.

The MAIN CPU system consists of CPU (U1), latch (U2), ROM (U3) and battery backed RAM (U4). Latches U23 and U24 buffer rear panel switch settings while IC's U9 and U10 are for address control. Three Serial/Parallel converters (U11-U13) add additional output capability to the system. Converter U12 provides VCO selection signals to the FIRST LO BOARD, converter U11 provides audio controls to the CONVERTER BOARD and U13 provides data to the MANUAL AGC DAC (U14). RS-

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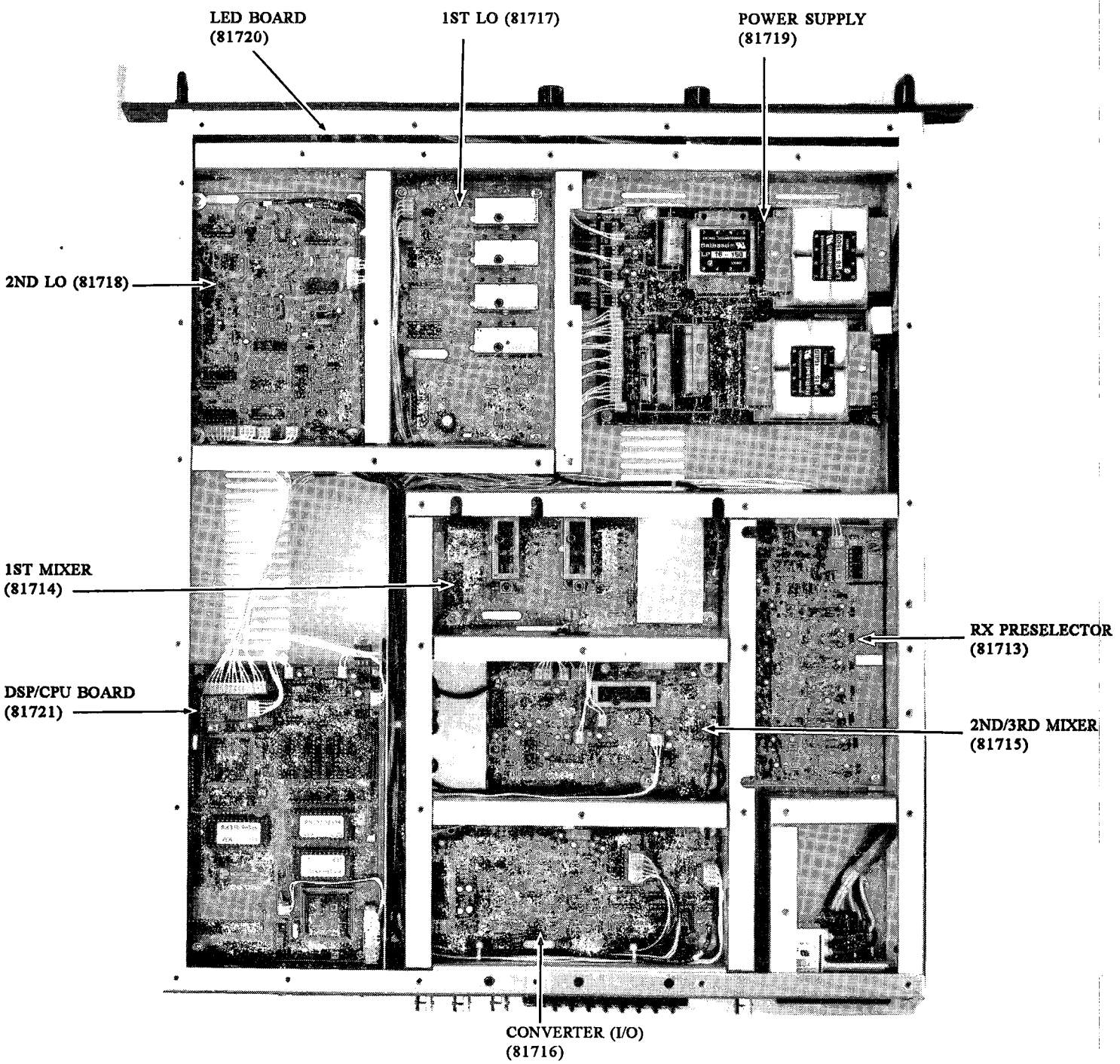

FIGURE 3-1 RX 330 TOP VIEW

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CHAPTER 4

DETAILED OPERATING INSTRUCTIONS

4-1 MULTI-DROP NETWORK The RX-330 has no front panel operating controls and thus must be controlled remotely via its MULTI-DROP RS-232 interface. A Personal Computer or similar controller may be used to control the receiver. It will be necessary to acquire or design control software appropriate to the intended application of the receiver. The RX-330 Interface is based on plain text (ASCII) codes and strings which reduces the software design burden. An ASCII based interface allows an operator to exercise the RX-330 via a simple terminal or PC running terminal emulation software. In this way, software designers can quickly become familiar with commands and responses of the RX-330.

The first step in hooking up the RX-330 to a controller is to construct or purchase the proper cable. The RX-330 receiver has been designed as a DCE device for serial interface applications. A 3-wire interface is required to connect the RX-330 to the proper controller (TXDATA,RXDATA and GND). When connecting multiple RX-330's to a single controller, all units are wired in a parallel fashion to the cable. In this way, all receivers share a single TXDATA line, RXDATA line and GND line. See figure 4-1.

After the receivers have been wired, they must be configured. Dipswitches S1 and S2 located on the rear panel allow users to set serial interface parameters and receiver addresses. Dip switch S1 is used to select serial interface parameters (see figure 4-2). Dip switch S2 is used to set the receivers address (range 0 to 127). Switch S1-1 is not used for address selection and should be left in the down position for normal operation. This switch is used to activate a FACTORY TEST/SERVICE MODE which is explained later.

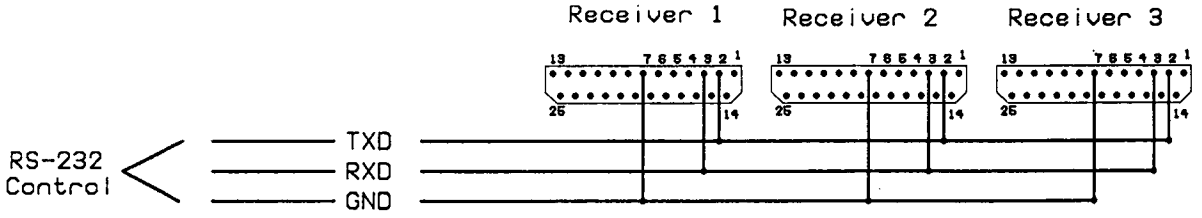

FIGURE 4-1 CONNECTION DIAGRAM

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return ASCII 13 (hex 0D). **NOTE:** Any command that would generate a response from a receiver will be ignored if multiple receivers have been addressed. In order for these commands to operate properly a single receiver must be selected.

4-4 RECEIVER CONTROL COMMANDS

The group of receiver control commands consists of commands that affect the operating status of the receiver. Commands to control frequency, mode and filter selection fall into this group. All commands in this group require that additional data follow a command code to complete the operation. If a command code is sent to a receiver without the proper data the receiver will ignore the command code and become deselected. The receiver will then ignore any characters until it receives a carriage return (ASCII 13) at which point it may again be re addressed.

The following text describes individual commands and the type and range of data that is to follow any given command. The format description for a command, such as Fnn.nnnnnn for example, describes a command, in this case the set frequency command, which is to be followed by up to 2 digits, a decimal point and then 6 digits. In most commands, a decimal point is required and any exceptions are noted below.

4-5 RX-330 RECEIVER CONTROL COMMAND SET

(Listed in Alphabetical Order)

COMMAND	DESCRIPTION	VALID RANGE
Annn	**MANUAL AGC ATTENUATION** Selects the amount of AGC Attenuation to use when in manual AGC mode. Setting covers 120 dB range. Attenuation may be set anytime but will only be used when receiver is in Manual AGC mode. Example: A30 (Set Attenuation to 30 dB)	0 - 120 dB
B+n.nnn **(B-n.nnn)**	**BFO FREQUENCY** Allows setting the receiver BFO frequency when receiver is in CW mode. BFO is fixed in sideband modes and not operational in others. Example: B200 (Set BFO to 200 Hz) B-2000 (Set BFO to -2000 Hz)	+/- 8000 Hz

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Inn.nn	**IF FILTER** This command selects the IF filter bandwidth. Bandwidths allowed are 100 Hz to 16 KHz in all detection modes except FM in which 500 Hz is the narrow filter limit. If an operator selects a filter that is not available the receiver will use a close but wider filter. Units are in KHz. Example: I3.2 (Set IF Bandwidth to 3.2 KHz) I0.5 (Set IF Bandwidth to 500 Hz)	1 - 16 KHz (FM .5 - 16 KHz)
Mn	**AGC OPERATING MODE** Selects the AGC operating mode. Where n is one of the following: 1 Fast AGC 2 Medium AGC 3 Slow AGC 4 Manual AGC Example: M1 (Set Fast AGC mode) M4 (Set Manual AGC mode)	1 - 4
Nnn.nnn	**NOTCH FREQUENCY** Allows tuning of the receiver's Notch Filter. The Notch filter is operational in CW,CW1,LSB and USB modes for IF Filter Bandwidths of 4 KHz or less. The Notch filter may be tuned +/- 2 KHz. A notch frequency of 0 Hz effectively turns the notch filter off. The frequency data indicates the audio tone to be notched. Example: N500 (Notch 500 Hz Audio Tone) N1000 (Notch 1000 Hz Audio Tone)	+/- 2000 Hz
Onn	**NOISE BLANKER WIDTH** Allows setting of the Noise Blanker Width. Range is 0 (off) to 10 Ms in 1 Ms increments. Example : O5 (Set Blanker width to 5 Ms) O0 (Set Blanker to OFF) *NOTE!!* This command is provided here for reference only and will be a future option to the RX-330. While the current version of RX-330 firmware	N/A

current operating frequency, it will respond with the format 'F10.12345'. In addition, whenever a receiver sends information, a status code is appended to the end of each response. The status code is the letter S followed by a number such as 'S1' which indicates that the receiver is operating in remote mode (which is always true of the RX-330). The status number is encoded as follows.

1	Receiver is in remote control mode
2	Synthesizer is out of lock
4	not used
8	last string had character transmission error
16	last string had data error
32	last string had lost data

With a properly operating receiver and interface a receiver would have a status code of 'S1'. A receiver response will be terminated with a carriage return ASCII 13 (hex 0D).

G **REPORT STATUS**

Receiver responds with all operating parameters relevant to the current operating mode. Parameters that are OFF or are not relevant to the current mode will not be included in the response. See also command 'J'.

command: G
response: F15.010000D2B-1800...etc...<CR>

Tx(xxx) **REPORT SPECIFIC STATUS**

The receiver responds with the operating data as specified along with the command.

Example:

command: TF - Request receiver operating frequency.
response: F15.0100000<CR>
for: frequency = 15.01 MHz

command: TFBNX - Request F,B,N settings and S-meter level
response: F15.010000B-1800N0.00X020<CR>
for: frequency = 15.01 MHz
BFO = -1800 Hz
Notch = 0.00 Hz (OFF Position)
S-meter = 20 db Signal

X **REPORT SIGNAL LEVEL**

This command forces the receiver to report the signal level or S-meter reading. Range is 0-120 covering the 120 dB range of the receiver.

Example:

command: X - request S-meter reading.

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6	Indicate if Battery Backed RAM data was valid on last power up.	Battery failure likely (replace U4)
7	Check DSP Sub-System operational status.	Logic board failure likely
8	Check IF noise level and S-meter operation. No signal in pass band.	Dead IF or Faulty AGC detector or cable
9	Check IF level and S-meter operation. Large Signal in pass band	IF Gain excessive or faulty AGC detector or cable.
10	Check IF Level and S-meter operation. Small Signal in pass band.	IF Gain excessive or faulty AGC detector or cable.
11	Check Manual AGC operation. Large signal in passband with Manual AGC activated.	Manual AGC DAC or associated circuits failure.
12	Check audio output. Large in passband, audio detector activated.	Audio amp and/or associated circuits or shorted speaker connections.

4-9 FACTORY SERVICE/FIELD TEST MODE

The RX-330 firmware also contains a special program for FACTORY/FIELD testing of the receiver. In this mode, the RX-330 runs an internal program in which it will directly control a dumb terminal and most receiver functions are available through on-screen controls. A PC running a terminal emulation program provides easy access to the FACTORY/FIELD test features. It is required that the Terminal or Terminal Emulation Software be capable of emulating a WYSE 50 terminal.

While the FACTORY/FIELD TEST MODE is a powerful testing tool, it is also simple to use. Keys for each function are designated by a single character contained in brackets, such as (I) for IF Bandwidth selection. Two other keys have meaning in this mode. Pressing 'Z' will initiate a MASTER RESET while pressing 'V' will cause the program to be restarted.

To enter FACTORY/FIELD TEST MODE set dipswitch S2-1 to the up position before applying power to the receiver. When the receiver is turned on, it will begin displaying information on the terminal. To exit FACTORY/FIELD TEST MODE, return S2-1 to its down position and cycle the power.

CAUTION!!! FACTORY/FIELD TEST MODE is intended to be used in a one receiver setup. It is not possible to operate multiple receivers in FACTORY/FIELD TEST MODE at once.

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CHAPTER 5

MAINTENANCE INSTRUCTIONS

WARNING

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may result if personnel fail to observe safety precautions.
Learn the areas containing high voltage within the equipment.
Be careful not to contact high voltage connections when installing, operating or maintaining this equipment.
Before working inside the equipment, turn power off and ground points of high potential before touching them.

5-1 INTRODUCTION To perform maintenance tasks on the Model RX-330 the technician shall identify faulty modules or subassemblies. The faulty module or subassembly shall be replaced with a known good one.

5-2 CLEANING AND LUBRICATION There are no cleaning or lubrication requirements for the Model RX-330.

5-3 TROUBLESHOOTING Troubleshooting the Model RX-330 consists of identifying faulty modules or subassemblies by the symptom of the fault. Table 5-1 lists symptoms and the probable module or modules associated with the fault.

5-4 INSPECTION There are no parts in the Model RX-330 that are subject to wear. Rear panel connectors should be inspected for damage whenever the unit is removed.

5-5 PERFORMANCE VERIFICATION TEST FOR MODEL RX-330 The following performance verification tests may be performed if there is a suspected failure. Perform the verification tests in the order listed, as previous tests may contain test setup procedures required for succeeding tests. The technician will need the following test equipment to perform the verification tests.

5-5.1 TEST EQUIPMENT REQUIRED FOR MODEL RX-330

Signal generator, HP8656A or equivalent.

Signal generator, HP8640B or equivalent (16 MHz phase noise less than -130 dBc @ 10 KHz offset), or 16.208 MHz crystal oscillator with +15 dBm output level.

RF Two-Tone test setup consisting of generators above, hybrid combiner (Anzac HH-107 or equivalent) and fabricated lowpass filters, amplifiers and pads to provide two 0 dBm tones at 16.208 and 16.308 MHz, or 16.208 and 16.2085 MHz with all intermodulation and harmonic outputs less than -70 dBm.

Audio analyzer, HP8903B or equivalent: AC Level, SINAD, and %THD capabilities.

Audio spectrum analyzer, HP141T/8852B/8553B or equivalent.

Step attenuator, 10 dB steps, 0-120 dB, HP355B or equivalent.

Step attenuator, 1 dB steps, 0-12 dB, HP355C or equivalent.

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IMAGE REJ. (90 dB typ. 70 dB min.)	FIRST MIXER: Receive frequency 15.01 MHz. USB Mode IF BW 3.2 KHz BFO -1800 Hz MAGC = 0 Apply 105.189 MHz, -50 dBm Increase level for 10 dB SINAD.	>10 dBm	-39 dBm MIN
	SECOND MIXER: Receive frequency 15.01 MHz. USB Mode IF BW 3.2 KHz BFO -1800 Hz MAGC = 0 Apply 15.923 MHz, -50 dBm Increase level for 10 dB SINAD.	-19 dBm	-39 dBm MIN
IF REJECTION (90 dB typ. 80 dB min.)	FIRST IF: Receive frequency 29.995 MHz. USB Mode IF BW 3.2 KHz BFO -1800 Hz MAGC = 0 Apply 45.104 MHz, -50 dBm Increase level for 10 dB SINAD.	>10 dBm	-29 dBm MIN
	SECOND IF: Receive frequency 0.505 MHz. Apply 456 KHz -50 dBm Increase level for 10 dB SINAD.	>10 dBm	-29 dBm MIN
3RD ORDER INTERCEPT POINT (+30 dBm typ. +25 dBm min.)	Configure the two-tone test set to produce a lowpass filtered 16.208 MHz. / 16.308 MHz. two-tone output with each tone at 0 dBm. Third order products and harmonics at the combiner output must be less than -80 dBm. Connect the two-tone output through a 1 dB step attenuator to the receiver RF input. Receive frequency 16.1072 MHz. Set MAGC to 65 dB Note audio output level in dBv. Reduce the two-tone level by 3 dB and observe a		

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@ 20 KHz offset	thru 10 dB and 1 dB step attenuators to RF in.		
	Connect audio analyzer to MONO AUDIO output.		
	Receive frequency 16.227 MHz, USB.		
	Set attenuator to 80 dB		
(120 dB/Hz typ.	MAGC = 20.		
-110 dB/Hz max.)	Note audio noise level in dBm.		
	Decrease attenuator setting for a 10 dB rise in noise level.		
	Attenuator setting should be:	39 dB	49 dB MAX

Note: 10 dB rise above typical receiver noise floor of -119 dBm/3.2 KHz is -144 dBm/Hz. Subtract RF input level from this to obtain dBc/Hz phase noise. Phase noise of the xtal oscillator or signal generator used must be at least 20 dB better than the expected measurement.

BLOCKING	AM Mode, 6 KHz BW.		
ON TUNE	Receive frequency 15.01 MHz.		
	Connect signal generator to RF input.		
	Set signal generator to 15.01 MHz, 30% AM/		
(<5% THD:	1 KHz, 0 dBm		
0 dBm input	MAGC = 0.		
30% AM 1 KHz,	AGC Mode = Slow.		
	Set audio analyzer to read % distortion.		
	Distortion should be less than:	2.5%	5% MAX
BLOCKING	Receive frequency 16.408 MHz.		
OFF TUNE	Connect a +15 dBm 16.208 MHz xtal oscillator through a step attenuator to a directional coupler input.		
	Connect the direct output of the directional coupler to the receiver RF input.		
(200 KHz			
offset.	Terminate the forward port of the coupler.		
15 dBm typ.	Connect a -40 dBm, 16.408 MHz, 30% AM/		
10 dBm min.)	1 KHz, signal generator to the reverse port of the directional coupler.		
	Set step attenuator to 50 dB		
	Set audio analyzer to read AC Level in dBm.		
	Increase MAGC setting until the AC Level reading drops by 10 dBm		
	Reduce attenuator setting until blocking begins (3 dB drop in AC Level).		
	RF input level should be:	> 15 dBm	10 dBm MIN

CHAPTER 6

PREPARATION FOR SHIPMENT OR STORAGE

6-1 PREPARATION FOR RESHIPMENT

If the Model RX-300 ever needs to be packaged for reshipment, it is recommended that the following steps be taken.

1. Remove all cords or cables attached to the unit.
2. Ensure that there is sufficient foam packing material in the shipping carton to protect the unit from any hard impact that may occur during shipment.
3. Place the unit in the center of the shipping carton.
4. Cover the unit with foam packing material.
5. If using a cardboard packing carton, securely tape the seams of the carton's top cover, bottom cover and side flaps with reinforced tape.
6. Fasten labels or stamp with indelible ink the word FRAGILE on the top, bottom, and all sides of the carton.

6-2 PREPARATION FOR STORAGE

If the Model RX-330 is not going to be used for a long period of time, it should be stored in its shipping case or some other suitable carton. The unit is rated for storage at temperatures from -50°F to 160°F. To prepare the unit for storage perform the following steps.

1. Remove all cords or cables attached to the unit.
2. Ensure that there is sufficient foam packing material in the container.
3. Place the unit in the center of the packing container.
4. Cover the unit with foam packing material.
5. If using a cardboard packing carton, securely tape the container with reinforced packing tape.
6. Fasten labels or stamp with indelible ink the word FRAGILE on the top, bottom, and all sides of the container.
7. Write the Model No. and quantities in large characters on top of the carton.

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CHAPTER 7

SINGLE SOURCE PARTS LIST

7-1 INTRODUCTION Table 7-1 is a listing of all the parts available from only one unique manufacturer or source. The table lists the Sub-Assembly Number, component ID, Manufacturer Part Numer, Manufacturer Code, Part Description, and the Ten-Tec Part Number.

TABLE 7-1 MODEL RX-330 SINGLE SOURCE PARTS LIST

S/A NO.	MFGR. PART No.	MFGR. CODE	DESCRIPTION	Ten-Tec PART No.
81713	UCN5895A	ALLEGRO	IC-8 CHANNEL SERIAL DRIVER	25344
81713	KS4522	FSI	DIODE-PIN-25 WATTS	28103
81713	85413-10	TT	COIL-RF 5 TURNS #28 BIFILAR ON 21167	85413-10
81713	85413-11	TT	COIL-RF 5 TURNS #28 BIFILAR 5 TURNS #24 ON 21037 AND 21167	85413-11
81714	MRF629	MOT	UHF TRANSISTOR	25128
81714	09-9001-1-03	CONCORD	PC JACK FOR .040 PIN	35054
81714	K24C/M	VECTOR	CONTACT PIN .041 DIAMETER	41009
81714	7MM	AURA	SHIELD CAN-COIL, 7MM NI PLATED	38131
81714	45.03 MHz HC 45	IFCP	CRYSTAL 45.03 MHz, FUND HC45	48173
81714	45.18 MHz HC 45	IFCP	CRYSTAL 45.18 MHz, FUND HC45	48174
81714	BLBC-2TX2-4P	CTC	TRANSFORMER - BIFILAR BALUN	21152
81714	BLBC-2TX3-4P	CTC	TRANSFORMER - TRIFILAR BALUN	21153
81714	85134	TT	TRANSFORMER - TRIFILAR	85134
81714	85149	TT	TRANSFORMER - RF 1:1 BALUN	85149

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TABLE 7-1 MODEL RX-330 SINGLE SOURCE PARTS LIST (cont.)

S/A NO.	MFGR. PART NO.	MFGR. CODE	DESCRIPTION	Ten-Tec PART NO.
81717	85413-05	TT	COIL 12 3/4 TURNS #30 ON 91566 FORM	85413-05
81717	85413-06	TT	COIL 15 3/4 TURNS #30 ON 91566 FORM	85413-06
81717	85413-07	TT	COIL 15 3/4 TURNS #36 ON 91566 FORM	85413-07
81717	91744	TT	ENCLOSURE - VCO	91744
81717	91745	TT	ENCLOSURE - COVER	91745
81718	BLBC-2TX2-4P	CTC	TRANSFORMER - BIFILAR BALUN	21152
81718	BLBC-2TX3-4P	CTC	TRANSFORMER - TRIFILAR BALUN	21153
81718	TE7730	TEMEX	MONOLYTHIC FILTER 45 MHz	48202
81718	MC175170P	MOT	PLL FREQUENCY SYNTHESIZER SERIAL INTERFACE	25296
81718	MBD101	MOT	DIODE - HOT CARRIER	28110
81718	NE612AN	SG	IC - MIXER	25319
81718	KV3902	FSI	DIODE - VARACTOR	28075
81718	CA3096E	HARRIS	IC - TRANSISTOR ARRAY	25345
81718	10 MHz HC 18 32P	FM	CRYSTAL 10 MHz .002% HC 18 32 PF	48112
81718	85413-01	TT	COIL 14 1/2 TURNS #24 ON 91566 FORM	85413-01
81718	85413-02	TT	COIL 10 1/2 TURNS #24 ON 91566 FORM	85413-02
81719	LP16-1500	SIGNAL	TRANSFORMER 16VCT 1.5A PC BOARD MOUNT	21168
81719	LP16-150	SIGNAL	TRANSFORMER .15A PC BOARD MOUNT	21184
81721	98126	TT	IC - PROGRAMMED	98126
81721	98127	TT	IC - PROGRAMMED	98127
81721	98128	TT	IC - PROGRAMMED	98128
81721	DS1220Y	DALLAS	IC - RAM WITH BATTERY	25311
81721	DSP-2101-KP80	AD	IC - DSP PROCESSOR	25330
81721	80C552	PHILLIPS	IC - MICROPROCESSOR	25331

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TABLE 7-2 PART MANUFACTURER'S INFORMATION

MFGR'S CODE	MANUFACTURER NAME AND ADDRESS
AD	ANALOG DEVICES INC., ONE TECHNOLOGY WAY, PO BOX 9106, NORWOOD, MA 02060-9106
ALLEGRO	ALLEGRO MICROSYSTEMS INC., 115 NORTHEAST CUTOFF BOX 15036, WORCESTER, MA 01615
AURA	AURA MRG. COMPANY, 50 MC DERMATT RD., NORTH HAVEN, CT 06473
CONCORD	CONCORD ELECTRONICS, 35 GREAT JONES ST., NEW YORK, NY 10012
CSF	TOMPSON-CSF COMPONENTS CORPORATION, SEMICONDUCTOR DIVISION 6660 VARIEL AVE., CANOGA PARK, CA 91303
CTC	CTC COILS LTD FLAT L-M, 141 F HARIBEST IND'L BLDG., 45-47 AU PUI, WAM STREET FO-TAN, SHATIN, NT HONG KONG
DALLAS	DALLAS SEMICONDUCTOR CORP., 4401 SOUTH BELTWOOD PARKWAY, DALLAS, TX 75244-3292
DAYSTAR	DAYSTAR MFG. INC., 11535 FRANKLIN AVE, FRANKLIN PARK, IL 60131
FSI	FREQUENCY SOURCES INC., SEMICONDUCTOR DIVISION, 16 MAPLE RD, CHELMS FORD, MA 01824
HARRIS	HARRIS CORP, SEMICONDUCTOR PRODUCTS DIV., PO BOX 883, MELBOURNE, FL 32902
HP	HEWLETT PACKARD CO., PO BOX 10301, PALO ALTO, CA 94303-0890
IFCP	INNOVATIVE FREQUENCY CONTROL PRODUCTS, 451 LINCOLN ST., CARLISLE, PA 17013
MAX	MAXIM INTEGRATED PRODUCTS INC., 120 SAN GABRIEL DR., SUNNYVALE, CA 94086
MOT	MOTOROLA SEMICONDUCTOR PRODUCTS INC., 3501 ED BLUESTEIN BLVD., AUSTIN, TX 78721
MOUSER	MOUSER ELECTRONICS INC., 1175 N.E. 24 STREET, PO BOX 5727 FORT LAUDERDALE, FL 33310
MURATA	MURATA ERIE NORTH AMERICA INC., 1148 FRANKLIN RD S.E., MARIETTA, GA 30067
PHILLIPS	SIGNETICS/PHILLIPS SEMICONDUCTORS, 811 EAST ARQUES AVE, SUNNYVALE, CA 94088-3409

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CHAPTER 8

FINAL ASSEMBLY
MODEL RX-330

8-1 INTRODUCTION: Table 8-1 is a listing of all the modules in the RX-330 that can be replaced in corrective maintenance procedures. Figure 3-1 illustrates where the modules are located in the chassis. Table 8-2 is a listing of additional small parts which may need to be replaced if the receiver has been damaged.

TABLE 8-1 RX-330 MODULES

DESCRIPTION	TT PART NO.
RX PRESELECTOR	81713
1ST MIXER	81714
2ND MIXER/3RD LO	81715
1ST LO	81717
2ND LO	81718
POWER SUPPLY	81719
LED BOARD	81720
DSP/CPU BOARD	81721
CONVERTER (I/O)	81716

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CHAPTER 9

ILLUSTRATIONS

9-1 INTRODUCTION This chapter contains the detailed illustrations for the manual. This includes the block and schematic diagrams, parts lists, component location illustrations, and in some cases circuit board trace views.

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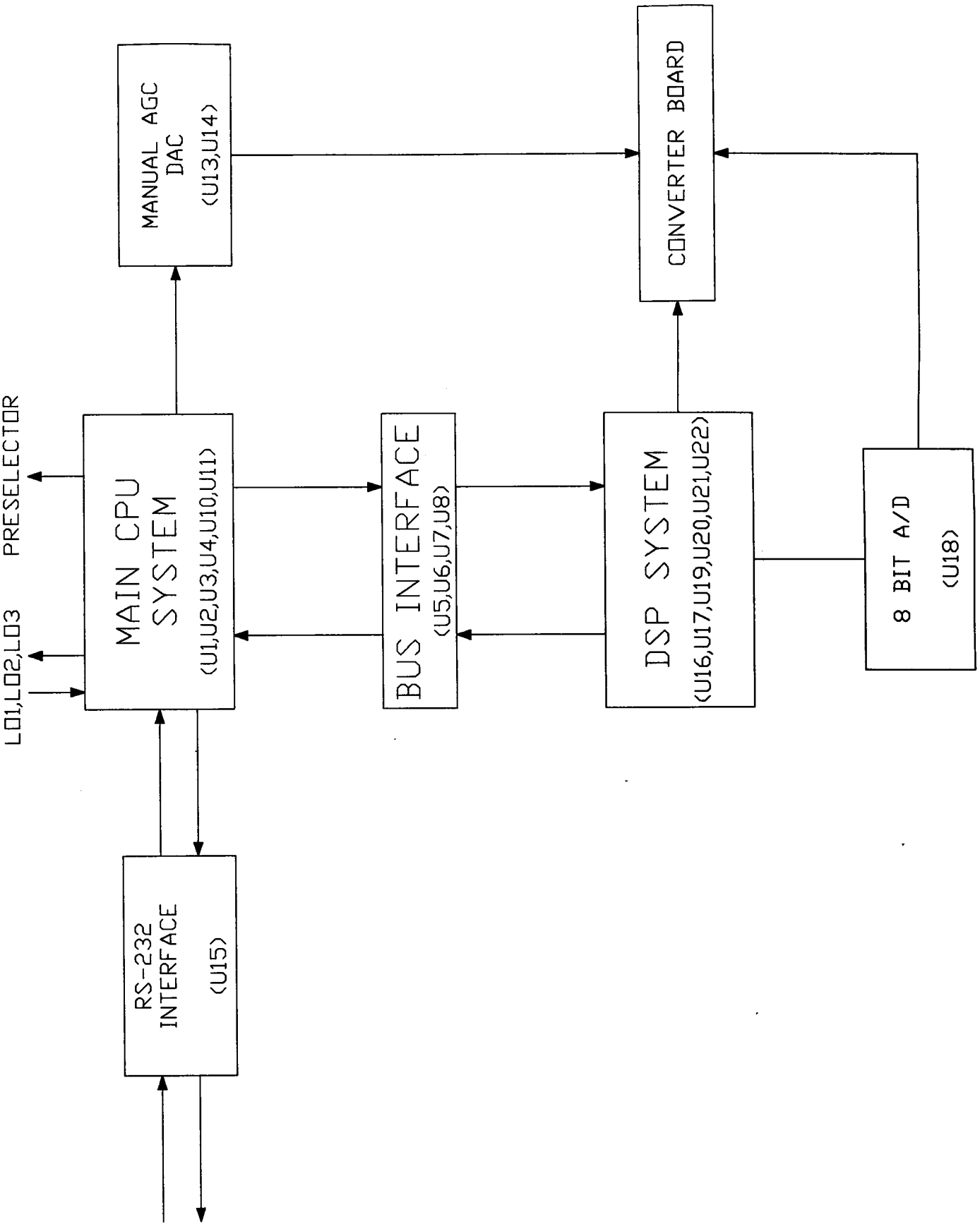

FIGURE 9-2 LOGIC BOARD BLOCK DIAGRAM

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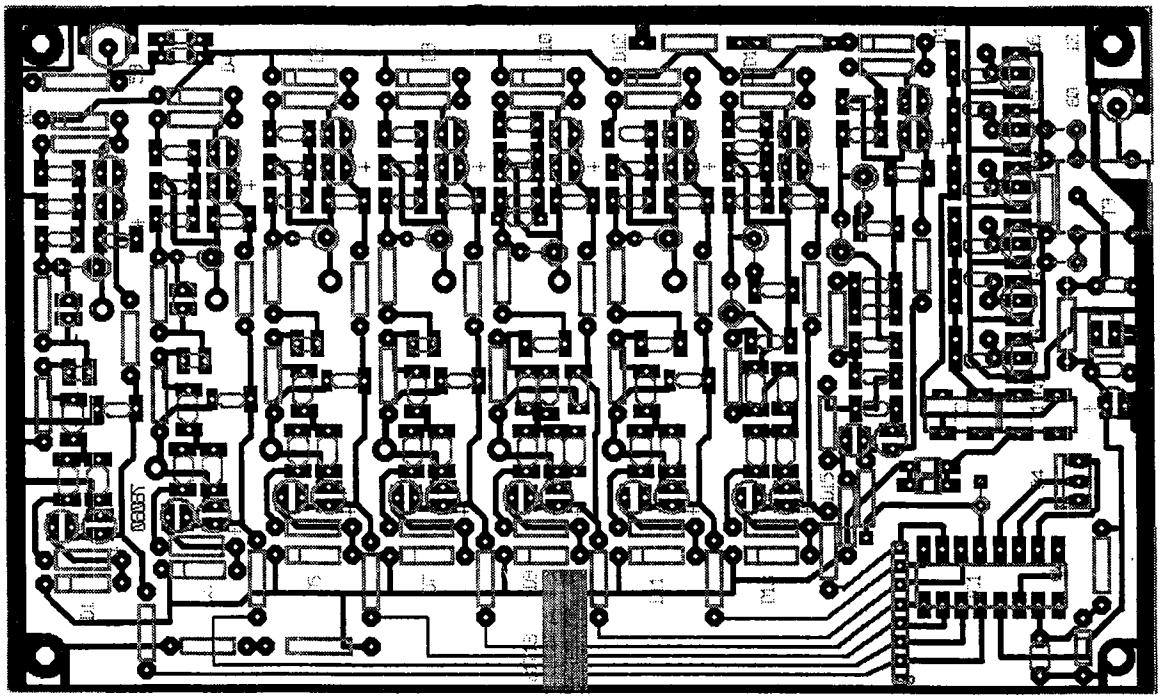

FIGURE 9-4. 81713 CIRCUIT TRACE

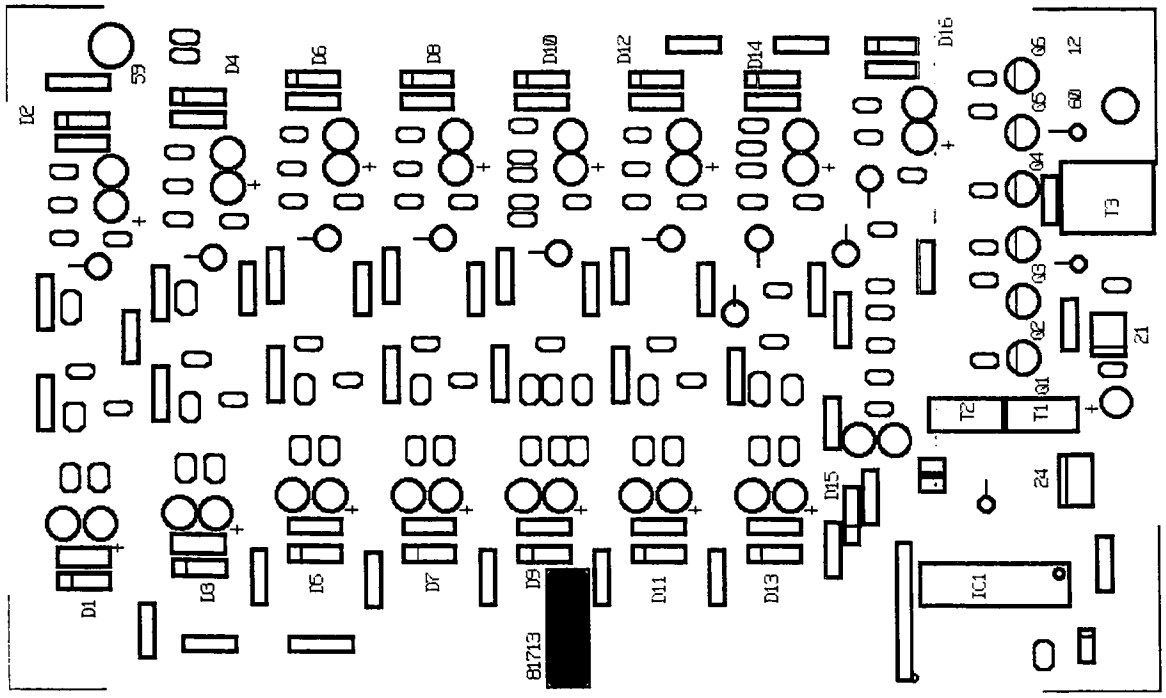

FIGURE 9-5. 81713 RX PRESELECTOR COMPONENT LAYOUT

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TABLE 9-1. 81713 RX PRESELECTOR PARTS LIST

ID	Description	Part No.
R1	47	30122
R2	100	30126
R3	47	30122
R4	100	30126
R5	47	30122
R6	100	30126
R7	47	30122
R8	100	30126
R9	47	30122
R10	100	30126
R11	47	30122
R12	100	30126
R13	47	30122
R14	100	30126
R15	150	30128
R16	47	30122
R17	100	30126
R18	220	30130
R19	100	30126
R20	100	30126
R21	100	30126
R22	100	30126
R23	100	30126
R24	100	30126
R25	1K	30138
R26	4.7	30111
R27	1K	30138
R28	2.2K	30142
R29	RES-NET	30425
C1	0.1	23261
C2	.01	23260
C3	56	23379
C4	180	23389
C5	180	23389
C6	5.0	23249
C7	8.0	23250
C8	180	23389
C9	180	23389
C10	47	23378
C11	1/50V	23264
C12	.01	23260
C13	.01	23260
C14	1/50V	23264

ID	Description	Part No.
C15	120	23386
C16	220	23396
C17	180	23389
C18	10	23251
C19	220	23396
C20	180	23389
C21	120	23386
C22	1/50V	23264
C23	.01	23260
C24	.01	23260
C25	1/50V	23264
C26	270	23397
C27	270	23397
C28	220	23396
C29	18	23302
C30	220	23396
C31	270	23397
C32	270	23397
C33	1/50V	23264
C34	.01	23260
C35	.01	23260
C36	1/50V	23264
C37	220	23396
C38	560	23401
C39	390	23399
C40	20	23254
C41	390	23399
C42	560	23401
C43	270	23397
C44	1/50V	23264
C45	.01	23260
C46	.01	23260
C47	1/50V	23264
C48	360	23147
C49	360	23147
C50	470	23400
C51	330	23389
C52	470	23400
C53	39	23377
C54	360	23147
C55	330	23389
C56	470	23400
C57	470	23400

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TABLE 9-1. 81713 RX PRESELECTOR PARTS LIST (continued)

ID	Description	Part No.
L35	100	21060
L36	100	21060
L37	4.7	21120
L38	5.6	21121
L39	39	21159
L40	5.6	21121
L41	4.7	21120
L42	100	21060
L43	820	21095
L44	12	21125
L45	100	21164
L46	68	21162
L47	27	21129
L48	12	21125
L49	820	21095
L50	820	21095
L51	820	21095
L52	6.8	21122
L53	100	21164
L54	18	21127
L55	68	21162
L56	5.6	21121
L57	820	21095
L58	820	21095
L59	2.2	21116
L60	2.2	21116
D1	KS4522	28103
D2	KS4522	28103
D3	KS4522	28103
D4	KS4522	28103
D5	KS4522	28103
D6	KS4522	28103
D7	KS4522	28103
D8	KS4522	28103
D9	KS4522	28103
D10	KS4522	28103
D11	KS4522	28103
D12	KS4522	28103
D13	KS4522	28103
D14	KS4522	28103
D15	KS4522	28103
D16	KS4522	28103
D17	IN751	28041

ID	Description	Part No.
T1	TORROID-BIFILAR	85413-10
T2	TORRIOD-BIFILAR	85413-10
T3	TORRIOD-BIFILAR	85413-11
Q1	J310	25115
Q2	J310	25115
Q3	J310	25115
Q4	J310	25115
Q4	J310	25115
Q5	J310	25115
U1	UCN5895A	25344

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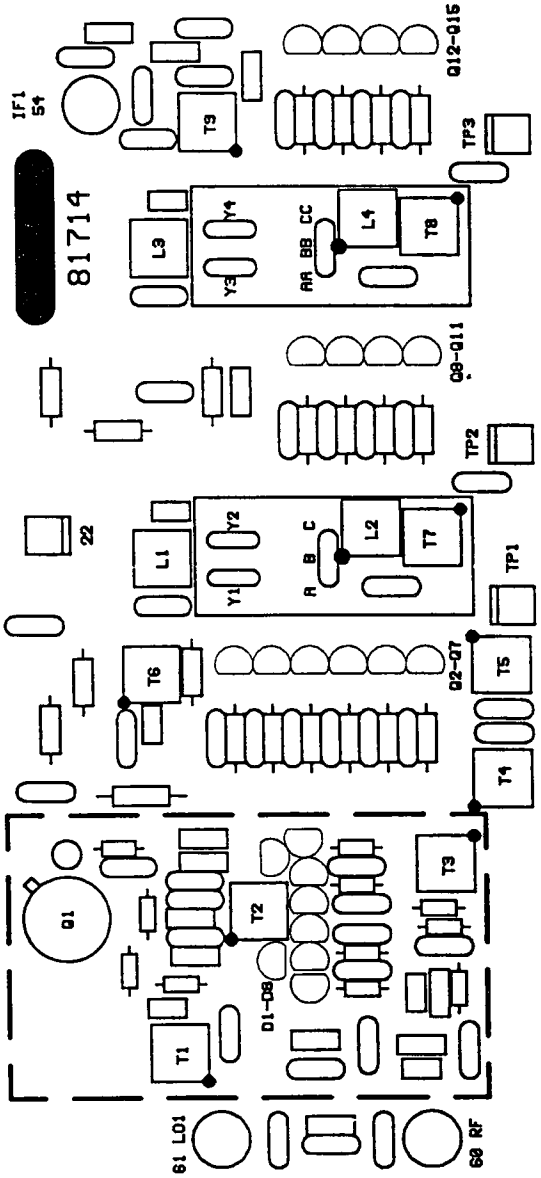

FIGURE 9-9. 81714 1st MIXER COMPONENT LAYOUT

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TABLE 9-2. 81714 1st MIXER PARTS LIST

ID.	Description	Part No.
R1	4.7 3/4W	30042
R2	3.3K 1/6W	30294
R3	220 1/6W	30290
R4	10 1/6W	30314
R5	560 1/6W	30440
R6	33 1/6W	30434
R7	33 1/6W	30434
R8	33 1/6W	30434
R9	33 1/6W	30434
R10	270	30131
R11	15 1/6W	30431
R12	270	30131
R13	100	30126
R14	100	30126
R15	100	30126
R16	100	30126
R17	100	30126
R18	100	30126
R19	2.2K	30142
R20	4.7	30111
R21	100	30126
R22	100	30126
R23	100	30126
R24	100	30126
R25	10	30115
R26	330	30132
R27	100	30126
R28	100	30126
R29	100	30126
R30	100	30126
R31	10	30115
C1	0.1	23261
C2	.01	23260
C3	.001	23245
C4	47	23378
C5	33	23376
C6	18	23373
C7	33	23376
C8	100	23385
C9	100	23385
C10	100	23385
C11	100	23385
C12	75	23382

ID.	Description	Part No.
C13	56	23379
C14	33	23376
C15	150	23388
C16	180	23389
C17	180	23389
C18	18	23302
C19	5.0	23249
C20	120	23386
C21	27	23375
C22	27	23375
C23	.01	23260
C24	.01	23260
C25	.01	23260
C26	.01	23260
C27	.01	23260
C28	.01	23260
C29	.001	23245
C30	0.1	23261
C31	0.1	23261
C32	56	23379
C33	15	23253
C34	10	23371
C35	220	23396
C36	27	23375
C37	.01	23260
C38	.01	23260
C39	.01	23260
C40	.01	23260
C41	NOT USED	
C42	0.1	23261
C43	56	23379
C44	15	23253
C45	10	23371
C46	220	23396
C47	27	23375
C48	.01	23260
C49	.01	23260
C50	.01	23260
C51	.01	23260
C52	.01	23260
C53	.01	23260
C54	NOT USED	
C55	68	23381

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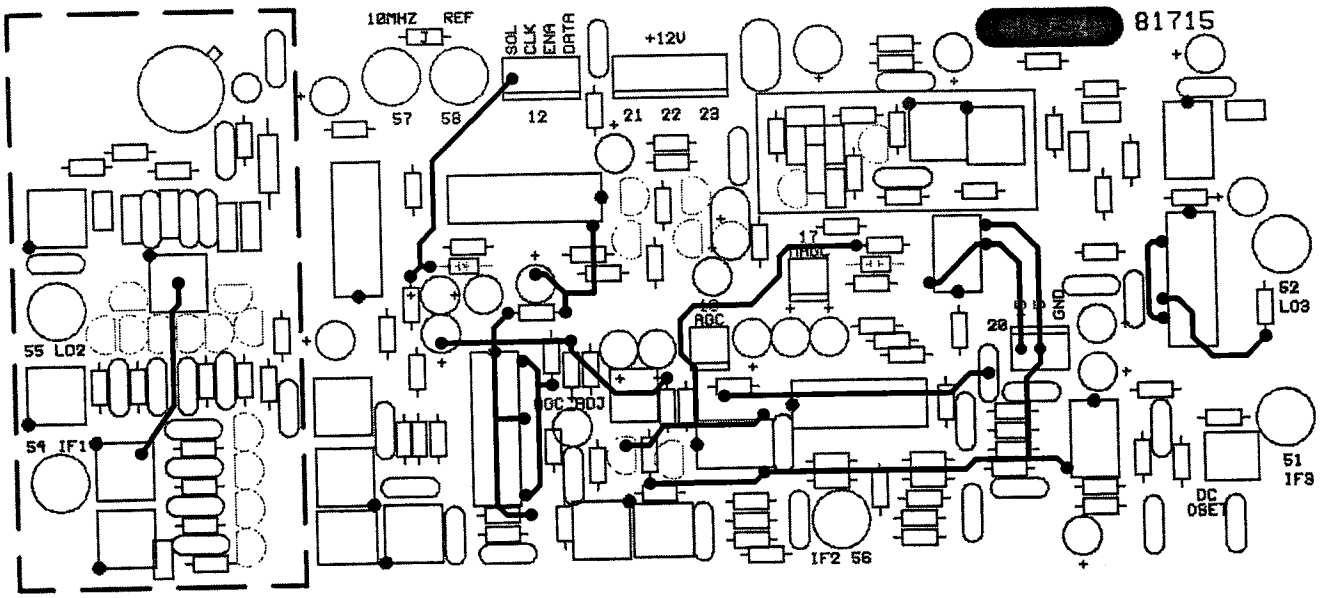

FIGURE 9-11. 81715 TOP CIRCUIT TRACE

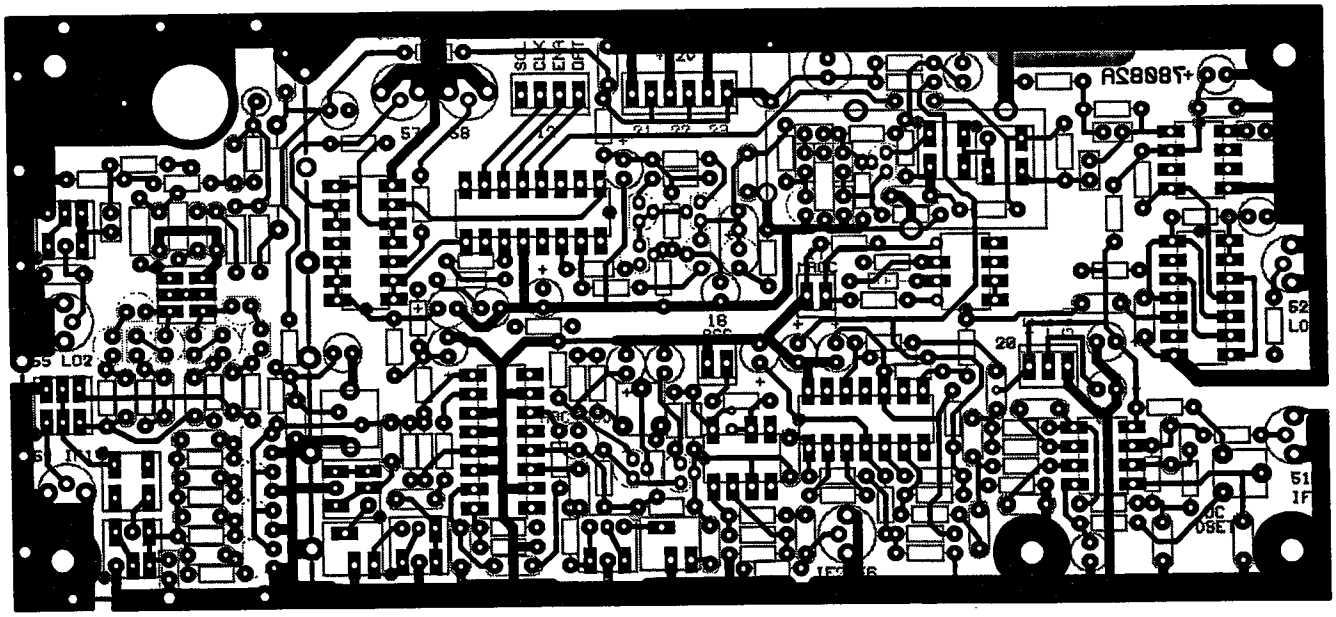

FIGURE 9-12. 81715 BOTTOM CIRCUIT TRACE

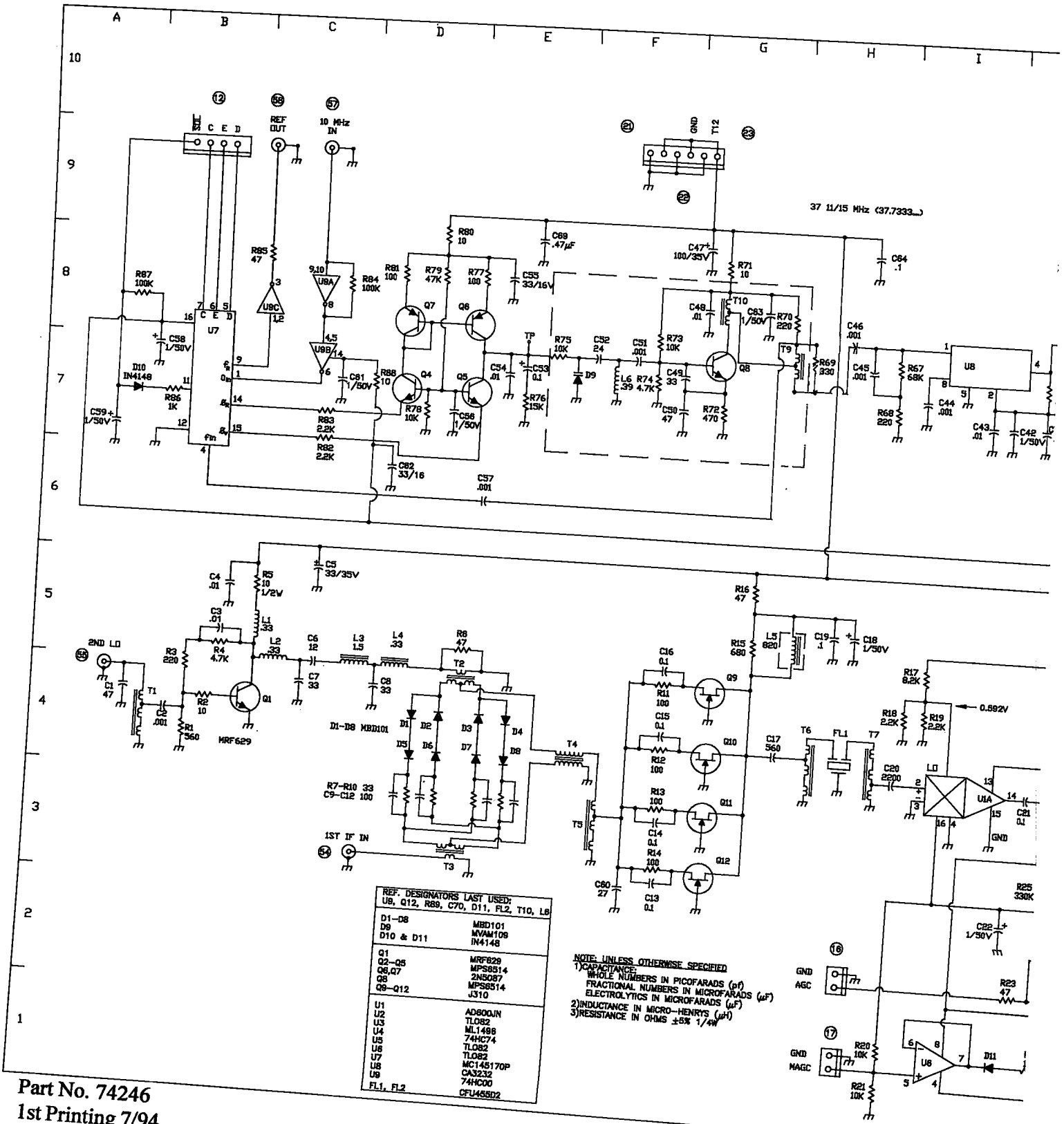

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FIGURE 9-14. 81715 2nd MIXER / IF S(

TABLE 9-3. 81715 2nd MIXER / IF PARTS LIST

ID.	Description	Part No.
R1	560	30440
R2	10	30314
R3	220	30290
R4	4.7K	30300
R5	10 1/2W	30022
R6	47	30289
R7	33	30434
R8	33	30434
R9	33	30434
R10	33	30434
R11	100	30309
R12	100	30309
R13	100	30309
R14	100	30309
R15	680	30292
R16	47	30289
R17	8.2K	30402
R18	2.2K	30293
R19	2.2K	30293
R20	10K	30296
R21	10K	30296
R22	100	30309
R23	47	30289
R24	470K	30448
R25	330K	30302
R26	100	30309
R27	5.6K	30295
R28	9.1K	30622
R29	820	30442
R30	1K	30333
R31	680	30292
R32	270	30131
R33	100	30309
R34	100	30309
R35	10K	30296
R36	10K	30296
R37	10K	30296
R38	100	30309
R39	100	30309
R40	10K	30296
R41	1K	30333
R42	10K	30296
R43	100	30309

ID.	Description	Part No.
R44	8.2K	30402
R45	6.8K	30332
R46	8.2K	30402
R47	10K	30296
R48	10K	30296
R49	10K	30296
R50	10K	30296
R51	47	30289
R52	5.6K	30295
R53	5.6K	30295
R54	1.2K	30623
R55	3.3K	30294
R56	1K	30333
R57	1K	30333
R58	2.2K	30293
R59	47	30289
R60	220	30290
R61	820	30442
R62	1K	30333
R63	1.5K	30322
R64	1.5K	30322
R65	10	30314
R66	1K	30333
R67	68K	30303
R68	220	30290
R69	330	30316
R70	220	30290
R71	10	30314
R72	470	30291
R73	10K	30296
R74	4.7K	30305
R75	10K	30296
R76	15K	30297
R77	100	30309
R78	10K	30296
R79	47K	30300
R80	10	30314
R81	100	30309
R82	2.2K	30293
R83	2.2K	30293
R84	100K	30301
R85	47	30289
R86	1K	30333

Part No. 74246
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TABLE 9-3. 81715 2nd MIXER / IF PARTS LIST (continued)

ID.	Description	Part No.
D7	MBD101	28110
D9	MVAM109	
D10	IN4148	
D11	IN4148	
T1	XFMR, TRIFILAR	21153
T2	XFMR, TRIFILAR	21153
T3	XFMR, TRIFILAR	21153
T4	XFMR, BIFILAR	85413-03
T5	XFMR, TRIFILAR	21153
T6	XFMR, TRIFILAR	21153
T7	XFMR, TRIFILAR	21153
T8	XFMR, TRIFILAR	21153
T9	XFMR, BIFILAR	21152
T10	XFMR, BIFILAR	21152
Q1	MRF629	
Q2	MPS6514	
Q3	MPS6514	
Q4	MPS6514	
Q5	MPS6514	
Q6	2N5087	
Q7	2N5087	
Q8	MPS6514	
Q9	J310	
Q10	J310	
Q11	J310	
Q12	J310	
U1	AD600JN	
U2	TL082	
U3	MC1496	
U4	74HC74	
U5	TL082	
U6	TL082	
U7	MC145170P	
U8	CA3232	
U9	74HC00	
FL	CFU45502	
FL2	CFU45502	

Part No. 74246
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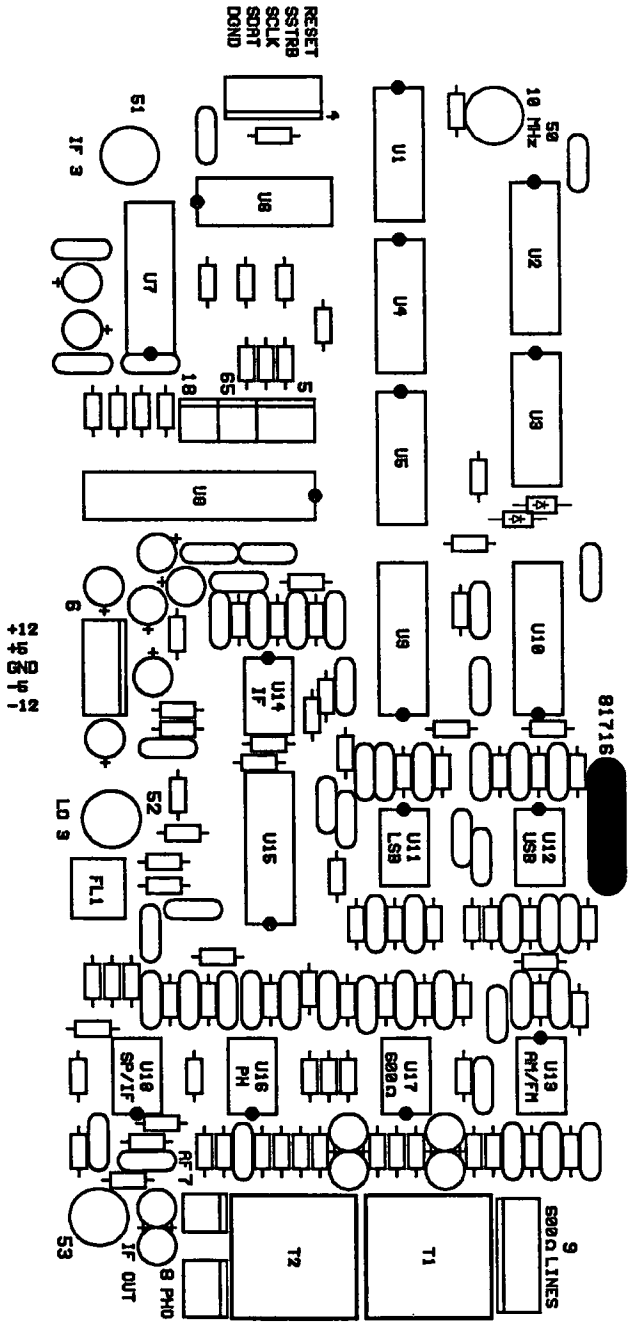

FIGURE 9-17. 81716 CONVERTER-I/O BOARD COMPONENT LAYOUT

Part No. 74246
1st Printing 7/94
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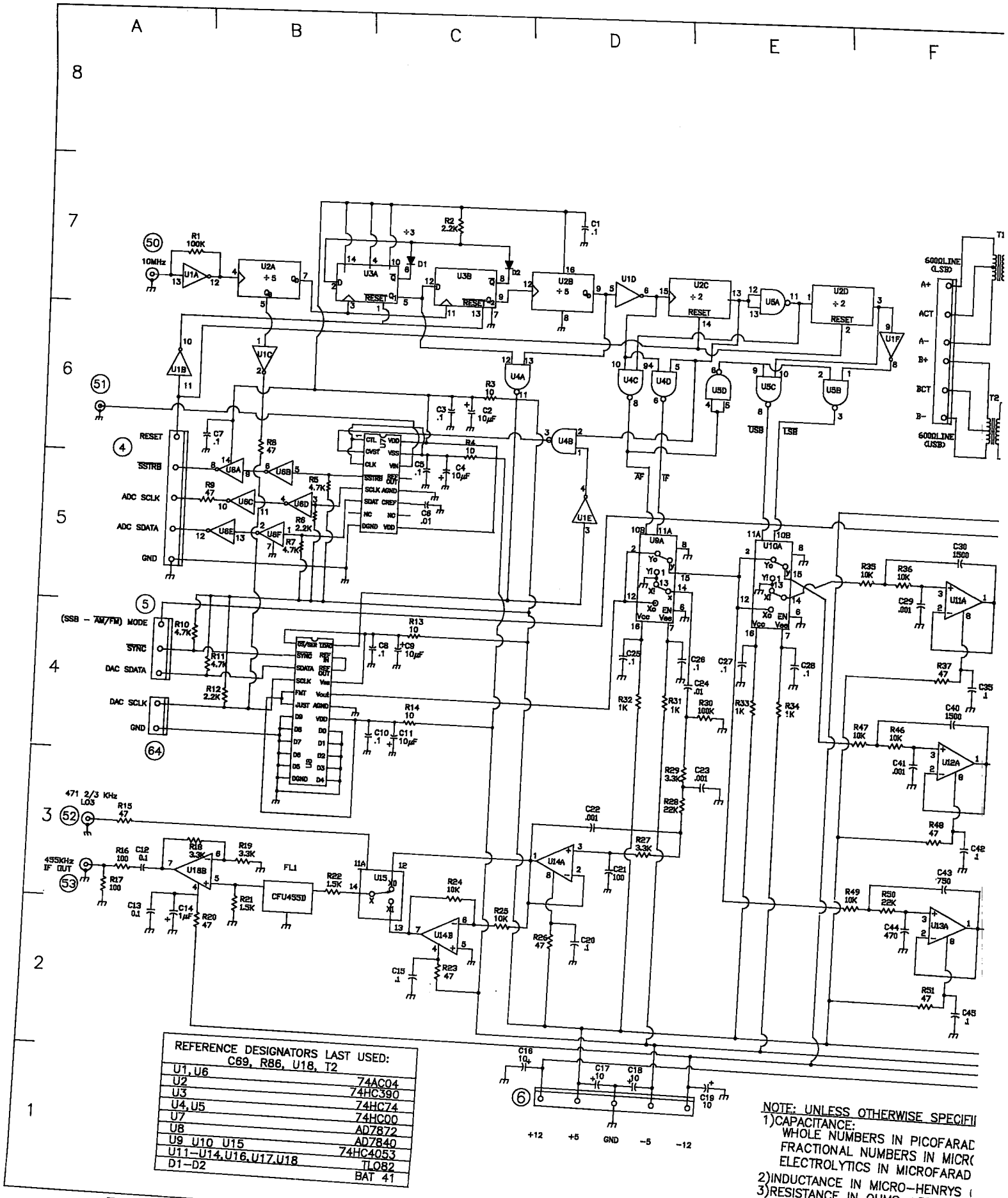

REFERENCE DESIGNATORS LAST USED: C69, R86, U18, T2	
U1, U6	74AC04
U2	74HC390
U3	74HC74
U4, U5	74HC00
U7	AD7872
U8	AD7840
U9 U10 U15	74HC4053
U11–U14, U16, U17, U18	TL082
D1–D2	BAT 41

NOTE: UNLESS OTHERWISE SPECIFI
1)CAPACITANCE:
WHOLE NUMBERS IN PICOFARAD
FRACTIONAL NUMBERS IN MICR(
ELECTROLYTICS IN MICROFARAD
2)INDUCTANCE IN MICRO–HENRYS
3)RESISTANCE IN OHMS ±5% 1/4W

Part No. 74246
1st Printing 7/94
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FIGURE 9-18. 81716 CONVERTER-I/(

TABLE 9-4. 81716 CONVERTER-I/O BOARD PARTS LIST

ID.	Description	Part No.
R1	100K	30301
R2	2.2K	30293
R3	10	30314
R4	10	30314
R5	4.7K	30305
R6	2.2K	30293
R7	4.7K	30305
R8	47	30289
R9	47	30289
R10	4.7K	30305
R11	4.7K	30305
R12	2.2K	30293
R13	10	30314
R14	10	30314
R15	47	30289
R16	100	30309
R17	100	30309
R18	3.3K	30294
R19	3.3K	30294
R20	47	30289
R21	1.5K	30322
R22	1.5K	30322
R23	47	30289
R24	10K	30296
R25	10K	30296
R26	47	30289
R27	3.3K	30294
R28	22K	30298
R29	3.3K	30294
R30	100K	30301
R31	1K	30333
R32	1K	30333
R33	1K	30333
R34	1K	30333
R35	10K	30296
R36	10K	30296
R37	47	30289
R38	2.2K	30293
R39	82K	30446
R40	33K	30299
R41	47	30289
R42	47	30289
R43	33K	30299

ID.	Description	Part No.
R44	82K	30446
R45	2.2K	30293
R46	10K	30296
R47	10K	30296
R48	47	30289
R49	10K	30296
R50	22K	30298
R51	47	30289
R52	1K	30333
R53	68K	30303
R54	68K	30303
R55	47	30289
R56	1K	30333
R57	47	30289
R58	47	30289
R59	1K	30333
R60	47	30289
R61	470	30291
R62	100K	30301
R63	10K	30296
R64	10K	30296
R65	10K	30296
R66	10K	30296
R67	47	30289
R68	10K	30296
R69	100K	30301
R70	470	30291
R71	47	30289
R72	470	30291
R73	100K	30301
R74	10K	30296
R75	100K	30301
R76	47	30289
R77	22K	30298
R78	3.3K	30294
R79	150	30438
R80	150	30438
R81	47	30289
R82	100K	30301
R83	22K	30298
R84	3.3K	30294
R85	150	30438
R86	150	30438

Part No. 74246
1st Printing 7/94
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TABLE 9-4. 81716 CONVERTER-I/O BOARD PARTS LIST (continued)

ID.	Description	Part No.
U16	TL082	25321
U17	TL082	25321
U18	TL082	25321
T1	CT-600CT	21185
T2	CT-600CT	21185
FL1	CFU H55D	48198

Part No. 74246
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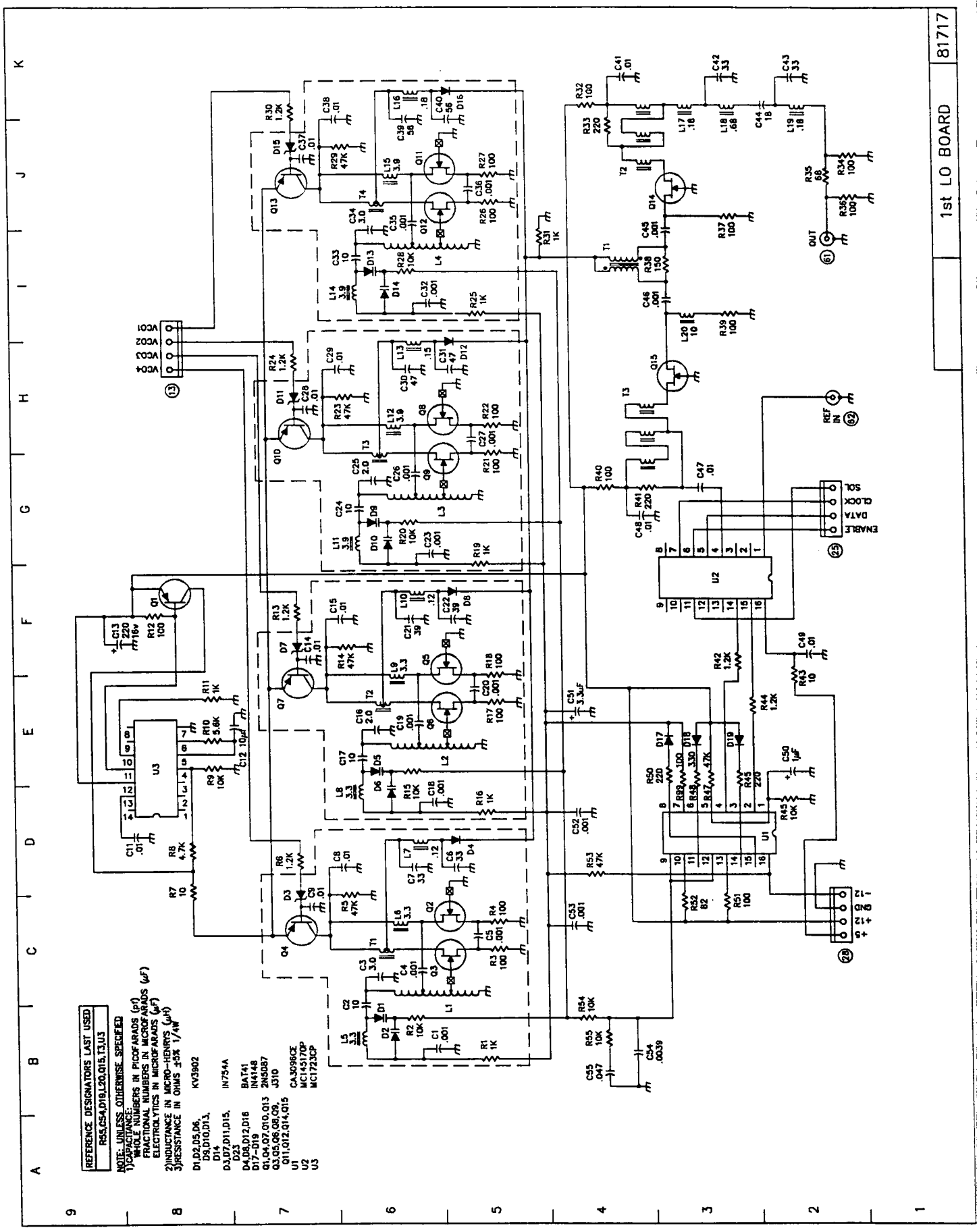

FIGURE 9-21. 81717 1ST LO BOARD SCHEMATIC

TABLE 9-5. 81717 1ST LO BOARD PARTS LIST (continued)

ID.	Description	Part No.
C32	.001	23245
C33	10	23251
C34	3	23248
C35	.011	23245
C36	.001	23245
C37	.01	23260
C38	.01	23260
C39	56	23379
C40	56	23379
C41	.01	23260
C42	33	23246
C43	33	23246
C44	18	23302
C45	.001	23245
C46	.001	23246
C47	.01	23260
C48	.01	23260
C49	.01	23260
C50	1µ	23264
C51	3.3µ	23265
C52	.001	23245
C53	.001	23245
C54	.0039	23334
C55	.047	23291
D1	KV3902	28075
D2	KV3902	28075
D3	IN754A	28006
D4	BAT41	28071
D5	KV3902	28075
D6	KV3902	28075
D7	IN754A	28006
D8	BAT41	28071
D9	KV3902	28075
D10	KV3902	28075
D11	IN754A	28006
D12	BAT41	28071
D13	KV3902	28075
D14	KV3902	28075
D15	IN754A	28006
D16	BAT41	28071
D17	IN4148	28001
D18	IN4148	28001
D19	IN4148	28001

ID.	Description	Part No.
T1	BIFILAR	21152
T2	TRIFILAR	21153
T3	TRIFILAR	21153
U1	CA3096CE	25345
U2	MC145170P	25296
U3	MC1723CP	25050
L1	COIL	85413-04
L2	COIL	85413-05
L3	COIL	85413-06
L4	COIL	85413-07
L5	3.3	21118
L6	3.3	21118
L7	.12	21101
L8	3.3	21118
L9	3.3	21118
L10	.12	21101
L11	3.9	21119
L12	3.9	21119
L13	.15	21102
L14	3.9	21119
L15	3.9	21119
L16	.18	21103
L17	.18	21103
L18	.68	21110
L19	.18	21103
L20	10	21124
Q1	2N5087	25001
Q2	J310	25115
Q3	J310	25115
Q4	2N5087	25001
Q5	J310	25115
Q6	J310	25115
Q7	2N5087	25001
Q8	J310	25115
Q9	J310	25115
Q10	2N5087	25001
Q11	J310	25115
Q12	J310	25115
Q13	2N5087	25001
Q14	J310	25115
Q15	J310	25115

Part No. 74246
1st Printing 7/94
Printed in U.S.A.

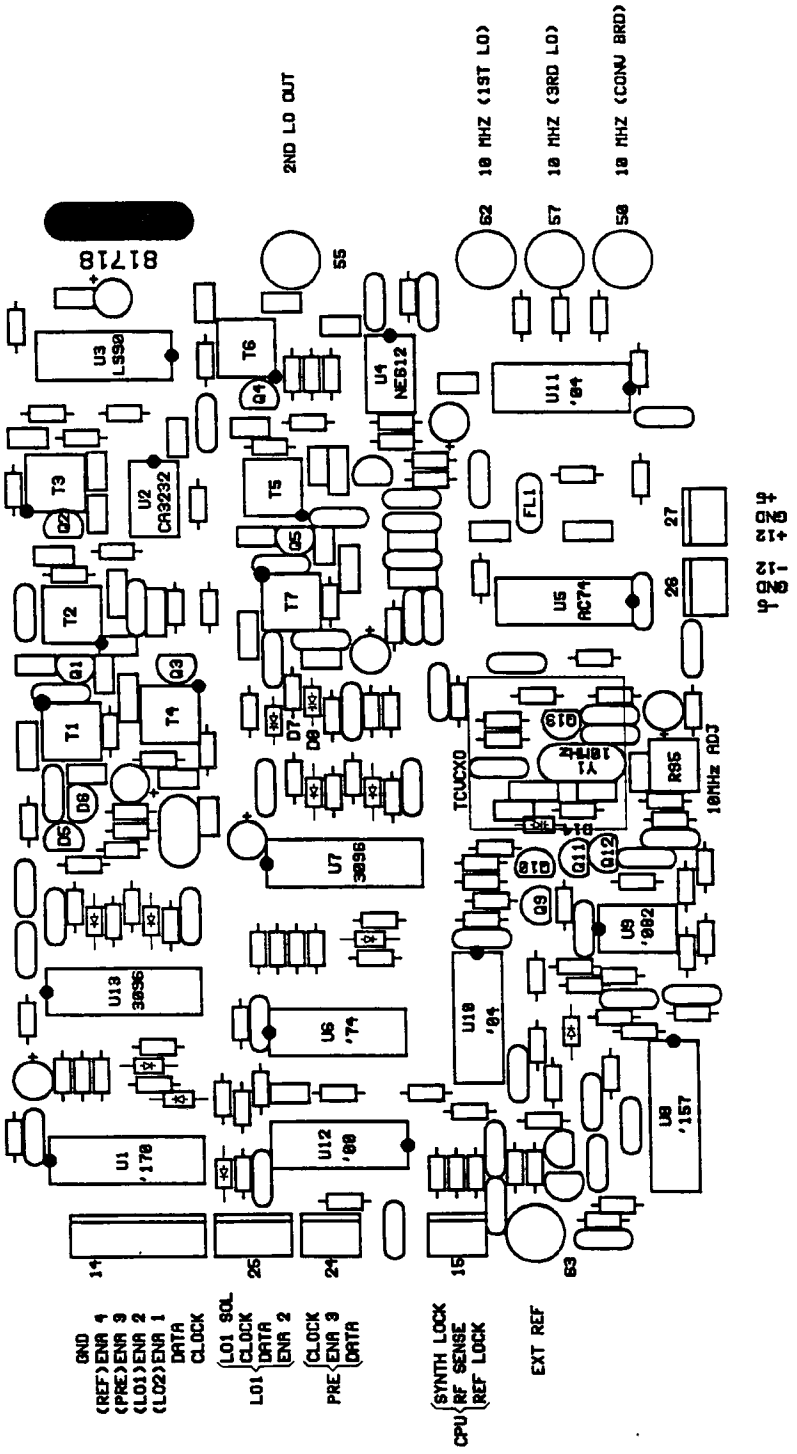

FIGURE 9-24. 81718 2ND LO COMPONENT LAYOUT

Part No. 74246
1st Printing 7/94
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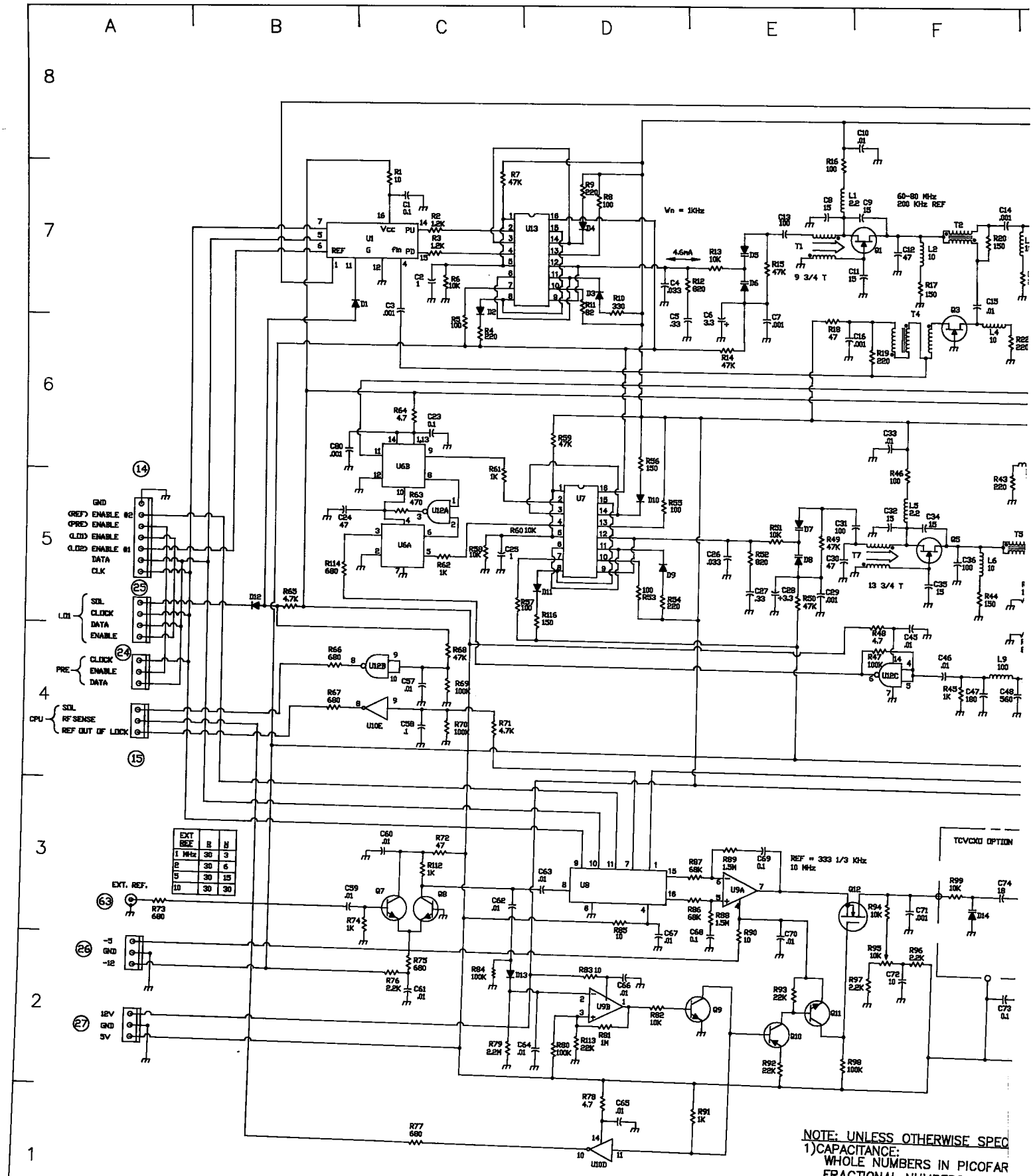

Part No. 74246
1st Printing 7/94
Printed in U.S.A.

FIGURE 9-25. 81718 2ND LO SCHEM

TABLE 9-6. 81718 2ND LO BOARD PARTS LIST

ID.	Description	Part No.
R1	10	30314
R2	1.2K	30623
R3	1.2K	30623
R4	220	30290
R5	100	30309
R6	10K	30296
R7	47K	30300
R8	100	30309
R9	220	30290
R10	330	30316
R11	82	30437
R12	820	30442
R13	10K	30296
R14	47K	30300
R15	47K	30300
R16	100	30309
R17	150	30438
R18	47	30289
R19	220	30290
R20	150	30438
R21	220	30290
R22	220	30290
R23	47	30289
R24	47	30289
R25	10	30314
R26	1K	30333
R27	4.7	30624
R28	33K	30299
R29	680	30292
R30	4.7	30624
R31	10	30314
R32	2.2K	30293
R33	470	30291
R34	3.3K	30294
R35	470	30291
R36	100	30309
R37	10	30314
R38	47	30289
R39	150	30438
R40	220	30290
R41	82	30437
R42	100	30309
R43	220	30290

ID.	Description	Part No.
R44	150	30438
R45	1K	30333
R46	100	30309
R47	100K	30301
R48	4.7	30624
R49	47K	30300
R50	47K	30300
R51	10K	30296
R52	820	30442
R53	100	30309
R54	220	30290
R55	100	30309
R56	150	30438
R57	100	30309
R58	10K	30296
R59	47K	30300
R60	10K	30296
R61	1K	30333
R62	1K	30333
R63	470	30291
R64	4.7	30624
R65	4.7K	30305
R66	680	30292
R67	680	30292
R68	47K	30300
R69	100K	30301
R70	100K	30301
R71	4.7K	30305
R72	47	30289
R73	680	30292
R74	1K	30333
R75	680	30292
R76	2.2K	30293
R77	680	32092
R78	4.7	30624
R79	2.2M	30625
R80	100K	30301
R81	1M	30360
R82	10K	30296
R83	10	30314
R84	100K	30301
R85	10	30314
R86	68K	30303

Part No. 74246
1st Printing 7/94
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TABLE 9-6. 81718 2ND LO BOARD PARTS LIST (continued)

I.D.	Description	Part No.
C57	.01µF	23260
C58	.1µF	23261
C59	.01µF	23260
C60	.01µF	23260
C61	.01µF	23260
C62	.01µF	23260
C63	.01µF	23260
C64	.01µF	23260
C65	.01µF	23260
C66	.01µF	23260
C67	.01µF	23260
C68	.1µF	23328
C69	.1µF	23328
C70	.01µF	23260
C71	.001µF	23245
C72	10µF	23266
C73	.1µF	23261
C74	18pF	23444
C75	150pF	23388
C76	150pF	23388
C77	.01µF	23260
C78	.01µF	23260
C79	.01µF	23260
C80	.001µF	23245
D1	IN4148	28001
D2	IN4148	28001
D3	IN4148	28001
D4	IN4148	28001
D5	MVAM125	28116
D6	MVAM125	28116
D7	KV3902	28075
D8	KV3902	28075
D9	IN4148	28001
D10	IN4148	28001
D11	IN4148	28001
D12	IN4148	28001
D13	BAT-41	28071
D14	KV3902	28075
L1	2.2µH	21116
L2	10µH	21124
L3	10µH	21124
L4	10µH	21124
L5	2.2µH	21116

I.D.	Description	Part No.
L6	10µH	21124
L7	10µH	21124
L8	100µH	21164
L9	100µH	21164
L10	1.2µH	21113
L11	15µH	21126
T1	COIL	85413-01
T2	XFMR BIFILAR	21152
T3	XFMR TRIFILAR	21153
T4	XFMR TRIFILAR	21153
T5	XFMR BIFILAR	21152
T6	XFMR TRIFILAR	21153
T7	COIL	85413-02
Q1	J310	25115
Q2	J310	25115
Q3	J310	25115
Q4	J310	25115
Q5	J310	25115
Q6	2N5087	25001
Q7	2N4124	25258
Q8	2N4124	25258
Q9	2N4124	25258
Q10	2N5087	25001
Q11	2N4124	25258
Q12	2N7000	25351
Q13	2N4124	25258
U1	MC145170P	25296
U2	CA3232	25175
U3	74LS90	25176
U4	NE612	25319
U5	74AC74	25346
U6	74AC74	25346
U7	CA3096E	25345
U8	MC145157P-2	25213
U9	TL082	25321
U10	74AC04	25340
U11	74AC04	25340
U12	74HC00	25161
U13	CA3096E	25345
FL1	FILTER CRYSTAL 45 MHz	48202
FL2	CRYSTAL 10 MHz	48112

Part No. 74246
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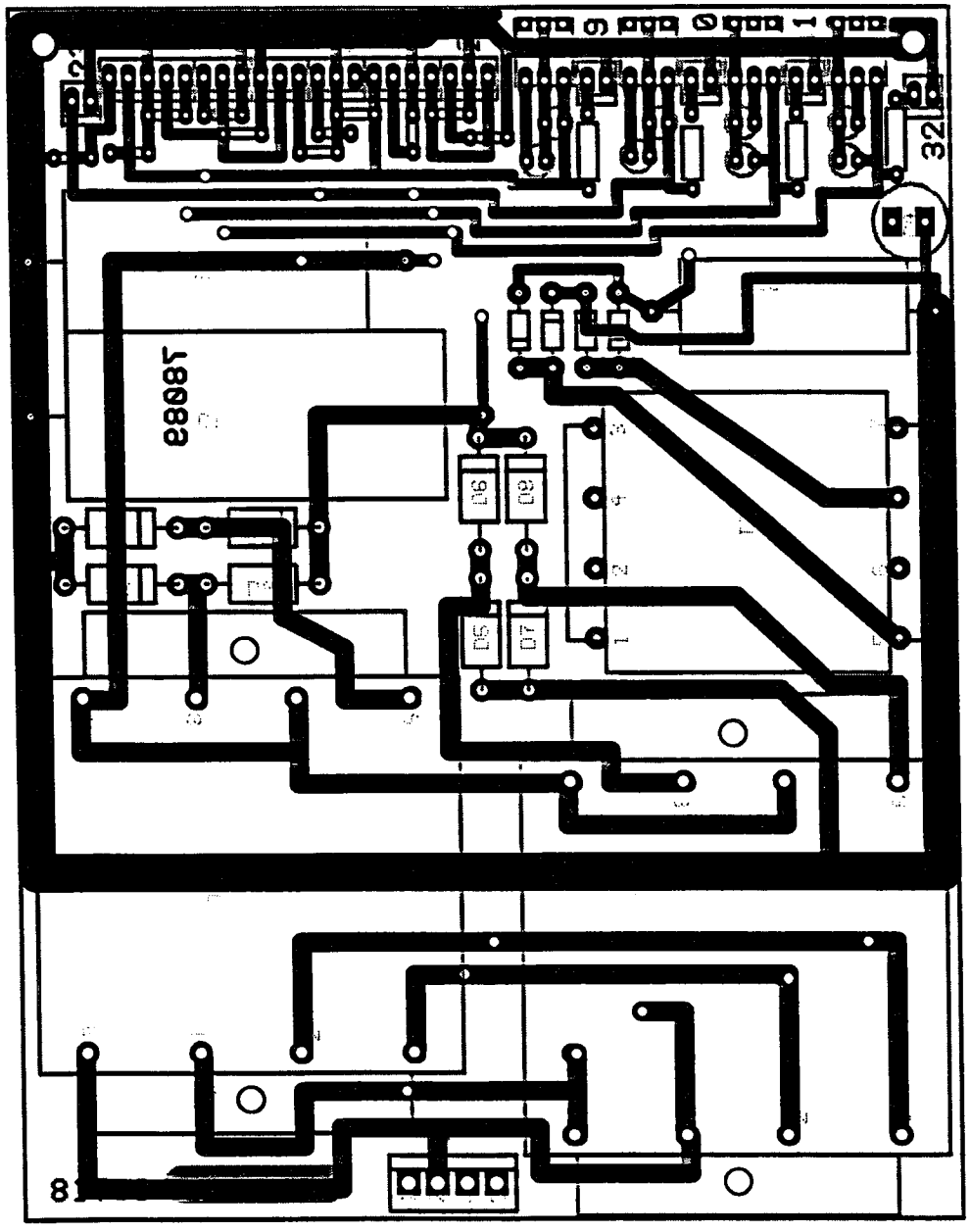

FIGURE 9-27. 81719 BOTTOM CIRCUIT TRACE

Part No. 74246
1st Printing 7/94
Printed in U.S.A.

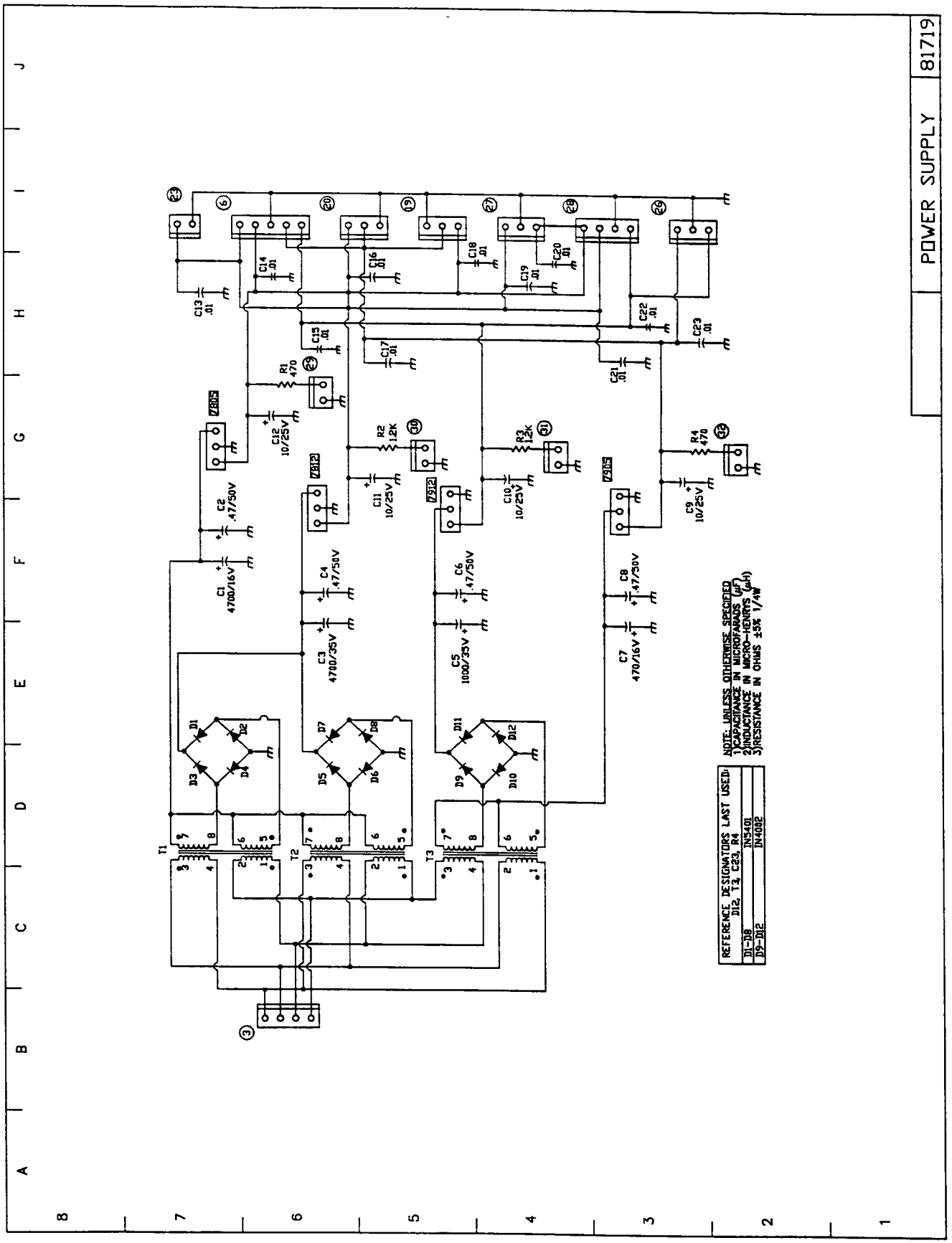

FIGURE 9-29. 81719 POWER SUPPLY SCHEMATIC

Part No. 74246
1st Printing 7/94
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FIGURE 9-30. 81720 TOP CIRCUIT TRACE

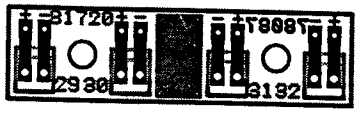


FIGURE 9-31. 81720 BOTTOM CIRCUIT TRACE

FIGURE 9-32. 81720 LED BOARD COMPONENT LAYOUT

Part No. 74246
1st Printing 7/94
Printed in U.S.A.

TABLE 9-8. 81720 LED BOARD PARTS LIST

ID.	Description	Part No.
D1	HMLP 1700	28066
D2	HMLP 1700	28066
D3	HMLP 1700	28066
D4	HMLP 1700	28066

Part No. 74246
1st Printing 7/94
Printed in U.S.A.

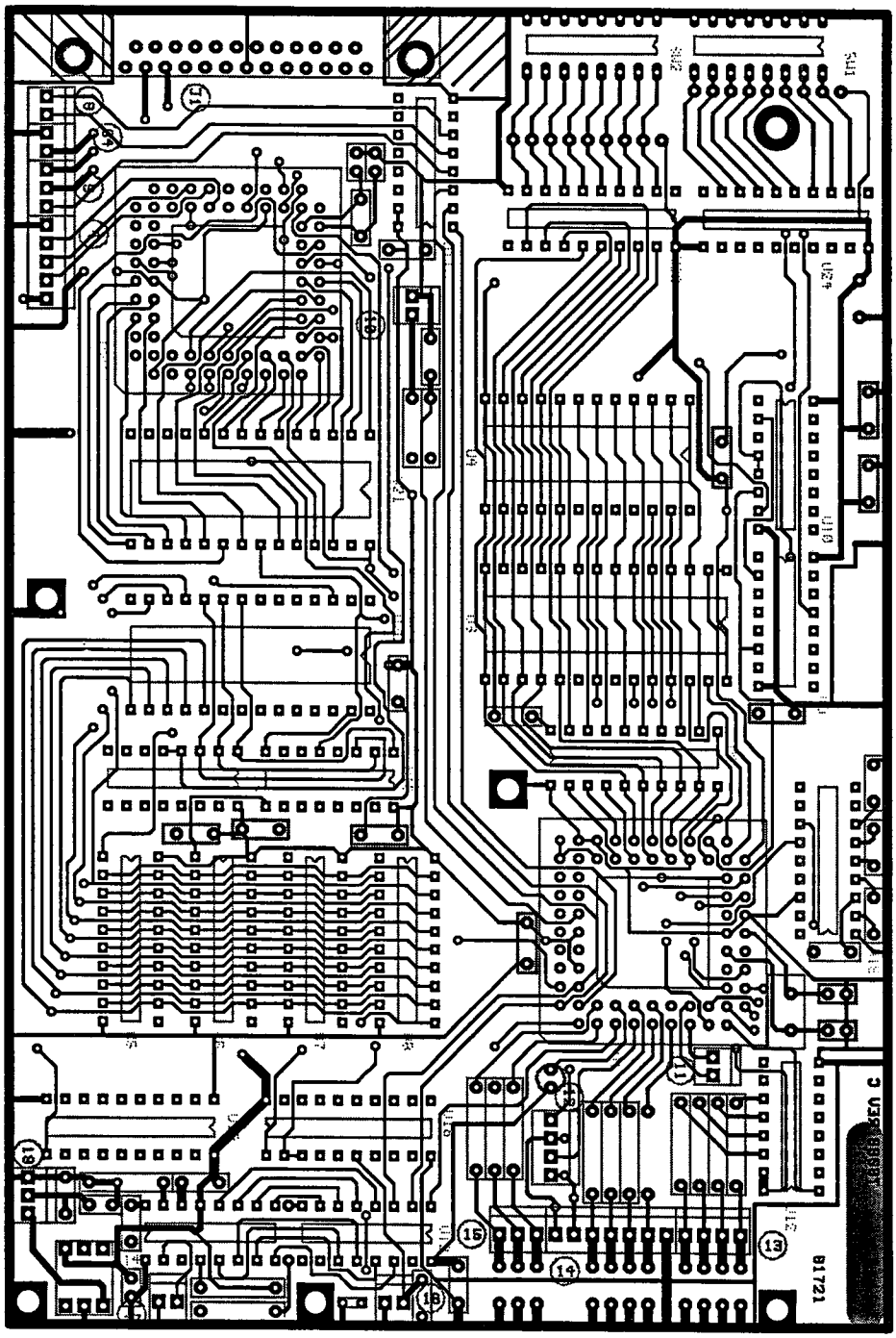
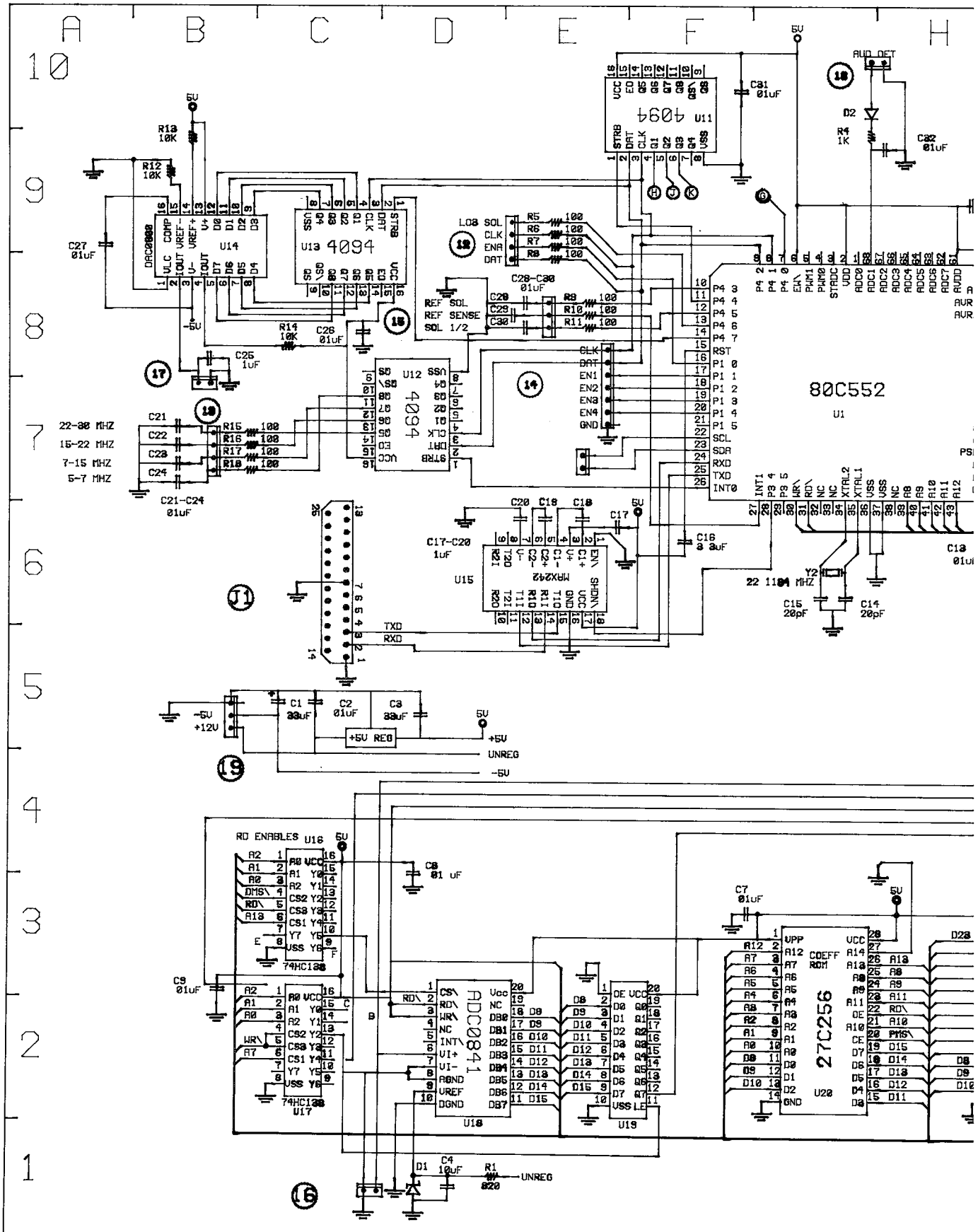


FIGURE 9-35. 81721 BOTTOM CIRCUIT TRACE

Part No. 74246
1st Printing 7/94
Printed in U.S.A.



Part No. 74246
1st Printing 7/94
Printed in U.S.A.

FIGURE 9-37. 81721 DSI

TABLE 9-9. 81721 DSP/CPU BOARD PARTS LIST

I.D.	Description	Part No.
R1	820	30137
R2	10K X 8	30404
R3	10K X 8	30404
R4	1K	30138
R5	100	30126
R6	100	30126
R7	100	30126
R8	100	30126
R9	100	30126
R10	100	30126
R11	100	30126
R12	10K	30150
R13	10K	30150
R14	10K	30150
R15	100	30126
R16	100	30126
R17	100	30126
R18	100	30126
C1	33µF	23308
C2	.01µF	23260
C3	33µF	23308
C4	10µF	23266
C5	18pF	23302
C6	15pF	23253
C7	.01µF	23260
C8	.01µF	23260
C9	.01µF	23260
C10	.01µF	23260
C11	.01µF	23260
C12	.01µF	23260
C13	.01µF	23260
C14	20pF	23254
C15	20pF	23254
C16	3.3µF	23265
C17	.10µF	23261
C18	.10µF	23261
C19	.10µF	23261
C20	.10µF	23261
C21	.01µF	23260
C22	.01µF	23260
C23	.01µF	23260
C24	.01µF	23260
C25	.10µF	23328

I.D.	Description	Part No.
C26	.01µF	23260
C27	.01µF	23260
C28	.01µF	23260
C29	.01µF	23260
C30	.01µF	23260
C31	.01µF	23260
C32	.01µF	23260
C33	.01µF	23260
C34	.01µF	23260
C35	.01µF	23260
C36	.01µF	23260
D1	IN4148	28001
D2	5.1V ZENER	28041
U1	80C522	25331
U2	74HC573	25158
U3	MAIN ROM	98326
U4	DS1220Y	25311
U5	74HC574	25333
U6	74HC574	25333
U7	74HC574	25333
U8	74HC574	25333
U9	74HC138	25190
U10	74HC138	25190
U11	MC14094	25267
U12	MC14094	25267
U13	MC14094	25267
U14	DAC0800	25334
U15	MAX242	25343
U16	74HC138	25190
U17	74HC138	25190
U18	ADC0841	25332
U19	74HC573	25333
U20	FILTER ROM	98328
U21	DSP ROM	98327
U22	ADSP2101	25330
Y1	22.1184 XTAL	48201
Y2	20 MHz XTAL	48180
SW1	8 POS DIP SW	32107
SW2	8 POS DIP SW	32107

Part No. 74246
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