

TW7000MS



TW7000

HF Transceiver

Technical Manual

Datron World Communications Inc.  
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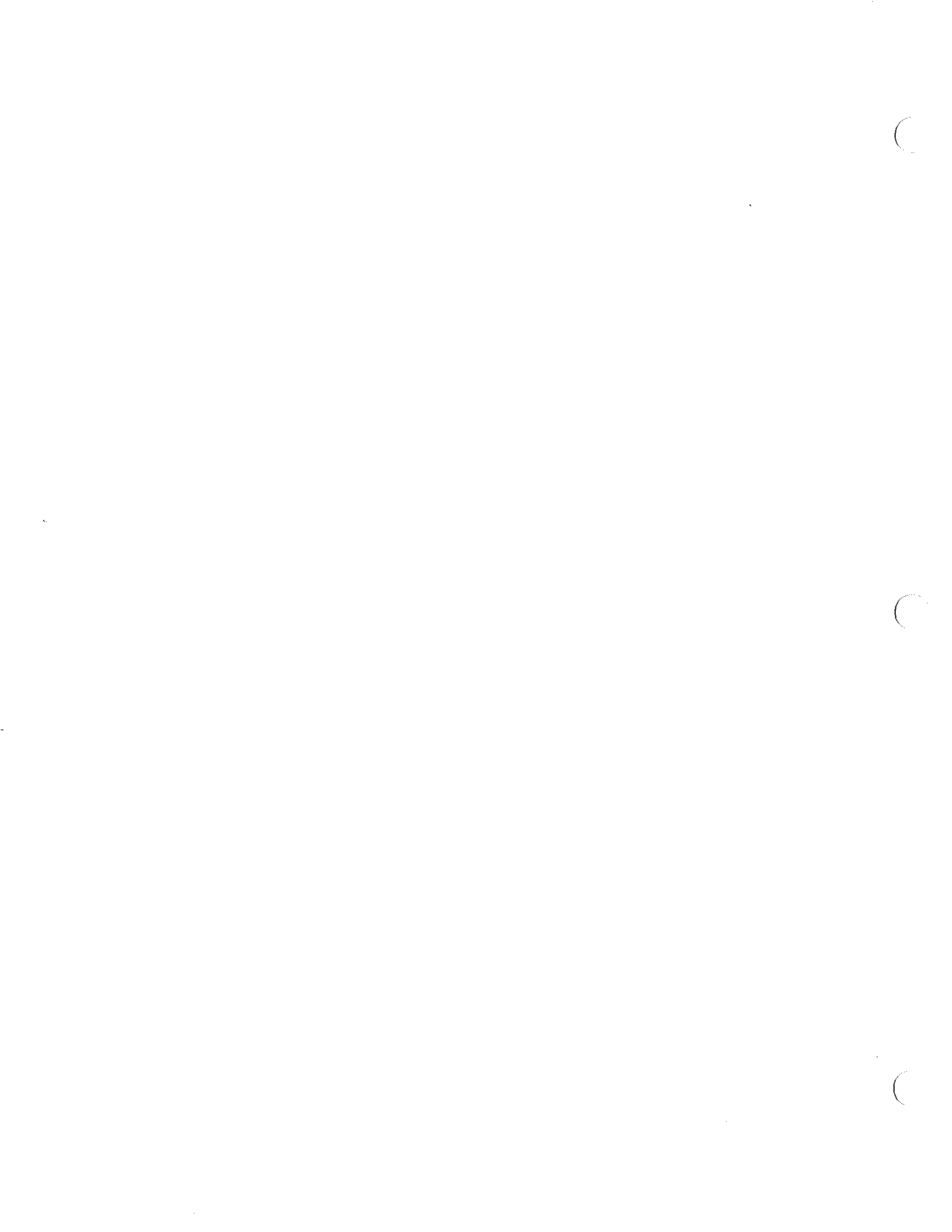
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## Change Description

Date of Revision	Revision Letter	Description of Changes	Pages Affected
2/2005	E	Information regarding updated boards, schematics, part lists including the new Processor board, Ref/Control board and the High Stability option.	All



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Physical damage to the equipment or its parts that does not involve defects in design, material, or workmanship, including damage by impact, liquids, temperature, or gases.

Damage to the equipment or its parts caused by lightning, static discharge, voltage transients, or application of incorrect supply voltages.

Defects or failures caused by unauthorized attempts to repair or modify the equipment.

Defects or failures caused by Buyer abuse or misuse.

**Return of Equipment - Domestic:** To obtain performance of any obligation under this warranty, the equipment must be returned freight prepaid to the Technical Support Services. Datron World Communications Inc., 3030 Enterprise Court, Vista, California 92083. The equipment must be packed securely. Datron shall not be responsible for any damage incurred in transit. A letter containing the following information must be included with the equipment.

- a. Model, serial number, and date of installation.
  - b. Name of dealer or supplier of the equipment.
  - c. Detailed explanation of problem.
  - d. Return shipping instructions.
  - c. Telephone or fax number where Buyer may be contacted.
- Datron will return the equipment prepaid by United Parcel Service, Parcel Post, or truck. If alternate shipping is specified by Buyer, freight charges will be made collect.

**Return of Equipment - International:** Contact Datron or your local Representative for specific instructions. Do not return equipment without authorization. It is usually not possible to clear equipment through U.S. Customs without the correct documentation. If equipment is returned without authorization, Buyer is responsible for all taxes, customs duties, clearance charges, and other associated costs.

**Parts Replacement:** The following instructions for the supply of replacement parts must be followed:

- a. Return the parts prepaid to "Parts Replacement" Datron World Communications Inc., 3030 Enterprise Court, Vista, California 92083; and
- b. Include a letter with the following information:
  1. Part number
  2. Serial number and model of equipment
  3. Date of installation

Parts returned without this information will not be replaced. In the event of a dispute over the age of the replacement part, components date-coded over 24 months previously will be considered out of warranty.

**Remedies:** Buyer's sole remedies and the entire liability of Datron are set forth above. In no event will Datron be liable to Buyer or any other person for any damages, including any incidental or consequential damages,

expenses, lost profits, lost savings, or other damages arising out of use of or inability to use the equipment. 1/95

## Safety Considerations

This product and manual must be thoroughly understood before attempting installation and operation. To do so without proper knowledge can result in equipment failure and bodily injury.

**Caution:** Before applying ac power, be sure that the equipment has been properly configured for the available line voltage. Attempted operation at the wrong voltage can result in damage and voids the warranty. See the manuals section on installation. DO NOT operate equipment with cover removed.

**Earth Ground:** All Datron products are supplied with a standard, 3-wire, grounded ac plug. DO NOT attempt to disable the ground terminal by using 2-wire adapters of any type. Any disconnection of the equipment ground causes a potential shock hazard that could result in personal injury. DO NOT operate any equipment until a suitable ground has been established. Consult the manual section on grounding.

**Servicing:** Trained personnel should only carry out servicing. To avoid electric shock, DO NOT open the case unless qualified to do so.

Various measurements and adjustments described in this manual are performed in ac power applied and the protective covers removed. Capacitors (particularly the large power supply electrolytics) can remain charged for a considerable time after the unit has been shut off. Use particular care when working around them, as a short circuit can release sufficient energy to cause damage to the equipment and possible injury.

To protect against fire hazard, always replace line fuses with ones of the same current rating and type (normal delay, slow-blow, etc.). DO NOT use higher value replacements in an attempt to prevent fuse failure. If fuses are failing repeatedly this indicates a probable defect in the equipment that needs attention.

Use only genuine Datron factory parts for full performance and safety of this product.



**Made in the USA**

# CONTENTS

## 1: Introduction

1.1	The TW7000 .....	1-1
1.2	Transceiver Configurations .....	1-1
1.3	Internal Options .....	1-2
1.4	TW7000 Variations .....	1-3
1.5	Input Power Requirements .....	1-3
1.6	Antenna Requirements .....	1-3
1.7	Accessories .....	1-4
1.8	Technical Specifications .....	1-4
1.9	Referenced Manuals .....	1-5

## 2: Installation

2.1	Unpacking and Inspection .....	2-1
2.2	Preinstallation Check .....	2-1
2.3	Location Considerations .....	2-1
2.3.1	Fixed Station .....	2-1
2.3.2	Vehicular or Marine .....	2-2
2.4	Front Panel Connections .....	2-2
2.5	Rear Panel Connections .....	2-2
	Figure 2-1. TW7000 Rear Panel .....	2-3
2.5.1	Power to the TW7000 .....	2-3
2.5.2	Antenna Connection .....	2-4
2.5.3	Accessory Connections .....	2-4
	Table 2-1. Pinouts for Accessory Connector 1 .....	2-5
	Table 2-2. Pinouts for Accessory Connector 2 .....	2-6
	Table 2-3. Pinouts for Accessory Connector 3 .....	2-7
	Figure 2-2. Power Cabling Accessories .....	2-12
	Figure 2-3. RF Cabling Accessories .....	2-13
	Figure 2-4. Control Cabling Accessories .....	2-14
2.5.4	Remote Control .....	2-15

## 3: Theory of Operation

3.1	Transceiver Boards .....	3-1
3.2	Power Distribution .....	3-1
	Figure 3-1. System Diagram .....	3-3
	Figure 3-2. Power Distribution Diagram .....	3-4
	Table 3-1. Transceiver Power Distribution .....	3-5
	Figure 3-3. Transceiver Frequency Generation .....	3-6
	Figure 3-4. Transceiver Frequency Mixing Schematic .....	3-7
3.3	Frequency Generation .....	3-8

3.4	Receiver Signal Flow . . . . .	3-9
	Figure 3-5. Transceiver Receive Path Diagram . . . . .	3-11
3.5	Transmit Signal Flow . . . . .	3-12
3.6	Receive and Transmit Path Subassemblies . . . . .	3-12
	Figure 3-6. Transceiver Transmit Path . . . . .	3-13
3.7	Transceiver Control Path . . . . .	3-14
3.8	Mainframe . . . . .	3-14
	Figure 3-7. Mainframe Wiring Schematic Diagram (994126 Rev. K) . . . . .	3-15

## 4: Technical Description

4.1	Power Supply Board . . . . .	4-1
4.1.1	Inter-connections . . . . .	4-2
	Table 4-1. Power Supply Interconnections . . . . .	4-2
4.1.2	Test Procedure . . . . .	4-3
	Figure 4-1. Power Supply Block Diagram . . . . .	4-4
	Figure 4-2. Power Supply Board Schematic Diagram (994158 Rev. K) . . . . .	4-5
	Figure 4-3. Power Supply Board Component Locations (738223 Rev. G) . . . . .	4-7
	Table 4-2. Power Supply Board Parts List (001-00410 Rev. V) . . . . .	4-8
4.2	Reference/Control Board . . . . .	4-11
4.2.1	Inter-connections . . . . .	4-11
	Table 4-3. Reference/Control Board Interconnects . . . . .	4-11
4.2.2	Test Procedures . . . . .	4-12
	Figure 4-4. Reference/Control Board Block Diagram . . . . .	4-14
	Figure 4-5. Reference/Control Board Schematic Diagram (994487 Rev. A) . . . . .	4-15
	Figure 4-6. Reference/Control Board Component Locations (738341 Rev. A) . . . . .	4-17
	Table 4-4. Reference/Control Board Parts List (001-00206 Rev. A) . . . . .	4-18
4.3	Synthesizer Board . . . . .	4-22
4.3.1	Inter-connections . . . . .	4-22
	Table 4-5. Synthesizer Board Interconnects . . . . .	4-22
4.3.2	Test Procedures . . . . .	4-23
	Figure 4-7. Synthesizer Board Block Diagram . . . . .	4-26
	Figure 4-8. Synthesizer Board Schematic Diagram (994304 Rev. B) . . . . .	4-27
	Figure 4-9. Synthesizer Board Component Locations (738351 Rev. F) . . . . .	4-29
	Table 4-6. Synthesizer Board Parts List (001-00901 Rev. M) . . . . .	4-30
4.4	VSWR Detector Board . . . . .	4-39
	Figure 4-10. VSWR Detector Board Block Diagram . . . . .	4-39
	Figure 4-11. VSWR Detector Board Schematic Diagram (994240 Rev. C) . . . . .	4-41
	Figure 4-12. VSWR Detector Board Component Locations (738293 Rev. F) . . . . .	4-43
	Table 4-7. VSWR Detector Board Parts List (001-00201 Rev. G) . . . . .	4-44
4.5	RF Filter Board . . . . .	4-45
	Figure 4-13. RF Filter Board Block Diagram . . . . .	4-46
	Figure 4-14. RF Filter Board Schematic Diagram (994139 Rev. M) . . . . .	4-47
	Figure 4-15. RF Filter Board Component Locations (738228 Rev. J) . . . . .	4-49
	Table 4-8. RF Filter Board Parts List (001-00320 Rev. T) . . . . .	4-50
4.6	RF Power Amplifier Board . . . . .	4-56
	Figure 4-16. RF Power Amplifier Board Block Diagram . . . . .	4-56
	Figure 4-17. RF Power Amplifier Board Schematic Diagram (994182 Rev. C) . . . . .	4-57
	Figure 4-18. RF Power Amplifier Board Component Locations (738254 Rev. E) . . . . .	4-59

	Table 4-9. RF Power Amplifier Board Parts List (001-00311 Rev. F) . . . . .	4-60
	Table 4-10. RF Amplifier Assembly Parts List (004-12260 Rev. K) . . . . .	4-62
4.7	75 MHz IF Board. . . . .	4-63
4.7.1	Receive Mode . . . . .	4-63
4.7.2	Transmit Mode . . . . .	4-63
4.7.3	Inter-connections . . . . .	4-64
	Table 4-11. 75 MHz IF Board Interconnections . . . . .	4-64
4.7.4	Test Procedures . . . . .	4-64
	Figure 4-19. 75 MHz IF Block Diagram. . . . .	4-66
	Figure 4-20. 75 MHz IF Board Schematic Diagram (994292 Rev. F) . . . . .	4-67
	Figure 4-21. 75 MHz IF Board Component Locations (738332 Rev. F) . . . . .	4-69
	Table 4-12. 75 MHz Board Parts List (001-00710 Rev. K). . . . .	4-70
4.8	5 MHz IF Board. . . . .	4-77
4.8.1	Receive Mode . . . . .	4-77
4.8.2	Transmit Mode . . . . .	4-77
4.8.3	Inter-connections . . . . .	4-78
	Table 4-13. 5 MHz IF Board Interconnections . . . . .	4-78
4.8.4	Test Procedures . . . . .	4-78
	Figure 4-22. 5 MHz IF Board Block Diagram . . . . .	4-80
	Figure 4-23. 5 MHz IF Board Schematic Diagram (994136 Rev. K). . . . .	4-81
	Figure 4-24. 5 MHz IF Board Component Locations (738208 Rev. J). . . . .	4-83
	Table 4-14. 5 MHz IF Board Parts List (001-00800 Rev. X) . . . . .	4-84
4.9	Audio Board. . . . .	4-94
4.9.1	Receive Mode . . . . .	4-94
4.9.2	Transmit Mode . . . . .	4-94
4.9.3	Inter-connections . . . . .	4-95
	Table 4-15. Audio Board Interconnections . . . . .	4-95
4.9.4	Test Procedures . . . . .	4-96
	Figure 4-25. Audio Board Block Diagram . . . . .	4-98
	Figure 4-26. Audio Board Schematic Diagram (994157 Rev. I) . . . . .	4-99
	Figure 4-27. Audio Board Component Locations (738211 Rev. G). . . . .	4-101
	Table 4-16. Audio Board Parts List (001-00600 Rev. R) . . . . .	4-102
4.10	Front Panel Assembly . . . . .	4-109
4.10.1	Front Panel Processor Board . . . . .	4-109
4.10.2	Keypad Board . . . . .	4-110
4.10.3	LCD/Driver Board . . . . .	4-110
	Figure 4-28. Front Panel Assembly Block Diagram . . . . .	4-111
	Table 4-17. Front Panel Interconnections to Motherboard . . . . .	4-112
	Table 4-18. Front Panel Interconnections to Display . . . . .	4-113
	Table 4-19. Front Panel Interconnection to Switch Board. . . . .	4-114
	Table 4-20. Front Panel Interconnection to Power/Volume Control. . . . .	4-114
	Table 4-21. Front Panel Interconnections to Clarifier . . . . .	4-115
	Table 4-22. Front Panel Interconnection to Microphone. . . . .	4-115
4.10.4	Switch Board . . . . .	4-115
	Figure 4-29. Front Panel Assembly Schematic Diagram (994130 Rev. P). . . . .	4-117
	Figure 4-30. Front Panel Assembly Component Locations (738207 Rev. J) . . . . .	4-119
	Table 4-23. Front Panel Assembly Parts List (001-00143 Rev. M) . . . . .	4-120
	Figure 4-31. Front Panel Switch Board Schematic Diagram (994149 Rev. A) . . . . .	4-127
	Figure 4-32. Switch Board Component Locations (738195 Rev. B) . . . . .	4-129
	Table 4-24. Switch Board Parts List (001-00110 Rev. A1). . . . .	4-130

	Figure 4-33. LCD/Driver Board Schematic Diagram (994134 Rev. A) . . . . .	4-131
	Figure 4-34. LCD/Driver Board Component Locations (738196 Rev. D) . . . . .	4-133
	Table 4-25. LCD/Driver Board Parts List (001-00121 Rev. D) . . . . .	4-134
4.11	Processor Board . . . . .	4-135
4.11.1	Micro-processor . . . . .	4-135
4.11.2	EPROM Program Storage . . . . .	4-135
4.11.3	RAM Program Storage . . . . .	4-135
4.11.4	Clock Oscillator Circuit . . . . .	4-135
4.11.5	Micro-processor Controller . . . . .	4-135
4.11.6	Memory Backup Circuit . . . . .	4-136
4.11.7	Micro-processor Control Logic . . . . .	4-136
4.11.8	DUART1 Serial Interface Chip . . . . .	4-137
4.11.9	DUART2 Serial Interface Chip . . . . .	4-137
4.11.10	DUART3 Serial Interface Chip . . . . .	4-137
4.11.11	DUART4 Serial Interface Chip . . . . .	4-137
4.11.12	Multi-Function Peripheral Chip . . . . .	4-137
4.11.13	Parallel Interface/Timer Chip . . . . .	4-138
4.11.14	Analog Converter System . . . . .	4-138
4.11.15	RS-232/422/485 Interface . . . . .	4-138
4.11.16	Miscellaneous Control Logic . . . . .	4-139
4.11.17	ATU Interface Logic . . . . .	4-139
4.11.18	Remote Interface . . . . .	4-139
4.11.19	TA/TC/SC Modem . . . . .	4-139
4.11.20	Serial Peripheral Interface (SPI) . . . . .	4-140
4.11.21	Parallel Printer . . . . .	4-140
4.11.22	Squelch Circuit . . . . .	4-140
4.11.23	Squelch Test Procedure . . . . .	4-140
	Figure 4-35. RX Audio Distribution Block Diagram . . . . .	4-141
	Figure 4-36. TX Audio Distribution Block Diagram . . . . .	4-141
4.11.24	Inter-connections . . . . .	4-142
	Table 4-26. Enable Line Description . . . . .	4-142
	Table 4-27. Parallel Printer Description . . . . .	4-143
	Table 4-28. Processor Board Interconnections . . . . .	4-144
	Figure 4-37. Main Processor Block Diagram . . . . .	4-150
	Figure 4-38. Processor Board Schematic Diagram 1 of 4 (994510 Rev. A) . . . . .	4-151
	Figure 4-39. Processor Board Schematic Diagram 2 of 4 (994510 Rev. A) . . . . .	4-153
	Figure 4-40. Processor Board Schematic Diagram 3 of 4 (994510 Rev. A) . . . . .	4-155
	Figure 4-41. Processor Board Schematic Diagram 4 of 4 (994510 Rev. A) . . . . .	4-157
	Figure 4-42. Processor Board Component Locations (738562 Rev. A) . . . . .	4-159
	Table 4-29. Processor Board Parts List (001-01101 Rev. A) . . . . .	4-161

## 5: Maintenance

5.1	Subassembly Breakdown . . . . .	5-1
5.2	Internal Layout . . . . .	5-1
5.3	Board Access . . . . .	5-2
5.3.1	Power Supply . . . . .	5-2
5.3.2	VSWR . . . . .	5-2

5.3.3	Heat Sink	5-2
	Figure 5-1. Board Locations	5-3
	Figure 5-2. Final Assembly	5-4
	Figure 5-3. Front Panel Assembly	5-5
	Figure 5-4. Rear Panel Assembly	5-6
	Table 5-1. Subassemblies	5-7
5.4	Test Equipment	5-8
5.5	Basic Performance Test	5-8
5.6	Detailed Performance Test	5-9
	Table 5-2. Detailed Performance Test Parameters	5-10
5.7	Subassembly Troubleshooting	5-11
5.7.1	Internal BITE System	5-11
	Table 5-3. BITE Line Descriptions	5-12
5.7.2	Other Diagnostics	5-13
5.8	Main Processor Troubleshooting	5-16
	Table 5-4. Troubleshooting the Processor Board	5-16
5.9	Alignment Procedures	5-18
	Table 5-5. Jumper Settings	5-18
5.9.1	Transmit ALC Adjustment	5-19
5.9.2	Master Oscillator Calibration	5-19
5.9.3	Processor Board Jumper Settings	5-19
	Table 5-6. COM2 Jumper Settings	5-20
	Table 5-7. COM1 Jumper Settings	5-21

## 6: Internal Options

6.1	Additional Channel Option (7000ACH)	6-2
	Figure 6-1. Additional Channel Jumper Placement	6-2
6.2	Automatic Link Establishment (7000ALE)	6-3
6.2.1	Installation	6-3
	Figure 6-2. ALE Jumper Placement	6-3
6.2.2	Circuit Description	6-4
6.2.3	EEPROM Program Storage	6-5
	Figure 6-3. ALE Block Diagram	6-7
	Figure 6-4. ALE Board Schematic Diagram (994166 Rev. C)	6-9
	Figure 6-5. ALE Board Component Locations (738215 Rev. A)	6-11
	Table 6-1. ALE Board Parts List (010-00200 Rev. D)	6-12
	Figure 6-6. ALE Interface Schematic Diagram (994159 Rev. A)	6-15
	Figure 6-7. ALE Interface Component Locations (738229 Rev. C)	6-17
	Table 6-2. ALE Interface Parts List (001-01301 Rev. D)	6-18
6.3	Clock Option (7000CLK)	6-19
	Figure 6-8. Clock Option Component and Jumper Placement	6-19
6.4	Data Interface Option (7000RS)	6-20
	Figure 6-9. Data Interface Component and Jumper Placement	6-20
6.5	Encryption Option (7000ENCR)	6-21
6.6	FSK Remote Control Option (7000RF)	6-21
	Figure 6-10. FSK Remote Control Jumper Placement	6-22
	Figure 6-11. FSK Remote Control Schematic Diagram (994162 Rev. C)	6-23

	Figure 6-12. FSK Remote Control Component Locations (738232 Rev. D) . . . . .	6-25
	Table 6-3. FSK Remote Control Parts List (001-01402 Rev. L) . . . . .	6-26
6.7	High-Stability Option (7000HS) . . . . .	6-34
	Figure 6-13. High Stability Schematic Diagram (994487 Rev. A) . . . . .	6-35
	Figure 6-14. High Stability Component Locations (738341 Rev. A) . . . . .	6-37
	Table 6-4. High Stability Parts List (001-01022 Rev. A) . . . . .	6-38
6.8	ISDN Remote Control Option (7000RI) . . . . .	6-42
	Figure 6-15. ISDN Remote Control Component Placement . . . . .	6-43
	Figure 6-16. ISDN Remote Control Schematic Diagram (994184 Rev. D) . . . . .	6-45
	Figure 6-17. ISDN Remote Control Component Locations (738248 Rev. E) . . . . .	6-47
	Table 6-5. ISDN Remote Control Parts List (001-01403 Rev. K) . . . . .	6-48
6.9	Narrowband CW Filter (7000CW) . . . . .	6-55
	Figure 6-18. Narrowband CW Component Placement . . . . .	6-55
6.10	Noise Blanker Option (7000NB) . . . . .	6-56
	Figure 6-19. Noise Blanker Schematic Diagram (994163 Rev. B) . . . . .	6-57
	Figure 6-20. Noise Blanker Component Locations (738233 Rev. C) . . . . .	6-59
	Table 6-6. Noise Blanker Parts List (001-01202 Rev. D2) . . . . .	6-60
6.11	Recorder Option (7000RCDR) . . . . .	6-62
	Figure 6-21. Recorder Jumper Placement . . . . .	6-62
6.12	Selcall, Transcall, TransAdapt Option (7000TC) . . . . .	6-63
	Figure 6-22. Selcall, Transcall and TransAdapt Component Placement . . . . .	6-63
6.13	Voice Enhancement Option (7000VEM) . . . . .	6-64
6.14	Wideband 1 Option (7000WB1) . . . . .	6-64
	Figure 6-23. Wideband 1 Component Placement . . . . .	6-65

## 7: System Variations

7.1	Computer Control (TW7000C) . . . . .	7-1
7.2	Extended Front Panel Control (TW7000E) . . . . .	7-1
	Figure 7-1. TW7000E Connector Transition Schematic Diagram (994187 Rev. B) . . . . .	7-3
	Figure 7-2. TW7000E Connector Transition Component Locations (738256 Rev. C) . . . . .	7-5
	Table 7-1. TW7000E Connector Transition Parts List (002-01003 Rev. F) . . . . .	7-6
7.3	Pre/Postselector (TW7000PP) . . . . .	7-7
	Figure 7-3. TW7000PP Internal Wiring Diagram . . . . .	7-8
	Figure 7-4. TW7000PP Cabling Connections . . . . .	7-9
7.4	FSK Remote Control (TW7000RF) . . . . .	7-10
7.5	ISDN Remote Control (TW7000RI) . . . . .	7-10
7.6	Receiver Only (TW7000RX) . . . . .	7-10
7.7	Transmitter Only (TW7000TX) . . . . .	7-10

# CHAPTER 1

## INTRODUCTION

### 1.1 The TW7000

The Datron World Communications Inc. (DWC) TW7000 is an advanced HF transceiver providing a complete range of both voice and data operation over the entire 1.6 to 30 MHz HF spectrum. The TW7000 uses multiple microprocessors, direct digital synthesis (DDS), and offers built-in options such as automatic link establishment (ALE), high-speed data transmission and encryption.

The TW7000 is part of an overall family of equipment offering a complete selection of accessories, including power supplies, antenna tuners, high power amplifiers, data terminal equipment, etc. DWC offers systems using the TW7000 configured in a variety of ways to solve communication requirements.



### 1.2 Transceiver Configurations

The TW7000 is offered in a fixed station package, in a rack mount version using the DWC rack mount kit, or in a number of remote and extended control configurations. The front panel of a standard TW7000 can easily be

removed for remote control up to 50 feet from the equipment. Full function, modem-based remote control heads using either FSK or ISDN signaling protocols are also available for long distance, 2-wire remote operation.

### 1.3 Internal Options

The following internal options are available in the TW7000. Chapter 6 is devoted to these options.

- 7000ACH** Additional channels. Increases operational channel capacity to 1000.
- 7000ALE** FED-STD-1045 compatible adaptive system. Provides complete 1045 capability, including link quality analysis, auto-linking, sounding, and orderwire message transmission and reception.
- 7000CLK** Internal clock keeps and displays the time and includes alarm features.
- 7000CW** Narrowband filter with 500 Hz bandwidth for CW operation.
- 7000ENCR** High-level voice encryptor uses enhanced domain transform (EDT) ciphering techniques providing long-term security.
- 7000HS** High-stability reference oscillator allows 0.1 parts per million frequency stability.
- 7000NB** Impulse-type noise blanker used in high-noise environments.
- 7000RCDR** Combines receive and transmit audio and routes them to Accessory 2.
- 7000RF** Internal modem allows remote contact from the TW7201F FSK controller.
- 7000RI** Internal modem allows remote contact from the TW7201I ISDN controller.
- 7000RS** Modem interface board configures a second serial port (RS422/485) to provide data protocol for external control of the radio through a computer. This is in addition to the standard RS232 interface.
- 7000TC** Digital selective calling system plus automatic path evaluation. Combines all functions of Transcall, Selcall, and Trans-Adapt.
- 7000VEM** DSP-based voice enhancement provides superior voice recognition and signal-quality improvement in noisy environments.

**7000WB1** Wideband data filter providing 300-3300 Hz with tailored group delay characteristics for data operation.

## 1.4 TW7000 Variations

This manual provides information necessary to operate any variation of the TW7000. Options described here may not be available on your transceiver. For more information about these variations, contact DWC. Chapter 7 is devoted to these variations.

**TW7000C** Designed for computer control. A blank front panel replaces the standard front panel.

**TW7000E** Designed for extended control use. A line driver panel replaces the standard front panel. It is used with the TW7201E control head for remote operation up to 15m (50 ft.).

**TW7000PP** Allows the addition of the TW5830 Pre/Postselector and TW5830INST installation kit for co-sited operation.

**Note:** *The TW5830 requires the TW7000 to have both the TW7000PP and the TW5830INST. The TW7000 is not field upgradeable to an TW7000PP.*

**TW7000RF** Designed for long distance remote-only use beyond 2 km. A blank front panel replaces the standard front panel. An internal modem card (7000RF) is installed. For full function FSK remote control, use with the TW7201F.

**TW7000RI** Designed for remote-only use up to 2 km. The standard front panel is replaced with a blank front panel. An internal modem card (7000RI) is installed. For full function, real time, ISDN remote control, use with the TW7201I.

**TW7000RX** Receiver only. It includes the full receiver functions of the TW7000, excluding transmit features.

**TW7000TX** Transmitter only. It includes the full transmitter functions of the TW7000, excluding receiver features.

## 1.5 Input Power Requirements

The TW7000 is powered from a nominal +12 Vdc. Good performance is achieved when the input voltage is between the range of 11V and 15.5V.

## 1.6 Antenna Requirements

The TW7000 has an output antenna impedance of 50 ohms and is used with either broadband or narrowband antennas, in conjunction with an automatic antenna tuner.

## 1.7 Accessories

The TW7000 interfaces with a variety of accessory equipment to create systems to meet the most complex of communication requirements. For more information on accessories, refer to the "Accessory Connections" section on page 2-4.

## 1.8 Technical Specifications

**Note:** *Specifications are subject to change without notice or obligation.*

Characteristic	Specification
Frequency Range	1.6 to 30 MHz for TX; .1 to 30 MHz for RX
Frequency Step	10 Hz, standard
Channels	256 standard, expandable to 1000
Frequency Entry	Keypad controlled
Display	Backlight alphanumeric LCD
Tuning	Up and down push buttons, programmable steps
Scanning	Multiple scan groups; selectable scan rates
Antenna Impedance	50 ohms
Frequency Stability	$\pm 0.5$ ppm $-30^{\circ}$ to $60^{\circ}\text{C}$ ; optional $\pm 0.1$ ppm
Operating Modes	USB, LSB, AME, PCS (standard), DATA, CW (optional); simplex or semi-duplex
Duty Cycle	Continuous
Input Power	+13.8 Vdc, nominal; 11 to 15.5 Vdc, operational
Input Power Protection	Reverse polarity, transient and under/over voltage
Switching Times	<12 ms. TX/RX and RX/TX <40 ms. (Frequency change)
Size (H x W x D)	4" x 13" x 17" (10.2 cm x 33 cm x 43 cm)
Weight	21 lb. (9.5 kg)
Transmitter	
Power Output	125W PEP, 100W average; three levels, programmable from front panel
Intermodulation	-32 dB, typical
Harmonics	-63 dB, typical, 2 to 30 MHz
Carrier Suppression	-50 dB, typical
Sideband Suppression	-55 dB, typical

Characteristic	Specification
VSWR Protection	Protected against antenna mismatch including open and short circuit
<b>Receiver</b>	
Frequency	100 kHz to 30 MHz
Clarifier	Digital $\pm 600$ Hz in 10 Hz steps
Receiver Protection	Can withstand +43 dBm input without damage
Sensitivity	10 dB SINAD min., for 0.5 $\mu$ V input
Image Rejection	-80 dB
IF Rejection	-80 dB
Selectivity	SSB: 300-2700 Hz at 3 dB, WB1: 300-3300, CW: 750-1250
Attenuator	+20 dB switchable
Audio	5W into 4 ohm
Fixed-level Audio	0 dBm into 600 ohm
AGC	Not more than 3 dB change in audio output for input signals from -103 to +13 dm
Squelch	Syllabic
<b>Environmental</b>	
Operating Temperature	-30° to +60°C
Storage Temperature	-40° to +70°C
Shock and Vibration	Per MIL-STD-810E

## 1.9 Referenced Manuals

- TW7000 Operator Manual (TW7000-MSOP)
- 7000ALE Radio Control Program Operator Manual (7000ALE-MSOP)
- 7000-Series Encryption Operator Manual (7000ENCR-MSOP)
- TW7201I ISDN Remote Control Head Technical Manual (TW7201I-MS)
- TW7201F FSK Remote Control Head Technical Manual (TW7201F-MS)



# CHAPTER 2

## INSTALLATION

### 2.1 Unpacking and Inspection

When unpacking the TW7000, carefully remove the equipment from its container and inspect it for any possible damage. If anything is damaged, notify DWC.

Check the equipment against the packing list. Save the original container and packing materials for storage or reshipping purposes.

### 2.2 Preinstallation Check

The TW7000 is completely aligned and tested prior to shipment. However, to insure proper functioning prior to installation, perform an operations check. For more information, refer to the "Basic Performance Test" section on page 5-8.

### 2.3 Location Considerations

The TW7000 can be deployed successfully in various locations, in a number of different configurations, depending on whether remote or extended control is used. Information in this section pertains to the main body of the TW7000, whether it is controlled locally or from a remote site.

#### 2.3.1

##### **Fixed Station**

Unless otherwise specified when ordered, the TW7000 is shipped ready for operation. It is also available for mounting in a rack, provided the appropriate rack kit is ordered.

Make sure the temperature at the location is within the specified range, and that there is adequate ventilation around the rear of the TW7000 to allow for air flow. The TW7000 uses an on-demand fan for cooling the internal heat sink during periods of prolonged transmit operation. The intake and exhaust vents for this fan are located on the rear panel. Provide sufficient space during installation for the cooling air to circulate properly.

To prevent unwanted noise, locate the TW7000 as far away as possible from electrostatic and magnetic field-generating equipment.

When attaching external cables to the TW7000, allow for sufficient slack in the cables. This prevents damage from sharp bends and ensures easy disconnection.

### 2.3.2

#### **Vehicular or Marine**

To operate the TW7000 in a particular vehicle or shipboard location, DWC offers rack, mobile and shock mount kits suitable for most installations.

## 2.4 Front Panel Connections

Two 6-pin microphone connectors on the front panel are wired in parallel and suitable for use by various audio accessories. Low-level audio accessories for use with the TW7000 include the following:

Part Number	Description
PM	Heavy-duty palm microphone
DM	Dynamic desk microphone
KEY	Morse key
EP	Headphones
EPL	Lightweight headphones

The input impedance is a nominal 150 ohm. Most dynamic, ceramic, or magnetic microphones operate satisfactorily with the TW7000. All DWC-supplied audio accessories have the correct mating connector on them. To use other low-level audio accessories, the correct mating connector can be obtained from DWC. The pin assignments for the two connectors are as follows:

Pin Number	Description
1	Ground
2	RX audio (unmuted)
3	PTT
4	TX audio
5	CW key line
6	+12 Vdc

## 2.5 Rear Panel Connections

The rear panel of the TW7000 is fabricated from aluminum sheet metal and attached to the rear panel bezel by 6 screws. The pattern of punched holes on right-side is the air intake for the internal heat sink. The left-side hole pattern is

the air exhaust. Between them are the rear panel connectors and the fuse holder. Behind the panel is an input power protection circuit board. Ribbon cables connect the rear panel to the motherboard.

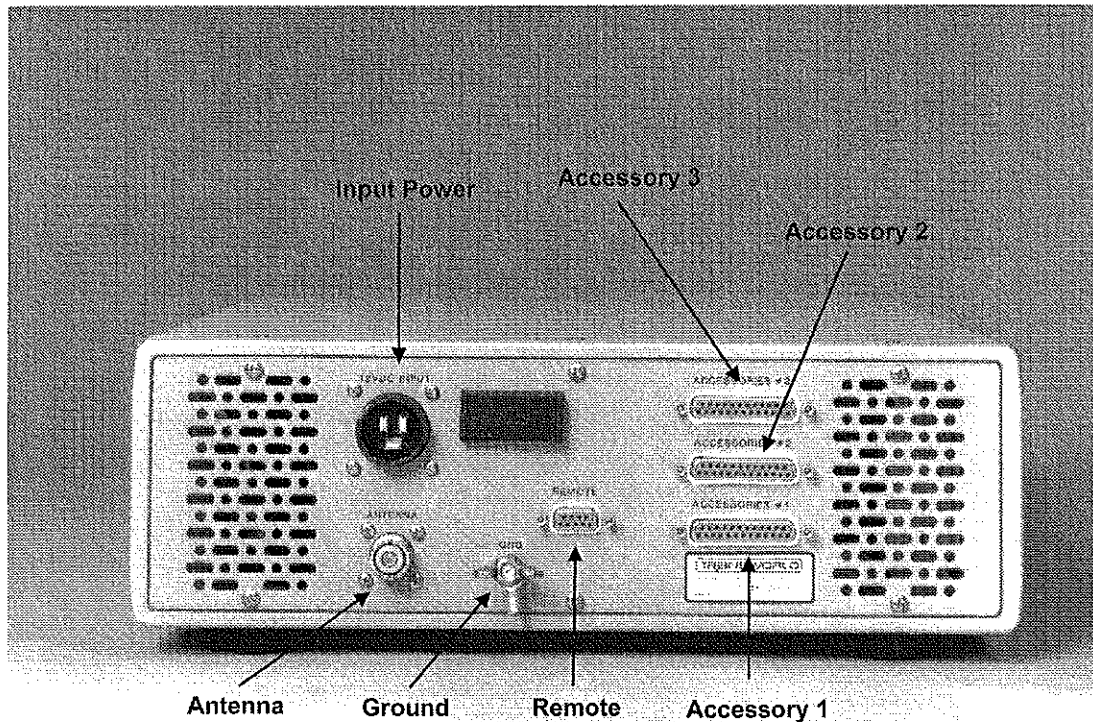


Figure 2-1. TW7000 Rear Panel

### 2.5.1 Power to the TW7000

Input power is nominally 13.8 Vdc, with a maximum current requirement of approximately 25A. The recommended operational voltage range of the TW7000 is 11 to 15.5 Vdc. The **12VDC INPUT** connector on the rear panel is a 2 pin 25A circular receptacle having a square mounting flange with 2 male pins. The mating plug is attached to the input DC power cable (C991829) supplied with the TW7000. This cable has two 12 AWG conductors, is 6.5 ft. long, and open-ended for convenient connection to a variety of +12 Vdc sources. For specific connections, refer to the "Power Cabling Accessories" figure on page 2-12.

The pin assignments for the input power connector are as follows:

Pin Number	Description
1	12 Vdc return (ground)
2	12 Vdc

The DC power connection between the TW7000 and its power source should be as short as possible. If a DWC power cable is not available, use a 14 AWG cable for runs up to 3 feet, a 12 AWG cable for runs to 9 feet, or a 10 AWG cable for longer runs.

Three DC power supplies, available from DWC, are recommended for use with the TW7000 when a +12 Vdc primary power source is not available.

**PS7000:** Voice duty cycle supply. Operates from either 110 or 220 VAC (strappable), 50/60 Hz, and designed for non-continuous duty operation. Connects to the TW7000 using cable C991829.

**PF7000:** Heavy duty FSK power supply permits continuous duty operation. Runs off 110/220 VAC, 50/60 Hz, with universal input. It requires a C991879 cable.

**PF3000:** Heavy duty power supply permits continuous duty operation. Runs off 110/220 VAC, 50/60 Hz, with switchable input range. Requires a C991829 cable.

The fuse holder (pin 346877) on the rear panel contains a 25A, 3-AG fuse, and a spare fuse of the same value.

### 2.5.2 Antenna Connection

The TW7000 is designed to work into a 50 ohm RF impedance. The output RF antenna connector is a type N connector. Broadband antennas and dipoles can be connected directly to this output, while high-power amplifiers and antenna tuners use specially-designed DWC cables. For specific connections, refer to the "RF Cabling Accessories" figure on page 2-13.

### 2.5.3 Accessory Connections

A variety of external accessories are available from DWC for use with the TW7000. For some of these accessories and their control cabling, refer to the "Control Cabling Accessories" figure on page 2-14. For more information on any individual accessory, refer to the manual for that piece of equipment.

There are three accessory connectors on the rear panel, each with different pin assignments. If multiple accessories are required that share one or more of the accessory connectors, an external accessory combiner box (TW7000IOX) can be attached to any of these connectors. Each of the three connectors on the rear panel is a D-Submini socket with 25 pins. For the location of these connectors, refer to the "TW7000 Rear Panel" figure on page 2-3.

**Table 2-1. Pinouts for Accessory Connector 1**

Pin Number	Description
1	Ground
2	COM1RXD (RX data)
3	COM1CTS (clear to send)
4	COM1TXD (TX data)
5	COM1RTS (ready to send)
6	BALRXA1 (balanced RX audio)
7	BALRXA2 (balanced RX audio)
8	BALTXA1 (balanced RX audio)
9	BALTXA2 (balanced RX audio)
10	AUXPTT\
11	Select
12	Busy
13	+12V ACC
14	EXTCWKEY (external CW key)
15	Strobe
16	Data 0
17	Data 1
18	Data 2
19	Data 3
20	Data 4
21	Data 5
22	Data 6
23	Data 7
24	ACK (acknowledge)
25	DI/OSEL

**Table 2-2. Pinouts for Accessory Connector 2**

Pin Number	Description
1	Ground
2	Ground
3	PWRON\
4	ATUINIT (tune initiate)
5	ATUKEY\ (tuner key line)
6	BALRXA3 (balanced RX audio)
7	BALRXA4 (balanced RX audio)
8	BALTXA3 (balanced TX audio)
9	BALTXA4 (balanced TX audio)
10	AUXPTT
11	COM2RXD COM2 (RX data)
12	COM2TXD COM2 (TX data)
13	+12V ACC
14	EXTCWKEY (external CW key)
15	Spare
16	ACHKTUNE (tuner check tune)
17	ADATA (tuner data)
18	ACLOCK (tuner clock)
19	ASTROBE (tuner strobe)
20	TC/SCALM (alarm)
21	RETX\ (retransmit)
22	EXTSPKR (speaker audio)
23	SQA (squelch audio)
24	+12V ACC
25	+12V ACC

**Table 2-3. Pinouts for Accessory Connector 3**

Pin Number	Description
1	Ground
2	Ground
3	FILTV
4	AMPALC (external amplifier ALC line)
5	AMPPTV (external amplifier PTT line)
6	FLTA (low-pass filter select lines)
7	FLTB (low-pass filter select lines)
8	FLTC (low-pass filter select lines)
9	FLTD (low-pass filter select lines)
10	FLTE (low-pass filter select lines)
11	FLTF (low-pass filter select lines)
12	FLTG (low-pass filter select lines)
13	+5V
14	Ground
15	Ground
16	EXTCLK (external clock)
17	EXTRXD (external RX data)
18	EXTTXD (external TX data)
19	ATURX (tuner RX data)
20	ATUTX (tuner TX data)
21	EXTEN1
22	EXTEN2
23	EXTIN1
24	+12V ACC
25	+12V ACC

#### External Encryption

The TW7000 has provision for an embedded encryption board, the 7000ENCR option. External encryption can also be used with the TW7000 and connected to Accessory 1 or Accessory 2 using the following pins:

Pin Number	Description
1	Ground
6	BALRXA3 (balanced RX audio)
7	BALRXA4 (balanced RX audio)
8	BALTXA3 (balanced TX audio)
9	BALTXA4 (balanced TX audio)
10	AUXPTT/
13	+12V ACC

Telephone Couplers

Telephone couplers like the TW5810 or TW5850 use either Accessory 1 or Accessory 2. The appropriate pins are as follows:

Pin Number	Description
1	Ground
6	BALRXA3 (balanced RX audio)
7	BALRXA4 (balanced RX audio)
8	BALTXA3 (balanced TX audio)
9	BALTXA4 (balanced TX audio)
10	AUXPTT/
13	+12V ACC

EIA Data Interface Standards

The TW7000 interfaces with a variety of data communications equipment (DCE) or data terminal equipment (DTE) using EIA standards RS232, RS422 or RS485. Accessory 1 is configured to provide the standard I/O port (COM1) for these interfaces. The RS232 protocol is standard; all others are optional. It is necessary to order the 7000RS option and to specify the required protocol so the appropriate interface chip is inserted into the processor. Pins on Accessory 1 are:

Pin Number	Description
1	Ground
2	COM1RXD (RS422/RS485)
3	COM1CTS (comport 1 clear-to-send)
4	COM1TXD (RS422/RS485)
5	COM1RTS (comport 1 request-to-send)

If the 7000RS option is installed, the COM1TXD and COM2RXD becomes a 2-wire bidirectional RS422/485 interface.

A 3-wire RS232 interface is also available on Accessory 2. Pins on Accessory 2 are:

Pin Number	Description
1	Ground
11	COM2RXD
12	COM2TXD

### Automatic Antenna Tuners

The TW7000 interfaces with the complete line of DWC automatic antenna tuners. This includes the older AT/RAT100 and RAT1000 as well as the newer AT/RAT7000B and RAT1000B.

The AT/RAT100, RAT1000A and RAT1000C connect to Accessory 2 using the following pins:

Pin Number	Description
1	Ground
2	Ground
4	ANUINIT (tune initiate)
5	ATUKEY
16	ACHKTUNE (tuner check tune)
17	ADATA (tuner data)
18	ACLOCK (tuner clock)
19	ASTROBE (tuner strobe)
24	+12V ACC

The AT/RAT7000 uses Accessory 3 with the following pins:

Pin Number	Description
14	Ground
15	Ground
19	ATURX (tuner RX data)
20	ATURX (tuner RX data)
24	+12V ACC
25	+12V ACC

**Data Terminal Interface** The TW7000 interfaces with its own line of data terminals or to other external units using Accessory 1. Pins on Accessory 1 are:

Pin Number	Description
1	Ground
2	COM1RXD (RS422/RS485)
4	COM1TXD (RS422/RS485)
6	BALRXA1 (balanced RX audio)
7	BALRXA2 (balanced RX audio)
8	BALTXA1 (balanced TX audio)
9	BALTXA2 (balanced TX audio)
10	AUXPTT
14	EXTCWKEY (external CW key)

**External Printers** A standard parallel printer connects to Accessory 1 to obtain a hard copy of text messages stored in the TW7000. Pins on Accessory 1 are as follows:

Pin Number	Description
1	Ground
11	Select
12	Busy
15	Strobe
16	Data 0
17	Data 1
18	Data 2
19	Data 3
20	Data 4
21	Data 5
22	Data 6
23	Data 7
24	ACK (acknowledge)

**ALE/Transcall/Selcall Alarm** The external ALE/Transcall/Selcall alarm driver is available on Accessory 2 using the following pins:

Pin Number	Description
14	EXTCWKEY
20	TC/SCALM (alarm)

### External Speaker

An external speaker attaches to the TW7000 at Accessory 2 using the following pins:

Pin Number	Description
14	EXTCWKEY
22	EXTSPKR (speaker audio)

### External High-Power Amplifiers

The TW7000 interfaces with all existing DWC high-power RF booster amplifiers using Accessory 3 with the following pins:

Pin Number	Description
1	Ground
2	Ground
3	FILTG\
4	AMPALC (external amplifier ALC line)
5	AMPPTT\
6	FLTA (low-pass filter select line)
7	FLTB (low-pass filter select line)
8	FLTC (low-pass filter select line)
9	FLTD (low-pass filter select line)
10	FLTE (low-pass filter select line)
11	FLTF (low-pass filter select line)
12	FLTG (low-pass filter select line)

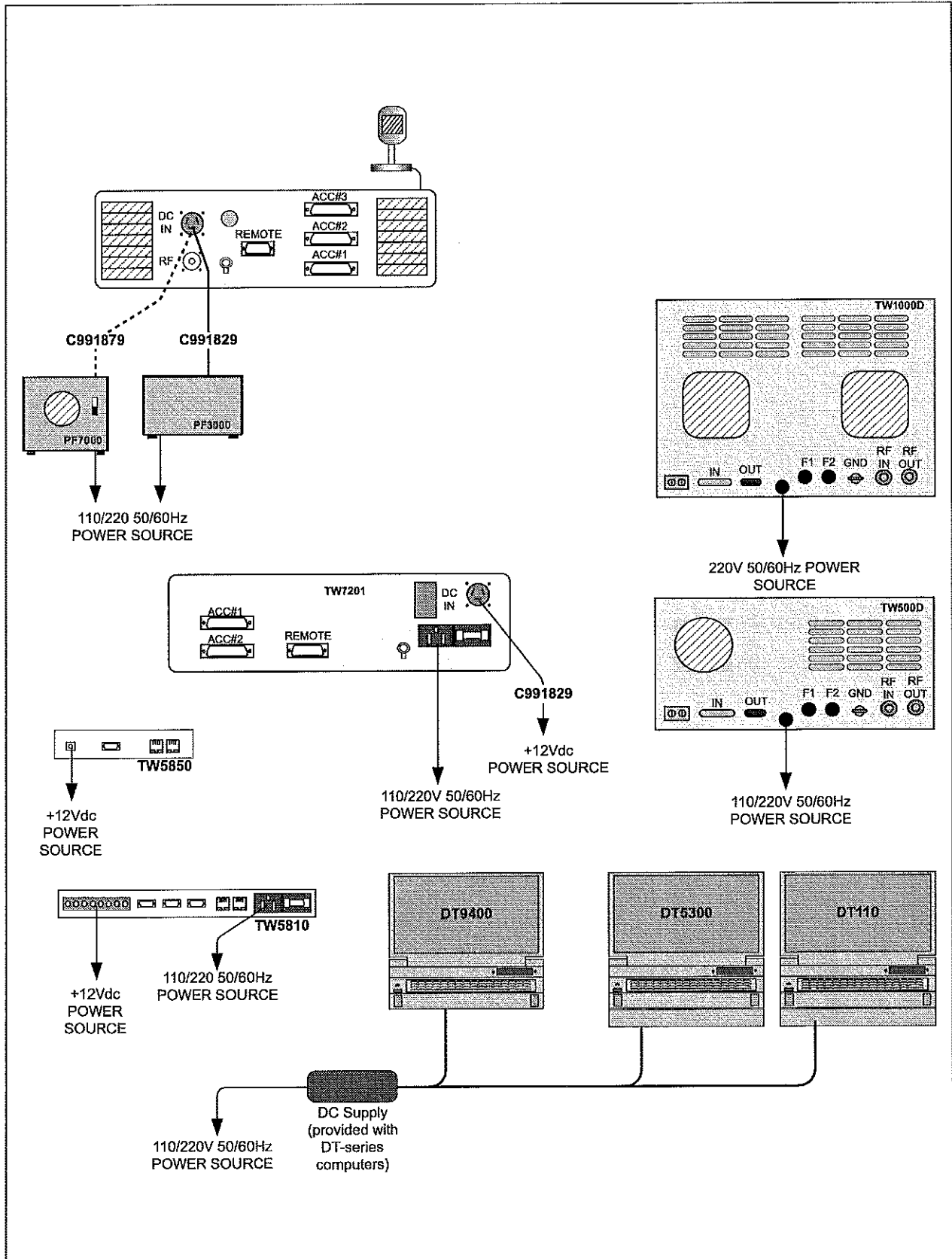


Figure 2-2. Power Cabling Accessories

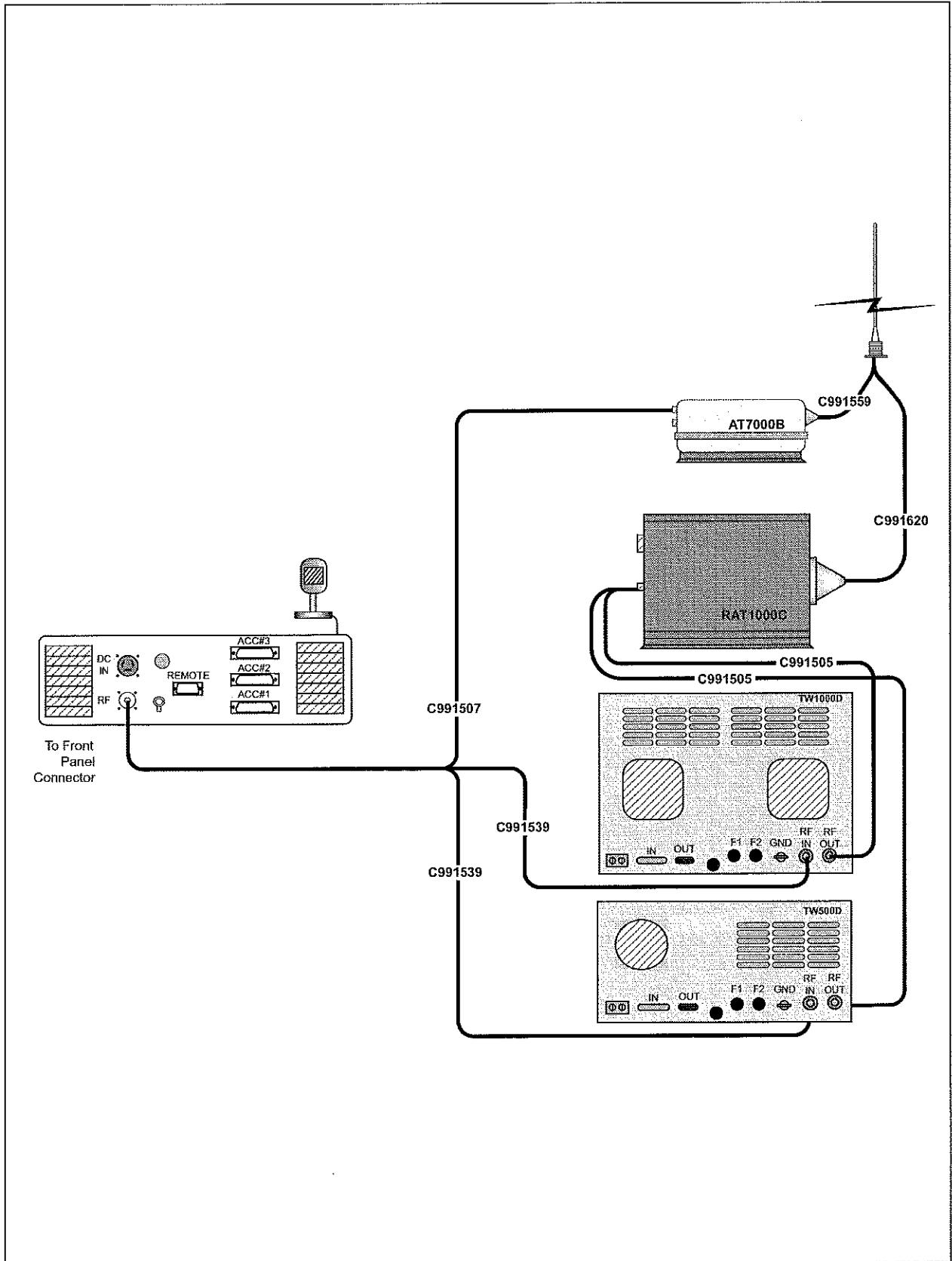


Figure 2-3. RF Cabling Accessories

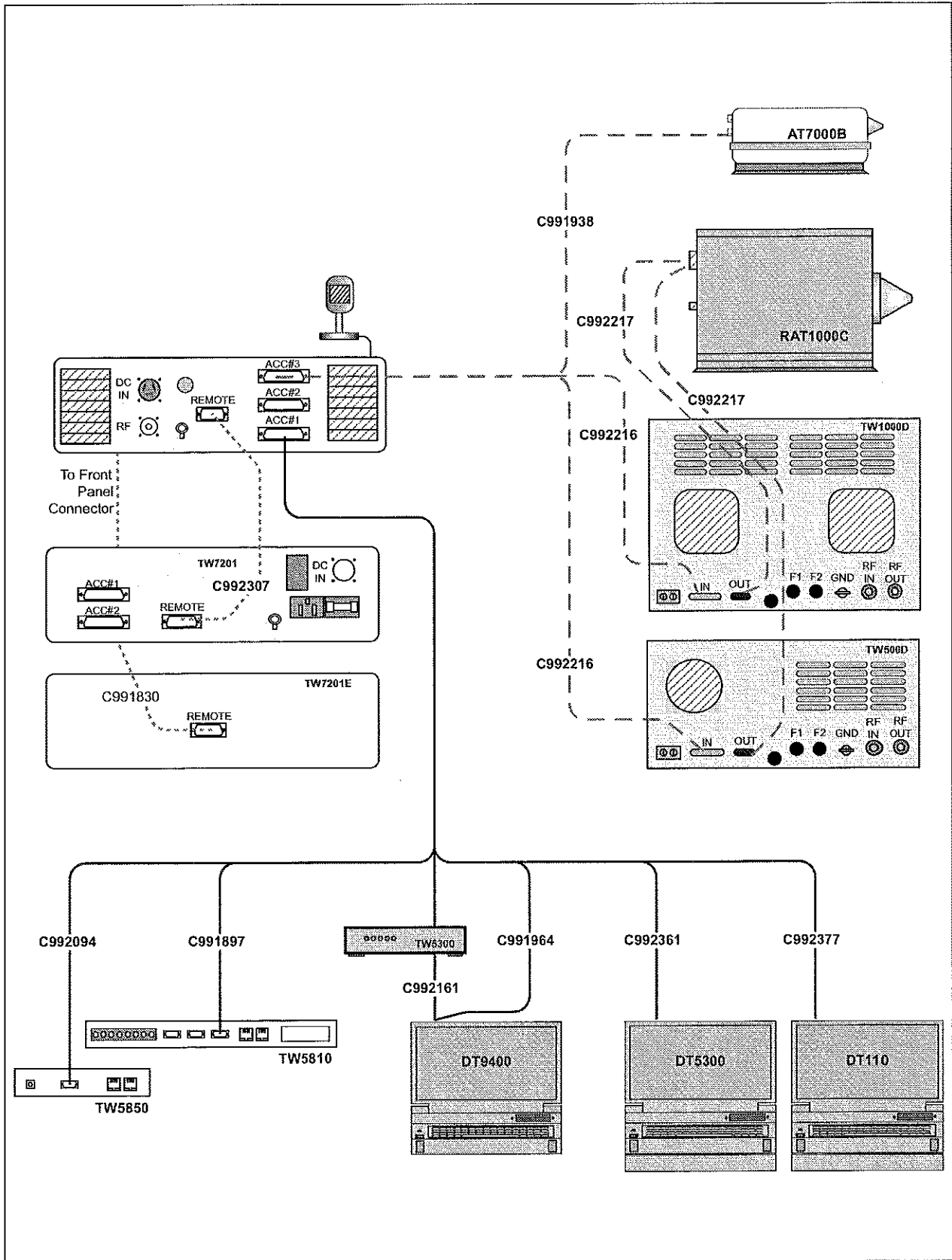


Figure 2-4. Control Cabling Accessories

**2.5.4****Remote Control**

The TW7000 can be controlled remotely using a computer, an extended front panel, or a remote control head.

**Computer Control**

You can control the TW7000 remotely from a standard computer using Accessory connectors 1 or 2 on the rear panel. A custom software program is available from DWC that runs on any PC using Windows™. For the connections to use, refer to the "EIA Data Interface Standards" section on page 2-8.

**Extended Front Panel Control**

You can remove the front panel of the TW7000 from the body of the TW7000 and replace it with a line driver panel (TW7000E) to control it remotely. This special version of the radio is used to control operations from distances up to 50 feet.

**FSK and ISDN Remote Control**

You can control the TW7000 remotely from longer distances using the TW7201F and the TW7201I remote control heads. Both control heads require that you install modem interface boards (7000RF or 7000RI) inside the TW7000. The TW7201F uses FSK and is for long-range remote requirements, while the TW7201I uses ISDN and is for real-time control up to 2 km.

These modem-based remote control units connect to the TW7000 via the remote connector on the rear panel. This connector is a circular MIL-C 10 with 9 pins.

Pin Number	Description	Remote Head
1	Ground	FSK, ISDN
2	+12V UNREG	FSK, ISDN
3	+12V ACC	
4	Spare (REMSP)	
5	ISDN1	ISDN
6	ISDN2	ISDN
7	REMRXA	FSK
8	REMTXA	FSK
9	PWRON\	FSK, ISDN

For a complete description of these pins, refer to the TW7201F FSK Remote Control Head (TW7201F-MS) technical manual or the TW7201I ISDN Remote Control Head (TW7201I-MS) technical manual.

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# CHAPTER 3

## THEORY OF OPERATION

This chapter describes the functional operation of the system from the viewpoint of power distribution, frequency generation, receive and transmit paths, and control signals. Operating principles of the individual boards and subassemblies explain functional behavior only.

### 3.1 Transceiver Boards

There are 15 boards in the TW7000: two in the front panel assembly, two in the rear panel assembly, and seven that plug directly into the motherboard. The squelch board mounts on the side of the Processor board, and the Interface Power Supply board is on the bottom rear. There are five open slots for option boards in the TW7000, one allocated for the remote control interface card, one for the ALE board, one for the Noise Blanker board, and two for option boards.

Most of the wiring between assemblies in the TW7000 is on the motherboard; there is no harnessing. Other connections between the individual boards, front and rear panel controls, and connectors, are made using a combination of coaxial cable and ribbon cable assemblies.

For more information on these boards, refer to the "System Diagram" figure on page 3-3.

### 3.2 Power Distribution

Figure 4-2 and Table 4-1 explain the power distribution in the TW7000. The TW7000 receives its primary power via the **12/28VDC INPUT** connector on the rear panel. This power is routed to the Power Supply board and enters connector J26. The PWRON line from the front panel (J21-7) activates a relay on the board, turning the TW7000 on and allowing the distribution of power to the other subassemblies. Voltages derived from the primary +12 Vdc input include the following:

Voltage	Description
+12V PA	Unregulated, unswitched, raw input power to the RF Power Amplifier board
+12V UNREG	Unregulated, switched input power to the front panel assembly and the remote control devices via the <b>REMOTE</b> rear panel connector

Voltage	Description
+12V ACC	Regulated, switched, filtered +12 Vdc provides power to all of the rear panel connectors
+12V FAN	Unregulated, switched, filtered +12 Vdc drives the optional external heat sink fan
+12V	Regulated, switched, filtered +12 Vdc provides power to all internal subassemblies in the TW7000 except the front panel
+5V	Regulated, switched, filtered +5 Vdc for the Processor board, accessory 3 connector, and the ALE option slot

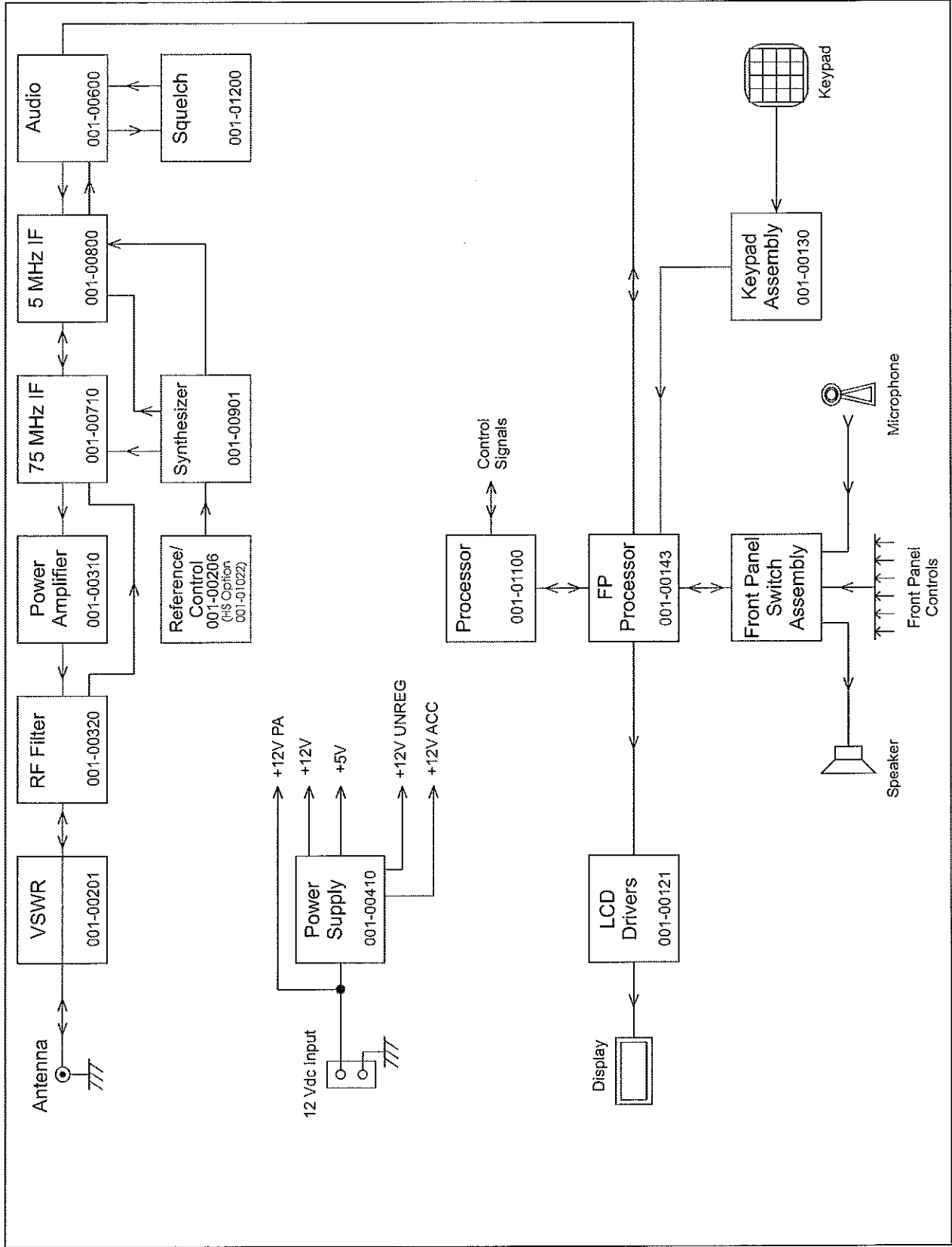


Figure 3-1. System Diagram

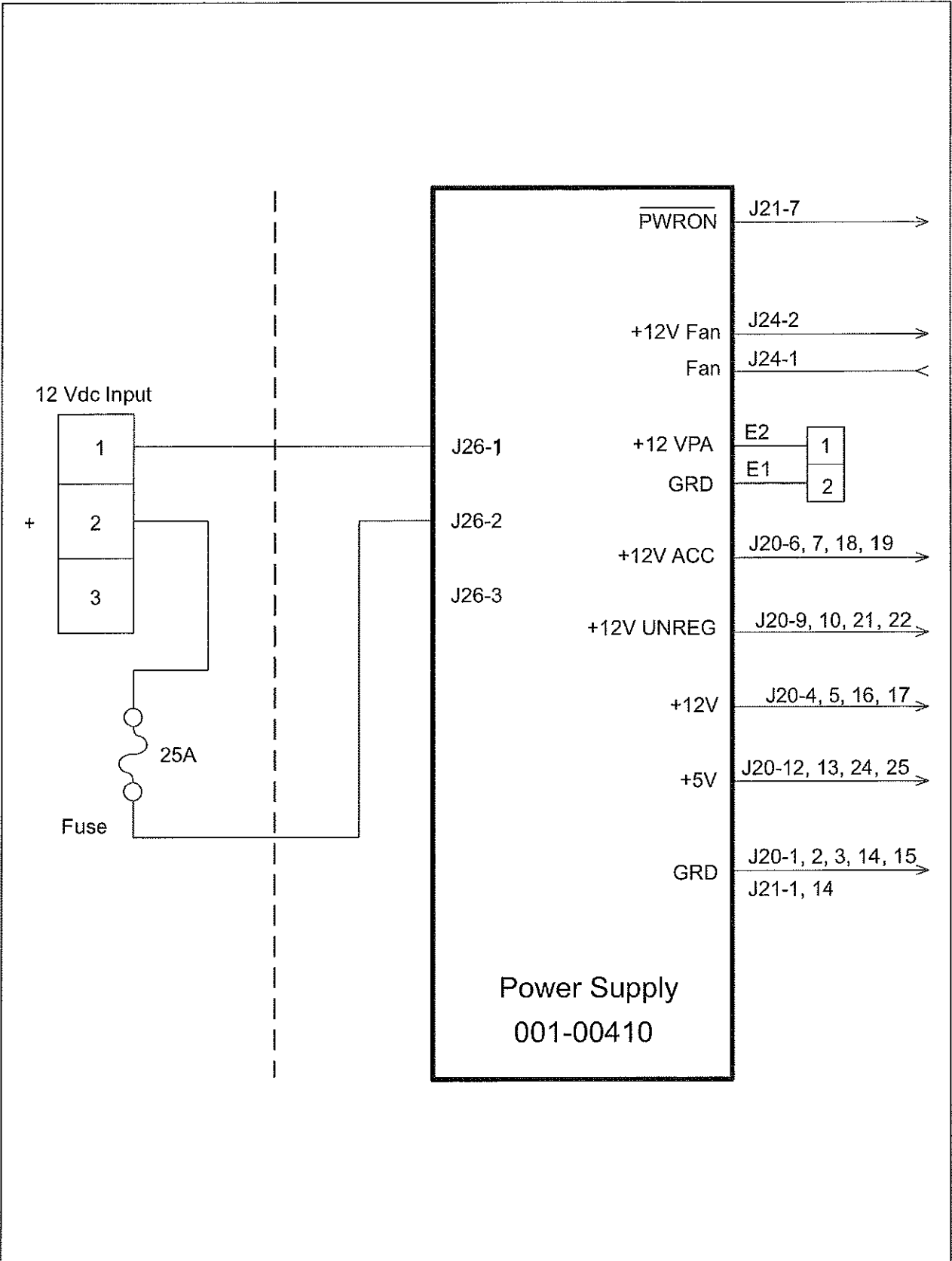


Figure 3-2. Power Distribution Diagram

**Table 3-1. Transceiver Power Distribution**

Voltage	Distribution	Connector
+12V PA	RF Power Amplifier board	
+12V ACC	Rear panel assembly	
	Remote	Pin 3
	Accessory 1	Pin 13
	Accessory 2	Pins 13, 24, 25
	Accessory 3	Pins 24, 25
+12V UNREG	Front panel assembly	J1-3, 4
	Rear panel assembly	
	Remote	Pin 2
+12V	Processor board	J14-A31, B31; J15-A31, B31
	Reference/control board	J3-2
	RF Filter board	J22-3, 4
	Synthesizer board	J4-2, 15
	75 MHz IF board	J6-2, 15
	5 MHz IF board	J5-2, 15
	Audio board	J7-2, 15
	ECU/RCU board	J11-2, 15
	ALE board	J13-2, 15
	Option slot 1	J9-2, 15
	Option slot 2	J10-2, 15
	Noise Blanker/FM board	J2-2, 15
+5V	Rear panel assembly	
	Accessory 3	Pin 13
	Processor board	J15-A29, A30, B29, B30
	ALE board	J13-6, 18
PWRON	Front panel assembly	J1-26
	Rear panel assembly	
	Remote	Pin 9
	Accessory 2	Pin 3

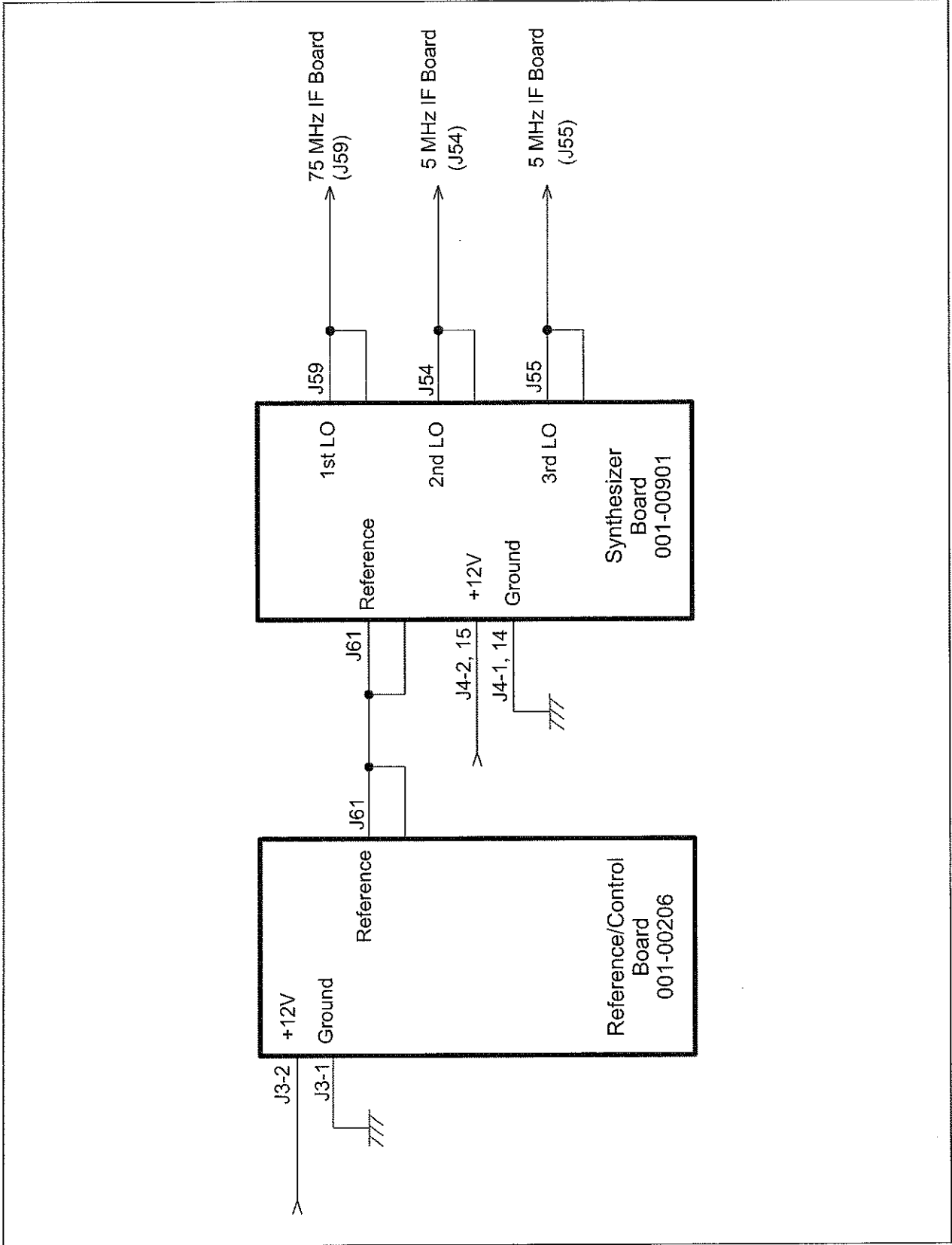


Figure 3-3. Transceiver Frequency Generation

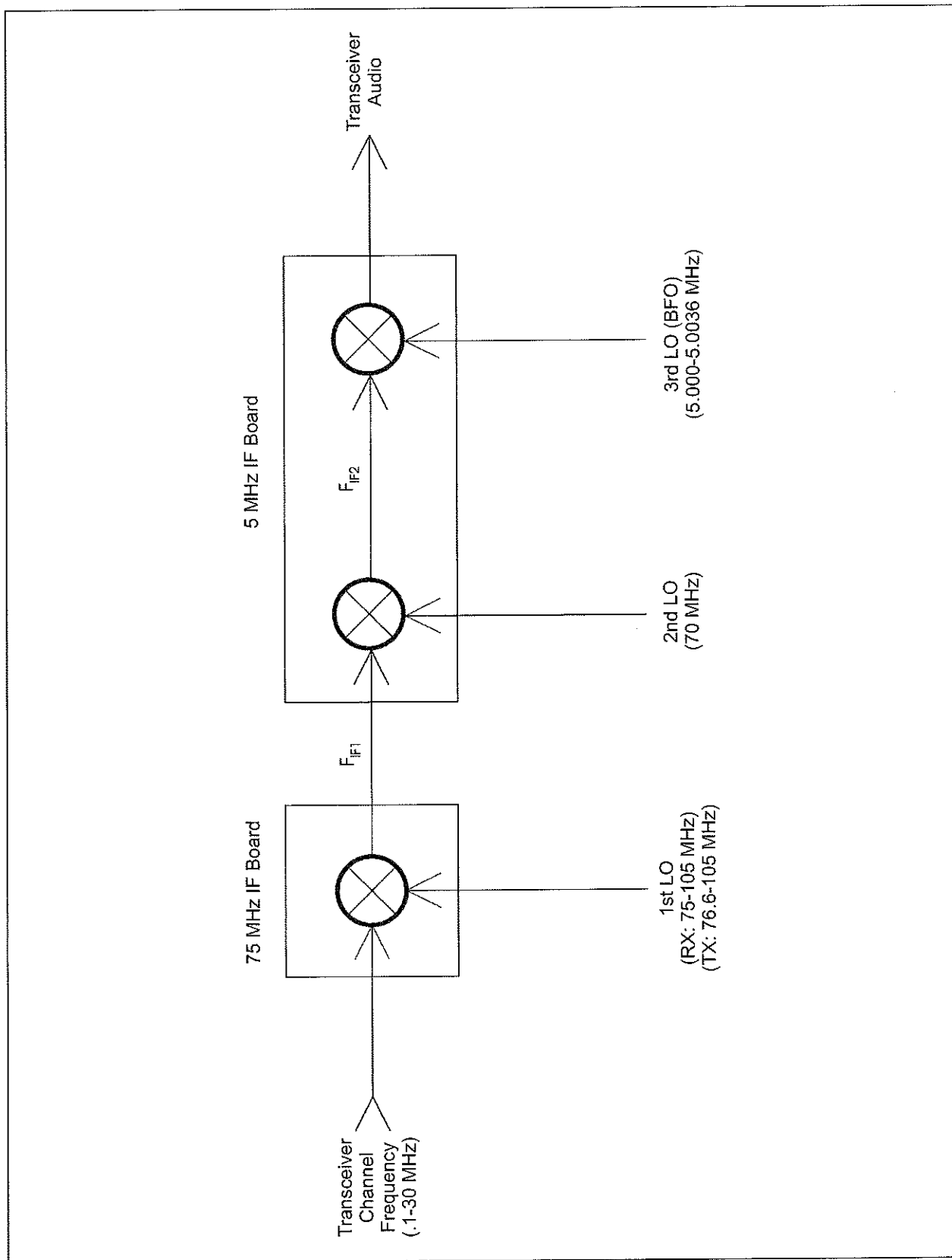


Figure 3-4. Transceiver Frequency Mixing Schematic

### 3.3 Frequency Generation

For a diagram of the boards used in frequency generation, refer to the "Transceiver Frequency Mixing Schematic" figure on page 3-7. All frequencies are tied to the reference oscillator located in the Reference/Control board. This oscillator has a frequency of 16.777216 MHz, and connects between the Reference/Control and Synthesizer boards via an internal coaxial cable (J61 on both boards). The synthesizer takes the reference frequency input and generates the three local oscillator (LO) output frequencies in the TW7000 mixing scheme. These are as follows:

Frequency	Value	Level
First LO	75.1 to 30 MHz (10 Hz steps)	0 dBm $\pm$ 2 dB (50 ohm)
Second LO	$\approx$ 70 MHz	0 dBm $\pm$ 2 dB (50 ohm)
Third LO	5.000 MHz (LSB, voice) 5.003 MHz (USB, voice) 5.0036 MHz (USB, data)	0 dBm $\pm$ 2 dB (50 ohm)

These LO frequencies result in intermediate frequencies (IF) of 75 MHz and 5 MHz. The beat frequency oscillator (BFO) has different values depending on the mode selected. This allows the use of only one sideband filter instead of the usual two (USB and LSB), giving the transceiver both modes as standard equipment. The third value of BFO (5.0036 MHz) is for USB operation when the optional wideband data filter is installed. The first LO is offset by 3 kHz in USB mode with the standard voice-grade filter, and by 3.6 kHz in USB mode with the optional data-grade filter. A few examples:

Channel frequency = 1.6 MHz, USB, voice, 1 kHz modulation	
First LO	= 75 MHz + channel frequency + 3 kHz
	= 75 MHz + 1.6 MHz + 3kHz
	= 76.603 MHz
First IF	= First LO - input frequency
	= 76.603 MHz - (1.6 MHz + 1 kHz)
	= 75.002 MHz
Second IF	= First IF - second LO
	= 75.002 MHz - 70 MHz
	= 5.002 MHz
Output Audio	= BFO - second IF
	= 5.003 MHz - 5.002 MHz
	= 1 kHz

<b>Channel frequency = 1.6 MHz, LSB, voice, 1 kHz modulation</b>	
First LO	= 75 MHz + channel frequency
	= 76.6 MHz
First IF	= 76.6 MHz - (1.6 MHz - 1 kHz)
	= 75.001 MHz
Second IF	= 75.001 MHz - 70 MHz
	= 5.001 MHz
Output Audio	= BFO - second IF
	= 5.000 MHz - 5.001 MHz
	= -1 kHz
<b>Channel frequency = 1.6 MHz, USB, data, 1 kHz modulation</b>	
First LO	= 76.6036 MHz
First IF	= 75.0026 MHz
Second IF	= 5.0026 MHz
<b>Channel frequency = 1.6 MHz, USB, data, 1 kHz modulation</b>	
Output Audio	= BFO - second IF
	= 5.0036 - 5.0026
	= 1 kHz

### 3.4 Receiver Signal Flow

For a block diagram of the receive path in the TW7000, refer to the "Transceiver Receive Path Diagram" figure on page 3-11. The receive signal (channel frequency) enters the radio via the 50 ohm antenna connector on the rear panel, passes through the VSWR board (E4), and goes to the RF Filter board at J50. In the RF Filter board, the signal is low-pass filtered before exiting and going to the 75 MHz IF board at J52.

In the 75 MHz IF board, the channel frequency is mixed with the first LO to form the first IF at 75 MHz, then filtered and amplified before going to the 5 MHz IF board at J53. The signal is mixed with the fixed 70 MHz second LO to obtain the second IF at 5 MHz, then filtered, amplified, and mixed with the third LO (BFO) to get to baseband audio.

The demodulated audio (DEMOMA) exits the 5 MHz IF at J5-21 and goes to the Audio board (J8-21). In the Audio board, audio is processed, passed through the squelch gate, and sent out as unbalanced squelched audio via J8-7 to the front panel (J1-30) to drive the speaker, or to Accessory 2 (pin T). Unbalanced squelched audio is provided at J8-6, 19 to both accessory 2 and accessory 3 (pins Z and a) connectors.

The Squelch is a syllabic squelch circuit that interfaces with the Audio board. The squelch circuit is activated via a signal from the Processor board and is controlled by the squelch on/off switch on the front panel. The receiver's automatic gain control (AGC) is generated and the threshold set in the 5 MHz IF board.

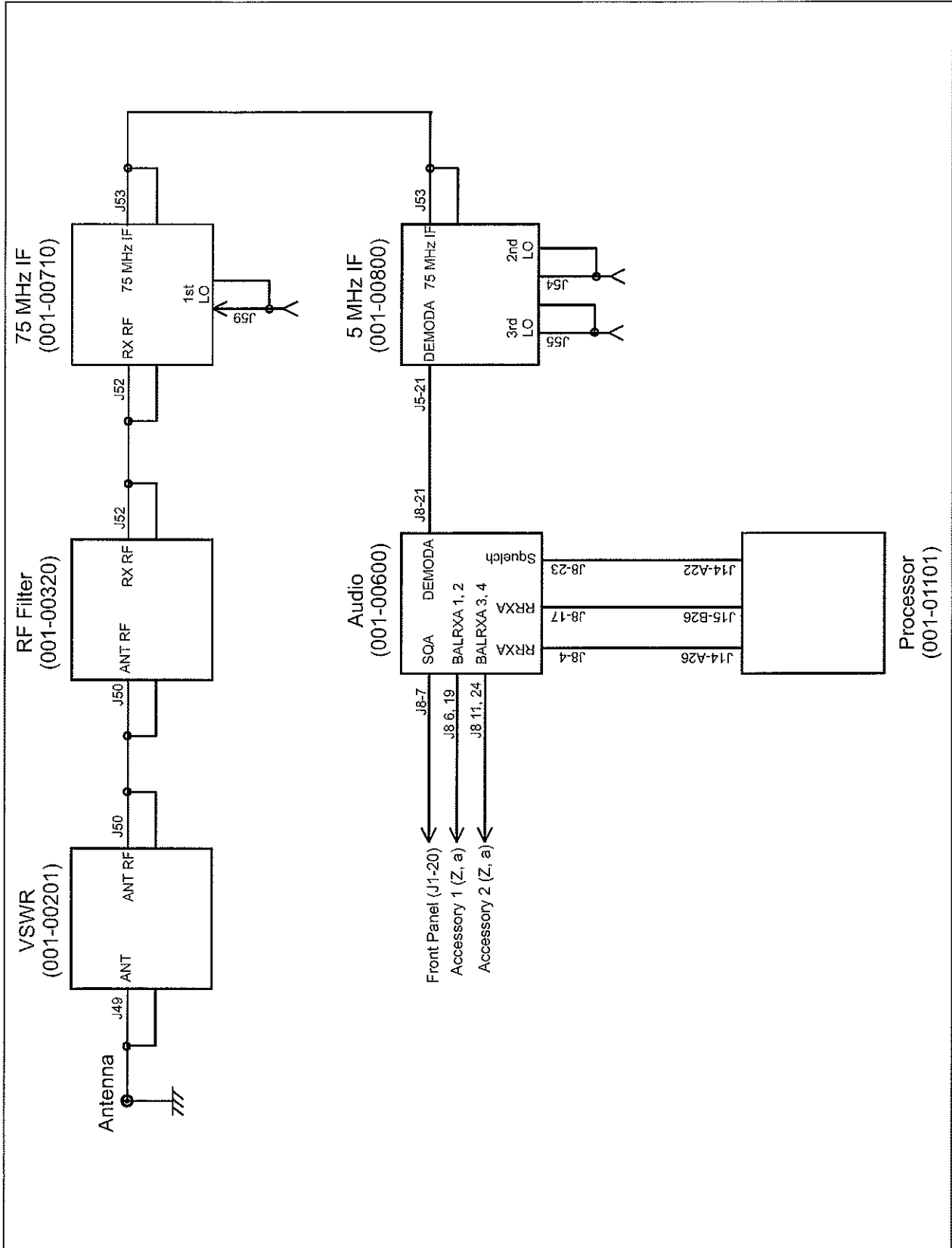


Figure 3-5. Transceiver Receive Path Diagram

### 3.5 Transmit Signal Flow

For a diagram of the transceiver transmit path, refer to the "Transceiver Transmit Path" figure on page 3-13. Primary unbalanced audio comes from the microphone connectors on the front panel (J1-25) and is routed to the Audio board at J8-20. Balanced 600 ohm audio is obtained from accessory 1 or 2 (pins 15, 17), and enters the Audio board at J8-5,18. Modulated audio (MODA) is sent to the 5 MHz IF board where it is mixed with the third LO (BFO) to form the IF at 5 MHz. It is filtered and amplified, then mixed with the second LO to form the IF at 75 MHz before routed to the 75-MHz IF board. The signal is amplified and filtered, and mixed with the first LO to form the low-level TX channel frequency RF. It is amplified again in the TX exciter circuitry before sent to the RF power amplifier.

In the power amplifier, the signal is amplified to its final output power level and routed to the RF Filter board. The RF Filter board provides the necessary harmonic filtering before the signal reaches the antenna port. Just prior to this, the signal passes through the VSWR circuit where it is sampled by a forward and reflected power detector. These RF samples are fed back to the Reference/Control board where they are processed to make up the transmitter automatic level control (ALC) circuit and VSWR measurement. The raw ALC voltage is sent back to the 75 MHz IF board where it controls the gain of the low-level exciter amplifier.

### 3.6 Receive and Transmit Path Subassemblies

Standard subassemblies in the receive/transmit path include the following:

- VSWR circuit
- RF Filter board
- RF Power Amplifier board
- 75 MHz IF board
- 5 MHz IF board
- Audio board
- Squelch board

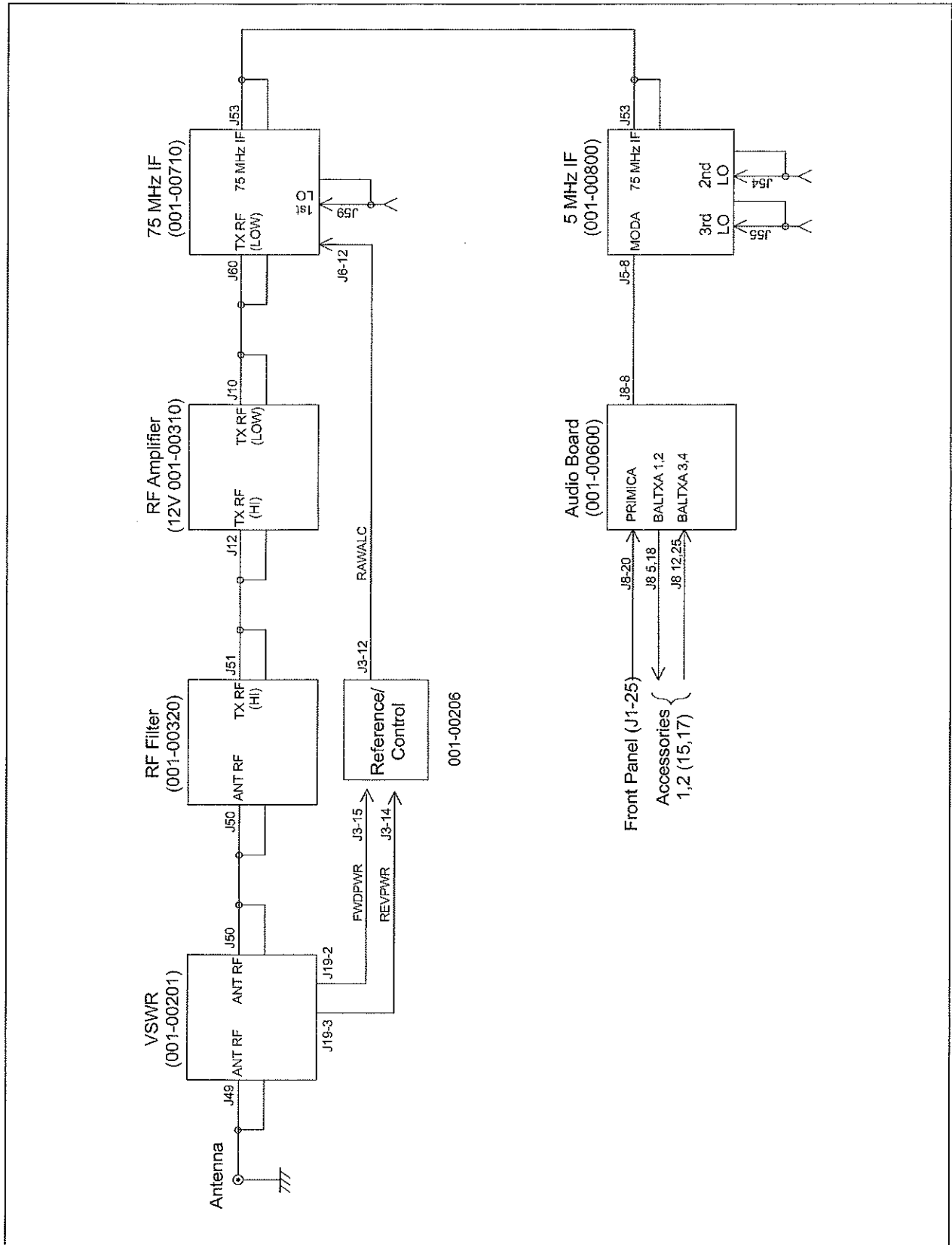


Figure 3-6. Transceiver Transmit Path

### 3.7 Transceiver Control Path

The transceiver is controlled by two microprocessors: the main controller on the Processor board, and a secondary controller in the front panel assembly. The secondary controller processes all of the commands from the front panel such as clarifier, volume, switch closures, and keypad entry. It relays them to the main processor to initiate the appropriate action in the radio. The main processor controls all radio operation and processes any commands received from the rear panel accessory connectors. For more information regarding the main processor, refer to the "Processor Board" section on page 4-135.

### 3.8 Mainframe

The mainframe schematic that follows displays all of the interconnect wiring between the front panel, rear panel, and motherboard. This schematic traces signals between assemblies. Most signal lines have arrows that help determine the direction of the signal flow.

REV	FCN	DESCRIPTION	DATE	APPR
A	7000-047	REF. BASE	01-15-93	
B	7000-093	J16-2 WAS GND	04-11-93	
C	7000-037	AMP INFC MODULE	04-12-93	
D	7000-044	KEY OPEN MODULE	04-12-93	
E	7000-070	ADDED TW/REG CONN.	08-20-93	
F	7000-099	ADD AMP SW	10-15-93	
G	7000-124	ISOLATE ADDRESS 28V	01-14-94	
H	7000-299	SPEL CN	09-10-95	
J	7000-351	DEL -5V	08-21-96	
K	94-009	IMPLCD	07-29-94	

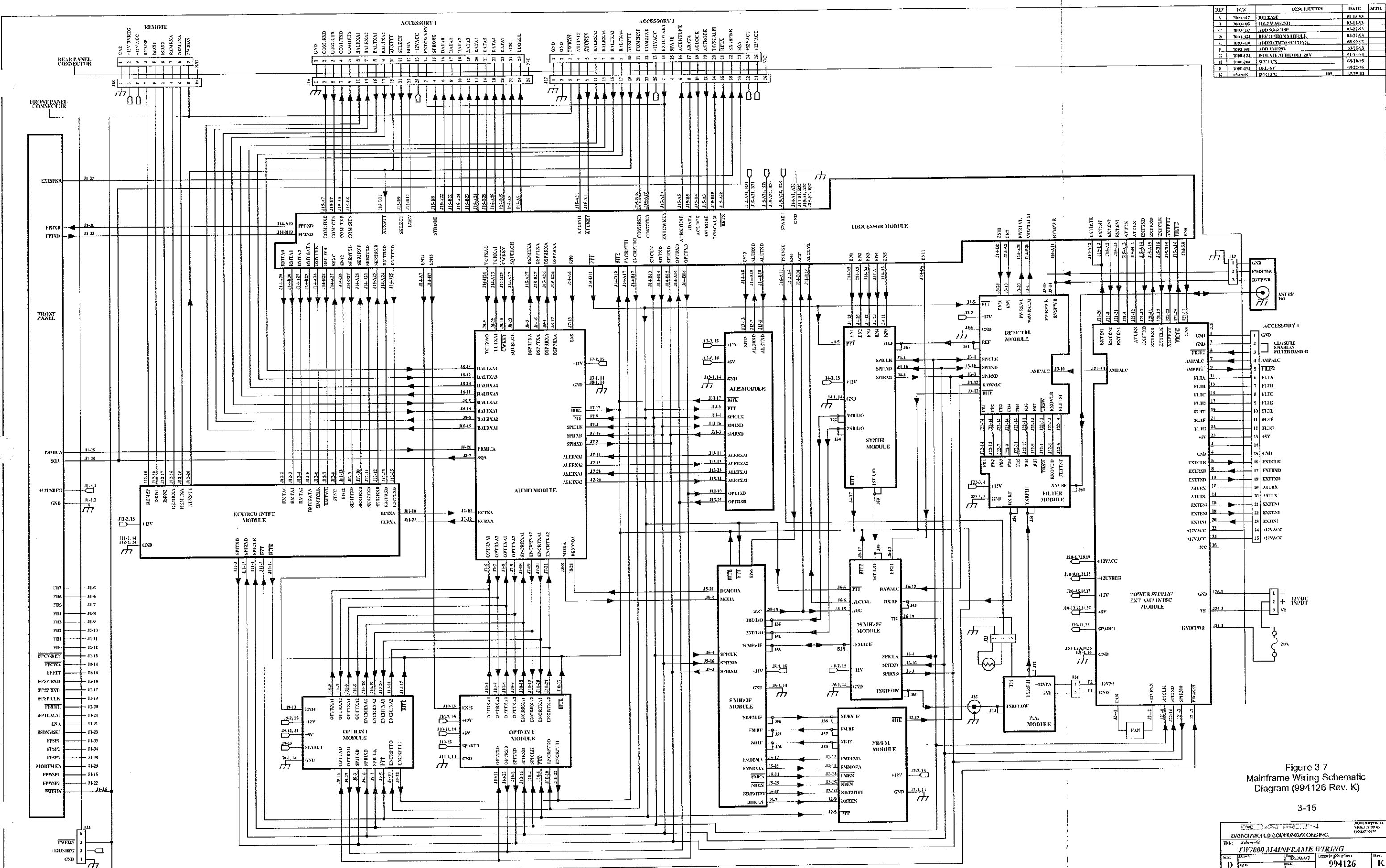
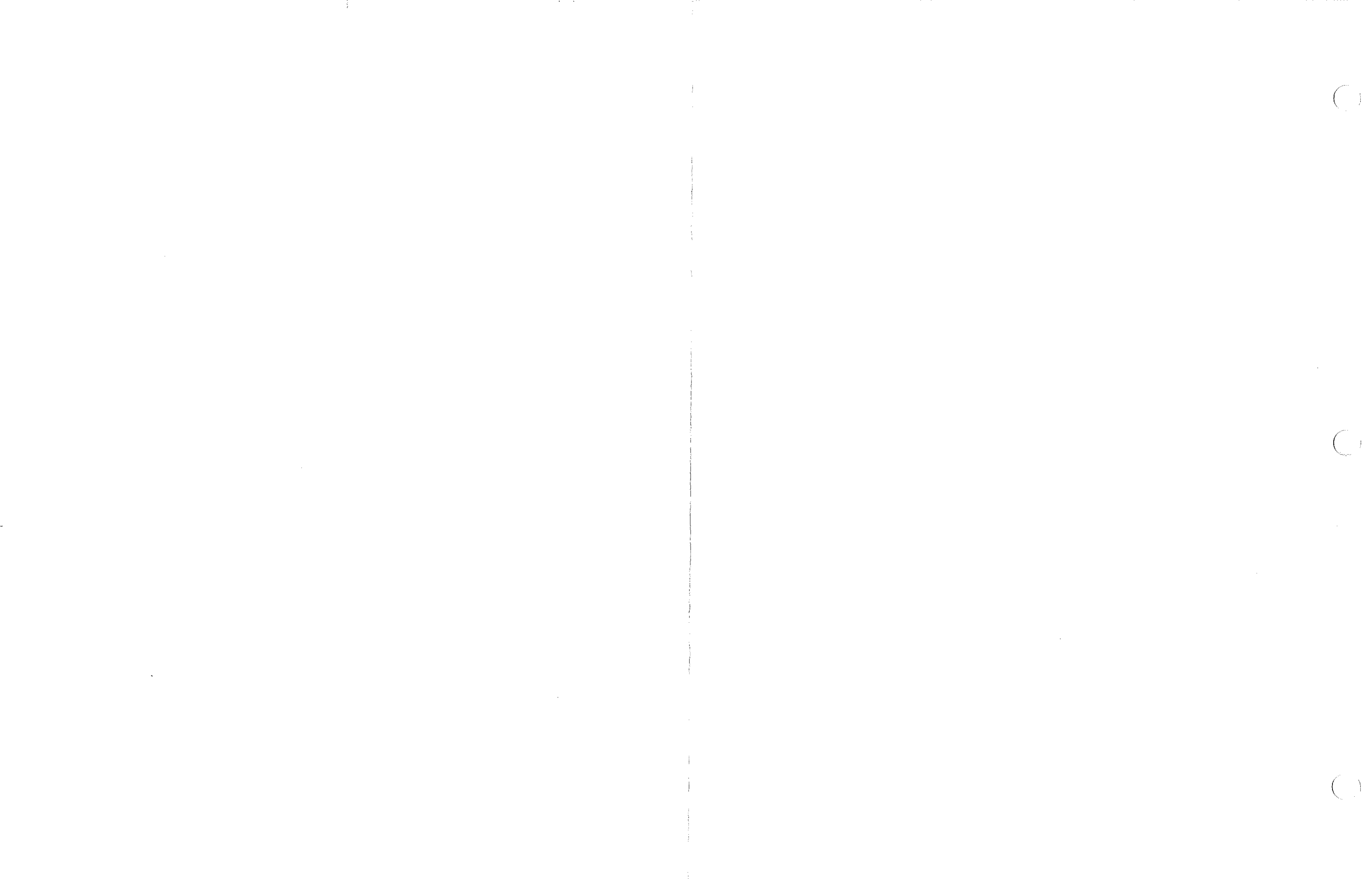


Figure 3-7  
Mainframe Wiring Schematic  
Diagram (994126 Rev. K)

Title		Schematic	
TW7000 MAINFRAME WIRING			
Doc No.	994126	Rev.	K
Date	08-29-97	Drawn/Checked	



# CHAPTER 4

## TECHNICAL DESCRIPTION

This chapter contains detailed information on each of the TW7000 boards. It should be read prior to servicing or adjusting the TW7000.

Remove a board by pulling it out of its card slot. To service it in the radio, mount it on the appropriate extender card, and replace it in the slot for servicing. The following kits are available to help service and make adjustments to these boards.

- 7000EXT extender kit
- TW7000TK tool kit

### 4.1 Power Supply Board

The Power Supply board consists of the power supply and its heat sink. The board is mounted to its heat sink and then mounted on the vertical chassis bracket located immediately behind the main heat sink, facing the inside of the rear panel. The Power Supply board is connected to the rear panel via the DC power cable which plugs into the 3-pin connector J26.

In addition to containing the regulators to generate the various DC voltages used throughout the radio, the power supply contains reverse polarity and over/under-voltage protective circuits. It has decoder and line driver circuitry that takes the serial harmonic filter band-switching data from the Processor board and translates it into parallel data for use with external high-power RF amplifiers. This information is sent via connector J25 directly to the Accessory 3 connector on the rear panel.

The TW7000 has an on-demand cooling fan controlled by a thermal sensor located on the RF Power Amplifier board heat sink. This sensor sends a signal to the processor when the heat sink temperature exceeds a predetermined level. The Processor board sends a signal on the serial data line to the BITE decoder circuit which turns on the fan.

The following table provides the interconnections between the Power Supply board and the rest of the TW7000.

**Note:** *There are several other lines that pass through this board, going between J21 (processor) and J25 (Accessory 3 on the rear panel). Table 5-1 lists only those lines that actually interface with the circuitry on the Power Supply board.*

### 4.1.1 Inter-connections

The following table provides the interconnections between the Power Supply board and the rest of the TW7000.

**Table 4-1. Power Supply Interconnections**

Connector J26	Description
1	Ground
2	12 Vdc PWR
3	VS
Connector J25	Description
1, 2, 3, 4	Ground
11	FLTA
13	FLTB
15	FLTC
17	FLTD
19	FLTE
21	FLTF
23	FLTG
Connector J20	Description
1, 2, 3, 14, 15	Ground
4, 5, 16, 17	+12V
6, 7, 18, 19	+12V ACC
9, 10, 21, 22	+12V UNREG
12, 13, 24, 25	+5V
Connector J21	Description
4	SPICLK
7	PWRON
13	EN8

### 4.1.2 Test Procedure

This test procedure requires the following equipment:

- Multimeter
- Power supply 0 to 20 Vdc minimum
- 3 Jumper cables

#### Ohm Meter Test

1. Check the following points for shorts to ground: J26-2, J20-9, J20-4, J20-6, J20-12, and J20-11 (if shorted, repair before applying power).
2. Check the following points for resistance; all readings should be 100 ohms  $\pm 5$  ohms:

J25-5 to J21-25	J25-12 to J21-22
J25-6 to J21-12	J25-14 to J21-9
J25-7 to J21-24	J25-16 to J21-21
J25-8 to J21-11	J25-18 to J21-8
J25-9 to J21-23	J25-20 to J21-20
J25-10 to J21-10	

#### Voltage Measurements

1. Apply 13.8 Vdc to the radio. Turn the radio on and check the following points for correct voltages:

J26-2, 13.8 Vdc $\pm 0.2$ Vdc	J20-6, 12.0 Vdc $\pm 0.6$ Vdc
J26-1, 13.8 Vdc $\pm 0.2$ Vdc	J20-7, 12.0 Vdc $\pm 0.6$ Vdc
J20-9, 13.8 Vdc $\pm 0.2$ Vdc	J20-18, 12.0 Vdc $\pm 0.6$ Vdc
J20-10, 13.8 Vdc $\pm 0.2$ Vdc	J20-19, 12.0 Vdc $\pm 0.6$ Vdc
J22-21, 13.8 Vdc $\pm 0.2$ Vdc	J20-22, 13.8 Vdc $\pm 0.2$ Vdc
J20-4, 12.0 Vdc $\pm 0.6$ Vdc	J20-12, 5.0 Vdc $\pm 0.25$ Vdc
J20-5, 12.0 Vdc $\pm 0.6$ Vdc	J20-13, 5.0 Vdc $\pm 0.25$ Vdc
J20-16, 12.0 Vdc $\pm 0.6$ Vdc	J20-24, 5.0 Vdc $\pm 0.25$ Vdc
J20-17, 12.0 Vdc $\pm 0.6$ Vdc	J20-25, 5.0 Vdc $\pm 0.25$ Vdc
J24-2, 13.8 Vdc $\pm 0.5$ Vdc	

2. Check the voltage protect circuit. Connect the volt meter to J20-4. 12.0 Vdc  $\pm 0.6$  Vdc should be present. Vary the power supply from 10.5 Vdc to 16 Vdc. The voltage at test point should drop to zero when the power supply is at or below 10.0 Vdc and at or above 15.8 Vdc.

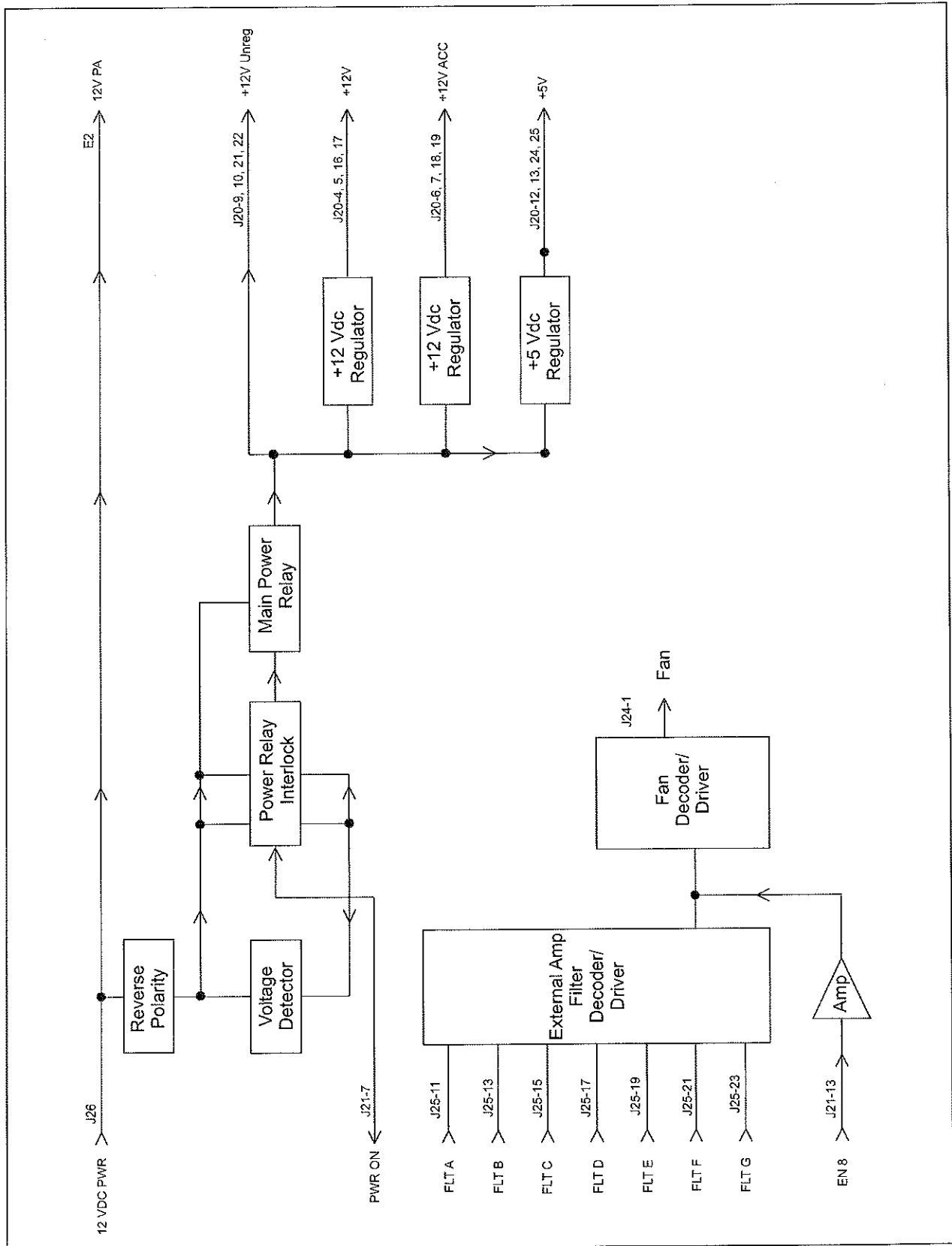
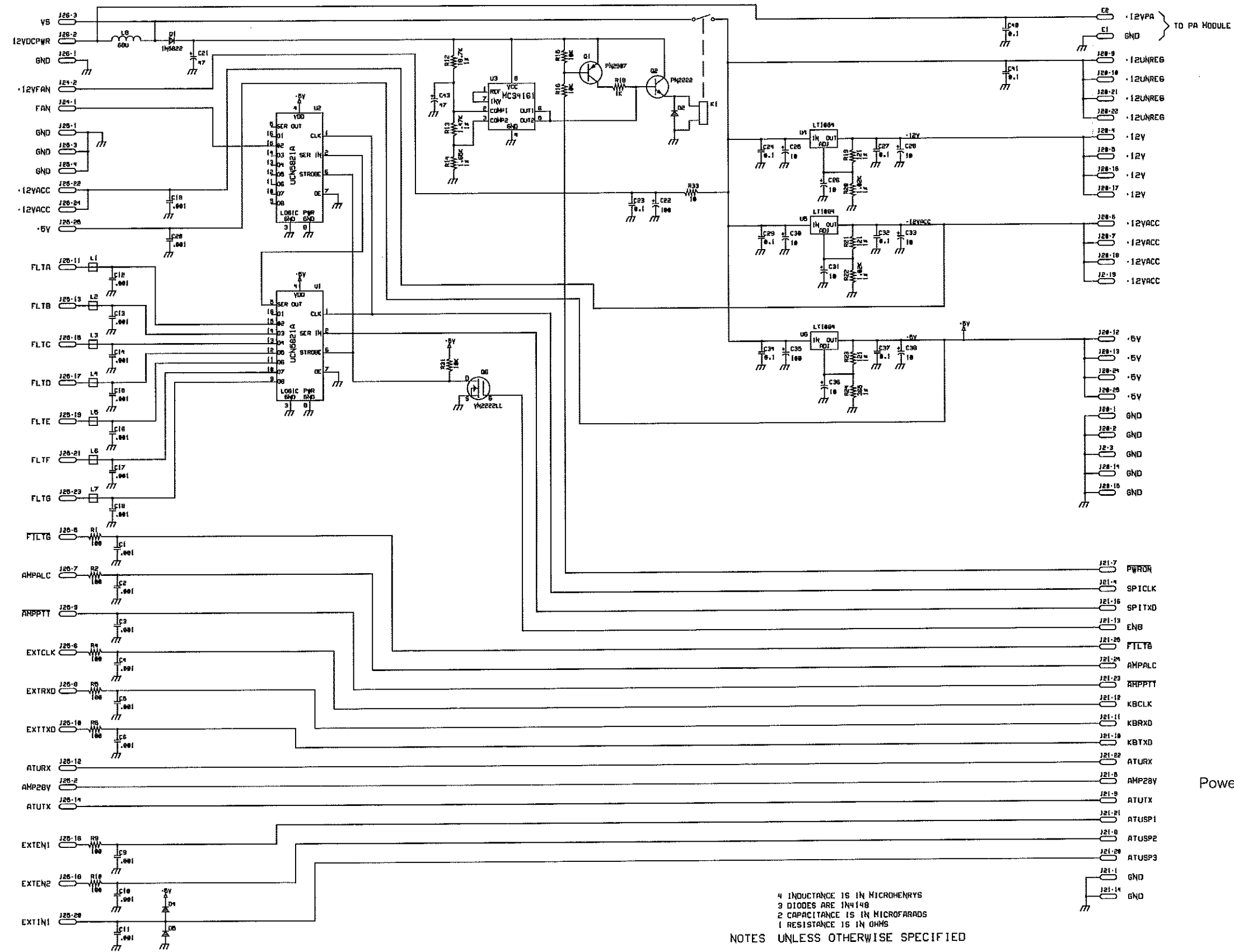


Figure 4-1. Power Supply Block Diagram

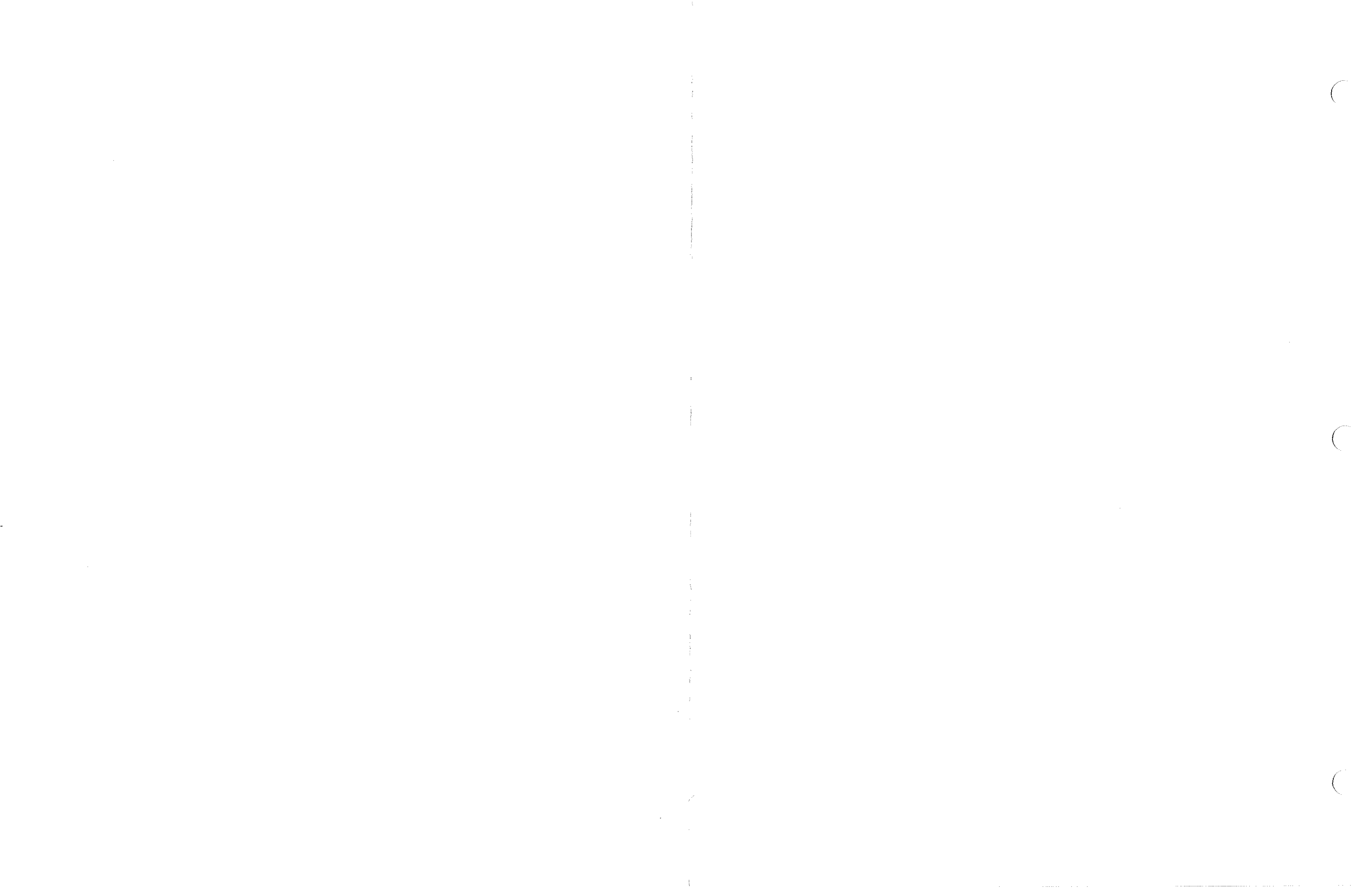
REV	ECH	DESCRIPTION	DATE	APPD
A	7800-012	PRODUCTION RELEASE	14DEC82	
B	7800-001	R23 WAS LG (100U), C22 WAS 10.	10MAY83	
C	7800-075	DEL R7,C7,R9,C8	12SEP83	
D	7800-031	DEL B1E, ADD AMP2BY	15OCT83	
E	7800-100	D1 WAS 1N4001, R18 WAS 10K, D14 WAS 1.0K, R13 WAS 1.0K.	20OCT83	
F	7800-119	DEL R3	1/18/84	
G	7800-208	SEE ECH	16AUG85	
H	7800-229	C43 WAS 10	20MAY86	
J	7800-204	REMOVED -BY DCT	08 08-22-95	
K	R17800-056	C21 WAS 100 IS 47 85	10-29-96	



4 INDUCTANCE IS IN MICROHENRYS  
 3 DIODES ARE 1N4148  
 2 CAPACITANCE IS IN MICROFARADS  
 1 RESISTANCE IS IN OHMS  
 NOTES UNLESS OTHERWISE SPECIFIED

Figure 4-2  
 Power Supply Schematic Diagram  
 (994158 Rev. K)

DATRON WORLD COMMUNICATIONS INC.			
TITLE SCHEMATIC			
POWER SUPPLY 1W7000			
SIZE	DRAWN	SHEET	REV.
D	ENR	994158	K
SCALE	20 OCT 91	SHEET 1 OF 1	



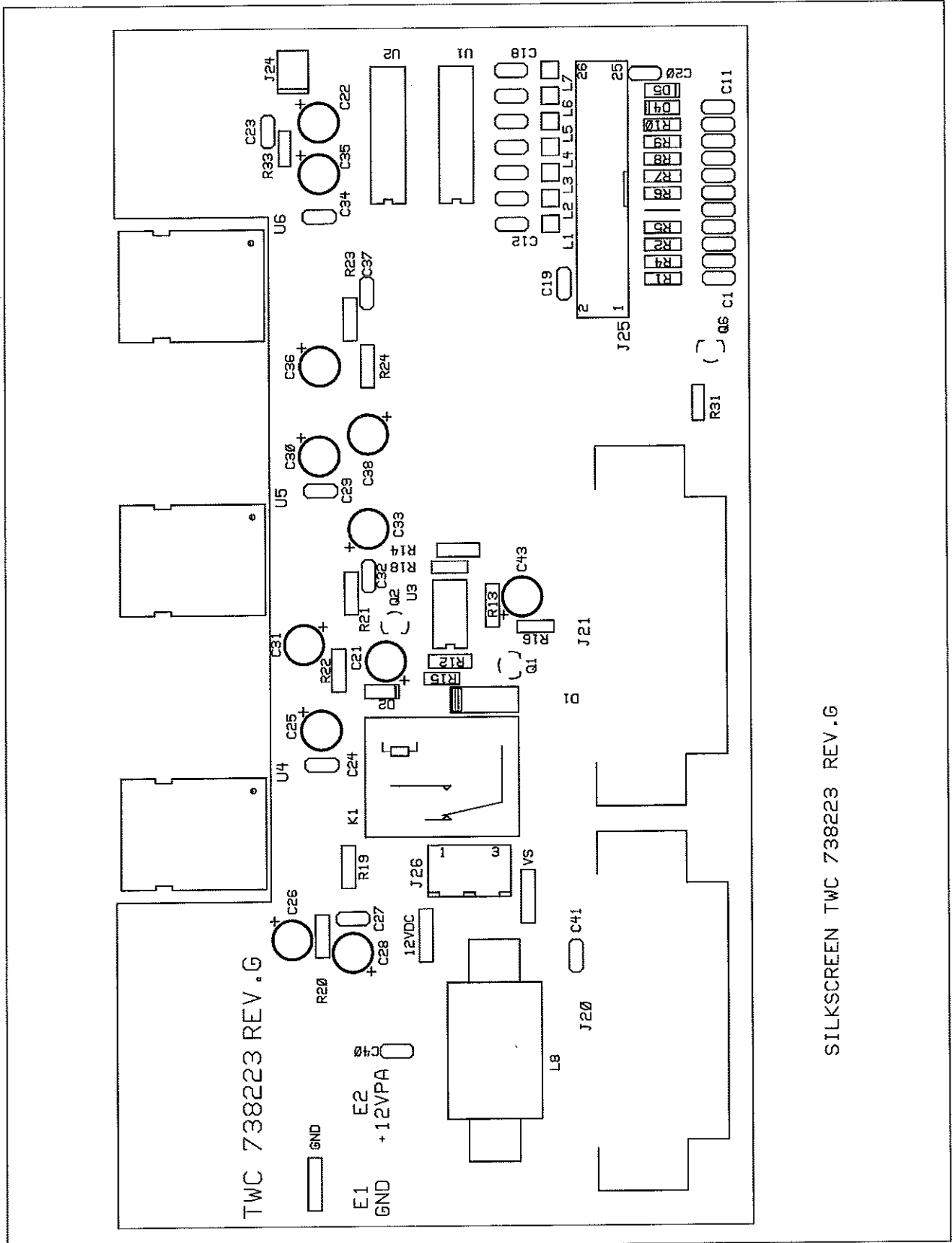


Figure 4-3. Power Supply Board Component Locations (738223 Rev. G)

Table 4-2. Power Supply Board Parts List (001-00410 Rev. V)

Designator	Part Number	Description
C1	214103	CAP,C,0.01U,50,10%,X,RA,.1SP
C10	214103	CAP,C,0.01U,50,10%,X,RA,.1SP
C11	214103	CAP,C,0.01U,50,10%,X,RA,.1SP
C12	214103	CAP,C,0.01U,50,10%,X,RA,.1SP
C13	214103	CAP,C,0.01U,50,10%,X,RA,.1SP
C14	214103	CAP,C,0.01U,50,10%,X,RA,.1SP
C15	214103	CAP,C,0.01U,50,10%,X,RA,.1SP
C16	214103	CAP,C,0.01U,50,10%,X,RA,.1SP
C17	214103	CAP,C,0.01U,50,10%,X,RA,.1SP
C18	214103	CAP,C,0.01U,50,10%,X,RA,.1SP
C19	214103	CAP,C,0.01U,50,10%,X,RA,.1SP
C2	214103	CAP,C,0.01U,50,10%,X,RA,.1SP
C20	214103	CAP,C,0.01U,50,10%,X,RA,.1SP
C21	234470	CAP,47MF 35V ELECT VRT
C22	237101	CAP,100MF 16V ELECT VRT
C23	275104	CAP,C,0.1U,50,10%,X,RA,.10SP
C24	275104	CAP,C,0.1U,50,10%,X,RA,.10SP
C25	232100	CAP,10MF 35V ELECT VRT
C26	232100	CAP,10MF 35V ELECT VRT
C27	275104	CAP,C,0.1U,50,10%,X,RA,.10SP
C28	232100	CAP,10MF 35V ELECT VRT
C29	275104	CAP,C,0.1U,50,10%,X,RA,.10SP
C3	214103	CAP,C,0.01U,50,10%,X,RA,.1SP
C30	232100	CAP,10MF 35V ELECT VRT
C31	232100	CAP,10MF 35V ELECT VRT
C32	275104	CAP,C,0.1U,50,10%,X,RA,.10SP
C33	232100	CAP,10MF 35V ELECT VRT
C34	275104	CAP,C,0.1U,50,10%,X,RA,.10SP
C35	237101	CAP,100MF 16V ELECT VRT
C36	232100	CAP,10MF 35V ELECT VRT
C37	275104	CAP,C,0.1U,50,10%,X,RA,.10SP
C38	232100	CAP,10MF 35V ELECT VRT
C4	214103	CAP,C,0.01U,50,10%,X,RA,.1SP

Table 4-2. Power Supply Board Parts List (001-00410 Rev. V)

Designator	Part Number	Description
C40	275104	CAP,C,0.1U,50,10%,X,RA,.10SP
C41	275104	CAP,C,0.1U,50,10%,X,RA,.10SP
C43	234470	CAP,47MF 35V ELECT VRT
C5	214103	CAP,C,0.01U,50,10%,X,RA,.1SP
C6	214103	CAP,C,0.01U,50,10%,X,RA,.1SP
C9	214103	CAP,C,0.01U,50,10%,X,RA,.1SP
D1	320420	DIODE,IN5822 3 AMP SCHOTTKY
D2	320002	DIODE,SI 100MA 1N4148/1N4150
D4	320002	DIODE,SI 100MA 1N4148/1N4150
D5	320002	DIODE,SI 100MA 1N4148/1N4150
E1	860008	LUG TURRET KEYSTONE 1553-2
E2	860008	LUG TURRET KEYSTONE 1553-2
J20	613163	CONN,DB-25 RT ANGLE PC PLUG
J21	613163	CONN,DB-25 RT ANGLE PC PLUG
J24	610105	HEADER,MLX,2PIN,.100,
J25	614021	HEADER,DIN,26PIN,.100,VERTICLE
J26	610209	HEADER,MLX,3PIN,.156,POLAR
K1	540079	RELAY,SPDT 12VDC 10 AMP
L1	450132	IND ASSY,3T#28 MGT 1-490201
L2	450132	IND ASSY,3T#28 MGT 1-490201
L3	450132	IND ASSY,3T#28 MGT 1-490201
L4	450132	IND ASSY,3T#28 MGT 1-490201
L5	450132	IND ASSY,3T#28 MGT 1-490201
L6	450132	IND ASSY,3T#28 MGT 1-490201
L7	450132	IND ASSY,3T#28 MGT 1-490201
L8	430048	CHOKE,68UH HEAVY DUTY HASH
Q1	310052	XISTOR,PNP,PN2907A,TO92
Q2	310057	XISTOR,NPN,PN2222A,TO92
Q6	310138	XISTOR,FET,VN2222LL,TO92
R1	113101	RES,100 OHM 1/8W 5% CF
R10	113101	RES,100 OHM 1/8W 5% CF
R12	1118701	RES, 18.7K, 1/8W, 1%
R13	1111471	RES, 1.47K, 1/8W, 1%, MF

**Table 4-2. Power Supply Board Parts List (001-00410 Rev. V)**

Designator	Part Number	Description
R14	1111651	RES, 1.65K, 1/8W, 1%, MF
R15	113103	RES,10K 1/8W 5% CARBON FILM
R16	113103	RES,10K 1/8W 5% CARBON FILM
R18	113102	RES, 1K, 1/8W, 5%, CF
R19	1111210	RES,121 1/8W 1% METAL FILM
R2	113101	RES,100 OHM 1/8W 5% CF
R20	1111021	RES,1.02K 1/8W 1%
R21	1111210	RES,121 1/8W 1% METAL FILM
R22	1111021	RES,1.02K 1/8W 1%
R23	1111210	RES,121 1/8W 1% METAL FILM
R24	1113650	RES, 365ohm, 1/8W, 1%, MF
R31	113103	RES,10K 1/8W 5% CARBON FILM
R33	113100	RES,10 OHM 1/8W 5% FILM
R4	113101	RES,100 OHM 1/8W 5% CF
R5	113101	RES,100 OHM 1/8W 5% CF
R6	113101	RES,100 OHM 1/8W 5% CF
R9	113101	RES,100 OHM 1/8W 5% CF
U1	330384	IC,UCN5821A
U2	330384	IC,UCN5821A
U3	330398	IC,MC34161P VOLTAGE MONITOR

## 4.2 Reference/Control Board

The Reference/Control board plugs into the motherboard at J3. It is located on the right side of the radio, second slot from the front.

In addition to the 16.777216-MHz reference oscillator, this board contains the transceiver ALC processing circuitry, the RF power level setting potentiometer, and the serial-to-parallel decoders that drive the harmonic filter band-switching circuits on the RF Filter board.

### 4.2.1 Inter-connections

For the interconnect lines between the Reference/Control board and the rest of the radio, refer to the table below. If the High Stability option is installed, the optional oscillator mounts to this board and is given a new part number (001-01022).

**Table 4-3. Reference/Control Board Interconnects**

Connector J3	Description	Comment
1	Ground	
2	+12V input	
3	No connection	
4	SPICLK	Clock
5	/PTT	
6	FB2	Filter band 2 control line
7	FB4	Filter band 4 control line
8	FB6	Filter band 6 control line
9	/TRSW	T/R relay control line
10	AMPALC	Input from external amplifier ALC
11	No connection	
12	RAWALC	Transceiver ALC line
13	EN7	External amplifier filter band decoder enable line
14	RVSPWR	Reflected power indicator
15	FWDPWR	Forward power indicator
16	SPITXD	Serial TX data line
17	/BITE	BITE line
18	FB1	Filter band 1 control line
19	FB3	Filter band 3 control line
20	FB5	Filter band 5 control line
21	FB7	Filter band 7 control line
22	No connection	

**Table 4-3. Reference/Control Board Interconnects**

Connector J3	Description	Comment
23	PWRLVL	RF power level status line
24	FLTST	RF Filter board status line
25	EN10	RF power level control enable

**4.2.2  
Test  
Procedures**

These test procedures require the following equipment:

- Frequency counter
- Dummy load 100W
- Wattmeter
- 250W slug
- Two-tone test box
- Extender card set

**Input/Output  
Signals**

1. Reference the signal output at J61; frequency = 16.777216 MHz Level = 2 VPP.
2. Forward power input (FWDPWR) at J3-15.
3. Reverse power input (RVSPWR) at J3-14.
4. External amplifier ALC input (AMPALC) at J3-10.
5. ALC output (RAWALC) at J3-12.
6. Power level output (PWRLVL) at J3-23.

**Adjustments  
and  
Measurements**

1. Measure the regulator voltage, U2 pin-16, +5 ±.25V, U5 output 8.0V ±.4.
2. Verify that the oscillator is stabilized.
3. Set the radio transmit frequency to 30.0 MHz and the radio mode to USB AME.
4. Key the PTT, measure the RF output of the radio and adjust the oscillator for 30.000000 MHz.
5. Verify the transmit frequency 15.0 and 2.0 MHz. The frequency error should not exceed the specification for the installed oscillator option.
6. Repeat the following adjustments to R1 and R22 until no further adjustment is required:
  - Adjust R1 (high power set) for a transmit output power of 100W average, single tone at 14.75 MHz.

- Adjust R22 (low power set) for 10W average, single tone at 14.75 MHz.
7. Remove load from the wattmeter. Key the radio in high power and adjust R29 (reverse power set) for 12W of reflected power.

Miscellaneous  
Test

1. Verify the radio low pass filter select by setting the radio to the following frequencies. The pin for the filter should be logic low with all other FB pins logic high.

Frequency	Filter	Pin
1.6 MHz	FB1	18
2.74 MHz	FB1	18
2.75 MHz	FB2	6
3.99 MHz	FB2	6
4.0 MHz	FB3	19
6.24 MHz	FB3	19
6.25 MHz	FB4	7
8.99 MHz	FB4	7
9.0 MHz	FB5	20
13.49 MHz	FB5	20
13.5 MHz	FB6	8
20.99 MHz	FB6	8
21.0 MHz	FB7	21
30.0 MHz	FB7	21

2. Key the radio at 30 MHz and ground J3-10. The power out should reduce.

Digital TX  
Power  
Adjustment

1. Key the radio in high power at 14.75 MHz.
2. Check for low power at approximately 10W, medium power at approximately 25W, and high-power at approximately 100W with Alpha 5 (refer to TW7000-MSOP) set to the default settings for each power level.

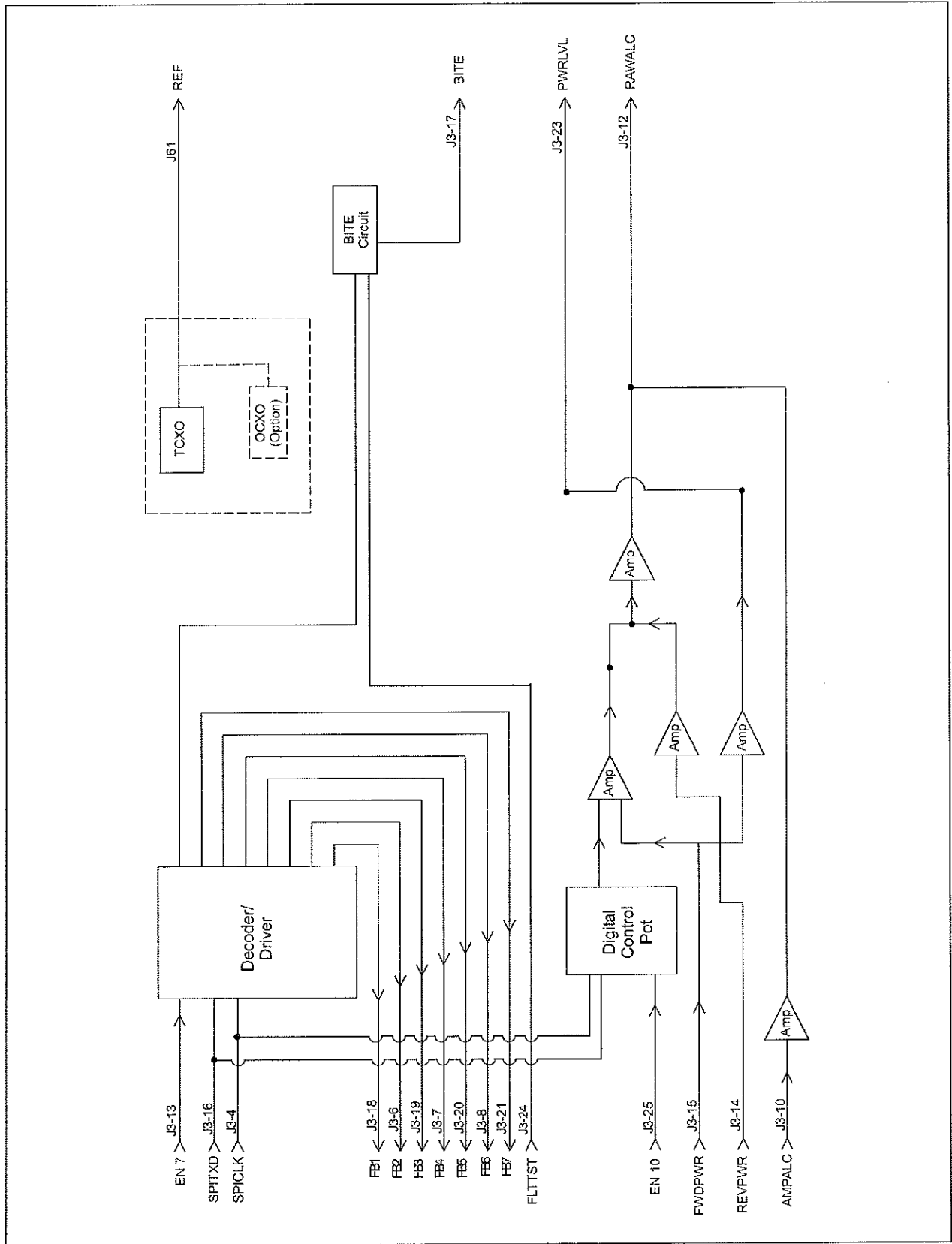


Figure 4-4. Reference/Control Board Block Diagram

REV	ECN	DESCRIPTION	DATE	APPR
A	02-0118	RELEASE	3-07-02	

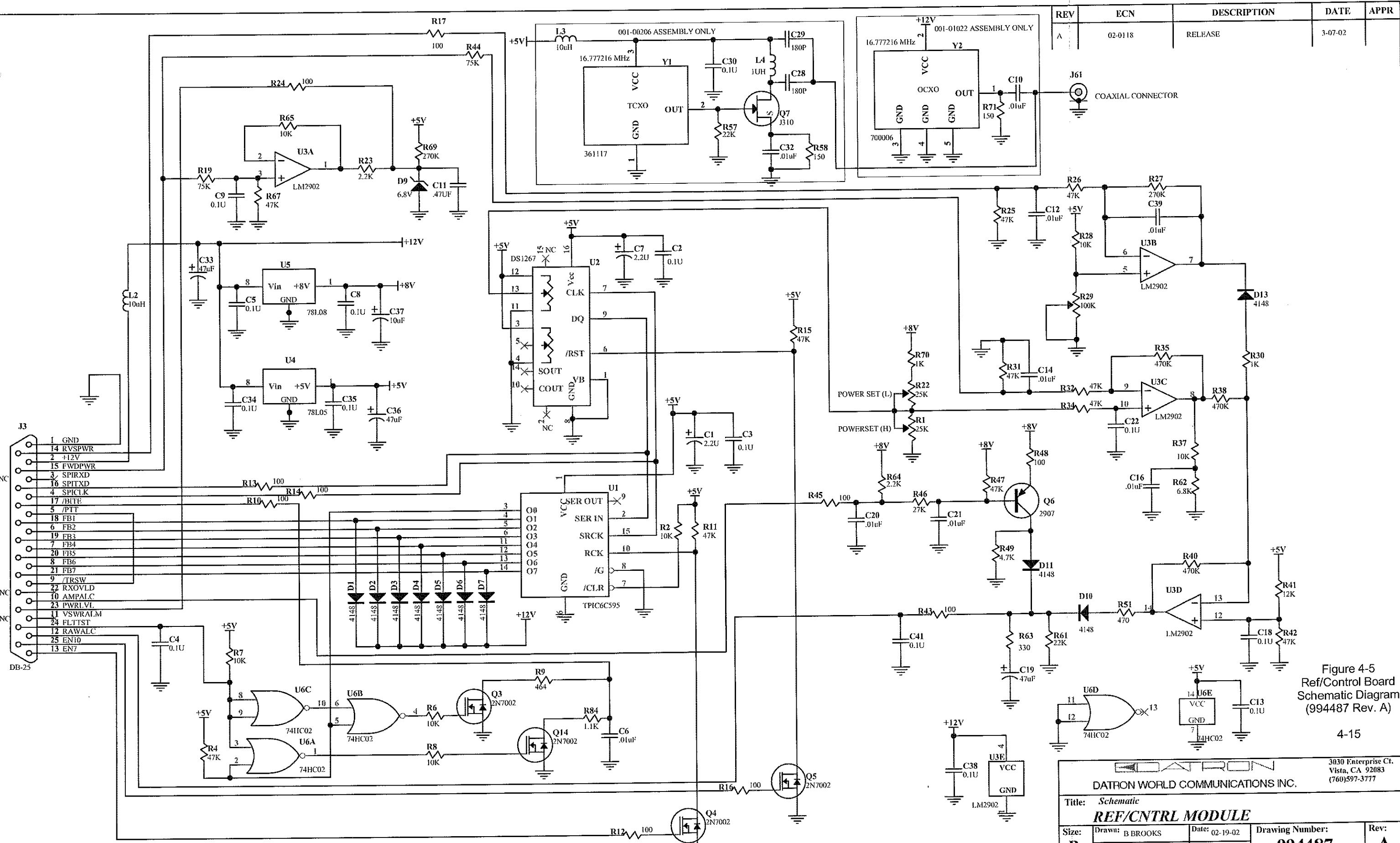


Figure 4-5  
Ref/Control Board  
Schematic Diagram  
(994487 Rev. A)

4-15

<b>DATRON WORLD COMMUNICATIONS INC.</b>				
3030 Enterprise Ct. Vista, CA 92083 (760)597-3777				
Title: Schematic				
<b>REF/CNTRL MODULE</b>				
Size: <b>B</b>	Drawn: B BROOKS	Date: 02-19-02	Drawing Number: <b>994487</b>	Rev: <b>A</b>
Appr:		Date:		



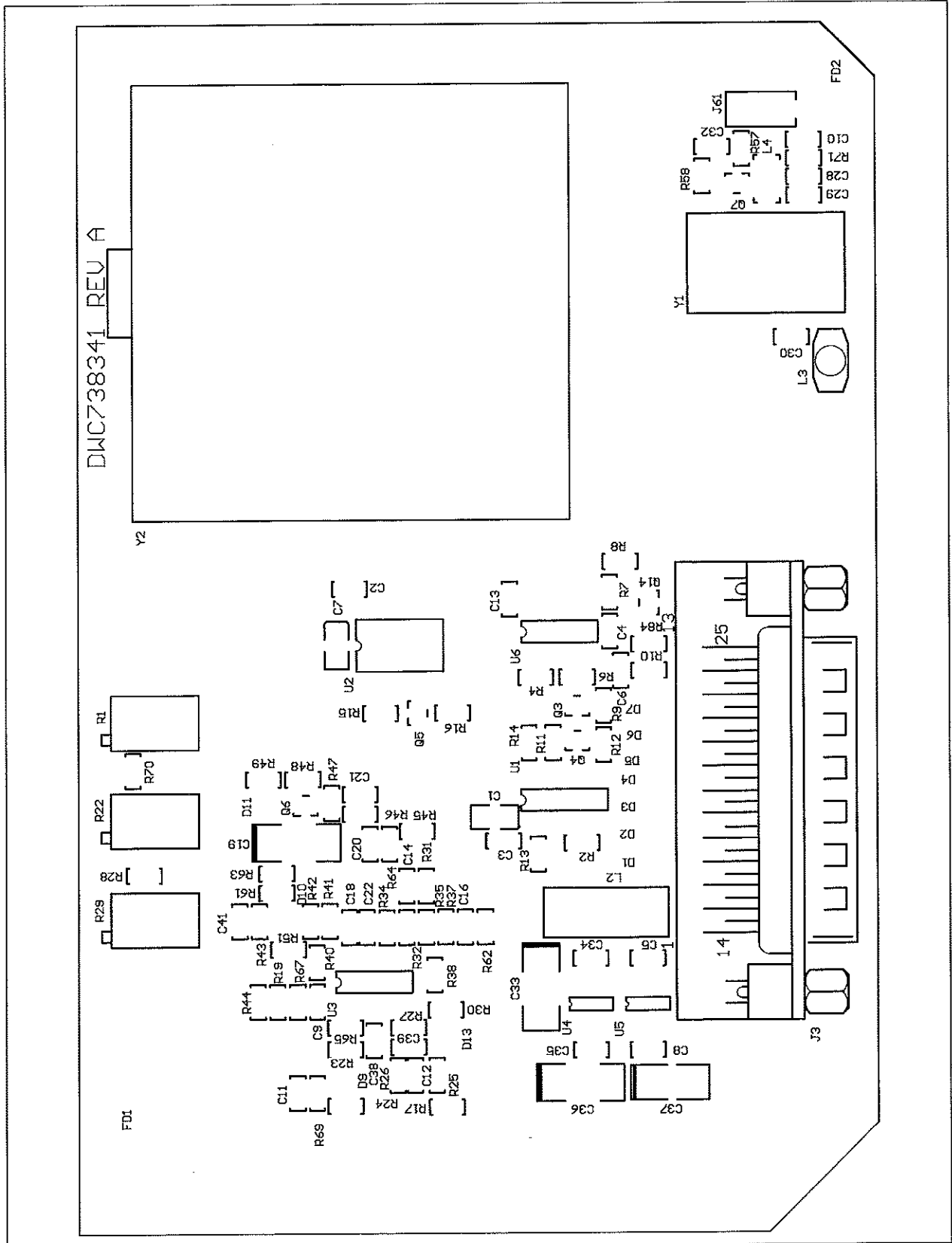


Figure 4-6. Reference/Control Board Component Locations (738341 Rev. A)

Table 4-4. Reference/Control Board Parts List (001-00206 Rev. A)

Designator	Part Number	Description
C1	022225000	CAP SM T 2.2U 16V 10% 3528
C11	021471003	CAP SM C .47UF 25V 0805
C12	021103000	CAP SM .01U 5% 0805
C13	021104000	CAP SM C 0.1U 25V 5% 0805
C14	021103000	CAP SM .01U 5% 0805
C16	021103000	CAP SM .01U 5% 0805
C18	021104000	CAP SM C 0.1U 25V 5% 0805
C19	022476000	CAP,SM,TANT,47uF,20V,20% 7343
C2	021104000	CAP SM C 0.1U 25V 5% 0805
C20	021103000	CAP SM .01U 5% 0805
C21	021103000	CAP SM .01U 5% 0805
C22	021104000	CAP SM C 0.1U 25V 5% 0805
C28	021181000	CAP SM C 180P 100V 5% N 0805
C29	021181000	CAP SM C 180P 100V 5% N 0805
C3	021104000	CAP SM C 0.1U 25V 5% 0805
C30	021104000	CAP SM C 0.1U 25V 5% 0805
C32	021103000	CAP SM .01U 5% 0805
C33	022476000	CAP,SM,TANT,47uF,20V,20% 7343
C34	021104000	CAP SM C 0.1U 25V 5% 0805
C35	021104000	CAP SM C 0.1U 25V 5% 0805
C36	022476000	CAP,SM,TANT,47uF,20V,20% 7343
C37	022106001	CAP SM T 10UF 16V 10% 6032
C38	021104000	CAP SM C 0.1U 25V 5% 0805
C39	021103000	CAP SM .01U 5% 0805
C4	021103000	CAP SM .01U 5% 0805
C41	021104000	CAP SM C 0.1U 25V 5% 0805
C5	021104000	CAP SM C 0.1U 25V 5% 0805
C6	021103000	CAP SM .01U 5% 0805
C7	022225000	CAP SM T 2.2U 16V 10% 3528
C8	021104000	CAP SM C 0.1U 25V 5% 0805
C9	021104000	CAP SM C 0.1U 25V 5% 0805
D1	037700005	DIODE,SM,MMBD4148,SOT-23
D10	037700005	DIODE,SM,MMBD4148,SOT-23

Table 4-4. Reference/Control Board Parts List (001-00206 Rev. A)

Designator	Part Number	Description
D11	037700005	DIODE,SM,MMBD4148,SOT-23
D13	037700005	DIODE,SM,MMBD4148,SOT-23
D2	037700005	DIODE,SM,MMBD4148,SOT-23
D3	037700005	DIODE,SM,MMBD4148,SOT-23
D4	037700005	DIODE,SM,MMBD4148,SOT-23
D5	037700005	DIODE,SM,MMBD4148,SOT-23
D6	037700005	DIODE,SM,MMBD4148,SOT-23
D7	037700005	DIODE,SM,MMBD4148,SOT-23
D9	037703002	DIODE, ZENER 6.8V SMD SOT-23
J3	613163	CONN,DB-25 RT ANGLE PC PLUG
J61	614024	CONN,RF FEMALE-TYPE A RECEPT
L2	041103002	IND SM 10UH 15% 4825
L3	041103003	IND,SM,10uH,.7A,DT1608C-103
L4	041102000	INDUCTOR,CHIP,1UH,SMT,1210,10%
Q14	032005	XISTOR,2N7002 SMT SOT-23
Q3	032005	XISTOR,2N7002 SMT SOT-23
Q4	032005	XISTOR,2N7002 SMT SOT-23
Q5	032005	XISTOR,2N7002 SMT SOT-23
Q6	032006	XISTOR,MMB2907 SMT SOT-23EBC
Q7	032001	XSTR,J310,NFET,SOT-23
R1	170335	RES, 25K TRIM SIDE ADJ
R10	013101000	RES SM CF 100R 0.1W 5% 0805
R11	013473000	RES SM CF 47K 0.1W 5% 0805
R12	013101000	RES SM CF 100R 0.1W 5% 0805
R13	013101000	RES SM CF 100R 0.1W 5% 0805
R14	013101000	RES SM CF 100R 0.1W 5% 0805
R15	013473000	RES SM CF 47K 0.1W 5% 0805
R16	013101000	RES SM CF 100R 0.1W 5% 0805
R17	013101000	RES SM CF 100R 0.1W 5% 0805
R19	013753000	RES,SM CF 75K 0.1W 5% 0805
R2	013103000	RES SM CF 10K 0.1W 5% 0805
R22	170335	RES, 25K TRIM SIDE ADJ
R23	013222000	RES SM CF 2.2K 0.1W 5% 0805

4: Technical Description

**Table 4-4. Reference/Control Board Parts List (001-00206 Rev. A)**

Designator	Part Number	Description
R24	013101000	RES SM CF 100R 0.1W 5% 0805
R25	013473000	RES SM CF 47K 0.1W 5% 0805
R26	013473000	RES SM CF 47K 0.1W 5% 0805
R27	013274000	RES SM CF 270K 0.1W 5% 0805
R28	013103000	RES SM CF 10K 0.1W 5% 0805
R29	170334	RES,100K TRIM SIDE ADJ
R30	013102000	RES SM CF 1K 0.1W 5% 0805
R31	013473000	RES SM CF 47K 0.1W 5% 0805
R32	013473000	RES SM CF 47K 0.1W 5% 0805
R34	013473000	RES SM CF 47K 0.1W 5% 0805
R35	013474000	RES SM CF 470K 0.1W 5% 0805
R37	013103000	RES SM CF 10K 0.1W 5% 0805
R38	013474000	RES SM CF 470K 0.1W 5% 0805
R4	013473000	RES SM CF 47K 0.1W 5% 0805
R40	013474000	RES SM CF 470K 0.1W 5% 0805
R41	013123000	RES SM CF 12K 0.1W 5% 0805
R42	013473000	RES SM CF 47K 0.1W 5% 0805
R43	013101000	RES SM CF 100R 0.1W 5% 0805
R44	013753000	RES,SM CF 75K 0.1W 5% 0805
R45	013101000	RES SM CF 100R 0.1W 5% 0805
R46	013273000	RES SM CF 27K 0.1W 5% 0805
R47	013473000	RES SM CF 47K 0.1W 5% 0805
R48	013101000	RES SM CF 100R 0.1W 5% 0805
R49	013472000	RES SM CF 4.7K 0.1W 5% 0805
R51	013471000	RES SM CF 470R 0.1W 5% 0805
R57	013223000	RES SM CF 22K 0.1W 5% 0805
R58	013151000	RES SM CF 150R 0.1W 5% 0805
R6	013103000	RES SM CF 10K 0.1W 5% 0805
R61	013223000	RES SM CF 22K 0.1W 5% 0805
R62	013682000	RES SM CF 6.8K 0.1W 5% 0805
R63	013331000	RES SM CF 330 0.1W 5% 0805
R64	013222000	RES SM CF 2.2K 0.1W 5% 0805
R65	013103000	RES SM CF 10K 0.1W 5% 0805

**Table 4-4. Reference/Control Board Parts List (001-00206 Rev. A)**

Designator	Part Number	Description
R67	013473000	RES SM CF 47K 0.1W 5% 0805
R69	013274000	RES SM CF 270K 0.1W 5% 0805
R7	013103000	RES SM CF 10K 0.1W 5% 0805
R70	013102000	RES SM CF 1K 0.1W 5% 0805
R8	013103000	RES SM CF 10K 0.1W 5% 0805
R84	013110100	RES,SM TK 1.1KOHM 0.1W 1% 0805
R9	013464000	RES,SM TK 464OHM 0.1W 1% 0805
U1	033087	IC,8BIT SHIFT,TPIC6C595,SO-16
U2	033305003	IC,10K DIG POTX2 DS1267,SOW-16
U3	033304000	IC,SM,LM2902D,QUAD-OP,SO-14
U4	033003	IC, 78L05, SM, SOP-8
U5	033002	IC, 78L08, SM, SOP-8
U6	033081	IC,MC74HC02AD, SO-14 751A-02
Y1	361117	TCXO 16.777216MHz, 0.5PPM

### 4.3 Synthesizer Board

The Synthesizer board plugs into the motherboard at J4. It is located immediately above the Reference/Control board in the TW7000.

The main purpose of this board is to take the reference frequency input (16.777216 MHz) from the Reference/Control board and use it to generate the three local oscillator frequencies. It uses direct digital synthesis (DDS) techniques, in combination with standard phase locked loop (PLL) circuitry, in the implementation of the LO scheme.

The heart of the synthesizer is the DDS, which generates an output of 5.95 to 7.00 MHz, depending on the selected input channel frequency. This is mixed with the output of the 70 MHz voltage controlled oscillator, then filtered and mixed again with the output of the first LO in the feedback path of the PLL which generates the first LO. The output of the first LO is 75 to 105 MHz in 10 Hz increments. The second LO is the fixed 70 MHz output of the voltage controlled oscillator. The third LO is generated by another PLL tied to the overall reference frequency of the radio and programmed to one of three outputs, depending on the setting of the front panel mode switch.

#### 4.3.1 Inter-connections

For the interconnect lines between the Synthesizer board and the rest of the radio, refer to the table below. Data for all of the synthesizers in the board is input in serial format, with all data clocked as required to update frequency selection. It is then latched into the particular synthesizer device by the appropriate enable line.

**Table 4-5. Synthesizer Board Interconnects**

Connector J4	Description	Comment
1	GND	Ground
2	+12V INPUT	
3	SPIRXD	Receive serial data line
4	SPICLK	Clock line
11	EN5	
12	EN3	First LO synthesizer enable
13	EN1	Third LO synthesizer enable
14	GND	Ground
15	+12V input	
16	SPITXD	Transmit serial data line
17	BITE	
24	EN4	BITE enable
25	EN2	DDS enable

### 4.3.2 Test Procedures

These test procedures require the following equipment:

- Oscilloscope
- SINAD meter
- Frequency counter
- Multimeter
- Power supply 0-20 Vdc
- Wattmeter
- -30 dBm Attenuator dummy load
- Two-tone test box
- Signal generator
- Extender card set

#### Alignment

1. Set the power supply for 13.8 Vdc.
2. Place the scope probe (x10) on J54. Adjust L7 for a maximum signal (approximately 480 mVAC, 70 MHz).
3. Place the scope probe on the bottom of R15 above J55 and adjust L1 for exactly 3 Vdc (ensure scope is set for DC).
4. Place the scope probe on U3, pin 3 (set the scope to a 10 mv scale, 20 ms time). Adjust L13-L17 for a maximum signal (approximately 130 mVPP minimum).
5. Set the radio frequency to 30.00 MHz. Carefully adjust L5 for 10 Vdc  $\pm$ .25 at U5, pin 1.

#### Miscellaneous Test

1. Measure the voltage at U5, pin 8 for 9 Vdc  $\pm$ .5V.
2. Verify that the RX tone is present with the signal generator set at -113 dBm and 8.001 MHz, and the radio at 8 MHz USB. SINAD should be approximately 10 dB or better. At -75 dBm level, the audio should be approximately 3V or better with maximum volume and the radio's speaker off.
3. At -113 dBm input, check SINAD at various frequencies from 1.6 to 30 MHz (this verifies that the synthesizer is locking).
4. With the signal generator set to 8.001 MHz +6 dBm level, turn carrier off, then on. The RX tone should sound normal.

#### 4: Technical Description

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- |                      |   |
|----------------------|---|
| TX Test              | <ol style="list-style-type: none"><li>1. Connect the dummy load to the oscilloscope (2V scale, .5ms time). At 8 MHz, key the radio with the test box (set to +10 dBm). The TX wave should be approximately 100W with no distortion.</li><li>2. Key the radio again at 2 MHz and 29.999 MHz. TX wave should be approximately 100W with no distortion.</li></ol>  |
| Input/Output Signals | <ol style="list-style-type: none"><li>1. The reference input signal at J61 should read 16,777,216 Hz. The level should be 2 VPP.</li><li>2. The first LO output signal at J59 should read 75 to 105 MHz. The level should be 0 dBm, <math>\pm 2</math> dBm.</li><li>3. The third LO (BFO) output signal at J55 should read 5.000 MHz and 5.003 MHz. The level should be 0 dBm, <math>\pm 2</math> dBm.</li><li>4. The second LO output signal at J54 should read approximately 70.000 MHz. The level should be 0 dBm, <math>\pm 2</math> dBm.</li></ol> |



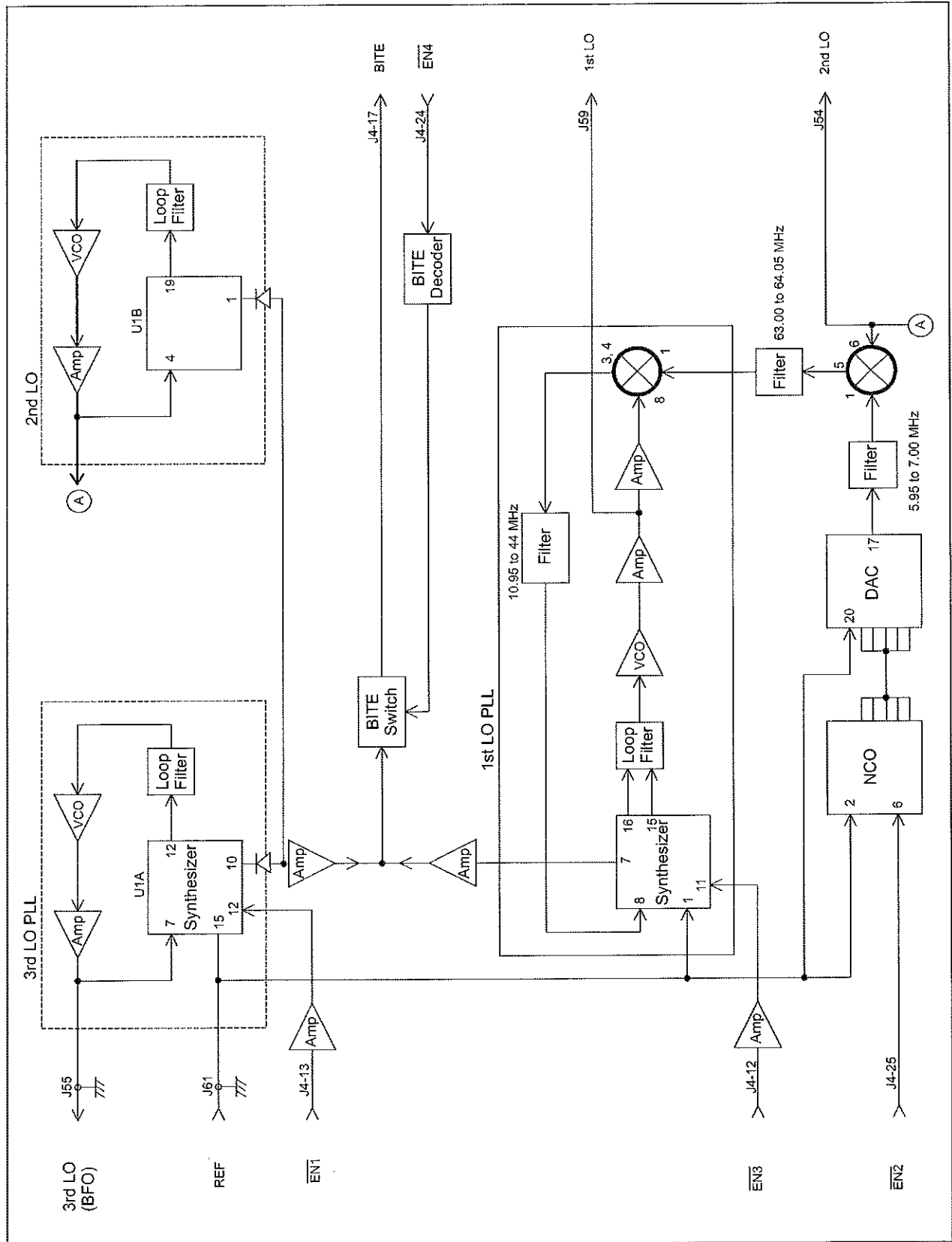


Figure 4-7. Synthesizer Board Block Diagram

REV	ECN	PROTO DESCRIPTION	DATE	APPR
02			11/28/96	
03			11/28/96	
A	NONE	NOT USED	05-28-96	
B	7800/216	RELEASE	25-07-96	

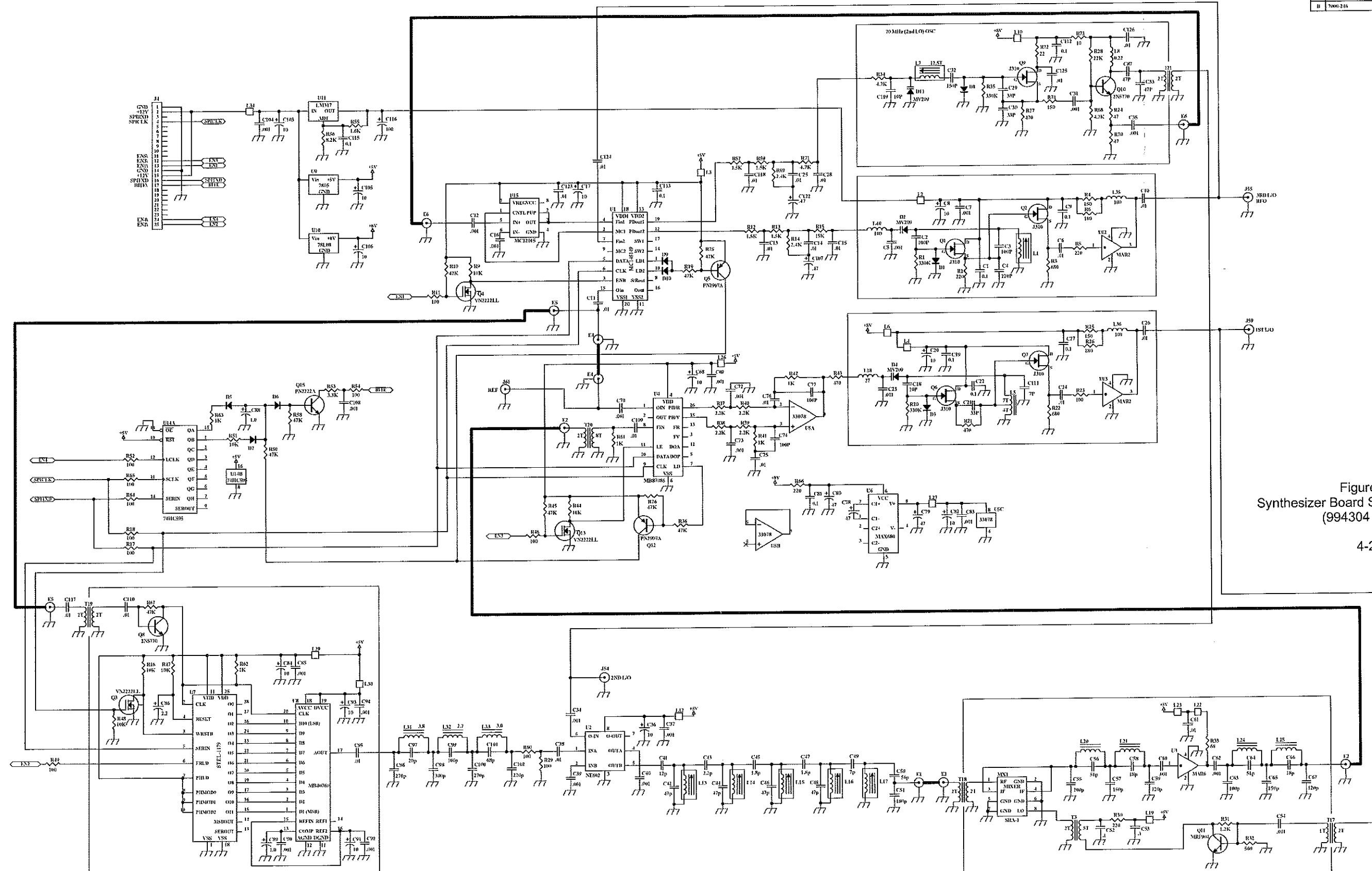


Figure 4-8  
Synthesizer Board Schematic Diagram  
(994304 Rev. B)

4-27

4 INDUCTANCE IS IN MICROHENRYS  
 3 DIMENSIONS ARE IN INCHES  
 3 CAPACITANCE IS IN MICROFARADS  
 1 RESISTANCE IS IN OHMS  
 UNLESS OTHERWISE SPECIFIED

DAIFORWORLD COMMUNICATIONS INC.			
SYNTHESIZER MODULE TW7000			
Sheet: 1	Date: 11/28/96	Drawing Number: 994304	Rev: B
Date: 03-16-2005		Time: 11:29:57	



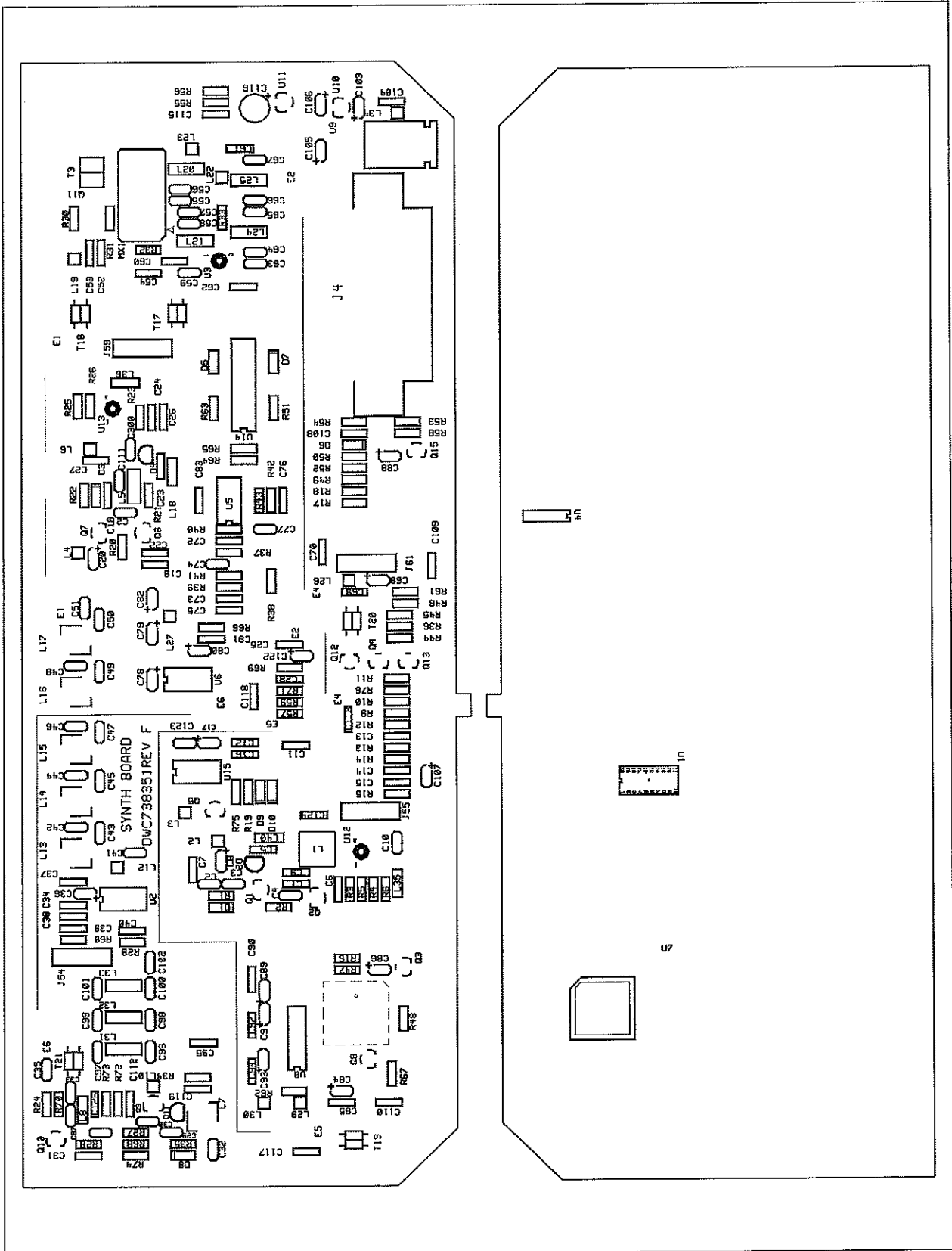


Figure 4-9. Synthesizer Board Component Locations (738351 Rev. F)

Table 4-6. Synthesizer Board Parts List (001-00901 Rev. M)

Designator	Part Number	Description
C1	277104	CAP,C,0.1U,50,10%,X,AX,.25SP
C10	214103	CAP,C,0.01U,50,10%,X,RA,.1SP
C100	275271	CAP,ML NPO 270PF 100V 5% 0.2S
C101	275680	CAP,68 PF NPO MONOLITHIC
C102	276221	CAP,ML 220PF NPO 5% 100V 0.1S
C103	241100	CAP,10MF DIP TANTALUM
C104	277102	CAP,C,1000P,100,10%,X,AX,.25SP
C105	241100	CAP,10MF DIP TANTALUM
C106	241100	CAP,10MF DIP TANTALUM
C107	241047	CAP,0.47MF 35V DIP TANT
C108	277102	CAP,C,1000P,100,10%,X,AX,.25SP
C109	277103	CAP,C,0.01U,100,10%,X,AX,.25SP
C11	277103	CAP,C,0.01U,100,10%,X,AX,.25SP
C110	277103	CAP,C,0.01U,100,10%,X,AX,.25SP
C111	210070	CAP,7 PF DISC NPO
C112	277104	CAP,C,0.1U,50,10%,X,AX,.25SP
C113	277104	CAP,C,0.1U,50,10%,X,AX,.25SP
C115	277104	CAP,C,0.1U,50,10%,X,AX,.25SP
C116	231101	CAP,A,100U,16V,20%,RA .2SP
C117	277103	CAP,C,0.01U,100,10%,X,AX,.25SP
C118	277103	CAP,C,0.01U,100,10%,X,AX,.25SP
C119	277100	CAP, ML 10PF AXIAL NPO 5%
C12	277102	CAP,C,1000P,100,10%,X,AX,.25SP
C122	241047	CAP,0.47MF 35V DIP TANT
C123	214103	CAP,C,0.01U,50,10%,X,RA,.1SP
C124	277103	CAP,C,0.01U,100,10%,X,AX,.25SP
C125	214103	CAP,C,0.01U,50,10%,X,RA,.1SP
C126	277103	CAP,C,0.01U,100,10%,X,AX,.25SP
C13	277103	CAP,C,0.01U,100,10%,X,AX,.25SP
C14	277103	CAP,C,0.01U,100,10%,X,AX,.25SP
C15	277103	CAP,C,0.01U,100,10%,X,AX,.25SP
C16	277102	CAP,C,1000P,100,10%,X,AX,.25SP
C17	241100	CAP,10MF DIP TANTALUM

Table 4-6. Synthesizer Board Parts List (001-00901 Rev. M)

Designator	Part Number	Description
C18	277100	CAP, ML 10PF AXIAL NPO 5%
C19	277104	CAP,C,0.1U,50,10%,X,AX,,25SP
C2	221101	CAP,100PF DM5 MICA
C20	241100	CAP,10MF DIP TANTALUM
C21	275330	CAP,ML NPO 33PF 100V 5% 0.1S
C22	277104	CAP,C,0.1U,50,10%,X,AX,,25SP
C23	277102	CAP,C,1000P,100,10%,X,AX,,25SP
C24	277103	CAP,C,0.01U,100,10%,X,AX,,25SP
C25	277103	CAP,C,0.01U,100,10%,X,AX,,25SP
C26	277103	CAP,C,0.01U,100,10%,X,AX,,25SP
C27	277104	CAP,C,0.1U,50,10%,X,AX,,25SP
C28	277103	CAP,C,0.01U,100,10%,X,AX,,25SP
C29	275330	CAP,ML NPO 33PF 100V 5% 0.1S
C3	221101	CAP,100PF DM5 MICA
C30	275330	CAP,ML NPO 33PF 100V 5% 0.1S
C31	277102	CAP,C,1000P,100,10%,X,AX,,25SP
C32	275151	CAP,ML 150PF NPO 100V 5% 0.1S
C33	275470	CAP,ML 47PF NPO 5% 100V 0.1SP
C34	277102	CAP,C,1000P,100,10%,X,AX,,25SP
C35	275102	CAP,C,.001UF,100V,5%,N,RA,,1SP
C36	241100	CAP,10MF DIP TANTALUM
C37	277102	CAP,C,1000P,100,10%,X,AX,,25SP
C38	277103	CAP,C,0.01U,100,10%,X,AX,,25SP
C39	277102	CAP,C,1000P,100,10%,X,AX,,25SP
C4	221221	CAP. 220PF, MICA
C40	277102	CAP,C,1000P,100,10%,X,AX,,25SP
C41	210120	CAP,12 PF DISC NPO
C42	275470	CAP,ML 47PF NPO 5% 100V 0.1SP
C43	210022	CAP,2.2 PF NPO DISC
C44	275470	CAP,ML 47PF NPO 5% 100V 0.1SP
C45	210018	CAP,1.8 PF NPO DISC
C46	275470	CAP,ML 47PF NPO 5% 100V 0.1SP
C47	210018	CAP,1.8 PF NPO DISC

Table 4-6. Synthesizer Board Parts List (001-00901 Rev. M)

Designator	Part Number	Description
C48	275470	CAP,ML 47PF NPO 5% 100V 0.1SP
C49	210022	CAP,2.2 PF NPO DISC
C5	277102	CAP,C,1000P,100,10%,X,AX,.25SP
C50	221560	CAP,56PF 5% DM5 MICA
C51	275181	CAP,ML 180PF NPO 5% 100V 0.1S
C52	277104	CAP,C,0.1U,50,10%,X,AX,.25SP
C53	277104	CAP,C,0.1U,50,10%,X,AX,.25SP
C54	277102	CAP,C,1000P,100,10%,X,AX,.25SP
C55	221101	CAP,100PF DM5 MICA
C56	210510	CAP,51 PF 5% 50V DISC NPO
C57	275151	CAP,ML 15OPF NPO 100V 5% 0.1S
C58	275180	CAP,ML 18PF 5% 100V NPO 0.1 S
C59	275121	CAP,ML 120PF NPO 5% 100V 0.1S
C6	277103	CAP,C,0.01U,100,10%,X,AX,.25SP
C60	277102	CAP,C,1000P,100,10%,X,AX,.25SP
C61	277104	CAP,C,0.1U,50,10%,X,AX,.25SP
C62	277102	CAP,C,1000P,100,10%,X,AX,.25SP
C63	221101	CAP,100PF DM5 MICA
C64	210510	CAP,51 PF 5% 50V DISC NPO
C65	275151	CAP,ML 15OPF NPO 100V 5% 0.1S
C66	275180	CAP,ML 18PF 5% 100V NPO 0.1 S
C67	275121	CAP,ML 120PF NPO 5% 100V 0.1S
C68	241100	CAP,10MF DIP TANTALUM
C69	277102	CAP,C,1000P,100,10%,X,AX,.25SP
C7	277102	CAP,C,1000P,100,10%,X,AX,.25SP
C70	277102	CAP,C,1000P,100,10%,X,AX,.25SP
C72	277102	CAP,C,1000P,100,10%,X,AX,.25SP
C73	277102	CAP,C,1000P,100,10%,X,AX,.25SP
C74	221101	CAP,100PF DM5 MICA
C75	277103	CAP,C,0.01U,100,10%,X,AX,.25SP
C76	277103	CAP,C,0.01U,100,10%,X,AX,.25SP
C77	221101	CAP,100PF DM5 MICA
C78	241476	CAP, 47MF, 20V DIP TANT

Table 4-6. Synthesizer Board Parts List (001-00901 Rev. M)

Designator	Part Number	Description
C79	241476	CAP, 47MF, 20V DIP TANT
C8	241100	CAP,10MF DIP TANTALUM
C80	241476	CAP, 47MF, 20V DIP TANT
C81	277104	CAP,C,0.1U,50,10%,X,AX,.25SP
C82	241100	CAP,10MF DIP TANTALUM
C83	277102	CAP,C,1000P,100,10%,X,AX,.25SP
C84	241100	CAP,10MF DIP TANTALUM
C85	277102	CAP,C,1000P,100,10%,X,AX,.25SP
C86	241020	CAP,2.2MF DIP TANTALUM
C87	275470	CAP,ML 47PF NPO 5% 100V 0.1SP
C88	241010	CAP,1.0 MF DIP TANTALUM
C89	241010	CAP,1.0 MF DIP TANTALUM
C9	277104	CAP,C,0.1U,50,10%,X,AX,.25SP
C90	277102	CAP,C,1000P,100,10%,X,AX,.25SP
C91	241100	CAP,10MF DIP TANTALUM
C92	277102	CAP,C,1000P,100,10%,X,AX,.25SP
C93	241100	CAP,10MF DIP TANTALUM
C94	277102	CAP,C,1000P,100,10%,X,AX,.25SP
C95	277103	CAP,C,0.01U,100,10%,X,AX,.25SP
C96	275271	CAP,ML NPO 270PF 100V 5% 0.2S
C97	210200	CAP,20 PF DISC NPO
C98	221301	CAP, 300 PF DM5 MICA
C99	221101	CAP,100PF DM5 MICA
D1	320002	DIODE,SI 100MA 1N4148/1N4150
D10	320002	DIODE,SI 100MA 1N4148/1N4150
D11	320305A	VARACTOR MV209,1099/TW2000
D2	320305A	VARACTOR MV209,1099/TW2000
D3	320002	DIODE,SI 100MA 1N4148/1N4150
D4	320305A	VARACTOR MV209,1099/TW2000
D5	320002	DIODE,SI 100MA 1N4148/1N4150
D6	320002	DIODE,SI 100MA 1N4148/1N4150
D7	320002	DIODE,SI 100MA 1N4148/1N4150
D8	320002	DIODE,SI 100MA 1N4148/1N4150

Table 4-6. Synthesizer Board Parts List (001-00901 Rev. M)

Designator	Part Number	Description
D9	320002	DIODE,SI 100MA 1N4148/1N4150
E1	769330-1	SEMI-RIGID CA,SYNTH,E1,TW7000
E2	769330-2	SEMI-RIGID CA,SYNTH,E2,TW7000
E4	769330-4	SEMI-RIGID CA,SYNTH,E4,TW7000
E5	769330-3	SEMI-RIGID CA,SYNTH,E5,TW7000
E6	769330-5	SEMI-RIGID CA,SYNTH,E5,TW7000
J4	613163	CONN,DB-25 RT ANGLE PC PLUG
J54	614026	CONN,RF FEMALE LOW-TYPE RECEPT
J55	614026	CONN,RF FEMALE LOW-TYPE RECEPT
J59	614026	CONN,RF FEMALE LOW-TYPE RECEPT
J61	614026	CONN,RF FEMALE LOW-TYPE RECEPT
L1	490146	INDUCTOR,12 UH VARIABLE
L10	459032	IND ASY,3T#30 MAGNET 1-490201
L12	459032	IND ASY,3T#30 MAGNET 1-490201
L13	490114	CORE 6.5T (MD) SQ LG PI CORE
L14	490114	CORE 6.5T (MD) SQ LG PI CORE
L15	490114	CORE 6.5T (MD) SQ LG PI CORE
L16	490114	CORE 6.5T (MD) SQ LG PI CORE
L17	490114	CORE 6.5T (MD) SQ LG PI CORE
L18	430013	INDUCTOR, FIXED 27 UHY
L19	459032	IND ASY,3T#30 MAGNET 1-490201
L2	459032	IND ASY,3T#30 MAGNET 1-490201
L20	459260	IND ASSY,8T#24 MAG 1-490032
L21	459261	IND ASSY,9T#24 MAG 1-490032
L22	459032	IND ASY,3T#30 MAGNET 1-490201
L23	459032	IND ASY,3T#30 MAGNET 1-490201
L24	459260	IND ASSY,8T#24 MAG 1-490032
L25	459261	IND ASSY,9T#24 MAG 1-490032
L26	459032	IND ASY,3T#30 MAGNET 1-490201
L27	459032	IND ASY,3T#30 MAGNET 1-490201
L29	459032	IND ASY,3T#30 MAGNET 1-490201
L3	459032	IND ASY,3T#30 MAGNET 1-490201
L30	459032	IND ASY,3T#30 MAGNET 1-490201

Table 4-6. Synthesizer Board Parts List (001-00901 Rev. M)

Designator	Part Number	Description
L31	459232	IND ASSY 2IT #26MAG 1-490060
L32	459230	IND ASSY 17T#26 MAG 1-490060
L33	459231	IND ASSY 18T#26 MAG 1-490060
L34	459032	IND ASY,3T#30 MAGNET 1-490201
L35	430014	INDUCTOR MOLDED MIN 100UH
L36	430014	INDUCTOR MOLDED MIN 100UH
L4	459032	IND ASY,3T#30 MAGNET 1-490201
L40	430014	INDUCTOR MOLDED MIN 100UH
L5	459259	IND,7T-TAP-4T#30 MAG 1-490068
L6	459032	IND ASY,3T#30 MAGNET 1-490201
L7	490109	COIL 12.5T (MD) SQ LG PI CORE
L8	430047	INDUCTOR,0.22 UH MOLDED
MX1	380006	MIXER MINI DOUBLE-BALANCED
Q1	310033	XISTOR,JFET,NCH,J310,TO92
Q10	310032	XISTOR,NPN,2N5770,TO92
Q11	310165	XISTOR,NPN,BFY90,TO18,RF
Q12	310052	XISTOR,PNP,PN2907A,TO92
Q13	310138	XISTOR,FET,VN2222LL,TO92
Q15	310057	XISTOR,NPN,PN2222A,TO92
Q2	310033	XISTOR,JFET,NCH,J310,TO92
Q3	310138	XISTOR,FET,VN2222LL,TO92
Q4	310138	XISTOR,FET,VN2222LL,TO92
Q5	310052	XISTOR,PNP,PN2907A,TO92
Q6	310033	XISTOR,JFET,NCH,J310,TO92
Q7	310033	XISTOR,JFET,NCH,J310,TO92
Q8	310032	XISTOR,NPN,2N5770,TO92
Q9	310033	XISTOR,JFET,NCH,J310,TO92
R1	113334	RES,330K 1/8W 5% CARBON FILM
R10	113473	RES,47K 1/8W 5% CARBON FILM
R11	113101	RES,100 OHM 1/8W 5% CF
R12	113152	RES,1.5K 1/8W 5% CARBON FILM
R13	113152	RES,1.5K 1/8W 5% CARBON FILM
R14	113242	RES,2.4K 1/8W 5% CARBON FILM

Table 4-6. Synthesizer Board Parts List (001-00901 Rev. M)

Designator	Part Number	Description
R15	113153	RES,15K 1/8W 5% CARBON FILM
R16	113103	RES,10K 1/8W 5% CARBON FILM
R17	113101	RES,100 OHM 1/8W 5% CF
R18	113101	RES,100 OHM 1/8W 5% CF
R19	113473	RES,47K 1/8W 5% CARBON FILM
R2	113221	RES,220 OHM 1/8W 5% CF
R20	113334	RES,330K 1/8W 5% CARBON FILM
R21	113471	RES,470 OHM 1/8W 5% CF
R22	113681	RES,680 OHM 1/8W 5% CF
R23	113101	RES,100 OHM 1/8W 5% CF
R24	113470	RES,47 OHM 1/8W 5% CARBON FILM
R25	113151	RES,150 OHM 1/8W 5% CF
R26	113181	RES,180 OHM 1/8W 5% CF
R27	113471	RES,470 OHM 1/8W 5% CF
R28	113223	RES,22K 1/8W 5% CARBON FILM
R29	113101	RES,100 OHM 1/8W 5% CF
R3	113681	RES,680 OHM 1/8W 5% CF
R30	113221	RES,220 OHM 1/8W 5% CF
R31	113122	RES,1.2K 1/8W 5% CARBON FILM
R32	113561	RES,560 OHM 1/8W 5% CF
R33	113680	RES,68 OHM 1/8W 5% CF
R34	113472	RES,4.7K 1/8W 5% CARBON FILM
R35	113334	RES,330K 1/8W 5% CARBON FILM
R36	113473	RES,47K 1/8W 5% CARBON FILM
R37	113222	RES,2.2K 1/8W 5% CARBON FILM
R38	113222	RES,2.2K 1/8W 5% CARBON FILM
R39	113222	RES,2.2K 1/8W 5% CARBON FILM
R4	113151	RES,150 OHM 1/8W 5% CF
R40	113222	RES,2.2K 1/8W 5% CARBON FILM
R41	113102	RES, 1K, 1/8W, 5%, CF
R42	113102	RES, 1K, 1/8W, 5%, CF
R43	113471	RES,470 OHM 1/8W 5% CF
R44	113103	RES,10K 1/8W 5% CARBON FILM

Table 4-6. Synthesizer Board Parts List (001-00901 Rev. M)

Designator	Part Number	Description
R45	113473	RES,47K 1/8W 5% CARBON FILM
R46	113101	RES,100 OHM 1/8W 5% CF
R47	113103	RES,10K 1/8W 5% CARBON FILM
R48	113103	RES,10K 1/8W 5% CARBON FILM
R49	113101	RES,100 OHM 1/8W 5% CF
R5	113221	RES,220 OHM 1/8W 5% CF
R50	113473	RES,47K 1/8W 5% CARBON FILM
R51	113103	RES,10K 1/8W 5% CARBON FILM
R52	113101	RES,100 OHM 1/8W 5% CF
R53	113332	RES,3.3K 1/8W 5% CARBON FILM
R54	113101	RES,100 OHM 1/8W 5% CF
R55	113162	RES,1.6K OHM 1/8W 5%
R56	113822	RES,8.2K 1/8W 5% CARBON FILM
R57	113152	RES,1.5K 1/8W 5% CARBON FILM
R58	113473	RES,47K 1/8W 5% CARBON FILM
R59	113152	RES,1.5K 1/8W 5% CARBON FILM
R6	113181	RES,180 OHM 1/8W 5% CF
R60	113101	RES,100 OHM 1/8W 5% CF
R61	113102	RES, 1K, 1/8W, 5%, CF
R62	113102	RES, 1K, 1/8W, 5%, CF
R63	113102	RES, 1K, 1/8W, 5%, CF
R64	113101	RES,100 OHM 1/8W 5% CF
R65	113101	RES,100 OHM 1/8W 5% CF
R66	113221	RES,220 OHM 1/8W 5% CF
R67	113473	RES,47K 1/8W 5% CARBON FILM
R68	113472	RES,4.7K 1/8W 5% CARBON FILM
R69	113242	RES,2.4K 1/8W 5% CARBON FILM
R70	113470	RES,47 OHM 1/8W 5% CARBON FILM
R71	113472	RES,4.7K 1/8W 5% CARBON FILM
R72	113220	RES,22 OHM 1/8W 5% CARBON FILM
R73	113100	RES,10 OHM 1/8W 5% FILM
R74	113151	RES,150 OHM 1/8W 5% CF
R75	113473	RES,47K 1/8W 5% CARBON FILM

**Table 4-6. Synthesizer Board Parts List (001-00901 Rev. M)**

Designator	Part Number	Description
R76	113473	RES,47K 1/8W 5% CARBON FILM
R9	113103	RES,10K 1/8W 5% CARBON FILM
T17	459258	XFMR,1T-2T#30 MAG 1-490316
T18	459237	XFMR 2T-2T#32 MAG 1-490316
T19	459265	XFMR,2T2T 32 AWG MAG 1-490351
T20	459238	XFMR 2T-8T #32 MAG 2-490201
T21	459237	XFMR 2T-2T#32 MAG 1-490316
T3	459239	XFMR 5T-2T#30 MAG 1-491301
U1	033304017	IC,PLL, DUAL,MC145149, SOG-20
U10	330018	IC,VREG,78L08,TO94,8V
U11	330343	IC, LM317LZ
U12	380013	IC,MAR-2 MONOLITHIC AMPLIFIER
U13	380013	IC,MAR-2 MONOLITHIC AMPLIFIER
U14	330273	IC 74HC595
U15	330105	IC,PRE,MC12015,2 MOD
U2	330417	IC,NE602AN
U3	380011	IC MAR6
U4	330639	IC,SMT,MB87086APF, FPT-16
U5	330368	IC,MC33078
U6	330471	IC,MAX680
U7	330418	IC,STEL-1179,NCO
U8	ADAPTERBD2	ADAPTER ASSY,330470
U9	330015	IC,VREG,7805,TO220,5V
XL13	490067	INDUCTOR CAN
XL14	490067	INDUCTOR CAN
XL15	490067	INDUCTOR CAN
XL16	490067	INDUCTOR CAN
XL17	490067	INDUCTOR CAN
XL7	490067	INDUCTOR CAN

## 4.4 VSWR Detector Board

The VSWR Detector board is located on the rear panel. It is mounted to the antenna connector and has a pendant 3-wire cable that plugs into the motherboard at J19.

The board contains reflected and forward power detectors that sample the transmit RF signal, and send indications of both powers back to the Reference/Control board for use in the ALC circuitry. Although both transmit and receive RF pass through this board, it is only used to process signals in the transmit path.

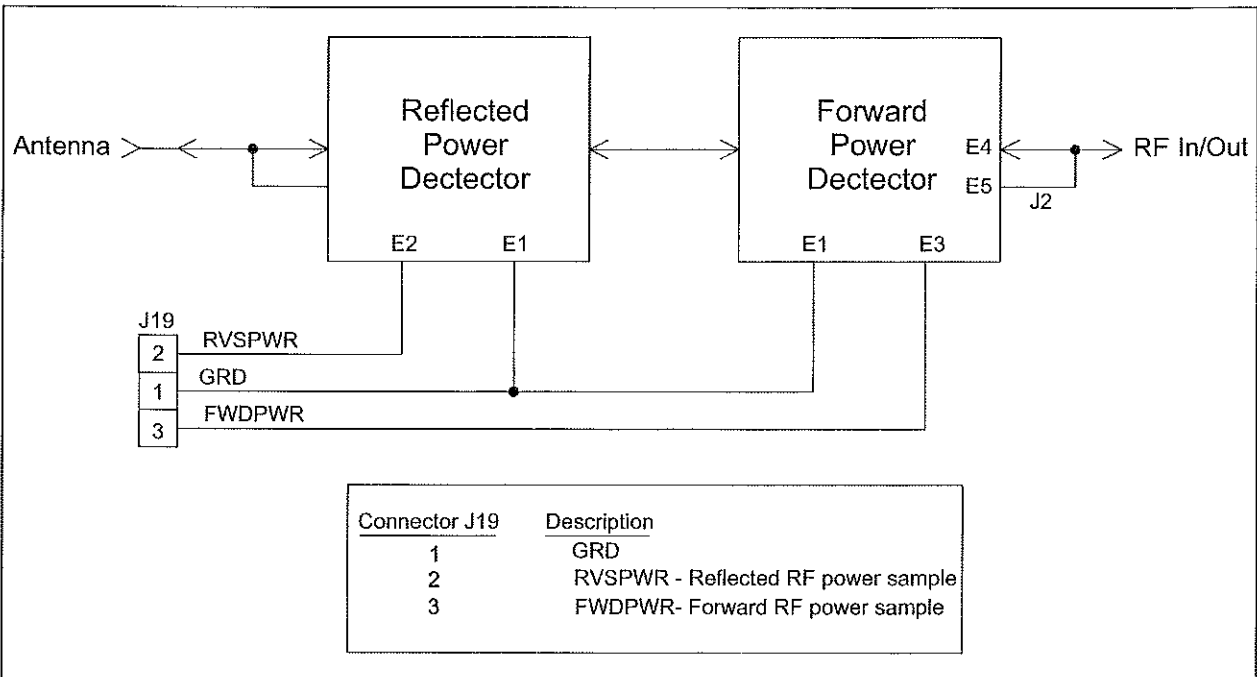


Figure 4-10. VSWR Detector Board Block Diagram



REV	ECN	DESCRIPTION	DATE	APPR
C	TW7000-275	REV AND REDRAWN	BS 5-25-97	

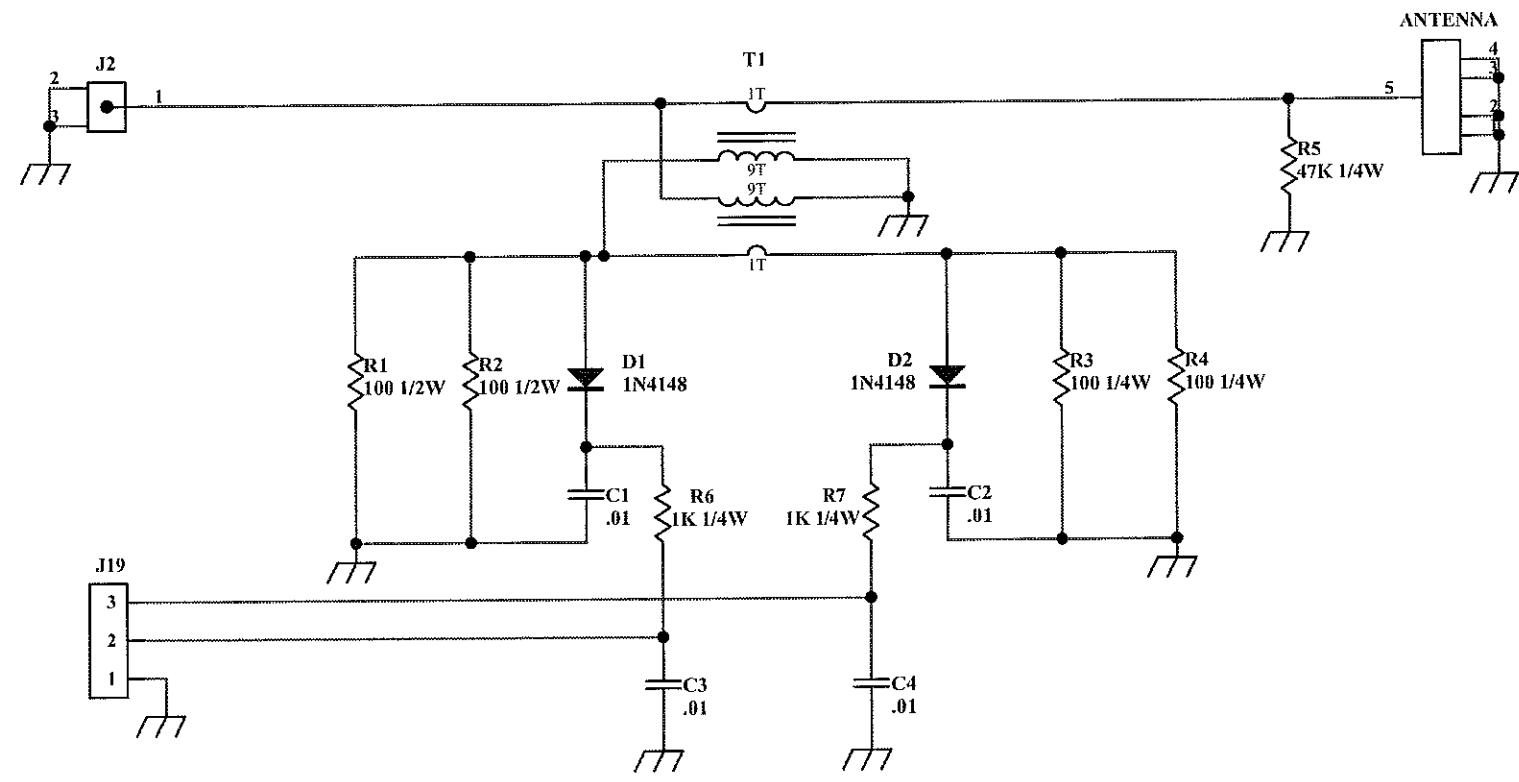


Figure 4-11  
VSWR Detector Board Schematic Diagram  
(994240 Rev. C)

4-41

<b>DATRON</b>		3030 Enterprise Ct. Vista, CA 92083 (760)597-3777	
DATRON WORLD COMMUNICATIONS INC.			
Title: Schematic			
<b>TW7000 VSWR DET</b>			
Size: <b>B</b>	Drawn: Appr:	Date: 5-25-97 Date:	Drawing Number: <b>994240</b>
		Rev: <b>C</b>	
File: 994240c.sch		Date: 24-Feb-2005	Time: 14:32:58 Sheet 1 of 1



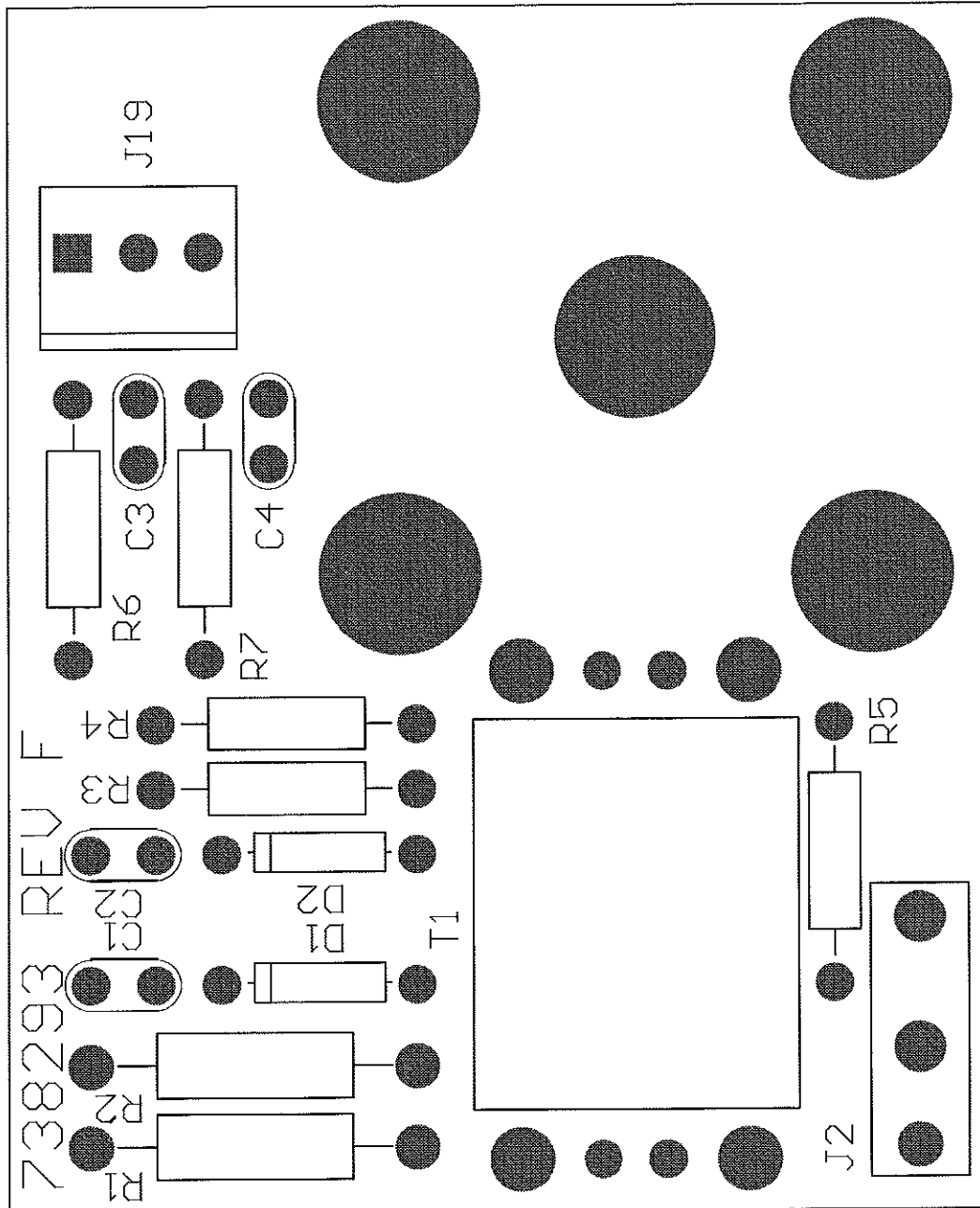


Figure 4-12. VSWR Detector Board Component Locations (738293 Rev. F)

Table 4-7. VSWR Detector Board Parts List (001-00201 Rev. G)

Designator	Part Number	Description
C1	214103	CAP,C,0.01U,50,10%,X,RA,,1SP
C2	214103	CAP,C,0.01U,50,10%,X,RA,,1SP
C3	214103	CAP,C,0.01U,50,10%,X,RA,,1SP
C4	214103	CAP,C,0.01U,50,10%,X,RA,,1SP
D1	320002	DIODE,SI 100MA 1N4148/1N4150
D2	320002	DIODE,SI 100MA 1N4148/1N4150
J19	610285	HEADER,MLX,3PIN,,100,
R1	134101	RES,100 OHM 1/2W 5% FILM
R2	134101	RES,100 OHM 1/2W 5% FILM
R3	124101	RES,100 OHM 1/4W 5% CF
R4	124101	RES,100 OHM 1/4W 5% CF
R5	124473	RES,47K 1/4W 5% CARBON FILM
R6	113102	RES, 1K, 1/8W, 5%, CF
R7	113102	RES, 1K, 1/8W, 5%, CF
T1	459316	XFMR ASSY, 9T/9T#30 1-490061

## 4.5 RF Filter Board

The RF Filter board is located on the heat sink assembly and connects via coaxial cable to the VSWR circuit (J50), the RF Power Amplifier board (J51), and the 75 MHz IF board (J52). Control interconnects are to the motherboard at connector J22.

A block diagram of the RF Filter board is shown below. It contains the seven harmonic filters, the receive/transmit relay, and the receive overload protection circuit. Connections to the rest of the radio are shown in the table below.

Connector J22	Description	Comment
1, 2	Ground	
3, 4	+12V input	
5	FB7	Filter band 7 select line
6	FLTTST	RF filter BITE line
7	FB3	Filter band 3 select line
9	FB4	Filter band 4 select line
10	TRSW	T/R relay control line
11	FB5	Filter band 5 select line
12	FB6	Filter band 6 select line
13	FB2	Filter band 2 select line
14	FB1	Filter band 1 select line

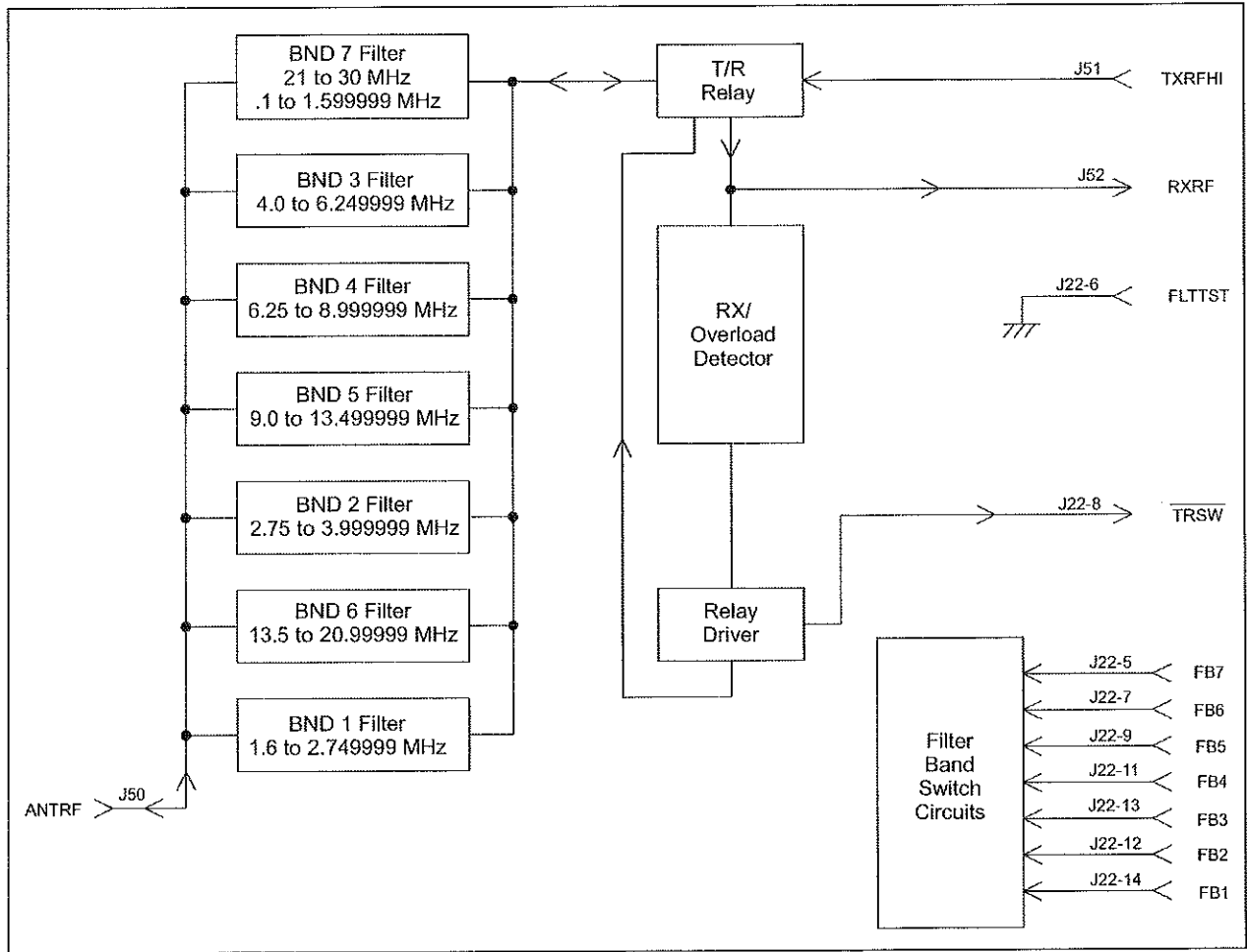


Figure 4-13. RF Filter Board Block Diagram

REV	ECN	DESCRIPTION	DATE	APPR
A	7000-011	RELEASE	12-10-93	
B	7000-040	REVERSE J22-8, J22-10	04-05-93	
C	7000-061	REV CAP VALUES	08-04-93	
D	TW7000-186	L20 WAS L4T IS L3T	03-29-95	
E	TW7000-203	SEE ECN	05-22-95	
F	TW7000-250	L18 7T WAS 8T	07-22-96	
G	TW7000-259	CHG K16 CKT		
H	7000-263	SFE ECN	AM	
J	TW7000-302	REDRAWN IN PROFEL	BS	10-06-98
K	ECO 01-0611	C49 WAS 500pF	BB	11-16-01
L	ECO 01-0679	C49 WAS 1600pF	BB	1-04-02
M	ECO 02-0030	L18 WAS 7T	DB	1-29-02

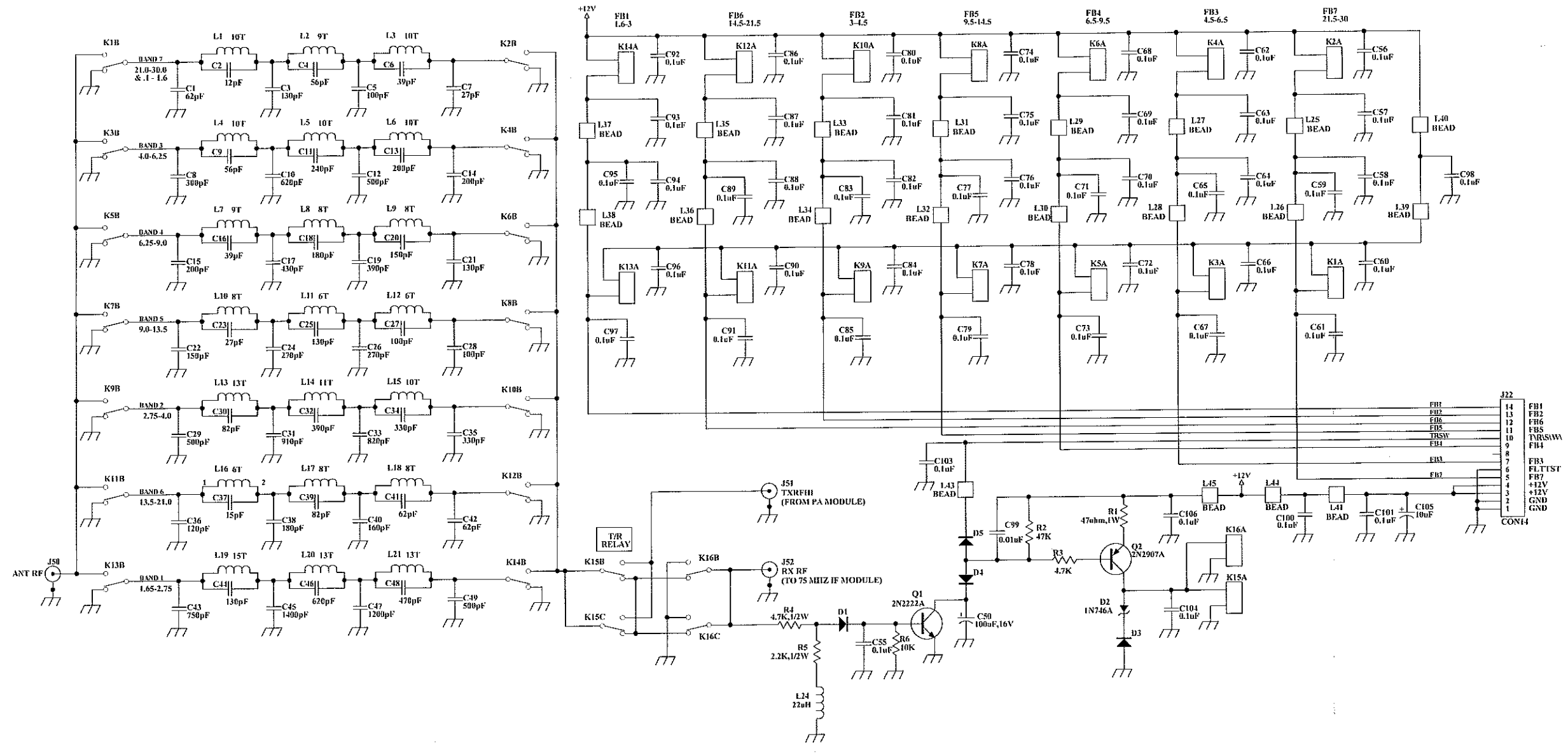


Figure 4-14  
RF Filter Board Schematic Diagram  
(994139 Rev. M)

TW7000-MS

		3030 Enterprise Ct. Vista, CA 92083 (760)997-3777	
Title: Schematic <b>RF FILTER MODULE, TW7000</b>			
Size: C	Drawn: A. MARTINEZ	Date: 13OC191	Rev: M
Appr:		Date:	994139
File: 994139A1.SCH		Date: 4-Oct-2004	Time: 13:13:20 Sheet 1 of 1



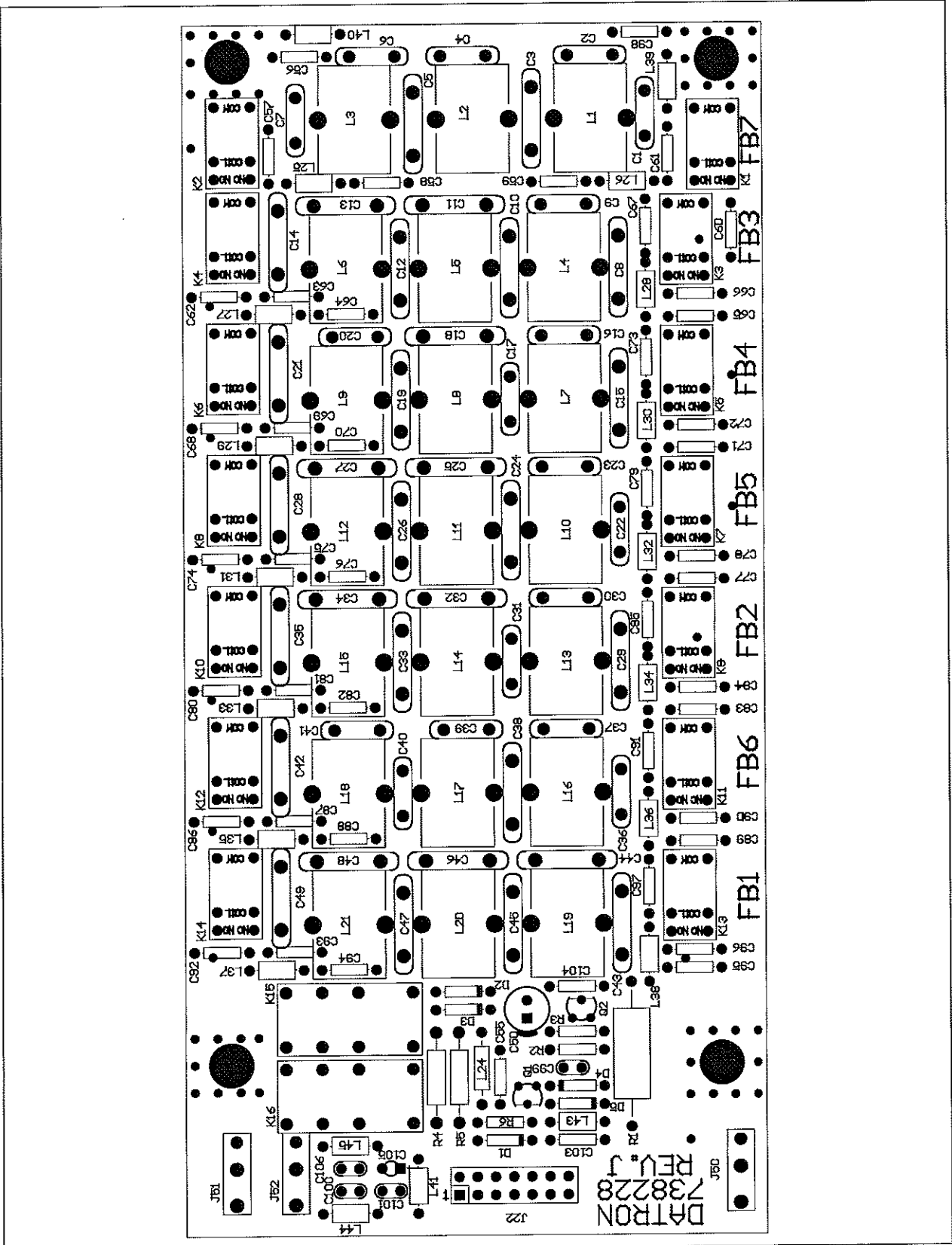


Figure 4-15. RF Filter Board Component Locations (738228 Rev. J)

Table 4-8. RF Filter Board Parts List (001-00320 Rev. T)

Designator	Part Number	Description
C1	220620	CAP,62PF DM15 MICA
C10	224621	CAP,620PF MICA DM19
C100	275104	CAP,C,0.1U,50,10%,X,RA,.10SP
C101	275104	CAP,C,0.1U,50,10%,X,RA,.10SP
C103	277104	CAP,C,0.1U,50,10%,X,AX,.25SP
C104	277104	CAP,C,0.1U,50,10%,X,AX,.25SP
C105	241100	CAP,10MF DIP TANTALUM
C106	275104	CAP,C,0.1U,50,10%,X,RA,.10SP
C11	224241	CAP,240PF DM19 MICA
C12	224501	CAP,500PF DM19 MICA
C13	224201	CAP,200PF DM19 MICA
C14	224201	CAP,200PF DM19 MICA
C15	224201	CAP,200PF DM19 MICA
C16	220390	CAP,39PF DM15 MICA
C17	220431	CAP,430PF DM15 MICA
C18	224181	CAP,180PF 5% DM19 MICA
C19	224391	CAP,390PF DM19 MICA
C2	220120	CAP,12PF DM15 MICA
C20	220151	CAP,150PF DM15 MICA
C21	224131	CAP,130PF DM19 MICA
C22	220151	CAP,150PF DM15 MICA
C23	220270	CAP,27PF 5% DM15 MICA
C24	224301	CAP,300PF DM19 MICA
C25	224131	CAP,130PF DM19 MICA
C26	224271	CAP,270PF 5% DM19 MICA
C27	220101	CAP,100PF DM15 MICA
C28	220101	CAP,100PF DM15 MICA
C29	224501	CAP,500PF DM19 MICA
C3	224131	CAP,130PF DM19 MICA
C30	220820	CAP,82PF DM15 MICA
C31	220911	CAP,910PF DM15 MICA
C32	224391	CAP,390PF DM19 MICA
C33	224821	CAP,820PF DM19 MICA

Table 4-8. RF Filter Board Parts List (001-00320 Rev. T)

Designator	Part Number	Description
C34	224331	CAP,330PF DM19 MICA
C35	224331	CAP,330PF DM19 MICA
C36	220121	CAP,120PF 5% MICA DIPPED
C37	220150	CAP,15PF DM15 MICA
C38	224181	CAP,180PF 5% DM19 MICA
C39	220820	CAP,82PF DM15 MICA
C4	220560	CAP,56PF DM15 MICA
C40	220161	CAP,160PF DM15 MICA
C41	220620	CAP,62PF DM15 MICA
C42	220620	CAP,62PF DM15 MICA
C43	224751	CAP, 750PF DM19 MICA
C44	224131	CAP,130PF DM19 MICA
C45	224142	CAP,1400PF DM19 MICA
C46	224621	CAP,620PF MICA DM19
C47	224122	CAP.1200PF MICA DM19
C48	224471	CAP,470PF DM19 MICA
C49	224501	CAP,500PF DM19 MICA
C5	220101	CAP,100PF DM15 MICA
C50	237101	CAP,100MF 16V ELECT VRT
C55	277104	CAP,C,0.1U,50,10%,X,AX,.25SP
C56	277104	CAP,C,0.1U,50,10%,X,AX,.25SP
C57	277104	CAP,C,0.1U,50,10%,X,AX,.25SP
C58	277104	CAP,C,0.1U,50,10%,X,AX,.25SP
C59	277104	CAP,C,0.1U,50,10%,X,AX,.25SP
C6	220390	CAP,39PF DM15 MICA
C60	277104	CAP,C,0.1U,50,10%,X,AX,.25SP
C61	277104	CAP,C,0.1U,50,10%,X,AX,.25SP
C62	277104	CAP,C,0.1U,50,10%,X,AX,.25SP
C63	277104	CAP,C,0.1U,50,10%,X,AX,.25SP
C64	277104	CAP,C,0.1U,50,10%,X,AX,.25SP
C65	277104	CAP,C,0.1U,50,10%,X,AX,.25SP
C66	277104	CAP,C,0.1U,50,10%,X,AX,.25SP
C67	277104	CAP,C,0.1U,50,10%,X,AX,.25SP

Table 4-8. RF Filter Board Parts List (001-00320 Rev. T)

Designator	Part Number	Description
C68	277104	CAP,C,0.1U,50,10%,X,AX,.25SP
C69	277104	CAP,C,0.1U,50,10%,X,AX,.25SP
C7	220270	CAP,27PF 5% DM15 MICA
C70	277104	CAP,C,0.1U,50,10%,X,AX,.25SP
C71	277104	CAP,C,0.1U,50,10%,X,AX,.25SP
C72	277104	CAP,C,0.1U,50,10%,X,AX,.25SP
C73	277104	CAP,C,0.1U,50,10%,X,AX,.25SP
C74	277104	CAP,C,0.1U,50,10%,X,AX,.25SP
C75	277104	CAP,C,0.1U,50,10%,X,AX,.25SP
C76	277104	CAP,C,0.1U,50,10%,X,AX,.25SP
C77	277104	CAP,C,0.1U,50,10%,X,AX,.25SP
C78	277104	CAP,C,0.1U,50,10%,X,AX,.25SP
C79	277104	CAP,C,0.1U,50,10%,X,AX,.25SP
C8	224301	CAP,300PF DM19 MICA
C80	277104	CAP,C,0.1U,50,10%,X,AX,.25SP
C81	277104	CAP,C,0.1U,50,10%,X,AX,.25SP
C82	277104	CAP,C,0.1U,50,10%,X,AX,.25SP
C83	277104	CAP,C,0.1U,50,10%,X,AX,.25SP
C84	277104	CAP,C,0.1U,50,10%,X,AX,.25SP
C85	277104	CAP,C,0.1U,50,10%,X,AX,.25SP
C86	277104	CAP,C,0.1U,50,10%,X,AX,.25SP
C87	277104	CAP,C,0.1U,50,10%,X,AX,.25SP
C88	277104	CAP,C,0.1U,50,10%,X,AX,.25SP
C89	277104	CAP,C,0.1U,50,10%,X,AX,.25SP
C9	220560	CAP,56PF DM15 MICA
C90	277104	CAP,C,0.1U,50,10%,X,AX,.25SP
C91	277104	CAP,C,0.1U,50,10%,X,AX,.25SP
C92	277104	CAP,C,0.1U,50,10%,X,AX,.25SP
C93	277104	CAP,C,0.1U,50,10%,X,AX,.25SP
C94	277104	CAP,C,0.1U,50,10%,X,AX,.25SP
C95	277104	CAP,C,0.1U,50,10%,X,AX,.25SP
C96	277104	CAP,C,0.1U,50,10%,X,AX,.25SP
C97	277104	CAP,C,0.1U,50,10%,X,AX,.25SP

Table 4-8. RF Filter Board Parts List (001-00320 Rev. T)

Designator	Part Number	Description
C98	277104	CAP,C,0.1U,50,10%,X,AX,.25SP
C99	214103	CAP,C,0.01U,50,10%,X,RA,.1SP
D1	320002	DIODE,SI 100MA 1N4148/1N4150
D2	320210	DIODE,ZENER 3.3V 1N746A
D3	320002	DIODE,SI 100MA 1N4148/1N4150
D4	320002	DIODE,SI 100MA 1N4148/1N4150
D5	320002	DIODE,SI 100MA 1N4148/1N4150
J22	620017	HEADER,MALE 14 PIN DUAL
J50	614026	CONN,RF FEMALE LOW-TYPE RECEPT
J51	614026	CONN,RF FEMALE LOW-TYPE RECEPT
J52	614026	CONN,RF FEMALE LOW-TYPE RECEPT
K1	540077	RELAY,SP PCB MOUNT
K10	540077	RELAY,SP PCB MOUNT
K11	540077	RELAY,SP PCB MOUNT
K12	540077	RELAY,SP PCB MOUNT
K13	540077	RELAY,SP PCB MOUNT
K14	540077	RELAY,SP PCB MOUNT
K15	540078	RELAY,DPDT PC MOUNT 6V
K16	540078	RELAY,DPDT PC MOUNT 6V
K2	540077	RELAY,SP PCB MOUNT
K3	540077	RELAY,SP PCB MOUNT
K4	540077	RELAY,SP PCB MOUNT
K5	540077	RELAY,SP PCB MOUNT
K6	540077	RELAY,SP PCB MOUNT
K7	540077	RELAY,SP PCB MOUNT
K8	540077	RELAY,SP PCB MOUNT
K9	540077	RELAY,SP PCB MOUNT
L1	459325	IND ASSY,10T,#20,1-490006
L10	451122	IND ASSY,8T#20 1-490008
L11	459424	IND ASSY,6T#20 1-490008 COMPRS
L12	459424	IND ASSY,6T#20 1-490008 COMPRS
L13	459119	IND ASSY, 13T#22 1-490009
L14	459103	IND ASSY,11T#22,AWG,1-490009

4: Technical Description

Table 4-8. RF Filter Board Parts List (001-00320 Rev. T)

Designator	Part Number	Description
L15	459174	IND ASSY,10T#22 AWG 1-490009
L16	459131	IND ASSY, 6T#20 AWG 1-490008
L17	451127	IND ASSY, 8T#20 1-490010
L18	459425	IND ASSY,8T#20 1-490010 COMPRS
L19	451115	IND ASSY,15T#22 1-490009
L2	459326	IND ASSY,9T,#20,2-490104
L20	459119	IND ASSY, 13T#22 1-490009
L21	459119	IND ASSY, 13T#22 1-490009
L24	430021	INDUCTOR FIXED RFC 22UH
L25	490204	BEAD FERRITE SHIELD 43 MAT
L26	490204	BEAD FERRITE SHIELD 43 MAT
L27	490204	BEAD FERRITE SHIELD 43 MAT
L28	490204	BEAD FERRITE SHIELD 43 MAT
L29	490204	BEAD FERRITE SHIELD 43 MAT
L3	459325	IND ASSY,10T,#20,1-490006
L30	490204	BEAD FERRITE SHIELD 43 MAT
L31	490204	BEAD FERRITE SHIELD 43 MAT
L32	490204	BEAD FERRITE SHIELD 43 MAT
L33	490204	BEAD FERRITE SHIELD 43 MAT
L34	490204	BEAD FERRITE SHIELD 43 MAT
L35	490204	BEAD FERRITE SHIELD 43 MAT
L36	490204	BEAD FERRITE SHIELD 43 MAT
L37	490204	BEAD FERRITE SHIELD 43 MAT
L38	490204	BEAD FERRITE SHIELD 43 MAT
L39	490204	BEAD FERRITE SHIELD 43 MAT
L4	459134	IND ASSY, 10T#22 AWG 1-490008
L40	490204	BEAD FERRITE SHIELD 43 MAT
L41	490204	BEAD FERRITE SHIELD 43 MAT
L43	490204	BEAD FERRITE SHIELD 43 MAT
L44	490204	BEAD FERRITE SHIELD 43 MAT
L45	490204	BEAD FERRITE SHIELD 43 MAT
L5	459134	IND ASSY, 10T#22 AWG 1-490008
L6	459134	IND ASSY, 10T#22 AWG 1-490008

Table 4-8. RF Filter Board Parts List (001-00320 Rev. T)

Designator	Part Number	Description
L7	459120	IND ASSY,9T#22 1-490008
L8	459105	IND ASSY, 8T#22 AWG 1-490008
L9	459105	IND ASSY, 8T#22 AWG 1-490008
Q1	310057	XISTOR,NPN,PN2222A,TO92
Q2	310052	XISTOR,PNP,PN2907A,TO92
R1	144470	RES,MO,47 OHM,1W,5%, .5 SP
R2	113473	RES,47K 1/8W 5% CARBON FILM
R3	113472	RES,4.7K 1/8W 5% CARBON FILM
R4	134472	RES,4.7K 1/2W FILM
R5	134222	RES,2.2K 1/2W 5% CF
R6	113103	RES,10K 1/8W 5% CARBON FILM

## 4.6 RF Power Amplifier Board

The RF Power Amplifier board is a two-stage broadband 1.6 to 30 MHz power amplifier capable of putting out 150W of RF power. It is located on the heat sink assembly and gets its drive from the exciter circuitry on the 75 MHz IF board via coaxial connector J10 (TXRFLOW). The high power output goes to the RF Filter board via connector J12 (TXRFHI). Power for the board is 12V PA, raw, unregulated, unswitched, primary input power, that comes in via a pendant cable terminated in connector J24. Refer to the block diagram below.

The board contains class-AB driver amplifiers and class-AB final amplifiers, both of which operate in a push-pull mode. Special broadband transformers are used in the combiner circuits shown in the diagram. Each stage has its own separate bias network, turned on by the T12 line (+12 Vdc only in transmit mode) coming from the 75 MHz IF board.

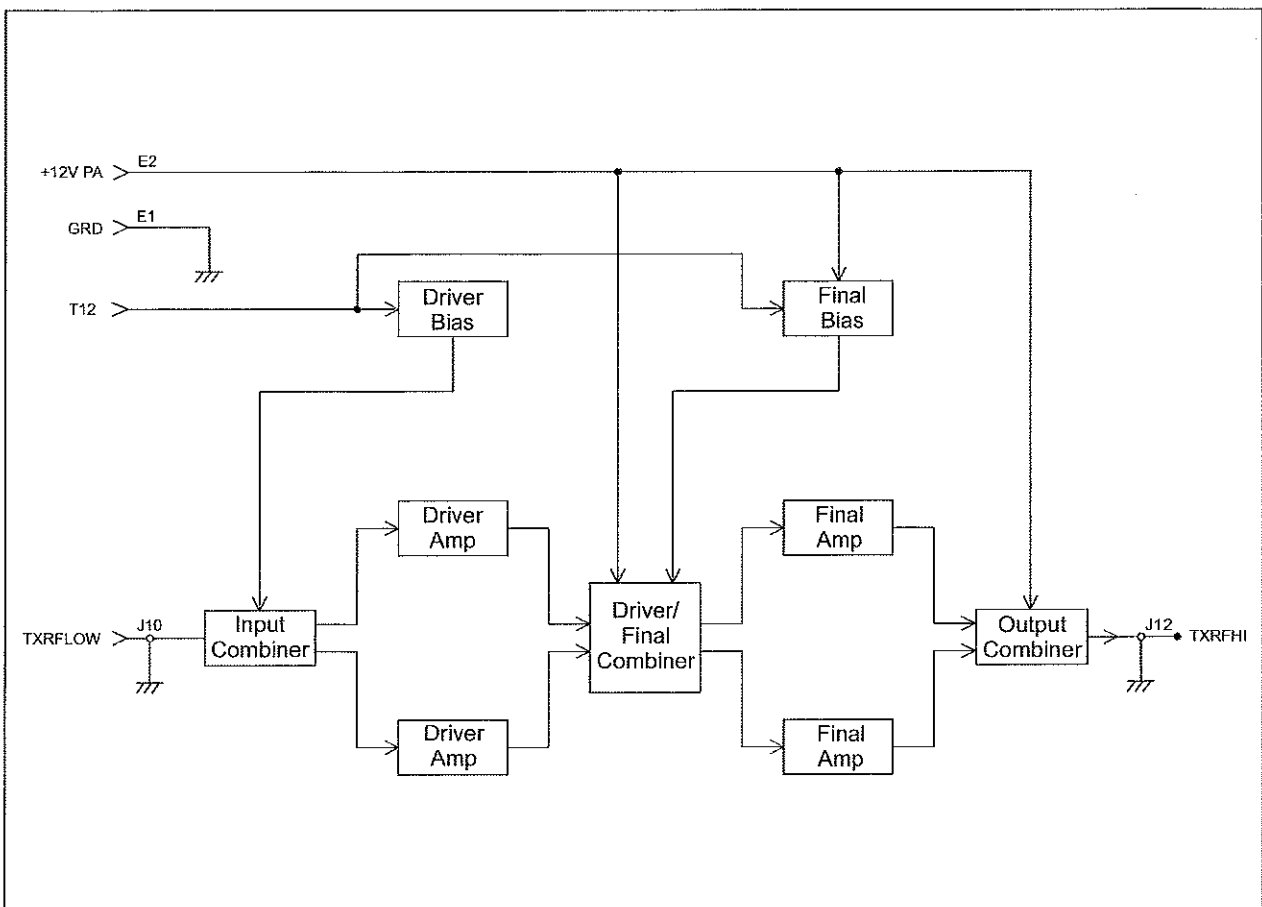
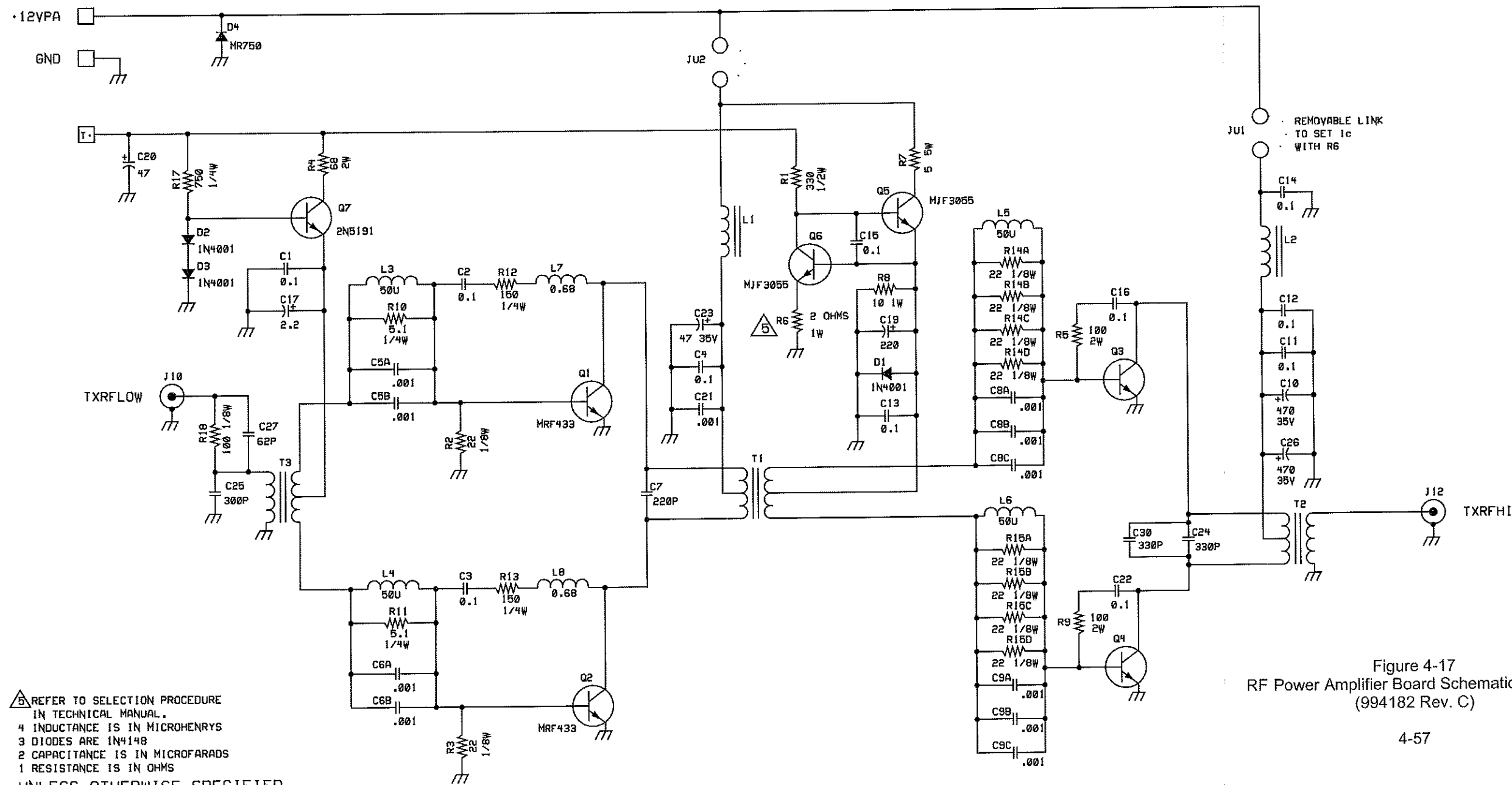


Figure 4-16. RF Power Amplifier Board Block Diagram

REV	ECH	DESCRIPTION	DATE	APPR
A	7000-063	RELEASE	11AUG93	
B	MISC-460	C19 WAS 220uF	4-8-96	
C	00-0295 ADD	C30, C36, C24 JC	7/17/00	



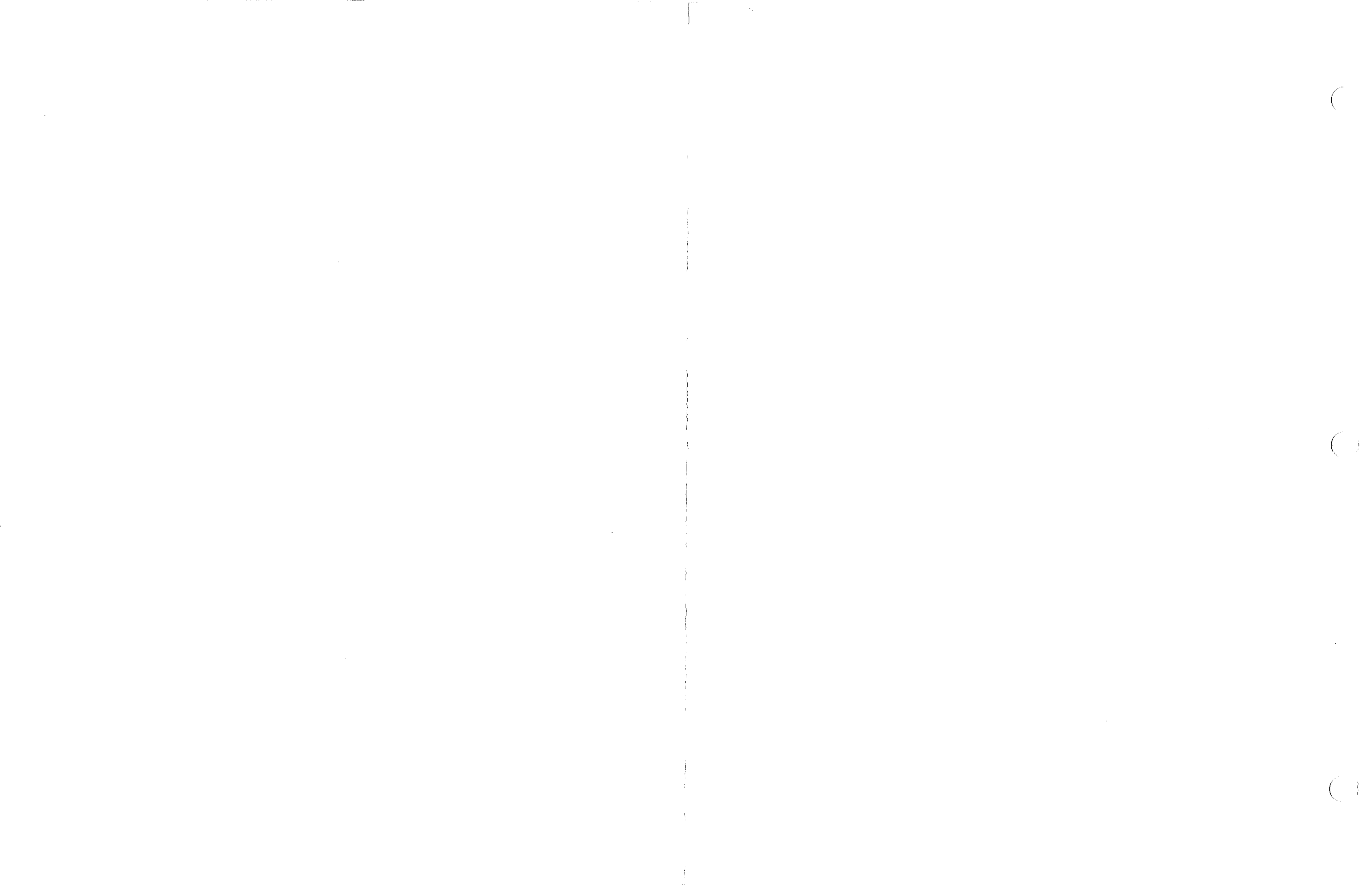
△ REFER TO SELECTION PROCEDURE  
 IN TECHNICAL MANUAL.  
 4 INDUCTANCE IS IN MICROHENRYS  
 3 DIODES ARE 1N4148  
 2 CAPACITANCE IS IN MICROFARADS  
 1 RESISTANCE IS IN OHMS  
 NOTES UNLESS OTHERWISE SPECIFIED

Figure 4-17  
RF Power Amplifier Board Schematic Diagram  
(994182 Rev. C)

4-57

TW7000-MS

<b>DATRON</b> DATRON WORLD COMMUNICATIONS INC.			
TITLE SCHEMATIC		TW7000	
<b>RF AMPLIFIER 12V</b>			
SIZE	DRAWN	DRAWING NUMBER	REV.
C	SATTEL	994182	C
ENGR			
SCALE	DATE	SHEET	OF
	3 APR 92	1	1



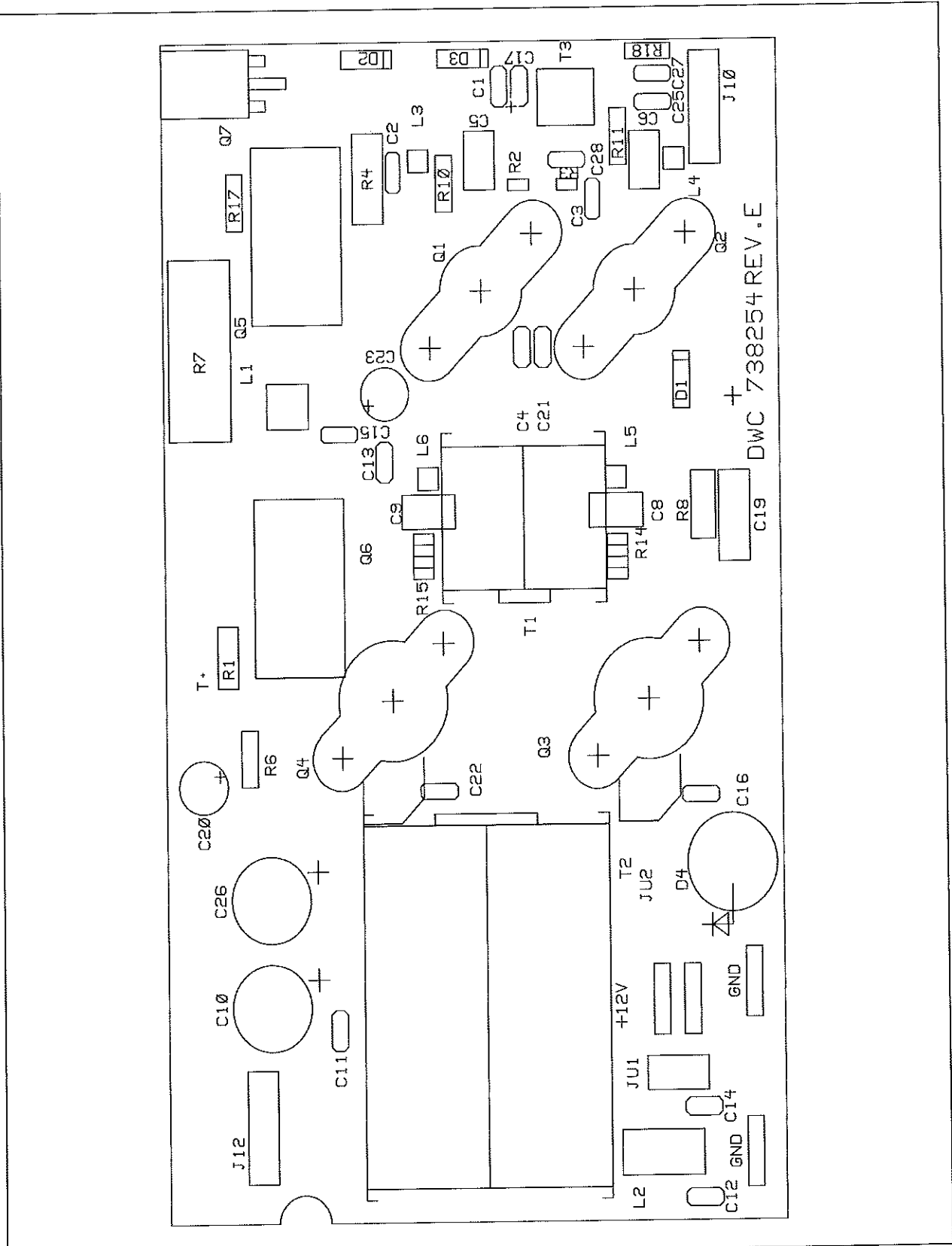


Figure 4-18. RF Power Amplifier Board Component Locations (738254 Rev. E)

Table 4-9. RF Power Amplifier Board Parts List (001-00311 Rev. F)

Designator	Part Number	Description
C1	275104	CAP,C,0.1U,50,10%,X,RA,.10SP
C10	233471	CAP,470MF,35V,ELECT,VERT
C11	275104	CAP,C,0.1U,50,10%,X,RA,.10SP
C12	275104	CAP,C,0.1U,50,10%,X,RA,.10SP
C13	275104	CAP,C,0.1U,50,10%,X,RA,.10SP
C14	275104	CAP,C,0.1U,50,10%,X,RA,.10SP
C15	275104	CAP,C,0.1U,50,10%,X,RA,.10SP
C16	275104	CAP,C,0.1U,50,10%,X,RA,.10SP
C17	231020	CAP,2.2MF VRT ELECT
C19	230201	CAP,220uF,16V,ELECT
C2	275104	CAP,C,0.1U,50,10%,X,RA,.10SP
C20	231500	CAP,A,47U,16V,20%,RA,.2SP
C21	210102	CAP,.001UF,50V,10%,NPO
C22	275104	CAP,C,0.1U,50,10%,X,RA,.10SP
C23	234470	CAP,47MF 35V ELECT VRT
C25	221301	CAP, 300 PF DM5 MICA
C26	233471	CAP,470MF,35V,ELECT,VERT
C27	221620	CAP,62PF DM5 MICA
C3	275104	CAP,C,0.1U,50,10%,X,RA,.10SP
C4	275104	CAP,C,0.1U,50,10%,X,RA,.10SP
C5A	216102-1	CAP,1000PF 10% CHIP CER
C5B	216102-1	CAP,1000PF 10% CHIP CER
C6A	216102-1	CAP,1000PF 10% CHIP CER
C6B	216102-1	CAP,1000PF 10% CHIP CER
C7	224221	CAP,220PF DM19 MICA
C8A	216102-1	CAP,1000PF 10% CHIP CER
C8B	216102-1	CAP,1000PF 10% CHIP CER
C8C	216102-1	CAP,1000PF 10% CHIP CER
C9A	216102-1	CAP,1000PF 10% CHIP CER
C9B	216102-1	CAP,1000PF 10% CHIP CER
C9C	216102-1	CAP,1000PF 10% CHIP CER
D1	320102	DIODE, 1N4001 RECT SI 1A 50V
D2	320102	DIODE, 1N4001 RECT SI 1A 50V

Table 4-9. RF Power Amplifier Board Parts List (001-00311 Rev. F)

Designator	Part Number	Description
D3	320102	DIODE, 1N4001 RECT SI 1A 50V
D4	320421	DIODE, MR750
J10	614026	CONN,RF FEMALE LOW-TYPE RECEPT
J12	614026	CONN,RF FEMALE LOW-TYPE RECEPT
L1	459113	IND ASSY,3T,#18,1-490302
L2	459113	IND ASSY,3T,#18,1-490302
L3	459114	IND ASSY,6T#30GA RED 1-490201
L4	459114	IND ASSY,6T#30GA RED 1-490201
L5	459114	IND ASSY,6T#30GA RED 1-490201
L6	459114	IND ASSY,6T#30GA RED 1-490201
Q7	310055	XISTOR,NPN,2N5191,TO126
R1	134331	RES,330 OHM 1/2W 5% CF
R10	124050	RES,5.1 OHM 1/4W 5% CF
R11	124050	RES,5.1 OHM 1/4W 5% CF
R14A	114220	RES,22 OHM 1/8W 5% LDLESS
R14B	114220	RES,22 OHM 1/8W 5% LDLESS
R14C	114220	RES,22 OHM 1/8W 5% LDLESS
R14D	114220	RES,22 OHM 1/8W 5% LDLESS
R15A	114220	RES,22 OHM 1/8W 5% LDLESS
R15B	114220	RES,22 OHM 1/8W 5% LDLESS
R15C	114220	RES,22 OHM 1/8W 5% LDLESS
R15D	114220	RES,22 OHM 1/8W 5% LDLESS
R17	124XXX	RESISTOR 1/4W, TBD
R18	113101	RES,100 OHM 1/8W 5% CF
R2	114220	RES,22 OHM 1/8W 5% LDLESS
R3	114220	RES,22 OHM 1/8W 5% LDLESS
R4	154680	RES,68 OHM 2W 5% FILM
R6	144XXX	RES,TBD,OHMS 1W 5%
R7	161050	RES,5 OHM 5W 10% WW
R8	144100	RES,10 OHM 1W 5% FILM
T1	459211	XFMR,1T1T #20AWG 6-490302
T2	459212	XFMR ASSY,4T#20 AWG 4-490502
T3	451136-1	XFMR ASSY,4T2T#32 GA 1-490303

**Table 4-10. RF Amplifier Assembly Parts List (004-12260 Rev. K)**

Designator	Part Number	Description
L7	430005	INDUCTOR FIXED .68UH
L8	430005	INDUCTOR FIXED .68UH
Q1	310140	XISTOR,RF DRVR,MRF433,12V,12W
Q2	310140	XISTOR,RF DRVR,MRF433,12V,12W
Q3	310071	XISTOR,NPN,SD1487-9,HF,100W
Q4	310071	XISTOR,NPN,SD1487-9,HF,100W
Q5	310133	XISTOR,NPN MJF3055 TO-220 INS
Q6	310133	XISTOR,NPN MJF3055 TO-220 INS
R12	124151	RES,150 OHM 1/4W 5% CF
R13	124151	RES,150 OHM 1/4W 5% CF
R5	154101	RES,100 OHM 2W 5% FILM
R9	154101	RES,100 OHM 2W 5% FILM

## 4.7 75 MHz IF Board

The 75 MHz IF board plugs into the motherboard at J6 and is located in the fourth card slot from the right side of the radio. It is used in both the transmit and receive paths.

The board is powered from +12V and generates its own 8 Vdc, receive-only 8 Vdc (R8), transmit-only 8 Vdc (T8), and transmit-only 12 Vdc (T12). T12 is used as the bias control line for the RF Power Amplifier board. T8 and R8 are used to power the transmit/receive switches and the circuits in the board that operate in either transmit or receive mode only.

The decoder/driver translates the serial data inputs from the processor into signals to drive the switch matrix. This switch circuit controls the high pass filter (relay K2), the 20 dB attenuator (relay K1), and the BITE status line.

### 4.7.1 Receive Mode

The RX RF from the RF Filter board is connected via a coaxial cable to connector J52. From there it goes through a high-pass filter (HPF) that is automatically switched into the circuit for all channel frequencies above 2 MHz. It then goes to a 20 dB attenuator controlled by a front panel switch. It is mixed with the first LO to form the first IF at 75 MHz. It is then amplified, filtered, and amplified again before going out to the 5 MHz IF board at coaxial connector J53. The AGC voltage for the receiver is applied at J6-18 and controls the gain of the last 75 MHz amplifier.

### 4.7.2 Transmit Mode

The modulated 75 MHz signal from the 5 MHz IF board comes in at J53 and goes through the transmit amplifier. The gain of this amplifier is controlled by the radio ALC system, in particular the (ALCLVL) J6-6 and the (RAWALC) J6-12 lines. The ALCLVL line comes from the processor and is used as the reference to set the output RF power level, while the RAWALC line is the ALC voltage from the Reference/Control board. The ALC voltage is a combination of forward and reflected power samples; when the antenna is a perfect 50 ohm match, there is no reflected voltage, and the ALC allows the radio to put out the power to which ALCLVL is set. As the VSWR increases, the reflected voltage goes up, and the larger value of the RAWALC line causes the output power to decrease proportionally.

From the transmit amplifier, the TX signal goes through the 75 MHz filter, and is amplified again prior to mixing with the first LO. The transmit signal, now at the channel frequency, goes to the transmitter exciter, a two-stage amplifier whose output is a push-pull amplifier with a nominal output of +20 dBm. The output signal is connected via a coaxial cable at J60 (TXRFLOW) to the RF Power Amplifier board.

**4.7.3  
Inter-connections**

For the interconnect lines between the 75 MHz board and the rest of the radio, refer to the table below.

**Table 4-11. 75 MHz IF Board Interconnections**

Connector J6	Description	Comment
1, 14	Ground	
2, 15	+12V input	
4	SPICLK	Clock
5	PTT	Push-to-talk
6	ALCLVL	Reference level for RF power output
12	RAWALC	ALC voltage
13	EN11	Decoder/driver enable
16	SPITXD	Serial TX data line
17	BITE	BITE status line
19	T12	+12 Vdc only in transmit

**4.7.4  
Test Procedures**

These test procedures require the following equipment:

- Oscilloscope
- SINAD meter
- Multimeter
- Power supply 0-20 Vdc
- Wattmeter
- 50 ohm, -30 dBm attenuator dummy load
- Two-tone test box
- Signal generator
- Extender card set

**RX Test**

1. Turn on the radio and check the input and output of U8. Input should be  $8.0V \pm .4 V$ , and output  $5.0V \pm .25V$ .
2. Set the radio to 8 MHz and the signal generator to 8.001 MHz, -113 dBm. Turn the volume knob fully clockwise with the speaker off, and peak both variable inductors (L35, L36) for maximum audio as read on the two-tone test box. The level should be approximately 3V or better. Set the volume to the 12:00 position.

3. Set the radio to 15.59 MHz USB and set the RF signal generator for 15.591 MHz with -113 dBm output. Test the radio at 1.65 MHz. The SINAD reading should be 10 dB or better.
4. Change the signal generator output to -93 dBm. Select **ATTN** on the TW7000 front panel to turn the attenuator on. The SINAD reading should be 10 dB or better. Select **ATTN** to turn the attenuator off.

**TX Test**

**Note:** *While keying the radio, the two-tone test box should be +10 dBm, 1 tone, and the reference potentiometer at about 2:00.*

1. Connect the output of the dummy load to the oscilloscope. Key the radio at 14.75 MHz. The output on the wattmeter should be approximately 100W  $\pm$ 20W.
2. Verify that the low and medium TX power is functioning.

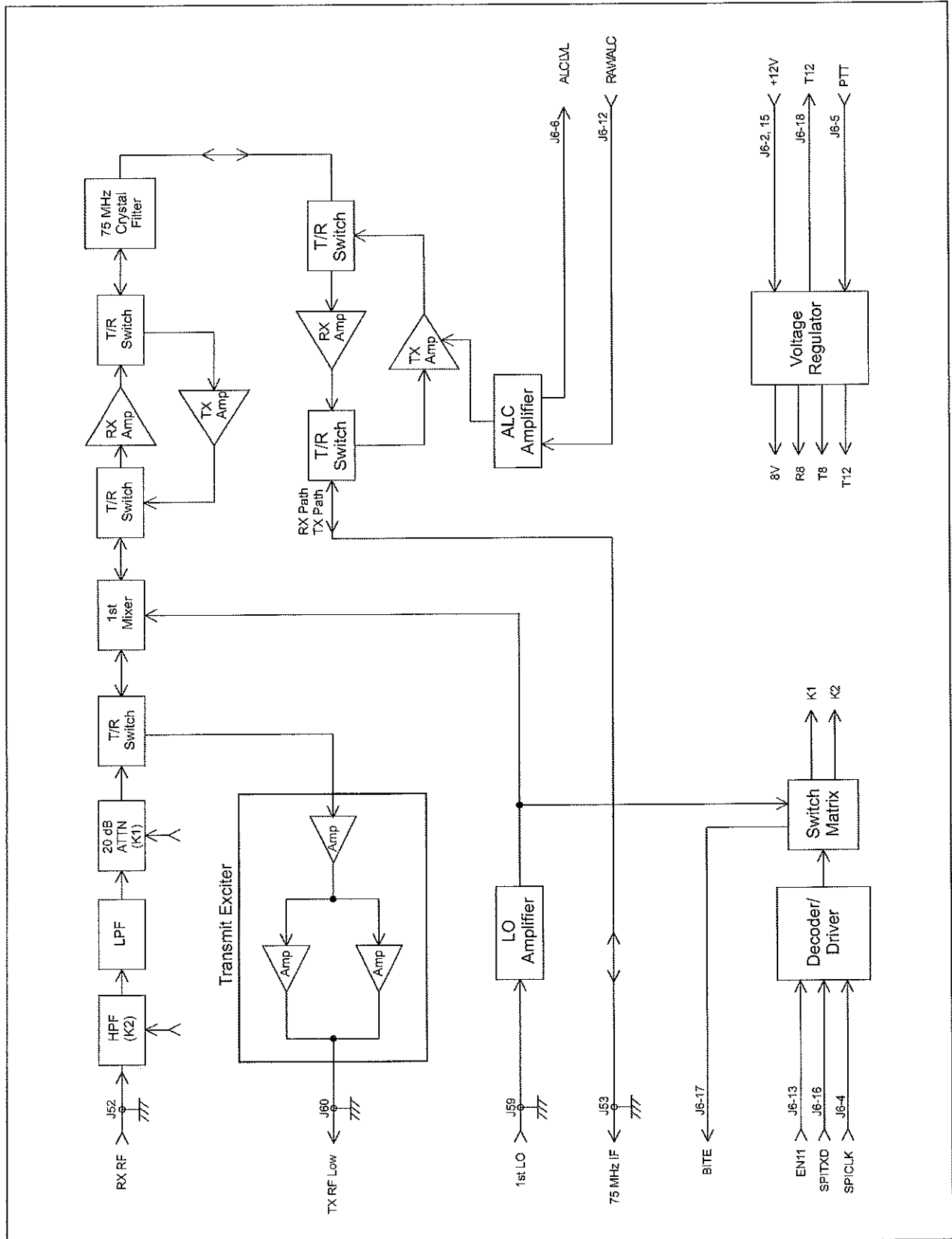


Figure 4-19. 75 MHz IF Block Diagram

REV	ECN	DESCRIPTION	DATE	APPR
A	7000-245	RELEASE	02-24-99	
B	7000-245	RELEASE	03-18-99	
C	01-002	CHANGE REFERENCE	10-17-01	
D	01-002	ADDED 15A, 12, C13	11-19-01	
E	02-013	15A, 15B, 15C, 15D, 15E, 15F, 15G, 15H, 15I, 15J, 15K, 15L, 15M, 15N, 15O, 15P, 15Q, 15R, 15S, 15T, 15U, 15V, 15W, 15X, 15Y, 15Z	05-15-02	
F	03-047	added RS	10-23-04	

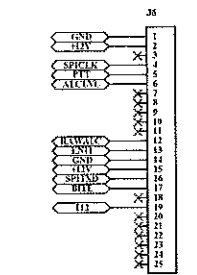
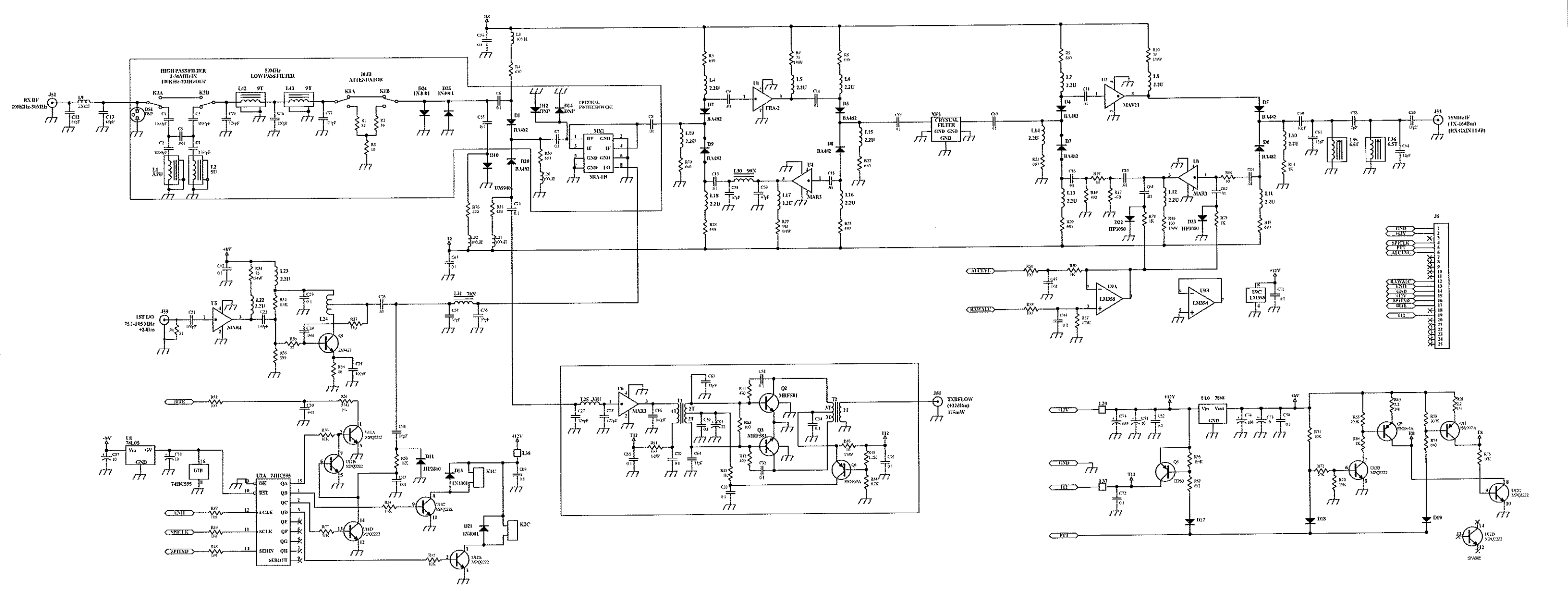


Figure 4-20  
75 MHz IF Board Schematic Diagram  
(994292 Rev. F)

4 INDUCTANCE IS IN MICROHENRYS.  
3 DIODES ARE IN VOLTS.  
2 CAPACITANCE IS IN MICROFARADS.  
1 RESISTANCE IS IN OHMS.  
NOTE: UNLESS OTHERWISE SPECIFIED

DATCOM WORLD COMMUNICATIONS INC.		3001 E. 15th St. Vista, CA 92083 (619) 593-3777	
Title:	Schematic	Drawing Number:	TW7000
Rev:	D	Date:	03/04/04
App:		Drawn:	994292
Date: 24-Feb-2004		Time: 14:17:58	Sheet: 1 of 1



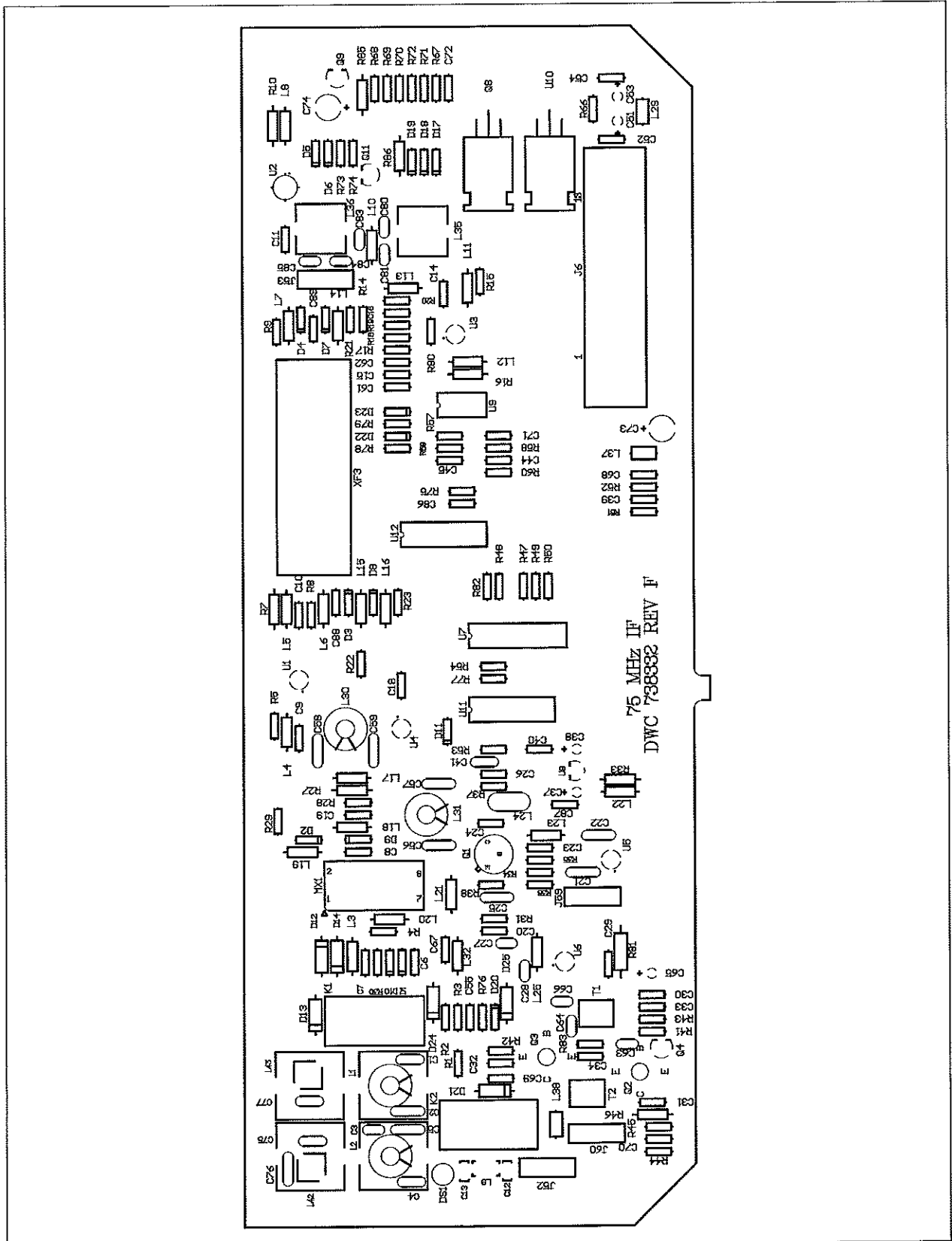


Figure 4-21. 75 MHz IF Board Component Locations (738332 Rev. F)

Table 4-12. 75 MHz Board Parts List (001-00710 Rev. K)

Designator	Part Number	Description
C1	254152	CAP,0.0015MF MYLAR
C10	277103	CAP,C,0.01U,100,10%,X,AX,.25SP
C11	277103	CAP,C,0.01U,100,10%,X,AX,.25SP
C12	021680001	CAP,SM,CER,68PF,2%,100V 0805
C13	021680001	CAP,SM,CER,68PF,2%,100V 0805
C14	277103	CAP,C,0.01U,100,10%,X,AX,.25SP
C15	277103	CAP,C,0.01U,100,10%,X,AX,.25SP
C16	277103	CAP,C,0.01U,100,10%,X,AX,.25SP
C18	277103	CAP,C,0.01U,100,10%,X,AX,.25SP
C19	277103	CAP,C,0.01U,100,10%,X,AX,.25SP
C2	254822-1	CAP,Y,8200PF,50V,5%,RA,.15
C20	277104	CAP,C,0.1U,50,10%,X,AX,.25SP
C21	210101	CAP,100P DISC NPO
C22	210101	CAP,100P DISC NPO
C23	277104	CAP,C,0.1U,50,10%,X,AX,.25SP
C24	277102	CAP,C,1000P,100,10%,X,AX,.25SP
C25	210101	CAP,100P DISC NPO
C26	277103	CAP,C,0.01U,100,10%,X,AX,.25SP
C27	210121	CAP,120 PF DISC NPO
C28	210121	CAP,120 PF DISC NPO
C29	277104	CAP,C,0.1U,50,10%,X,AX,.25SP
C3	254102	CAP,0.001MF 5% MYLAR
C30	277104	CAP,C,0.1U,50,10%,X,AX,.25SP
C31	277104	CAP,C,0.1U,50,10%,X,AX,.25SP
C32	277104	CAP,C,0.1U,50,10%,X,AX,.25SP
C33	277104	CAP,C,0.1U,50,10%,X,AX,.25SP
C34	277104	CAP,C,0.1U,50,10%,X,AX,.25SP
C37	241100	CAP,10MF DIP TANTALUM
C38	241100	CAP,10MF DIP TANTALUM
C39	277102	CAP,C,1000P,100,10%,X,AX,.25SP
C4	254272	CAP,0.0027MF 50V MYLAR
C40	277102	CAP,C,1000P,100,10%,X,AX,.25SP
C41	210100	CAP,10 PF DISC NPO

Table 4-12. 75 MHz Board Parts List (001-00710 Rev. K)

Designator	Part Number	Description
C44	277104	CAP,C,0.1U,50,10%,X,AX,.25SP
C45	277102	CAP,C,1000P,100,10%,X,AX,.25SP
C5	254182	CAP,Y,1800PF,50V,5%,RA,.15
C51	241100	CAP,10MF DIP TANTALUM
C52	277104	CAP,C,0.1U,50,10%,X,AX,.25SP
C53	241100	CAP,10MF DIP TANTALUM
C54	277104	CAP,C,0.1U,50,10%,X,AX,.25SP
C55	277104	CAP,C,0.1U,50,10%,X,AX,.25SP
C56	210390	CAP, 39 PF NPO
C57	210390	CAP, 39 PF NPO
C58	210470	CAP,47 PF DISC NPO
C59	210470	CAP,47 PF DISC NPO
C6	277104	CAP,C,0.1U,50,10%,X,AX,.25SP
C61	277103	CAP,C,0.01U,100,10%,X,AX,.25SP
C62	277103	CAP,C,0.01U,100,10%,X,AX,.25SP
C63	210330	CAP,33 PF DISC NPO
C64	210330	CAP,33 PF DISC NPO
C65	241226	CAP,T,22UF,25V,20%,RA,.1SP
C66	221101	CAP,100PF DM5 MICA
C67	277104	CAP,C,0.1U,50,10%,X,AX,.25SP
C68	277104	CAP,C,0.1U,50,10%,X,AX,.25SP
C69	277104	CAP,C,0.1U,50,10%,X,AX,.25SP
C7	277104	CAP,C,0.1U,50,10%,X,AX,.25SP
C70	277104	CAP,C,0.1U,50,10%,X,AX,.25SP
C71	277104	CAP,C,0.1U,50,10%,X,AX,.25SP
C72	277104	CAP,C,0.1U,50,10%,X,AX,.25SP
C73	231101	CAP,A,100U,16V,20%,RA .2SP
C74	231101	CAP,A,100U,16V,20%,RA .2SP
C75	210121	CAP,120 PF DISC NPO
C76	210151	CAP,150 PF 10% DISC
C77	210121	CAP,120 PF DISC NPO
C8	277103	CAP,C,0.01U,100,10%,X,AX,.25SP
C80	210100	CAP,10 PF DISC NPO

Table 4-12. 75 MHz Board Parts List (001-00710 Rev. K)

Designator	Part Number	Description
C81	210120	CAP,12 PF DISC NPO
C83	210020	CAP,2 PF DISC NPO
C84	210120	CAP,12 PF DISC NPO
C85	210100	CAP,10 PF DISC NPO
C86	277104	CAP,C,0.1U,50,10%,X,AX,,25SP
C87	277104	CAP,C,0.1U,50,10%,X,AX,,25SP
C88	277103	CAP,C,0.01U,100,10%,X,AX,,25SP
C89	277103	CAP,C,0.01U,100,10%,X,AX,,25SP
C9	277103	CAP,C,0.01U,100,10%,X,AX,,25SP
D1	320005	DIODE, PIN SWITCHING, BA482
D10	320005	DIODE, PIN SWITCHING, BA482
D11	320015	DIODE,HP2800
D13	320102	DIODE, 1N4001 RECT SI 1A 50V
D17	320002	DIODE,SI 100MA 1N4148/1N4150
D18	320002	DIODE,SI 100MA 1N4148/1N4150
D19	320002	DIODE,SI 100MA 1N4148/1N4150
D2	320005	DIODE, PIN SWITCHING, BA482
D20	320432	DIODE,PIN,ANT SW,5.5W,UM9401B
D21	320102	DIODE, 1N4001 RECT SI 1A 50V
D22	320503	DIODE,PIN 5082-3080
D23	320503	DIODE,PIN 5082-3080
D24	320102	DIODE, 1N4001 RECT SI 1A 50V
D25	320102	DIODE, 1N4001 RECT SI 1A 50V
D3	320005	DIODE, PIN SWITCHING, BA482
D4	320005	DIODE, PIN SWITCHING, BA482
D5	320005	DIODE, PIN SWITCHING, BA482
D6	320005	DIODE, PIN SWITCHING, BA482
D7	320005	DIODE, PIN SWITCHING, BA482
D8	320005	DIODE, PIN SWITCHING, BA482
D9	320005	DIODE, PIN SWITCHING, BA482
J52	614026	CONN,RF FEMALE LOW-TYPE RECEPT
J53	614026	CONN,RF FEMALE LOW-TYPE RECEPT
J59	614026	CONN,RF FEMALE LOW-TYPE RECEPT

Table 4-12. 75 MHz Board Parts List (001-00710 Rev. K)

Designator	Part Number	Description
J6	613163	CONN,DB-25 RT ANGLE PC PLUG
J60	614026	CONN,RF FEMALE LOW-TYPE RECEPT
K1	540073	RELAY,2PDT MDX-12-01
K2	540073	RELAY,2PDT MDX-12-01
L1	459228	IND HORZ,32T AWG32 1-490033
L10	430031	INDUCTOR FIXED MOLDED 2.2UH
L11	430031	INDUCTOR FIXED MOLDED 2.2UH
L12	430031	INDUCTOR FIXED MOLDED 2.2UH
L13	430031	INDUCTOR FIXED MOLDED 2.2UH
L14	430031	INDUCTOR FIXED MOLDED 2.2UH
L15	430031	INDUCTOR FIXED MOLDED 2.2UH
L16	430031	INDUCTOR FIXED MOLDED 2.2UH
L17	430031	INDUCTOR FIXED MOLDED 2.2UH
L18	430031	INDUCTOR FIXED MOLDED 2.2UH
L19	430031	INDUCTOR FIXED MOLDED 2.2UH
L2	459229	IND HORZ,39T 32AWG 1-490033
L20	430014	INDUCTOR MOLDED MIN 100UH
L21	430014	INDUCTOR MOLDED MIN 100UH
L22	430031	INDUCTOR FIXED MOLDED 2.2UH
L23	430031	INDUCTOR FIXED MOLDED 2.2UH
L24	459227	IND ASSY,IT/IT 32AWG 1-491301
L25	430045	INDT, MOLD, 0.33uh, T/R
L29	450132	IND ASSY,3T#28 MGT 1-490201
L3	430014	INDUCTOR MOLDED MIN 100UH
L30	459243	IND ASSY,7T#22AWG 1-490032
L31	459244	IND ASSY,4T#22AWG 1-490032
L32	430014	INDUCTOR MOLDED MIN 100UH
L35	490144	IND,VAR 0.22-0.25UH BLUE 10MM
L36	490144	IND,VAR 0.22-0.25UH BLUE 10MM
L37	490204	BEAD FERRITE SHIELD 43 MAT
L38	490204	BEAD FERRITE SHIELD 43 MAT
L4	430031	INDUCTOR FIXED MOLDED 2.2UH
L42	490127	COIL 9.5T (MD) SQ

Table 4-12. 75 MHz Board Parts List (001-00710 Rev. K)

Designator	Part Number	Description
L43	490127	COIL 9.5T (MD) SQ
L5	430031	INDUCTOR FIXED MOLDED 2.2UH
L6	430031	INDUCTOR FIXED MOLDED 2.2UH
L7	430031	INDUCTOR FIXED MOLDED 2.2UH
L8	430031	INDUCTOR FIXED MOLDED 2.2UH
L9	041221000	INDUCTOR SM 220nH 20% 1210
MX1	380021	MIXER, T17DBM 50KHZ
Q1	310011	XISTOR,NPN,2N4427,TO5
Q11	310052	XISTOR,PNP,PN2907A,TO92
Q2	310130	XISTOR,MRF581A,317-01 CASE
Q3	310130	XISTOR,MRF581A,317-01 CASE
Q4	310052	XISTOR,PNP,PN2907A,TO92
Q8	310083	XISTOR,PNP,TIP30C,TO220
Q9	310052	XISTOR,PNP,PN2907A,TO92
R1	113390	RES,39 OHM 1/8W 5% CARBON FILM
R10	124470	RES,47 OHM 1/4W 5% CARBON FILM
R14	113102	RES, 1K, 1/8W, 5%, CF
R15	113681	RES,680 OHM 1/8W 5% CF
R16	124101	RES,100 OHM 1/4W 5% CF
R17	113471	RES,470 OHM 1/8W 5% CF
R18	113100	RES,10 OHM 1/8W 5% FILM
R19	113471	RES,470 OHM 1/8W 5% CF
R2	113390	RES,39 OHM 1/8W 5% CARBON FILM
R20	113681	RES,680 OHM 1/8W 5% CF
R21	113681	RES,680 OHM 1/8W 5% CF
R22	113681	RES,680 OHM 1/8W 5% CF
R23	113681	RES,680 OHM 1/8W 5% CF
R27	124101	RES,100 OHM 1/4W 5% CF
R28	113681	RES,680 OHM 1/8W 5% CF
R29	113681	RES,680 OHM 1/8W 5% CF
R3	113100	RES,10 OHM 1/8W 5% FILM
R30	113681	RES,680 OHM 1/8W 5% CF
R31	113681	RES,680 OHM 1/8W 5% CF

Table 4-12. 75 MHz Board Parts List (001-00710 Rev. K)

Designator	Part Number	Description
R33	124750	RES,75 OHM 1/4W 5% CARBON FILM
R34	113182	RES,1.8K 1/8W 5% CARBON FILM
R35	113220	RES,22 OHM 1/8W 5% CARBON FILM
R36	113331	RES,330 OHM 1/8W 5% CF
R37	113331	RES,330 OHM 1/8W 5% CF
R38	113100	RES,10 OHM 1/8W 5% FILM
R4	113681	RES,680 OHM 1/8W 5% CF
R41	113471	RES,470 OHM 1/8W 5% CF
R42	113471	RES,470 OHM 1/8W 5% CF
R43	113102	RES, 1K, 1/8W, 5%, CF
R44	113822	RES,8.2K 1/8W 5% CARBON FILM
R45	113122	RES,1.2K 1/8W 5% CARBON FILM
R46	124100	RES,10 OHM 1/4W 5% CARBON FILM
R47	113101	RES,100 OHM 1/8W 5% CF
R48	113101	RES,100 OHM 1/8W 5% CF
R49	113101	RES,100 OHM 1/8W 5% CF
R5	113681	RES,680 OHM 1/8W 5% CF
R50	113103	RES,10K 1/8W 5% CARBON FILM
R51	1112741	RES,2740 OHMS 1/8W 1% RN55
R52	113101	RES,100 OHM 1/8W 5% CF
R53	113103	RES,10K 1/8W 5% CARBON FILM
R54	113103	RES,10K 1/8W 5% CARBON FILM
R57	113474	RES,470K 1/8W 5% CARBON FILM
R58	113101	RES,100 OHM 1/8W 5% CF
R59	113102	RES, 1K, 1/8W, 5%, CF
R6	013510	RES,51 OHM 1/8W 5% SMT 1206
R60	113101	RES,100 OHM 1/8W 5% CF
R66	113104	RES,100K 1/8W 5% CARBON FILM
R67	113681	RES,680 OHM 1/8W 5% CF
R68	113104	RES,100K 1/8W 5% CARBON FILM
R69	113102	RES, 1K, 1/8W, 5%, CF
R7	124750	RES,75 OHM 1/4W 5% CARBON FILM
R70	113103	RES,10K 1/8W 5% CARBON FILM

Table 4-12. 75 MHz Board Parts List (001-00710 Rev. K)

Designator	Part Number	Description
R71	113103	RES,10K 1/8W 5% CARBON FILM
R72	113103	RES,10K 1/8W 5% CARBON FILM
R73	113104	RES,100K 1/8W 5% CARBON FILM
R74	113681	RES,680 OHM 1/8W 5% CF
R75	113103	RES,10K 1/8W 5% CARBON FILM
R76	113471	RES,470 OHM 1/8W 5% CF
R77	113103	RES,10K 1/8W 5% CARBON FILM
R78	113102	RES, 1K, 1/8W, 5%, CF
R79	113102	RES, 1K, 1/8W, 5%, CF
R8	113681	RES,680 OHM 1/8W 5% CF
R80	113100	RES,10 OHM 1/8W 5% FILM
R81	134151	RES,150 OHM 1/2W 5% FILM
R82	113103	RES,10K 1/8W 5% CARBON FILM
R83	113101	RES,100 OHM 1/8W 5% CF
R85	124020	RES,2.2 OHM 1/4W 5% CF
R86	124020	RES,2.2 OHM 1/4W 5% CF
R9	113681	RES,680 OHM 1/8W 5% CF
T1	459226	IND ASSY,2T2T/4T#32 1-490303
T2	459169	XFMR,3T3T/2T#32 AWG 1-490303
U1	380022	IC,MONOLITHIC AMPLIFIER
U10	330100	IC,VREG,7808,TO220,8V
U11	310101	XISTOR,NPN,MPQ2222A,14-DIP,IC
U12	310101	XISTOR,NPN,MPQ2222A,14-DIP,IC
U2	310131	XISTOR,MAV11,MONO-AMPLIFIER
U3	380015	IC,MAR-3 MONO AMPLIFIER
U4	380015	IC,MAR-3 MONO AMPLIFIER
U5	380012	IC,MAR-4 MONO AMPLIFIER
U6	380015	IC,MAR-3 MONO AMPLIFIER
U7	330273	IC 74HC595
U8	330025	IC,VREG,78L05,TO92,5V
U9	330081	IC,LIN,LM358N,DIP8,OP-AMP
XF3	361111	XTAL FILTER,75MHZ,4 POLE

## 4.8 5 MHz IF Board

The 5 MHz IF board plugs directly into the motherboard in the third card slot from the right side of the radio. It is connected to the motherboard via connector J5 and is used in both transmit and receive paths.

The board is powered from +12V and contains voltage regulation and switching circuitry to generate +8 Vdc, +8 Vdc RX only, and +8 Vdc TX only for internal use on the boards. The board contains decoder/driver and switching circuits that process the incoming serial data from the processor, using the different enable lines to turn on their appropriate circuits as requested. For example, BITEEN (J5-7) is the BITE enable line that allows the processor to read the status of the BITE line (J5-17). EN1 (J5-13) tells the decoders to latch in the appropriate input data. NBEN (J5-25) is enabled when the optional Noise Blanker board is installed and used. It activates relay K3 which routes 5 MHz IF, in receive only, to and from the noise blanker. NB (J5-10) is the status line for the noise blanker.

### 4.8.1 Receive Mode

The 75 MHz IF signal comes into the board via coaxial connector J53 and is mixed with the 70 MHz second LO to form the second IF at 5 MHz. In standard operation, the RX IF signal is then amplified and sent to the crystal filter where the main receiver selectivity is achieved. If the noise blanker option is installed, switch K3 is activated and the 5 MHz is routed via J56 to the Noise Blanker board before going through the standard receive path. If the noise blanker is present and selected, the signal is processed and returned via J58 where it then goes through the standard IF processing.

The standard crystal filter is a voice-grade 300 to 2700 Hz, 6-pole, filter with a 60 dB BW of 5 kHz. An optional wideband filter is available with tailored group delay characteristics, a pass band of 300 to 3300 Hz, and a 60 dB BW of 5.6 kHz. Both filters can be installed simultaneously in the TW7000, with filter selection determined by the front panel mode select buttons. An optional CW narrowband is available with a 500 Hz bandwidth center at 1 kHz.

After filtering, the RX signal is again amplified and heterodyned with the third LO (BFO) to produce baseband audio. The audio is then amplified and sent to the Audio board via J5-21 (DEMODA). The demodulated audio is also used as input to the AGC circuit. In this circuit, the AGC threshold is set and the AGC output controls the gain of the IF amplifiers.

### 4.8.2 Transmit Mode

The modulated audio (MODA) comes into the 5 MHz IF board at J5-8. It is routed to the third mixer (which now functions like a balanced modulator) where it is heterodyned with the BFO. It is then amplified and applied to the crystal filter.

After filtering, the TX signal is amplified and routed to the second mixer where it is mixed with the fixed 70 MHz LO and sent to the 75 MHz IF board at J53. If the radio is operating in AME or PCS modes, the carrier is injected on the TX signal immediately before the last amplifier stage.

**4.8.3  
Inter-connections**

For the interconnect lines between the 5 MHz board and the rest of the radio, refer to the table below.

**Table 4-13. 5 MHz IF Board Interconnections**

Connector J5	Description	Comment
1, 14	Ground	
2, 15	+12V input	
3	SPIRXD	Serial RX data line
4	SPICLK	Clock
5	PTT	Push-to-talk
6	Not connected	
7	BITEEN	BITE enable input
8	MODA	Modulated audio input
9	Not connected	
10	NB/FMTST	Noise blanker status line
13	EN6	
16	SPITXD	Serial TX data line input
17	BITE	BITE status line output
18	AGC	RX AGC voltage output
19	Not connected	
20	Not connected	
21	DEMODA	Demodulated audio output
22	Not connected	
23	Not connected	
24	FMEN	
25	NBEN	Enable line from Noise Blanker board

**4.8.4  
Test Procedures**

These test procedures require the following equipment:

- TW7000
- Oscilloscope
- Voltmeter

- 
- SINAD meter
  - RF signal generator
  - Two-tone test box
  - Wattmeter with a 250W element
  - 12V power supply
  - Extender card set
- RX Test
1. Turn the radio on and check the voltage at U5. Input should be  $8V \pm .4V$  and output  $5V \pm .25V$ .
  2. Set the radio to 15.59 MHz (USB). Turn the speaker off. Turn the volume control to its maximum. Set the signal generator to 15.591 MHz. Set the signal generator to a level just below clipping of the wave form on the scope. Adjust L1 and L3 for maximum output, lowering the level of the signal generator to maintain no clipping. Set the volume to its middle position.
  3. Set the signal generator to -113 dBm and check the SINAD on both USB and LSB. They should be 10 dB or better.
  4. Check the AGC. Put the scope probe on J5-21. Set the signal generator to -20 dBm. Set R52 for maximum audio on the scope just before clipping occurs. Change the signal generator to +6 dBm. If there is clipping, slightly readjust R52.
  5. Vary the signal generator from +6 dBm to -70 dBm. There should be no more than 3 dB of change on the ac voltmeter.
- TX Test
1. Set the radio to 14.75 MHz USB. Key the radio on single tone. Power out should be  $100W \pm 20W$ .
  2. With the two-tone box off (no tone), radio in USB AME and key the radio. Adjust R102 for 25W. Unkey and set the radio to LSB AME. Key the radio. Power out should be  $25W \pm 5W$ . Unkey the radio.
  3. Set the reference potentiometer fully counterclockwise and the selector switch to off. Set the TW7000 to USB PCS mode. Key the PTT. Adjust R101 for 2.5W.
  4. Set the TW7000 to USB. Key the transceiver without modulation input and read the residual carrier output. The reading should be -50 dBc or better.

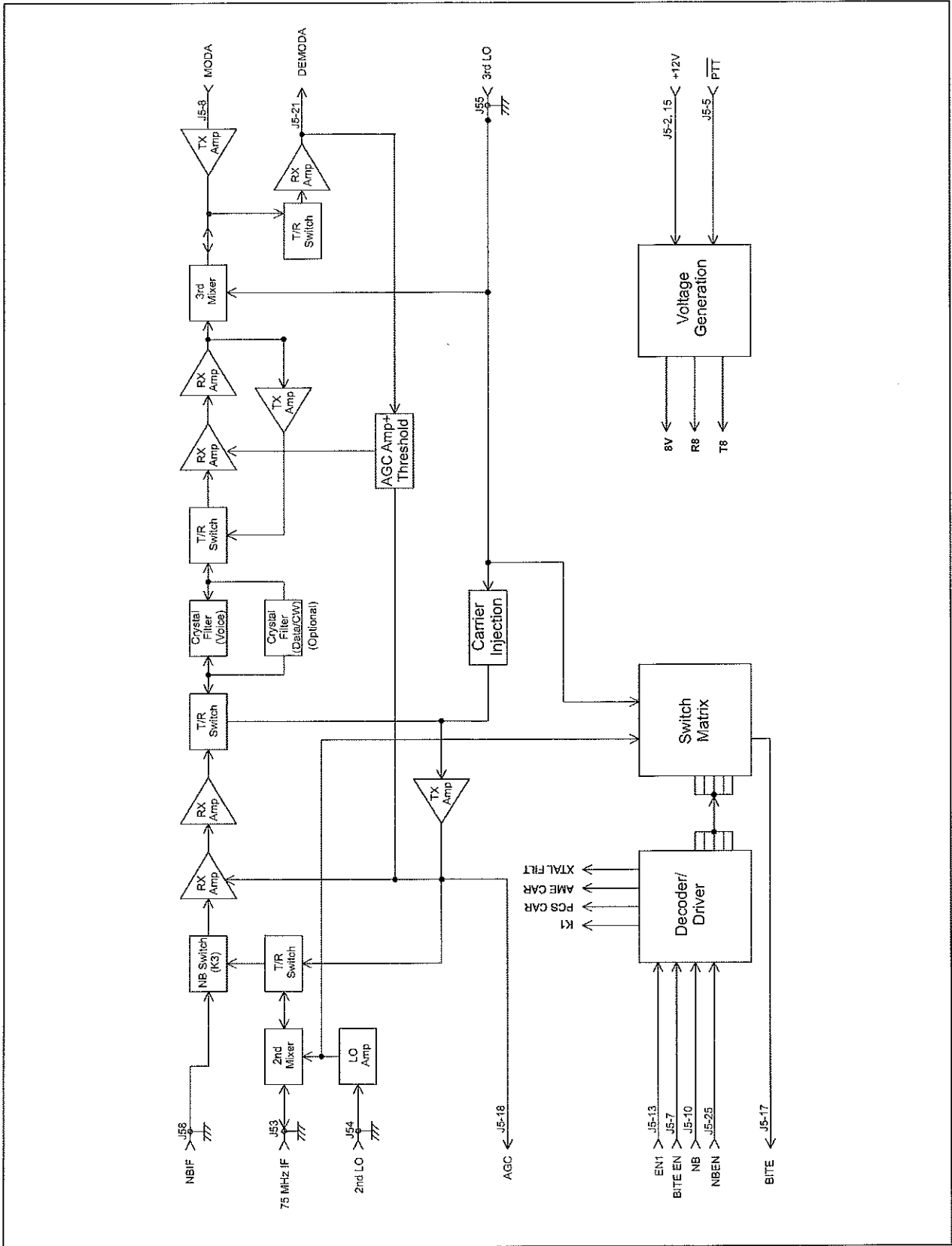


Figure 4-22. 5 MHz IF Board Block Diagram





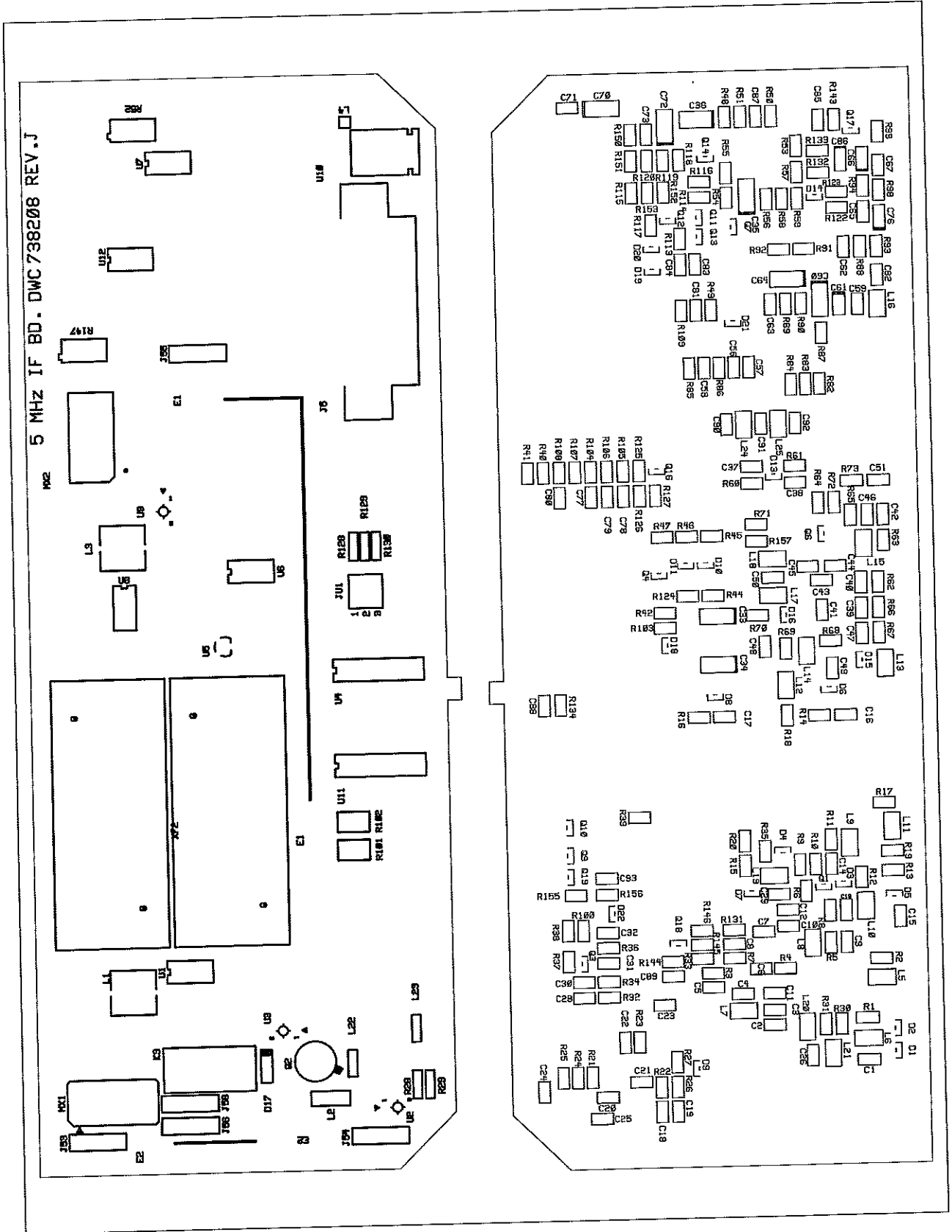


Figure 4-24. 5 MHz IF Board Component Locations (738208 Rev. J)

Table 4-14. 5 MHz IF Board Parts List (001-00800 Rev. X)

Designator	Part Number	Description
C1	021104	CAP,.1MF 50V 10% X7R SMT 1206
C10	020221	CAP,220PF, 50V 10% NPO SMT1206
C11	021104	CAP,.1MF 50V 10% X7R SMT 1206
C12	021102	CAP,.001MF 50V 10% SMT 1206
C13	021104	CAP,.1MF 50V 10% X7R SMT 1206
C14	021104	CAP,.1MF 50V 10% X7R SMT 1206
C15	021104	CAP,.1MF 50V 10% X7R SMT 1206
C16	021104	CAP,.1MF 50V 10% X7R SMT 1206
C17	021104	CAP,.1MF 50V 10% X7R SMT 1206
C18	021103	CAP,.01MF 50V 10% X7R SMT1206
C19	020010	CAP,1 PF 50V NPO SMT 1206
C2	021104	CAP,.1MF 50V 10% X7R SMT 1206
C20	021104	CAP,.1MF 50V 10% X7R SMT 1206
C21	021102	CAP,.001MF 50V 10% SMT 1206
C22	020101	CAP,100PF 50V 5% NPO SMT 1206
C23	021104	CAP,.1MF 50V 10% X7R SMT 1206
C24	020101	CAP,100PF 50V 5% NPO SMT 1206
C25	020101	CAP,100PF 50V 5% NPO SMT 1206
C26	021104	CAP,.1MF 50V 10% X7R SMT 1206
C28	021104	CAP,.1MF 50V 10% X7R SMT 1206
C29	021104	CAP,.1MF 50V 10% X7R SMT 1206
C3	020561	CAP,560PF 50V 5% NPO SMT 1206
C30	021104	CAP,.1MF 50V 10% X7R SMT 1206
C31	021104	CAP,.1MF 50V 10% X7R SMT 1206
C32	021103	CAP,.01MF 50V 10% X7R SMT1206
C33	022100	CAP,SMT,TANT,10MF,10%,16V,2213
C34	022100	CAP,SMT,TANT,10MF,10%,16V,2213
C35	023047	CAP,4.7UF,16V,SMT,TANT,6032
C36	022220	CAP,22 UF 16V SMT TANT 2818
C37	021104	CAP,.1MF 50V 10% X7R SMT 1206
C38	021104	CAP,.1MF 50V 10% X7R SMT 1206
C39	021102	CAP,.001MF 50V 10% SMT 1206
C4	020561	CAP,560PF 50V 5% NPO SMT 1206

Table 4-14. 5 MHz IF Board Parts List (001-00800 Rev. X)

Designator	Part Number	Description
C40	021104	CAP,.1MF 50V 10% X7R SMT 1206
C41	021104	CAP,.1MF 50V 10% X7R SMT 1206
C42	021104	CAP,.1MF 50V 10% X7R SMT 1206
C43	020221	CAP,220PF, 50V 10% NPO SMT1206
C44	021104	CAP,.1MF 50V 10% X7R SMT 1206
C45	021103	CAP,.01MF 50V 10% X7R SMT1206
C46	021104	CAP,.1MF 50V 10% X7R SMT 1206
C47	021104	CAP,.1MF 50V 10% X7R SMT 1206
C48	021104	CAP,.1MF 50V 10% X7R SMT 1206
C49	021104	CAP,.1MF 50V 10% X7R SMT 1206
C5	021102	CAP,.001MF 50V 10% SMT 1206
C50	021103	CAP,.01MF 50V 10% X7R SMT1206
C51	021104	CAP,.1MF 50V 10% X7R SMT 1206
C56	020101	CAP,100PF 50V 5% NPO SMT 1206
C57	021104	CAP,.1MF 50V 10% X7R SMT 1206
C58	021104	CAP,.1MF 50V 10% X7R SMT 1206
C59	021103	CAP,.01MF 50V 10% X7R SMT1206
C6	021104	CAP,.1MF 50V 10% X7R SMT 1206
C60	022100	CAP,SMT,TANT,10MF,10%,16V,2213
C61	022010	CAP,1.0 MF 16V TANT SMT 1206
C62	020221	CAP,220PF, 50V 10% NPO SMT1206
C63	020680	CAP,68PF 50V 5% NPO SMT 1206
C64	022100	CAP,SMT,TANT,10MF,10%,16V,2213
C65	021102	CAP,.001MF 50V 10% SMT 1206
C66	022010	CAP,1.0 MF 16V TANT SMT 1206
C67	021103	CAP,.01MF 50V 10% X7R SMT1206
C7	021104	CAP,.1MF 50V 10% X7R SMT 1206
C70	022100	CAP,SMT,TANT,10MF,10%,16V,2213
C71	021104	CAP,.1MF 50V 10% X7R SMT 1206
C72	022100	CAP,SMT,TANT,10MF,10%,16V,2213
C73	021104	CAP,.1MF 50V 10% X7R SMT 1206
C76	022010	CAP,1.0 MF 16V TANT SMT 1206
C77	021102	CAP,.001MF 50V 10% SMT 1206

Table 4-14. 5 MHz IF Board Parts List (001-00800 Rev. X)

Designator	Part Number	Description
C78	021102	CAP,.001MF 50V 10% SMT 1206
C79	021102	CAP,.001MF 50V 10% SMT 1206
C8	021104	CAP,.1MF 50V 10% X7R SMT 1206
C80	021102	CAP,.001MF 50V 10% SMT 1206
C81	021102	CAP,.001MF 50V 10% SMT 1206
C82	021103	CAP,.01MF 50V 10% X7R SMT1206
C83	021104	CAP,.1MF 50V 10% X7R SMT 1206
C84	021104	CAP,.1MF 50V 10% X7R SMT 1206
C85	021103	CAP,.01MF 50V 10% X7R SMT1206
C86	022010	CAP,1.0 MF 16V TANT SMT 1206
C87	021104	CAP,.1MF 50V 10% X7R SMT 1206
C88	021102	CAP,.001MF 50V 10% SMT 1206
C89	021104	CAP,.1MF 50V 10% X7R SMT 1206
C9	021104	CAP,.1MF 50V 10% X7R SMT 1206
C90	020561	CAP,560PF 50V 5% NPO SMT 1206
C91	021102	CAP,.001MF 50V 10% SMT 1206
C92	020561	CAP,560PF 50V 5% NPO SMT 1206
C93	021103	CAP,.01MF 50V 10% X7R SMT1206
D1	031005	DIODE,HSMP-3820 PIN SOT-23
D10	031002	DIODE,BAS16 SMT SOT 23
D11	031002	DIODE,BAS16 SMT SOT 23
D13	031005	DIODE,HSMP-3820 PIN SOT-23
D14	031002	DIODE,BAS16 SMT SOT 23
D15	031005	DIODE,HSMP-3820 PIN SOT-23
D16	031005	DIODE,HSMP-3820 PIN SOT-23
D17	320102	DIODE, 1N4001 RECT SI 1A 50V
D18	031002	DIODE,BAS16 SMT SOT 23
D19	031002	DIODE,BAS16 SMT SOT 23
D2	031005	DIODE,HSMP-3820 PIN SOT-23
D20	031002	DIODE,BAS16 SMT SOT 23
D21	031006	DIODE,HSMS-2800 SCHOT SOT-23AK
D22	031005	DIODE,HSMP-3820 PIN SOT-23
D3	031005	DIODE,HSMP-3820 PIN SOT-23

Table 4-14. 5 MHz IF Board Parts List (001-00800 Rev. X)

Designator	Part Number	Description
D4	031005	DIODE,HSMP-3820 PIN SOT-23
D5	031005	DIODE,HSMP-3820 PIN SOT-23
D6	031005	DIODE,HSMP-3820 PIN SOT-23
D7	031005	DIODE,HSMP-3820 PIN SOT-23
D8	031005	DIODE,HSMP-3820 PIN SOT-23
D9	031006	DIODE,HSMS-2800 SCHOT SOT-23AK
E1	769331-1	SEMI-RIGID CA,5MHZ IF,TW7000
E2	769331-2	SEMI-RIGID CA,5MHZ IF,TW7000
J5	613163	CONN,DB-25 RT ANGLE PC PLUG
J53	614026	CONN,RF FEMALE LOW-TYPE RECEPT
J54	614026	CONN,RF FEMALE LOW-TYPE RECEPT
J55	614026	CONN,RF FEMALE LOW-TYPE RECEPT
J56	614026	CONN,RF FEMALE LOW-TYPE RECEPT
J58	614026	CONN,RF FEMALE LOW-TYPE RECEPT
JU1	614057	HEADER,9 PIN MALE 3 X 3
JU1	860097	MICRO SHUNT, .100 CENTERS
K3	540073	RELAY,2PDT MDX-12-01
L1	420017	INDUCTOR IF 10.7MHZ
L10	045104	INDUCTOR,100 UH 10% SMT 1210
L11	045104	INDUCTOR,100 UH 10% SMT 1210
L12	045104	INDUCTOR,100 UH 10% SMT 1210
L13	045104	INDUCTOR,100 UH 10% SMT 1210
L14	045104	INDUCTOR,100 UH 10% SMT 1210
L15	045104	INDUCTOR,100 UH 10% SMT 1210
L16	045104	INDUCTOR,100 UH 10% SMT 1210
L17	045104	INDUCTOR,100 UH 10% SMT 1210
L18	045104	INDUCTOR,100 UH 10% SMT 1210
L19	045104	INDUCTOR,100 UH 10% SMT 1210
L2	459242	XFMR,2T#28 AWG 1-491301
L20	045104	INDUCTOR,100 UH 10% SMT 1210
L21	045104	INDUCTOR,100 UH 10% SMT 1210
L22	430031	INDUCTOR FIXED MOLDED 2.2UH
L23	430031	INDUCTOR FIXED MOLDED 2.2UH

Table 4-14. 5 MHz IF Board Parts List (001-00800 Rev. X)

Designator	Part Number	Description
L24	045222	INDUCTOR,2.2 UH 20% SMT 1210
L25	045222	INDUCTOR,2.2 UH 20% SMT 1210
L3	420017	INDUCTOR IF 10.7MHZ
L4	459032	IND ASY,3T#30 MAGNET 1-490201
L5	045104	INDUCTOR,100 UH 10% SMT 1210
L6	045104	INDUCTOR,100 UH 10% SMT 1210
L7	045222	INDUCTOR,2.2 UH 20% SMT 1210
L8	045104	INDUCTOR,100 UH 10% SMT 1210
L9	045104	INDUCTOR,100 UH 10% SMT 1210
MX1	380008	MIXER,SRA-1H +17 DBM
MX2	380007	MIXER
Q1	032001	XSTR,J310,NFET,SOT-23
Q10	032005	XISTOR,2N7002 SMT SOT-23
Q11	032006	XISTOR,MMB2907 SMT SOT-23EBC
Q12	032006	XISTOR,MMB2907 SMT SOT-23EBC
Q13	032004	XISTOR,MMBT2222AL SMT SOT 23
Q14	032004	XISTOR,MMBT2222AL SMT SOT 23
Q16	032005	XISTOR,2N7002 SMT SOT-23
Q17	032001	XSTR,J310,NFET,SOT-23
Q18	032001	XSTR,J310,NFET,SOT-23
Q19	032006	XISTOR,MMB2907 SMT SOT-23EBC
Q2	310011	XISTOR,NPN,2N4427,TO5
Q3	032003	XISTOR,MMBTH24L SMT SOT 23
Q4	032004	XISTOR,MMBT2222AL SMT SOT 23
Q6	032001	XSTR,J310,NFET,SOT-23
Q7	032005	XISTOR,2N7002 SMT SOT-23
Q9	032005	XISTOR,2N7002 SMT SOT-23
R1	013681	RES,680 OHM 1/8W 5% SMT 1206
R10	013270	RES,27 OHM 1/8W 5% SMT 1206
R100	013223	RES,22K 1/8W 5% SMT 1206
R101	170224	RES,1K VARIABLE MINI
R102	170224	RES,1K VARIABLE MINI
R103	013472	RES,4.7K 1/8W 5% SMT 1206

Table 4-14. 5 MHz IF Board Parts List (001-00800 Rev. X)

Designator	Part Number	Description
R104	013101	RES,100 OHM 1/8W 5% SMT 1206
R105	013101	RES,100 OHM 1/8W 5% SMT 1206
R106	013101	RES,100 OHM 1/8W 5% SMT 1206
R107	013103	RES,10K OHM 1/8W 5% SMT 1206
R108	013101	RES,100 OHM 1/8W 5% SMT 1206
R109	013101	RES,100 OHM 1/8W 5% SMT 1206
R11	013681	RES,680 OHM 1/8W 5% SMT 1206
R113	013103	RES,10K OHM 1/8W 5% SMT 1206
R114	013104	RES,100K OHM 1/8W 5% SMT 1206
R115	013104	RES,100K OHM 1/8W 5% SMT 1206
R116	013102	RES,1K 1/8W 5% SMT 1206
R117	013681	RES,680 OHM 1/8W 5% SMT 1206
R118	013102	RES,1K 1/8W 5% SMT 1206
R119	013332	RES,3,3K 1/8W 5% SMT 1206
R12	013681	RES,680 OHM 1/8W 5% SMT 1206
R120	013332	RES,3,3K 1/8W 5% SMT 1206
R122	013103	RES,10K OHM 1/8W 5% SMT 1206
R123	013103	RES,10K OHM 1/8W 5% SMT 1206
R124	013104	RES,100K OHM 1/8W 5% SMT 1206
R125	013101	RES,100 OHM 1/8W 5% SMT 1206
R126	013473	RES, 47K 1/8W 5% SMT 1206
R127	013103	RES,10K OHM 1/8W 5% SMT 1206
R128	1111101	RES, 1.10K 1%
R129	1115902	RES 59K 1/8 WATT 1% METAL FILM
R13	013102	RES,1K 1/8W 5% SMT 1206
R130	1111911	RES, 1.91K 1/8W 1%
R131	013223	RES,22K 1/8W 5% SMT 1206
R132	013104	RES,100K OHM 1/8W 5% SMT 1206
R133	013104	RES,100K OHM 1/8W 5% SMT 1206
R134	013101	RES,100 OHM 1/8W 5% SMT 1206
R14	013102	RES,1K 1/8W 5% SMT 1206
R143	013104	RES,100K OHM 1/8W 5% SMT 1206
R144	013470	RES,47 OHM 1/8W 5% SMT

Table 4-14. 5 MHz IF Board Parts List (001-00800 Rev. X)

Designator	Part Number	Description
R145	013331	RES,330 OHM 1/8W 5% SMT 1206
R146	013510	RES,51 OHM 1/8W 5% SMT 1206
R147	170336	RES, 1K TRIM SIDE ADJ
R15	013102	RES,1K 1/8W 5% SMT 1206
R150	013470	RES,47 OHM 1/8W 5% SMT
R151	013821	RES,820 OHMS 1/8W 5% SMT 1206
R152	013100	RES,SMT,10ohm,1/8W,5%,1206
R153	013100	RES,SMT,10ohm,1/8W,5%,1206
R155	013103	RES,10K OHM 1/8W 5% SMT 1206
R156	013472	RES,4.7K 1/8W 5% SMT 1206
R157	013221	RES,220 OHM 1.8W 5% SMT 1206
R16	013102	RES,1K 1/8W 5% SMT 1206
R17	013221	RES,220 OHM 1.8W 5% SMT 1206
R18	013221	RES,220 OHM 1.8W 5% SMT 1206
R19	013103	RES,10K OHM 1/8W 5% SMT 1206
R2	013681	RES,680 OHM 1/8W 5% SMT 1206
R20	013103	RES,10K OHM 1/8W 5% SMT 1206
R21	013182	RES,1.8K 1/8W 5% SMT 1206
R22	013331	RES,330 OHM 1/8W 5% SMT 1206
R23	013100	RES,SMT,10ohm,1/8W,5%,1206
R24	013220	RES,22 OHM 1/8W 5% SMT 1206
R25	013331	RES,330 OHM 1/8W 5% SMT 1206
R26	013471	RES,470 OHMS 1/8W 5% SMT 1206
R27	013103	RES,10K OHM 1/8W 5% SMT 1206
R28	124101	RES,100 OHM 1/4W 5% CF
R29	124151	RES,150 OHM 1/4W 5% CF
R3	013510	RES,51 OHM 1/8W 5% SMT 1206
R30	013681	RES,680 OHM 1/8W 5% SMT 1206
R31	013221	RES,220 OHM 1.8W 5% SMT 1206
R32	013150	RES,15 OHM 1/8W 5% SMT 1206
R33	013150	RES,15 OHM 1/8W 5% SMT 1206
R34	013101	RES,100 OHM 1/8W 5% SMT 1206
R35	013681	RES,680 OHM 1/8W 5% SMT 1206

Table 4-14. 5 MHz IF Board Parts List (001-00800 Rev. X)

Designator	Part Number	Description
R36	013470	RES,47 OHM 1/8W 5% SMT
R37	013470	RES,47 OHM 1/8W 5% SMT
R38	013512	RES,5.1K 1/8W 5% SMT 1206
R39	013102	RES,1K 1/8W 5% SMT 1206
R4	013470	RES,47 OHM 1/8W 5% SMT
R40	013101	RES,100 OHM 1/8W 5% SMT 1206
R41	013101	RES,100 OHM 1/8W 5% SMT 1206
R42	013472	RES,4.7K 1/8W 5% SMT 1206
R44	013472	RES,4.7K 1/8W 5% SMT 1206
R45	013472	RES,4.7K 1/8W 5% SMT 1206
R46	013104	RES,100K OHM 1/8W 5% SMT 1206
R47	013102	RES,1K 1/8W 5% SMT 1206
R48	013332	RES,3,3K 1/8W 5% SMT 1206
R49	013102	RES,1K 1/8W 5% SMT 1206
R5	013100	RES,SMT,10ohm,1/8W,5%,1206
R50	013104	RES,100K OHM 1/8W 5% SMT 1206
R51	013104	RES,100K OHM 1/8W 5% SMT 1206
R52	170336	RES, 1K TRIM SIDE ADJ
R53	013331	RES,330 OHM 1/8W 5% SMT 1206
R54	013681	RES,680 OHM 1/8W 5% SMT 1206
R55	013105	RES,1M OHM 1/8W SMT 1206
R56	013224	RES,220K 1/8W 5% SMT 1206
R57	013471	RES,470 OHMS 1/8W 5% SMT 1206
R58	013224	RES,220K 1/8W 5% SMT 1206
R59	013103	RES,10K OHM 1/8W 5% SMT 1206
R6	013472	RES,4.7K 1/8W 5% SMT 1206
R60	013102	RES,1K 1/8W 5% SMT 1206
R61	013102	RES,1K 1/8W 5% SMT 1206
R62	013470	RES,47 OHM 1/8W 5% SMT
R63	013100	RES,SMT,10ohm,1/8W,5%,1206
R64	013472	RES,4.7K 1/8W 5% SMT 1206
R65	013470	RES,47 OHM 1/8W 5% SMT
R66	013510	RES,51 OHM 1/8W 5% SMT 1206

Table 4-14. 5 MHz IF Board Parts List (001-00800 Rev. X)

Designator	Part Number	Description
R67	013681	RES,680 OHM 1/8W 5% SMT 1206
R68	013681	RES,680 OHM 1/8W 5% SMT 1206
R69	013332	RES,3,3K 1/8W 5% SMT 1206
R7	013332	RES,3,3K 1/8W 5% SMT 1206
R70	013681	RES,680 OHM 1/8W 5% SMT 1206
R71	013221	RES,220 OHM 1.8W 5% SMT 1206
R72	013221	RES,220 OHM 1.8W 5% SMT 1206
R73	013100	RES,SMT,10ohm,1/8W,5%,1206
R8	013470	RES,47 OHM 1/8W 5% SMT
R82	013271	RES,270 OHM 1/8W 5% SMT 1206
R83	013150	RES,15 OHM 1/8W 5% SMT 1206
R84	013271	RES,270 OHM 1/8W 5% SMT 1206
R85	013104	RES,100K OHM 1/8W 5% SMT 1206
R86	013103	RES,10K OHM 1/8W 5% SMT 1206
R87	013151	RES,150 OHM 1/8W 5% SMT 1206
R88	013223	RES,22K 1/8W 5% SMT 1206
R89	013474	RES,470K 1/8W 5% SMT 1206
R9	013331	RES,330 OHM 1/8W 5% SMT 1206
R90	013222	RES,2.2K 1/8W 5% SMT 1206
R91	013104	RES,100K OHM 1/8W 5% SMT 1206
R92	013104	RES,100K OHM 1/8W 5% SMT 1206
R93	013472	RES,4.7K 1/8W 5% SMT 1206
R94	013472	RES,4.7K 1/8W 5% SMT 1206
R98	013101	RES,100 OHM 1/8W 5% SMT 1206
R99	013101	RES,100 OHM 1/8W 5% SMT 1206
U1	330009	IC,LIN,MC1350P,DIP8,IF AMP
U10	330100	IC,VREG,7808,TO220,8V
U11	330384	IC,UCN5821A
U12	330368	IC,MC33078
U2	380012	IC,MAR-4 MONO AMPLIFIER
U3	380011	IC MAR6
U4	330273	IC 74HC595
U5	330025	IC,VREG,78L05,TO92,5V

Table 4-14. 5 MHz IF Board Parts List (001-00800 Rev. X)

Designator	Part Number	Description
U6	330185	IC LM393N
U7	330081	IC,LIN,LM358N,DIP8,OP-AMP
U8	330009	IC,LIN,MC1350P,DIP8,IF AMP
U9	380013	IC,MAR-2 MONOLITHIC AMPLIFIER
XF1	361088	CRYSTAL FILTER 5MHZ, STANDARD
XF1	830017	WASHER SEAL

## 4.9 Audio Board

The Audio board is located in the fifth card slot from the right side of the radio. It connects to the motherboard via connectors J7 and J8, and is used in both receive and transmit paths.

The board runs off a +12V input and has on-board regulators to generate +10 Vdc and +5 Vdc for internal use. Decoder/driver circuits take the serial data control inputs and translates them into on/off commands for the TX and RX gates in the boards. These gates are used to direct RX and TX audio to the various optional devices used in the TW7000.

### 4.9.1

#### Receive Mode

Demodulated audio comes into the board as (DEMOMA) J8-21, goes through an op amp, and passes through the RX CMOS gates. Depending on what options are used in the radio, RX audio is routed to any number of card slots or accessory connectors using these gates and the commands from the decoder/driver circuits. Primary receiver audio is then sent through another op amp and out to the Squelch board at J8-4 (DSPRRXA).

In the squelch circuit, the audio is sampled and routed back to the Audio board at J8-17 (DSPPRX2). The squelch (J8-23) signal from the processor controls the squelch gate in the Audio board. If the front panel squelch is off, squelch is disabled and the squelch gate is always open; if it is on, the squelch gate is controlled by the level and the syllabic nature of the RX audio sampled on the Squelch board. After processing, squelched audio (SQA) leaves the Audio board at J8-7 and goes to the front panel.

Balanced RX audio comes into the board from accessory 1 or accessory 2 at J8-6, 19. It is transformed down to unbalanced audio and processed as described above.

### 4.9.2

#### Transmit Mode

Primary microphone audio (PRIMICA) comes from the front panel at J8-20. Balanced audio from the accessory 1 or accessory 2 connector comes in at J8-5, 18 and is transformed to unbalanced before processed like microphone audio. These inputs pass through the TX gating circuits having the same function on the transmit side that the RX gating circuits have on the RX side. The modulated audio output (MODA) goes out to the 5 MHz IF board at J8-8.

The Audio board also contains the CW oscillator keyed by the CWKEY line (J8-10). CW tone output is routed through the transmit processing path and goes out as MODA, while a sample of the same tone is connected into the receive path and used for CW sidetone. R99 adjusts the frequency of the CW oscillator.

### 4.9.3 Inter- connections

For the interconnect lines between the Audio board and the rest of the radio, refer to the table below.

**Table 4-15. Audio Board Interconnections**

Connector J7	Description	Comment
1, 14	Ground	
2, 15	+12V input	
3	SPIRXD	Serial RX data line
4	SPICLK	Clock
5	PTT\	Push-to-talk
6	OPTRXA1	RX audio to option slots
7	OPTRXA2	RX audio to option slots
8	OPTTXA1	TX audio to option slots
9	OPTTXA2	TX audio to option slots
10	ECTXA	TX audio from RCU interface slot
11	ALERXA1	RX audio to ALE option slot
12	ALERXA2	RX audio to ALE option slot
13	EN9	Data enable
16	SPITXD	Serial TX data line
17	BITE\	BITE status line
18	ENCRRXA1	RX audio to encryption slots
19	ENCRRXA2	RX audio to encryption slots
20	ENCRTXA1	TX audio to encryption slots
21	ENCRTXA2	TX audio to encryption slots
22	ECRXA	RX audio to RCU interface slot
23	ALETXA1	TX audio from ALE option slot
24	ALETXA2	TX audio from ALE option slot
Connector J8	Description	Comment
1, 14	Ground	
3	DSPRTXA	
4	DSPRRXA	
5	BALTXA2	Balanced TX audio from accessory 2
18	BALTXA1	Balanced TX audio from accessory 1
6	BALRXA2	Balanced RX audio from accessory 2
19	BALRXA1	Balanced RX audio from accessory 1
7	SQA	Squelched RX audio output

**Table 4-15. Audio Board Interconnections**

Connector J8	Description	Comment
8	MODA	Modulated TX audio output
9	TCTXAO	
10	CWKEY\	CW key line
11	BALRXA3	
12	BALTXA3	
16	DSPPTXA	
17	DSPPRXA	
20	PRIMICA	Microphone audio input
21	DEMODA	Demodulated RX audio input
22	TCRXAI	
23	Squelch	
24	BALRXA4	
25	BALTXA4	

#### 4.9.4 Test Procedures

These test procedures require the following equipment:

- SINAD meter/ac voltmeter
- RF signal generator
- Oscilloscope
- Two-tone test box
- Multimeter
- 12V power supply
- Wattmeter
- TW7000 test radio
- Extender card set

#### RX Test

1. Install the board on the extender card. Turn the radio on. Measure the input of U15 10V  $\pm$ .5, output 5V  $\pm$ .25.
2. Set the USB mode to 15.59 MHz. Set the signal generator to 15.591 MHz, -113 dBm. RX tone should be present. SINAD should measure 10 dB or better.
3. Turn the speaker off and the volume to maximum. Set the signal generator to -95 dBm. Press the SINAD meter ac volts button. Approximately 3V or better should be measured. Turn the volume to its middle level and turn the speaker on.

4. Turn squelch on. The RX tone should mute. Vary the signal generator up, then back, by 1000 Hz. Squelch should open, then close. Turn off the squelch.

TX Test

1. Set the TW7000 to 14.75 MHz. Key the radio with the two-tone test box set to single tone. Check for 100W out  $\pm 20$ W. Unkey the radio.
2. Turn off the single tone and key the radio with CW. Check for 100W  $\pm 20$ W.

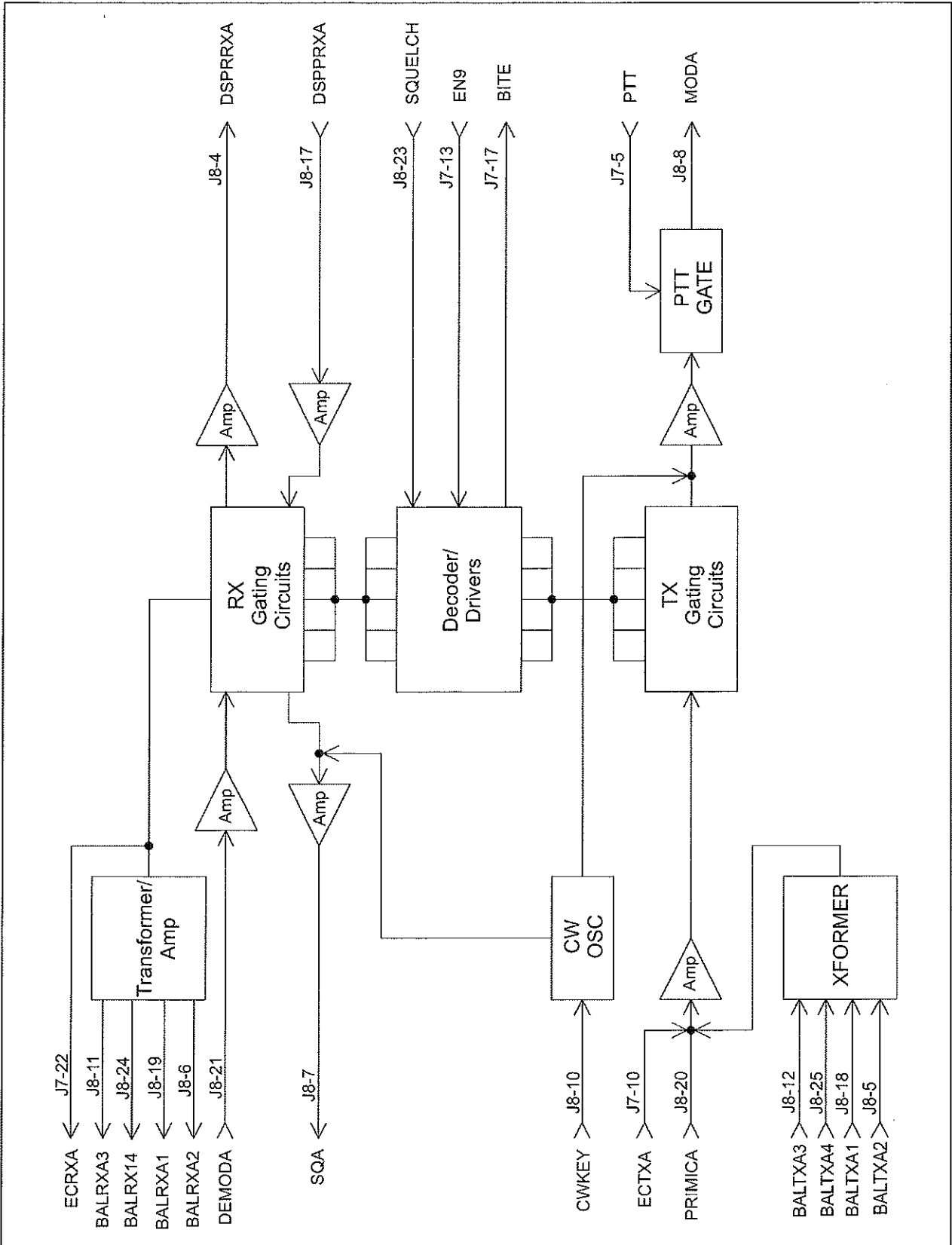


Figure 4-25. Audio Board Block Diagram

REV	ECN	DESCRIPTION	DATE	APP
A	7000-086	PRODUCTION RELEASE	13NOV92	
B	7000-034	SEC ECN	12MAR93	
C	7000-042	R2 WAS 4.7K	04APR93	
D	7000-053	R38 WAS AT U13-10.	11JUN93	
E	7000-077	R42 WAS 4.7K	13SEP93	
F	7000-124	ISOLATE AUDIO	2FEB94	JC
G	7000-139	ADD R37, TP1, TP2. R2 WAS 4.7K.	1MAY94	
H	7000-174	U7, U8, U14 WERE LH324	14OCT94	
I	7000-199	SEC ECN	05-09-95	

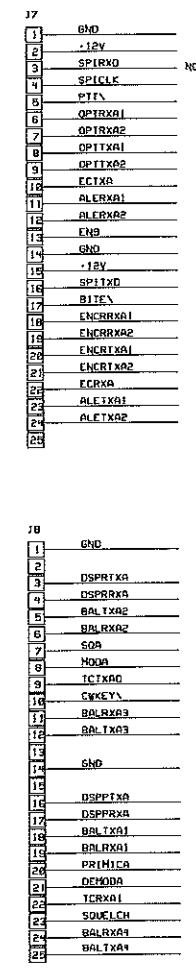
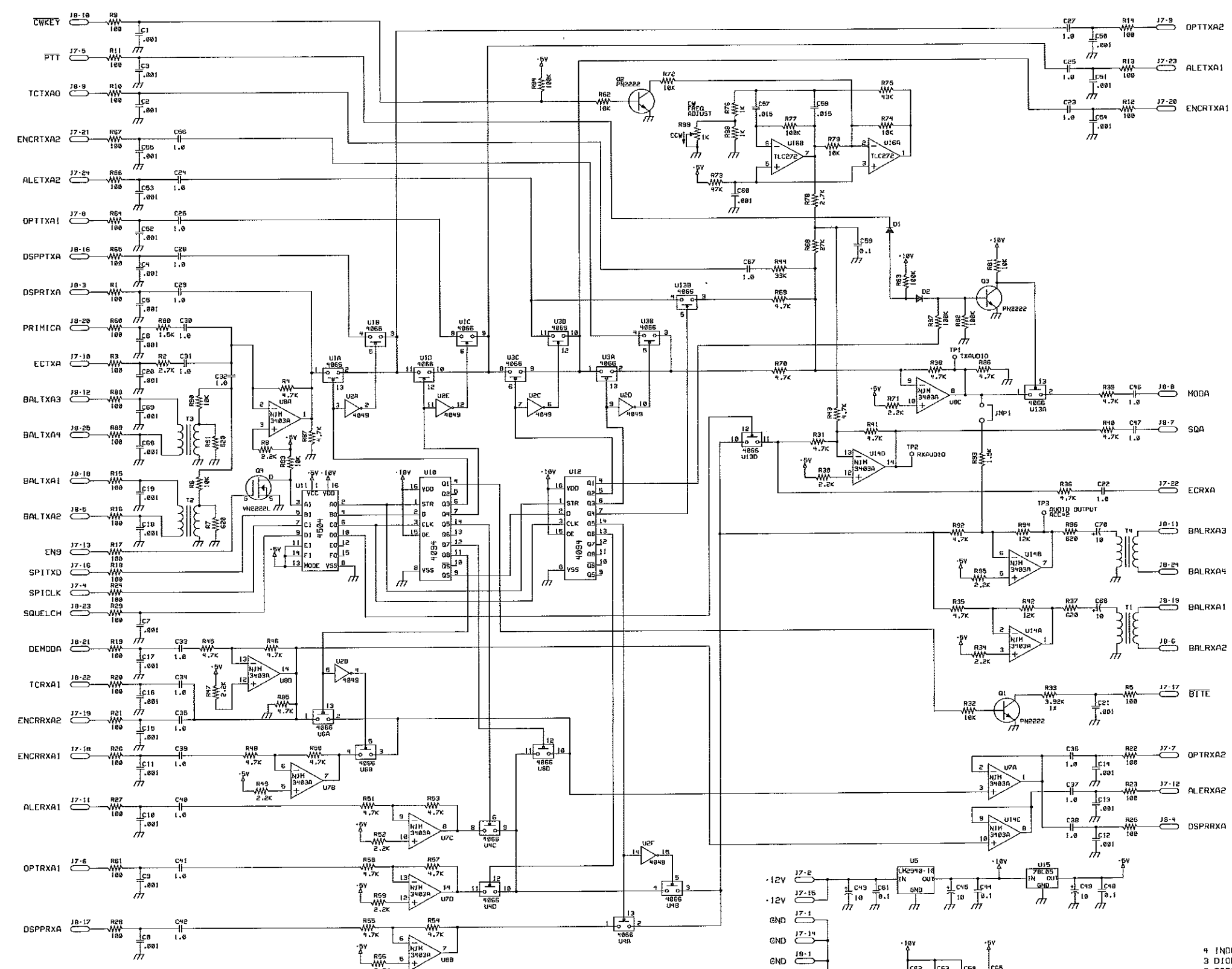


Figure 4-26  
Audio Board Schematic Diagram  
(994157 Rev. I)

4-99

TW7000-MS

4 INDUCTANCE IS IN MICROHENRYS  
3 DIODES ARE 1N4148  
2 CAPACITANCE IS IN MICROFARADS  
1 RESISTANCE IS IN OHMS

NOTES UNLESS OTHERWISE SPECIFIED

PCBD 738211 BOM 001-00000

**DAITRON**  
DAITRON WORLD COMMUNICATIONS INC.

TITLE SCHEMATIC  
**AUDIO MODULE TW7000**

SIZE DRAWN SATTEL DRAWING NUMBER REV.  
D ENGR 994157 I

SCALE SHEET 1 OF 1



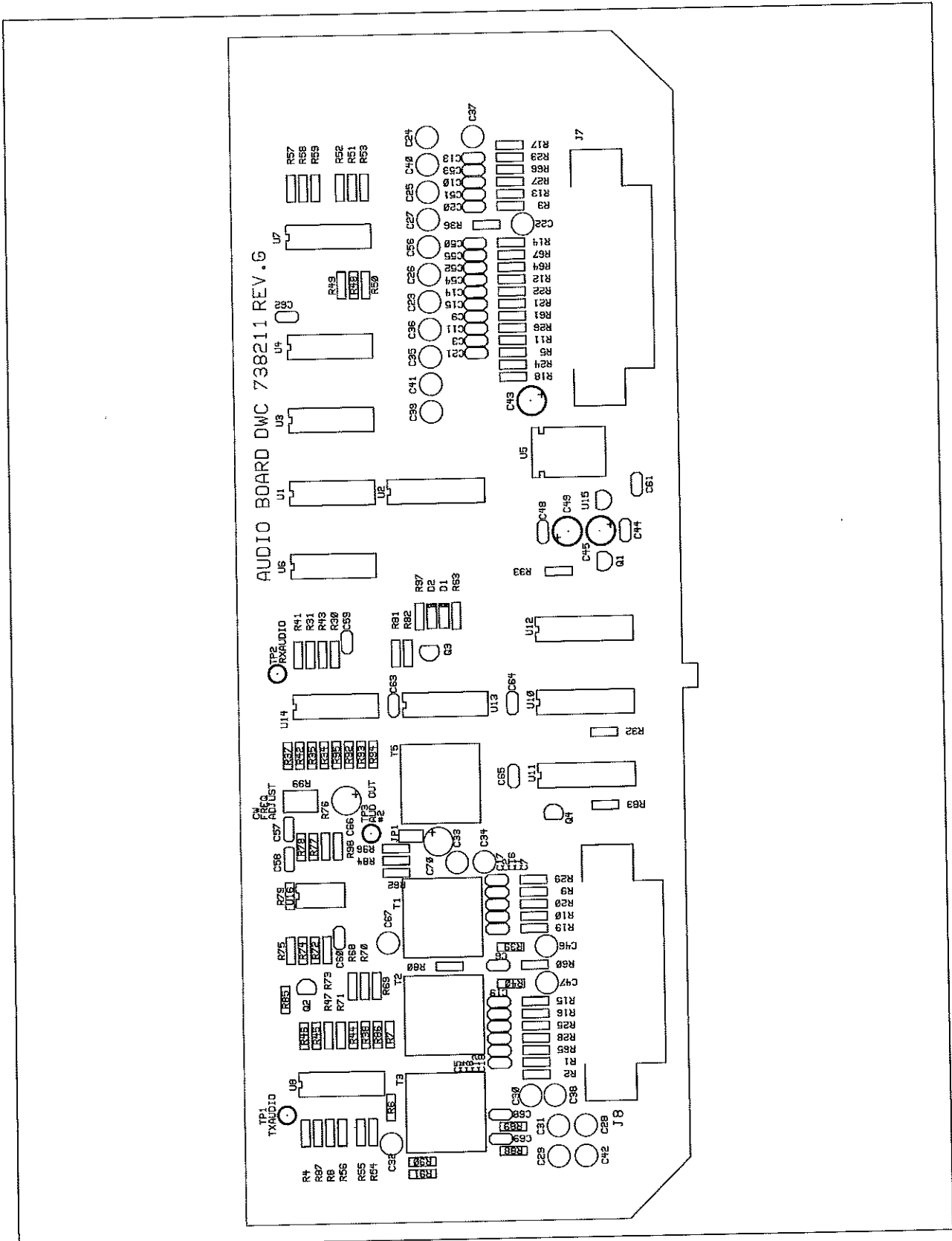


Figure 4-27. Audio Board Component Locations (738211 Rev. G)

Table 4-16. Audio Board Parts List (001-00600 Rev. R)

Designator	Part Number	Description
C1	210102	CAP,.001UF,50V,10%,NPO
C10	210102	CAP,.001UF,50V,10%,NPO
C11	210102	CAP,.001UF,50V,10%,NPO
C12	210102	CAP,.001UF,50V,10%,NPO
C13	210102	CAP,.001UF,50V,10%,NPO
C14	210102	CAP,.001UF,50V,10%,NPO
C15	210102	CAP,.001UF,50V,10%,NPO
C16	210102	CAP,.001UF,50V,10%,NPO
C17	210102	CAP,.001UF,50V,10%,NPO
C18	210102	CAP,.001UF,50V,10%,NPO
C19	210102	CAP,.001UF,50V,10%,NPO
C2	210102	CAP,.001UF,50V,10%,NPO
C20	210102	CAP,.001UF,50V,10%,NPO
C21	210102	CAP,.001UF,50V,10%,NPO
C22	230010	CAP,1 MF 50V ELECT NON POLAR
C23	230010	CAP,1 MF 50V ELECT NON POLAR
C24	230010	CAP,1 MF 50V ELECT NON POLAR
C25	230010	CAP,1 MF 50V ELECT NON POLAR
C26	230010	CAP,1 MF 50V ELECT NON POLAR
C27	230010	CAP,1 MF 50V ELECT NON POLAR
C28	230010	CAP,1 MF 50V ELECT NON POLAR
C29	230010	CAP,1 MF 50V ELECT NON POLAR
C3	210102	CAP,.001UF,50V,10%,NPO
C30	230010	CAP,1 MF 50V ELECT NON POLAR
C31	230010	CAP,1 MF 50V ELECT NON POLAR
C32	230010	CAP,1 MF 50V ELECT NON POLAR
C33	230010	CAP,1 MF 50V ELECT NON POLAR
C34	230010	CAP,1 MF 50V ELECT NON POLAR
C35	230010	CAP,1 MF 50V ELECT NON POLAR
C36	230010	CAP,1 MF 50V ELECT NON POLAR
C37	230010	CAP,1 MF 50V ELECT NON POLAR
C38	230010	CAP,1 MF 50V ELECT NON POLAR
C39	230010	CAP,1 MF 50V ELECT NON POLAR

Table 4-16. Audio Board Parts List (001-00600 Rev. R)

Designator	Part Number	Description
C4	210102	CAP,.001UF,50V,10%,NPO
C40	230010	CAP,1 MF 50V ELECT NON POLAR
C41	230010	CAP,1 MF 50V ELECT NON POLAR
C42	230010	CAP,1 MF 50V ELECT NON POLAR
C43	232100	CAP,10MF 35V ELECT VRT
C44	275104	CAP,C,0.1U,50,10%,X,RA,.10SP
C45	232100	CAP,10MF 35V ELECT VRT
C46	230010	CAP,1 MF 50V ELECT NON POLAR
C47	230010	CAP,1 MF 50V ELECT NON POLAR
C48	275104	CAP,C,0.1U,50,10%,X,RA,.10SP
C49	232100	CAP,10MF 35V ELECT VRT
C5	210102	CAP,.001UF,50V,10%,NPO
C50	210102	CAP,.001UF,50V,10%,NPO
C51	210102	CAP,.001UF,50V,10%,NPO
C52	210102	CAP,.001UF,50V,10%,NPO
C53	210102	CAP,.001UF,50V,10%,NPO
C54	210102	CAP,.001UF,50V,10%,NPO
C55	210102	CAP,.001UF,50V,10%,NPO
C56	230010	CAP,1 MF 50V ELECT NON POLAR
C57	254153	CAP,0.015MF 100V MYLAR
C58	254153	CAP,0.015MF 100V MYLAR
C59	275104	CAP,C,0.1U,50,10%,X,RA,.10SP
C6	210102	CAP,.001UF,50V,10%,NPO
C60	210102	CAP,.001UF,50V,10%,NPO
C61	275104	CAP,C,0.1U,50,10%,X,RA,.10SP
C62	275104	CAP,C,0.1U,50,10%,X,RA,.10SP
C63	275104	CAP,C,0.1U,50,10%,X,RA,.10SP
C64	275104	CAP,C,0.1U,50,10%,X,RA,.10SP
C65	275104	CAP,C,0.1U,50,10%,X,RA,.10SP
C66	232100	CAP,10MF 35V ELECT VRT
C67	230010	CAP,1 MF 50V ELECT NON POLAR
C68	210102	CAP,.001UF,50V,10%,NPO
C69	210102	CAP,.001UF,50V,10%,NPO

Table 4-16. Audio Board Parts List (001-00600 Rev. R)

Designator	Part Number	Description
C7	210102	CAP,.001UF,50V,10%,NPO
C70	232100	CAP,10MF 35V ELECT VRT
C8	210102	CAP,.001UF,50V,10%,NPO
C9	210102	CAP,.001UF,50V,10%,NPO
D1	320002	DIODE,SI 100MA 1N4148/1N4150
D2	320002	DIODE,SI 100MA 1N4148/1N4150
J7	613163	CONN,DB-25 RT ANGLE PC PLUG
J8	613163	CONN,DB-25 RT ANGLE PC PLUG
JP1	650048	HEADER,2 PIN .025 SQ
Q1	310057	XISTOR,NPN,PN2222A,TO92
Q2	310057	XISTOR,NPN,PN2222A,TO92
Q3	310057	XISTOR,NPN,PN2222A,TO92
Q4	310138	XISTOR,FET,VN2222LL,TO92
R1	113101	RES,100 OHM 1/8W 5% CF
R10	113101	RES,100 OHM 1/8W 5% CF
R11	113101	RES,100 OHM 1/8W 5% CF
R12	113101	RES,100 OHM 1/8W 5% CF
R13	113101	RES,100 OHM 1/8W 5% CF
R14	113101	RES,100 OHM 1/8W 5% CF
R15	113101	RES,100 OHM 1/8W 5% CF
R16	113101	RES,100 OHM 1/8W 5% CF
R17	113101	RES,100 OHM 1/8W 5% CF
R18	113101	RES,100 OHM 1/8W 5% CF
R19	113101	RES,100 OHM 1/8W 5% CF
R2	113272	RES,2.7K 1/8W 5% CARBON FILM
R20	113101	RES,100 OHM 1/8W 5% CF
R21	113101	RES,100 OHM 1/8W 5% CF
R22	113101	RES,100 OHM 1/8W 5% CF
R23	113101	RES,100 OHM 1/8W 5% CF
R24	113101	RES,100 OHM 1/8W 5% CF
R25	113101	RES,100 OHM 1/8W 5% CF
R26	113101	RES,100 OHM 1/8W 5% CF
R27	113101	RES,100 OHM 1/8W 5% CF

Table 4-16. Audio Board Parts List (001-00600 Rev. R)

Designator	Part Number	Description
R28	113101	RES,100 OHM 1/8W 5% CF
R29	113101	RES,100 OHM 1/8W 5% CF
R3	113101	RES,100 OHM 1/8W 5% CF
R30	113222	RES,2.2K 1/8W 5% CARBON FILM
R31	113472	RES,4.7K 1/8W 5% CARBON FILM
R32	113103	RES,10K 1/8W 5% CARBON FILM
R33	1113921	RES, 3.92K 1%
R34	113222	RES,2.2K 1/8W 5% CARBON FILM
R35	113472	RES,4.7K 1/8W 5% CARBON FILM
R36	113472	RES,4.7K 1/8W 5% CARBON FILM
R37	113621	RES,620 OHM 1/8W 5% CF
R38	113472	RES,4.7K 1/8W 5% CARBON FILM
R39	113472	RES,4.7K 1/8W 5% CARBON FILM
R4	113472	RES,4.7K 1/8W 5% CARBON FILM
R40	113472	RES,4.7K 1/8W 5% CARBON FILM
R41	113472	RES,4.7K 1/8W 5% CARBON FILM
R42	113123	RES,12K 1/8W 5% CARBON FILM
R43	113472	RES,4.7K 1/8W 5% CARBON FILM
R44	113333	RES,33K 1/8W 5% CARBON FILM
R45	113472	RES,4.7K 1/8W 5% CARBON FILM
R46	113472	RES,4.7K 1/8W 5% CARBON FILM
R47	113222	RES,2.2K 1/8W 5% CARBON FILM
R48	113472	RES,4.7K 1/8W 5% CARBON FILM
R49	113222	RES,2.2K 1/8W 5% CARBON FILM
R5	113101	RES,100 OHM 1/8W 5% CF
R50	113472	RES,4.7K 1/8W 5% CARBON FILM
R51	113472	RES,4.7K 1/8W 5% CARBON FILM
R52	113222	RES,2.2K 1/8W 5% CARBON FILM
R53	113472	RES,4.7K 1/8W 5% CARBON FILM
R54	113472	RES,4.7K 1/8W 5% CARBON FILM
R55	113472	RES,4.7K 1/8W 5% CARBON FILM
R56	113222	RES,2.2K 1/8W 5% CARBON FILM
R57	113472	RES,4.7K 1/8W 5% CARBON FILM

Table 4-16. Audio Board Parts List (001-00600 Rev. R)

Designator	Part Number	Description
R58	113472	RES,4.7K 1/8W 5% CARBON FILM
R59	113222	RES,2.2K 1/8W 5% CARBON FILM
R6	113103	RES,10K 1/8W 5% CARBON FILM
R60	113101	RES,100 OHM 1/8W 5% CF
R61	113101	RES,100 OHM 1/8W 5% CF
R62	113103	RES,10K 1/8W 5% CARBON FILM
R63	113104	RES,100K 1/8W 5% CARBON FILM
R64	113101	RES,100 OHM 1/8W 5% CF
R65	113101	RES,100 OHM 1/8W 5% CF
R66	113101	RES,100 OHM 1/8W 5% CF
R67	113101	RES,100 OHM 1/8W 5% CF
R68	113273	RES,27K 1/8W 5% CARBON FILM
R69	113472	RES,4.7K 1/8W 5% CARBON FILM
R7	113621	RES,620 OHM 1/8W 5% CF
R70	113472	RES,4.7K 1/8W 5% CARBON FILM
R71	113222	RES,2.2K 1/8W 5% CARBON FILM
R72	113103	RES,10K 1/8W 5% CARBON FILM
R73	113473	RES,47K 1/8W 5% CARBON FILM
R74	113103	RES,10K 1/8W 5% CARBON FILM
R75	113433	RES,43K 1/8W 5% CARBON FILM
R76	113102	RES, 1K, 1/8W, 5%, CF
R77	113104	RES,100K 1/8W 5% CARBON FILM
R78	113272	RES,2.7K 1/8W 5% CARBON FILM
R79	113103	RES,10K 1/8W 5% CARBON FILM
R8	113222	RES,2.2K 1/8W 5% CARBON FILM
R80	113152	RES,1.5K 1/8W 5% CARBON FILM
R81	113103	RES,10K 1/8W 5% CARBON FILM
R82	113104	RES,100K 1/8W 5% CARBON FILM
R83	113103	RES,10K 1/8W 5% CARBON FILM
R84	113104	RES,100K 1/8W 5% CARBON FILM
R85	113472	RES,4.7K 1/8W 5% CARBON FILM
R86	113472	RES,4.7K 1/8W 5% CARBON FILM
R87	113472	RES,4.7K 1/8W 5% CARBON FILM

Table 4-16. Audio Board Parts List (001-00600 Rev. R)

Designator	Part Number	Description
R88	113101	RES,100 OHM 1/8W 5% CF
R89	113101	RES,100 OHM 1/8W 5% CF
R9	113101	RES,100 OHM 1/8W 5% CF
R90	113103	RES,10K 1/8W 5% CARBON FILM
R91	113621	RES,620 OHM 1/8W 5% CF
R92	113472	RES,4.7K 1/8W 5% CARBON FILM
R93	113152	RES,1.5K 1/8W 5% CARBON FILM
R94	113123	RES,12K 1/8W 5% CARBON FILM
R95	113222	RES,2.2K 1/8W 5% CARBON FILM
R96	113621	RES,620 OHM 1/8W 5% CF
R97	113104	RES,100K 1/8W 5% CARBON FILM
R98	113102	RES, 1K, 1/8W, 5%, CF
R99	170224	RES,1K VARIABLE MINI
T1	410019	TRANSFORMER,MINI
T2	410019	TRANSFORMER,MINI
T3	410019	TRANSFORMER,MINI
T5	410019	TRANSFORMER,MINI
TP1	860083	TERMINAL TURRET
TP2	860083	TERMINAL TURRET
TP3	860083	TERMINAL TURRET
U1	330074	IC,DIG,CD4066BE,DIP14,ANALOGSW
U10	330126	IC CD4094BE/MC14094BCP
U11	330395	IC,MC14504B LEVEL SHIFTER
U12	330126	IC CD4094BE/MC14094BCP
U13	330074	IC,DIG,CD4066BE,DIP14,ANALOGSW
U14	330515	IC, QUAD OP AMP
U15	330025	IC,VREG,78L05,TO94,5V
U16	330163	IC TLC272CP
U2	330080	IC,DIG,MC14049UBE,DIP16,BUFFER
U3	330074	IC,DIG,CD4066BE,DIP14,ANALOGSW
U4	330074	IC,DIG,CD4066BE,DIP14,ANALOGSW
U5	330396	IC, REGULATOR
U6	330074	IC,DIG,CD4066BE,DIP14,ANALOGSW

#### 4: Technical Description

**Table 4-16. Audio Board Parts List (001-00600 Rev. R)**

<b>Designator</b>	<b>Part Number</b>	<b>Description</b>
U7	330515	IC, QUAD OP AMP
U8	330515	IC, QUAD OP AMP
XU14	621005	SOCKET,14 PIN IC
XU7	621005	SOCKET,14 PIN IC
XU8	621005	SOCKET,14 PIN IC

## 4.10 Front Panel Assembly

The front panel assembly consists of the front panel and four boards: Front panel processor, Keypad, LCD/Driver, and Switch. It connects to the main body of the radio by a single ribbon cable attached to connector J1. For a block diagram of the interconnections between the two boards, refer to the "Front Panel Assembly Block Diagram" figure on page 4-111.

### 4.10.1 Front Panel Processor Board

The front panel Processor board has direct electrical connections to the speaker (J5), microphone connectors (J9, J10), mode (J19), status (J14), function (J15), clarifier (J8), volume control (J7), lite (J16), power (J12), and the motherboard (J1). The boards main function is the processing of the front panel commands, and the interaction with the main transceiver processor. It also contains the TX and RX paths for the front panel audio processing. TX audio comes in either of the two microphone connectors at pin D, goes through a VOGAD (providing speech compression) and out to the transceiver as PRIMICA (J1-25). The RX audio comes to the front panel on J-30 as SQA, is routed to the top of the volume control (J7-3), and comes out the wiper of the control (J7-4) to the audio amplifier before going to J9 and J10, pin B. It also is routed to the speaker disable circuit before going to both the speaker (J5-2) and to the motherboard connector (J1-27). A separate call alarm located in the front panel alerts the operator of incoming calls and linking during Transcall/TransAdapt operation.

U5 is a parity tree that monitors the PTT, CW, clarifier, and keypad. Any change of status in one of these causes the output at pin 9 to change its state. U4 is a one shot; it outputs a 20 ms pulse for an input change. The output goes to Q1 which is connected to the interrupt line of processor U13 (pin-2 IRQ). U16 provides power on/off conditioning for the processor. Y1 (2.3576 MHz) is the crystal for the internal clock of the processor (OSC1 and OSC2). PD0 through PD7 are ports. PA0 through PA7 are inputs into the processor. PB0 through PB7 are outputs from the processor to the front panel processor board. PC0 through PC7 are outputs from the processor. The processor updates the display and sends commands to the radio as required.

When a key is pressed, a row column gets crossed and a connection is made. This causes a pulse to come out of U12 pin 3. The pulse then stops the keypad scanning oscillator U19C. The oscillator drives counter U9 which is scanning the rows and columns. When keypad scanning stops, U10 records the count which corresponds to a unique key. After reading the key, the processor restarts the scanning loop by toggling U3 pin 7. U2 is a parallel to serial chip, and jumpers J11 configure the front panel. This configuration is read by the processor on power up. The function of J11 jumpers are as follows:

JU11 Functions	Normal Position
1. All function lockout	off
2. Frequency change lockout	off
3. Frequency display lockout	off
4. Mode change lockout	off
5. Power change lockout	off
6. PTT lockout	off
7. CW lockout	off
8. TW7000 lockout	off
9. Not assigned	
10. Not assigned	

**4.10.2  
Keypad  
Board**

The keypad mounts to a small board on the front panel Processor board. The Keypad board connects electrically via J11 to the front panel Switching board. Contact closures on the keypad are as follows:

Key	J11 Connections	Key	J11 Connections
0, sp	1-9	4, jkl	5-9
8, vwx	1-10	C	5-10
1, abc	2-9	5, mno	6-9
9, yz-	2-10	, -	6-10
2, def	3-9	6, pqr	7-9
, .	3-10	E	7-10
3, ghi	4-9	7, stu	8-9
, -	4-10	F	8-10

**4.10.3  
LCD/Driver  
Board**

The LCD/Driver board contains a custom LCD that mounts to a board and connects to the front panel Processor board via J3 and J4. It has two display driver circuits that provide the input for the different LCD segments. It also has an LCD serial driver circuit that takes in serial TX data. It provides parallel input for the display bar graph and a few other indicators.

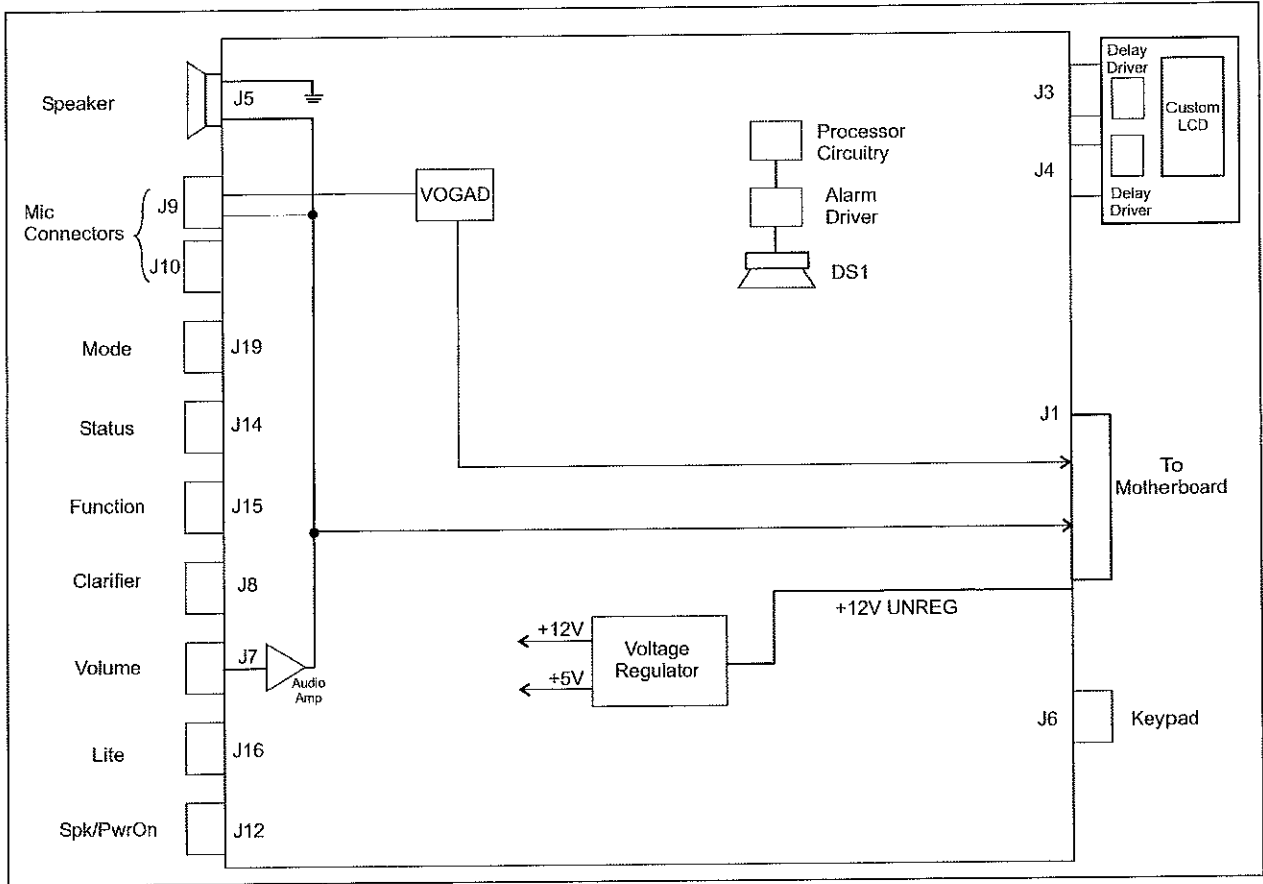


Figure 4-28. Front Panel Assembly Block Diagram

Table 4-17. Front Panel Interconnections to Motherboard

Connector J1	Description	Comment
1, 2	Ground	
3, 4	+12V UNREG	
5	PB7	Data bus line for display drivers
6	PB6	Data bus line for display drivers
7	PB5	Data bus line for display drivers
8	PB4	Data bus line for display drivers
9	PB3	Data bus line for display drivers
10	PB2	Data bus line for display drivers
11	PB1	Data bus line for display drivers
12	PB0	Data bus line for display drivers
13	FPCWKEY	CW key line
14	FPCWA	CW audio
15	FPWSP1	Front panel spare
16	FPPTT	Front panel PTT
17	FPSPITXD	Front panel serial TX data
18	FPSPIRXD	Front panel serial RX data
19	FPSPICLK	Front panel serial clock
20	FPBITE	Front panel BITE
21	ENA	Enable
22	FPWSP2	Front panel spare
23	ISDNMSEL	ISDN
24	FPTCALM	Transcall alarm tone
25	PRIMICA	Microphone audio output
26	PWRON	Power on/off switch status
27	EXTSPKR	Speaker RX audio
28	CWKEY	CW key line
29	MODEM EN	Modem enable
30	SQA	Squelched RX audio output
31	FPRXD	Front panel RX data
32	FPTXD	Front panel TX data
33	FPSP1	Front panel spare
34	EXAUDPTT	External audio PTT

Table 4-18. Front Panel Interconnections to Display

Connector J3	Description	Comment
1	PB0	Display driver data bus
2	PB1	Display driver data bus
3	PB2	Display driver data bus
4	PB3	Display driver data bus
5	PB4	Display driver data bus
6	PB5	Display driver data bus
7	PB6	Display driver data bus
8	PB7	Display driver data bus
9	+5 Vdc	
10	Ground	
11	BKLT1	
12	BKLT2	
Connector J4	Description	Comment
1	SYNC	
2	WE	Write enable
3	RE	Read enable
4	READY	
5	+12V	Heater
6	CS2	Chip select 2
7	CS1	Chip select 1
8	SPITXD	Serial peripheral interface
9	CLKDIS	
10	HEATER SW	
11	SENSE 1	
12	CONTRAST	

**Table 4-19. Front Panel Interconnection to Switch Board**

Connector J6	Description	Comment
1	C0	Column 0 switch matrix data
2	C1	Column 1 switch matrix data
3	C2	Column 2 switch matrix data
4	C3	Column 3 switch matrix data
5	C4	Column 4 switch matrix data
6	C5	Column 5 switch matrix data
7	C6	Column 6 switch matrix data
8	C7	Column 7 switch matrix data
9	R0	Row 0 switch matrix data
10	R1	Row 1 switch matrix data
11	R2	Row 2 switch matrix data
12	R3	Row 3 switch matrix data
13	R4	Row 4 switch matrix data
14	R5	Row 5 switch matrix data
15	R6	Row 6 switch matrix data

**Table 4-20. Front Panel Interconnection to Power/Volume Control**

Connector J7	Description	Comment
1, 5	Ground	
2	PWRON	Power switch status (ground when on)
3	SQA	Squelched RX audio, top of volume pot
4	Volume control	Volume-controlled RX audio (wiper of volume pot)

**Table 4-21. Front Panel Interconnections to Clarifier**

Connector J8	Description	Comment
1	Ground	
2	Clarifier control A	
3	Clarifier control B	
4	Clarifier switch A	
5	Clarifier switch B	

**Table 4-22. Front Panel Interconnection to Microphone**

Connector J9, J12	Description	Comment
1	Ground	
2	Handset audio	
3	PTT	
4	Mic audio	
5	CW key	
6	+12V	

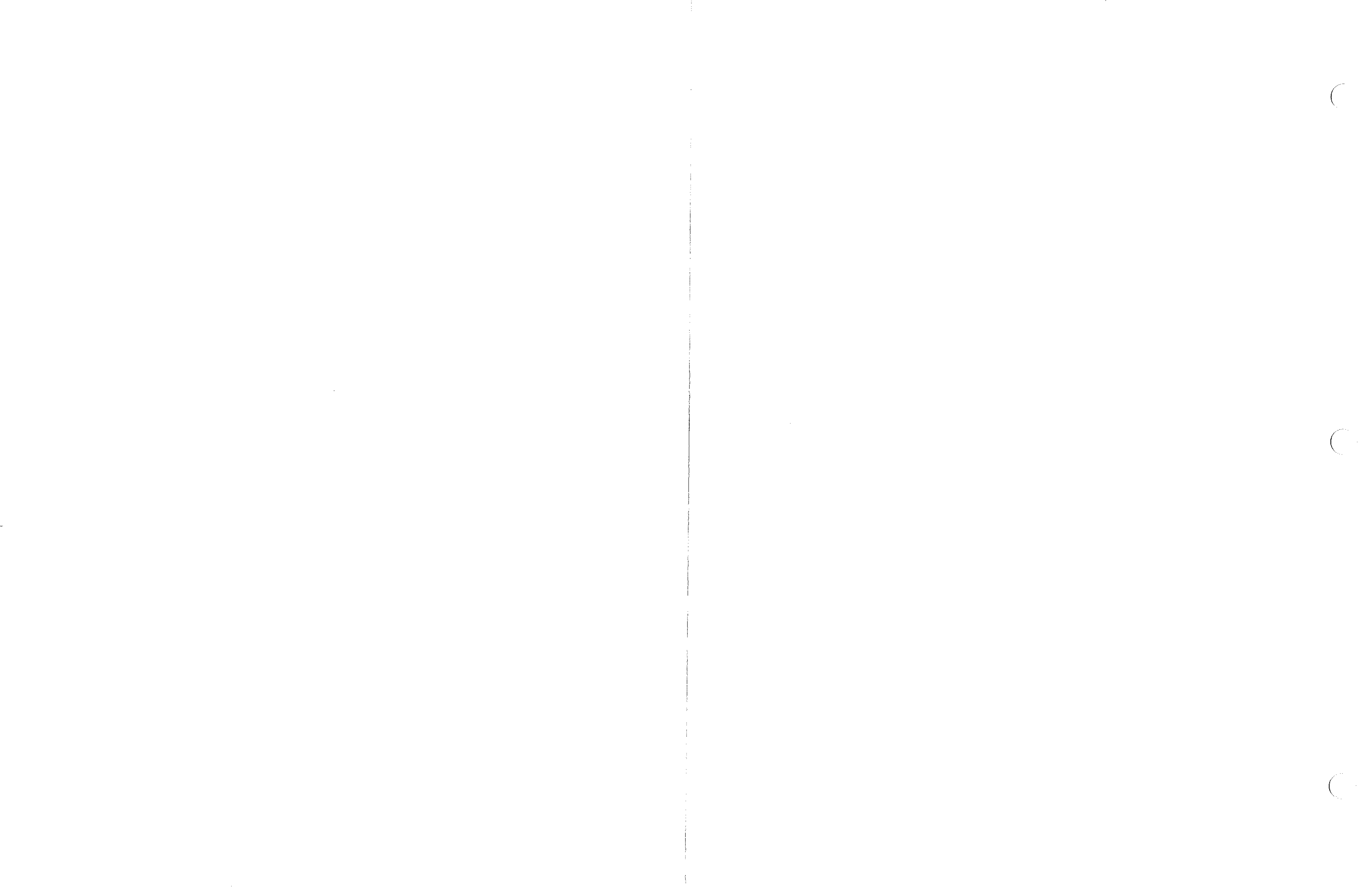
#### 4.10.4 Switch Board

The Switch board mounts to a small board attached to the front panel Processor board. It electrically connects to this board via connector J6. The switch matrix uses the same column lines from the keypad (J11), but includes three unique row lines. Contact closures for each front panel key are as follows:

Switch	J6 Connections	Switch	J6 Connections
Option	1-11	(Select 2)	4-13
Attenuator	1-12	Scan Group	5-11
Send	1-13	SQ	5-12
Status	2-11	(Select 3)	5-13
Tune	2-12	Scan	6-11
Alpha	2-13	(Spare 1)	6-12
Δ	3-11	RF Power	7-11
Ext Amp	3-12	Speaker	7-12
(Select 1)	3-13	Call	8-11
∇	4-11	(Spare 2)	8-12
Priority	4-12		







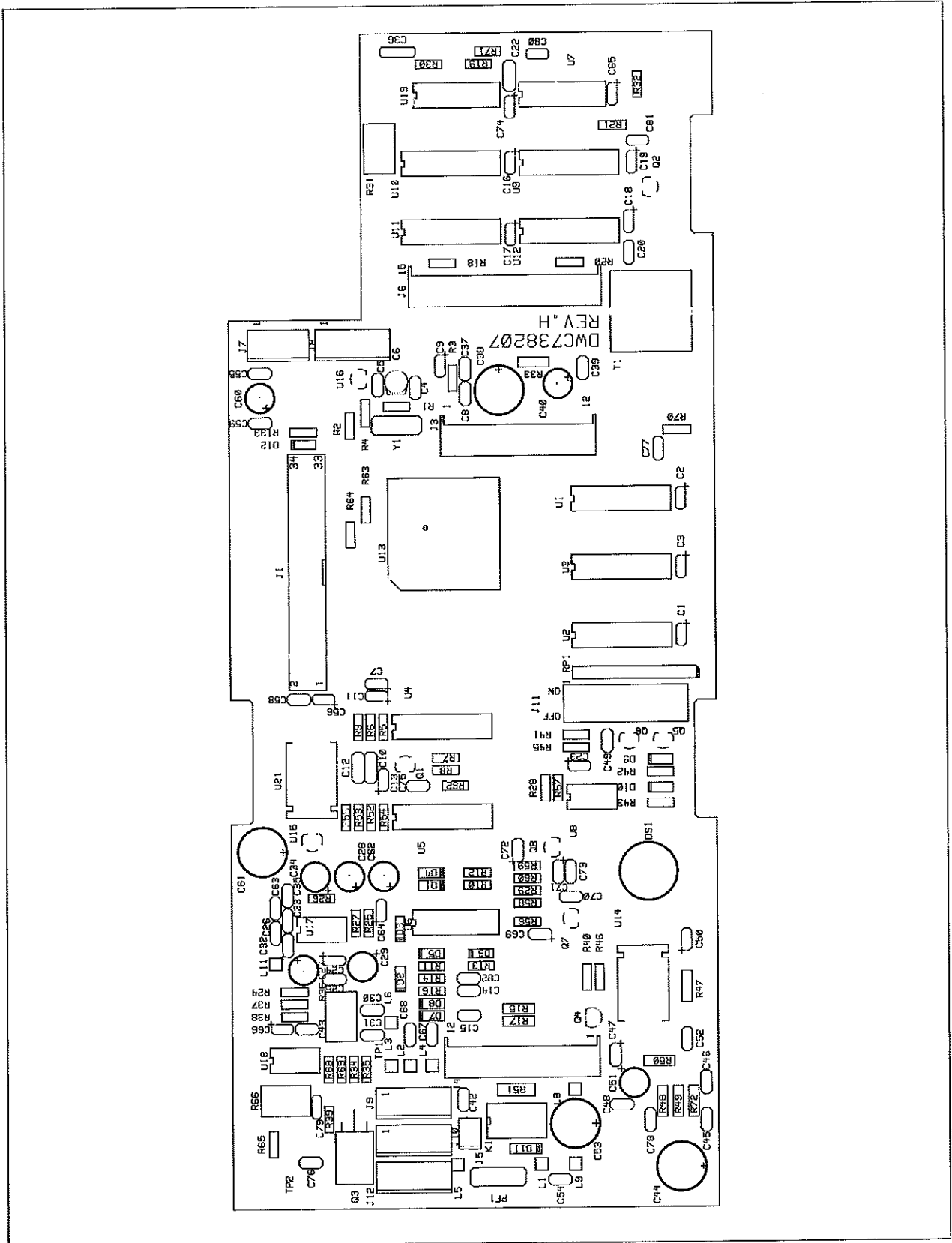


Figure 4-30. Front Panel Assembly Component Locations (738207 Rev. J)

Table 4-23. Front Panel Assembly Parts List (001-00143 Rev. M)

Designator	Part Number	Description
C1	241020	CAP,2.2MF DIP TANTALUM
C10	254203	CAP,0.02MF 10% MYLAR
C11	241020	CAP,2.2MF DIP TANTALUM
C12	254203	CAP,0.02MF 10% MYLAR
C13	241020	CAP,2.2MF DIP TANTALUM
C14	214103	CAP,C,0.01U,50,10%,X,RA,.1SP
C15	214103	CAP,C,0.01U,50,10%,X,RA,.1SP
C16	241020	CAP,2.2MF DIP TANTALUM
C17	241020	CAP,2.2MF DIP TANTALUM
C18	241020	CAP,2.2MF DIP TANTALUM
C19	241020	CAP,2.2MF DIP TANTALUM
C2	241020	CAP,2.2MF DIP TANTALUM
C20	275104	CAP,C,0.1U,50,10%,X,RA,.10SP
C22	210121	CAP,120 PF DISC NPO
C23	241020	CAP,2.2MF DIP TANTALUM
C24	241020	CAP,2.2MF DIP TANTALUM
C25	275104	CAP,C,0.1U,50,10%,X,RA,.10SP
C26	275104	CAP,C,0.1U,50,10%,X,RA,.10SP
C27	241100	CAP,10MF DIP TANTALUM
C28	241100	CAP,10MF DIP TANTALUM
C29	241100	CAP,10MF DIP TANTALUM
C3	241020	CAP,2.2MF DIP TANTALUM
C30	214103	CAP,C,0.01U,50,10%,X,RA,.1SP
C31	214103	CAP,C,0.01U,50,10%,X,RA,.1SP
C32	241020	CAP,2.2MF DIP TANTALUM
C33	214103	CAP,C,0.01U,50,10%,X,RA,.1SP
C34	241100	CAP,10MF DIP TANTALUM
C35	210102	CAP,.001UF,50V,10%,NPO
C36	254153	CAP,0.015MF 100V MYLAR
C37	275104	CAP,C,0.1U,50,10%,X,RA,.10SP
C38	231471	CAP,A,470UF,16V,20%,RA,.20SP
C39	275104	CAP,C,0.1U,50,10%,X,RA,.10SP
C4	210270	CAP,27 PF DISC NPO

Table 4-23. Front Panel Assembly Parts List (001-00143 Rev. M)

Designator	Part Number	Description
C40	231103	CAPACITOR,16V,1000 UF 10X16
C44	231471	CAP,A,470UF,16V,20%,RA,,20SP
C45	275104	CAP,C,0.1U,50,10%,X,RA,,10SP
C46	275104	CAP,C,0.1U,50,10%,X,RA,,10SP
C47	241100	CAP,10MF DIP TANTALUM
C48	210102	CAP,,001UF,50V,10%,NPO
C49	275104	CAP,C,0.1U,50,10%,X,RA,,10SP
C5	210270	CAP,27 PF DISC NPO
C50	241010	CAP,1.0 MF DIP TANTALUM
C51	231101	CAP,A,100U,16V,20%,RA .2SP
C52	275104	CAP,C,0.1U,50,10%,X,RA,,10SP
C53	231471	CAP,A,470UF,16V,20%,RA,,20SP
C54	214103	CAP,C,0.01U,50,10%,X,RA,,1SP
C55	275104	CAP,C,0.1U,50,10%,X,RA,,10SP
C56	241100	CAP,10MF DIP TANTALUM
C58	275104	CAP,C,0.1U,50,10%,X,RA,,10SP
C59	275104	CAP,C,0.1U,50,10%,X,RA,,10SP
C6	261600	CAP,6-50PF,TRIMMER,GREEN
C60	231101	CAP,A,100U,16V,20%,RA .2SP
C61	231471	CAP,A,470UF,16V,20%,RA,,20SP
C62	231101	CAP,A,100U,16V,20%,RA .2SP
C63	275104	CAP,C,0.1U,50,10%,X,RA,,10SP
C64	241020	CAP,2.2MF DIP TANTALUM
C65	241020	CAP,2.2MF DIP TANTALUM
C66	241020	CAP,2.2MF DIP TANTALUM
C67	214103	CAP,C,0.01U,50,10%,X,RA,,1SP
C68	214103	CAP,C,0.01U,50,10%,X,RA,,1SP
C69	241100	CAP,10MF DIP TANTALUM
C7	241020	CAP,2.2MF DIP TANTALUM
C70	214103	CAP,C,0.01U,50,10%,X,RA,,1SP
C71	241100	CAP,10MF DIP TANTALUM
C72	241100	CAP,10MF DIP TANTALUM
C73	214103	CAP,C,0.01U,50,10%,X,RA,,1SP
C74	241020	CAP,2.2MF DIP TANTALUM

Table 4-23. Front Panel Assembly Parts List (001-00143 Rev. M)

Designator	Part Number	Description
C75	214103	CAP,C,0.01U,50,10%,X,RA,.1SP
C77	214103	CAP,C,0.01U,50,10%,X,RA,.1SP
C78	275104	CAP,C,0.1U,50,10%,X,RA,.10SP
C8	214103	CAP,C,0.01U,50,10%,X,RA,.1SP
C80	275104	CAP,C,0.1U,50,10%,X,RA,.10SP
C81	210102	CAP,.001UF,50V,10%,NPO
C82	214103	CAP,C,0.01U,50,10%,X,RA,.1SP
C9	241020	CAP,2.2MF DIP TANTALUM
D1	320002	DIODE,SI 100MA 1N4148/1N4150
D10	320002	DIODE,SI 100MA 1N4148/1N4150
D11	320002	DIODE,SI 100MA 1N4148/1N4150
D12	320002	DIODE,SI 100MA 1N4148/1N4150
D2	320002	DIODE,SI 100MA 1N4148/1N4150
D3	320002	DIODE,SI 100MA 1N4148/1N4150
D4	320002	DIODE,SI 100MA 1N4148/1N4150
D5	320002	DIODE,SI 100MA 1N4148/1N4150
D6	320002	DIODE,SI 100MA 1N4148/1N4150
D7	320002	DIODE,SI 100MA 1N4148/1N4150
D8	320002	DIODE,SI 100MA 1N4148/1N4150
D9	320002	DIODE,SI 100MA 1N4148/1N4150
DS1	710104	BUZZER,MICRO
J1	620050	HEADER 34PIN RT ANGLE
J10	610103	HEADER,MLX,6PIN,.100
J11	614017	HEADER,30 PIN MALE 3 X 10
J12	610103	HEADER,MLX,6PIN,.100
J3	613155	CONN,BOTTOM ENTRY,12 PIN,GOLD
J4	613155	CONN,BOTTOM ENTRY,12 PIN,GOLD
J5	610105	HEADER,MLX,2PIN,.100,
J6	613156	CONNECTOR,15 PIN BOTTOM ENTRY
J7	610215	HEADER,MLX,5PIN,.100
J8	610103	HEADER,MLX,6PIN,.100
J9	610103	HEADER,MLX,6PIN,.100
K1	540077	RELAY,SP PCB MOUNT
L1	459032	IND ASY,3T#30 MAGNET 1-490201

Table 4-23. Front Panel Assembly Parts List (001-00143 Rev. M)

Designator	Part Number	Description
L11	459032	IND ASY,3T#30 MAGNET 1-490201
L2	459032	IND ASY,3T#30 MAGNET 1-490201
L3	459032	IND ASY,3T#30 MAGNET 1-490201
L4	459032	IND ASY,3T#30 MAGNET 1-490201
L5	459032	IND ASY,3T#30 MAGNET 1-490201
L6	459032	IND ASY,3T#30 MAGNET 1-490201
L8	459032	IND ASY,3T#30 MAGNET 1-490201
L9	459032	IND ASY,3T#30 MAGNET 1-490201
PF1	550042	FUSE,POLY RESISTOR 1.4 AMPS
Q1	310057	XISTOR,NPN,PN2222A,TO92
Q2	310057	XISTOR,NPN,PN2222A,TO92
Q4	310057	XISTOR,NPN,PN2222A,TO92
Q5	310057	XISTOR,NPN,PN2222A,TO92
Q6	310057	XISTOR,NPN,PN2222A,TO92
Q7	310033	XISTOR,JFET,NCH,J310,TO92
Q8	310033	XISTOR,JFET,NCH,J310,TO92
R1	113105	RES,1M 1/8W 5% CARBON FILM
R10	113473	RES,47K 1/8W 5% CARBON FILM
R11	113473	RES,47K 1/8W 5% CARBON FILM
R12	113473	RES,47K 1/8W 5% CARBON FILM
R13	113473	RES,47K 1/8W 5% CARBON FILM
R133	113103	RES,10K 1/8W 5% CARBON FILM
R14	113473	RES,47K 1/8W 5% CARBON FILM
R15	124471	RES,470 OHM 1/4W 5% CF
R16	113473	RES,47K 1/8W 5% CARBON FILM
R17	124471	RES,470 OHM 1/4W 5% CF
R18	113221	RES,220 OHM 1/8W 5% CF
R19	113154	RES,150K 1/8W 5% CARBON FILM
R2	113473	RES,47K 1/8W 5% CARBON FILM
R20	113472	RES,4.7K 1/8W 5% CARBON FILM
R21	113474	RES,470K 1/8W 5% CARBON FILM
R24	113105	RES,1M 1/8W 5% CARBON FILM
R25	113333	RES,33K 1/8W 5% CARBON FILM
R26	113122	RES,1.2K 1/8W 5% CARBON FILM

Table 4-23. Front Panel Assembly Parts List (001-00143 Rev. M)

Designator	Part Number	Description
R27	113474	RES,470K 1/8W 5% CARBON FILM
R28	113474	RES,470K 1/8W 5% CARBON FILM
R29	113101	RES,100 OHM 1/8W 5% CF
R3	113473	RES,47K 1/8W 5% CARBON FILM
R30	113474	RES,470K 1/8W 5% CARBON FILM
R31	170213	RES,1M 20Y TRIMMER VRT
R32	113472	RES,4.7K 1/8W 5% CARBON FILM
R33	124100	RES,10 OHM 1/4W 5% CARBON FILM
R4	113563	RES,56K 1/8W 5% CARBON FILM
R40	113472	RES,4.7K 1/8W 5% CARBON FILM
R41	113473	RES,47K 1/8W 5% CARBON FILM
R42	113472	RES,4.7K 1/8W 5% CARBON FILM
R43	113472	RES,4.7K 1/8W 5% CARBON FILM
R45	113472	RES,4.7K 1/8W 5% CARBON FILM
R46	113221	RES,220 OHM 1/8W 5% CF
R47	124020	RES,2.2 OHM 1/4W 5% CF
R48	124221	RES,220 OHM 1/4W 5% CF
R49	124100	RES,10 OHM 1/4W 5% CARBON FILM
R5	113473	RES,47K 1/8W 5% CARBON FILM
R50	124101	RES,100 OHM 1/4W 5% CF
R51	134470	RES,47 OHM 1/2W 5% CARBON FILM
R52	113104	RES,100K 1/8W 5% CARBON FILM
R53	113472	RES,4.7K 1/8W 5% CARBON FILM
R54	113104	RES,100K 1/8W 5% CARBON FILM
R55	113472	RES,4.7K 1/8W 5% CARBON FILM
R56	113474	RES,470K 1/8W 5% CARBON FILM
R57	113474	RES,470K 1/8W 5% CARBON FILM
R58	113474	RES,470K 1/8W 5% CARBON FILM
R59	113474	RES,470K 1/8W 5% CARBON FILM
R6	113104	RES,100K 1/8W 5% CARBON FILM
R60	113101	RES,100 OHM 1/8W 5% CF
R62	113103	RES,10K 1/8W 5% CARBON FILM
R63	113104	RES,100K 1/8W 5% CARBON FILM
R64	113104	RES,100K 1/8W 5% CARBON FILM

Table 4-23. Front Panel Assembly Parts List (001-00143 Rev. M)

Designator	Part Number	Description
R7	113472	RES,4.7K 1/8W 5% CARBON FILM
R70	113624	RES,620K OHM 1/8W 5%
R71	113274	RES,270K 1/8W 5% CARBON FILM
R72	134015	RES,1.5 OHM 1/2W 5% CF
R8	113472	RES,4.7K 1/8W 5% CARBON FILM
R9	113104	RES,100K 1/8W 5% CARBON FILM
RP1	182002	RES,9 X 100K PAK
T1	410071	TRANSFORMER,50K/1K,CT,AUDIO
U1	330348	IC,74HC259N
U10	330381	IC,74HC589
U11	330194	IC CD4051BE
U12	330194	IC CD4051BE
U13	001-00144	SOFTWARE TW7000 FPNL PROC
U14	330043	IC TDA2002-H TO220
U15	330025	IC,VREG,78L05,TO92,5V
U16	330341	IC, VOLTAGE DETECTOR
U17	330029	IC IC6270CP
U19	330342	IC,MC14093BCP
U2	330349	IC, 74HC251N
U21	330002	IC,LIN,LM2940-12,TO220
U3	330380	IC,74HC137
U4	330115	IC MC14528BCP
U5	330130	IC MC14531
U6	330342	IC,MC14093BCP
U7	330040	IC,DIG,CD4013,DIP14,FLIP-FLOP
U8	330382	IC,KM93C06/NM93C06N
U9	330057	IC CD4520BE
XU13	621019	SOCKET, 44 PIN
XY1	364001	INSULATOR CRYSTAL HC25/U
Y1	361085	XTAL,2.4576 MHZ



REV	EDN	DESCRIPTION	DATE	APPD
A	7800-000	PRODUCTION RELEASE	10/03/98	

TO FRONT PANEL CONTROL PC BOARD

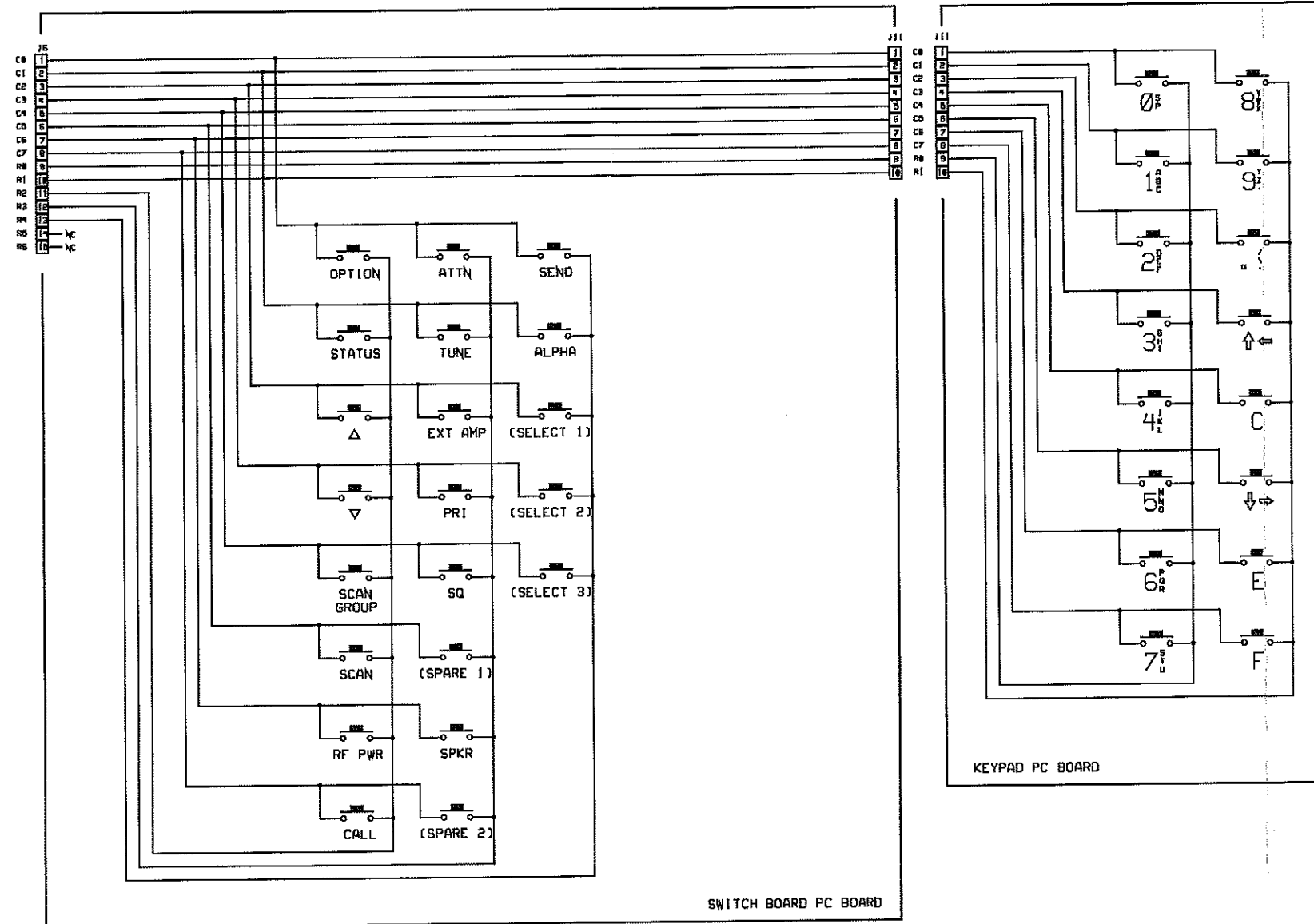
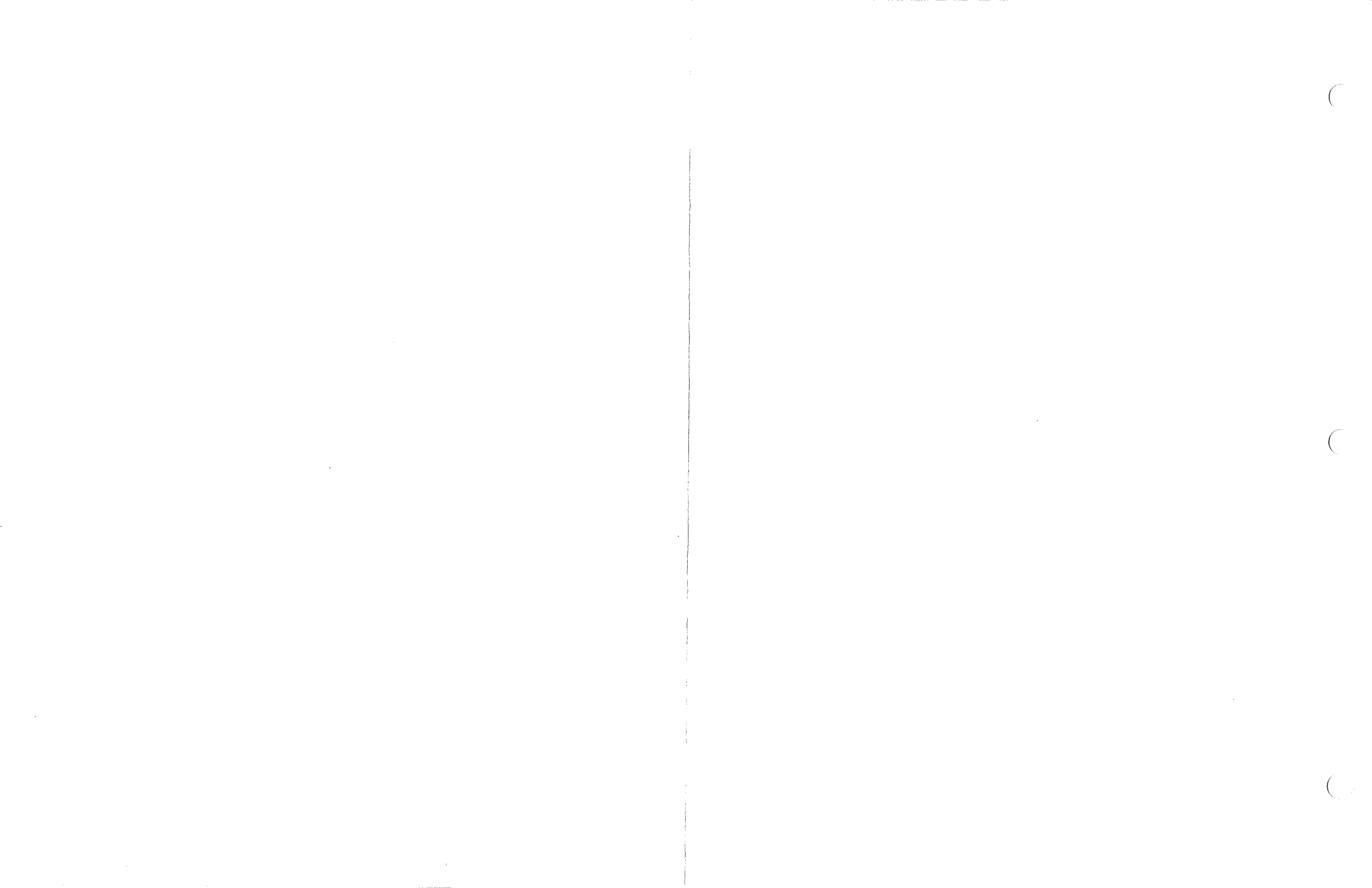


Figure 4-31  
Switch Board Schematic Diagram  
(994149 Rev. A)

4-127

TW7000-MS

SATCOM			
DATCOM WORLD COMMUNICATIONS INC.			
TITLE		SCHEMATIC	
FRONT PANEL SWITCHING		TW7000	
SIZE	DRAWN	DRAWING NUMBER	REV.
D	EMER	994149	A
SCALE	3 SEP 91	SHEET 1 OF 1	



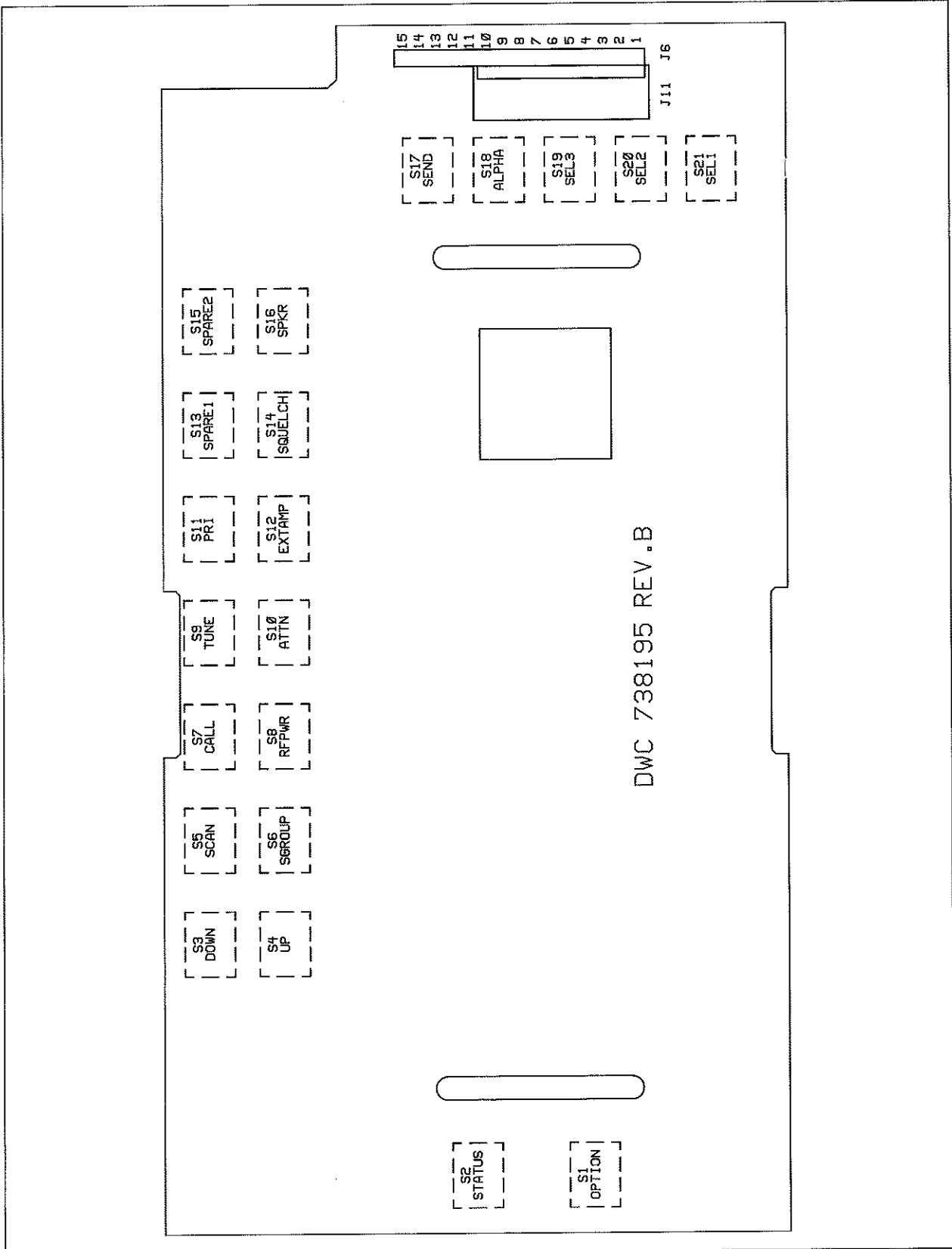
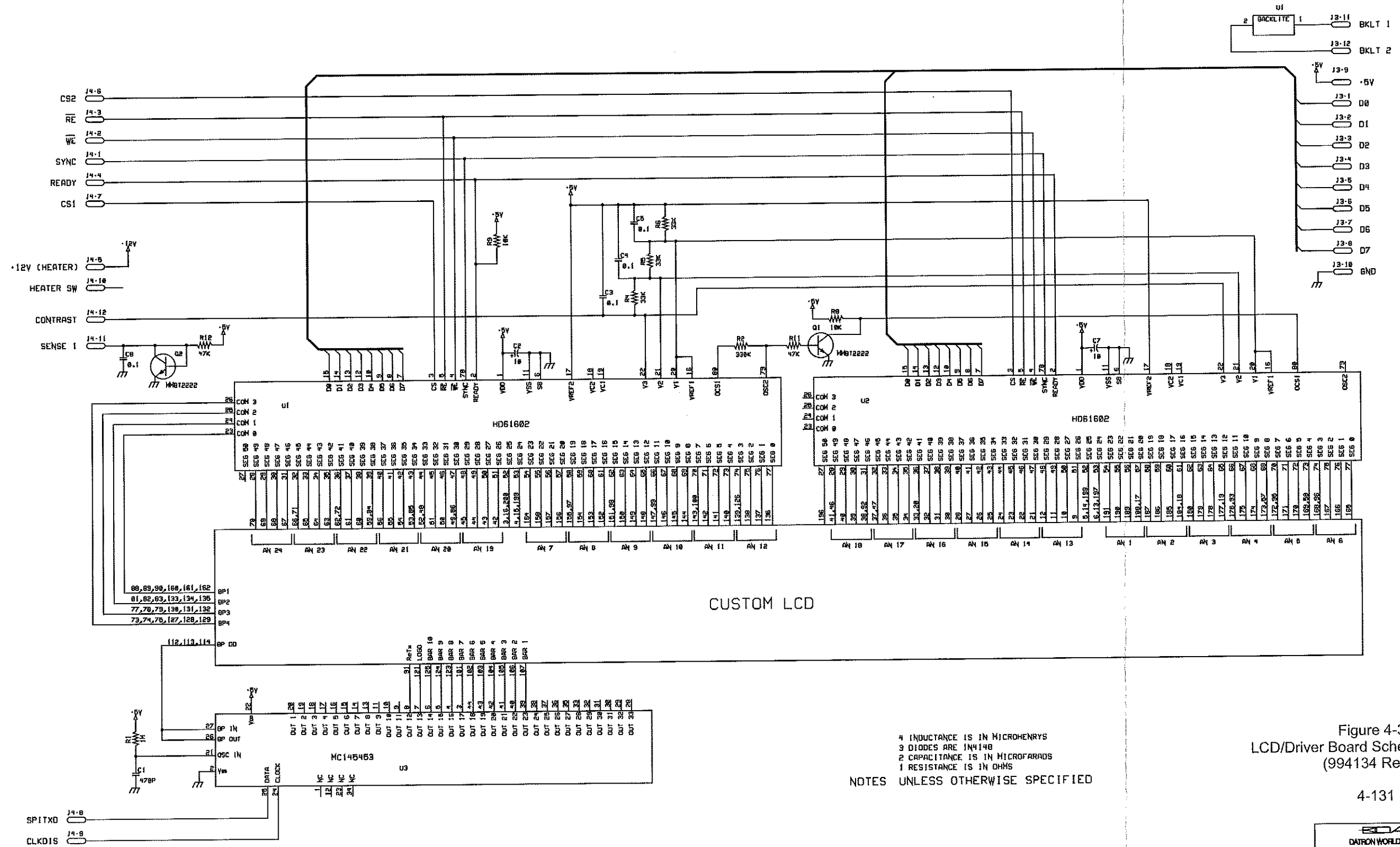


Figure 4-32. Switch Board Component Locations (738195 Rev. B)

Table 4-24. Switch Board Parts List (001-00110 Rev. A1)

Designator	Part Number	Description
J11	614027	CONN,10 POS BOTTOM ENTRY MOLX
J6	610286	HEADER,SIL,15PIN,.100,
S1	530105	SWITCH,TW7000 F.P.
S10	530105	SWITCH,TW7000 F.P.
S11	530105	SWITCH,TW7000 F.P.
S12	530105	SWITCH,TW7000 F.P.
S13	530105	SWITCH,TW7000 F.P.
S14	530105	SWITCH,TW7000 F.P.
S15	530105	SWITCH,TW7000 F.P.
S16	530105	SWITCH,TW7000 F.P.
S17	530105	SWITCH,TW7000 F.P.
S18	530105	SWITCH,TW7000 F.P.
S19	530105	SWITCH,TW7000 F.P.
S2	530105	SWITCH,TW7000 F.P.
S20	530105	SWITCH,TW7000 F.P.
S21	530105	SWITCH,TW7000 F.P.
S3	530105	SWITCH,TW7000 F.P.
S4	530105	SWITCH,TW7000 F.P.
S5	530105	SWITCH,TW7000 F.P.
S6	530105	SWITCH,TW7000 F.P.
S7	530105	SWITCH,TW7000 F.P.
S8	530105	SWITCH,TW7000 F.P.
S9	530105	SWITCH,TW7000 F.P.

REV	EDN	DESCRIPTION	DATE	APPR
A	7898-682	PRODUCTION RELEASE	11NOV92	



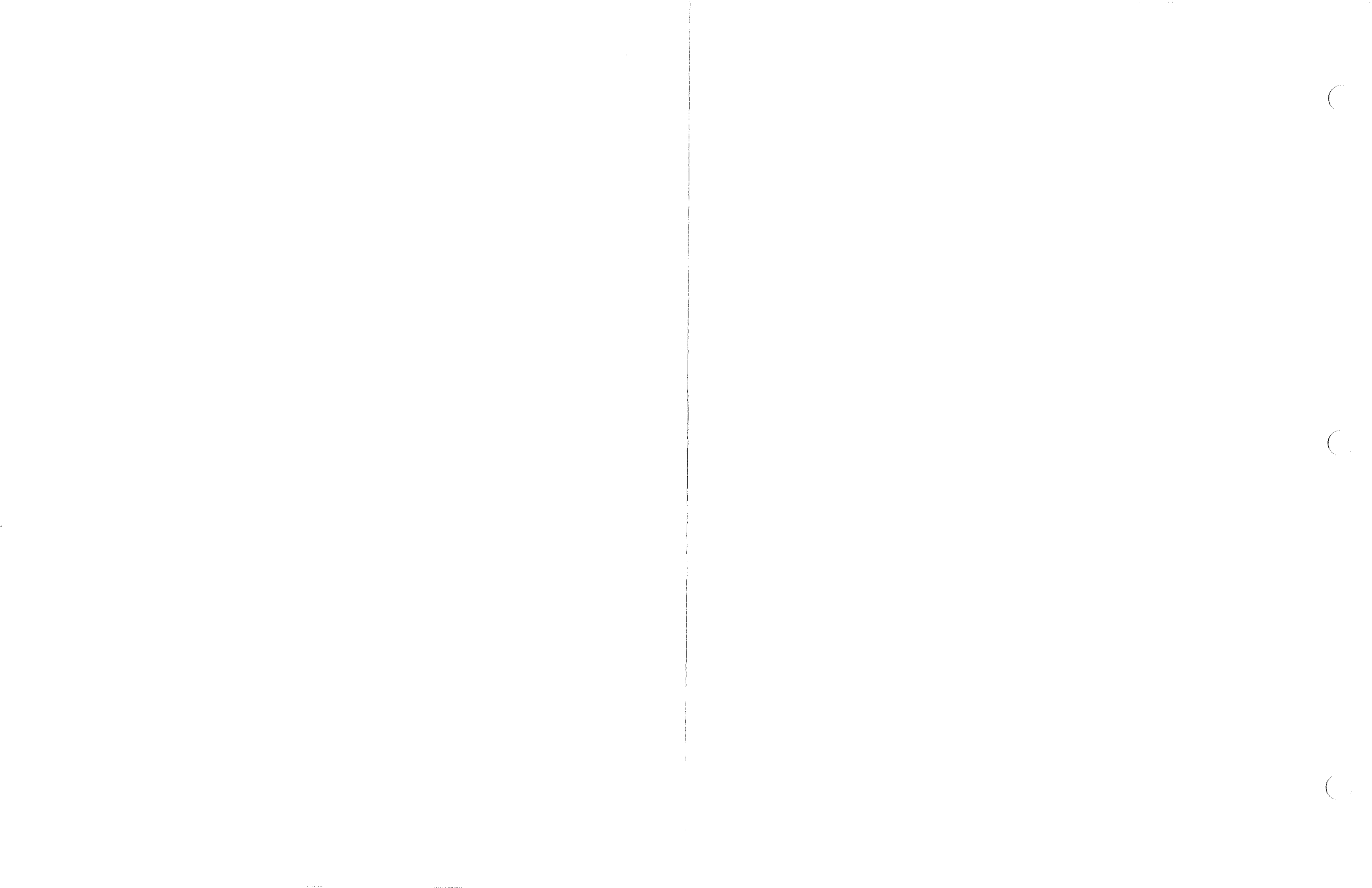
4 INDUCTANCE IS IN MICROHENRYS  
 3 DIODES ARE 1N4148  
 2 CAPACITANCE IS IN MICROFARADS  
 1 RESISTANCE IS IN OHMS  
 NOTES UNLESS OTHERWISE SPECIFIED

Figure 4-33  
 LCD/Driver Board Schematic Diagram  
 (994134 Rev. A)

4-131

EDATRON DATRON WORLD COMMUNICATIONS INC.			
TITLE LCD/DRIVER PCB		T#7000	
SIZE D	DRAWN EMER	SATTTEL BRASSINGTON	DRAWING NUMBER 994134
SCALE		REV. A	SHEET 1 OF 1

TW7000-MS



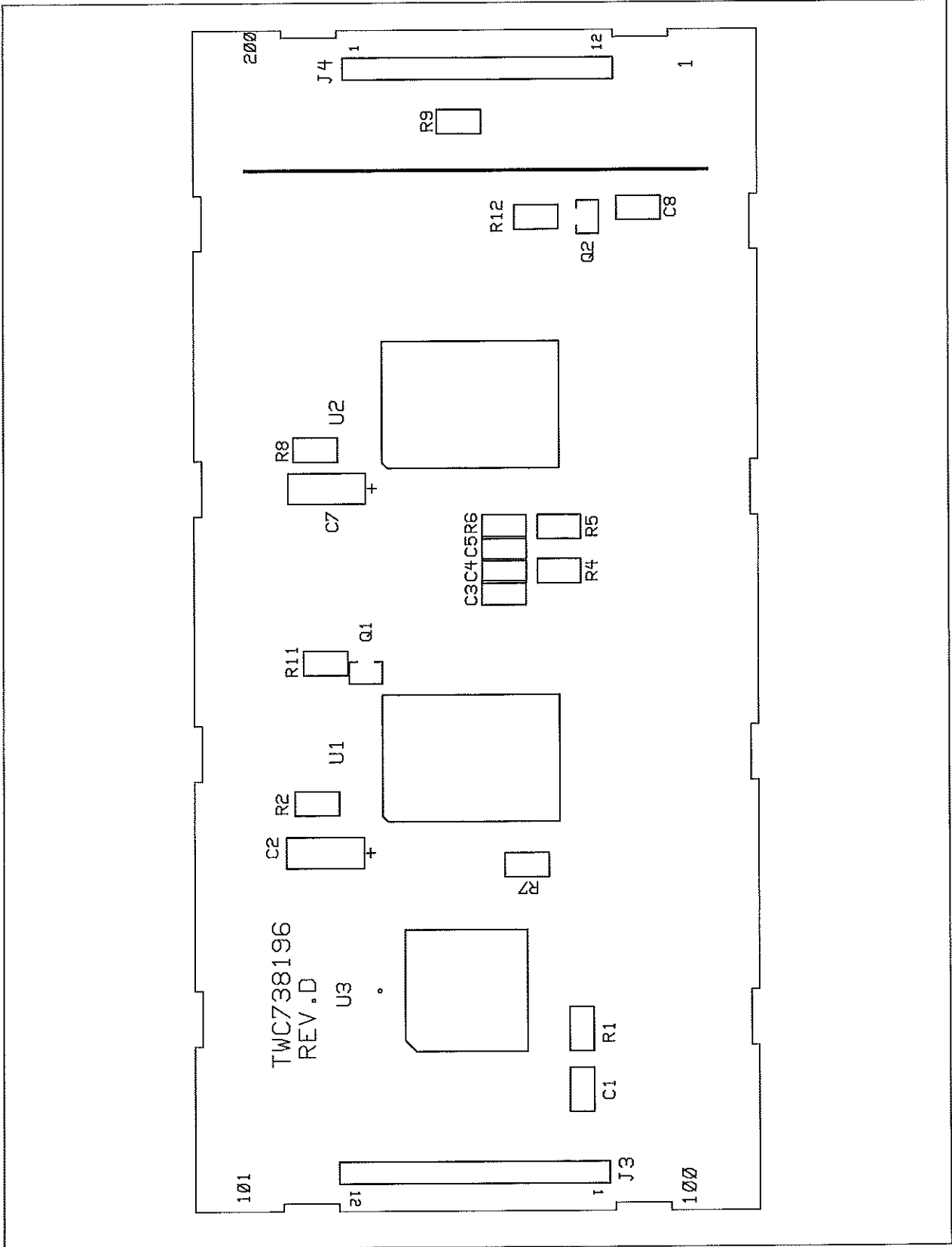


Figure 4-34. LCD/Driver Board Component Locations (738196 Rev. D)

Table 4-25. LCD/Driver Board Parts List (001-00121 Rev. D)

Designator	Part Number	Description
C1	020471	CAP,470PF 100V 5% NPO SMT1206
C2	022100	CAP,SMT,TANT,10MF,10%,16V,2213
C3	021104	CAP,.1MF 50V 10% X7R SMT 1206
C4	021104	CAP,.1MF 50V 10% X7R SMT 1206
C5	021104	CAP,.1MF 50V 10% X7R SMT 1206
C7	022100	CAP,SMT,TANT,10MF,10%,16V,2213
C8	021104	CAP,.1MF 50V 10% X7R SMT 1206
Q1	032004	XISTOR,MMBT2222AL SMT SOT 23
Q2	032004	XISTOR,MMBT2222AL SMT SOT 23
R1	013105	RES,1M OHM 1/8W SMT 1206
R11	013473	RES, 47K 1/8W 5% SMT 1206
R12	013473	RES, 47K 1/8W 5% SMT 1206
R2	013334	RES,330K 1/8W 5% SMT 1206
R4	013333	RES,33K 1/8W 5% SMT 1206
R5	013333	RES,33K 1/8W 5% SMT 1206
R6	013333	RES,33K 1/8W 5% SMT 1206
R8	013103	RES,10K OHM 1/8W 5% SMT 1206
R9	013103	RES,10K OHM 1/8W 5% SMT 1206
U1	033075	IC, HD61602R
U2	033075	IC, HD61602R
U3	033074	IC,MC145453FN

## 4.11 Processor Board

The Processor board contains the microprocessor control for the TW7000. It also has interface capabilities to all other boards and remote control features. The processor contains a Motorola 68HC000 microprocessor that performs all radio control functions. For a block diagram of the Processor board, refer to the "Main Processor Block Diagram" figure on page 4-150. These components are described below.

### 4.11.1 Micro-processor

Microprocessor U1 is combined with the input/output circuits to form a special purpose microcomputer. Its theory of operation is beyond the scope of this manual. Simply stated, the microprocessor controls the operation of the TW7000 in response to the control inputs in accordance with the program stored in memory.

The processor is a Motorola MC68HC000 and uses the 68000 CMOS microprocessor core. It has the capability of addressing up to 1 MB of PROM memory and 64 KB of static RAM program expansion.

The microprocessor operates at a normal clock frequency of 7.3728 MHz and uses external oscillator Y3. Address lines A1-A23 and data lines D0-D15 are for communications with the external EPROM, RAM, and analog converter system.

### 4.11.2 EPROM Program Storage

EPROM chips U2 and U3 store the software program for the TW7000. EPROM storage was chosen for speed, ease of reprogram ability, high reliability factor, and low current consumption. The chip enable (CE) and output enable (OE) signals control reading of the data from EPROM.

### 4.11.3 RAM Program Storage

RAM chips U4 and U5 are storage for all the channel and scan group data information. RAM storage was chosen for its speed, high reliability factor, and low current consumption. The chip select 1 (CS1) and output enable (OE) signals control access to RAM. The write enable (WE) signal controls read/write operations to the RAM.

### 4.11.4 Clock Oscillator Circuit

The clock oscillator is external to the microprocessor and consists of Y3, U33 and U37. The high-speed CMOS oscillator Y3, supplies the three main processor board clocks. U33 and U37 create CLK2 at 7.3728 MHz and CLK3 at 3.6864 MHz.

### 4.11.5 Micro-processor Controller

Controller U41 provides multiple processor control functions. It functions as a reset controller and has a voltage detector that monitors the +5V line. It generates a reset output to hold the microprocessor's reset line low whenever the +5V line is below 4.65 Vdc. An internal monostable multivibrator holds the

reset line low for 200 milliseconds after the +5V line rises above 4.65 Vdc. This prevents repeated toggling of the reset line. Whenever a power failure occurs, this power failure detector also issues a non-maskable interrupt to the microprocessor allowing the microprocessor to power down to the correct state for retaining data.

The chip supplies memory backup preserving the contents of RAM storage. This is storage for frequency program information and must be preserved at all times. When a power failure is detected, the lithium battery switches automatically to preserve RAM data.

The chip also has a watchdog function that monitors the processor and resets it if the WDI line is not toggled at least every 1.2 seconds. This function also drives the fault light indicator. If the fault light is intermittently flashing, it is a good indication that one of the peripheral chips is not functioning. If the processor internal bus is completely stopped, the fault light is on steadily.

### **4.11.6 Memory Backup Circuit**

This circuit contains the memory backup battery BT1, current limiting resistor R43, and reverse protection diode D4. This battery is for backing up RAM storage data.

### **4.11.7 Micro- processor Control Logic**

The main address control logic consists of chips U13, U14, and U15. The main address decoder is U14, a programmable generic array logic (GAL) chip specially configured to handle all the memory address functions in conjunction with U13. U14 decodes the addresses for U2, U3, U4, U5, U13, and the squelch board. The peripheral address decoder chip is U13, which decodes the addresses for peripheral chips U6, U11, U17, U18, U19, U20, and U39. When a chip's address is selected by the microprocessor, it is decoded by U14 and U13 until the appropriate chip select line is selected. Once this happens, the microprocessor waits for a data acknowledge (DTACK) signal from that chip. This comes into U15 on the DTACK line from the appropriate chip, activates the DTACK line on the microprocessor, signals the end of that address cycle, and moves onto the next instruction.

EPROM U2 and U3, and RAM U4 and U5, have no DTACK capability. U14 provides the DTACK signal after waiting enough time for the data to be valid from these chips.

The interrupt control logic consists of chips U12, U26, and U34. The interrupt decode chip is U26, which decodes the interrupt coming in and assigns it a priority level. This priority level is represented on the IPL0-2 lines. It allows a higher priority device to override a lower priority interrupt to get servicing immediately. The microprocessor decodes the interrupt to see where it is coming from. Once determined, the microprocessor presents an address to the interrupt acknowledge (IACK) chip (U12). The microprocessor puts a valid

code out on the function code (FC0-2) lines that decode by U34 and activate U12. U12 signals the interrupting chip that the interrupt is received and can be cleared.

Bus driver chips U27 and U35 drive the main data and address buses to all the chips.

#### **4.11.8 DUART1 Serial Interface Chip**

The dual universal asynchronous receiver/transmitter (DUART1) chip U11 supplies serial communication information to the front panel Processor board and to the COM1 transceiver (U8). The serial link to the front panel is a 9600 baud TTL/CMOS level data link. The serial link to COM1 is variable between 50 and 19200 baud and controls all radio functions through the COM1 port. This chip is also for other output functions such as RTS, watchdog timer, amplifier PTT, and encryption PTT. It also senses the input states of FILTG, RTS, and JU10.

#### **4.11.9 DUART2 Serial Interface Chip**

DUART2 chip U17 supplies serial communications information to the COM2 transceiver (U8) and to the AT7000 transceiver (U43). The serial link to COM2 is variable between 50 and 19200 baud and controls all radio functions through the COM2 port. The serial link to the AT7000 is a 9600 baud TTL/CMOS level data link. This chip is also for other output functions such as RTS, ADATA, ATUINIT, and ACHKTUNE. It also senses the input states of ATUKEY, ASTROBE, ACLOCK, and JU11.

#### **4.11.10 DUART3 Serial Interface Chip**

DUART3 chip U18 supplies serial communications information to the ISDN and FSK remote. The serial link to the ISDN is a 9600 baud TTL/CMOS level data link. The serial link to the FSK remote is a 1200 baud TTL/CMOS level data link. This chip is also for other output functions such as RMTA0, RMTA1, RMTA2, RMTWR, RMTCLK, and RMTDATA. It also senses the input states of SYNC and JU12.

#### **4.11.11 DUART4 Serial Interface Chip**

DUART4 chip U19 supplies serial communications information to the ALE card and to the TA/TC/SC modem (U10). The serial link to the ALE card is a 9600 baud TTL/CMOS level data link. The serial link to the TA/TC/SC modem is a 300 baud TTL/CMOS level data link. This chip is also for other output functions such as TATX (OP2), TALOOP (OP3), ATUSP1 (EXT\_EN1), ATUSP2 (EXT\_EN2), and TC/SCALM. It also senses the input states of EXTIN1 and JU13.

#### **4.11.12 Multi- Function Peripheral Chip**

Multi-function peripheral chip U20 provides all the main interrupt sources and outputs for the TW7000. Interrupt sources include Squelch INTR (I2), EXTCWKEY (I3), ENCRPTTI (I4), and AUXPTT IN (I7). The outputs include

PTT (I0), CWKEY (I5), and AUXPTT OUT (I6). The Schmitt trigger chip U22 squares the incoming interrupt signals to eliminate false interrupts. This chip also contains the UART for communications with the ENCR option board.

**4.11.13  
Parallel  
Interface/  
Timer Chip**

Parallel interface/timer chip U6 supplies parallel input/output for the parallel printer bus as well as the synchronous serial peripheral interface (SPI) communications to the rest of the TW7000. The parallel printer interface is accomplished through port B and in conjunction with U28 and U29. SPI is accomplished through port A using U21 and U31. This chip also contains the main processor timer.

**4.11.14  
Analog  
Converter  
System**

The analog converter system consists of the analog to digital converter (ADC) chip U39 and the decoder chip U40. The ADC chip has a 256-position precision resistor array inside that lets it determine the input voltage down to a resolution of 20 mV. The analog converter system allows precise monitoring of the BITE line, AGC line, ALC line, output power level, RF power amplifier temperature sense, 12 Vdc voltage sense, reverse power, and external BITE.

The BITE system checks the status of each of the boards. From the BITE line it can be determined which boards are in the radio and if they are functioning.

The AGC line determines bar graph readings displayed on the TW7000 during receive. The ALC and PWR LVL lines determine bar graph readings displayed on the TW7000 during transmit. The TSENSE line determines the power amplifier heat sink temperature. It determines if the temperature is hot enough for the fan to come on. If the temperature becomes too hot, the processor begins scaling back the transmit power until the heat sink can cool to a safe temperature. The 12VSENSE line monitors the 12 Vdc line for under or overvoltage conditions. The RVS PWR line determines the amount of reverse power from the VSWR bridge. This determines approximate VSWR values for the processor. The EXTBITE line detects the presence and function of the C1021 and TW5830.

**4.11.15  
RS-232/422/  
485 Interface**

Chip U8 is for serial RS-232 communications with COM1 and COM2 communication ports. This chip has an on-board capacitor charge pump for generating the -10 Vdc and +10 Vdc necessary for RS-232 communications. Chip U9 is for RS-422 single point differential communications or RS-485 multipoint differential communications. Jumpers R4, R7, R18, and R17 route the COM1 communications to either the RS-232 chip or the RS-422/485 chip. For the correct jumper placements, refer to the "Jumper Settings" table on page 5-18.

**4.11.16  
Miscellaneous  
Control Logic**

DUART1(U11) OP6 controls transistor Q1 and provides the internal encryption PTT output signal. DUART1(U11) OP5 controls transistor Q6 and provides the amplifier PTT signal that controls an external amplifier.

**4.11.17  
ATU  
Interface  
Logic**

This interface provides communication with the R/AT7000 antenna tuners using U43 as a 9600 baud RS-422 transceiver for the communications protocol between the TW7000 and the AT/RAT7000 tuners.

For the AT/RAT100 and RAT1000 antenna tuners, the interface is provided by line driver chips U16 and U23. They provide the signals for the ATUINIT, ATUKEY, ADATA, ACHKTUNE, ACLOCK, and ASTROBE lines.

The ATUINIT line initiates the antenna tuner tune cycle and goes low briefly to start the tune cycle. The antenna tuner brings the ATUKEY line low to tell the radio to supply CW at a low power level for the antenna tuner to tune to.

The ATUKEY line goes high when the tune cycle is complete. The other lines are for the memory AT/RAT100 and provide channel change information to the antenna tuner.

The ACHKTUNE line provides the interrupt to the antenna tuner to alert it to receive the serial channel data.

The ASTROBE line goes high, briefly indicating the antenna tuner is ready to receive data. The radio sends the BCD channel information to the antenna tuner with the ADATA and ACLOCK lines. The ACHKTUNE goes high when data receive is complete.

**4.11.18  
Remote  
Interface**

Remote interface provides communication with the ISDN and FSK remote control systems. The ISDN protocol handles two 9600 baud communication channels. One is for a standard 9600 baud front panel display communication channel and is routed on SER2. The second ISDN is for control functions routed on SER1. The FSK remote is a 1200 baud communications channel meant to accommodate noisy environments such as telephone lines. The RMTA0, RMTA1, RMTA2, RMTWR, RMTCLK, and RMTDATA, program the FSK modem on the FSK remote board.

**4.11.19  
TA/TC/SC  
Modem**

The optional TA/TC/SC modem (U10) is installed for TA/TC/SC operation. It generates the TA/TC/SC transmitted tones and decodes the incoming TA/TC/SC tones. The TATX line from DUART4 (U19) OP2 toggles the modem from transmit to receive. The TALOOP line from DUART4 (U19) OP3 provides loopback testing of the modem.

#### 4.11.20

##### **Serial Peripheral Interface (SPI)**

The SPI is the heart of transceiver programming. This synchronous serial data link connects to all the boards in the TW7000 providing full microprocessor control of the radio. This data link consists of port A of U6, U21, and U31. Demultiplexer chips U21 and U31 provide the SPI enable pulses to each of the boards. The enable lines are normally high and pulse low for about 1 ms when programming of the appropriate board is finished. As the boards are programmed, data is sent out on the SPITXD line. For descriptions of these lines, refer to the "Enable Line Description" table on page 4-142.

#### 4.11.21

##### **Parallel Printer**

The parallel printer interface consists of port B of U6, U28, and U29. Bus driver chips U28 and U29 provide bidirectional data transfer on all of the interface lines. For a description of the lines, refer to the table below.

#### 4.11.22

##### **Squelch Circuit**

The Squelch circuit is U7, U24, U25 and U36 on the Processor board. The Processor board routes DSPPRXA audio to the Squelch circuit from the motherboard. The Squelch circuit supplies SQIN to the Processor board so that it can mute/unmute the receive audio if the squelch control is on.

The RX block diagram (page 4-141) shows the RX audio distribution in the radio. DSPRRXA is the raw audio coming from the Audio board. It loops through the processor and goes back to the Audio board. The SQIN signal is syllabic in nature and indicates whether a valid audio signal is detected above the squelch audio threshold. It is routed to the processor, where it is used in conjunction with the front panel squelch on/off setting to generate the squelch signal going to the Audio board to control the squelch gate.

The TX block diagram (page 4-141) shows the TX audio distribution.

#### 4.11.23

##### **Squelch Test Procedure**

This test requires the following equipment:

- TW7000
  - RF signal generator
  - 12V power supply
1. Turn the radio on. Measure the regulator output at U25 pin 14. The voltage should be  $8.0V \pm 4 V$ . Hook the generator and dummy load to the test radio. Set the squelch potentiometer so the radio stays squelched without RX input.
  2. Set the radio to 15.591 MHz (USB) with the squelch and speaker on. Set the signal generator to 15.590 MHz at -95 dBm. Vary the generator up by 1 kHz. Vary the generator frequency down by 1 kHz. Squelch should open, then close. Turn off squelch and verify that it's disabled.

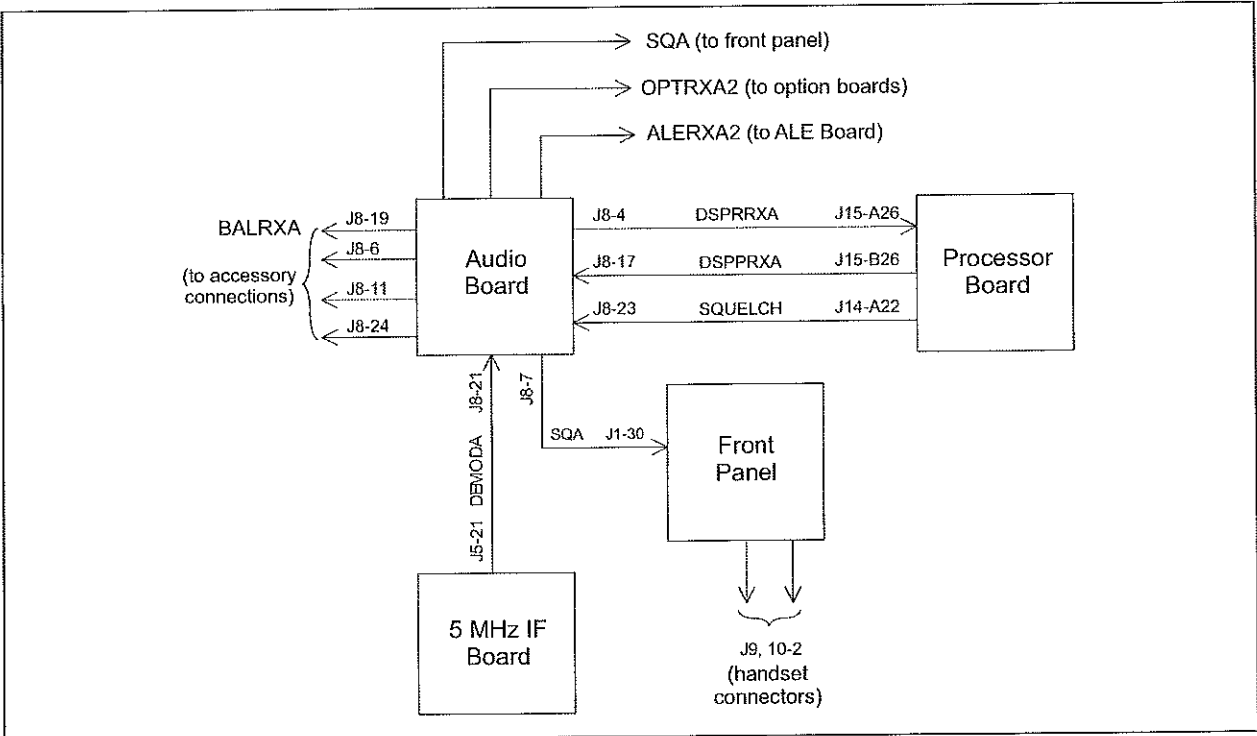


Figure 4-35. RX Audio Distribution Block Diagram

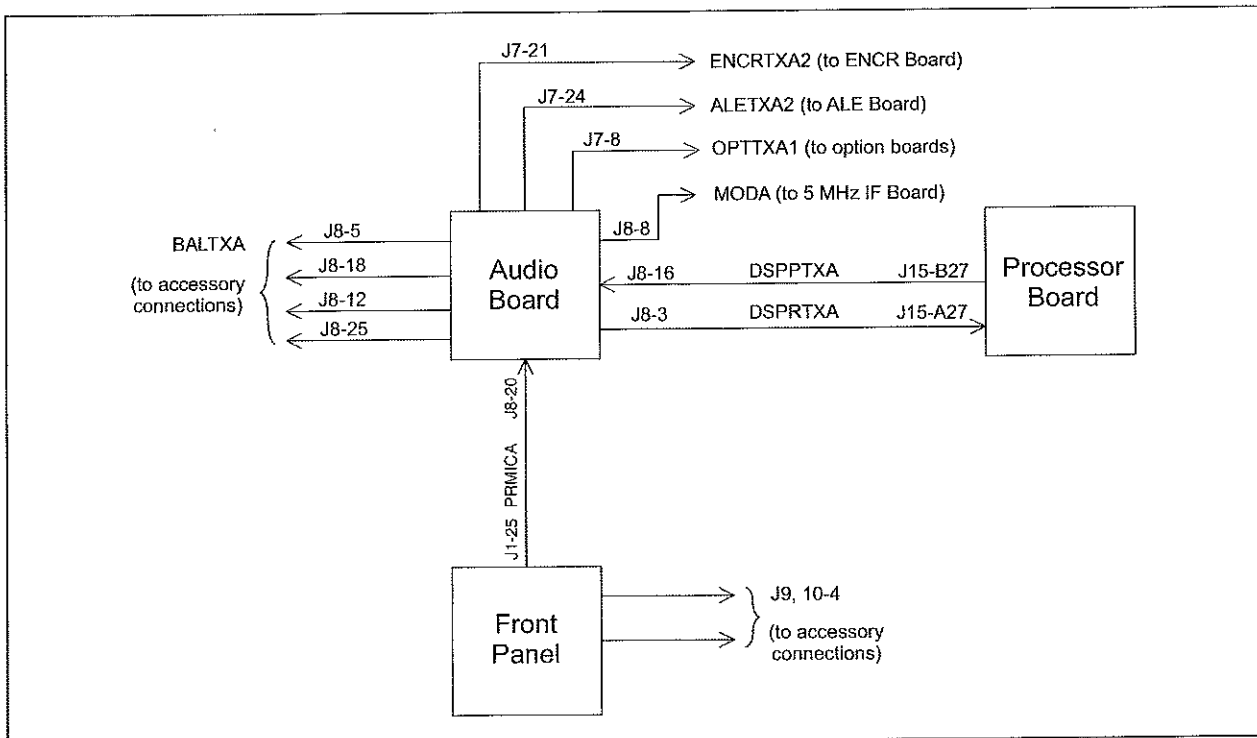


Figure 4-36. TX Audio Distribution Block Diagram

**4.11.24****Inter-connections**

For Processor board interconnects with the TW7000, refer to the "Processor Board Interconnections" table on page 4-144. For troubleshooting procedures, refer to the "Troubleshooting the Processor Board" table on page 5-16.

**Table 4-26. Enable Line Description**

<b>Enable</b>	<b>Description</b>
1	Main synthesizer - BFO synthesizer
2	Main synthesizer - direct digital synthesizer (DDS)
3	Main synthesizer - main loop synthesizer
4	Main synthesizer - BITE line
5	Not used
6	5 MHz IF board programming
7	Reference/control board programming - filter bands
8	Power supply/external amplifier board programming
9	Audio board programming
10	Reference/control board programming - RF power level
11	75 MHz IF board programming
12	ECU/RCU interface board programming
13	ALE board programming
14	Option 1 board programming
15	Option 2 board programming
16	Serial EEPROM chip programming

**Table 4-27. Parallel Printer Description**

Line	Printer
DATA0	D0 line (LSB)
DATA1	D1 line
DATA2	D2 line
DATA3	D3 line
DATA4	D4 line
DATA5	D5 line
DATA6	D6 line
DATA7	D7 line (MSB)
STROBE	Strobe line
ACK	Acknowledge
SELECT	Select line
BUSY	Busy line
DI/OSEL	Data in/out select line

Table 4-28. Processor Board Interconnections

Connector J14	Description	Comment
A1	Ground	
A2	EN7	Reference/control board programming
A3	EN2	Main synthesizer DDS programming
A4	EN4	Main synthesizer BITE line
A5	EN6	5 MHz IF board programming
A6	EN9	Audio board programming
A7	EN14	Option 1 slot programming
A8	EN13	ALE board programming
A9	N/C	No connection
A10	ALERXD	ALE board receive data line
A11	RVSPWR	Reverse power line
A12	EXTBITE	C1021 detect
A13	N/C	No connection
A14	N/C	No connection
A15	N/C	No connection
A16	SERRXD	Option slots receive data line
A17	ENCRPTTI	Encryption PTT input line
A18	AGC	Automatic gain control line
A19	FPRXD	Front panel receive data line
A20	PWRLVL	Power level line
A21	N/C	No connection
A22	SQUELCH	Audio board squelch line
A23	TCRXAI	TA/TC/SC receive audio line
A24	RMTRXD	FSK remote receive data line
A25	SER2RXD	ISDN front panel receive data line
A26	SER1RXD	ISDN second serial channel receive data line
A27	SYNC	ISDN synchronization line
A28	RMTCLK	FSK remote modem clock line
A29	RMTA2	FSK remote modem address 2 line
A30	RMTA0	FSK remote modem address 0 line

Table 4-28. Processor Board Interconnections

Connector J14	Description	Comment
A31	+12V	+12V
A32	Ground	
B1	Ground	
B2	EN10	Reference/control board programming
B3	EN1	Main synthesizer BFO programming
B4	EN3	Main synthesizer main loop programming
B5	EN5	Not used
B6	EN11	75 MHz IF board programming
B7	EN15	Option 2 slot programming
B8	EN12	ECU/RCU interface board programming
B9	EN8	Power supply/external amplifier board programming
B10	ALETXD	ALE board transmit data line
B11	PTT	Internal radio PTT line
B12	BITE	BITE line
B13	SPICLK	Serial peripheral interface (SPI) clock line
B14	SPITXD	SPI transmit data line
B15	SPIRXD	SPI receive data line
B16	SERTXD	Option slots transmit data line
B17	ENCRPTTO	Encryption PTT output line
B18	ALCLVL	ALC transmit level line
B19	FPTXD	Front panel transmit data line
B20	VSWRALM	VSWR alarm line
B21	N/C	No connection
B22	N/C	No connection
B23	CWKEY	Audio board CW key line
B24	TCTXA0	TA/TC/SC transmit audio line
B25	RMTTXD	FSK remote transmit data line
B26	SER2TXD	ISDN front panel transmit data line

Table 4-28. Processor Board Interconnections

Connector J14	Description	Comment
B27	SERITXD	ISDN second serial channel transmit data line
B28	RMTWR	FSK remote modem write line
B29	RMTDATA	FSK remote modem data line
B30	RMTA1	FSK remote modem address 1 line
B31	+12V	+12V supply line
B32	Ground	
Connector J15	Description	Comment
A1	Ground	
A2	EXTEN2	External SPI enable
A3	ASTROBE	AT/RAT100 memory strobe line
A4	ATUKEY	AT/RAT100 tune cycle key line
A5	ACHKTUNE	AT/RAT100 memory check tune line
A6	COMITXD	COM1 transmit data line
A7	COM1RXD	COM1 receive data line
A8	ACK	Printer acknowledge line
A9	DI/OSEL	Data input/output select line
A10	N/C	No connection
A11	TSENSE	Heat sink temperature sense line
A12	N/C	No connection
A13	ATUTX	AT7000 transmit data line
A14	EXTTXD	Keyboard transmit data line
A15	EXTRXD	Keyboard receive data line
A16	FILTG	Filter G select line
A17	COM2TXD	COM2 transmit data line
A18	RETX	Re-transmit signal line
A19	N/C	No connection
A20	EXTCWKEY	External CW key line
A21	ATUINIT	AT/RAT100 tune cycle initiate line
A22	DATA0	Printer data 0 line
A23	DATA2	Printer data 2 line
A24	DATA4	Printer data 4 line
A25	DATA6	Printer data 6 line

**Table 4-28. Processor Board Interconnections**

Connector J15	Description	Comment
A26	DSPRRXA	Squelch receive audio line
A27	DSPRTXA	Audio loop
A28	N/C	No connection
A29	+5V	+5V supply line
A30	+5V	+5V supply line
A31	+12V	+12V supply line
A32	Ground	
B1	Ground	
B2	EXTIN1	Currently unused
B3	EXTEN1	Ext SPI enable 1
B4	ACLOCK	RAT1000 clock line
B5	ADATA	RAT1000 data line
B6	COM1RTS	COM1 RTS line
B7	COM1CTS	COM1 CTS line
B8	STROBE	Printer strobe line
B9	SELECT	Printer select line
B10	BUSY	Printer busy line
B11	AUXPTT	Auxiliary PTT line
B12	N/C	No connection
B13	N/C	No connection
B14	ATURX	AT7000 receive data line
B15	AMPPTT	External amplifier PTT line
B16	EXTCLK	Ext SPI clock line
B17	N/C	No connection
B18	COM2RXD	COM2 receive data line
B19	TC/SCALM	TA/TC/SC alarm line
B20	N/C	No connection
B21	N/C	No connection
B22	DATA1	Printer data 1 line
B23	DATA3	Printer data 3 line

**Table 4-28. Processor Board Interconnections**

Connector J15	Description	Comment
B24	DATA5	Printer data 5 line
B25	DATA7	Printer data 7 line
B26	DSPPRXA	Receive audio line
B27	DSPPTXA	Audio loop
B28	N/C	No connection
B29	+5V	+5V supply line
B30	+5V	+5V supply line
B31	+12V	+12V supply line
B32	Ground	



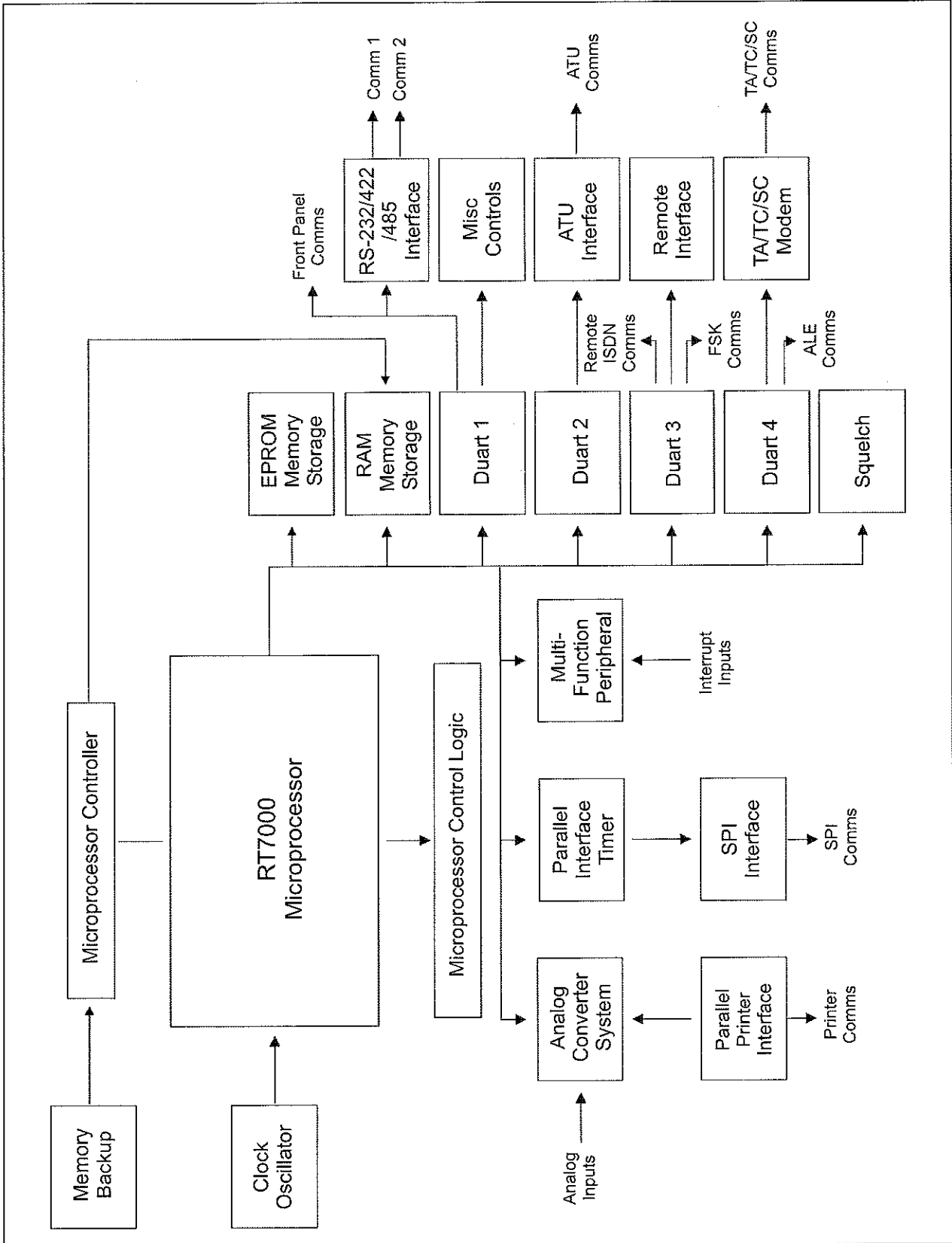
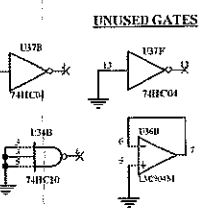
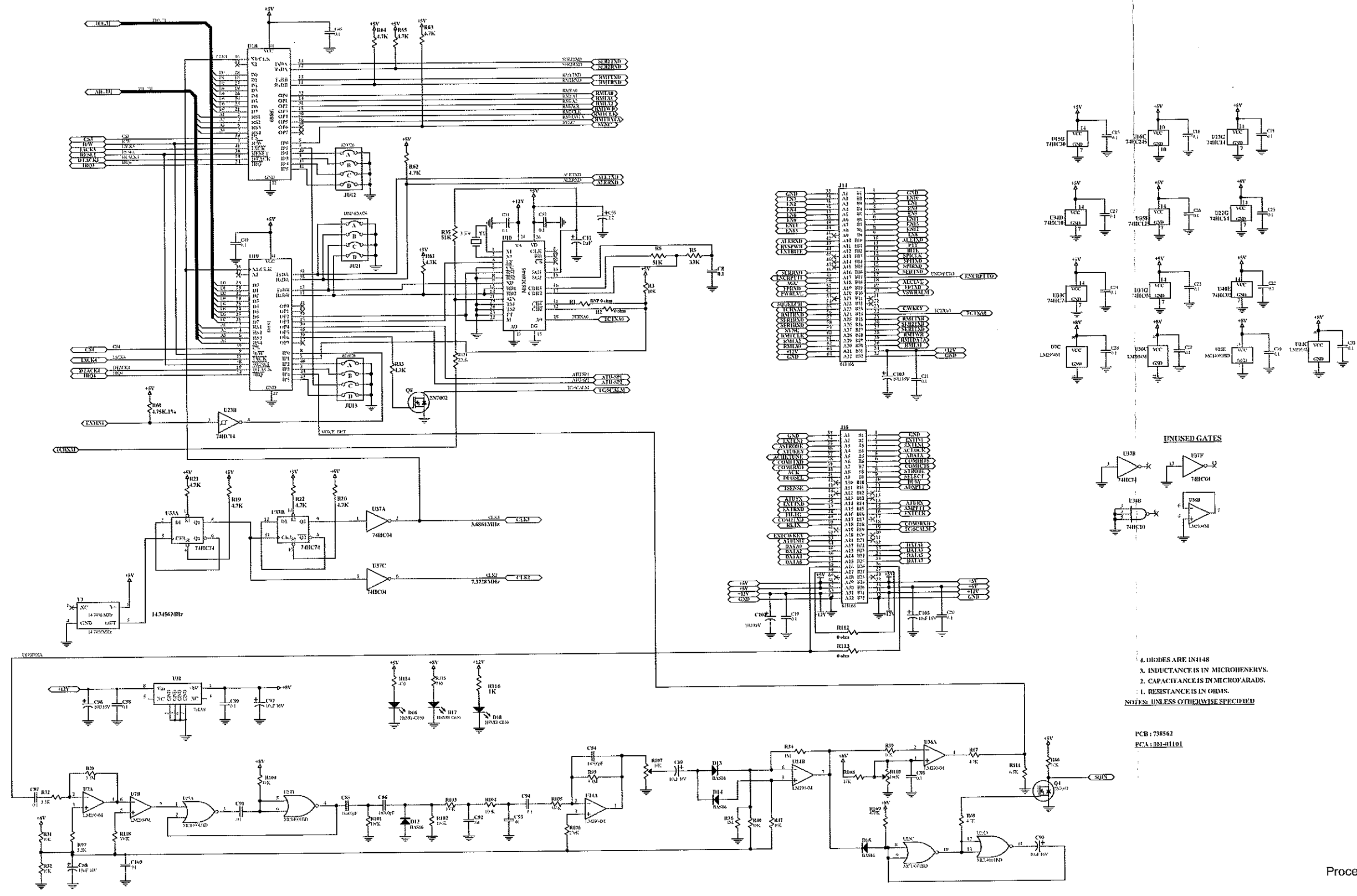


Figure 4-37. Main Processor Block Diagram

REV	ECN	DESCRIPTION	DATE	APPR
A	03-01-80	RELEASE	BB	04-17-80

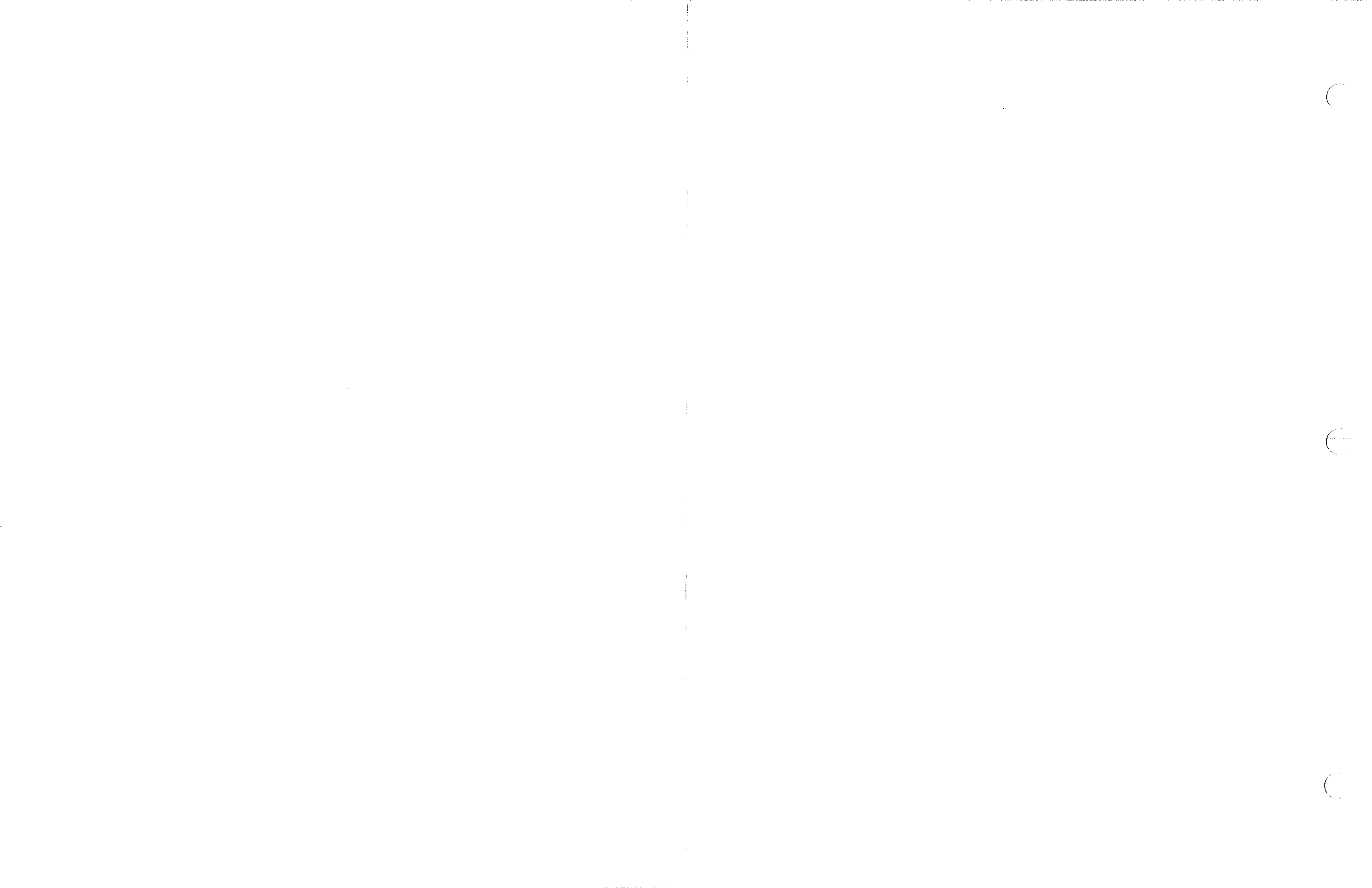


4. DIODES ARE 1N4148  
 3. INDUCTANCE IS IN MICROHENRYS.  
 2. CAPACITANCE IS IN MICROFARADS.  
 1. RESISTANCE IS IN OHMS.  
 NOTES: UNLESS OTHERWISE SPECIFIED

PCB: 738562  
 PCA: 001-01101

Figure 4-38  
 Processor Board Schematic Diagram  
 1 of 4 (994510 Rev. A)

DAIYON WORLD COMMUNICATIONS INC.		940 Enterprise Ct Irvine, CA 92618 714/952-3177	
MICROPROCESSOR, TW7000			
Sheet: D	Rev: 1	Drawn: 11/11/80	Checked: 11/11/80
Date: 11/11/80		Time: 11:42:23	
File: 994510_1.SCH		Sheet: 1 of 4	



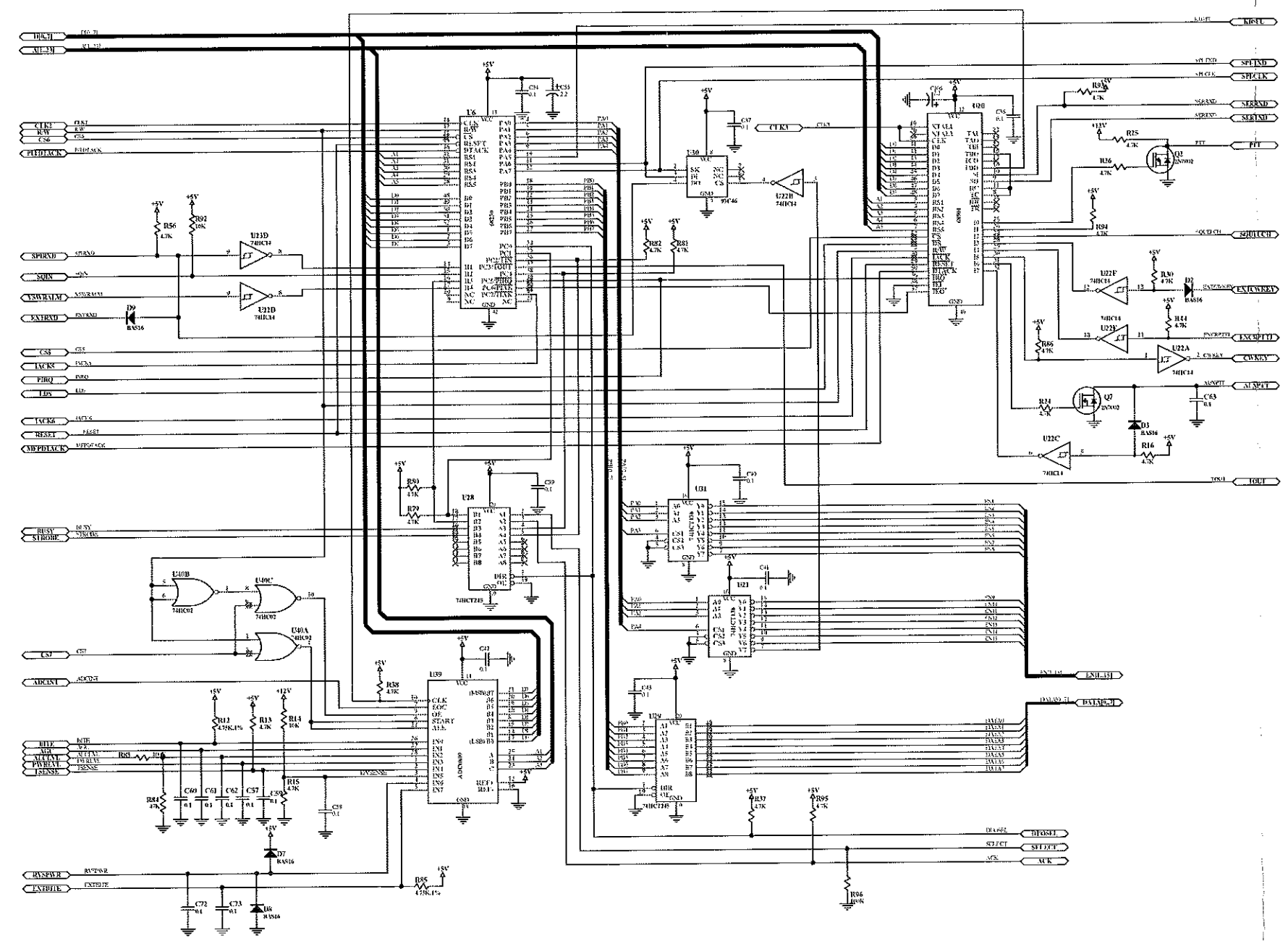


Figure 4-39  
Processor Board Schematic Diagram  
2 of 4 (994510 Rev. A)

		3601 Zanker Rd. Milpitas, CA 95031 (415) 951-3377
This Schematic <b>MICROPROCESSOR, TW7000</b>		
Size: <b>D</b> Qty: <b>1</b>	Date: <b>994510</b> Rev: <b>A</b>	File: 994510A.2/3/1 Date: 24-FEB-2008 Time: 14:57:43 Sheet: 2 of 4



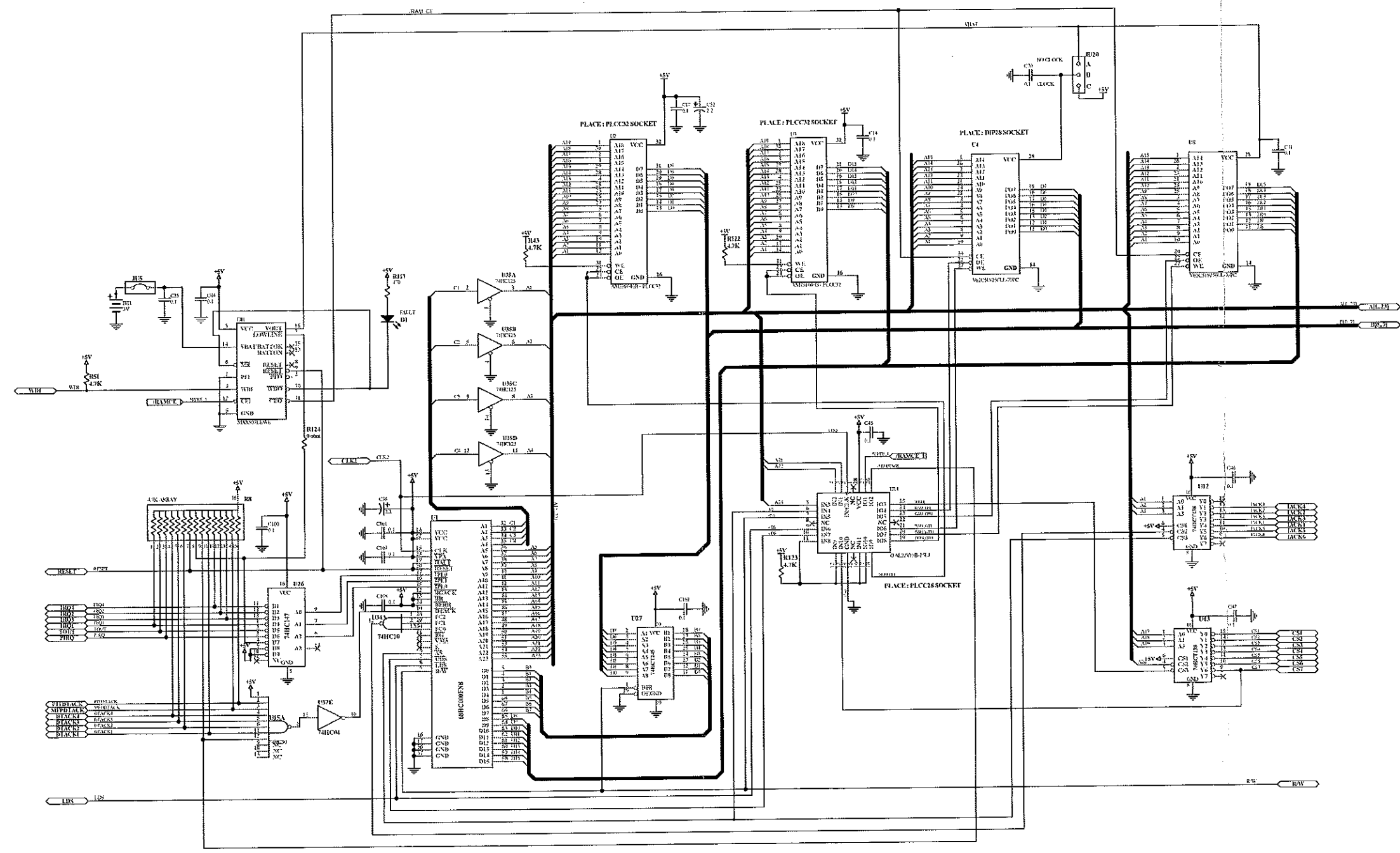
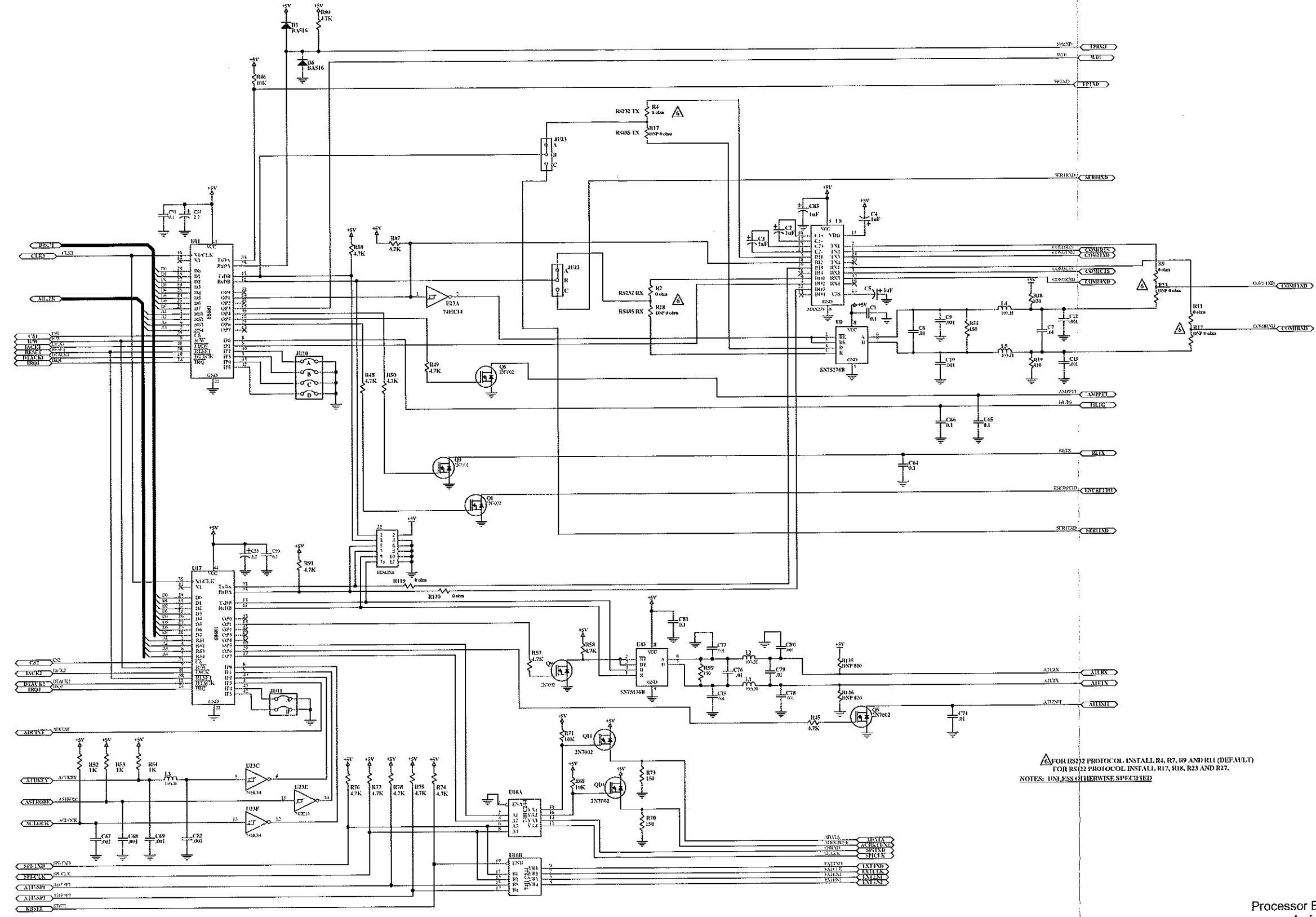


Figure 4-40  
Processor Board Schematic Diagram  
3 of 4 (994510 Rev. A)

DAEMON WORLD COMMUNICATIONS INC.			
Title: Schematic			
MICROPROCESSOR, TW7000			
Sheet: D	Drawn: [ ]	Drawing Number: 994510	Rev: A
Date: [ ]	Date: [ ]	Date: [ ]	Date: [ ]
Date: 24-Feb-2005 Time: 11:53:41 Sheet: 3 of 4			

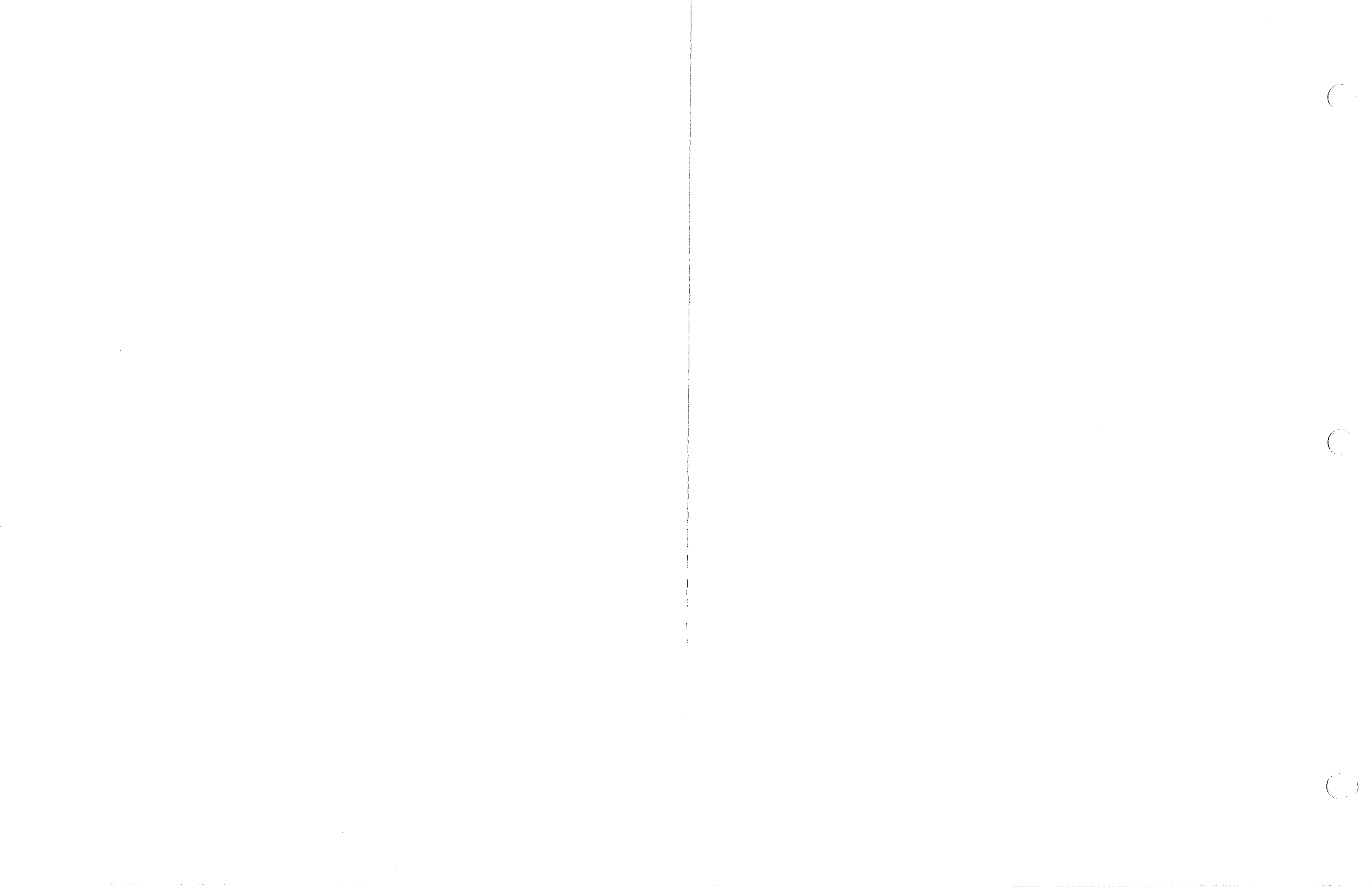


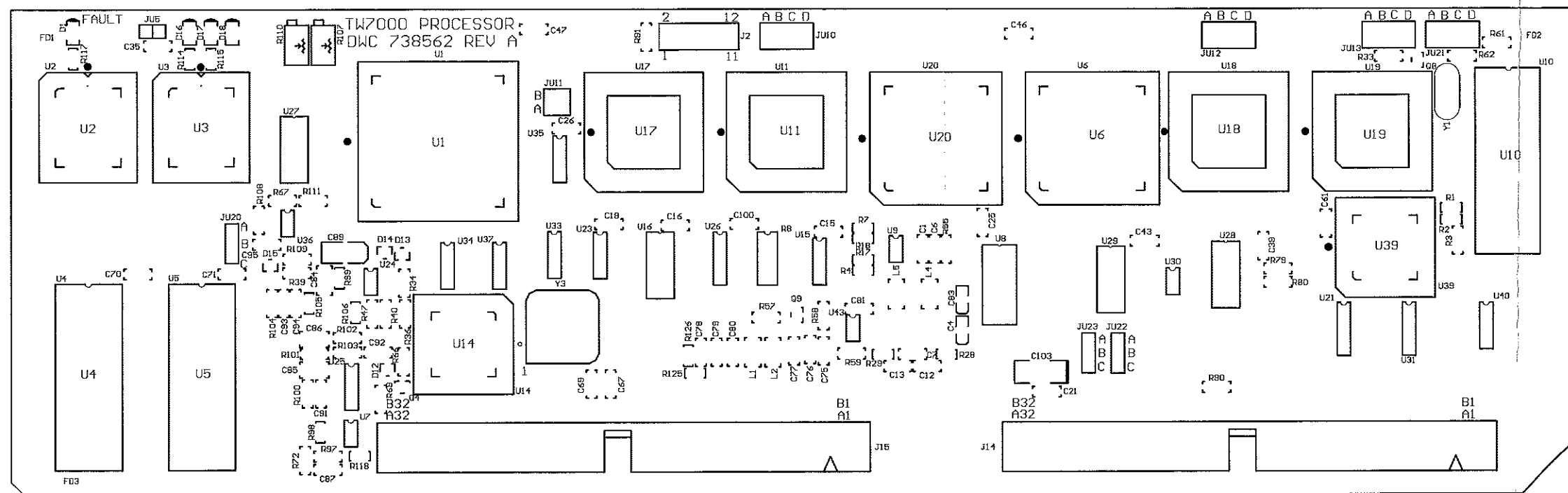


FOR RS232 PROTOCOL INSTALL R4, R7, R9 AND R11 (DEFAULT)  
 FOR RS485 PROTOCOL INSTALL R17, R18, R23 AND R27.  
 NOTES: UNLESS OTHERWISE SPECIFIED

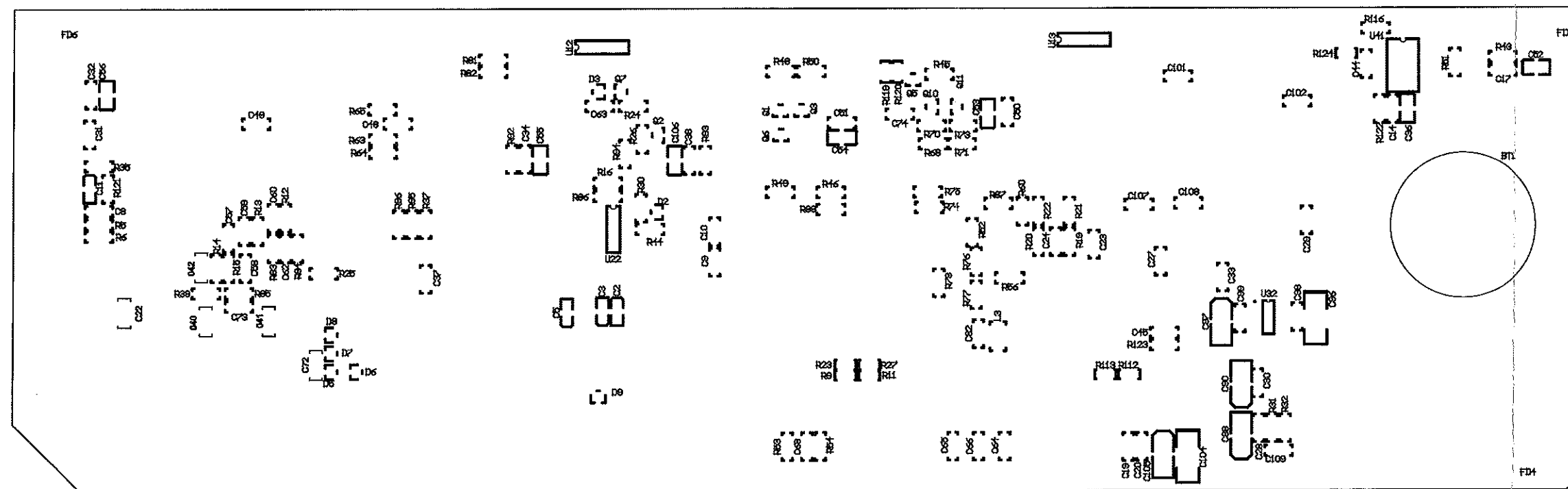
Figure 4-41  
 Processor Board Schematic Diagram  
 4 of 4 (994150 Rev. A)

DAIFON WORLD COMMUNICATIONS INC.		San Francisco, CA	
Title: Schematic		9945110	
Rev: D	Date: 11/03/2003	Drawn: 11/03/2003	Appr: A





Top



Bottom

Figure 4-42  
Processor Board Component Locations  
(738562 Rev. A)

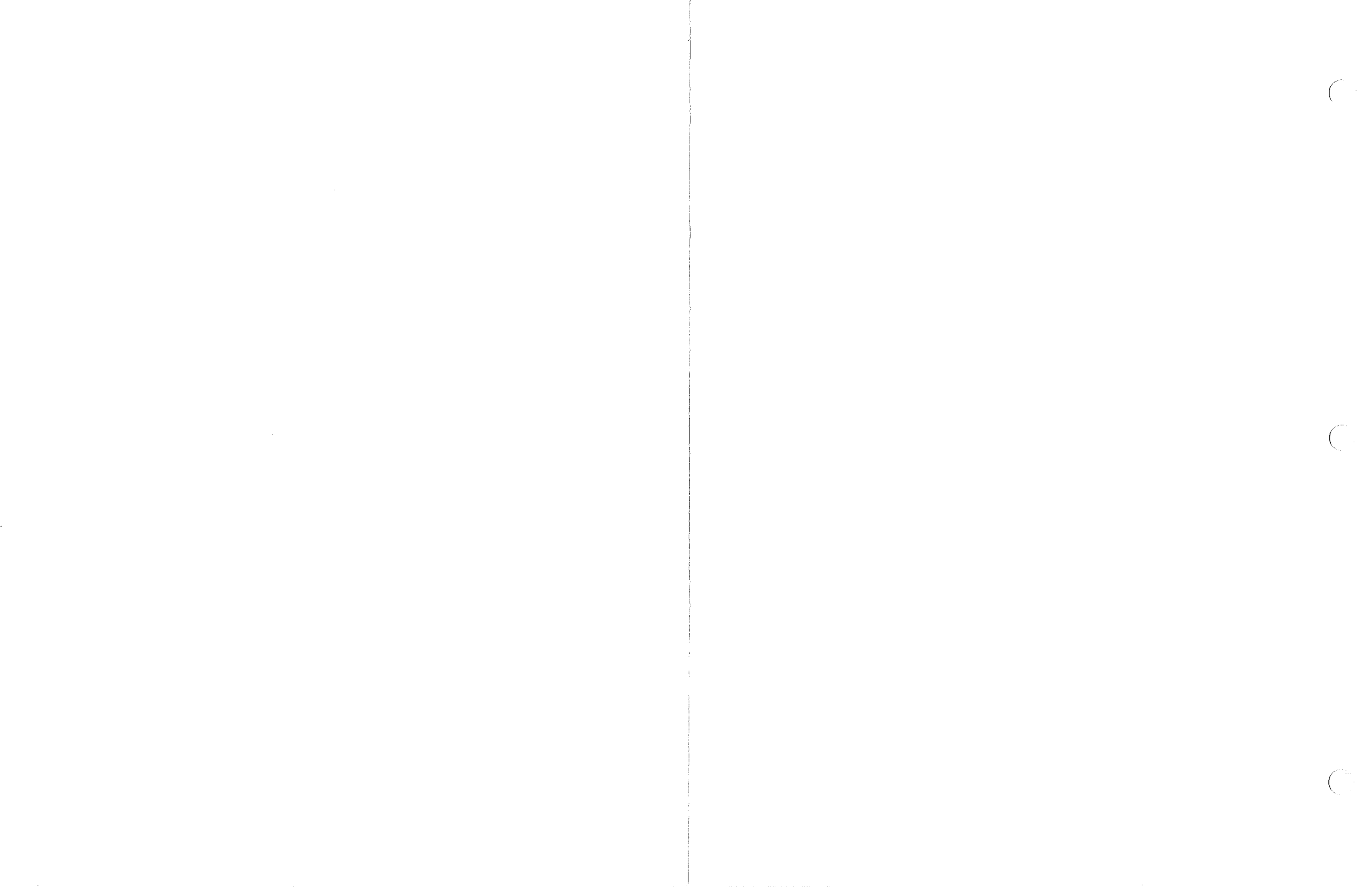


Table 4-29. Processor Board Parts List (001-01101 Rev. A)

Designator	Part Number	Description
BT1	750057	BATTERY,3V LITHIUM CR2450
C1	021104	CAP,.1MF 50V 10% X7R SMT 1206
C10	021102	CAP,.001MF 50V 10% SMT 1206
C100	021104	CAP,.1MF 50V 10% X7R SMT 1206
C101	021104	CAP,.1MF 50V 10% X7R SMT 1206
C102	021104	CAP,.1MF 50V 10% X7R SMT 1206
C103	022106000	CAP,SM,T,10U 35V 10% 7343
C104	022106000	CAP,SM,T,10U 35V 10% 7343
C105	022106001	CAP SM T 10UF 16V 10% 6032
C106	022020	CAP, 2.2UF 20V SMT TANT 3528
C107	021104	CAP,.1MF 50V 10% X7R SMT 1206
C108	021104	CAP,.1MF 50V 10% X7R SMT 1206
C109	021103	CAP,.01MF 50V 10% X7R SMT1206
C11	022105000	CAP SM T 1u 20V 10% 3216
C12	021102	CAP,.001MF 50V 10% SMT 1206
C13	021102	CAP,.001MF 50V 10% SMT 1206
C14	021104	CAP,.1MF 50V 10% X7R SMT 1206
C15	021104	CAP,.1MF 50V 10% X7R SMT 1206
C16	021104	CAP,.1MF 50V 10% X7R SMT 1206
C17	021104	CAP,.1MF 50V 10% X7R SMT 1206
C18	021104	CAP,.1MF 50V 10% X7R SMT 1206
C19	021104	CAP,.1MF 50V 10% X7R SMT 1206
C2	022105000	CAP SM T 1u 20V 10% 3216
C20	021104	CAP,.1MF 50V 10% X7R SMT 1206
C21	021104	CAP,.1MF 50V 10% X7R SMT 1206
C22	021104	CAP,.1MF 50V 10% X7R SMT 1206
C23	021104	CAP,.1MF 50V 10% X7R SMT 1206
C24	021104	CAP,.1MF 50V 10% X7R SMT 1206
C25	021104	CAP,.1MF 50V 10% X7R SMT 1206
C26	021104	CAP,.1MF 50V 10% X7R SMT 1206
C27	021104	CAP,.1MF 50V 10% X7R SMT 1206
C28	021104	CAP,.1MF 50V 10% X7R SMT 1206
C29	021104	CAP,.1MF 50V 10% X7R SMT 1206

**Table 4-29. Processor Board Parts List (001-01101 Rev. A)**

Designator	Part Number	Description
C3	022105000	CAP SM T 1u 20V 10% 3216
C30	021104	CAP,.1MF 50V 10% X7R SMT 1206
C31	021104	CAP,.1MF 50V 10% X7R SMT 1206
C32	021104	CAP,.1MF 50V 10% X7R SMT 1206
C33	021104	CAP,.1MF 50V 10% X7R SMT 1206
C34	021104	CAP,.1MF 50V 10% X7R SMT 1206
C35	021104	CAP,.1MF 50V 10% X7R SMT 1206
C36	022020	CAP, 2.2UF 20V SMT TANT 3528
C37	021104	CAP,.1MF 50V 10% X7R SMT 1206
C38	021104	CAP,.1MF 50V 10% X7R SMT 1206
C39	021104	CAP,.1MF 50V 10% X7R SMT 1206
C4	022105000	CAP SM T 1u 20V 10% 3216
C40	021104	CAP,.1MF 50V 10% X7R SMT 1206
C41	021104	CAP,.1MF 50V 10% X7R SMT 1206
C42	021104	CAP,.1MF 50V 10% X7R SMT 1206
C43	021104	CAP,.1MF 50V 10% X7R SMT 1206
C44	021104	CAP,.1MF 50V 10% X7R SMT 1206
C45	021104	CAP,.1MF 50V 10% X7R SMT 1206
C46	021104	CAP,.1MF 50V 10% X7R SMT 1206
C47	021104	CAP,.1MF 50V 10% X7R SMT 1206
C48	021104	CAP,.1MF 50V 10% X7R SMT 1206
C49	021104	CAP,.1MF 50V 10% X7R SMT 1206
C5	022105000	CAP SM T 1u 20V 10% 3216
C50	021104	CAP,.1MF 50V 10% X7R SMT 1206
C51	021104	CAP,.1MF 50V 10% X7R SMT 1206
C52	022020	CAP, 2.2UF 20V SMT TANT 3528
C53	022020	CAP, 2.2UF 20V SMT TANT 3528
C54	022020	CAP, 2.2UF 20V SMT TANT 3528
C55	022020	CAP, 2.2UF 20V SMT TANT 3528
C56	022020	CAP, 2.2UF 20V SMT TANT 3528
C57	021104	CAP,.1MF 50V 10% X7R SMT 1206
C58	021104	CAP,.1MF 50V 10% X7R SMT 1206
C59	021104	CAP,.1MF 50V 10% X7R SMT 1206

Table 4-29. Processor Board Parts List (001-01101 Rev. A)

Designator	Part Number	Description
C6	021103	CAP,.01MF 50V 10% X7R SMT1206
C60	021104	CAP,.1MF 50V 10% X7R SMT 1206
C61	021104	CAP,.1MF 50V 10% X7R SMT 1206
C62	021104	CAP,.1MF 50V 10% X7R SMT 1206
C63	021104	CAP,.1MF 50V 10% X7R SMT 1206
C64	021104	CAP,.1MF 50V 10% X7R SMT 1206
C65	021104	CAP,.1MF 50V 10% X7R SMT 1206
C66	021104	CAP,.1MF 50V 10% X7R SMT 1206
C67	021102	CAP,.001MF 50V 10% SMT 1206
C68	021102	CAP,.001MF 50V 10% SMT 1206
C69	021102	CAP,.001MF 50V 10% SMT 1206
C7	021103	CAP,.01MF 50V 10% X7R SMT1206
C70	021104	CAP,.1MF 50V 10% X7R SMT 1206
C71	021104	CAP,.1MF 50V 10% X7R SMT 1206
C72	021104	CAP,.1MF 50V 10% X7R SMT 1206
C73	021104	CAP,.1MF 50V 10% X7R SMT 1206
C74	021103	CAP,.01MF 50V 10% X7R SMT1206
C75	021102	CAP,.001MF 50V 10% SMT 1206
C76	021103	CAP,.01MF 50V 10% X7R SMT1206
C77	021102	CAP,.001MF 50V 10% SMT 1206
C78	021102	CAP,.001MF 50V 10% SMT 1206
C79	021103	CAP,.01MF 50V 10% X7R SMT1206
C8	021104	CAP,.1MF 50V 10% X7R SMT 1206
C80	021102	CAP,.001MF 50V 10% SMT 1206
C81	021104	CAP,.1MF 50V 10% X7R SMT 1206
C82	021102	CAP,.001MF 50V 10% SMT 1206
C83	022105000	CAP SM T 1u 20V 10% 3216
C84	021183001	CAP,SM,CER.018UF,5%,NPO50V1210
C85	021183001	CAP,SM,CER.018UF,5%,NPO50V1210
C86	021183001	CAP,SM,CER.018UF,5%,NPO50V1210
C87	021104	CAP,.1MF 50V 10% X7R SMT 1206
C88	022106001	CAP SM T 10UF 16V 10% 6032
C89	022106001	CAP SM T 10UF 16V 10% 6032

Table 4-29. Processor Board Parts List (001-01101 Rev. A)

Designator	Part Number	Description
C9	021102	CAP,.001MF 50V 10% SMT 1206
C90	022106001	CAP SM T 10UF 16V 10% 6032
C91	021103	CAP,.01MF 50V 10% X7R SMT1206
C92	021103	CAP,.01MF 50V 10% X7R SMT1206
C93	021103	CAP,.01MF 50V 10% X7R SMT1206
C94	021104	CAP,.1MF 50V 10% X7R SMT 1206
C95	021104	CAP,.1MF 50V 10% X7R SMT 1206
C96	022106000	CAP,SM,T,10U 35V 10% 7343
C97	022106001	CAP SM T 10UF 16V 10% 6032
C98	021104	CAP,.1MF 50V 10% X7R SMT 1206
C99	021104	CAP,.1MF 50V 10% X7R SMT 1206
D1	035500003	LED,SM,RED,1206,APT3216ID
D12	031002	DIODE,BAS16 SMT SOT 23
D13	031002	DIODE,BAS16 SMT SOT 23
D14	031002	DIODE,BAS16 SMT SOT 23
D15	031002	DIODE,BAS16 SMT SOT 23
D16	035500002	LED,SM,GREEN,1206
D17	035500002	LED,SM,GREEN,1206
D18	035500002	LED,SM,GREEN,1206
D2	031002	DIODE,BAS16 SMT SOT 23
D3	031002	DIODE,BAS16 SMT SOT 23
D5	031002	DIODE,BAS16 SMT SOT 23
D6	031002	DIODE,BAS16 SMT SOT 23
D7	031002	DIODE,BAS16 SMT SOT 23
D8	031002	DIODE,BAS16 SMT SOT 23
D9	031002	DIODE,BAS16 SMT SOT 23
J14	613166	HEADER,64 PIN RT ANGLE PC MNT
J15	613166	HEADER,64 PIN RT ANGLE PC MNT
J2	620172	CONN,2X6 STRAIGHT HEADER
JU10	620026	HEADER,8 PIN DUAL MALE
JU11	620025	HEADER,4 PIN DUAL MALE
JU12	620026	HEADER,8 PIN DUAL MALE
JU13	620026	HEADER,8 PIN DUAL MALE

Table 4-29. Processor Board Parts List (001-01101 Rev. A)

Designator	Part Number	Description
JU20	620030	HEADER,3 PIN .025 SQ POST
JU22	620030	HEADER,3 PIN .025 SQ POST
JU23	620030	HEADER,3 PIN .025 SQ POST
JU5	650048	HEADER,2 PIN .025 SQ
L1	045104	INDUCTOR,100 UH 10% SMT 1210
L2	045104	INDUCTOR,100 UH 10% SMT 1210
L3	045104	INDUCTOR,100 UH 10% SMT 1210
L4	045104	INDUCTOR,100 UH 10% SMT 1210
L5	045104	INDUCTOR,100 UH 10% SMT 1210
Q1	032005	XISTOR,2N7002 SMT SOT-23
Q10	032005	XISTOR,2N7002 SMT SOT-23
Q11	032005	XISTOR,2N7002 SMT SOT-23
Q2	032005	XISTOR,2N7002 SMT SOT-23
Q3	032005	XISTOR,2N7002 SMT SOT-23
Q4	032005	XISTOR,2N7002 SMT SOT-23
Q5	032005	XISTOR,2N7002 SMT SOT-23
Q6	032005	XISTOR,2N7002 SMT SOT-23
Q7	032005	XISTOR,2N7002 SMT SOT-23
Q8	032005	XISTOR,2N7002 SMT SOT-23
Q9	032005	XISTOR,2N7002 SMT SOT-23
R100	013473	RES, 47K 1/8W 5% SMT 1206
R101	013104	RES,100K OHM 1/8W 5% SMT 1206
R102	013104	RES,100K OHM 1/8W 5% SMT 1206
R103	013104	RES,100K OHM 1/8W 5% SMT 1206
R104	013104	RES,100K OHM 1/8W 5% SMT 1206
R105	013334000	RES SM CF 330K 0.1W 5% 0805
R106	013274000	RES SM CF 270K 0.1W 5% 0805
R108	013273	RES,27K 1/8W 5% SMT 1206
R109	013474	RES,470K 1/8W 5% SMT 1206
R11	013000000	RES,SM,CF,0K,0805
R111	013682	RES, 6.8K 1/8W 5% SMT 1206
R112	013000000	RES,SM,CF,0K,0805
R113	013000000	RES,SM,CF,0K,0805

Table 4-29. Processor Board Parts List (001-01101 Rev. A)

Designator	Part Number	Description
R114	013471000	RES SM CF 470R 0.1W 5% 0805
R115	013751000	RES SM CF 750R 0.1W 5% 0805
R116	013102	RES,1K 1/8W 5% SMT 1206
R117	013471000	RES SM CF 470R 0.1W 5% 0805
R118	013334000	RES SM CF 330K 0.1W 5% 0805
R119	013000000	RES,SM,CF,0K,0805
R12	014472000	RES,SM,CF,4.75K,1/8W,1%,1206
R120	013000000	RES,SM,CF,0K,0805
R121	013224	RES,220K 1/8W 5% SMT 1206
R122	013472	RES,4.7K 1/8W 5% SMT 1206
R123	013472	RES,4.7K 1/8W 5% SMT 1206
R124	013000000	RES,SM,CF,0K,0805
R13	013472	RES,4.7K 1/8W 5% SMT 1206
R14	013103	RES,10K OHM 1/8W 5% SMT 1206
R15	013472	RES,4.7K 1/8W 5% SMT 1206
R16	013472	RES,4.7K 1/8W 5% SMT 1206
R19	013472	RES,4.7K 1/8W 5% SMT 1206
R2	013000000	RES,SM,CF,0K,0805
R20	013472	RES,4.7K 1/8W 5% SMT 1206
R21	013472	RES,4.7K 1/8W 5% SMT 1206
R22	013472	RES,4.7K 1/8W 5% SMT 1206
R24	013472	RES,4.7K 1/8W 5% SMT 1206
R25	013472	RES,4.7K 1/8W 5% SMT 1206
R26	013472	RES,4.7K 1/8W 5% SMT 1206
R28	013821000	RES SM CF 820 0.1W 5% 0805
R29	013821000	RES SM CF 820 0.1W 5% 0805
R3	013103	RES,10K OHM 1/8W 5% SMT 1206
R30	013472	RES,4.7K 1/8W 5% SMT 1206
R31	013103	RES,10K OHM 1/8W 5% SMT 1206
R32	013103	RES,10K OHM 1/8W 5% SMT 1206
R33	013472	RES,4.7K 1/8W 5% SMT 1206
R34	013105	RES,1M OHM 1/8W SMT 1206
R35	013513	RES,51K 1/8W 5% SMT 1206

Table 4-29. Processor Board Parts List (001-01101 Rev. A)

Designator	Part Number	Description
R36	013105	RES,1M OHM 1/8W SMT 1206
R37	013472	RES,4.7K 1/8W 5% SMT 1206
R38	013472	RES,4.7K 1/8W 5% SMT 1206
R39	013103	RES,10K OHM 1/8W 5% SMT 1206
R4	013000000	RES,SM,CF,0K,0805
R40	013103	RES,10K OHM 1/8W 5% SMT 1206
R43	013472	RES,4.7K 1/8W 5% SMT 1206
R44	013472	RES,4.7K 1/8W 5% SMT 1206
R45	013472	RES,4.7K 1/8W 5% SMT 1206
R46	013103	RES,10K OHM 1/8W 5% SMT 1206
R47	013103	RES,10K OHM 1/8W 5% SMT 1206
R48	013472	RES,4.7K 1/8W 5% SMT 1206
R49	013472	RES,4.7K 1/8W 5% SMT 1206
R5	013333	RES,33K 1/8W 5% SMT 1206
R50	013472	RES,4.7K 1/8W 5% SMT 1206
R51	013472	RES,4.7K 1/8W 5% SMT 1206
R52	013102	RES,1K 1/8W 5% SMT 1206
R53	013102	RES,1K 1/8W 5% SMT 1206
R54	013102	RES,1K 1/8W 5% SMT 1206
R55	013151	RES,150 OHM 1/8W 5% SMT 1206
R56	013472	RES,4.7K 1/8W 5% SMT 1206
R57	013472	RES,4.7K 1/8W 5% SMT 1206
R58	013472	RES,4.7K 1/8W 5% SMT 1206
R59	013151	RES,150 OHM 1/8W 5% SMT 1206
R6	013513	RES,51K 1/8W 5% SMT 1206
R60	014472000	RES,SM,CF,4.75K,1/8W,1%,1206
R61	013472	RES,4.7K 1/8W 5% SMT 1206
R62	013472	RES,4.7K 1/8W 5% SMT 1206
R63	013472	RES,4.7K 1/8W 5% SMT 1206
R64	013472	RES,4.7K 1/8W 5% SMT 1206
R65	013472	RES,4.7K 1/8W 5% SMT 1206
R66	013103	RES,10K OHM 1/8W 5% SMT 1206
R67	013472	RES,4.7K 1/8W 5% SMT 1206

Table 4-29. Processor Board Parts List (001-01101 Rev. A)

Designator	Part Number	Description
R68	013103	RES,10K OHM 1/8W 5% SMT 1206
R69	013472	RES,4.7K 1/8W 5% SMT 1206
R7	013000000	RES,SM,CF,0K,0805
R70	013151	RES,150 OHM 1/8W 5% SMT 1206
R71	013103	RES,10K OHM 1/8W 5% SMT 1206
R72	013332	RES,3,3K 1/8W 5% SMT 1206
R73	013151	RES,150 OHM 1/8W 5% SMT 1206
R74	013472	RES,4.7K 1/8W 5% SMT 1206
R75	013472	RES,4.7K 1/8W 5% SMT 1206
R76	013472	RES,4.7K 1/8W 5% SMT 1206
R77	013472	RES,4.7K 1/8W 5% SMT 1206
R78	013472	RES,4.7K 1/8W 5% SMT 1206
R79	013472	RES,4.7K 1/8W 5% SMT 1206
R8	082001	RNET,SM,B,4.7K,1/8W,5%,SO16
R80	013472	RES,4.7K 1/8W 5% SMT 1206
R81	013472	RES,4.7K 1/8W 5% SMT 1206
R82	013472	RES,4.7K 1/8W 5% SMT 1206
R83	013104	RES,100K OHM 1/8W 5% SMT 1206
R84	013473	RES, 47K 1/8W 5% SMT 1206
R85	014472000	RES,SM,CF,4.75K,1/8W,1%,1206
R86	013472	RES,4.7K 1/8W 5% SMT 1206
R87	013472	RES,4.7K 1/8W 5% SMT 1206
R88	013472	RES,4.7K 1/8W 5% SMT 1206
R9	013000000	RES,SM,CF,0K,0805
R90	013472	RES,4.7K 1/8W 5% SMT 1206
R91	013472	RES,4.7K 1/8W 5% SMT 1206
R92	013103	RES,10K OHM 1/8W 5% SMT 1206
R93	013472	RES,4.7K 1/8W 5% SMT 1206
R94	013472	RES,4.7K 1/8W 5% SMT 1206
R95	013472	RES,4.7K 1/8W 5% SMT 1206
R96	013104	RES,100K OHM 1/8W 5% SMT 1206
R97	013332	RES,3,3K 1/8W 5% SMT 1206
R98	013335000	RES,SM,CF,3.3M,0.1W,5%,0805

Table 4-29. Processor Board Parts List (001-01101 Rev. A)

Designator	Part Number	Description
R99	013335000	RES,SM,CF,3.3M,0.1W,5%,0805
U1	033026	IC,MC68HC000 PROC, SM, QFP-64
U10	330369	IC, MSM6946RS MODEM
U11	033029	IC,MC68681FN,DUART,SM PLCC-40
U12	033043	IC,74HCT138 1-8 DEC/DEMUX S016
U13	033043	IC,74HCT138 1-8 DEC/DEMUX S016
U15	033036	IC,74HC30 8-INPUT NAND, SO-14
U16	033303004	IC,SM,DIG,74HC244,SOL-20
U17	033029	IC,MC68681FN,DUART,SM PLCC-40
U19	033029	IC,MC68681FN,DUART,SM PLCC-40
U20	033028	IC,MC68901FN MFP SMT
U21	033043	IC,74HCT138 1-8 DEC/DEMUX S016
U22	033303001	IC,SM,DIG,74HC14,SOIC-14
U23	033303001	IC,SM,DIG,74HC14,SOIC-14
U24	033304020	IC,SM,DUAL OP AMP,LM2904M,MO8A
U25	033303056	IC,DIG,MC14001BD, SO-14
U26	033040	IC,74HC147 DEC-BCD ENCOD,SO-16
U27	033045	IC,74HCT245 OCT BUS XCVR,SOW20
U28	033045	IC,74HCT245 OCT BUS XCVR,SOW20
U29	033045	IC,74HCT245 OCT BUS XCVR,SOW20
U30	033030	IC,93C46 SER EEPROM, SM, SOW-
U31	033043	IC,74HCT138 1-8 DEC/DEMUX S016
U32	033002	IC, 78L08, SM, SOP-8
U33	033037	IC,74HC74 DUAL-D FF, SO-14
U34	033034	IC,74HC10, 3-INP NAND, SO-14
U35	033303002	IC, DIG,74HC125, SO-14
U36	033304020	IC,SM,DUAL OP AMP,LM2904M,MO8A
U37	033016	IC, SM, MC74HC04AD, SO-14
U39	033082	IC,ADC0809FN SMT PLCC
U4	330494	IC, 256K LOW-PWR SRAM
U40	033081	IC,MC74HC02AD, SO-14 751A-02
U41	033301003	IC,SM,UP,MAX807LEWE
U43	033085	IC,75176B,RS-485 BUS SCVR,SOP8

Table 4-29. Processor Board Parts List (001-01101 Rev. A)

Designator	Part Number	Description
U5	330494	IC, 256K LOW-PWR SRAM
U6	033027	IC,MC68230FN8 PI/T PLCC52 SMT
U7	033304020	IC,SM,DUAL OP AMP,LM2904M,MO8A
U8	033305023	RS232 DRIVER MAX238CWG
U9	033085	IC,75176B,RS-485 BUS SCVR,SOP8
XU14	062008	SOCKET, 28 PIN PLCC SMT
XU18	062001	SOCKET,44 PIN PLCC SMT
XU2	062004	SOCKET,32 PIN SMD LOW PROFILE
XU3	062004	SOCKET,32 PIN SMD LOW PROFILE
XU4	621009	SOCKET,28 PIN DIP
XU5	621009	SOCKET,28 PIN DIP
Y1	361081	CRYSTAL,3.579545 MHZ
Y3	361087	OSCILLATOR,14.7456 MHZ CMOS

# CHAPTER 5

## MAINTENANCE

This chapter provides information for testing and troubleshooting the TW7000. These procedures provide a quick and accurate way of evaluating the essential operating characteristics of the TW7000. If a fault is indicated, these procedures aid in determining intermediate maintenance solutions.

### 5.1 Subassembly Breakdown

The TW7000 consists of a final assembly and an accessory kit. The accessory kit consists of one cable (C991829) and two slow blow fuses (25A). The main functional subassemblies of the standard TW7000 and their respective boards and cables, are listed in the "Subassemblies" table on page 5-7. For an illustration of the TW7000 final assembly, refer to the "Final Assembly" figure on page 5-4.

### 5.2 Internal Layout

The TW7000 is a modular mechanical design concept. It features plug-in boards that permit simple field repair as well as field upgrades. Major internal options, such as ALE and remote control, are field-installable by inserting the new circuit board in the appropriate slot.

For the location of each board, refer to the "Board Locations" figure on page 5-3.

Most boards in the TW7000 have dedicated slots that plug into the motherboard. These include the following:

- Reference/Control
- Synthesizer
- 5 MHz IF
- 75 MHz IF
- Audio
- Processor
- Noise blanker (option)
- ALE (option)
- RCU interface (option)

## 5.3 Board Access

To access these boards, remove the top cover of the TW7000. The top cover (and bottom) is held in place by 6 screws, three in the front and three in the rear. Remove a board by pulling it out of its card slot. To service a board in the radio, remove it from the card slot, mount it on the appropriate extender card, and replace it in the radio. Use the following kits to assist in servicing and adjusting these boards.

- 7000EXT extender kit
- TW7000TK tool kit

Remove the front panel from the main body of the radio by taking out the 2 large screws holding it to the side panels (after first removing the top and bottom covers). The entire panel connects electrically to the main body by a single ribbon cable.

### 5.3.1

#### Power Supply

The Power Supply board is made up of the power supply and its heat sink. It mounts onto the vertical chassis bracket located immediately behind the main heat sink facing the inside of the rear panel.

To access this board,

1. Remove the top and bottom of the radio.
2. Remove the two large screws holding the side rails to the rear panel.
3. Pull the rear panel away from the main body of the radio, exposing the Power Supply board. The rear panel connects to the main body of the radio by the individual cables going to the rear panel connectors. Sufficient service loops exist in these cables so the power supply and rear panel circuitry can be checked without disconnecting them. The board connects to the rear panel via DC power cable (001-00411), which plugs into the 3-pin connector J26.
4. To remove the board and its heat sink from the chassis bracket, remove the two outermost screws on top of the board. Disconnect the various cables running to the board.

### 5.3.2

#### VSWR

The VSWR board is the small board mounted directly on the inside of the antenna connector on the rear panel. Access it by going through the same steps described for the Power Supply board.

### 5.3.3

#### Heat Sink

The heat sink assembly contains the RF Power Amplifier and RF Filter boards. To remove the heat sink assembly from the radio:

1. Unscrew the long hex nut accessible inside the vertical cutout on the left front of the heat sink next to the chassis card-cage.

2. Pull the board out of the radio. Disconnect the cables running to the boards.
3. Access the RF Power Amplifier and RF Filter boards by removing the six screws holding its shield to the heat sink.

For a breakdown of the front panel assembly, refer to the "Front Panel Assembly" figure on page 5-5. For a breakdown of the rear panel assembly, refer to the "Rear Panel Assembly" figure on page 5-6.

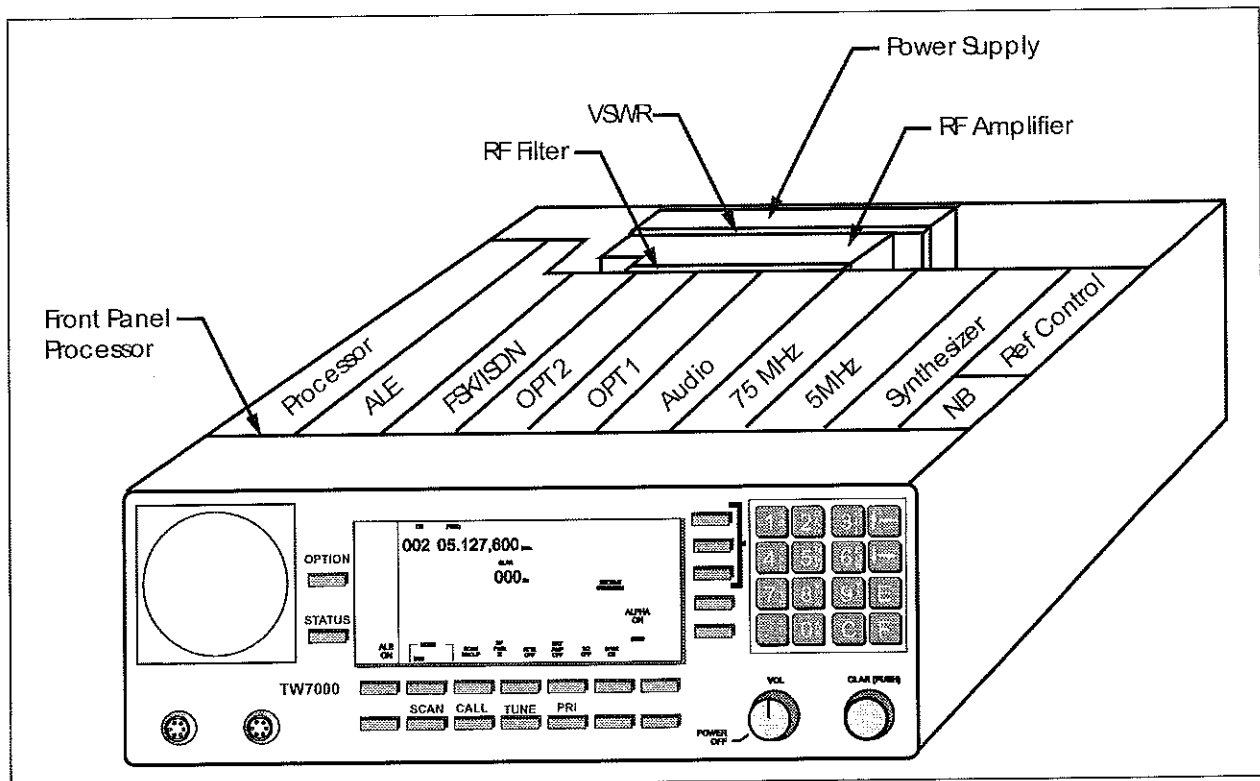


Figure 5-1. Board Locations

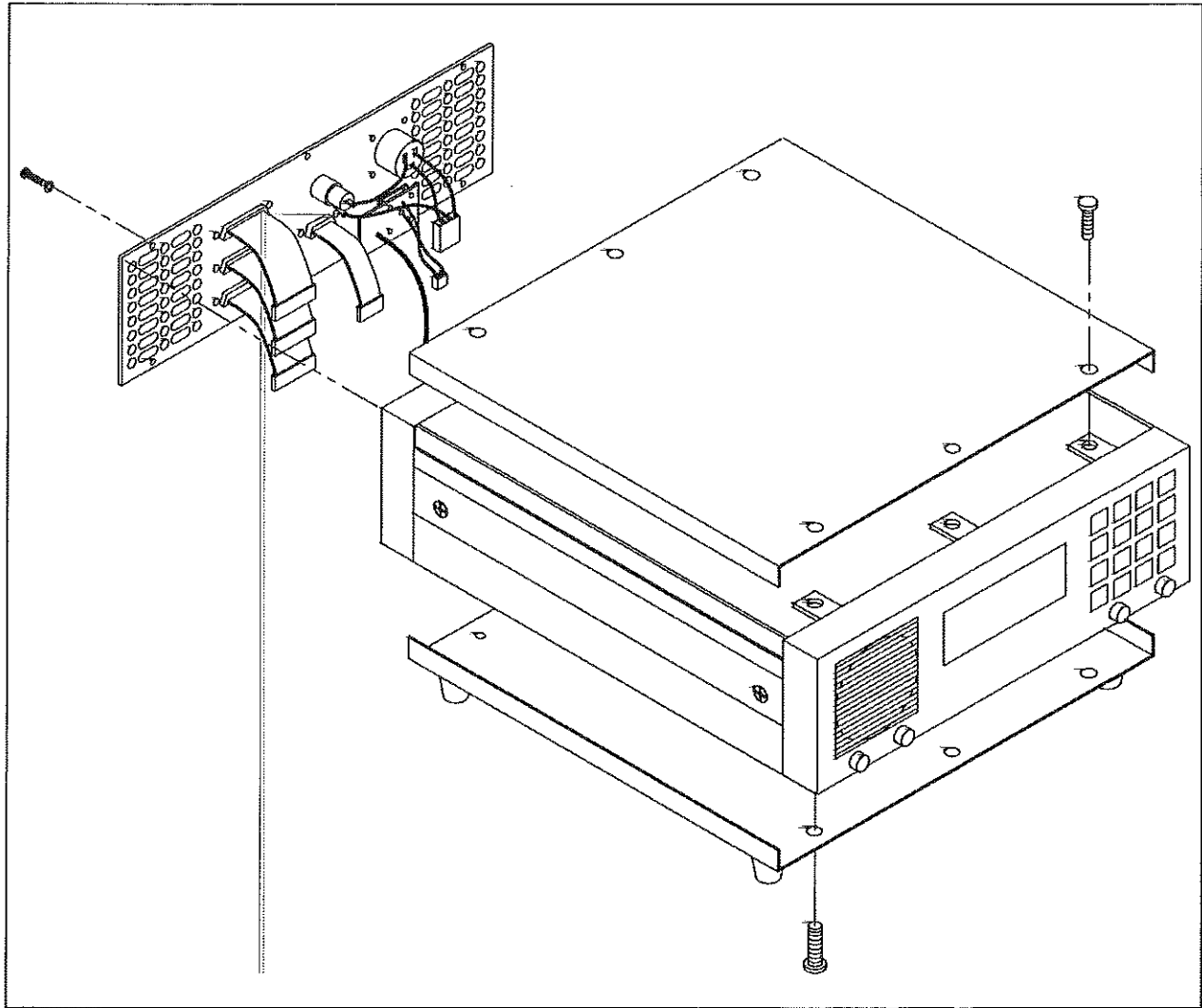


Figure 5-2. Final Assembly

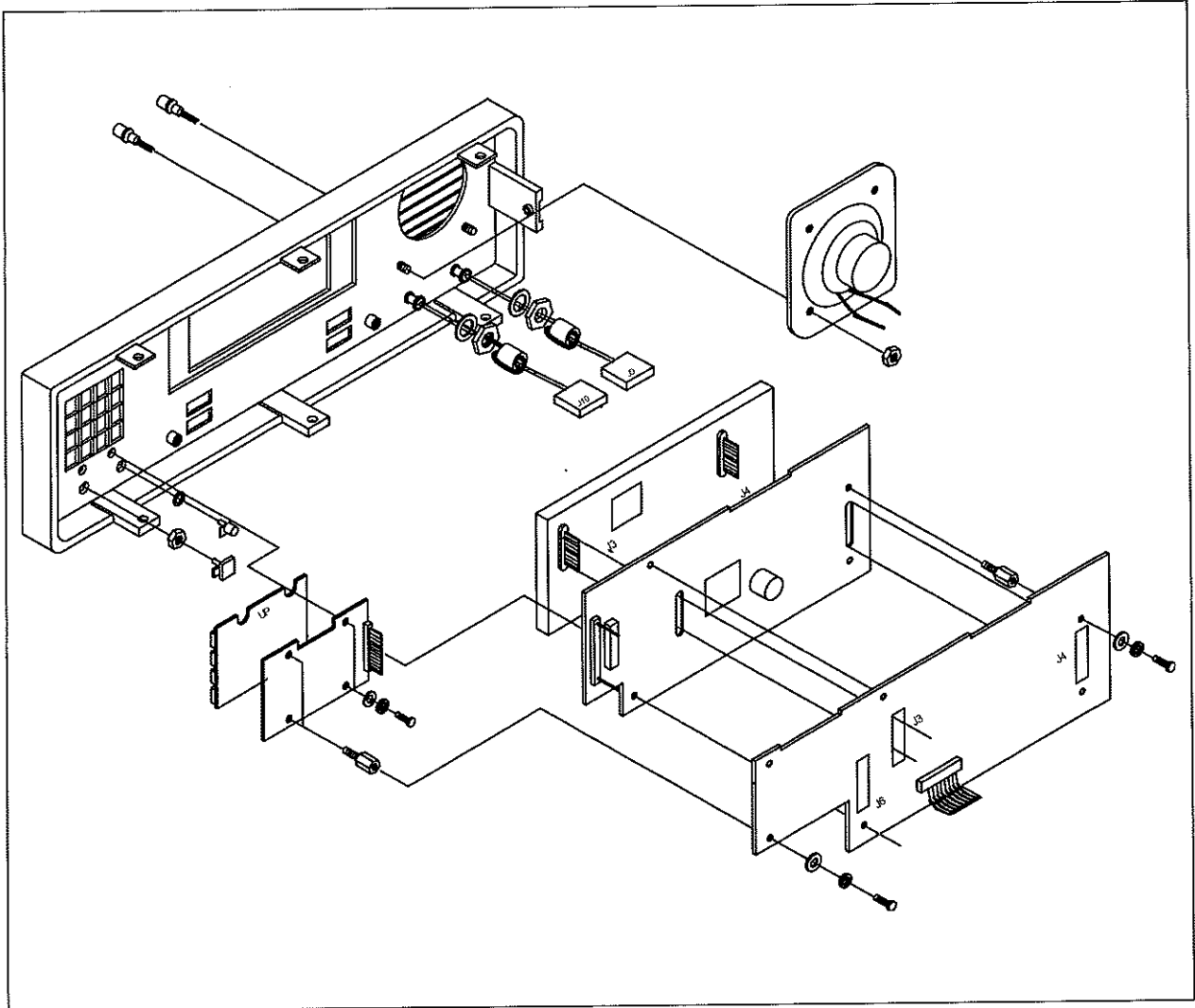


Figure 5-3. Front Panel Assembly

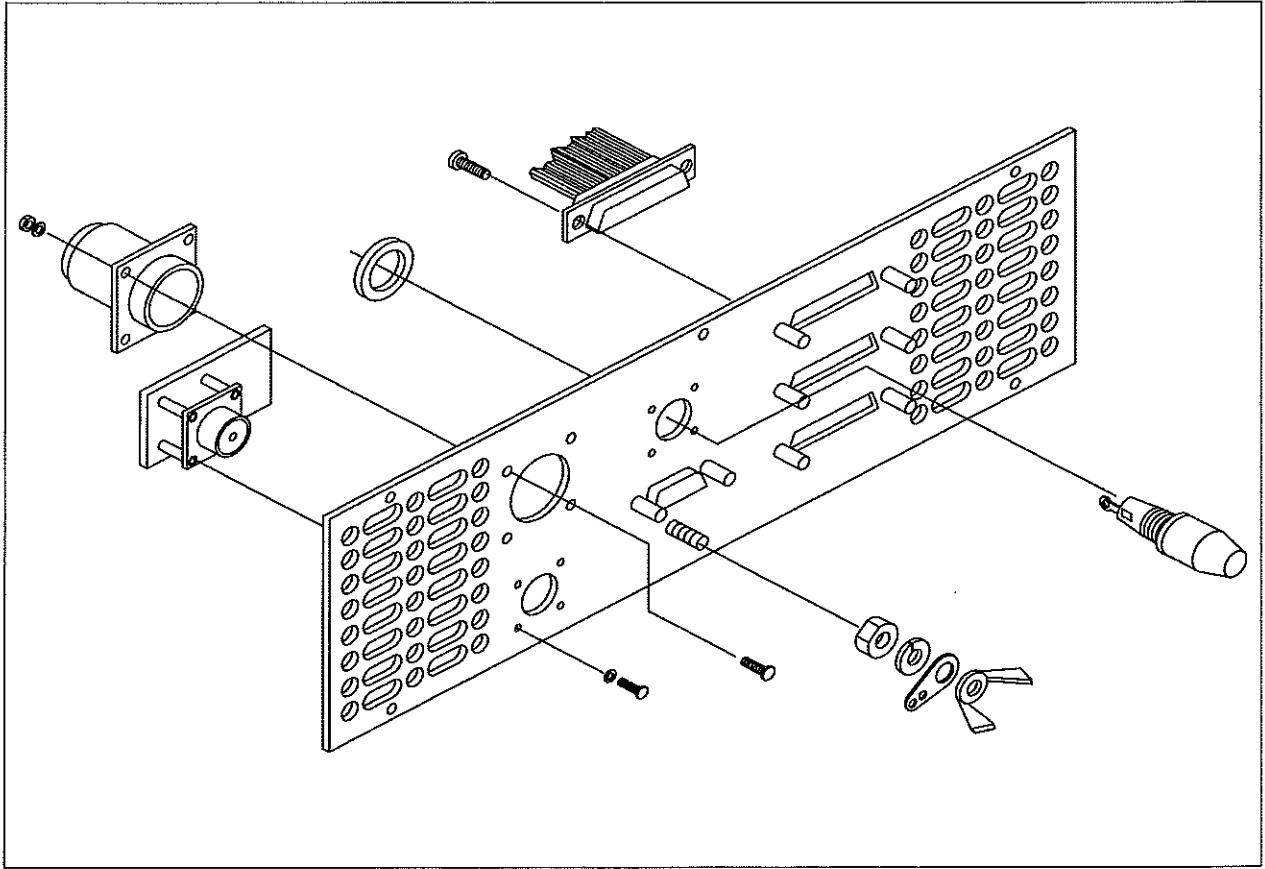


Figure 5-4. Rear Panel Assembly

Table 5-1. Subassemblies

Subassembly	Description	Contains
001-00100	Front panel assembly	(001-00110): Switch board (001-00120): LCD assembly (001-00121): LCD/Driver board (001-00130): Keypad board (001-00143): Front panel Processor board (001-00141): Ribbon cable assembly (001-00142): Front panel software (001-00150): Volume cable assembly (001-00161): Clarifier cable assembly (001-00170): Speaker assembly (001-00180): Mic connector cable assembly
001-00200	Rear panel assembly	(001-00210): VSWR Detector board (001-00211): Coax cable assembly (001-00220): DB25 cable assembly (001-00230): DB9 cable assembly (001-00241): DC cable assembly
001-00300	Heat sink assembly	(001-00310): RF Power Amplifier board (001-00320): RF Filter board (001-00330): Fan assembly (001-00340): Ribbon cable assembly (001-00350): Heat sink cable assembly (001-00360): RF power amplifier cable assembly
001-00400	Power supply assembly	(001-00410): Power supply board (001-00411): DC power cable assembly
001-00500	Chassis assembly	(001-00510): Motherboard
001-00600	Audio board	
001-00710	75 MHz IF board	
001-00800	5 MHz IF board	
001-00901	Synthesizer board	
001-00206	Reference/Control board	TCXO
001-01022	Optional Reference/ Control board	High Stability option
001-01100	Processor board	(001-01110): Programmed chip (001-01120): Processor board
001-01200	Squelch board	

## 5.4 Test Equipment

The following equipment is required to test and troubleshoot the TW7000. If the specified test equipment is not available, equivalent items can be substituted.

Item	Model Recommended	Specification
Attenuator	Bird 8323	30 db, 100W, 50 ohms
Wattmeter	Bird 43	50W and 250W elements
Signal generator	Marconi 2022D	10k to 500 MHz
Counter	Leader LDC-824S	
SINAD meter	Helper Sinadder 3	
Oscilloscope	Kikusui	100 MHz/analog/dual trace
12V Power supply	Astron 35M	15 Vdc 25A
Multimeter	Fluke 85	
Test set	Hewlett Packard 8920	
Microphone	MHS/MDR/MRR	
CW key	KYR	
DC power cable (C991829)		
Broadband 50 ohm antenna		

## 5.5 Basic Performance Test

A brief test checks the overall operation of the TW7000. Perform the test on initial inspection of the equipment, after the equipment is repaired, or any time you suspect degradation. This test requires the following equipment:

- Power supply: 0 to 15 Vdc, 25A
  - TW7000 DC power cable (C991829)
  - Microphone
  - Broadband 50 ohm antenna
1. Attach the power supply to the TW7000 using the C991829 power cable. Connect the antenna and the microphone to the TW7000.
  2. Turn the power switch on. The TW7000 internal BITE circuit activates automatically on power-up. If there is a BITE fault in the TW7000, the faulty subassembly displays on the front panel. If there is no BITE fault, the channel number and frequency of the last channel used is displayed.

3. Turn the speaker switch on and the volume control up. You should hear noise in the speaker.
4. Select a WWV frequency and listen to the tone. The tone should be recognizable and approximately 1 kHz.
5. Press the PTT on the microphone and speak into it. Receive audio clears, and the bar graph on the display indicates an RF output power proportional to the transmit audio input from the microphone.

## 5.6 Detailed Performance Test

When detailed performance data is needed, or if performance degradation is suspected in certain areas, refer to the Detailed Performance Test Parameters table below. The tests are arranged in 3 groups.

**General Operational Tests:** Check all power-supply voltages and verifying all display and front panel switch functions. Required test equipment is a DC power supply and a multimeter.

**Receiver Tests:** Check all standard receiver parameters. Required test equipment is a DC power supply, an RF signal generator (connected to the antenna terminal), a SINAD meter and an audio voltmeter.

**Transmitter Tests:** Check all standard transmitter parameters. Required test equipment includes a power supply, 50 ohm load (connected to the antenna terminal), an in-line wattmeter between the 50 ohm load and the TW7000, and an oscilloscope.

Table 5-2. Detailed Performance Test Parameters

General Operational Tests	
Regulated Power Supply Voltages (on power supply board)	Main +12V $\pm$ 0.6V ACC +12V $\pm$ 0.6V 5V +5V $\pm$ 0.25V
Keypad Functions	Verify channel, frequency, alpha, and arrow keypad entry
LCD Display	Verify all display functions and icons are visible and operational.
Button/Icon Operations	Verify that ALPHA, SPKR, SQ, EXT AMP, ATTN, RF PWR, SCAN GROUP, MODE, and OPTION buttons/icons operate
Receiver Tests	
Receiver Current	2A maximum (volume at minimum)
Audio Output/Distortion	2.8 VRMS $\pm$ 0.25V at microphone jack with -100 dBm input
SINAD	10 dB at -113 dBm input
AGC Operation	3 dB change over input range of -103 dBm to +13 dBm
Squelch Operation	Operational at -110 dBm
Pass Band Response	300 to 2700 Hz $\pm$ 3 dB with standard 5 MHz filter
Clarifier Operation	$\pm$ 600 Hz in 10 Hz steps
Attenuator Operation	Verify attenuator is functioning
Bar Graph Operation	Verify bar graph is functioning
Transmitter Tests	
Transmit Current	3A maximum at idle, 20A maximum at 100W
Power Output	All tests use -10 dBm 1kHz audio into the microphone audio pin of the microphone jack. Low: 10W $\pm$ 2W with Alpha 5* set to 10 Medium: 25W $\pm$ 5W with Alpha 5* set to 30 High: 100W $\pm$ 20W with Alpha 5* set to 200
CW Mode Operation	Low: 10W $\pm$ 2W with Alpha 5* set to 10 Medium: 25W $\pm$ 5W with Alpha 5* set to 30 High: 100W $\pm$ 20W with Alpha 5* set to 200
AME Mode Operation	Verify carrier is 10 to 80W in LSB at 14.75 MHz
PCS Mode Operation	Verify carrier is 2.5W $\pm$ 1W in LSB at 14.75 MHz
Carrier Suppression	Verify that a PTT key with no audio input is less than 200 mVPP at the RF output
Two-Tone Distortion	Verify waveform linearity and freedom from distortion (flat-topping). Use 1kHz and 1.8 kHz tones at 50mV each into microphone jack

**Table 5-2. Detailed Performance Test Parameters**

<b>Transmitter Tests (continued)</b>	
Microphone Operation	Verify operation of both front panel microphone jacks
Bar Graph Operation	Verify bar graph is functioning
VSWR (Power Reduction)	Verify power reduction at 3:1 VSWR
Frequency Calibration	$\pm 5$ Hz at 30 MHz
* Refer to the TW7000-MSOP for information on using the Alpha menu.	

## 5.7 Subassembly Troubleshooting

This chapter contains TW7000 troubleshooting information down to the subassembly level. The objective is to identify the faulty board in the TW7000 by utilizing logical diagnostic procedures along with the internal BITE system. After replacing the suspect board, proper performance is verified as below.

### 5.7.1

#### **Internal BITE System**

The BITE system aids in troubleshooting the equipment down to the board level. The BITE routine performs the following:

1. Checks that each board is in its proper location inside the standard TW7000.
2. Checks for the presence of options.
3. Checks the performance of certain key parameters on the following boards.
  - **75 MHz IF:** Verifies that the injection level of the 1st LO into the first mixer is correct.
  - **5 MHz IF:** Verifies that injection levels of the 2nd and 3rd LOs into the second and third mixers are correct.
  - **Synthesizer:** Verifies that all PLLs are locked and operating properly.
  - **Reference/Control:** Verifies connection to filter assembly.

The BITE system activates automatically at power up, or manually using the keypad (refer to the TW7000-MSOP). If a fault is diagnosed, a coded fault message displays. If faults in several boards are identified, the fault codes for each board displays.

All of the boards have special circuitry to control the BITE line. The line is controlled by the SPI bus. The BITE line descriptions are explained in the following table. The values are approximate with a  $\pm 1$  Vdc of the stated voltage.

**Table 5-3. BITE Line Descriptions**

<b>Board</b>	<b>Type of BITE</b>	<b>BITE Voltage</b>
Reference/Control	Receiver overload, filter board and reference oscillator	.53* Vdc
Reference/Control VSWR	Receiver overload, filter board and reference oscillator	1.08* Vdc
Synthesizer	First local oscillator, BFO	.84 Vdc
Synthesizer 2	Second local oscillator, BFO	2.06 Vdc
5 MHz IF (STD)	Second local oscillator, BFO and standard filter	1.08 Vdc
5 MHz IF (STD + WB)	Second local oscillator, BFO, standard and wideband filter	1.53 Vdc
5 MHz IF (STD + WB1)	Second local oscillator, BFO, standard and wideband 1 filter	4.63 Vdc
5 MHz IF (STD + CW)	Second local oscillator, BFO, standard and CW filter	2.29 Vdc
5 MHz IF (CW and WB1)	Second local oscillator, BFO, CW and wideband 1 filter	3.41 Vdc
75 MHz IF	First local oscillator	1.88 Vdc
Audio	Audio board installed	2.29 Vdc
ALE	ALE board installed	2.50 Vdc
ALE GPS	ALE board installed	2.73 Vdc
Encryption	Encryption board installed	2.71 Vdc
Noise Blanker	Noise blanker installed	2.95 Vdc
FSK Remote	FSK remote board installed	3.59 Vdc
ISDN Remote	ISDN remote board installed	3.80 Vdc
Option 1	Option 1 board installed	4.04 Vdc
Option 2	Option 2 board installed	4.26 Vdc
Option 3	Option 3 board installed	4.42 Vdc
Option 4	Option 4 board Installed	4.61 Vdc
* Result is .53 Vdc when filter board bad or missing, 5 Vdc when good		

### 5.7.2 Other Diagnostics

While the BITE system is extremely useful in troubleshooting down to the board level, there are other diagnostics to perform on the TW7000. Identifying faulty boards in a malfunctioning transceiver is one of logical deduction and analysis. For example, if the BITE system indicates a fault in a particular board, replace the board and run BITE again. If there is no BITE fault indication and the TW7000 is still not functioning properly, other diagnostics can pinpoint the problem.

The most frequent transceiver symptoms are listed below and offer logical troubleshooting techniques to identify a faulty board.

#### TW7000 Doesn't Turn On

1. Check the external power source. Its voltage under load should be between 11 and 16 Vdc; otherwise, the radio does not turn on because the high/low voltage protection circuit inhibits it.
2. Check the DC power cable. Measure the DC voltage at the **+12/28VDC INPUT** terminal on the rear panel.
3. Check the rear panel fuse. Replace a blown fuse only if you have resolved the reason for its occurrence.
4. Check the front panel power switch. Ground the PWRON line to verify proper switch operation.
5. Check the power supply board voltages:
  - +12V: J29, A1, A2, A3, B1, B2, B3
  - +12 UNREG: J29, A4, A5, B4, B5
  - +12V ACC: J16-25, J17-26, J25-26, J18-10
  - +5V: J29, A9, A18, B9, B10
  - +12 VPA: E2

Chapter 4 describes where each of these generated DC voltages are used in the TW7000.

#### No Front Panel Control

If the TW7000 is not responding to input from the keypad or any of the controls on the front panel, it is an indication that the main processor board is out of lock and must be reset.

1. Remove the radio's top cover and observe the LED mounted on the Processor board. If it is flashing, the board is out of lock.
2. Turn the TW7000 off.
3. Place the jumper provided at JU10 of the Processor board across the two pins JU10-D. If a jumper is unavailable, substitute a metal object such as a screw driver.

4. Turn the TW7000 on and allow it to go through its power-up sequence.
5. Turn the radio off and remove the jumper at JU10-D. This reverts all channel information to the default settings.

If these steps don't solve the problem, systematically replace the boards by starting with the Reference/Control board and continuing with boards to the left until you have located the source of the problem. If board replacement does not reveal the problem, the motherboard is probably defective and should be replaced.

No Front  
Panel Display

1. Check the +12 UNREG to the front panel on J1-3, 4. The front panel assembly runs off the unregulated +12V and has its own on-board +5 and +12V regulators.
2. Check the main processor data lines (J1-31, 32). Toggling between 0 and +5V indicates the passage of data.

No Receive  
Audio Output

You can easily check the receiver path with a DC multimeter, a signal generator, and an RF voltmeter. Connect the generator to the antenna port with an input level of -50 dBm and a frequency set to generate a 1 kHz tone.

**75 MHz IF:** Check the on-board regulated voltages (+12, +8, +R8). The input RF signal level at J52 should be -51 dBm nominal at the channel frequency. The RF output level at J53 should be -41 dBm, nominal, at 75 MHz.

**5 MHz IF:** Check the on-board regulated voltages (+12, +8, +R8). The input RF signal level at J53 should be -41 dBm nominal, at 75 MHz. The output audio level at J5-21 should be 2.6 VPP nominal.

**Audio:** On-board regulated voltages are +10V and +5V. The input audio at J8-21 should be 2.6 VPP nominal, and the output audio level at J8-7 should be 1.2 VPP.

**Front panel:** Check the audio input at J1-30 (SQA). It should be 1.2 VPP nominal. Turn the volume up fully with the speaker on and check for speaker noise; you may have to replace the speaker or it may have a bad connection to the front panel Processor board. If input to the panel and the speaker is correct, the problem is probably in the audio amplifier on the board.

No Transmit  
Audio Output

The transmit path is checked in a similar manner as the receiver but in the opposite direction. The transmit levels, used for comparison below, are obtained with a 1 kHz tone applied to the microphone input (J9, 10-pin 4).

**Front panel:** Check the output of the microphone (J9, 10-pin 4) to make sure it is not defective. Check the audio output (PRIMICA) at J1-25 which should be about 0.2 VPP nominal. If the microphone input is correct but the audio output is bad, the problem is probably with the compressor amplifier on the board.

**Audio:** The Audio board uses the same on-board regulators in both transmit and receive. The audio input level at J8-20 should be 0.2 VPP nominal, and the output (MODA) at J8-8, 0.25 VPP nominal.

**5 MHz IF:** Check the +T8V on-board regulator. The audio input at J5-8 should be 0.25 VPP nominal, and the 75 MHz output at J53, -14 dBm, nominal.

**75 MHz IF:** Check the +T12 and +T8V on-board regulators. The 75 MHz input at J53 should be -14 dBm nominal, and the channel frequency output at J60, +20 dBm nominal.

**RF Power Amplifier:** Check the T12 and +12V PA input lines. The RF input at J10 should be +20 dBm nominal, and the output at J12, 200 VPP nominal.

Other areas to check in the transmit path (if above tests are normal) include the input (J51) and output (J50) of the RF Filter board, and the antenna connector on the rear panel.

**Note:** *If the TW7000 doesn't go into transmit mode when you activate the PTT, the problem could be the main transmit/receive relay on the RF Filter board, the PTT connection (pin C) on the microphone jack, or Alpha 8 (Receive set RX only) is energized for that channel.*

#### Frequency Generation Problems

The BITE system checks the injection levels of all the LO's and the reference oscillator, so if it indicates a fault in the synthesizer or either of the IF boards, it is possible the faulty board is the synthesizer or the Reference/Control board. For example, if replacing the IF board did not clear the fault indication, then the Synthesizer board is probably the problem. To verify this, replace the synthesizer, or take the following measurements:

**Synthesizer:** Check on-board +5V and +8V. All LO levels (J59-1st, J54-2nd, J55-3rd) should be 0 dBm nominal, and the reference input level (J61), 1 VPP, nominal.

**Reference/Control:** Check on-board regulated +5, +8, and +12V. The reference output signal level at J61 should be 1 VPP nominal with J61 disconnected, and +.5 VPP nominal with J61 connected.

It is also possible the master oscillator is out of adjustment causing speech to sound garbled and the clarifier to offset needlessly. If this is the case, recalibrate the oscillator and refer to the "Alignment Procedures" section on page 5-18.

## 5.8 Main Processor Troubleshooting

The Processor board is not intended for repair by the average user. The board is complicated and constructed with surface mount technology (SMT), requiring specialized soldering/desoldering equipment. Any troubleshooting should be performed by personnel experienced with these types of circuits. This text does not attempt to explain 68000 microprocessor operation. For processor troubleshooting suggestions, refer to the table below.

**Table 5-4. Troubleshooting the Processor Board**

Indication	Possible Fault	Action
For proper jumper settings, refer to the "Jumper Settings" table on page 5-18.		
Fault LED steady	Processor cannot talk to U2, U3, U4, or U5. Usually means the processor bus itself is not working. Oscillator may not be running.	Check all address and data lines going between all ICs attached to these lines. Check Y3, U33, and U37 for proper voltages and signals in and out.
Fault LED flashing	Processor cannot talk to U2, U3, U4, U5, U6, U11, U17, or U20.	Physically check U2, U3, U4, U5, U6, U11, U17, and U20 for bent pins or unsoldered contacts. Check U2, U3, U4, and U5 for correct placement of jumpers on JU1, JU2, JU3, JU4, and JU20.
Lost channel memory	Processor having problems with U4 or U5. Battery BT1 may be bad.	Physically check U4 and U5 for bent pins or unsoldered contacts. Check for correct placement of jumper JU20. Check voltage from BT1.
No front panel display	No communication with U11. The interrupt ACK circuit of U12 and U26 may not be operating.	Check U11 for proper voltages and signals in and out. Check for fault LED operation and consult that section. Check U12 and U26 for proper voltages and signals in and out.
COM1 not operational	Jumpers JU22, JU23, R4, R7, R9, R11, R17, R18, R23, and R27 configured wrong. No communication with U8, U11 or U9.	Check U8, U11, and U9 for proper voltages and signals in and out.
COM2 not operational	No communication with U8 and U17.	Check U8 and U17 for proper voltages and signals in and out.
AT7000 not operational	No communication with U17, U43 and Q9.	Check U17, U43, and Q9 for proper voltages and signals in and out.

**Table 5-4. Troubleshooting the Processor Board**

<b>Indication</b>	<b>Possible Fault</b>	<b>Action</b>
AT/RAT100 or RAT1000 not operational	Problem with U16, U17, U23 or Q5.	Check U16, U17, U23, and Q5 for proper voltages and signals in and out.
No external amplifier PTT operation	Problem with Q6 or U11.	Check Q6 and U11 for proper voltages and signals in and out.
No AUXPTT operation	Problem with U20, Q7 or D3.	Check U20, Q7, and D3 for proper voltages and signals in and out.
No internal PTT operation	Problem with U20 or Q2.	Check U20 and Q2 for proper voltages and signals in and out.
No external CW operation	Problem with U20, U22, or D2.	Check U20, U22, and D2 for proper voltages and signals in and out.
No radio board programming (SPI bus)	Problem with U6, U16, U21, or U31.	Check U6, U16, U21, and U31 for proper voltages and signals in and out.
No receiver bar graph operation	Problem with U39.	Check U39 AGC line for proper voltages and signals in and out.
No transmit bar graph operation	Problem with U39.	Check U39 PWRLVL line for proper voltages and signals in and out.
No BITE line operation	Problem with U39.	Check U39 BITE line for proper voltages and signals in and out.
No fan operation	Problem with U39.	Check U39 TSENSE line for proper voltages and signals in and out.
No parallel printer operation	Problem with U6, U28, or U29.	Check U6, U28 and U29 for proper voltages and signals in and out.
<b>Optional Parts</b>		
ISDN remote not operational	Jumpers JU11A and JU12A configured wrong. No communication with U18.	Check U18 for proper voltages and signals in and out.
FSK remote not operational	Jumpers JU11A and JU12B configured wrong. No communication with U18.	Check U18 for proper voltages and signals in and out.
ALE board not operational	Jumpers JU11B and JU13A configured wrong. No communication with U19.	Check U19 for proper voltages and signals in and out.
TA/TC/SC Modem not operational	Jumpers JU11B and JU13B configured wrong. No communication with U19 or U10.	Check U19 and U10 for proper voltages and signals in and out.

**Table 5-4. Troubleshooting the Processor Board**

Indication	Possible Fault	Action
RS-485 not operational	Jumpers JU22, JU23, R4, R7, R9, R11, R17, R18, R23, and R27 configured wrong. No communication with U8, U11 or U9.	Check U8, U11 and U9 for proper voltages and signals in and out.

## 5.9 Alignment Procedures

Alignment procedures (after replacement of boards) include the transmitter ALC adjustment, master oscillator calibration, and option jumper settings on the Processor board.

**Table 5-5. Jumper Settings**

Jumper	Normal Position	A-B (or In)	B-C (or None)	Function
JU5	None	Battery Connected	N/C	Battery
JU10A	None	ACH Option	N/C	ACH Option
JU10B	None	None	N/C	None
JU10C	None	S/W Upgrade	N/C	S/W Upgrade
JU10D	None	RAM Clear	N/C	RAM Clear
JU11A	None	U18 Select	N/C	U18 Select
JU11B	IN	U19 Select	N/C	U19 Select
JU12A	None	ISDN REM	N/C	ISDN Select
JU12B	None	FSK REM	N/C	FSK Select
JU12C	None	NONE	N/C	None
JU12D	None	NONE	N/C	None
JU13A	None	ALE Option	N/C	ALE Select
JU13B	None	TA/TC/SC	N/C	TA/TC/SC
JU13C	None	None	N/C	None
JU13D	None	ALE Load	N/C	ALE Load
JU20	A-B	No Clock	Clock	Clock Installed
JU22	A-B	Local ACC1 RX	72011 ACC1 RX	Select COM1 Conn
JU23	A-B	Local ACC1 TX	72011 ACC1 TX	Select COM1 Conn

**5.9.1  
Transmit  
ALC  
Adjustment**

The transmit ALC adjustments are located on the Reference/Control board.

1. Measure the regulator voltage, U2 pin-16,  $+5 \pm .25V$ , U5 output  $8.0V \pm .4$ .
2. Verify that the oscillator is stabilized.
3. Set the radio transmit frequency to 30.0 MHz and the radio mode to USB AME.
4. Key the PTT, measure the RF output of the radio and adjust the oscillator for 30.000000 MHz.
5. Verify the transmit frequency 15.0 and 2.0 MHz. The frequency error should not exceed the specification for the installed oscillator option.
6. Make the following adjustments to R1 and R22 until no further adjustment is required:
  - Adjust R1 (high power set) for a transmit output power of 100W average, single tone at 14.75 MHz.
  - Adjust R22 (low power set) for 10W average, single tone at 14.75 MHz.
7. Remove load from the wattmeter. Key the radio in high power and adjust R29 (reverse power set) for 12W of reflected power.

**5.9.2  
Master  
Oscillator  
Calibration**

The master oscillator is also located on the Reference/Control board.

1. Terminate the TW7000 in 50 ohms, and monitor the RF output with a frequency counter.
2. Set the radio to 30.000000 MHz.
3. Put the TW7000 in AME mode and key it.
4. Adjust the reference oscillator until the output frequency reads the same as the selected channel frequency (as displayed on the front panel).

**5.9.3  
Processor  
Board  
Jumper  
Settings**

The Processor board has multiple jumpers to accommodate a wide variety of system configurations and options. For a quick overview of the jumper settings and their functions, refer to the "Jumper Settings" table on page 5-18. Some jumpers are zero ohm resistors and are shown in the next two tables.

**JU5 RAM  
Battery  
Jumper**

This jumper enables the RAM backup battery. The normal setting is the A-B position. This jumper is for voltage and current checking on the battery.

**COM2 Source Select Jumpers** These jumpers route the COM2 serial communications through the RS-232 driver connected to the Accessory2 connector on the back of the radio or to the optional internal GPS module.

**Table 5-6. COM2 Jumper Settings**

COM2 Source	R119	R120
Radio RS-232	X	X
GPS Option 001-01300		

**JU10 - DUART1 Configuration Jumpers**

This jumper bank is for various radio configurations including software upgrade and RAM clear jumpers.

**JU10A** activates the ACH option that gives the radio 1000 channels. This is only used with the 32K x 8 RAM (62256 or 62257) for U4 and U5.

**JU10B** is currently not used.

**JU10C** clears only the necessary RAM variables to enable a software upgrade. This does not disturb any of the channel or scan group programming.

**JU10D** clears the entire RAM space and loads all DWC default channel information and scan groups.

**JU11 - DUART2 Configuration Jumpers**

This jumper bank selects optional DUART3 (U18) and DUART4 (U19) installations.

**JU11A** selects the installation of DUART3 (U18). It lets the processor know the chip is installed and ready for programming. For DUART3 configuration information, refer to the JU12-DUART3 Configuration Jumper section below.

**JU11B** selects the installation of DUART4 (U19). It lets the processor know the chip is installed and ready for programming. For DUART4 configuration information, refer to the JU13-DUART4 Configuration Jumpers section below.

**JU12 - DUART3 Configuration Jumper**

This jumper bank enables the selected UART for the ISDN or FSK remote options.

**JU12A** tells the processor to enable the DUART3 ISDN remote UART. Enable this jumper with JU11A to establish communications with the ECU/RCU board.

**JU12B** tells the processor to enable the DUART3 FSK remote UART. Enable this jumper along with JU11A to establish communications with the ECU/RCU board.

**JU12C** is currently not used.

**JU12D** is currently not used.

- JU13 - DUART4 Configuration Jumpers**
- This jumper bank enables the selected UART for the ALE or TA/TC/SC remote options.
- JU13A** enables the DUART4 ALE UART. Enable this jumper with JU11B to establish communications with the ALE board.
- JU13B** enables the DUART4 TA/TC/SC UART. Enable this jumper with JU11B to establish communications with the TA/TC/SC modem.
- JU13C** is currently not used.
- JU13D** loads the ALE card with a DWC default configuration. To do a default load, be sure the ALE option is installed and turned on. Turn the radio off, install the jumper and turn on the radio. **LOADING ALE** displays. It takes up to 90 seconds to load ALE. When finished, **LOAD DONE** displays and the radio starts scanning. Remove jumper JU13D and put it in a safe place.
- JU20 - Clock Select Jumper**
- This jumper indicates whether there is a ramified clock chip in U4. The normal setting is the A-B position for no clock. Use the B-C setting when a ramified clock chip (1643 or 644) is in U4.
- JU22 and JU23 COM1 Source Select Jumpers**
- This collection of jumpers routes the COM1 serial communications through the RS-232 driver connected to the Accessory1 connector on the back of the radio, through the RS-422/485 driver also connected to Accessory1, or through the RS-232 driver connected to the Accessory1 connector on the back of the TW7201I remote control head.

**Table 5-7. COM1 Jumper Settings**

COM1 Source	JU22	JU23	R4	R17	R7	R18	R9	R23	R11	R27
Radio RS-232	A-B	A-B			X		X		X	
Radio RS422/485	A-B	A-B		X		X		X		X
TW7201I RS-232	B-C	B-C	X		X		X		X	



# CHAPTER 6

## INTERNAL OPTIONS

This chapter covers internal options that can be added to the TW7000. They are generally factory installed. If added in the field, installation requires a #2 Phillips-head screwdriver and a board puller included in the following maintenance kits.

- 7000EXT extender kit
- TW7000TK tool kit

Internal Option	Part Number	See Page
Additional Channel	7000ACH	6-2
ALE	7000ALE	6-3
Clock	7000CLK	6-19
Data Interface RS422/423/485	7000RS	6-20
Encryption	7000ENCR	6-21
FSK Remote Control	7000RF	6-21
High Stability	7000HS	6-34
ISDN Remote Control	7000RI	6-42
Narrowband CW Filter	7000CW	6-55
Noise Blanker	7000NB	6-56
Recorder	7000RCDR	6-62
Selcall, Transcall and TransAdapt	7000TC	6-63
Voice Enhancement Module	7000VEM	6-64
Wideband Data Filter	7000WB1	6-64

For information on changing the on or off status of these options, refer to the TW7000-MSOP operator manual.

## 6.1 Additional Channel Option (7000ACH)

This option gives the 7000-series transceiver a 1000 channel capability. It is compatible with revision D and later processor boards.

**CAUTION: This option involves RAM; any programmed information is over-written.**

To install this option, follow the steps below. For jumper placement, refer to the figure below.

1. Turn the TW7000 off and remove the cover. Remove the board hold-down bars.
2. Using the correct antistatic procedures and board puller, locate and remove the Processor board.
3. Install jumper JU10A.
4. Install jumper JU10D (this jumper clears the old RAM).
5. Reinsert the Processor board into its guide. Turn on the TW7000, and verify it goes from 000-999 for a total of 1000 channels. Turn the TW7000 off and remove jumper JU10D.
6. Reinstall the cover on the radio.

When powered up, the TW7000 operates with up to 1000 channels.

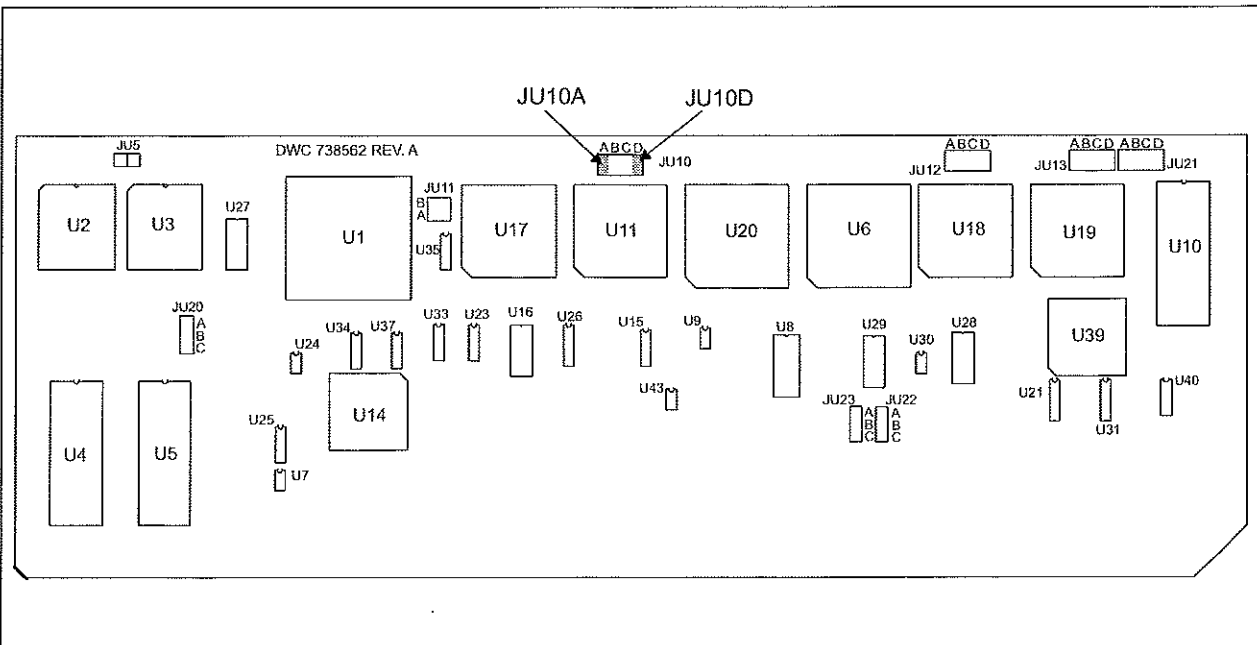


Figure 6-1. Additional Channel Jumper Placement

## 6.2 Automatic Link Establishment (7000ALE)

The FED-STD-1045 compatible adaptive ALE system provides complete 1045 capability including link quality analysis, auto-linking, and order wire message transmissions.

### 6.2.1 Installation

The ALE option is a plug-in board containing the ALE interface circuitry and the ALE assembly. Connector J13 connects to the radio and J1 to the ALE card. For correct placement of jumpers, refer to the figure below.

1. Turn the radio off and remove the top cover. Remove the board hold-down bars.
2. Locate the Processor board and remove it using the board puller. Using correct anti-static procedures install jumpers JU13A and JU11B.
3. Reinsert the Processor board.
4. Install the ALE board (next to the Processor board).
5. Replace the hold-down bars and the cover of the radio.
6. When powered up, the ALE icon displays.

For operational information on ALE, refer to the ALE operator manual (7000ALE-MSOP).

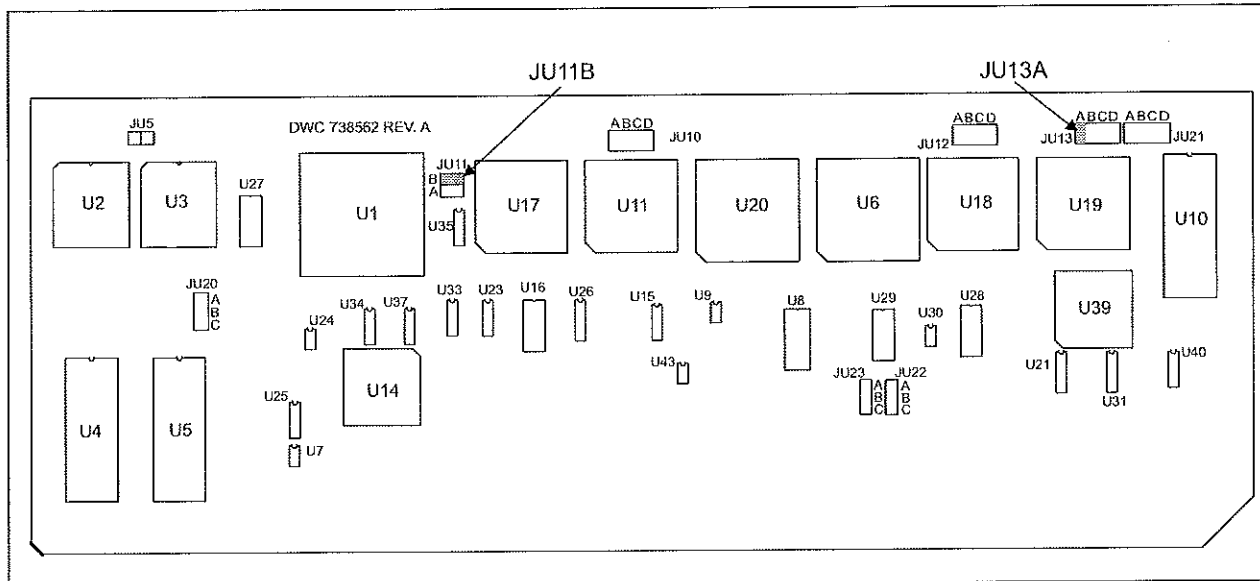


Figure 6-2. ALE Jumper Placement

**6.2.2**

**Circuit**

**Description**

The ALE board contains the main processor and DSP. For a block diagram of the board, refer to the "ALE Block Diagram" figure on page 6-7.

Micro-processor

Microprocessor U3 is combined with the input/output circuits to form a special purpose microcomputer. The microprocessor controls the processing of the ALE data as it comes into it from the DSP. It also prepares the ALE data before it is sent to the DSP for transmission.

The microprocessor addresses up to 64 kilobytes of static RAM for future program expansion. It has one UART, 2 timers, 32 bidirectional input/output lines, and 6 external interrupt sources. It operates at a clock frequency of 11.0592 MHz and uses external oscillator U2. UART communicates with the main radio processor through the serial buffers.

Port 1 is for miscellaneous control functions. P1.0 selects the communications mode for the external serial-control interface which is strictly for processor control or control through an external dumb terminal. P1.1 sets the serial control interface baud rate of 9600 or 19200 baud. P1.2 is a keyline output drive for keying the PTT line of an external device. P1.3 is an input that reads the current status of the PTT line. P1.4 provides the microprocessor watchdog output to reset controller chip U1. P1.5 provides a control input into the DSP. P1.6 monitors the dual port RAM interrupt going to the DSP. P1.7 provides the DSP reset pulse for a controlled power-up of the DSP.

Port 3 is for interrupt functions that have high priority. P3.1 is the transmit driver pin for the serial-control interface. P3.2 is the receive pin for the serial-control interface. P3.3 is the interrupt from the dual port RAM that indicates the DSP has left data that must be retrieved for processing. P3.4 and P3.5 are external timing inputs from the DSP.

The ALE, PSEN, RD, WR, address/data lines AD0-AD7 and address lines A8-A15 are for communications with the external EPROM, RAM, EEPROM, and DSP.

Reset Controller

The controller (U1) provides three functions. The first function is as a reset pulse generator that monitors the +5V line. It generates a reset output to hold the microprocessor's reset line low whenever the +5V line is below 4.5 Vdc. On power-up, an internal monostable multivibrator holds the reset line low for 250 ms, which allows the power supply to stabilize before generating the reset pulse. This also prevents repeated toggling of the reset line.

The second function is as a debounced reset-input line used as an external push button to reset the microprocessor. It is available on J1 pin 7.

The third function of U1 is as a microprocessor watchdog that requires the microprocessor to toggle STB input at least once every 500 ms. If the microprocessor fails to do so, the reset controller assumes it has had a lockup and provides a reset pulse to start it again. This is a rare occurrence and the ALE board is able to recover from it without external help.

Clock Oscillator	Clock oscillator U2 provides the internal clock for the main processor (U1). Clock oscillator U12 is a high-stability oscillator that provides the internal clock and timing for the DSP.
Buffers	The inverter/buffer chip (U22) provides protection for the main processor from the outside world. Outputs U22D and U22C buffer the serial control interface. Outputs U22E and U22F buffer the PTT input and output.
EPROM Program Storage	The EPROM chip (U4) stores the main software operating program for the ALE board. The DSP EPROM chips U18 and U19 store the high-speed DSP. EPROM storage is chosen for its speed, reprogramming ease, high reliability factor, and low current consumption.
RAM Program Storage	The RAM chip (U5) stores all the current operating data. DSP RAM chips U14 and U15 execute the high-speed DSP. RAM storage is chosen for its speed, high reliability factor, an low current consumption.
Memory Backup	Capacitor C10 provides memory backup to the RAM chip (U5). It is designed to provide only a limited retention period (a few days) on RAM memory.
<b>6.2.3 EEPROM Program Storage</b>	EEPROM chips U6 and U7 provide storage to long term operating data and parameters. EEPROM storage is chosen for its non-volatile memory characteristics.
Dual Port RAM	The dual port RAM (DPRAM) chip (U9) provides an easy interface between the main microprocessor and the DSP. Each time the DSP receives ALE data, it stores it in the DPRAM then sends an interrupt to the main processor to indicate data is waiting. The main processor retrieves and processes the data. Conversely, when the microprocessor wants to transmit, it stores the data in DPRAM. The DPRAM sends an interrupt to the DSP. The DSP then retrieves the data and transmits it.
Control Logic	The PAL chip (U20) is a programmable logic-array chip which contains all the interface logic between the main microprocessor and its memories, and the DSP and its memories. It also provides the control interface between the main and DSPs.

The bus multiplex chip (U21) multiplexes the address and data lines coming from the main microprocessor. The address is first presented to the lower address bus and then is latched with the ALE signal from the main microprocessor. The bus is then able to read or write data on AD0-AD8.

Digital Signal Processor

The DSP (U13) is a special purpose microprocessor optimized for fast math functions. Its theory of operation is beyond the scope of this manual. Digital processing enables the DSP to distinguish ALE tones from normal background noise in noisy environments. It also generates transmit tones with superb quality enhancing the likelihood of detection at the receiving end.

The DSP operates at a clock frequency of 20.736 MHz. It is a high-stability oscillator necessary for precise ALE tone generation and decoding.

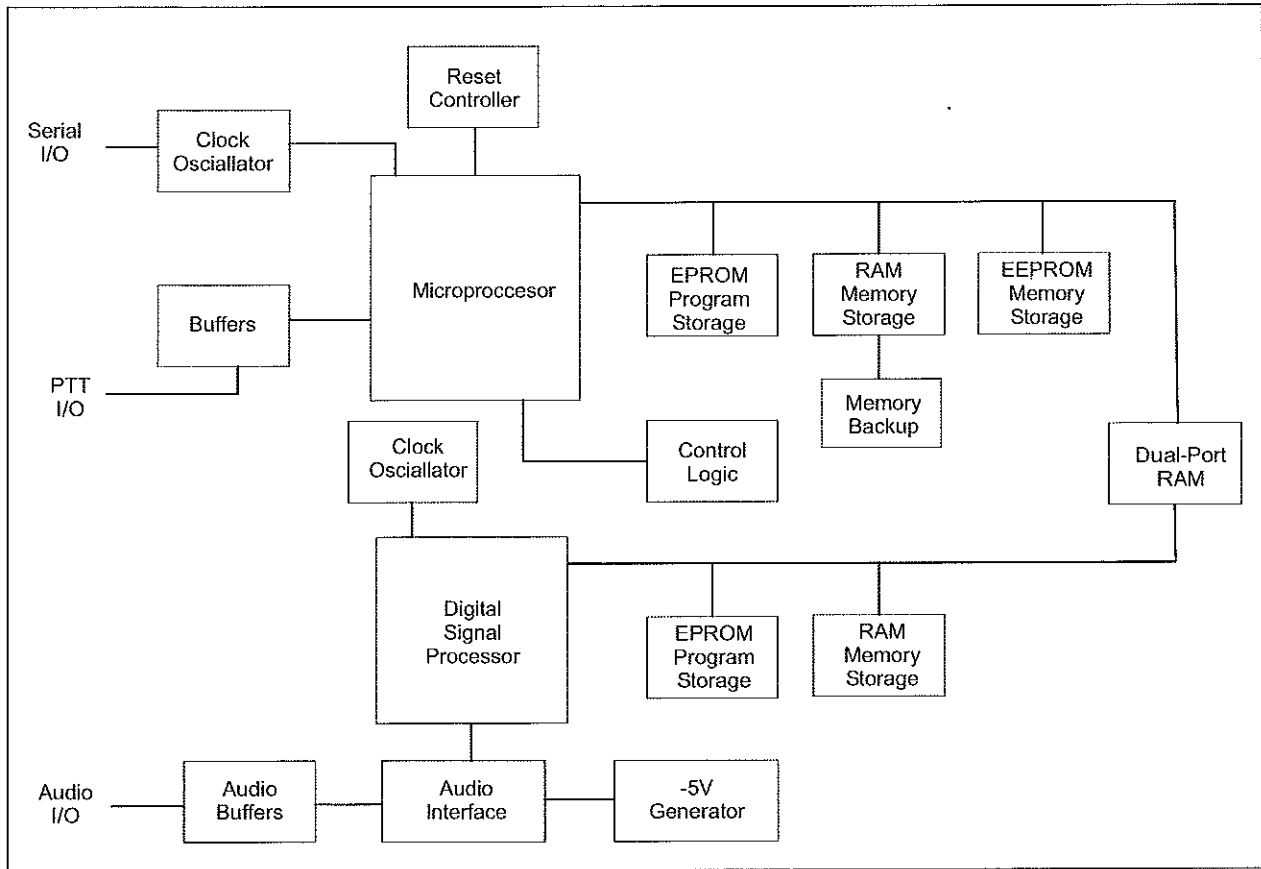
The DSP interfaces to U11, the analog interface chip, which processes all the incoming received audio and digitizes it for the DSP. It also generates the ALE transmit tones from the digital data that the DSP sends. The DS, PS, IS, STAB, and RW are used in conjunction with U20 to provide the switching logic for the external EPROM, RAM, and DPRAM chips. Address lines A0-A15 and D0-D15 are used for communication with the external EPROM, RAM, and DPRAM chips.

Audio Interface

The audio interface chip (U11) is responsible for the decoding and generation of ALE tones. The chip is divided into two parts, the receive and the transmit circuitry. The receive circuits consist of a 14-bit ADC that breaks down the incoming signal into a digital sequence which is sent to the DSP. The transmitting circuits use a 14-bit digital-to-analog converter (DAC) to convert the incoming digital sequence from the DSP into a precise transmit audio tone.

**-5V Generator:** The -5V generator (U10) generates the -5 Vdc needed by the audio interface chip (U11). It uses a monolithic charge-pump inverter that converts the +5 Vdc input to -5 Vdc. This uses capacitors C3 and C4 at 45 kHz to generate the necessary voltage and current.

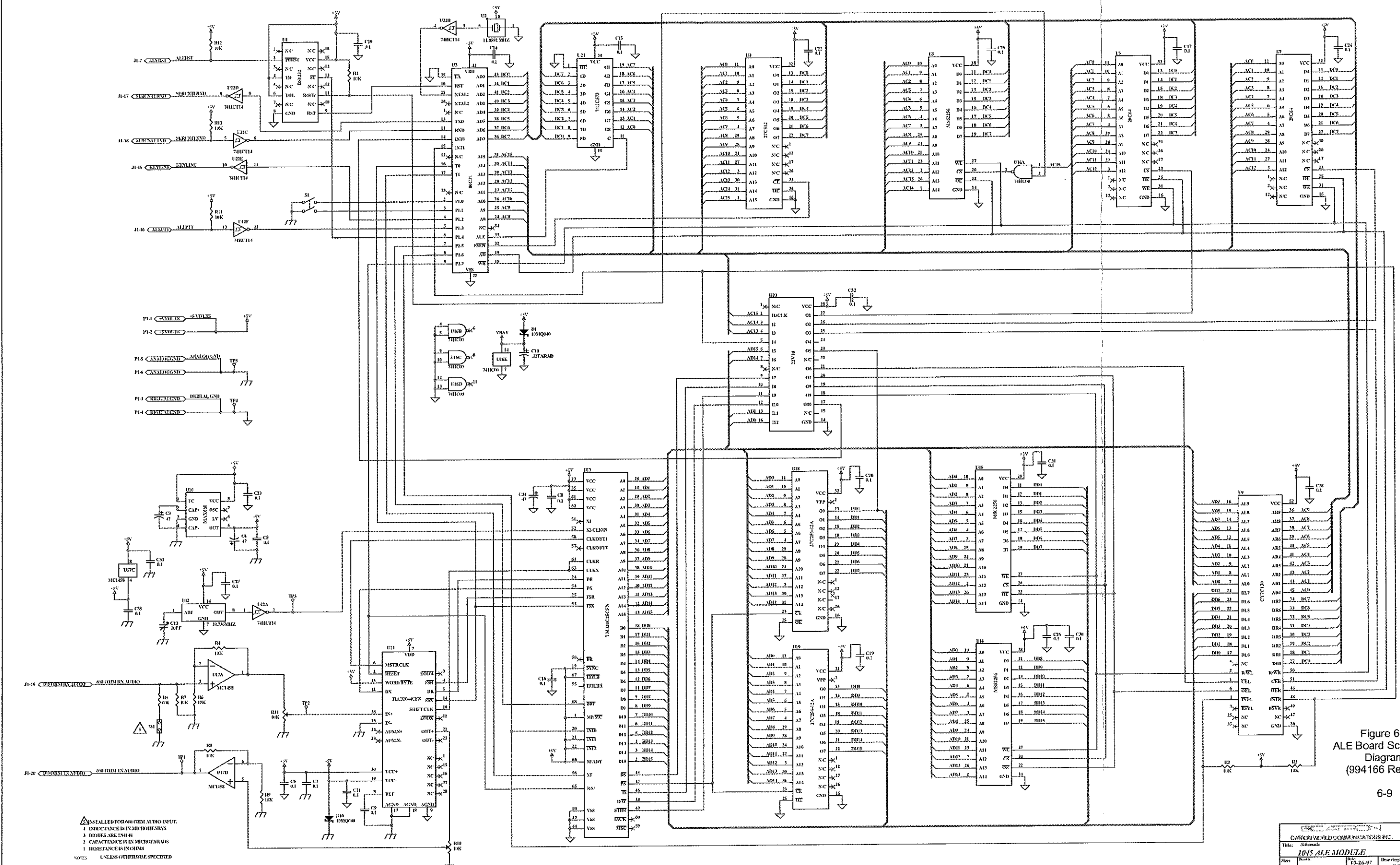
**Audio Buffers:** The audio buffer chip (U17) provides buffering of the receive audio input and transmit audio output. It also allows adjustment of the input and output levels by adjusting R10 and R11. For location of adjustment points, refer to the "ALE Board Schematic Diagram (994166 Rev. C)" figure on page 6-9.



**Figure 6-3. ALE Block Diagram**



REV	DESCRIPTION	DATE	BY	APP'D
1	1045 ALE BOARD	11/15/97	WJ	
2	1045 ALE BOARD	11/15/97	WJ	
3	1045 ALE BOARD	11/15/97	WJ	



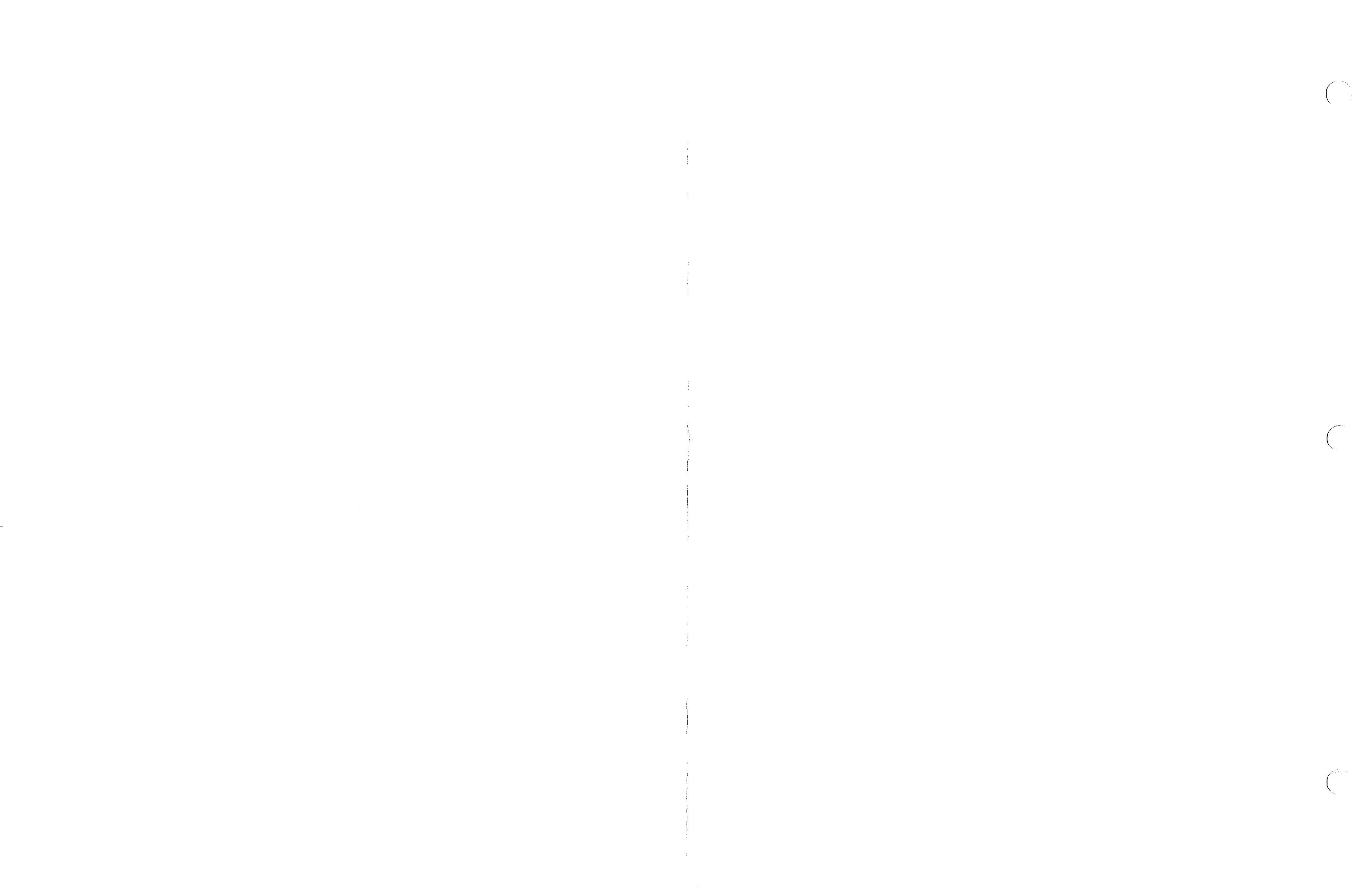
- 1 UNPLUGGED FOR 600 OHM AUDIO INPUT.
- 2 INDICATOR IS IN MICRO CHANNELS.
- 3 DIODES ARE 1N4148.
- 4 CAPACITANCE IS IN MICROFARADS.
- 5 RESISTANCE IS IN OHMS.

NOTES UNLESS OTHERWISE SPECIFIED

TW7000-MS

Figure 6-4  
ALE Board Schematic  
Diagram  
(994166 Rev. C)

1045 ALE MODULE		Drawing Number		Rev	
D	1045 ALE MODULE	994166	C		
Date: 11/15/97		By: WJ		App'd: WJ	



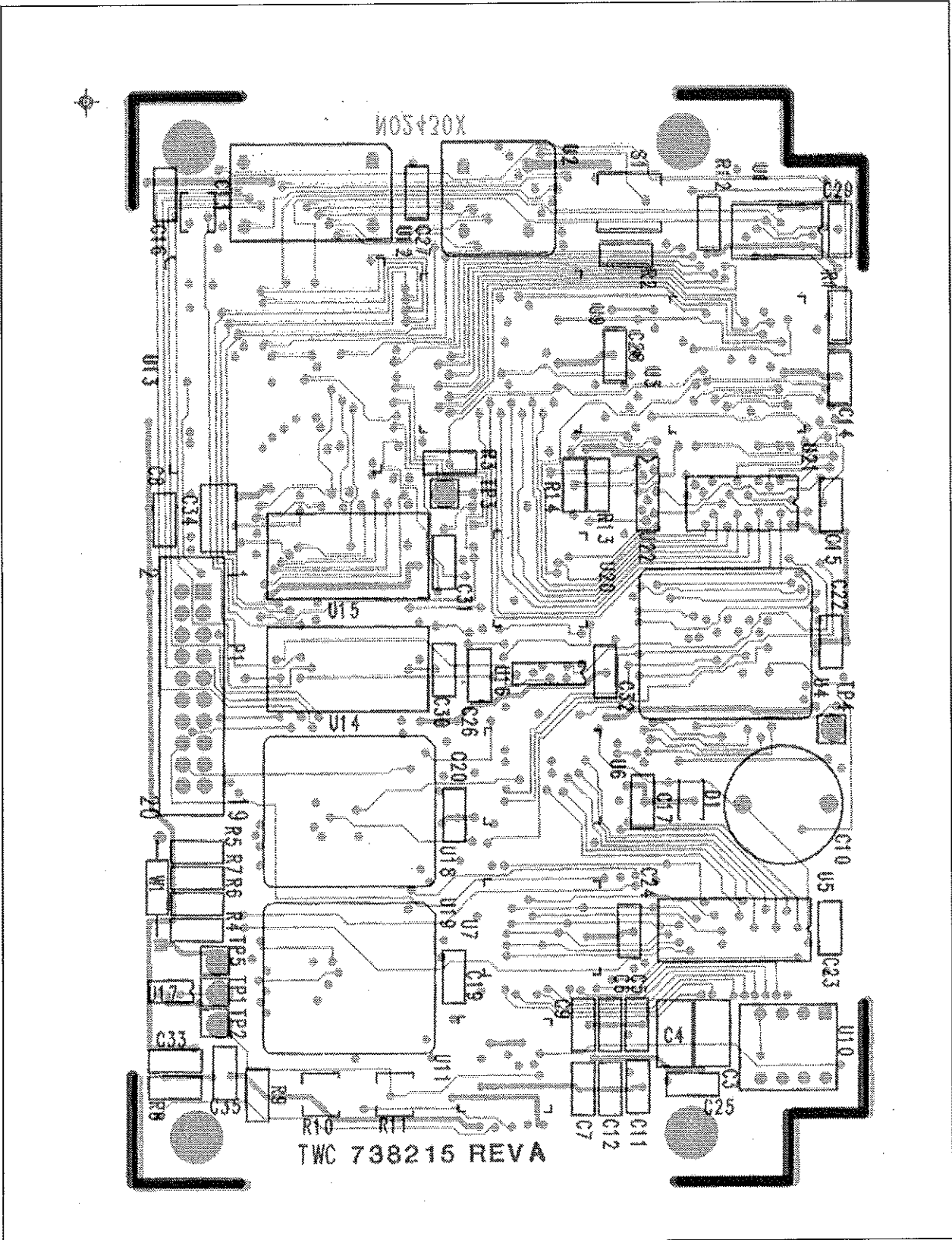


Figure 6-5. ALE Board Component Locations (738215 Rev. A)

Table 6-1. ALE Board Parts List (010-00200 Rev. D)

Designator	Part Number	Description
C10	238224	CAP,.22F 5.5V HORIZONTAL ELEC
C11	021104	CAP,.1MF 50V 10% X7R SMT 1206
C13	025003	CAP,SMT,4.5-20PF,50V,TRIM,2822
C14	021104	CAP,.1MF 50V 10% X7R SMT 1206
C15	021104	CAP,.1MF 50V 10% X7R SMT 1206
C16	021104	CAP,.1MF 50V 10% X7R SMT 1206
C17	021104	CAP,.1MF 50V 10% X7R SMT 1206
C19	021104	CAP,.1MF 50V 10% X7R SMT 1206
C20	021104	CAP,.1MF 50V 10% X7R SMT 1206
C22	021104	CAP,.1MF 50V 10% X7R SMT 1206
C23	021104	CAP,.1MF 50V 10% X7R SMT 1206
C24	021104	CAP,.1MF 50V 10% X7R SMT 1206
C25	021104	CAP,.1MF 50V 10% X7R SMT 1206
C26	021104	CAP,.1MF 50V 10% X7R SMT 1206
C27	021104	CAP,.1MF 50V 10% X7R SMT 1206
C28	021104	CAP,.1MF 50V 10% X7R SMT 1206
C29	021104	CAP,.1MF 50V 10% X7R SMT 1206
C3	023470	CAP, 47uF 10V 10% TANT SMT7343
C30	021104	CAP,.1MF 50V 10% X7R SMT 1206
C31	021104	CAP,.1MF 50V 10% X7R SMT 1206
C32	021104	CAP,.1MF 50V 10% X7R SMT 1206
C33	021104	CAP,.1MF 50V 10% X7R SMT 1206
C34	023470	CAP, 47uF 10V 10% TANT SMT7343
C35	021104	CAP,.1MF 50V 10% X7R SMT 1206
C4	023470	CAP, 47uF 10V 10% TANT SMT7343
C5	021104	CAP,.1MF 50V 10% X7R SMT 1206
C6	021104	CAP,.1MF 50V 10% X7R SMT 1206
C7	021104	CAP,.1MF 50V 10% X7R SMT 1206
C8	021104	CAP,.1MF 50V 10% X7R SMT 1206
C9	021104	CAP,.1MF 50V 10% X7R SMT 1206
D1	031004	DIODE,SCHOT 1 AMP 40V SMT2212
D2	031004	DIODE,SCHOT 1 AMP 40V SMT2212
R1	001002	RES,10K 1/8W 1% SMT 1206

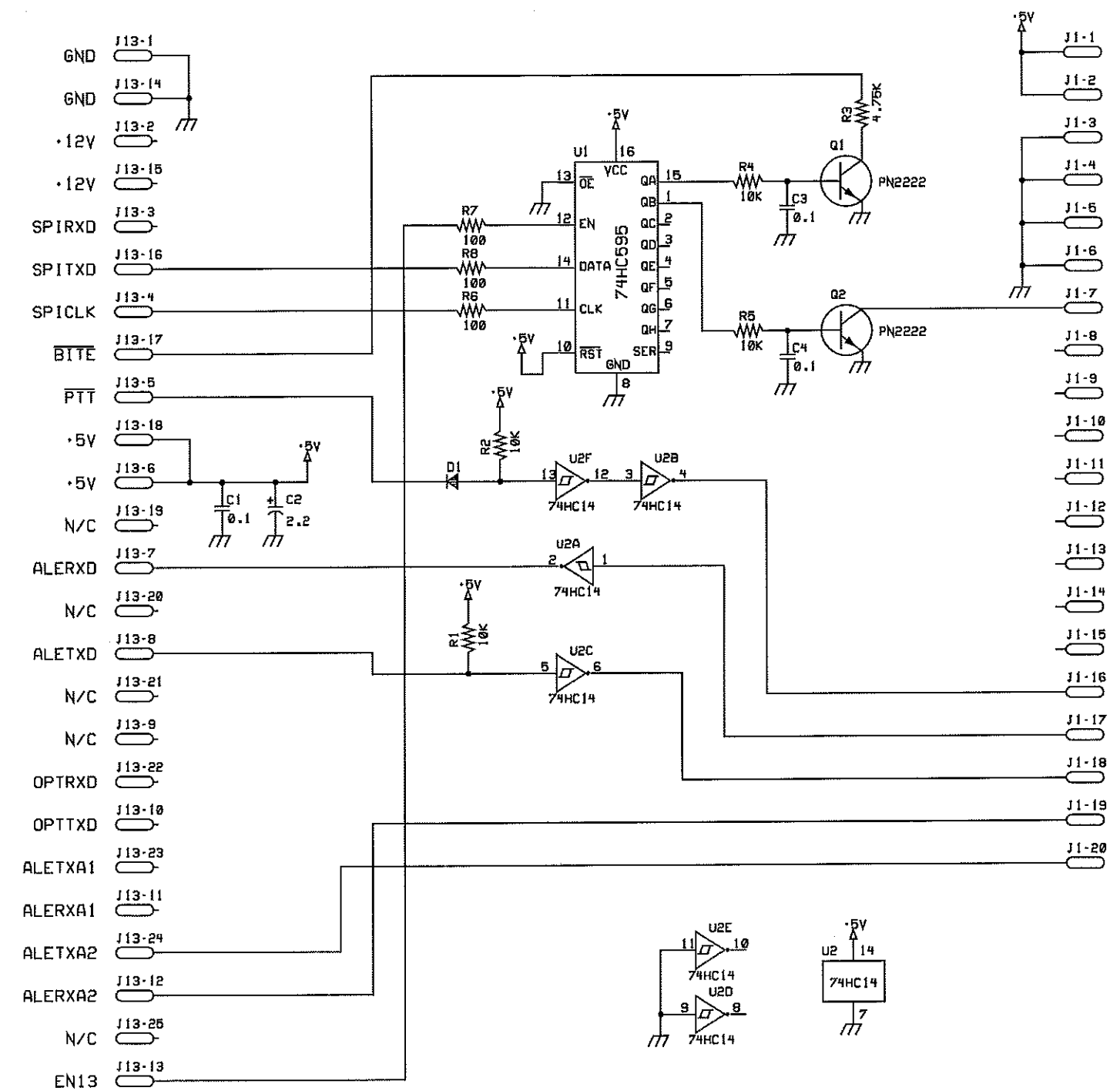
Table 6-1. ALE Board Parts List (010-00200 Rev. D)

Designator	Part Number	Description
R10	017003	RES,10K VARIABLE SMT 1 T 1206
R11	017003	RES,10K VARIABLE SMT 1 T 1206
R12	001002	RES,10K 1/8W 1% SMT 1206
R13	001002	RES,10K 1/8W 1% SMT 1206
R14	001002	RES,10K 1/8W 1% SMT 1206
R2	001002	RES,10K 1/8W 1% SMT 1206
R3	001002	RES,10K 1/8W 1% SMT 1206
R4	001002	RES,10K 1/8W 1% SMT 1206
R5	006040	RES,604 OHM 1/8W 1% SMT 1206
R6	001002	RES,10K 1/8W 1% SMT 1206
R7	001002	RES,10K 1/8W 1% SMT 1206
R8	001002	RES,10K 1/8W 1% SMT 1206
R9	001002	RES,10K 1/8W 1% SMT 1206
S1	053001	IC,SMD,SW,2 POS,DIP,3SP
TP1	653004	TERMINAL ASSEMBLY,PCB
TP2	653004	TERMINAL ASSEMBLY,PCB
TP3	653004	TERMINAL ASSEMBLY,PCB
TP4	653004	TERMINAL ASSEMBLY,PCB
TP5	653004	TERMINAL ASSEMBLY,PCB
U1	033056	IC,DS1232/S MICRO MONIT,SOW-16
U10	033060	IC, MAX660CPA CONVERTER,DIP-8
U11	033054	IC,TLC32044 VOICE BAND, LCCC28
U12	361091	XTAL OSCILLATOR,20.736 MHZ
U13	330407	IC,TMS320C25FNL 68 PIN PLCC
U14	033049	IC,SMT 32 X 8 SRAM, SOJ-28-5
U15	033049	IC,SMT 32 X 8 SRAM, SOJ-28-5
U16	033057	IC,MM74HC00M NAND GATE SOP-14
U17	033061	IC,MC1458D DUAL AMP, SO-8
U2	361090	XTAL OSCIL,11.0592 MHZ 5VDC
U20	010-00101	PROGRAMMED GAL
U21	033058	IC,74HC573ADW ALTCH, SOW-20
U22	033059	IC,74ACT14M DIGITAL, SO-14
U3	033051	IC, SMT 80C31 PLCC-44

**Table 6-1. ALE Board Parts List (010-00200 Rev. D)**

<b>Designator</b>	<b>Part Number</b>	<b>Description</b>
U5	033048	IC,SOP,28PIN,256K SRAM,CMOS
U6	033050	IC, SMT EEPROM CMOS PLCC32
U7	033050	IC, SMT EEPROM CMOS PLCC32
U9	033053	IC,IDT7130LA55J DUAL-PORT RAM
XU18	062004	SOCKET,32 PIN SMD LOW PROFILE
XU19	062004	SOCKET,32 PIN SMD LOW PROFILE
XU4	062004	SOCKET,32 PIN SMD LOW PROFILE

REV	ECN	DESCRIPTION	DATE	APPR
A	7000-078	RELEASE	18SEP93	



4 INDUCTANCE IS IN MICROHENRYS  
 3 DIODES ARE 1N4148  
 2 CAPACITANCE IS IN MICROFARADS  
 1 RESISTANCE IS IN OHMS

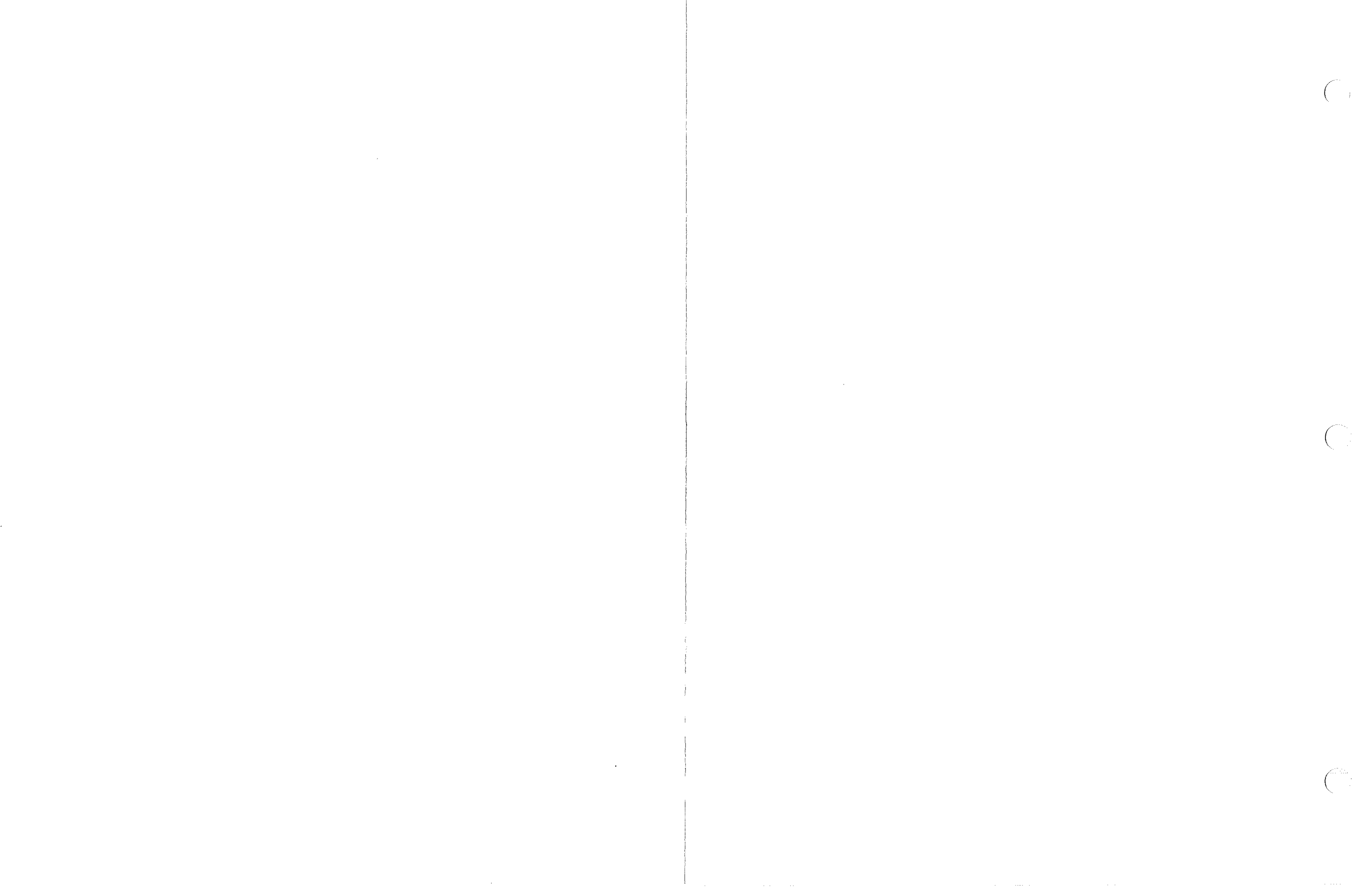
NOTES UNLESS OTHERWISE SPECIFIED

Figure 6-6  
 ALE Interface Schematic Diagram  
 (994159 Rev. A)

6-15

TW7000-MS

<b>EDATRON</b>				
DATRON WORLD COMMUNICATIONS INC.				
TITLE SCHEMATIC				
ALE INTERFACE TW7000				
SIZE	DRAWN	SATEL	DRAWING NUMBER	REV.
C	ENBR		994159	A
SCALE	DATE	15 MAR 92	SHEET	1 OF 1



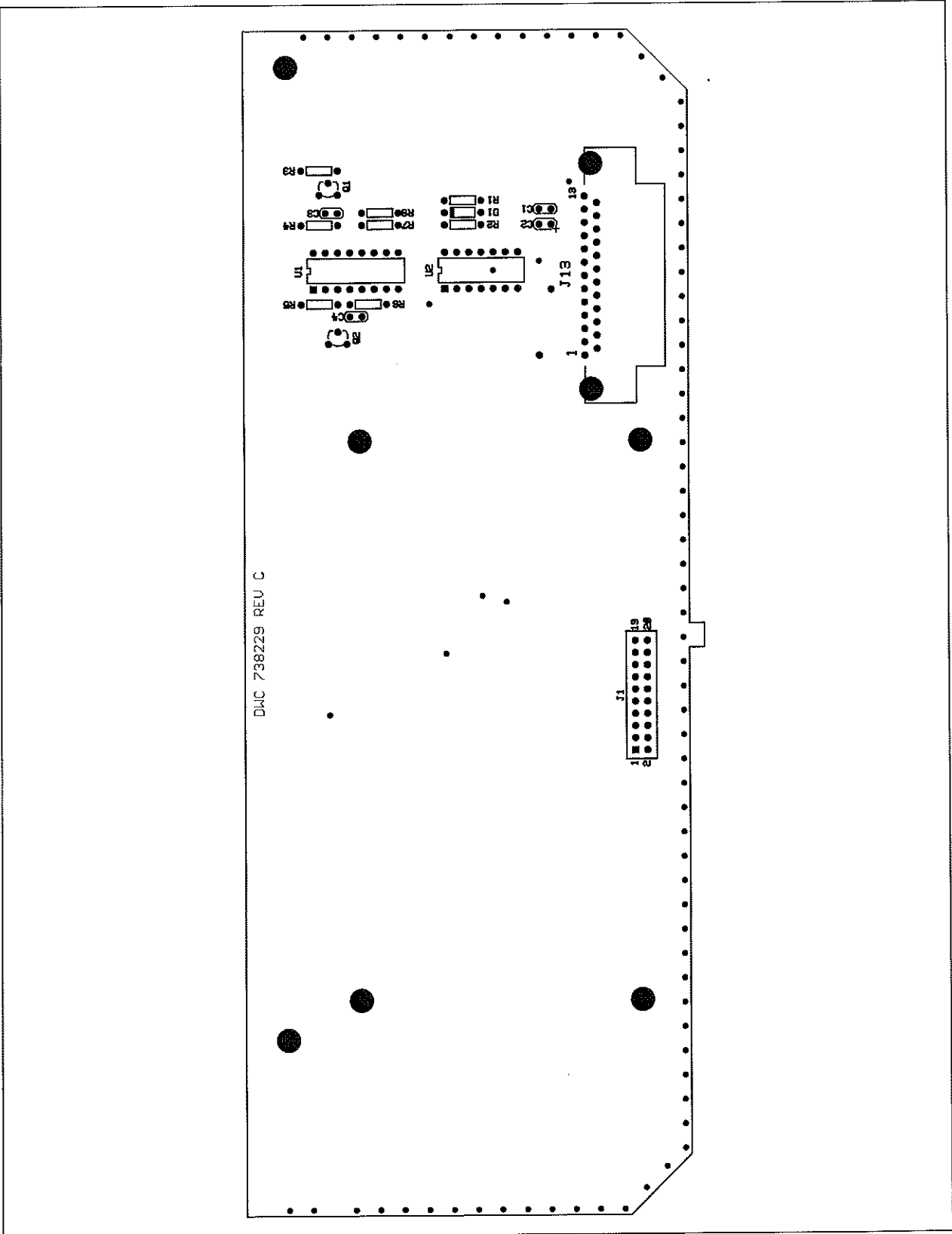


Figure 6-7. ALE Interface Component Locations (738229 Rev. C)

Table 6-2. ALE Interface Parts List (001-01301 Rev. D)

Designator	Part Number	Description
C1	275104	CAP,C,0.1U,50,10%,X,RA,.10SP
C2	241020	CAP,2.2MF DIP TANTALUM
C3	275104	CAP,C,0.1U,50,10%,X,RA,.10SP
C4	275104	CAP,C,0.1U,50,10%,X,RA,.10SP
D1	320002	DIODE,SI 100MA 1N4148/1N4150
J1	610292	CONN,2X10 LOW PROFILE SOCKET
J13	613163	CONN,DB-25 RT ANGLE PC PLUG
Q1	310057	XISTOR,NPN,PN2222A,TO92
Q2	310057	XISTOR,NPN,PN2222A,TO92
R1	113103	RES,10K 1/8W 5% CARBON FILM
R2	113103	RES,10K 1/8W 5% CARBON FILM
R3	1114751	RES 4.75K 1/8W 1% MF
R4	113103	RES,10K 1/8W 5% CARBON FILM
R5	113103	RES,10K 1/8W 5% CARBON FILM
R6	113101	RES,100 OHM 1/8W 5% CF
R7	113101	RES,100 OHM 1/8W 5% CF
R8	113101	RES,100 OHM 1/8W 5% CF
U1	330273	IC 74HC595
U2	330419	IC,74HC14 TRIGGER INVERTER

### 6.3 Clock Option (7000CLK)

This option adds a time keeping clock to the 7000-series radios. It is compatible with revision D and later processor boards, and revision I and later software.

**CAUTION: This option replaces a part of RAM with time-keeping RAM. Installing this option requires reprogramming the TW7000.**

To install this option follow the steps below. For component placement, refer to the figure below.

1. Turn the radio off and remove the top cover. Remove the board hold-down bars.
2. Using proper antistatic procedures and a board puller, locate and remove the Processor board.
3. Remove U4 and install a new U4 (330498) time-keeping RAM.
4. Move jumper J20 from AB to BC.
5. Reinsert the processor board in its guide.
6. Install a jumper on JU10D (this jumper clears the old RAM).
7. Power up the radio.
8. Remove the jumper from JU10D.
9. Reinstall the cover on the radio. When powered up, the clock is operational.

To set the time using the Alpha 9 function, refer to the TW7000-MSOP operator manual.

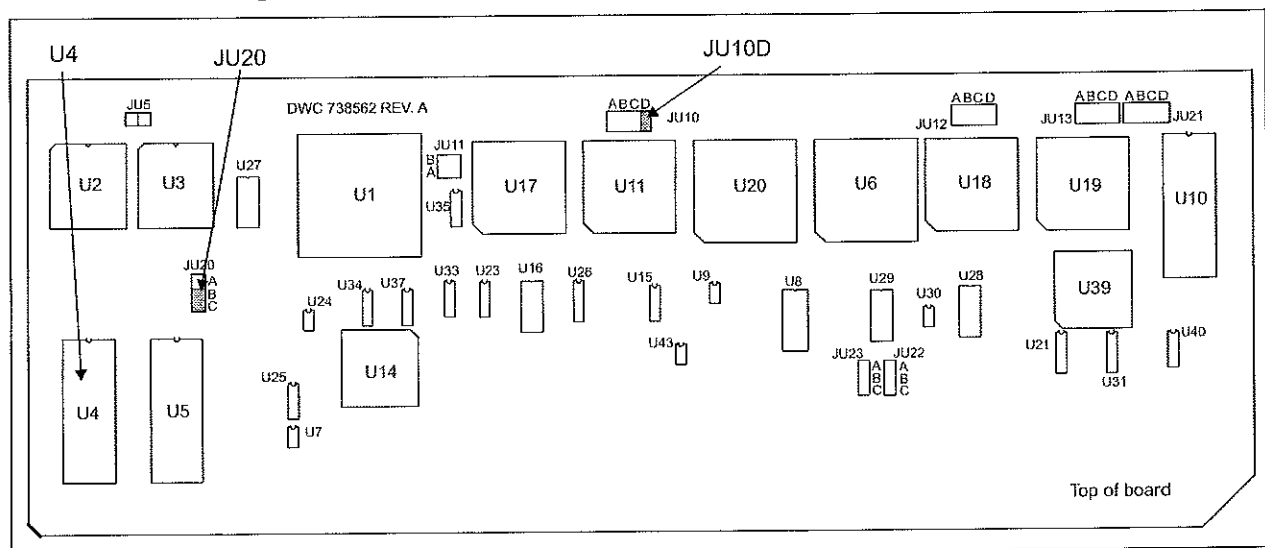


Figure 6-8. Clock Option Component and Jumper Placement

## 6.4 Data Interface Option (7000RS)

Radio communications via COM1 is standard RS-232. With this option COM1 can be set to RS422/423/485. Only COM1 is changed; COM2 remains RS-232.

To install this option, follow the steps below. For component and referenced jumper placement, refer to the figures below.

1. Turn the radio off and remove the cover. Remove the board hold-down bars.
2. Using proper antistatic procedures, locate and remove the Processor board using a board puller.
3. Set jumpers according to the "COM1 Jumper Settings" table on page 5-21.
4. Reinsert the Processor board.
5. Reinstall the hold-down bar and cover.

The selected interface standard is now available as COM1 at the Accessory 1 output connector in the back of the radio.

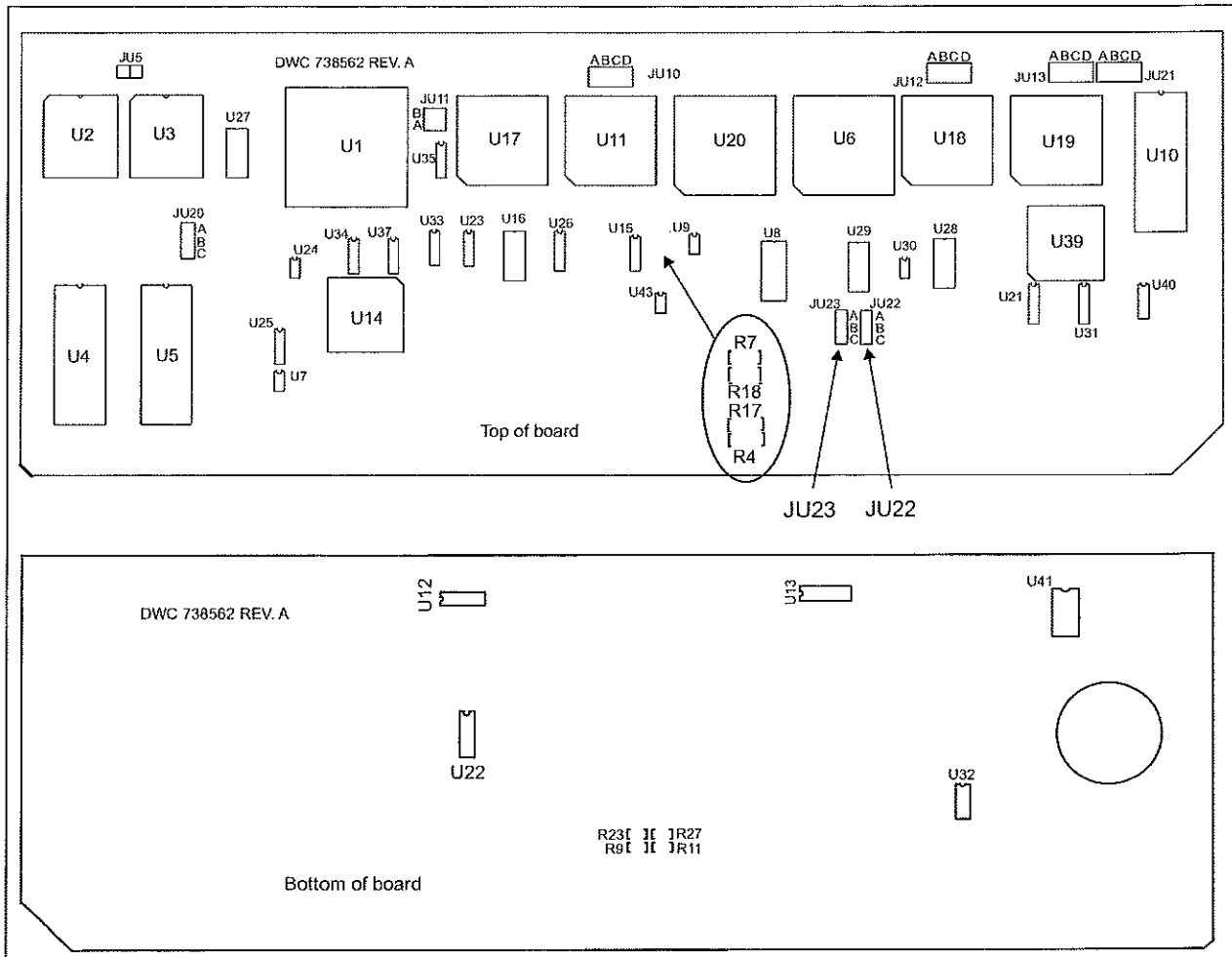


Figure 6-9. Data Interface Component and Jumper Placement

## 6.5 Encryption Option (7000ENCR)

This option provides an extremely secure voice encryption capability. It is compatible with revision F and later processor boards, and with software revision N or later. For installation into radios with processor boards of an earlier revision, contact DWC's Technical Support Services.

**Note:** *If the system has a narrowband antenna with a tuner, encryption must be off before attempting to tune the radio.*

To install the Encryption option:

1. Turn the TW7000 off and remove the top cover.
2. Remove the board hold-down bars.
3. Carefully insert the 7000ENCR board into the OPT2 slot.
4. Reinstall the hold-down bars and the cover.

Operational procedures for the TW7000 remain the same with this option installed. The only noticeable difference is the ability to turn encryption on and off. For complete operating instructions, refer to the 7000ENCR operator manual (7000ENCR-MSOP).

## 6.6 FSK Remote Control Option (7000RF)

This option provides complete voice and data service operation of the TW7000 over a 2-wire or 4-wire audio pair. It requires use of the TW7201F remote control head and the 7000RF internal FSK modem for the TW7000. The following configuration is standard:

### **Remote/Local Control**

Transceiver: TW7000

Internal FSK modem: 7000RF

Remote control head: TW7201F

Interface cable: C992307

The TW7201F is microprocessor-controlled and shares the line between audio and data control. The modem allows remote operation in conjunction with local radio operation with the radio as master in the system. A custom LCD provides channel, frequency data, feedback and other front-panel control functions, BITE information, and orderwire text messages. For a more detailed technical description, refer to the TW7201F technical manual (TW7201F-MS).

To install this option, follow the steps below. For component placement, refer to the figure below.

1. Turn the TW7000 off and remove the top cover. Remove the board hold-down bars.
2. Locate the Processor board and remove it using the board puller.

3. Using proper antistatic procedures, install U18 (033029). Install jumpers JU12B and JU11A.
4. Reinsert the Processor board.
5. Install the FSK Remote board in the FSK/ISDN slot. Verify that the board configuration is correct for the line configuration (2-wire or 4-wire).
6. Reinstall the hold down bar and the cover.

For operating information on this option, refer to the TW7201F operator manual (TW7201F-MSOP).

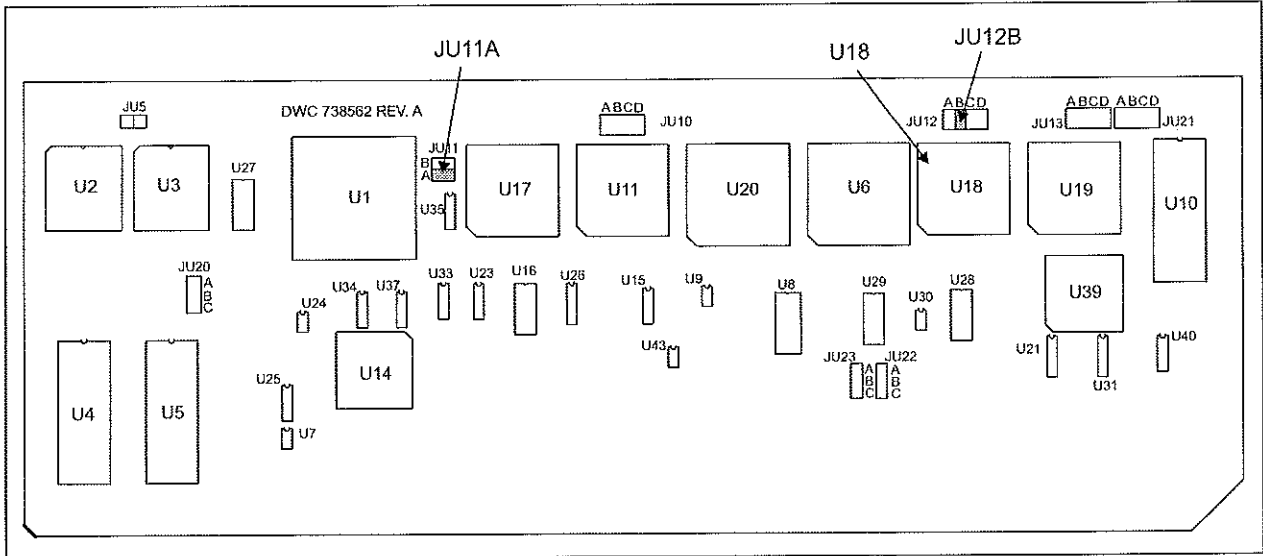
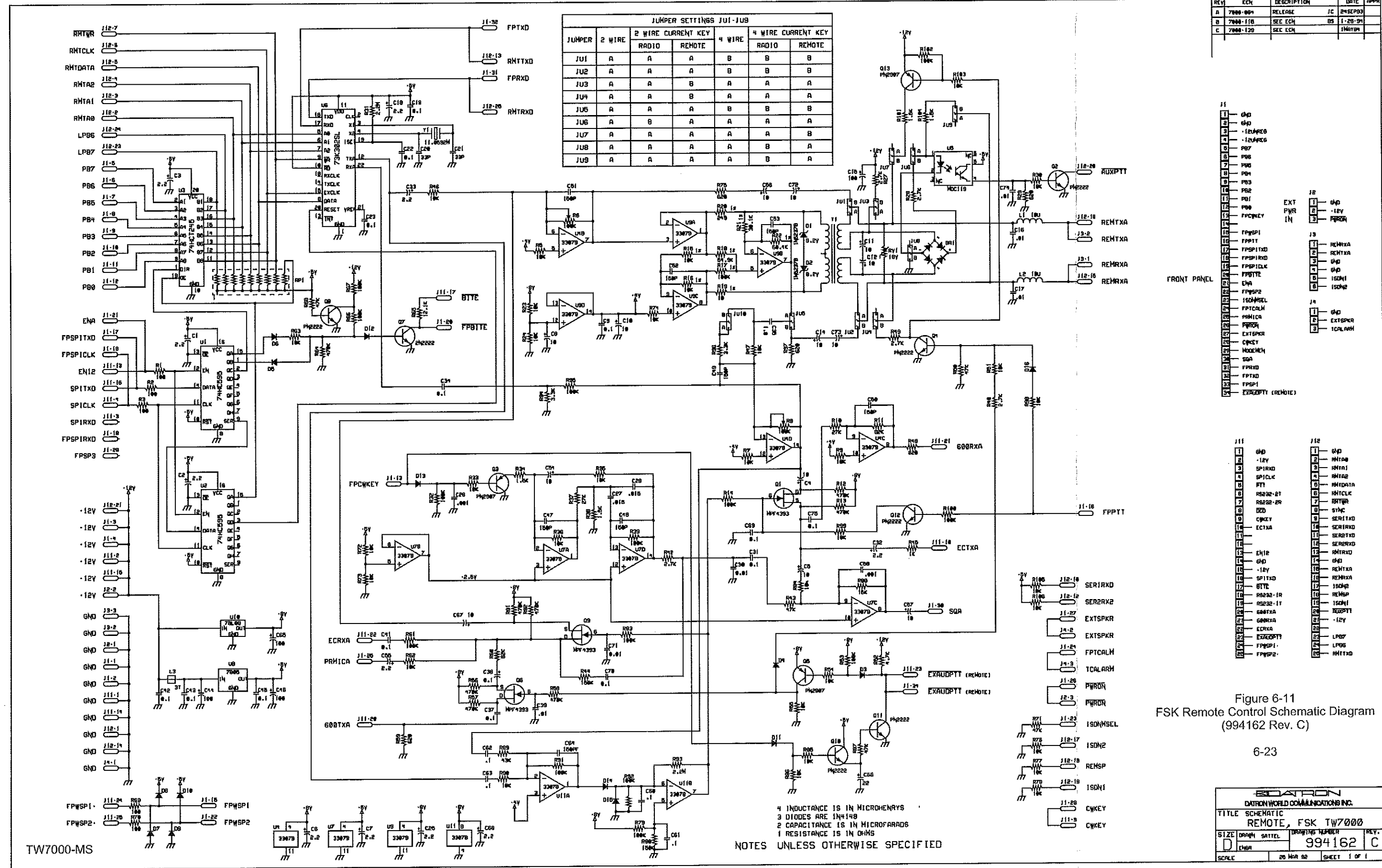


Figure 6-10. FSK Remote Control Jumper Placement

REV	ECH	DESCRIPTION	DATE	APPR
A	7000-001	RELEASE	JC	24SEP53
B	7000-118	SEE ECH	BS	1-23-54
C	7000-120	SEE ECH		1MAY54



JUMPER	2 WIRE	2 WIRE CURRENT KEY		4 WIRE CURRENT KEY	
		RADIO	REMOTE	RADIO	REMOTE
JU1	A	A	A	B	B
JU2	A	A	A	B	B
JU3	A	A	B	A	A
JU4	A	A	B	A	A
JU5	A	B	A	B	B
JU6	A	B	A	A	A
JU7	A	A	A	A	B
JU8	A	A	A	B	A
JU9	A	A	A	A	A

FRONT PANEL

J1	J2	J3	J4
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9
10	10	10	10
11	11	11	11
12	12	12	12
13	13	13	13
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99	99	99	99
100	100	100	100

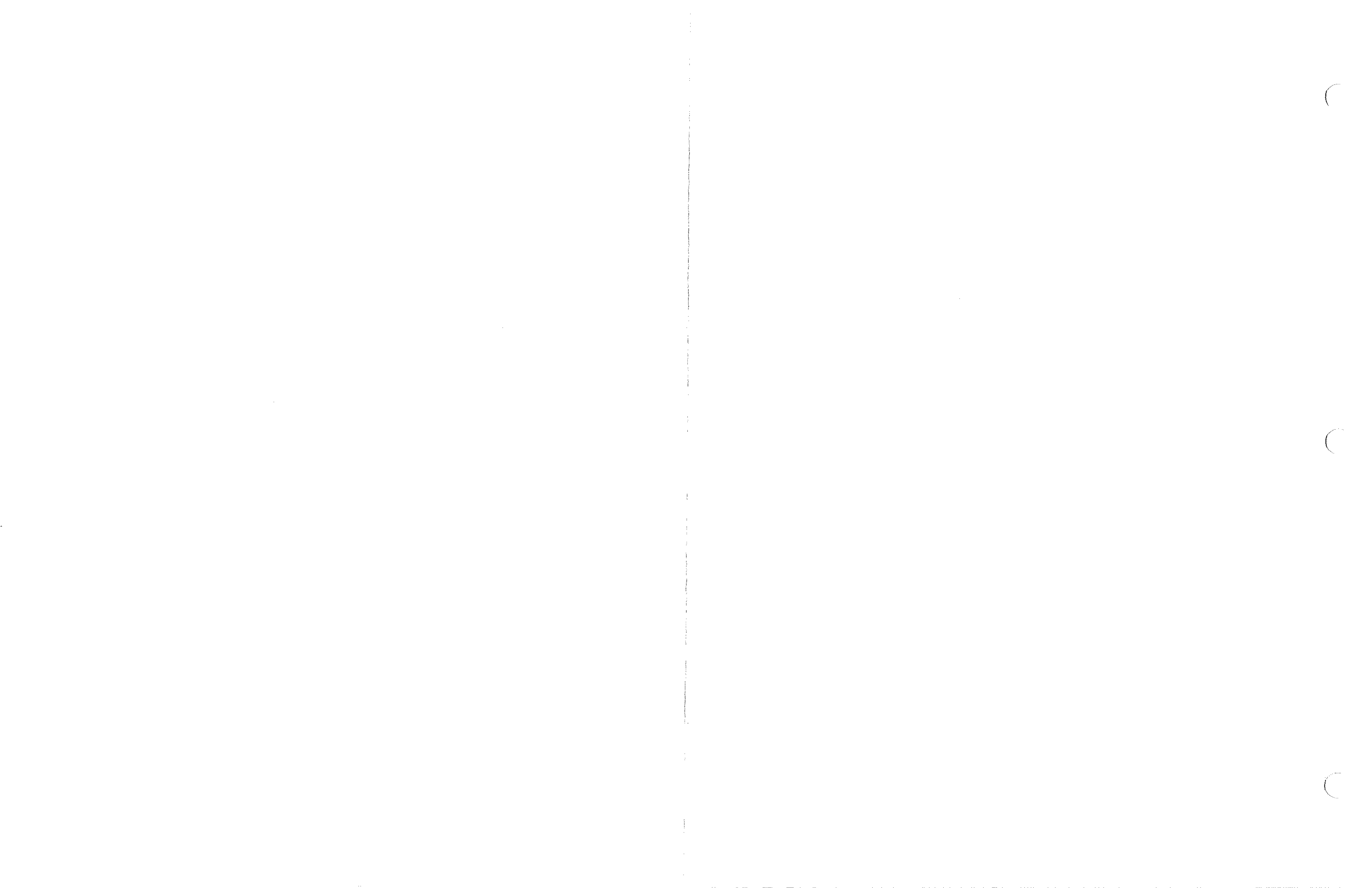
Figure 6-11  
FSK Remote Control Schematic Diagram  
(994162 Rev. C)

6-23

4 INDUCTANCE IS IN MICROHENRYS  
3 DIODES ARE 1N4148  
2 CAPACITANCE IS IN MICROFARADS  
1 RESISTANCE IS IN OHMS  
NOTES UNLESS OTHERWISE SPECIFIED

EDATRON DATRON WORLD COMMUNICATIONS INC.			
TITLE SCHEMATIC REMOTE, FSK TW7000			
SIZE	DRAWN	DATE	REV.
D	EMH	994162	C
SCALE	20 MAR 52	SHEET 1 OF 1	

TW7000-MS



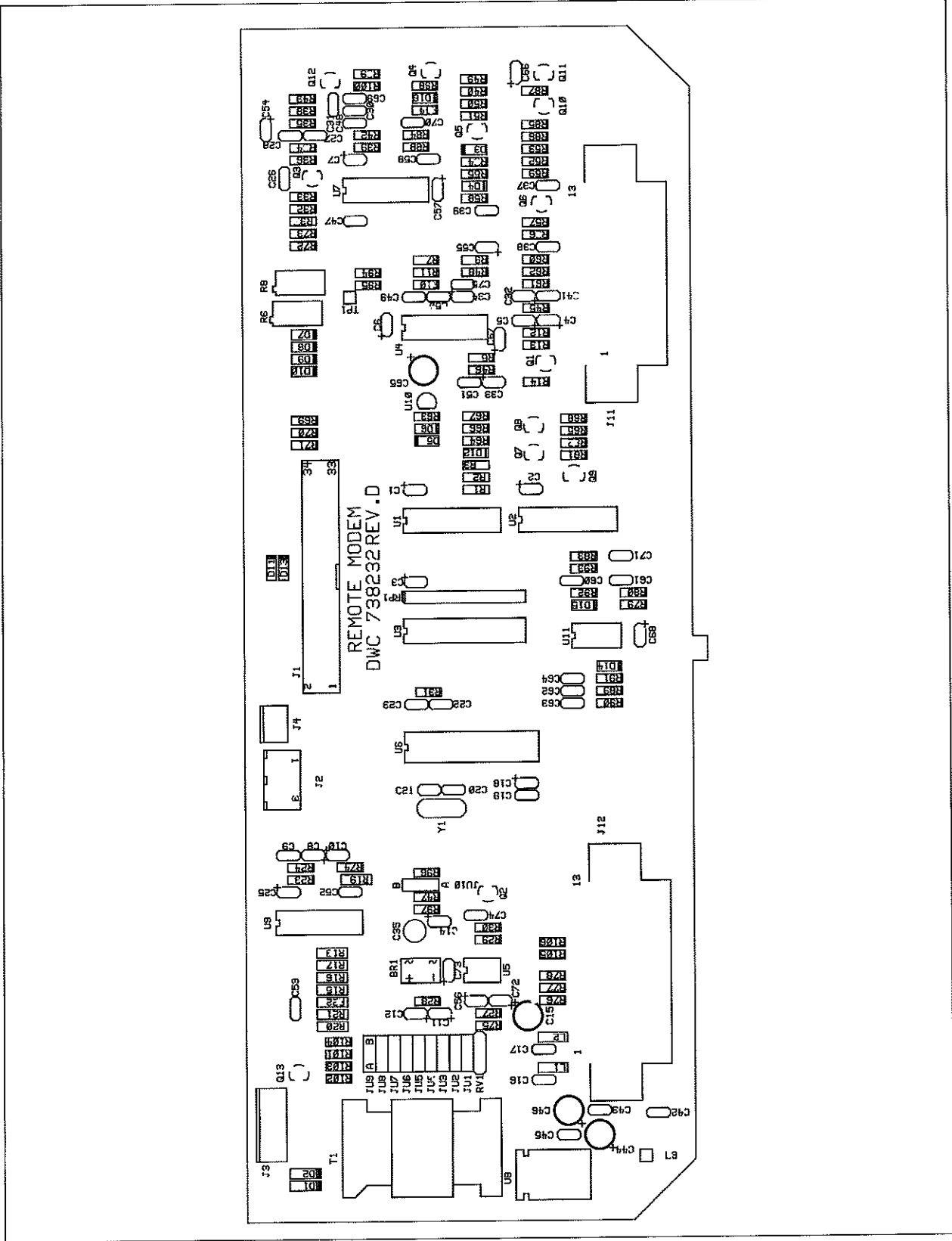


Figure 6-12. FSK Remote Control Component Locations (738232 Rev. D)

Table 6-3. FSK Remote Control Parts List (001-01402 Rev. L)

Designator	Part Number	Description
(U8)_	831403	WASHER INTERNAL LOCK #4 SS
BR1	320424	DIODE BRIDGE, DB102
C1	241020	CAP,2.2MF DIP TANTALUM
C10	241100	CAP,10MF DIP TANTALUM
C11	241100	CAP,10MF DIP TANTALUM
C12	241100	CAP,10MF DIP TANTALUM
C14	241100	CAP,10MF DIP TANTALUM
C15	231101	CAP,A,100U,16V,20%,RA .2SP
C16	214103	CAP,C,0.01U,50,10%,X,RA,.1SP
C17	214103	CAP,C,0.01U,50,10%,X,RA,.1SP
C18	241020	CAP,2.2MF DIP TANTALUM
C19	275104	CAP,C,0.1U,50,10%,X,RA,.10SP
C2	241020	CAP,2.2MF DIP TANTALUM
C20	210330	CAP,33 PF DISC NPO
C21	210330	CAP,33 PF DISC NPO
C22	275104	CAP,C,0.1U,50,10%,X,RA,.10SP
C23	275104	CAP,C,0.1U,50,10%,X,RA,.10SP
C25	241020	CAP,2.2MF DIP TANTALUM
C26	275102	CAP,C,.001UF,100V,5%,N,RA,.1SP
C27	254153	CAP,0.015MF 100V MYLAR
C28	254153	CAP,0.015MF 100V MYLAR
C3	241020	CAP,2.2MF DIP TANTALUM
C30	214103	CAP,C,0.01U,50,10%,X,RA,.1SP
C31	275104	CAP,C,0.1U,50,10%,X,RA,.10SP
C32	241020	CAP,2.2MF DIP TANTALUM
C33	241020	CAP,2.2MF DIP TANTALUM
C34	275104	CAP,C,0.1U,50,10%,X,RA,.10SP
C35	230010	CAP,1 MF 50V ELECT NON POLAR
C37	275104	CAP,C,0.1U,50,10%,X,RA,.10SP
C38	275104	CAP,C,0.1U,50,10%,X,RA,.10SP
C39	214103	CAP,C,0.01U,50,10%,X,RA,.1SP
C4	241100	CAP,10MF DIP TANTALUM
C41	275104	CAP,C,0.1U,50,10%,X,RA,.10SP

Table 6-3. FSK Remote Control Parts List (001-01402 Rev. L)

Designator	Part Number	Description
C42	275104	CAP,C,0.1U,50,10%,X,RA,.10SP
C43	275104	CAP,C,0.1U,50,10%,X,RA,.10SP
C44	231101	CAP,A,100U,16V,20%,RA .2SP
C45	275104	CAP,C,0.1U,50,10%,X,RA,.10SP
C46	231101	CAP,A,100U,16V,20%,RA .2SP
C47	210151	CAP,150 PF 10% DISC
C48	210151	CAP,150 PF 10% DISC
C49	210151	CAP,150 PF 10% DISC
C5	241100	CAP,10MF DIP TANTALUM
C50	210151	CAP,150 PF 10% DISC
C51	210151	CAP,150 PF 10% DISC
C52	210151	CAP,150 PF 10% DISC
C53	210151	CAP,150 PF 10% DISC
C54	241100	CAP,10MF DIP TANTALUM
C55	241020	CAP,2.2MF DIP TANTALUM
C56	241100	CAP,10MF DIP TANTALUM
C57	241100	CAP,10MF DIP TANTALUM
C58	275102	CAP,C,.001UF,100V,5%,N,RA,.1SP
C6	241020	CAP,2.2MF DIP TANTALUM
C60	275104	CAP,C,0.1U,50,10%,X,RA,.10SP
C61	275104	CAP,C,0.1U,50,10%,X,RA,.10SP
C62	275104	CAP,C,0.1U,50,10%,X,RA,.10SP
C63	275104	CAP,C,0.1U,50,10%,X,RA,.10SP
C64	210151	CAP,150 PF 10% DISC
C65	231101	CAP,A,100U,16V,20%,RA .2SP
C66	241226	CAP,T,22UF,25V,20%,RA,.1SP
C67	241100	CAP,10MF DIP TANTALUM
C68	241020	CAP,2.2MF DIP TANTALUM
C69	275104	CAP,C,0.1U,50,10%,X,RA,.10SP
C7	241020	CAP,2.2MF DIP TANTALUM
C70	275104	CAP,C,0.1U,50,10%,X,RA,.10SP
C71	214103	CAP,C,0.01U,50,10%,X,RA,.1SP
C72	241100	CAP,10MF DIP TANTALUM

Table 6-3. FSK Remote Control Parts List (001-01402 Rev. L)

Designator	Part Number	Description
C73	241100	CAP,10MF DIP TANTALUM
C74	214103	CAP,C,0.01U,50,10%,X,RA,.1SP
C75	275104	CAP,C,0.1U,50,10%,X,RA,.10SP
C8	241100	CAP,10MF DIP TANTALUM
C9	275104	CAP,C,0.1U,50,10%,X,RA,.10SP
D1	320202	DIODE, ZENER 8.2V 1N5237B
D10	320002	DIODE,SI 100MA 1N4148/1N4150
D11	320002	DIODE,SI 100MA 1N4148/1N4150
D12	320002	DIODE,SI 100MA 1N4148/1N4150
D13	320002	DIODE,SI 100MA 1N4148/1N4150
D14	320002	DIODE,SI 100MA 1N4148/1N4150
D15	320002	DIODE,SI 100MA 1N4148/1N4150
D16	320002	DIODE,SI 100MA 1N4148/1N4150
D2	320202	DIODE, ZENER 8.2V 1N5237B
D3	320002	DIODE,SI 100MA 1N4148/1N4150
D4	320002	DIODE,SI 100MA 1N4148/1N4150
D5	320002	DIODE,SI 100MA 1N4148/1N4150
D6	320002	DIODE,SI 100MA 1N4148/1N4150
D7	320002	DIODE,SI 100MA 1N4148/1N4150
D8	320002	DIODE,SI 100MA 1N4148/1N4150
D9	320002	DIODE,SI 100MA 1N4148/1N4150
J1	620038	CONN HDR 2X17 SHROUDED PC MNT
J11	613163	CONN,DB-25 RT ANGLE PC PLUG
J12	613163	CONN,DB-25 RT ANGLE PC PLUG
J2	610209	HEADER,MLX,3PIN,.156,POLAR
J3	610103	HEADER,MLX,6PIN,.100
J4	610285	HEADER,MLX,3PIN,.100,
JU1	620040	MALE HEADER 15 PIN 3X5
JU10	620030	HEADER,3 PIN .025 SQ POST
JU2	620040	MALE HEADER 15 PIN 3X5
JU3	620040	MALE HEADER 15 PIN 3X5
JU4	620040	MALE HEADER 15 PIN 3X5
JU5	620040	MALE HEADER 15 PIN 3X5

Table 6-3. FSK Remote Control Parts List (001-01402 Rev. L)

Designator	Part Number	Description
JU6	614004	HEADER 3X4 .1 LEAD SPACING
JU7	614004	HEADER 3X4 .1 LEAD SPACING
JU8	614004	HEADER 3X4 .1 LEAD SPACING
JU9	614004	HEADER 3X4 .1 LEAD SPACING
L1	430029	INDUCTOR,10 UH 10% FIXED MOLD
L2	430029	INDUCTOR,10 UH 10% FIXED MOLD
L3	459032	IND ASY,3T#30 MAGNET 1-490201
Q1	310046	XISTOR,JFET,NCH,MPF4393,TO92
Q10	310057	XISTOR,NPN,PN2222A,TO92
Q11	310057	XISTOR,NPN,PN2222A,TO92
Q12	310057	XISTOR,NPN,PN2222A,TO92
Q13	310052	XISTOR,PNP,PN2907A,TO92
Q2	310057	XISTOR,NPN,PN2222A,TO92
Q3	310052	XISTOR,PNP,PN2907A,TO92
Q4	310057	XISTOR,NPN,PN2222A,TO92
Q5	310052	XISTOR,PNP,PN2907A,TO92
Q6	310046	XISTOR,JFET,NCH,MPF4393,TO92
Q7	310057	XISTOR,NPN,PN2222A,TO92
Q8	310057	XISTOR,NPN,PN2222A,TO92
Q9	310046	XISTOR,JFET,NCH,MPF4393,TO92
R1	113101	RES,100 OHM 1/8W 5% CF
R10	113273	RES,27K 1/8W 5% CARBON FILM
R100	113104	RES,100K 1/8W 5% CARBON FILM
R101	113152	RES,1.5K 1/8W 5% CARBON FILM
R102	113104	RES,100K 1/8W 5% CARBON FILM
R103	113103	RES,10K 1/8W 5% CARBON FILM
R104	113152	RES,1.5K 1/8W 5% CARBON FILM
R105	113103	RES,10K 1/8W 5% CARBON FILM
R106	113103	RES,10K 1/8W 5% CARBON FILM
R11	113823	RES,82K 1/8W 5% CARBON FILM
R12	113474	RES,470K 1/8W 5% CARBON FILM
R13	113474	RES,470K 1/8W 5% CARBON FILM
R14	113104	RES,100K 1/8W 5% CARBON FILM

Table 6-3. FSK Remote Control Parts List (001-01402 Rev. L)

Designator	Part Number	Description
R15	1111002	RES,10K 1/8W 1% FILM
R16	1111002	RES,10K 1/8W 1% FILM
R17	1111003	RES,100K 1/8W 1% FILM
R18	1115492	RES,54.9K 1/8W METAL FILM
R19	113100	RES,10 OHM 1/8W 5% FILM
R2	113101	RES,100 OHM 1/8W 5% CF
R20	1112490	RES,249 OHM 1/8W 1% FILM
R21	1113012	RES,30.1K 1/4W 1% FILM
R22	1116042	RES,60.4K 1/8W 1%
R23	113103	RES,10K 1/8W 5% CARBON FILM
R24	113103	RES,10K 1/8W 5% CARBON FILM
R27	113272	RES,2.7K 1/8W 5% CARBON FILM
R28	113272	RES,2.7K 1/8W 5% CARBON FILM
R29	113621	RES,620 OHM 1/8W 5% CF
R3	113101	RES,100 OHM 1/8W 5% CF
R30	113103	RES,10K 1/8W 5% CARBON FILM
R31	113225	RES,2.2M OHM 1/8W 5%
R32	113104	RES,100K 1/8W 5% CARBON FILM
R33	113103	RES,10K 1/8W 5% CARBON FILM
R34	113152	RES,1.5K 1/8W 5% CARBON FILM
R35	113103	RES,10K 1/8W 5% CARBON FILM
R36	113103	RES,10K 1/8W 5% CARBON FILM
R37	113273	RES,27K 1/8W 5% CARBON FILM
R38	113152	RES,1.5K 1/8W 5% CARBON FILM
R39	113104	RES,100K 1/8W 5% CARBON FILM
R40	113272	RES,2.7K 1/8W 5% CARBON FILM
R42	113272	RES,2.7K 1/8W 5% CARBON FILM
R43	113473	RES,47K 1/8W 5% CARBON FILM
R44	113154	RES,150K 1/8W 5% CARBON FILM
R45	113102	RES, 1K, 1/8W, 5%, CF
R46	113103	RES,10K 1/8W 5% CARBON FILM
R47	113103	RES,10K 1/8W 5% CARBON FILM
R48	113621	RES,620 OHM 1/8W 5% CF

Table 6-3. FSK Remote Control Parts List (001-01402 Rev. L)

Designator	Part Number	Description
R49	113272	RES,2.7K 1/8W 5% CARBON FILM
R5	113103	RES,10K 1/8W 5% CARBON FILM
R50	113473	RES,47K 1/8W 5% CARBON FILM
R51	113103	RES,10K 1/8W 5% CARBON FILM
R52	113472	RES,4.7K 1/8W 5% CARBON FILM
R53	113104	RES,100K 1/8W 5% CARBON FILM
R54	113103	RES,10K 1/8W 5% CARBON FILM
R55	113103	RES,10K 1/8W 5% CARBON FILM
R56	113474	RES,470K 1/8W 5% CARBON FILM
R57	113474	RES,470K 1/8W 5% CARBON FILM
R58	113474	RES,470K 1/8W 5% CARBON FILM
R59	113621	RES,620 OHM 1/8W 5% CF
R6	170334	RES,100K TRIM SIDE ADJ
R60	113823	RES,82K 1/8W 5% CARBON FILM
R61	113104	RES,100K 1/8W 5% CARBON FILM
R62	113103	RES,10K 1/8W 5% CARBON FILM
R63	113103	RES,10K 1/8W 5% CARBON FILM
R64	113474	RES,470K 1/8W 5% CARBON FILM
R65	1111212	RES, 12.1Kohm 1% 1/8W MF
R66	113104	RES,100K 1/8W 5% CARBON FILM
R67	113104	RES,100K 1/8W 5% CARBON FILM
R68	113473	RES,47K 1/8W 5% CARBON FILM
R69	113101	RES,100 OHM 1/8W 5% CF
R7	113103	RES,10K 1/8W 5% CARBON FILM
R70	113101	RES,100 OHM 1/8W 5% CF
R71	113473	RES,47K 1/8W 5% CARBON FILM
R72	113103	RES,10K 1/8W 5% CARBON FILM
R73	113103	RES,10K 1/8W 5% CARBON FILM
R74	113103	RES,10K 1/8W 5% CARBON FILM
R75	113621	RES,620 OHM 1/8W 5% CF
R76	113103	RES,10K 1/8W 5% CARBON FILM
R77	113103	RES,10K 1/8W 5% CARBON FILM
R78	113103	RES,10K 1/8W 5% CARBON FILM

**Table 6-3. FSK Remote Control Parts List (001-01402 Rev. L)**

Designator	Part Number	Description
R79	113104	RES,100K 1/8W 5% CARBON FILM
R8	170334	RES,100K TRIM SIDE ADJ
R80	113154	RES,150K 1/8W 5% CARBON FILM
R81	113474	RES,470K 1/8W 5% CARBON FILM
R82	113474	RES,470K 1/8W 5% CARBON FILM
R83	113104	RES,100K 1/8W 5% CARBON FILM
R84	113103	RES,10K 1/8W 5% CARBON FILM
R85	113103	RES,10K 1/8W 5% CARBON FILM
R86	113103	RES,10K 1/8W 5% CARBON FILM
R87	113473	RES,47K 1/8W 5% CARBON FILM
R88	113153	RES,15K 1/8W 5% CARBON FILM
R89	113433	RES,43K 1/8W 5% CARBON FILM
R9	113103	RES,10K 1/8W 5% CARBON FILM
R90	113103	RES,10K 1/8W 5% CARBON FILM
R91	113104	RES,100K 1/8W 5% CARBON FILM
R92	113104	RES,100K 1/8W 5% CARBON FILM
R93	113225	RES,2.2M OHM 1/8W 5%
R94	113332	RES,3.3K 1/8W 5% CARBON FILM
R95	113104	RES,100K 1/8W 5% CARBON FILM
R96	113332	RES,3.3K 1/8W 5% CARBON FILM
R97	113621	RES,620 OHM 1/8W 5% CF
R98	113103	RES,10K 1/8W 5% CARBON FILM
R99	113103	RES,10K 1/8W 5% CARBON FILM
RP1	182015	RES PACK,10K X 9
RV1	350003	VARISTOR 18 VOLT
T1	410060	XFMR,DATA MODEM COUPLING
U1	330273	IC 74HC595
U10	330018	IC,VREG,78L08,TO94,8V
U11	330368	IC,MC33078
U2	330273	IC 74HC595
U3	330504	IC, BUFFER
U4	330322	IC, MC33079P
U5	320701	COUPLER OPTO DIP

**Table 6-3. FSK Remote Control Parts List (001-01402 Rev. L)**

<b>Designator</b>	<b>Part Number</b>	<b>Description</b>
U6	330394	IC,73K302SL-1P MODEM
U7	330322	IC, MC33079P
U8	330015	IC,VREG,7805,TO220,5V
U9	330322	IC, MC33079P
Y1	361086	XTAL,11.0592 MHZ

## 6.7 High-Stability Option (7000HS)

7000HS provides 0.1 ppm frequency stability to the 7000-series of HF transceivers (3 Hz at 30 MHz). It replaces the standard Reference/Control board with one that has a precision OCXO in place of the standard crystal oscillator.

To install this option:

1. Turn the TW7000 off and remove the top cover.
2. Remove the board hold-down bars.
3. Locate the standard Reference/Control board and remove it with the board puller. Remove the J61 reference coax connection.
4. Reinsert the new high stability Reference/Control board. Reconnect J61 coax connection and slide the new board into the Ref Control slot.
5. Test the transmit operation of the TW7000. Check the power output. Check output frequency only if an accurate counter/standard is available.
6. If adjustments are required for power or frequency, adjust as shown in the "Reference/Control Board" section on page 4-11. For the frequency setting, allow for a 15 minute warm up period before measuring the frequency. If it needs to be adjusted, remove the screw on the OCXO and set the frequency using the internal potentiometer. Replace the screw.

---

**CAUTION: When adjusting the frequency of the high-stability oscillator, make sure the standard used for the counter is better than 0.1 ppm.**

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7. Reinstall the hold-down bars and top cover.

REV	ECN	DESCRIPTION	DATE	APPR
A	02-0118	RELEASE	3-07-02	

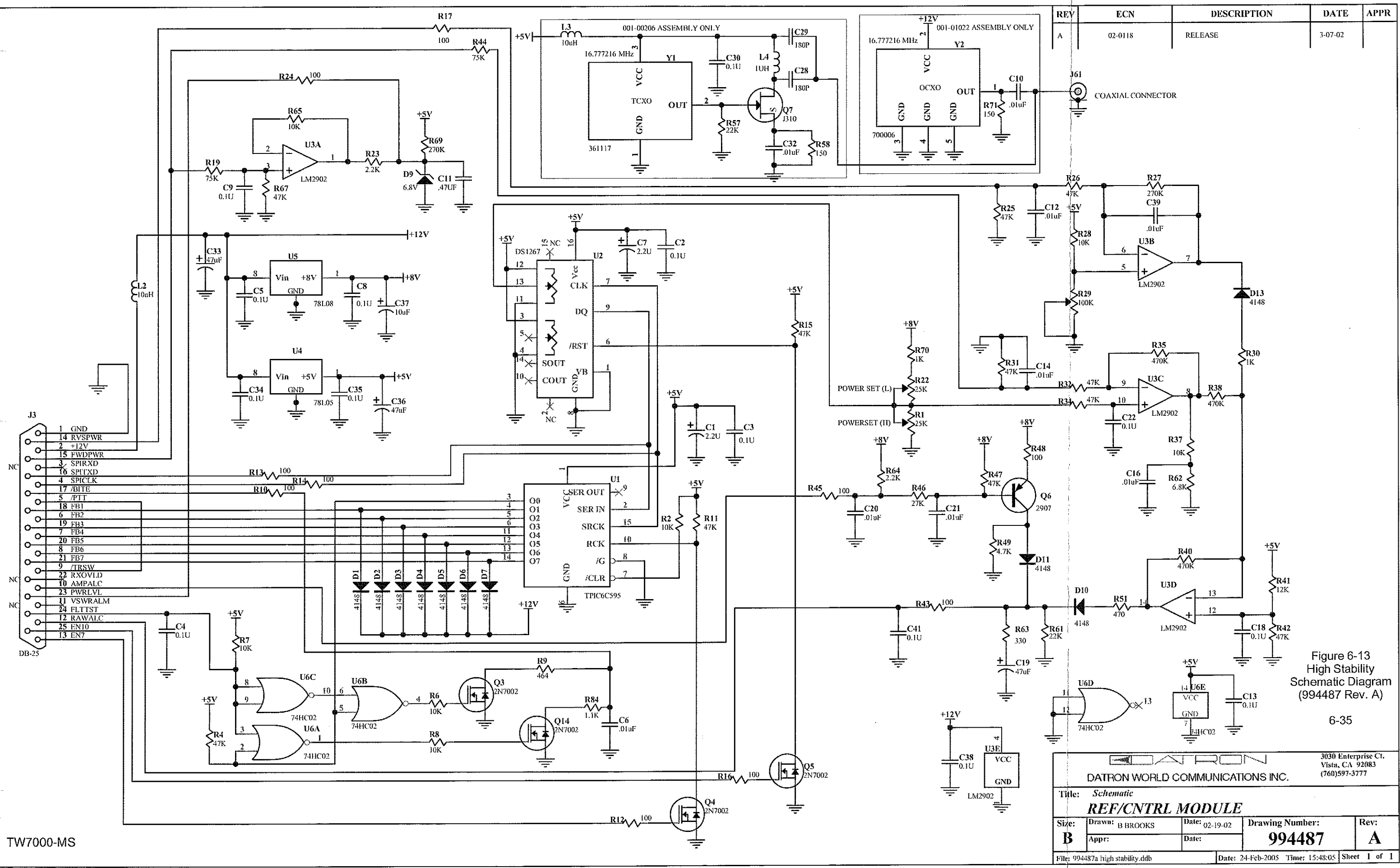
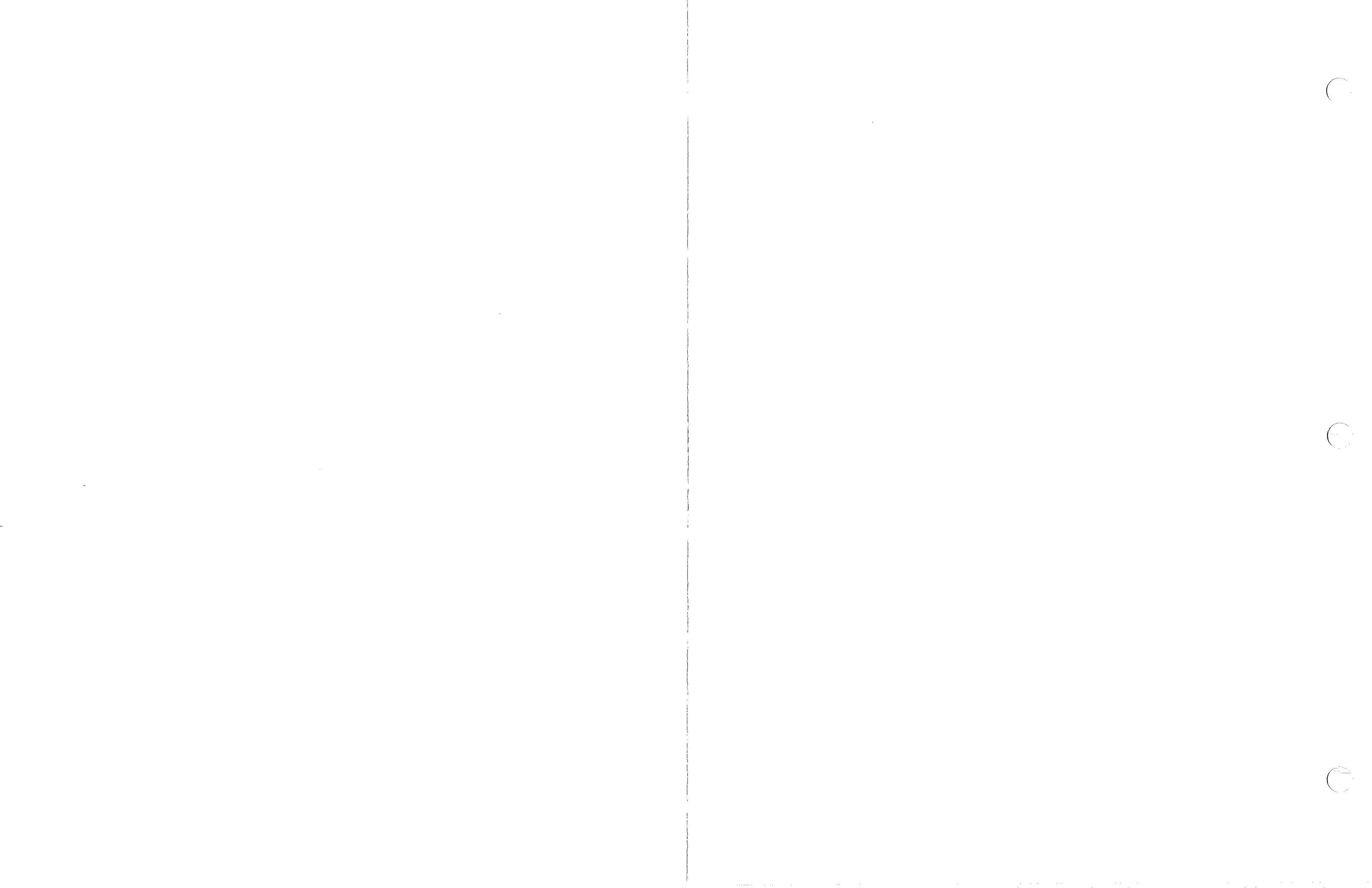


Figure 6-13  
High Stability  
Schematic Diagram  
(994487 Rev. A)

6-35

<b>DATRON</b>		3030 Enterprise Ct. Vista, CA 92083 (760)597-3777	
DATRON WORLD COMMUNICATIONS INC.			
Title: <i>Schematic</i> <b>REF/CNTRL MODULE</b>			
Size: <b>B</b>	Drawn: B BROOKS	Date: 02-19-02	Drawing Number: <b>994487</b>
Appr:	Date:		Rev: <b>A</b>
File: 994487a high stability.ddb		Date: 24-Feb-2005	Time: 15:48:05
		Sheet	1 of 1

TW7000-MS



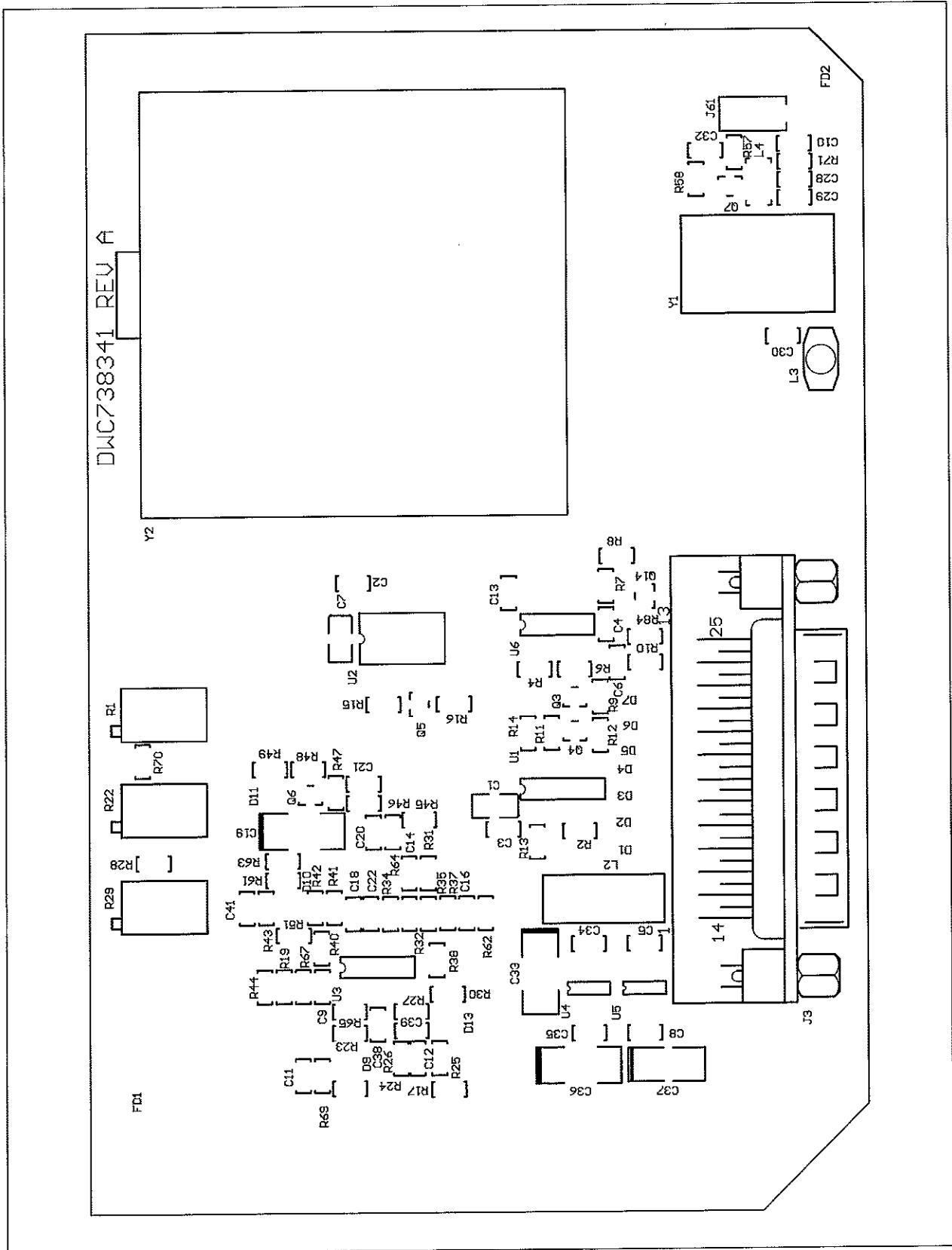


Figure 6-14. High Stability Component Locations (738341 Rev. A)

Table 6-4. High Stability Parts List (001-01022 Rev. A)

Designator	Part Number	Description
C1	022225000	CAP SM T 2.2U 16V 10% 3528
C10	021103000	CAP SM .01U 5% 0805
C11	021471003	CAP SM C .47UF 25V 0805
C12	021103000	CAP SM .01U 5% 0805
C13	021104000	CAP SM C 0.1U 25V 5% 0805
C14	021103000	CAP SM .01U 5% 0805
C16	021103000	CAP SM .01U 5% 0805
C18	021104000	CAP SM C 0.1U 25V 5% 0805
C19	022476000	CAP,SM,TANT,47uF,20V,20% 7343
C2	021104000	CAP SM C 0.1U 25V 5% 0805
C20	021103000	CAP SM .01U 5% 0805
C21	021103000	CAP SM .01U 5% 0805
C22	021104000	CAP SM C 0.1U 25V 5% 0805
C3	021104000	CAP SM C 0.1U 25V 5% 0805
C33	022476000	CAP,SM,TANT,47uF,20V,20% 7343
C34	021104000	CAP SM C 0.1U 25V 5% 0805
C35	021104000	CAP SM C 0.1U 25V 5% 0805
C36	022476000	CAP,SM,TANT,47uF,20V,20% 7343
C37	022106001	CAP SM T 10UF 16V 10% 6032
C38	021104000	CAP SM C 0.1U 25V 5% 0805
C39	021103000	CAP SM .01U 5% 0805
C4	021103000	CAP SM .01U 5% 0805
C41	021104000	CAP SM C 0.1U 25V 5% 0805
C5	021104000	CAP SM C 0.1U 25V 5% 0805
C6	021103000	CAP SM .01U 5% 0805
C7	022225000	CAP SM T 2.2U 16V 10% 3528
C8	021104000	CAP SM C 0.1U 25V 5% 0805
C9	021104000	CAP SM C 0.1U 25V 5% 0805
D1	037700005	DIODE,SM,MMBD4148,SOT-23
D10	037700005	DIODE,SM,MMBD4148,SOT-23
D11	037700005	DIODE,SM,MMBD4148,SOT-23
D13	037700005	DIODE,SM,MMBD4148,SOT-23
D2	037700005	DIODE,SM,MMBD4148,SOT-23

Table 6-4. High Stability Parts List (001-01022 Rev. A)

Designator	Part Number	Description
D3	037700005	DIODE,SM,MMBD4148,SOT-23
D4	037700005	DIODE,SM,MMBD4148,SOT-23
D5	037700005	DIODE,SM,MMBD4148,SOT-23
D6	037700005	DIODE,SM,MMBD4148,SOT-23
D7	037700005	DIODE,SM,MMBD4148,SOT-23
D9	037703002	DIODE, ZENER 6.8V SMD SOT-23
J3	613163	CONN,DB-25 RT ANGLE PC PLUG
J61	614024	CONN,RF FEMALE-TYPE A RECEPT
L2	041103002	IND SM 10UH 15% 4825
Q14	032005	XISTOR,2N7002 SMT SOT-23
Q3	032005	XISTOR,2N7002 SMT SOT-23
Q4	032005	XISTOR,2N7002 SMT SOT-23
Q5	032005	XISTOR,2N7002 SMT SOT-23
Q6	032006	XISTOR,MMB2907 SMT SOT-23EBC
R1	170335	RES, 25K TRIM SIDE ADJ
R10	013101000	RES SM CF 100R 0.1W 5% 0805
R11	013473000	RES SM CF 47K 0.1W 5% 0805
R12	013101000	RES SM CF 100R 0.1W 5% 0805
R13	013101000	RES SM CF 100R 0.1W 5% 0805
R14	013101000	RES SM CF 100R 0.1W 5% 0805
R15	013473000	RES SM CF 47K 0.1W 5% 0805
R16	013101000	RES SM CF 100R 0.1W 5% 0805
R17	013101000	RES SM CF 100R 0.1W 5% 0805
R19	013753000	RES,SM CF 75K 0.1W 5% 0805
R2	013103000	RES SM CF 10K 0.1W 5% 0805
R22	170335	RES, 25K TRIM SIDE ADJ
R23	013222000	RES SM CF 2.2K 0.1W 5% 0805
R24	013101000	RES SM CF 100R 0.1W 5% 0805
R25	013473000	RES SM CF 47K 0.1W 5% 0805
R26	013473000	RES SM CF 47K 0.1W 5% 0805
R27	013274000	RES SM CF 270K 0.1W 5% 0805
R28	013103000	RES SM CF 10K 0.1W 5% 0805
R29	170334	RES,100K TRIM SIDE ADJ

Table 6-4. High Stability Parts List (001-01022 Rev. A)

Designator	Part Number	Description
R30	013102000	RES SM CF 1K 0.1W 5% 0805
R31	013473000	RES SM CF 47K 0.1W 5% 0805
R32	013473000	RES SM CF 47K 0.1W 5% 0805
R34	013473000	RES SM CF 47K 0.1W 5% 0805
R35	013474000	RES SM CF 470K 0.1W 5% 0805
R37	013103000	RES SM CF 10K 0.1W 5% 0805
R38	013474000	RES SM CF 470K 0.1W 5% 0805
R4	013473000	RES SM CF 47K 0.1W 5% 0805
R40	013474000	RES SM CF 470K 0.1W 5% 0805
R41	013123000	RES SM CF 12K 0.1W 5% 0805
R42	013473000	RES SM CF 47K 0.1W 5% 0805
R43	013101000	RES SM CF 100R 0.1W 5% 0805
R44	013753000	RES,SM CF 75K 0.1W 5% 0805
R45	013101000	RES SM CF 100R 0.1W 5% 0805
R46	013273000	RES SM CF 27K 0.1W 5% 0805
R47	013473000	RES SM CF 47K 0.1W 5% 0805
R48	013101000	RES SM CF 100R 0.1W 5% 0805
R49	013472000	RES SM CF 4.7K 0.1W 5% 0805
R51	013471000	RES SM CF 470R 0.1W 5% 0805
R6	013103000	RES SM CF 10K 0.1W 5% 0805
R61	013223000	RES SM CF 22K 0.1W 5% 0805
R62	013682000	RES SM CF 6.8K 0.1W 5% 0805
R63	013331000	RES SM CF 330 0.1W 5% 0805
R64	013222000	RES SM CF 2.2K 0.1W 5% 0805
R65	013103000	RES SM CF 10K 0.1W 5% 0805
R67	013473000	RES SM CF 47K 0.1W 5% 0805
R69	013274000	RES SM CF 270K 0.1W 5% 0805
R7	013103000	RES SM CF 10K 0.1W 5% 0805
R70	013102000	RES SM CF 1K 0.1W 5% 0805
R71	013151000	RES SM CF 150R 0.1W 5% 0805
R8	013103000	RES SM CF 10K 0.1W 5% 0805
R84	013110100	RES,SM TK 1.1KOHM 0.1W 1% 0805
R9	013464000	RES,SM TK 464OHM 0.1W 1% 0805

**Table 6-4. High Stability Parts List (001-01022 Rev. A)**

Designator	Part Number	Description
U1	033087	IC,8BIT SHIFT,TPIC6C595,SO-16
U2	033305003	IC,10K DIG POTX2 DS1267,SOW-16
U3	033304000	IC,SM,LM2902D,QUAD-OP,SO-14
U4	033003	IC, 78L05, SM, SOP-8
U5	033002	IC, 78L08, SM, SOP-8
U6	033081	IC,MC74HC02AD, SO-14 751A-02
Y2	700006	OEXO,16.777216 MHZ .1 PPM

## 6.8 ISDN Remote Control Option (7000RI)

The 7000RI provides complete voice and data service operation of the TW7000 over a 2-wire ISDN pair. It requires the TW7201I remote control head and the 7000RI internal ISDN modem for the TW7000. The following configuration is standard:

### **Remote/Local Control**

Transceiver: TW7000

Internal ISDN modem: 7000RI

Remote control head: TW7201I

Interface cable: C992307

The TW7201I is microprocessor controlled and features two full-duplex data channels as well as a full-duplex digitized voice channel. The modem allows high-speed remote operation in conjunction with local radio operation. For a detailed technical description, refer to the TW7201I technical manual (TW7201I-MS). For information on its operation, refer to the TW7201I operator manual (TW7201I-MSOP).

To install this option, follow the steps below. For component placement, refer to the figure below.

1. Turn the TW7000 off and remove the top cover. Remove the board hold-down bars.
2. Locate the Processor board and remove it using the board puller. Using proper anti-static procedures, install U18 (033029) as shown below. Install jumpers JU12A and JU11A.
3. Reinsert the Processor board into the guide.
4. Install the ISDN Remote board in the FSK/ISDN slot.
5. Replace the hold-down bars and the cover of the TW7000.
6. If Com1 is used at the 7201I Accessory1 connector, move JU22 and JU23 to position B-C.

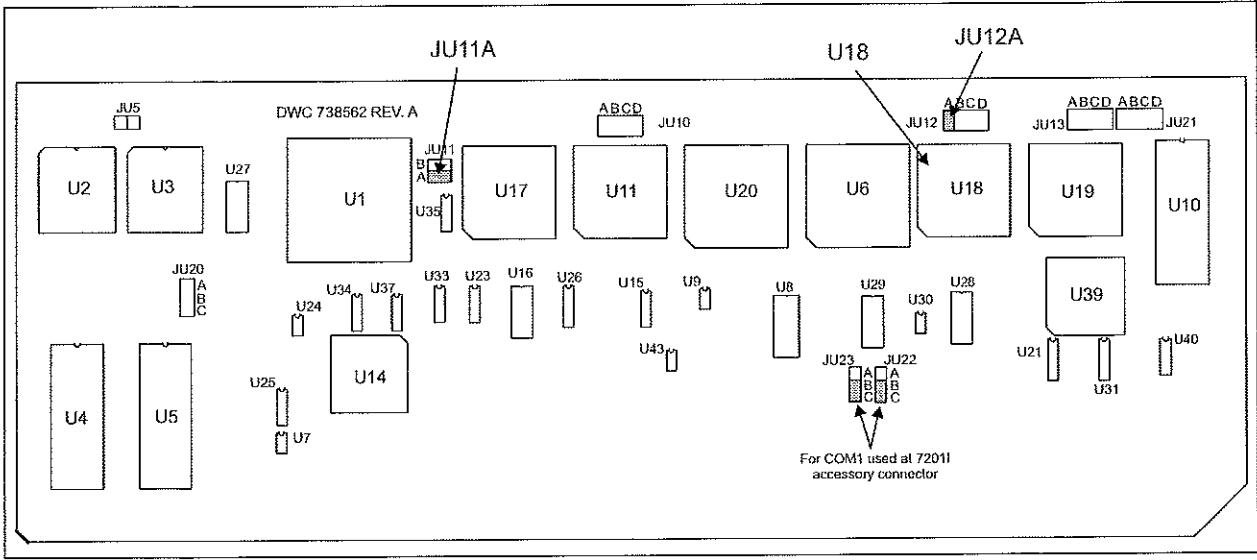
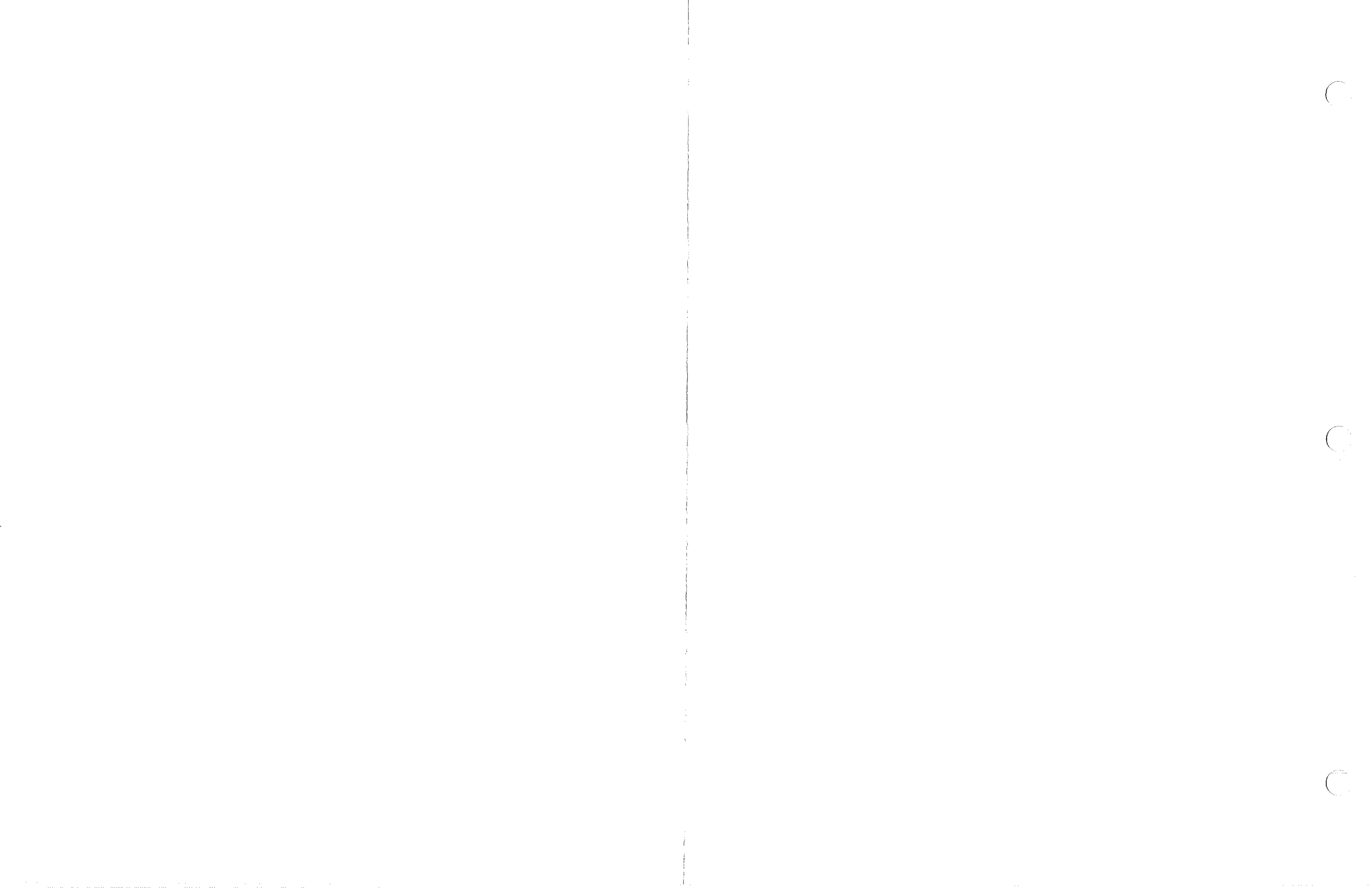


Figure 6-15. ISDN Remote Control Component Placement







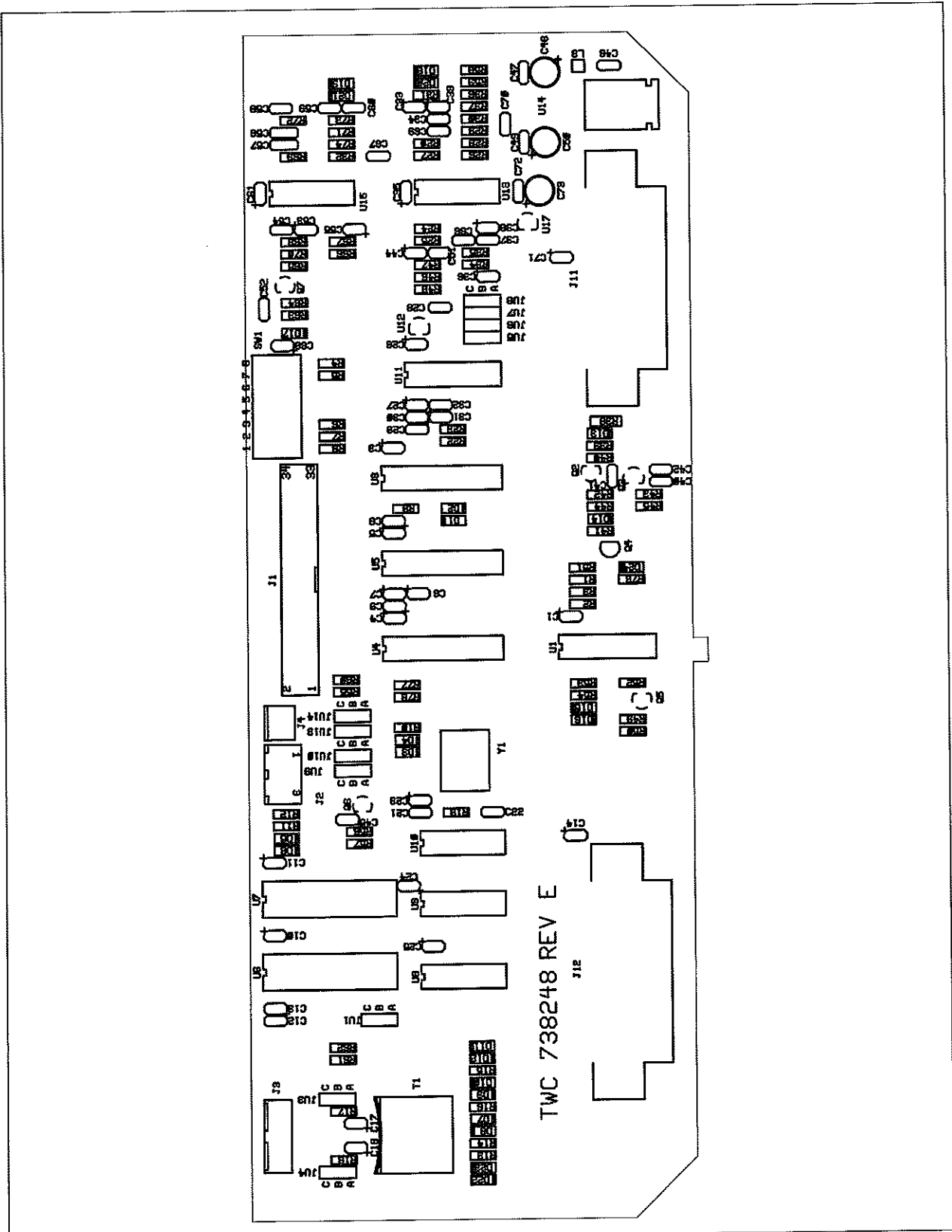


Figure 6-17. ISDN Remote Control Component Locations (738248 Rev. E)

Table 6-5. ISDN Remote Control Parts List (001-01403 Rev. K)

Designator	Part Number	Description
C1	241020	CAP,2.2MF DIP TANTALUM
C10	241020	CAP,2.2MF DIP TANTALUM
C11	241020	CAP,2.2MF DIP TANTALUM
C12	275104	CAP,C,0.1U,50,10%,X,RA,.10SP
C13	241010	CAP,1.0 MF DIP TANTALUM
C14	241010	CAP,1.0 MF DIP TANTALUM
C17	241020	CAP,2.2MF DIP TANTALUM
C18	241020	CAP,2.2MF DIP TANTALUM
C21	210220	CAP,22PF NPO
C22	210220	CAP,22PF NPO
C23	241020	CAP,2.2MF DIP TANTALUM
C24	241020	CAP,2.2MF DIP TANTALUM
C25	241020	CAP,2.2MF DIP TANTALUM
C26	241020	CAP,2.2MF DIP TANTALUM
C27	241020	CAP,2.2MF DIP TANTALUM
C28	275104	CAP,C,0.1U,50,10%,X,RA,.10SP
C29	275104	CAP,C,0.1U,50,10%,X,RA,.10SP
C3	241020	CAP,2.2MF DIP TANTALUM
C30	241020	CAP,2.2MF DIP TANTALUM
C31	241020	CAP,2.2MF DIP TANTALUM
C32	275104	CAP,C,0.1U,50,10%,X,RA,.10SP
C33	241100	CAP,10MF DIP TANTALUM
C34	275104	CAP,C,0.1U,50,10%,X,RA,.10SP
C35	241020	CAP,2.2MF DIP TANTALUM
C36	241100	CAP,10MF DIP TANTALUM
C37	275104	CAP,C,0.1U,50,10%,X,RA,.10SP
C38	241100	CAP,10MF DIP TANTALUM
C39	241020	CAP,2.2MF DIP TANTALUM
C4	241020	CAP,2.2MF DIP TANTALUM
C40	275104	CAP,C,0.1U,50,10%,X,RA,.10SP
C41	275104	CAP,C,0.1U,50,10%,X,RA,.10SP
C42	214103	CAP,C,0.01U,50,10%,X,RA,.1SP
C44	241020	CAP,2.2MF DIP TANTALUM

Table 6-5. ISDN Remote Control Parts List (001-01403 Rev. K)

Designator	Part Number	Description
C45	241100	CAP,10MF DIP TANTALUM
C46	275104	CAP,C,0.1U,50,10%,X,RA,.10SP
C47	275104	CAP,C,0.1U,50,10%,X,RA,.10SP
C48	231101	CAP,A,100U,16V,20%,RA .2SP
C49	275104	CAP,C,0.1U,50,10%,X,RA,.10SP
C5	241100	CAP,10MF DIP TANTALUM
C50	231101	CAP,A,100U,16V,20%,RA .2SP
C51	241100	CAP,10MF DIP TANTALUM
C52	210102	CAP,.001UF,50V,10%,NPO
C53	241100	CAP,10MF DIP TANTALUM
C54	275101	CAP,ML NPO 100PF 100V 5% 0.2S
C55	241100	CAP,10MF DIP TANTALUM
C56	254153	CAP,0.015MF 100V MYLAR
C57	254153	CAP,0.015MF 100V MYLAR
C58	275101	CAP,ML NPO 100PF 100V 5% 0.2S
C6	241100	CAP,10MF DIP TANTALUM
C60	275104	CAP,C,0.1U,50,10%,X,RA,.10SP
C61	241020	CAP,2.2MF DIP TANTALUM
C66	210102	CAP,.001UF,50V,10%,NPO
C67	210102	CAP,.001UF,50V,10%,NPO
C68	241020	CAP,2.2MF DIP TANTALUM
C69	210102	CAP,.001UF,50V,10%,NPO
C7	241020	CAP,2.2MF DIP TANTALUM
C70	210102	CAP,.001UF,50V,10%,NPO
C71	241100	CAP,10MF DIP TANTALUM
C72	275104	CAP,C,0.1U,50,10%,X,RA,.10SP
C73	231101	CAP,A,100U,16V,20%,RA .2SP
C8	241100	CAP,10MF DIP TANTALUM
C9	241100	CAP,10MF DIP TANTALUM
D1	320002	DIODE,SI 100MA 1N4148/1N4150
D10	320002	DIODE,SI 100MA 1N4148/1N4150
D11	320002	DIODE,SI 100MA 1N4148/1N4150
D12	320002	DIODE,SI 100MA 1N4148/1N4150

Table 6-5. ISDN Remote Control Parts List (001-01403 Rev. K)

Designator	Part Number	Description
D13	320002	DIODE,SI 100MA 1N4148/1N4150
D14	320002	DIODE,SI 100MA 1N4148/1N4150
D15	320002	DIODE,SI 100MA 1N4148/1N4150
D16	320002	DIODE,SI 100MA 1N4148/1N4150
D17	320002	DIODE,SI 100MA 1N4148/1N4150
D18	320002	DIODE,SI 100MA 1N4148/1N4150
D19	320002	DIODE,SI 100MA 1N4148/1N4150
D2	320002	DIODE,SI 100MA 1N4148/1N4150
D20	320002	DIODE,SI 100MA 1N4148/1N4150
D21	320002	DIODE,SI 100MA 1N4148/1N4150
D22	320002	DIODE,SI 100MA 1N4148/1N4150
D23	320002	DIODE,SI 100MA 1N4148/1N4150
D24	320002	DIODE,SI 100MA 1N4148/1N4150
D3	320002	DIODE,SI 100MA 1N4148/1N4150
D4	320002	DIODE,SI 100MA 1N4148/1N4150
D5	320002	DIODE,SI 100MA 1N4148/1N4150
D6	320002	DIODE,SI 100MA 1N4148/1N4150
D7	320002	DIODE,SI 100MA 1N4148/1N4150
D8	320002	DIODE,SI 100MA 1N4148/1N4150
D9	320002	DIODE,SI 100MA 1N4148/1N4150
J1	620038	CONN HDR 2X17 SHROUDED PC MNT
J11	613163	CONN,DB-25 RT ANGLE PC PLUG
J12	613163	CONN,DB-25 RT ANGLE PC PLUG
J2	610209	HEADER,MLX,3PIN,.156,POLAR
J3	610197	HEADER,MLX,6PIN,.100
J4	610285	HEADER,MLX,3PIN,.100,
JU1	620030	HEADER,3 PIN .025 SQ POST
JU10	620030	HEADER,3 PIN .025 SQ POST
JU13	620030	HEADER,3 PIN .025 SQ POST
JU14	620030	HEADER,3 PIN .025 SQ POST
JU3	620030	HEADER,3 PIN .025 SQ POST
JU4	620030	HEADER,3 PIN .025 SQ POST
JU5	614004	HEADER 3X4 .1 LEAD SPACING

Table 6-5. ISDN Remote Control Parts List (001-01403 Rev. K)

Designator	Part Number	Description
JU6	614004	HEADER 3X4 .1 LEAD SPACING
JU7	614004	HEADER 3X4 .1 LEAD SPACING
JU8	614004	HEADER 3X4 .1 LEAD SPACING
JU9	620030	HEADER,3 PIN .025 SQ POST
L3	459032	IND ASY,3T#30 MAGNET 1-490201
Q2	310052	XISTOR,PNP,PN2907A,TO92
Q3	310033	XISTOR,JFET,NCH,J310,TO92
Q4	310057	XISTOR,NPN,PN2222A,TO92
Q5	310057	XISTOR,NPN,PN2222A,TO92
Q6	310057	XISTOR,NPN,PN2222A,TO92
Q7	310052	XISTOR,PNP,PN2907A,TO92
R1	113101	RES,100 OHM 1/8W 5% CF
R10	113104	RES,100K 1/8W 5% CARBON FILM
R11	113103	RES,10K 1/8W 5% CARBON FILM
R12	113474	RES,470K 1/8W 5% CARBON FILM
R13	113472	RES,4.7K 1/8W 5% CARBON FILM
R14	113472	RES,4.7K 1/8W 5% CARBON FILM
R15	113221	RES,220 OHM 1/8W 5% CF
R16	113221	RES,220 OHM 1/8W 5% CF
R17	113102	RES, 1K, 1/8W, 5%, CF
R18	113102	RES, 1K, 1/8W, 5%, CF
R19	113106	RES,10M 1/8W 5% CARBON FILM
R2	113101	RES,100 OHM 1/8W 5% CF
R20	113472	RES,4.7K 1/8W 5% CARBON FILM
R22	113103	RES,10K 1/8W 5% CARBON FILM
R23	113103	RES,10K 1/8W 5% CARBON FILM
R24	113103	RES,10K 1/8W 5% CARBON FILM
R25	113103	RES,10K 1/8W 5% CARBON FILM
R26	113103	RES,10K 1/8W 5% CARBON FILM
R27	113103	RES,10K 1/8W 5% CARBON FILM
R28	113103	RES,10K 1/8W 5% CARBON FILM
R29	113103	RES,10K 1/8W 5% CARBON FILM
R3	113101	RES,100 OHM 1/8W 5% CF

Table 6-5. ISDN Remote Control Parts List (001-01403 Rev. K)

Designator	Part Number	Description
R30	113103	RES,10K 1/8W 5% CARBON FILM
R31	113103	RES,10K 1/8W 5% CARBON FILM
R32	113103	RES,10K 1/8W 5% CARBON FILM
R34	113103	RES,10K 1/8W 5% CARBON FILM
R35	113103	RES,10K 1/8W 5% CARBON FILM
R36	113102	RES, 1K, 1/8W, 5%, CF
R37	113621	RES,620 OHM 1/8W 5% CF
R38	113471	RES,470 OHM 1/8W 5% CF
R39	113104	RES,100K 1/8W 5% CARBON FILM
R4	113104	RES,100K 1/8W 5% CARBON FILM
R40	113103	RES,10K 1/8W 5% CARBON FILM
R41	113103	RES,10K 1/8W 5% CARBON FILM
R42	113474	RES,470K 1/8W 5% CARBON FILM
R43	113474	RES,470K 1/8W 5% CARBON FILM
R44	113474	RES,470K 1/8W 5% CARBON FILM
R45	113621	RES,620 OHM 1/8W 5% CF
R46	113823	RES,82K 1/8W 5% CARBON FILM
R47	113103	RES,10K 1/8W 5% CARBON FILM
R48	113103	RES,10K 1/8W 5% CARBON FILM
R49	113103	RES,10K 1/8W 5% CARBON FILM
R5	113104	RES,100K 1/8W 5% CARBON FILM
R50	113474	RES,470K 1/8W 5% CARBON FILM
R51	1111502	RESISTOR 15K 1/8W 1%
R52	113104	RES,100K 1/8W 5% CARBON FILM
R53	113104	RES,100K 1/8W 5% CARBON FILM
R54	113473	RES,47K 1/8W 5% CARBON FILM
R55	113103	RES,10K 1/8W 5% CARBON FILM
R56	113103	RES,10K 1/8W 5% CARBON FILM
R57	113473	RES,47K 1/8W 5% CARBON FILM
R58	113101	RES,100 OHM 1/8W 5% CF
R59	113101	RES,100 OHM 1/8W 5% CF
R6	113104	RES,100K 1/8W 5% CARBON FILM
R60	113473	RES,47K 1/8W 5% CARBON FILM

Table 6-5. ISDN Remote Control Parts List (001-01403 Rev. K)

Designator	Part Number	Description
R61	113103	RES,10K 1/8W 5% CARBON FILM
R62	113103	RES,10K 1/8W 5% CARBON FILM
R63	113104	RES,100K 1/8W 5% CARBON FILM
R64	113103	RES,10K 1/8W 5% CARBON FILM
R65	113102	RES, 1K, 1/8W, 5%, CF
R66	113103	RES,10K 1/8W 5% CARBON FILM
R67	113103	RES,10K 1/8W 5% CARBON FILM
R68	113103	RES,10K 1/8W 5% CARBON FILM
R69	113103	RES,10K 1/8W 5% CARBON FILM
R7	113104	RES,100K 1/8W 5% CARBON FILM
R70	113273	RES,27K 1/8W 5% CARBON FILM
R71	113152	RES,1.5K 1/8W 5% CARBON FILM
R72	113104	RES,100K 1/8W 5% CARBON FILM
R73	113272	RES,2.7K 1/8W 5% CARBON FILM
R74	113473	RES,47K 1/8W 5% CARBON FILM
R76	113104	RES,100K 1/8W 5% CARBON FILM
R77	113104	RES,100K 1/8W 5% CARBON FILM
R78	113104	RES,100K 1/8W 5% CARBON FILM
R8	113104	RES,100K 1/8W 5% CARBON FILM
R9	113104	RES,100K 1/8W 5% CARBON FILM
S1	530010	SWITCH DIP 8 SECT SPST
T1	410062	TRANSFORMER,ISDN
U1	330273	IC 74HC595
U10	330482	IC,4069 HEX INVERTER
U11	330485	IC, MC145503P
U12	330484	IC,78L09 9VOLT REGULATOR TO92
U13	330322	IC, MC33079P
U14	330015	IC,VREG,7805,TO220,5V
U15	330322	IC, MC33079P
U17	330018	IC,VREG,78L08,TO94,8V
U3	330489	IC,MC145428P
U4	330489	IC,MC145428P
U5	330488	IC, MC145407P

**Table 6-5. ISDN Remote Control Parts List (001-01403 Rev. K)**

Designator	Part Number	Description
U6	330486	IC,MC145422 80KBPS UDLT MASTER
U6	621007	SOCKET, 22 PIN IC DIP
U7	621007	SOCKET, 22 PIN IC DIP
U8	330305	IC, 74HC393
U9	330483	IC,74HC74 DUAL D FLIP FLOP
Y1	360037	CRYSTAL HC18/U HOLDER 4.096MH

## 6.9 Narrowband CW Filter (7000CW)

This option provides a narrowband filter with 500 Hz bandwidth for CW operation. For component placement, refer to the figure below.

To install this option:

1. Turn the TW7000 off and remove the top cover.
2. Remove the board hold-down bars.
3. Remove the 5 MHz board.
4. Install the crystal into position XF2. Also, if required, change R130 to 3.92k if XF1 is a standard voice crystal and JU1 to position 3.

**Note:** On boards with CW and WB1 options, the CW crystal is installed in position XF1 and the WB1 crystal is installed in XF2. If required, change R129 to 10k. Set JU1 to position 2.

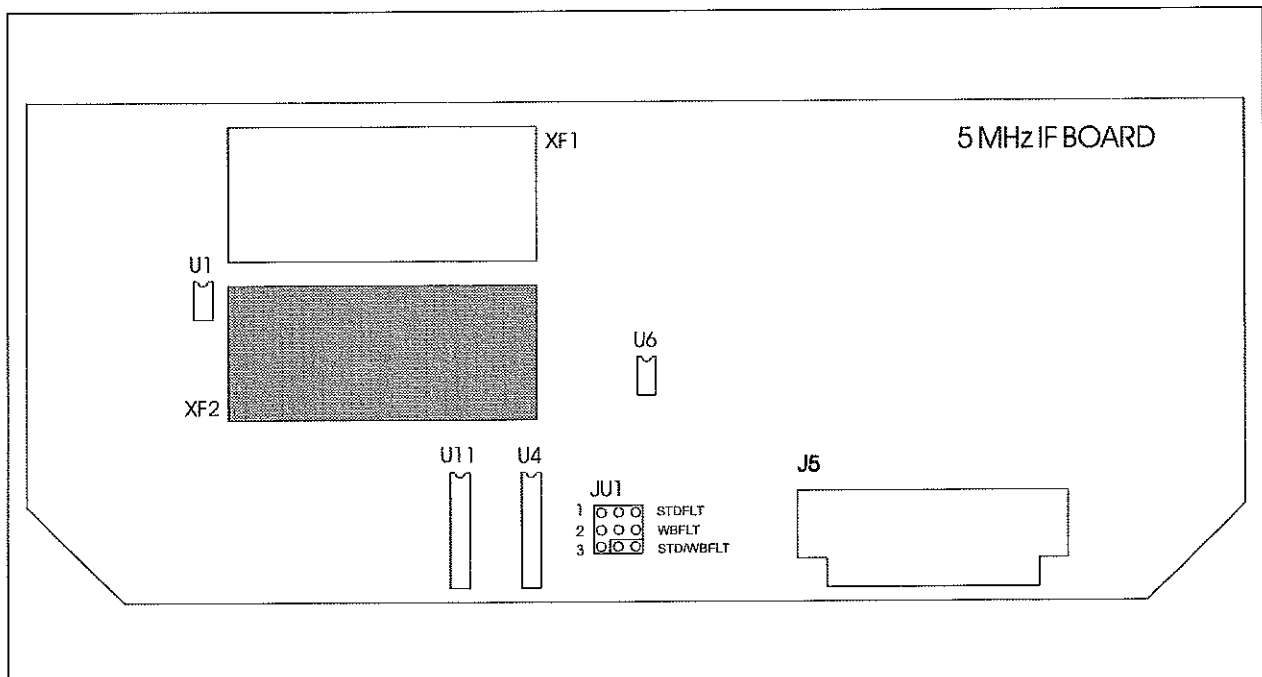


Figure 6-18. Narrowband CW Component Placement

## 6.10 Noise Blanker Option (7000NB)

The 7000NB adds a noise blanker to the 7000-series of radios. It minimizes interference caused by certain types of impulse noise, such as ignition noise in a vehicle.

To install this option:

1. Turn the TW7000 off and remove the top and bottom covers. Remove the board hold-down bars.
2. Run the cables from the 5 MHz IF board J56 and J58, to the appropriate connectors on the Noise Blanker board.
3. Install the board in the NB slot.
4. Reinstall the top and bottom covers.
5. When powered up, the **NB** icon displays.
6. To activate this option, refer to the TW7000-MSOP operator manual.

When activated, the 5 MHz IF is sampled via connector J56. IF is routed to U2-2 where the rising edge of noise pulses are detected and used to trigger the gates of U4 and U6. This causes attenuation of the IF signal for a duration of time specified by R16. The timing is factory-set for a blanking pulse of approximately 80 ms. The IF signal is routed out of the noise blanker via control J58.

REV	ECN	DESCRIPTION	DATE	APPR
B	7000-295	SEE ECN	09-30-98	

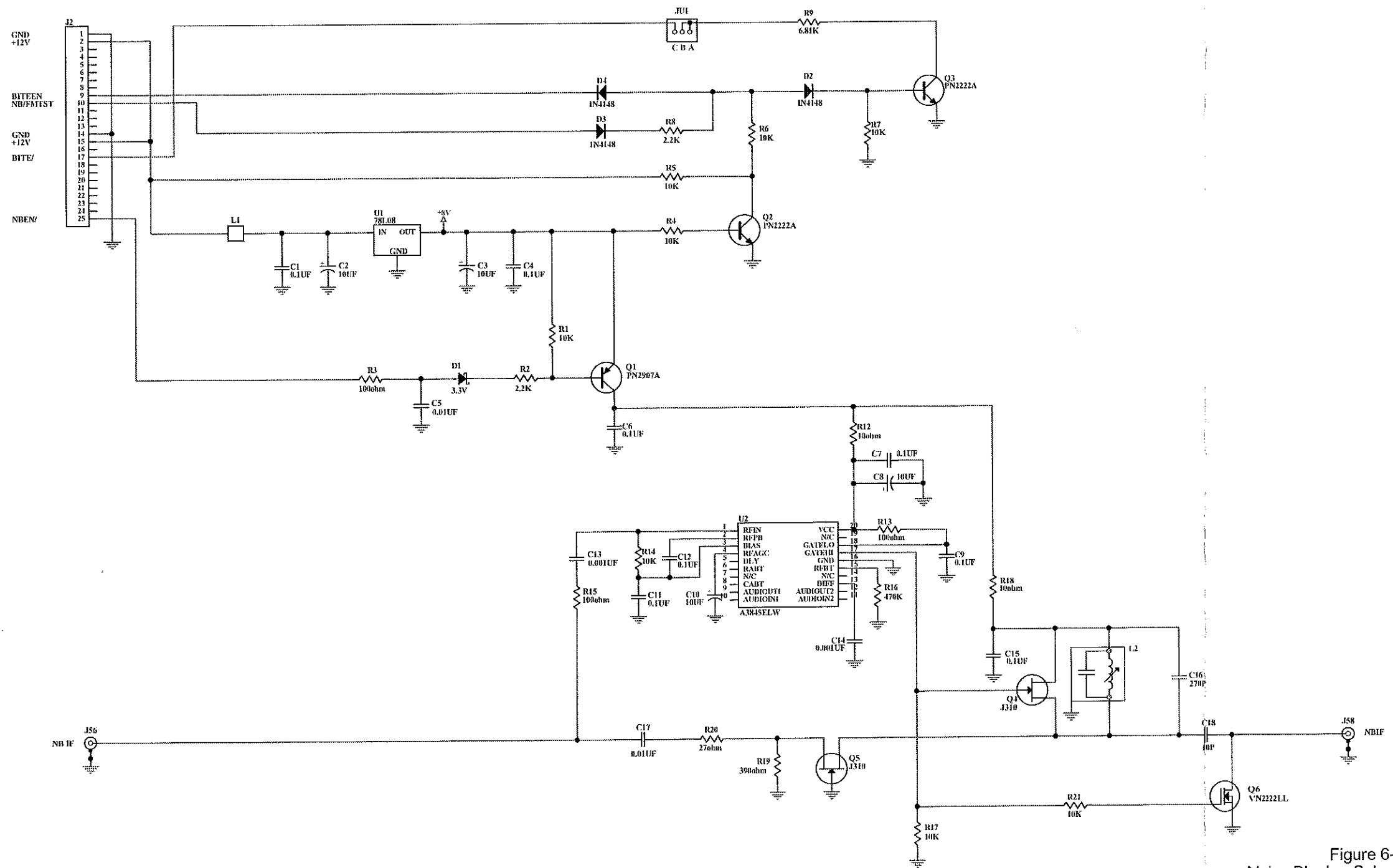
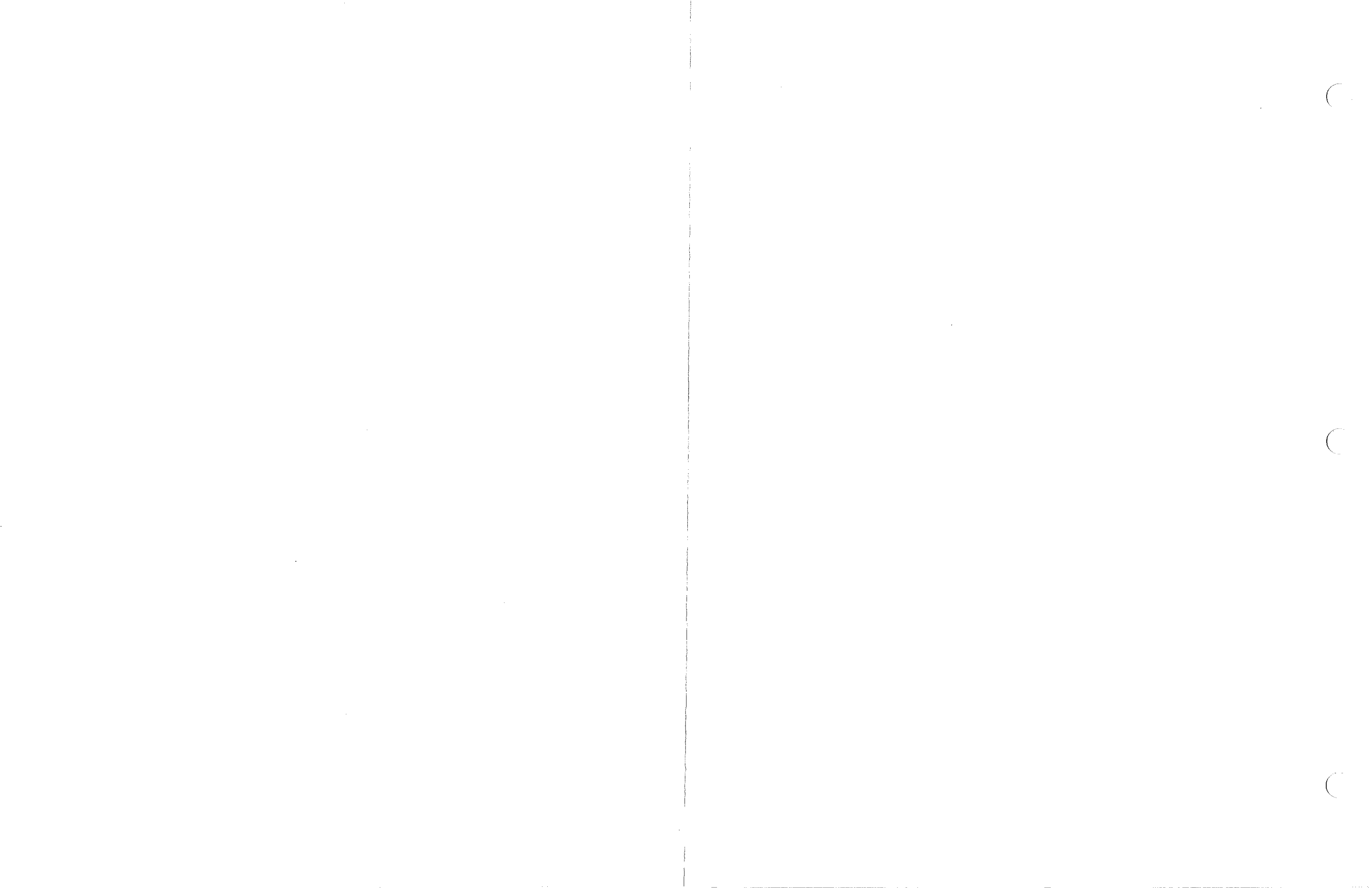


Figure 6-19  
Noise Blander Schematic Diagram  
(994163 Rev. B)

6-57

TW7000-MS

		3630 Ewerprie Ct. Vista, CA 92083 (760)597-3777	
Title: Schematic			
<b>NB MODULE</b>			
Size: C	Drawn: Appn	Date:	Rev: B
DrawingNumber: 994163		Date:	
File: 994163B.SCH			



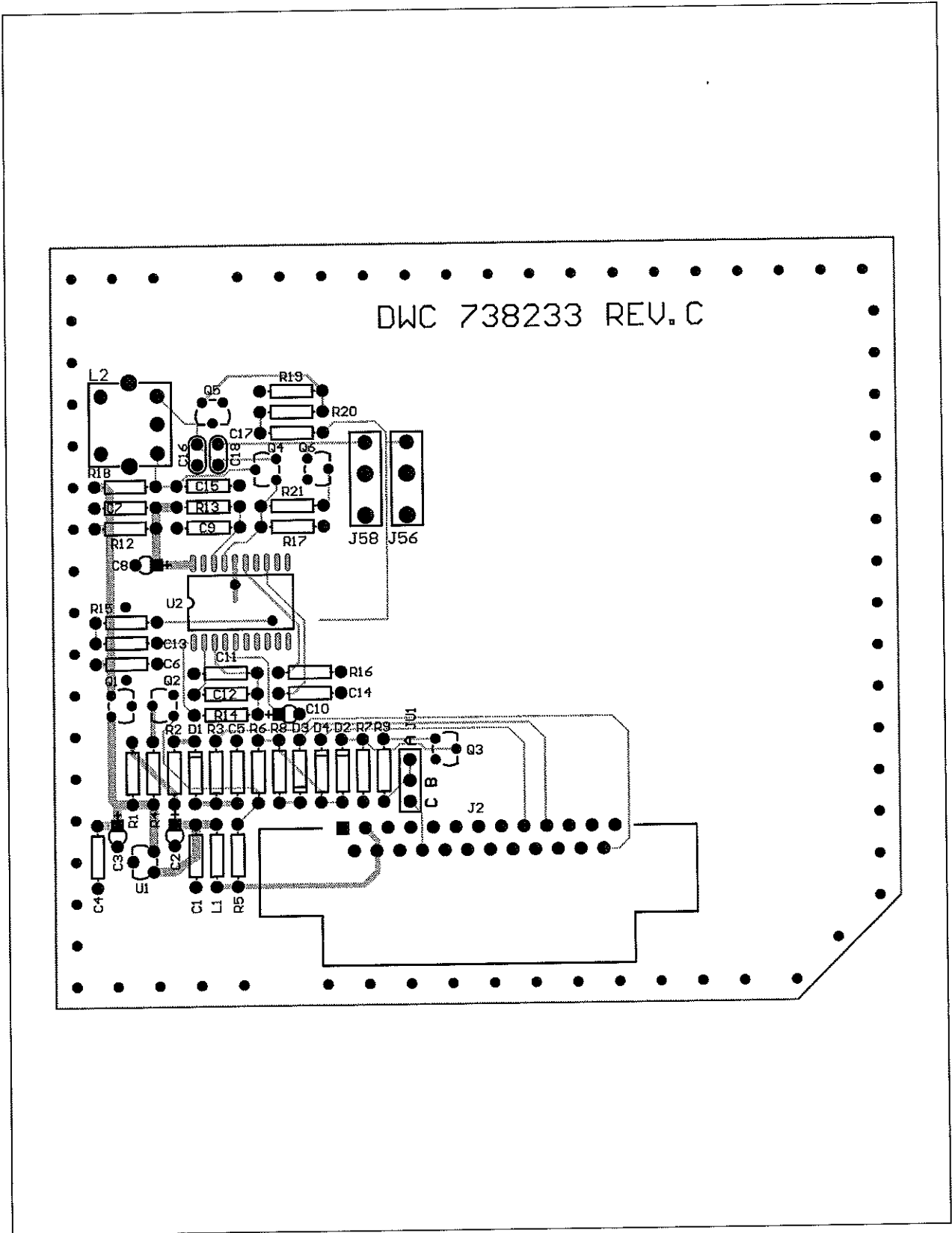


Figure 6-20. Noise Blower Component Locations (738233 Rev. C)

Table 6-6. Noise Blanker Parts List (001-01202 Rev. D2)

Designator	Part Number	Description
C1	277104	CAP,C,0.1U,50,10%,X,AX,.25SP
C10	241100	CAP,10MF DIP TANTALUM
C11	277104	CAP,C,0.1U,50,10%,X,AX,.25SP
C12	277104	CAP,C,0.1U,50,10%,X,AX,.25SP
C13	277102	CAP,C,1000P,100,10%,X,AX,.25SP
C14	277102	CAP,C,1000P,100,10%,X,AX,.25SP
C15	277104	CAP,C,0.1U,50,10%,X,AX,.25SP
C16	275271	CAP,ML NPO 270PF 100V 5% 0.2S
C17	277103	CAP,C,0.01U,100,10%,X,AX,.25SP
C18	210100	CAP,10 PF DISC NPO
C2	241100	CAP,10MF DIP TANTALUM
C3	241100	CAP,10MF DIP TANTALUM
C4	277104	CAP,C,0.1U,50,10%,X,AX,.25SP
C5	277103	CAP,C,0.01U,100,10%,X,AX,.25SP
C6	277104	CAP,C,0.1U,50,10%,X,AX,.25SP
C7	277104	CAP,C,0.1U,50,10%,X,AX,.25SP
C8	241100	CAP,10MF DIP TANTALUM
C9	277104	CAP,C,0.1U,50,10%,X,AX,.25SP
D1	320210	DIODE,ZENER 3.3V 1N746A
D2	320002	DIODE,SI 100MA 1N4148/1N4150
D3	320002	DIODE,SI 100MA 1N4148/1N4150
D4	320002	DIODE,SI 100MA 1N4148/1N4150
J2	613163	CONN,DB-25 RT ANGLE PC PLUG
J56	614026	CONN,RF FEMALE LOW-TYPE RECEPT
J58	614026	CONN,RF FEMALE LOW-TYPE RECEPT
JU1	620030	HEADER,3 PIN .025 SQ POST
JU1	860097	MICRO SHUNT, .100 CENTERS
L1	459032	IND ASY,3T#30 MAGNET 1-490201
L2	420017	INDUCTOR IF 10.7MHZ
Q1	310052	XISTOR,PNP,PN2907A,TO92
Q2	310057	XISTOR,NPN,PN2222A,TO92
Q3	310057	XISTOR,NPN,PN2222A,TO92
Q4	310033	XISTOR,JFET,NCH,J310,TO92

Table 6-6. Noise Blanker Parts List (001-01202 Rev. D2)

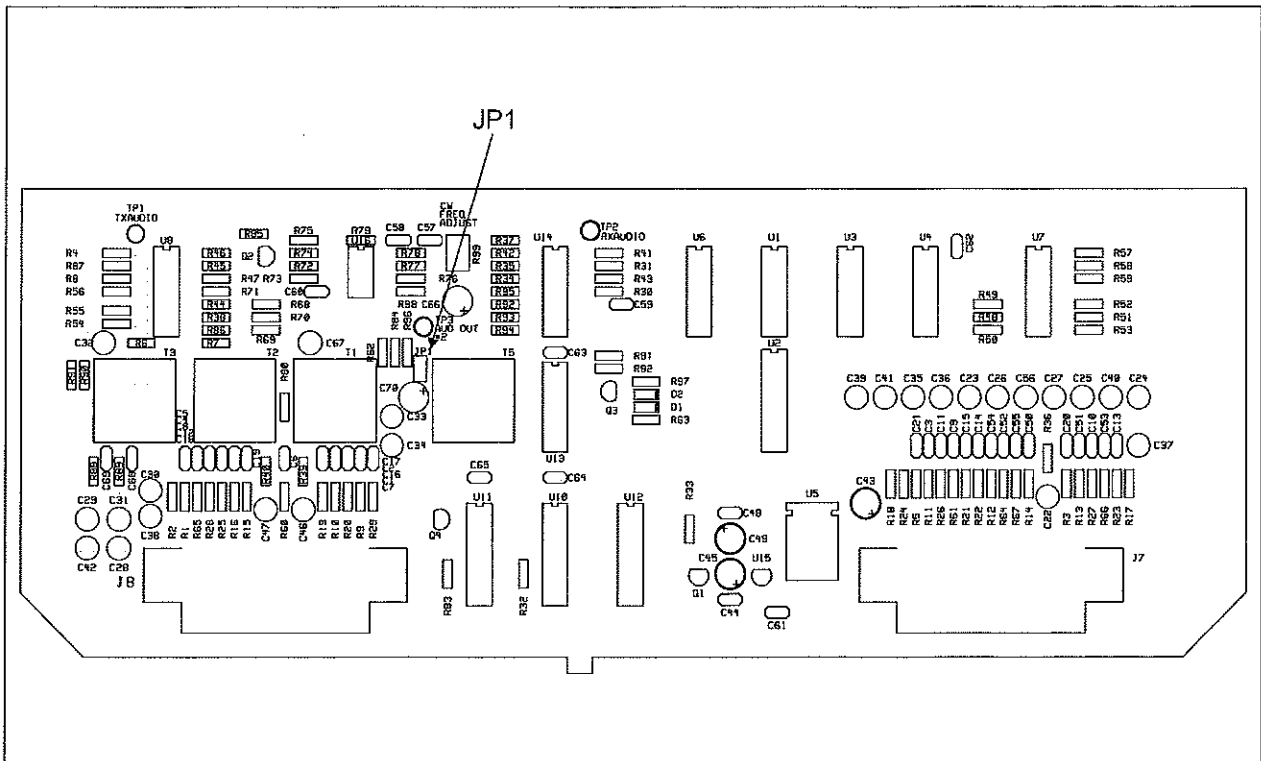
Designator	Part Number	Description
Q5	310033	XISTOR,JFET,NCH,J310,TO92
Q6	310138	XISTOR,FET,VN2222LL,TO92
R1	113103	RES,10K 1/8W 5% CARBON FILM
R12	113100	RES,10 OHM 1/8W 5% FILM
R13	113101	RES,100 OHM 1/8W 5% CF
R14	113103	RES,10K 1/8W 5% CARBON FILM
R15	113101	RES,100 OHM 1/8W 5% CF
R16	113474	RES,470K 1/8W 5% CARBON FILM
R17	113103	RES,10K 1/8W 5% CARBON FILM
R18	113100	RES,10 OHM 1/8W 5% FILM
R19	113331	RES,330 OHM 1/8W 5% CF
R2	113222	RES,2.2K 1/8W 5% CARBON FILM
R20	113270	RES,27 OHM 1/8W 5% CARBON FILM
R21	113103	RES,10K 1/8W 5% CARBON FILM
R3	113101	RES,100 OHM 1/8W 5% CF
R4	113103	RES,10K 1/8W 5% CARBON FILM
R5	113103	RES,10K 1/8W 5% CARBON FILM
R6	113103	RES,10K 1/8W 5% CARBON FILM
R7	113103	RES,10K 1/8W 5% CARBON FILM
R8	113222	RES,2.2K 1/8W 5% CARBON FILM
R9	1116811	RES, 6.8K 1/8W 1% FILM
U1	330018	IC,VREG,78L08,TO94,8V
U2	033304028	IC,SM,LIN,A3845ELW, SOW-20

### 6.11 Recorder Option (7000RCDR)

This option makes transmit and receive audio available for recording or split site purposes at accessory port 2.

To install this option, follow the steps below. For jumper placement, refer to the figure below.

1. Turn the TW7000 off, remove the top cover and remove the board hold-down bars.
2. Using the proper antistatic procedures and a board puller, locate and remove the Audio board.
3. Install a jumper on JP1.
4. Reinsert the Audio board, hold-down bars and top cover.
5. Turn on the TW7000 and operate normally.



**Figure 6-21. Recorder Jumper Placement**

## 6.12 Selcall, Transcall, TransAdapt Option (7000TC)

This option supports TransAdapt (TA), Transcall (TC), and Selcall (SC) selective calling systems. For operating instructions, refer to the TW7000-MSOP operator manual.

To install this option, follow the steps below. For component placement, refer to the figure below.

1. Turn the TW7000 off and remove the top cover. Remove the board hold-down bars.
2. Locate the Processor board and remove it using the board puller. Install jumpers JU11B and JU13B.
3. Reinsert the processor board into its guide.
4. Replace the hold-down bars and cover. When powered up, the TC, SC and TA icons are displayed.

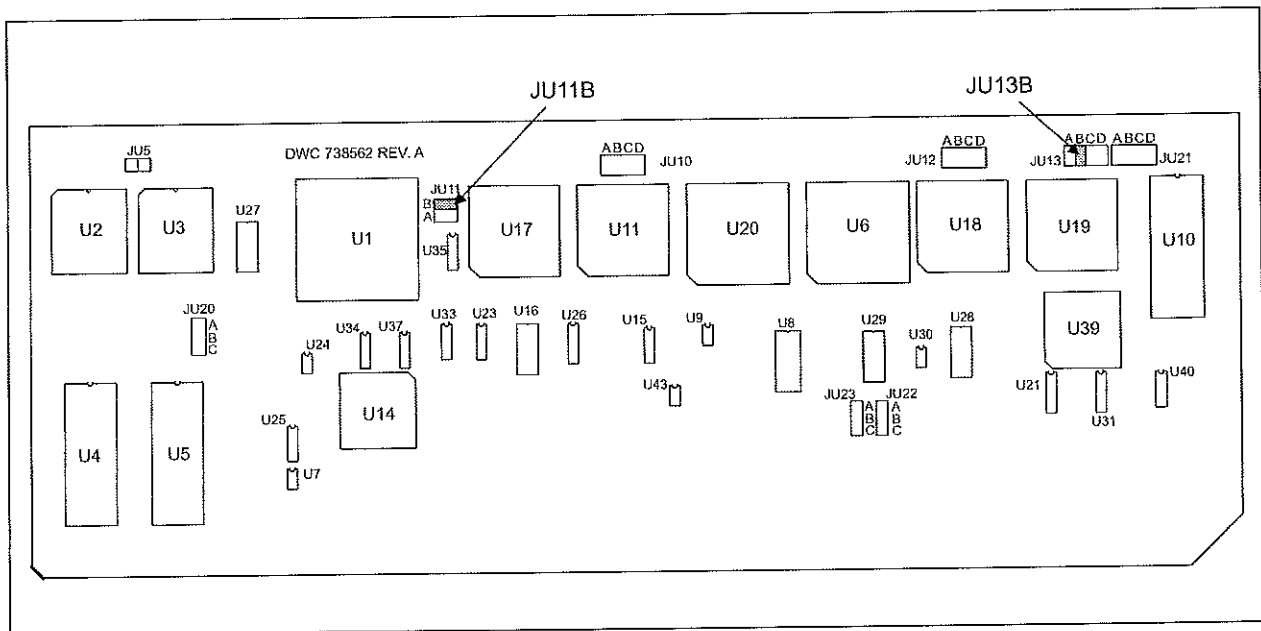


Figure 6-22. Selcall, Transcall and TransAdapt Component Placement

### 6.13 Voice Enhancement Option (7000VEM)

This option provides superior voice recognition and signal-quality improvement in noisy environments.

To install this option:

1. Turn the TW7000 off and remove the top cover.
2. Remove the board hold-down bars.
3. Install the VEM board into the OPT1 slot.
4. Replace the cover.

### 6.14 Wideband 1 Option (7000WB1)

This option provides a 300 to 3300 Hz wideband filter with tailored group delay characteristics for data operation (USB/LSB).

**Note:** *7000WB1 requires the 5 MHz IF board is revision U or higher.*

If necessary to perform a field installation, a soldering iron and cutters are required. Follow the steps below. For component placement, refer to the figure below.

1. Turn the TW7000 off and remove the cover. Remove the board hold-down bars.
2. Locate and remove the 5 MHz IF board using a board puller.
3. Remove the coaxial cables connected to the board. With the insulation washers under the filter, mount the filter to the board in position XF2. Solder the filter leads, trimming any excess.
4. Change jumper JU1 from position 1 to position 2 when the 5 MHz board has the standard and WB1 filters.
5. Reinsert the 5 MHz IF board.
6. Reinstall the hold-down bars and the cover.

When powered up, the filter band modes **USB DATA** and **LSB DATA** (wideband) display on the TW7000. For information on selecting a mode, refer to the TW7000-MSOP operator manual.

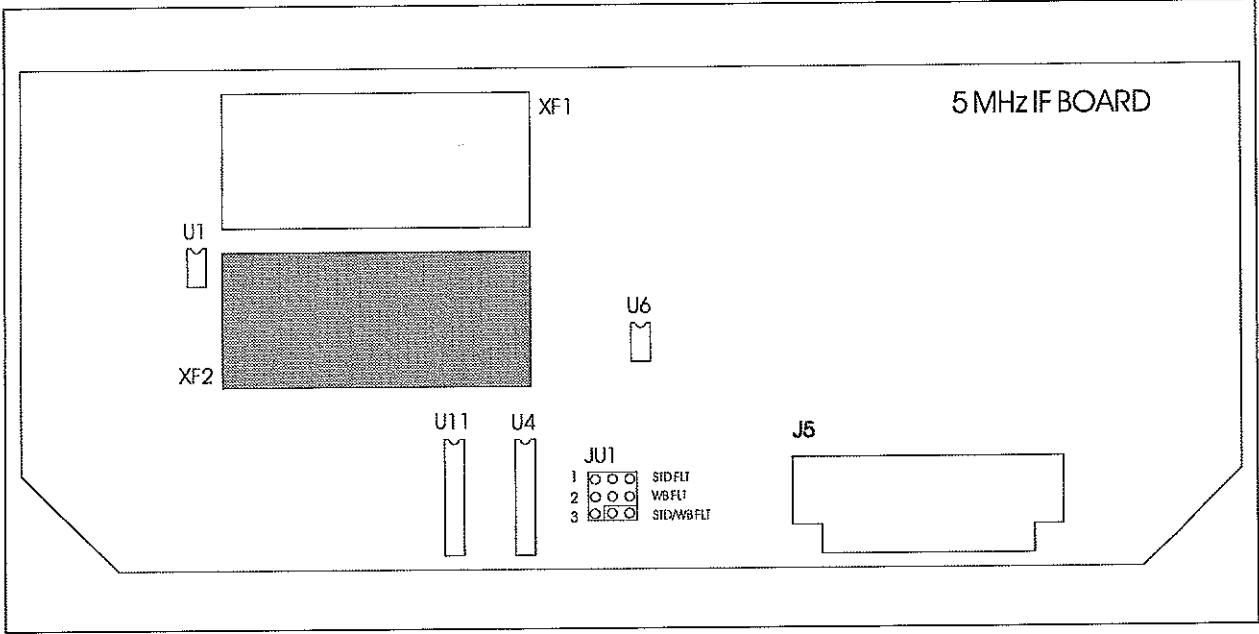


Figure 6-23. Wideband 1 Component Placement

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# CHAPTER 7

## SYSTEM VARIATIONS

### 7.1 Computer Control (TW7000C)

The TW7000C is a computer-controlled version of the TW7000. The front panel consists of an on/off switch and a power LED indicator.

### 7.2 Extended Front Panel Control (TW7000E)

The TW7000E is an extended control version of the TW7000. It has a front panel containing a single connector. The front panel contains an interface board and connector transition. The interface board converts the serial communications to a differential RS-485 format. At the radio end, jumpers JU1 C and D are installed.

The TW7000E is used with the TW7201E control console which attaches to the connector via control cable C991830. The console can be up to 50 feet away.

The TW7201E consists of the standard TW7000 front panel and an extended control interface board. Operation from the TW7201E is identical to that of the standard TW7000.

The TW7201E uses the same interface board as the TW7000E front panel and is installed with jumpers JU1 A and B. The TW7201E chassis consists of a housing and base mount plate.



- NOTES: UNLESS OTHERWISE SPECIFIED  
 1. RESISTANCE IS IN OHMS.  
 2. CAPACITANCE IS IN MICROFARADS.  
 3. DIODES ARE 1N4148.  
 4. INDUCTANCE IS IN MICROHENRYS.

REV	ECN	DESCRIPTION	DATE	APPR
A	TW7000F-001	RELEASE	08-13-93	J.C.
B	00-0294	REVISED PER ECO RWS	05-04-01	

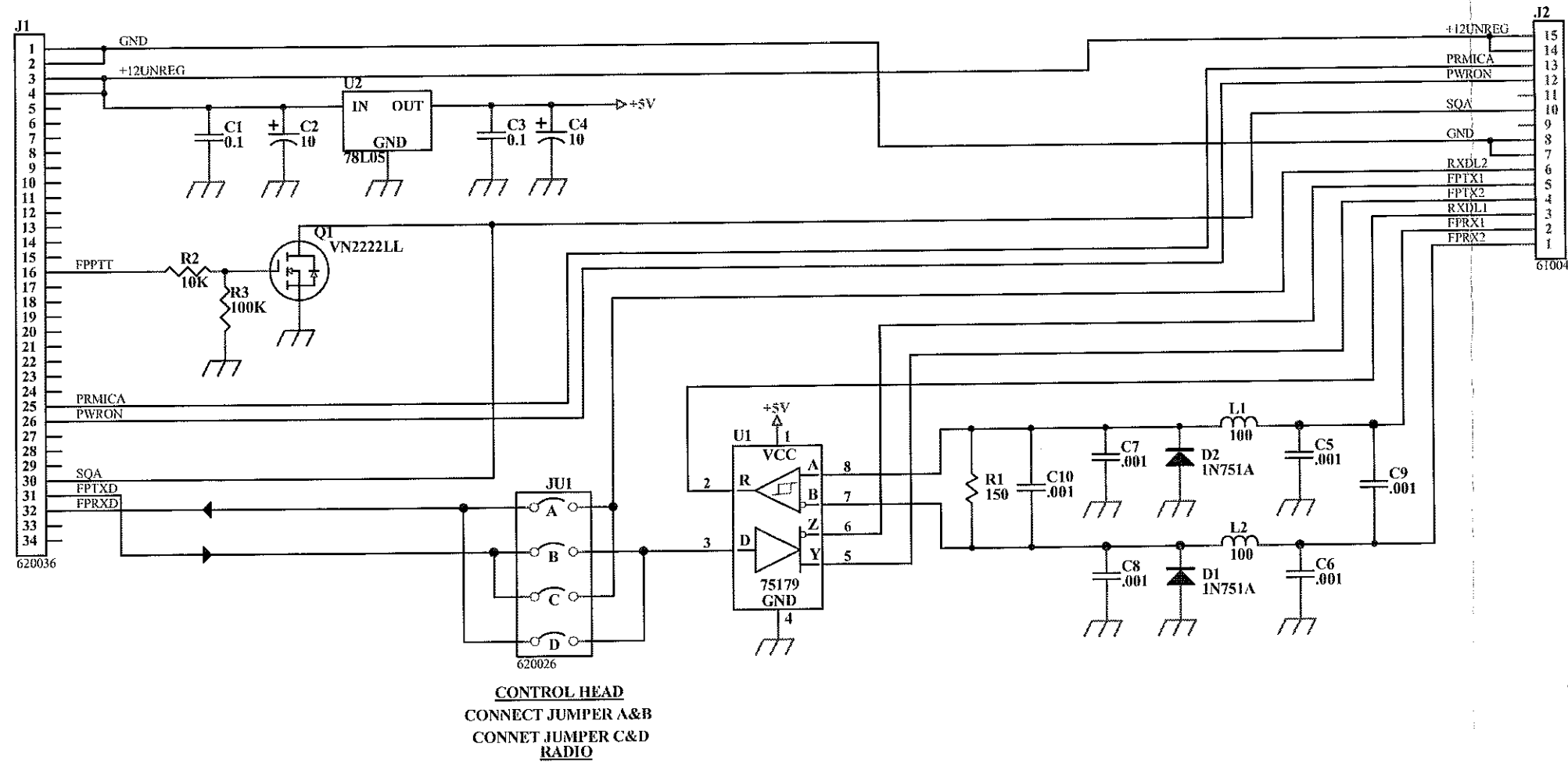


Figure 7-1  
 TW7000E Connector Transition  
 Schematic Diagram (994187 Rev. B)

7-3

TW7000-MS

BOM 002-01003 PCB 738256

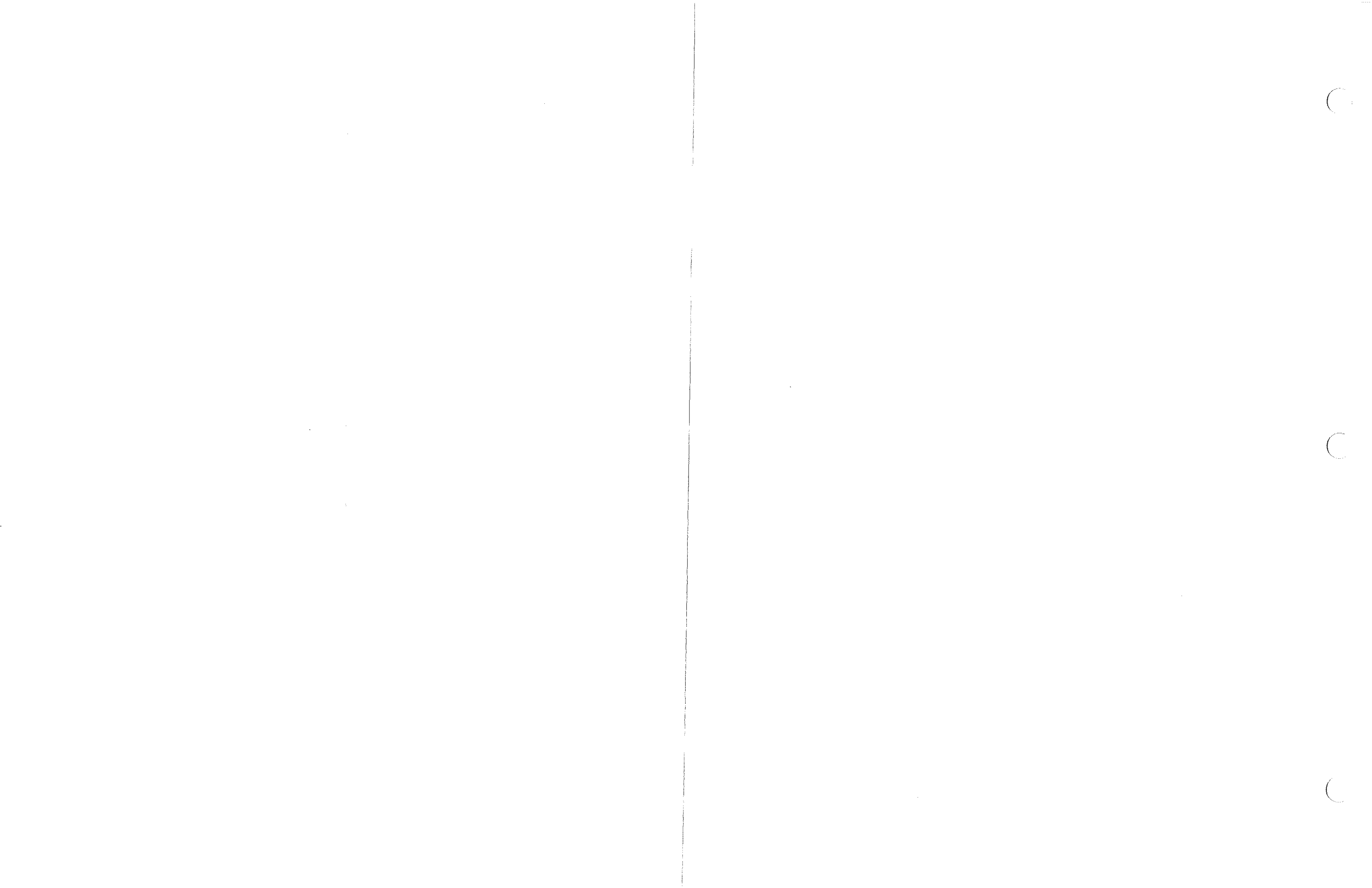
**DATRON** 3030 Enterprise Ct.  
 Vista, CA 92083  
 (760)597-3777

**DATRON WORLD COMMUNICATIONS INC.**

Title: Schematic TW7000/RT7000/TW7000F  
**CONN TRANSITION 7000-EFP**

Size: <b>B</b>	Drawn:	Date: 10-10-96	Drawing Number: <b>994187</b>	Rev: <b>B</b>
	Appr:	Date:		

File: 994187B.sch Date: 24-Feb-2005 Time: 15:35:48 Sheet 1 of 1



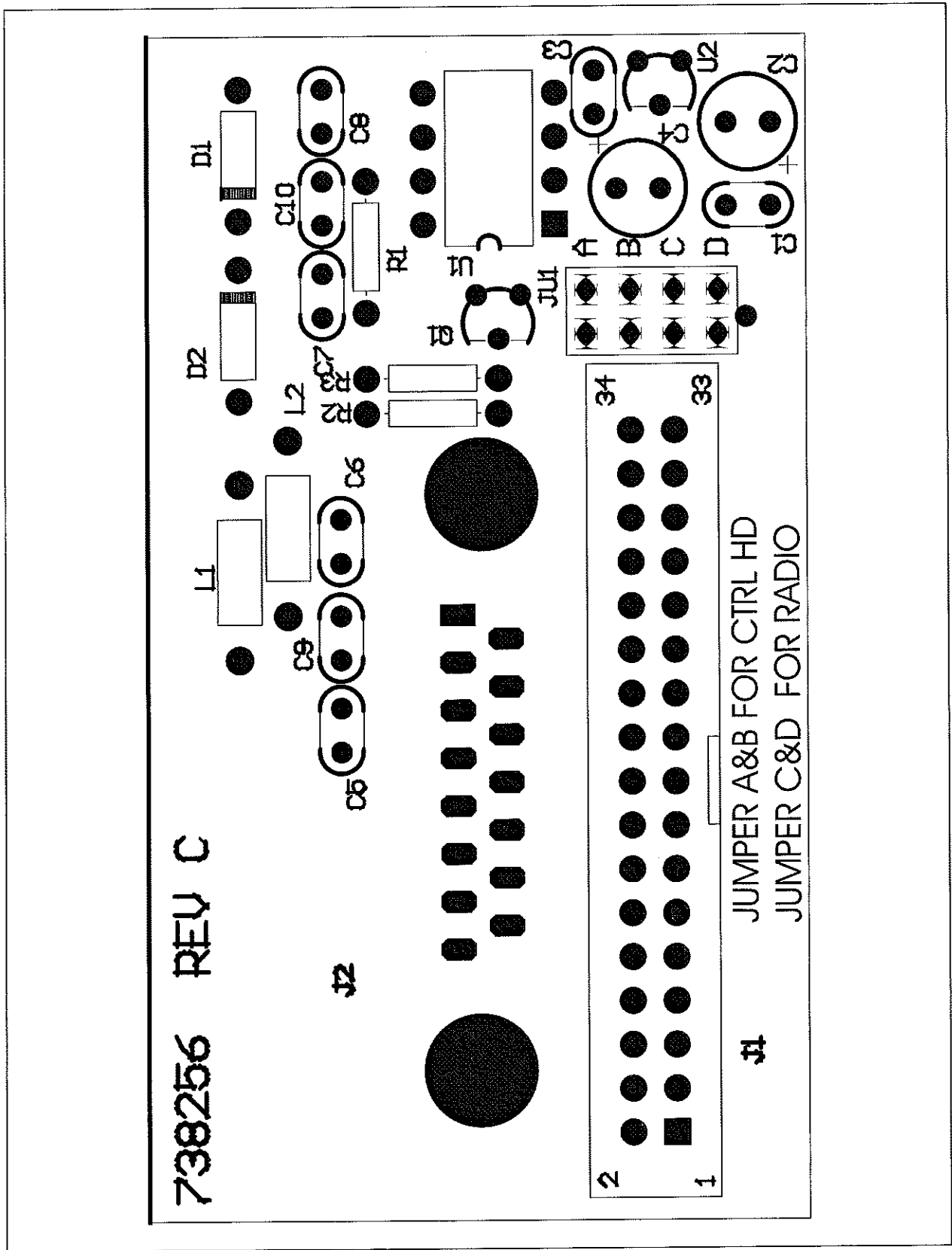


Figure 7-2. TW7000E Connector Transition Component Locations (738256 Rev. C)

Table 7-1. TW7000E Connector Transition Parts List (002-01003 Rev. F)

Designator	Part Number	Description
C1	275104	CAP,C,0.1U,50,10%,X,RA,.10SP
C10	275102	CAP,C,.001UF,100V,5%,N,RA,.1SP
C2	231100	CAP,10MF 16V ELECT VRT
C3	275104	CAP,C,0.1U,50,10%,X,RA,.10SP
C4	231100	CAP,10MF 16V ELECT VRT
C5	275102	CAP,C,.001UF,100V,5%,N,RA,.1SP
C6	275102	CAP,C,.001UF,100V,5%,N,RA,.1SP
C7	275102	CAP,C,.001UF,100V,5%,N,RA,.1SP
C8	275102	CAP,C,.001UF,100V,5%,N,RA,.1SP
C9	275102	CAP,C,.001UF,100V,5%,N,RA,.1SP
D1	320204	DIODE, ZENER 5.1V
D2	320204	DIODE, ZENER 5.1V
J1	620036	HEADER,34 PIN DUAL ROW MALE
J2	610449	CONN,D-SUB 15 PIN MALE PC MNT
JU1	620026	HEADER,8 PIN DUAL MALE
L1	430014	INDUCTOR MOLDED MIN 100UH
L2	430014	INDUCTOR MOLDED MIN 100UH
Q1	310138	XISTOR,FET,VN2222LL,TO92
R1	113151	RES,150 OHM 1/8W 5% CF
R2	113103	RES,10K 1/8W 5% CARBON FILM
R3	113104	RES,100K 1/8W 5% CARBON FILM
U1	330495	IC, RS-485 TRANSCEIVER
U2	330025	IC,VREG,78L05,TO92,5V

### 7.3 Pre/Postselector (TW7000PP)

This section describes the interface requirements between the 7000-series radios and the 5830-series pre/postselectors.

The TW5830 provides sharp band-pass filtering of both transmit and receive RF signals. It is most frequently used in co-site installations. The radio communicates frequency information to the TW5830, which then inserts the proper filters and conditioning circuits.

To use the 5830-series pre/postselector device, the TW7000PP version is used in conjunction with the C1021 interface device. The following modifications are factory installed:

- Rear panel assembly replaced by new PP version
- Internal RF wiring changed
- Jumper JU11B inserted on Processor board
- U19 (UART) installed on Processor board

The transmit RF path is broken between the 75 MHz IF board and the RF Power Amplifier board. The RF lines are routed to the new BNC connectors located on the rear panel of the radio while the control and BITE lines are routed to Accessory 3. Transmit RF flows from the 75 MHz IF board, through the postselector portion of the TW5830, and back to the RF Power Amplifier board. For a diagram of the internal wiring, refer to the "TW7000PP Cabling Connections" figure on page 7-9.

The receive signal is automatically filtered by the TW5830. This section is placed in bypass mode when the system is in transmit mode.

The TW5830 requires frequency information from the radio. To obtain this, serial data is converted from Accessory 3 to parallel data. The C1021 interface is a serial-to-parallel converter, and performs this task in addition to providing BITE information back to the radio.

The only selectable feature in the C1021 is the device address. By placing the jumper in position 1 or 2, the radio can selectively address the TW5830s. Normally, it comes pre-configured as device 1.

The C1021 provides an interface between the TW7000PP and the TW5830. It performs this for both the control signals and BITE diagnostics. On power-up and during a forced BITE (refer to TW7000-MSOP), the radio's processor reads the BITE resistor located in the C1021 (R1). The valid voltage range is between 0.5 Vdc (low range) and 5.0 Vdc (high range).

If the proper levels fail, the radio displays **BAD OR NONE PRESELECTOR 1** or **BAD OR NONE PRESELECTOR 2**, depending on the device addressed.

In addition to detecting the presence of C1021, the TW7000 responds to an internal 5830 failure. This same BITE line indicates a fault and the radio does not send any data to the 5830 until it is cleared. There is also a visual indication by the fault LED on the 5830.

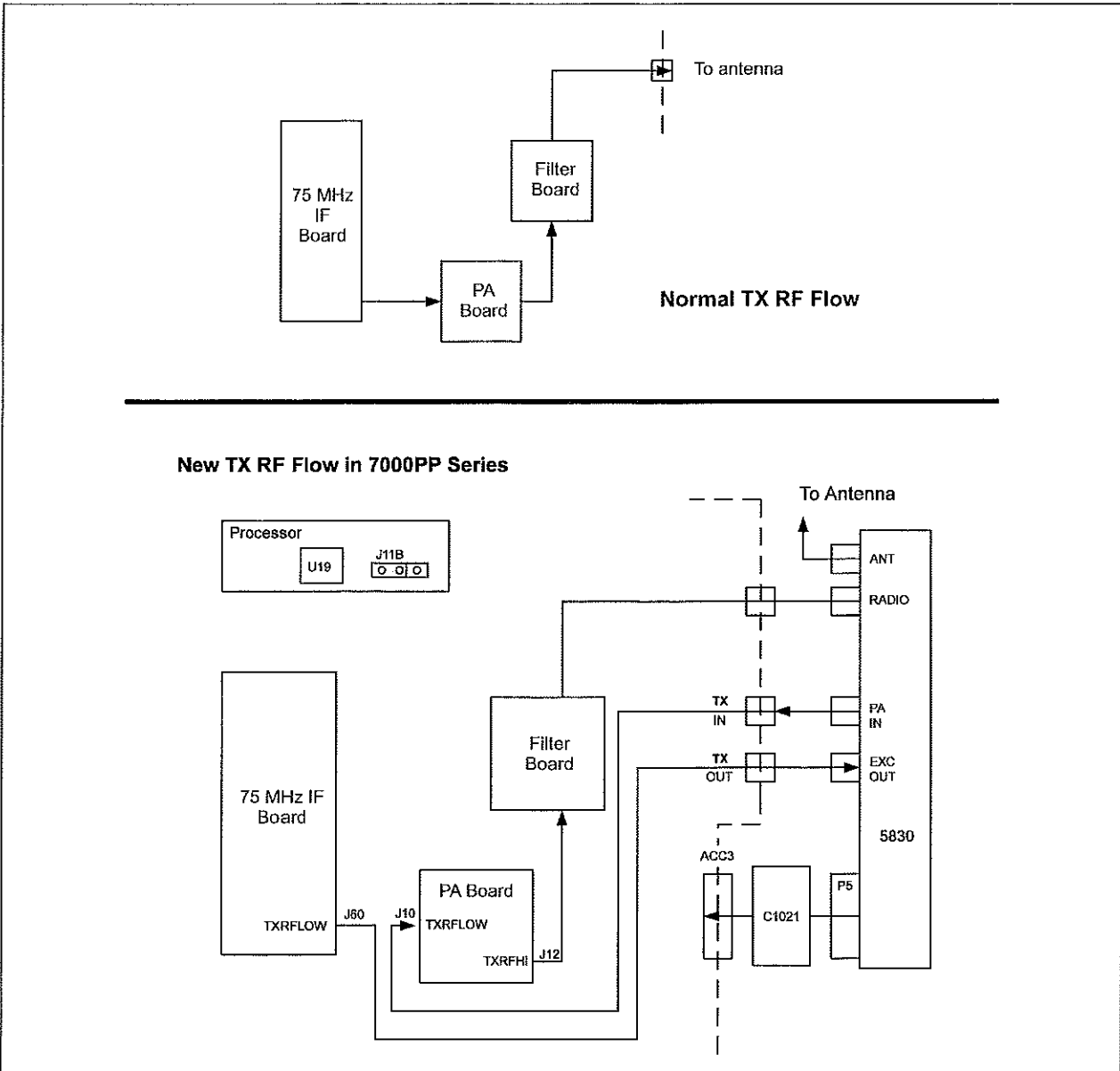


Figure 7-3. TW7000PP Internal Wiring Diagram

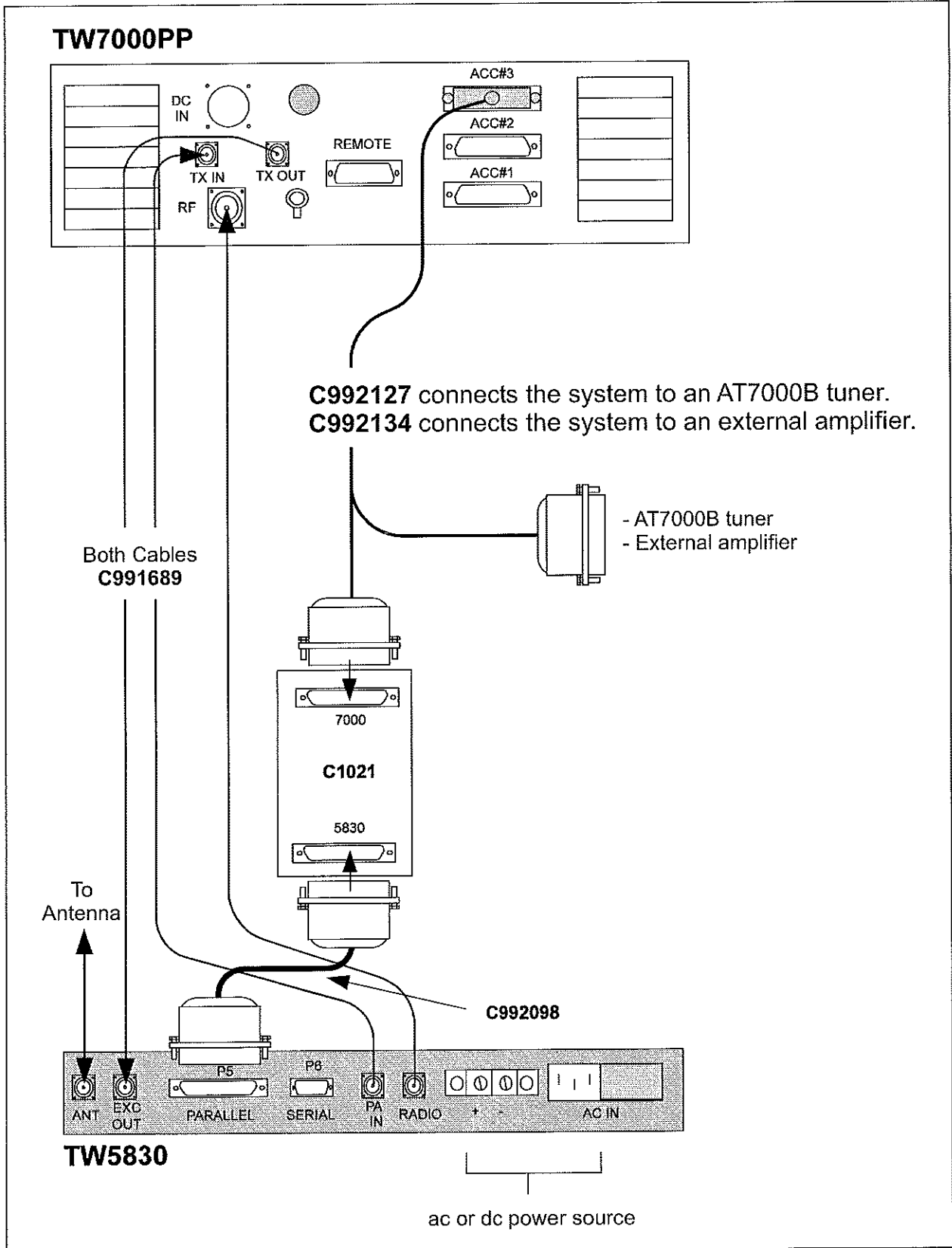


Figure 7-4. TW7000PP Cabling Connections

#### 7.4 FSK Remote Control (TW7000RF)

The TW7000RF is the transceiver with a blank front panel designed for long-range remote control from a TW7201F control console. It includes the internal 7000RF modem.

#### 7.5 ISDN Remote Control (TW7000RI)

The TW7000RI is the transceiver with a blank front panel designed for up to 2 km remote control from a TW7201I control console. It includes the internal 7000RI modem.

#### 7.6 Receiver Only (TW7000RX)

The TW7000RX is a receiver-only variation of the TW7000 with full features of the TW7000, excluding transmit.

#### 7.7 Transmitter Only (TW7000TX)

The TW7000TX is a transmitter-only variation with full features of the TW7000, excluding receive.