TW7000MS

TW7000

HF Transceiver

Technical Manual

Datron World Communications Inc.
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3030 Enterprise Court
Vista, CA 92081, U.S.A.
Phone: (760) 597-1500 Fax: (760) 597-1510
E-Mail: sales@dtwc.com
www.dtwc.com

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
6/2007	F	Removal of references to LCD/driver board, information for the FALC option and updates as required to boards, schematics and part lists.	All

Datron World Communications

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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.
e. 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.

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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

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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 be 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

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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.
7000FALC	Fast ALC loop for use with linear amplifiers like the TW1000D that utilize peak detection ALC.
7000HS	High-stability reference oscillator allows 0.1 parts per million frequency stability.
7000HS-FALC	High Stability reference oscillator and fast ALC loop operation.
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 TransAdapt.

7000VEM DSP-based voice enhancement provides superior voice recognition and signal-quality improvement in noisy environments.

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

TW7000AIRSELCALL

Operating with N-1304A (or equivalent) SELCALL devices and Datron power amplifiers, it adds a secondary control line to the radio and allows use of the ICAO-mandated ground-to-air SELCALL 3-tone system.

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 a 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 RF output 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
General	
Frequency Range	1.6 to 30 MHz (TX); 100 Hz to 30 MHz (RX); 10 Hz channel spacing
Preset Channels	256 standard, 1000 optional
Scanning	Multiple scan groups, operator selectable scan rates
Channel Programming	From front panel or remotely via computer or dedicated remote control console
Frequency Stability	0.5 ppm
Modes	USB, LSB, CW, AME; simplex or half-duplex
Input Power	11 to 15.5 Vdc
Input Power Protection	Reverse polarity, transient and under/over voltage
Antenna Port	SO-239
Antennas	50 ohms or automatic antenna tuner (AT7000, RAT1000C)
Interface	Control: two RS32 COM ports; compatible with EIA RS422/423/485 with option. Audio: 600 ohms, balanced and isolated

Characteristic	Specification
Mechanical, Environmental	
Size (H x W x D)	3.5 in. x 13 in. x 17 in. (8.9 cm x 33 cm x 43 cm)
Weight	21 lbs. (9.5 kg)
Cooling	On-demand fan (internal)
Temperature	-30°C to +60°C, operating
Shock, Vibration	Per MIL-STD-819
Transmitter	
RF Power Output	125W PEP, 100W average
Duty Cycle	Continuous service, all modes
Harmonics	-60 dB (2 to 30 MHz) nominally
Receiver	
Sensitivity	10 dB SINAD for 0.5µV input (2 to 30 MHz)
Attenuator	+20 dB, operator switchable
Audio	5W into 4 ohm; 0 dBm into 600 ohms

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.

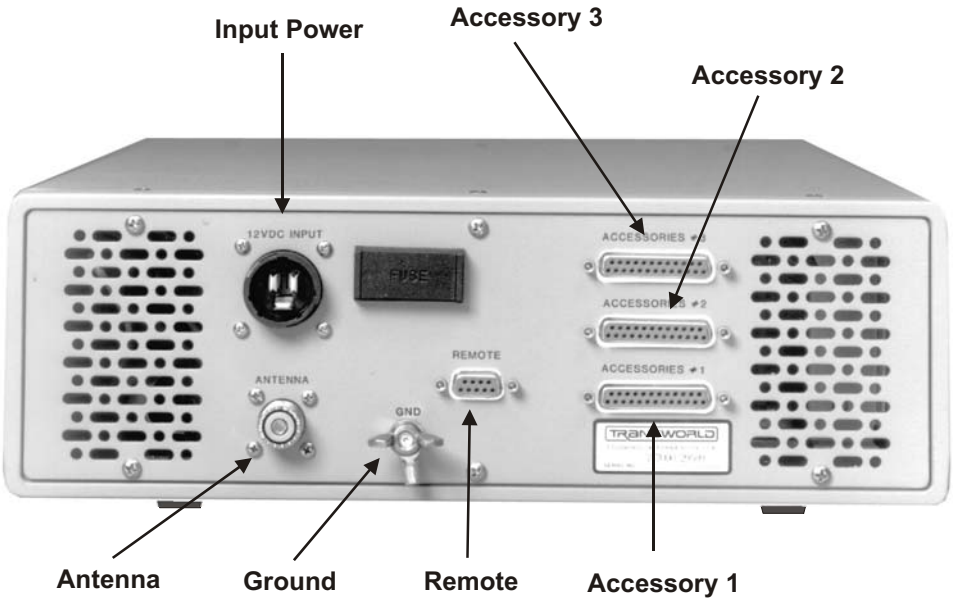


Figure 2-1. TW7000 Rear Panel

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 (strapable), 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 SO-239 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 TX audio)
9	BALTXA2 (balanced TX 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	FILTG\
4	AMPALC (external amplifier ALC line)
5	AMPPTT\ (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 AT100 and RAT100 as well as the newer AT7000B, RAT7000B and RAT1000C.

The AT100, RAT100 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 AT7000B and RAT7000B 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
1	Ground
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)

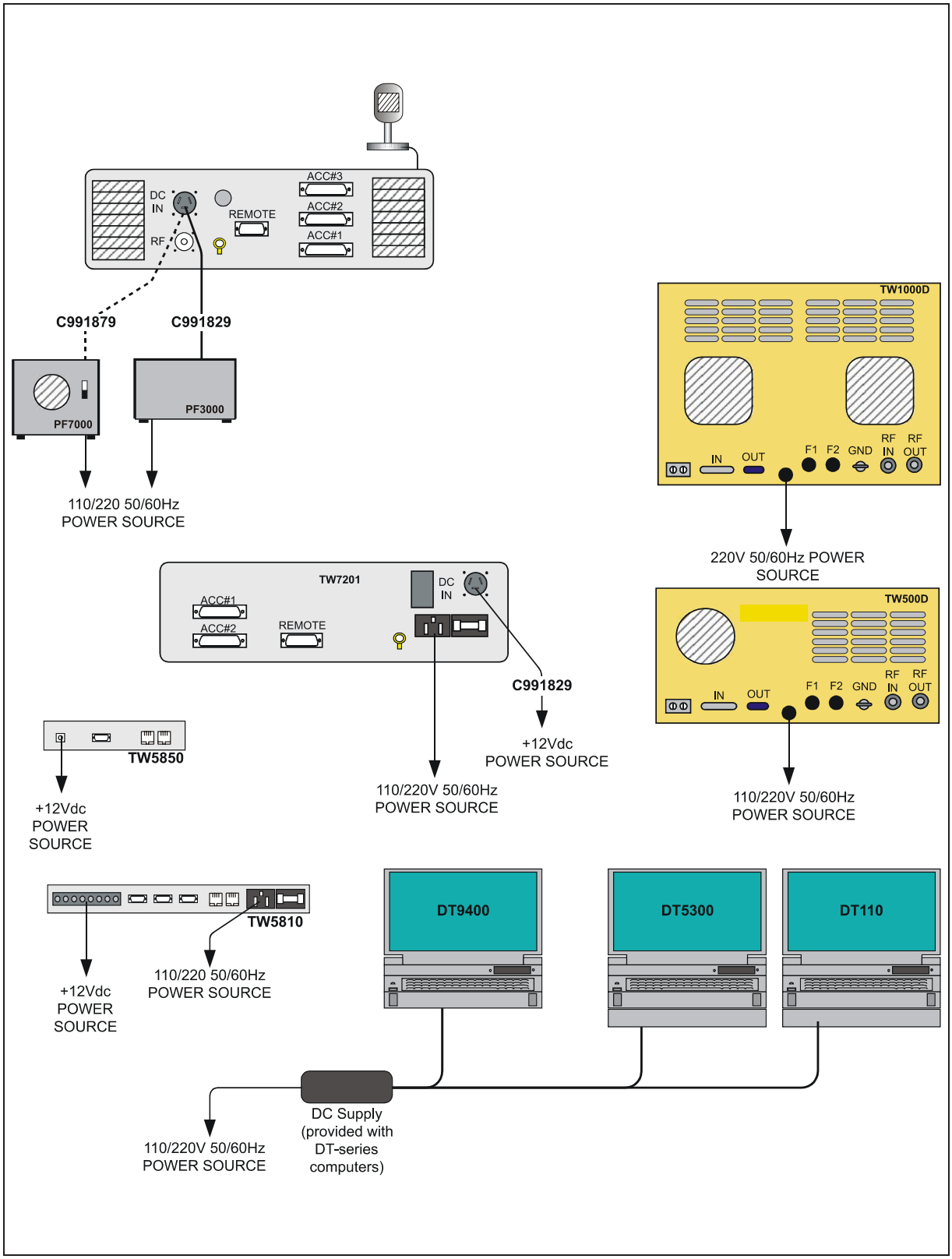


Figure 2-2. Power Cabling Accessories

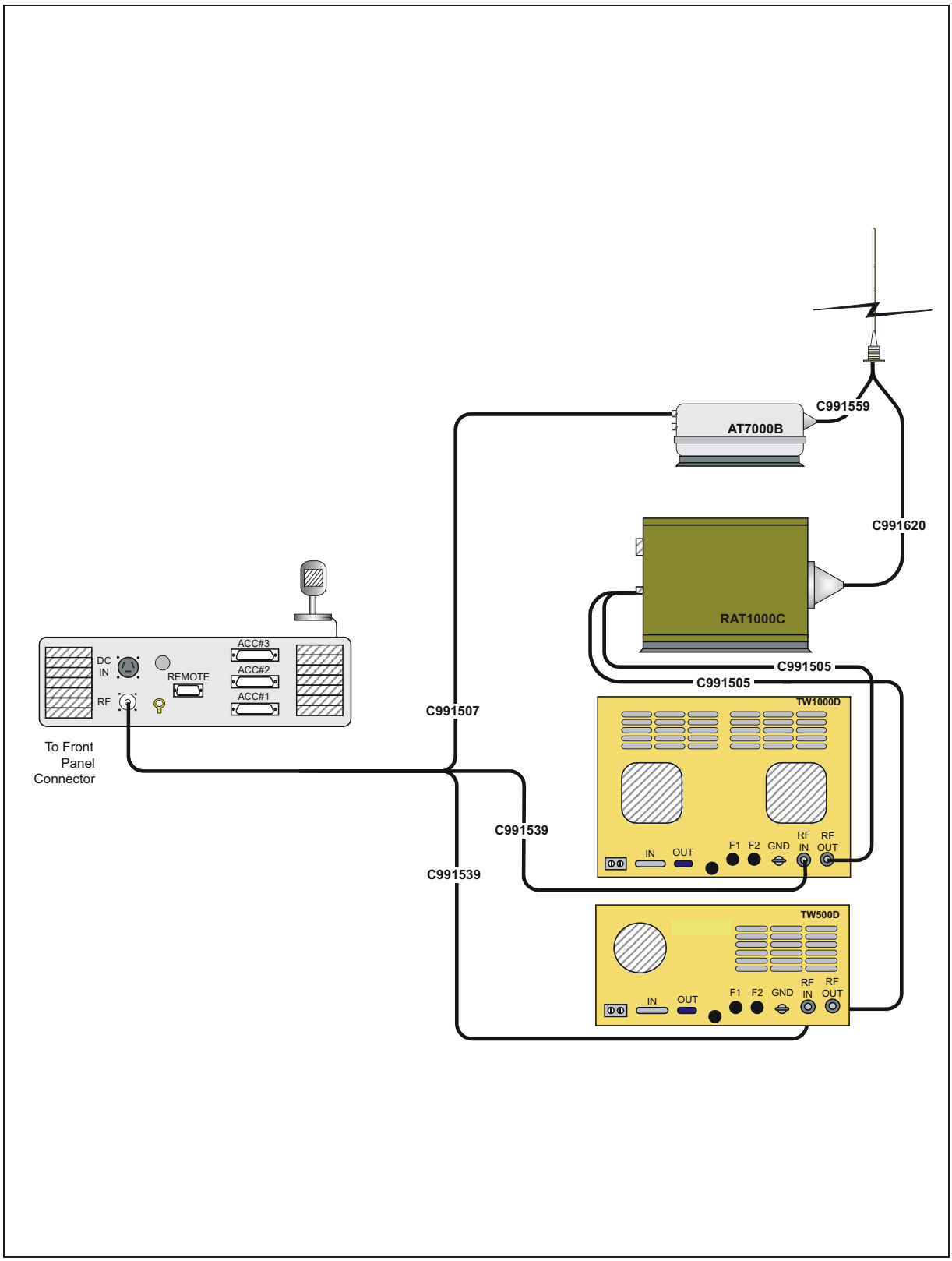


Figure 2-3. RF Cabling Accessories

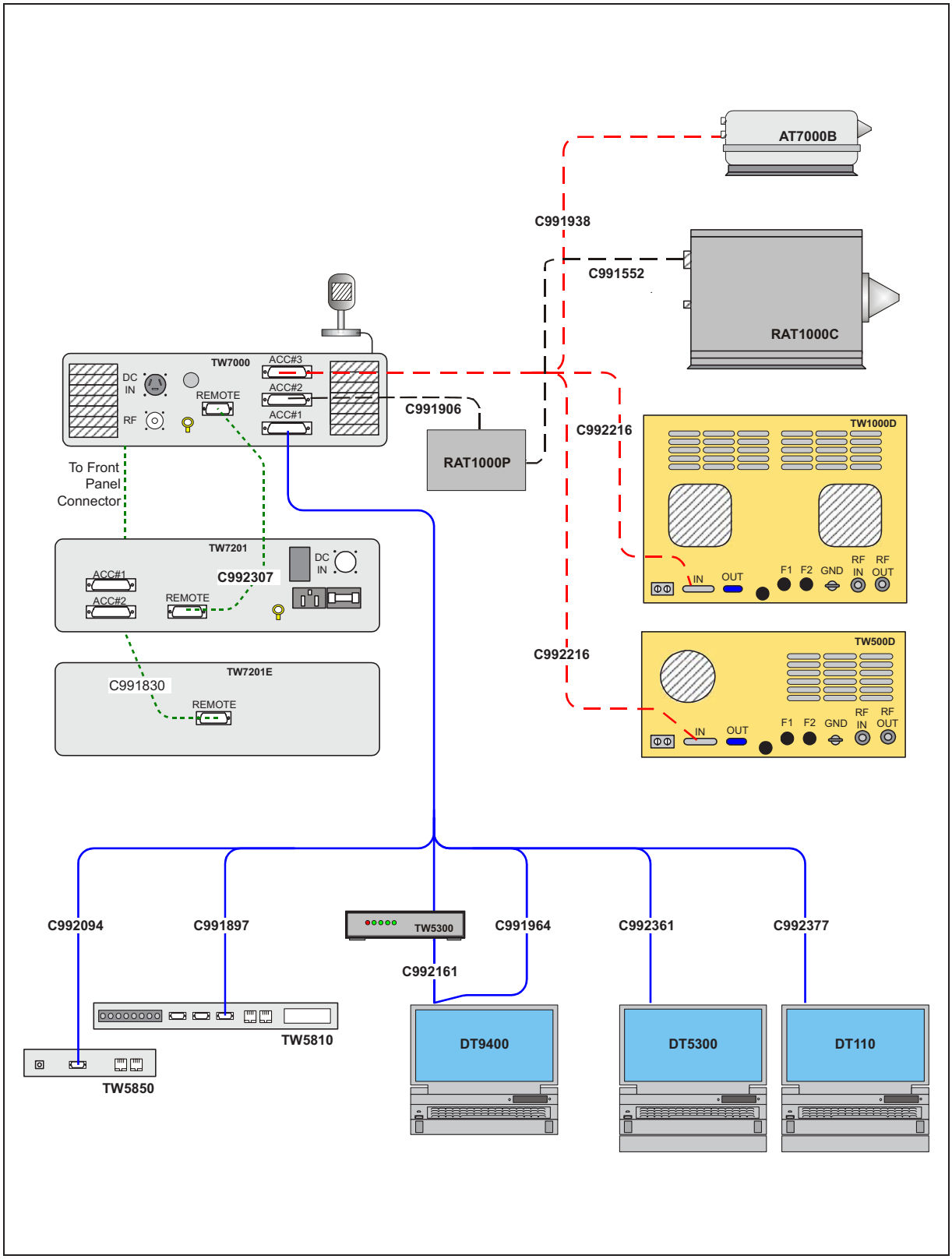


Figure 2-4. Control Cabling Accessories

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 Datron 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.

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

A total of twenty boards can occupy the TW7000 including standard boards and option boards. Many of these boards occupy plug-in slots that can be easily intalled and serviced. For the location of these boards, refer to the "Board Locations" figure on page 5-3.

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 **REMOTE** rear panel connector
+12V ACC	Regulated, switched, filtered +12 Vdc provides power to all of the rear panel connectors

Voltage	Description
+12V FAN	Unregulated, switched, filtered +12 Vdc drives the 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

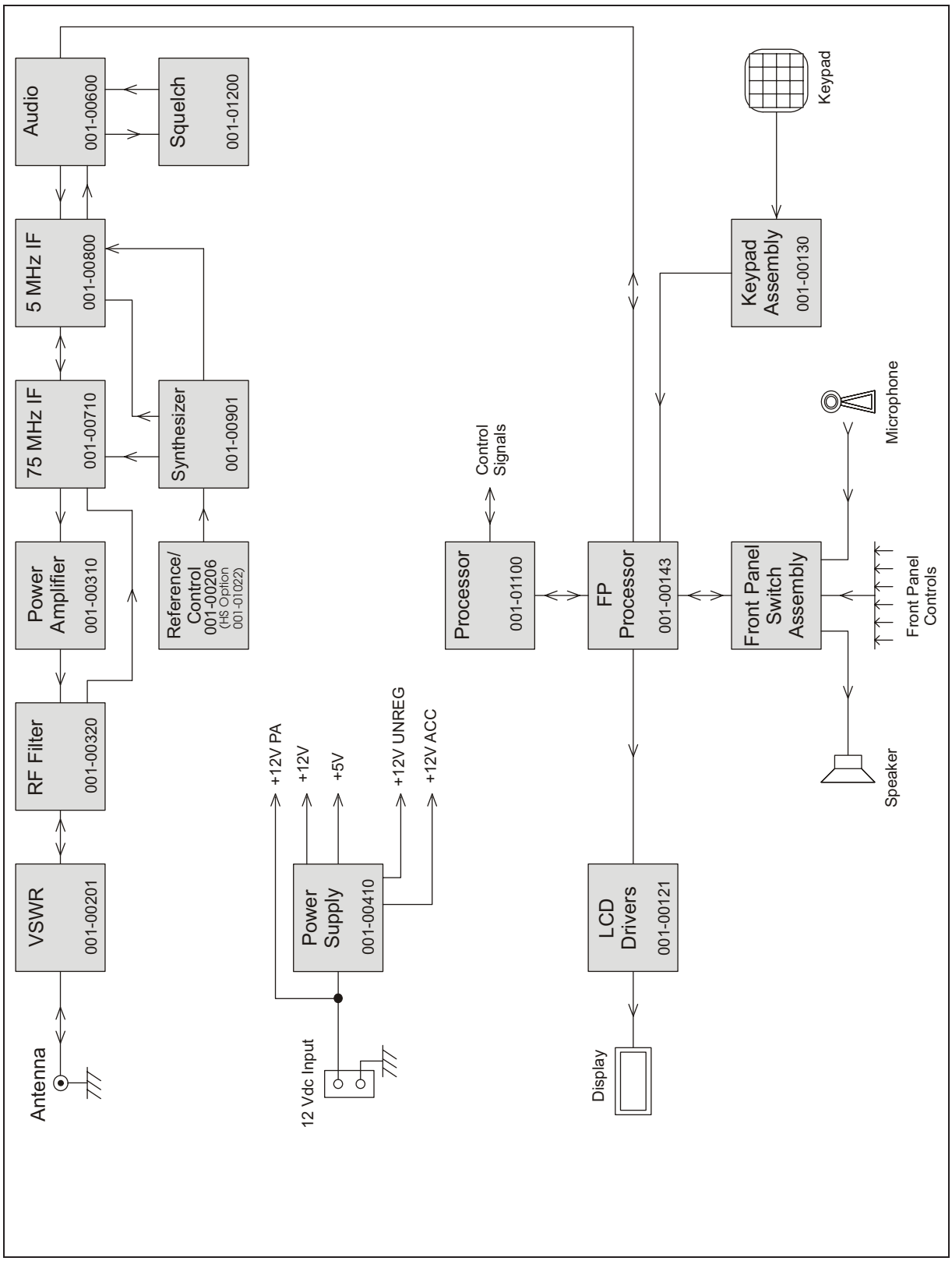


Figure 3-1. System Diagram

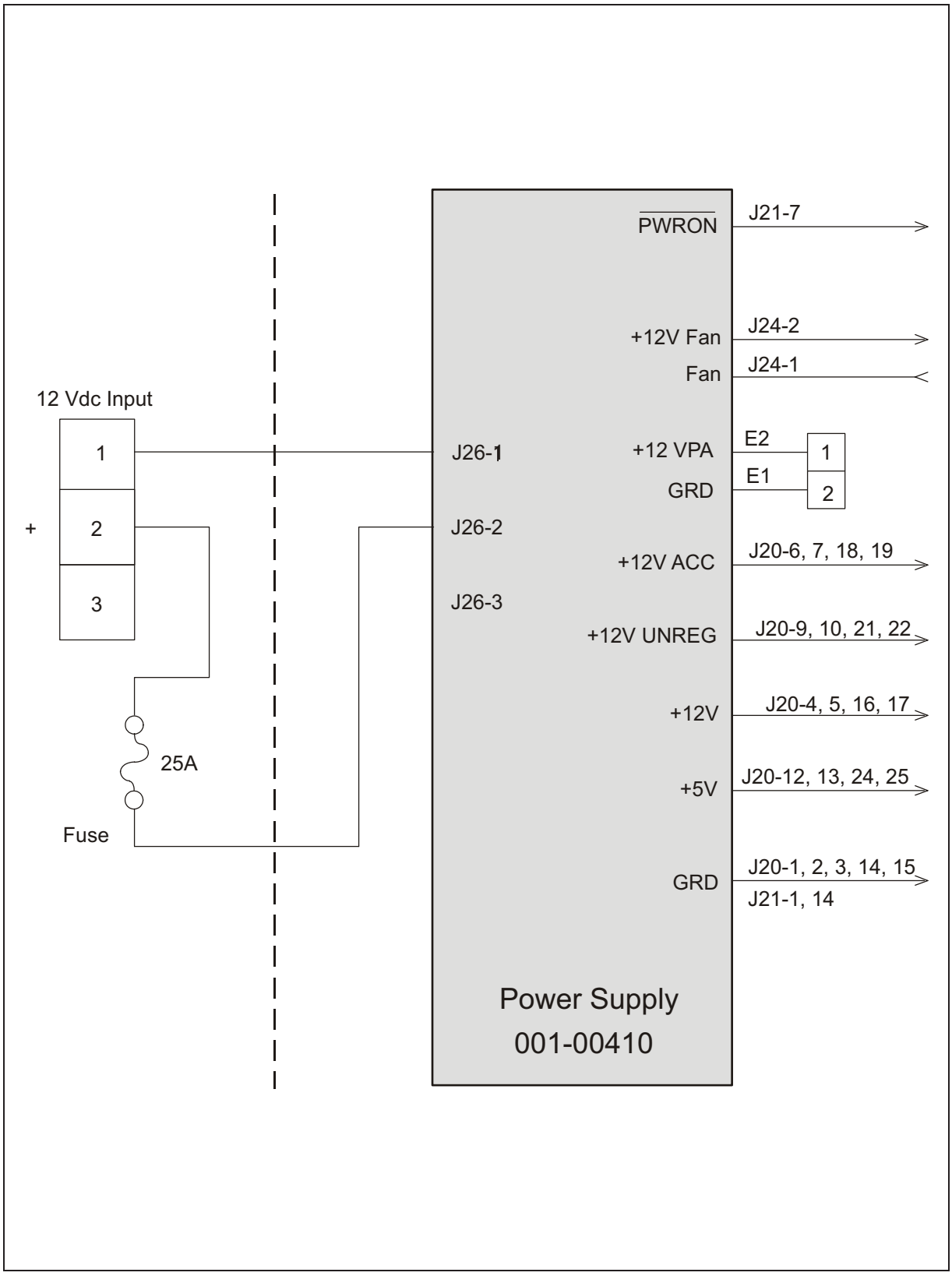


Figure 3-2. Power Distribution Diagram

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

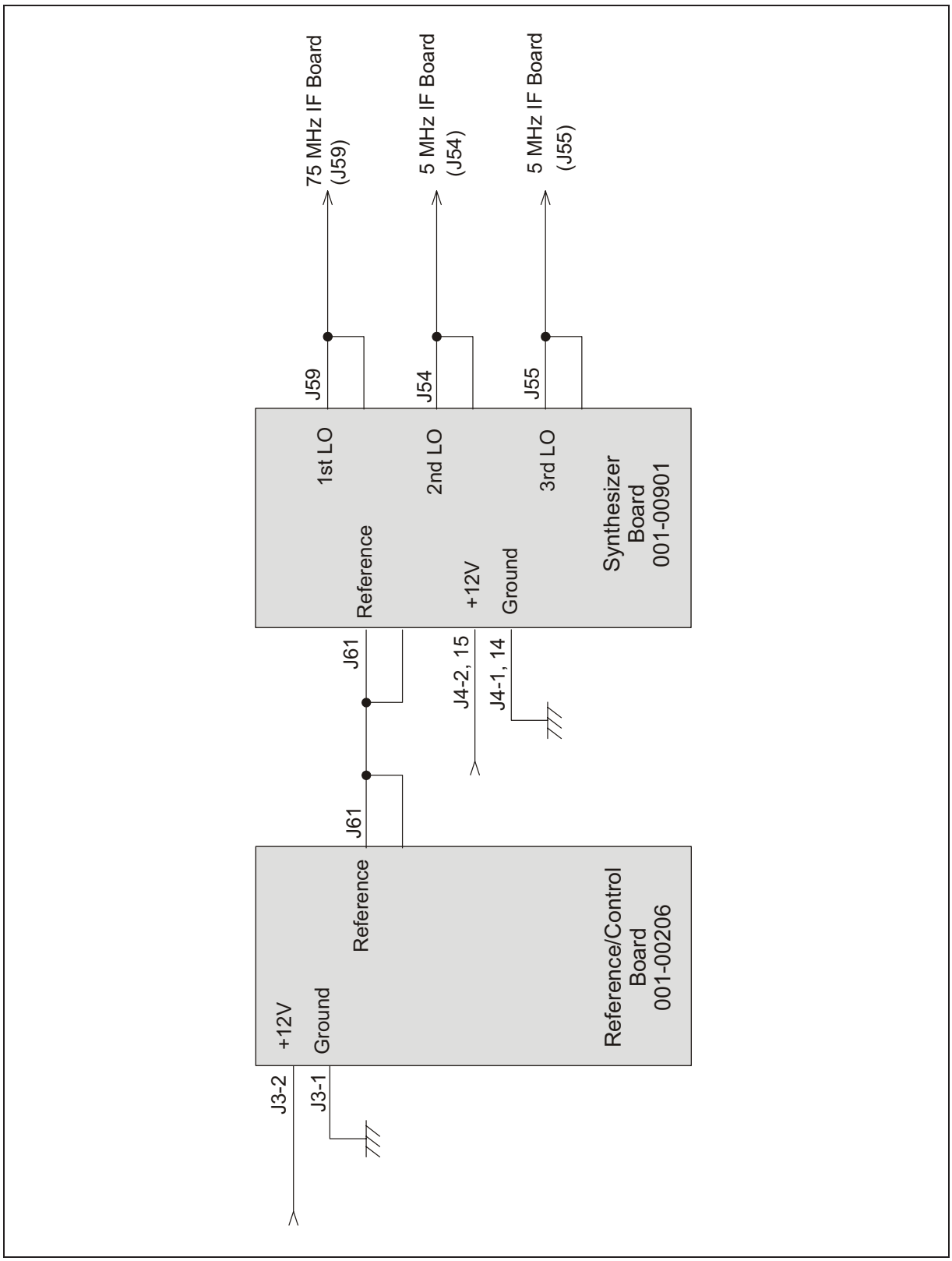


Figure 3-3. Transceiver Frequency Generation

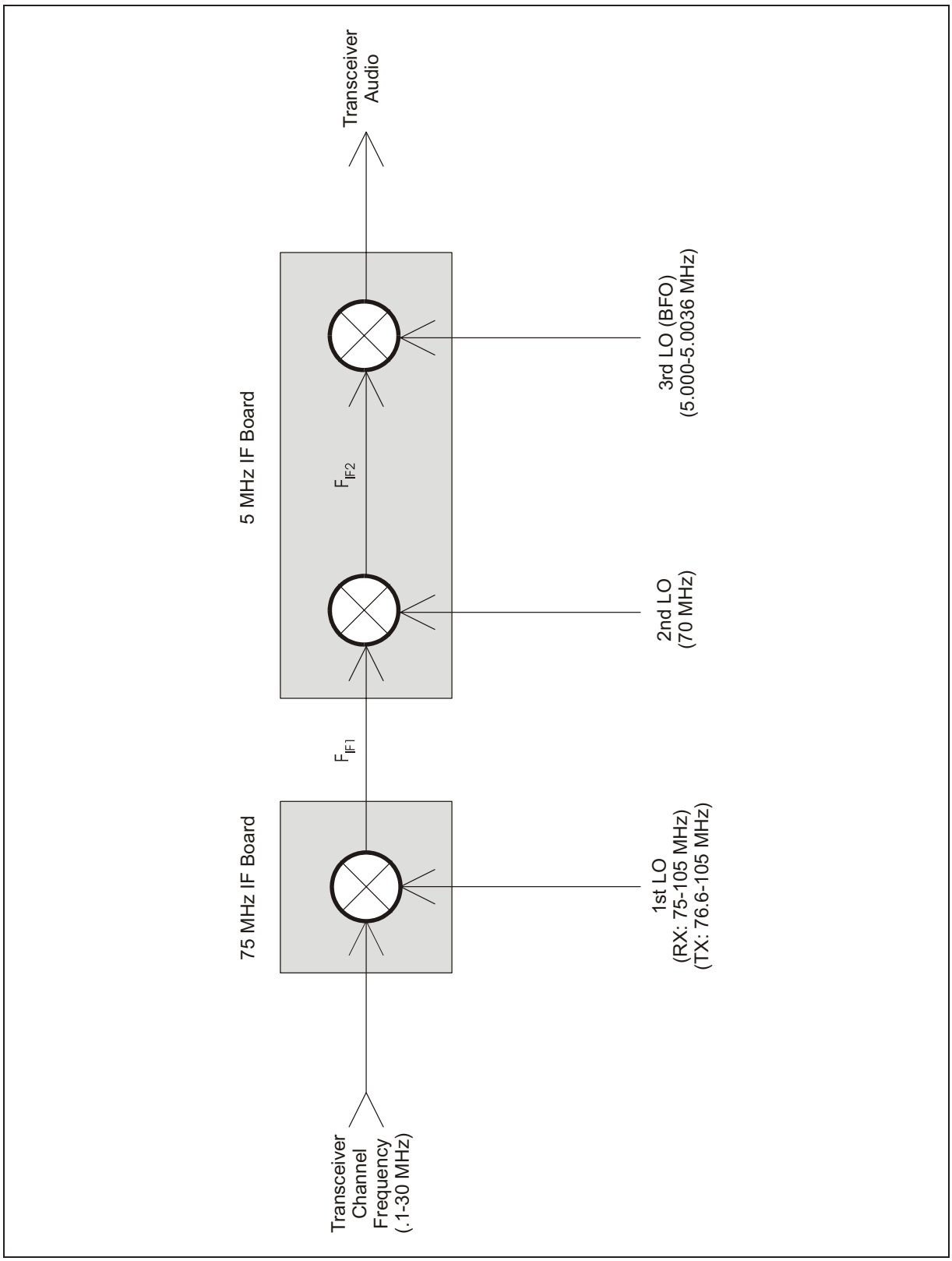


Figure 3-4. Transceiver Frequency Mixing Schematic

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 105 MHz (10 Hz steps)	0 dBm ± 2 dB (50 ohm)
Second LO	≈ 70 MHz	0 dBm ± 2 dB (50 ohm)
Third LO	5.000 MHz (LSB, voice) 5.003 MHz (USB, voice) 5.0036 MHz (USB, data)	0 dBm ± 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

Channel frequency = 1.6 MHz, LSB, voice, 1 kHz modulation	
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
Channel frequency = 1.6 MHz, USB, data, 1 kHz modulation	
First LO	= 76.6036 MHz
First IF	= 75.0026 MHz
Second IF	= 5.0026 MHz
Channel frequency = 1.6 MHz, USB, data, 1 kHz modulation	
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 (DEMODA) 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 22). Unbalanced squelched audio is provided at J8-6, J18-19 to both accessory 2 and accessory 3 (pins 6 and 13) 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.

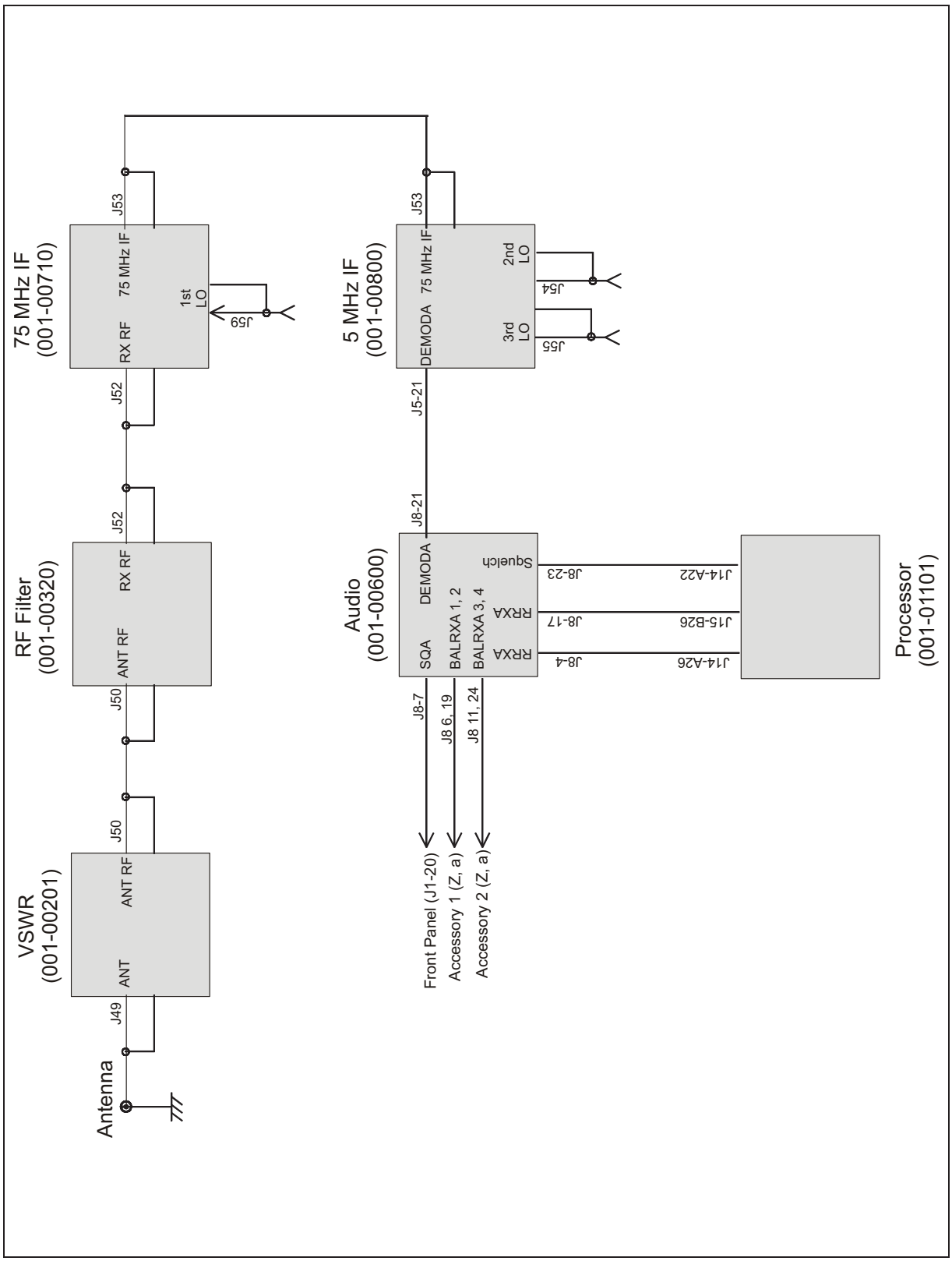


Figure 3-5. Transceiver Receive Path Diagram

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

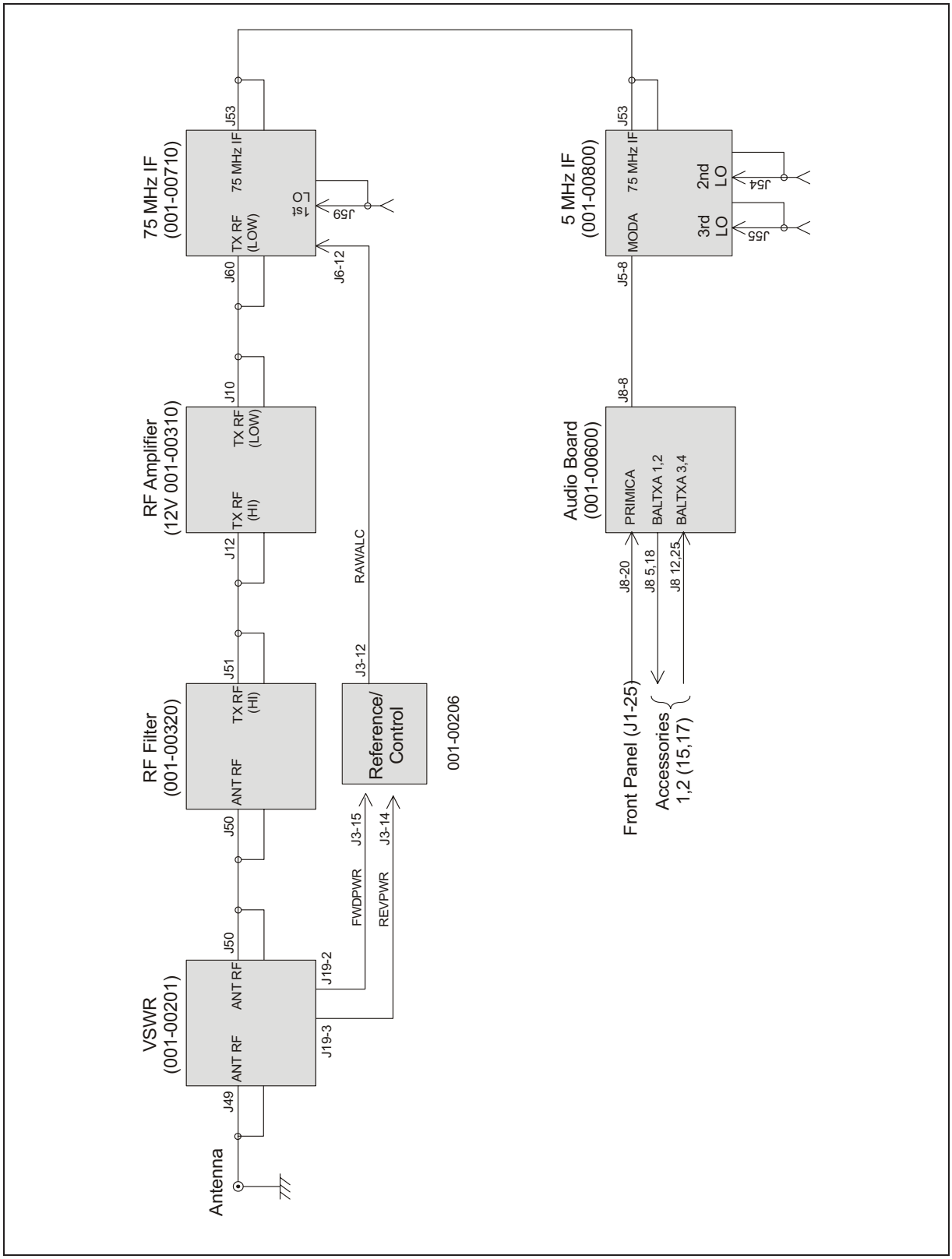


Figure 3-6. Transceiver Transmit Path

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 4-132.

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.

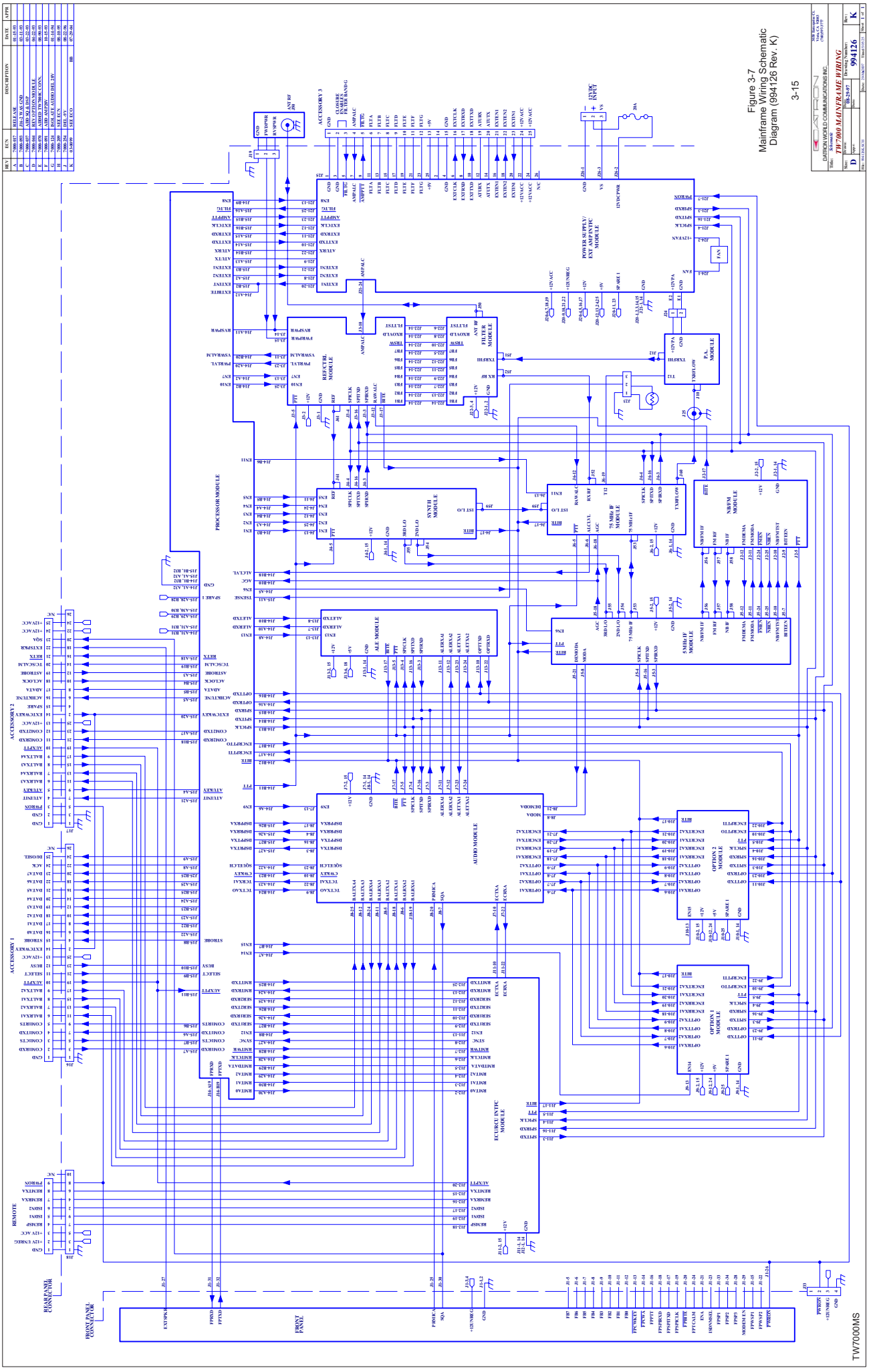


Figure 3-7
Mainframe Wiring Schematic
Diagram (994126 Rev. K)

3-15

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 ±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 ±.2 Vdc	J20-6, 12.0 Vdc ±.6 Vdc
J26-1, 13.8 Vdc ±.2 Vdc	J20-7, 12.0 Vdc ±.6 Vdc
J20-9, 13.8 Vdc ±.2 Vdc	J20-18, 12.0 Vdc ±.6 Vdc
J20-10, 13.8 Vdc ±.2 Vdc	J20-19, 12.0 Vdc ±.6 Vdc
J22-21, 13.8 Vdc ±.2 Vdc	J20-22, 13.8 Vdc ±.2 Vdc
J20-4, 12.0 Vdc ±.6 Vdc	J20-12, 5.0 Vdc ±.25 Vdc
J20-5, 12.0 Vdc ±.6 Vdc	J20-13, 5.0 Vdc ±.25 Vdc
J20-16, 12.0 Vdc ±.6 Vdc	J20-24, 5.0 Vdc ±.25 Vdc
J20-17, 12.0 Vdc ±.6 Vdc	J20-25, 5.0 Vdc ±.25 Vdc
J24-2, 13.8 Vdc ±.5 Vdc	

2. Check the voltage protect circuit. Connect the volt meter to J20-4. 12.0 Vdc ±.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.

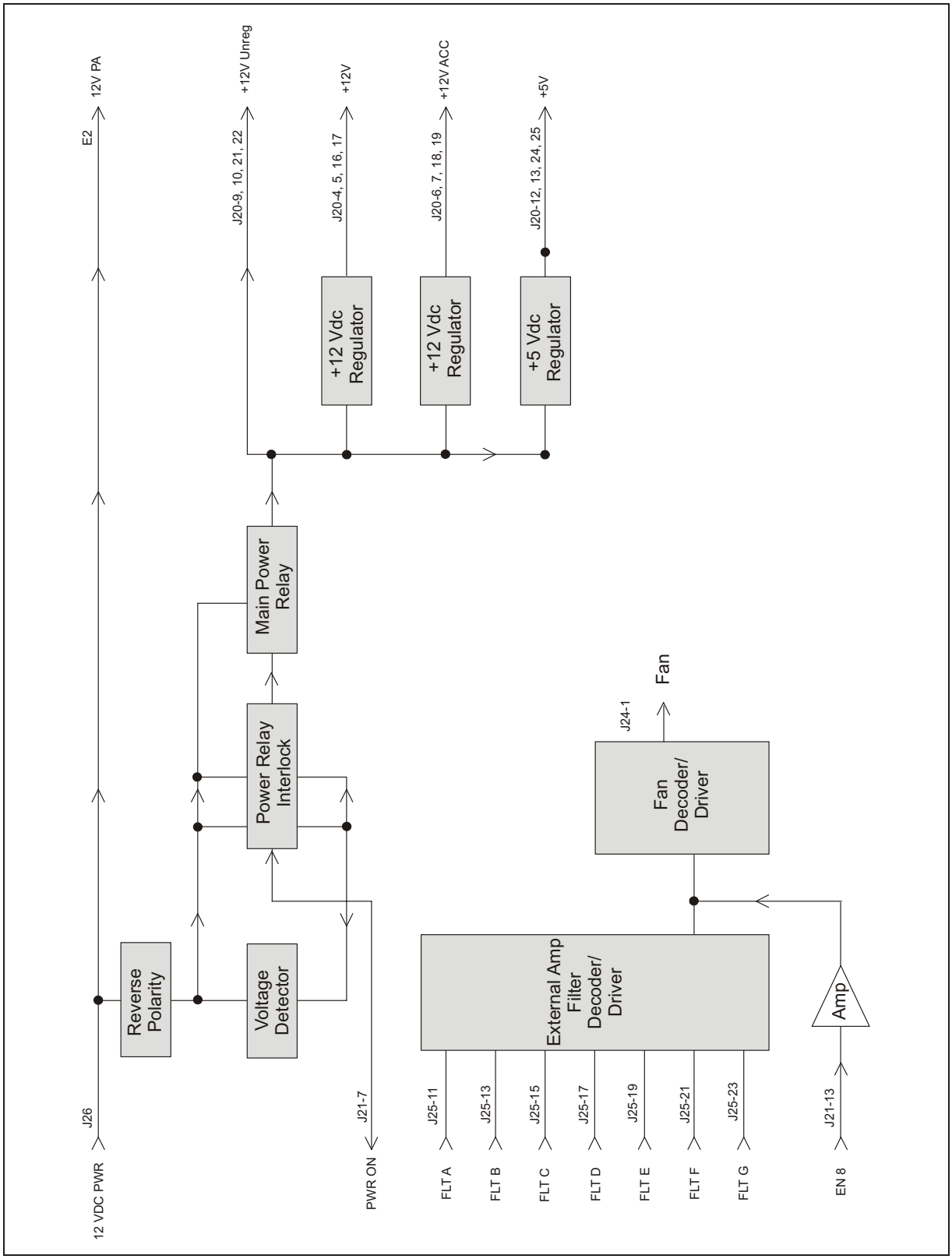


Figure 4-1. Power Supply Block Diagram

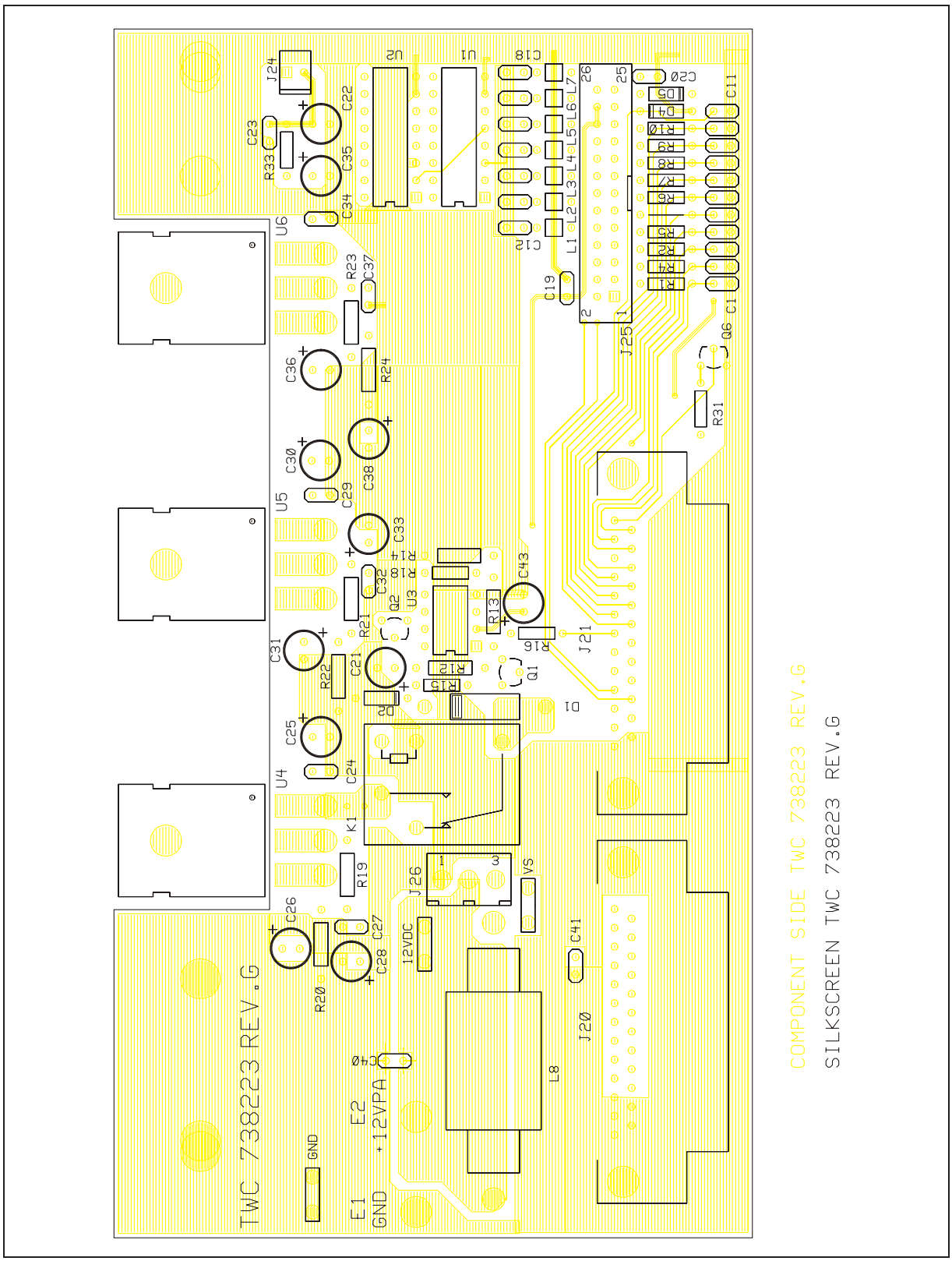
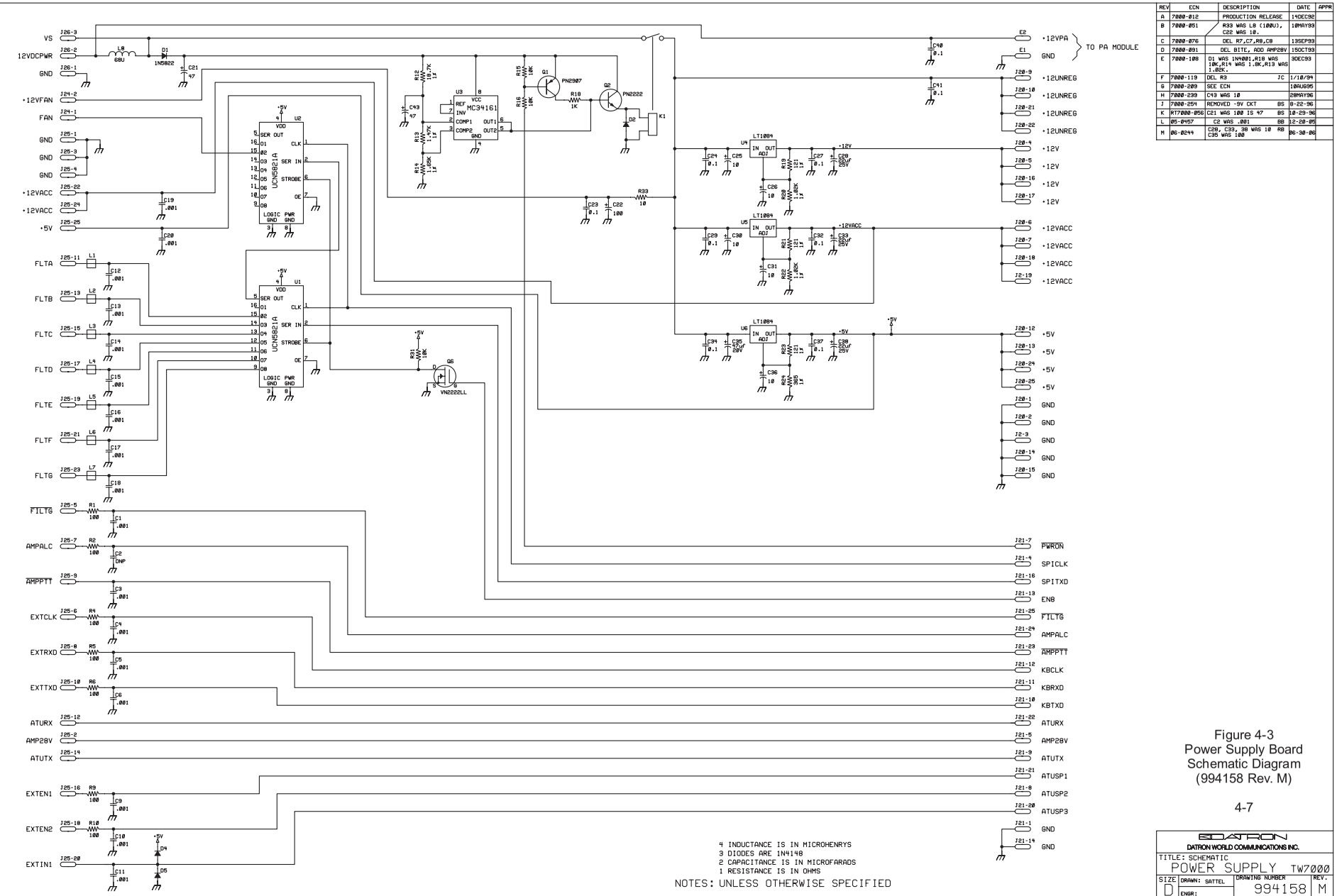


Figure 4-2. Power Supply Board Component Locations (738223 Rev. G)



4 INDUCTANCE IS IN MICROHENRYS
3 DIODES ARE IN4148
2 CAPACITANCE IS IN MICROFARADS
1 RESISTANCE IS IN OHMS
NOTES: UNLESS OTHERWISE SPECIFIED

REV	ECN	DESCRIPTION	DATE	APPR
A	7000-012	PRODUCTION RELEASE	14DEC92	
B	7000-051	R33 WAS L8 (100U), C22 WAS 10.	10MAY93	
C	7000-076	DEL R7,C7,R8,C8	13SEP93	
D	7000-091	DEL BITE, ADD AMP28V	15OCT93	
E	7000-100	D1 WAS 1N4001,R18 WAS 10K,R14 WAS 1.8K,R13 WAS 1.02K.	3DEC93	
F	7000-119	DEL R3 JC	1/10/94	
G	7000-209	SEE ECN	10AUG95	
H	7000-239	C43 WAS 10	20MAY96	
J	7000-254	REMOVED -9V CKT BS	8-22-96	
K	R7000-056	C21 WAS 100 IS 47 BS	10-29-96	
L	05-0457	C2 WAS .001 BB	12-20-05	
M	06-0244	C28, C33, 38 WAS 10 RB C35 WAS 100	06-30-06	

Figure 4-3
Power Supply Board
Schematic Diagram
(994158 Rev. M)

DATRON WORLD COMMUNICATIONS INC.

TITLE: SCHEMATIC
POWER SUPPLY TW7000

SIZE D | DRAWN: SATTEL | ENGR: | DRAWING NUMBER 994158 | REV. M

SCALE: | 29 OCT 91 | SHEET 1 OF 1

TW7000MS

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

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
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, 0.1UF X7R 50V 10% 0.1LS
C24	275104	CAP, 0.1UF X7R 50V 10% 0.1LS
C25	232100	CAP, 10UF AL 35V 20% 5X7 0.1LS
C26	232100	CAP, 10UF AL 35V 20% 5X7 0.1LS
C27	275104	CAP, 0.1UF X7R 50V 10% 0.1LS
C28	241226	CAP,T,22UF,25V,20%,RA,.1SP
C29	275104	CAP, 0.1UF X7R 50V 10% 0.1LS
C3	214103	CAP,C,0.01U,50,10%,X,RA,.1SP
C30	232100	CAP, 10UF AL 35V 20% 5X7 0.1LS
C31	232100	CAP, 10UF AL 35V 20% 5X7 0.1LS
C32	275104	CAP, 0.1UF X7R 50V 10% 0.1LS
C33	241226	CAP,T,22UF,25V,20%,RA,.1SP
C34	275104	CAP, 0.1UF X7R 50V 10% 0.1LS
C35	241476	CAP, 47UF TA 20V 20% 0.1LS
C36	232100	CAP, 10UF AL 35V 20% 5X7 0.1LS
C37	275104	CAP, 0.1UF X7R 50V 10% 0.1LS
C38	241226	CAP,T,22UF,25V,20%,RA,.1SP
C4	214103	CAP,C,0.01U,50,10%,X,RA,.1SP
C40	275104	CAP, 0.1UF X7R 50V 10% 0.1LS

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

Designator	Part Number	Description
C41	275104	CAP, 0.1UF X7R 50V 10% 0.1LS
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, 1N4148/1N4150 DO-35
D4	320002	DIODE, 1N4148/1N4150 DO-35
D5	320002	DIODE, 1N4148/1N4150 DO-35
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, 1X2 W/LB-LOCK 0.1 TH
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	XSTR, PN2907A PNP 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
R14	1111651	RES, 1.65K, 1/8W, 1%, MF

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

Designator	Part Number	Description
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
R3	1110000	RES,0 OHM,1/8W,1%
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
R7	1110000	RES,0 OHM,1/8W,1%
R8	1110000	RES,0 OHM,1/8W,1%
R9	113101	RES,100 OHM 1/8W 5% CF
U1	330384	IC,5821 8-BIT SER DRIVER DIP16
U2	330384	IC,5821 8-BIT SER DRIVER DIP16
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 potentiometers, 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 the board is given a new part number.

Table 4-3. Reference/Control Board Interconnects

Connector J3	Description	Comment
1	Ground	
2	+12V input	
3	No connection	No connection
4	SPICLK	Clock
5	/PTT	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	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	No connection

Table 4-3. Reference/Control Board Interconnects

Connector J3	Description	Comment
23	PWRLVL	RF power level status line
24	FLTTST	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
- 100W Dummy load
- 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 at 15.0 MHz 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 the 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's low pass filter select by setting it to the following frequencies. The pin for the filter should be logic low with all other Filter board 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 set to the default settings for each power level (refer to the TW7000-MSOP operator manual for information on the Alpha menu and function 5).

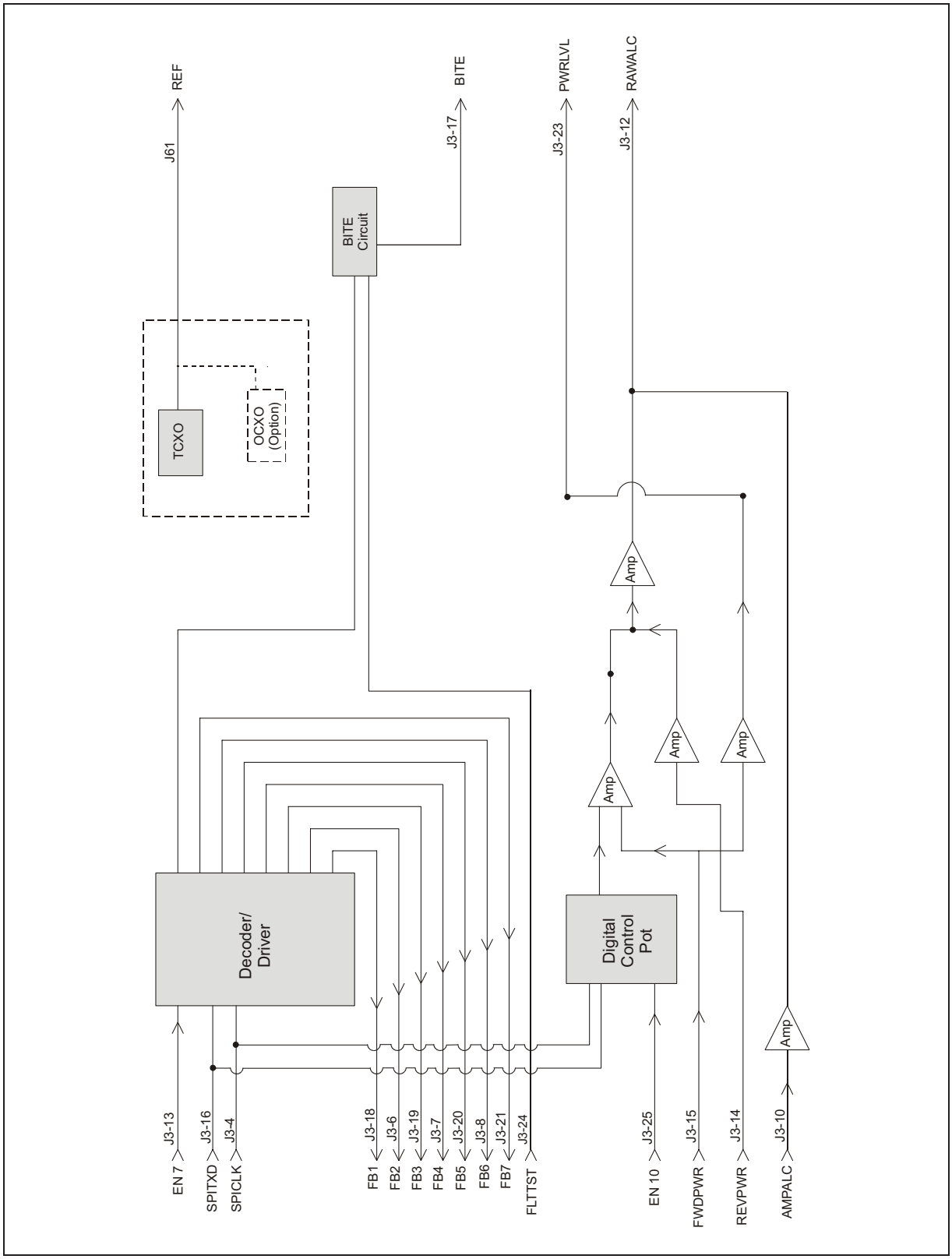


Figure 4-4. Reference/Control Board Block Diagram

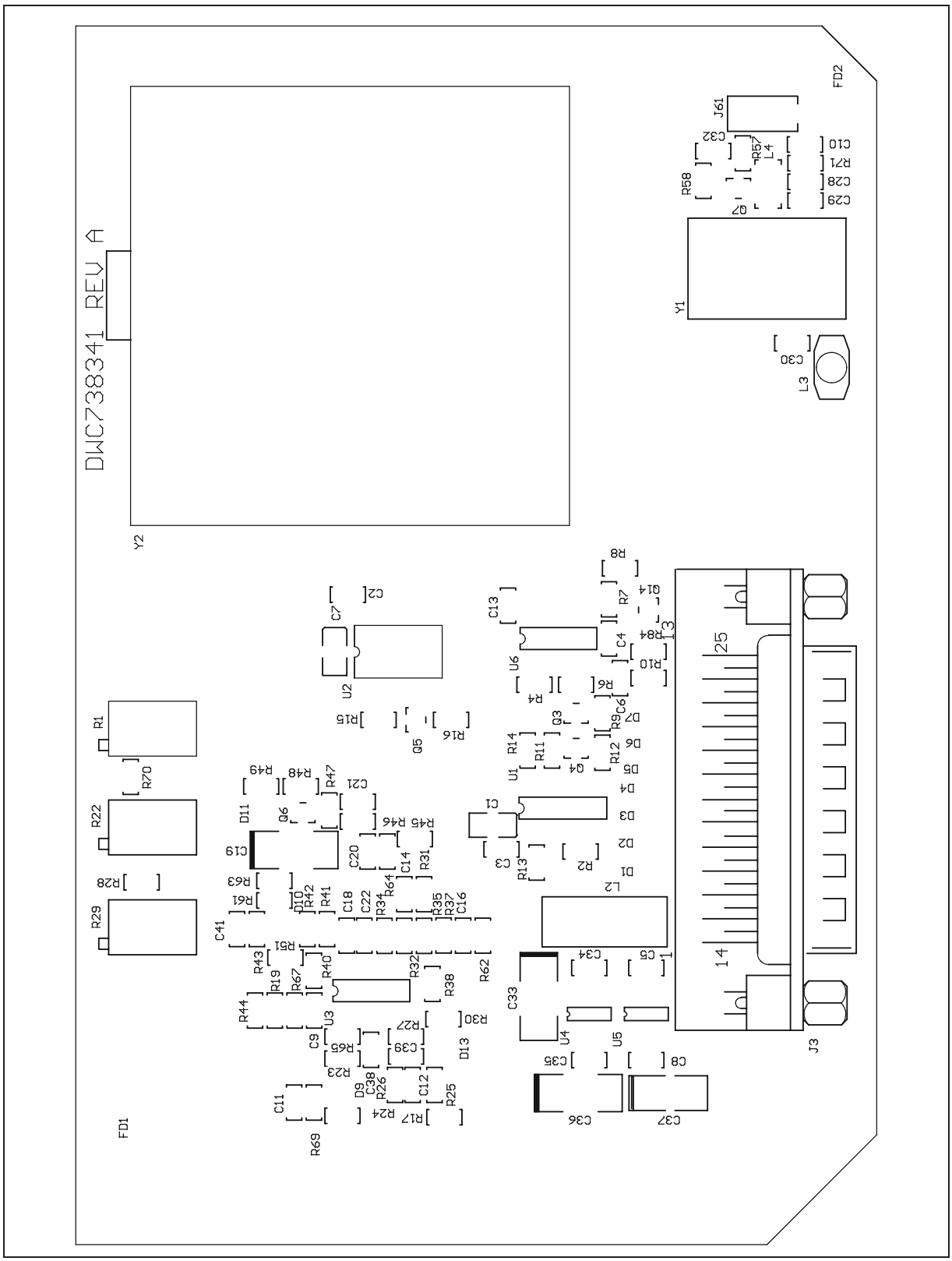


Figure 4-5. Reference/Control Board Component Locations (738341 Rev. A)

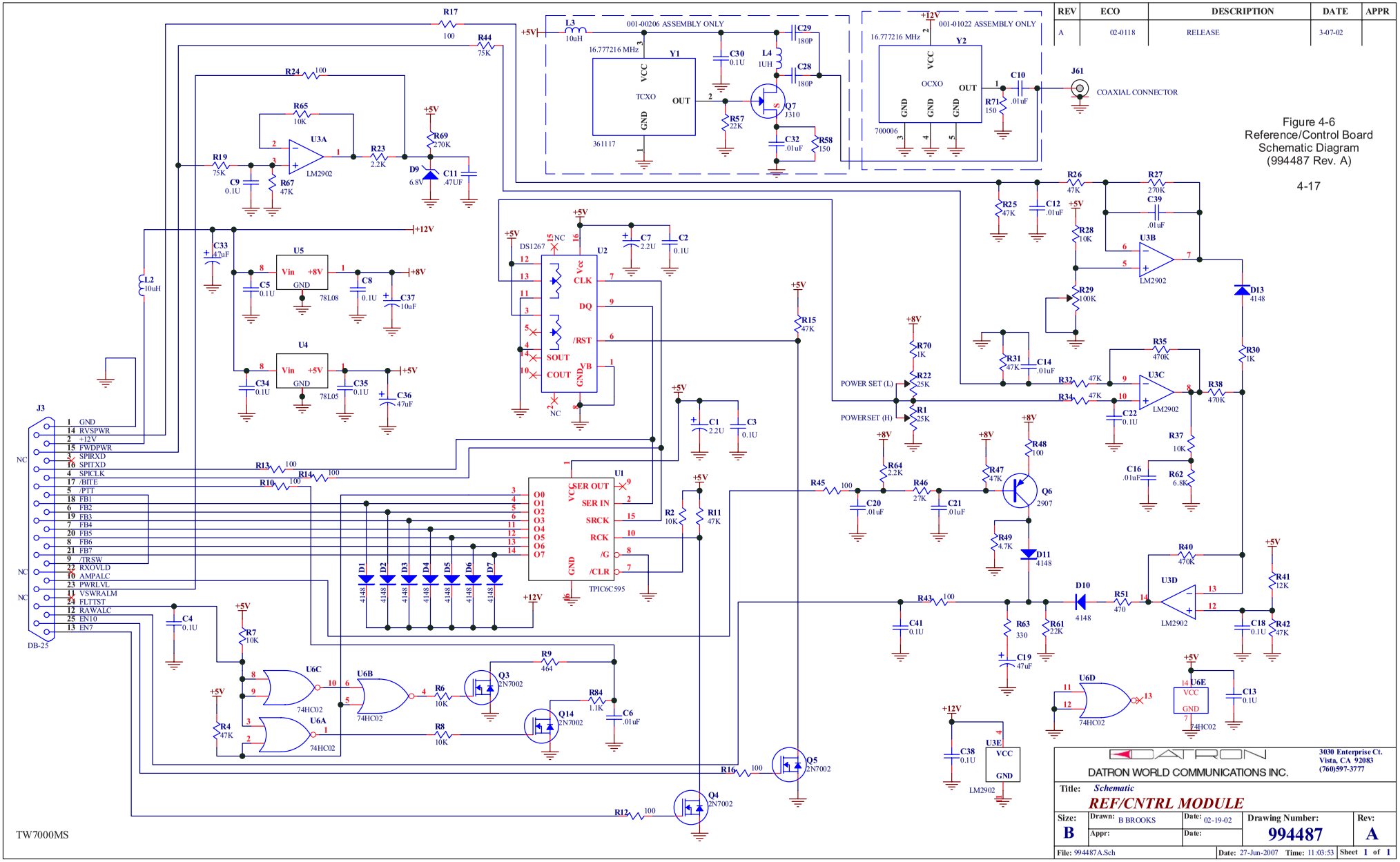

REV | ECO | DESCRIPTION | DATE | APPR
A | 02-0118 | RELEASE | 3-07-02
001-00206 ASSEMBLY ONLY
001-01022 ASSEMBLY ONLY
16.777216 MHz
TCXO
OCXO
COAXIAL CONNECTOR
J3
DB-25
U1
TPIC6C595
U2
DS1267
LM2902
74HC02
2N7002
J310
78L08
78L05
Figure 4-6
Reference/Control Board
Schematic Diagram
(994487 Rev. A)
4-17
DATRON WORLD COMMUNICATIONS INC.
3030 Enterprise Ct.
Vista, CA 92083
(760)597-3777
Title: Schematic
REF/CNTRL MODULE
Size: B
Drawn: B BROOKS
Date: 02-19-02
Appr:
Date:
Drawing Number: 994487
Rev: A
File: 994487A.Sch
Date: 27-Jun-2007
Time: 11:03:53
Sheet 1 of 1
TW7000MS

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

Designator	Part Number	Description
C1	022225000	CAP SM T 2.2U 16V 10% 3528
C11	021471003	CAP,0.47UF Y5V 16V 80/20% 0805
C12	021103000	CAP, 0.01UF X7R 50V 5% 0805
C13	021104000	CAP, 0.1UF X7R 25V 5% 0805
C14	021103000	CAP, 0.01UF X7R 50V 5% 0805
C16	021103000	CAP, 0.01UF X7R 50V 5% 0805
C18	021104000	CAP, 0.1UF X7R 25V 5% 0805
C19	022476000	CAP, 47UF TA 20V 20% 7343
C2	021104000	CAP, 0.1UF X7R 25V 5% 0805
C20	021103000	CAP, 0.01UF X7R 50V 5% 0805
C21	021103000	CAP, 0.01UF X7R 50V 5% 0805
C22	021104000	CAP, 0.1UF X7R 25V 5% 0805
C28	021181000	CAP 180PF NPO 100V 5% 0805
C29	021181000	CAP 180PF NPO 100V 5% 0805
C3	021104000	CAP, 0.1UF X7R 25V 5% 0805
C30	021104000	CAP, 0.1UF X7R 25V 5% 0805
C32	021103000	CAP, 0.01UF X7R 50V 5% 0805
C33	022476000	CAP, 47UF TA 20V 20% 7343
C34	021104000	CAP, 0.1UF X7R 25V 5% 0805
C35	021104000	CAP, 0.1UF X7R 25V 5% 0805
C36	022476000	CAP, 47UF TA 20V 20% 7343
C37	022106001	CAP, 10UF TA 16V 10% 6032
C38	021104000	CAP, 0.1UF X7R 25V 5% 0805
C39	021103000	CAP, 0.01UF X7R 50V 5% 0805
C4	021103000	CAP, 0.01UF X7R 50V 5% 0805
C41	021104000	CAP, 0.1UF X7R 25V 5% 0805
C5	021104000	CAP, 0.1UF X7R 25V 5% 0805
C6	021103000	CAP, 0.01UF X7R 50V 5% 0805
C7	022225000	CAP SM T 2.2U 16V 10% 3528
C8	021104000	CAP, 0.1UF X7R 25V 5% 0805
C9	021104000	CAP, 0.1UF X7R 25V 5% 0805
D1	037700005	DIODE, MMBD4148 SOT-23
D10	037700005	DIODE, MMBD4148 SOT-23

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

Designator	Part Number	Description
D11	037700005	DIODE, MMBD4148 SOT-23
D13	037700005	DIODE, MMBD4148 SOT-23
D2	037700005	DIODE, MMBD4148 SOT-23
D3	037700005	DIODE, MMBD4148 SOT-23
D4	037700005	DIODE, MMBD4148 SOT-23
D5	037700005	DIODE, MMBD4148 SOT-23
D6	037700005	DIODE, MMBD4148 SOT-23
D7	037700005	DIODE, 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 PIN FEMALE JACK #45
L2	041103002	IND SM 10UH 15% 4825
L3	041103003	IND,SM,10uH,.7A,DTI608C-103
L4	041102000	INDUCTOR,CHIP,1UH,SMT,1210,10%
Q14	032005	XSTR, 2N7002 N-MOSFET SOT-23
Q3	032005	XSTR, 2N7002 N-MOSFET SOT-23
Q4	032005	XSTR, 2N7002 N-MOSFET SOT-23
Q5	032005	XSTR, 2N7002 N-MOSFET SOT-23
Q6	032006	XSTR,MMBT2907A PNP 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

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

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, 1K OHM 1/8W 5% TK 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, 12K OHM 1/8W 5% TK 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. E)

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, 1K OHM 1/8W 5% TK 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, 464 OHM 1/8W 1% TK 0805
U1	033087	IC,8BIT SHIFT,TPIC6C595,SO-16
U2	033305003	IC,DS1267S 10KX2 DIG POT SOW16
U3	033304000	IC,SM,LM2902D,QUAD-OP,SO-14
U4	033003	IC,VREG 78L05 5V 5% SOIC-8
U5	033002	IC,VREG 78L08 8V 5% SOIC-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. 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 MHz 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 75MHz 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 Interconnections

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	+12V
3	SPIRXD	Receive serial data line
4	SPICLK	Clock line
11	EN5	Not used
12	EN3	First LO synthesizer enable
13	EN1	Third LO synthesizer enable
14	GND	Ground
15	+12V input	+12V
16	SPITXD	Transmit serial data line
17	BITE	BITE signal to processor
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 (approximately130 mVPP minimum).
5. Set the radio frequency to 30.00 MHz. Carefully adjust L5 for 10 Vdc ±.25 at U5, pin 1.

Miscellaneous Test

1. Measure the voltage at U5, pin 8 for 9 Vdc ±.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.

TX Test

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.
2. Key the radio again at 2 MHz and 29.999 MHz. TX wave should be approximately 100W with no distortion.

Input/Output Signals

1. The reference input signal at J61 should read 16,777,216 Hz. The level should be 2 VPP.
2. The first LO output signal at J59 should read 75 to 105 MHz. The level should be 0 dBm, ± 2 dBm.
3. The third LO (BFO) output signal at J55 should read 5.000 MHz and 5.003 MHz. The level should be 0 dBm, ±2 dBm.
4. The second LO output signal at J54 should read approximately 70.000 MHz. The level should be 0 dBm, ±2 dBm.

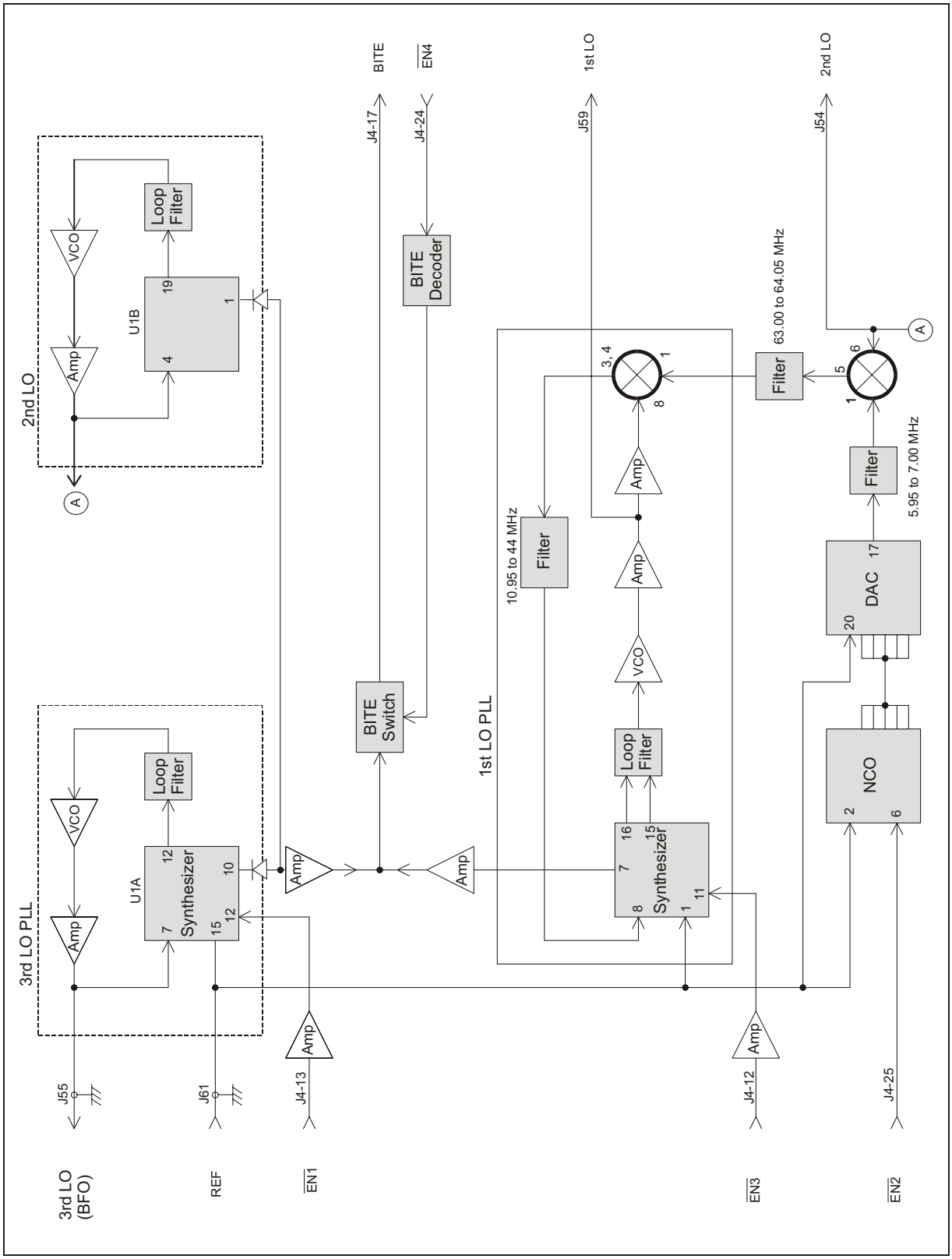


Figure 4-7. Synthesizer Board Block Diagram

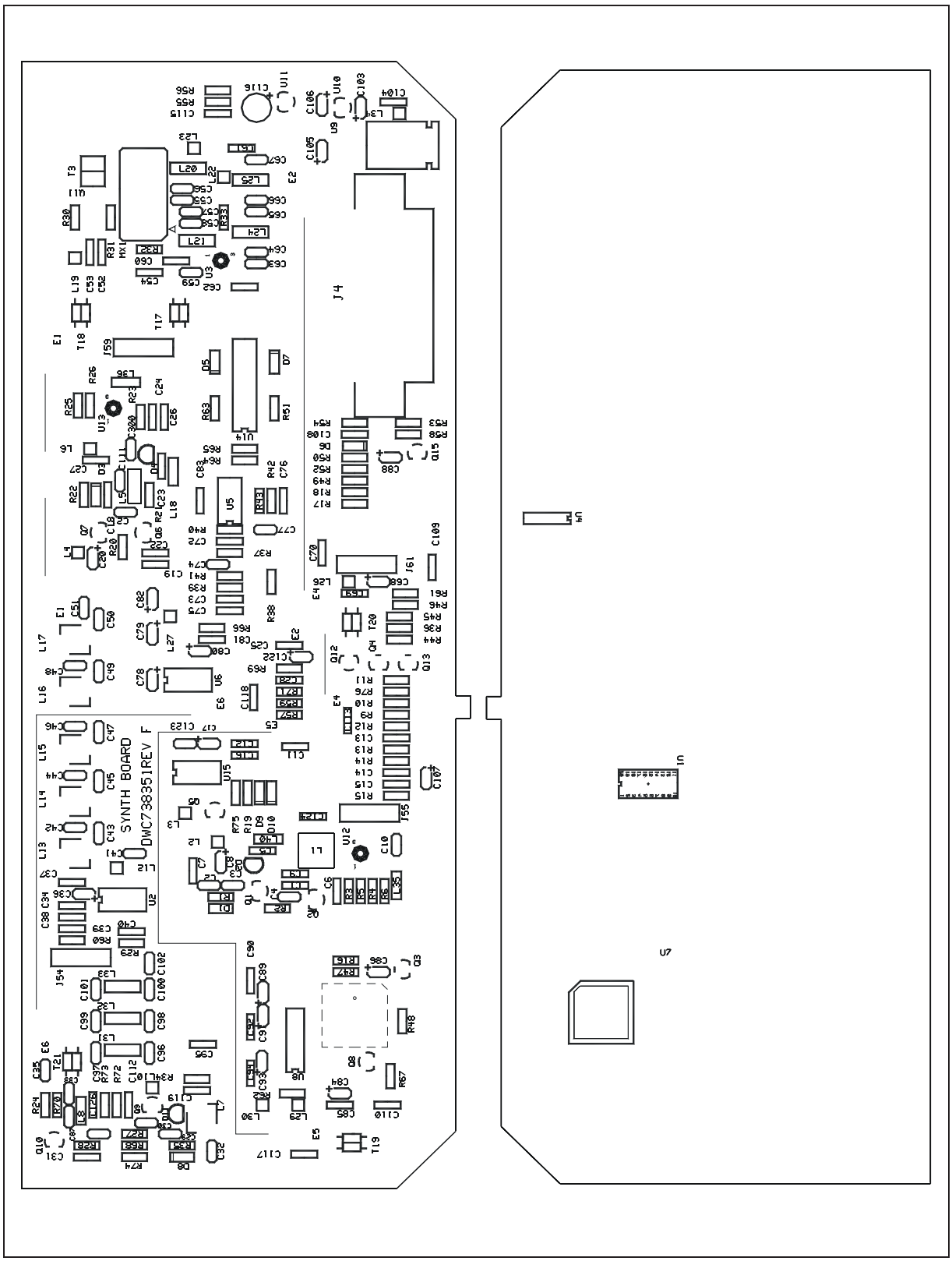
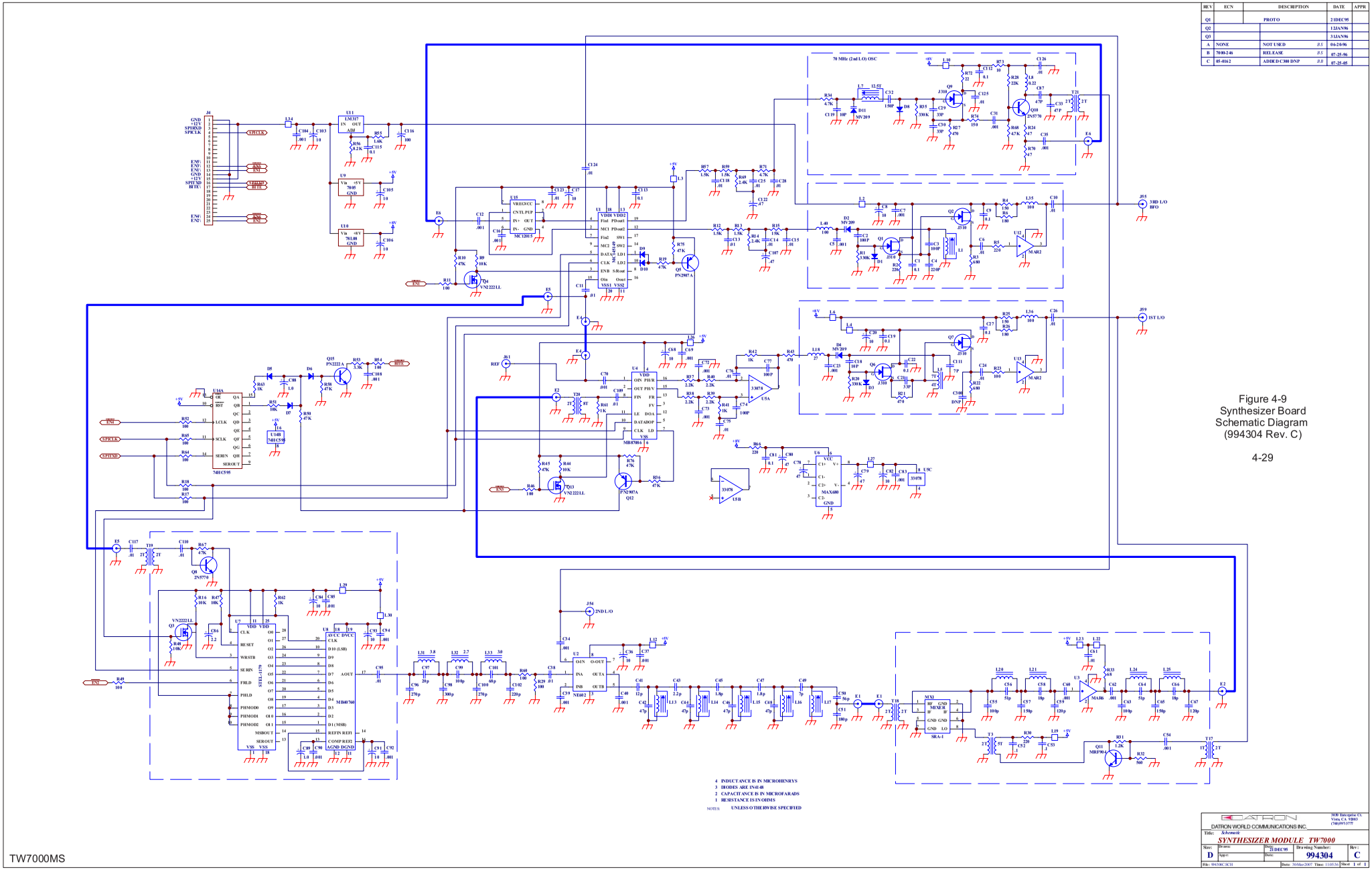


Figure 4-8. Synthesizer Board Component Locations (738351 Rev. F)



REV	ECN	DESCRIPTION		DATE	APPR
Q1		PROTO		21DEC95	
Q2				12JAN96	
Q3				31JAN96	
A	NONE	NOT USED	B3	06-20-96	
B	70-0L2-46	RELEASE	B3	07-25-96	
C	05-016.2	ADDED C300 DNP	B4	07-25-05	

Figure 4-9
Synthesizer Board
Schematic Diagram
(994304 Rev. C)

TW7000MS

DATRON WORLD COMMUNICATIONS INC.		3030 Enterprise Ct. Vista, CA 92083 (760)597-1777	
Title: Schematic			
SYNTHESIZER MODULE TW7000			
Size: D	Drawn: Date: 21DEC95	Drawing Number: 994304	Rev: C
File: 994304C.SCH		Date: 30-Mar-2007 Time: 11:03:56	Sheet 1 of 1

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

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,7PF NPO 50V .5PF 0.1LS DSK
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,100U,16V,20%,RADIAL, .1SP
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. P)

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 15OPF 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,2.2PF NPO 50V 0.1LS DSK
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. P)

Designator	Part Number	Description
C48	275470	CAP,ML 47PF NPO 5% 100V 0.1SP
C49	210022	CAP,2.2PF NPO 50V 0.1LS DSK
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, 47UF TA 20V 20% 0.1LS

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

Designator	Part Number	Description
C79	241476	CAP, 47UF TA 20V 20% 0.1LS
C8	241100	CAP,10MF DIP TANTALUM
C80	241476	CAP, 47UF TA 20V 20% 0.1LS
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, 1N4148/1N4150 DO-35
D10	320002	DIODE, 1N4148/1N4150 DO-35
D11	320305A	VARACTOR MV209,1099/TW2000
D2	320305A	VARACTOR MV209,1099/TW2000
D3	320002	DIODE, 1N4148/1N4150 DO-35
D4	320305A	VARACTOR MV209,1099/TW2000
D5	320002	DIODE, 1N4148/1N4150 DO-35
D6	320002	DIODE, 1N4148/1N4150 DO-35
D7	320002	DIODE, 1N4148/1N4150 DO-35
D8	320002	DIODE, 1N4148/1N4150 DO-35

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

Designator	Part Number	Description
D9	320002	DIODE, 1N4148/1N4150 DO-35
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. P)

Designator	Part Number	Description
L31	459232	IND ASSY 21T #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	XSTR, J310 N-JFET TO92
Q10	310032	XISTOR,NPN,2N5770,TO92
Q11	310165	XSTR, BFY90 NPN RF TO-72
Q12	310052	XSTR, PN2907A PNP TO92
Q13	310138	XISTOR,FET,VN2222LL,TO92
Q15	310057	XISTOR,NPN,PN2222A,TO92
Q2	310033	XSTR, J310 N-JFET TO92
Q3	310138	XISTOR,FET,VN2222LL,TO92
Q4	310138	XISTOR,FET,VN2222LL,TO92
Q5	310052	XSTR, PN2907A PNP TO92
Q6	310033	XSTR, J310 N-JFET TO92
Q7	310033	XSTR, J310 N-JFET TO92
Q8	310032	XISTOR,NPN,2N5770,TO92
Q9	310033	XSTR, J310 N-JFET 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. P)

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. P)

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% CF
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. P)

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	330105-1	IC, PRE, MC12015, 2 MOD
U2	330417	IC,NE602AN
U3	380011	IC, MAR-6+ RF AMP MICRO-X
U4	330639	IC, MB87086APF PLL SYN SOIC16
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.

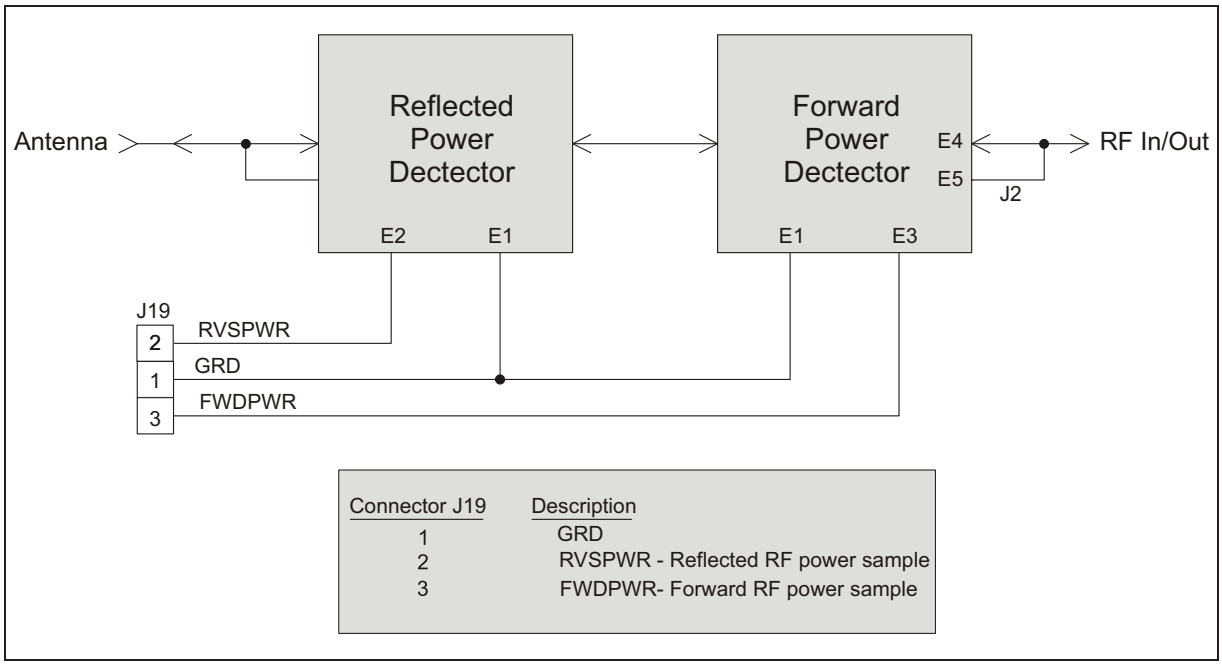


Figure 4-10. VSWR Detector Board Block Diagram

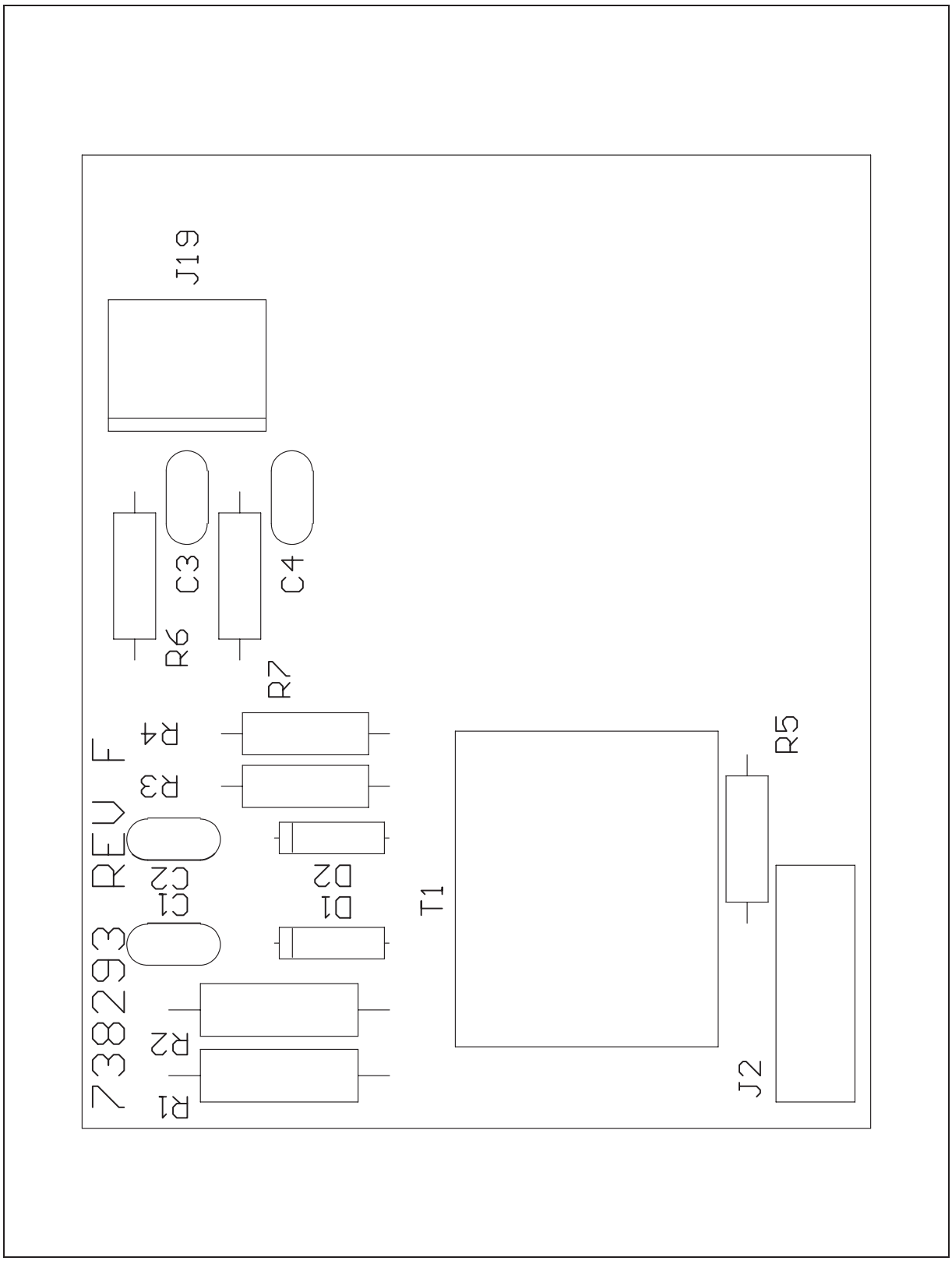
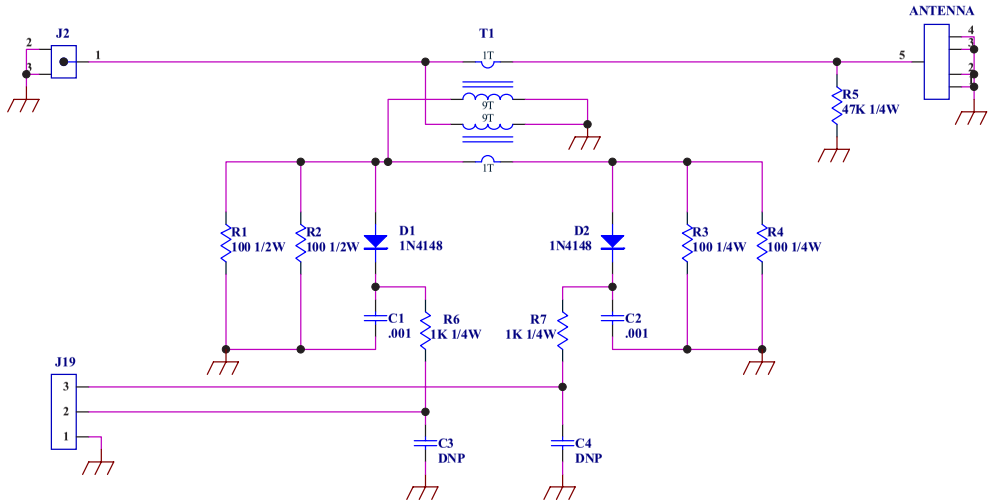


Figure 4-11. VSWR Detector Board Component Locations (738293 Rev. F)

REV	ECO	DESCRIPTION		DATE	APPR
C	TW7000-275	REV AND REDRAWN	BS	5-25-97	
D	ECO 05-0457	C1-C4 was .01	RB	01-12-06	



NOTES: UNLESS OTHERWISE SPECIFIED

1. INDUCTANCE IS IN MICROHENRYS
2. DIODES ARE 1N4148
3. CAPACITANCE IS IN MICROFARADS
4. RESISTANCE IS IN OHMS, 1/8W.

Figure 4-12
VSWR Detector Board
Schematic Diagram
(994240 Rev. D)

DATRON WORLD COMMUNICATIONS INC.
3030 Enterprise Ct.
Vista, CA 92083
(760)597-3777

Title: *Schematic*

TW7000 VSWR DET

Size:	Drawn: SAYLES	Date: 5-25-97	Drawing Number:	Rev:
B	Appr:	Date:	994240	D

File: 994240d.SCH | Date: 30-Mar-2007 Time: 12:02:53 | Sheet 1 of 1

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

Designator	Part Number	Description
C1	275102	CAP,C,.001UF,100V,5%,N,RA,.1SP
C2	275102	CAP,C,.001UF,100V,5%,N,RA,.1SP
D1	320002	DIODE, 1N4148/1N4150 DO-35
D2	320002	DIODE, 1N4148/1N4150 DO-35
J19	610285	HEADER,PIN 1X3 MLX 0.1 W/LOCK
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

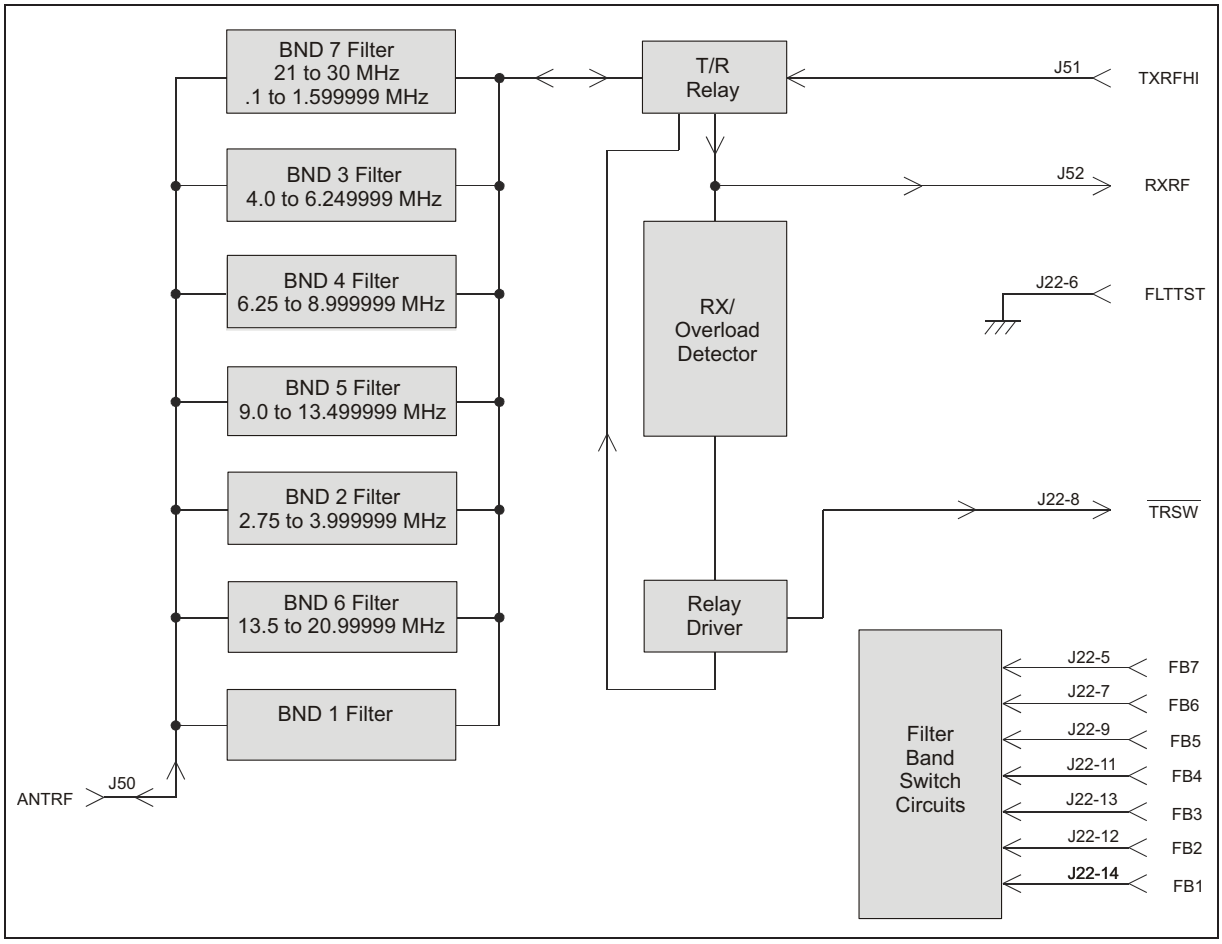


Figure 4-13. RF Filter Board Block Diagram

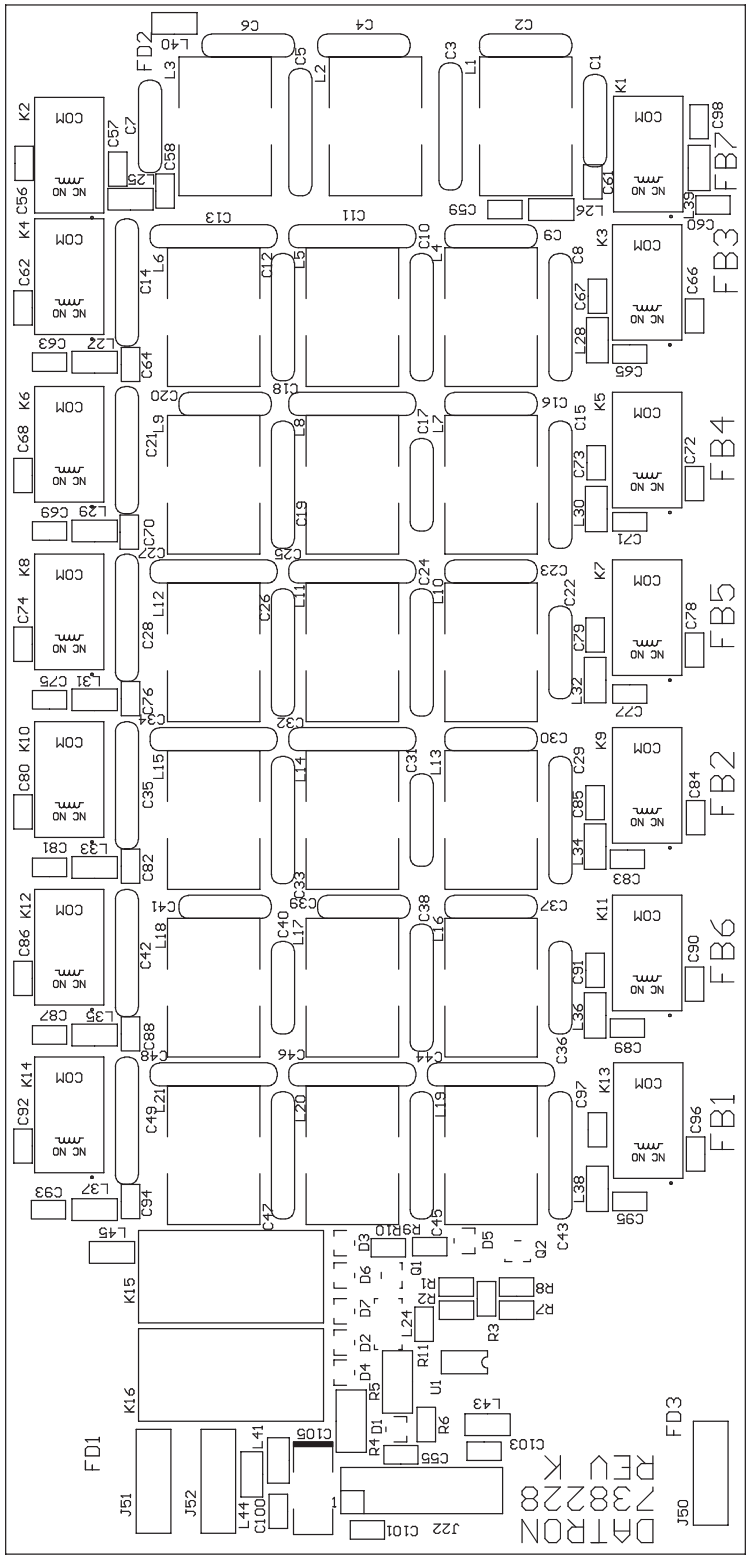


Figure 4-14. RF Filter Board Component Locations (738228 Rev. K)

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 14T IS 13T	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	SEE ECN AM		
J	TW7000-302	REDRAWN IN PROTEL 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 BB	1-29-02	
N	05-0061	SEE ECO BB	3-02-05	

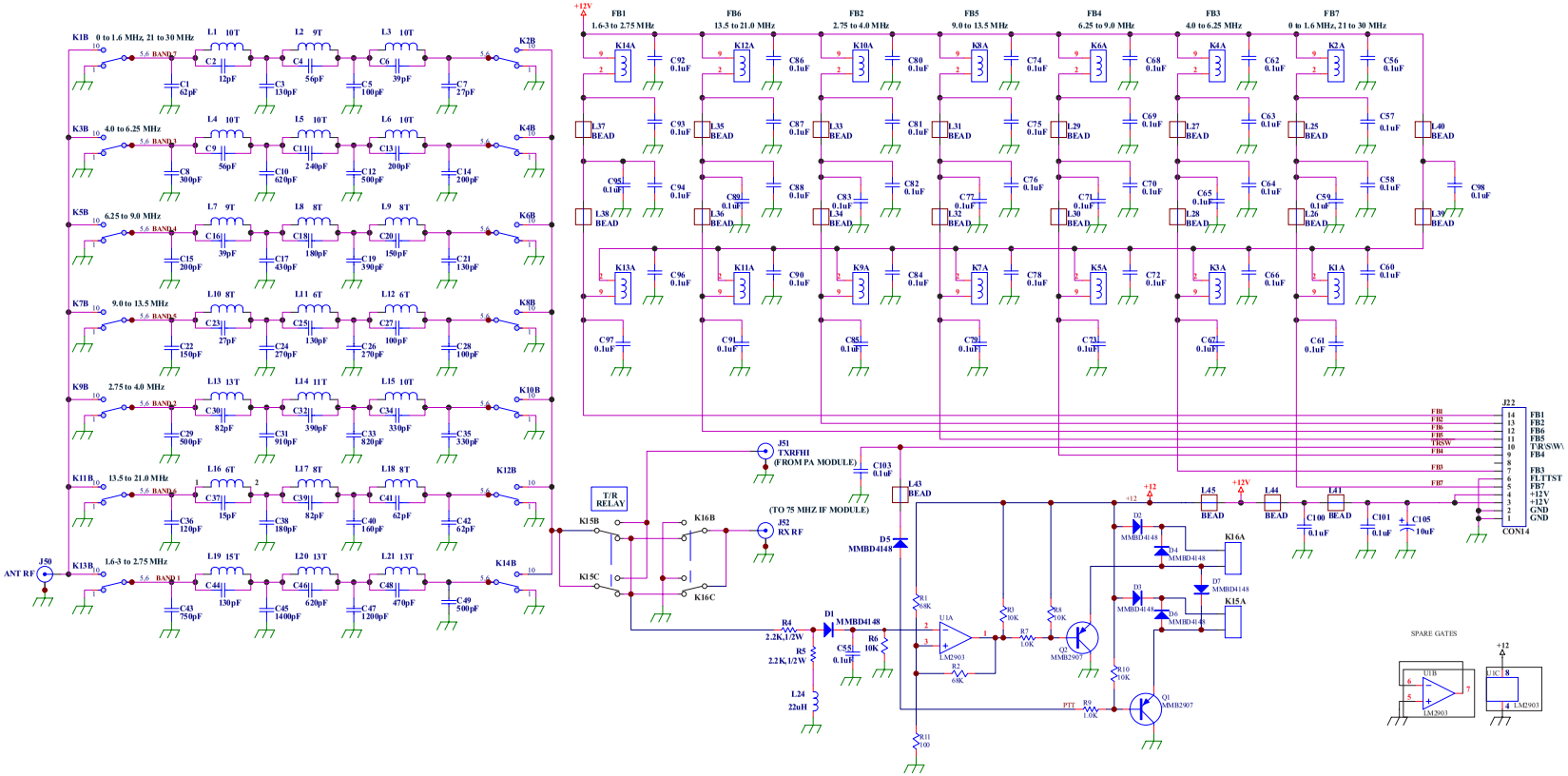


Figure 4-15
RF Filter Board
Schematic Diagram
(994139 Rev. N)

DATRON WORLD COMMUNICATIONS INC.
3030 Enterprise Ct.
Vista, CA 92083
(760)597-3777

Title: Schematic
RF FILTER MODULE, TW7000

Size:	Drawn: A. MARTINEZ	Date: 13OCT94	Drawing Number:	Rev:
C	Appr:	Date:	994139	N

File: 994139N.SCH | Date: 30-Mar-2007 Time: 13:18:25 | Sheet 1 of 1

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

Designator	Part Number	Description
C1	220620	CAP,62PF DM15 MICA
C10	224621	CAP,620PF MICA DM19
C100	021104000	CAP, 0.1UF X7R 25V 5% 0805
C101	021104000	CAP, 0.1UF X7R 25V 5% 0805
C103	021104000	CAP, 0.1UF X7R 25V 5% 0805
C105	022106000	CAP, 10UF TA 35V 10% 7343-31
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
C34	224331	CAP,330PF DM19 MICA
C35	224331	CAP,330PF DM19 MICA

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

Designator	Part Number	Description
C36	220121	CAP,120PF 5% MICA DIPPED
C37	220150	CAP,15PF DM15 5% 500V 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
C55	021104000	CAP, 0.1UF X7R 25V 5% 0805
C56	021104000	CAP, 0.1UF X7R 25V 5% 0805
C57	021104000	CAP, 0.1UF X7R 25V 5% 0805
C58	021104000	CAP, 0.1UF X7R 25V 5% 0805
C59	021104000	CAP, 0.1UF X7R 25V 5% 0805
C6	220390	CAP,39PF DM15 MICA
C60	021104000	CAP, 0.1UF X7R 25V 5% 0805
C61	021104000	CAP, 0.1UF X7R 25V 5% 0805
C62	021104000	CAP, 0.1UF X7R 25V 5% 0805
C63	021104000	CAP, 0.1UF X7R 25V 5% 0805
C64	021104000	CAP, 0.1UF X7R 25V 5% 0805
C65	021104000	CAP, 0.1UF X7R 25V 5% 0805
C66	021104000	CAP, 0.1UF X7R 25V 5% 0805
C67	021104000	CAP, 0.1UF X7R 25V 5% 0805
C68	021104000	CAP, 0.1UF X7R 25V 5% 0805
C69	021104000	CAP, 0.1UF X7R 25V 5% 0805
C7	220270	CAP,27PF 5% DM15 MICA

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

Designator	Part Number	Description
C70	021104000	CAP, 0.1UF X7R 25V 5% 0805
C71	021104000	CAP, 0.1UF X7R 25V 5% 0805
C72	021104000	CAP, 0.1UF X7R 25V 5% 0805
C73	021104000	CAP, 0.1UF X7R 25V 5% 0805
C74	021104000	CAP, 0.1UF X7R 25V 5% 0805
C75	021104000	CAP, 0.1UF X7R 25V 5% 0805
C76	021104000	CAP, 0.1UF X7R 25V 5% 0805
C77	021104000	CAP, 0.1UF X7R 25V 5% 0805
C78	021104000	CAP, 0.1UF X7R 25V 5% 0805
C79	021104000	CAP, 0.1UF X7R 25V 5% 0805
C8	224301	CAP,300PF DM19 MICA
C80	021104000	CAP, 0.1UF X7R 25V 5% 0805
C81	021104000	CAP, 0.1UF X7R 25V 5% 0805
C82	021104000	CAP, 0.1UF X7R 25V 5% 0805
C83	021104000	CAP, 0.1UF X7R 25V 5% 0805
C84	021104000	CAP, 0.1UF X7R 25V 5% 0805
C85	021104000	CAP, 0.1UF X7R 25V 5% 0805
C86	021104000	CAP, 0.1UF X7R 25V 5% 0805
C87	021104000	CAP, 0.1UF X7R 25V 5% 0805
C88	021104000	CAP, 0.1UF X7R 25V 5% 0805
C89	021104000	CAP, 0.1UF X7R 25V 5% 0805
C9	220560	CAP,56PF DM15 MICA
C90	021104000	CAP, 0.1UF X7R 25V 5% 0805
C91	021104000	CAP, 0.1UF X7R 25V 5% 0805
C92	021104000	CAP, 0.1UF X7R 25V 5% 0805
C93	021104000	CAP, 0.1UF X7R 25V 5% 0805
C94	021104000	CAP, 0.1UF X7R 25V 5% 0805
C95	021104000	CAP, 0.1UF X7R 25V 5% 0805
C96	021104000	CAP, 0.1UF X7R 25V 5% 0805
C97	021104000	CAP, 0.1UF X7R 25V 5% 0805
C98	021104000	CAP, 0.1UF X7R 25V 5% 0805
D1	037700005	DIODE, MMBD4148 SOT-23
D2	037700005	DIODE, MMBD4148 SOT-23

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

Designator	Part Number	Description
D3	037700005	DIODE, MMBD4148 SOT-23
D4	037700005	DIODE, MMBD4148 SOT-23
D5	037700005	DIODE, MMBD4148 SOT-23
D6	037700005	DIODE, MMBD4148 SOT-23
D7	037700005	DIODE, MMBD4148 SOT-23
J22	620017	HEADER, 2X7 MLX 0.1 BOX PLAIN
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	540080	RELAY,DPDT 2 AMP SEALED
K16	540080	RELAY,DPDT 2 AMP SEALED
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
L15	459174	IND ASSY,10T#22 AWG 1-490009
L16	459131	IND ASSY, 6T#20 AWG 1-490008

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

Designator	Part Number	Description
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	041223000	IND SM 22UH 1210 10%
L25	045000001	BEAD, FERRITE Z=120 1206
L26	045000001	BEAD, FERRITE Z=120 1206
L27	045000001	BEAD, FERRITE Z=120 1206
L28	045000001	BEAD, FERRITE Z=120 1206
L29	045000001	BEAD, FERRITE Z=120 1206
L3	459325	IND ASSY,10T,#20,1-490006
L30	045000001	BEAD, FERRITE Z=120 1206
L31	045000001	BEAD, FERRITE Z=120 1206
L32	045000001	BEAD, FERRITE Z=120 1206
L33	045000001	BEAD, FERRITE Z=120 1206
L34	045000001	BEAD, FERRITE Z=120 1206
L35	045000001	BEAD, FERRITE Z=120 1206
L36	045000001	BEAD, FERRITE Z=120 1206
L37	045000001	BEAD, FERRITE Z=120 1206
L38	045000001	BEAD, FERRITE Z=120 1206
L39	045000001	BEAD, FERRITE Z=120 1206
L4	459134	IND ASSY, 10T#22 AWG 1-490008
L40	045000001	BEAD, FERRITE Z=120 1206
L41	045000001	BEAD, FERRITE Z=120 1206
L43	045000001	BEAD, FERRITE Z=120 1206
L44	045000001	BEAD, FERRITE Z=120 1206
L45	045000001	BEAD, FERRITE Z=120 1206
L5	459134	IND ASSY, 10T#22 AWG 1-490008
L6	459134	IND ASSY, 10T#22 AWG 1-490008
L7	459120	IND ASSY,9T#22 1-490008
L8	459105	IND ASSY, 8T#22 AWG 1-490008

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

Designator	Part Number	Description
L9	459105	IND ASSY, 8T#22 AWG 1-490008
Q1	032006	XSTR,MMBT2907A PNP SOT-23EBC
Q2	032006	XSTR,MMBT2907A PNP SOT-23EBC
R1	013683000	RES,SM,CF,68K 0.1W 5% 0805
R10	013103002	RES,SM,TK,10K,1%,1/8W,0805
R11	013101002	RES, 100 OHM 1/8W 1% TK 0805
R2	013683000	RES,SM,CF,68K 0.1W 5% 0805
R3	013103002	RES,SM,TK,10K,1%,1/8W,0805
R4	019222002	RES,SM,2.2K,1/2W,5%,2010
R5	019222002	RES,SM,2.2K,1/2W,5%,2010
R6	013103002	RES,SM,TK,10K,1%,1/8W,0805
R7	013102002	RES, 1K OHM 1/8W 1% TK 0805
R8	013103002	RES,SM,TK,10K,1%,1/8W,0805
R9	013102002	RES, 1K OHM 1/8W 1% TK 0805
U1	033304061	IC,SM,LIN,COMPAR,DUAL,LM2903MX