TW1000A/B

LINEAR AMPLIFIER

OPERATOR/TECHNICAL MANUAL

Datron World Communications Inc.
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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 Group, 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
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.

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.

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 manual's section on Installation.

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: Only trained personnel should perform 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 with 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.

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SECTION 1: INTRODUCTION

1.1 General Information

The TW1000A/B Linear Amplifier is designed for use with the 7000-series of synthesized HF transceivers to form a high-power, 2 to 30 MHz communication system. The power output is 1000W. With the correct choice of power source, the TW1000A/B is rated for continuous service in all operational modes. The TW1000A/B has a power gain of 10-12 dB and can be used with any transmitter or transceiver with a power output of 100W. The TW1000A/B is used to increase the signal strength and the range and reliability of the HF communication system. With the correct choice of antennas and operating frequencies, the system provides worldwide coverage.

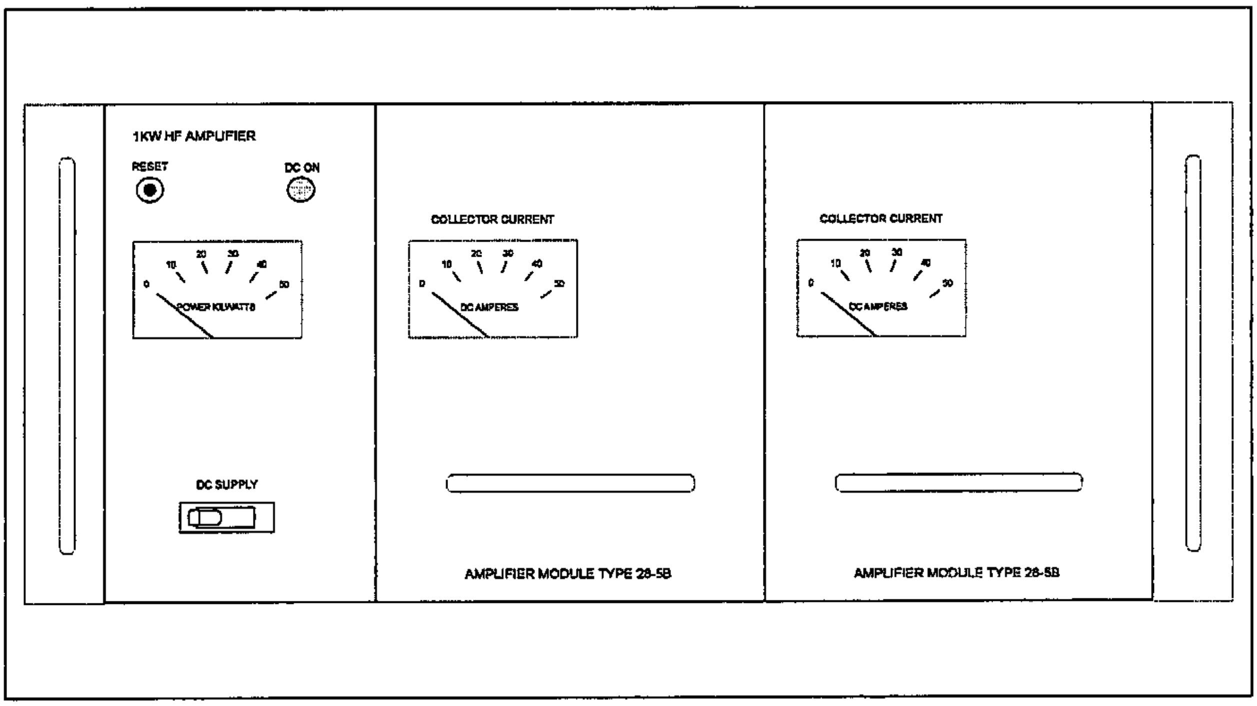

Figure 1-1
TW1000A/B Linear Amplifier Front Panel

1.2 Manual Conventions

This manual uses the following typographical convention.

¤ This symbol appears before each instruction that must be performed in order to operate the TW1000A/B.

1.3 General Description

The TW1000A/B is entirely solid state and operates from a high-current 28 Vdc supply source. The TW1000A/B uses two 500W plug-in amplifier modules. Each module uses two push-pull 250W amplifiers combined for an output of 500W. The amplifiers are completely broadband in design and cover the frequency range of 2-30 MHz without adjustment. The TW1000A/B is constructed in a compact aluminum case, designed for mounting in a standard 19-inch rack.

1.4 Applications

The TW1000A/B has been designed for continuous-duty commercial requirements where high performance and reliability are essential. The TW1000A/B is normally mounted in a 19-inch rack with the companion exciter and receiver, or the transceiver together with the Frequency-Shift Keying (FSK) modem and any other ancillary equipment. The amplifier is normally operated with the PS1000SWA power supply, running on 115V or 230V, and 50 or 60 Hz ac power mains. The TW1000A/B operates from a high-current 28 Vdc supply source for shipboard or emergency applications.

1.5 Modes

The TW1000A/B operates in linear service and is normally operated in Single-Sideband (SSB) or FSK service. The TW1000A/B is suitable for almost any relatively narrow-band mode including Carrier Wave (CW), Amplitude Modulation (AM), and Narrow-band Frequency Modulation (NBFM). The peak or average power output should not exceed 1000W.

1.6 Duty Cycle

The TW1000A/B is rated for continuous operation at a maximum power output of 1000W (average). The power supply must be capable of continuous operation at the rated supply current, which is approximately 70A for FSK service and 30A for SSB service.

1.7 Modules

The TW1000A/B uses two 500W modules. These modules are provided with individual metering and cooling fans. The modules plug into the front panel and may be changed by removing the four screws and withdrawing the module. If a module should fail, the amplifier continues working at a reduced efficiency. The plug-in modules are a great advantage for simplicity of service and maintenance.

1.8 Cooling System

Each module is provided with a 28 Vdc (Hall-Effect) cooling fan mounted directly on the heat sinks. The fan blows air through the fins in the center of the module and provides efficient cooling. The fans are controlled by 60°C thermostats mounted on the heat sinks and operate only when the heat sink temperature reaches 60°C. In typical SSB service, the fans seldom operate and switch off soon after the amplifier FSK transmit cycle is ended. A second thermostat on each module switches the amplifier to the straight-through mode if the heat sink temperature exceeds 85°C.

1.9 Bypass Mode

Turning the dc power-off, switches the exciter through to the antenna. This feature is useful for providing lower-power operation or as a fail-safe method of providing communications in the event of an amplifier fault condition.

1.10 Harmonic Filters

The TW1000A/B uses six seven-pole elliptic function filters, covering the frequency range in six bands. The filters provide excellent suppression of all harmonics. The filters are normally selected automatically by the exciter or transceiver. An optional manual switch for filter selection is available. When this manual switch is used, a Voltage Standing Wave Radio (VSWR) bridge is used between the amplifier and the filters. This bridge detects selection of the wrong filter and prevents damage to the amplifier by switching it off.

1.11 Metering

The collector current to each amplifier module is measured separately. The collector current in both modules should be approximately equal. Fault conditions are immediately indicated by imbalances in the collector currents between modules. A third meter is used to measure the power output.

1.12 Fuses

Current limiting is provided by a 100A magnetic circuit breaker that is also used as the amplifier's on/off switch. The circuit breaker is reset from the front panel.

1.13 Automatic Level Control (ALC) Antenna Mismatch Protection

A VSWR bridge is used to provide the ALC voltage. The reverse arm of the bridge reduces the power output as the VSWR rises and protects the TW1000A/B against all conditions of mismatch.

1.14 Interfacing with the Exciter

The TW1000A/B is designed for simple interfacing with the 7000-series of transmitters and receivers. Plugging in the control cable between the amplifier and the transceiver provides automatic selection of the harmonic filters, control of the drive level, and operation through the microphone Push-to-Talk (PTT) switch. The control circuit is simple, and interfacing with other types of equipment is usually not difficult. Contact Datron World Communications Inc. (DWC) for more information.

1.15 High-Speed Switching

The TW1000A/B uses a high-speed switching circuit for applications such as Automatic Repeat Request (ARQ) (SITOR). A provision was made to control an external high-speed vacuum relay for antenna switching.

1.16 *Power Supplies*

The TW1000A/B may be operated on SSB from a 28V, 50 (peak) supply source. This same supply may be used for FSK operation at a 500W output. For operation at 1000W (average) in FSK service or similar modes, the power supply source should be rated at 28V 70A (minimum) continuous.

The PS1000SWA is a heavy-duty 80A power supply rated for continuous operation. With this power supply, both the transceiver and amplifier may be operated continuously in any mode at 1000W output.

The PS1000SWA uses Constant Voltage Transformers (CVT) to provide good regulation without electronic circuitry. The reliability of the CVT is outstanding and provides almost complete protection against line transients. The supply is also short circuit proof. Internal connections are provided to operate from 115V to 230V, and from 50 to 60 Hz.

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SECTION 2: TECHNICAL SPECIFICATIONS

2.1 *Technical Specifications*

The technical specifications for the TW1000A/B are defined in Table 2-1.

Note: All specifications are subject to change without notice or obligation.

Table 2-1
Technical Specifications

Specification	**Description**
Power Output	1000W PEP or average ±1 dB
Frequency Range	2-30 MHz (1.6-2 MHz at reduced harmonic specification)
Intermodulation Distortion*	2-24 MHz 30 dB 3rd order 36 dB 5th order 24-30 MHz 26 dB 3rd order 30 dB 5th order Measured relative to PEP output
Spurious Products	-60 dB
Harmonic Filters	7 pole elliptic function
Ranges:	2-3 MHz 8-13 MHz 3-5 MHz 13-20 MHz 5-8 MHz 20-30 MHz The filters are selected by grounding each filter control line
Duty Cycle	Rated for continuous services, all modes
Drive Level	100W nominal
Input Impedance	50 ohm VSWR less than 1.5:1
Output Impedance	50 ohm
Power Requirements	28 Vdc negative ground SSB 30A average voice FSK 70A typical

Specification	Description
Cooling	Dual fans controlled by 60°C thermostats. (Over-temperature shutoff at 85°C)
Circuit Breaker	100A magnetic
Size (WHD)	48.3 cm x 22.3 cm x 38.9 cm
Weight	23.6 kg
Controls	Amplifier on/off
Metering	Module collector current 50A (2x) Power output 0-1500W
Connectors	RF input UHF RF output UHF Control 10 pin Auxiliary 28V 2 pin dc power 4 pin

*The intermodulation distortion and spurious products are also a function of the excitation source. They are measured using two high-power RF signal generators as the two-tone test source. The generators are coupled through a combiner adjusted for maximum isolation between input ports. The output is coupled to the amplifier through low-pass harmonic filters. To ensure compliance with the published specifications, the excitation sources should have a minimum distortion figure at least 3 dB greater than the amplifier at the required drive level. The spurious products should not exceed -60 dB and the harmonic level should not exceed -40 dB. Spurious products in the exciter, below the cutoff frequency of the TW1000A/B low-pass filter, are amplified without attenuation. Spurious products and harmonics, above the filter cutoff frequency, will be attenuated by the amplifier. However, excessive harmonic or spurious output from the exciter may increase the distortion products.

SECTION 3: INSTALLATION

3.1 Unpacking

Remove the TW1000A/B from the shipping carton. Inspect carefully for any shipping damage. If the TW1000A/B has been damaged, a claim should immediately be lodged with the shipping company. Retain the shipping carton and the packing material in case the amplifier has to be reshipped.

3.2 Mounting

The TW1000A/B should be mounted in the 9-inch rack using the mounting screws on each side of the panel. It is important to ensure that the back panel of the TW1000A/B is completely unobstructed to ensure free airflow to the amplifier. DWC recommends installing the power supply at the bottom of the rack, and the TW1000A/B above the rack. If there is spare rack space available, the blank panels may be inserted between the power supply and the amplifier so that the meters and controls are at a convenient height.

> Caution: The TW1000A/B should never be installed in a closed rack unless forced air circulation is provided through the cabinet.

3.3 Ground Connections

It is important to make a good ground connection to the TW1000A/B. Without a good ground connection, circulating currents may cause feedback in the amplifier and transceiver. The entire equipment may be at a high RF potential and could cause burns when touched. Grounding is particularly important when an antenna tuner or unbalanced antenna is used. A heavy-gauge copper strap should be used for the ground connection and the ground strap kept as short as possible.

3.4 Interconnections

For interconnections between the TW1000A/B and the transceiver in DWC's TW1500 rack-mount system, refer to Figure 3-1. Other system configurations are available. If the equipment is ordered as a system, all interconnecting cables are supplied and assembled. It is only necessary to connect the RF control and the power cables between the amplifier and the transceiver.

External cables needed to interface the TW1000A/B with the equipment shown in Figure 3-1 are listed below.

Cable Part Number	Description
C991539	TW7000 to TW1000A/B, RF cable
C991541	PS1000SWA to TW1000A/B, dc power cable
C991889	TW7000 to TW1000A/B, control cable
C991907	PSW1000SWA to TW7000, dc power cable

PL1 is the connector that receives primary dc power from the PS1000SWA. Table 3-1 shows the pin-outs for PL1. PL2 is the connector that provides dc input to the 7000-series transceiver. Table 3-2 shows the pin-outs for PL2. PL3 is the connector that provides control information between the TW1000A/B and the transceiver. Table 3-3 shows the pin-outs for PL3.

For transceivers other than those manufactured by DWC, it is necessary that the appropriate filter is enabled by the transceiver itself. To achieve this, the transceiver must ground the control line of the correct filter-selection relay pair. The filter ranges are 2-3 MHz, 3-5 MHz, 5-8 MHz, 8-13 MHz, 13-20 MHz, and 20-30 MHz. In some cases it may be necessary to interface with the synthesizer arithmetic logic to allow the entire action to take place automatically.

When absolutely necessary, a version of the amplifier with a manual front-panel switch for filter selection can be supplied, but in view of the danger of amplifier damage due to wrong filter selection, this is not a recommended technique.

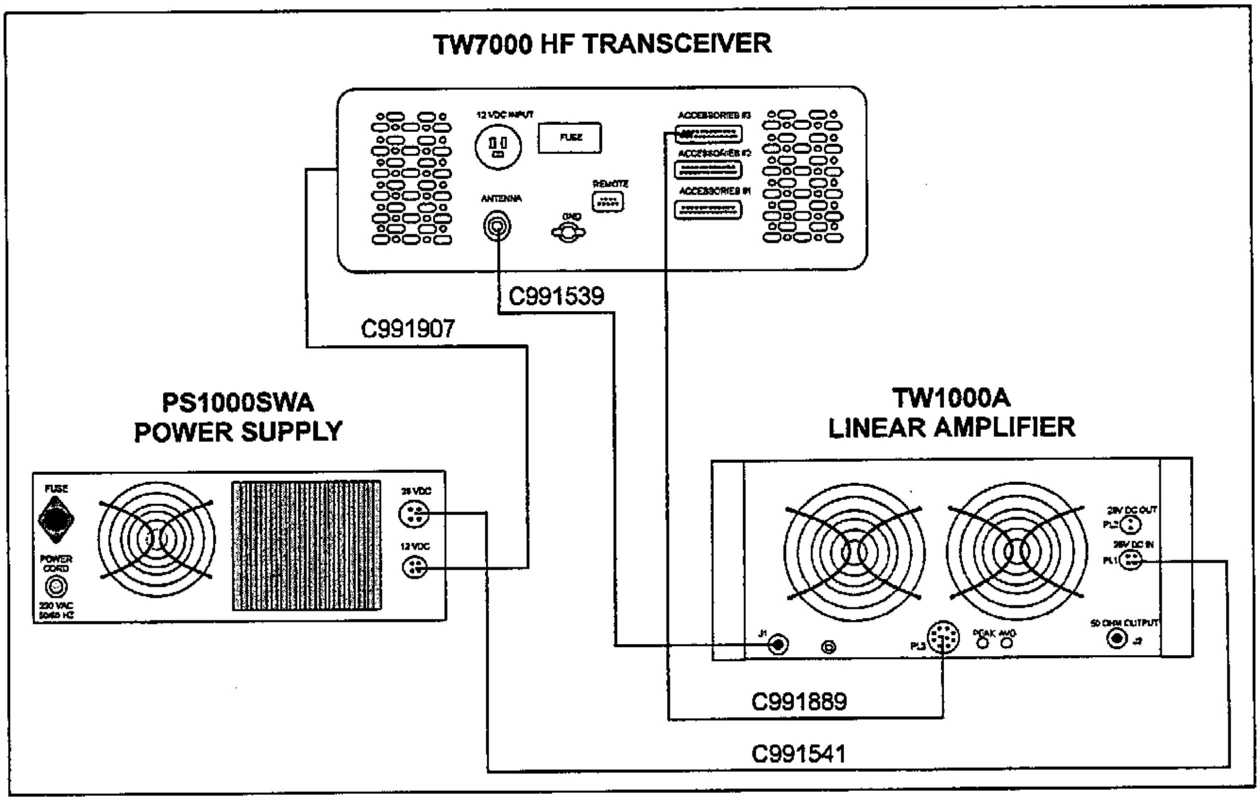

Figure 3-1
TW1500 System Diagram

Table 3-1
TW1000A/B (PL1) Connector Pins and System Equipment Connections

Pins on TW1000A/B (PL1)	Description	Pins on PS1000SWA (J1)
A	+28 Vdc	A
B	Ground	B
C	Ground	C
D	+28 Vdc	D

Table 3-2
TW1000A/B (PL2) Connector Pins and System Equipment Connections

Pins on TW1000A/B (PL2)	Description	Pins on 7000-Series (J6)
A	+28 Vdc	A
B	Ground	B

Table 3-3
TW1000A/B (PL3) Connector Pins and System Equipment Connections

Pins on TW1000A/B (PL3)	Description	Pins on 7000-Series (J3)
A	2-3 MHz	4
B	3-5 MHz	5
C	5-8 MHz	6
D	8-13 MHz	7
E	13-20 MHz	8
F	20-30 MHz	9
H	PTT	3
I	ALC	2
J	Ground	1

3.5 Power Connections

The amplifier and transceiver may draw peak currents as high as 100A; low-resistance connections are essential. The power-supply connection uses two contacts, each for the positive and negative leads. A 4-wire 8 AWG cable must be used for the power cable. The length of the power cable must not exceed 1.25m (4 feet). If the power source is located some distance from the amplifier, the power cable should be terminated at a heavy-duty junction box as close as possible to the transceiver.

The junction box should be connected to the power source using a heavy-duty cable, capable of carrying the heavy current with negligible loss. A heavy-duty starter cable is ideal.

Note: A cable resistance of 0.1 ohm causes a voltage drop of 10V.

3.6 Antenna Connection

The output impedance of the TW1000A/B is 50 ohm. For connection to the antenna or the antenna tuner, a heavy-duty coaxial cable of the RG8/U type should be used. The connections should be securely tightened, as the peak RF currents exceed 5A.

3.7 *Antenna Matching*

For best efficiency, the TW1000A/B must operate into a correctly matched antenna system. If the VSWR exceeds 1.5:1, the automatic protection circuits progressively reduce the power output and the performance of the system is reduced. A Bird Model 43 with a 1000-H element should be used. The reflected power should not exceed 30% of the forward power.

3.8 *Antenna Systems*

The antenna system should have a minimum power capability of 1 kW. The antenna is normally fed with a 50 ohm coaxial line and the antenna matching should be adjusted for the lowest VSWR (preferably less than 1.5:1). The choice of antenna depends on the frequencies and distances to be covered. If the TW1000A/B is to be used on specific bands or channels, resonant dipoles or multiple dipoles are an excellent choice.

The TW1000A/B provides continuous coverage from 2-30 MHz. When used with exciters covering the 2 to 30 MHz range, it is necessary to use an antenna tuner or a broadband antenna system. Best results are obtained with the broadband antenna systems such as the discone type of construction of the log periodic beams. Many excellent proprietary brands of broadband antenna covering every frequency range in both omnidirectional and directional forms are available.

When there is insufficient space for a broadband antenna, an antenna tuner may be used with a tower or long-wire antenna. Tuners are available for manual adjustment. For maximum flexibility, the automatic tuner with motor driven elements that tune for minimum VSWR is used.

3.9 *Adjustments*

The TW1000A/B is fully broadband and requires no tuning or adjustment for operation at any frequency. If the equipment is ordered as a system, the ALC is set for the correct power output. The following adjustment procedure should be followed if the power output level is not correct.

3.9.1 *Power Output Adjustment*

Two separate controls provide a control voltage that is proportional to either the peak or average value of the power output.

Note: When operation is planned for more than one mode (e.g., SSB and CW operation), and a large change in peak-to-average power ratio will occur, it is necessary to adjust both controls. Adjusting both controls is necessary in any condition that results in amplifier or power supply overload. For example, if the PS1000SWA is in use, the peak control would provide the correct power level for all modes.

Initially, the average control should be advanced to the maximum power setting (fully counterclockwise). After the peak control has been set, the average control may be set to restrict power levels if a mode change results in overload. It should be noted that there may be a small interaction between controls.

It is not possible for either control circuit to increase the power level if the other is already the controlling circuit. It is necessary to provide test signals in both modes to correctly set both controls. If only one control is in use, the other control must be advanced to its fully clockwise (maximum power) position.

3.10 *Power Supplies*

It is very important that the power supply has been connected for the correct mains supply voltage and frequency. For more information on the power supply, refer to the power supply's manual.

3.11 *Operation with Other Exciters*

If the TW1000A/B is used with other types of exciters or transceivers, contact DWC for appropriate interfacing information.

SECTION 4: OPERATION

4.1 Tuning

The TW1000A/B requires no tuning adjustments. If the antenna is correctly matched at the operating frequency, the amplifier delivers full output power.

4.2 On/Off Controls

When the TW1000A/B is used with exciters that provide automatic filter selection, the only operating control is the on/off switch. In the off position, the amplifier is bypassed and the exciter delivers the normal power output directly to the antenna. Turning the switch on brings the amplifier on line; no further adjustments are required.

The on/off switch can also be considered the high-low power switch. The switch is a magnetic circuit breaker. If there is a fault in the amplifier that is causing excessive current drain, the switch trips.

4.3 Optional Controls-Filter Selection

These controls are only required when the exciter does not provide for the automatic selection of the output filters. The switch should be turned to the filter range that corresponds to the operating frequency.

> Caution: Do not switch filters when the TW1000A/B is operating.

4.4 Metering

4.4.1 Power Output

The meter measures the power output to the antenna. On FSK or CW transmissions, the meter should give a steady reading at approximately 1000W. On SSB voice transmissions, the meter kicks up on voice peaks towards the 1000W mark. If the meter does not indicate normal power output, the antenna is probably not correctly matched. The protective circuitry automatically reduces the output power when the antenna does not provide a correct match.

4.4.2 *Collector Current*

Each module is provided with a meter to measure the collector current. Monitoring the collector current to each module provides a very good indication of correct operation. The collector current to each module should be approximately equal. Any large imbalance in the collector current indicates a fault in one of the modules.

4.5 *Cooling Fans*

The operation of the cooling fans is automatic. They are controlled by individual thermostats on the modules. When the heat sink temperature reaches 60°C, the cooling fan comes on. It is normal for the fans in each module to switch on and off at slightly different times due to small variations in the thermostat operating temperatures.

The fans will not switch on for short voice transmissions unless the ambient temperature is very high. If the heat sink temperature exceeds 85°C a second thermostat on each power module in the TW1000A/B switches the amplifier to the straight-through mode.

SECTION 5: TECHNICAL DESCRIPTION

5.1 General Description

The TW1000A/B consists of two 500W plug-in modules with an input and output impedance of 50 ohm. The two modules are combined using 2:1 combining transformers at the input and output sources. The input is fed through a gain-leveling network providing a 50 ohm input and a substantial level gain throughout the frequency range. The output of the amplifier is coupled to the antenna through a series of six low-pass filters. Each amplifier module uses two 250W push-pull amplifiers with an input and output of 100 ohm. These amplifiers give a combined input and output of 50 ohm.

5.2 28V, 250W RF Amplifiers

The broadband, push-pull, 250W amplifiers use modem, high-power, and linear power transistors. These transistors use emitter-ballasted chief design to control impedance and gain over a bandwidth of more than a decade.

Transistors Q1 and Q2 connect in a conventional transformer-coupled push-pull circuit. In order to provide uniform performance over nearly four octaves, it is essential to use high-performance input and output transformers. The output transformer T2 must not only be capable of providing the correct impedance transformation over the 2 to 30 MHz range, it must also operate at high efficiency at the high-current levels and at a power level of 250W.

The specially designed transformers use ferrite-loaded brass tubes as the base and collector windings with Teflon insulated wires wound inside the tubes to form the 100 ohm input and output windings. The center taps of the transformers operate at a RF ground potential. Extensive bypassing provides a very low impedance at audio frequencies and up through the RF operating range.

Negative feedback is essential to prevent spurious operations and to reduce the gain variations through the range. Resistive feedback is used directly from the collector to the base. The dc blocking capacitor provides a low impedance into the audio range. While it is necessary to dissipate substantial power in the feedback resistor, this system ensures feedback independent of the characteristics of the input and output transformers.

For maximum efficiency and good linearity, the amplifiers are operated in class AB. It is essential to provide a stable, low-impedance bias source for the bases of the transistors. The emitters of the transistors are grounded and the base impedance changes as the transistors heat, which leads to a potentially unstable bias condition. This means that apart from providing a low-impedance bias source, it is essential to provide thermal compensation with temperature sensing closely coupled to the high-power RF transistors.

The bias circuit uses transistors Q3 and Q4. The bias voltage at the center tap of the transformer is equal to the sum of the voltage across the adjustable resistor R3 and the emitter base voltage of Q4. The emitter base voltage of Q4 must be lower than the voltage required to produce the forward bias current for Q1 and Q2. R3 may then be adjusted to provide the correct bias current. Q3 is an emitter follower with the base of Q4 connected to the emitter of Q3. The circuit provides the low impedance bias source required by the high-power RF transistors. The diode D1 effectively shunts the bases of Q1 and Q2 and provides backup to the primary bias circuit. In the event of any defect in the bias circuit, D1 prevents catastrophic damage to the RF transistor.

Q4 is mounted on the copper heat sink immediately adjacent to the RF power transistors. The tight thermal coupling ensures that Q4 compensates the 2 mV/°C emitter-base voltage change of the output transistors. The circuit provides excellent thermal tracking with the desirable attribute of a small negative-temperature characteristic. This causes a small reduction of the amplifier quiescent current at elevated temperatures.

Each of the four amplifiers uses identical circuitry. Individual bias regulators for each amplifier ensure uniform control of the quiescent current even if there are variations between the transistors used in each amplifier.

5.3 500W Modules

Each 500W module uses two amplifiers mounted on individual heat sinks. The heat sinks are mounted so that the fins face in and form a tunnel, with a +28 Vdc Hall-effect brushless fan mounted at the end of the heat sinks. This ensures an excellent flow of cooling air through the module while retaining accessibility to the amplifiers.

A 60°C thermostat is mounted on one heat sink and activates the fan when the heating temperature rises above 60°C. A second 85°C thermostat, mounted on the other heat sink, switches the amplifier to the bypass mode if the cooling system fails.

The modules contain plugs on the rear frame for the RF input and output connections and the 28 Vdc supply. A tapered guide pin ensures correct alignment of the connectors. Each module is provided with a 50A panel meter. The modules are held in the amplifier frame using four retaining screws on the front panel.

The input and output impedance of each amplifier is 100 ohm. The connections to each amplifier are made through 100 ohm coaxial cables and are cut to the exact same lengths to maintain phase symmetry. The outputs and inputs are combined to provide the module with 50 ohm inputs and outputs.

The 100 ohm inputs and outputs are each combined in separate hybrids to provide a nominal impedance of 50 ohm in each case. The input impedance of the transistor pair varies considerably with frequency, as does the gain. Compensation of these effects is provided in the amplifier mainframe.

5.4 Input Circuit

The input circuits of the two modules are combined in the input combiner T1. The transformer is a 2:1 Christmas tree design, which combines two 50 ohm inputs to the modules. These inputs provide a 50 ohm impedance to the amplifier.

The gain-leveling network uses capacitive, resistive, and inductive elements to compensate for the lower gain of the amplifiers at the upper end of the frequency range. The network has been designed to maintain a constant input impedance with a VSWR of less than 1.5:1 over the entire frequency range.

5.5 *Output Circuit*

The outputs of the two modules are 50 ohm. They are combined in the output combiner T2, which uses a 2:1 Christmas tree design to provide an output impedance of 50 ohm with good port-to-port isolation. When the two modules are in balance, the voltages are equal at both ends of the primary winding of the combiner. No power is dissipated in resistors R25 and R26.

In the event of imbalance or failure of either module, power is dissipated in R25 and R26. In the event of complete failure of one module, 50% of the remaining power is dissipated in the resistors, but the amplifier continues to operate. R25 and R26 are high-wattage non-inductive designs that use the chassis as a heat sink.

5.6 *Output Filters*

A broadband transistor amplifier has a high-level of harmonic output. As the TW1000A/B operates in push-pull, the even-order harmonics tend to cancel but there is less suppression of odd-order harmonics. On the lower-channel frequencies, the second harmonic level is typically -30 dB, while the third harmonic may be as much as -15 dB. Subsequently, the filters must have an ultimate attenuation of at least 50 dB to meet the amplifier design specification. The selected filter design is a seven-pole elliptic function with a reflection coefficient of 5%. A low-reflection coefficient is essential to prevent excessive VSWR between the amplifier and the filter.

The frequency range is divided into six bands. The cutoff frequency of each filter is just above the highest frequency in each band. The characteristics of the filter ensure a minimum attenuation of -50 dB at the third harmonics of the signal frequency, when operating at the lowest frequency in the band. For example: The attenuation of the 2 to 4 MHz filter is a minimum of -50 dB at 6 MHz. This is the third harmonic of 2 MHz. Designing for this worst-case situation ensures high-harmonic attenuation throughout the operational range.

The filters are selected by relays K3 to K14. Separate relays are used at the input and output of each filter. The unused filters are shorted at the inputs and outputs.

To provide filters capable of operating at continuous power levels of 1000W, multiple high-voltage ceramic disc capacitors are used. Each capacitor in the filter consists of two or three disc capacitors so that the current is distributed between them.

In order to keep the filters compact, toroidal inductors are provided for the five lower-frequency filters. These inductors have the advantage of a restricted external field and eliminate the necessity to assemble the filters in individually shielded compartments. In the physical construction of the filter, the liberal use of ferrite sleeves, extensive bypassing of the dc control wiring, and the careful selection of ground points are used. It is important not to change any of the wiring or grounds, as unwanted loops will frequently bypass the filter, causing a major reduction in the harmonic attenuation.

The filters are selected by grounding the control wire to each pair of relays. Diode isolation from the control switching in the transceiver is provided by Dl through D6. If manual switching is provided, the filter-select switch grounds the relays for each filter in turn.

5.7 *Directional Coupler*

The directional coupler is used to measure the forward power to provide the ALC voltage and to reduce the amplifier power when the VSWR increases.

T4 is a toroidal pickup transformer, which senses the magnitude and phase of the current. The inner conductor of the output coaxial cable passes through the center of the toroid to form a single-turn primary winding. L3 provides a dc center tap to the secondary of T4. C90 and C91 form a capacitive divider that provides a sample of the voltage on the coaxial line. When the amplifier is terminated in a 50 ohm load, the bridge balances and there is no output from the reverse arm of the bridge.

The forward arm of the bridge is rectified by D10 and D12. R30 and C98 provide a filter network that gives an output corresponding to the average power output from the TW1000A/B. C97 connects directly to D12 and provides a peak-reading circuit. The potentiometer, R31, sets the peak power output. The average and peak power-control voltages are combined with the output from the reverse arm of the bridge. Diodes D11, D13, and D14 provide isolation of the three outputs.

5.8 *ALC Operation*

The three outputs from the directional coupler are applied to the base of the Darlington transistor, Q1. In the DWC transceivers, the gain is controlled by reducing the voltage on the high-impedance control line. The collector of Q1 is connected to the control line, as the forward bias increases on Q1. The collector voltage is reduced until the system gain reaches the preset level.

The peak and average reading outputs from the bridge are adjusted to give the correct output in the SSB and FSK or CW modes. There is no output from the reverse arm of the bridge when the amplifier is operating into a correctly matched load. This output increases as the VSWR rises and progressively reduces the power output. This protects the RF transistors in the TW1000A/B against mismatches.

The two separate ALC are labeled average and peak. In general, it is intended that only the peak control be used with full 1kW average systems using the 80A supply; and the average control should only be used with the smaller system using the 40A supply. In either case, the control not in use should be rotated clockwise to its maximum power position.

5.9 *Power-Output Meter*

The output power is measured at the peak detector D12. The Darlington transistor Q2 drives the meter. R11 is the calibration control.

5.10 *High-Speed On/off Switching*

In accordance with the requirements of modem ARQ teletype systems, the modular amplifiers have special circuitry enabling them to cycle from receive to transmit and back in much shorter time than was customary in older equipment. Typically, switch times are approximately 10 milliseconds or less.

The PTT line is a low-current drain (typically less than 1 mA) circuit, enabling it to be switched by almost any normal transceiver PTT line or any logic system, without interfering with the system operation. It is internally diode-isolated so that voltage differences are ignored. To switch to the transmit condition, pin H of the interface socket must be pulled down to 0.6V or less from its normal level of approximately 3.6V.

Q3, a low-power Darlington transistor, is normally held in conduction by the divider chain composed of R9, R13, and R8. The collector of Q3 is directly connected to base Q4, which in turn drives the output relay, K2. Although the output relay is nominally a 12V device, it is provided by the 28V supply via R15. R15 limits the current flowing into K2 to its normal value. This supplies the relay with a constant current source, hastening the relay closure.

The current flowing into the coil of K2 is sensed by R10 in the emitter of Q4. When the current becomes a value sufficient to close K2, Q5 is switched on via R12 which closes the input relay, K1. K1 uses the same supply system as K2, via R16. The overall effect of this circuitry, on PTT closure, is to ensure that the input relay closes after the output relay. This ensures that the amplifier cannot be driven until the load is applied. When the PTT line is opened, the reverse must take place.

When the PTT line is allowed to rise in voltage, Q3 again conducts, switching off Q4. The current in K2 is prevented from collapsing instantly by D7 and R14; consequently K2 does not open immediately. Q5 switches off without delay and opens the input relay. The output relay always switches on first when going from receive to transmit and always switches off last when switching in the opposite direction. The protection circuitry is also incorporated in the PTT circuitry and is described in Section 5.11.

5.11 Protective Circuitry

The protective circuits described in this section refer to the high Standing Wave Radio (SWR) circuitry. The TW1000A/B has inherent protection provided by a ferroresonant power supply.

Although no protective system can provide absolute immunity to incorrect operation, particularly the conditions that occur when an amplifier is heavily driven while in an unloaded or shorted condition, it is possible to provide a reasonable tolerance to circumstances likely to be encountered in the field.

Note: There is no protection provided against a wrong filter selection.

The following control systems are activated by excessive SWR.

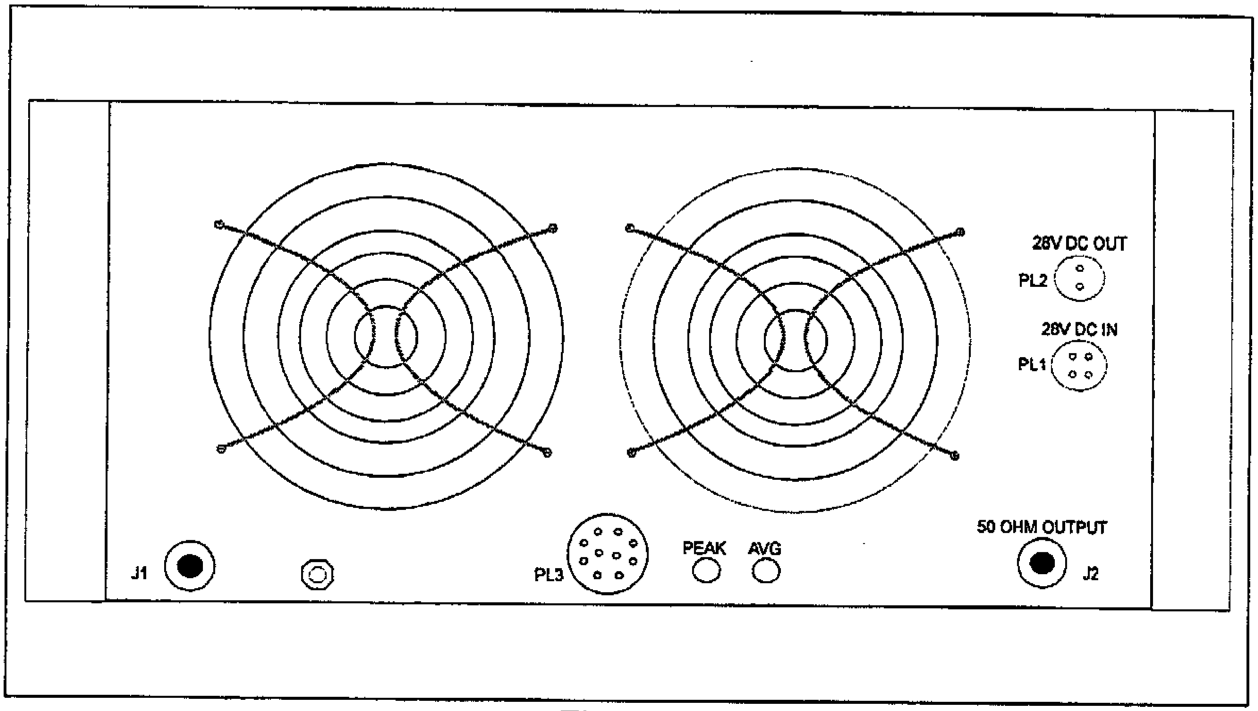

Figure 5-1
TW1000A/B Back Panel

5.11.1 Transceiver ALC System

The transceiver ALC system keeps the transceiver from supplying normal drive to the amplifier and is not subject to adjustment by either of the amplifier's ALCs. (High SWR provides an open collector ground via the 2.2k ohm resistor, R4, at pin I of the control socket.)

Note: If a transceiver not made by DWC is used, it may be necessary to use a different ALC interface.

5.11.2 Internal Trip System

This control disables the PTT line, causing the amplifier to switch to the receive or bypass condition. It automatically resets when the PTT line is returned to the high state by the external control. Some versions of the amplifier have a reset button on the front panel to reset the system without having to drop the PTT line. Repeated tripping of this protective system is a signal that a problem may exist.

5.11.3 Imbalance Detector System

Also included as protective circuitry is an imbalance detector system. This system detects an imbalance if a module shuts down or fails. A sensor located on the rear of the main output combiner detects this and trips the amplifier into the straight-through condition. If this precaution is not taken, the transceiver (when sensing lower output from the amplifier) compensates by increasing its output, resulting in heavy peak flattening and distortion.

Note: The trip circuitry resets every time the PTT line returns to the receive condition.

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SECTION 6: SERVICE AND MAINTENANCE

6.1 Maintenance

The TW1000A/B requires no routine maintenance. The power transistors are rated for an extended service life. It is important to ensure that the ALC is adjusted correctly. If the ALC is set at a power output that is too high, interference occurs on adjacent channels and may cause possible damage to the amplifiers.

6.2 Cleaning

If the TW1000A/B is operated in a dusty atmosphere, it is necessary to clean the interior of the amplifier regularly. A soft brush and compressed air should be used to clean the interior. It is important that all air passages and cooling fans are clean.

6.3 Amplifier Modules

6.3.1 Changing Modules

The TW1000A/B uses field-replaceable modules. To remove a module:

¤ Unscrew the four retaining screws on the front panel and withdraw the module from the amplifier.

To replace the module:

¤ Be sure the module is in the plastic guide rails and slide it back until the connectors engage.

¤ Replace the four retaining screws.

6.3.2 *Fault Detection*

The collector current in each module is monitored independently by the front-panel meters. A fault in a module is usually indicated by an imbalance in the collector current between the two modules and a decrease in the power output. It is normal for small differences in the collector currents between the different transistors. Variations up to 10% are acceptable.

The quiescent current should be checked in each module. The bias has been set for a quiescent collector current of 200-300 mA for the module. The panel meter reads 50A full scale and it will not be possible to measure the quiescent current accurately. There should be a small deflection of the meter when the TW1000A/B is keyed. No meter movement or a substantial meter movement in one module indicates a fault in the bias circuit.

The operation of each module may be checked by removing the suspect module and operating the amplifier with only one module in place. The power output will be approximately 25% of normal, as 50% of the power is dissipated in the balance resistors in the combining network. If both modules deliver equal power when operated alone, the fault is not in the modules.

The best method for checking incorrect operation is to examine the modules by using a known good module.

6.3.3 *Module Repair*

The most probable fault in a module is the failure of a RF power transistor. If the power transistor is suspected at fault, (as evidenced by a markedly lower collector current for the module, combined with a substantial drop in maximum output power for the entire amplifier) perform the following procedures:

- Remove the module.
- Terminate the output connector of the module (right-hand connector viewed from the front of the module) in a 50 ohm 500W dummy load or high-power attenuator.
- Connect a suitable source of 28-30 Vdc to the power connector of the module. Jumper this voltage to the bias supply connector that is immediately adjacent to the output coaxial connector.

¤ Ensure that the negative lead of the power source is firmly grounded to the dc power source.

6.3.3.1 Bias Check

Measure the dc voltage between the base of the power transistors and ground onto each amplifier block. It should be in the range of +0.6V to +0.7V. If not, a thorough check of the bias circuitry should be made. For a description of this circuitry, refer to Section 5.2.

6.3.3.2 Functional Check

¤ Connect a source of two-tone RF power, at about 15 MHz (maximum power 10-15W), to the input coaxial connector.

¤ Adjust the power level until a collector current of 3-5A is indicated.

¤ With an oscilloscope, observe the amplitude of the RF envelope at the output terminal of each amplifier block. If either block shows a markedly low output, further examine the particular transistor pair and continue these steps.

¤ Remove the RF drive source and disconnect the dc power.

¤ Carefully remove the solder from the base and collector leads of each transistor with a solder sucker or other solder-removal tool.

¤ With a suitable metal probe or other tool, applying further heat if necessary, gently pry the base and collector leads of both transistors to isolate them from the printed circuitry.

¤ Set a conventional multimeter to a low-resistance measuring scale (1000 ohm full scale).

¤ Connect the multimeter positive terminal (check which terminal actually has a positive voltage relative to the other) to the base of the transistor being tested and leave it there for the following tests.

¤ Connect the other multimeter lead to the PC board ground. The meter should read a typical diode-drop value (10-20 ohm). A similar reading should be obtained when connecting the test lead to the collector lead.

If any doubt exists as to what the ohmmeter should read, a test performed on any general-purpose silicon diode establishes a normal reading. If either test results in other than a normal reading, the transistor should be replaced. Although this test is very basic, the nature of high-power transistor failure ensures that almost all failed parts are detected by this procedure.

6.3.4 *RF Transistor Replacement*

¤ Remove the two mounting screws from the transistor mounting flange.

¤ Unsolder the four transistor leads. This operation requires dexterity and an assistant with a second soldering iron may prove helpful. Remove as much solder as possible with a desoldering tool or one of the proprietary solder removal tapes. It will then be possible to unsolder each lead in turn.

¤ Remove the defective transistor.

Note: If it is necessary at any time to replace the final RF power transistors, all transistors in each module must have matching beta codes, and each chassis must contain modules that have transistors with the same beta codes. Contact DWC for additional information.

¤ Coat the mounting flange of the replacement transistor with heat sink compound and inspect the mounting area for dirt, etc.

¤ Ensure that the leads are correctly aligned and mount the transistor on the heat sink.

¤ Tightened the screws securely, but do not over-tighten, to avoid distortion of the mounting flange. Do not solder the leads until the mounting screws are tightened.

¤ Use a large capacity soldering iron to solder the leads in place. Complete the joint as quickly as possible so that the leads are soldered in place before the heat has time to be conducted to the transistor chip.

6.4 *Power Supply*

Measure the power source at both no load and full load. The voltage should not exceed 32V without load and should be 28V at full power output. The amplifier continues to operate at lower supply voltages but does not deliver the rated power output.

6.5 *Filter Service*

A filter defect is usually only apparent on one filter range. If the defect is present on more than one range, the filter wiring should be checked for contacts sticking in the on position in one of the relays. If the fault is confined to one filter, the relays should be checked for dc continuity through the filter.

If a capacitor in the filter fails, the capacitor will probably have a burned appearance making it visually identifiable. The inductors are unlikely to give any problems unless the toroidal cores are broken.

A special procedure is used in the factory for filter alignment, where a sweep generator is essential. Fortunately, the replacement of a single capacitor, or even an inductor, will not cause sufficient change to require realignment. If the filters suffer substantial damage (only likely if there is severe physical damage to the amplifier), a replacement filter assembly should be installed, or the original filter should be returned to the DWC for service.

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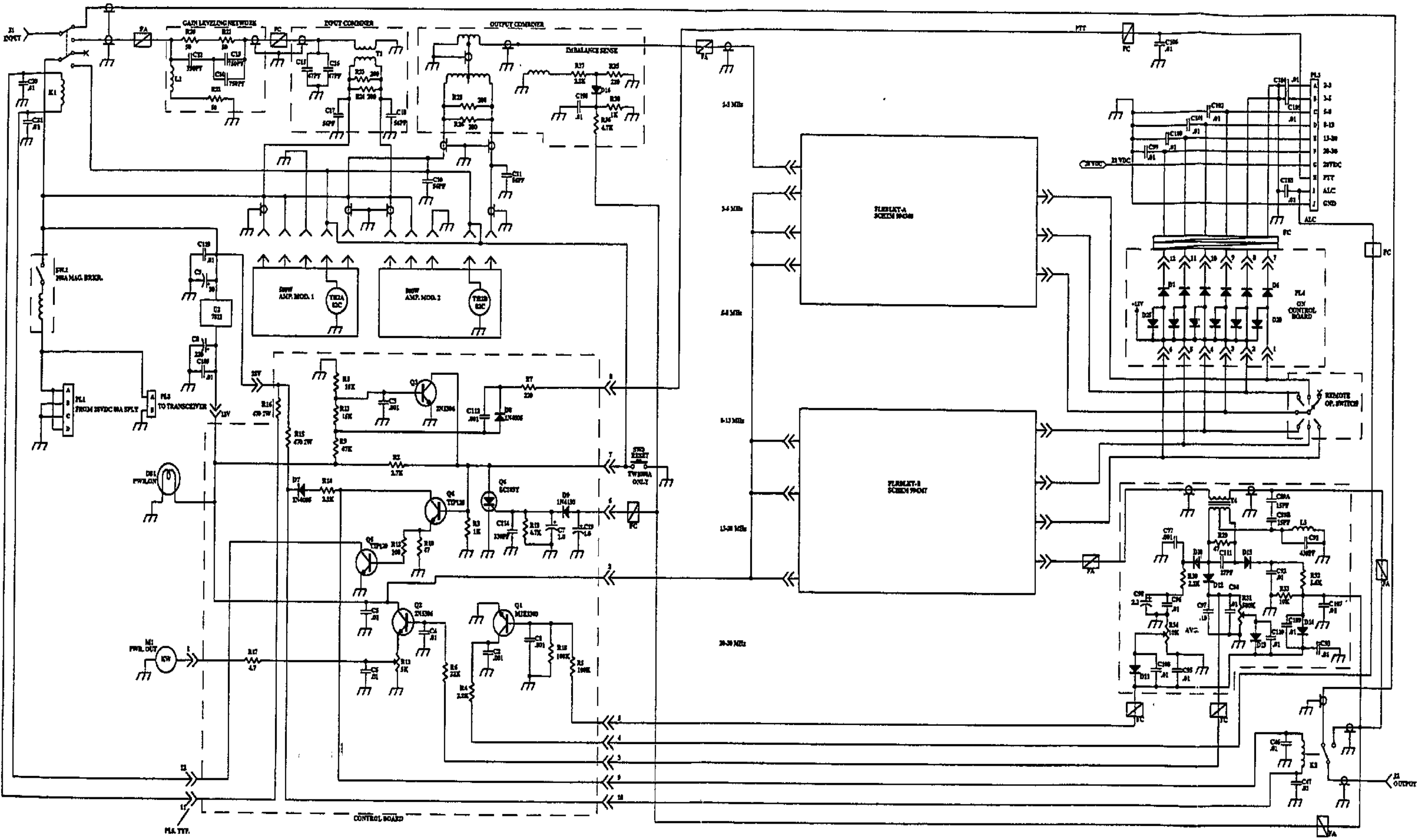

NOTES: UNLESS OTHERWISE SPECIFIED
1 RESISTANCE IS IN OHMS
2 CAPACITANCE IS IN MICROFARADS
3 DIODES ARE 1N4148
4 INDUCTANCE IS IN MICROHENRYS

Figure 6-1
Filter Block Schematic Diagram (991159 Rev. P)

DATRON WORLD COMMUNICATIONS INC.

Title: Schematic RA1000/TW1000A

Size: D | Drawn: A.MARTINEZ | Drawing Number: 991159 | Rev: P

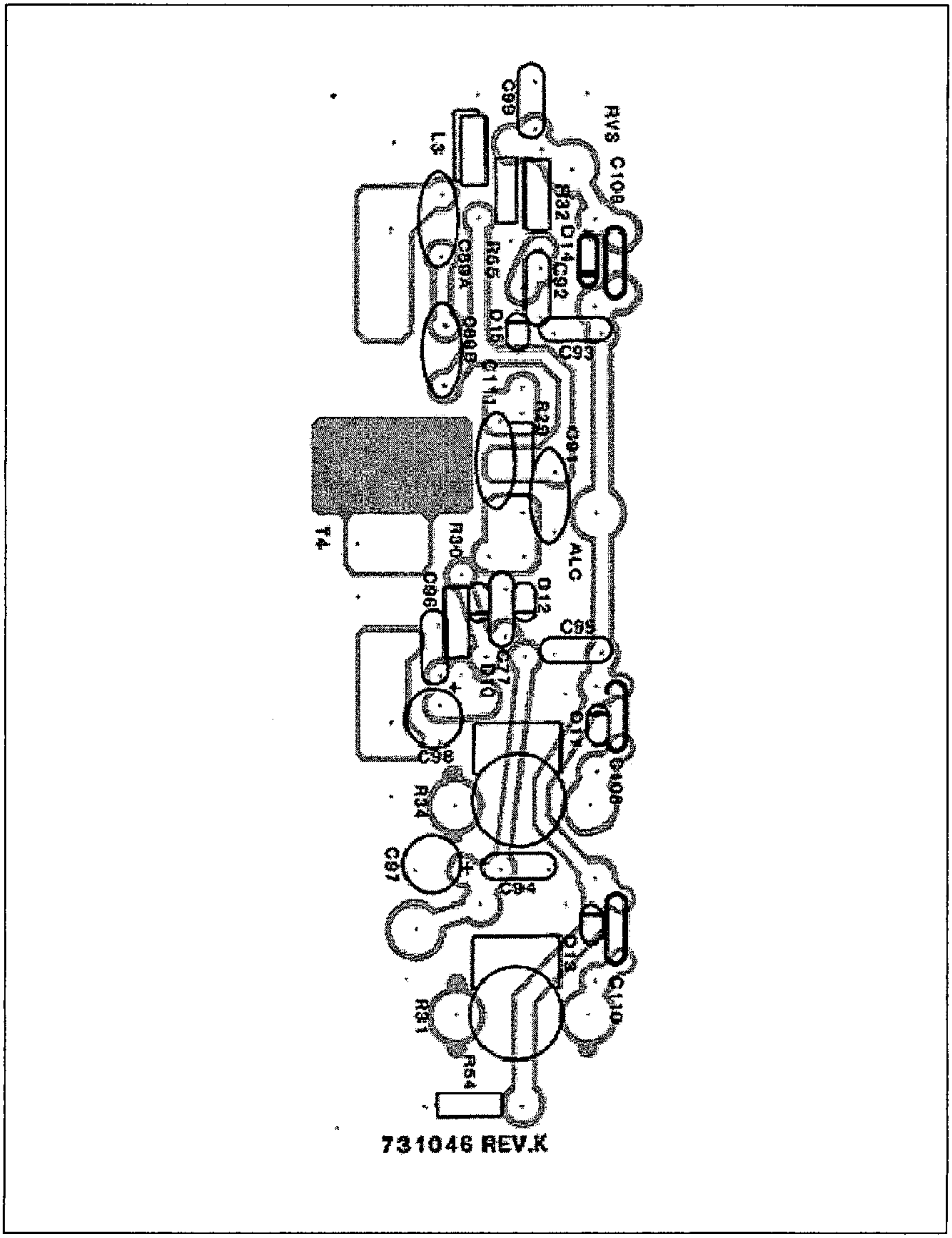

Figure 6-2

ALC Board Component Locations (731046 Rev. K)

Table 6-1
ALC Board Parts List (ALC-BRD Rev. D2)

PARENT ASSEMBLY NUMBER: ALC-BRD REV. D2

DESIGNATOR	PART NUMBER	DESCRIPTION
C108	210103	CAP,.01UF CERAMIC DISC 25V
C109	210103	CAP,.01UF CERAMIC DISC 25V
C110	210103	CAP,.01UF CERAMIC DISC 25V
C111	220270	CAP,27PF 5% DM15 MICA
C77	210102	CAP,C,.001UF,25V,20%,Y,RA,.1SP
C89A	220150	CAP,15PF DM15 MICA
C89B	220150	CAP,15PF DM15 MICA
C91	220431	CAP,430PF DM15 MICA
C92	210103	CAP,.01UF CERAMIC DISC 25V
C93	210103	CAP,.01UF CERAMIC DISC 25V
C94	210103	CAP,.01UF CERAMIC DISC 25V
C95	210103	CAP,.01UF CERAMIC DISC 25V
C96	210103	CAP,.01UF CERAMIC DISC 25V
C97	241001	CAP,0.1MF DIP TANTALUM
C98	241020	CAP,2.2MF DIP TANTALUM
C99	210103	CAP,.01UF CERAMIC DISC 25V
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
L3	459218	IND ASSY,7T#30AWG 2-490202
R29	134470	RES,47 OHM 1/2W 5% CARBON FILM
R30	124222	RES,2.2K 1/4W 5% CARBON FILM
R31	170106	RES,500K TRIMMER
R32	124562	RES,5.6K 1/4W 5% CARBON FILM
R34	170101	RES,10K 15MM TRIMMER
R55	124103	RES,10K 1/4W 5% CARBON FILM
T4	459219	IND ASSY,16T#24AWG 1-490401

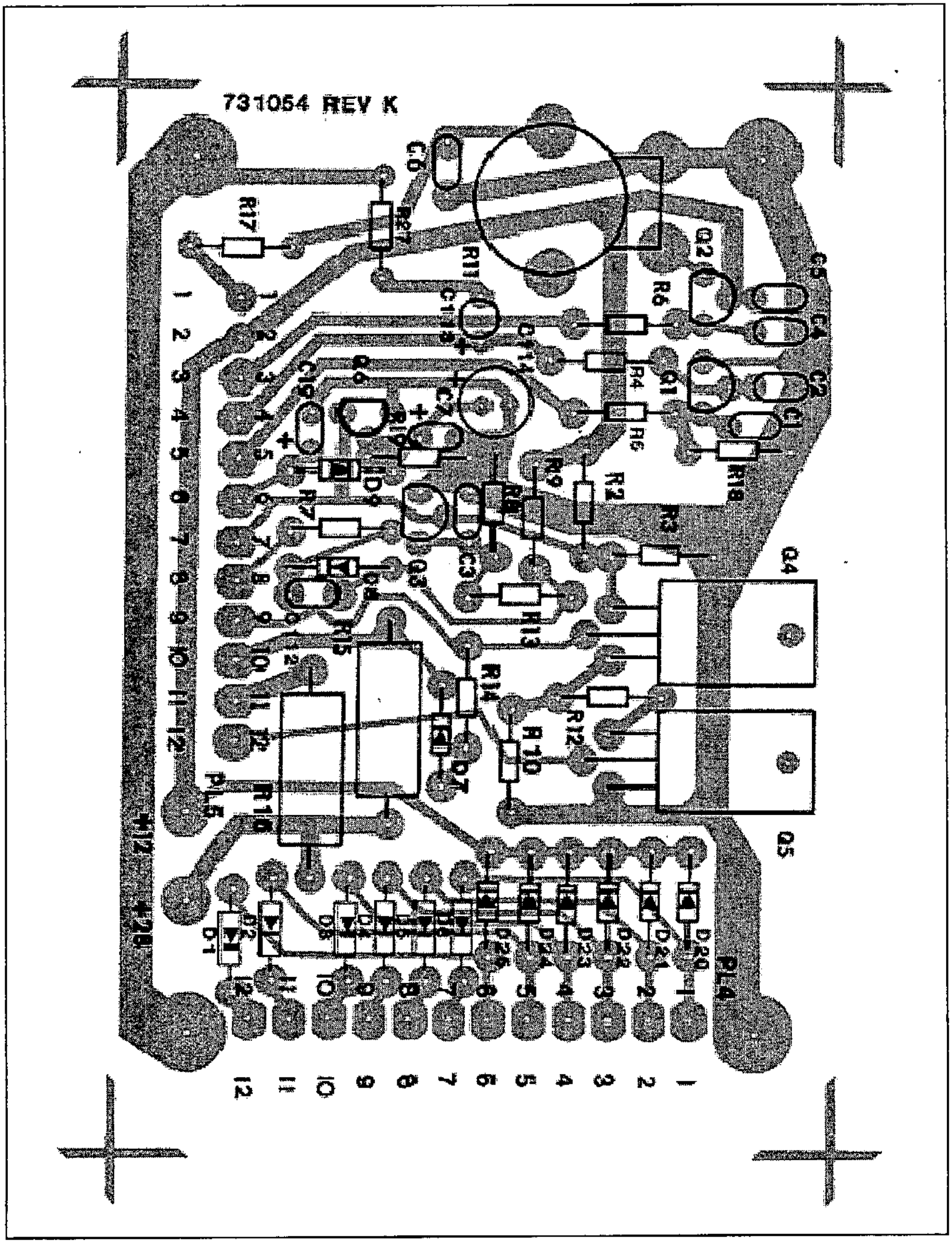

Figure 6-3

Control Board Component Locations (731054 Rev. K)

Table 6-2

Control Board Parts List (CONTBD-ARQ Rev. H)

PARENT ASSEMBLY NUMBER: CONTBD-ARQ REV. H

DESIGNATOR	PART NUMBER	DESCRIPTION
C1	210102	CAP,C,.001UF,25V,20%,Y,RA,.1SP
C112	210102	CAP,C,.001UF,25V,20%,Y,RA,.1SP
C114	220331	CAP,330PF 5% DIPPED MICA
C19	241010	CAP,1.0 MF DIP TANTALUM
C2	210102	CAP,C,.001UF,25V,20%,Y,RA,.1SP
C3	210102	CAP,C,.001UF,25V,20%,Y,RA,.1SP
C4	210103	CAP,.01UF CERAMIC DISC 25V
C5	210103	CAP,.01UF CERAMIC DISC 25V
C6	210103	CAP,.01UF CERAMIC DISC 25V
C7	241010	CAP,1.0 MF DIP TANTALUM
D1	320101	DIODE, RECT. SI 1A 600V
D2	320101	DIODE, RECT. SI 1A 600V
D20	320101	DIODE, RECT. SI 1A 600V
D21	320101	DIODE, RECT. SI 1A 600V
D22	320101	DIODE, RECT. SI 1A 600V
D23	320101	DIODE, RECT. SI 1A 600V
D24	320101	DIODE, RECT. SI 1A 600V
D25	320101	DIODE, RECT. SI 1A 600V
D3	320101	DIODE, RECT. SI 1A 600V
D4	320101	DIODE, RECT. SI 1A 600V
D5	320101	DIODE, RECT. SI 1A 600V
D6	320101	DIODE, RECT. SI 1A 600V
D7	320101	DIODE, RECT. SI 1A 600V
D8	320101	DIODE, RECT. SI 1A 600V
D9	320002	DIODE,SI 100MA 1N4148/1N4150
Q1	310091	XISTOR,NPN,DARL,MJE3300,T0126
Q2	310027	XISTOR,NPN,DARL,2N5306,T092
Q3	310027	XISTOR,NPN,DARL,2N5306,T092
Q4	310053	XISTOR,NPN,DARL,TIP120,T0220
Q5	310053	XISTOR,NPN,DARL,TIP120,T0220
Q6	320602	SCR, 0.8A 30V EC103Y
R10	124470	RES,47 OHM 1/4W 5% CARBON FILM
R11	170103	RES,5K 15MM TRIMMER

Table 6-2
Control Board Parts List (continued)

DESIGNATOR	PART NUMBER	DESCRIPTION
R12	124101	RES,100 OHM 1/4W 5% CF
R13	124153	RES,15K 1/4W 5% CARBON FILM
R14	124222	RES,2.2K 1/4W 5% CARBON FILM
R15	144471	RES,470 OHM 1W 5% FILM
R16	144471	RES,470 OHM 1W 5% FILM
R17	124472	RES,4.7K 1/4W 5% CARBON FILM
R18	124104	RES,100K 1/4W 5% CARBON FILM
R19	124472	RES,4.7K 1/4W 5% CARBON FILM
R2	124272	RES,2.7K 1/4W 5% CARBON FILM
R3	124102	RES,1K 1/4W 5% CARBON FILM
R4	124222	RES,2.2K 1/4W 5% CARBON FILM
R5	124104	RES,100K 1/4W 5% CARBON FILM
R6	124223	RES,22K 1/4W 5% CARBON FILM
R7	124221	RES,220 OHM 1/4W 5% CF
R8	124103	RES,10K 1/4W 5% CARBON FILM
R9	124473	RES,47K 1/4W 5% CARBON FILM

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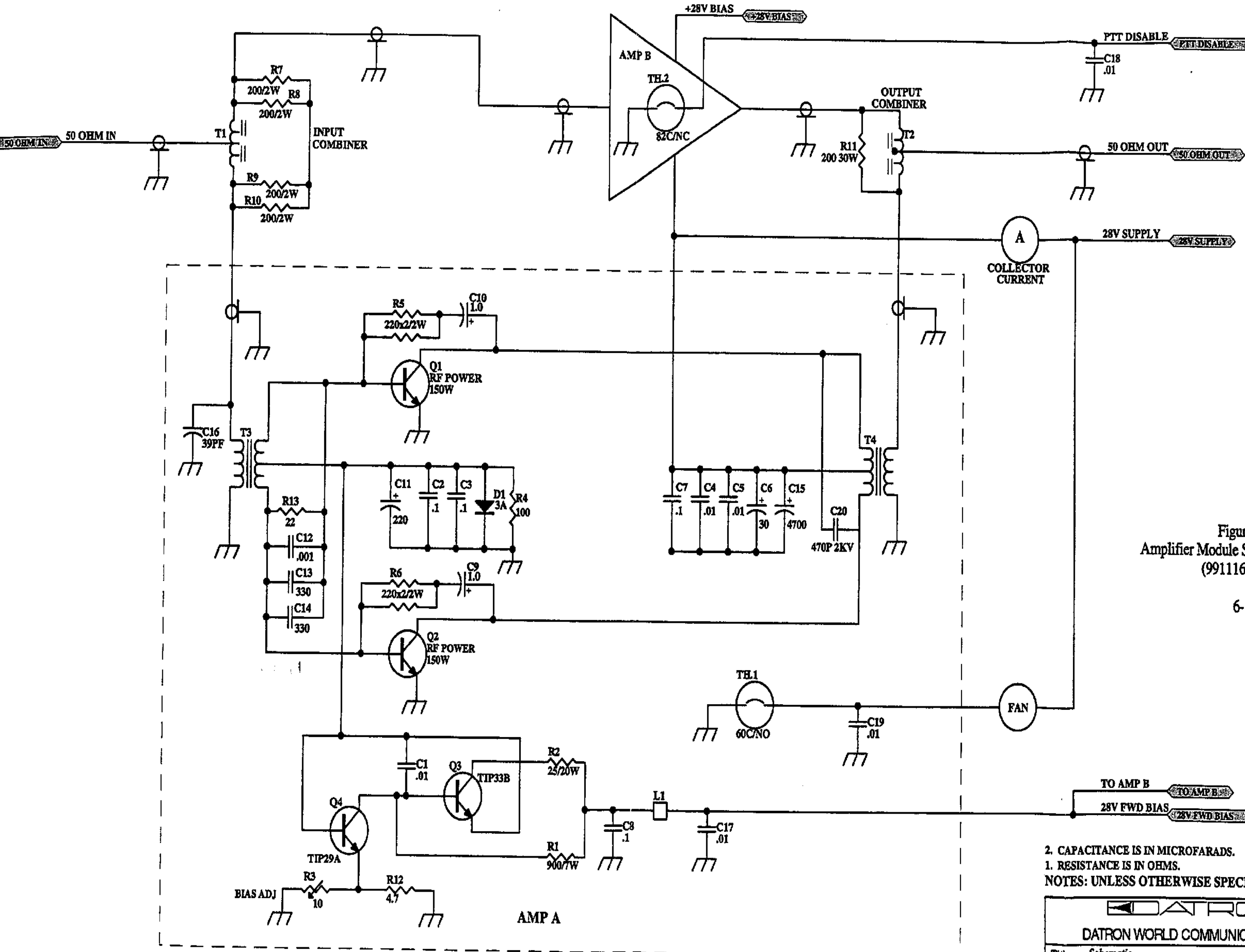

500W PLUG IN MODULE CONSISTS OF TWO 250W AMP BLOCKS A,B

Figure 6-4
Amplifier Module Schematic Diagram
(991116 Rev. C)

NOTES: UNLESS OTHERWISE SPECIFIED
1. RESISTANCE IS IN OHMS.
2. CAPACITANCE IS IN MICROFARADS.

DATRON WORLD COMMUNICATIONS INC.			304 Enter[illegible] Escondido (619)747-1 FAX (619)
Title: *Schematic* *RA/TW1000A AMPLIFIER MODULE*			
Size: B	Drawn: A.MARTINEZ	Date: 8-6-96	Drawing Number: 991116
	Appr:	Date:	

Table 6-3

Amplifier Module Parts List (AMPMODRA1A Rev. K)

PARENT ASSEMBLY NUMBER: AMPMODRA1A REV. K

DESIGNATOR	PART NUMBER	DESCRIPTION
C1	211103	CAP,0.01 MF 500V DISC
C10	240010	CAP,1MF 75V 107AXL TANT
C11	230201	CAP,220uF,16V,ELECT
C15	230502	CAP,4700MF 35V ELECT
C16	220390	CAP,39PF DM15 MICA
C17	211103	CAP,0.01 MF 500V DISC
C2	210104	CAP,.1MF 25V DISC
C3	210104	CAP,.1MF 25V DISC
C4	211103	CAP,0.01 MF 500V DISC
C5	211103	CAP,0.01 MF 500V DISC
C6	230300	CAP,30MF 100V ELECT
C7	254104	CAP,0.1MF 100V MYLAR
C8	254104	CAP,0.1MF 100V MYLAR
C9	240010	CAP,1MF 75V 107AXL TANT
D1	320103	DIODE,SI 3A 50V 1N5400
Q3	310025	XSTOR,NPN,TO218AC,100V,10A
Q4	310024	XISTOR,NPN,MJE29A,TO220
R1	160901	RES,900 OHM 7W 5% WW
R12	124047	RES,4.7 OHM 1/4W 5% CF
R2	160250	RES,25 OHM 20W 5% WW
R3	170212	RES,10 OHM 15T TRIMMER
R4	144101	RES,100 OHM 1W 5% FILM
R5	153221	RES,220 OHM 2W 5% FP FILM
R6	153221	RES,220 OHM 2W 5% FP FILM
T3	459144	XFMR ASSY,AMP MOD 4T 6-490302
T4	459145	XFMR ASSY AMP MOD 4T-459502

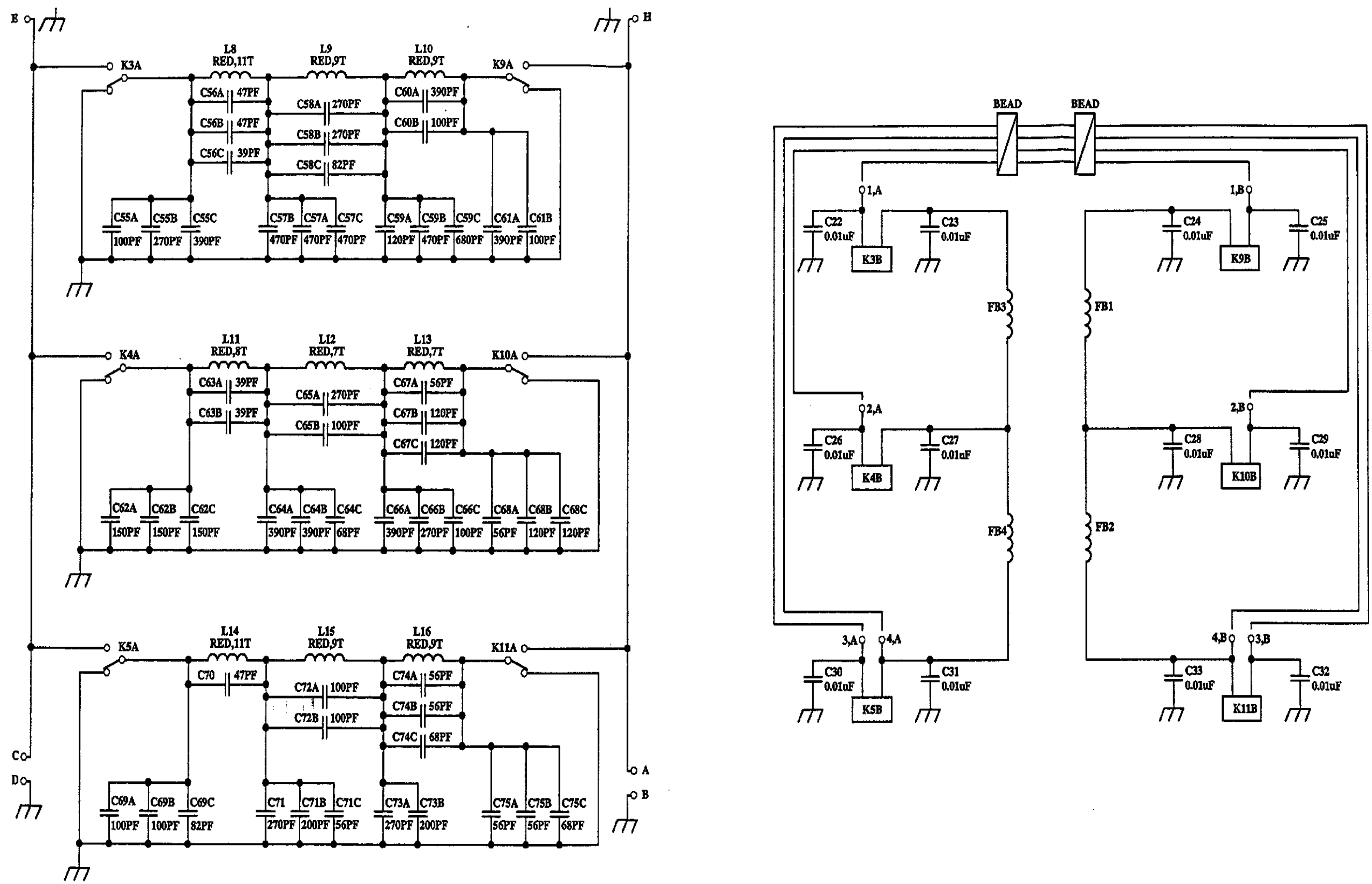

Figure 6-5
Filter Assembly 2-8 MHz Schematic Diagram (994368 Rev. A)

DATRON WORLD COMMUNICATIONS INC.

304 Enterprise St.
Escondido, CA 92029
(760)747-1079
FAX (760)747-2625

Title: Schematic FLRBLKT-1B			
Size: B	Drawn: SAYLES / Appr:	Date: / Date:	Drawing Number: 994368	Rev: A

Table 6-4
Filter Assembly 2-8 MHz Parts List (FLRBLKT-A Rev. A)

PARENT ASSEMBLY NUMBER: FLRBLKT-A REV. A

DESIGNATOR	PART NUMBER	DESCRIPTION
C22	211103	CAP,0.01 MF 500V DISC
C23	211103	CAP,0.01 MF 500V DISC
C24	211103	CAP,0.01 MF 500V DISC
C25	211103	CAP,0.01 MF 500V DISC
C26	211103	CAP,0.01 MF 500V DISC
C27	211103	CAP,0.01 MF 500V DISC
C28	211103	CAP,0.01 MF 500V DISC
C29	211103	CAP,0.01 MF 500V DISC
C30	211103	CAP,0.01 MF 500V DISC
C31	211103	CAP,0.01 MF 500V DISC
C32	211103	CAP,0.01 MF 500V DISC
C33	211103	CAP,0.01 MF 500V DISC
C55A	212101	CAP,100PF 3KV DISC
C55B	212271	CAP,C,270P,2K,5%,HT,RA,.375
C55C	212391	CAP,C,390P,2K,5%,HT,RA,.375
C56A	212470	CAP, 47 PF 3KV DISC
C56B	212470	CAP, 47 PF 3KV DISC
C56C	212390	CAP,C,39P,3K,5%,HT,RA,.375
C57A	212471	CAP,C,470P,2K,5%,HT,RA,.375
C57B	212471	CAP,C,470P,2K,5%,HT,RA,.375
C57C	212471	CAP,C,470P,2K,5%,HT,RA,.375
C58A	212271	CAP,C,270P,2K,5%,HT,RA,.375
C58B	212271	CAP,C,270P,2K,5%,HT,RA,.375
C58C	212820	CAP,82PF 5KV DISC
C59A	212121	CAP,C,120P,3K,5%,HT,RA,.375
C59B	212471	CAP,C,470P,2K,5%,HT,RA,.375
C59C	212681	CAP,C,680P,2K,5%,HT,RA,.375
C60A	212391	CAP,C,390P,2K,5%,HT,RA,.375
C60B	212101	CAP,100PF 3KV DISC
C61A	212391	CAP,C,390P,2K,5%,HT,RA,.375
C61B	212101	CAP,100PF 3KV DISC
C62A	212151	CAP,C,150P,4K,5%,HT,RA,.375
C62B	212151	CAP,C,150P,4K,5%,HT,RA,.375

Table 6-4

Filter Assembly 2-8 MHz Parts List (continued)

DESIGNATOR	PART NUMBER	DESCRIPTION
C62C	212151	CAP,C,150P,4K,5%,HT,RA,.375
C63A	212390	CAP,C,39P,3K,5%,HT,RA,.375
C63B	212390	CAP,C,39P,3K,5%,HT,RA,.375
C64A	212391	CAP,C,390P,2K,5%,HT,RA,.375
C64B	212391	CAP,C,390P,2K,5%,HT,RA,.375
C64C	212680	CAP,C,68P,3K,5%,HT,RA,.375
C65A	212271	CAP,C,270P,2K,5%,HT,RA,.375
C65B	212101	CAP,100PF 3KV DISC
C66A	212391	CAP,C,390P,2K,5%,HT,RA,.375
C66B	212271	CAP,C,270P,2K,5%,HT,RA,.375
C66C	212101	CAP,100PF 3KV DISC
C67A	212560	CAP,C,56P,3K,5%,HT,RA,.375
C67B	212121	CAP,C,120P,3K,5%,HT,RA,.375
C67C	212121	CAP,C,120P,3K,5%,HT,RA,.375
C68A	212560	CAP,C,56P,3K,5%,HT,RA,.375
C68B	212121	CAP,C,120P,3K,5%,HT,RA,.375
C68C	212121	CAP,C,120P,3K,5%,HT,RA,.375
C69A	212101	CAP,100PF 3KV DISC
C69B	212101	CAP,100PF 3KV DISC
C69C	212820	CAP,82PF 5KV DISC
C70	212470	CAP, 47 PF 3KV DISC
C71A	212271	CAP,C,270P,2K,5%,HT,RA,.375
C71B	212201	CAP, 200 PF 2 KV DISC
C71C	212560	CAP,C,56P,3K,5%,HT,RA,.375
C72A	212101	CAP,100PF 3KV DISC
C72B	212101	CAP,100PF 3KV DISC
C73A	212271	CAP,C,270P,2K,5%,HT,RA,.375
C73B	212201	CAP, 200 PF 2 KV DISC
C74A	212560	CAP,C,56P,3K,5%,HT,RA,.375
C74B	212560	CAP,C,56P,3K,5%,HT,RA,.375
C74C	212680	CAP,C,68P,3K,5%,HT,RA,.375
C75A	212560	CAP,C,56P,3K,5%,HT,RA,.375
C75B	212560	CAP,C,56P,3K,5%,HT,RA,.375
C75C	212680	CAP,C,68P,3K,5%,HT,RA,.375
K10	540013	RELAY SPDT 12VDC 10AMP

Table 6-4
Filter Assembly 2-8 MHz Parts List (continued)

DESIGNATOR	PART NUMBER	DESCRIPTION
K11	540013	RELAY SPDT 12VDC 10AMP
K3	540013	RELAY SPDT 12VDC 10AMP
K4	540013	RELAY SPDT 12VDC 10AMP
K5	540013	RELAY SPDT 12VDC 10AMP
K9	540013	RELAY SPDT 12VDC 10AMP
L10	450502	TOROID DOUBLE RED 9 TURNS
L11	450503	TOROID DOUBLE RED 8 TURNS
L12	450504	TORIOD DOUBLE RED 7 TURN
L13	450504	TORIOD DOUBLE RED 7 TURN
L14	450505	TORIOD DOUBLE YELLOW 7 TURNS
L15	450506	TORIOD DOUBLE YELLOW 6 TURNS
L16	450506	TORIOD DOUBLE YELLOW 6 TURNS
L8	450501	TOROID DOUBLE RED 11 TURNS
L9	450502	TOROID DOUBLE RED 9 TURNS

Table 6-5
Filter Assembly 8-30 MHz Parts List (FLRBLKT-B Rev. C)

PARENT ASSEMBLY NUMBER: FLRBLKT-B REV. C

DESIGNATOR	PART NUMBER	DESCRIPTION
C34	211103	CAP,0.01 MF 500V DISC
C35	211103	CAP,0.01 MF 500V DISC
C36	211103	CAP,0.01 MF 500V DISC
C37	211103	CAP,0.01 MF 500V DISC
C38	211103	CAP,0.01 MF 500V DISC
C39	211103	CAP,0.01 MF 500V DISC
C40	211103	CAP,0.01 MF 500V DISC
C41	211103	CAP,0.01 MF 500V DISC
C42	211103	CAP,0.01 MF 500V DISC
C43	211103	CAP,0.01 MF 500V DISC
C44	211103	CAP,0.01 MF 500V DISC
C45	211103	CAP,0.01 MF 500V DISC
C48	216101	CAP,100PF HV DOOR KNOB
C50A	216101	CAP,100PF HV DOOR KNOB
C50B	216101	CAP,100PF HV DOOR KNOB
C52A	216101	CAP,100PF HV DOOR KNOB
C52B	216101	CAP,100PF HV DOOR KNOB
C54	216101	CAP,100PF HV DOOR KNOB
C78A	212101	CAP,100PF 3KV DISC
C78B	212820	CAP,82PF 5KV DISC
C78C	212820	CAP,82PF 5KV DISC
C79A	212390	CAP,C,39P,3K,5%,HT,RA,.375
C79B	212470	CAP, 47 PF 3KV DISC
C80A	212121	CAP,C,120P,3K,5%,HT,RA,.375
C80B	212121	CAP,C,120P,3K,5%,HT,RA,.375
C80C	212560	CAP,C,56P,3K,5%,HT,RA,.375
C81	212470	CAP, 47 PF 3KV DISC
C82A	212470	CAP, 47 PF 3KV DISC
C82B	212470	CAP, 47 PF 3KV DISC
C82C	212390	CAP,C,39P,3K,5%,HT,RA,.375
C83B	216101	CAP,100PF HV DOOR KNOB
C85A	216101	CAP,100PF HV DOOR KNOB
C85B	216201	CAP,DOORKNOB,200P,7.5KV

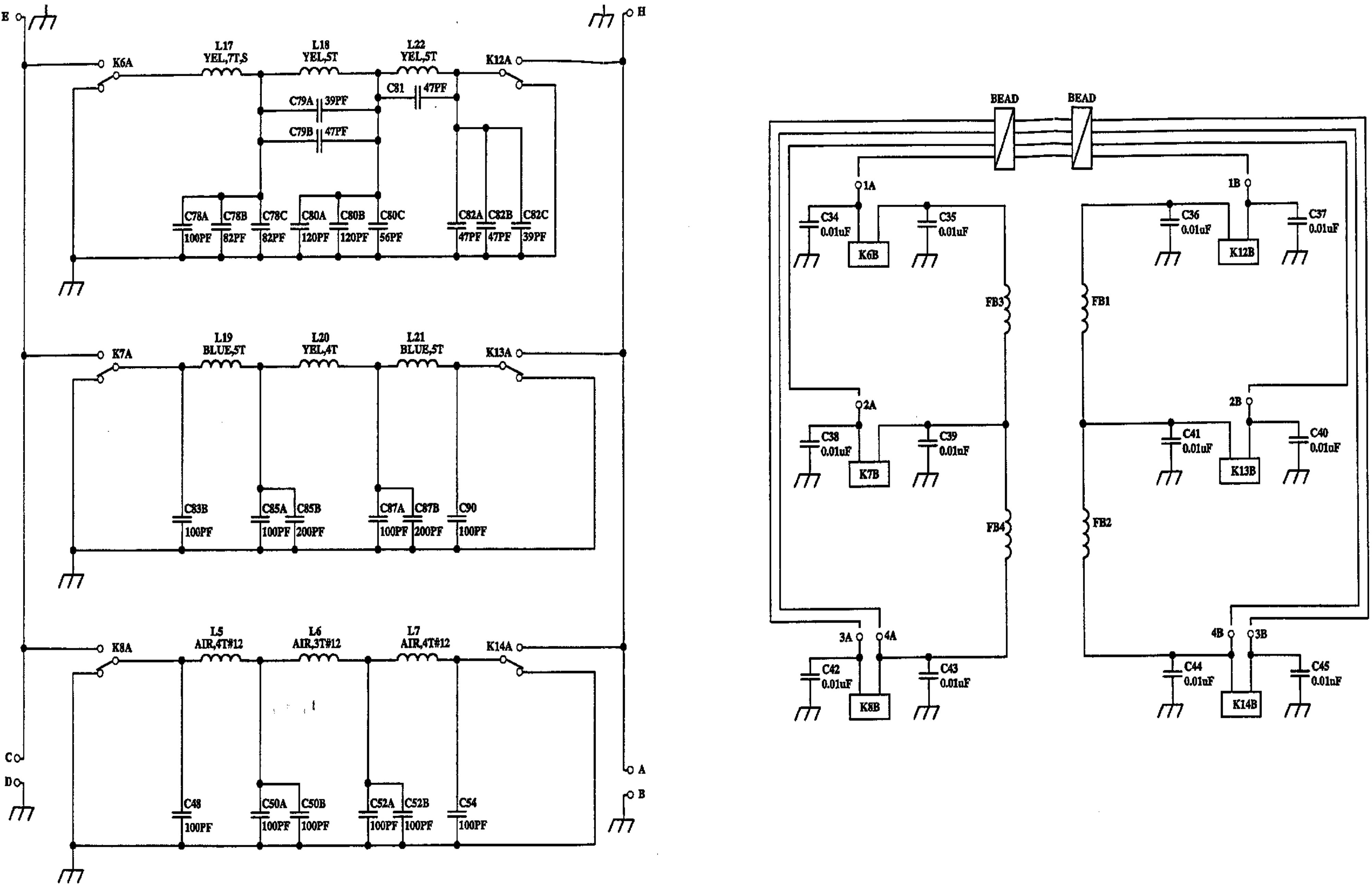

Figure 6-6
Filter Assembly 8-30 MHz Schematic Diagram (994367 Rev. C)

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Title: *Schematic*	***FLRBLKT-B***		
Size: **B**	Drawn: A.MARTINEZ / Appr:	Date: / Date:	Drawing Number: **994367**	Rev: **C**

Table 6-5

Filter Assembly 8-30 MHz Parts List (continued)

DESIGNATOR	PART NUMBER	DESCRIPTION
C87A	216101	CAP,100PF HV DOOR KNOB
C87B	216201	CAP,DOORKNOB,200P,7.5KV
C90	216101	CAP,100PF HV DOOR KNOB
K12	540013	RELAY SPDT 12VDC 10AMP
K13	540013	RELAY SPDT 12VDC 10AMP
K14	540013	RELAY SPDT 12VDC 10AMP
K6	540013	RELAY SPDT 12VDC 10AMP
K7	540013	RELAY SPDT 12VDC 10AMP
K8	540013	RELAY SPDT 12VDC 10AMP
L17	450508	TORIOD SINGLE YELLOW 7 TURNS
L18	450507	TORIOD DOUBLE YELLOW 5 TURNS
L19	450052	TOROID DOUBLE BLUE 5 TURNS
L20	450605	TOROID DOUBLE YELLOW 4 TURNS
L21	450052	TOROID DOUBLE BLUE 5 TURNS
L22	450507	TORIOD DOUBLE YELLOW 5 TURNS
L5	450414	AIR COIL 4T #12 .625DIA
L6	450413	AIR COIL 3T #12 .625DIA
L7	450414	AIR COIL 4T #12 .625DIA