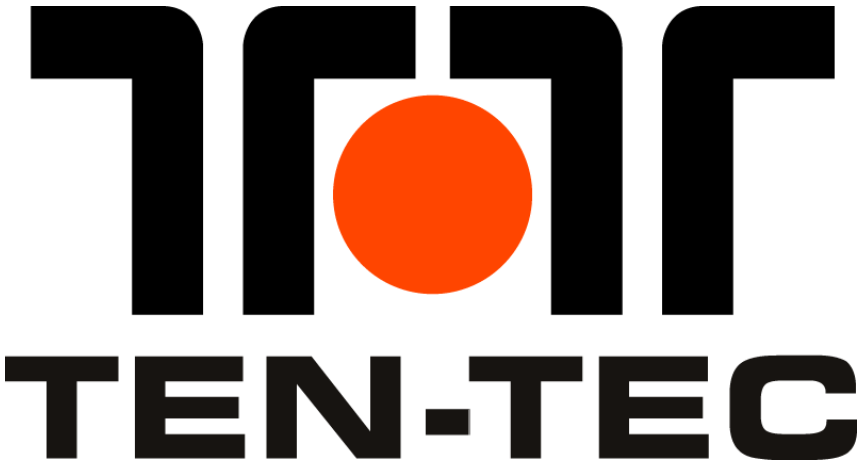


This obsolete manual file is provided as a courtesy to you by Ten-Tec, Inc.

Ten-Tec's service department can repair and service virtually everything we have built going back to our first transceivers in the late 1960's. It is our ability to continue offering service on these rigs that has led to their re-sale value remaining high and has made a major contribution to our legendary service reputation.

Printed and bound copies of all manuals are available for purchase through our service department if you would prefer not to use this copy as your transceiver manual.

We can repair or service your Ten-Tec equipment at our facility in Sevierville, TN. We also offer support via telephone for all products via during usual business hours of 8 a.m. to 5 p.m. USA Eastern time, Monday through Friday. We have a large supply of parts for obsolete products. Repairing a transceiver or amplifier yourself? Contact us for parts pricing information.

Service department direct line: (865) 428-0364
Ten-Tec office line: (865) 453-7172
Service department email: service@tentec.com
Address: 1185 Dolly Parton Parkway, Sevierville, TN 37862 USA

We have found it is most effective for us to help you troubleshoot or repair equipment with a consultation via telephone rather than by email.

Suggested contact methods are:

Troubleshooting or repairing equipment – call (865) 428-0364
Other inquiries – call (865) 428-0364 or email service@tentec.com

THANK YOU AND 73 FROM ALL OF US AT TEN-TEC

TEN-TEC

OPERATOR'S MANUAL

HERCULES II
MODEL 420
LINEAR AMPLIFIER

TABLE OF CONTENTS

PARAGRAPH PAGE

LIST OF ILLUSTRATIONS

SPECIFICATIONS

OPERATING FREQUENCY:	1.8 to 30 MHz in seven bands. (22-30 MHz Band is disabled on domestic model).
MAXIMUM POWER:	550 watts output CW,RTTY and SSB. (1 KW dc input).
DRIVE POWER REQUIRED:	50 to 80 watts typical for 550 watts output.
DUTY CYCLE:	SSB- continuous voice modulation; CW/RTTY- 50% duty cycle continuously; 15 minutes maximum continuous key-down at 550 watts output.
DISTORTION:	Third order products -35dB from 550 watt output level.
INPUT AND OUTPUT IMPEDANCES:	50 ohms unbalanced, VSWR < 2:1.
METERING:	Switch selectable Forward Power, SWR (calibrated @ 500W Forward Power), Icc (collector current), Vcc (collector voltage). Ten element LED bargraph instantly displays Peak Output Power.
TX/RX SWITCHING TIME:	Less than 5 mS.
PROTECTIVE CIRCUITS:	Hot switching T/R protection. Over-voltage and over-current lockout. Automatically switched input pad in overdriven condition. Front panel "overdrive" LED indicates fault condition.
PRIMARY POWER:	RF Deck — 12.5-14 volts @ 80 amps. (100 amps maximum).
FINAL AMPLIFIER TRANSISTORS:	Eight MRF458, SD1405, or equivalent.
COOLING:	Internal forced air, rear exhaust.
FRONT PANEL CONTROLS:	Power (ON-OFF), Control (QSK/RELAY), Meter (FWD,REF,Ic, Vcc), Band (REMOTE,1.8-2.5,2.5-4.0,4.0-6.5,6.5-10.5,10.5-15.0,15.0-22.0,22.0-30.0).
REAR PANEL CONNECTIONS:	RF Input, RF Output, DC Power, Key In, Key Out, Vox Key, Speaker, Remote Control, Ground.
SIZE:	HWD 5.25" x 12" x 14.5", (13.3 x 30.5 x 36.8 cm).
WEIGHT:	15 lbs, (6.8 Kg).

INTRODUCTION

The HERCULES II Model 420 is a compact, lightweight, solid state KW Linear Amplifier featuring instant on, 12-14 Vdc operation, no-tune broadband design, fast QSK CW/AMTOR/PACKET T/R switching, and optional remote control. The companion Model 9420 Power Supply provides 14 Vdc at 80 amps to the HERCULES II with an additional 20 amp reserve to optionally power a 100 watt exciter. Mobile/portable operation from a 12-14 Vdc vehicular supply is also possible. Remote bandswitching is possible with transceivers that provide band outputs. Completely remoted operation is possible with the Model 9423 Remote Control Head.

This amplifier uses ducted forced air cooling and operates at a continuous 550 watts output SSB PEP or 50% duty cycle CW; 15 minutes maximum key-down RTTY/SSTV/FM. The front panel multimeter can be switched to monitor forward power output, SWR (calibrated @ 500 watts forward power),Icc (collector current), or Vcc (collector voltage). A ten element LED bargraph display continuously monitors peak output power. An "overdrive" LED indicates excess drive resulting in high Icc or power output greater than 550 watts. An input attenuator is temporarily switched in during an overdriven condition. The "overdrive" LED also lights for an overvoltage, overcurrent, or unbalanced condition, and in this case, latches the amplifier off until the cause of the condition is remedied and the POWER switch is cycled.

UNPACKING

Carefully remove the amplifier from the packing carton and inspect it for signs of shipping damage. If the amplifier has been damaged, notify the delivering carrier immediately, stating the full extent of the damage. Save all damaged cartons and packing material. Liability for any shipping damage rests with the carrier. Complete the warranty registration form and mail to TEN-TEC immediately.

Save the packing material for re-use in the event that moving, storage, or reshipment is necessary. Shipment of your TEN-TEC amplifier in other than factory packing may result in damage which is not covered under warranty. The following hardware and accessories are packed with your HERCULES II. Make sure you have not overlooked anything.

1 — #27015	Fuse, 4 A, Slo-Blo
1 — #35111	12 pin Connector Plug
1 — #35205	15 pin Connector Plug
2 — #35206	Strain Relief
1 — #38040	.050" Hex Allen Wrench
1 — #38088	.062" Hex Allen Wrench
2 — #38181	Connector Cover
15 — #41023	Terminal, male
12 — #41054	Terminal, female
2 — #41055	1/4" Ring Lug
2 — #60025	6-32, 1/4"Lg. Screw
2 — #65026	#6 X5/8" Screw
1 — #74020	Warranty Card
1 — #74196	Operator's Manual
1 — #86019	Speaker Cable
1 — #46160	Key In/Out Cable

If any of the above items are missing, contact the customer service department at Ten-Tec for replacements.

CHAPTER 1

INSTALLATION

1-1 INTRODUCTION When setting up the station, provide adequate ventilation for the amplifier and power supply. Also, select a location that allows adequate clearance for rear panel connections.

1-2 POWER SUPPLY TO RF AMPLIFIER INTERCONNECTIONS Connecting the Model 9420 AC Power Supply is straight-forward. Refer to the Model 9420 operator's manual to configure the supply for either 120 or 240 Vac operation. To connect the 9420 Power Supply proceed as follows:

1] Be sure the HERCULES II Power switch is turned off and the power supply is unplugged from the wall outlet.

2] Push the 12 pin dc power plug from the supply firmly into the mating DC POWER connector on the rear panel of the HERCULES II until the locking tabs snap into place.

3] If you wish to power your transceiver from the Model 9420 also, push one end of the double 4 pin connector dc cable supplied with the 9420 firmly into the mating 4 pin connector on the power supply. Turn your transceiver Power switch off. Connect the other end of the cable to your transceiver.

4] Plug the power supply line cord into a wall outlet of the correct voltage and current rating. You should now be ready to connect your antenna, transceiver and other station equipment as described in the next section.

OTHER DC SUPPLIES — For mobile or portable operation, the HERCULES II can be powered from any negative ground dc power source capable of supplying 12.5-14 volts at 80 amperes. Figure 1-1 shows the connections required for dc operation.

1-3 EXCITER INTERCONNECTIONS The first thing to remember about amplifier-transceiver interconnection is that the amplifier MUST be keyed into the transmit mode BEFORE rf drive power is delivered to the input connector. The HERCULES II incorporates protective circuitry which senses the presence of rf on the antenna coax and prevents the amplifier T/R relays from switching if rf is present.

There are two keying inputs to the HERCULES II. A "key" command on either of these inputs is sufficient to place the amplifier into the transmit mode. Two of the rear panel connectors are labeled "KEY IN" and "KEY OUT". A connection to ground on the KEY IN connector will place the HERCULES II in transmit (assuming no rf is present when the connection is made). A closure to ground on the KEY IN is fed directly to the KEY OUT connector, which can then be used as a key output. Ten-Tec transceivers with "TX OUT" and "TX EN" connectors (such as the Model 585 PARAGON) can be cabled to the "KEY IN" and "KEY OUT" connectors of the HER-

CULES II as shown in FIGURE 1-2. This is the only keying connection necessary for these transceivers. When using this keying system the HERCULES II Control Mode switch should be placed in the QSK position for all operating modes.

A second keying connector on the rear panel of the HERCULES II is labeled "VOX KEY". This input has the same function as the KEY IN and KEY OUT connectors, but is diode isolated from them and therefore can only be used as an input. Also, the "VOX KEY" input is only connected to the internal keying circuitry of the HERCULES II when the front panel Control Mode switch is placed in the RELAY position. When this switch is in the RELAY position, a ground at the VOX KEY connector will put the HERCULES II into the transmit mode. No ground signal is fed to the KEY OUT connector from the VOX KEY input. Amplifier keying via the VOX KEY connector permits non-QSK (semi break-in) CW and PTT/VOX SSB operation with transceivers that have fast mechanical or solid state keying relay outputs. The transceiver keying relay MUST provide a closure to ground BEFORE rf output appears or the HERCULES II will refuse to switch to transmit with the exciter, but will wait for the first pause in drive, typically switching in after the first dit on CW or the first syllable on SSB. FIGURE 1-3 shows a hookup that can be used with transceivers having fast keying relay outputs. When using this hookup system, the Control Mode switch should be placed in the RELAY position. This system is to be used with semi break-in CW or SSB vox relay keying only.

If your transceiver has a slow vox relay (one which closes after rf output appears), proper CW and PTT operation can be obtained by using the hookup shown in FIGURE 1-4. Vox operation may still drop the first syllable of speech if the relay is too slow. The HERCULES II Control Mode switch should be placed in the QSK position for CW and in the RELAY position for SSB. This hookup will also work fine for VOX if the PTT/RELAY line goes low fast enough when the VOX is activated.

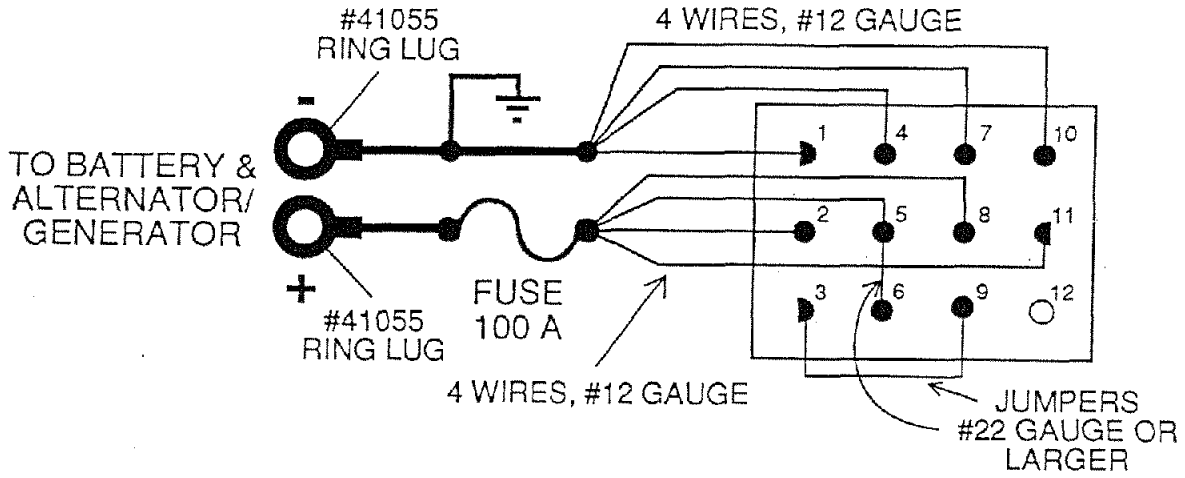
1-4 ANTENNA REQUIREMENTS The HERCULES II amplifier has been designed for use with antennas resonant at the frequency of operation and having impedances within the limits of 25 to 100 ohms, and an SWR of 2:1 or less.

The nominal output impedance of the amplifier is 50 ohms and the SWR of the load should not exceed 2:1. Many antennas exhibit an SWR range over an entire amateur band that exceeds 2:1. For operation under this condition, we recommend using an antenna matching network which will enable the HERCULES II to work into a 50 ohm load for maximum power transfer to the antenna. The TEN-TEC Model 229 or 238 Tuner is a suitable companion.

CAUTION!!!

Never attempt to operate the HERCULES II without first connecting a suitable antenna or 50 ohm dummy load of sufficient power rating or SERIOUS DAMAGE MAY RESULT.

1-5 GROUND CONNECTIONS In the interest of personal safety and to reduce the possibility of stray RF pickup on interconnecting cables, all station equipment should be well grounded to earth. It is important to strap all equipment chassis together with short, heavy leads.



PIN NUMBER	FUNCTION	PIN NUMBER	FUNCTION
1	GROUND	7	GROUND
2	+14V @ 80A	8	+14V @ 80A
3	PWR SWITCH OUT	9	+14V SWITCHED
4	GROUND	10	GROUND
5	+14V @ 80A	11	+14V @ 80A
6	PWR SWITCH IN	12	NO CONNECTION

FIGURE 1-1. CONNECTION DIAGRAM FOR 12-14 VDC POWER

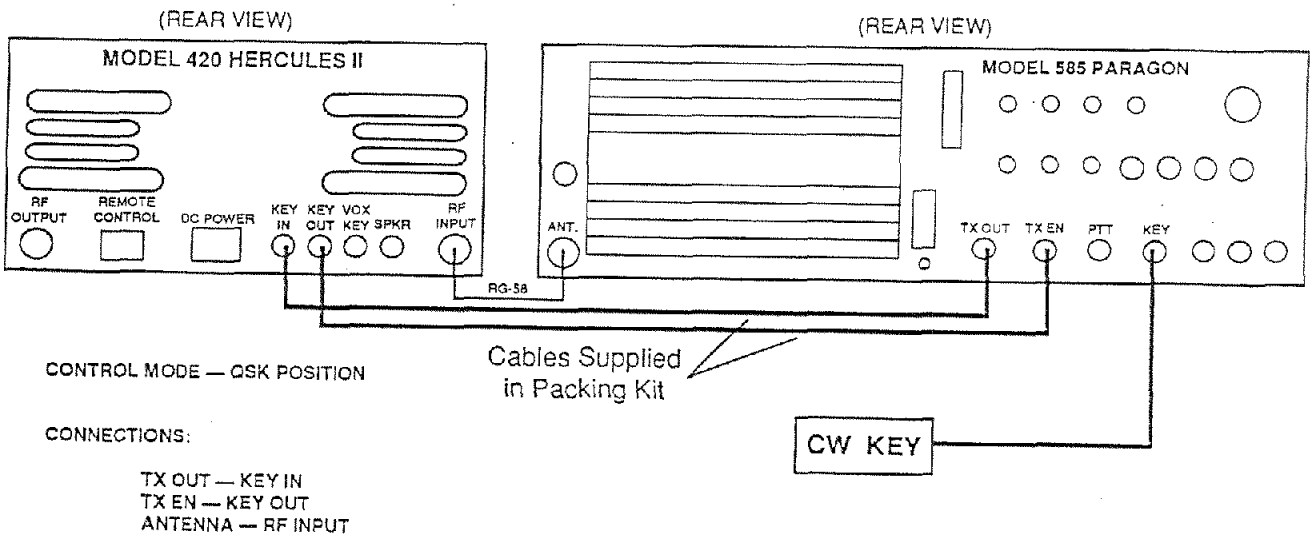


FIGURE 1-2. TEN-TEC TRANSCEIVERS (WITH TX OUT & TX EN)

CONTROL MODE

SSB (VOX / PTT) — RELAY

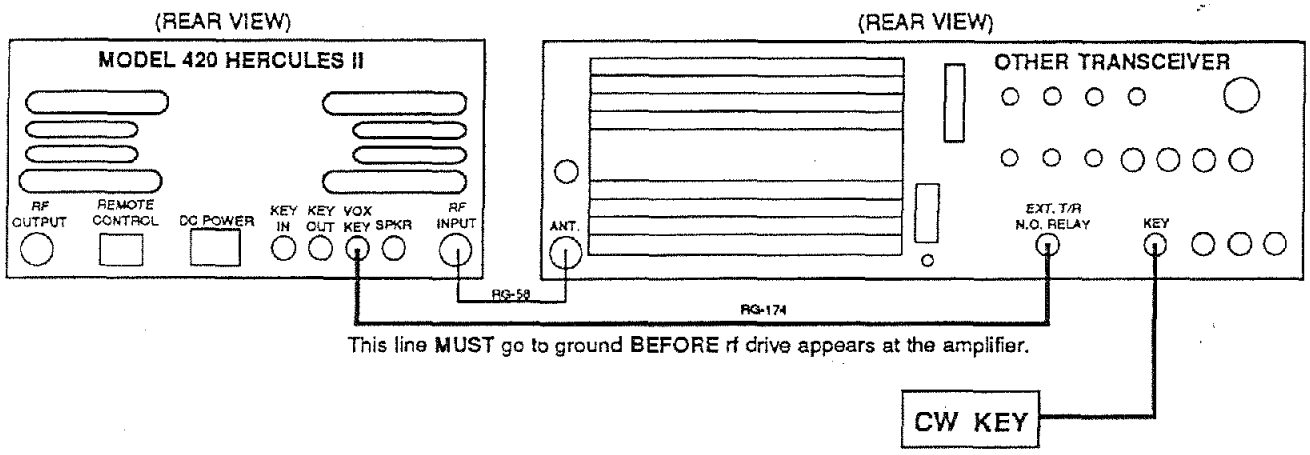


FIGURE 1-3. HOOKUP DIAGRAM FOR VOX RELAY CONTROL

CONTROL MODE

CW — QSK
SSB — RELAY

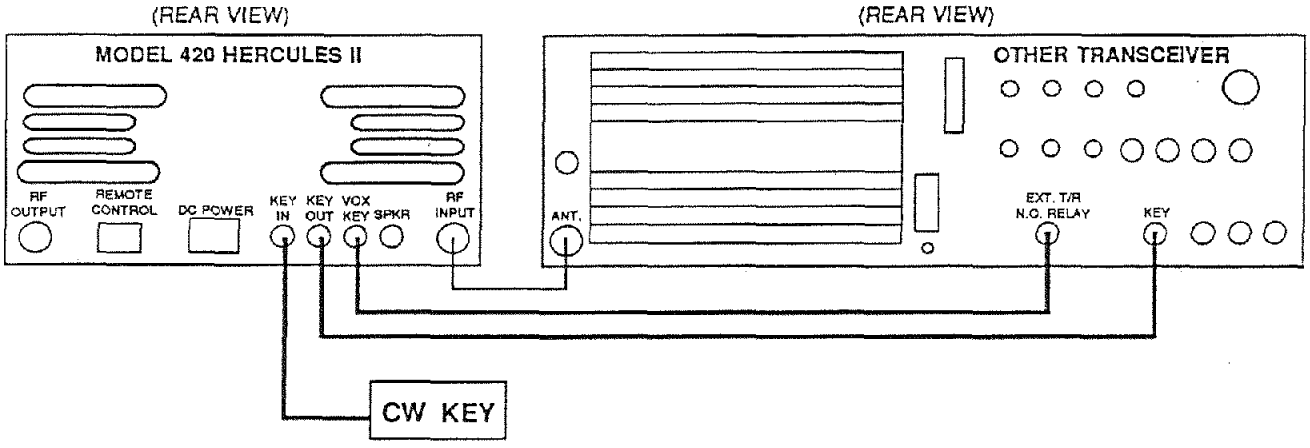


FIGURE 1-4. HOOKUP FOR OTHER TRANSCEIVERS WITH SLOW KEYING

CHAPTER 2

OPERATING INSTRUCTIONS

2-1 INTRODUCTION The following instructions will enable the operator to quickly place the HERCULES II into operation. Included are descriptions of the Front Panel controls and Rear Panel connections followed by detailed Tune-Up procedures. Refer to CHAPTER 3 for further information and operating hints.

2-2 FRONT PANEL CONTROL FUNCTIONS The Front Panel controls and their functions are described below.

2-2.1 BAND This switch is used to select the desired frequency range of operation. This is an eight position switch and covers 1.8 through 30.0 MHz. The 22.0-30.0 MHz band position is normally inoperative. To enable operation on this band you must install the optional Model 420-10 Ten Meter Option board (available from Ten-Tec at no charge to licensed amateur operators). A REMOTE position is also provided for use with automatic band select wiring connections.

2-2.2 POWER This is the main power switch. When switched ON, the amplifier should power up and the appropriate BAND LED should light. Also, the meter lamps should come on and the "OVERDRIVE" LED should be turned off.

2-2.3 CONTROL MODE When placed in the QSK position, the keying of the HERCULES II is controlled by the KEY IN input and the KEY OUT signal is generated inside the HERCULES II. This position is used for CW operation where fast keying is required. Placing the switch in the RELAY position allows the HERCULES II to be controlled by the VOX/KEY input jack. When in this position, the KEY IN signal is connected directly to the KEY OUT jack. This position is used for SSB (PTT/VOX) operation.

2-2.4 METER This switch is used to select what is being displayed on the built-in illuminated meter. When in the Ic position it selects collector current, 150 Amps DC full scale. The Vcc position selects collector voltage, 20 VDC full scale. When placed in the FWD position it selects forward power, 1000 watts full scale. The REF position selects reverse power and SWR scales (>3:1 full scale).

2-2.5 PEAK POWER METER This is a ten segment LED readout used to display the peak output power of the HERCULES II. *Please note that the last LED (red) of the bargraph display has been calibrated to light with approximately 550 watts output power.*

2-2.6 OVERDRIVE This LED annunciator is used to alert the operator to a possible fault condition which needs correction. This may either be a transient fault or a latching type fault. For more information see section 2-7.

2-3 REAR PANEL CONNECTOR FUNCTIONS The following sections describe the rear panel connectors and their function.

2-3.1 RF INPUT This is a standard SO-239 receptacle designed for a mating PL-259 ("UHF" type) plug. RG-58/U or similar small 50 ohm coaxial cable is required to connect to the station exciter or transceiver's output or antenna jack. This cable should be as short as possible, preferably 3 feet or less.

2-3.2 RF OUTPUT This is a standard SO-239 receptacle designed for a mating PL-259 plug. RG-8/U or similar large coaxial cable rated for 1 KW must be used to connect to the antenna system.

2-3.3 DC POWER This connector provides the dc operating voltage to the amplifier and is designed for use with the Model 9420 Power Supply or for connecting another source of 12-14 VDC power to the HERCULES II. If a supply other than the Model 9420 is used, it must be capable of supplying 100 amps at 12-14 VDC. You should use four #12 gauge or larger wires for the positive and negative supply leads and keep the cable lengths as short as possible.

2-3.4 KEY IN This jack controls the HERCULES II's transmit/receive relay system. When used with the Model 585 PARAGON transceiver, this jack is connected to the TX OUT jack on the PARAGON. When used with other transceivers, a key or keyer is plugged into this jack.

2-3.5 KEY OUT When used with the Model 585 PARAGON, this jack is connected to the TX EN jack on the PARAGON. When used with other transceivers, this jack is connected to the transceiver KEY input jack.

2-3.6 VOX KEY IN This jack is used to control the HERCULES II's transmit/receive system when the Control Mode switch is placed in the RELAY position. This jack is normally connected to the external T/R (n.o. relay) connector on the exciter, and is used for keying the HERCULES II in SSB and VOX modes of operation.

2-3.7 SPEAKER This jack connects to the built in speaker in the HERCULES II cabinet. It may be connected to the external speaker connector on the exciter. The internal speaker is 8 ohms and is rated at 1 watt.

2-3.8 REMOTE CONTROL This connector is for controlling the HERCULES II from a remote location. When the BAND switch is in the REMOTE position, the HERCULES II BAND selection can be automatically set by a transceiver which provides the proper band information via this connector.

2-3.9 ALC CONTROL Units manufactured starting August, 1994 have capability added to accomodate transmitter/transceivers with negative going ALC systems.

NOTE: This feature will rarely if ever be used in amateur radio applications. It is included primarily for commercial requirements.

The ALC control, centered on the rear panel, adjusts the negative output voltage on the jack below it from approximately -1 to -8 vdc with 50 watts of input RF.

2-4 INITIAL TURN-ON The following steps should be followed when turning on your HERCULES II:

1] Place the POWER switch in the OFF position.

2] Place the BAND switch on the desired operating frequency band or in the REMOTE position if a remote control cable is attached to a transceiver with band outputs (such as Ten-Tec PARAGON, OMNI or CORSAIR I).

3] Place the METER switch in the Vcc position to monitor the collector voltage at turn on.

2-5 TUNE UP PROCEDURE (CW/RTTY/SSTV/FM) The following procedure should be used for tuning up in all modes except SSB.

Turn the POWER switch ON. The meter lights and the proper band indicator should come on. The voltmeter should read about 14 volts and the fan should be running at low speed.

2. Select the desired band of operation or check that the bandswitch is in the REMOTE position and the proper band is indicated if automatic bandswitching is being used.

3. Place the meter in the forward power (FWD) position.

4. Set the exciter rf power (DRIVE) control to minimum.

5. Place the exciter in the tune (LOCK) or key down mode.

6. Increase drive from the exciter until the meter reads 500 watts forward power. The OVERDRIVE LED should remain off.

7. If the exciter has a variable ALC threshold separate from the rf power (DRIVE) control, adjust the ALC so that the forward power is limited to 500 watts.

8. Place the Control switch in either QSK or RELAY position depending on how you are keying the HERCULES II.

9. Using the METER switch, check that Icc is less than 80 amps, Vcc is 12.5-14 volts, and SWR is less than 2:1. The bargraph display should be indicating approximately 500 watts output.

10. Place the exciter in the CW mode and key a few characters. The bargraph should indicate 500 watts peak output.

11. If either the OVERDRIVE indicator or the red segment of the bargraph display lights, reduce the exciter output slightly.

2-6 TUNE UP PROCEDURE (SSB) The following procedure should be used for tuning up in SSB mode.

1. Follow the tune up procedure in section 2-6 for steps 1-9.

2. Key the exciter in SSB mode and adjust the MIC gain for normal ALC action. The bargraph display should indicate 500 watts output on voice peaks.

3. If either the OVERDRIVE indicator or the red segment of the bargraph lights on voice peaks, reduce the exciter output slightly. The red bargraph segment lights at about 550 watts output.

Occasionally check the SWR while operating to make sure it remains below 2:1. Also, monitoring reflected power is useful in that any sudden change provides warning of antenna problems such as bad connections, antenna coupler faults, transmission line flaws, or trap or balun failure. Particularly in the case of flashover (arcing) problems, the reflected power indication may flicker sharply upward only on high voice peaks.

2-7 FAULT CONDITIONS Fault conditions can be divided into two groups: transient and latching. The transient conditions are overdrive and excessive power output. Overdrive is indicated by the "OVERDRIVE" LED and output power in excess of 550 watts is indicated by the red segment of the bargraph display. Either of these transient indications are temporary. That is, when drive is reduced

to remove the fault condition, the indicator is extinguished and normal operation can continue. The latching fault conditions are overvoltage, overcurrent, amplifier unbalance, and disabled band selected. These conditions result in a constant illumination of the "OVERDRIVE" indicator and the amplifier is automatically placed in the "BYPASS" mode, connecting the exciter directly through to the antenna. To clear a latching fault, turn the POWER switch off, correct the condition that caused the fault, and turn the POWER switch back on. Since most latching faults indicate a system defect of some kind, you may have to refer to the "ILLUSTRATIONS AND CIRCUIT SCHEMATICS" section of this manual and troubleshoot the cause. The disabled band selected fault is cleared by simply switching to a valid frequency band.

If you write Ten-Tec (and enclose a photocopy of your license), you will be sent a parts kit to enable operation on the 22-30 MHz band. There is no charge for this kit. See paragraph 3-1.3 for ordering information.

HF = HAVE FUN!

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ORION II: Unparalleled in amateur radio.

Independent testing rates the receiver performance of the ORION II the highest for close-in dynamic range of any HF transceiver ever offered. Ham-bands-only main receiver from 10-160 meters plus a general coverage second receiver. Up to 7 mode-appropriate roofing filters can be installed. 590 DSP receive filters per receiver. Dual 32-bit DSP's. Super bright, TFT color display with CCFL backlighting. Nothing else even comes close!

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General coverage receive from 10-160 meters with 39 built-in DSP filters. 100 watts output on all bands. Green backlit LCD screen. The SSB transmit audio of this rig is so well regarded that we used the same controls for tailoring transmit audio on the new OMNI-VII! The same great QSK CW as used on our other transceivers. No other transceiver in this price class tops this level of performance.

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This compact 20 watt HF transceiver is ideal for the new ham on a budget or the experienced ham looking for an easy-to-use low power transceiver. Ten-Tec's reputation for quiet, dynamic receiver performance continues with the little gem of an HF rig. AM, FM, CW, SSB operation on 10-160 meters, general coverage from 500 kHz to 30 MHz on receive. PSK31 ready - plug it into your sound card without any dropping resistors in the TX line or a rig-to-computer interface and you're ready to operate. 35 built-in DSP receive filters.

$895.

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Shipping is additional. TN residents add 9.5% sales tax

TEN-TEC

FIGURE 2-1. MODEL 420 FRONT PANEL

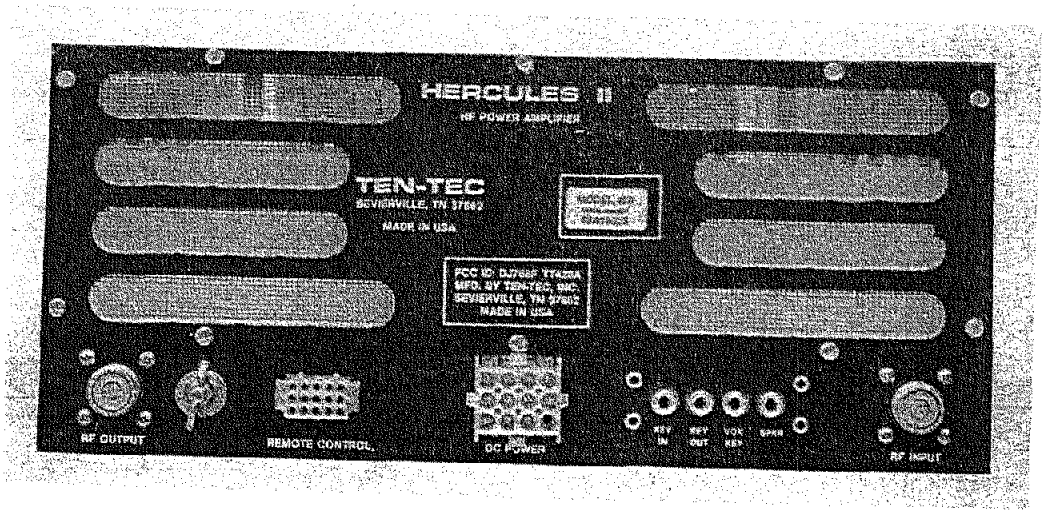


FIGURE 2-2. MODEL 420 REAR PANEL

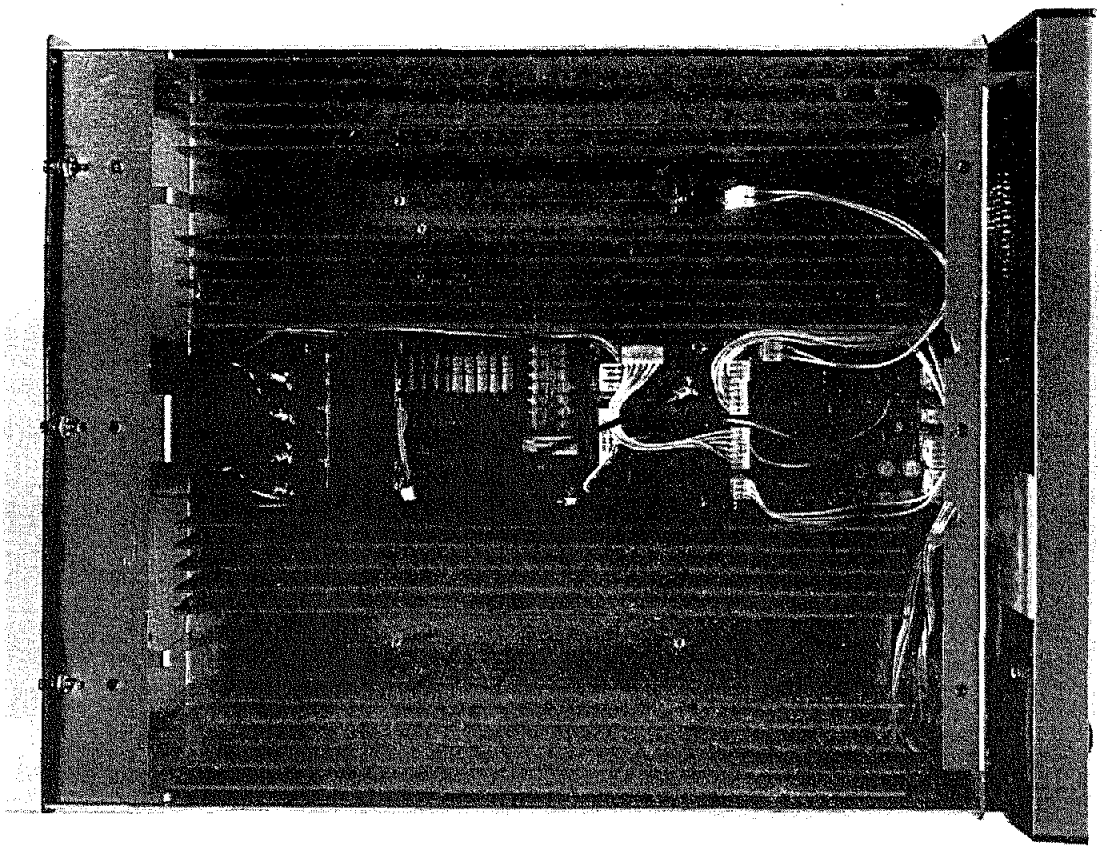


FIGURE 2-3. MODEL 420 TOP VIEW

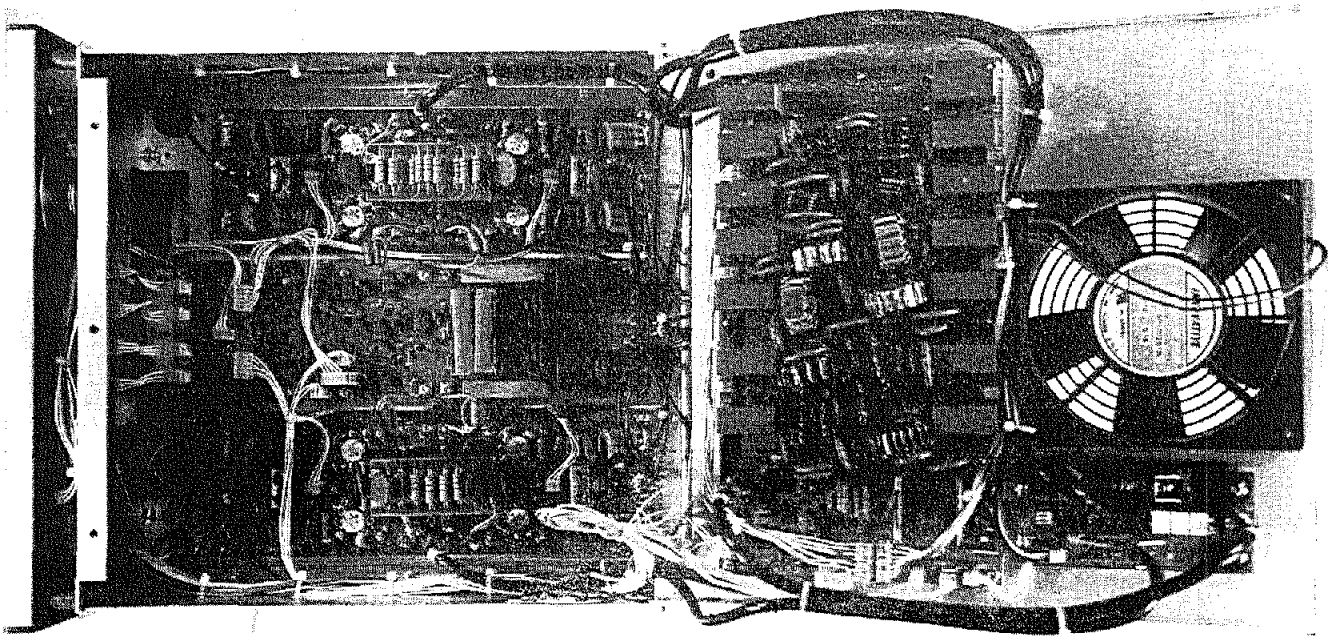


FIGURE 2-4. MODEL 420 BOTTOM VIEW

CHAPTER 3

OPERATING HINTS

3-1 INTRODUCTION The following paragraphs provide additional useful information for getting the best performance out of your HERCULES II.

3-1.1 REMOTE BANDSWITCHING When the HERCULES II bandswitch is in the "REMOTE" position, the operating band is determined by band information input to the REMOTE CONTROL connector on the rear panel. Most transceivers that provide parallel band outputs (one wire for each band) can be adapted to control the HERCULES II. Some older Ten-Tec transceivers (OMNI & CORSAIR I) have a rear panel "LINEAR" connector. These can be connected to the HERCULES II with an adapter cable constructed according to FIGURE 3-1. Notice that since the HERCULES II is a general coverage HF amplifier, some amateur bands share a band position on the amplifier and one amplifier band is unused. If the cable is wired correctly, the HERCULES II will automatically select the proper general coverage band for the amateur band in use.

Ten-Tec PARAGON transceivers can be adapted to the HERCULES II remote control connector through the rear panel DB-25 connector that is used for the RS-232 computer interface. If you have the computer interface (accessory Model 258), order the Ten-Tec Model 236 Remote Bandswitching Kit and follow the instructions enclosed. This kit contains the additional internal and external cables needed to bring the PARAGON band information out on unused pins on the DB-25 connector and cable them to the HERCULES II REMOTE CONTROL connector. If you do not have the computer interface installed, order the Ten-Tec Model 237 Remote Bandswitch Connector Kit and follow the instructions enclosed with the kit. This kit contains a DB-25 Connector Board and the necessary internal and external cables to provide the remote bandswitching function only.

3-1.2 TOTAL REMOTE CONTROL In addition to the bandswitching lines, the rear panel REMOTE CONTROL connector provides all of the control and metering connections necessary for complete remote control of the HERCULES II. A Model 9423 Remote Control Head and cable assembly will be available from Ten-Tec. Refer to the manual enclosed with the control head for installation and operating instructions.

3-1.3 OPERATION ON THE 22-30 MHZ BAND To enable the HERCULES II for operation on the 22.0-30.0 MHz band, the Model 420-10 Ten Meter Option must be installed. To obtain the Model 420-10 Ten Meter Option kit, at no charge to you, just mail in a photocopy of your license, your warranty card with the serial number of your HERCULES II, and a note requesting the Model 420-10 Ten Meter Option Kit to:

Ten-Tec, Inc.
Customer Service Department
Model 420-10 Upgrade
Highway 411 East
Sevierville, TN 37862

You will then receive a solder-in "piggy-back" circuit board to be installed on the 81429 LOW PASS FILTER BOARD assembly of the HERCULES II. Complete installation instructions will accompany the Model 420-10 kit.

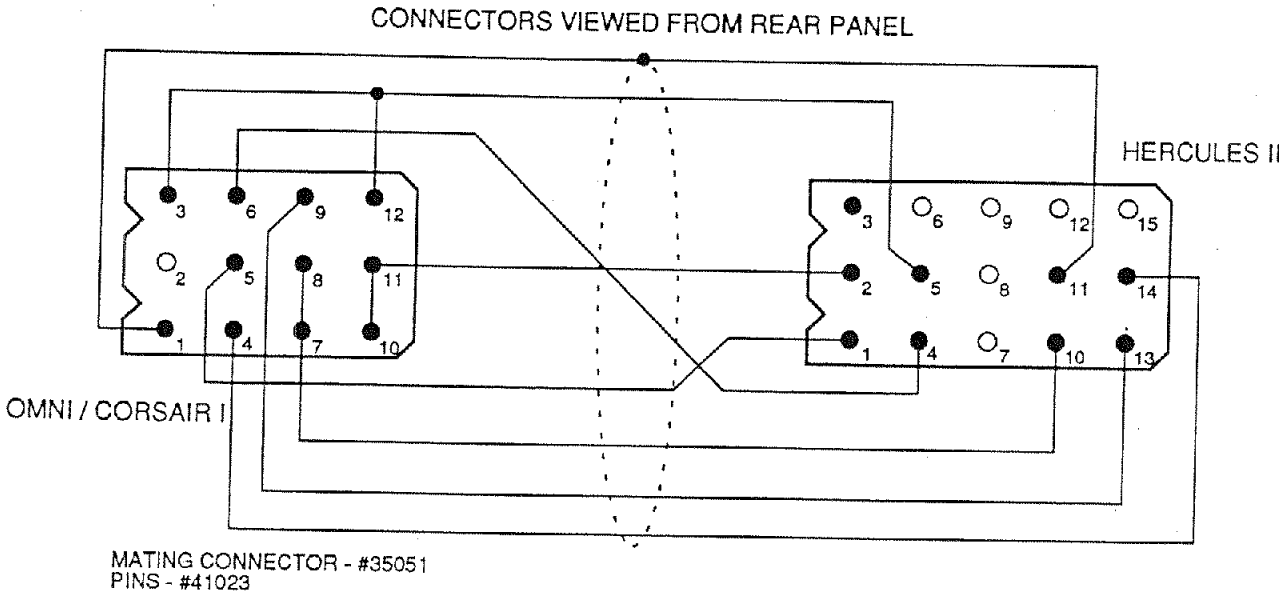


FIGURE 3-1. REMOTE BANDSWITCH ADAPTER CABLE — OMNI / CORSAIR I

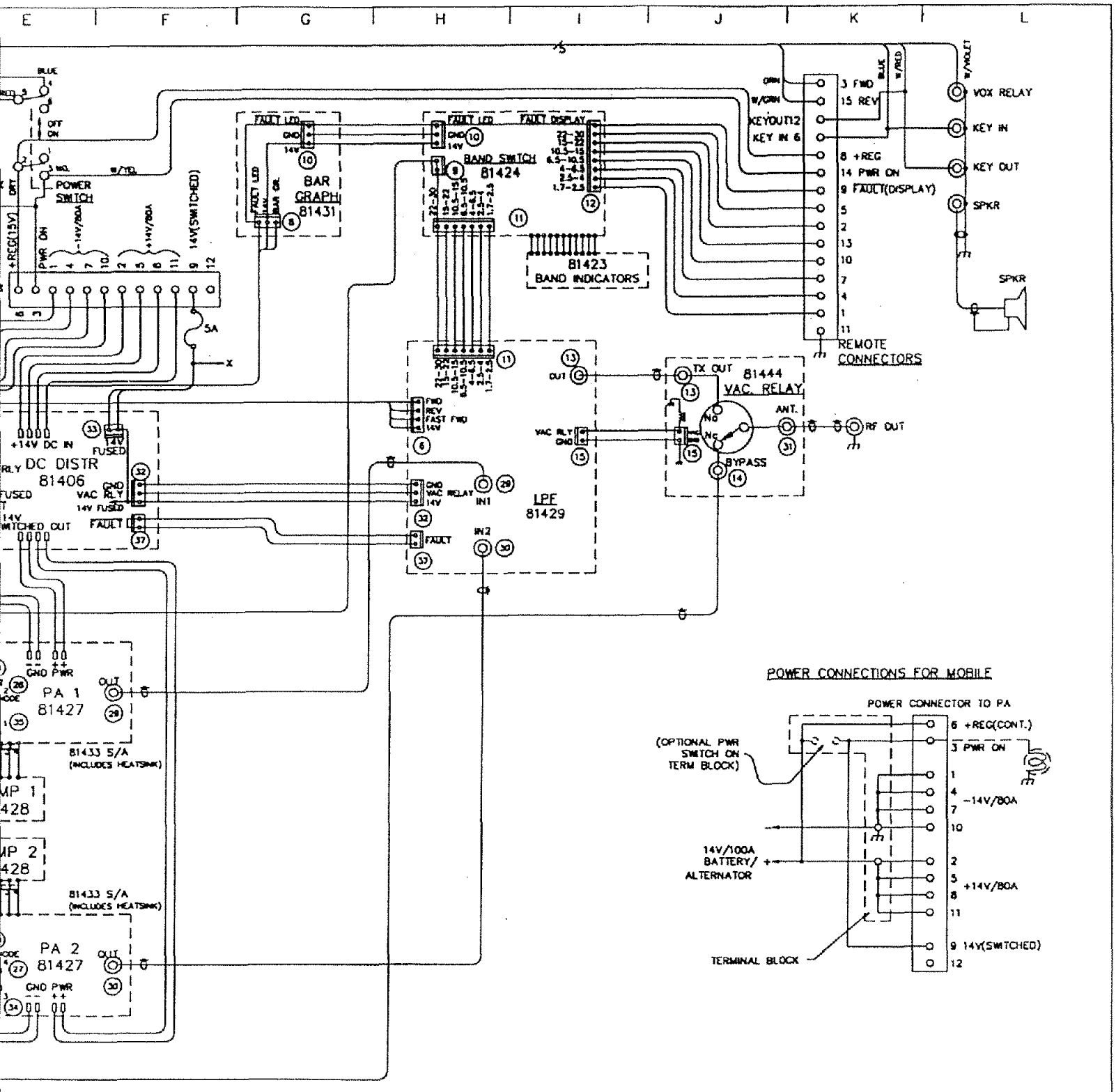
OMNI / CORSAIR I PIN NUMBER	FUNCTION	HERCULES II PIN NUMBER	
1	GND & SHIELD	11	
2	T	—	
3	12M, 22-30 MHZ	5	
4	COMM,PWR ON	14	
5	160M, 1.7-2.5 MHZ	1	
6	80M, 2.5-4 MHZ	4	
7	40M, 6.5-10.5 MHZ	10	
8	30M, 6.5-10.5 MHZ	10	
9	20M, 10.5-15 MHZ	13	
10	18M (17M), 15-22 MHZ	2	
11	15M, 15-22 MHZ	2	
12	10M, 22-30 MHZ	5	
	4-6.5 MHZ	7	
	FWD	3	
	KEY	6	
	+REG	8	NO CONNECTION
	FAULT	9	
	REV	15	
	KEY OUT	12	

FIGURE 3-2. HERCULES II REMOTE CONTROL CONNECTOR PINOUT

CHAPTER 4

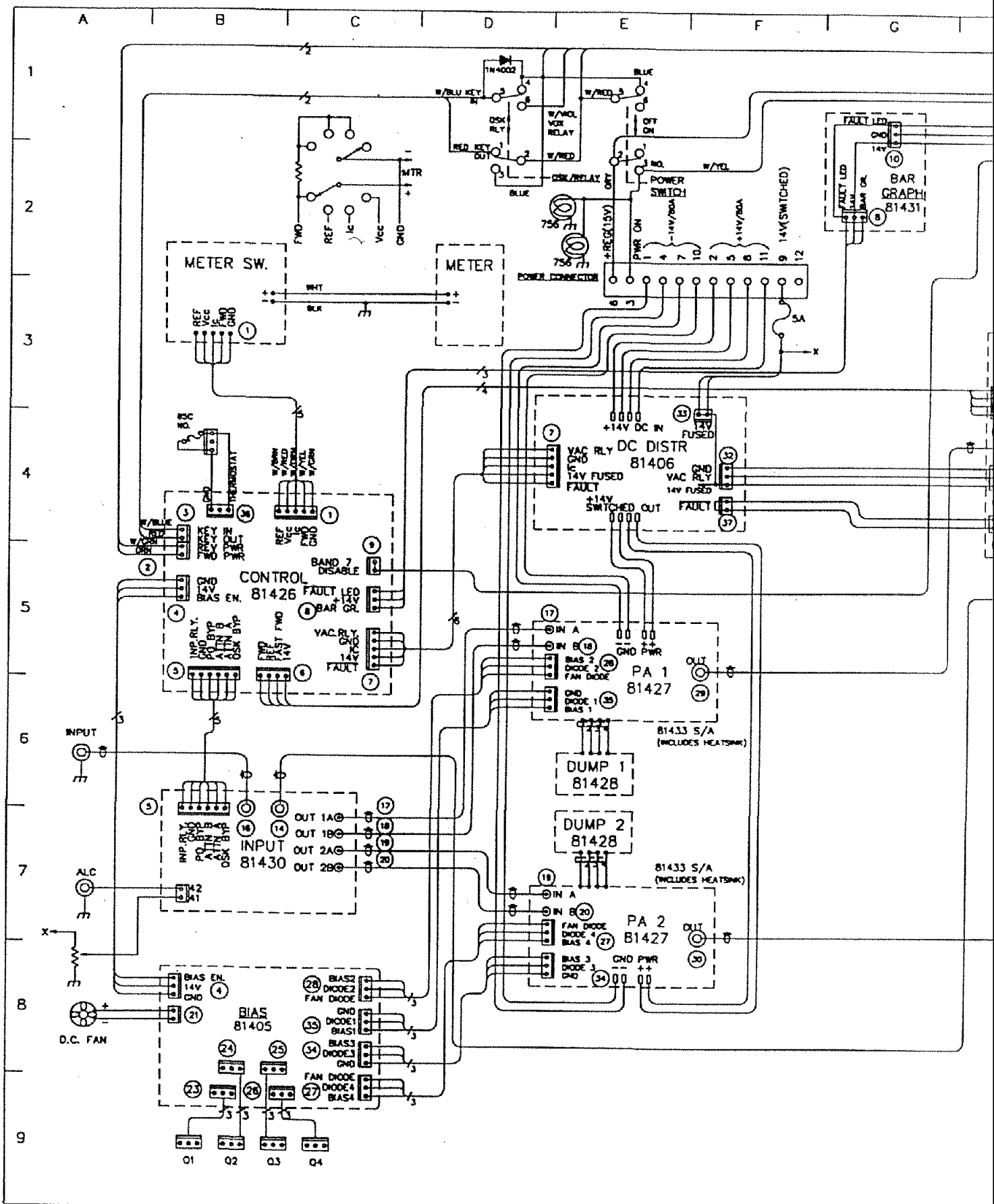
ILLUSTRATIONS AND CIRCUIT SCHEMATICS

4-1 INTRODUCTION The following sections contain circuit trace drawings and detailed component layout diagrams for all of the printed circuit board subassemblies used in the Model 420 Solid State Linear Amplifier. These drawings are followed by fold-out schematic diagrams for each circuit board subassembly. In addition, there is an overall wiring diagram for the Model 420 Linear Amplifier.



4-3/4-4 blank

FIGURE 4-1	420 WIRING DIA.	420-W


METER SW.
METER
MTR
FWD
REF
Ic
Vcc
GND
1N4002
W/BLU KEY IN
W/BLU KEY OUT
DSK RLY
W/WHT VOX RELAY
W/RED
BLUE
OFF ON
POWER SWITCH
W/YEL
DSK/RELAY
756
+REG(13V)
PWR ON
+14V/80A
14V(SWITCHED)
POWER CONNECTOR
5A
FAULT LED
BAR GRAPH 81431
DC DISTR 81406
+14V DC IN
VAC RLY
14V FUSED
FAULT
+14V SWITCHED OUT
CONTROL 81426
BAND 7 DISABLE
BAR GR.
INP.RLY.
PA 1 81427
PA 2 81427
81433 S/A (INCLUDES HEATSINK)
DUMP 1 81428
DUMP 2 81428
INPUT
INPUT 81430
OUT 1A
OUT 1B
OUT 2A
OUT 2B
ALC
BIAS 81405
D.C. FAN
Q1
Q2
Q3
Q4

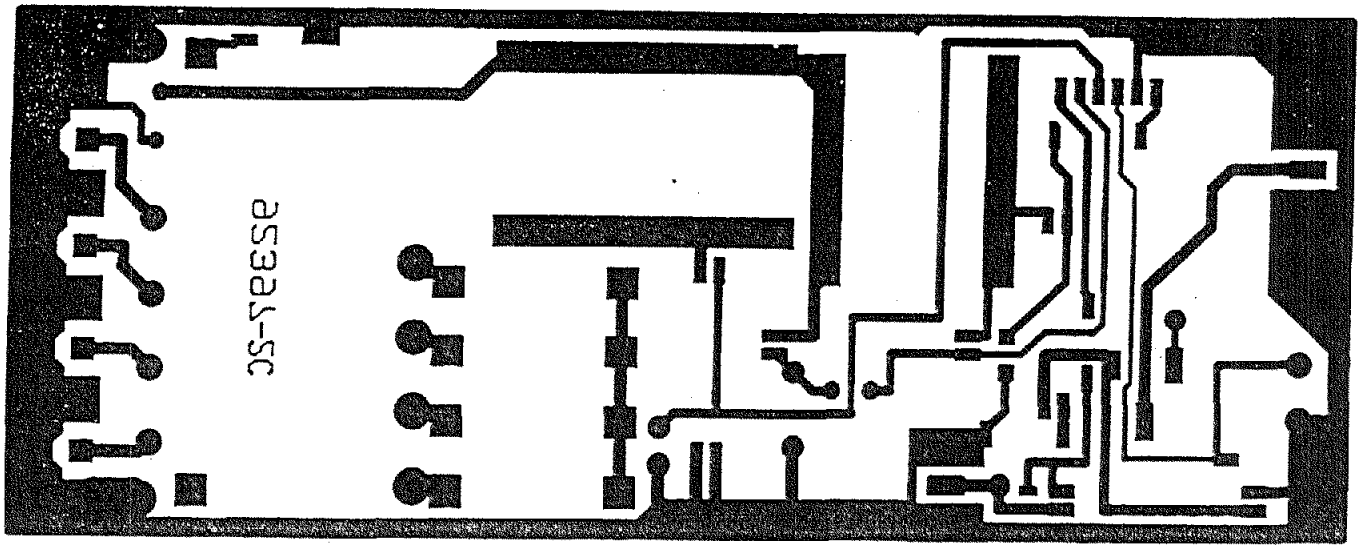


FIGURE 4-2. 81430 INPUT SPLITTER BOARD CIRCUIT TRACE

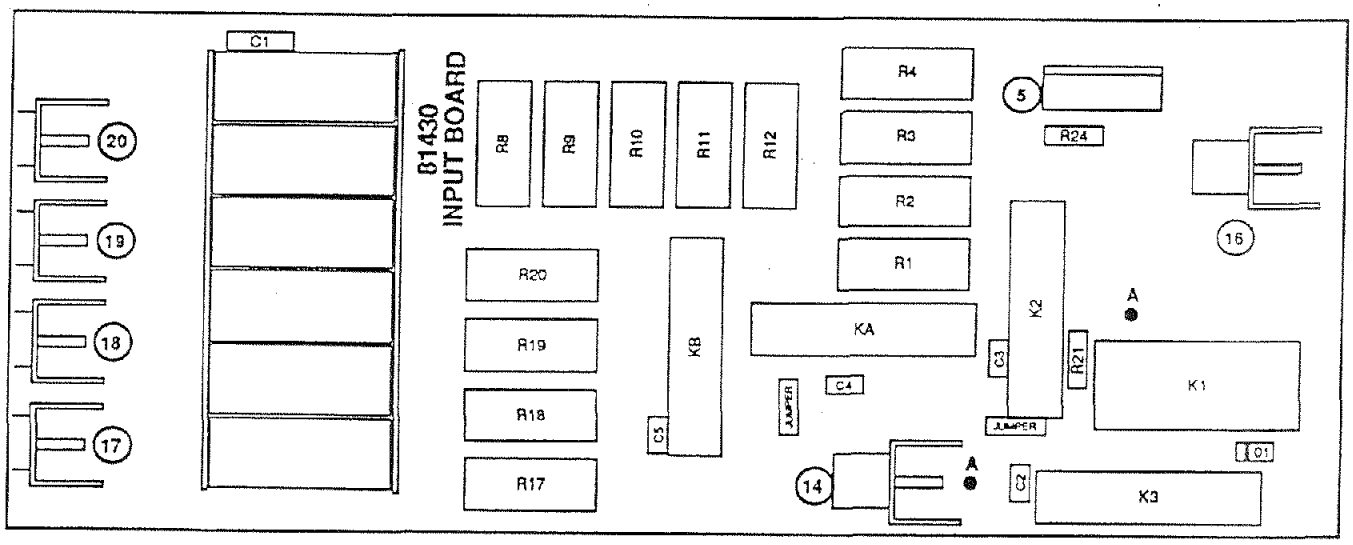
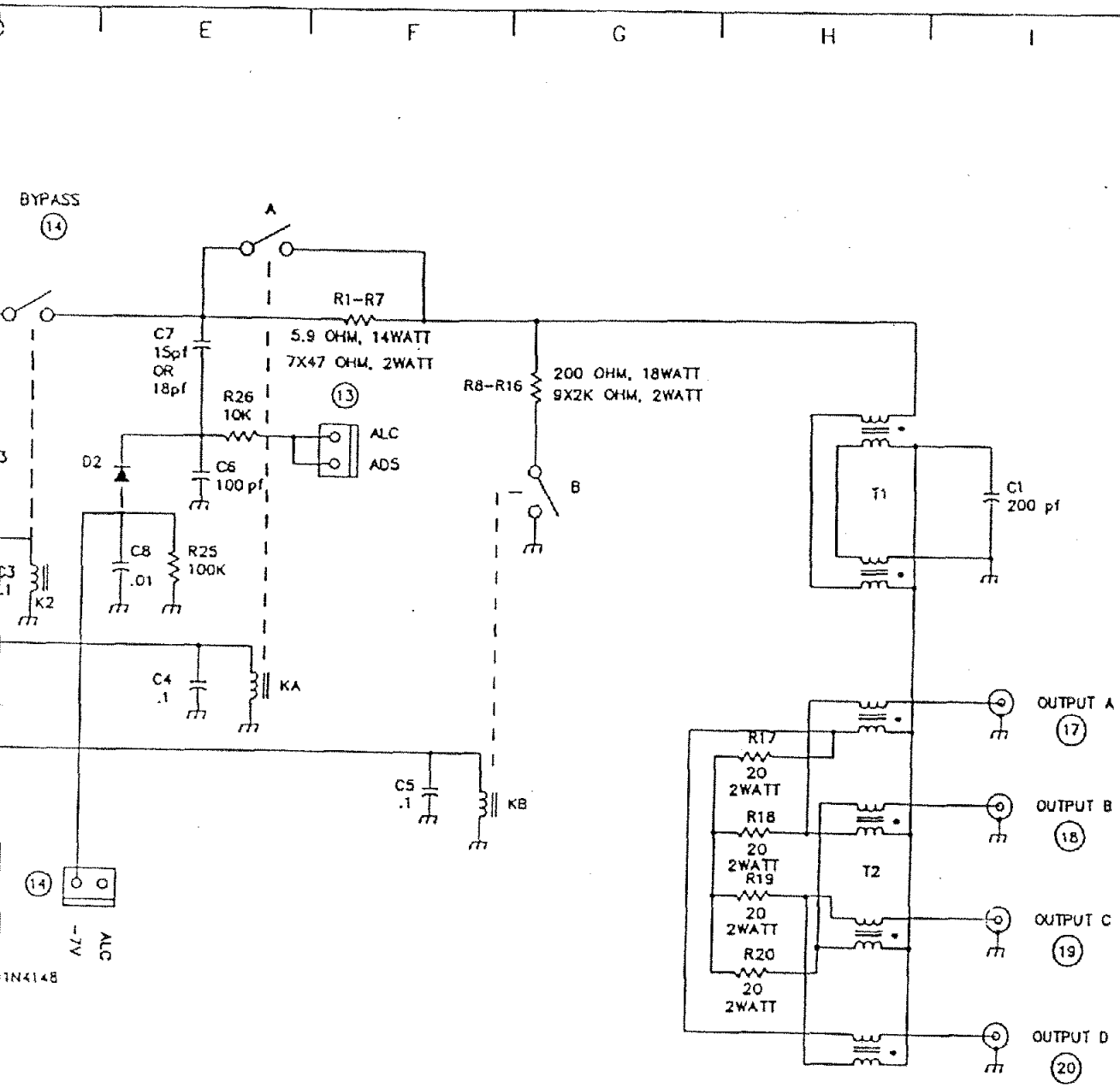
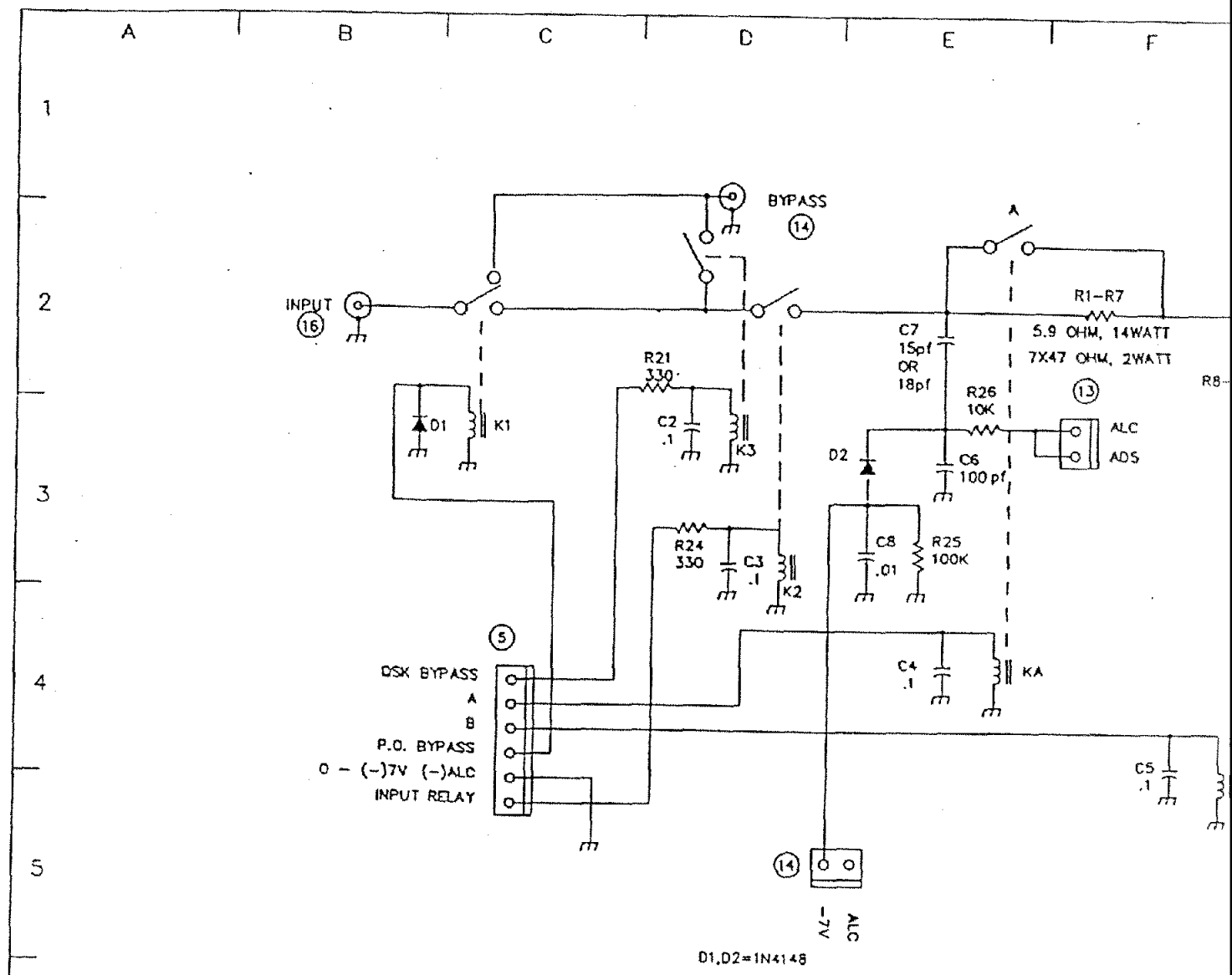


FIGURE4-3. 81430 INPUT SPLITTER BOARD COMPONENT LAYOUT



4-7/4-8 blank

FIGURE 4–4	INPUT BOARD	81430


A
B
C
D
E
F
1
2
3
4
5
6
7
8
BYPASS
14
INPUT
16
A
R1-R7
5.9 OHM, 14WATT
7X47 OHM, 2WATT
C7
15pf
OR
18pf
R21
330
R26
10K
13
ALC
ADS
D1
K1
C2
.1
K3
D2
C6
100 pf
R24
330
C3
.1
K2
C8
.01
R25
100K
5
DSK BYPASS
A
B
P.O. BYPASS
0 - (-)7V (-)ALC
INPUT RELAY
C4
.1
KA
C5
.1
14
-7V
ALC
D1,D2=1N4148

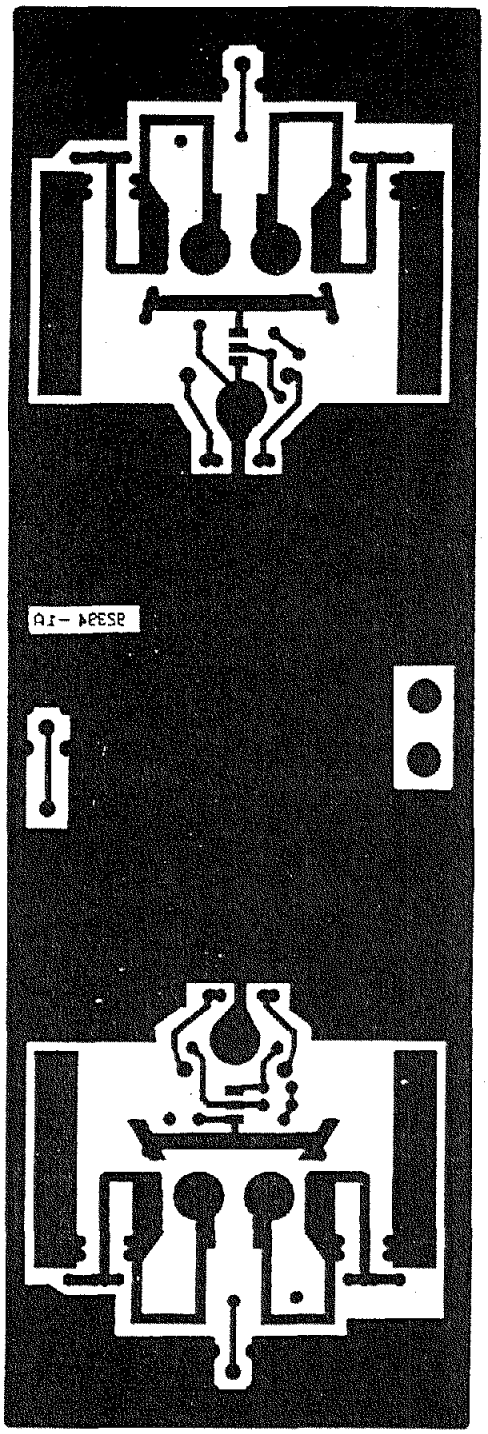


FIGURE 4-5. 81427 RF POWER AMP. BOARD CIRCUIT TRACE, BOTTOM

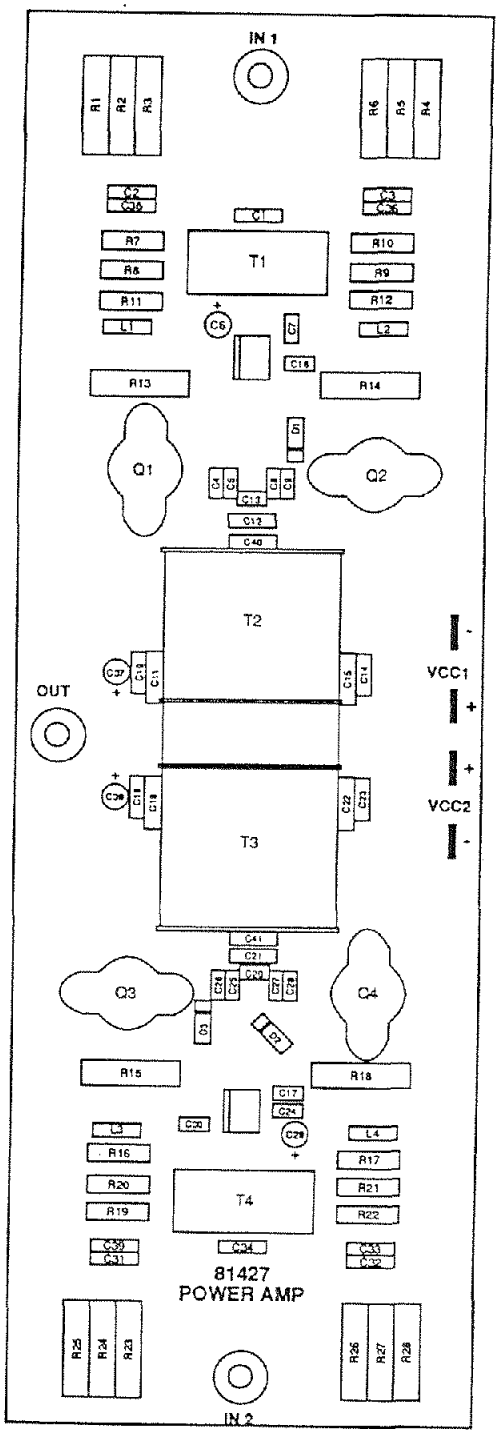
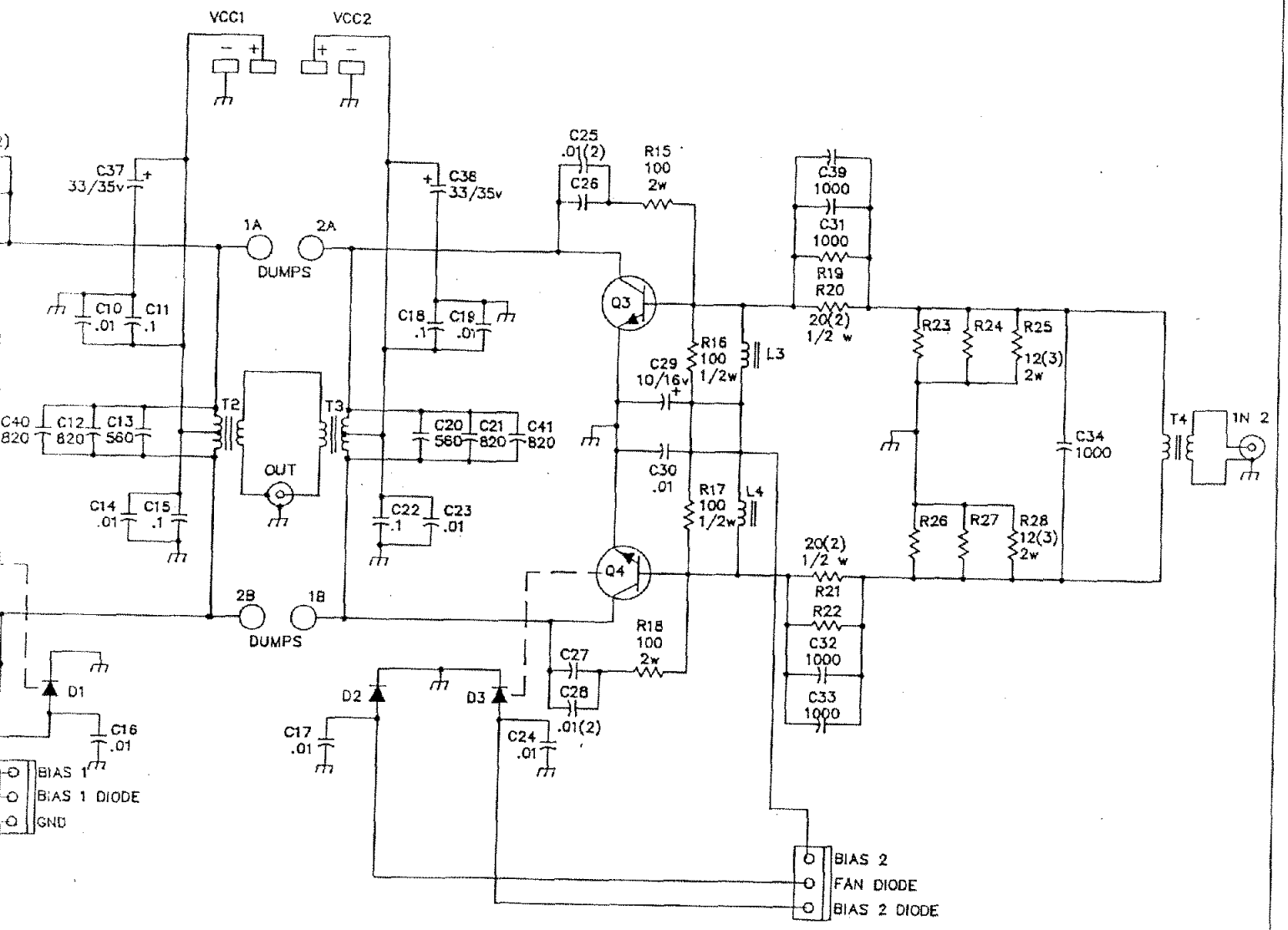


FIGURE 4-6. 81427 RF POWER AMP. BOARD COMPONENT LAYOUT

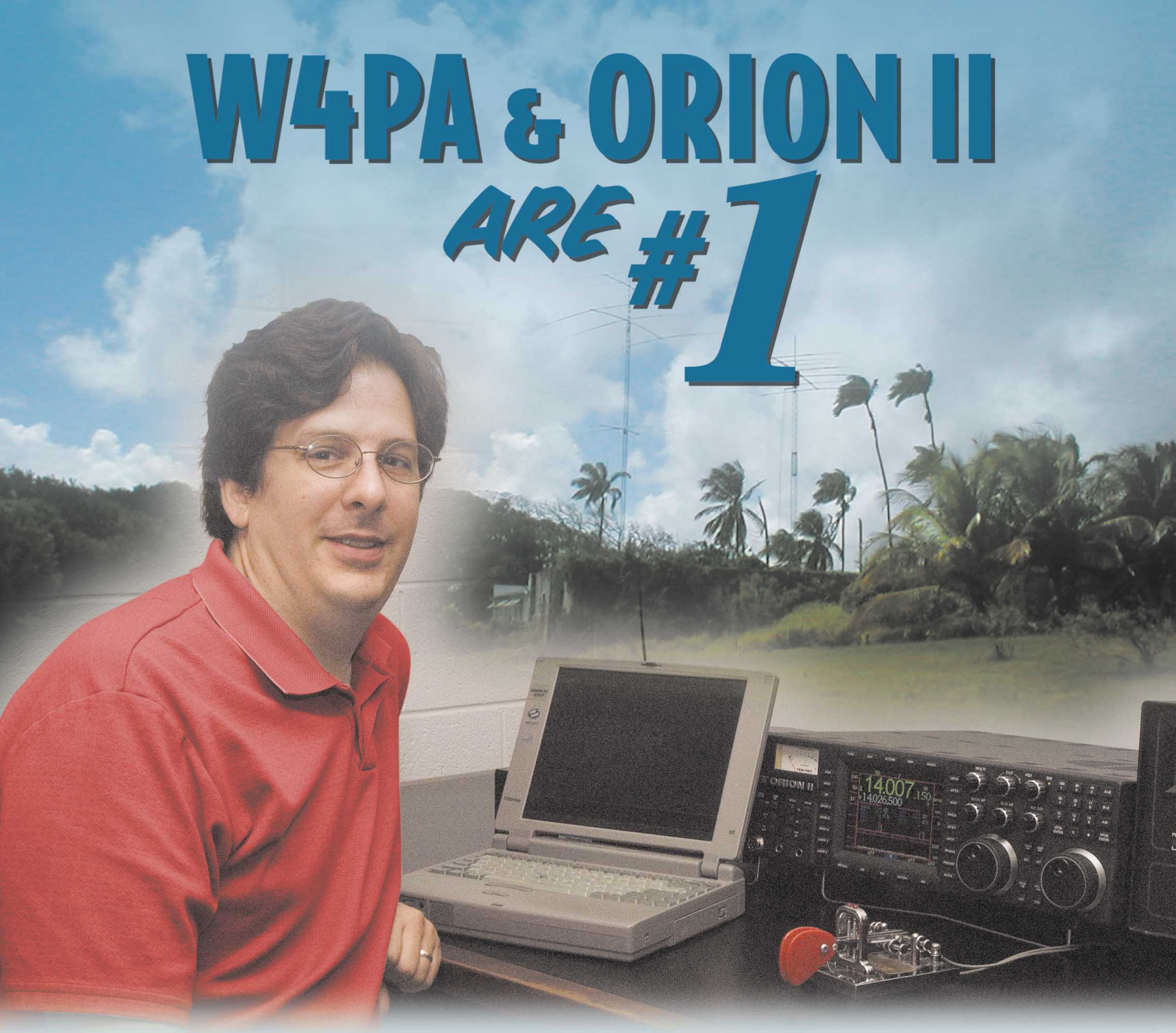


REFERENCE INDICATORS LAST USED
R28,C41,Q4,T4,L4,D3

4-13/4-14 blank

FIGURE 4-7	POWER AMP	81427

W4PA & ORION II ARE #1



February 2006 was magic for Scott Robbins, W4PA. Most folks travel to Barbados to marvel in the Caribbean splendor. But, not Scott. Operating as 8P9PA in the ARRL DX CW contest, 5206 QSOs in 48 hours is what it took to win #1 World Single Op. Scott had reached a goal he set for himself decades earlier as a teenage ham.

Corner Scott at a hamfest, and ask him how he did it. Like any experienced contester, he'll tell you, "you can't work 'em if you can hear 'em!" He will also tell you his ORION II is the finest contest rig ever built. Believe him, he has personally used them all. To be fair, Scott is a bit prejudiced. His day job as TEN-TEC's Amateur Radio Product Manager gave him a pivotal role in the development of the ORION II. All the hams here at TEN-TEC join in congratulating Scott on two great achievements—his #1 World Single Op and for his invaluable contribution to the world's finest HF transceiver.

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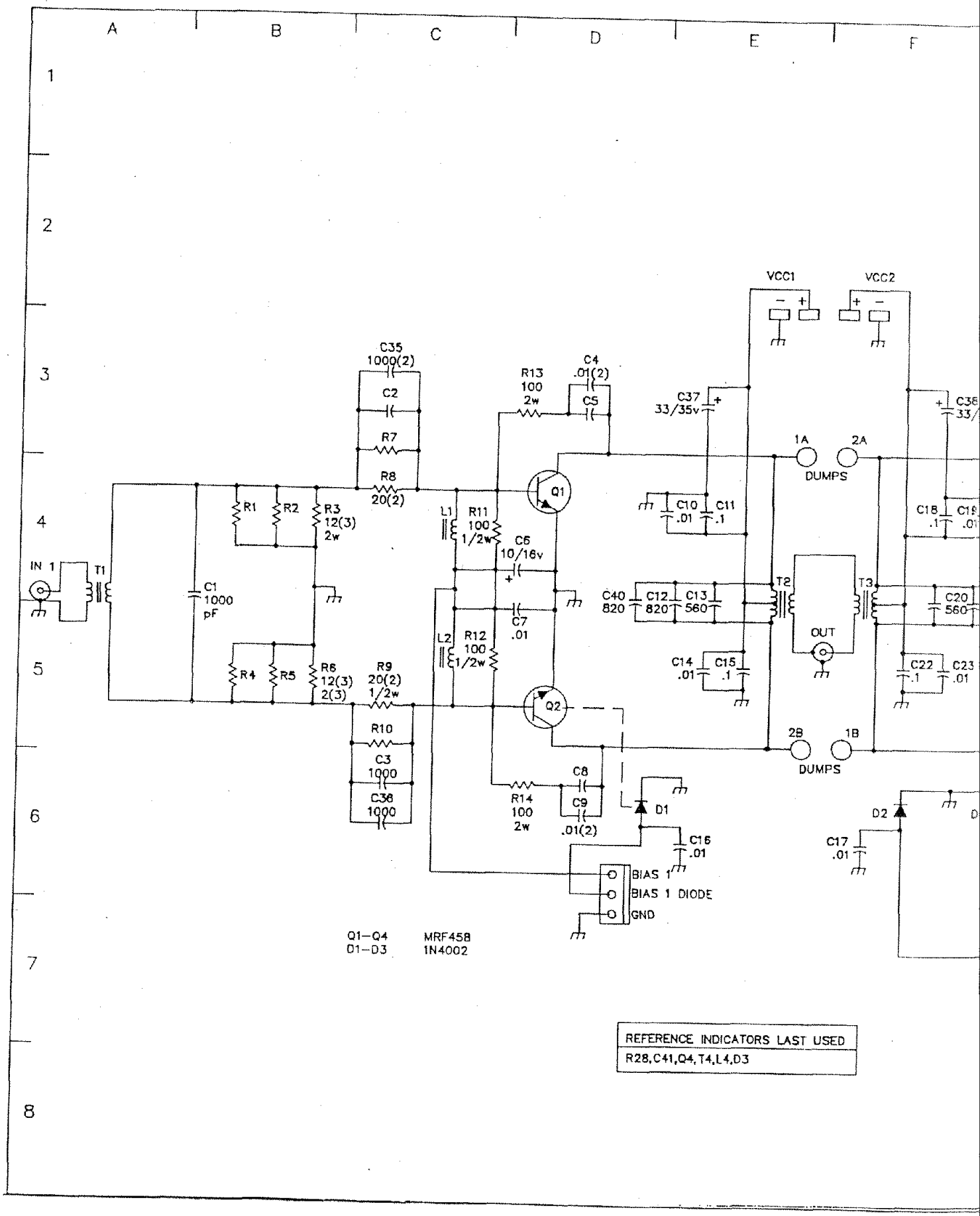
Office: (865) 453-7172 • FAX: (865) 428-4483
Shipping is additional. TN residents add 9.5% TN sales tax.


A
B
C
D
E
F
1
2
3
4
5
6
7
8
VCC1
VCC2
C35
1000(2)
C2
R7
R8
20(2)
R13
100
2w
C4
.01(2)
C5
C37
33/35v
1A
2A
DUMPS
R1
R2
R3
12(3)
2w
L1
R11
100
1/2w
C6
10/16v
Q1
C10
.01
C11
.1
C18
.1
C19
.01
IN 1
T1
C1
1000
pF
C40
820
C12
820
C13
560
T2
T3
OUT
C20
560
C7
.01
L2
R12
100
1/2w
C14
.01
C15
.1
C22
.1
C23
.01
R4
R5
R6
12(3)
2(3)
R9
20(2)
1/2w
Q2
2B
1B
DUMPS
R10
C3
1000
C36
1000
C8
R14
100
2w
C9
.01(2)
D1
C16
.01
D2
C17
.01
BIAS 1
BIAS 1 DIODE
GND
Q1–Q4
D1–D3
MRF458
1N4002
REFERENCE INDICATORS LAST USED
R28,C41,Q4,T4,L4,D3

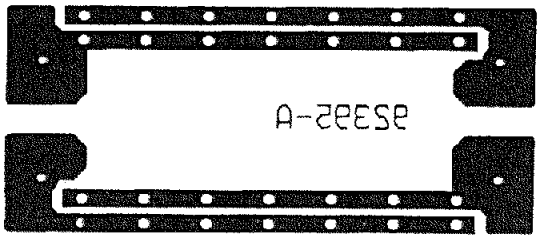


FIGURE 4-8. 81428 POWER AMP. DUMP BOARD CIRCUIT TRACE

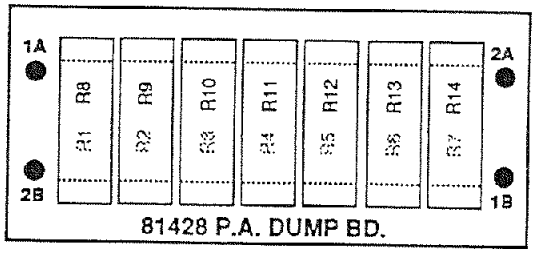
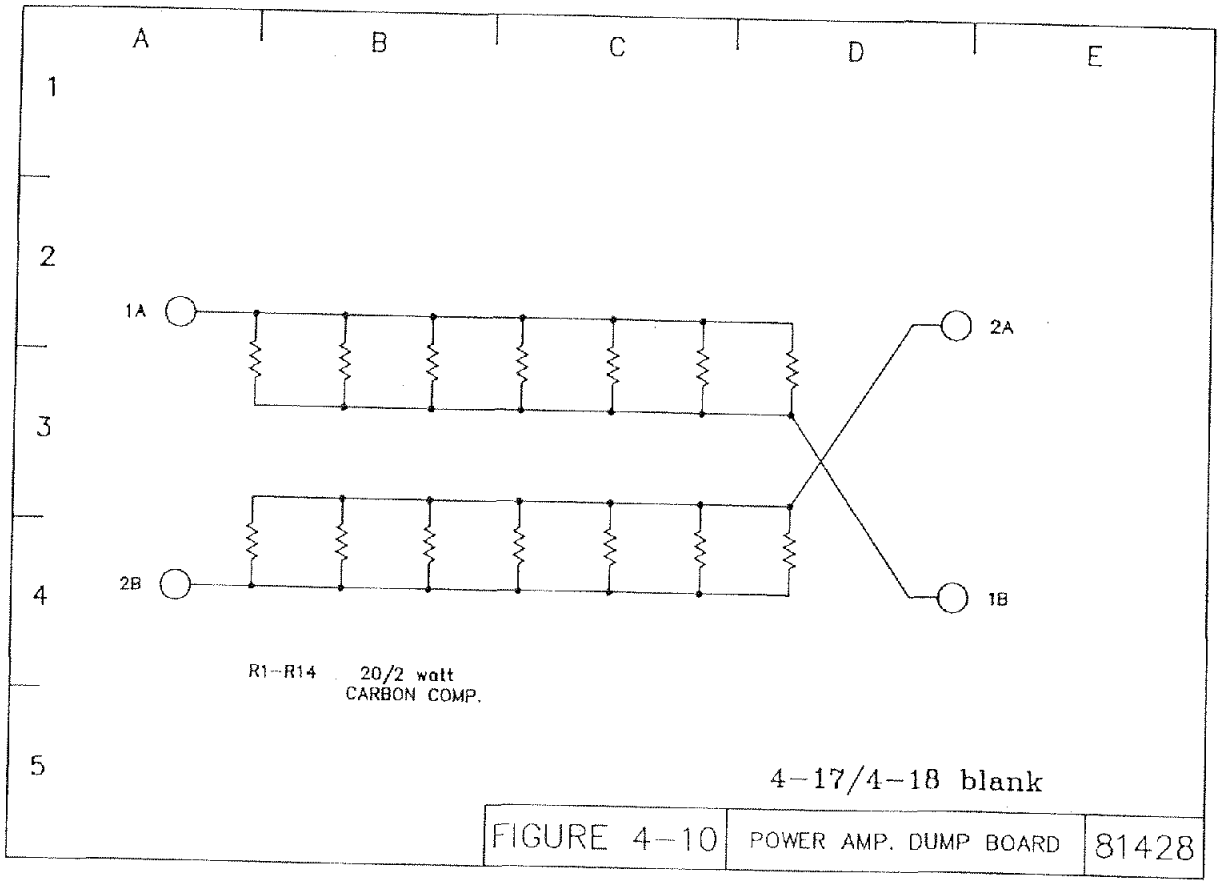


FIGURE 4-9. 81428 POWER AMP. DUMP BOARD COMPONENT LAYOUT



4–17/4–18 blank

FIGURE 4–10 | POWER AMP. DUMP BOARD | 81428

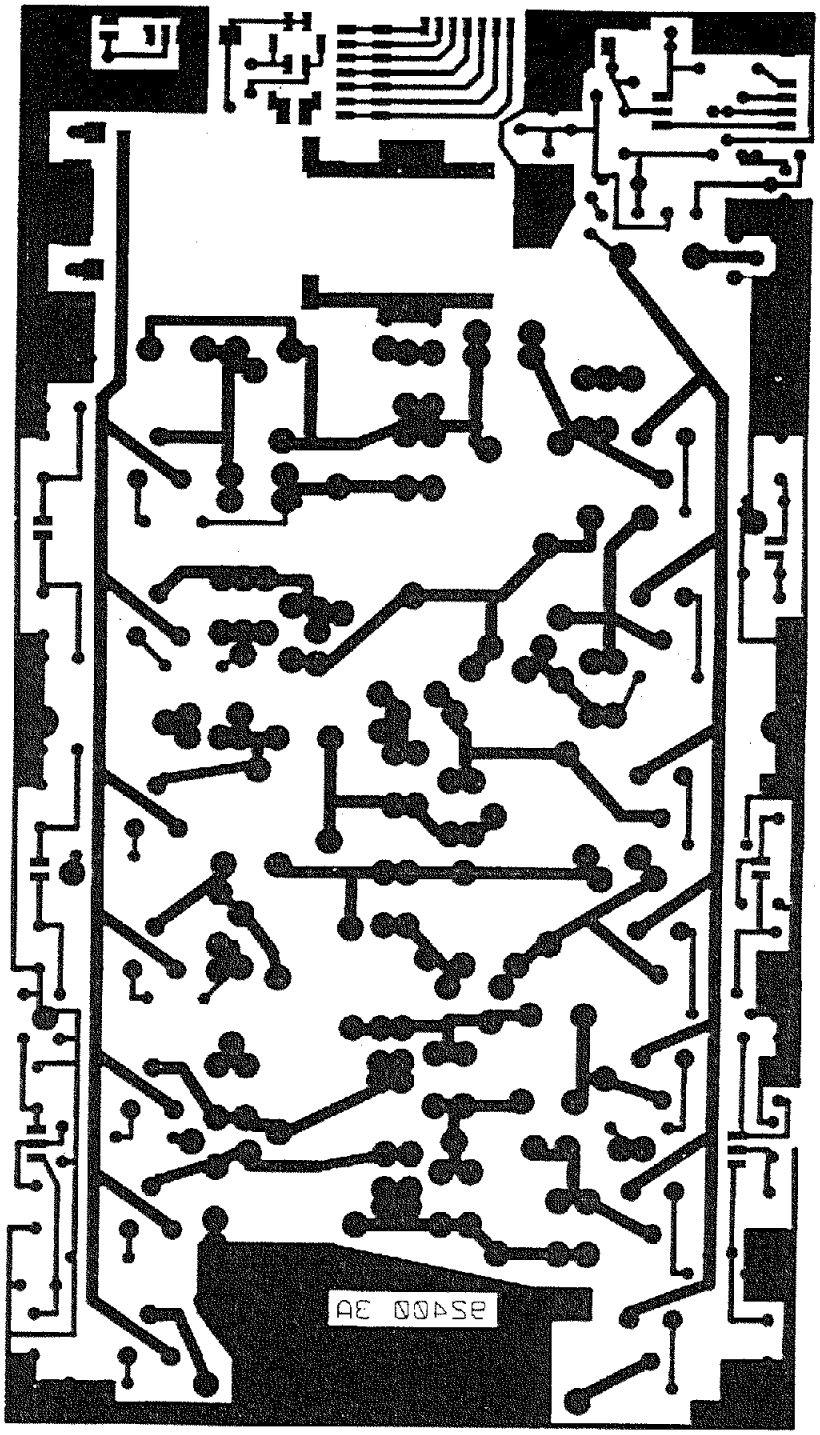


FIGURE 4-11. 81429 LOW PASS FILTER BOARD CIRCUIT TRACE

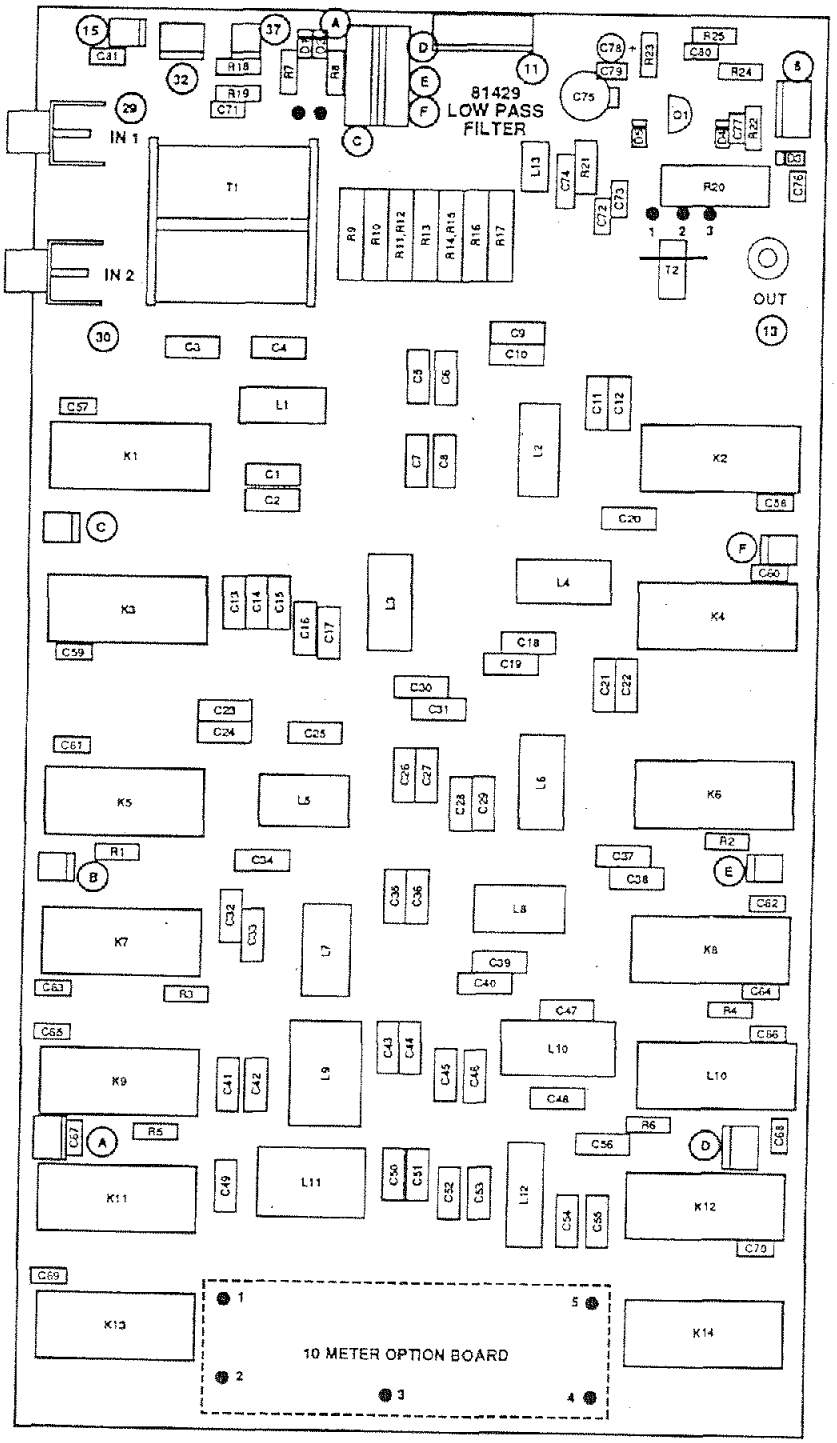
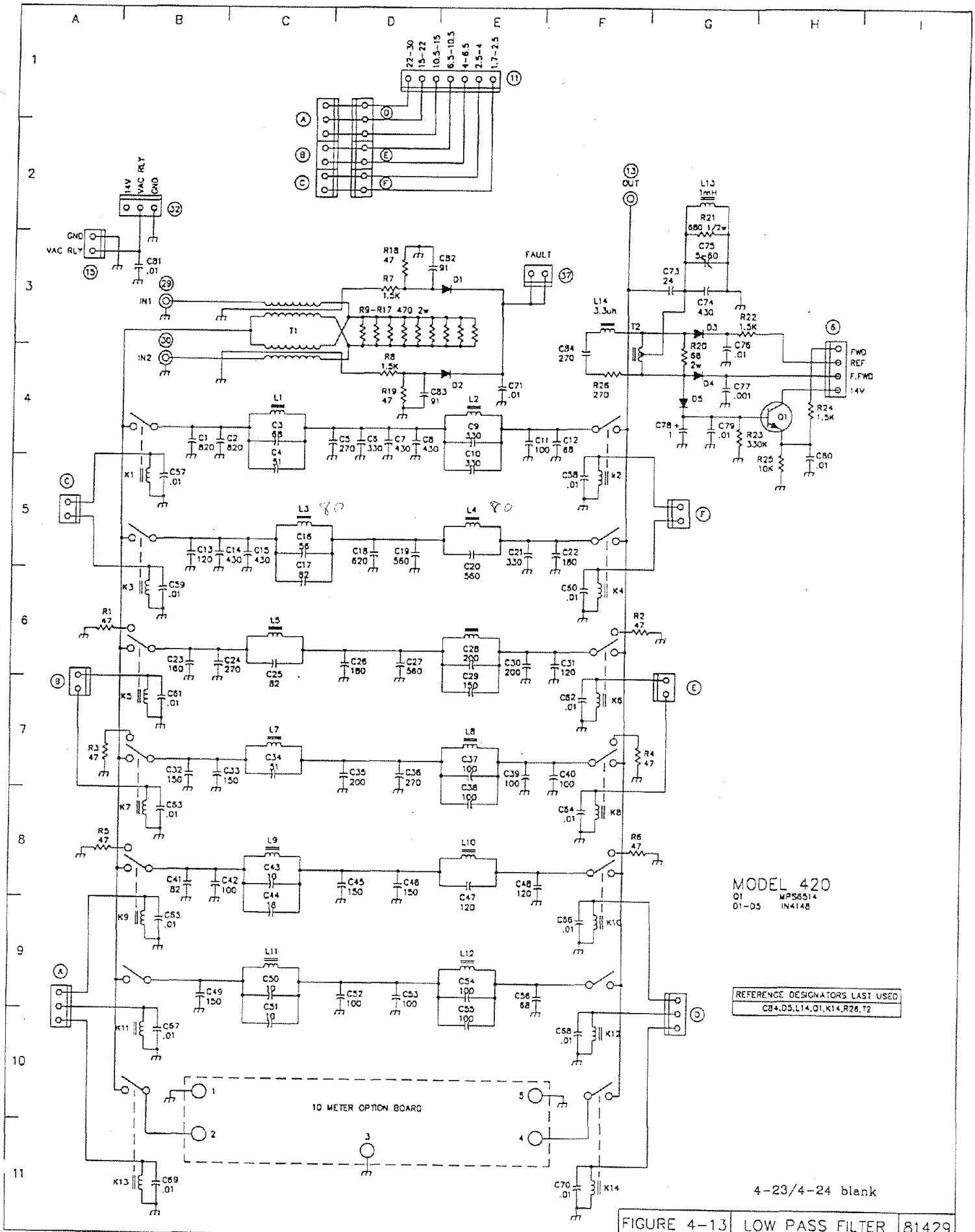


FIGURE 4-12. 81429 LOW PASS FILTER BOARD COMPONENT LAYOUT


22-30
15-22
10.5-15
6.5-10.5
4-6.5
2.5-4
1.7-2.5
14V
VAC RLY
GND
FAULT
IN1
IN2
T1
R9-R17 470 2w
OUT
L13 1mH
R21 680 1/2w
C75 5-60
L14 3.3uh
T2
D3
R22 1.5K
R20 68 2w
C76 .01
FWD
REF
F.FWD
14V
D4
D5
C77 .001
Q1
R24 1.5K
R23 330K
R25 10K
C80 .01
C78
C79 .01
L1
L2
L3
L4
L5
L7
L8
L9
L10
L11
L12
K1
K2
K3
K4
K5
K6
K7
K8
K9
K10
K11
K12
K13
K14
10 METER OPTION BOARD
MODEL 420
Q1 MPS6514
D1-D5 IN4148
REFERENCE DESIGNATORS LAST USED
C84,D5,L14,Q1,K14,R26,T2
4-23/4-24 blank
FIGURE 4-13 LOW PASS FILTER 81429

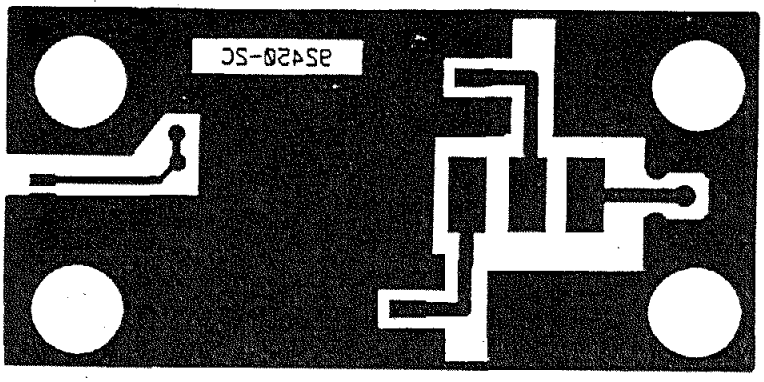


FIGURE 4-14. 81444 VAC RELAY BOARD CIRCUIT TRACE

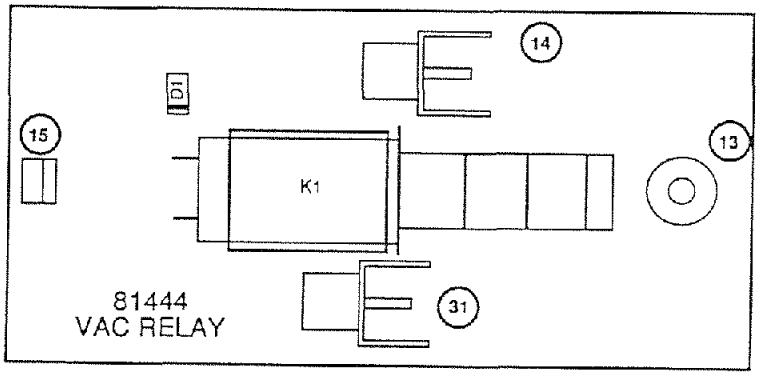
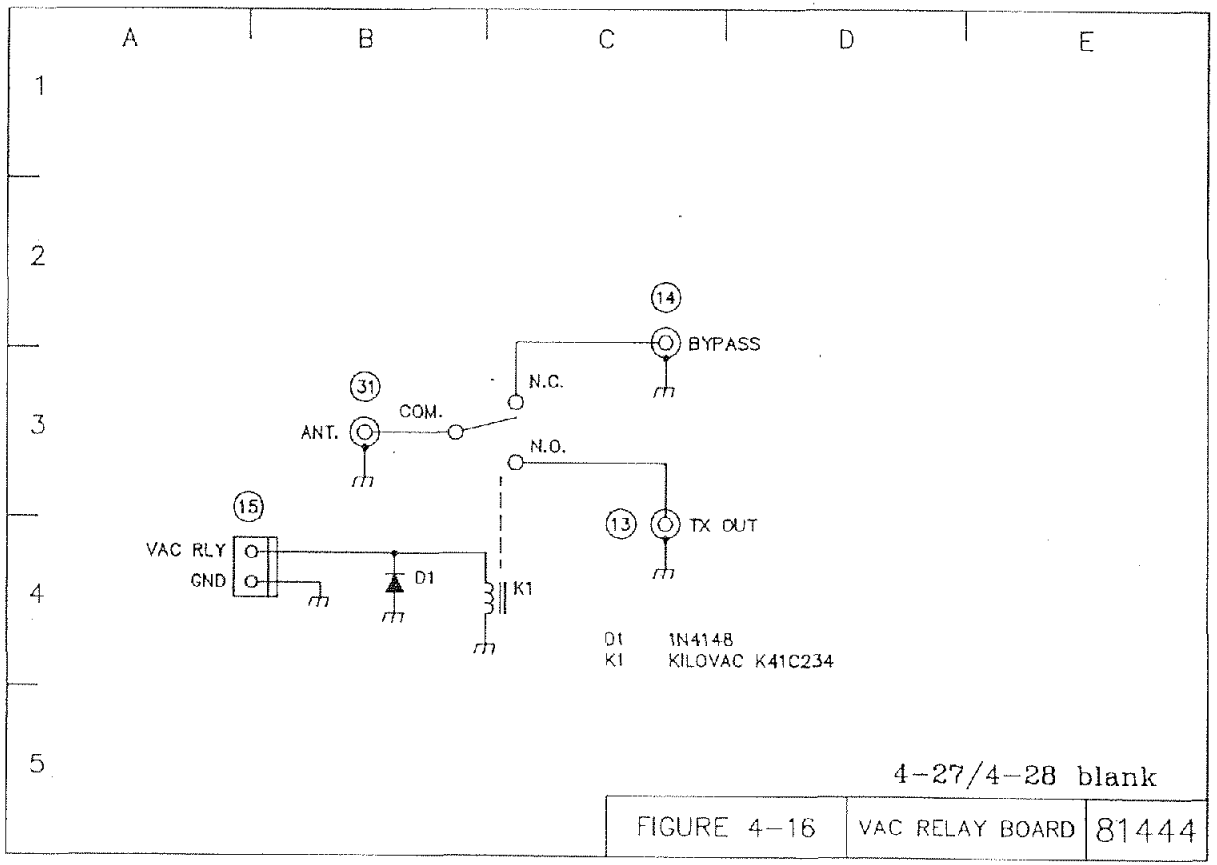


FIGURE 4-15. 81444 VAC RELAY BOARD COMPONENT LAYOUT



4-27/4-28 blank

FIGURE 4-16	VAC RELAY BOARD	81444

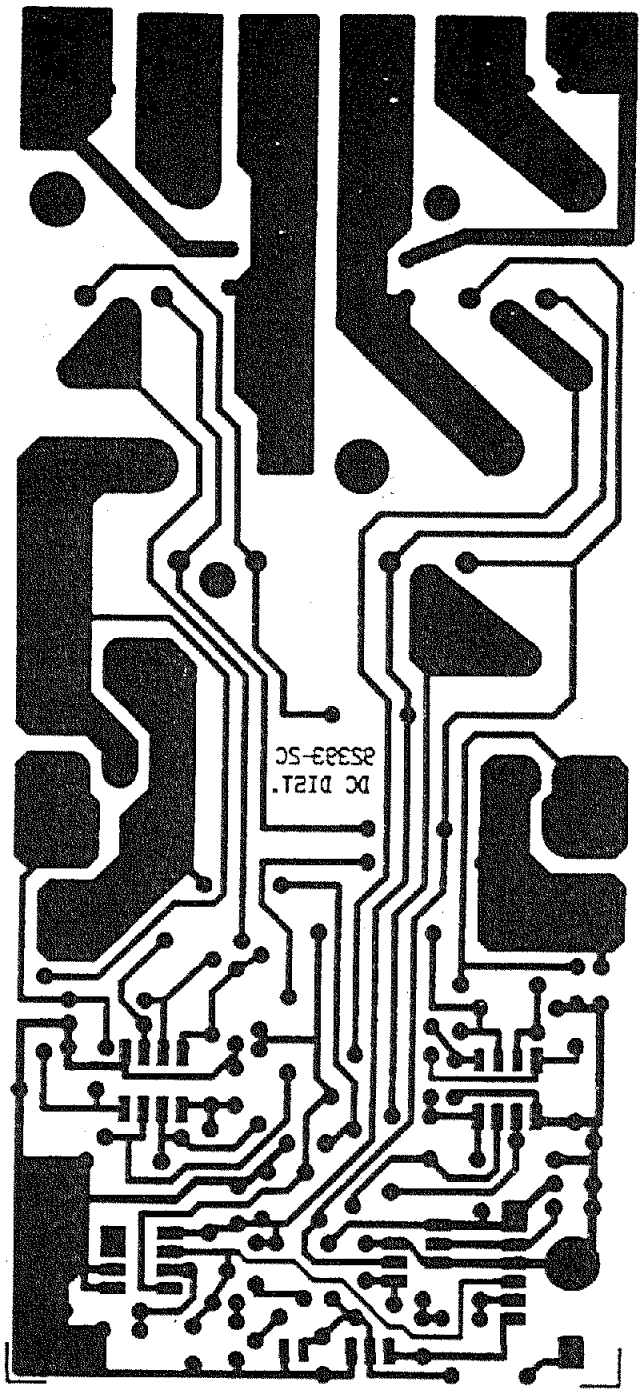


FIGURE 4-17. 81406 D.C. DISTRIBUTION BOARD CIRCUIT TRACE

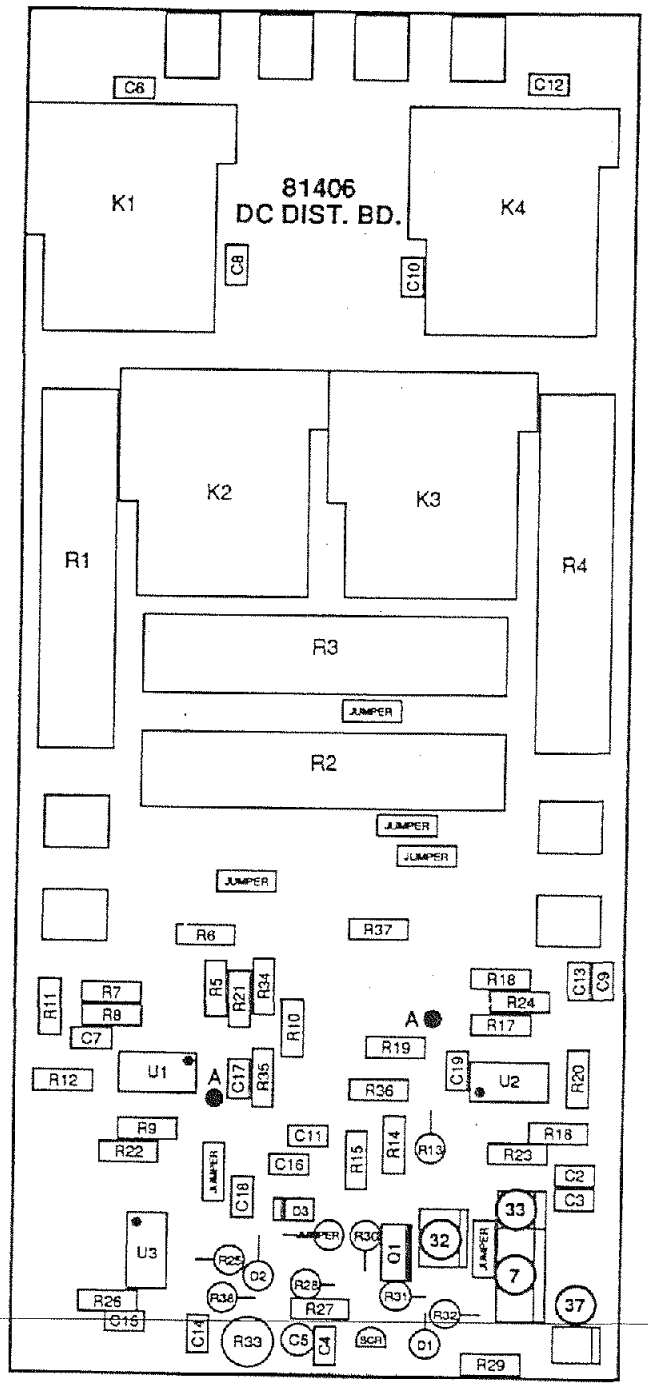
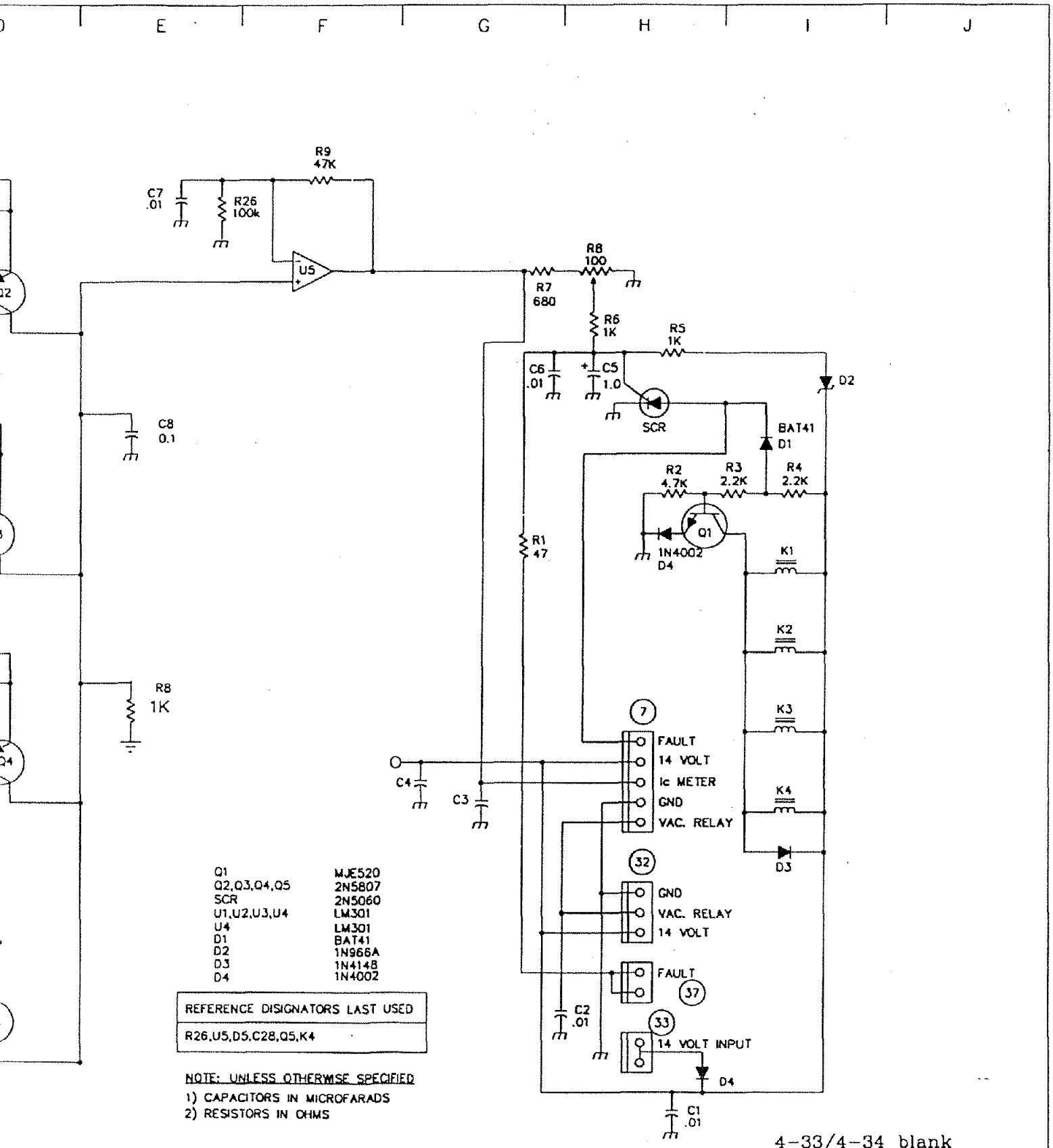


FIGURE 4-18. 81406 D.C. DISTRIBUTION BOARD COMPONENT LAYOUT



Q1	MJE520
Q2,Q3,Q4,Q5	2N5807
SCR	2N5060
U1,U2,U3,U4	LM301
U4	LM301
D1	BAT41
D2	1N966A
D3	1N4148
D4	1N4002

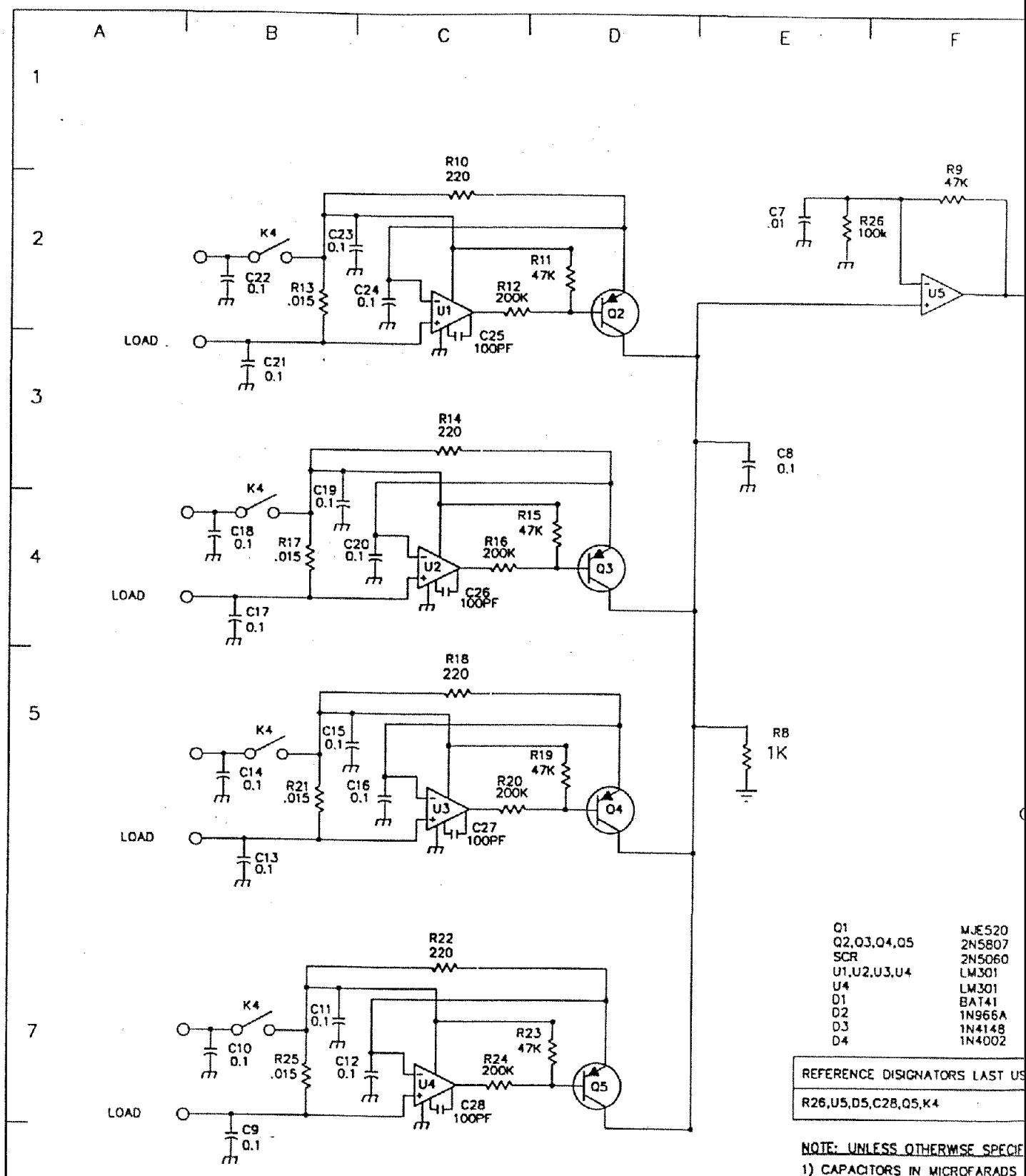
REFERENCE DISIGNATORS LAST USED
R26,U5,D5,C28,Q5,K4

NOTE: UNLESS OTHERWISE SPECIFIED
1) CAPACITORS IN MICROFARADS
2) RESISTORS IN OHMS

4-33/4-34 blank

GARY BRENDER 1/25/93

FIGURE 4-19	DC.DISTRIBUTION	81406



Q1	MJE520
Q2,Q3,Q4,Q5	2N5807
SCR	2N5060
U1,U2,U3,U4	LM301
U4	LM301
D1	BAT41
D2	1N966A
D3	1N4148
D4	1N4002

REFERENCE DISIGNATORS LAST US
R26,U5,D5,C28,Q5,K4

NOTE: UNLESS OTHERWISE SPECIF

1) CAPACITORS IN MICROFARADS
2) RESISTORS IN OHMS

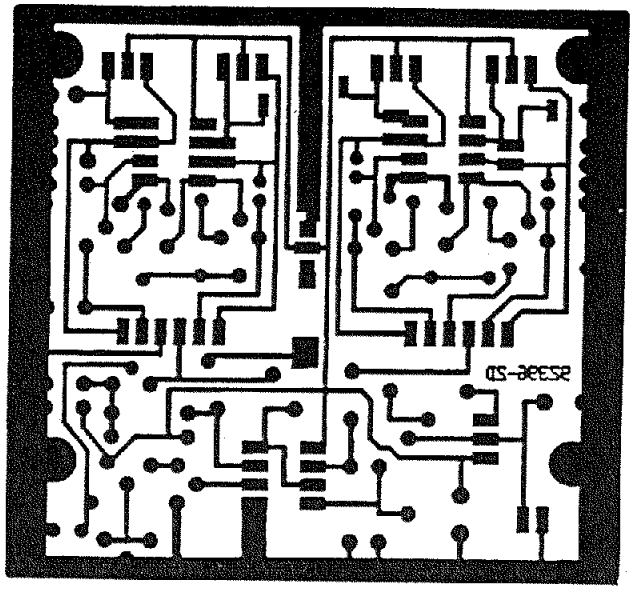


FIGURE 4-20. 81405 POWER AMP. BIAS BOARD CIRCUIT TRACE

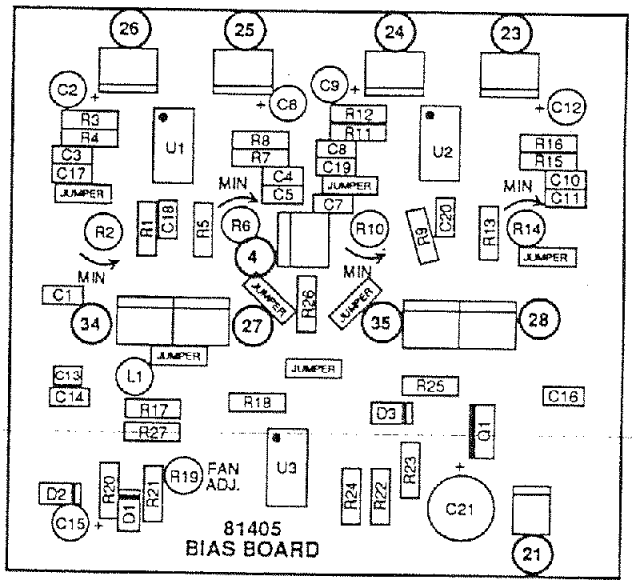
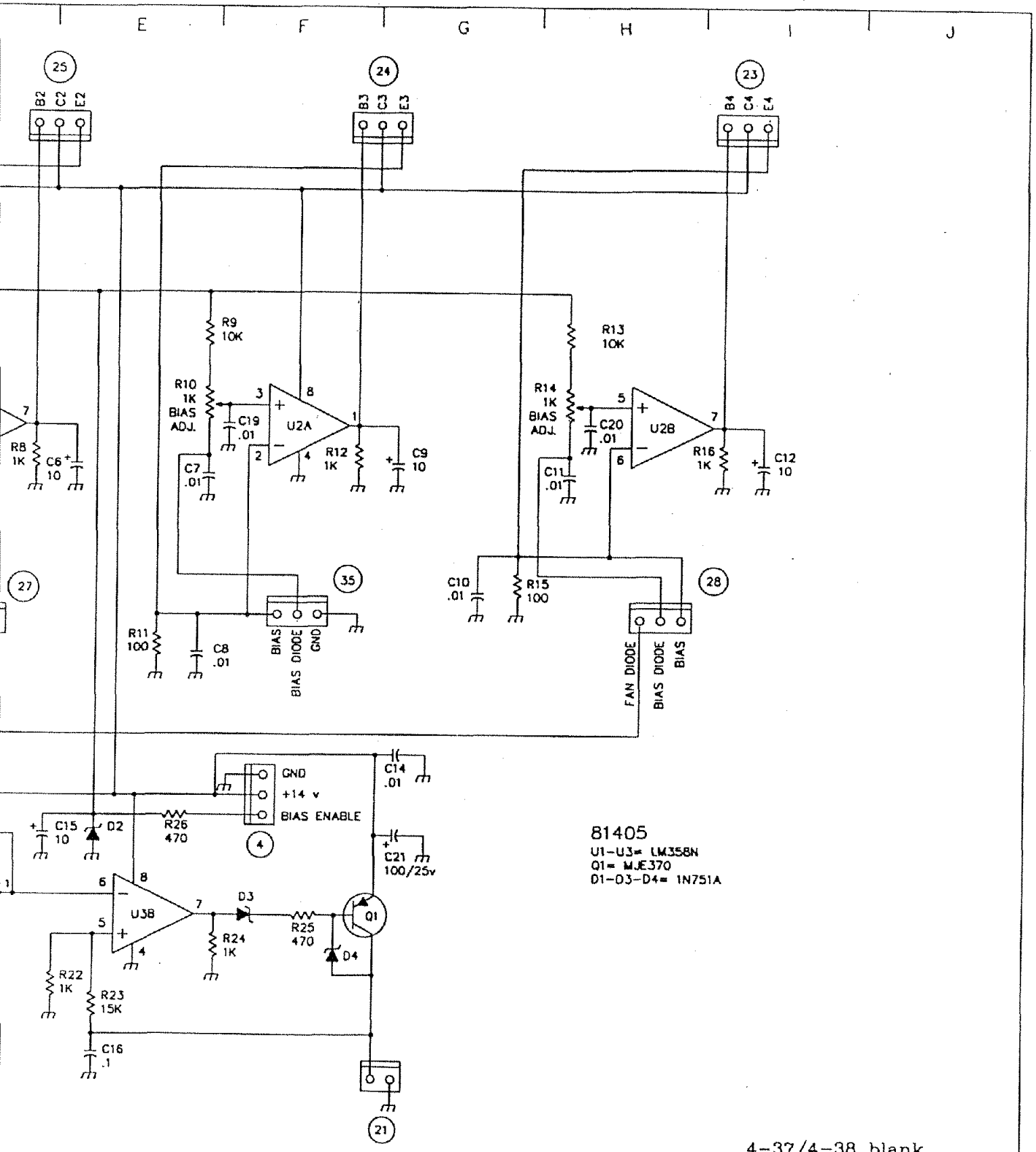


FIGURE 4-21. 81405 POWER AMP. BIAS BOARD COMPONENT LAYOUT



81405

U1-U3= LM358N
Q1= MJE370
D1-D3-D4= 1N751A

4-37/4-38 blank

FIGURE 4-22	BIAS BOARD	81405

ON4UN & ORION II

John could own any transceiver he wants. His choice? A pair of ORION II's.

CQ Contest Hall of Fame member John Devoldere, ON4UN, literally wrote the book on DXing. "Low Band DXing" is now in its 4th edition after more than 20 years in print and is regarded worldwide as THE indispensable book for low band operating advice.

ON4UN was issued the first ever 5 band Worked All Zones award. His 353 countries confirmed on 80 meters, (#1 world total), and 299 more on 160 meters, (#1 outside the USA), and numerous contest records set over the last 40 years stand as a testament to his lifelong dedication to Amateur Radio.

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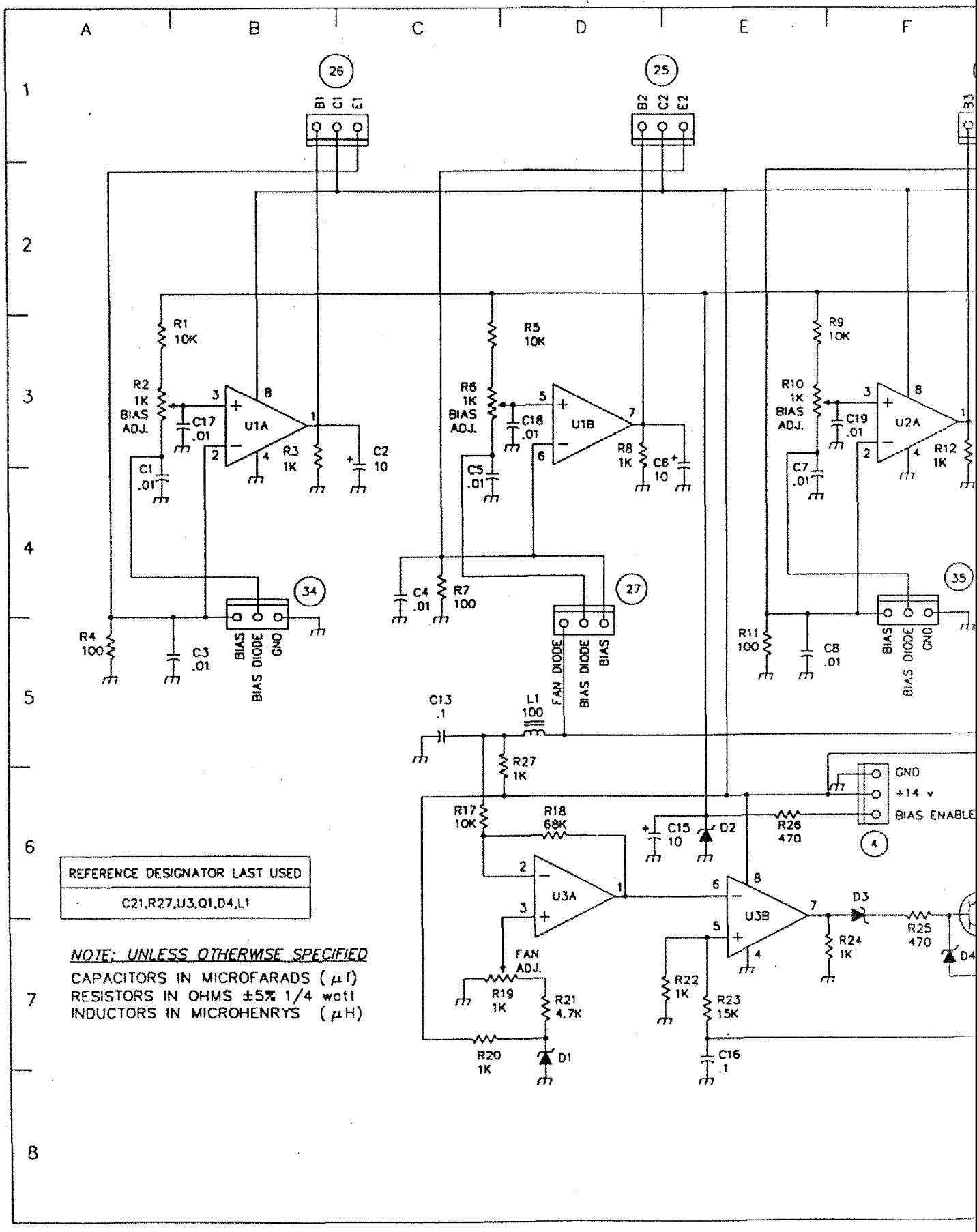
Sales: Mon-Fri 8:00-5:30 Eastern sales@tentec.com. Service: Mon-Fri 8:00-5:00 Eastern service@tentec.com (865) 428-0364.

*Shipping is additional. TN residents add 9.5% sales tax

TEN-TEC



REFERENCE DESIGNATOR LAST USED
C21,R27,U3,Q1,D4,L1

NOTE: UNLESS OTHERWISE SPECIFIED

CAPACITORS IN MICROFARADS (μf)
RESISTORS IN OHMS ±5% 1/4 watt
INDUCTORS IN MICROHENRYS (μH)

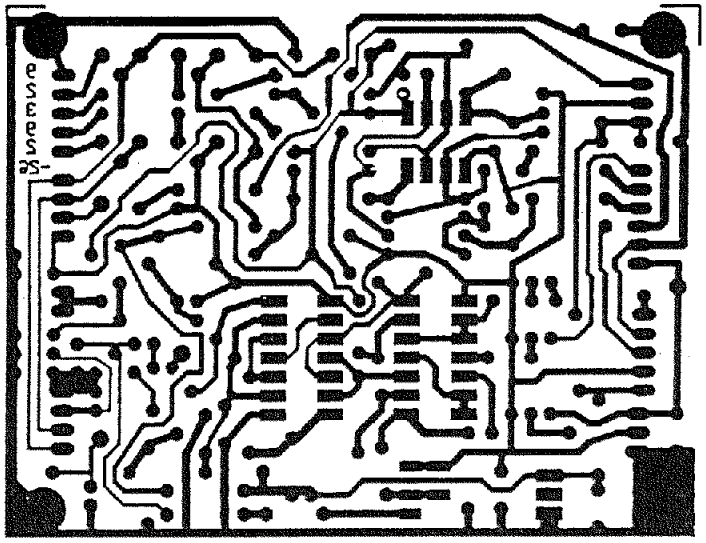


FIGURE 4-23. 81426 CONTROL BOARD CIRCUIT TRACE

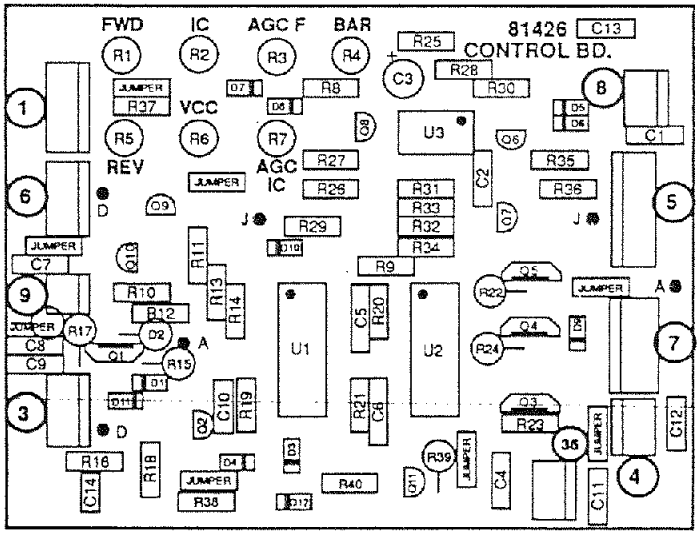
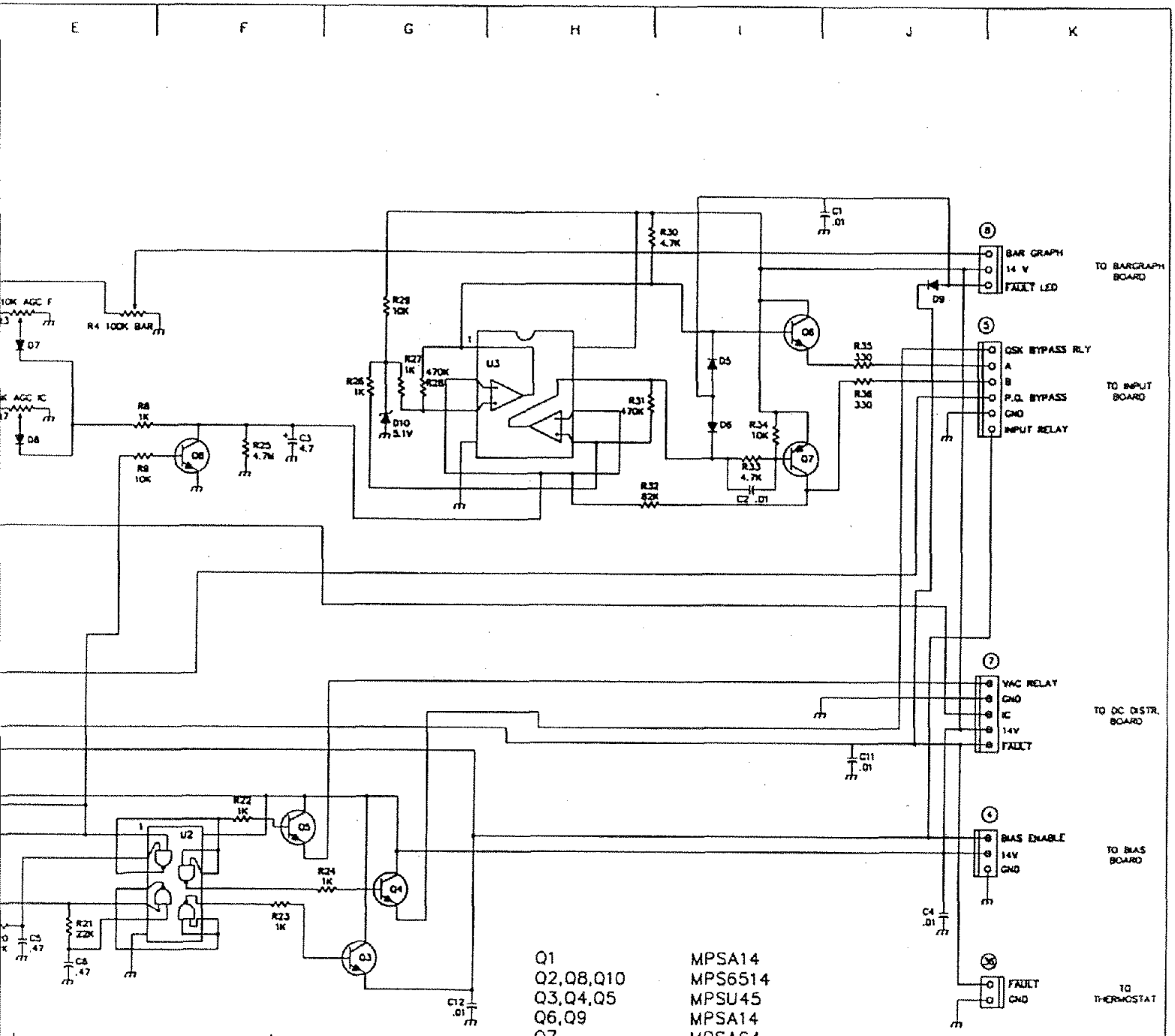


FIGURE 4-24. 81426 CONTROL BOARD COMPONENT LAYOUT

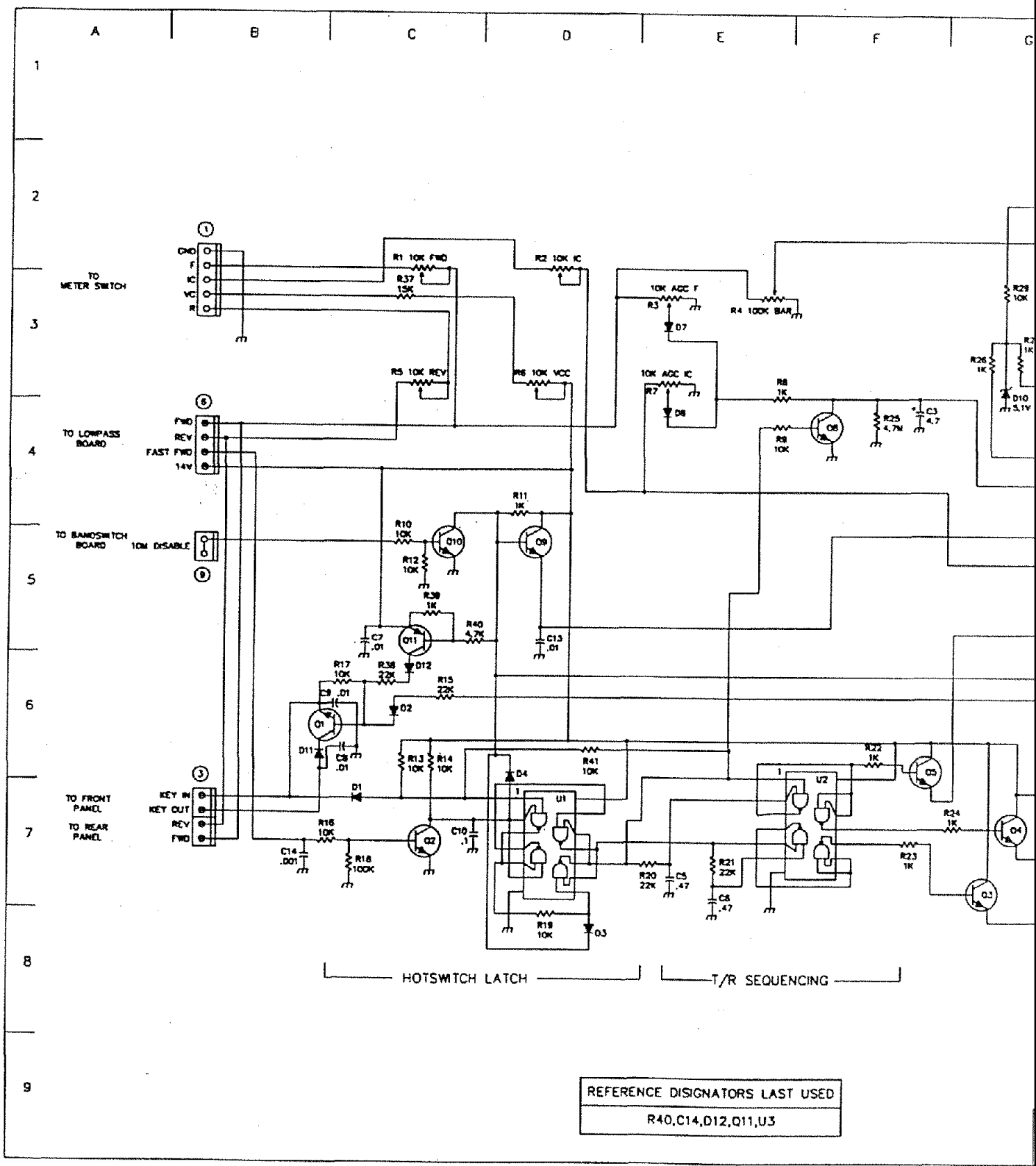


Q1	MPSA14
Q2,Q8,Q10	MPS6514
Q3,Q4,Q5	MPSU45
Q6,Q9	MPSA14
Q7	MPSA64
Q11	2N5087
U1,U2	MC14011B
U3	LM393N
D1–D9,D12	1N4148
D10	1N751A
D11	1N4002

4–41/4–42 blank

CE DISIGNATORS LAST USED
R40,C14,D12,Q11,U3

FIGURE 4–25 | CONTROL BOARD | 81426



REFERENCE DISIGNATORS LAST USED
R40,C14,D12,Q11,U3

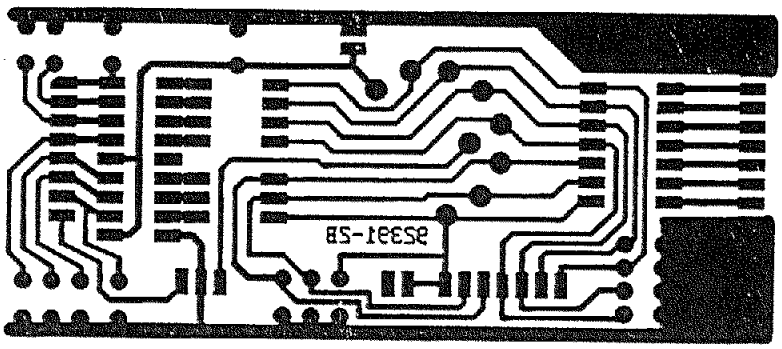


FIGURE 4-26. 81424 BANDSWITCH BOARD CIRCUIT TRACE

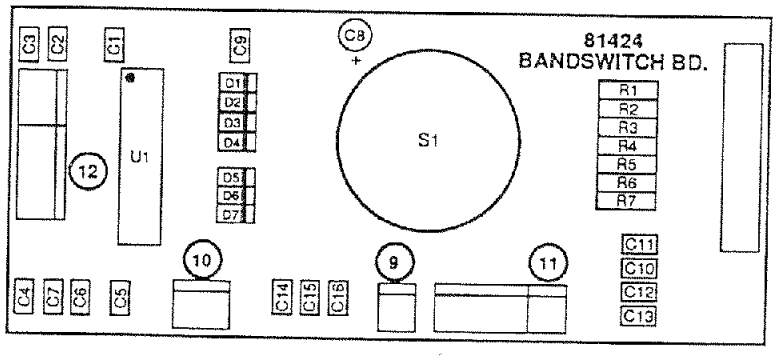
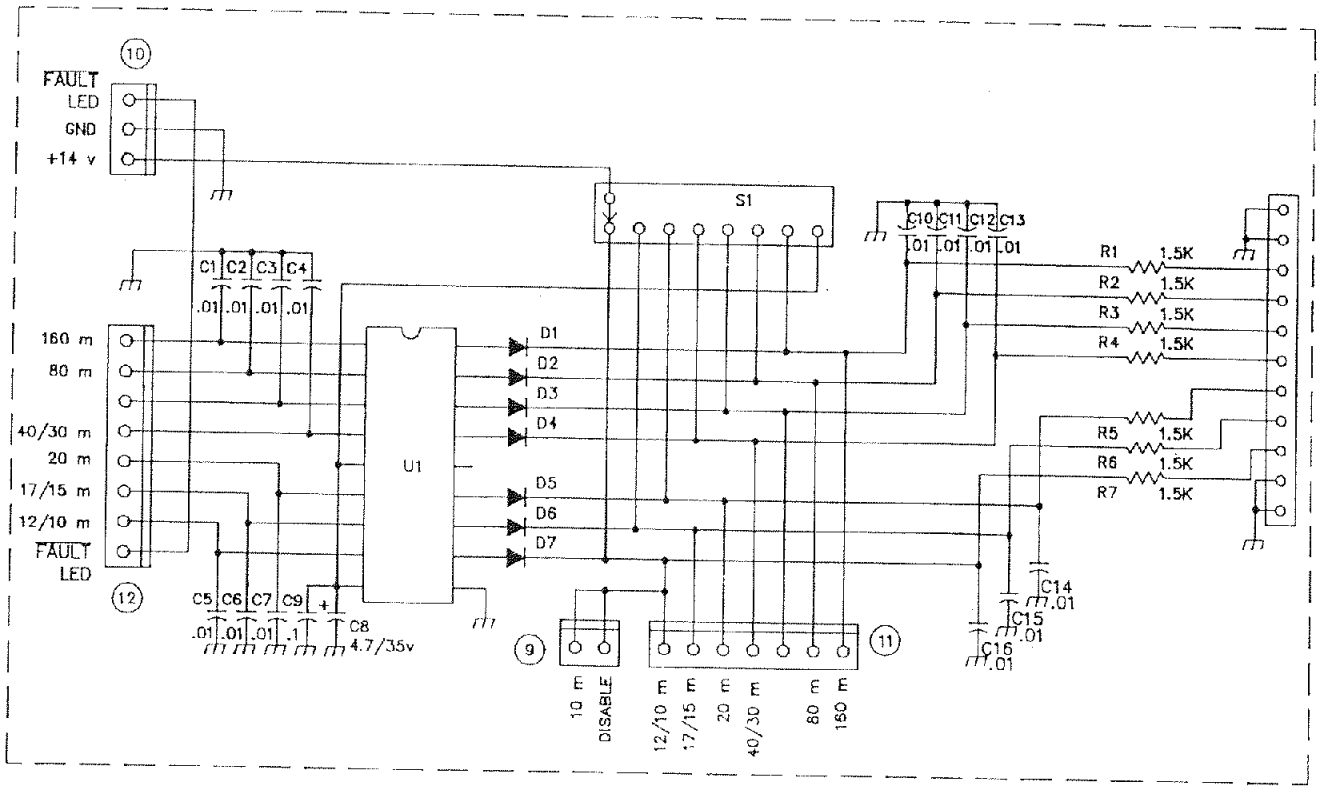


FIGURE 4-27. 81424 BANDSWITCH BOARD COMPONENT LAYOUT



D1–D7= 1N4002
U1= UDN2982A

REFERENCE DESIGNATORS LAST USED
R7,C16,D7,S1,U1

NOTE: UNLESS OTHERWISE SPECIFIED
CAPACITORS IN MICROFARADS (μf)
RESISTORS IN OHMS ±5% 1/4 watt

4-45/4-46 blank

FIGURE 4-28 | BANDSWITCH BOARD | 81424

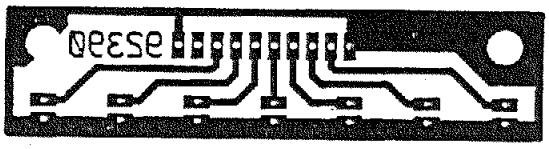


FIGURE 4-29. 81423 BANDSWITCH LED BOARD CIRCUIT TRACE

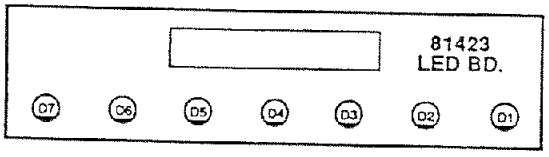
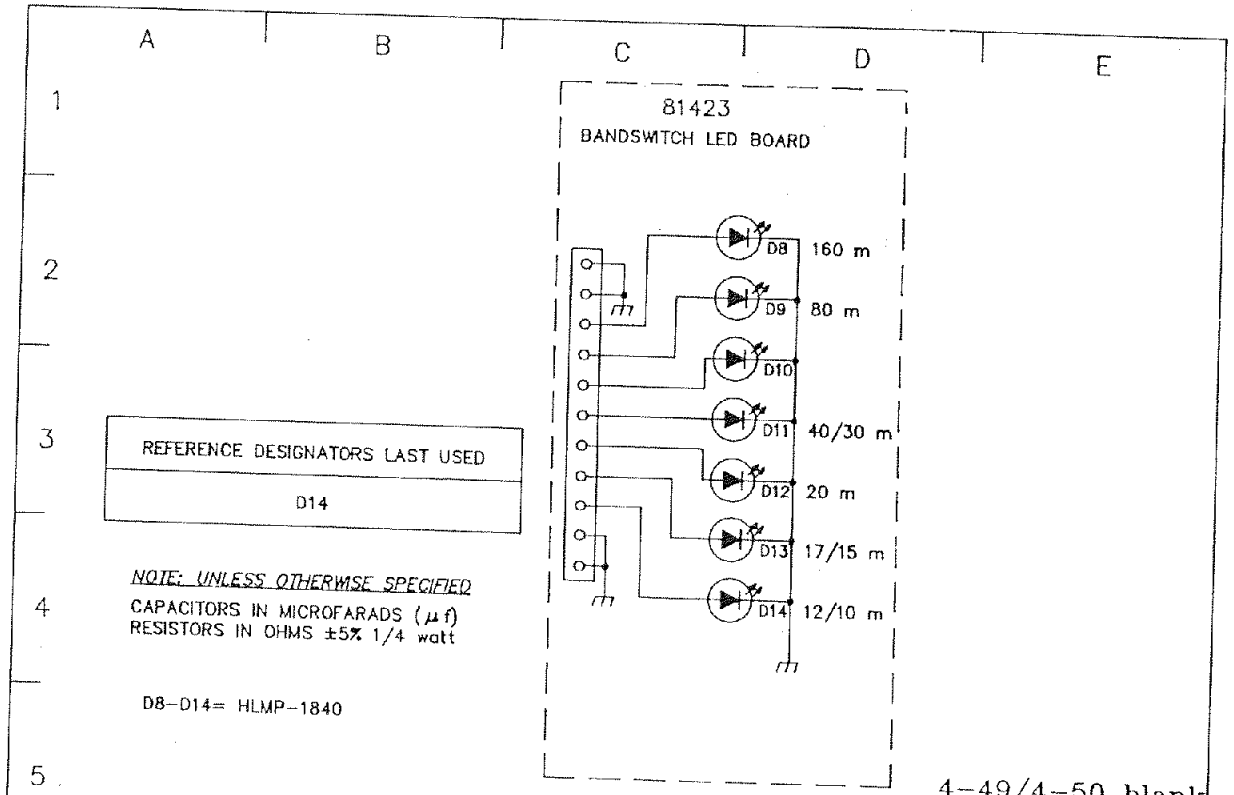


FIGURE 4-30. 81423 BANDSWITCH LED BOARD COMPONENT LAYOUT



4–49/4–50 blank

FIGURE 4–31 BANDSWITCH LED BOARD 81423

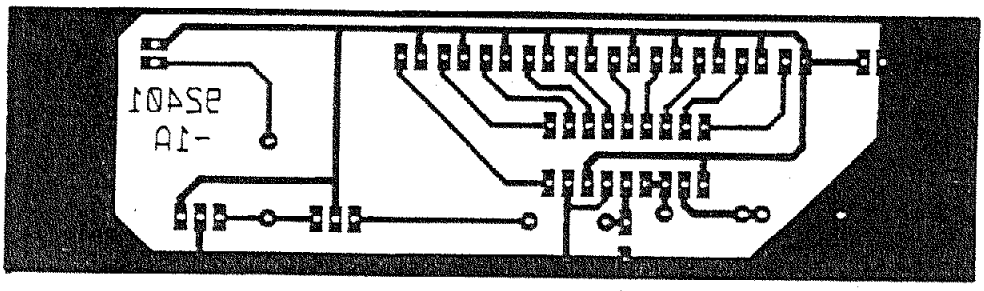


FIGURE 4-32. 81431 LED BARGRAPH DISPLAY BOARD CIRCUIT TRACE

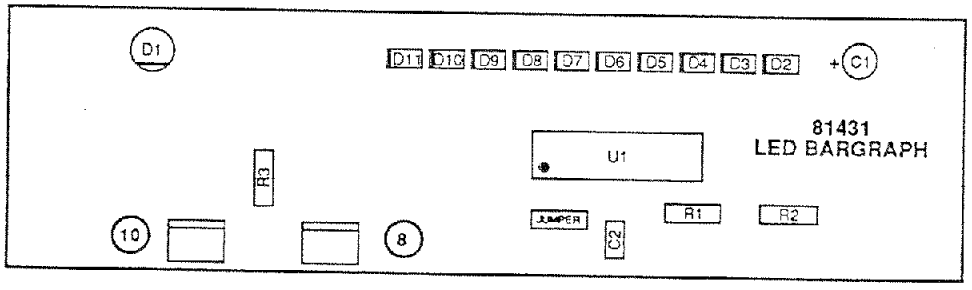
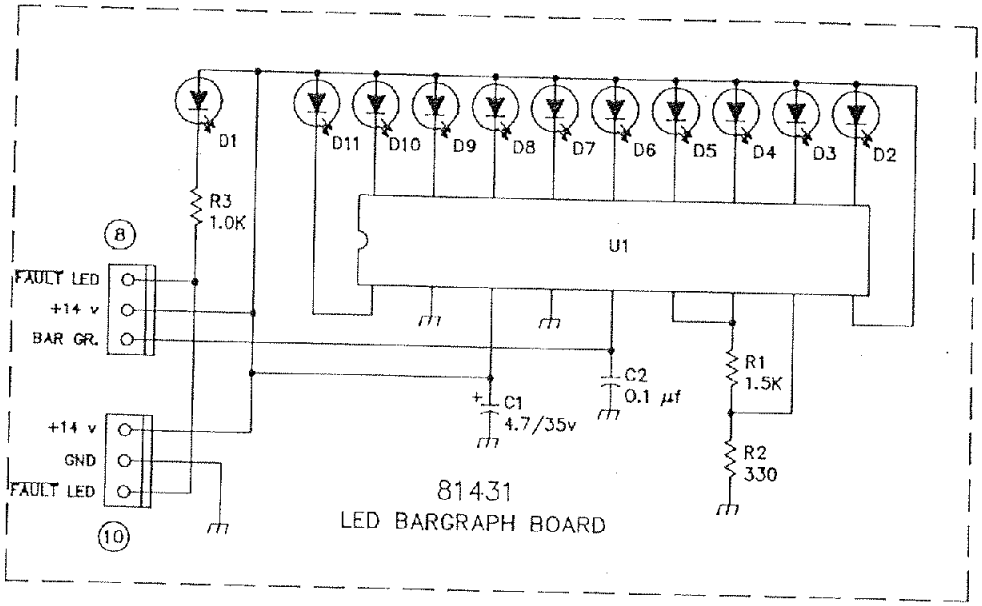


FIGURE 4-33. 81431 LED BARGRAPH DISPLAY BOARD COMPONENT LAYOUT



REFERENCE DESIGNATORS LAST USED
R3,C2,D11,U1

D1= 5082-4855
D2= LN224RP
D3-D11= P316-ND
U1= LM3914

NOTE: UNLESS OTHERWISE SPECIFIED

CAPACITORS IN MICROFARADS (µf)
RESISTORS IN OHMS ±5% 1/4 watt

4-53/4-54 blank

FIGURE 4-34	LED BARGRAPH BOARD	81431

CAUTION TO PARAGON OWNERS

WITH

RS-232 BOARD INSTALLED

Some of the early RS-232 boards (Model 258) do not have the band information brought out to the rear panel "D" connector for remote control of the Hercules II amplifier. The later versions do have the information lines at the connector but will require RF by-passing.

The current version of the Model 258 (now Model 258-H) board is by-passed and has both the computer interconnect cable and the Hercules II control cable factory installed. If your RS-232 board does not have both cables installed, please contact our customer service department BEFORE YOU ATTEMPT REMOTE OPERATION.

As explained in this manual, there is also a control interface that provides remote control of the Hercules II only. This is a circuit board that provides the rear panel "D" connector and patches into the Paragon cabling system. The plug-in cable that connects the Paragon to the Hercules II is included.

TEN-TEC, Inc.

Customer Service Telephone: 423-428-0364

FAX: 423-428-4483

Ten-Tec, Inc.
1185 Dolly Parton Parkway
Sevierville, TN 37862
Repair Service: (865) 428-0364

LIMITED WARRANTY AND SERVICE POLICY, U.S.A. AND CANADA

Ten-Tec, Inc., warrants this product to be free from defects in material and workmanship for a period of one (1) year from the date of purchase, under these conditions:

1. THIS WARRANTY APPLIES ONLY TO THE ORIGINAL OWNER. It is important that the warranty registration card be sent to us promptly.

2. READ THE MANUAL THOROUGHLY. This warranty does not cover damage resulting from improper operation. Developing a thorough understanding of this equipment is your responsibility.

3. IF TROUBLE DEVELOPS we recommend you contact our customer service group direct at the address or phone number shown above. It has been our experience that factory direct service is expeditious and usually results in less down-time on the equipment. Some overseas dealers do offer warranty service and, of course, have our complete support.

4. EQUIPMENT RETURNED TO THE FACTORY must be properly packaged, preferably in the original shipping carton(s). You pay the freight to us and we prepay surface freight back to you. Canadian customers must have proper customs documentation sent with incoming repair equipment. Duties or fees charged due to improper documenting are the responsibility of the owner of the equipment.

5. EXCLUSIONS. This warranty does not cover damage resulting from misuse, lightning, excess voltages, polarity errors or damage resulting from modifications not recommended or approved by Ten-Tec. In the event of transportation damage, a claim must be filed with the carrier. Under no circumstances is Ten-Tec liable for consequential damages to persons or property caused by the use of this equipment.

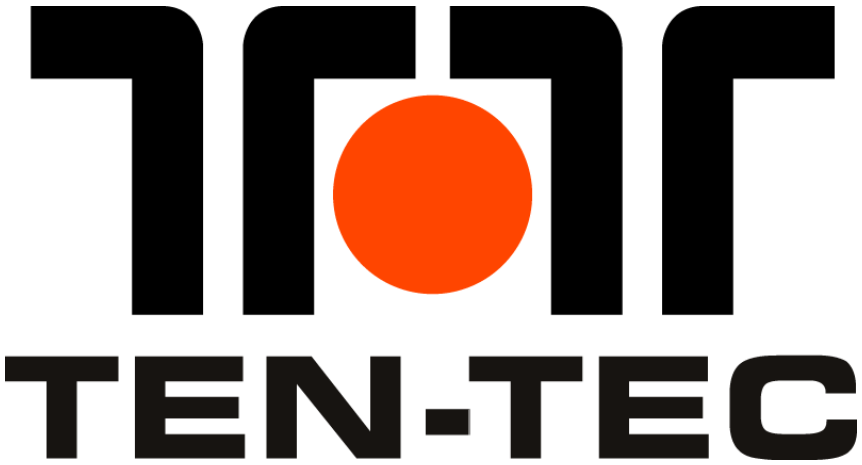
6. TEN-TEC RESERVES the right to make design changes without any obligation to modify equipment previously manufactured, or to notify owners of changes to existing equipment.

7. THIS WARRANTY is given in lieu of any other warranty, expressed or implied.

SERVICE OUTSIDE OF THE U.S.A. OR CANADA

Many of our international dealers provide warranty service on the equipment they sell. Many of them also provide out of warranty service on all equipment whether they sold it or not. If your dealer does not provide service or is not conveniently located, follow the procedure outlined above. Equipment returned to us will be given the same attention as domestic customers but roundtrip freight expense, customs and broker fees will be paid by you.

Part no. 74244



This obsolete manual file is provided as a courtesy to you by Ten-Tec, Inc.

Ten-Tec's service department can repair and service virtually everything we have built going back to our first transceivers in the late 1960's. It is our ability to continue offering service on these rigs that has led to their re-sale value remaining high and has made a major contribution to our legendary service reputation.

Printed and bound copies of all manuals are available for purchase through our service department if you would prefer not to use this copy as your transceiver manual.

We can repair or service your Ten-Tec equipment at our facility in Sevierville, TN. We also offer support via telephone for all products via during usual business hours of 8 a.m. to 5 p.m. USA Eastern time, Monday through Friday. We have a large supply of parts for obsolete products. Repairing a transceiver or amplifier yourself? Contact us for parts pricing information.

Service department direct line: (865) 428-0364
Ten-Tec office line: (865) 453-7172
Service department email: service@tentec.com
Address: 1185 Dolly Parton Parkway, Sevierville, TN 37862 USA

We have found it is most effective for us to help you troubleshoot or repair equipment with a consultation via telephone rather than by email.

Suggested contact methods are:

Troubleshooting or repairing equipment – call (865) 428-0364
Other inquiries – call (865) 428-0364 or email service@tentec.com

THANK YOU AND 73 FROM ALL OF US AT TEN-TEC