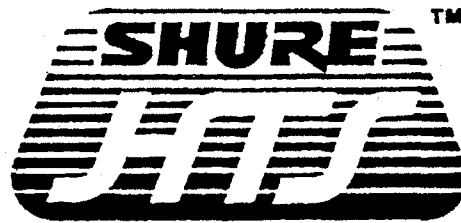


HOME THEATER SOUND

HTS5000 SURROUND AUDIO PROCESSOR

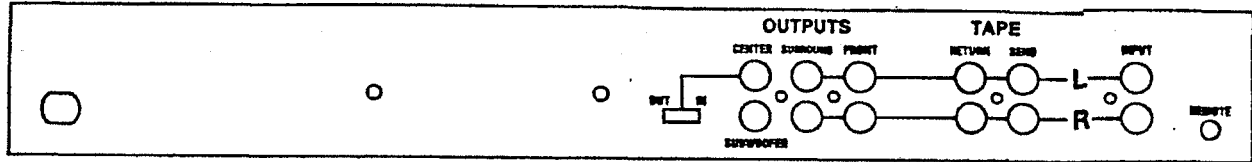
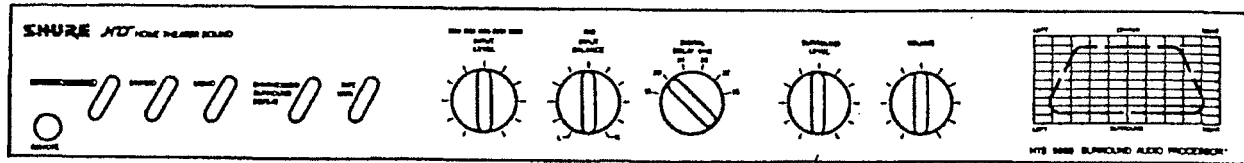
SERVICE INFORMATION

MODELS: HTS5000, HTS5000E, HTS5000J



Home Theater Sound Division
SHURE BROTHERS INCORPORATED
222 Hartrey Avenue
Evanston, Illinois 60202-3696

DESCRIPTION



The HTS5000 Surround Audio Processor provides a theater-sound environment in the home. This Home Theater Sound (HTS) system decodes Dolby¹ stereo sound encoded in video discs, video tape, and broadcast television. The HTS5000 provides up to six channels of audio output: left, center, right, two surround channels, and a subwoofer. Acra-Vector[®] decoder circuitry replicates the directional accuracy of the finest theater sound equipment. True digital time delays provide the same performance, free of distortion and noise, as in the theater. The Acoustic Space Generator creates the same immersion in sound as in the theater, but using a minimum number of speakers. All these features help to re-create the sound field of an original theater showing. The HTS5000 can also produce simulated surround sound from ordinary stereo, and even from mono sources.

Three models of the HTS5000 are presently available: the HTS5000, for 120 Vac, 60 Hz operation; the HTS5000E, for 220-240 Vac, 50/60 Hz operation; and the HTS5000J, for 100 Vac, 50/60 Hz operation. All three models are described in this document.

A basic HTS Surround Sound Installation employs four loudspeakers and two stereo amplifiers; a complete system uses six loudspeakers and three stereo amplifiers to reproduce the theater experience. The system operates as follows: Exclusive Acra-Vector circuits enhance the directional accuracy of the reproduced sound field. In the front, this creates a spacious stereo panorama with realistic "motion" effects from moving sources. In the basic system, dialogue originates from a phantom center channel. However, to keep the acoustic image properly located regardless of where the listener sits in the room, the addition of a center front loudspeaker is recommended.

The surround channel signals are delayed according to a user-selected digital display setting chosen for the particular room environment. Then an Acoustic Space Generator processes the delayed signal to further enhance the perception of spaciousness.

The finishing touch to complete the system is an added subwoofer. Because the film industry uses very low-frequency audio as an integral part of the creation of mood and place, using a subwoofer reinforces the

theater illusion and intensifies the verisimilitude of the performance. To conveniently add a subwoofer, the HTS5000 has a subwoofer output containing only low-frequency information (below 80 Hz). The subwoofer will smoothly extend the response of typical bookshelf or satellite speakers, or it can be used to augment the bass output of larger speakers. (The left, center, and right outputs are full-frequency-range and also contain this low-frequency information.)

The HTS5000 front-panel controls and displays include push-button operating mode selectors: Dolby Surround, synthesized-surround stereo or mono, and, by means of a defeat button, pure stereo or mono. There is also push-button choice of the audio source from either Left and Right inputs or Tape Monitor Return inputs. Rotary knobs on the front adjust the following: Input level, with a five-LED display; input balance, with an LED for visual determination of correct listening room; and volume and surround levels. An overriding wired remote control lets the listener adjust surround and overall volume levels from the listening position. The remote also permits muting of the audio outputs. A four-channel graphic display provides visual demonstration of the surround characteristics of the input signal.

The HTS5000 rear panel includes left and right audio inputs; outputs for front left and right and surround left and right channels; a separately switched front-center output jack; and a subwoofer output jack. Tape Monitor Send outputs and Left and Right Return inputs are also included. These audio input and output jacks are all phono types. In addition, front- and rear-panel eighth-inch-diameter phone jacks accommodate the wired remote control.

The HTS5000 Installation/Operator's Manual contains specifications, troubleshooting and safety/maintenance information.

1. Manufactured under license from Dolby Laboratories Licensing Corporation. Additionally licensed under one or more of the following patents: U.S. numbers 3,632,886, 3,746,792, and 3,959,590; Canada numbers 1,004,803 and 1,037,677. "Dolby" and the double-D symbol are trademarks of Dolby Laboratories Licensing Corporation

*Patent pending.

SERVICE

This section contains information on replacement parts, service access, fuse replacement, and complete equipment checkout. If difficulties in HTS5000 installation or operation are experienced, the Troubleshooting Guide in the Installation/Operator's Manual should be consulted. If that information fails to correct the problem, the checkout procedure given here can be performed.

Note that circuitry information is only given where it can be of use in field service; most internal adjustments cannot be made and some circuit blocks cannot be serviced without factory test equipment.

WARNING

Voltages in this equipment are hazardous to life. No user-serviceable parts inside. Refer all servicing to qualified service personnel.

Replacement Parts

Parts that are readily available through local electronic parts distributors are not shown on the accompanying Parts List. Their values are shown on the Circuit Diagram. Commercial parts not readily available and unique parts are shown on the Parts List and may be ordered directly from the factory.

The commercial alternates shown on the Parts List are not necessarily equivalents, but may be used in the event that direct factory replacements are not immediately available. To maintain the highest possible performance and reliability, Shure factory replacement parts should be used. When ordering replacement parts, specify the Shure replacement part number, description, product model number, and serial number.

External Parts

The following parts can be removed and replaced without disassembling the HTS5000:

- Remote Control (A13)
- Rotary Knob (MP1-MP5)
- Foot (MP6-MP9)

All five front-panel knobs are either pull-off or setscrew-retained types and are interchangeable. Setscrew-type knobs must be unscrewed from *inside* the front panel before removing the knobs.

Service Access

Disconnect the HTS5000 from its ac power source. Remove two cover-securing screws from each side panel. Slide the cover back toward the rear of the unit and upward to remove.

Fuse Replacement

To replace the fuse or fuses in the HTS5000, disconnect the line cord from the ac source and remove the top cover as described above. Locate the defective fuse on the printed circuit board adjacent to the power transformer, and replace with a fuse of identical size and value (see table). Note that all fuses are slow-blow (time lag) types.

Model	Operation at	Fuse(s)	Type
HTS5000*	120 Vac, 60 Hz	0.3A, 250V	3AG, AGC
HTS5000E	220-240 Vac, 50/60 Hz	0.16A, 250V 1.0A, 250V	T160mA/250V 2AG
HTS5000J	100 Vac, 50/60 Hz	375 mA, 125V 1.0A, 250V	SDLC 2AG

*Also contains non-replaceable thermal cutout inside power transformer.

Test Conditions

The HTS5000 test procedures that follow are based on the following test conditions:

Ac power source: 120 Vac, 60 Hz

Output Level Trimmers (bottom of chassis): full clockwise

Switch/control positions:

Center In/Out switch: In

Volume control (remote control removed):

Maximum (clockwise)

Surround Level control: Maximum (clockwise)

Digital Delay (ms) switch: 16 milliseconds

Input Balance control: Set to null position (LED above control lit) with input signal applied to left and right channels

Tape Monitor switch: Out (off)

Synthesized Surround Defeat switch: Out (off)

*Mode switches are set as specified depending on measurement; Input Level control is set per the *Preliminary Checkout* procedure.

Test signals are applied only to the channels specified in each section of the test procedures. The voltages listed in each section are ac mVrms unless otherwise listed. No significant dc potential (>50 mV) should be present at any audio output jack.

When feeding audio test signals to the HTS5000, do not use excessive drive levels. With the Input Level control set to maximum (clockwise), distortion will appear with approximately 0.3V at the input terminals.

Test Equipment

Use a high-quality audio generator to supply the signals to the HTS5000 input jacks. The distortion contribution of the HTS5000 is negligible; if a low-distortion audio signal is used for testing, little distortion will be found at the test point signals.

Ac signal voltages should be measured with a high-impedance ac voltmeter (≥ 100 -kilohm input impedance). Dc voltages can be measured with a voltohmmeter (≥ 100 -kilohm input impedance).

Preliminary Checkout

To perform all testing, the unit must be factory-calibrated and warmed up (at least 5 minutes).

After warmup, apply a 100 mV, 1 kHz signal to both channels. With the unit in Dolby mode, adjust the Input Level control for 500 mV at the center output. Adjust the Input Balance control for minimum output at the left surround output. Under these conditions, the unit should provide the voltages listed in the following table within ± 2 dB.

Mode Switch: Dolby Surround

Output	1 kHz, 100 mV Input to:		
	Left Ch.	Right Ch.	Both Ch.
Left	380 mV	<5 mV	50 mV
Center	<20 mV	<20 mV	500 mV
Right	<5 mV	380 mV	50 mV
Left Surround	<20 mV	<20 mV	<10 mV
Right Surround	<20 mV	<20 mV	<10 mV

Mode Switch: Stereo

Output	135 Hz, 100 mV Input to:		
	Left Ch.	Right Ch.	Both Ch.
Left	270 mV	<5 mV	270 mV
Center	<5 mV	<5 mV	<5 mV
Right	<5 mV	270 mV	270 mV
Left Surround	500 mV	500 mV	<10 mV
Right Surround	500 mV	500 mV	<10 mV

Mode Switch: Mono

Before Preliminary Checkout in the mono mode, adjust the Mono Enhance Adjust control (located on the chassis bottom). With the unit in the mono mode and a 100 mV, 1 kHz signal applied to both channels, adjust the Mono Enhance Adjust control for 300 mV at the left output.

Output	1 kHz, 100 mV Input to both channels
Left	300 mV
Center	390 mV
Right	225 mV
Left Surround	280 mV
Right Surround	280 mV

Subwoofer Output

Proper operation of the subwoofer output can be verified by measuring the following voltages.

Mode Switch	1 kHz, 100 mV Input to both channels
Mono	180 mV
Dolby	270 mV

If the above voltages are measured, the HTS5000 is operating correctly. If any voltages are outside the specified limits, the following procedure will aid in isolating the major circuit block that is causing the problem. Any circuit block (visible on the printed circuit as an outlined block of components), with the exception of the Directional Enhancement (A6), Direction Sensing (A7) and Digital Delay (A12) Blocks, can be serviced using conventional circuit troubleshooting techniques.

Checkout Procedure (cover removed) Power Supply Block (A11)

Component measured (to ground)	Measurement
Cathode of diode D1105	+ 15 Vdc
Anode of diode D1100	- 15 Vdc
Cathode of diode D1110	+ 5 Vdc

WARNING

Use extreme care when measuring voltages near the 120 Vac power supply fuses (F1100, F1101, F1102).

Input Block (A2)

Mode switch: Dolby. Proper operation of the Input Block is verified by the following test point TP2A and TP2B voltages.

Test Point	1 kHz, 100 mV Input to:	
	Left Channel	Both Channels
TP2A	400 mV	800 mV
TP2B	400 mV	<20 mV

Directional Enhancement (A6) and Direction Sensing (A7) Blocks

Proper operation of the Directional Enhancement and Direction Sensing Blocks was verified in the Preliminary Checkout procedure in the Dolby mode. **IMPORTANT:** If incorrect voltages were obtained in the Preliminary Checkout, the unit *must* be returned to Shure Brothers Service Department. The Directional Enhancement (A6) and Direction Sensing (A7) Blocks are *not* field-serviceable.

Digital Delay Block (A12)

Proper operation of the Digital Delay Block was verified in the Preliminary Checkout procedure. **IMPORTANT:** If incorrect voltages were obtained in the Preliminary Checkout, the unit *must* be returned to Shure Brothers Service Department. The Digital Delay (A12) Block is *not* field-serviceable.

Dolby Noise Reduction Block (A3)

Proper operation of the Dolby Noise Reduction Block is verified by the following voltages at Test Point TP3A.

Mode switch: Dolby Surround
Input to: Left Channel

Input Frequency	Input Level	
	100 mV	10 mV
400 Hz	730 mV	70 mV
4 kHz	700 mV	35 mV

Output Level Control and Remote Block (A9, A10)

Proper operation of the Output Level Control and Remote Blocks was verified in the Preliminary Checkout procedure in all modes.

Remote Control Voltage

The Volume (R1016) and Surround Level (R1014) controls can be checked by turning them both to their minimum (counterclockwise) positions and measuring the following voltages with the wired remote control disconnected from the HTS5000.

Test Point TP10A 4 Vdc
Potentiometer R1014 (ungrounded side) 4 Vdc

Wired Remote Control Unit

Resistance readings made at the miniature stereo phone plug of the HTS5000 remote control unit will indicate proper operation.

Measurement	Switch/Control	Setting	Reading
Sleeve to ring	Mute	On or Off	800-1200Ω
	Surround Level	Minimum	800-1200Ω
	Surround Level	Maximum	>25Ω
Sleeve to tip (Mute on)	Volume Level	Max-Min	No change
	Volume Level	Max-Min	1600-100Ω
Sleeve to tip (Mute off)	Surround Level	Maximum	No change
	Volume Level	Minimum	850-200
	Volume Level	Maximum	<25Ω

PARTS LIST

The following pages contain a replacement parts list for the HTS5000. Part numbers *not* shown on the parts list (except for Directional Enhancement, Direction Sensing, and Digital Delay Block parts which are also not listed) are readily available through local electronics parts suppliers. In these instances, the circuit diagram shows only the reference designation and value of the standard parts.


SERVICE ILLUSTRATIONS

Following the parts list are an HTS5000 block diagram, and circuit diagrams and printed circuit board

layouts, including the basic HTS5000, HTS5000E, and HTS5000J power supplies.

Note that circuit information on the non-field-serviceable Directional Enhancement, Direction Sensing, and Digital Delay Blocks (A6, A7 and A12) is not included.

WARNING

Power Supply (A11) parts shown on the circuit diagram with a  are critical and must be replaced *only* with identical parts as specified by Shure Brothers.

REPLACEMENT PARTS LIST

Reference Designation	Description	Shure Part Number/ Commercial Alternate
A13	Remote Control Assembly	Shure 90A8248
C202,C205	Capacitor, Electrolytic, 22- μ F, 6.3V	Shure 86V628; Mallory TAC226K010P05
C301,C305-C306	Capacitor, Electrolytic, 1 μ F, 50V	Shure 86S628; Cornell-Dubilier NLW1-50
C303,C312	Capacitor, Electrolytic, 10 μ F, 16V	Shure 86Y628; Cornell-Dubilier NLW10-16
C309	Capacitor, Electrolytic, 220 μ F, 25V	Shure 86X629; Nichicon 1E220MAA
C400-C407	Capacitor, Electrolytic, 2.2 μ F, 25V	Shure 86AB628; Mallory TAC225K025P02
C1100,C1106, C1110	Capacitor, Electrolytic, 10 μ F, 35V	Shure 86AA628; Mallory CTL-106M050P1A
C1102,C1107, C1111	Capacitor, Electrolytic, 1000 μ F, 35V	Shure 86J629; Sprague 503D108F050SJ
D416-D420	Light-Emitting Diode, Clear	Shure 86A8411
D500-D503	Light-Emitting Diode, Green	Shure 86A8410
D504	Light-Emitting Diode, Red	Shure 86B8410
D800	Light-Emitting Diode, Yellow	Shure 86C8410
D912,D914	Zener Diode, 5.6V	Shure 86A8409; Motorola 1N5232A
D1100-D1110	Diode, Silicon Rectifier, 100V, 1/2A	Shure 86A404; Motorola 1N4002
F1100	Fuse, Slo-Blo, 3AG, 0.3A, 250V (HTS5000)	Shure 80J159; Littelfuse Ser. 313000
F1100	Fuse, Time Delay, 375 mA, 125V (HTS5000J)	Shure 86A8059; San-O SDLC
F1101	Fuse, Time Lag, 0.16A, 250V (HTS5000E)	Shure 80D380; Schurter 034.3109
F1101	Fuse, Slo-Blo, Pigtail, 2AG, 1A, 250V (HTS5000E, HTS5000J)	Shure 80A8052; Littelfuse Ser. 230001
J200	Phono Jack, Dual	Shure 95A8127
J201	Phono Jack, 4-Position	Shure 95A8128
J202	Phono Jack, 6-Position	Shure 95A8129
J900,J1000	Phone Jack, Miniature, Stereo	Shure 95A8130
L1	Ferrite Balun Core (HTS5000, HTS5000J)	Shure 80A8051
MP1-MP5	Knob, Front Panel	Shure 31A8010
MP6-MP9	Feet	Shure 66A8002
Q800-Q801	Transistor, NPN	Shure 86A350; Motorola 2N5210
R107, R309	Potentiometer, Trim, 10k	Shure 46B084
R211	Potentiometer, Dual, 100k	Shure 46A8019

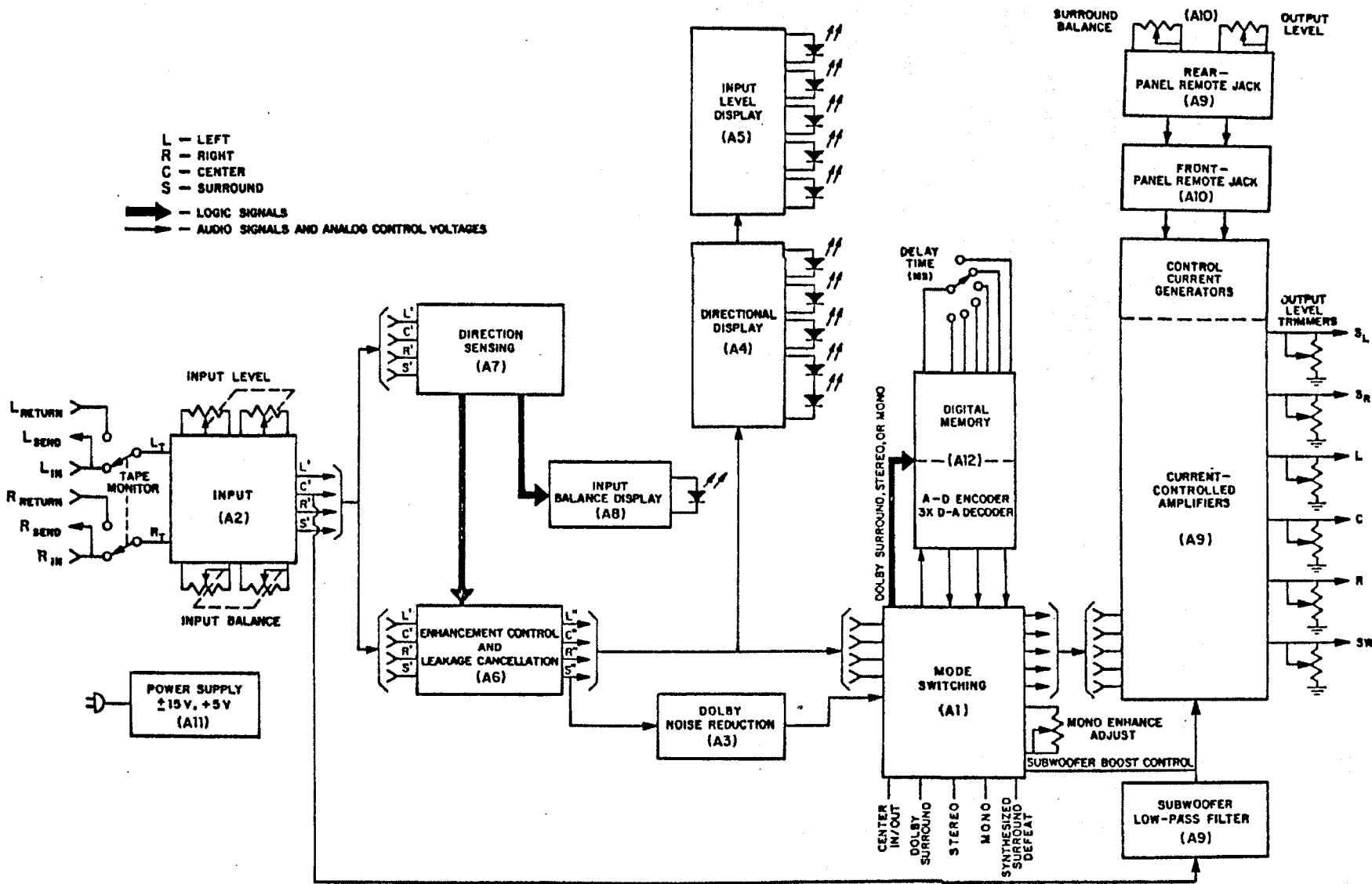
REPLACEMENT PARTS LIST

Reference Designation	Description	Shure Part Number/ Commercial Alternate
R223	Potentiometer, 10k	Shure 46B8019
R1014, R1016	Potentiometer, 1k	Shure 46B8013
R1015	Potentiometer, Trim, 50k	Shure 46B8014
S100/S102	Switch, 3-Gang, Push-Button	Shure 95A8120; Alps SUF-S-001
S103/S104	Switch, 2-Gang, Push-Button	Shure 95A8121; Alps SPUF24
T1	Transformer, Power (HTS5000)	Shure 51A8029
T1	Transformer, Power (HTS5000E)	Shure 51A8027
T1	Transformer, Power (HTS5000J)	Shure 51A8028
U200, U401	Integrated Circuit, JFET Input Op Amp	Shure 86B8834A; TI TL074AN
U300	Integrated Circuit, Dolby Noise Reduction Circuit	Shure 86A8856A; Signetics NE645N, NE650N
U301	Integrated Circuit, Dual Op Amp	Shure 86A811A; Raytheon RC4559NB
U400	Integrated Circuit, Quad Op Amp	Shure 86A808A; Raytheon RC4156DB
U500	Integrated Circuit, Dual Comparator	Shure 86A8819A; TI LM393P
U501	Integrated Circuit, Quad Comparator	Shure 86A806A; Raytheon LM339DB
U1100	Voltage Regulator, -15V	Shure 86A810A; Motorola MC7915CT
U1101	Voltage Regulator, +15V	Shure 86A809A; Motorola MC7815CT
U1102	Voltage Regulator, +5V	Shure 86A8830A; Motorola MC7805CT
W1	Line Cord and Plug, 1.8m (6 ft) (HTS5000)	Shure 95F94
W1	Line Cord (without plug, with L1), 1.9m (6 ft 4 in.) (HTS5000E)	Shure 90A8289
W1	Line Cord and Plug, 2m (6 ft 6 in.) (HTS5000J)	Shure 95B8161
W2	Cable, Stereo Pair	Shure 95A8132

REPLACEMENT PARTS LIST

REMOTE CONTROL ASSEMBLY A13

Reference Designation	Description	Shure Part Number/ Commercial Alternate
D101	Light-Emitting Diode, Red	Rohm SLR-34UR3
MP1	Button, Switch (Mute)	Shure 65A8078
MP2-MP3	Button, Variable Resistor (Volume, Surround)	Shure 65A8079
MP4	Case, Front	Shure 65B8076
MP5	Case, Back	Shure 65A8077
P1	Connector, Miniature Stereo Phone Plug	Radio Shack 274-284; Shure 95A1000
R101-R102	Resistor, Variable, 1k	Shure 46A8020
R103	Potentiometer, Linear Taper, 50k	Shure 46B084
S101	Switch, Slide, SPST	Shure 55A8041; Alps SST012
W1	Cable and Plug Assembly, 6.1m (20 ft)	Shure 90A8251



**MODEL HTS5000
SURROUND AUDIO PROCESSOR
BLOCK DIAGRAM**

NOTES TO SERVICE ILLUSTRATIONS

The notes below apply to the partial circuit diagrams and printed circuit board layouts shown on the following pages. As previously stated, information is *not* included on the Directional Enhancement Block (A6), Direction Sensing Block (A7), and Digital Delay Block (A12). In addition, only partial information is given on the Output Level Control & Remote Block (A9, A10). This is done because the equipment required for troubleshooting, adjusting and repairing these circuits is not available outside Shure's factory.

Remember that *all* internal adjustments are considered factory-serviceable only. Field repair should be limited to replacing known defective parts, repairing defective connections, etc. Attempting to calibrate the HTS5000 in the field without proper equipment (including computer setup) can result in serious performance problems.

1. All resistors are 1/4W, 5% unless otherwise specified.
2. All capacitors in microfarads and 50 volts or more unless otherwise specified. Electrolytic capacitors shown in microfarads X volts.
3. The following symbols denote:



PC Board
Ground




Chassis
Ground

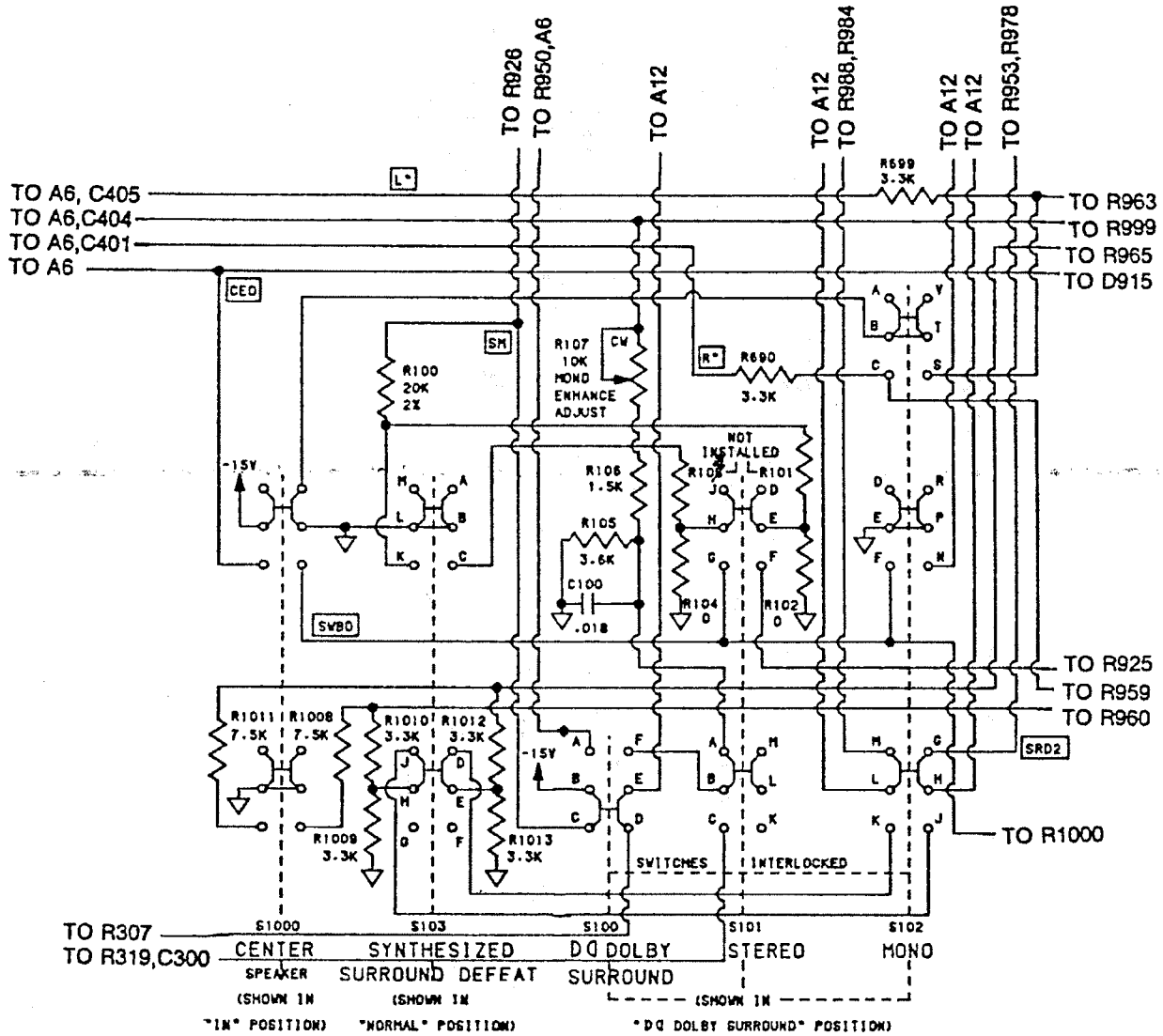
4. The printed circuit board is subdivided into sections where the first two digits of the part number describe its "block."

A1 - Mode Switching Block
A2 - Input Block
A3 - Dolby Noise Reduction Block
A4 - Directional Display Block
A5 - Input Level Display Block
A6 - Directional Enhancement Block
(drawings not supplied)
A7 - Direction Sensing Block (drawings not supplied)
A8 - Input Balance Display Block
A9,10 - Output Level Control & Remote Block
(partial drawings supplied)
A11 - Power Supply Block*
A12 - Digital Delay Block (drawings not supplied)
A13 - Remote Control Assembly

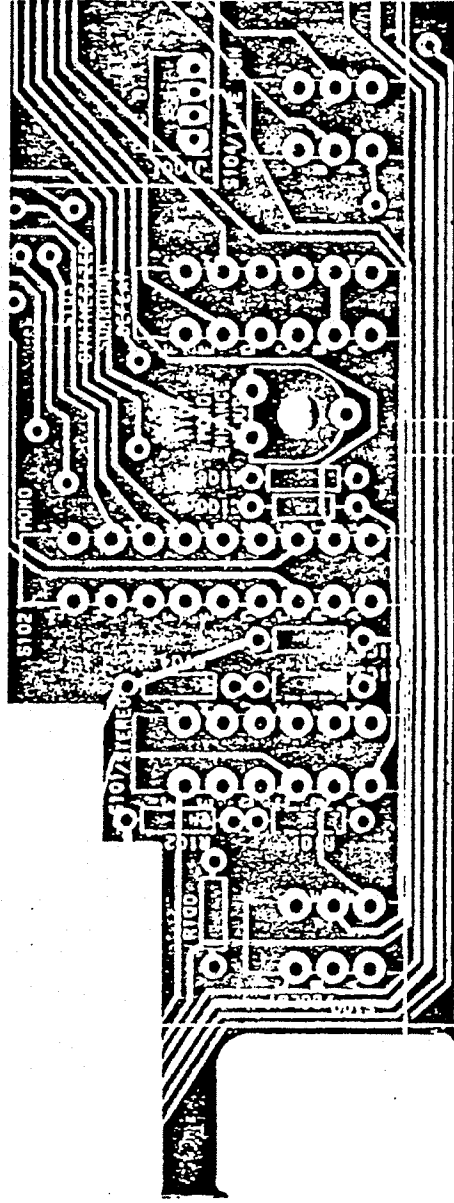
*Separate drawings provided for the HTS5000, HTS5000E and HTS5000J.

5. To eliminate risk of fire or electrical shock, all components in the power supply indicated with  are critical components and must be replaced only with identical parts as specified by Shure Brothers Inc.

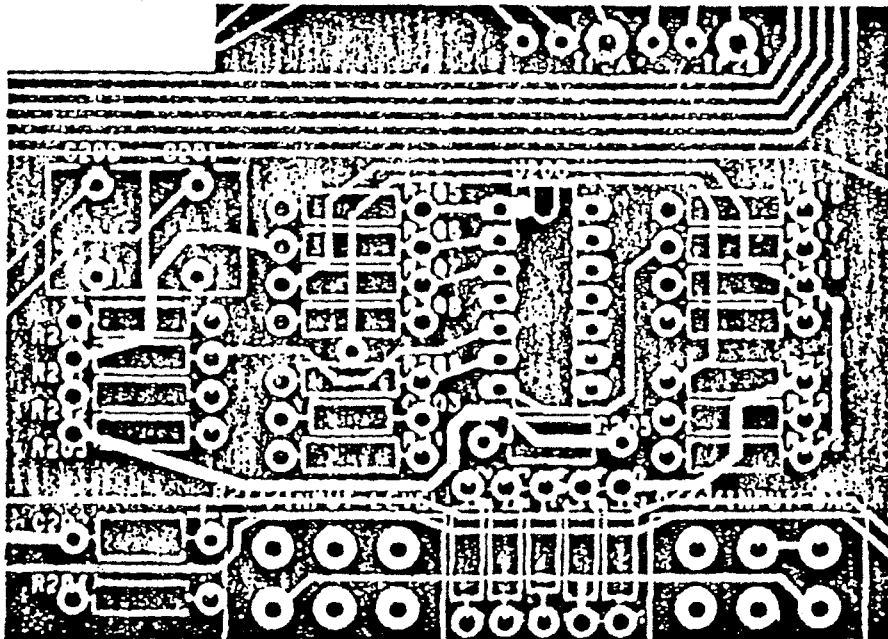
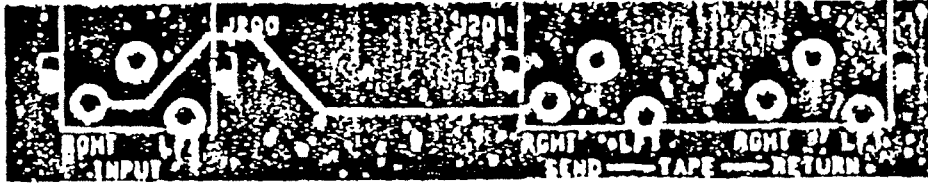
MODE SWITCHING BLOCK A1



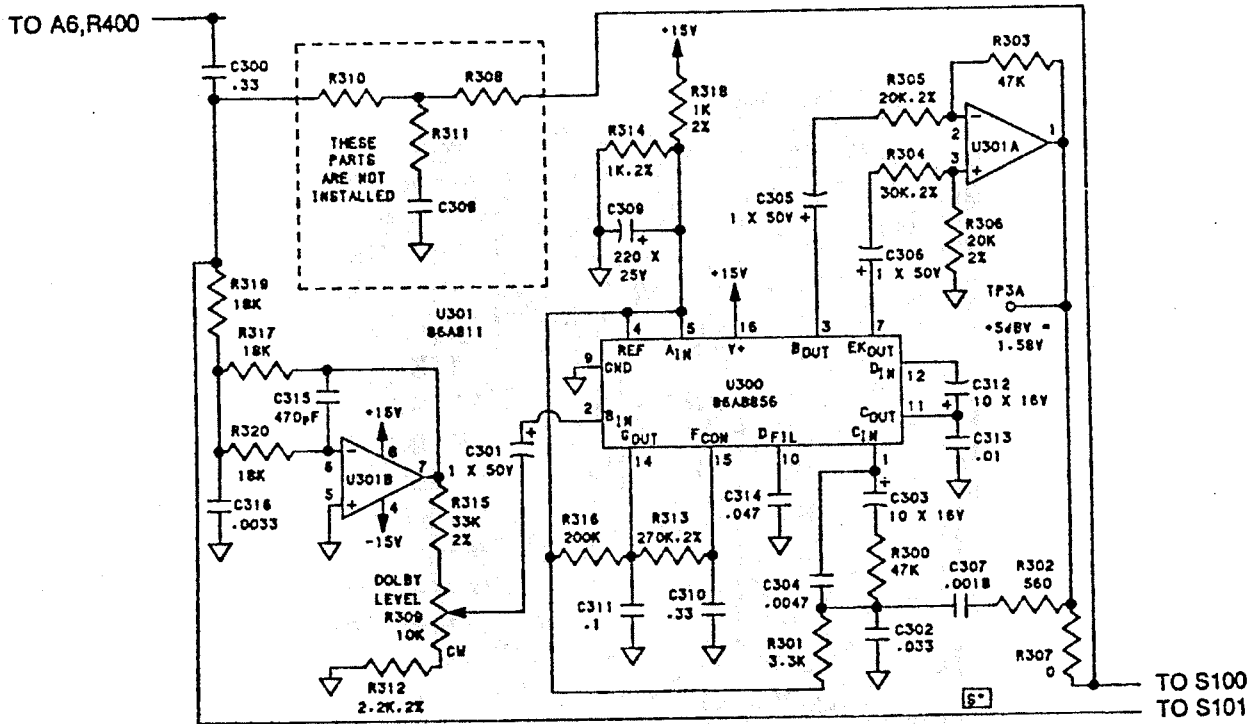
MODE SWITCHING BLOCK A1



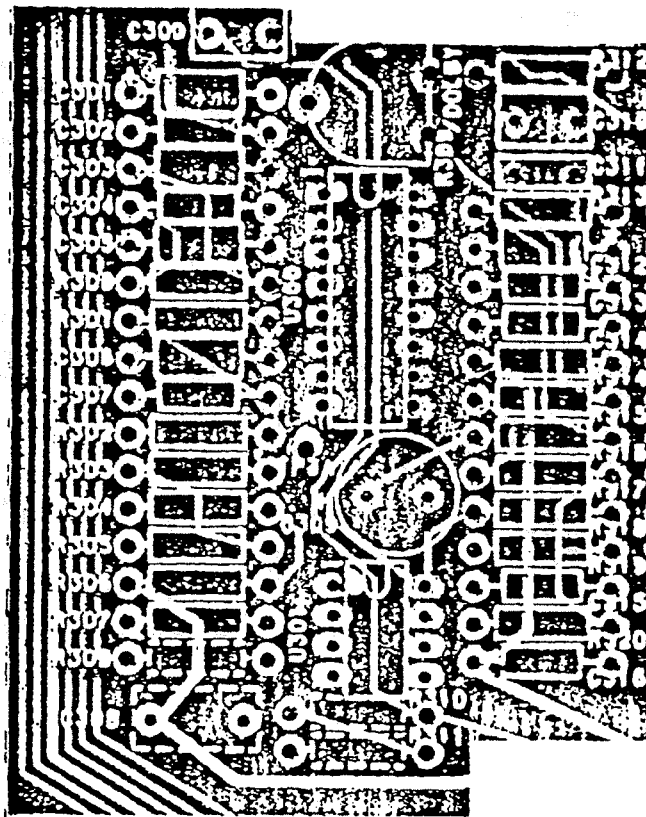
INPUT BLOCK A2



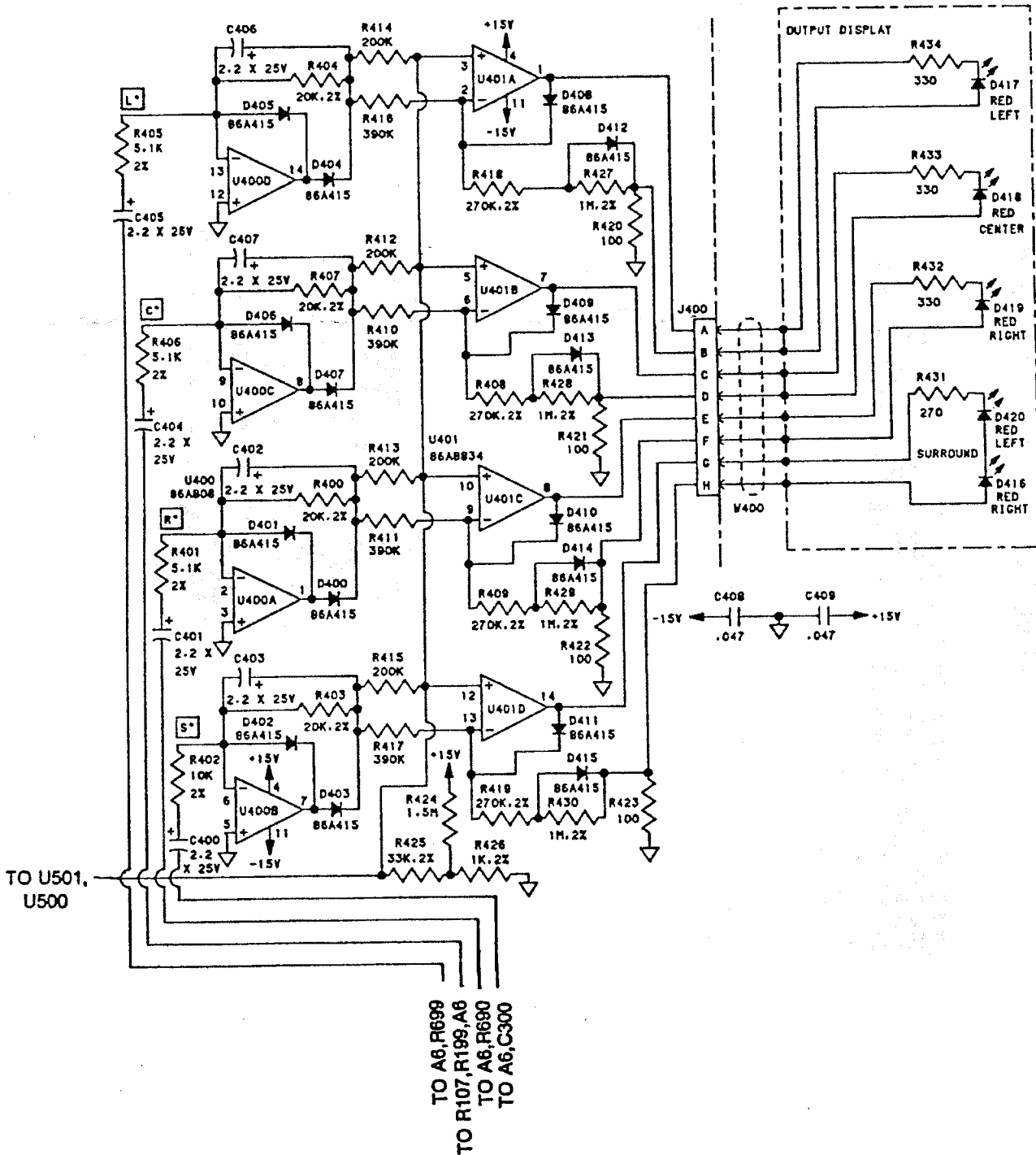
DOLBY NOISE REDUCTION BLOCK A3



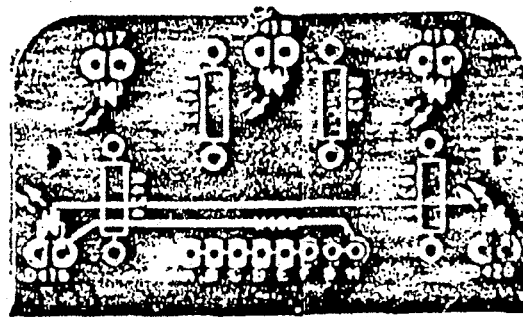
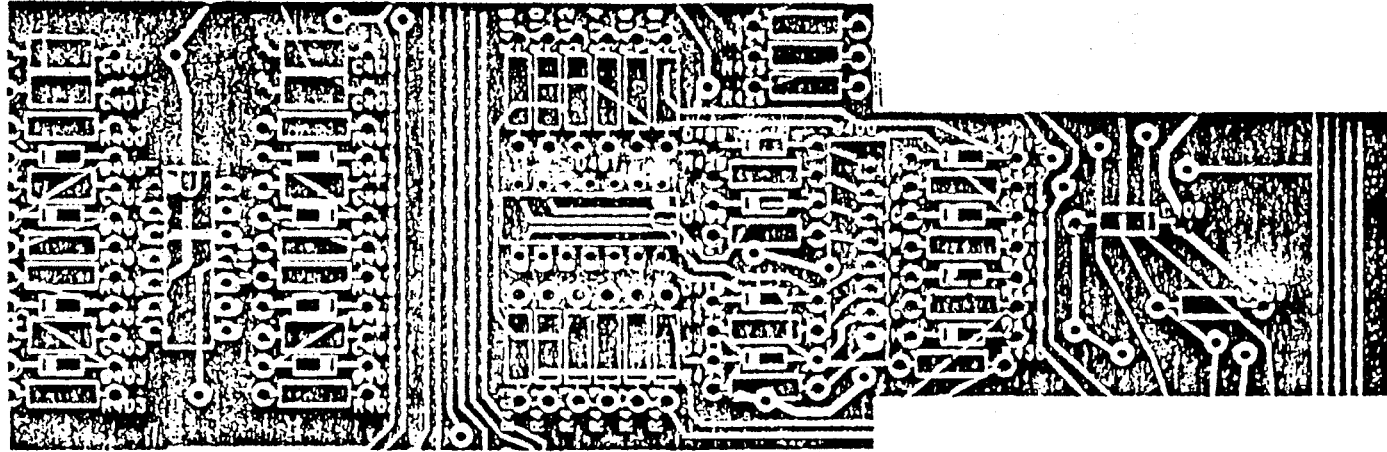
DOLBY NOISE REDUCTION BLOCK A3



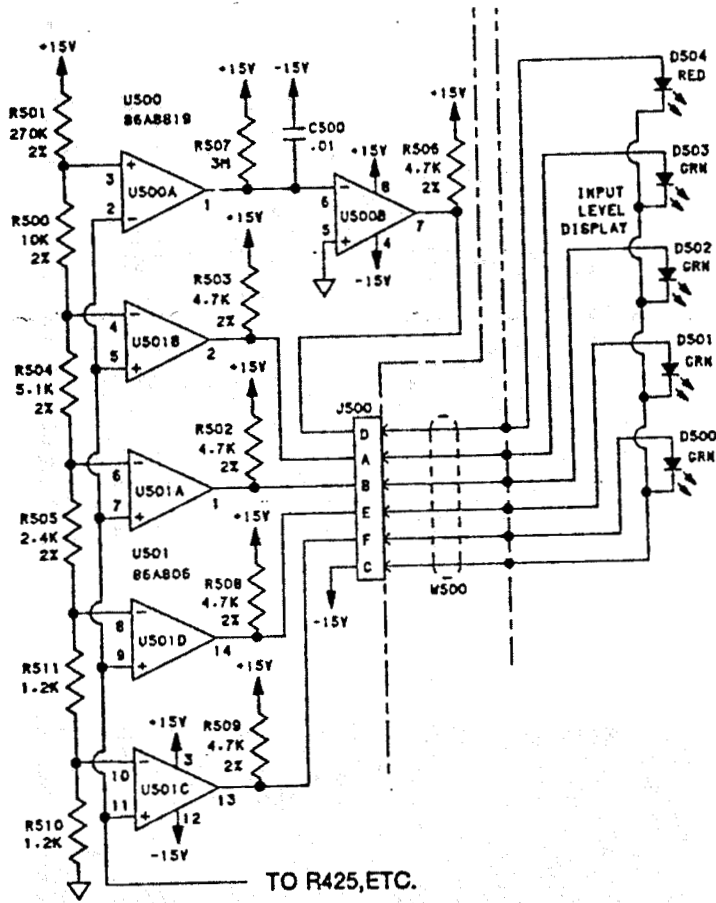
DIRECTIONAL DISPLAY BLOCK A4



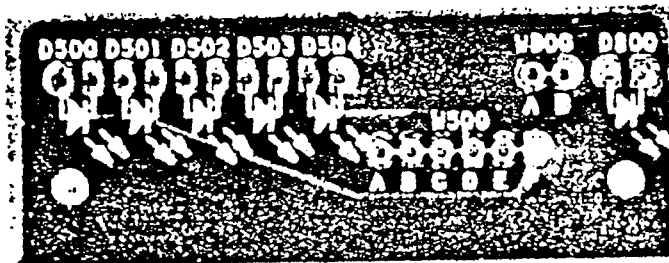
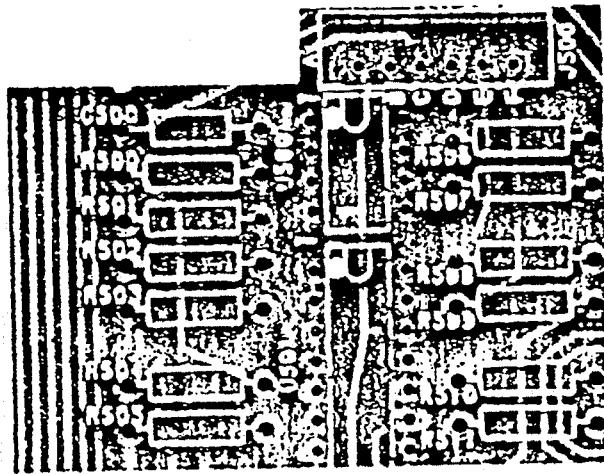
DIRECTIONAL DISPLAY BLOCK A4



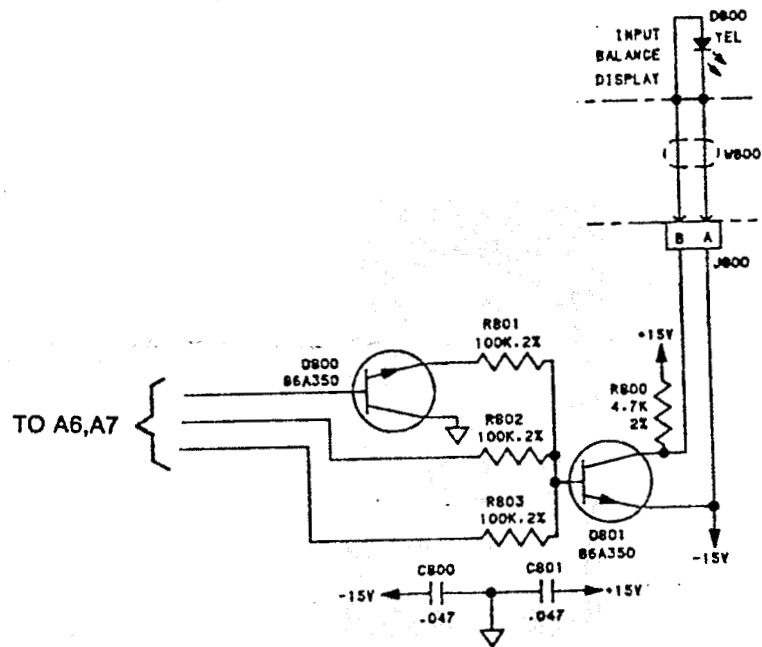
INPUT LEVEL DISPLAY BLOCK A5



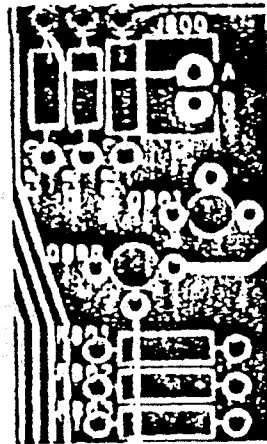
INPUT LEVEL DISPLAY BLOCK A5



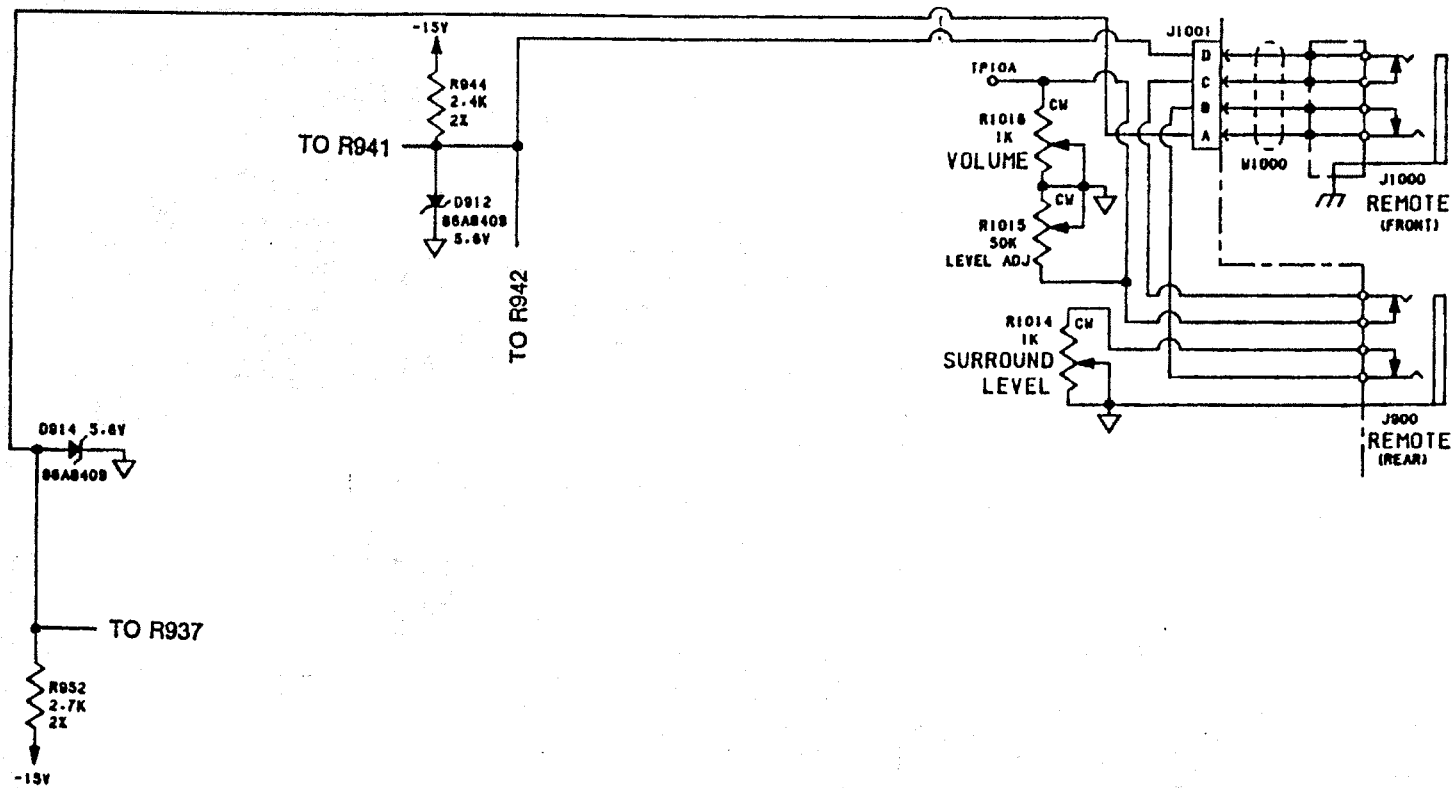
INPUT BALANCE DISPLAY BLOCK A8



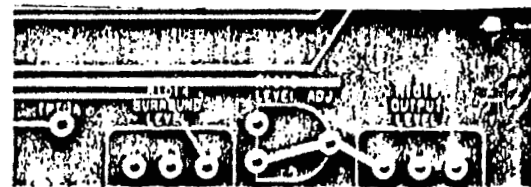
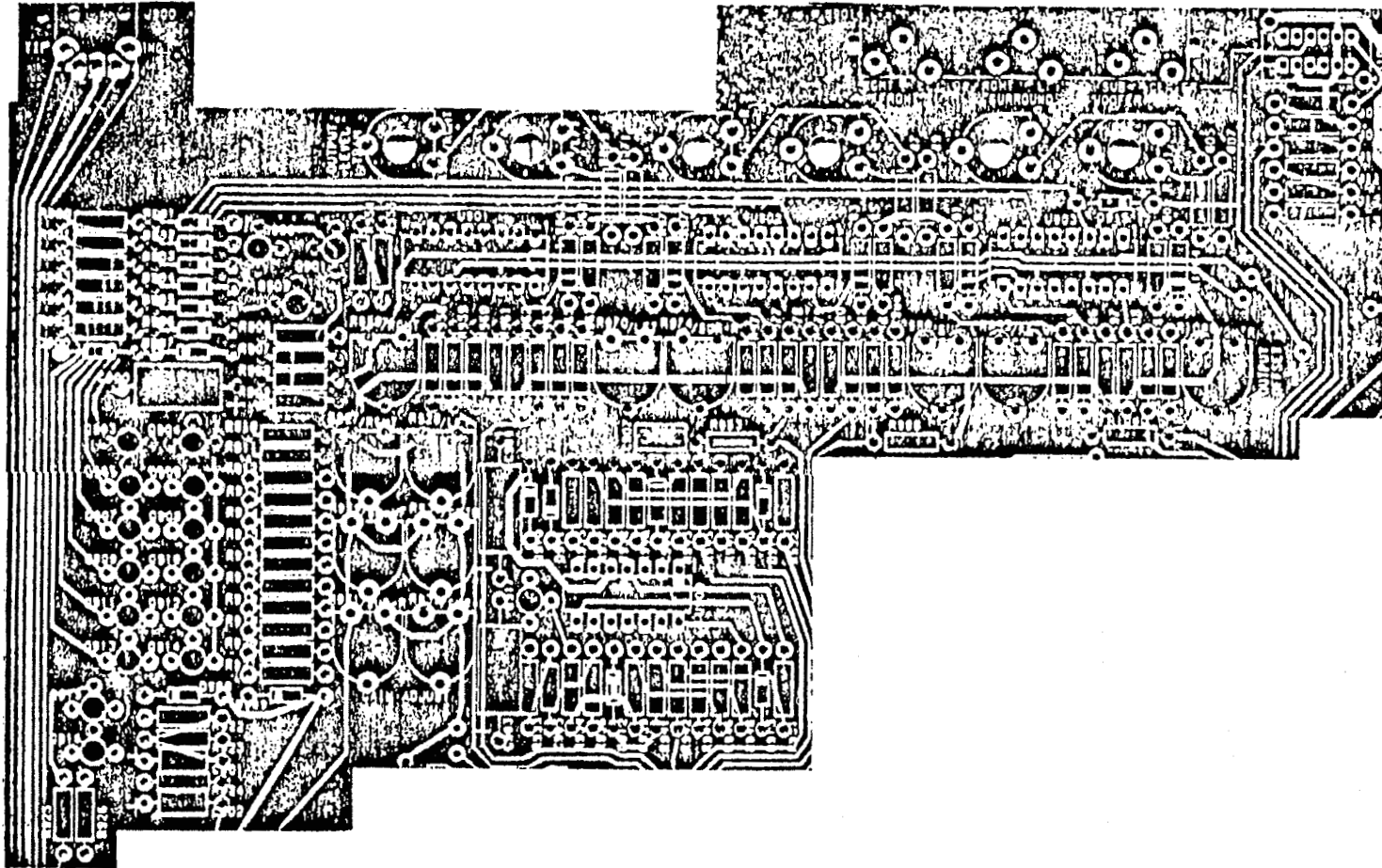
INPUT BALANCE DISPLAY BLOCK A8



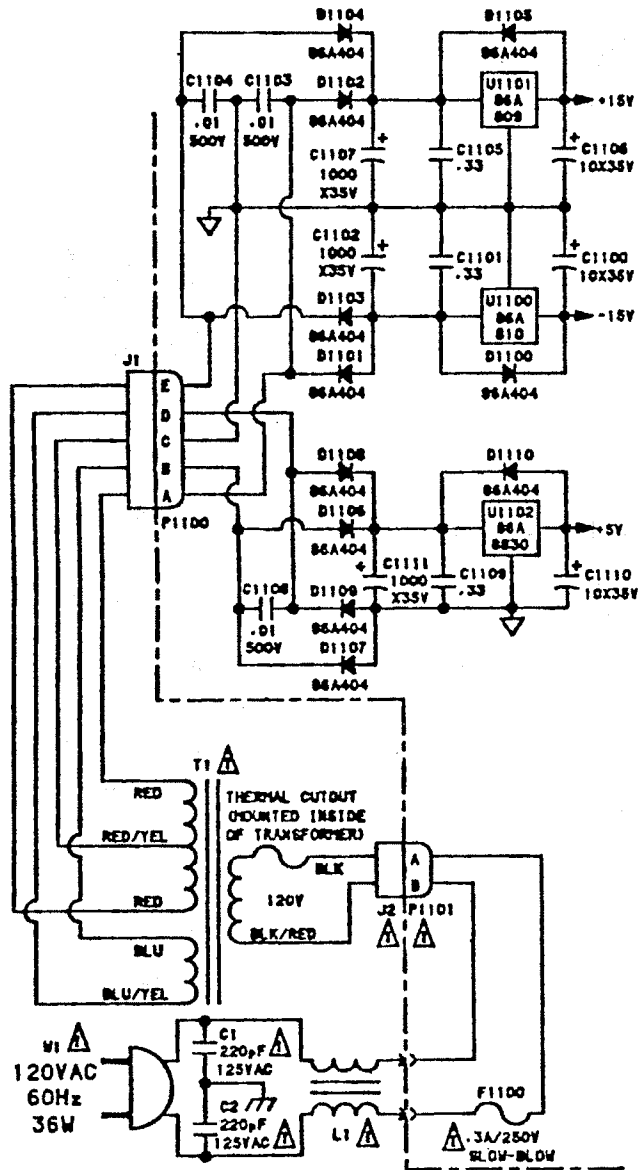
OUTPUT LEVEL CONTROL & REMOTE BLOCK A9, A10 (PARTIAL DRAWINGS SUPPLIED)



OUTPUT LEVEL CONTROL & REMOTE BLOCK A9, A10
(PARTIAL DRAWINGS SUPPLIED)

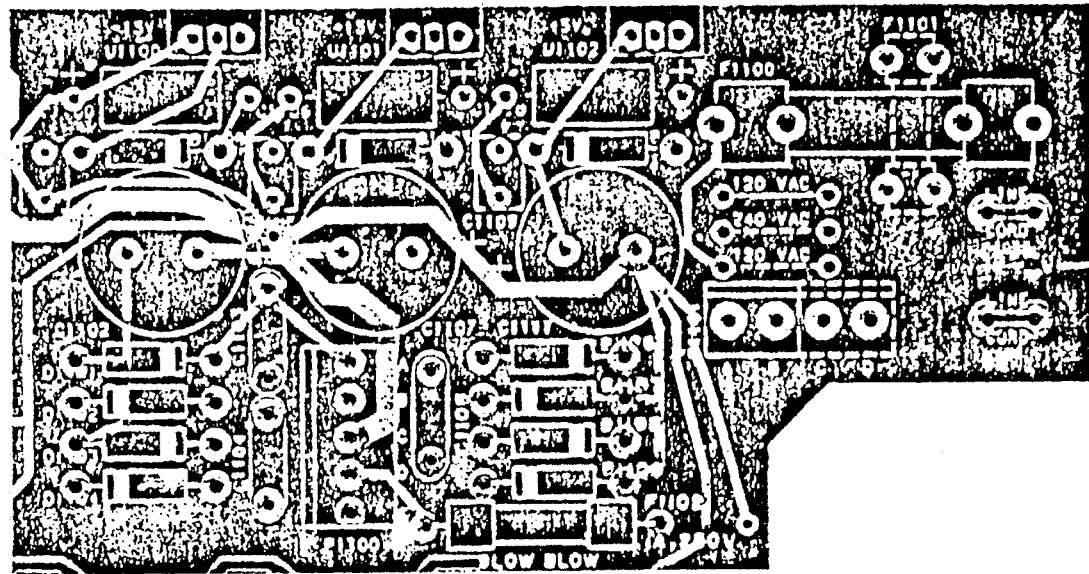


POWER SUPPLY BLOCK A11 (HTS5000)



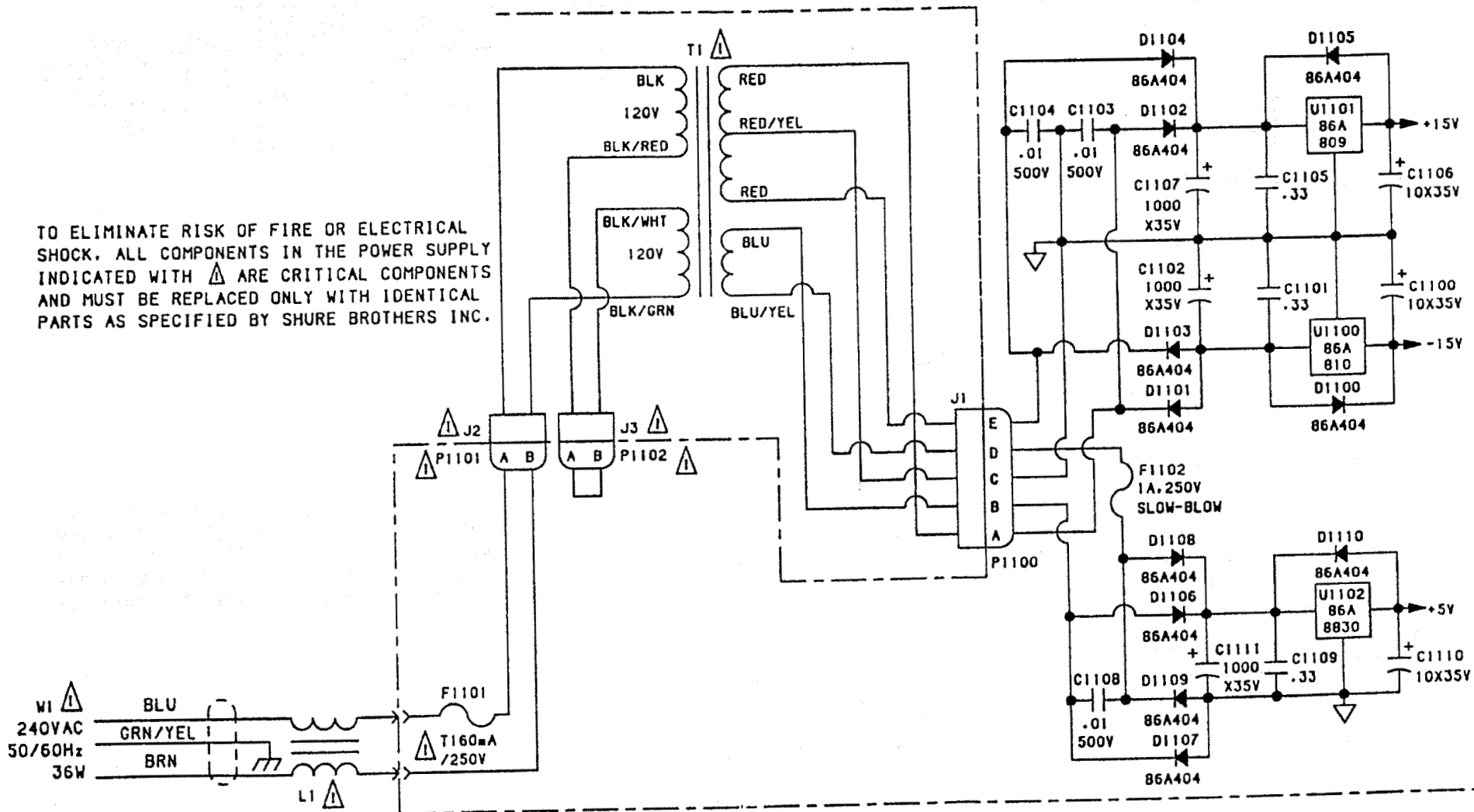
TO ELIMINATE RISK OF FIRE OR ELECTRICAL SHOCK, ALL COMPONENTS IN THE POWER SUPPLY INDICATED WITH Δ ARE CRITICAL COMPONENTS AND MUST BE REPLACED ONLY WITH IDENTICAL PARTS AS SPECIFIED BY SHURE BROTHERS INC.

POWER SUPPLY BLOCK A11



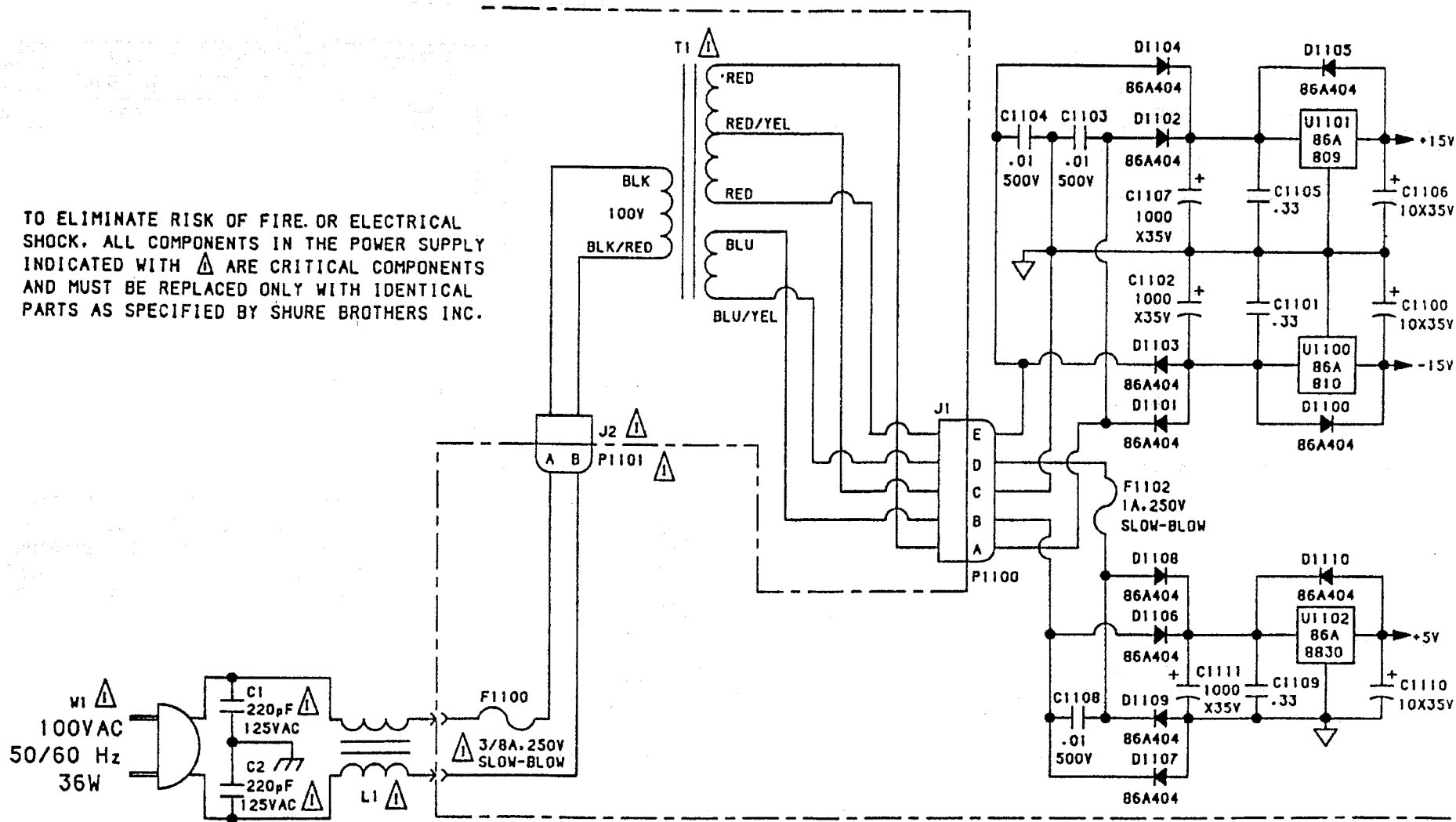
POWER SUPPLY BLOCK A11 (HTS5000E)

TO ELIMINATE RISK OF FIRE OR ELECTRICAL SHOCK, ALL COMPONENTS IN THE POWER SUPPLY INDICATED WITH \triangle ARE CRITICAL COMPONENTS AND MUST BE REPLACED ONLY WITH IDENTICAL PARTS AS SPECIFIED BY SHURE BROTHERS INC.



POWER SUPPLY BLOCK A11 (HTS5000J)

TO ELIMINATE RISK OF FIRE OR ELECTRICAL SHOCK. ALL COMPONENTS IN THE POWER SUPPLY INDICATED WITH Δ ARE CRITICAL COMPONENTS AND MUST BE REPLACED ONLY WITH IDENTICAL PARTS AS SPECIFIED BY SHURE BROTHERS INC.



REMOTE CONTROL ASSEMBLY A13

